

UL TEST REPORT AND PROCEDURE

Standard:	UL 60950-1, 2nd Edition, 2014-10-14 (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:	Switching Power Supply
Model:	HWS600-ade fg, HWS600-42/DS (a = 3, 5, 12, 15, 24, 48 or 55, d = / or blank, e = PV or blank, f = CO, HD or blank, g = LLF) Only 24 Vdc output models maybe followed by suffixes "/RY", "/RYCO", "/RYLLF", "/RYHD" or "/MESC". Only 12Vdc output model maybe followed by suffix "/RF". Only Model HWS600-48 maybe followed by suffix "/HKM", "/PVLNF". HWS600P-bdefg, HWS600PCN-cdefg (b = 24, 36 or 48, c = 24 or 30, d = / or blank, e = PV or blank, f = CO, HD or blank, g = LLF) Only 24 Vdc output models maybe followed by suffixes "/RY", "/RYCO", "/RYLLF" or "/RYHD".
Rating:	Input: AC 100-240 V, 50/60 Hz, 8.2 A (except for Models HWS600P-24, HWS600P-36, and HWS600P-48) Input: AC 100-240 V, 50/60 Hz, 8.7 A (for Models HWS600P-24, HWS600PCN-24, HWS600PCN-30, HWS600P-36, and HWS600P-48)
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.

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

Issue Date: 2010-05-31
2019-03-07

Page 2 of 28

Report Reference #

E122103-A38-UL

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: Tetsuo Iwasaki

Reviewed by: Ikuro Kinno

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 product covered is a building-in type switching power supply with a single output circuit.

The switching power supply is intended to be connected to a protective earth of the end product via Terminal Block.

Model Differences

All models are identical, except for output rating, secondary winding of isolation transformer and some minor secondary components.

Models with suffix "PV", "CO", "HD", "HKM", "RY", "RYCO", "RYLLF", "RYHD", "MESC", "RF", "PVLNF" or "LLF" are identical to the original models except for following:

"PV" - C222 added, R337 open, R340 jumped in the secondary circuit.

"CO" - Coated on PWB soldering surface.

"HD" - Coated on both of PWB component/soldering surfaces and Tma of 71°C at 20% load.

"HKM" - Model name for limited user.

"RY" - Use relay instead of PC3 in signal circuit of HWS600.

"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.

"MESC" - Identical except alternate fan, output derating curve and Y-cap, where the capacitance of C11, C14, C15 and C33 changes from 1000pF to 680pF.

"RF" - Identical except reversed fan and derating curve.

"PVLNF" - /PV with low speed fan.

"LLF" - Use Long Life Fan

"DS" - No safety relevant variation. (Identification for sales purpose only)

Only 24 Vdc output models maybe followed by suffixes "/RY", "/RYCO", "/RYLLF", "/RYHD" or "/MESC".

Only 12 Vdc output model maybe followed by suffix "/RF".

Only Model HWS600-48 maybe followed by suffix "/HKM" or "/PVLNF".

Models HWS600P-24 and HWS600P-48 are identical to Models HWS600-24 and HWS600-48 except for over current protection circuit, fan speed control circuit, peak output condition, and minor components and major component. (see appended table 1.5.1)

Model HWS600P-36 is identical to Model HWS600P-24 except for output rating, transformer, and some minor secondary components.

Model HWS600PCN-30 is identical to Model HWS600P-24 except for output rating, transformer, and using input/output connector instead of terminal block.

Model HWS600PCN-24 is identical to Model HWS600P-24 except for input/output connector instead of terminal block.

Technical Considerations

- Equipment mobility : for building-in
- Connection to the mains : N/A
- Operating condition : continuous
- Access location : operator accessible
- 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) : 20
- Pollution degree (PD) : PD 2
- IP protection class : IP X0
- Altitude of operation (m) : up to 2000
- Altitude of test laboratory (m) : approximately 10 to 20
- Mass of equipment (kg) : approximately 1.5
- The product was submitted and evaluated for use at the maximum ambient temperature (T_{ma}) permitted by the manufacturer's specification of: T_{ma} are different in accordance with load %. See Enclosure Id. 7-01 for details.
- 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 following Production-Line tests are conducted for this product: Earthing Continuity
- The end-product Electric Strength Test is to be based upon a maximum working voltage of: Primary - Secondary: 364 Vrms, 632 Vpk, Primary - Ground: 365 Vrms, 616 Vpk for all models except for Model HWS600-55. Primary-Secondary: 367 Vrms, 604 Vpk, Primary-Earthed Dead Metal: 367 Vrms, 604 Vpk for Model HWS600-55.
- The following secondary output circuits are SELV: All models' output
- The following secondary output circuits are at hazardous energy levels: All models' output
- The power supply terminals and/or connectors are: Suitable for factory wiring only
- The maximum investigated branch circuit rating is: 20 A
- The investigated Pollution Degree is: 2
- An investigation of the protective bonding terminals has: Been conducted
- The following end-product enclosures are required: Mechanical, Fire, Electrical
- The fans included as part of this component are suitable for use in a user access area: No

- Cover and Chassis has not been evaluated as internal enclosure.
- Y-Capacitors (C3, C4) and Y-Capacitors (C11, C14, C15, C33) maybe rated maximum 3300 pF or not provided; therefore, consideration shall be given to conducting the Touch Current Test in end product with respect to variation in C3, C4, C11, C14, C15, and C33.
- Model HWS600-5 was tested with output voltage range of 4.0 - 6.0 Vdc (maximum 120 A, maximum 600 W). Model HWS600-12 was tested with output voltage range of 9.6 - 14.4 Vdc (maximum 53 A, maximum 636 W). Model HWS600-12/RF was tested with output voltage range of 9.6 - 14.4 Vdc (maximum 48A, maximum 576W); Model HWS600-24 was tested with output voltage range of 19.2 - 28.8 Vdc (maximum 27 A, maximum 648 W); Model HWS600-48 was tested with output voltage range of 38.4 - 52.8 Vdc (maximum 13 A, maximum 624 W); Model HWS600-3 was tested with output voltage range of 2.64 - 3.96 Vdc (maximum 120 A, maximum 396 W); Model HWS600-15 was tested with output voltage range of 12.0 - 18.0 Vdc (maximum 43 A, maximum 645 W); Model HWS600-42/DS was tested with output voltage range of 38.4 - 46.2 Vdc (maximum 13 A, maximum 546 W); Model HWS600-55 was tested with output voltage range of 44.0 - 56.0 Vdc (maximum 11 A, maximum 605 W); Model HWS600-48/PVLNF was tested with output voltage range of 9.6 - 52.8 Vdc (maximum 13A, maximum 624W). Adjustment was made via Variable Resistor (VR51). Tests conducted with rated output voltage, ampere load, and VA. Additional testing shall be considered if the end product is outside this range.
- Model HWS600P-24 was tested with output voltage range of 19.2 - 26.4 Vdc (maximum 25 A, maximum 600 W), and with peak current 40.5 A (maximum 972 W for 100-170 Vac input) / peak current 83 A (maximum 1992 W for 170-240 Vac input), maximum 5 seconds, duty maximum 35 %; Model HWS600P-36 was tested with output voltage range of 28.8 - 39.6 Vdc (maximum 16.7 A, maximum 601.2 W), and with peak current 27 A (maximum 972 W for 100-170 Vac input) / peak current 55.5A (maximum 1998 W for 170-240 Vac input), maximum 5 seconds, duty maximum 35 %; Model HWS600P-48 was tested with and output voltage range of 38.4 - 52.8 Vdc (maximum 12.5 A, maximum 960 W), and with peak current 20 A (maximum 960 W for 100-170 Vac input) / peak current 41.5 A (maximum 1992 W for 170-240 Vac input), maximum 5 seconds, duty maximum 35 % (See Enclosure Id. 7-03 for details.). Adjustment was made via Variable Resistor (VR51). Tests conducted with rated output voltage, ampere load, and VA. Additional testing shall be considered if the end product is outside this range.
- The following magnetic devices (e.g. transformers or inductor) are provided with an IEC 60085 (equivalent to UL1446) insulation system with the indicated rating greater than Class 105(A): T32 (Class 155(F))
- The following output circuits are at ES1 energy levels : All models' output
- The following output circuits are at PS3 energy levels : All models' output
- Proper bonding to the end-product main protective earthing termination is : Required (via chassis)
- 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

Output: 3 Vdc, 120 A (for HWS600-3)
5 Vdc, 120 A (for HWS600-5)
12 Vdc, 53 A (for HWS600-12)
12 Vdc, 48 A (for HWS600-12/RF)
15 Vdc, 43 A (for HWS600-15)
24 Vdc, 27 A (for HWS600-24)

48 Vdc, 13 A (for HWS600-48)
42 Vdc, 13 A (for HWS600-42/DS)
55 Vdc, 11 A (for HWS600-55)

24 Vdc, 25 A / Peak Current 40.5 A (Maximum 972 W for 100-170 Vac Input)
/ Peak Current 83 A (Maximum 1992 W for 170-240 Vac Input), maximum 5 seconds,
Duty Maximum 35 % (for HWS600P-24 and HWS600PCN-24)

30Vdc, 20A / Peak Current 32A(Maximum 960W for 100-170 Vac Input)
/ Peak Current 66 A (Maximum 1980 W for 170-240 Vac Input), maximum 5 seconds
Duty Maximum 35% (for HWS600PCN-30)

36 Vdc, 16.7 A / Peak Current 27 A (Maximum 972 W for 100-170 Vac Input)
/ Peak Current 55.5 A (Maximum 1998 W for 170-240 Vac Input), maximum 5 seconds,
Duty Maximum 35 % (for HWS600P-36)

48 Vdc, 12.5 A / Peak Current 20 A (Maximum 960 W for 100-170 Vac Input)
/ Peak Current 41.5 A (Maximum 1992 W for 170-140 Vac Input), maximum 5 seconds,
Duty Maximum 35 % (for HWS600P-48)

See Enclosure Id. 7-01 for Output Derating Curve and Mounting Positions A and B details.
See Enclosure Id. 7-03 for Output Derating Curve and Mounting Positions A and B, and Peak Output Condition details.
See Enclosure Id. 7-04 for Output Derating Curve and Mounting Positions A, B, C and D.
See Enclosure Id. 7-07 for Output Derating Curve and Mounting Positions of "/MESC".
See Enclosure Id. 7-08 for Output Derating Curve and Mounting Positions of "/RF".
See Enclosure Id. 7-10 for Output Derating Curve and Mounting Positions of "/PVLNF".

Mounting Position A = Horizontal.
Mounting Position B = Vertical
Mounting Position C = Vertical located input connector up
Mounting Position D = Horizontal to be installed on right side

100% load at 50°C ambient and 50% load at 70°C ambient for mounting position A and mounting position B.
100% load at 50°C ambient and 50% load at 70°C ambient for mounting position A, B, C and mounting position D for HWS600PCN-30.
100% load at 40°C ambient and 87.5% load at 50°C for mounting position A for HWS600-12/RF.
100% load at 35°C ambient and 50% load at 60°C ambient for mounting position A and B for HWS600-48/PVLNF.

Unless otherwise indicated, all tests were conducted on Model HWS600-5, HWS600-24 or HWS600-48. Tests conducted on Model HWS600-5, HWS600-24 or HWS600-48 were considered to be representative of entire HWS600 Series.

Only necessary tests were conducted on Models HWS600-3, HWS600-15, HWS600P-24, HWS600P-36, and HWS600P-48.

Additional Standards

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 -	

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.
1.7.1 Power rating - Company identification	Listee's or Recognized company's name, Trade Name, Trademark or File Number