



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-A6002-CB-1

Date of issue.....: 2019-01-07 ; Amendment 3 : 2021-04-23

Total number of pages: 26

Applicant's name.....: TDK-LAMBDA UK LTD

Address: KINGSLEY AVE
ILFRACOMBE
EX34 8ES UNITED KINGDOM

Name of Test Laboratory: UL International Polska sp. z o.o.

preparing the Report: Równoległa 4, PL-02-235 Warszawa, Poland

Test specification:

Standard: IEC 62368-1:2014 (Second Edition)

Test procedure: CB Scheme

Non-standard test method.....: N/A

Test Report Form No.....: IEC62368_1B

Test Report Form(s) Originator: UL(US)

Master TRF.....: 2014-03

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Test Item description :	AC-DC Switch mode power supply
Trade Mark	TDK-Lambda 
Manufacturer	TDK-LAMBDA UK LTD KINGSLEY AVE ILFRACOMBE EX34 8ES UNITED KINGDOM
Model/Type reference	CUS150M (may be prefixed and followed by alphanumeric characters - See model differences section for details of nomenclature) CUS150MD (may be prefixed and followed by alphanumeric characters - See model differences section for details of nomenclature) CUS100ME (may be prefixed and followed by alphanumeric characters - See model differences section for details of nomenclature) KCUS100ME-32/0001# (where # can be any letter or character indicating non-safety related changes)
Ratings	Input: CUS150M-xxVx/yyyy 100-240Vac; 47-63Hz or 47-440 Hz 2.2Arms Max. CUS150MD-xxVx/yyyy 133-318Vdc, 1.8A Max CUS100ME-xxVx/yyyy 100-240Vac; 47-63Hz; 1.4Arms Max. KCUS100ME-32/0001# 100-240Vac; 47-63Hz; 1.4A RMS Max. Output: CUS150M-12/yyyy output: 12-13.2Vdc 12.5A CUS150M-15/yyyy output: 15-16.5Vdc 10A CUS150M-18/yyyy output: 18-19.8Vdc 8.33A CUS150M-24/yyyy output: 24-26.4Vdc 6.25A CUS150M-28/yyyy output: 28-30.8Vdc 5.4A CUS150M-36/yyyy output: 36-39.6Vdc 4.2A CUS150M-48/yyyy output: 48-50Vdc 3.125A CUS150MD-12/yyyy output: 12-13.2Vdc 12.5A CUS150MD-15/yyyy output: 15-16.5Vdc 10A CUS150MD-18/yyyy output: 18-19.8Vdc 8.33A

		CUS150MD-24/yyyy output: 24-26.4Vdc 6.25A CUS150MD-28/yyyy output: 28-30.8Vdc 5.4A CUS150MD-36/yyyy output: 36-39.6Vdc 4.2A CUS150MD-48/yyyy output: 48-50Vdc 3.125A CUS100ME-12/yyyy output: 12-13.2Vdc 8.33A CUS100ME-15/yyyy output: 15-16.5Vdc 6.66A CUS100ME-18/yyyy output: 18-19.8Vdc 5.55A CUS100ME-24/yyyy output: 24-26.4Vdc 4.16A CUS100ME-28/yyyy output: 28-30.8Vdc 3.57A CUS100ME-36/yyyy output: 36-39.6Vdc 2.77A CUS100ME-48/yyyy output: 48-50Vdc 2.08A KCUS100ME-32/0001# output: 32.2Vdc 3.11A Each output has a range shown in the table above which is factory configurable only. For further details please see model differences section.	
Testing procedure and testing location:			
<input checked="" type="checkbox"/>	CB Testing Laboratory:		
Testing location/ address		UL International Polska sp. z o.o., Równoległa 4, PL-02-235 Warszawa, Poland	
Tested by (name + signature).....:		Pawel Ciuba / Project Handler	
Approved by (name + signature)		Robert Dmitruk / Reviewer	
Testing procedure: CTF Stage 1			
Testing location/ address..... :			
Tested by (name + signature).....:			
Approved by (name + signature)			
Testing procedure: CTF Stage 2			
Testing location/ address..... :			

Tested by (name + signature).....:			
Witnessed by (name + signature).....:			
Approved by (name + 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 + signature).....:		Nick Marsh / Safety	See the original CBTR for signatures
Witnessed by (name + signature).....:		Mark John De Sagun / Project Handler	See the original CBTR for signatures
Approved by (name + signature)		Dennis Butcher / Reviewer	See the original CBTR for signatures
Supervised by (name + signature)		Dennis Butcher / Reviewer	See the original CBTR for signatures

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

National Differences (0 pages)

Enclosures (0 pages)

Summary of testing:**Tests performed (name of test and test clause):**
None**Testing Location: None****Summary of compliance with National Differences:****List of countries addressed:**☒ **The product fulfils the requirements of:** EN 62368-1:2014 + AC:2017+ A11:2017

UL 62368-1 2ND Ed, Issued December 1, 2014

CSA CAN/CSA-C22.2 NO. 62368-1 2nd Ed, Issued December 1, 2014

AS/NZS 62368.1:2018

List of countries addressed:

Australia

Austria (EN 62368-1:2014)

CENELEC Group deviation (EN 62368-1:2014)

Finland (EN 62368-1:2014)

Italy(EN 62368-1:2014+A11)

Norway (EN 62368-1:2014)

Sweden (EN 62368-1:2014)

UK (EN 62368-1:2014)

US/CAN

Copy of Marking Plate - Refer to Enclosure titled Marking Plate for copy.

TEST ITEM PARTICULARS:	
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..... :	N/A
Date (s) of performance of tests..... :	N/A
GENERAL REMARKS:	
<p>"(See Enclosure #)" refers to additional information appended to the report.</p> <p>"(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 IEC60068-2-1:	
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
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 TDK-LAMBDA MALAYSIA SDN BHD LOT 2 & 3, BATU 9 3/4 KAWASAN PERINDUSTRIAN BANDAR BARU JAYA GADING 26070 KUANTAN PAHANG MALAYSIA PANYU TRIO MICROTRONICS CO LTD SHIJI INDUSTRIAL ESTATE DONGYONG NANSHA GUANGZHOU GUANGDONG 511453 CHINA
GENERAL PRODUCT INFORMATION:	

Report Summary

The original report was modified on 2021-04-23 to include the following changes/additions:

Technical Amendment

The original report was modified due to the following Critical Component list updates:

- Added alternate input connector J1 - 09652038 (5273 Series) manufactured by Molex,
- Added manufacturer to the TX100 insulation system CB2 and CB3.

CBTL changed to UL International Poland Sp. z o.o.

Based on the previous investigation no additional testing was considered necessary.

Product Description

The product is a power supply for building in to end equipment. It is available as open frame, U chassis, U chassis and lid, Base plate and with a top fan version (CUS150M model only).

The power supply can be used as either a Class I or a Class II construction except for KCUS100ME-32/0001# which is a Class II only.

- 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. The power supply needs to be fixed so that it is insulated from any unearthed accessible conductive part by reinforced insulation.

The power supply provides two fuses for input protection. One in the Live line and one in the Neutral line. Option E uses one fuse only. This is fitted in the live line only.

The power supply can be forced air (top fan or customer air), convection or conduction cooled. Due to the fact that air flow for cooling depends on end product use, only convection cooling and top fan configurations were considered during temperature measurement.

The component temperatures listed in the additional information shall not be exceeded.

Model Differences

The CUS has two ranges of 100W and 150W each with seven nominal output voltages of 12, 15, 18, 24, 28, 36 and 48 Vdc. Each output has a range shown in the table below which is factory configurable only.

CUS models as described below:

Units may be marked with a Product Code: CUSZ-xxVx/yyyy where Z is 100ME or 150M and x may be any number of numbers or left blank to indicate the output voltage. V represents a decimal place when required or can be left blank. y can be any number of numbers or letters (excluding M, E, U, A, F, B, H) when indicating non-safety related model differences. y can be M, E, U, A, F, B, H when indicating the standard options as listed below.

Unit Product Code may be prefixed by K, SP # and/or NS # followed by / or - (where # may be any number of characters indicating non-safety related model differences).

Unit Product Code:

CUSZ-xxVx/yyyy

Where

Z = 150M for 150W model (May be followed by 'D' for DC input)

100ME for 100W model

xxVx = Channel 1 output voltage from within the output voltage adjustment range from the Output Parameters Table below.

yyyy = Unit options from list of standard unit options below, or non-safety related model differences

/M = Molex connectors

/E = Single fuse in the live line

/U = U chassis

/A = Cover and U chassis

/F = Top fan, cover and U chassis (CUS150M model only)

/B = Baseplate

/H = alternate link wire and discharge resistors (60335-1 compliant, and 62368-1 approved only)

Non standards

KCUSZ-xxVx-yyyy/H

Where:

Z = 150M for 150W model (May be followed by 'D' for DC input)
100ME for 100W model

xxVx = Channel 1 output voltage from within the output voltage adjustment range from the Output Parameters Table below.

yyyy = Unit options from list of standard unit options below, or non-safety related model differences

/M = Molex connectors

/E = Single fuse in the live line

/U = U chassis

/A = Cover and U chassis

/F = Top fan, cover and U chassis (CUS150M model only)

/B = Baseplate

Followed by

/H = alternate link wire and discharge resistors (60335-1 compliant, 62368-1 approved only CUS150M model)

Input Parameters

Standard	60601-1	62368-1/61010-1	62368-1/61010-1/60601-1*
Nominal input voltage	100 - 240Vac	100 - 240Vac	133 - 318Vdc
Input voltage range	85 - 264Vac	85 - 264Vac	120 - 350Vdc
Input frequency range	47 - 63Hz	47 - 440Hz	DC
Maximum input current	2.2A rms	2.2A rms	1.8A

* 60601-1 2nd ed, 300Vdc input max.

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

Output power is reduced linearly by 10% for input voltages from 90 to 85Vac

Output Parameters

There are seven CUS150M and CUS100ME standard models as shown in the tables below. All of these models may be fan(CUS150M model only), forced air, conduction or convection cooled. The output parameters are shown in the tables below.

Outputs are not user adjustable but can be factory set.

CUS150M

Model	Vout Range (V)	*Fan Vnom (V)	Max Iout (A)	Max Pout (W)	*Fan Output ratings	
					Inom (A)	Pnom (W)
12	12-13.2	11.6	12.5	150	0.5	5.8
15	15-16.5	9.8	10	150	0.5	4.9
18	18-19.8	11.6	8.33	150	0.5	5.8
24	24-26.4	11.6	6.25	150	0.5	5.8
28	28-30.8	10.8	5.4	150	0.5	5.4
36	36-39.6	11.6	4.2	150	0.5	5.8
48	48-50	11.6	3.125	150	0.5	5.8

* Fan output tracks Vout Range

Variation and Limitations:

Customer Forced Air Cooling max ambient 85°C (note 1)

Convection and conduction/cold plate Cooling (U chassis with lid-Option A) max ambient 75°C (note 1)

Convection and conduction/cold plate Cooling (U chassis and open frame) max ambient 80°C (note 1)

Fan supplied ratings/Option F max ambient 70°C, from 50°C to 70°C the output power is de-rated by 0.5°C per watt

Note 1. Maximum output power and current ratings are dependent on the ambient used in the end equipment.

CUS100M

Model	Vout Range (V)	Max Iout (A)	Max Pout (W)
12	12-13.2	8.33	100
15	15-16.5	6.66	100
18	18-19.8	5.55	100
24	24-26.4	4.16	100
28	28-30.8	3.57	100
36	36-39.6	2.77	100
48	48-50	2.08	100

Variation and Limitations:

Customer Forced Air Cooling max ambient 85°C (note 1)

Convection and conduction/cold plate Cooling (U chassis with lid-Option A) max ambient 75°C (note 1)

Convection and conduction/cold plate Cooling (U chassis and open frame) max ambient 80°C (note 1)

Note 1. Maximum output power and current ratings are dependent on the ambient used in the end equipment.

KCUS100ME-32/0001# is electrically identical to CUS100ME series except for the following:

- model designation
- Input tolerances (see technical consideration for details).
- Class II only
- output ratings
- Input (J1)/Output (J100) connectors are placed on the underside of the PCB and J2 not fitted.

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

Cooling for units with forced air cooling.

The product can also operate at input voltage lowered to 85Vac with linear output de-rating to -10%.

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 tests 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.

Test 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.

Cooling for unit temperature table:

CUS150M Cooling for Unit Temperature Table:

Circuit Ref.	Description	Max. Temperature (°C)
L1	Common Mode Choke	110 (130)
L2	PFC choke	125 (130)
L3	Differential mode choke	125 (130)
C1	Film capacitor	105
C2, C110	Electrolytic Capacitors	86 (105)
C6, C102, C104, C105	Electrolytic Capacitors	92 (105)
C3	X Capacitor	100
C5, C100, C101, C103	Y Capacitors	105
TX100	Transformer Winding	110
XU101, XU102	Opto-Coupler	100 (110)
XD8	Diode	130
J1	Input Connector	105

J100 Output Connector 105

CUS100ME Cooling for Unit Temperature Table:

Circuit Ref.	Description	Max. Temperature (°C)
L1	Common Mode Choke	110 (130)
L2	PFC choke	125 (130)
L3	Differential mode choke	125 (130)
C1	Film capacitor	105
C2	Electrolytic Capacitors	90 (105)
C104, C105	Electrolytic Capacitors	92 (105)
C6, C102	Electrolytic Capacitors	93 (105)
C3	X Capacitor	100
C5, C100, C101, C103Y	Capacitors	105
TX100	Transformer Winding	110
XU101, XU102	Opto-Coupler	100 (110)
XD8	Diode	130
J1	Input Connector	105
J100	Output Connector	105

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

Technical Amendment

The original report was modified due to the following Critical Component list updates:

- Added alternate input connector J1 - 09652038 (5273 Series) manufactured by Molex,
- Added manufacturer to the TX100 insulation system CB2 and CB3.

CBTL changed to UL International Poland Sp. z o.o.

Based on the previous investigation no additional testing was considered necessary.

Technical Considerations

- The product was submitted and evaluated for use at the maximum ambient temperature (Tma) permitted by the manufacturer's specification of : 50°C
- The product is intended for use on the following power systems : TN, TT, IT(Norway), DC mains supply (CUS150M DC rated only) nominal voltage range 133-318 Vdc, restricted voltage 120-350Vdc.
- Considered current rating of protective device as part of the building installation (A) : 20
- Mains supply tolerance (%) or absolute mains supply values : AC Mains supply: +10%/-10%; (+10%/-20% for KCUS100ME-32/0001# only); DC mains supply: (CUS150M DC rated only) +10%/-10%
- The equipment disconnect device is considered to be : Provided in the end-product
- 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 means of connection to the mains supply is: to be determined in the end-product.
- Above 50°C the total output power and current ratings are both de-rated to ensure power curves are met. Refer to Handbook in Enclosures 6-01 and 6-02 for the power curves.
- 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. The

power supply needs to be fixed so that it is insulated from any unearthed accessible conductive part by reinforced insulation.

- The component temperatures listed in the Additional Information shall not be exceeded.
- The minimum CLEARANCE is multiplied by the factor 1.48 corresponding altitude of 5000m given in IEC 60664-1.
- The power supply can be used as either a Class I or a Class II construction except for KCUS100ME-32/0001# which is a Class II only.

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 : Electric Strength, Earthing Continuity (except for XMSxD model)
- The end-product Electric Strength Test is to be based upon a maximum working voltage of : Primary-Secondary: 283 Vrms, 480 Vpk, Primary-Earthed Dead Metal: 404.7 Vrms, 421.7 Vpk
- The following output circuits are at ES1 energy levels : 12V, 15V, 18V, 24V and 36V models
- The following output circuits are at ES2 energy levels : 48V models
- The following output circuits are at PS3 energy levels : All circuits
- The maximum investigated branch circuit rating is : 20 A
- The investigated Pollution Degree is : 2
- The following end-product enclosures are required : Mechanical, Electrical, Fire
- The following magnetic devices (e.g. transformers or inductor) are provided with an OBJ2 insulation system with the indicated rating greater than Class A (105°C) : TX100 Class B
- 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.
- Fans: The fan provided in this sub-assembly is not intended for operator access.
- The power supply can be forced air (top fan or customer air) or convection cooled. Due to the fact that air flow for cooling depends on end product use, only convection cooling and top fan configurations were considered during temperature measurement.
- The following output terminals were referenced to earth during performance testing: Output negative.
- For option /E = Single fuse in the live line, end-product must be provided with a polarized plug.
- If this product is installed as Class I the protective bonding point J100 must be verified in the end-product.
- Prospective touch voltage, touch current and protective conductor current has not been evaluated for 440 Hz supply must be evaluated in the end-product.
- For Class II construction, if any unearthed conductive parts are provided in the end product besides the outputs these part or parts must be tested for Prospective touch voltage, and touch current as part of the end-product.