Test Report issued under the responsibility of:

TEST REPORT

IEC 60950-1

Information technology equipment – Safety – Part 1: General requirements

Report Number. .....:	T223-0448/14
Date of issue .....:	2014-12-05
Total number of pages.....	284 pages
Applicant's name.....:	TDK-Lambda UK Limited
Address .....:	Kingsley Avenue, Ilfracombe, Devon EX34 8ES, United Kingdom
Test specification:	
Standard .....:	IEC 60950-1:2005 (Second Edition) + Am 1:2009 + Am 2:2013
Test procedure.....:	CB Scheme
Non-standard test method.....:	N/A
Test Report Form No.....:	IEC60950_1F
Test Report Form(s) Originator.....:	SGS Fimko Ltd
Master TRF .....:	Dated 2014-02

If this Test Report Form is used by non-IECEE members, the IECEE/IEC logo and the reference to the CB Scheme procedure shall be removed.

This report is not valid as a CB Test Report unless signed by an approved CB 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 CB Testing Laboratory. The authenticity of this Test Report and its contents can be verified by contacting the NCB, responsible for this Test Report.

Test item description .....:	Switch mode power supply for building-in
Trade Mark .....:	TDK-Lambda
Manufacturer.....:	TDK-Lambda UK Limited Kingsley Avenue, Ilfracombe, Devon EX34 8ES, United Kingdom
Model/Type reference.....:	ZMS100-X/E/T/J or CUS100MA-X/E/T/J Where: -X = Output Voltage as detailed in the Output Parameters tables below. /E = Curve B radiated for emc /T = Earth fast-on terminal not fitted /J = JST input and/or output connectors fitted Type references may be prefixed by SP and/or NS # followed by / or - (where # may be any number of characters indicating non-safety related model differences)
Ratings .....:	Input: 100 – 240 Vac; 47 – 63 Hz; 2,2 A max. Output:

Forced air cooling

Model	Output voltage (V⎓)	Output current (A)	Output power (W)
ZMS100-12	12	8,4	100,8
ZMS100-15	15	6,7	100,5
ZMS100-24	24	4,2	100,8
ZMS100-28	28	3,6	100,8
ZMS100-36	36	2,8	100,8
ZMS100-48	48	2,1	100,8

Convection cooling

ZMS100-12	12	6,7	80,4
ZMS100-15	15	5,4	81
ZMS100-24	24	3,4	81,6
ZMS100-28	28	2,9	81,2
ZMS100-36	36	2,25	81
ZMS100-48	48	1,67	80,2

Testing procedure and testing location:			
☒	CB Testing Laboratory:	Slovenian Institute of Quality and Metrology (SIQ) Testing Laboratory is accredited by Slovenian Accreditation, Reg. No.: LP-009	
Testing location/ address.....:		Tržaška c. 2, SI-1000 Ljubljana Slovenia	
☐	Associated CB Testing Laboratory:		
Testing location/ address.....:			
Tested by (name + signature).....:		Janez Vidmar	
Approved by (name + signature).....:		Gregor Schoss	
☐	Testing procedure: TMP/CTF Stage 1:		
Testing location/ address.....:			
Tested by (name + signature).....:			
Approved by (name + signature).....:			
☐	Testing procedure: WMT/CTF Stage 2:		
Testing location/ address.....:			
Tested by (name + signature).....:			
Witnessed by (name + signature).....:			
Approved by (name + signature).....:			
☐	Testing procedure: SMT/CTF Stage 3 or 4:		
Testing location/ address.....:			
Tested by (name + signature).....:			
Witnessed by (name + signature).....:			
Approved by (name + signature).....:			
Supervised by (name + signature).....:			

List of Attachments:

1. Test Report
2. National Differences – Enclosure No. 1
3. European Group Differences and National Differences according to EN 60950-1:2006 + A1:2010 + A2:2013 + A11:2009 + A12:2011 – Enclosure No. 1a
4. Pictures – Enclosure No. 2
5. Schematics, Layouts, Transformer data - Enclosure No. 3
6. IEC 61010-1:2010 / EN 61010-1:2010 requirements – Enclosure No. 4

Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**
1.6.2 Input Test **1.7.11 Durability** **2.1.1.5 Energy Hazard Measurements** **2.1.1.7 Capacitance Discharge Test** **2.2.2 SELV: Hazard Voltage (Circuit) Measurement Test** **2.2.3 SELV Reliability testing** **2.4 Limited Current Circuit (Bridging components)** **2.6 Earthing Test, earth trace test (UL PAG)** **2.9.2 Humidity Test** **2.10.2 Working Voltage measurement on PCB and Transformer** **2.10.3/2.10.4 Clearance and Creepage distance measurement** **2.10.5 Distance Through Insulation measurement** **4.2.2 Steady force test, 10N** **4.5.2 Heating (Temperature) Test** **4.5.5 Resistance to abnormal heat (Ball pressure test)** **5.1 Touch Current and protective conductor current** **5.2 Electric Strength Test** **5.3 Abnormal Operating Tests foreseeable misuse:** **SELV reliability and failure in the voltage regulation** **Functional insulation,** **Component faults** **Overload and short at the outputs**	**SIQ Ljubljana, Tržaška c. 2, SI-1000 Ljubljana, Slovenia**

Summary of compliance with National Differences

List of countries addressed:

Argentina**, Australia, Austria***, Bahrain**, Belarus**, Belgium***, Brazil**, Bulgaria***, Canada, China, Cyprus***, Colombia**, Croatia**, Czech Republic***, Denmark***, Finland***, France***, Germany***, Greece***, Hungary***, India**, Indonesia**, Iran**, Ireland***, Israel, Italy***, Japan*, Kazakhstan**, Kenya**, Korea, Lybia**, Malaysia**, Mexico**, Netherlands***, New Zealand*, Norway***, Pakistan**, Poland***, Portugal***, Romania***, Russian Federation**, Saudi Arabia**, Serbia**, Singapore**, Slovakia***, Slovenia***, South Africa**, Spain***, Sweden, Switzerland, Thailand**, Turkey***, Ukraine**, United Arab Emirates**, United Kingdom, Uruguay**, USA, Vietnam**

* No national differences to IEC 60950-1:2005 (2nd edition) (+ A1 + A2) declared

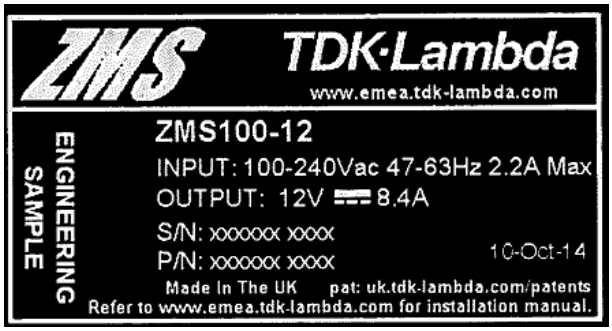
** No national differences to IEC 60950-1:2005 (2nd edition) + A1 + A2 or IEC 60950-1:2001 (1st edition) declared

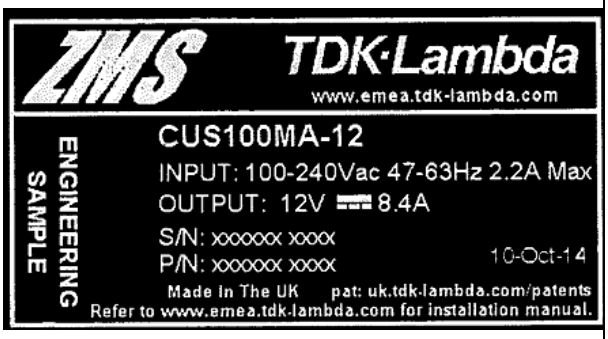
*** EU group differences

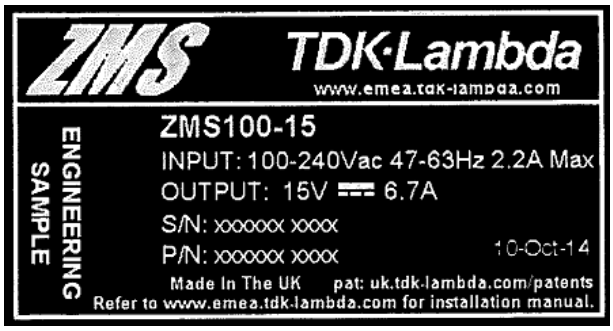
☒ **The product fulfils the requirements of EN 60950-1:2006 + A1:2010 + A2:2013 + A11:2009 + A12:2011 (see Enclosure No. 1a).**

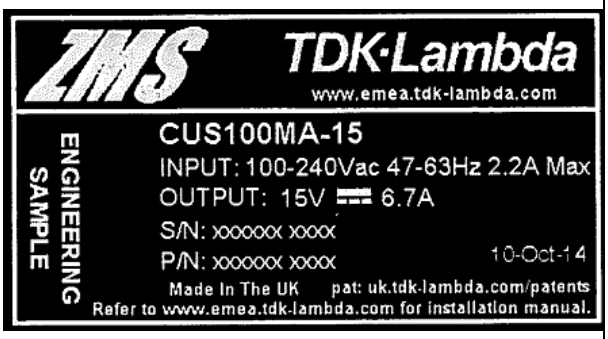
Copy of marking plate

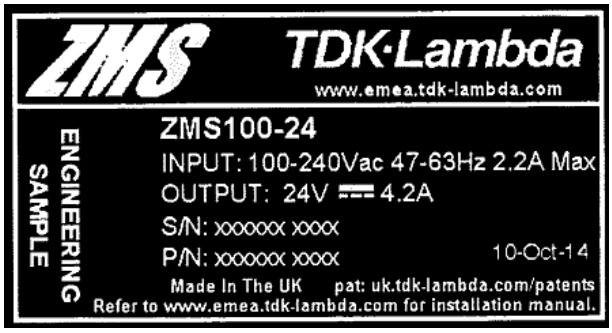
The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.

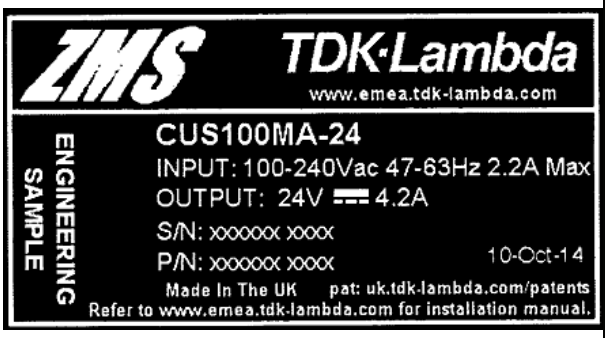


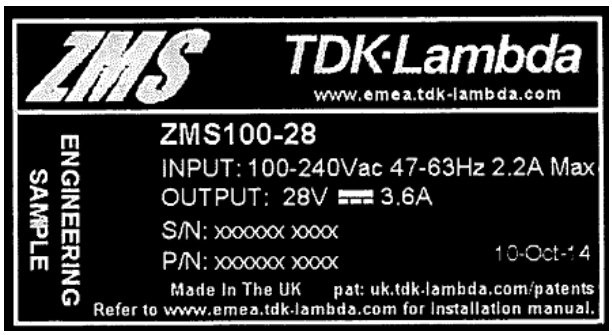


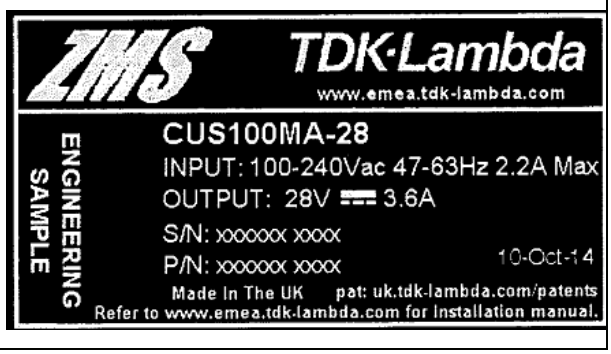


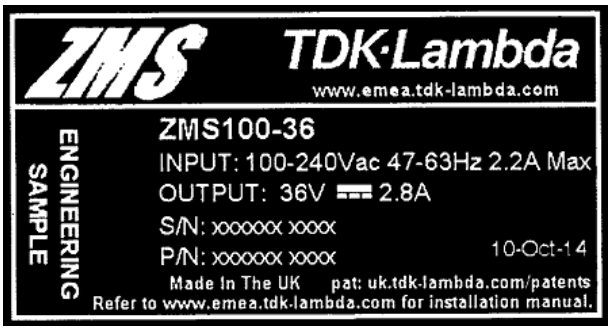


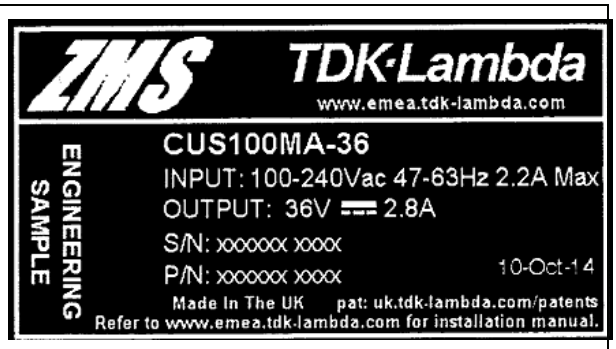


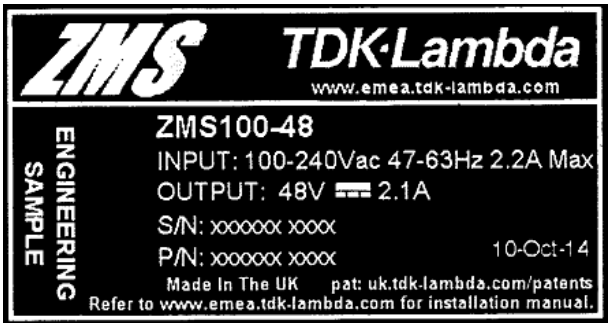


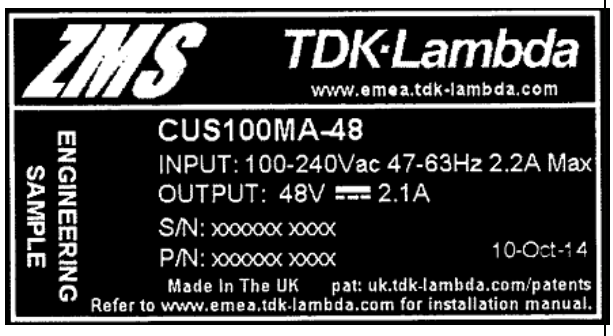





ZMS
TDK·Lambda
www.emea.tdk-lambda.com
ENGINEERING SAMPLE
ZMS100-36
INPUT: 100-240Vac 47-63Hz 2.2A Max
OUTPUT: 36V ⎓ 2.8A
S/N: xxxxxx xxxx
P/N: xxxxxx xxxx
10-Oct-14
Made In The UK pat: uk.tdk-lambda.com/patents
Refer to www.emea.tdk-lambda.com for installation manual.


ZMS
TDK·Lambda
www.emea.tdk-lambda.com
ENGINEERING SAMPLE
CUS100MA-36
INPUT: 100-240Vac 47-63Hz 2.2A Max
OUTPUT: 36V ⎓ 2.8A
S/N: xxxxxx xxxx
P/N: xxxxxx xxxx
10-Oct-14
Made In The UK pat: uk.tdk-lambda.com/patents
Refer to www.emea.tdk-lambda.com for installation manual.


ZMS
TDK·Lambda
www.emea.tdk-lambda.com
ENGINEERING SAMPLE
ZMS100-48
INPUT: 100-240Vac 47-63Hz 2.2A Max
OUTPUT: 48V ⎓ 2.1A
S/N: xxxxxx xxxx
P/N: xxxxxx xxxx
10-Oct-14
Made In The UK pat: uk.tdk-lambda.com/patents
Refer to www.emea.tdk-lambda.com for installation manual.


ZMS
TDK·Lambda
www.emea.tdk-lambda.com
ENGINEERING SAMPLE
CUS100MA-48
INPUT: 100-240Vac 47-63Hz 2.2A Max
OUTPUT: 48V ⎓ 2.1A
S/N: xxxxxx xxxx
P/N: xxxxxx xxxx
10-Oct-14
Made In The UK pat: uk.tdk-lambda.com/patents
Refer to www.emea.tdk-lambda.com for installation manual.

Test item particulars ..... :	
Equipment mobility ..... :	[] movable [] hand-held [] transportable [] stationary [x] for building-in [] direct plug-in
Connection to the mains ..... :	[] pluggable equipment [] type A [] type B [] permanent connection [] detachable power supply cord [] non-detachable power supply cord [x] not directly connected to the mains
Operating condition ..... :	[x] continuous [] rated operating / resting time:
Access location ..... :	[] operator accessible [] restricted access location [x] service access area (for building-in)
Over voltage category (OVC) ..... :	[] OVC I [x] OVC II [] OVC III [] OVC IV [] other:
Mains supply tolerance (%) or absolute mains supply values ..... :	85 – 264 Vac 47 – 440 Hz
Tested for IT power systems ..... :	[] Yes [x] No
IT testing, phase-phase voltage (V) ..... :	N/A
Class of equipment ..... :	[] Class I [] Class II [] Class III [x] Not classified SMPS complies with either class I or Class II construction.
Considered current rating of protective device as part of the building installation (A) ..... :	16 A and 20 A
Pollution degree (PD) ..... :	[] PD 1 [x] PD 2 [] PD 3
IP protection class ..... :	IPX0
Altitude during operation (m) ..... :	5000
Altitude of test laboratory (m) ..... :	300
Mass of equipment (kg) ..... :	0,15
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 ..... :	2014-06-02, 2014-09-16, 2014-10-03, 2014-10-08, 2014-10-17, 2014-10-20
Date(s) of performance of tests ..... :	From 2014-06-20 to 2014-10-22

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 6.2.5 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 Limited
Kingsley Avenue, Ilfracombe, Devon EX34 8ES,
United Kingdom

Panyu Trio Microtronic Co., Ltd
Shiji Industrial Estate, Dongyong, Nansha,
Guangzhou Guangdong,
China

General product information:

The power supply is an open frame switch mode power supply for building-in.

The power supply can be used as Class I or Class II construction.

- For Class I construction, the SMPS need to be reliably earthed and professionally installed and fixed with metal screws.
- For Class II construction no earthing connection is required. The SMPS need to be fixed so, that it is insulated from any unearthed accessible conductive part by reinforced insulation for a working voltage of 240 Vrms (e.g. fixed to metal enclosure by means of plastic spacers and plastic screws).

The power supply provides internally two fuses, one in line and one in neutral.

The power supply may be either forced air or convection cooled. Due to the fact, that air flow for cooling depends on end product use, only convection cooling was considered during temperature measurement.

Therefore, the following temperatures within end equipment use shall not be exceeded:

Circuit Ref.	Description	Max. Temperature (°C)
L1	Common Mode Choke	155
C6, C7, C8	Electrolytic Capacitors	105
C5	Electrolytic Capacitors	105
C1	X Capacitor	100
C2, C3, C4, C10, C11	Y Capacitors	125
TX1	Transformer Winding	140
XU2, XU4	Opto-Coupler	100
J1	Input Connector	85
J2	Output Connector	85

Model Differences:

All models provide different transformer construction. The secondary output windings have different number of turns to get different secondary output voltages.

12V and 15V models have an additional secondary winding (W4). This winding is not used for the other models. Winding W4 utilises triple insulated wire, which provides reinforced insulation between the output contacts. Therefore, no short or overload was applied directly on the output contacts.

2 different PCB layouts are used: the 12V & 15V models have the same PCB layout, and the 24V, 28V, 36V and 48V models have the same PCB layouts.

The units provide also differences in electrical scheme due to different output voltages:

- 12V & 15V models have different values of resistors XR20, XR21, XR35 and XR42
- 24V, 28V, 36V and 48V models have different values of resistors XR20, XR21, XR5, XR41

The following components are glued to prevent movement:

- For 12V & 15V models: RT1, C5, C11, C7, C8, C9, C12, FE wire on PCB near C8, primary windings of transformer TX1 on PCB
- 24V, 28V, 36V and 48V models: RT1, C5, C6, C7, C8, C11, C2, FE wire on PCB near C2/C11, primary windings of transformer TX1 on PCB

Explanation of the test program:

a) The component was additionally tested according to the standard IEC 61010-1:2010 and EN 61010-1:2010 and fulfils the requirements of these standards.

b) Secondary output circuit is separated from mains by reinforced insulation and rated SELV. The output does not provide hazard energy level.

c) In case the power supply is used as class I construction, the power supply shall be properly bonded to the main protective bonding termination in the end product. The earth leakage current is within the specified limits.

d) The transformers TX1 provide reinforced insulation and utilize a UL Insulation System (see appended table 1.5.1 for details)

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

f) A suitable Electrical and Fire enclosure shall be provided in the end equipment.

g) The SMPS was evaluated for convection cooling for a maximum ambient of 50°C with the following output load condition. Additionally, from 85 Vac to 90 Vac input voltage, the output power is de-rated linearly from 80 W to 70 W.

Model	ut voltage (V⎓)	ut current (A)	ut power (W)
MS100-12	12	6,7	80,4
MS100-15	15	5,4	81,0
MS100-24	24	3,4	81,6
MS100-28	28	2,9	81,2
MS100-36	36	2,25	81,0
MS100-48	48	1,67	80,2

h) The SMPS was also evaluated for convection cooling for a maximum ambient up to 70°C with the output power (see table above) de-rated at 2,5% per °C from 50°C to 70°C ambient.

i) The power supply may be either forced air or convection cooled. Due to the fact, that air flow for cooling depends on end product use, only convection cooling was considered during temperature measurement.

Approval within the end product:

- Leakage current measurement should be verified with the unit built into the end product.
- EMC testing has to be performed together with the end medical product.
- Temperatures within end ME Equipment use shall not be exceeded.

Abbreviations used in the report:

- normal conditions	**N.C**.	- single fault conditions	**S.F.C**
- functional insulation	**OP**	- basic insulation	**BI**
- double insulation	**DI**	- supplementary insulation	**SI**
- between parts of opposite polarity	**BOP**	- reinforced insulation	**RI**

Indicate used abbreviations (if any)