

CERTIFICATE OF COMPLIANCE

Certificate Number 20160217-E155698
Report Reference E155698-A16-UL
Issue Date 2016-FEBRUARY-17

Issued to: TDK-LAMBDA LTD
56 HAHAROSHET STREET
P.O.B. 500 KARMIEL INDUSTRIAL ZONE
2161401 KARMIEL ISRAEL

This is to certify that representative samples of COMPONENT - POWER SUPPLIES, INFORMATION TECHNOLOGY EQUIPMENT INCLUDING ELECTRICAL BUSINESS EQUIPMENT
See Addendum Page for Models

Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.


Standard(s) for Safety: UL 60950-1 and CAN/CSA C22.2 No. 60950-1-07, Information Technology Equipment - Safety - Part 1: General Requirements

Additional Information: See the UL Online Certifications Directory at www.ul.com/database for additional information

Only those products bearing the UL Certification Mark should be considered as being covered by UL's Certification and Follow-Up Service.

Recognized components are incomplete in certain constructional features or restricted in performance capabilities and are intended for use as components of complete equipment submitted for investigation rather than for direct separate installation in the field. The final acceptance of the component is dependent upon its installation and use in complete equipment submitted to UL LLC.

Look for the UL Certification Mark on the product.



Bruce Mahrenholz, Director North American Certification Program

UL LLC

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This is to certify that representative samples of the product as specified on this certificate were tested according to the current UL requirements.

Switching Power Supply and Accessory Rack

1) Single Power Supply Modules:

HFE2500-48xyzu, -32xzu, -24xzu, -12xzu
(x="/S", blank; y="/POE", blank; z=-R, blank; u=/CO, blank)

2) Single Power Supply Modules:

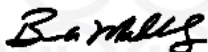
RFE2500-48xyu, -32xu, -24xu, -12xu
(x="/S", blank; y="/POE", blank; u=/CO, blank)

3) HFE2500-48/S-CQC

4) HFE2500-12/S-R/RE

5) Accessory rack:

HFE2500-S1Uwu
(w="-TB", blank; u=/CO, blank)



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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)
Product:	Switching Power Supply and Accessory Rack
Model:	1) Single Power Supply Modules: HFE2500-48xyzu, -32xzu, -24xzu, -12xzu (x="/S", blank; y="/POE", blank; z=-R, blank; u=/CO, blank) 2) Single Power Supply Modules: RFE2500-48xyu, -32xu, -24xu, -12xu (x="/S", blank; y="/POE", blank; u=/CO, blank) 3) HFE2500-48/S-CQC 4) HFE2500-12/S-R/RE 5) Accessory rack: HFE2500-S1Uwu (w="-TB", blank; u=/CO, blank) see model differences for details.
Rating:	1) a) Models without suffix -R (base models) Input: 100 - 240 VAC, 15A max., 50/60 Hz; Output: Main output at ambient temperature up to 50°C, @ Vin=170-240Vac: - 48VDC (38.4~58.0VDC), 52A max., 2500W max. - 32VDC (25.6~38,4VDC), 74A max., 2500W max. - 24VDC (19.2~29.0VDC), 104A max., 2500W max. - 12VDC (9.6~13.2VDC), 200A max., 2500W max. b) Models with suffix -R (reverse fan models) Input: 100 - 240 VAC, 13.5A max., 50/60 Hz; Output: Main output at ambient temperature up to 50°C, @ Vin=170-240Vac: - 48VDC (38.4~58.0VDC), 41.6A max., 2000W max. - 32VDC (25.6~38,4VDC), 59.2A max., 2000W max. - 24VDC (19.2~29.0VDC), 83.2A max., 2000W max. - 12VDC (9.6~13.2VDC), 160A max., 2000W max. 2) Input: 100 - 240 VAC, 15A max., 50/60 Hz; Output: Main output at ambient temperature up to 50°C, @ Vin=170-240Vac: - 48VDC (38.4~58.0VDC), 52A max., 2500W max. - 32VDC (25.6~38,4VDC), 74A max., 2500W max. - 24VDC (19.2~29.0VDC), 104A max., 2500W max.

- 12VDC (9.6~13.2VDC), 200A max., 2500W max.

3) Input: 100 - 240 VAC, 15A max., 50/60 Hz;
Output: Main output at ambient temperature up to 50°C, @ Vin=170-240Vac:

- 48VDC (38.4~58.0VDC), 52A max., 2500W max.

4) Input: 100 - 240 VAC, 14A max., 50/60 Hz;
Output: Main output at ambient temperature up to 40°C, @ Vin=180-240Vac:

- 12VDC (9.6~13.2VDC), 180A max., 2200W max.

5) Input: (per each input): 100-240Vac, 15A max., 50/60 Hz;
Output:

Main output:

-output voltage: same with installed units

-output current: according to number of installed modules but not more than 320A max. per each output, total 640A max.

Auxiliary output (all above except 4): 12VDC/0.5A

Applicant Name and Address:

TDK-LAMBDA LTD
56 HAHAROSHET STREET
P.O.B. 500 KARMIEL INDUSTRIAL ZONE
2161401 KARMIEL ISRAEL

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.

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Prepared by: Isaia Bonavoglia

Reviewed by: ChienFong Wang

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

HFE2500 is a power supply module that may be used separately from the accessory rack HFE2500-S1U in accordance with the "Conditions of Use".

The accessory rack HFE2500-S1Uz is intended for use only with HFE2500 power supply modules.

RFE2500 power supply modules are same with the HFE2500 power supply modules (el. schematic, components, mech. construction) and have minor differences due to using of separate input TB, separate signals connectors and output bus-bars instead of common I/O connector which used in HFE2500 power supply modules.

Model Differences

Model configuration code for HFE2500-aaxyzu , RFE2500-aaxyu and HFE2500-S1Uwu

aa = (all models)

number denoting output voltage ratings (see Ratings)

x = (all models)

/S - with communication option

blank - without

y = (HFE2500-48 and RFE2500-48 only)

/POE - with output circuit additionally meets of requirements of IEEE 802.3 Standard

blank - standard model

z = (HFE2500 only)

-R - with reverse air flow

blank - standard air flow

u = (all models)

-CO - conformal coating used

blank - without conformal coating

w = (HFE2500-S1U only)

-TB - with input terminal blocks instead of IEC inlets

blank - with IEC inlet

Model HFE2500-48/S-CQC is fully same with base model HFE2500-48/S, "-CQC" is an identification for specific customer.

Model HFE2500-12/S-R/RE is fully same with model HFE2500-12/S-R but has a different rating (see ratings).

Technical Considerations

- Equipment mobility : for building-in
- Connection to the mains : pluggable A (for HFE2500-S1U rack only, connection to mains depends on model; refers to General Product Information.)
- 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 : Yes (Norway only)
- IT testing, phase-phase voltage (V) : 230
- Class of equipment : Class I (earthed)
- Considered current rating of protective device as part of the building installation (A) : N/A
- Pollution degree (PD) : PD 2
- IP protection class : IP X0
- Altitude of operation (m) : 3000
- Altitude of test laboratory (m) : 50
- Mass of equipment (kg) : 1-4) max 2.1kg - 5) max 10.5 kg (with all power modules installed)
- The product was submitted and evaluated for use at the maximum ambient temperature (Tma) permitted by the manufacturer's specification of: - HFE2500: -50°C, 70°C (with output de-rated), - HFE2500-R (reverse air flow): -50°C, 55°C (with output de-rated), - RFE2500: -50°C, 70°C (with output de-rated), - HFE2500-48/S-CQC= -50°C, 70°C (with output de-rated), - HFE2500-12/S-R/RE: -40°C, 55°C (with output de-rated), - HFES1U rack: -50°C, 70°C (with output de-rated)
- The means of connection to the mains supply is: Pluggable A for HFE2500-S1U., For HFE2500/RFE2500 power supply modules using separately and for the accessory rack HFE2500-S1U-TB the means of connection to the mains shall be specified in end-installation.,
- The product is intended for use on the following power systems: TT, TN, IT (only for Norway)
- The equipment disconnect device is considered to be: - for HFE2500-S1U: appliance coupler. , - for HFE2500/RFE2500 power supply modules themselves and the accessory rack HFE2500-S1UTB have no disconnect device provided with unit. An appropriate disconnect device shall be provided by end-installation.,
- The "POE" designation used does not refer to Power Over Ethernet with LPS limit. It is used by the manufacturer for connection to an end product with the POE designation. Additional evaluation is required in the end product to determine if the output designated as POE meets the LPS criteria.
- All outputs considered SELV and separated by reinforced insulation from primary mains.
- All outputs are unearthed and may or may not be connected to earth in end-installation.

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:

- All outputs are separated by reinforced insulation from supply mains and primary circuit. Outputs are , unearthed and may or may not be earthed during product installation.
- When HFE2500-xy unit is used separately, the voltage for Dielectric Strength Test should be based on the , maximum supply voltage for end-product.
- For accessory rack HFE2500-S1U, an appliance coupler(s) is considered as Disconnect device(s). , HFE2500-xy units and accessory rack HFE2500-S1U/TB have no disconnect device provided , with unit. An appropriate disconnect device shall be provided by end-installation.

- The power supply modules are suitable for the maximum ambient operating temperature of 50°C at max. output power less than or equal to 2500W. The following de-rating criteria shall be applied when the ambient temperatures will exceed 50°C: +50°C to +60°C: the max. output power should be de-rated by 2%/°C; +60°C to +70°C: the max. output power should be de-rated by 2.5%/°C.
- Depending on the input supply voltage the following de-rating criteria shall be applied • 265VAC≥Vin≤170VAC - the max. output power equal 2500W • 132VAC>Vin≤100VAC - the max. output power equal 1500W • Vin<100VAC - linear derating 1.3%/V from the max. output power at 100VAC.
- The Accessory Rack HFE2500-S1U/TB is provided with terminal blocks for AC Mains connections. A field wiring terminal shall be provided for these connections when installed in the end product.
- The Power Modules and Accessory Rack were not evaluated for Current Interruption.
- Considerations to Touch Current in the end product for unearthed circuits shall be considered.
- Earth Fault test using a current of 2000 A was conducted on the various pwb grounding traces. See Enclosure 5-01, 5-02 and 5-03, Schematics and PWB.
- The end-product Electric Strength Test is to be based upon a maximum working voltage of: Primary-SELV: 240 Vrms, 500 Vpk Primary-Earthed Dead Metal: 240Vrms, 483 Vpk
- The following secondary output circuits are SELV: All outputs.
- The following secondary output circuits are at hazardous energy levels: The main outputs (48VDC, 32VDC, 24VDC or 12VDC).
- The following secondary output circuits are at non-hazardous energy levels: 12 Vdc Auxiliary.
- The power supply terminals and/or connectors are: Not investigated for field wiring
- The maximum investigated branch circuit rating is: 20 A when installed in Accessory Rack HFE2500-S1U per inlet (4 appliance inlet provided)., 30 A when installed in Accessory Rack HFE2500-S1U/TB.
- 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 magnetic devices (e.g. transformers or inductor) are provided with an OBJ2 insulation system with the indicated rating greater than Class A (105°C): All transformers are Class F (155).
- The following end-product enclosures are required: Mechanical, Fire, Electrical

Additional Information

All products are Class I, designed for Installation Category II and Pollution Degree 2.

Additional Standards

The product fulfills the requirements of: CSA C22.2 No. 60950-1-07 + A1:2011 + A2:2014

Markings and instructions

Clause Title	Marking or Instruction Details
2.1.1.1 - Energy Hazard	"The main output of HFE2500-S1U is capable of providing hazardous energy. Due to hazardous energy level the output bus bars and connections therefore must not be user accessible. Manufacturer's final equipment must provide protection to service personnel against inadvertent contact with output bus bars." (Instruction).
1.7.1 Power	Ratings (voltage, frequency/dc, current)

rating - Ratings	
1.7.1 Power rating - Company identification	Listee's or Recognized company's name, Trade Name, Trademark or File Number
1.7.1 Power rating - Model	Model Number
1.7.6 Fuses - Non-operator access/soldered-in fuses	Unambiguous reference to service documentation for instructions for replacement of fuses replaceable only by service personnel
1.7.7.1 Terminal for main protective earthing	Provided adjacent to the main protective earthing terminal (60417-5019)
1.7.9 Multiple power sources	"Disconnect power supply cords before servicing"
1.7.14 Restricted Access Location	"Equipment intended for installation in Restricted Access Location" or equivalent. (Instruction)
1.7 Safety Instructions - Rack Mount	<p>"Rack Mount Instructions - The following or similar rack-mount instructions are included with the installation instructions:</p> <p>A) Elevated Operating Ambient - If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than room ambient. Therefore, consideration should be given to installing the equipment in an environment compatible with the maximum ambient temperature (T_{ma}) specified by the manufacturer.</p> <p>B) Reduced Air Flow - Installation of the equipment in a rack should be such that the amount of air flow required for safe operation of the equipment is not compromised.</p> <p>C) Mechanical Loading - Mounting of the equipment in the rack should be such that a hazardous condition is not achieved due to uneven mechanical loading.</p> <p>D) Circuit Overloading - Consideration should be given to the connection of the equipment to the supply circuit and the effect that overloading of the circuits might have on overcurrent protection and supply wiring. Appropriate consideration of</p>

	<p>equipment nameplate ratings should be used when addressing this concern.</p> <p>E) Reliable Earthing - Reliable earthing of rack-mounted equipment should be maintained. Particular attention should be given to supply connections other than direct connections to the branch circuit (e.g. use of power strips)."</p>
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Special Instructions to UL Representative

Verify marked grounding pattern from Enclosures 5-01, 5-02 and 5-03.

Production-Line Testing Requirements

Electric Strength Test Special Constructions - Refer to Generic Inspection Instructions, Part AC for further information.

Model	Component	Removable Parts	Test probe location	V rms	V dc	Test Time, s
TDK-Lambda Part No. IA688-35-02	T101	-	Primary to Secondary	300 0	-	1
TDK-Lambda Part No. IA688-35-04	T102	-	Primary to Secondary	300 0	-	1
TDK-Lambda Part No: IA689-35-07; IA689-35-06; IA689-35-05	T104	-	Primary to Secondary	300 0	-	1

Earthing Continuity Test Exemptions - This test is not required for the following models:

-

Electric Strength Test Exemptions - This test is not required for the following models:

-

Electric Strength Test Component Exemptions - The following solid-state components may be disconnected from the remainder of the circuitry during the performance of this test:

-

Sample and Test Specifics for Follow-Up Tests at UL

Model	Component	Material	Test	Sample(s)	Test Specifics
N/A					