






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-A6081-CB-1
Date of issue	2024-01-10
Total number of pages	166
Name of Testing Laboratory preparing the Report	UL International Polska sp. z o.o.
Applicant's name	TDK-LAMBDA UK LTD
Address	KINGSLEY AVE ILFRACOMBE EX34 8ES UNITED KINGDOM
Test specification:	
Standard	IEC 62368-1: 2018
Test procedure	CB Scheme
Non-standard test method	N/A
TRF template used	IECEE OD-2020-F1:2021, Ed.1.4
Test Report Form No.	IEC62368_1E
Test Report Form(s) Originator ...	UL(US)
Master TRF	Dated 2022-04-14
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General disclaimer:	
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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 Power Supply
Trade Mark(s)	TDK-Lambda 
Manufacturer	TDK-LAMBDA UK LTD KINGSLEY AVE ILFRACOMBE DEVON EX34 8ES UNITED KINGDOM
Model/Type reference	EFE300 Series or EFE-300 Series May be prefixed by NS-# or SP followed by / or – (where # may be any number of characters indicating non-safety related model differences, e.g. extra labels on the unit, SP represents a sales code). Products may additionally be marked with U2x or Y2x where x can be any number of characters indicating non-safety related model differences. Followed by x-a-bcde-f-g-hij. See test report model differences for details of models and nomenclature.
Ratings	100-240Vac, 4.7Arms max, 45-440Hz 133-318Vdc, 3.8Adc max (See model differences for details of ratings)

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):


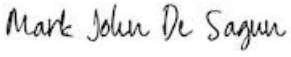

<input checked="" type="checkbox"/> CB Testing Laboratory:		
Testing location/ address	UL International Polska sp. z o.o. Równoległa 4, PL-02-235 Warszawa, Poland	
Tested by (name, function, signature)..... :	Kamil Janeczek / Project Handler	
Approved by (name, function, signature) .. :	Mark John De Sagun / Reviewer	

Testing procedure: CTF Stage 1:

<input type="checkbox"/> Testing procedure: CTF Stage 1:		
Testing location/ address		
Tested by (name, function, signature)..... :		
Approved by (name, function, signature) .. :		

Testing procedure: CTF Stage 2:

<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 AVENUE, ILFRACOMBE, DEVON, UNITED KINGDOM, EX34 8ES
Tested by (name, function, signature)..... :		Matt Carter / Tester 
Witnessed by (name, function, signature) . :		Jan J. Jensen / Mark John De Sagun / Engineer Handler See GPI for Details
Approved by (name, function, signature) .. :		Mark John De Sagun / Reviewer 
Supervised by (name, function, signature) :		Kamil Janeczek / Project Handler 

List of Attachments (including a total number of pages in each attachment):	
National Differences (43 pages) Enclosures (164 pages)	
Summary of testing:	
Tests performed (name of test and test clause):	Testing Location:
G.10.2, G.10.3 - CONDITIONING AND RESISTOR TEST	CBTL: UL International Polska sp. z o.o. Równoległa 4, PL-02-235 Warszawa, Poland Test data accepted based on CBTR Ref. No. E135494-A6018-1 issued on 2020-10-20, CBTC Ref. No. DK-91579-M1-UL issued on 2020-10-21. Test was conducted at UL International Polska sp. z o.o., Równoległa 4, PL-02-235 Warszawa, Poland
Tests performed (name of test and test clause):	Testing Location:
5.2.2.1-5.2.2.6 – CLASSIFICATION OF ELECTRICAL ENERGY SOURCES	CTF Stage 3: TDK-LAMBDA UK LTD KINGSLEY AVENUE, ILFRACOMBE, DEVON, UNITED KINGDOM, EX34 8ES Test data accepted based on CBTR Ref. No. E135494-A6018-1 issued on 2019-12-30, CBTC Ref. No. DK-91579-UL issued on 2019-12-30. Test was conducted at TDK LAMBDA UK LTD, KINGSLEY AVENUE, ILFRACOMBE, DEVON, EX34 8ES, UNITED KINGDOM
5.4.1.8 – DETERMINATION OF WORKING VOLTAGE	Test data accepted based on CBTR Ref. No. E135494-A6018-1 issued on 2023-11-16, CBTC Ref. No. DK-91579-M2-UL issued on 2023-11-16. Test was conducted at TDK LAMBDA UK LTD, KINGSLEY AVENUE, ILFRACOMBE, DEVON, EX34 8ES, UNITED KINGDOM
5.4.4.6.2 – SEPARABLE THIN SHEET MATERIAL	Additional tests were conducted under UL project 4790231446.9 to include the requirement of cl. 5.4.4.9 Solid insulation requirements at frequencies higher than 30 kHz.
5.4.9.1 – ELECTRIC STRENGTH TEST – TYPE TESTING OF SOLID INSULATION	Test data accepted based on CBTR Ref. No. E135494-A6018-1 issued on 2019-12-30, CBTC Ref. No. DK-91579-UL issued on 2019-12-30. Test was conducted at TDK LAMBDA UK LTD, KINGSLEY AVENUE, ILFRACOMBE, DEVON, EX34 8ES, UNITED KINGDOM Additional tests were conducted under UL project 4790231446.9 to include the requirement of cl. 5.4.4.9 Solid insulation requirements at frequencies higher than 30 kHz.
5.6.6.2 – RESISTANCE OF THE PROTECTIVE BONDING SYSTEM	Test data accepted based on CBTR Ref. No. E135494-A6018-1 issued on 2019-12-30, CBTC Ref. No. DK-91579-UL issued on 2019-12-30. Test was conducted at TDK LAMBDA UK LTD, KINGSLEY AVENUE, ILFRACOMBE, DEVON, EX34 8ES, UNITED KINGDOM

<p>5.7.4 – TOUCH VOLTAGE AND TOUCH CURRENT MEASUREMENT – UNEARTHED ACCESSIBLE PARTS</p>	<p>Test data accepted based on CBTR Ref. No. E135494-A6018-1 issued on 2019-12-30, CBTC Ref. No. DK-91579-UL issued on 2019-12-30. Test was conducted at TDK LAMBDA UK LTD, KINGSLEY AVENUE, ILFRACOMBE, DEVON, EX34 8ES, UNITED KINGDOM</p>
<p>B.2.5 – INPUT TEST: TELEVISION RECEIVERS/MONITORS</p>	<p>Test data accepted based on CBTR Ref. No. E135494-A6018-1 issued on 2019-12-30, CBTC Ref. No. DK-91579-UL issued on 2019-12-30. Test was conducted at TDK LAMBDA UK LTD, KINGSLEY AVENUE, ILFRACOMBE, DEVON, EX34 8ES, UNITED KINGDOM</p>
<p>B.2.6, 5.4.1.4, 6.3, 9.3, B.1.5 – NORMAL OPERATING CONDITIONS TEMPERATURE MEASUREMENT</p>	<p>Test data accepted based on CBTR Ref. No. E135494-A6018-1 issued on 2019-12-30, CBTC Ref. No. DK-91579-UL issued on 2019-12-30. Test was conducted at TDK LAMBDA UK LTD, KINGSLEY AVENUE, ILFRACOMBE, DEVON, EX34 8ES, UNITED KINGDOM</p>
<p>B.3 – SIMULATED ABNORMAL OPERATING CONDITIONS</p>	<p>Test data accepted based on CBTR Ref. No. E135494-A6018-1 issued on 2019-12-30, CBTC Ref. No. DK-91579-UL issued on 2019-12-30. Test was conducted at TDK LAMBDA UK LTD, KINGSLEY AVENUE, ILFRACOMBE, DEVON, EX34 8ES, UNITED KINGDOM</p>
<p>B.4 – SIMULATED SINGLE FAULT CONDITIONS</p>	<p>Test data accepted based on CBTR Ref. No. E135494-A6018-1 issued on 2019-12-30, CBTC Ref. No. DK-91579-UL issued on 2019-12-30. Test was conducted at TDK LAMBDA UK LTD, KINGSLEY AVENUE, ILFRACOMBE, DEVON, EX34 8ES, UNITED KINGDOM</p>
<p>G.5.3.3 – TRANSFORMER OVERLOAD</p>	<p>Test data accepted based on CBTR Ref. No. E135494-A6018-1 issued on 2019-12-30, CBTC Ref. No. DK-91579-UL issued on 2019-12-30. Test was conducted at TDK LAMBDA UK LTD, KINGSLEY AVENUE, ILFRACOMBE, DEVON, EX34 8ES, UNITED KINGDOM</p>
<p>T.2, 5.4.2.6, 5.4.3.2, G.15.2.6 – STEADY FORCE TEST, 10 N</p>	<p>Test data accepted based on CBTR Ref. No. E135494-A6018-1 issued on 2019-12-30, CBTC Ref. No. DK-91579-UL issued on 2019-12-30. Test was conducted at TDK LAMBDA UK LTD, KINGSLEY AVENUE, ILFRACOMBE, DEVON, EX34 8ES, UNITED KINGDOM</p>

Summary of compliance with National Differences (List of countries addressed):

Australia - AU, New Zealand - NZ, EU Group Differences, Japan - JP, Singapore - SG, United States of America - US, Canada - CA

United Kingdom (per customer's request shown separately)

The product fulfils the requirements of AS/NZS 62368.1:2022, EN IEC 62368-1:2020+A11:2020, BS EN IEC 62368-1:2020+A11:2020, CSA/UL62368-1:2019, Special National Conditions for Singapore

Use of uncertainty of measurement for decisions on conformity (decision rule) :

No decision rule is specified by the IEC standard, when comparing the measurement result with the applicable limit according to the specification in that standard. The decisions on conformity are made without applying the measurement uncertainty (“simple acceptance” decision rule, previously known as “accuracy method”).

Other:... (to be specified, for example when required by the standard or client, or if national accreditation requirements apply)

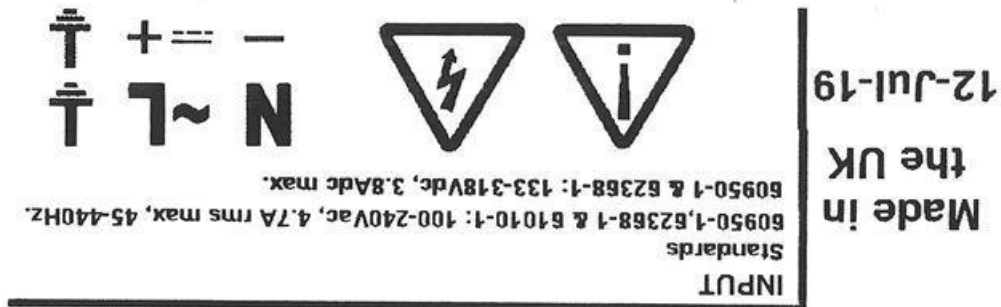
Information on uncertainty of measurement:

The uncertainties of measurement are calculated by the laboratory based on application of criteria given by OD-5014 for test equipment and application of test methods, decision sheets and operational procedures of IECEE. IEC Guide 115 provides guidance on the application of measurement uncertainty principles and applying the decision rule when reporting test results within IECEE scheme, noting that the reporting of the measurement uncertainty for measurements is not necessary unless required by the test standard or customer.

Calculations leading to the reported values are on file with the NCB and testing laboratory that conducted the testing.

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.



TDK-Lambda **EFE-300**

www.emea.tdk-lambda.com

Product Code : U2Y021K

Serial Number : 8191920219

Description : EFE300-26-ECMDS-V

Customer Data :



<p>OUTPUT 26V_12.5A</p>	<p>Refer to emea.tdk-lambda.com/manual for installation manual.</p> <p>For Test Certificate: Refer to http://testcert.emea.tdk-lambda.com</p> <p>pat: uk.tdk-lambda.com/patents</p>
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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:	
Product group	built-in component
Classification of use by	Skilled person
Supply Connection	AC Mains DC Mains not mains connected: ES3
Supply tolerance	+10%/-10%
Supply connection – type	mating connector
Considered current rating of protective device	20 A; Location: building
Equipment mobility	for building-in
Over voltage category (OVC)	OVC II
Class of equipment	Class I
Special installation location	N/A 0
Pollution degree (PD)	PD 2
Manufacturer’s specified Tma (°C)	50°C (Full Load); 70°C (Output power decreased linearly by 2.5%/°C above 50°C)
IP protection class	IPX0
Power systems	TN
Altitude during operation (m)	3000 m
Altitude of test laboratory (m)	2000 m or less
Mass of equipment (kg)	< 1kg
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	2019-08-02 TO 2019-11-21, 2020-09-02, 2022-11-22, 2023-08-01
Date (s) of performance of tests	2019-08-06 to 2019-11-21, 2020-10-05, 2023-08-01
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 IEC60335-1:	

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

<p>Name and address of factory (ies)</p>	<p>TDK-LAMBDA UK LTD KINGSLEY AVE ILFRACOMBE DEVON EX34 8ES UNITED KINGDOM</p> <p>Panyu Trio Microtronics Co Ltd SHIJI INDUSTRIAL ESTATE DONGYONG NANSHA GUANGZHOU Guangdong Sheng 511453 CHINA</p> <p>TDK-LAMBDA CORP 2704-1 SETTAYA-MACHI NAGAOKA-SHI Niigata 940-1195 JAPAN</p> <p>Trio-Tronics (Thailand) Ltd 7/295 Mu. 6 Map Yang Phon Sub-District Pluak Daeng District Rayong THAILAND</p>
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General product information and other remarks:

Product Description
EFE300 or EFE-300 Series. Switch mode power supplies for building into end equipment
May be prefixed by NS-# or SP followed by / or – (where # may be any number of characters indicating non-safety related model differences, e.g. extra labels on the unit, SP represents a sales code).
Products may additionally be marked with U2x or Y2x where x can be any number of characters indicating non-safety related model differences. Followed by x-a-bcde-f-g-hij. See test report model differences for details of models and nomenclature.

Model Differences
Model Differences –
Nominal Input Voltage Range 100 – 240Vac or 133 – 318Vdc (conditioned)
Maximum Input Voltage Range 90* – 264Vac or 120 – 350Vdc
Input Frequency 45 – 440*Hz Maximum or DC
Maximum Input Current 4.7A rms or 3.8A dc

*Channel 1 output is linearly derated from 90Vac to 85Vac, 4W/Volt to 280W

All ratings apply for ambient temperatures up to 50°C. From 50 to 70°C the output power is derated at 2.5% per °C.

Unit Configuration Code:

EFE300x-a-bcde-f-g-hij or EFE-300x-a-bcde-f-g-hij

(may be prefixed by NS - # / where # may be any number of characters indicating non-safety related model differences). Products may additionally be marked with U2x or Y2x where x can be any number of characters indicating non-safety related model differences.

May be prefixed by SP followed by / or – (SP represents a sales code)

Where:

x = Nothing or J for Japanese models (may have non-safety differences)

a = Channel 1 output voltage: any voltage within the adjustment range for the Vout (nom) from the Output Table below e.g. 12.8 for 12.8V output (12Vout nom), 24.6 for 24.6V output (24Vout nom).

b = CN for Open Frame with Fan Output

CU for U-Chassis with Fan Output

CC for U-Chassis and Cover with Fan Output

EC for U-Chassis and Cover with Fan

c = M for Molex input connector, J for JST connector or equivalent

d = D for Dual Fused Input or L for Single Fuse in the live line

e = S for Standard Leakage, L for Low Leakage, R for Reduced Leakage, T for Tiny Leakage*

f = Nothing for Horizontal Output Connector, V for Vertical Output Connector

g = Nothing for standard channel 1 output voltage. xD or xPD where D is for units with programmed negative load regulation. PD is for units with programmed positive load regulation. x is the voltage of the regulation in 100mV and is within the Output Adjustment Range (example: 7D = 0.7V of negative load regulation, 24PD = 2.4V of positive load regulation)

hij = Three numbers from 0 to 9 which denotes various output voltage/current settings within the specified ranges of each output for a particular unit or blank for the standard output settings (may define non-safety related parameters/features e.g. reduced primary current limit, reduced OVP)

* At 440Hz leakage current is > 3.5mA and therefore must be assessed in the end use application

* L = < 300µA leakage, R = < 150µA Leakage and T = <75µA Leakage

Output Parameters:

O/P Channel Vout nom (V) Range (V) Max O/P (A) Max O/P (W)

CH1 12 11.4 – 13.2* 25 300 (400**)

24 22.8 – 26.4* 12.5 300 (400**)

Fan output 12 Fixed 0.25 3

* Can be adjusted from nominal at the factory only

** Peak power of 400W for 10 seconds maximum, maximum RMS power of 300W

Maximum continuous power output 300W (excluding fan output)

Output Limitations:

All outputs are ES1.

All outputs have functional spacing's to earth and due consideration must be given to this in the end product.

For open frame units no electrical ratings are placed on a marking label. Electrical ratings in the manual must match those in the test report.

Additional Information

Additional application considerations – (Considerations used to test a component or sub-assembly) –
Customer Air Cooling (CN, CU and CC options):

The following components require special consideration during end-product thermal (heating) tests due to the indicated maximum temperature measurements during component-level testing. The components listed in the following table must not exceed the temperature given. To determine the component temperatures the heating tests must be conducted in accordance with the requirement of the standard concerned. There is no requirement to perform abnormal or single fault testing as this has been considered in the testing of this report.

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 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 stabilised.

Circuit Reference Description Max. Temperature (°C)

J1 Input connector 75

L1, L2 Common mode choke winding 115 (130)

C7, C8 X Capacitors 100

C9 Reservoir Capacitor (Electrolytic) 60 (105)

L3 Boost Choke Winding 115 (140)

TX2 Transformer Winding 120 (130)

TX2 Transformer Core 120 (130)

TX2 Transformer Braid 120 (130)

U2 Opto-coupler 75 (100)

C10, C11 Channel 1 Output Capacitors 80 (105)

L6 Primary Choke (24V model only) 120 (130)

L4 Channel 1 Output Choke 115 (130)

XU2/XU8 Fan Regulator 115 (130)

XQ201 Boost FET (IMS Board) 115 (130)

Q1 Channel 1 Output FET (Adjacent to R4) 115 (130)

XU3 Primary Driver IC 100 (130)

Various All Other Electrolytic Capacitors 80 (105)

This report is a standard upgrade from IEC 62368-1 2nd edition to 3rd edition. Test data were accepted based on CBTR E135494-A6018-CB-1, dated 2023-11-16 and CBTC DK-91579-M2-UL, dated 2023-11-16.

In this report, testing of ELECTRICAL STRENGTH TEST - TYPE TESTING OF SOLID INSULATION and SEPARABLE THIN SHEET MATERIAL were conducted.

The test date and sample receipt date shown are those of the original testing and additional test under project no. 4790231446.

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), Simulated Abnormal Operating Conditions (B.3), and 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. (4790099713, DA file 331).

This report is based on previously conducted testing and the review of product construction evaluated per IEC/UL 62368-1 2nd edition in CB report Ref. No E135494-A6018-CB-1 with certificate no. DK-91579-M2-UL issued on 2023-11-16.

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 (full load); 70°C (power and output current decreasing linearly by 2.5%/°C above 50°C)
- The product is intended for use on the following power systems : TN
- Considered current rating of protective device as part of the building installation (A) : 20
- Mains supply tolerance (%) or absolute mains supply : +10%/-10%
- The equipment disconnect device is considered to be : 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 : EN IEC 62368-1:2020+A11:2020, CAN/CSA C22.2 No. 62368-1:19, 3rd Edition, UL 62368-1 3rd Edition, Issued December 13, 2019
- Capacitors are rated for 230V due to the IT power system used in Norway. Further evaluation may be required in the end use product.
- A maximum of 2 units are permitted to be connected in series
- Series connection of units is not permitted in conjunction with DC input

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
- The end-product Electric Strength Test is to be based upon a maximum working voltage of : Primary-Secondary: 392 Vrms, 762 Vpk, Primary – Earthed Dead Metal: 392 Vrms 668 Vpk
- The following output circuits are at ES1 energy levels : All
- The following output circuits are at ES3 energy levels : Series connected outputs
- The following output circuits are at PS3 energy levels : All Outputs
- 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
- An investigation of the protective bonding terminals has : been conducted
- The following end-product enclosures are required : Mechanical, Fire, Electrical
- 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) : Transformer TX2 (Class F) – See table 4.1.2 for details of insulation system used.
- The following components require special consideration during end-product Thermal (Heating) tests due to the indicated maximum temperature measurements during component-level testing : Customer air models require component temperatures to be monitored as detailed in the Additional Application Considerations section under additional information of this report.
- The equipment is suitable for direct connection to : AC and/or DC mains supply
- The power supply was evaluated to be used at altitudes up to : 3000m
- Fans: The fan provided in this sub-assembly is provided with a fan guard to reduce the risk of contact with the rotor. The fan provided in this sub-assembly is not intended for operator access
- DC supply tolerance is equal to +10% / -10% due to restriction of connection to a conditioned power supply system