




Test Report issued under the responsibility of:



<b>TEST REPORT</b> <b>IEC 62368-1</b> <b>Audio/video, information and communication technology equipment</b> <b>Part 1: Safety requirements</b>	
Report Number .....	E135494-A6001-CB-1
Date of issue.....	2018-08-24 ; Amendment 3 : 2020-12-11
Total number of pages .....	36
Applicant's name.....	<b>TDK-LAMBDA UK LTD</b>
Address .....	<b>KINGSLEY AVE</b> <b>ILFRACOMBE</b> <b>EX34 8ES UNITED KINGDOM</b>
Name of Test Laboratory preparing the Report .....	UL VS Limited Unit 1-3 Horizon, Wade Road, Kingsland Business Park, Basingstoke RG24 8AH, United Kingdom
<b>Test specification:</b>	
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	:	XMS350 or XMS-350, XMS500 or XMS-500, XMS500P or XMS-500P, XMS500A or XMS-500A, XMS500AP or XMS-500AP series switch mode power supplies (see report Model Differences for details)
Ratings	:	XMS350, XMS-350: 100-240Vac nom, 47-63Hz, 5.3A rms max. XMS500, XMS-500, XMS500P, XMS-500P, XMS500A, XMS-500A, XMS500AP, XMS-500AP: 100-240Vac nom, 47-63Hz, 7A rms max. (see report Model Differences for details and variations)
<b>Testing procedure and testing location:</b>		
<input type="checkbox"/>	CB Testing Laboratory:	
Testing location/ address		
Tested by (name + signature)		
Approved by (name + signature)		
<input type="checkbox"/>	Testing procedure: CTF Stage 1	
Testing location/ address		
Tested by (name + signature)		
Approved by (name + signature)		
<input type="checkbox"/>	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).....:	Matt Carter / Tester	See the original/ amendment CBTR for signatures
Witnessed by (name + signature).....:	Hubert Koszewski / Witness	See the original/ amendment CBTR for signatures
Approved by (name + signature) .....	Tracy Burgess / Approver	See the original/ amendment CBTR for signatures
Supervised by (name + signature) .....	Dennis Butcher / Reviewer	See the original/ amendment CBTR for signatures

<p><b>List of Attachments (including a total number of pages in each attachment):</b></p> <p>National Differences (0 pages) Enclosures (3 pages)</p>	
<p><b>Summary of testing:</b></p>	
<p><b>Tests performed (name of test and test clause):</b> None</p>	<p><b>Testing Location: None</b></p>
<p><b>Summary of compliance with National Differences:</b></p> <p><b>List of countries addressed:</b> EU Group and National Differences, USA / Canada</p> <p>EU Group and National Differences applies to CENELEC member countries: Austria , Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom</p> <p><input checked="" type="checkbox"/> <b>The product fulfils the requirements of:</b> 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</p>	

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

<b>TEST ITEM PARTICULARS:</b>	
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
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)	1kg max
<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..... :	2016-09-27, 2018-05-30 to 2020-06-17
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 IEC60068-2-1:</b>	

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"/> <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.**

<b>Name and address of factory (ies) .....</b> :	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  TRIO-TRONICS (THAILAND) LTD 7/295 MU. 6 MAP YANG PHON SUB-DISTRICT PLUAK DAENG DISTRICT RAYONG PROVINCE THAILAND
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**GENERAL PRODUCT INFORMATION:**

**Report Summary**

The original report was modified on 2020-12-11 to include the following changes/additions:  
 Technical Amendment: This report has been revised for adding an alternate magnetic supplier "Axis Corporation" in the LoCC table.

Based on the previously conducted testing and the review of product technical documentation, it has been determined that the product continues to comply with the standard and all required tests were carried out under the original investigation.

This report should be read in conjunction with CBTR Ref. No: E135494-A6001-CB-1-Original - Amendment-1, and -Amendment-2; CBTC Ref. no: DK-76011-M2-UL issued on 2020-07-30.

**Product Description**

XMS350 or XMS500 series switch mode power supplies  
 (See Model Differences for details and variations)

The series consists of two power outputs, a 350W and 500W, these use the same topology with some component variations.

The XMS series switch mode power supply consists of:

1. Input filter, consisting of the input fuse(s), X and Y capacitors, common mode chokes up to the bridge and series choke after the bridge.
2. PFC (boost circuit), consisting of the boost choke and associated switching FETs/circuitry.
3. Forward converter, consisting of the main transformer and switching FETs/circuitry supplying channel 1 and fan supply outputs.

4. Standby circuit, consisting of the standby transformer and switching IC/circuitry supplying the standby output.
5. Secondary circuits (ES1 and ES2 as applicable), consisting of channel 1 output, standby output, fan supply (derived from the channel 1 output ), power OK and inhibit/enable.

#### Model Differences

XMS350 or XMS500 series (may also be marked as XMS-350 or XMS-500) as described below:

Units may be marked with a Product Code: Xy where y may be any number of characters.

Unit Configuration Code (Description): may be prefixed with NS # or K # followed by / or - (where # may be any number of characters indicating non-safety related model differences).

Unit Configuration Code (Description): may be prefixed by SP followed by / or – (where SP represents a sales code)

Unit Configuration (Description)

XMSxy-a-bc-defghijklm

where:

x = 350 for 350W model  
 500 for 500W model  
 500A for enhanced 500W model (less than 1W inhibited)  
 500P for 576W peak power models (36V, 40V and 48V output models only)  
 500AP for enhanced 500W model with 576W peak power (36V, 40V and 48V output models only)

y = Blank for Class I  
 D for Class II

a = Channel 1 Output Voltage (see Ch1 in the table below, adjustment range column).

b = Standby Output Voltage: see standby voltage in table below  
 N for no supply  
 5 for 5 volt  
 12 for 12 volt

c = Standby Output Current†:  
 C for 0.5A  
 M for 1.0A  
 H for 2.0A  
 N for no supply or 0 amps output

d = Fan Supply†:  
 N for no fan supply (customer cooling)  
 N1 for 24V fan supply (customer cooling)  
 N2 for 12V variable supply



N3 for 12V fixed supply  
 KF for non-standard top fan  
 TF for top-fan

e = U for non-standard U chassis  
 P for perforated frame  
 N for Open Frame  
 C for custom chassis/covers for non-standard models  
 S for standard U chassis  
 B for standard U chassis with perforated cover

f = Touch (Enclosure) current:  
 B for <100uA  
 T for <75uA

g = Earth leakage current:  
 D for Class II (no Earth)  
 L for <300uA  
 R for <150uA  
 T for <100uA

h = E or In for inhibit  
 T or En for enable

i = A for AC OK option  
 N for no AC OK option  
 P for Power Good Option (500A or 500PA models only)

j = Blank for dual fuses fitted  
 FL for single fuse fitted in the Live line

klm = Blank for standard output settings

May be three numbers from 0 to 9 (preceded by -) which denotes various output voltage/current settings within the specified ranges of each output for a particular unit. (may define non-safety related parameters/feature, e.g. reduced primary current limit, reduced OVP)

#### Input Parameters

Nominal input voltage	100 - 240 Vac
Input voltage range	85 - 264 Vac
Input frequency range	47 - 63 Hz
Maximum input current	7A (5.3A*) rms

\* Input for 350W models.

All ratings apply for ambient temperatures up to 50°C.

At 85Vac the following deratings apply to all XMS500 TF models: 500W output power at 40°C ambient or 400W output power at 50°C ambient.

Output Parameters

†Output ratings are in accordance with the following table:

Standard models:

Output Channel	Voltage Designation	Vout nom.(V)	Adjustment Range (V)	Output Current (A)	Output Power (W)
CH1 (500W)	12	12	11.6 - 13.2	41.6	500
	24	24	23.8 - 25.2	20.8	500
	36	36	35.4 - 37.8	13.8(16*)	500(576*)
	40	40	38 - 42	12.5(15.16*)	500(576*)
	48	48	47-50	10.4(12*)	500(576*)
CH1 (350W)	24	24	23.8 - 25.2	14.6	350
Standby Option	5	5	5 - 5.5	0.5	2.75
	5	5	5 - 5.5	2.0	11.0
	12	12	12-13.2	1	13.2
	N	10	5 – 15	0	0
Fan Supply	N	-	-	-	-
	N1	24	Fixed	0.2	4.8
	N2	12	6-12	-	3.0
	N3	12	Fixed	0.25	3.0

\*576W peak power up to 2 minutes with 500Wrms power using the following formula:

$$500Wrms = ((peakpower^2 \times T1 + reducedpower^2 \times T2)/(T1 + T2))^{1/2}$$

Where T1 = peak power time on in seconds

T2 = reduced power time on in seconds

Non-Standard Models:

X00011#	XMS350-24-NN-N1CBLEN	Customer specific chassis
X00023#	XMS500D-24.5-5C-KFCBDEN	Customer specific top fan/chassis model
X00073#	XMS500-24-NN-NCBRInA	Customer specific chassis/cover

Where # can be any letter denoting non-safety related changes.

Output Limitations:

The following outputs are ES1: 12, 24, 36, 40V

The following outputs are ES2: 48V

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

Cooling for units with customer supplied air (all models except KF and TF fan supplies)

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:

Circuit Ref:	Description	Max. Temperature (°C)
J1	Input Connector	105
C7, C8	X Capacitor	100
L2, L4	Common Mode Choke Winding	130 (145)
L6	Series Mode Choke Winding	130
ASY5 D7	Bridge Diode	125 (130)
C14, C11, C21, C22, C10, C23, C24, C6, C18 (++)	Y Capacitors	100
C26	Capacitor	85 (105)
RLY1	Relay	100
U1, U2, U5, U6, U7 (++)	Opto-Coupler	100
TX1 (Standby)	Windings and core	120 (130)
TX3 500W	Windings and core	120 (130)
TX3 350W	Windings and core	100 (110)
ASY6 Q3	Boost FET	127 (130)
ASY4 Q1	Forward FET	127 (130)
ASY3 Q4	Output FET	127 (130)
C13	Boost Capacitor	80 (105)
C9	Boost Capacitor	70 (105)
L3, L5	Boost Choke Winding	130 (140)
L7	Channel 1 Output Choke	130 (140)
C4, C5, C15, C16, C17		

C19, C20 (++)	Electrolytic Capacitors	80 (105)
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+ The higher temperature limits in brackets may be used but product life may be reduced.

++ When fitted

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The marking label provided is representative of all models.

The test item receipt dates shown are those of the original/ amendment testing.

### 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
- 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-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
- Multi-layer PWBs accepted under CBTR Ref. No. E349607-A23 dated 2014-07-31 and letter report in Enclosure 8-01.
- 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 voltage.

### 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 – Earthed Dead Metal: 365Vrms, 632Vpk; Primary-Secondary: 405Vrms, 655Vpk
- The following output circuits are at ES1 energy levels : 12, 24, 36, 40V 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
- Proper bonding to the end-product main protective earthing termination is : Required (except for the XMSxD model)
- An investigation of the protective bonding terminals has : been conducted
- 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) : TX1 Class F. TX3 (Class B or F) see table 1.5.1 for details of insulation systems used.
- 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.
- All models require component temperatures monitored as detailed in the additional information (except - KF and -TF fan models)

- The product was tested for use at the maximum ambient temperature (TMA) 50°C in normal conditions permitted by the manufacturer, see additional information for details.
- The Customer fixings screw penetration require special attention: see handbook in enclosures for details.