

## UL TEST REPORT AND PROCEDURE

<b>Standard:</b>	UL 62368-1, 2nd Ed, 2014-12-01 (Audio/video, information and communication technology equipment Part 1: Safety requirements) CAN/CSA C22.2 No. 62368-1-14, 2nd Ed-(Audio/video, information and communication technology equipment Part 1: Safety requirements)
<b>Certification Type:</b>	Component Recognition
<b>CCN:</b>	QQJQ2, QQJQ8 (Power Supplies for Use in Audio/Video, Information and Communication Technology Equipment)
<b>Complementary CCN:</b>	N/A
<b>Product:</b>	Power Supply
<b>Model:</b>	<p>Models:</p> <ol style="list-style-type: none"> <li>1) PFH500X-48-xxx-R,</li> <li>2) PFH500X-28-xxx-R,</li> <li>3) PFH500X-12-xxx-R</li> </ol> <p>Where "X" is to indicate that this can be a "F" for full feature or a "S" for simple feature.</p> <p>Where xxx can be any alphanumeric character or blank representing non-safety critical options such as pin length, mounting style, control function, etc.</p>
<b>Rating:</b>	<p>Rating:</p> <ol style="list-style-type: none"> <li>1) PFH500X-48-xxx-R, Input: AC 100-240 V, 7A, 50/60 Hz Output: DC 48 V, 10.5 A</li> <li>2) PFH500X-28-xxx-R, Input: AC 100-240 V, 8A, 50/60 Hz Output: DC 28 V, 18 A</li> <li>3) PFH500X-12-xxx-R Input: AC 100-240 V, 7.5A, 50/60 Hz Output: DC 12 V, 42 A</li> </ol> <p>Max 504 Watts</p> <p>(for model matrix refer to appendix)</p>

<b>Applicant Name and Address:</b>	TDK-LAMBDA AMERICAS INC SUITE 100 3320 MATRIX DR RICHARDSON TX 75082 UNITED STATES
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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.

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: Mengis Tesfay / Project Handler      Reviewed By: Scott Shepler / 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**

Open frame power supply for building-in, electrical components are mounted on PWB.

The PFH product family consists of high density AC-DC power converter modules intended to be used as a component in an end-user's power system. The input voltage range is from 85Vac – 265Vac (RMS) input. The output voltage range will be between 12V and 48V depending upon the model number.

The PFH product is available in one mechanical configuration using the same transformer core set, the same input PFC (Power Factor Correction) inductor core set, and the same output filter inductor core set with the same geometry except for the air gap and number of turns used in the output inductor. PFH product is a fully vacuum potted power module using Momentive TSE3331 Silicon Rubber Compound with dielectric strength of 26kV/mm.

There are two house-keeping transformers used in PFH platform, AT00175 bias transformer with triple insulation wires, and AT00174 current sensing transformer with molded one (1) primary turn.

There are also two digital controllers responsible for PFC and DC-DC controls. A 4-channel digital isolator with wide body SOIC-16 package is used to deliver the drive pulses and PMBus communication commands to cross the primary to secondary isolation boundary with reinforced isolation. The digital isolator is UL 1577 recognized up to 5kVrms, CSA component notice 5A approval, (IEC 60950-1 reinforced insulation), VDE Certification conformity, and CQC certification approval, GB4943.1.

**Model Differences**

All models within this report are identical, except for model designation, output rating, and secondary winding of main Transformer.

**Test Item Particulars**

Classification of use by	Instructed person
Supply Connection	AC Mains
Supply % Tolerance	+10%/-10%
Supply Connection – Type	For building in

Considered current rating of protective device as part of building or equipment installation	10 A (The power modules are not internally fused. An external input line fast-acting fuse with a maximum value of 10 A is required.) A; equipment
Equipment mobility	for building-in
Over voltage category (OVC)	OVC II
Class of equipment	Class II
Access location	N/A
Pollution degree (PD)	PD 2
Manufacturer's specified maximum operating ambient (°C)	25 °C
IP protection class	IPX0
Power Systems	TN
Altitude during operation (m)	2000 m or less
Altitude of test laboratory (m)	2000 m or less
Mass of equipment (kg)	Less than 1 kg

### Technical Considerations

- The product was submitted and evaluated for use at the maximum ambient temperature (T<sub>ma</sub>) permitted by the manufacturer's specification of : 25°C
- The product is intended for use on the following power systems : TN
- Considered current rating of protective device as part of the building installation (A) : 10 A (The power modules are not internally fused. An external input line fast-acting fuse with a maximum value of 10 A is required.)
- Mains supply tolerance (%) or absolute mains supply values : +10%/-10%. No direct connection to Mains.
- The equipment disconnect device is considered to be : N/A - to be determined in end use application
- The following are available from the Applicant upon request : Installation (Safety) Instructions / Manual
- The product was investigated to the following additional standard : EN 62368-1:2014 + A11:2017

### 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 product-line tests are conducted for this product : Electric Strength
- The end-product Electric Strength Test is to be based upon a maximum working voltage of : Primary-Secondary: 265 Vrms, 375 Vpk ,
- The following output circuits are at ES1 energy levels : Secondary Outputs
- The following output circuits are at PS3 energy levels : All
- The maximum investigated branch circuit rating is : 10 A (The power modules are not internally fused. An external input line fast-acting fuse with a maximum value of 10 A is required.)
- The investigated Pollution Degree is : 1
- The following end-product enclosures are required : Fire, Electrical
- The following components require special consideration during end-product Thermal (Heating) tests due to the indicated maximum temperature measurements during component-level testing : T1 Winding and core, and T2
- The maximum continuous power supply output (Watts) relied on forced air cooling from : All Heating Test were performed with 11.5cm x 11.5cm x 3.5cm tall pin fin heat sink attached to PFH module. Fan (Minebea Matsushita Motor Corp – model #3110KL-04WB30, 12VDC) was used to cool heat sink. For Heating test, the following fan voltage and resulting airflow (approximate due to turbulence) were used: (1)90Vin, 10.5Vfan, ~200LFM (2)100Vin, 13.5Vfan, ~325LFM (3)240Vin, 3.8Vfan, ~55LFM (4)265Vin, 3.5Vfan, ~30LFM.
- The power supply was evaluated to be used at altitudes up to : "2,000 m"
- 1.11 The power supply terminals and/or connectors are: Not investigated for field wiring
- Cap discharge test was not conducted. End product consideration.
- EUT is for building in. Prospective touch voltage and touch current test to be conducted in the end product.
- EUT is for building in. Input terminals not suitable for direct connection to Mains.
- Separation of primary and secondary circuits shall be maintained.

**Additional Information**

This report is based on VDE CB report 236820-C13-1 and CB Test Certificate Ref. DE1-59169 respectively which was previously evaluated to UL/CSA/IEC 60950-1, 2nd edition, + Amendment 1, and Amendment 2. Testing conducted in accordance with IEC 60950-1:2005 (Second Edition), Am1:2009 + Am2:2013; UL 60950-1, 2nd Edition, 2014-10-14; and CAN/CSA C22.2 No. 60950-1-07, 2nd Edition, 2014-10, and was deemed equivalent to test required by IEC62368-1, 2nd Edition, CAN/CSA-C22.2 NO. 62368-1 2nd Ed, Issued December 1, 2014, and UL 62368-1 2nd Ed, Issued December 1, 2014. Testing correlation explanation is provided in Enclosure.

All original sample and test dates are noted in the testing portion of this report. 2020-05-06 is for construction review only.

The nameplate included in the report is representative of all models covered under this report.

**Additional Standards**

The product fulfills the requirements of: EN 62368-1:2014 + A11:2017

**Markings and Instructions**

Clause Title	Marking or Instruction Details
Equipment identification marking – Manufacturer identification	Listee’s or Recognized companys name, Trade Name, Trademark or File Number

Equipment identification marking – model identification	Model Number
Equipment rating marking – ratings	"Input Ratings (voltage, frequency/dc, current/power)", "Output Ratings (voltage, frequency/dc, current/power)"
<b>Special Instructions to UL Representative</b> N/A	