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-A6066-CB-1
Date of issue .....:	2022-12-06 ; Amendment 2 : 2025-10-27
Total number of pages .....:	83
Name of Testing Laboratory preparing the Report .....:	UL VS Limited
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

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.

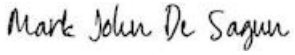
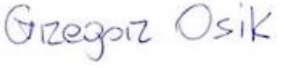
This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

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 :	AC-DC Power Supply
Trade Mark(s) .....:	TDK-Lambda
Manufacturer.....:	TDK-LAMBDA UK LTD KINGSLEY AVE ILFRACOMBE EX34 8ES UNITED KINGDOM
Model/Type reference .....:	EFE400Mxy-a-b-cdef-gh-i-j-klm or EFE-400M-a-b-cdef-gh-i-j-klm Units may be marked with a Product Code: U6x or Y6x where x may be any number of characters. Unit Configuration Code (Description :) may be prefixed by NS # 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 (SP represents a sales code) Where: x = blank or J y = blank, P or D a = Channel one output voltage and can be from 11.4 to 50 b = Standby voltage 5 or 12 c = BC, HN, HU, HC, EC, NN, NU, NC, HP, NP or TF d = M or S e = D, F, E or G f = L, R, T or Z g = Y or N h = T, E or N i = V or blank j = blank, xD, xPD klm = number from 0-9, or blank Non-standard models Y60001# Y60002#
Ratings .....:	100-240Vac nom, 45-440Hz, 6.1A rms max. or 133-318Vdc nom, 5A max. (See Model Differences for details of ratings)

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
☐	**CB Testing Laboratory:**	
Testing location/ address ..... :		
Tested by (name, function, signature)..... :		

Approved by (name, function, signature) .. :		
☐ **Testing procedure: CTF Stage 1:**		
Testing location/ address ..... :		
Tested by (name, function, signature)..... :		
Approved by (name, function, signature) .. :		
☐ **Testing procedure: CTF Stage 2:**		
Testing location/ address ..... :		
Tested by (name, function, signature)..... :		
Witnessed by (name, function, signature) . :		
Approved by (name, function, signature) .. :		
☒ **Testing procedure: CTF Stage 3:**		
☐ **Testing procedure: CTF Stage 4:**		
Testing location/ address ..... :	TDK-LAMBDA UK LTD KINGSLEY AVE ILFRACOMBE EX34 8ES UNITED KINGDOM	
Tested by (name, function, signature)..... :	Mark Gisbey / Tester	
Witnessed by (name, function, signature) . :	Mark John De Sagun / Senior Project Engineer	
Approved by (name, function, signature) .. :	Tracy Burges / Approver	
Supervised by (name, function, signature) :	Grzegorz Osik / Project Handler	

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):	**Testing Location:**
	Unless otherwise noted, test are all conducted in
	CTF Stage 3: TDK-LAMBDA UK LTD
	KINGSLEY AVE
	ILFRACOMBE
	EX34 8ES UNITED KINGDOM
5.4.9.1 – ELECTRIC STRENGTH TEST – TYPE TESTING OF SOLID INSULATION	
B.2.6, 5.4.1.4, 6.3, 9.3, B.1.5 – NORMAL OPERATING CONDITIONS TEMPERATURE MEASUREMENT	
B.4 – SIMULATED SINGLE FAULT CONDITIONS	
G.5.4.6.3 – ALTERNATIVE LOCKED-ROTOR OVERLOAD TEST FOR DC MOTORS	

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

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

United Kingdom (per customer's request shown separately)

☒ **The product fulfils the requirements of** BS EN IEC 62368-1:2020 + A11:2020, EN IEC 62368-1:2020+A11:2020, J62368-1(2023), AS/NZS 62368.1:2022, CSA/UL 62368-1:2019

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 - Refer to Enclosure titled Marking Plate for copy.

Test item particulars:	
Product group ..... :	built-in component
Classification of use by ..... :	Skilled person
Supply Connection ..... :	AC Mains DC Mains
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 Class II (for model with suffix 'y' = 'D')
Special installation location ..... :	N/A
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 TT
Altitude during operation (m) ..... :	5000 m or less m
Altitude of test laboratory (m) ..... :	2000 m or less
Mass of equipment (kg) ..... :	1Kg Max
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 .....:	2023-04-05 to 2025-08-05
Date (s) of performance of tests .....:	2023-07-23 to 2025-08-05
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 4.2.5 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 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

General product information and other remarks:

The original report was modified on 2025-10-27 to include the following changes/additions:

Project 4791915350

Technical Amendment 2

The original report was modified on 2025-10-8 to include the following changes/additions:

This test report should be read in conjunction with the original report number:

- E135494-A6066-CB-1, issued 2022-12-06, with CB Certificate No. (DK-135516-UL), issued 2022-12-06 and Amendment 1, E135494-A6066-CB-1, issued 2024-10-24, with CB Certificate No. (DK-135516-M1-UL), issued 2024-10-24

This report has been amended (technical amendment), due to:

- Add alternate Fan source, Type YS Tech FD124020UB-H-NCB 12V, 0.22A DC Brushless Fan
- Add alternate Fan source, Type YS Tech FD124020UB-H-NAH 12V, 0.27A DC Brushless Fan
- Add prefix PSE to TX1 transformer in model description
- Add prefix PSE to TX2 transformer in model description and update overall dimensions in LoCC
- Add prefixes to TX3 transformer in model description

Based on previously conducted testing and the review of product construction, only the following tests were deemed necessary:

5.4.9.1 – ELECTRIC STRENGTH TEST – TYPE TESTING OF SOLID INSULATION

B.2.6, 5.4.1.4, 6.3, 9.3, B.1.5 – NORMAL OPERATING CONDITIONS TEMPERATURE MEASUREMENT

B.4 – SIMULATED SINGLE FAULT CONDITIONS

G.5.4.6.3 – ALTERNATIVE LOCKED-ROTOR OVERLOAD TEST FOR DC MOTORS

Product Description

The EFE400M or EFE-400M series are switch-mode power supplies for building into host equipment.

Model Differences

Standard 62368-1

Nominal input voltage 100-240Vac 133-318Vdc

Input voltage range 90-264Vac 120-350Vdc

Input frequency range 45-440Hz dc

Maximum input current 6.1Arms 5A

*Input de-rated, see variations and limitations below.

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

Output Parameters

There are three EFE400M standard models and two non-standard models with various options and output parameters shown in the tables below.

Standard models:

Output Channel	Vout Nom.	Adjustment Range (V)	Output Current (A)	Maximum Power (W)
Channel 1	12	11.4 - 13.2*	33.33	400 (530**)
	24	22.8 - 26.4*	16.67	400 (530**)
	48	47 - 50*	8.33	400 (470**)
Fan output (optional)	12	12	1	12
Standby output	5	5	2	10
	12	12 - 12.2*	1	12.2

Variations and limitations of use for Standard models:

1. Output power de-rated 1% per volt from 100V to 90V input (channel 1 power 360W at 90V input).
2. Output power further de-rated 2% per volt from 90V to 85V input (channel 1 power 320W at 85V input).
3. Maximum ambient 70°C (de-rating output power 2.5% per °C above 50°C).
4. * Can be adjusted at the factory only.
5. Maximum continuous power output 400W (including fan output).
6. ** Peak power for 10 seconds maximum, maximum rms power of 400Wrms:

Non-Standard Models:

Non- Standard model: Y60001# (# can be any letter) (EFE400M-48-5-BCSDL-NT)

Output Channel	Vout Nom.	Adjustment Range (V)	Output Current (A)	Maximum Power (W)
Channel 1	48	47 to 50*	8.33	400
Standby output	5	fixed	2	10

Variations and limitations of use for Non- Standard model Y60001#:

1. Output power de-rated 1% per volt from 100V to 90V input. (e.g. channel 1 power 360W at 90V input)
2. Maximum ambient 50°C.
3. * Can be adjusted at the factory only.

Non- Standard model: Y60002# (# can be any letter) (EFE400M-12-5-NNMDL-NE-V)

Output Channel	Vout Nom.	Adjustment Range (V)	Output Current (A)	Maximum Power (W)
Channel 1	12	11.4 - 13.2*	47.5	450 (530**)
Standby output	5	fixed	2	10

Variations and limitations of use for Non- Standard model Y60002#:

1. Output power de-rated linearly from 450W to 410W from 100V to 90V input. (e.g. channel 1 power 410W at 90V input)
2. IEC/EN62368-1 only.
3. Maximum ambient 40°C.
4. * Can be adjusted at the factory only.
5. ** Peak power for 10 seconds maximum, maximum rms power of 400W.

Additional Information

Only ELECTRIC STRENGTH TEST was conducted under this report. All the other required tests were carried out under the original investigation evaluated per IEC/UL 62368-1:2014 (2nd edition) in CBTR Ref. No: E135494-A6009-CB-1-Original, including Amendment-1, Correction-1, Amendment-2 and Amendment-3; CBTC Ref. no: DK-92032-M3-UL issued on 2022-08-24. The test sample received dates and the test dates are from the original report. Per the previously conducted testing and the review of product technical documentation including photos, schematics, wiring diagrams and similar, it has been determined that the product continues to comply with the standard. Refer to Section “Test performed” covering all conducted performance tests in those reports.

The following tests were selected as representative of the test program applicable to model covered by this CBTR: Normal Operating Conditions Temperature Measurement, Simulated Abnormal Operation Conditions and Electric Strength Test. These tests have been witnessed for models selected as representative of the standard covered by this report and the applicable test program.

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

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 (see layout drawings below):

Circuit Ref.	Description	Max. Temperature (°C) †
J1	input connector	105 (75††)
C12, C8, C7	X cap	100
L1, L2	Common mode choke winding	130 (145)
L6	Series mode choke winding	130
TX1	Standby trx winding	130
U2, U3, U5, U6, U7	Opto-coupler	100
TX2	Primary, secondary windings and core	130
C5	Capacitor	85 (105)
C9	Boost capacitor	70 (105)
L3	Boost choke winding	130 (140)
L7	Channel 1 output choke	130
XQ225	Boost FET (ASY2 primary IMS)	125 (130)
Q2	Chan1 O/P FET (ASY4 secondary IMS)	125 (130)
L8	Prim resonant choke (not 12V model)	130 (140)
J2	Output connector	105
XL701 1A	fan output choke	110 (125)
C1, C11, C19, C20	Electrolytic capacitors	75 (105)

† The higher temperatures limits in brackets may be used but product life may be reduced.

Single sided or double sided boards refer to Daughter and IMS boards while Multi-layer boards refer to Main board.

Project 4791915350

Technical Amendment 2

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Based on previously conducted testing and the review of product construction, only the following tests were deemed necessary:

5.4.9.1 – ELECTRIC STRENGTH TEST – TYPE TESTING OF SOLID INSULATION

B.2.6, 5.4.1.4, 6.3, 9.3, B.1.5 – NORMAL OPERATING CONDITIONS TEMPERATURE MEASUREMENT

B.4 – SIMULATED SINGLE FAULT CONDITIONS

G.5.4.6.3 – ALTERNATIVE LOCKED-ROTOR OVERLOAD TEST FOR DC MOTORS

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 (full load); 70°C (output power decreased linearly by 2.5%/°C above 50°C).
- The product is intended for use on the following power systems : TN, TT, DC mains supply
- Considered current rating of protective device as part of the building installation (A) : 20
- Mains supply tolerance (%) or absolute mains supply : +10%/-10% for both AC mains and DC mains supply
- The equipment disconnect device is considered to be : provided by 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
- Further evaluation must be considered in the end use product if used in IT power systems. Capacitors are rated for 230V due to the IT power system used in Norway.
- Equipment was evaluated for a maximum supply range of 85-264Vac and 120-350Vdc.
- Components have been evaluated for compliance to IEC or national standards. It shall be noted that provision of clause 4.1.1 was considered for components and subassemblies complying with IEC 60950-1 or IEC 60065 used as part of equipment covered by this standard without further evaluation other than to give consideration to the appropriate use of the component or subassembly in the end-product. Additional certificates may be required at the discretion of the accepting NCB or local authorities.

Engineering Conditions of Acceptability

When installed in an end-product, consideration must be given to the following:

- The following output circuits are at ES1 energy levels : 12 and 24V (Nom) outputs after rectification of TX2
- The following output circuits are at ES2 energy levels : 48V (Nom) output after rectification of TX2
- The following output circuits are at PS3 energy levels : All circuits
- When installed in an end-product, consideration must be given to the following:

  • H4 is connected to the input connector Earth and this must be considered for Class I open frame models in the end equipment.
  • The following Production-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: 396 Vrms, 922 Vpk. , Primary-Earthed Dead Metal: 381 Vrms, 672 Vpk
  • Series connection of channel 1 is permitted however a maximum limit of 2 units must not be exceeded.
  • Series operation is not permitted for DC Input or Class II variants.
  • 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.
  • The power supply terminals and/or connectors are: Not investigated for field wiring
  • 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 EFE400MxD Class II models)
  • The following magnetic devices (e.g. transformers or inductor) are provided with an OBJY3 insulation system with the indicated rating greater than Class A (105°C): Transformer TX1 andTX2 - Class F
  • The following end-product enclosures are required: Fire, , Electrical and Mechanical,
  • An investigation of the protective bonding terminals has: Been conducted
- When operated at frequencies in excess of 63Hz, the requirements for Touch Current and Protective Conductor Current must be considered in the end equipment. as the leakage current for input frequencies above 63Hz may exceed 5mA.

- Ratings in the end product need to be evaluated due to the use of input voltage dependent de-rating.
- The perforated cover when fitted to the EFE400MxD models (Class II) must be treated as a live part with Basic Insulation from primary to chassis and Supplementary Insulation from secondary circuit to chassis.
- • Products are restricted to connection to DC Mains conditioned power supply system with narrower tolerance +10%, -10%.
- • Marking for equipment provided with fuses located in both line and neutral of a single phase mains to be considered in end-product