

## UL TEST REPORT AND PROCEDURE

<b>Standard:</b>	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)
<b>Certification Type:</b>	Component Recognition
<b>CCN:</b>	QQGQ2, QQGQ8 (Power Supplies for Information Technology Equipment Including Electrical Business Equipment)
<b>Product:</b>	Power Supply Modules & Accessory Rack
<b>Model:</b>	PSU models:  HFE1600-48xy, HFE1600-32xy, HFE1600-24xy, HFE1600-12xy,  HFE1600-48xy-z, HFE1600-32xy-z, HFE1600-24xy-z, HFE1600-12xy-z,  RFE1600-48xy, RFE1600-32xy, RFE1600-24xy, RFE1600-12xy  Where:  x = /S or blank, y = POE or blank z = R  HFE1600-48/SD HFE1600-48/INF HFE1600-12/S-R/001  Accessory rack models:  HFE1600-S1U, HFE1600-S1U-TB, HFE1600-D1U, HFE1600-D1U-TB
<b>Rating:</b>	Input:  HFE1600-48xy: AC 100 - 240V, 14.2 A max., 50/60 Hz; HFE1600-32xy: AC 100 - 240V, 14.2 A max., 50/60 Hz; HFE1600-24xy: AC 100 - 240V, 14.2 A max., 50/60 Hz; HFE1600-12xy: AC 100 - 240V, 14.2 A max., 50/60 Hz;  HFE1600-48xy-z: AC 100 - 240V, 11.7 A max., 50/60 Hz; HFE1600-32xy-z: AC 100 - 240V, 11.7 A max., 50/60 Hz;

HFE1600-24xy-z: AC 100 - 240V, 11.7 A max., 50/60 Hz;  
HFE1600-12xy-z: AC 100 - 240V, 11.7 A max., 50/60 Hz;

RFE1600-48xy: AC 100 - 240V, 14.2 A max., 50/60 Hz;  
RFE1600-32xy: AC 100 - 240V, 14.2 A max., 50/60 Hz;  
RFE1600-24xy: AC 100 - 240V, 14.2 A max., 50/60 Hz;  
RFE1600-12xy: AC 100 - 240V, 14.2 A max., 50/60 Hz;

HFE1600-48/SD: AC 100 - 240V, 14.2 A max., 50/60 Hz;  
HFE1600-48/INF: AC 100 - 240V, 14.2 A max., 50/60 Hz;  
HFE1600-12/S-R/001: AC 100 - 240V, 11.7 A max., 50/60 Hz;

Output:

HFE1600-48xy at ambient temperature up to 50°C: DC 48V (DC 38.4~58V), 33A max., 1600W max.  
HFE1600-32xy at ambient temperature up to 50°C: DC 32V (DC 25.6~38.4V), 50A max., 1600W max.  
HFE1600-24xy at ambient temperature up to 50°C: DC 24V (DC 19.2~29V), 67A max., 1600W max.  
HFE1600-12xy at ambient temperature up to 50°C: DC 12V (DC 9.6~13.2V), 133A max., 1600W max.

HFE1600-48xy-z at ambient temperature up to 50°C: DC 48V (DC 38.4~58V), 27A max., 1300W max.  
HFE1600-32xy-z at ambient temperature up to 50°C: DC 32V (DC 25.6~38.4V), 38A max., 1200W max.  
HFE1600-24xy-z at ambient temperature up to 50°C: DC 24V (DC 19.2~29V), 54A max., 1300W max.  
HFE1600-12xy-z at ambient temperature up to 50°C: DC 12V (DC 9.6~13.2V), 107A max., 1300W max.

RFE1600-48xy at ambient temperature up to 50°C: DC 48V (DC 38.4~58V), 33A max., 1600W max.  
RFE1600-32xy at ambient temperature up to 50°C: DC 32V (DC 25.6~38.4V), 50A max., 1600W max.  
RFE1600-24xy at ambient temperature up to 50°C: DC 24V (DC 19.2~29V), 67A max., 1600W max.  
RFE1600-12xy: at ambient temperature up to 50°C: DC 12V (DC 9.6~13.2V), 133A max., 1600W max.

HFE1600-48/SD at ambient temperature up to 50°C: DC 48V (DC 38.4~58V), 33A max., 1600W max.  
HFE1600-48/INF at ambient temperature up to 50°C: DC 48V (DC 38.4~58V), 33A max., 1600W max.  
HFE1600-12/S-R/001 at ambient temperature up to 35°C: DC 12V (DC 9.6~13.2V), 113A max., 1356W max.

Auxiliary output (all single power supply modules): 12V/0.5A

For HFE1600-S1U, HFE1600-S1U-TB, HFE1600-D1U and HFE1600-D1U-TB:

Input (per each input): AC 100-240V, 14.2A/8.1A max., 50/60 Hz.

Output Voltage: Dependent on the installed PSU's  
Output Current:  
HFE1600-S1U and HFE1600-S1U-TB:  
Dependent on the number of installed modules but not more than 266A max on each output. Total current not to exceed 532A.  
HFE1600-D1U and HFE1600-D1U-TB:  
Dependent on the number of installed modules but not more than 266A max on each output, 6080W Max.  
Auxiliary output: 12Vdc, 0.5A

<b>Applicant Name and Address:</b>	TDK-LAMBDA LTD 56 HAHAROSHET STREET P.O.B. 500 KARMIEL INDUSTRIAL ZONE 2161401 KARMIEL ISRAEL
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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.

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

Prepared by: Robert Dmitruk

Reviewed by: Piotr A. Bizunowicz

### 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 HFE1600-xy, HFE1600-xy-z and RFE1600-xy models are switch mode power supply modules for use in an accessory rack HFE1600-S1U, HFE1600-S1U-TB, HFE1600-D1U, HFE1600-D1U-TB. The power supplies can also be used outside of the rack in accordance with the CoA's outlined in this report. The accessory racks however, are only intended for use with the HFE1600-xy and HFE1600-xy-z power supply units.

### Model Differences

The RFE1600-xy models are electrically identical to respective HFE1600-xy models, except for:  
-separate input terminal block;  
-separate signal connectors;  
-output bus-bars instead of common I/O connector

HFE1600-xy / HFE1600-xy-z / RFE1600-xy: xy key:

- i) Blank: Basic power supply modules without communication options, front-to-rear air flow
- ii) "/S": Unit fitted with communication option, front-to-rear air flow
- iii) "/POE" : Output circuit additionally meets the requirements of IEEE 802.3 standard, front-to-rear air flow
- iv) HFE1600-48/INF – fully same with HFE1600-48, specific customer suffix, without handle and PS release knob, front-to-rear air flow
- v) "-R" - with reversed air-flow direction, rear-to-front air flow
- vi) HFE1600-12/S-R/001 – fully same with HFE1600-12/S-R, specific customer suffix
- vii) HFE1600-48/SD – fully same with HFE1600-48-R, specific customer suffix

The accessory racks are identical except for means for connection to the mains supply:

- i) HFE1600-S1U, HFE1600-D1U: Fitted with appliance inlets for connection to mains supply
- ii) HFE1600-S1U/TB, HFE1600-D1U-TB: Fitted with terminal blocks for connection to mains supply

HFE1600-S1Uz (z is blank or -TB) contains five power supply units, which are all connected to a common output bus. This bus is then connected to two pairs of output terminals. There are five mains or dc input terminals. There is a single external communications connector.

HFE1600-D1Uz (z is blank or -TB) contains four power supply units, which are connected in pairs to two output busses. Each bus is then connected to a single pair of output terminals. There are four mains or dc input terminals.

There are dual external communications so that the unit can be controlled as two separate power supplies.

### Technical Considerations

- Equipment mobility : for building-in
- Connection to the mains : not directly connected to the mains
- Operating condition : continuous
- Access location : restricted access location
- 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) : 230Vac
- Class of equipment : Class I (earthed)
- Considered current rating of protective device as part of the building installation (A) : 20A
- Pollution degree (PD) : PD 2
- IP protection class : IP X0
- Altitude of operation (m) : Up to and include 3000m
- Altitude of test laboratory (m) : less than 2000 meters
- Mass of equipment (kg) : HFE1600 models: 1.55kg, Loaded Accessory Rack: 8.5kg
- All units (except HFE1600-48/SD, HFE1600-xy-R and HFE1600-12/S-R/001) were submitted and evaluated for use at the maximum ambient temperature (T<sub>ma</sub>) permitted by the manufacturer's specification of: 50°C at max. output power equal or less than 1600W. HFE1600-48/SD and HFE1600-xy-R are suitable for the maximum ambient operating temperature 50°C at max. output power equal or less of 1300W max. HFE1600-12/S-R/001 is suitable for the maximum ambient operating temperature 35° at max. output power equal or less of 1356W. The following de-rating criteria shall be applied when the ambient temperatures exceed 50°C: +50°C to +60°C the max. output power shall be de-rated by 2%/°C +60°C to +70°C the max. output power shall be de-rated by 2.5%/ °C
- The means of connection to the mains supply is: For building-in, to be determined in the end product application
- The product is intended for use on the following power systems: TN, IT (For Norway only)
- The equipment disconnect device is considered to be: Appliance inlet for accessory rack HFE1600-S1U and HFE1600-D1U
- The following are available from the Applicant upon request: Installation (Safety) Instructions / Manual

#### **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:

- Consideration must be given to Clause 5.1.2.3 when the complete rack is installed in the end product.
- Markings must be applied to the equipment in accordance with Clause 1.7.9 when installed in the end product.
- The end-product Electric Strength Test is to be based upon a maximum working voltage of: Models HFE1600-xy, HFE1600-xy-z and RFE1600-xy fitted in accessory rack, , Primary-Earthed Metal: 240Vrms, 340Vpk
- The following secondary output circuits are SELV: All outputs
- The following secondary output circuits are at hazardous energy levels: All outputs except Auxiliary 12Vdc output

- The following secondary output circuits are at non-hazardous energy levels: Auxiliary output
- The power supply terminals and/or connectors are: Not investigated for field wiring
- The maximum investigated branch circuit rating is: 30 A max.
- The investigated Pollution Degree is: 2
- 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): T102 (Class F), T104 (Class F)
- The following end-product enclosures are required: Electrical, Fire
- The equipment is suitable for direct connection to: AC mains supply
- Proper bonding to the end-product main protective earthing termination is: Required
- An investigation of the protective bonding terminals has: Been conducted

**Additional Information**

N/A

**Markings and instructions**

Clause Title	Marking or Instruction Details
1.7.1 Power rating - Ratings	Ratings (voltage, frequency/dc, current)
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
1.7.2 Disconnect device - Permanently connected equipment	Statement indicating that a readily accessible disconnect device shall be incorporated in the building installation wiring. (Instruction)
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

**Special Instructions to UL Representative**

N/A