Test Report issued under the responsibility of:

TEST REPORT
IEC 61010-1
Safety requirements for electrical equipment for measurement, control, and laboratory use
Part 1: General requirements

Report Number. .....:	T223-0317/22
Date of issue .....:	2022-05-27
Total number of pages.....:	237
Name of Testing Laboratory preparing the Report.....:	**SIQ Ljubljana**
Applicant's name .....:	TDK-Lambda UK Ltd
Address .....:	Kingsley Avenue Ilfracombe, Devon GB-EX34 8ES United Kingdom
Test specification:	
Standard .....:	IEC 61010-1:2010, IEC 61010-1:2010/AMD1:2016
Test procedure .....:	Type test
Non-standard test method .....:	N/A
TRF template used .....:	IECEE OD-2020-F1:2020, Ed.1.3
Test Report Form No. .....:	IEC61010_1P
Test Report Form(s) Originator ....:	VDE Prüf- und Zertifizierungsinstitut GmbH
Master TRF.....:	2021-04-12

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

General disclaimer:

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

Test item description ..... :	AC-DC Switch Mode Power Supply
Trade Mark ..... :	TDK·Lambda
Manufacturer ..... :	TDK-Lambda UK Ltd, Kingsley Avenue Ilfracombe, Devon GB-EX34 8ES United Kingdom
Model/Type reference ..... :	CUS250M series (See model differences for details of models and nomenclature)
Ratings ..... :	100-240 Vac; 3,1 A; 47-440 Hz (See model differences for details of ratings)

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

☒	**CB Testing Laboratory:**	SIQ Ljubljana	
Testing location/ address ..... :		Mašera-Spasićeva ulica 10, SI-1000 Ljubljana, Slovenia	
Tested by (name, function, signature) ..... :		Matej Šmidovnik (Service Provider)	
Approved by (name, function, signature) .. :		Boštjan Glavič (Approved Signatory)	
☐	**Testing procedure: CTF Stage 1:**		
Testing location/ address ..... :			
Tested by (name, function, signature) ..... :			
Approved by (name, function, signature) .. :			
☐	**Testing procedure: CTF Stage 2:**		
Testing location/ address ..... :			
Tested by (name + signature) ..... :			
Witnessed by (name, function, signature) . :			
Approved by (name, function, signature) .. :			
☐	**Testing procedure: CTF Stage 3:**		
☐	**Testing procedure: CTF Stage 4:**		
Testing location/ address ..... :			
Tested by (name, function, signature) ..... :			
Witnessed by (name, function, signature) . :			
Approved by (name, function, signature) .. :			
Supervised by (name, function, signature) :			

List of Attachments (including a total number of pages in each attachment)		
Document No.	Documents included / attached to this report (description)	Page No.
Enclosure No. 1	National Deviations for IEC 61010-1:2010 3rd Edition + A1	From 119 to 148
Enclosure No. 2	Pictures of the unit	From 149 to 157
Enclosure No. 3	Documentation	From 158 to 159
Enclosure No. 4	Additional Test Data	From 160 to 237

Documents referenced by this report (available on request):		
Document Name or No.	Documents description	Page No.

Summary of testing:

The products were tested according to the standard IEC 61010-1: 2010 (Third Edition) + Corrigendum 1:2011 + AMD1:2016 + Corrigendum 1:2019 and EN 61010-1:2010 + AMD1:2019 + Corrigendum 1:2019. Additionally products were also evaluated according to the standards CAN/CSA C22.2 No. 61010-1-12 and UL 61010-1:2012 (Third Edition).

1. The products were tested to be suitable for connection to ≤20 A (USA) branch circuit or a ≤16 A (IEC) branch circuit. The unit is approved for TN, TT.

2. All secondary output circuits are separated from mains by reinforced insulation and rated SELV hazardous energy levels.

3. The unit provides no disconnecting device. Disconnect device must be provided in the final installation.

4. Safety Instructions: Built in product, safety instructions are end product considerations. In addition there are some safety instructions in the manual.

5. The power supply can be used in Class I or Class II applications.
   For Class I construction, the power supply needs to be reliably earthed, professionally installed and fixed with suitable metal screws.
   For Class II construction no earth connection is required however the power supply needs to be fixed so that it is insulated from any unearthed accessible conductive part by reinforced insulation.

6. The transformers TX1 (class F), TX300 (Class B) provide reinforced insulation. They provide in addition an UR (OBJY2) insulation system. (Refer also to List of safety critical components).

7. The equipment has been evaluated for use in a Pollution Degree 2 and overvoltage category II environment and a maximum altitude of 5000 m.

8. A suitable Electrical, Mechanical and Fire enclosure must be provided in the end equipment.

9. The power supply can be forced air cooled (top fan or customer air versions), convection cooled, or convection and conduction cooled. All variants that are not supplied with a fan are dependent on the end equipment application and therefore testing must be carried out in the end equipment to ensure compliance with the stated component temperatures listed in the “General product information and other remarks“ section of this report. The fan provided in this sub-assebly is not intended to operator access.

10. The product was submitted and evaluated for use at the maximum ambient temperature (Tma) permitted by the manufacturer’s specification of: 50°C maximum rated ambient (with appropriate deratings), 70°C maximum extended ambient for fan variants, 75°C maximum extended ambient for cover variants, 80°C maximum extended ambient for open frame and U Channel only variants.

Approval within the end product:

- Prospective touch voltage, touch current and protective conductor current has not been evaluated for 440Hz supply and must be evaluated in the end equipment
- Prospective touch voltage and touch current has not been evaluated for Class II constructions and must be evaluated in the end equipment.
- For option E (single fuse in the live line) the end equipment must be provided with a polarized plug
- The end-product Electric Strength Test is to be based upon a maximum working voltage of: Primary-Secondary: 400 Vrms, 588 Vpk, Primary – Earthed Dead Metal: 375 Vrms, 562 Vpk
- Temperature tests must be caried out in the end equipment. See point 9 in “Summary of testing” section above.

Only limited tests were conducted under this investigation base on testing previously conducted under CBTR E135494-A6052-CB-1 according to IEC 62368-1:2014 issued by UL (OD2020). All additional tests performed under this investigation marked in test results table with “Additional test”. For all other tests, results from CBTR E135494-A6052-CB-1 report were considered acceptable base on comparison between methods and based on review of test data.

Clause	Comment
—	—

Test Report History:
This report may consist of more than one report and is only valid with additional or previous issued reports:

Report Ref. No.	Item
(refer to previous page for OD2020)	

Tests performed (name of test and test clause):	**Testing location:**
4.4 Testing in SINGLE FAULT CONDITION: **4.4.2.3 PE conductor interrupted** **4.4.2.7 Mains transformer short and overload** **4.4.2.8 output abnormal testing** **4.4.2.10 Air holes closed, fan stopped** **4.4.2.12 Single faults on components** **5.1.3c) MAINS supply** **5.3 Durability of markings** **6.2 Determination of ACCESSIBLE parts** **6.3.1 Values in NORMAL CONDITION*** **6.3.2 Values in SINGLE FAULT CONDITION*** **6.7 Insulation requirements- Clearances and Creepage distances** **6.8 Dielectric strength test*** **10 Temperature Measurements** **10.5.3 Ball pressure test** All additional tests performed under this investigation marked in test results table with "Additional test" and with * in above list of tests performed. For all other tests, results from CBTR E135494-A6052-CB-1 report were considered acceptable base on comparison between methods and based on review of test data.	**SIQ Ljubljana** **Mašera-Spasićeva ulica 10, SI-1000 Ljubljana, Slovenia**

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

☒ **The product fulfils the requirements of National differences for Canada, USA, European group differences and national differences, Japan and Switzerland. For details refer to Enclosure No. 1.**

☒ **The product fulfils the requirements of EN 61010-1:2010 + AMD1:2019.**

☒ **The product fulfils the requirements of CAN/CSA C22.2 No. 61010-1-12 and UL 61010-1:2012 (3rd Ed.).**

Statement concerning the uncertainty of the measurement systems used for the tests

☐ **Internal procedure used for type testing through which traceability of the measuring uncertainty has been established:**

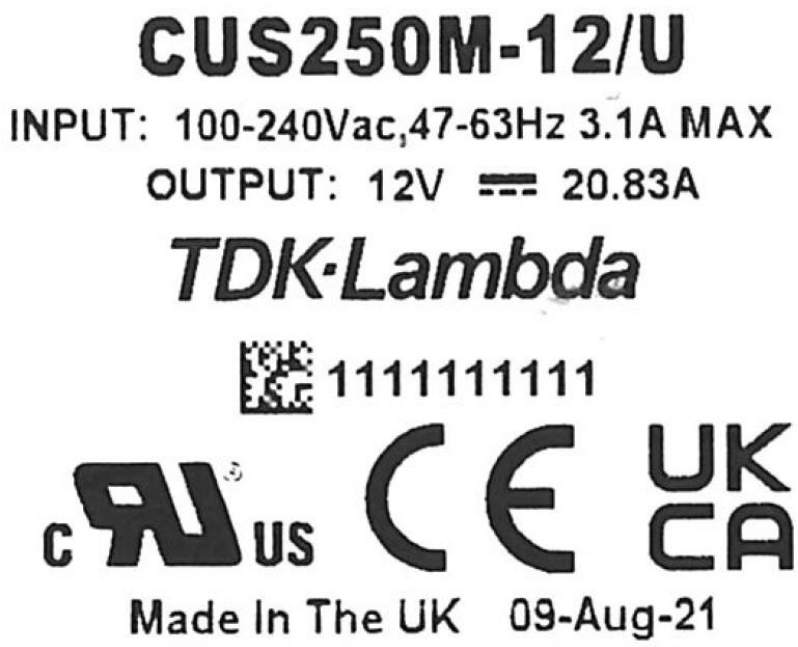
Procedure number, issue date and title:

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

☒ **Statement not required by the standard used for type testing**

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.



Note: Copy above is a representative sample. Whilst not shown above, 440Hz is acceptable as per the terms of this report.

Test item particulars:	
Type of item ..... :	Measurement / Control / Laboratory
Description of equipment function..... :	Power supply
Connection to MAINS supply ..... :	The unit is for building-in and to be permanently connected to mains.
Overvoltage category..... :	II
POLLUTION DEGREE..... :	2
Means of protection..... :	Not classified; for use in Class I or Class II applications - See Summary of testing
Environmental conditions ..... :	Extended (Specify): See summary of testing
For use in wet locations..... :	No
Equipment mobility..... :	Built-in
Operating conditions..... :	Continuous
Overall size of equipment (W x D x H)..... :	Approx.: 11,8 x 6,4 x 5,9 cm
Mass of equipment (kg)..... :	Approx. : 320 g
Marked degree of protection to IEC 60529 ..... :	/
Possible test case verdicts:	
- Test case does not apply to the test object .....:	N/A (Not Applicable)
- Test object does meet the requirement.....:	P (Pass)
- Test object does not meet the requirement.....:	F (Fail)
Testing:	
Date of receipt of test item.....:	2021-12-16
Date (s) of performance of tests .....:	From 2022-02-28 to 2022-03-07

General remarks:

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.
"(see ENCLOSURE #)" refers to additional information appended to the report.
"(see Form A.xx)" refers to a Table appended to the report.
Bottom lines for measurement Tables Forms A.xx are optional if used as record.

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

Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:	
The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided..... :	☒ **Yes** ☐ **Not applicable**
When differences exist; they shall be identified in the general product information section.	
Name and address of factory (ies) ..... :	TDK-LAMBDA UK LTD, KINGSLEY AVENUE, ILFRACOMBE, DEVON, EX34 8ES UNITED KINGDOM PANYU TRIO MICROTRONICS CO LTD SHIJI INDUSTRIAL ESTATE DONGYONG NANSHA GUANGZHOU GUANGDONG 511453 CHINA

General product information and other remarks:
Description of unit:

The CUS250M is an AC-DC switch mode power supply designed for building in to end equipment in either a class I or class II configuration. It is available in the following mechanical configurations:

- Standard model with integral metal baseplate,
- U channel,
- U channel with cover,
- U channel, cover and top mounted fan,
- M3 inserts for underside mounting

The unit is fitted with two fuses as standard with one fuse in the live line and one in the neutral line. Option E allows for a single fuse to be fitted in the live line.

The unit can be cooled via forced air (top fan and customer air versions), convection or conduction. All variants that are not supplied with a fan are dependent on the end equipment application and therefore testing must be carried out in the end equipment to ensure compliance with the stated component temperatures listed in the “General product information and other remarks” section of this report.

For Class I construction, the power supply needs to be reliably earthed, professionally installed and fixed with suitable metal screws.

For Class II construction no earth connection is required however the power supply needs to be fixed so that it is insulated from any unearthed accessible conductive part by reinforced insulation.

Cooling for units with forced air cooling:

The following method must be used for determining the safe operation of PSUs.

The components listed in the following table must not exceed the temperatures given. To determine the component temperatures the heating test must be conducted in accordance with the requirements of the standard in question. Consideration should also be given to the requirements of other safety standards.

The requirements include: PSU to be fitted in its end-use equipment and operated under the most adverse conditions permitted in the end-use equipment handbook/specification and which will result in the highest temperatures in the PSU. To determine the most adverse conditions consideration should be given to the end use equipment maximum operating ambient, the PSU loading and input voltage, ventilation, end-use equipment orientation, the position of doors & covers etc. Temperatures should be monitored using type K fine wire thermocouples (secured with cyanoacrylate adhesive or similar) placed on the hottest part of the component (out of any direct airflow) and the equipment should be run until all temperatures have stabilized

CUS250M forced air cooling temperature table:

Circuit Reference	Description	Max. Temperature (°C)
L1	Common Mode Choke	110
L3	PFC Choke	125
L4	Differential Mode Choke	140
C5	Film Capacitors	105
C6, C104, XC104, XC105, XC400, XC502	Electrolytic Capacitors	85 (105)
C1	X Capacitors	110
C2, C3, C100, C102, C103	Y Capacitors	119 (125)
TX1	Transformer Winding	125
TX300	Transformer Winding	110
XU100, XU301, XU402	Opto-couplers	106 (125)
XD1, XD2, XD3, XD4	Bridge Diodes	130
XQ2	FET	130
J1	Input Connector	105

Higher temperature limits (in brackets) may be used but product life may be reduced.

Description of model differences:

The CUS250M has a maximum rated power of 250W and has two nominal output voltages of 12Vdc and 24Vdc. Output parameters are shown in the table below and are factory configurable only.

Nomenclature

Unit Product Code: CUS250M-xxVx/yyyyyyy

Where: xxVx = Channel 1 output voltage from within the output voltage adjustment range from the “Output Parameters” table below

Where yyyyyyy = unit options from the list of standard options below

Case Options

Blank	=	Open frame (with integral baseplate)
U	=	U channel
A	=	U channel with cover
F	=	U channel, cover and top mounted fan
C	=	M3 inserts for underside mounting

Connector Options:

Blank	=	JST connector
M	=	Molex type connector

Fuse Options:

Blank	=	Dual fuse (standard)
E	=	Single fuse in live line

Signal, Standby Options:

Blank	=	No options (CH1 and fan supply are standard)
G	=	5V, 0.1A standby supply, remote on/off (enable), DC_OK, AC_Fail
J	=	5V, 0.1A standby supply, remote on/off (inhibit), DC_OK, AC_Fail
K	=	Remove fan supply (CH1 only)

Leakage Current Options:

Blank	=	Standard leakage (<150µA)
T	=	Reduced leakage current (<50µA)

Output Connector Options:

Blank	=	Screw terminal
L*	=	Custom option *can be any number denoting different connector type

Coating Options:

Blank	=	No coating
P	=	Protective coating

Example: CUS250M-24V5/UEP = 24.5V with U channel, JST connector, single fuse in the live line, no options, standard leakage and protective coating.

Unit product code may be prefixed with 'K' followed by any standard product code followed by /NNNNL where N is a string of numbers which identifies the non-standard requirement and L is an optional letter, starting with 'A' which is incremented for any customer revision.

Example: KCUS250M-24/0001A

Unit product code may be suffixed by /NNNNL where N is a string of numbers which identifies the non-standard requirement. L is an optional letter, starting with 'A', which is incremented for any customer revision.

Example: CUS250M-24/0001A

Unit product code may be suffixed by SPNN (where NN may be any number of characters indicating non-safety related model differences) (SP represents a sales code).

Example: CUS250M-24/FE/SP01

Input Parameters

Nominal Input Voltage	100 – 240Vac
Input Voltage Range	85 – 264Vac
Input Frequency Range	47 – 440Hz
Maximum Input Current	3.1Arms

All ratings apply for ambient temperatures up to 50°C (see Variations and Limitations below)

Output power is reduced by 1%/V between 100V and 90Vac (225W max at 90Vac)

Output power is reduced by 2%/V between 90V and 85Vac (200W max at 85Vac)

Output Parameters

The model variants listed below may be fan, forced air, conduction or convection cooled. The output parameters are shown in the table below.

CUS250M CH1 Outputs:

Model	Vout Range (V)	Max Iout (A)	Max Pout (W)
12	12 – 13.2	20.83	250
24	24 – 26.4	10.41	250

CUS250M Standby Output:

Model	Vout Fixed (V)	Max Iout (A)	Max Pout (W)
5	5	0.1	0.5

CUS250M Fan Output:

Vout Fixed (V)	Max Iout (A)
11.6	0.5

Variations and Limitations:

- Customer forced air cooling max ambient: 85°C (see *Note 1*)
- Convection and conduction/cold plate cooling (U channel with cover, Option A) max ambient: 75°C (see note 1)
- Convection and conduction/cold plate cooling (U channel (U Option) and open frame) max ambient: 80°C (see note 1)
- Fan cooling max ambient: 70°C (F Option) (output power de-rated linearly by 2.5W/°C above 50°C)

Note 1: Maximum output power and current ratings are dependent on the ambient used in the end equipment. Refer to the CUS250M Handbook/Instructional manual.

Description of special features:
(HV circuits, high pressure systems etc.)

None.