UL TEST REPORT AND PROCEDURE

Standard:	UL 62368-1, 3rd Ed, 2021-10-22 (Audio/video, information and communication technology equipment Part 1: Safety requirements) CAN/CSA C22.2 No. 62368-1:19, 3rd Ed, 2021-10-22 (Audio/video, information and communication technology equipment Part 1: Safety requirements)
Certification Type:	Component Recognition
CCN:	QQJQ2, QQJQ8 (Power Supplies for Use in Audio/Video, Information and Communication Technology Equipment)
Complementary CCN:	N/A
Product:	AC-DC Switch Mode Power Supply
Model:	NV175 Series or NV-175 Series Model NVx 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). Where x is 1, followed by NVx-abcde-f-g-h-ijk (see Model Differences for details) NV1-1G000 (see Model Differences for details)
Rating:	NV175 Series; NV-175 Series: 100-240Vac (Nominal), 90-264V (Full Tolerance), 45-440Hz, 3Arms NV175 Series; NV-175 Series: 133-318Vdc (Nominal), 120-350Vdc (Full Tolerance), 2.2Adc NV1-1G000 only: 88.9-240Vac (Nominal), 80-264Vac (Full Tolerance), 45-440Hz, 3Arms (See Model Differences for details)
Applicant Name and Address:	TDK-LAMBDA UK LTD KINGSLEY AVE ILFRACOMBE EX34 8ES UNITED KINGDOM

This is to certify that representative samples of the products covered by this Test Report have been investigated in accordance with the above referenced Standards. The products have been found to comply with the requirements covering the category and the products are judged to be eligible for Follow-Up Service under the indicated Test Procedure. The manufacturer is authorized to use the UL Mark on such products which comply with this Test Report and any other applicable requirements of UL LLC ('UL') in accordance with the Follow-Up Service Agreement. Only those products which properly bear the UL Mark are considered as being covered by UL's Follow-Up Service under the indicated Test Procedure.

The applicant is authorized to reproduce the referenced Test Report provided it is reproduced in its entirety.

UL authorizes the applicant to reproduce the latest pages of the referenced Test Report consisting of the first page of the Specific Technical Criteria through to the end of the Conditions of Acceptability.

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL.

Prepared By: Daniel Wong / Project Handler Reviewed By: Jan J. Jensen / Reviewer

Supporting Documentation

The following documents located at the beginning of this Procedure supplement the requirements of this Test Report:

A. Authorization - The Authorization page may include additional Factory Identification Code markings.

B. Generic Inspection Instructions -

i. Part AC details important information which may be applicable to products covered by this Procedure. Products described in this Test Report must comply with any applicable items listed unless otherwise stated in the body of this Test Report.

ii. Part AE details any requirements which may be applicable to all products covered by this Procedure. Products described in this Test Report must comply with any applicable items listed unless otherwise stated in the body of each Test Report.

iii. Part AF details the requirements for the UL Certification Mark which is not controlled by the technical standard used to investigate these products. Products are permitted to bear only the Certification Mark(s) corresponding to the countries for which it is certified, as indicated in each Test Report.

Product Description

NV175 or NV-175 series are switch mode power supplies for building into host equipment.

Model Differences

NV175 or NV-175 models as described below:

Units may be marked with a TDK Product Code: K1x or Q1x where x may be any number of letters and/or numbers 0 to 9, to identify models with customer specific requirements, for example fixed BOM.

No differences between NV175 series and NV-175 series except for marketing purpose.

Differences between NV1-1G000 and base model NV175 series:

NV1-1G000 is a customer specific open frame model with specific input ratings. (see Model and Ratings section for details)

Unit Configuration (Description) Code 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:

(z) NVx-abcde-f-g-h-ijk

where:

(z)= Blank for standard product

NS # followed by / or - (# may be any number of characters indicating non- safety related model differences)

or SP followed by /or – (SP represents a sales code).

x = 1 for 175

a = Number of Outputs : 1, 2, 3 or 4

b = Channel 1 Output Voltage†: 5, T, F, E or G

c = Channel 2 Output Voltage†: 1 , 2, 3, 5, 5L, 7, F or 0

d = Channel 3 Output Voltage†: 3L, 5L, 7, TL, FL, T, F, G followed by Y for negative output or 0

e = Channel 4 Output Voltage†: 3H, 5H, 7, T, F, TH, FH, 0H (fan only channel 4 output) followed by V for variable output followed by P for positive output or 0
f = Global Option : N for 5V version, N1 for 12V version, N2 for 13.5V version, N3 for 5V version with ATX compatibility, N4 for 12V version with ATX compatibility, N5 for 13.5V version with ATX, N6 for 12-13.5V version, N7 for 12-13.5V version with ATX or nothing for no Global Option present
g = U for U chassis, C for U chassis and cover, F for U chassis and cover with fan, I for U chassis and cover with fan and IEC inlet or nothing for Open Frame
h = Blank is the standard upright output connector, R is for the right angle output connector, H is for high altitude, HR is for high altitude with right angle output connector, M is for IEC60601-1, MR is for IEC60601-1 spacings with right angle connector
ijk = Three numbers from 0 to 9 which denotes various output voltages and currents within the specified ranges of each output for a particular unit or blank for standard output settings

† Table1: Output Voltage Cross Reference

Designation	Output Voltage
0	Omit output
A	1.5
1	1.8
B	2
2	2.7
3	3.3
5	5
7	7
T	12
F	15
E	18
G	24

Output channels and Global Options ratings are in accordance with the following table subject to variations and limitations of use below:

Output Channel	Designation	Vout	Adj. Range	Output Current
CH1	5	5	5 – 5.5	25A
	T	12	12 – 15.5	15A
	F	15	12 – 15.5	15A
	E	18	16 – 20	10A
	G	24	24 – 28.5	7.5A
CH2	1	1.8	0.9 – 3.8	15A
	2	2.7	2.5 – 3.8	15A
	3	3.3	2.5 – 3.8	15A
CH2 (CH1 12V)	5	5	3.3 – 5.5	10A
CH2 (CH1 15V)	5	5	3.3 – 5.5	10A
CH2 (CH1 24V)	5L	5	Fixed	2A
	5	5	3.3 – 5.5	8A
	7	7	5.5 – 8	5.5A

	F	15	12 – 15.5	6A
CH3	7	+/-7	7 – 8	5A
	T	+/-12	12 – 15	5A
	F	+/-15	12 – 15	5A
	G	+/-24	18 – 24.5	2.5A
	3L	+/-3.3	Fixed	2A
	5L	+/-5	Fixed	2A
	TL	+/-12	Fixed	2A
	FL	+/-15	Fixed	2A
CH4	3H	+/-3.3	Fixed	2A
	5H	+/-5	Fixed	2A
	7	+/-7	7 – 8	1A
	T	+/-12	Fixed	1A
	F	+/-15	Fixed	1A
	TH	+/-12	Fixed	2A
	FH	+/-15	Fixed	2A
	THV	+/-12	12 – 15	2A
	FHV	+/-15	12 – 15	2A
CH4 (fan	OH	-	-	-
output) Global	N	5	Fixed	2A
Option	N1	12	Fixed	1A
	N2	13.5	Fixed	1A
	N3	5 (ATX)	Fixed	2A
	N4	12 (ATX)	Fixed	1A
	N5	13.5 (ATX)	Fixed	1A
	N6	12	12 – 13.5*	1A
	N7	12 (ATX)	12 – 13.5*	1A

Channels 1 and 2 combined output currents must not exceed 25A

*Can only be set at the factory.

Variations and limitations of use:

All NV175 or NV-175 PSUs can output 180W except 5V channel 1 models which can output 175W. These power ratings are for channels 1 to 4. The global option output can be run in addition to the channel 1 to 4 maximum power outputs.

Units with channel 1 T and G outputs (no other channels fitted) have a peak power output of 200W including the global option with the following duty cycles:

In any 5 minutes 30% at 200W followed by 70% at 171W (average 180W)

In any 5 minutes 20% at 200W followed by 80% at 175W (average 180W)

Options -H and -HR meet spacings for 5000m.

Options -M and -MR meet IEC60601-1 Edition 2 Reinforced spacing's with the following limitations (interpolated creepage spacings):

Channel 1 cannot be 5V model (T1 and T2 with foils)
Channel 2 cannot be fitted
Cannot be global option variants

Fan versions:

Channel 1 with G output, 25V maximum with 5V channel 2 maximum output current of 7A.
Channel 1 with G output, 25V maximum with 7V channel 2 maximum output current of 5.5A.
Channel 1 with G output, 5L channel 2 maximum output current 1.8A.
Channel 2 with T and F outputs, channel 2 maximum output current of 9A.
Channel 4 maximum output current of 1.5A

Model NV1-1G000 (with or without global option or -M/-MR option) may also be run with Channel 1 output voltage range 22.5V to 28V with maximum current of 7.5A and maximum power of 180W

Model NV1-1G000 (with or without -M option) may also be run at 80Vac to 264Vac input, output: 24V to 28V at 6.25A maximum current and 150W maximum power.

The products listed in the following table are typical examples:

Model	CH1	CH2	CH3	CH4	Global Option
NV1-453FF	5V/25A	3.3V/15A	15V/5A	15V/1A	-
NV1-4G5FFH-N3	24V/7.5A	5V/8A	15V/5A	15V/2A	5V/2A
NV1-350TT-N	5V/25A	-	12V/5A	12V/1A	5V/2A
NV1-453TT-N1	5V/25A	-	12V/5A	12V/1A	12V/1A
NV1-250T0-N2	5V/25A	-	12V/5A	-	13.5V/1A

Custom Models:

All ratings as per standard models unless otherwise stated.

Model: NS-LAM/NV1-453TTH-N2-H-C (K10035)
Rated to 4600m altitude
Input voltage range from 90Vac to 264Vac

Model: NS-LAMF/NV1-4G5TTH-F (K10066)
5L low current channel 2 fitted.
Channel 2 rated: 5V, 1.4A

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
Special installation location	N/A
Pollution degree (PD)	PD 2
Manufacturer's specified Tma (°C)	50°C, 65°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 (standard) or 5000 m (for –H and –HR options) m
Altitude of test laboratory (m)	2000 m or less
Mass of equipment (kg)	0.6kg

Technical Considerations

- The product was submitted and evaluated for use at the maximum ambient temperature (Tma) permitted by the manufacturer's specification of : 65°C (power and current de-rated 2.5% per °C from 50°C to 65°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 : AC mains: +10%/-10%, DC mains: absolute mains supply.
- The equipment disconnect device is considered to be : N/A, 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
- The product was investigated to the following additional standard : EN IEC 62368-1:2020+A11:2020, UL 62368-1 3rd Edition, Issued December 13, 2019, CAN/CSA C22.2 No. 62368-1:19, 3rd Edition

Engineering Conditions of Acceptability

For use only in or with complete equipment where the acceptability of the combination is determined by UL LLC. When installed in an end-product, consideration must be given to the following:

- The following product-line tests are conducted for this product : Earthing Continuity, Electric Strength
- The end-product Electric Strength Test is to be based upon a maximum working voltage of : Primary-SELV: 444 Vrms, 660 Vpk., Primary-Earthed Dead Metal: 423 Vrms, 608 Vpk
- The following output circuits are at ES1 energy levels : All outputs
- 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
- 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 OBJY2 insulation system with the indicated rating greater than Class A (105°C) : T1, T2, TX701 (Class F) see critical component table for details of insulation systems used with an OBJY3 insulation system.
- The following components require special consideration during end-product Thermal (Heating) tests due to the indicated maximum temperature measurements during component-level testing : Models without a fan require component temperatures monitored as detailed in the Additional Information
- The equipment is suitable for direct connection to : AC mains supply (IEC inlet models only)
- The power supply was evaluated to be used at altitudes up to : 3000 m standard or 5000 m for –H and –HR options
- The power supply terminals and/or connectors are: Not investigated for field wiring
- Orientations: Customer air models: All except horizontal with PWB uppermost. Fan models: All except horizontal with chassis base uppermost and vertical with input uppermost.
- End equipment required to be supplied via DC mains must utilise a conditioned power supply with a +/- 10% tolerance. Additional evaluation must be considered in end application.

Additional Information

- Model label provided is representative of all series
- No testing was conducted under this report. All required tests were carried out under the original investigation evaluated per IEC/UL 62368-1:2014 (2nd edition) in CB report E135494-A6003-CB-1, cert no. DK-79117-UL, latest issued date on 2018-12-12. 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.

Cooling for units with customer supplied air (open frame, U and C options)

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.

Circuit Ref	Description Max.	Temperature (°C)
L3, L7	Common mode choke winding	140
C1, C4	X capacitors	100
C6, C12	Capacitors	105
L2	Boost choke winding	130
C7	Electrolytic capacitor	70 (105)

T1, T2	Transformer winding	130
XU3	Control board optocoupler	100
TX701	Global option transformer	90
L5	Channel 1 output choke	125
XL401	Channel 2 output choke	125
XL601	5L channel 2 output choke	125
XU601	5L channel 2 IC	115
XL501 or XL601	Channel 3 and 4 output choke	125
IC1*	Channel 4 voltage regulator	110
XQ406	Channel 2 highside FET (SMA 2)	115
XV504	Channel 3 highside FET (SMA 3)	115
XU601	Channel 4 IC (SMA 4)	115
Various	All other electrolytic capacitors	90 (105)

* 1A channel 4 only

Higher temperatures limits (in brackets) may be used but product life may be reduced.

Additional Standards

The product fulfills the requirements of: AS/NZS 62368.1:2022,
EN IEC 62368-1:2020+A11:2020, BS EN IEC 62368-1:2020 + A11:2020,
United Kingdom (per customer's request shown separately),
CSA/UL 62368-1:2019

Markings and Instructions

Clause Title	Marking or Instruction Details
Equipment identification marking – Manufacturer identification	Listee's or Recognized Company's name, Trade Name, Trademark or File Number
Equipment identification marking – model identification	Model Number
Equipment rating marking – ratings	"Input Ratings (voltage, frequency/dc, current/power)", "Output Ratings (voltage, frequency/dc, current/power)"

Special Instructions to UL Representative

N/A