UL TEST REPORT AND PROCEDURE

Standard:	UL 61010-1, 3rd Edition, Revised 2024-11-15 (Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements) CAN/CSA-C22.2 No. 61010-1-12, 3rd Edition, Revised 11/2024 (Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements)
Certification Type:	Component Recognition
CCN:	QQHC2, QQHC8 (Power Supplies for Measurement, Control and Laboratory Use)
Complementary CCN:	N/A
Product:	Switching power supplies and accessory rack
Model:	1. Single power supply modules: HFE3500-24/FSD, HFE3500-24/TSD, HFE3500-24/FSE, HFE3500-24/TSE, HFE3500-48/FSD, HFE3500-48/TSD, HFE3500-48/FSE, HFE3500-48/TSE 2. Rack module: HFE3500-S1U/TB
Rating:	1. Single Power Supply Modules ratings: Input: 100-240 V a.c.; 25 A max; 47 – 440 Hz; (for 2016 W output) 200-240 V a.c.; 22 A max; 47 – 440 Hz; (for 3504 W output) Output: 24 V d.c., 84 A (2016 W); 12 V d.c., 1 A (24 V version power supply module @ input 100-240 V a.c.); 24 V d.c., 146 A (3504 W); 5 V d.c., 2 A (24 V version power supply module @ input 200-240 V a.c.); 48 V d.c., 42 A (2016 W); 12 V d.c., 1 A (48 V version power supply module @ input 100-240 V a.c.); 48 V d.c., 73 A (3504 W); 5 V d.c., 2 A (48 V version power supply module @ input 200-240 V a.c.) 2. Rack module ratings: Input: refer to power supply modules (4 power supply modules included in the rack; each power supply module with individual connection to mains) Output: For output voltage refer to power supply modules (up to 4 power supply modules included in the rack), max output current of the rack: 584 A (max 320 A per metal busbar), max output power of the rack: 14016 W
Applicant Name and Address:	TDK-LAMBDA UK LTD KINGSLEY AVE

ILFRACOMBE
DEVON
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:	Kacper Pytlewski / Project Handler	Reviewed By:	Kamil Janeczek / 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 single power supply modules series HFE3500 is a family of front-end (component) power supplies for built-in use with 3504 W output power. All units provide a handle on front side for plugging/unplugging the unit to/from the rack. Rear side contains a connector with AC pins, output DC pins and signal pins. Only the front side is accessible to ordinary person once unit installed in the accessory racks.

The power supply modules are intended for accessory racks. The power supply modules may be used in the complete set of the accessory rack HFE3500-S1U/TB.

The complete EUT is rack module equipped with up to 4 power supply modules included for building-in intended for use within information technology or audio/video equipment. There exist two different main output options (24 V d.c. or 48 V d.c.). Max. total power of each power supply module is 3504 W and max. power of rack module is 14016 W.

Model Differences

Minor changes between 48 V and 24 V version power supply modules such as transformer turns, output capacitors, synchronous rectifiers.

Power supply modules nomenclature

Unit Configuration Code:

HFEx-y/abcde

Where:

x - 3500

y - 24 or 48

Channel 1 output voltage

- Input Voltage: 100-240Vac, Output Voltage Channel 1: 24V, Voltage Range: 21.6-28.8V, Max Iout: 84A, Max Pout: 2016W

- Input Voltage: 100-240Vac, Output Voltage Channel 1: 48V, Voltage Range: 43.2-57.6V, Max Iout: 42A, Max Pout: 2016W

- Input Voltage: 200-240Vac, Output Voltage Channel 1: 24V, Voltage Range: 21.6-28.8V, Max Iout: 146A, Max Pout: 3504WW

- Input Voltage: 200-240Vac, Output Voltage Channel 1: 48V, Voltage Range: 43.2-57.6V, Max Iout: 73A, Max Pout: 3504WW

a - Standby Output Voltage

F = 5V @ 2A

T = 12V @ 1A
b - Digital Interface
S = PMBus (fitted as standard)
c - Air flow
Blank = standard air flow
d - Fuse options
D = Dual AC Fuse
E = Single AC fuse in the live line
e - Coating options
blank = no coating options
CO = Coating
COx = Alternate Coating
Example: HFE3500-48/FSD
For a HFE3500, 48V with 5V standby, PMBus and dual fuse

Rack module nomenclature
Unit Configuration Code:
HFEx-y/abc
Where:
x - 3500
y - S1U
a – TB
b - LAN Digital Interface
Blank = Not fitted (note PMBus is provided as standard on rack)
LAN = LAN interface (integrated into rack backplane, connector on rack rear panel)
c - Coating options
Blank = No Coating
CO = Coating
COx = Alternate Coating

Test Item Particulars	
Type of item ..... :	Measurement / Control / Laboratory
Description of equipment function ..... :	Power supply
Connection to mains supply ..... :	The unit is for building-in and to be permanently connected to mains.
Overvoltage category ..... :	II
Pollution degree ..... :	2
Means of protection ..... :	Class I (PE connected)
Environmental conditions ..... :	Extended (Specify): The product was evaluated for a maximum ambient of 40°C or 50 °C (see summary of testing for more information and deratings). Altitude ≤ 5000 m. Humidity ≤ 95 % (at 25°C, without condensation).
For use in wet locations ..... :	No
Equipment mobility ..... :	Built-in
Operating conditions ..... :	Continuous
Overall size of equipment (W x D x H) ..... :	Power supply: 108mm x 350mm x 40mm

	Rack: 483mm x 421mm x 45mm
Mass of equipment (kg) ..... :	Approx. 1.950 kg (Power Supply Modules), approx. 12.750 kg (Rack equipped with all 4 Power Supply Modules)
Marked degree of protection to IEC 60529 ..... :	N/A

Technical Considerations

- The products were tested to be suitable for connection to max. 32 A branch circuit (each internal Power Supply Module). The unit is approved for connection to the following connections to TN / TT power distribution systems.
- All secondary output circuits are separated from mains by reinforced insulation and rated nonhazardous live (within 6.3.1 limits), hazardous energy levels.
- The input and output terminals on Rack module are suitable for factory and field wiring.
- The transformers T301 (aux), TX1 and TX2 (inside of the power supply modules) provide reinforced insulation. These transformers are built up to fulfil the requirement of insulation class F and provide in addition an UR (OBJY2) insulation system).
- The products were evaluated for a maximum ambient of 40°C for 48 V output power supply modules and 40°C or 50°C for 24 V output power supply modules. De-rating as specified below be considered for ambient above 40°C (for 24 V output power supply modules). De-rating as specified under Supplement 07-01 shall be considered for input voltage.
  De-rating for 24 V output power supply modules for ambient above 40°C:
  Input voltage: 180 Vac → output load 3300 W (@ambient 50°C)
  Input voltage: 264 Vac → output load 3300 W (@ambient 50°C)

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 unit provides no disconnecting device. Disconnect device must be provided in the final installation (end-product consideration).
- Safety Instructions: Built in product, safety instructions are end product considerations. In addition there are some safety instructions in the manual and/or Technical datasheet.
- The power supplies and complete rack is rated class I. The power supply modules and rack module shall be properly bonded to the main protective bonding termination in the end product.
- The equipment has been evaluated for use in a Pollution Degree 2 and overvoltage category II environment and a maximum altitude of 5000 m.
- A suitable Electrical and Fire enclosure shall be provided in the end equipment. Front side of power supply modules (parts near fans when power supply modules inserted in the rack) are comply with the requirements of the fire and electrical enclosure.
- Output of the unit (main output and aux. output) should be connected with PE in end application. Reliable earth provided/required.

Additional Information

N/A

Markings and Instructions

Clause Title	Marking or Instruction Details
Company	Listee's or Recognized company's name, Trade name, Trademark or File Number

Manufacturers identification	Factory identification
Model identification	Model number
Nature and ratings of mains supply	Frequency or frequency range, power in watts or VA or input current in amperes
Protective conductor terminal	
Special Instructions to UL Representative N/A	