Test Report issued under the responsibility of:

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

Report Number .....:	31583701.300
Date of issue .....:	October 2, 2020
Total number of pages .....:	175 pages + Attachments
Applicant's name .....:	TDK-Lambda Americas Inc.
Address .....:	401 Mile of Cars Way, Suite 325, National City, CA, 91950 USA
Test specification:	
Standard .....:	IEC 62368-1:2014 (Second Edition)
Test procedure .....:	CB Scheme
Non-standard test method .....:	N/A
Test Report Form No. .....:	IEC62368_1B
Test Report Form(s) Originator .....:	UL(US)
Master TRF .....:	2014-03

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 .....:		Power supply	
Trade Mark .....:		TDK·Lambda	
Manufacturer.....:		Same as applicant	
Model/Type reference .....:		1) TPS3000-24-xxx (x = A-Z, 0-9 or blank) 2) TPS3000-48-xxx (x = A-Z, 0-9 or blank) 3) TPS4000-24-xxx (x = A-Z, 0-9 or blank) 4) TPS4000-12-xxx (x = A-Z, 0-9 or blank) 5) TPS4000-48-xxx (x = A-Z, 0-9 or blank)	
Ratings .....:		1),2) Input: 3AC 400-480V, 50-60Hz, 6A per phase (Operating Range 360 – 528Vac) 3),4),5) Input: 3 AC 400-480V,50-60Hz, 8A per phase, 4600W (Operating Range 360 – 528Vac) 1) Output: DC 19.2-29.0V, 133.3A max, 3200W max (See Output Rating Table I) 2) Output: DC 38.4-58.0V, 66.7A max, 3200W max (See Output Rating Table II) 3) Output: DC 19.2-28.5V, 170A max, 4000W max (See Output Rating Table III) 4) Output: DC 4-18 V, 170A max, 3000W max (See Output rating Table IV) 5) Output: DC 24-58 V, 85A max, 4000W max (See Output rating Table V)	
Testing procedure and testing location:			
☐	CB Testing Laboratory:	TUV Rheinland of North America, Inc.	
Testing location/ address ..... :		1279 Quarry Lane, Ste. A, Pleasanton, CA 94566 USA	
☐	Associated CB Testing Laboratory:		
Testing location/ address..... :			
Tested by (name + signature) .....:			
Approved by (name + signature).....:			
☒	Testing procedure: TMP/CTF Stage 1	TDK-Lambda Americas, Inc	
Testing location/ address..... :		401 Mile of Cars Way, Suite 325 National City, CA 91950	
Tested by (name + signature) .....:		Dan Aquino	
Approved by (name + signature).....:		James Howell	
☐	Testing procedure: WMT/CTF Stage 2		
Testing location/ address..... :			
Tested by (name + signature) .....:			
Witnessed by (name + signature) .....:			
Approved by (name + signature).....:			

☐	Testing procedure: SMT/CTF Stage 3 or 4		
Testing location/ address ..... :			
Tested by (name + signature) .....:			
Approved by (name + signature).....:			
Supervised by (name + signature) .....:			

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

Attachment 1: National Differences (37 pages)
Attachment 2: Photos (8 pages)
Attachment 3: Schematics and PCB Layouts (14 pages)
Attachment 4: Transformer/Inductor Construction Sheet (16 pages)
Attachment 5: IEC/UL/CSA 60950-1 Limited Power Source Measurement (4 pages)

Summary of testing:

The test data was taken from the TUV CB report 31583701.001, 31583701.003, 31583701.005 and 31583701.007 which is in accordance with IEC 60950-1.

The product was tested on a bench top with full load which drew the output power to the max. rated value. Refer to body of report and appended tables for details of each test.

Tests performed (name of test and test clause):	**Testing location:**
31583701.300 Electrical Strength Test (5.4.9) Safeguards Against Capacitor Discharge after Disconnection of a Capacitor (5.5.2.2) Earthed Accessible Conductive part Test (5.7.2) Protective Conductor Current (5.7.5)	31583701.300 TDK-Lambda Americas, Inc. 401 Mile of Cars Way, Suite 325 National City, CA 91950
31583701.007 Power Input Measurements (B.2.5) Determination of Working Voltage(5.4.1.8 Simulated Abnormal operating condition tests (B.3) Simulated single fault conditions (B.4)	31583701.007 TDK-Lambda Americas, Inc. 401 Mile of Cars Way, Suite 325 National City, CA 91950
31583701.005 Power Input Measurements (B.2.5) Determination of Working Voltage Temperature Test (5.4.1.4, 6.3.2, 9.0, B.2.6) Minimum Clearances/Creepage distance (5.4.2.2, 5.4.2.4 and 5.4.3) Earthed Accessible Conductive part Test (5.7.2) Electric strength Test (5.4.9) Simulated Abnormal operating condition tests (B.3) Simulated single fault conditions (B.4)	31583701.005 TDK-Lambda Americas, Inc. 401 Mile of Cars Way, Suite 325 National City, CA 91950
31583701.003 Power Input Measurements (B.2.5) Determination of Working Voltage(5.4.1.8) Temperature Test (5.4.1.4, 6.3.2, 9.0, B.2.6) Minimum Clearances/Creepage distance (5.4.2.2, 5.4.2.4 and 5.4.3) Earthed Accessible Conductive part Test (5.7.2) Electric strength Test (5.4.9) Simulated Abnormal operating condition tests (B.3) Simulated single fault conditions (B.4)	31583701.003 TDK-Lambda Americas, Inc. 401 Mile of Cars Way, Suite 325 National City, CA 91950

31583701.001, Power Input Measurements (B.2.5) Stored Discharge on Capacitors Test (5.5.2.2) Resistance of protective conductors and terminations (5.6.6.2 Humidity Test (5.4.8) Working Voltage Measurement Test (5.4.1.8) Temperature Test (5.4.1.4, 6.3.2, 9.0, B.2.6) Ball Pressure Test (5.4.10.3) Earthed Accessible Conductive part Test (5.7.2) Electric strength Test (5.4.9) Minimum Clearances/Creepage distance (5.4.2.2, 5.4.2.4 and 5.4.3) Simulated Abnormal operating condition tests (B.3) Simulated single fault conditions (B.4)	31583701.001 TDK-Lambda Americas, Inc. 401 Mile of Cars Way, Suite 325 National City, CA 91950

Summary of compliance with National Differences:

List of countries addressed

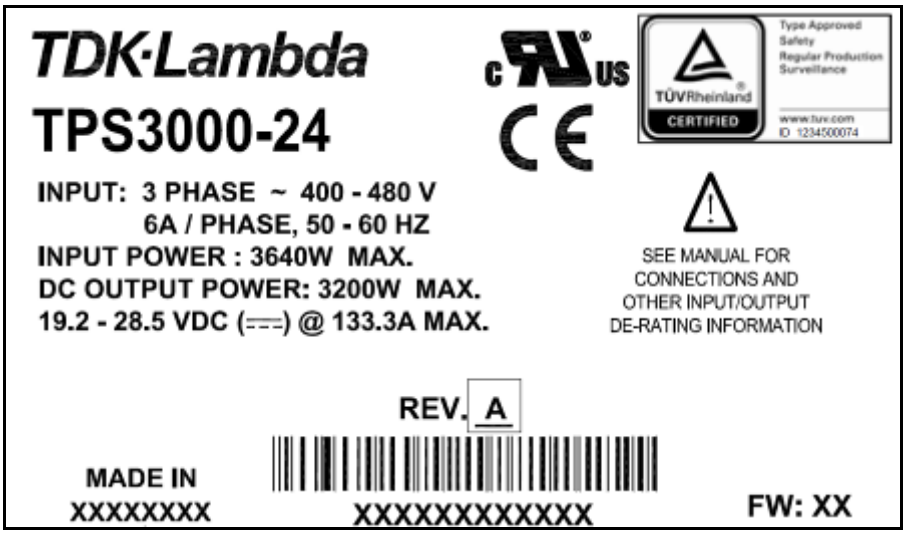
EU Group Differences, EU Special National Conditions, CA, DK, US, AU, NZ, IT, JP

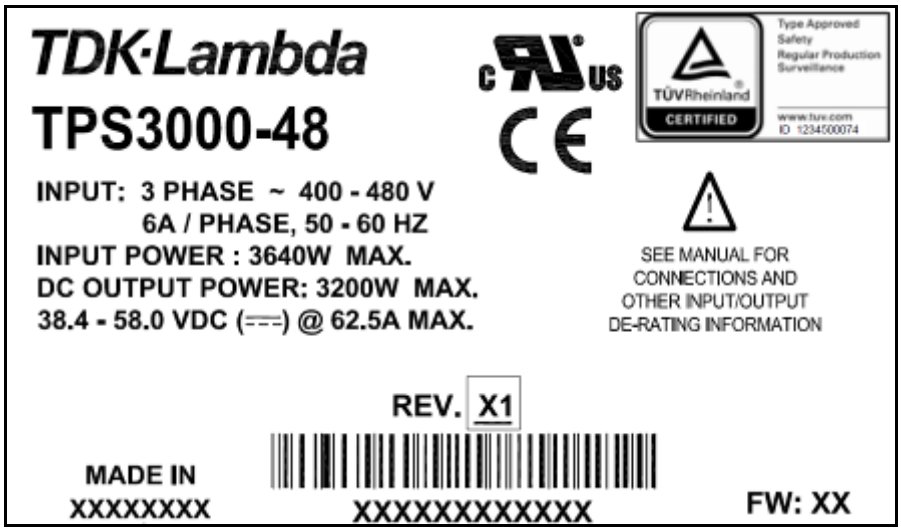
Explanation of used codes: CA = Canada, DK = Denmark, US = United States of America, AU = Australia, NZ = New Zealand, IT = Italy, JP = Japan

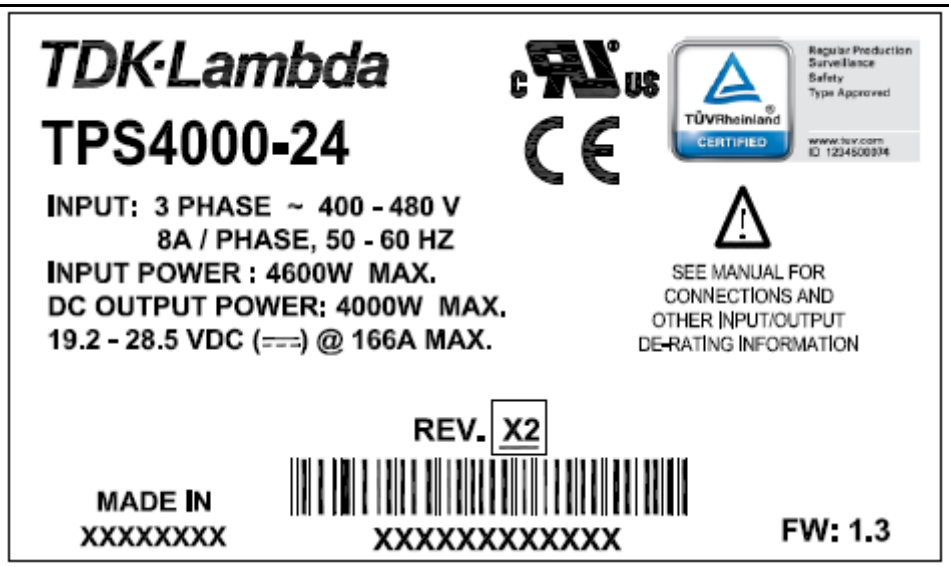
☒ **The product fulfils the requirements of EN 62368-1:2014+A11:2017.**

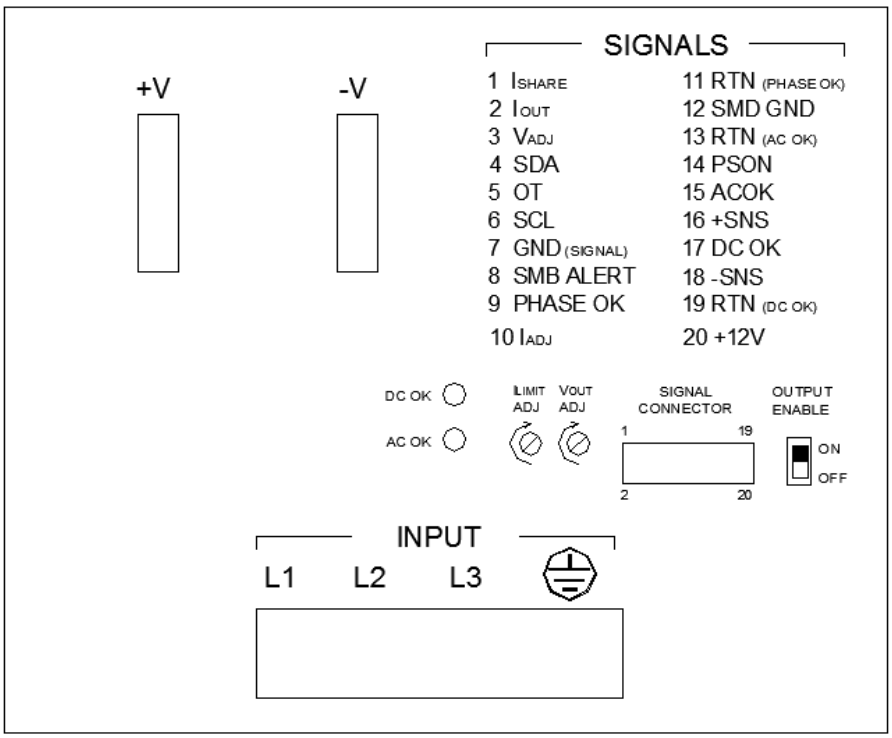
Copy of marking plate:

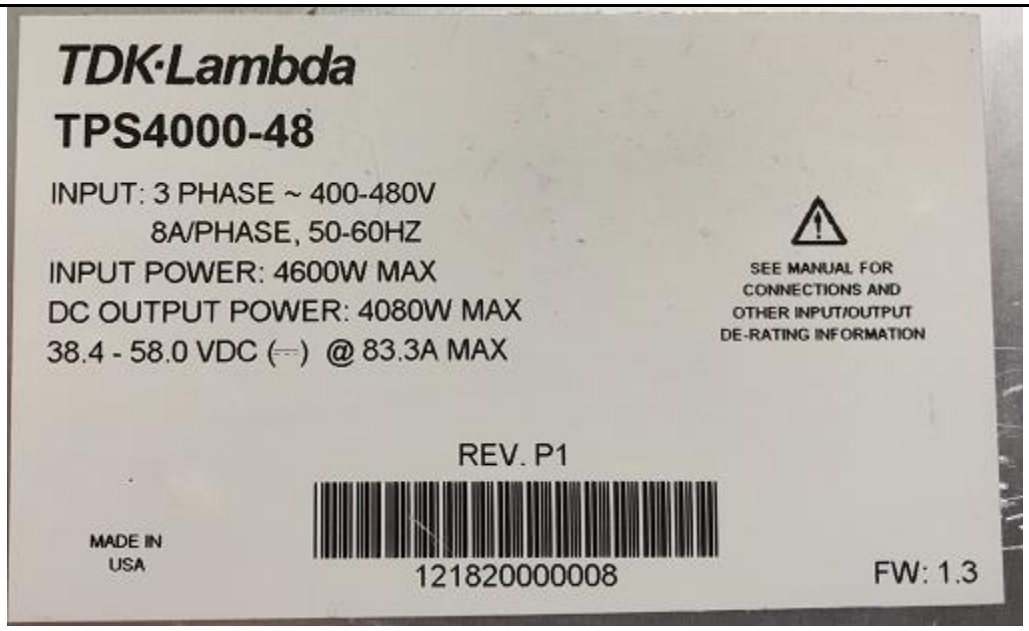
The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.






TDK·Lambda
TPS4000-24
INPUT: 3 PHASE ~ 400 - 480 V
8A / PHASE, 50 - 60 HZ
INPUT POWER : 4600W MAX.
DC OUTPUT POWER: 4000W MAX.
19.2 - 28.5 VDC (⎓) @ 166A MAX.
SEE MANUAL FOR CONNECTIONS AND OTHER INPUT/OUTPUT DE-RATING INFORMATION
REV. X2
MADE IN XXXXXXXX
XXXXXXXXXXXX
FW: 1.3


SIGNALS
+V
-V
1 ISHARE
2 IOUT
3 VADJ
4 SDA
5 OT
6 SCL
7 GND (SIGNAL)
8 SMB ALERT
9 PHASE OK
10 IADJ
11 RTN (PHASE OK)
12 SMD GND
13 RTN (AC OK)
14 PSON
15 ACOK
16 +SNS
17 DC OK
18 -SNS
19 RTN (DC OK)
20 +12V
DC OK
AC OK
ILIMIT ADJ
VOUT ADJ
SIGNAL CONNECTOR
1
19
2
20
OUTPUT ENABLE
ON
OFF
INPUT
L1
L2
L3


TDK·Lambda
TPS4000-48
INPUT: 3 PHASE ~ 400-480V
8A/PHASE, 50-60HZ
INPUT POWER: 4600W MAX
DC OUTPUT POWER: 4080W MAX
38.4 - 58.0 VDC ⎓ @ 83.3A MAX
SEE MANUAL FOR CONNECTIONS AND OTHER INPUT/OUTPUT DE-RATING INFORMATION
REV. P1
MADE IN USA
121820000008
FW: 1.3

TEST ITEM PARTICULARS:	
Classification of use by ..... :	☒ Ordinary person ☒ Instructed person ☒ Skilled person ☐ Children likely to be present
Supply Connection..... :	☒ AC Mains ☐ DC Mains ☐ External Circuit - not Mains connected - ☐ ES1 ☐ ES2 ☒ ES3
Supply % Tolerance ..... :	☒ +10%/-10% ☐ +20%/-15% ☐ +____%/ -_____% ☐ None
Supply Connection – Type ..... :	☐ pluggable equipment type A - ☐ non-detachable supply cord ☐ appliance coupler ☐ direct plug-in ☐ mating connector ☐ pluggable equipment type B - ☐ non-detachable supply cord ☐ appliance coupler ☒ permanent connection ☐ mating connector ☐ other:_____
Considered current rating of protective device as part of building or equipment installation..... :	Not relying on protective device as part of the building installation, power supply has 90A circuit breakers for overcurrent protection. Installation location: ☒ building; ☐ equipment
Equipment mobility ..... :	☐ movable ☐ hand-held ☐ transportable ☐ stationary ☒ for building-in ☐ direct plug-in ☐ rack-mounting ☐ wall-mounted
Over voltage category (OVC) ..... :	☐ OVC I ☒ OVC II ☐ OVC III ☐ OVC IV ☐ other: _____
Class of equipment ..... :	☒ Class I ☐ Class II ☐ Class III
Access location ..... :	☐ restricted access location ☒ N/A Operator Accessible.
Pollution degree (PD) ..... :	☐ PD 1 ☒ PD 2 ☐ PD 3
Manufacturer's specified maxium operating ambient:	50°C at full load, 60°C at 80% load, 70°C at 60% load
IP protection class ..... :	☒ IPX0 ☐ IP___
Power Systems ..... :	☒ TN ☐ TT ☐ IT - ____ V_{L-L}
Altitude during operation (m) ..... :	☐ 2000 m or less ☒ 4000 m
Altitude of test laboratory (m) ..... :	☐ 2000 m or less ☒ 50 m
Mass of equipment (kg) ..... :	☒ 1) 3.4kg; 2) 3.6kg; 3),4),5) 3.9kg
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..... :	03/10/2020 (Report No. 31583701.300) 05/02/2018 (Report No. 31583701.007) 11/30/2017 (Report No. 31583701.005) 5/19/2016 (Report No. 31583701.003) 11/03/2015 (Report No. 31583701.001)
Date (s) of performance of tests ..... :	03/10/2020 - 03/12/2020 (Report No. 31583701.300) 05/02/18 - 05/11/18 (Report No. 31583701.007) 11/30/2017 (Report No. 31583701.005) 5/19/2016 (Report No. 31583701.003) 11/03/2015 - 11/05/2016 (Report No. 31583701.001)
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 Malaysia Sdn Bhd Lot 2 & 3, Batu 9 3/4 Kawasan Perindustrian Bandar Baru Jaya Gading 26070 Kuantan, Malaysia TDK-Lambda America Inc. 405 Essex Road, Neptune, NJ 07753 USA

GENERAL PRODUCT INFORMATION:

The equipment is a switch-mode power supply. It is fully enclosed, with single output and with forced air cooling.

Conditions of Acceptability:

1. The equipment is considered to operate under the conditions of:
- Pollution Degree 2 environment
- Equipment mobility: Component for building-in
- Class of Equipment: Class I (grounded)
- Operating altitude: 4000 meters
2. Rated ambient 50°C at full load (3,200 and 3,000W), 60°C at 80% load (2,400 W), 70°C at 60% load (1,800 W).
3. Fire enclosure requirements must be addressed in the end product.
4. Output is considered to be at hazardous energy levels.
5. Heating test must be re-evaluated in the end use application.
6. All fuses used are non-user accessible and replaceable UL/CSA fuses

Model Differences:

Model TPS3000-48-xxx is designed to be a higher voltage version of model TPS3000-24-xxx. The input ratings will remain the same and output rating is 'DC 38.4-58.0V, 66.7A max, 3200W max'. Both models use the same input board. The output board of the new model use two primary side chokes with an extra turn (3 vs 2 when compared to TPS3000-24-xxx) and different mains transformer. The construction of the mains transformer is identical, except for the tapping of the secondary. The control circuitry of the output board's secondary has also changed to account for the higher voltage.

Model TPS4000-24-xxx was designed to be a higher wattage version of the existing model TPS3000-24-xxx. The input current for model TPS4000-24-xxx has been increased to 8A per phase and the output rating is 'DC 19.2-28.5V, 166A max, 4000W'. The input board has been updated to handle the increased current generation and to include a fault protection circuit. The mains transformers (T303 and T305) on the output board are identical to the mains transformers for model TPS3000-24. The circuitry of the output board has been updated to account for higher currents.

Model TPS4000-12-xxx & TPS4000-48-xxx are identical to Model TPS4000-24-xxx, but with 12V & 48V output with the output power the same. The circuitry of the output board has been updated.

Output Ratings Table:

Output Rating Table I (TPS3000-24-xxx)

Orientation	Output Rating (dc)			
	Voltage (V)	Current (A) Max	Power (W) Max	Ambient (°C) max
1	24.0	133.3	3,200	50
1, 2, 3	24.0	125	3,000	50
1, 2, 3	24.0	100	2,400	60
1, 2, 3	24.0	75	1,800	70
1, 2, 3	19.2	125	2,400	50 and 60
1, 2, 3	19.2	93.8	1,800	70
1, 2, 3	29.0	103.5	3,000	50
1, 2, 3	29.0	82.8	2,400	60
1, 2, 3	29.0	62.1	1,800	70

Output Rating Table II (TPS3000-48-xxx)

Orientation	Output Rating (dc)			
	Voltage (V)	Current (A) Max	Power (W) Max	Ambient (°C) max
1, 2, 3	48.0	66.7	3,200	50
1, 2, 3	48.0	50	2,400	60
1, 2, 3	48.0	37.5	1,800	70
1, 2, 3	38.4	66.7	2561	50
1, 2, 3	38.4	62.5	2400	60
1, 2, 3	38.4	46.9	1,800	70
1, 2, 3	58.0	55.2	3,200	50
1, 2, 3	58.0	41.4	2,400	60
1, 2, 3	58.0	31.1	1,800	70
1, 2, 3	30	66.7	2,001	50 and 60
1, 2, 3	30	60	1,800	70

Orientation are as follows:

1. Horizontal/sideways
2. Vertical - input/output connectors on top, fan at the bottom
3. Vertical - input/output connectors at the bottom, fan on top

Output Rating Table III (TPS4000-24-xxx):

Orientation	Output Rating (dc)			
	Voltage (V)	Current (A) Max	Power (W) Max	Ambient (°C) max
1, 2, 3	24.0	170	4,080	50
1, 2, 3	24.0	136	3,264	60
1, 2, 3	24.0	93.5	2,244	70
1, 2, 3	29.0	140.7	4,080	50
1, 2, 3	29.0	112.6	3,264	60
1, 2, 3	29.0	77.4	2,244	70
1, 2, 3	19.2	170.0	3,264	50 and 60
1, 2, 3	19.2	116.9	2,244	70

Orientation are as follows:

1. Horizontal/sideways
2. Vertical - input/output connectors on top, fan at the bottom
3. Vertical - input/output connectors at the bottom, fan on top

Output Rating Table IV (TPS4000-12-xxx)

Orientation	Output Rating (dc)			
	Voltage (V)	Current (A) Max	Power (W) Max	Ambient (°C) max
1, 2, 3	4	170	680	70
1, 2, 3	12	170	2040	70
1, 2, 3	18	170	3060	60
1, 2, 3	18	124.6	2244	70

Orientation are as follows:

1. Horizontal/sideways
2. Vertical - input/output connectors on top, fan at the bottom
3. Vertical - input/output connectors at the bottom, fan on top.

Output Rating Table V (TPS4000-48-xxx)

Orientation	Output Rating (dc)			
	Voltage (V)	Current (A) Max	Power (W) Max	Ambient (°C) max
1, 2, 3	58	70.3	4,080	50
1, 2, 3	58	56.3	3,264	60
1, 2, 3	58	38.7	2,244	70
1, 2, 3	48	85	4,080	50
1, 2, 3	48	68	3,264	60
1, 2, 3	48	46.8	2,244	70
1, 2, 3	38	85	3,230	60
1, 2, 3	38	59.1	2,244	70
1, 2, 3	24	85	2040	70

Orientation are as follows:

1. Horizontal/sideways
2. Vertical - input/output connectors on top, fan at the bottom
3. Vertical - input/output connectors at the bottom, fan on top

History of CB report:

31583701.300 - Original IEC/EN 62368-1 CB report

ENERGY SOURCE IDENTIFICATION AND CLASSIFICATION TABLE:	
(Note 1: Identify the following six (6) energy source forms based on the origin of the energy.) (Note 2: The identified classification e.g., ES2, TS1, should be with respect to its ability to cause pain or injury on the body or its ability to ignite a combustible material. Any energy source can be declared Class 3 as a worse case classification e.g. PS3, ES3.	
Electrically-caused injury (Clause 5): (Note: Identify type of source, list sub-assembly or circuit designation and corresponding energy source classification) Example: +5 V dc input ES1	
Source of electrical energy	**Corresponding classification (ES)**
Primary circuit	ES3
Output circuit	ES3
Electrically-caused fire (Clause 6): (Note: List sub-assembly or circuit designation and corresponding energy source classification) Example: Battery pack (maximum 85 watts): PS2	
Source of power or PIS	**Corresponding classification (PS)**
Power Supply Primary circuit	PS3
Power Supply Output circuit	PS3
Injury caused by hazardous substances (Clause 7) (Note: Specify hazardous chemicals, whether produces ozone or other chemical construction not addressed as part of the component evaluation.) Example: Liquid in filled component Glycol	
Source of hazardous substances	**Corresponding chemical**
No hazardous substances present in the product.	N/A
Mechanically-caused injury (Clause 8) (Note: List moving part(s), fan, special installations, etc. & corresponding MS classification based on Table 35.) Example: Wall mount unit MS2	
Source of kinetic/mechanical energy	**Corresponding classification (MS)**
Equipment Weight/Mass	MS3
Sharp Edges	MS1
Thermal burn injury (Clause 9) (Note: Identify the surface or support, and corresponding energy source classification based on type of part, location, operating temperature and contact time in Table 38.) Example: Hand-held scanner – thermoplastic enclosure TS1	
Source of thermal energy	**Corresponding classification (TS)**
Power Supply Enclosure	TS1
Radiation (Clause 10) (Note: List the types of radiation present in the product and the corresponding energy source classification.) Example: DVD – Class 1 Laser Product RS1	
Type of radiation	**Corresponding classification (RS)**
No ionizing radiation produced in the product.	N/A

ENERGY SOURCE DIAGRAM

Indicate which energy sources are included in the energy source diagram. Insert diagram below

☒ **ES** ☒ **PS** ☒ **MS** ☒ **TS** ☐ **RS**