



Test Report issued under the responsibility of:



TEST REPORT
IEC 62368-1
Audio/video, information and communication technology equipment
Part 1: Safety requirements

Report Number: E135494-A6052-CB-1
Date of issue.....: 2021-11-05
Total number of pages: 164

Name of Test Laboratory: UL VS Limited
preparing the Report: Unit 1-3 Horizon, Wade Road, Kingsland Business Park, Basingstoke
 RG24 8AH, United Kingdom


Applicant's name.....: **TDK-LAMBDA UK LTD**
Address: **KINGSLEY AVE**
ILFRACOMBE
EX34 8ES UNITED KINGDOM


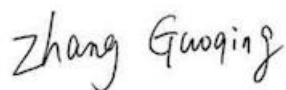

Test specification:
Standard: IEC 62368-1:2014
Test procedure: CB Scheme
Non-standard test method.....: N/A

TRF template used: IECEE OD-2020-F1:2020, Ed.1.3
Test Report Form No.....: IEC62368_1D
Test Report Form(s) Originator: UL(US)
Master TRF.....: Dated 2021-02-04

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Test Item description	AC-DC Switch Mode Power Supply	
Trade Mark(s)	TDK-Lambda 	
Manufacturer	TDK-LAMBDA UK LTD KINGSLEY AVE ILFRACOMBE EX34 8ES UNITED KINGDOM	
Model/Type reference	CUS250M series (See model differences for details of models and nomenclature)	
Ratings	100-240Vac, 3.1A max, 47-440Hz (See model differences for details of ratings)	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
<input type="checkbox"/>	CB Testing Laboratory:	
Testing location/ address		
Tested by (name, function, signature)		
Approved by (name, function, signature)		
<input type="checkbox"/>	Testing procedure: CTF Stage 1:	
Testing location/ address		
Tested by (name, function, signature)		
Approved by (name, function, signature)		
<input type="checkbox"/>	Testing procedure: CTF Stage 2:	
Testing location/ address		
Tested by (name, function, signature)		
Witnessed by (name, function, signature)		
Approved by (name, function, signature)		
<input checked="" type="checkbox"/>	Testing procedure: CTF Stage 3:	
<input type="checkbox"/>	Testing procedure: CTF Stage 4:	
Testing location/ address		TDK-LAMBDA UK LTD KINGSLEY AVE

	ILFRACOMBE EX34 8ES UNITED KINGDOM	
Tested by (name, function, signature)	Matt Carter, M. Gisbey / Tester	
Witnessed by (name, function, signature) ...:	Dennis Butcher / Witness Engineer	See GPI for details
Approved by (name, function, signature).....:	Guoqing Zhang / Reviewer	
Supervised by (name, function, signature) ..:	Mark John De Sagun / Project Handler	

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

National Differences (30 pages)

Enclosures (79 pages)

Summary of testing:

Tests performed (name of test and test clause):

CLASSIFICATION OF ELECTRICAL ENERGY SOURCES (5.2.2.1-5.2.2.6)

DETERMINATION OF WORKING VOLTAGE (5.4.1.8)

BALL PRESSURE TEST (5.4.1.10.3)

HUMIDITY CONDITIONING (5.4.8)

ELECTRIC STRENGTH TEST – TYPE TESTING OF SOLID INSULATION (5.4.9.1)

SAFEGUARDS AGAINST CAPACITOR DISCHARGE AFTER DISCONNECTION OF A CAPACITOR (5.5.2.2)

RESISTANCE OF THE PROTECTIVE BONDING SYSTEM (5.6.6.2)

TOUCH CURRENT MEASUREMENT – EARTHED ACCESSIBLE CONDUCTIVE PARTS – SINGLE-PHASE EQUIPMENT ON TN OR TT SYSTEM (5.7.4)

INPUT TEST: SINGLE PHASE (B.2.5)

NORMAL OPERATING CONDITIONS TEMPERATURE MEASUREMENT (B.2.6, 5.4.1.4, 6.3, 9.2)

SIMULATED ABNORMAL OPERATING CONDITIONS (B.3)

SIMULATED SINGLE FAULT CONDITIONS (B.4)

TRANSFORMER OVERLOAD (ANNEX G.5.3.3)

ALTERNATIVE LOCKED-ROTOR OVERLOAD TEST FOR D.C. MOTORS (ANNEX G.5.4.6.3)

LIMITED SHORT CIRCUIT TEST (ANNEX R.1, 5.6.4.1, 5.6.4.4, 5.6.5.1)

STEADY FORCE TEST, 10 N (ANNEX T.2 , 5.4.2.6, 5.4.3.2, G.15.3.6)

Testing Location:

**CTF Stage 3: TDK-LAMBDA UK LTD
KINGSLEY AVE
ILFRACOMBE
EX34 8ES UNITED KINGDOM**

Summary of compliance with National Differences:

List of countries addressed: Australia / New Zealand, EU Group and National Differences, Japan, USA / Canada

The product fulfils the requirements of: BS EN 62368-1:2014 + A11:2017, EN 62368-1:2014 + A11:2017, CSA CAN/CSA-C22.2 No. 62368-1 2nd Edition, Issued December 1, 2014, UL 62368-1 2nd Edition, Issued December 1, 2014

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

(Note: When IEC or ISO standard requires a statement concerning the uncertainty of the measurement systems used for tests, this should be reported above. The informative text in parenthesis should be delete in both cases after selecting the applicable option)

Copy of marking plate:

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

CUS250M-12/U

INPUT: 100-240Vac, 47-440Hz 3.1A max

OUTPUT: 12V \equiv 20.83A

TDK-Lambda



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Made In The UK 09-Aug-21

Note: The above markings are the minimum requirements required by the safety lab. For the final production samples, the additional markings which do not give rise to misunderstanding may be added.

TEST ITEM PARTICULARS:	
Classification of use by	Skilled person
Supply Connection	AC Mains
Supply % Tolerance	+10%/-10%
Supply Connection – Type	mating connector
Considered current rating of protective device as part of building or equipment installation	20 A; building;
Equipment mobility	for building-in
Over voltage category (OVC)	OVC II
Class of equipment	Class I Class II
Access location	N/A
Pollution degree (PD)	PD 2
Manufacturer’s specified maximum operating ambient (°C)	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
IP protection class	IPX0
Power Systems	TN TT
Altitude during operation (m)	5000 m
Altitude of test laboratory (m)	2000 m or less
Mass of equipment (kg)	<1
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..... :	2021-01-19 TO 2021-08-12
Date (s) of performance of tests..... :	2021-01-21 TO 2021-10-25
GENERAL REMARKS:	
<p>"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report.</p> <p>Throughout this report a <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.</p>	
Manufacturer’s Declaration per sub-clause 4.2.5 of IEC 60335-1:	

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 :	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> Not applicable
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When differences exist; they shall be identified in the General product information section.

Name and address of factory (ies) :	TDK-LAMBDA UK LTD KINGSLEY AVE ILFRACOMBE EX34 8ES UNITED KINGDOM PANYU TRIO MICROTRONICS CO LTD SHIJI INDUSTRIAL ESTATE DONGYONG NANSHA GUANGZHOU GUANGDONG 511453 CHINA
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GENERAL PRODUCT INFORMATION:

Report Summary
 All applicable tests according to the referenced standard(s) have been carried out.

Product Description
 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 "Additional application considerations" 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.

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/yyyyyy

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

Where yyyyyy = 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.

Outputs are not user adjustable but can be factory set.

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:

Model	Vout Fixed (V)	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 included in Enclosure 6-01 of this report for further details.

Additional application considerations – (Considerations used to test a component or sub-assembly) -

The marking label provided is representative of all models.

The following tests were selected as representative of the test program applicable to model covered by this CBTR: Operating temperature measurement conditions (Cl. B.2.6), Steady force test, 10 N (Cl. T.2), Safeguards against capacitor discharge after disconnection of a connector (Cl. 5.5.2.2), Separable thin sheet material (Cl. 5.4.4.6.2), Input test (Cl. B.2.5), Electric Strength (Cl. 5.4.9).

These tests have been witnessed for models selected as representative of the standard covered by this report and the applicable test program.

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

Technical Considerations

- The product was submitted and evaluated for use at the maximum ambient temperature (T_{ma}) 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
- The product is intended for use on the following power systems : TN, TT
- Considered current rating of protective device as part of the building installation (A) : 20
- Mains supply tolerance (%) or absolute mains supply values : +10%/-10%
- The equipment disconnect device is considered to be : Provided in the end-equipment
- The following were investigated as part of the protective earthing/bonding : Printed wiring board trace (refer to Enclosure - Schematics + PWB for layouts)
- The following are available from the Applicant upon request : Installation (Safety) Instructions / Manual
- The product was investigated to the following additional standard : CSA CAN/CSA-C22.2 NO. 62368-1 2nd Ed, Issued December 1, 2014, EN 62368-1:2014 + A11:2017, BS EN 62368-1:2014 + A11:2017
- The means of connection to the mains supply is: to be determined in the end-equipment
- The total output power and current ratings are both de-rated to ensure power curves are met. Refer to the Handbook included in Enclosure 6-01 of this report.
- (for reference only) Multilayer PWB's accepted under CBTR Ref. No E349607-A23 dated 2020-09-18 and Letter Report included in Enclosure 7-04 of this report.
- For Class I construction, the power supply will need to be reliably earthed, professionally installed and fixed with suitable metal screws. For Class II construction no earthing 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.
- The minimum CLEARANCE is multiplied by 1.48 to correspond with an altitude of 5000m as per IEC 60664-1.
- Capacitors are rated for 230V due to the IT power system used in Norway. Further evaluation may be required in the end equipment for IT power systems.

Engineering Conditions of Acceptability

When installed in an end-product, consideration must be given to the following:

- The following product-line tests are conducted for this product : Earthing Continuity, Electric Strength
- The end-product Electric Strength Test is to be based upon a maximum working voltage of : Primary – Earthed Dead Metal: 375 Vrms/562 Vpk, Primary-Secondary: 400 Vrms/588 Vpk
- The following output circuits are at ES1 energy levels : 12V, 24V
- The following output circuits are at PS3 energy levels : All circuits (declared)
- The maximum investigated branch circuit rating is : 20 A
- The investigated Pollution Degree is : 2
- Proper bonding to the end-product main protective earthing termination is : Required (except Class II models)
- An investigation of the protective bonding terminals has : not been conducted
- The following end-product enclosures are required : Electrical, Fire, Mechanical
- The following magnetic devices (e.g. transformers or inductor) are provided with an OBJY2 insulation system with the indicated rating greater than Class A (105°C) : TX1 (Class F), TX300 (Class B).
- The following components require special consideration during end-product Thermal (Heating) tests due to the indicated maximum temperature measurements during component-level testing : see additional information
- The power supply was evaluated to be used at altitudes up to : "5,000 m"
- The power supply terminals and/or connectors are: Not investigated for field wiring
- The fan provided in this sub-assembly is not intended for operator access
- 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 "Additional application considerations" section of this report.
- The following output terminals were referenced to earth during performance testing: All outputs and their return lines individually referenced to earth to obtain maximum working voltages
- For option E (single fuse in the live line) the end equipment must be provided with a polarized plug
- For protection from moving parts, the required mechanical enclosure must prevent access to the fan blades. Fan blades should only be accessible to a skilled person after the removal of the metal enclosure. The moving part is obvious.
- Prospective touch voltage, touch current and protective conductor current has not been evaluated for frequency above 63Hz 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.
- Marking for equipment provided with fuses located in both line and neutral of a single phase mains to be considered in end-product