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-A6071-CB-1
Date of issue .....:	2023-03-23
Total number of pages.....:	104
Name of Testing Laboratory preparing the Report.....:	UL VS Limited Unit 1-3 Horizon, Wade Road, Kingsland Business Park, Basingstoke RG24 8AH, United Kingdom
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.

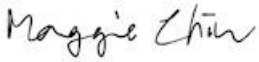
This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

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 .....:	Switch mode power supply
Trade Mark(s) .....:	TDK-Lambda
Manufacturer.....:	TDK-LAMBDA UK LTD KINGSLEY AVE ILFRACOMBE EX34 8ES UNITED KINGDOM
Model/Type reference .....:	NVM175 or NVM-175 Series: Models NVMx or NVM-x may be prefixed by NS # or SP followed by / or – (# is any number of characters indicating non-safety related model differences); where x is 1 or 1D. followed by y-abcdefghijklm. See report Model Differences for details.
Ratings .....:	100-240Vac nom. 45-440Hz, 3A rms max. (See Model Differences for output rating)

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)..... :	Matt Carter / CTF tester	
Witnessed by (name, function, signature) . :	Mark John De Sagun / Witness Engineer	See GPI for details
Approved by (name, function, signature) .. :	Jan J. Jensen / Reviewer	
Supervised by (name, function, signature) :	Maggie Chiu / Project Handler	

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

National Differences (38 pages)
Enclosures (186 pages)

Summary of testing:

Tests performed (name of test and test clause):	**Testing Location:** **CTF Stage 3: TDK-LAMBDA UK LTD** **KINGSLEY AVE** **ILFRACOMBE** **EX34 8ES UNITED KINGDOM**
5.2.2.1-5.2.2.6 – CLASSIFICATION OF ELECTRICAL ENERGY SOURCES	Test data accepted based on CBTR# No E135494-A6016-CB-1 with amendment1, CBTC#DK-94635-M1-UL, according to IEC62368-1:2014 (2nd edition)
5.4.1.8 – DETERMINATION OF WORKING VOLTAGE	Test data accepted based on CBTR# No E135494-A6016-CB-1 with amendment1, CBTC#DK-94635-M1-UL, according to IEC62368-1:2014 (2nd edition)
5.4.7, 5.4.1.5.3 – TESTS FOR SEMICONDUCTOR COMPONENTS AND CEMENTED JOINTS	Test data accepted based on CBTR# No E135494-A6016-CB-1 with amendment1, CBTC#DK-94635-M1-UL, according to IEC62368-1:2014 (2nd edition)
5.4.9.1 – ELECTRIC STRENGTH TEST – TYPE TESTING OF SOLID INSULATION	Conducted in this re-issued report and part of test data accepted based on CBTR# No E135494-A6016-CB-1 with amendment1, CBTC#DK-94635-M1-UL, according to IEC62368-1:2014 (2nd edition)
5.5.2.2 – CAPACITOR DISCHARGE AFTER DISCONNECTION OF A CONNECTOR	Test data accepted based on CBTR# No E135494-A6016-CB-1 with amendment1, CBTC#DK-94635-M1-UL, according to IEC62368-1:2014 (2nd edition)
5.6.6.2 – RESISTANCE OF THE PROTECTIVE BONDING SYSTEM	Test data accepted based on CBTR# No E135494-A6016-CB-1 with amendment1, CBTC#DK-94635-M1-UL, according to IEC62368-1:2014 (2nd edition)
5.7.5 – TOUCH CURRENT MEASUREMENT – EARTHED ACCESSIBLE CONDUCTIVE PARTS – SINGLE-PHASE EQUIPMENT ON TN OR TT SYSTEM	Test data accepted based on CBTR# No E135494-A6016-CB-1 with amendment1, CBTC#DK-94635-M1-UL, according to IEC62368-1:2014 (2nd edition)
B.2.5 – INPUT TEST: SINGLE PHASE	Test data accepted based on CBTR# No E135494-A6016-CB-1 with amendment1, CBTC#DK-94635-M1-UL, according to IEC62368-1:2014 (2nd edition)
B.2.6, 5.4.1.4, 6.3, 9.3, B.1.5 – NORMAL OPERATING CONDITIONS TEMPERATURE MEASUREMENT	Test data accepted based on CBTR# No E135494-A6016-CB-1 with amendment1, CBTC#DK-94635-M1-UL, according to IEC62368-1:2014 (2nd edition)
B.3 – SIMULATED ABNORMAL OPERATING CONDITIONS	Test data accepted based on CBTR# No E135494-A6016-CB-1 with amendment1, CBTC#DK-94635-M1-UL, according to IEC62368-1:2014 (2nd edition)
B.4 – SIMULATED SINGLE FAULT CONDITIONS	Test data accepted based on CBTR# No E135494-A6016-CB-1 with amendment1, CBTC#DK-94635-M1-UL, according to IEC62368-1:2014 (2nd edition)
G.5.3.3 – TRANSFORMER OVERLOAD	Test data accepted based on CBTR# No E135494-A6016-CB-1 with amendment1, CBTC#DK-94635-M1-UL, according to IEC62368-1:2014 (2nd edition)

R.1-R.4 - LIMITED SHORT CIRCUIT TEST	Test data accepted based on CBTR# No E135494-A6016-CB-1 with amendment1, CBTC#DK-94635-M1-UL, according to IEC62368-1:2014 (2nd edition)
T.2, 5.4.2.6, 5.4.3.2, G.15.2.6 – STEADY FORCE TEST, 10 N	Test data accepted based on CBTR# No E135494-A6016-CB-1 with amendment1, CBTC#DK-94635-M1-UL, according to IEC62368-1:2014 (2nd edition)
5.4.8 - HUMIDITY CONDITIONING	Test data accepted based on CBTR# No E135494-A6016-CB-1 with amendment1, CBTC#DK-94635-M1-UL, according to IEC62368-1:2014 (2nd edition)

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

Australia / New Zealand, EU Group and National Differences, Singapore, USA / Canada

United Kingdom (per customer request shown separately)

☒ **The product fulfils the requirements of** BS EN IEC 62368-1:2020 + A11:2020, EN IEC 62368-1:2020+A11:2020, , UL 62368-1 3rd Edition, Revised October 22, 2021, CAN/CSA C22.2 No. 62368-1:19, 3rd Edition, Revised October 22, 2021, AS/NZS 62368.1:2018, Singapore - Special National Conditions

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
Supply tolerance	+10%/-10%
Supply connection – type	mating connector Connection to mains to be determined in end use.
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
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
Altitude during operation (m)	5000 m
Altitude of test laboratory (m)	64 m
Mass of equipment (kg)	Less than 1 kg
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 .....:	2017-11-06 to 2019-12-04, 2020-02-18, 2022-08-17
Date (s) of performance of tests .....:	2019-06-10 to 2019-12-20, 2022-10-10 to 2022-11-15, 2023-03-09
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:

Product Description

The NVM-175 Series are switched mode power supplies for building into host equipment.

Model Differences

NVM175 or NVM-175 models as described below:

Units may be marked with a Product Code: X5x or NVM1x 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).

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

Unit Configuration Code:
NVMxy-abcdefghijklm

Where:

x = 1 for 175 or 1D (1D for Double insulated or Class II unit)
y = Blank for Y2 capacitors from output to earth (except 1D models)
P for Y1 capacitors from output to earth (except 1D models)

a = Number of Outputs: 1.

b = Channel 1 Output Voltage where: T is for 12V, F is for 15V and G is for 24V.

c = O (for omit).

d = O (for omit).

e = O (for omit).

f = Standby supply:

Blank for no standby and no remote on/off (enable) or '-' followed by

S for 12V version with power good, logic level high enables main output.

S1 for 12V version with power good, logic level low enables main output.

S2 for 12V version with Channel 1 good, logic level high enables main output.

S3 for 12V version with Channel 1 good, logic level low enables main output.

S4 for 12V 0.8A version with power good, logic level low enables main output.

S5 for 5V 0.5A version with power good, logic level low enables main output.

S6 for 5V 0.5A version with power good, logic level high enables main output.

0 for no standby and no remote on/off (enable).

g = Blank for Open Frame or '-' followed by U for U chassis, C for U chassis with cover, K for custom chassis with cover and IEC inlet.

h = Blank for standard upright output connector or '-' followed by R for the right angle output connector, S for the screw terminal.

i = Blank for standard leakage or '-' followed by L for low leakage, Zx for custom leakage which is less than standard leakage and x is a number between 1 and 9 for different custom leakage current options.

jkl = Blank for standard output setting or '-' followed by three numbers from 0 to 9 which denotes various output voltages and currents within the specified range of channel 1 output for a particular unit.

m = Blank for dual fuse input or -FL for single fuse input in the Live line

Output Parameters

There are three NVM1 standard models with various options, and 3 non-standard models with output parameters shown in the tables below:

Output Channel	Voltage Designation	Vout Nom.	Adjustment Range (V)	Output Current (A)	Maximum Power (W)
Channel 1	T	12	12 - 15.5	15	180
	F	15	12 - 15.5	15	180
	G	24	24 - 28.5	7.5	180
Standby output	S	12	Fixed	0.2	2.4
	S1	12	Fixed	0.2	2.4
	S2	12	Fixed	0.2	2.4
	S3	12	Fixed	0.2	2.4
	S4	12	12 - 13	0.8	10.4
	S5	5	Fixed	0.5	2.5
	S6	5	Fixed	0.5	2.5

Variations and limitations of use:

NVM175 PSUs can output 180W from channel 1 plus 10.4W maximum from the standby output.

Component temperatures must be monitored in the end use application as described in the “COOLING FOR UNIT” section.

All ratings apply for ambient temperatures up to 50°C. From 50 to 70°C the total output power and current ratings are both derated at 2.5% per deg C.

Non- Standard model:

X50015# (where # can be any letter except A, B, C, D, E or F) NVM1-1T000-S1-K-S-L:

Factory fitted output loom

Earth connection made via ring tag and screw

X50007# - NVM1D - 1G-f-g-h-j

may be any letter where this indicates any of the options described in the nomenclature table above for f, g, h and j and where g will always be blank (open frame). D indicates that the product is double insulated (no earth connections). This product has 18-way output connector.

Maximum storage temperature 65°C.

For ambient temperature requirements see Conditions of Acceptability and user manual (Enclosure 6-01).

Input Parameters

Parameter	62368-1
Nominal input voltage	100 - 240 Vac
Input voltage range	90 - 264Vac
Input frequency range	45 - 440Hz
Maximum input current	3A rms

Series connection

It is possible to connect a maximum of two NVM175 units in series. Doing so changes the working voltages and also changes the Energy Source Classification. Refer to Conditions of Acceptability.

Environmental Specifications:

Description	Operation	Storage & Transportation
Use	Indoor -	
Temperature	0°C - +70°C (See O/P tables for deratings)	-40°C - +85°C
Humidity	5 - 95% RH, non-condensing	5 - 95% RH, non-condensing
Altitude	-200m - 5000m	-200m - 5000m
Pressure	63kPa - 106kPa	54kPa - 106kPa

Orientation The unit may be mounted on either side, vertical with input lowest and horizontal. (Customer Air versions can be mounted in any orientation).

Additional Information

Only "ELECTRIC STRENGTH TEST – TYPE TESTING OF SOLID INSULATION" was conducted under this report. All other required tests were carried out under the original investigation evaluated per IEC/UL 62368-1:2014 (2nd edition) in CB report E135494-A6016-CB-1, cert no. DK-94635-M1-UL, latest issued date on 2023-01-19. Test sample received dates and the previous 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 and this report.

The following tests were selected as representative of the test program applicable to model covered by this CBTR: Normal Operating Conditions Temperature Measurement (Cl. B.2.6), Simulated Abnormal Operating Conditions (Cl. B.3), Electric Strength Test (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.

Cooling for units:

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 stabilised.

Cooling for unit temperature table:

Circuit Ref.	Description	Max. Temperature (°C)
L3, L7	Common mode choke winding	115 (155)
C1, C4	X capacitors	100
C6	Capacitor	105
C12	Resonant capacitor	105
T3	Aux trx windings	130
L2	Boost choke winding	120 (155)
C7	Electrolytic capacitor	70 (105)
T1, T2	Transformer winding	130
L1	Primary choke (24V channel 1 only)	140
XU3, XU4, XU106	Opto-couplers on control board	100
U1, U2	Opto-couplers on base board	100
L5	Channel 1 output choke	125 (140)
L4	Standby output choke	85
J2	Input connector	105
J1	Output connector	105
Various	All other electrolytic capacitors	90 (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 (Tma) 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). Model X50001x, 60°C (full load); 65°C (power and, output current decreasing linearly by 2.5%/°C above 60°C) NVM1D max temp 65°C.
- The product is intended for use on the following power systems : TN, IT (Norway only)
- 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 : 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 including French for Canada
- The means of connection to the mains supply is: To be determined in the end-use product
- Multilayer PWB's accepted under CBTR Ref. No.: E349607-A23 dated 2014-07-31 and letter Report, Enclosure 08-05 of this report.
- IEC 62368-1:2014 2nd Edition report has been accepted for UL/IEC 62368-1:2018 3rd Edition since the technical requirements are the same. Test results from the 2nd Edition report are considered valid for UL/IEC 62368-1 3rd Edition.

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 NVM1D model)
- The end-product Electric Strength Test is to be based upon a maximum working voltage of : Primary-Secondary: 410 Vrms, 697 Vpk, Primary-Earthed Dead Metal: 398 Vrms, 662 Vpk
- The following output circuits are at ES1 energy levels : All
- The following output circuits are at ES2 energy levels : All series connection 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 NVM1D model)
- An investigation of the protective bonding terminals has : been conducted
- The following end-product enclosures are required : Electrical, Fire, Mechanical
- 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 T1, T2 and T3 (Class F) - See table 4.1.2 for details of insulation systems used
- The following components require special consideration during end-product Thermal (Heating) tests due to the indicated maximum temperature measurements during component-level testing : Refer to enclosure Manuals ID 6-01 Cooling for units table.
- The power supply was evaluated to be used at altitudes up to : "5,000 m"
- • 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: Suitable for factory wiring only
- For models with IEC inlet, Steady force test and impact test were not conducted. Acceptability is to be determined as part of the end device evaluation.
- Prospective touch voltage, touch current and protective conductor current has not been evaluated for frequencies above 63Hz supply and must be evaluated in the end equipment.
- NVM1D units are permitted to be configured as open frame only. Double or Reinforced Insulation is to be provided in the end equipment from any earthed part.