UL TEST REPORT AND PROCEDURE

Standard:	UL 60950-1, 2nd Edition, 2019-05-09 (Information Technology Equipment - Safety - Part 1: General Requirements) CAN/CSA C22.2 No. 60950-1-07, 2nd Edition, 2014-10 (Information Technology Equipment - Safety - Part 1: General Requirements)
Certification Type:	Component Recognition
CCN:	QQGQ2, QQGQ8 (Power Supplies for Information Technology Equipment Including Electrical Business Equipment)
Complementary CCN:	QQJQ2, QQJQ8 (Power Supplies for Use in Audio/Video, Information and Communication Technology Equipment)
Product:	Power Supply
Model:	HWS1500-3, HWS1500-5, HWS1500-6, HWS1500-7, HWS1500-12, HWS1500-15, HWS1500-24, HWS1500-36, HWS1500-48, HWS1500-48/SB1800, and HWS1500-60 may be followed by "/CO", "/DOV", "/HD", "/LNF", "/RL", "/SB", "/RY", "/RYCO", "/RYLLF", "/RYHD" or "/LNF3K". Suffix "/DOV" for Model HWS1500-24 only. Suffix "/LNF" for Models HWS1500-24, HWS1500-36, and HWS1500-48 only. Suffixes "/RY", "/RYCO", "/RYLLF" or "/RYHD" for Model HWS1500-24 only. Suffix "/LNF3K" for Model HWS1500-24 only.
Rating:	Input: AC 100-240 V, 50/60 Hz, 15 A for model HWS1500-3 20 A for other models Output: Refer to General Product Information
Applicant Name and Address:	TDK-LAMBDA CORP NAGAOKA TECHNICAL CENTER R&D DIV 2704-1 SETTAYA-MACHI NAGAOKA-SHI NIIGATA 940-1195 JAPAN

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.

Prepared By:	Toshiyuki Suzuki / Project Handler	Reviewed By:	Masatomo Takiyama / 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

The products are Component AC/DC Switching Power Supply with Fan intended for use in Information Technology Equipment (ITE).

<Output rating>

HWS1500-3: 3.3Vdc, 300 A.

HWS1500-5: 5Vdc, 300 A.

HWS1500-6: 6Vdc, 250 A.

HWS1500-7: 7.5Vdc, 200 A.

HWS1500-12: 12Vdc, 125 A.

HWS1500-15: 15Vdc, 100 A.

HWS1500-24: 24Vdc, 65 A (100 - 180 Vac) and 70 A (180 - 240 Vac). Also following peak output rating decleared: Peak current 105 A (max. 2520 W), max. 10 sec., duty 35% (180 - 240 Vac).

HWS1500-36: 36Vdc, 42 A (100 - 180 Vac) and 46.5 A (180 - 240 Vac). Also following peak output rating decleared: Peak current 70 A (max. 2520 W), max. 10 sec., duty 35% (180 - 240 Vac).

HWS1500-48: 48Vdc, 32 A.

HWS1500-60: 60Vdc, 25.6 A (100 - 180 Vac) and 28 A (180 - 240 Vac). Also following peak output rating decleared: Peak current 42 A (max. 2520 W), max. 10 sec., duty 35% (180 - 240 Vac).

Model Differences

Models HWS1500-12, HWS1500-15, HWS1500-24, HWS1500-36, HWS1500-48, and HWS1500-60 are identical, except for output rating, Transformer (T201), Inductor (L401) and some components on secondary circuit.

Model HWS1500-3 is identical in construction to Model HWS1500-12, except for Transformer (T201), FETs, PWB [Board No. PDA-033#] and some primary and secondary components described in Table 1.5.1.

Models HWS1500-3, HWS1500-5, and HWS1500-6 are identical in construction, except for temperature rating of Thermostat (TH201).

Models HWS1500-3 and HWS1500-7 are identical in construction, except for Transformer (T201), temperature rating of Thermostat (TH201) and some secondary components described in Table 1.5.1.

Model HWS1500-48/SB1800 is identical in construction to Model HWS1500-48/SB except for output power at 180-240Vac input, the use of class H Transformer (T201) only and the difference of constant of some secondary components.

Differences - Type Designation Suffixes:

"/blank": No thin coating for PWB.

"/CO": Thin coating for solder side of PWB.

"/DOV": OVP range is changed to maximum 30.5 Vdc. Changed rating of Resistor (R919) for Model HWS1500-24 only.

"/HD": Thin coating for both side of PWB.

"/LNF": Provided with Low Noise Fan. For Models HWS1500-24, HWS1500-36, and HWS1500-48 only. Models with this suffix have Tma different from other models. See CE1.2 in Technical Considerations.

"/LNF3K": Provided with Low Noise Fan and corresponded to an altitude of 3000 m. For Model HWS1500-24 only. Model with this suffix have Tma different from other models. See CE1.2 in Technical Considerations.

"/RL": Logic of Remote ON/OFF control is reversing. Change PWB name to PDA-034.

"/SB": This suffix model is identical in construction to models without the /SB suffix except the output terminal +) and -) is shortened by 11.0 mm.

"/RY": Uses relay instead of optocoupler in signal circuit of Model HWS1500.

"/RYCO": Based on /CO except with relay.

"/RYLLF": Based on /RY except fan. Fan is longer life fan.

"/RYHD": Based on /HD except with relay

Only 24 Vdc output models may be followed by suffixes "/RY", "/RYCO", "/RYLLF" or "/RYHD" and PWB p/n is changed from PDA-010_ to SCB365_ because of design change for above models.

Test Item Particulars	
Equipment mobility	for building-in
Connection to the mains	not directly connected to the mains
Operating condition	continuous
Access location	N/A
Over voltage category (OVC)	OVC II
Mains supply tolerance (%) or absolute mains supply values	+10%, -10%
Tested for IT power systems	No
IT testing, phase-phase voltage (V)	N/A
Class of equipment	Class I (earthed)
Considered current rating of protective device as part of the building installation (A)	30
Pollution degree (PD)	PD 2
IP protection class	IP X0
Altitude of operation (m)	Up to 2000 (Up to 3000 for Model HWS1500-24/LNF3K only)
Altitude of test laboratory (m)	less than 2000 meters
Mass of equipment (kg)	Approximately 3.5

Technical Considerations

- 1.2 The power supply was submitted and evaluated for use at the maximum ambient temperature (Tma) permitted by the manufacturer's specification of: Models HWS1500-3 and HWS1500-5: 40°C

[100% Output Load] and 70°C [50% Output Load]. Models HWS1500-6, HWS1500-7, HWS1500-12, HWS1500-15, HWS1500-24, HWS1500-36, HWS1500-48, and HWS1500-60: 50°C [100% Output Load] and 70°C [50% Output Load]. Models HWS1500-24/LNF, HWS1500-36/LNF, HWS1500-48/LNF, and HWS1500-24/LNF3K: 30°C [100% Output Load], 50°C [60% Output Load], and 70°C [20% Output Load]. Model HWS1500-24/RYLLF: 35°C [100% Output Load], 50°C [70% Output Load], and 70°C [20% Output Load]. See Enclosure Id. 6-01 for Model HWS1500-24/RYLLF derating curve details. Models HWS1500-48/SB1800: 40°C [100% Output Load], and 70°C [50% Output Load]. See Enclosure Id. 6-02 for Models HWS1500-48/SB1800.

- 1.4 The product is intended for use on the following power systems: TN

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 end-product Electric Strength Test is to be based upon a maximum working voltage of : Primary - Secondary: 346 Vrms, 656 Vpk and Primary - Earthed Dead Metal: 346 Vrms, 624 Vpk for all models except for Models HWS1500-60, HWS1500-3, HWS1500-5, HWS1500-6, and HWS1500-7. Primary - Secondary: 373 Vrms, 736 Vpk and Primary - Earthed Dead Metal: 373 Vrms, 540 Vpk for Model HWS1500-60. Primary - Secondary: 380 Vrms, 540 Vpk and Primary - Earthed Dead Metal: 380 Vrms, 540 Vpk for Models HWS1500-3, HWS1500-5, HWS1500-6, and HWS1500-7. Primary -Secondary and Primary - Earthed Dead Metal: 237 Vrms, 664 Vpk for Model HWS1500-48/SB1800.
- The following secondary output circuits are SELV : Outputs of Models HWS1500-3, HWS1500-5, HWS1500-6, HWS1500-7, HWS1500-12, HWS1500-15, HWS1500-24, HWS1500-24/DOV, HWS1500-36, and HWS1500-48
- The following secondary output circuits are at hazardous energy levels : Outputs of Models HWS1500-3, HWS1500-5, HWS1500-6, HWS1500-7, HWS1500-12, HWS1500-15, HWS1500-24, HWS1500-24/DOV, HWS1500-36, HWS1500-48, HWS1500-48/SB1800 and HWS1500-60.
- The power supply terminals and/or connectors are : Suitable for factory wiring only
- Proper bonding to the end-product main protective earthing termination is : Required (via Chassis or Cover)
- The following input terminals/connectors must be connected to the end-product supply neutral : Terminal 2 of Terminal Block (TB1)
- 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) : T201 (Class 155(F)) for Models HWS1500-12, HWS1500-15, HWS1500-24, HWS1500-36, and HWS1500-48, T201 (Class 180(H)) for Models HWS1500-3, HWS1500-5, HWS1500-6, HWS1500-7, HWS1500-48/SB1800, and HWS1500-60, T700 (Class 130(B))
- The following end-product enclosures are required : Mechanical, Fire, Electrical
- The chassis of power supply shall be properly bonded to Protective Earthing Terminal in the end product.
- All tests measuring temperatures of components were conducted by horizontal position. (Nameplate/Rating Label Side Up)
- FG Terminals of Terminal Block (TB1) has not been evaluated as Protective Earthing Terminal.
- Terminal Block (TB1) was not evaluated for direct connection to the mains supply cord/wire of end product.
- Cover and Chassis have not been evaluated as external/internal enclosure.
- The following secondary output circuit is Hazardous Voltage: Output of Model HWS1500-60 (Output voltage did not comply with SELV and ELV requirements. Output separated by double/reinforced insulation.)
- The Clearances and Creepage Distances have additionally been assessed for suitability up to 3000 m elevation. (For Model HWS1500-24/LNF3K)
- Line to ground Capacitors (C18, C19) may have variation in capacitance up to 4700 pF. Primary to ground Capacitor (C16, C14, C209) may have variation in capacitance up to 2200 pF. Therefore, consideration shall be given in controlling the capacitance value in end product application with respect to touch current issue.
- Line to Line Capacitors (C1, C2, C20, C21, C22) may have variation in capacitance up to 1.0 uF. Therefore, consideration shall be given in controlling the capacitance value in the end-product application with respect to capacitance discharge issue.
- The following output circuits are at ES1 energy levels : All models' output except Model HWS1500-60
- The following output circuits are at ES2 energy levels : Output of Model HWS1500-60
- The following output circuits are at PS3 energy levels : All models' output
- Humidity conditioning has been conducted by tropical condition.
- Classification of PIS has not been conducted. Therefore, all electrical components and conductors including printed wirings were assumed to be arcing/resistive PIS.
- This component has been evaluated in "control of fire spread" method assuming appropriate fire enclosure is provided in end product. Unless the fire enclosure is made of non-combustible or V-0 material, the separation from the PIS shall be considered

Additional Information

The following are the output voltage ranges considered during the evaluation:

HWS1500-3: 3.3Vdc (2.64 - 3.96 Vdc), maximum 300 A and 990 W.
HWS1500-5: 5Vdc (4.0 - 6.0 Vdc), maximum 300 A and 1500 W.
HWS1500-6: 6Vdc (4.8 - 7.2 Vdc), maximum 250 A and 1500 W.
HWS1500-7: 7.5Vdc (6.0 - 9.0 Vdc), maximum 200 A and 1500 W.
HWS1500-12: 12Vdc (9.6 - 14.4 Vdc), maximum 125 A and 1500 W.
HWS1500-15: 15Vdc (12.0 - 18.0 Vdc), maximum 100 A and 1500 W.
HWS1500-24: 24Vdc (19.2 - 28.8 Vdc), maximum 65 A and 1560 W (100 - 180 Vac), maximum 70 A and 1680 W (180 - 240 Vac).
HWS1500-36: 36Vdc (28.8 - 43.2 Vdc), maximum 42 A and 1512 W (100 - 180 Vac), maximum 46.5 A and 1674 W (180 - 240 Vac).
HWS1500-48: 48Vdc (38.4 - 52.8 Vdc), maximum 32 A and 1536 W.
HWS1500-60: 60Vdc (48 - 66 Vdc), maximum 25.6 A and 1536 W (100 - 180 Vac), maximum 28 A and 1680 W (180 - 240 Vac).

Adjustment was made via Variable Resistor (VR900)

Additional Standards

The product fulfills the requirements of: The product fulfills the requirements of: UL 62368-1, 2nd Edition, 2014-12-01, CAN/CSA C22.2 No. 62368-1-14, 2nd Edition, 2014-12.

Markings and Instructions

Clause Title	Marking or Instruction Details
1.7.1 - Power rating - Company identification	Recognized company's name or tradename: "E122103", "TDK Lambda" or Trademark
1.7.1 - Power rating - Ratings	Optional. Ratings (voltage, frequency/dc, current)
1.7.1 Power rating - Model	Model Number
1.7.6 Fuses - Rating	Rated current and voltage and type located on or adjacent to fuse or fuseholder.