Test Report issued under the responsibility of:

TEST REPORT
IEC 62368-1
Audio/video, information and communication technology equipment
Part 1: Safety requirements

Report Number..... :	T223-0310/25
Date of issue ..... :	2025-11-12
Total number of pages ..... :	284 pages
Name of Testing Laboratory preparing the Report ..... :	SIQ Ljubljana SIQ Ljubljana is accredited by Slovenian Accreditation with accreditation number LP-009 in the field of testing (SIST EN ISO/IEC 17025).
Applicant's name ..... :	TDK-Lambda UK Ltd.
Address ..... :	Kingsley Ave, Ilfracombe, EX34 8ES, United Kingdom
Test specification:	
Standard ..... :	IEC 62368-1: 2018
Test procedure..... :	CB Scheme
Non-standard test method..... :	N/A
TRF template used ..... :	IECEE OD-2020-F1:2021, Ed.1.4
Test Report Form No. ..... :	IEC62368_1E
Test Report Form(s) Originator.... :	UL(US)
Master TRF ..... :	Dated 2022-04-14

If this Test Report Form is used by non-IECEE members, the IECEE/IEC logo and the reference to the CB Scheme procedure shall be removed.

This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

General disclaimer:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing CB Testing Laboratory. The authenticity of this Test Report and its contents can be verified by contacting the NCB, responsible for this Test Report.

Test item description .....:	Switching power supplies and accessory rack
Trade Mark(s) .....:	TDK·Lambda
Manufacturer.....:	TDK-Lambda UK Ltd. Kingsley Ave, Ilfracombe, EX34 8ES, United Kingdom
Model/Type reference .....:	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
Ratings .....:	1. Single Power Supply Modules ratings: Input: 100-240 V a.c.; 25 A max; 47 – 440 Hz; 2016 W 200-240 V a.c.; 22 A max; 47 – 440 Hz; 3504 W Output: 24 V d.c., 84 A; 12 V d.c., 1 A (24 V version power supply module @ input 100-240 V a.c.); 24 V d.c., 146 A; 5 V d.c., 2 A (24 V version power supply module @ input 200-240 V a.c.); 48 V d.c., 42 A; 12 V d.c., 1 A (48 V version power supply module @ input 100-240 V a.c.); 48 V d.c., 73 A; 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

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):			
☒	**CB Testing Laboratory:**	SIQ Ljubljana	
Testing location/ address ..... :		Mašera-Spasićeva ulica 10, SI-1000 Ljubljana Slovenia	
Tested by (name, function, signature) ..... :		Rok Štampohar (Authorization of test report) Service Provider	
Approved by (name, function, signature) .. :		Matej Šmidovnik Reviewer	
☐	**Testing procedure: CTF Stage 1:**		
Testing location/ address ..... :			
Tested by (name, function, signature) ..... :			
Approved by (name, function, signature) .. :			
☐	**Testing procedure: CTF Stage 2:**		
Testing location/ address ..... :			
Tested by (name, function, signature) ..... :			
Witnessed by (name, function, signature) . :			
Approved by (name, function, signature) .. :			
☐	**Testing procedure: CTF Stage 3:**		
☐	**Testing procedure: CTF Stage 4:**		
Testing location/ address ..... :			
Tested by (name, function, signature) ..... :			
Witnessed by (name, function, signature) . :			
Approved by (name, function, signature) .. :			
Supervised by (name, function, signature) :			

List of Attachments (including a total number of pages in each attachment):

1. National differences according to IEC 62368-1:2018 (Third Edition) – Enclosure No. 1 (52 pages)
2. Pictures of the unit – Enclosure No. 2 (15 pages)
3. Technical documentation – Enclosure No. 3 (69 pages)

Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**
5.2 Electrical energy source measurement (classification) 5.4.1.4 Measurement of maximum operating temperatures for materials, components and systems 5.4.1.8 Determination of working voltage 5.4.1.10.3 Ball pressure test 5.4.2 / 5.4.3 Clearance and creepage distances 5.4.4.2 Minimum distance through insulation 5.4.4.6.2 Separable thin sheet material 5.4.8 Humidity conditioning 5.4.9 Electric strength test 5.5.2.2 Capacitor discharge test 5.6.6 Resistance of the protective bonding system 5.7 Prospective touch voltage, touch current and protective conductor current 6.2.2.2 Power measurement for worst-case fault 6.2.2.3 Power measurement for worst-case power source fault 9.3 Temperature test (accessible parts) B.2.5 Input test B.3.1 – B.3.8 Simulated abnormal operating conditions: - Covering of ventilation openings - Maximum load at output terminals B.4.1 – B.4.9 Simulated single fault conditions: - Blocked motor test - Short circuit of clearances for functional insulation - Short circuit of creepage distances for functional insulation - Short circuit and interruption of electrodes in tubes and semiconductors - Short circuit or disconnection of passive devices	**SIQ Ljubljana** **Mašera-Spasićeva ulica 10, SI-1000 Ljubljana, Slovenia**

F.3.10 Permanence of markings G.5.3.3 Transformer overload test T.2 Steady force test, 10 N T.3 Steady force test, 30 N T.5 Steady force test, 250 N T.6 Enclosure impact test V.1.2 Test method 1 - Surfaces and openings tested with jointed test probe V.1.3 Test method 2 - Openings tested with straight unjointed test probes	

Summary of compliance with National Differences (List of countries addressed):

EUROPEAN GROUP AND NATIONAL DIFFERENCES (CENELEC), USA, Canada, Saudi Arabia, Australia, New Zealand, Singapore, China, Japan, Argentina and Korea.

☒ **The product fulfils the requirements of EN IEC 62368-1:2020 + A11:2020, BS EN IEC 62368-1:2020 + A11:2020.**

Use of uncertainty of measurement for decisions on conformity (decision rule) :

☒ No decision rule is specified by the IEC standard, when comparing the measurement result with the applicable limit according to the specification in that standard. The decisions on conformity are made without applying the measurement uncertainty (“simple acceptance” decision rule, previously known as “accuracy method”).

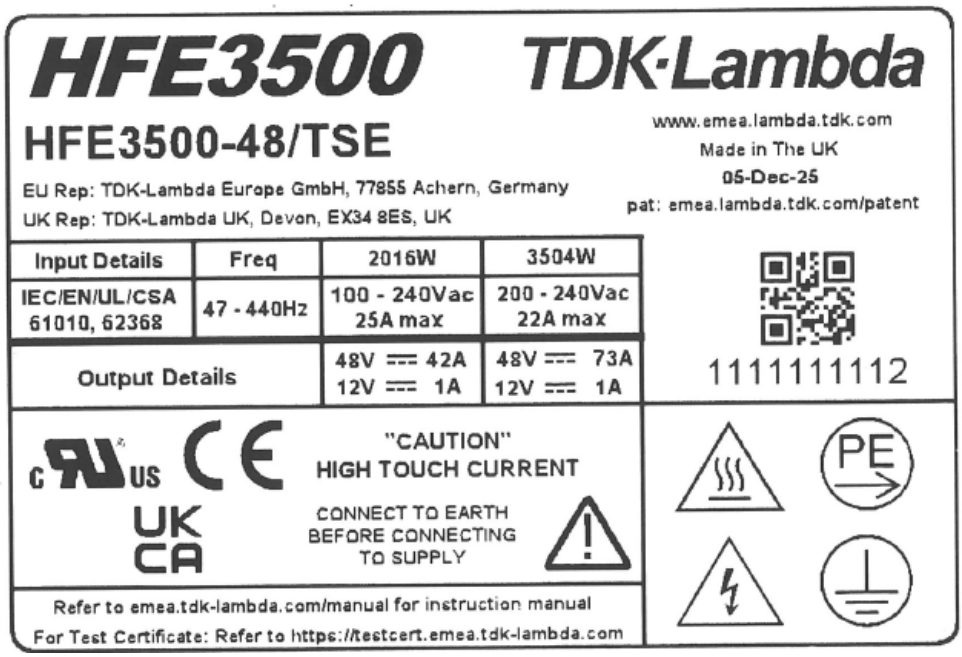
☐ Other:… (to be specified, for example when required by the standard or client, or if national accreditation requirements apply)

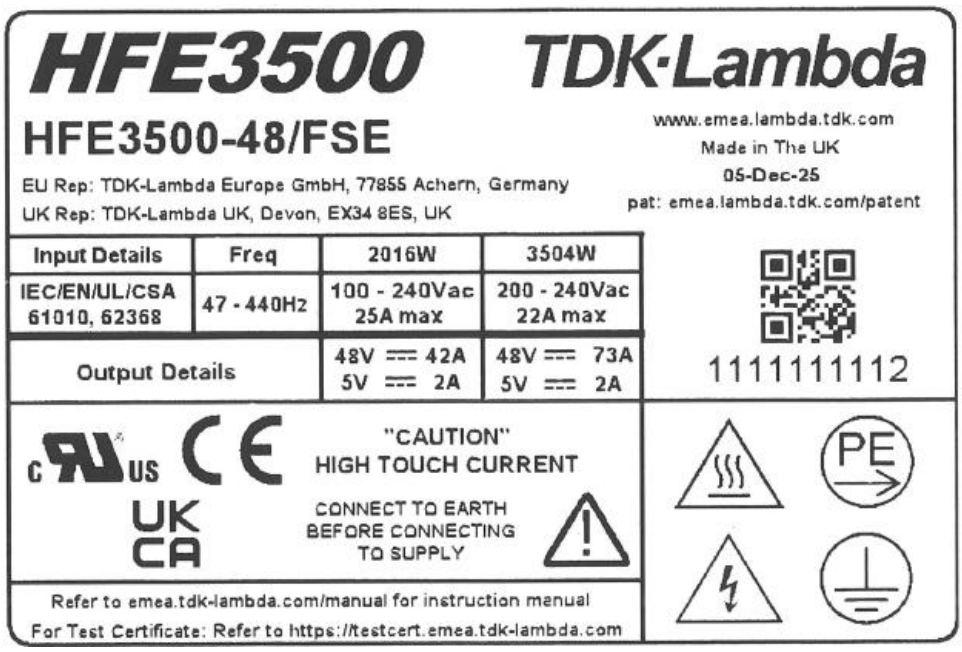
Information on uncertainty of measurement:
The uncertainties of measurement are calculated by the laboratory based on application of criteria given by OD-5014 for test equipment and application of test methods, decision sheets and operational procedures of IECEE.
IEC Guide 115 provides guidance on the application of measurement uncertainty principles and applying the decision rule when reporting test results within IECEE scheme, noting that the reporting of the measurement uncertainty for measurements is not necessary unless required by the test standard or customer.
Calculations leading to the reported values are on file with the NCB and testing laboratory that conducted the testing.

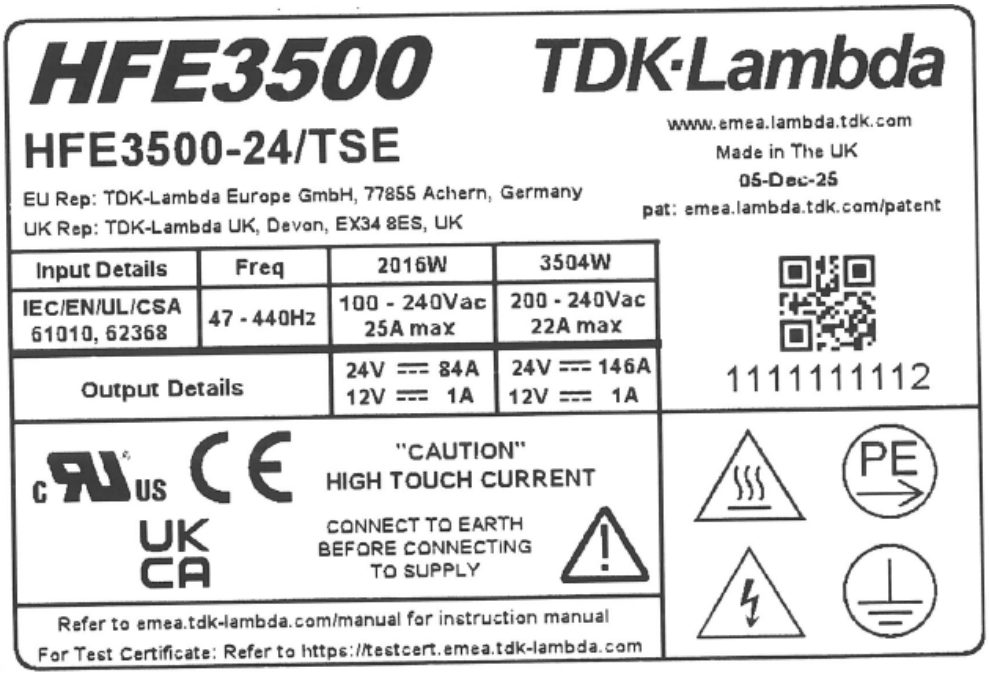
Copy of marking plate:

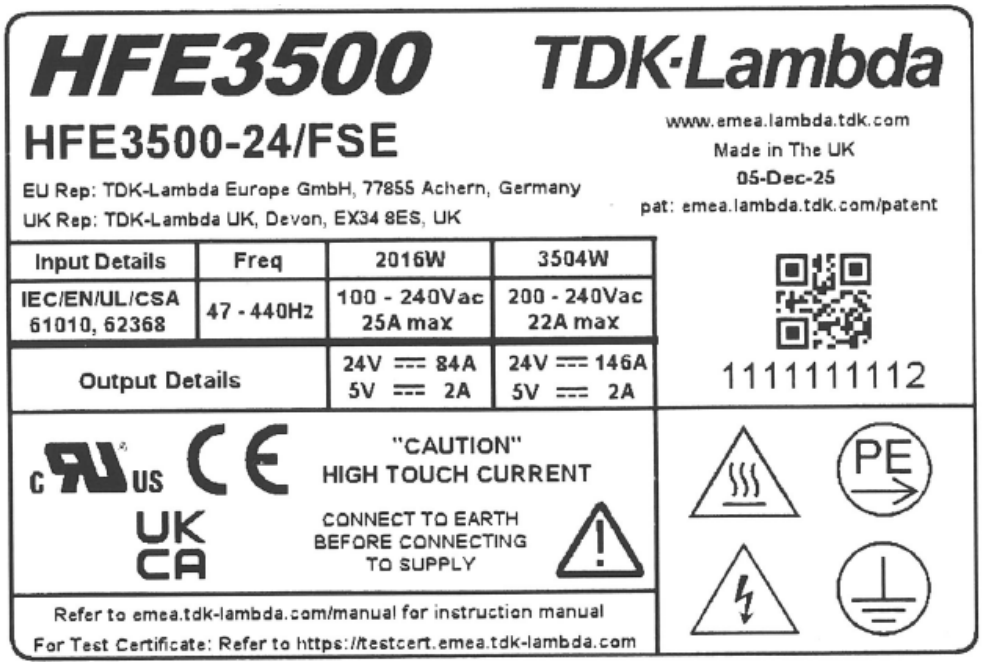
The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.

Power Supply modules

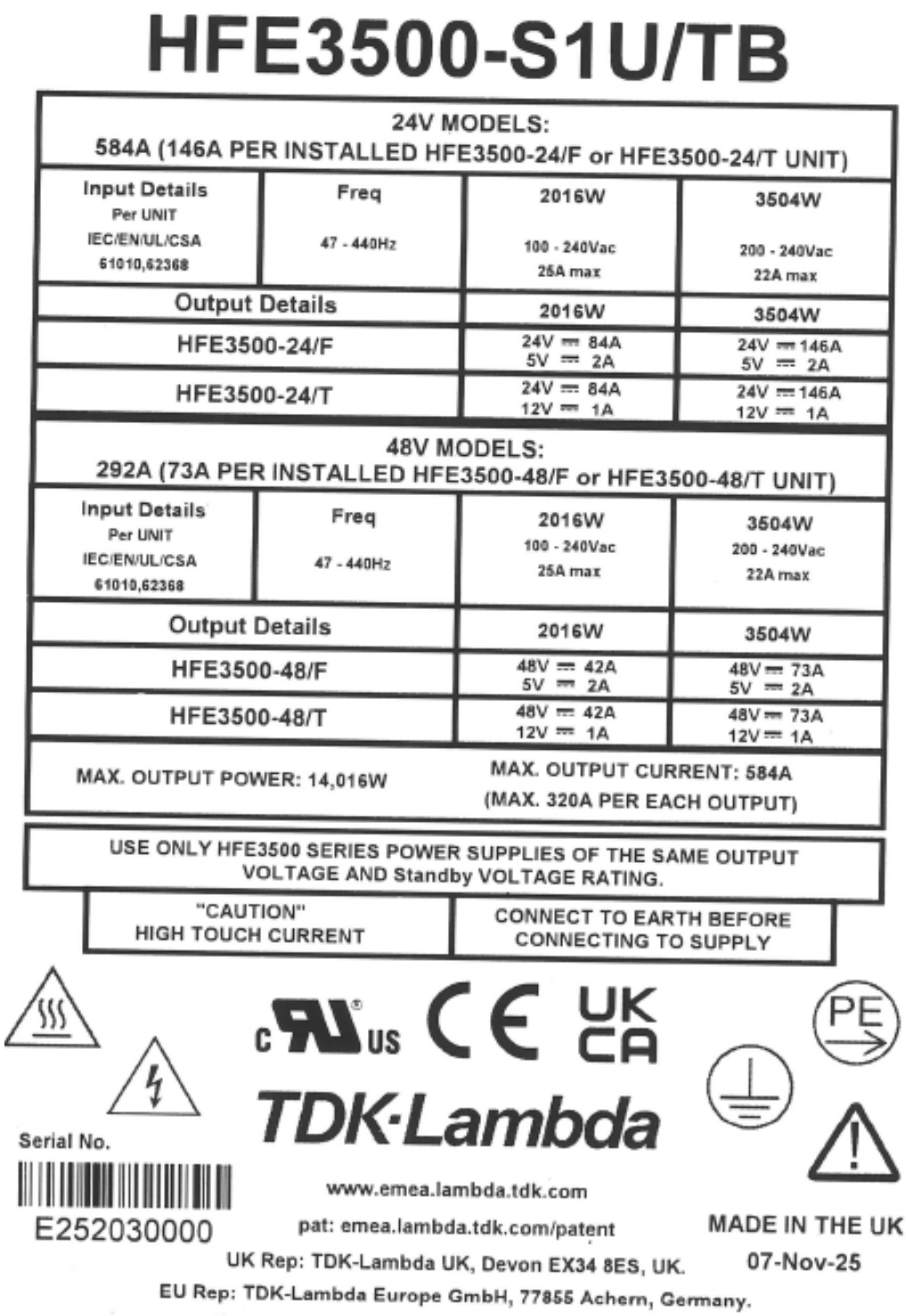


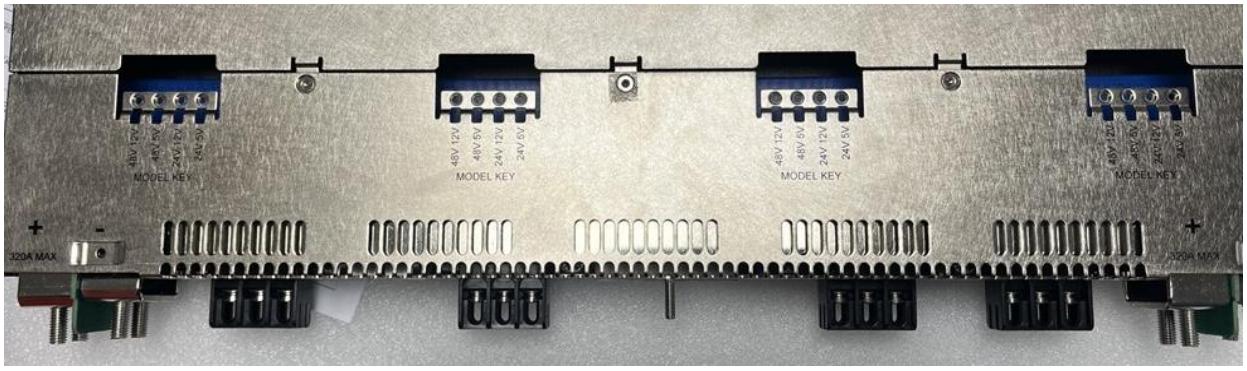


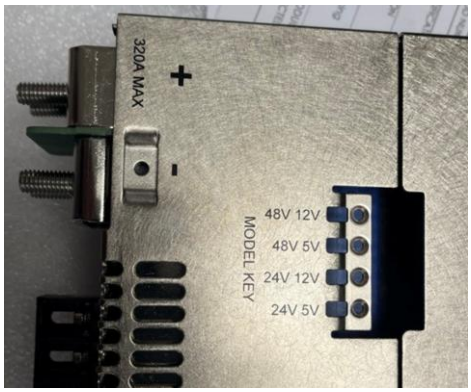

HFE3500
TDK·Lambda
HFE3500-24/TSE
www.emea.lambda.tdk.com
Made in The UK
05-Dec-25
pat: emea.lambda.tdk.com/patent
EU Rep: TDK-Lambda Europe GmbH, 77855 Achern, Germany
UK Rep: TDK-Lambda UK, Devon, EX34 8ES, UK
Input Details
Freq
2016W
3504W
IEC/EN/UL/CSA 61010, 62368
47 - 440Hz
100 - 240Vac 25A max
200 - 240Vac 22A max
Output Details
24V 84A
12V 1A
24V 146A
12V 1A
1111111112
"CAUTION"
HIGH TOUCH CURRENT
CONNECT TO EARTH BEFORE CONNECTING TO SUPPLY
PE
Refer to emea.tdk-lambda.com/manual for instruction manual
For Test Certificate: Refer to https://testcert.emea.tdk-lambda.com

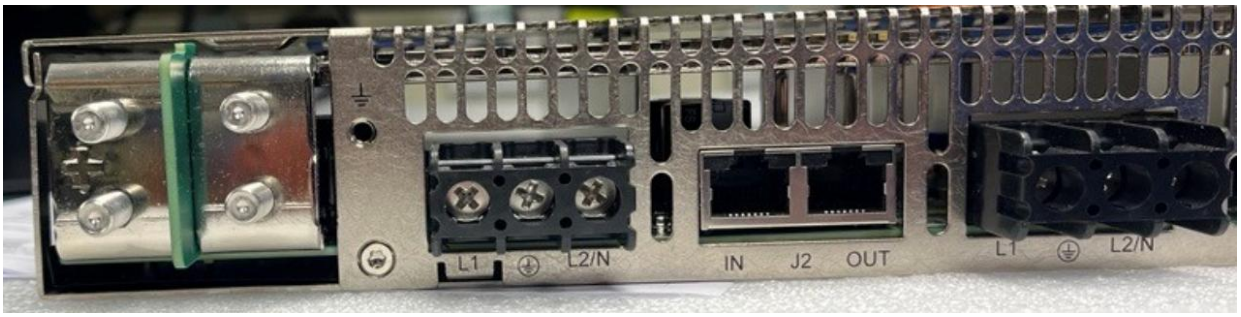

HFE3500
TDK·Lambda
HFE3500-24/FSE
www.emea.lambda.tdk.com
Made in The UK
05-Dec-25
pat: emea.lambda.tdk.com/patent
EU Rep: TDK-Lambda Europe GmbH, 77855 Achern, Germany
UK Rep: TDK-Lambda UK, Devon, EX34 8ES, UK
Input Details
Freq
2016W
3504W
IEC/EN/UL/CSA 61010, 62368
47 - 440Hz
100 - 240Vac 25A max
200 - 240Vac 22A max
Output Details
24V 84A
5V 2A
24V 146A
5V 2A
1111111112
"CAUTION"
HIGH TOUCH CURRENT
CONNECT TO EARTH BEFORE CONNECTING TO SUPPLY
PE
Refer to emea.tdk-lambda.com/manual for instruction manual
For Test Certificate: Refer to https://testcert.emea.tdk-lambda.com

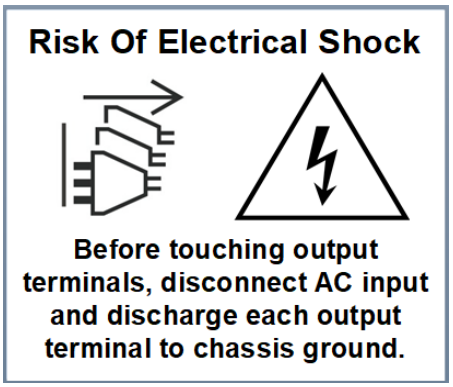
RACK label:


HFE3500-S1U/TB
24V MODELS:
584A (146A PER INSTALLED HFE3500-24/F or HFE3500-24/T UNIT)
Input Details
Per UNIT
IEC/EN/UL/CSA
61010,62368
Freq
47 - 440Hz
2016W
100 - 240Vac
25A max
3504W
200 - 240Vac
22A max
Output Details
2016W
3504W
HFE3500-24/F
24V 84A
5V 2A
24V 146A
5V 2A
HFE3500-24/T
24V 84A
12V 1A
24V 146A
12V 1A
48V MODELS:
292A (73A PER INSTALLED HFE3500-48/F or HFE3500-48/T UNIT)
Input Details
Per UNIT
IEC/EN/UL/CSA
61010,62368
Freq
47 - 440Hz
2016W
100 - 240Vac
25A max
3504W
200 - 240Vac
22A max
Output Details
2016W
3504W
HFE3500-48/F
48V 42A
5V 2A
48V 73A
5V 2A
HFE3500-48/T
48V 42A
12V 1A
48V 73A
12V 1A
MAX. OUTPUT POWER: 14,016W
MAX. OUTPUT CURRENT: 584A
(MAX. 320A PER EACH OUTPUT)
USE ONLY HFE3500 SERIES POWER SUPPLIES OF THE SAME OUTPUT VOLTAGE AND Standby VOLTAGE RATING.
"CAUTION"
HIGH TOUCH CURRENT
CONNECT TO EARTH BEFORE CONNECTING TO SUPPLY
PE
Serial No.
E252030000
TDK·Lambda
www.emea.lambda.tdk.com
pat: emea.lambda.tdk.com/patent
MADE IN THE UK
07-Nov-25
UK Rep: TDK-Lambda UK, Devon EX34 8ES, UK.
EU Rep: TDK-Lambda Europe GmbH, 77855 Achern, Germany.


MODEL KEY
MODEL KEY
MODEL KEY
MODEL KEY
+
-
320A MAX


320A MAX
+
-
MODEL KEY
48V 12V
48V 5V
24V 12V
24V 5V


L1
L2/N
IN
J2
OUT
L1
L2/N


Risk Of Electrical Shock
Before touching output terminals, disconnect AC input and discharge each output terminal to chassis ground.

Test item particulars:	
Product group .....:	☐ end product ☒ built-in component
Classification of use by .....:	☒ Ordinary person (front side) ☐ Children likely present ☐ Instructed person ☒ Skilled person
Supply connection.....:	☒ AC mains ☐ DC mains ☐ not mains connected: ☐ ES1 ☐ ES2 ☐ ES3
Supply tolerance .....:	☐ +10%/-10% ☐ +20%/-15% ☒ +10%/ -15% ☐ None
Supply connection – type .....:	☐ pluggable equipment type A - ☐ non-detachable supply cord ☐ appliance coupler ☐ direct plug-in ☐ pluggable equipment type B - ☐ non-detachable supply cord ☐ appliance coupler ☒ permanent connection (rack module) ☒ mating connector (power supply modules) ☐ other:
Considered current rating of protective device.....:	☒ 32 A; Location: ☒ building ☐ equipment ☐ N/A
Equipment mobility .....:	☐ movable ☐ hand-held ☐ transportable ☐ direct plug-in ☐ stationary ☒ for building-in ☐ wall/ceiling-mounted ☐ SRME/rack-mounted ☐ other:
Overvoltage category (OVC) .....:	☐ OVC I ☒ OVC II ☐ OVC III ☐ OVC IV ☐ other:
Class of equipment .....:	☒ Class I ☐ Class II ☐ Class III ☐ Not classified ☐
Special installation location .....:	☒ N/A ☐ restricted access area ☐ outdoor location ☐
Pollution degree (PD) .....:	☐ PD 1 ☒ PD 2 ☐ PD 3
Manufacturer's specified T_{ma}.....:	40°C or 50°C ☐ Outdoor: minimum °C
IP protection class .....:	☒ IPX0 ☐ IP___
Power systems .....:	☒ TN ☒ TT ☐ IT - V_{L-L} ☐ not AC mains
Altitude during operation (m) .....:	☐ 2000 m or less ☒ 5000 m
Altitude of test laboratory (m) .....:	☒ 2000 m or less ☐ m
Mass of equipment (kg) .....:	Approx. 1,950 kg (Power Supply Modules), approx. 12,750 kg (Rack equipped with all 4 Power Supply Modules)

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 .....:	2025-04-25; 2025-05-20; 2025-07-08; 2025-09-18
Date (s) of performance of tests .....:	From 2025-06-02 to 2025-10-21

General remarks:

"(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 IECEE 02:

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**

When differences exist; they shall be identified in the General product information section.

Name and address of factory (ies) ..... :	TDK-Lambda UK Ltd. Kingsley Ave, Ilfracombe, EX34 8ES, United Kingdom Panyu Trio Microtronics Co Ltd.p Shiji industrial estate, Dongyong, Nansha, Guangzhou, Guangdong 511453, China

General product information and other remarks:

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.

Power supply modules nomenclature

Unit Configuration Code:

HFEx-y/abcde

Where:

x - 3500

y - 24 or 48

Channel 1 output voltage

Input Voltage	Model	Output Voltage Channel 1	Voltage Range	Max Iout	Max Pout
100-240Vac	HFE3500	24	21.6-28.8	84	2016W
		48	43.2-57.6	42	
200-240Vac		24	21.6-28.8	146	3504W
		48	43.2-57.6	73	

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

Model Differences –

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

Additional application considerations – (Considerations used to test a component or sub-assembly) –

The component was tested according to the standard IEC 62368-1:2018 (3rd Edition) and/or EN IEC 62368-1:2020 + A11:2020 and/or BS EN IEC 62368-1:2020 + A11:2020.

Additionally, the component was also evaluated according to the standards CSA C22.2 No. 62368-1:2019 and UL 62368-1:2019 (3rd Edition) and fulfils the requirements of these standards.

1. 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.
2. All secondary output circuits are separated from mains by reinforced insulation and rated ES1.
3. Disconnect device is end system consideration.
4. Safety Instructions: Built in product, safety instructions are end product considerations.
5. Power supply cords not part of investigation.
6. 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.
7. 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).
8. The equipment has been evaluated for use in a Pollution Degree 2 and overvoltage category II environment and a maximum altitude of 5000 m.
9. 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.
10. Measured touch current exceeds ES2 limits: “Caution” on the label → High touch current. Output of the unit should be connected with PE in end application. Reliable earth should be provided in end application.
11. 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 Encl. No. 3.0 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)

(I)	Output Characteristics			HFE3500-24	HFE3500-48
1	Continuous output power	180 ≤ Vin ≤ 264Vac	W	3504	3504
		170 ≤ Vin < 180Vac	W	Linear derating 1% per V ac from 180V ac	
		90 ≤ Vin < 170Vac	W	2016	2016
		85V ≤Vin < 90Vac	W	Linear derating 1.3% per V ac from 90V ac	
2	Rated Output Current	180 < Vin ≤ 264Vac	A	146	73
		90 ≤ Vin ≤ 132Vac	A	84	42
		85V ≤Vin < 90Vac	A	Linear derating 1.3% per V ac from 90V ac	