



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 ; Correction 1 : 2019-02-18  
**Total number of pages** .....: 17

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

**Name of Test Laboratory** .....: UL International Polska Sp. z o.o.  
**preparing the Report** .....: Aleja Krakowska 81, 05-090 Sekocin Nowy, 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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**General disclaimer:**  
The test results presented in this report relate only to the object tested.  
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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 .....	SAME AS APPLICANT
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)
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.  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  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. Aleja Krakowska 81, 05-090 Sekocin Nowy, Poland	
<input type="checkbox"/> Associated CB Testing Laboratory:		
Testing location/ address .....		
Tested by (name + signature).....:	Casper Larsen / Project Handler	
	Approved by (name + signature).....:	Jan J. Jensen / Reviewer
		
<input type="checkbox"/> Testing procedure: TMP/CTF Stage 1		
Testing location/ address .....		
Tested by (name + signature).....:		
Approved by (name + signature) .....		
<input type="checkbox"/> Testing procedure: WMT/CTF Stage 2		
Testing location/ address .....		
Tested by (name + signature).....:		
Witnessed by (name + signature).....:		
Approved by (name + signature) .....		

<input type="checkbox"/>	Testing procedure: SMT/CTF Stage 3 or 4	
Testing location/ address..... :		
Tested by (name + signature).....:		
Approved by (name + signature).....:		
Supervised by (name + signature).....:		

Correction 1 2019-02-18

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

National Differences (0 pages)

Enclosures (2 pages)

**Summary of testing:**

No tests were conducted.

**Tests performed (name of test and test clause):****Testing Location:****Summary of compliance with National Differences:****List of countries addressed:** AU,NZ, EU Group Differences, US,CA **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

Correction 1 2019-02-18

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

Correction 1 2019-02-18

<b>TEST ITEM PARTICULARS:</b>	
Classification of use by	Skilled person
Supply Connection	AC Mains DC Mains ES3
Supply % Tolerance	+10%/-10%
Supply Connection – Type	pluggable equipment type A - mating connector permanent connection
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	50 °C
IP protection class	IPX0
Power Systems	TN TT IT - 230Vac(Norway) V L-L
Altitude during operation (m)	5000 m
Altitude of test laboratory (m)	2000 m or less
Mass of equipment (kg)	1kg max kg
<b>POSSIBLE TEST CASE VERDICTS:</b>	
- 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)
<b>TESTING:</b>	
Date of receipt of test item..... :	N/A
Date (s) of performance of tests..... :	N/A
<b>GENERAL REMARKS:</b>	
<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>	
<b>Manufacturer’s Declaration per sub-clause 4.2.5 of IEC60335-1:</b>	

Correction 1 2019-02-18

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

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

**Report Summary**  
The original report was modified on 2019-02-18 to include the following changes/additions:  
This non technical correction is due to the following changes:  
- Correct the Unit production code nomenclatura due to typos.  
- Clarify Engineering Condition of Acceptability regarding Class II construction and unearthed conductive parts.

**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.  
- 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.



Correction 1 2019-02-18

**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 left 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

Correction 1 2019-02-18

- /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:

Correction 1 2019-02-18

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.

**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:

Correction 1 2019-02-18

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 Considerations

- The product was submitted and evaluated for use at the maximum ambient temperature (T<sub>ma</sub>) permitted by the manufacturer's specification of : 50°C

Correction 1 2019-02-18

- 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%; 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.

### 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 OBJY2 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.

Correction 1 2019-02-18

- 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.

### ENERGY SOURCE DIAGRAM

Indicate which energy sources are included in the energy source diagram. Insert diagram below

ES     PS     MS     TS     RS



**PS3**



**TS3**

48 V output models:



Other models:

