



Test Report issued under the responsibility of:



TEST REPORT
IEC 60950-1
Information technology equipment – Safety –
Part 1: General requirements

Report Number: 31182226.016

Date of issue: June 1, 2017

Total number of pages.....: 165 pages

Applicant's name.....: TDK-Lambda Ltd.

Address: 56 Haharoshet St., P.O.B. 500 Karmiel Industrial Zone Karmiel
2161401, Israel

Test specification:

Standard: IEC 60950-1:2005 (Second Edition) + Am 1:2009 + Am 2:2013

Test procedure.....: CB Scheme

Non-standard test method.....: N/A

Test Report Form No......: IEC60950_1F

Test Report Form(s) Originator.....: SGS Fimko Ltd

Master TRF: Dated 2014-02

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General disclaimer:




The test results presented in this report relate only to the object tested.

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Test item description	Switching power supplies and accessory rack
Trade Mark	TDK-Lambda, <i>TDK-Lambda</i>
Manufacturer.....	TDK-Lambda Ltd.
Model/Type reference	<p>1) Single Power Supply Modules: HFE2500-48xyz, HFE2500-32xz, HFE2500-24xz, HFE2500-12xz (x=/S, blank; y=/POE, blank; z=-R, blank; u=/CO, blank)</p> <p>2) Single Power Supply Modules: RFE2500-48xy, RFE2500-32xu, RFE2500-24xu, RFE2500-12xu (x=/S, blank; y=/POE, blank; u=/CO, blank)</p> <p>3) HFE2500-48/S-CQC</p> <p>4) HFE2500-12/S-R/RE</p> <p>5) Accessory rack: HFE2500-S1Uw (w=-TB, blank; u=/CO, blank)</p> <p>6) HFE2500-LAN</p>
Ratings	<p>1)</p> <p>a) models without suffix -R (base models): Input: 100 - 240 VAC, 15 A 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.</p> <p>b) models with suffix -R (reverse fan models): Input: 100 - 240 VAC, 13.5 A 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.</p> <p>2) Input: 100 - 240 VAC, 15 A 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.</p> <p>3) Input: 100 - 240 VAC, 15 A max., 50/60 Hz; Output: Main output a) at ambient temperature up to 50°C, Vin=170-240Vac 48VDC (38.4~58.0VDC), 52A max., 2500W max.</p> <p>4) Input: 100 - 240 VAC, 15A max., 50/60 Hz; Output: Main output at ambient temperature up to 42°C, Vin=180-240Vac 12,6VDC (9.6~13.2VDC), 185A max., 2331W max.</p> <p>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.</p>

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

6) Input: 12 Vdc, 0.5A max.

Testing procedure and testing location:		
<input checked="" type="checkbox"/>	CB Testing Laboratory:	TÜV Rheinland of North America, Inc.
Testing location/ address		1279 Quarry Lane, Ste. A, Pleasanton, CA 94566
<input type="checkbox"/>	Associated CB Testing Laboratory:	
Testing location/ address		
Tested by (name + signature).....		
Approved by (name + signature).....		
<hr/>		
<input type="checkbox"/>	Testing procedure: TMP/CTF Stage 1:	
Testing location/ address		
Tested by (name + signature).....		
Approved by (name + signature).....		
<hr/>		
<input type="checkbox"/>	Testing procedure: WMT/CTF Stage 2:	
Testing location/ address		
Tested by (name + signature).....		
Witnessed by (name + signature)		
Approved by (name + signature).....		
<hr/>		
<input checked="" type="checkbox"/>	Testing procedure: SMT/CTF Stage 3 or 4:	
Testing location/ address		TDK-Lambda Ltd. 56 Haharoshet St., P.O.B. 500 Karmiel Industrial Zone Karmiel 2161401, Israel
Tested by (name + signature).....		Valery Rodionov 
Witnessed by (name + signature)		Jameel Armstrong 
Approved by (name + signature).....		Rahul Mehta  <small>Digitally signed by Rahul Mehta DN: cn=Rahul Mehta, o=TUV Rheinland of North America,TUV Rheinland of North America, ou, email=rmehta@us.tuv.com, c=cn Date: 2017.06.05 16:53:55 -0700</small>
Supervised by (name + signature).....		
<hr/>		

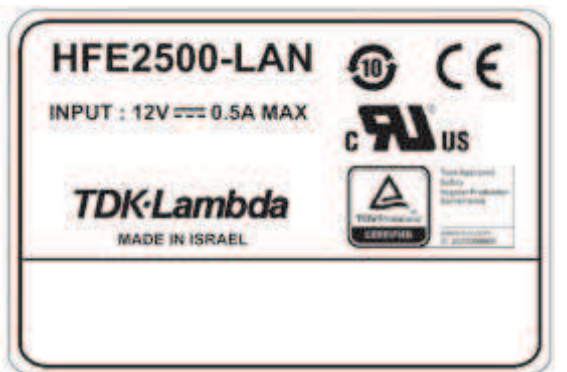
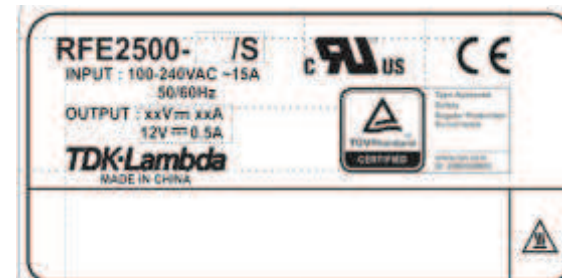
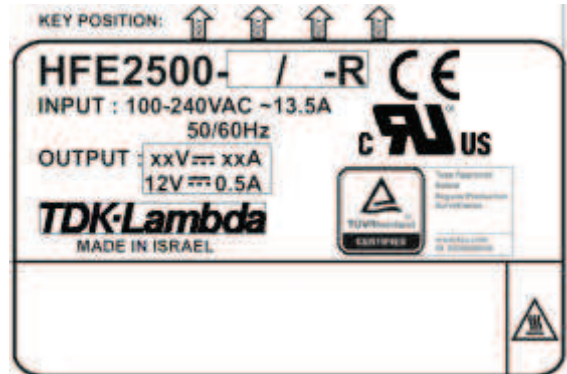
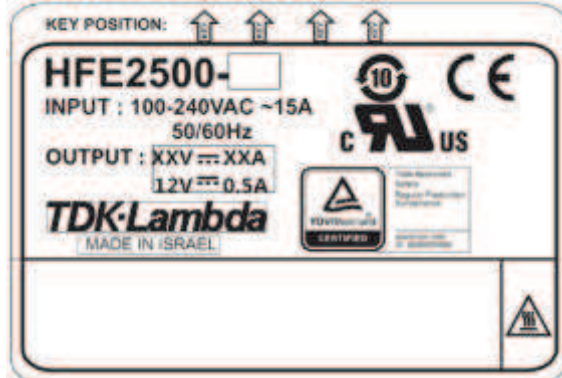
List of Attachments (including a total number of pages in each attachment):	
<ul style="list-style-type: none"> - Attachment 1: National Differences (38 pages) - Attachment 2: Photo Documentation (8 pages) - Attachment 3: Schematics (11 pages) - Attachment 4: PCB Artwork (24 pages) 	
Summary of testing:	
<p>Testing during original evaluation according to report number 31182226.001, no further testing was deemed necessary for this upgrade of standard for existing models and for HFE2500-48/S-CQC.</p> <p>For other new added models only partial testing applied due to similarity of el. schematic, construction.</p>	
Tests performed (name of test and test clause):	Testing location:
<u>31182226.001</u> Clause 1.6.2 Power Input Measurements Clause 1.7.11 Durability of Marking Test Clause 2.1.1.1 Accessibility to Energized parts Clause 2.1.1.5 Energy hazard measurements Clause 2.1.1.7 Capacitor discharge test Clause 2.2 SELV circuits – voltage measurements (normal and fault conditions) Clause 2.6.3.4 Protective earthing trace earth fault current; Earthing test Clause 2.9.1 Humidity test Clause 2.10.2 Determination of working voltage Clause 2.10.11 Semiconductor devices and cemented joints Clause 4.2 Mechanical strength test Clause 4.4 Hazardous moving parts Clause 4.5 Temperature rise measurements Clause 5.1 Touch current measurements Clause 5.2 Dielectric strength test Clause 5.3 Abnormal operating and fault conditions Annex C Transformer Evaluation	TDK-Lambda Ltd. 56 Haharoshet St., P.O.B. 500 Karmiel Industrial Zone Karmiel 2161401, Israel
<u>31182226.003</u> No further testing performed.	
<u>31182226.005</u> No further testing performed for the Amendment 1.	
<u>31182226.006</u> No further testing performed.	
<u>31182226.008</u> No further testing performed.	
<u>31182226.010</u> No further testing performed.	
<u>31182226.011</u> Clause 1.6.2 Power Input Measurements	TDK-Lambda Ltd. 56 Haharoshet St., P.O.B. 500

<p>Clause 4.5 Temperature rise measurements Clause 5.1 Touch current measurements Clause 5.2 Dielectric strength test Clause 5.3 Abnormal operating and fault conditions</p> <p><u>31182226.013</u> No further testing performed.</p> <p><u>31182226.014</u> The partial tests as listed below were done for HFE2500-LAN. Clause 1.6.2 Input Current Clause 2.6.3.4 Earthing Test Clause 2.10.2 Working Voltage Measurement. Clause 5.2 Dielectric Strength Test.</p> <p>The partial tests as listed below were done for HFE2500-12/S-R-RE. Clause 1.6.2 Input Current Clause 4.5 Temperature rise measurements Clause 5.2 Dielectric strength test Clause 5.3 Abnormal operating</p> <p><u>31182226.016</u> The partial tests as listed below were done for HFE2500-12/S-R-RE. Clause 1.6.2 Input Current Clause 4.5 Temperature measurements</p>	<p>Karmiel Industrial Zone Karmiel 2161401, Israel</p> <p>TDK-Lambda Ltd. 56 Haharoshet St., P.O.B. 500 Karmiel Industrial Zone Karmiel 2161401, Israel</p> <p>TDK-Lambda Ltd. 56 Haharoshet St., P.O.B. 500 Karmiel Industrial Zone Karmiel 2161401, Israel</p>
<p>Summary of compliance with National Differences</p> <p>List of countries addressed:</p> <p>EU Group Differences, EU Special National Conditions, CA, US, *(JP)</p> <p>Explanation of used codes: CA = Canada, US = United States of America, *(JP=Japan)</p> <p>* National differences to IEC 60950-1:2005 + Amd. 1:2009 evaluated.</p> <p><input checked="" type="checkbox"/> The product fulfils the requirements of IEC 60950-1:2005 + Am 1:2009 + Am 2:2013; EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011 + A2:2013</p>	

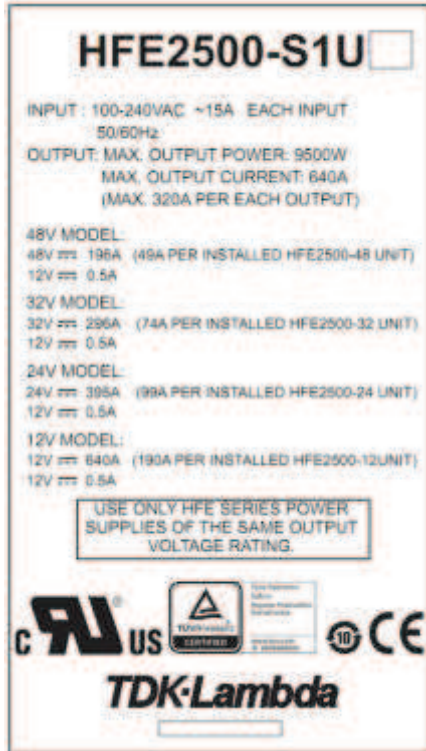
Copy of marking plate

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.

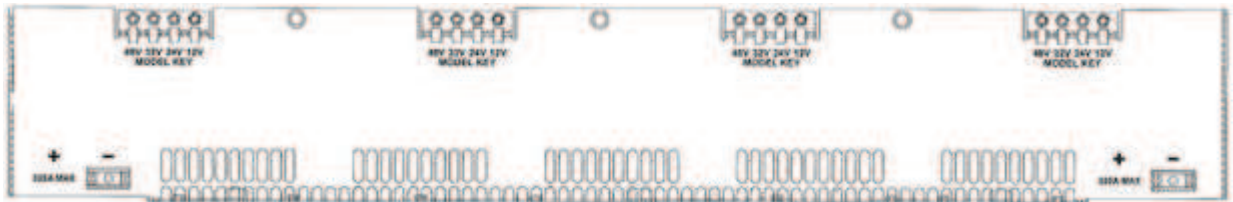
Label for individual power supply modules



Label/Screening for Accessory rack



320A max marking for HFE2500-S1U (screening on the top)



Test item particulars:	
Equipment mobility:	<input type="checkbox"/> movable <input type="checkbox"/> hand-held <input type="checkbox"/> transportable <input type="checkbox"/> stationary <input checked="" type="checkbox"/> for building-in <input type="checkbox"/> direct plug-in
Connection to the mains:	<input checked="" type="checkbox"/> pluggable equipment (*) <input checked="" type="checkbox"/> type A <input type="checkbox"/> type B <input type="checkbox"/> permanent connection <input checked="" type="checkbox"/> detachable power supply cord <input type="checkbox"/> non-detachable power supply cord <input type="checkbox"/> not directly connected to the mains <i>(*)-for HFE2500-S1U rack only, see Note below. NOTE: Connection to the mains depends on model: refer to General Product Information below.</i>
Operating condition:	<input checked="" type="checkbox"/> continuous <input type="checkbox"/> rated operating / resting time:
Access location	<input checked="" type="checkbox"/> operator accessible (see NOTE below) <input type="checkbox"/> restricted access location <i>NOTE: Only front side of HFE2500/RFE2500 modules and HFE2500-S1U rack may be accessible for user. Component for build-in</i>
Over voltage category (OVC)	<input type="checkbox"/> OVC I <input checked="" type="checkbox"/> OVC II <input type="checkbox"/> OVC III <input type="checkbox"/> OVC IV <input type="checkbox"/> other:
Mains supply tolerance (%) or absolute mains supply values	
Tested for IT power systems	<input checked="" type="checkbox"/> Yes (Norway only) <input type="checkbox"/> No
IT testing, phase-phase voltage (V)	230
Class of equipment	<input checked="" type="checkbox"/> Class I <input type="checkbox"/> Class II <input checked="" type="checkbox"/> Class III (HFE2500-LAN) <input type="checkbox"/> Not classified
Considered current rating of protective device as part of the building installation (A)	
Pollution degree (PD)	<input type="checkbox"/> PD 1 <input checked="" type="checkbox"/> PD 2 <input type="checkbox"/> PD 3
IP protection class	IP X0
Altitude during operation (m)	max. 3000m
Altitude of test laboratory (m)	50m
Mass of equipment (kg)	1-4) max. 2.1kg 5) max. 10.5kg (with all power modules installed)
Possible test case verdicts:	
- test case does not apply to the test object	N/A
- test object does meet the requirement	P (Pass)
- test object does not meet the requirement	F (Fail)
Testing:	

Date of receipt of test item..... : May 2nd, 2011 (31182226.001)
 N/A (31182226.003)
 N/A (31182226.005)
 N/A (31182226.006)
 N/A (31182226.008)
 N/A (31182226.010)
 August 23th, 2015 (31182226.011)
 N/A (31182226.013)
 October 09th, 2016 (31182226.014)
 November 16th, 2016 (31182226.014)
May 10th, 2017 (31182226.016)

Date(s) of performance of tests : May 3rd, 2011 to May 29th, 2011 (31182226.001)
 N/A (31182226.003)
 N/A (31182226.005)
 N/A (31182226.006)
 N/A (31182226.008)
 N/A (31182226.010)
 August 23th, 2015 to September 24th, 2015
 (31182226.011)
 N/A (31182226.013)
 October 09th -10th, 2016 (31182226.014)
 November 16th-20th, 2016 (31182226.014)**May 10th,
 2017 (31182226.016)**

General remarks:

SMT was checked as the report template does not include a selection for CTF Stage 3, but the testing location is registered as CTF Stage 3

"(See Enclosure #)" refers to additional information appended to the report.

"(See appended table)" refers to a table appended to the report.

Throughout this report a comma / point is used as the decimal separator.

Manufacturer's Declaration per sub-clause 4.2.5 of IEC60950-1:

The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided.....:

- Yes**
 Not applicable

The units manufactured in each factory are fully identical. All tested samples are representing products from each factory.

Name and address of factory (ies) : 1) TDK-Lambda Ltd.

56 Haharoshet St., P.O.B. 500 Karmiel Industrial Zone Karmiel 2161401, Israel

2) WUXI TDK-LAMBDA ELECTRONICS CO LTD
 NO 6 XING CHUANG ER LU WUXI JIANGSU
 214028 CHINA

General product information:

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

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

The accessory rack HFE2500-S1U 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.

Accessory rack HFE2500-S1U is Pluggable Type A.

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.

For the accessory rack HFE2500-S1U the appliance couplers are considered as disconnect devices.

The HFE2500/RFE2500 power supply modules themselves and the accessory rack HFE2500-S1U-TB have no disconnect device provided with unit. An appropriate disconnect device shall be provided by end-installation.

Model HFE2500-48/S-CQC is fully same with base model HFE2500-48/S.

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

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.

The maximum operational altitude for all units: 3000 meter above sea level.

The max. ambient:

- 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: **42°C**
- HFES1U rack: 50°C, 70°C (with output de-rated)

Model variations:

1. HFE2500-48, HFE2500-32, HFE2500-24 or HFE2500-12:

- Basic power supply modules without communication option;
- Followed by "/S"-with communication option;
- Followed by "/POE" (HFE2500-48 only)- with output circuit additionally meets of requirements of IEEE 802.3 Standard.

2. Accessory rack HFE2500-S1U:

- Basic model: with IEC inlets on the rear side;
- Followed by “-TB”- option with input terminal blocks instead of IEC inlets.

3. HFE2500-LAN is optional communication module which may be used in the complete set of the accessory rack HFE2500-S1U and powered by +12 VDC from auxiliary output of power supplies within the rack or separately by an external +12V supply in accordance with the user manual.

Variable:	Range of variable:	Content:
x	/S – with communication option blank-without	(all models) external communication
y	/POE - with output circuit additionally meets of requirements of IEEE 802.3 Standard blank-standard model	For HFE2500-48 only
z	-R – with reverse air flow blank-standard air flow	(HFE2500 only) standard air flow: front to rear
u	-CO – conformal coating used blank-without conformal coating	(all models) conformal coating used for environmental protection only
w	-TB- with input terminal blocks instead of IEC inlets blank-with IEC inlet	For HFE2500-S1U rack only

Test Report History:

[31182226.001](#)-original report

[31182226.003](#)-New test report for an upgrade of standard according to IEC60950-1:2005+A1

[31182226.005](#)-Amendment 1 to 31182226.003 for the listing of an alternate PCB-material in the list of Critical Components. The PCB is manufactured by an alternate manufacturer but according to identical specification and drawings from the applicant which haven't changed.

[31182226.006](#)-New test report for an upgrade of standards according to from (IEC 60950-1:2005 +Am 1:2009) to (IEC 60950-1:2005 + Am 1:2009 + Am 2:2013) and (EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011) to (EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011+ A2:2013)

[31182226.008](#)-Amendment 1 to report 31182226.006 for addition of suffix “z” to models HFE2500-48.

Explanation below.

-CQC (HFE2500-48/S only)-identification for specific customer, fully same with base model HFE2500-48/S.

[31182226.010](#)-Amendment 2 to report 31182226.008 for correction of typing error: missed tables of clearance and creepage distance measurements (tables 2.10.3 & 2.10.4) for model HFE2500-XYZ.

Reference report 31182226.001

[31182226.011](#)- New CB report. This report covers the following:

- Additional models HFE2500 reverse fan
- RFE2500, HFE2500-48/S-CQC and HFE2500-12/S-R/RE, correction of Critical Component List
- Change of configuration code.

[31182226.013](#)- Amendment 1 to report 31182226.011 for adding the follow:

- Alternate Fan “Nidec model: W40S12BHA5-53”.

[31182226.014](#)- Amendment 2 to report 31182226.011 covers listing of optional communication module

HFE2500-LAN; adding of different marking for components used in HFE2500-12/RFE2500-12; correct listing of p/n of CN101/CN1101 in critical components list; correction of listing of L101, L102 in critical component list; changing of input/output rating for model HEF2500-12/S-R/RE from Iout=180A to Iout=190A, from Pout=2200W to Pout=2300W and from Iin=14A to Iin=15A; adding IEC60950-1: 2001 National Differences for Japan.

31182226.016 – Amendment 3 to report 31182226.011 covers changing of output rating for model HEF2500-12/S-R/RE from Vout=12VDC to Vout=12.6VDC, from Iout=190A to Iout=185A, from Pout=2300W to Pout=2331W, changing of max. ambient temperature from Ta max.=40°C to Ta max.=42°C, changing fan's model for HFE2500-12/S-R/RE from W40S12BHA5-52 or W40S12BHA5-53 or V40S12BHA5-53 to same as for standard models of HFE2500/RFE2500 modules.

Abbreviations used in the report:

- normal conditions	N.C.	- single fault conditions	S.F.C
- functional insulation	OP	- basic insulation	BI
- double insulation	DI	- supplementary insulation	SI
- between parts of opposite polarity	BOP	- reinforced insulation	RI

Indicate used abbreviations (if any)

- primary	PRI
- ground (protective earth)	GND
- safety extra low voltage	SELV
- terminal block	TB
- Triple Insulated Wire	TIW

CONDITIONS OF USE:

- All units shall be installed in compliance with the enclosure, mounting, spacing, casualty, segregation and other safety related requirements of the final application.
- The main outputs (48VDC, 32VDC, 24VDC or 12VDC) have been investigated for SELV with energy hazardous level
- Auxiliary output (12VDC) has been investigated for SELV with non-energy hazardous level
- 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/RFE2500 units used separately the voltage for Dielectric Strength Test should be based on the maximum supply voltage for end-product.
- A suitable Electrical and Fire enclosure shall be provided for HFE2500/RFE2500 units by the end-product.
- The products shall be properly bonded to the protective earth in the end-product.
- For accessory rack HFE2500-S1U an appliance coupler(s) is considered as Disconnect device(s). HFE2500/RFE2500 units and accessory rack HFE2500-S1U-TB have no disconnect device provided with unit. An appropriate disconnect device shall be provided by end-installation.
- All units were tested on a 30A branch circuit for each AC input. If used on a branch circuit greater than listed above, an additional testing may be necessary.
- The max. ambient:
 - 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-**42**°C
- HFES1U rack-50°C, 70°C (with output de-rated)