



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: 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

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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	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:		
<input type="checkbox"/>	CB Testing Laboratory:	TUV Rheinland of North America, Inc.
Testing location/ address		1279 Quarry Lane, Ste. A, Pleasanton, CA 94566 USA
<input type="checkbox"/>	Associated CB Testing Laboratory:	
Testing location/ address		
Tested by (name + signature)		
Approved by (name + signature).....		
<input checked="" type="checkbox"/>	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
<input type="checkbox"/>	Testing procedure: WMT/CTF Stage 2	
Testing location/ address		
Tested by (name + signature)		
Witnessed by (name + signature)		
Approved by (name + signature).....		

<input type="checkbox"/>	Testing procedure: SMT/CTF Stage 3 or 4	
Testing location/ address		
Tested by (name + signature)		
Approved by (name + signature).....		
Supervised by (name + signature)		

<p>List of Attachments (including a total number of pages in each attachment):</p> <p>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)</p>	
<p>Summary of testing:</p> <p>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.</p> <p>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.</p>	
<p>Tests performed (name of test and test clause):</p> <p><u>31583701.300</u> 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)</p> <p><u>31583701.007</u> 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)</p> <p><u>31583701.005</u> 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)</p> <p><u>31583701.003</u> 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)</p>	<p>Testing location:</p> <p><u>31583701.300</u> TDK-Lambda Americas, Inc. 401 Mile of Cars Way, Suite 325 National City, CA 91950</p> <p><u>31583701.007</u> TDK-Lambda Americas, Inc. 401 Mile of Cars Way, Suite 325 National City, CA 91950</p> <p><u>31583701.005</u> TDK-Lambda Americas, Inc. 401 Mile of Cars Way, Suite 325 National City, CA 91950</p> <p><u>31583701.003</u> TDK-Lambda Americas, Inc. 401 Mile of Cars Way, Suite 325 National City, CA 91950</p>

<p><u>31583701.001.</u> 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)</p>	<p><u>31583701.001</u> TDK-Lambda Americas, Inc. 401 Mile of Cars Way, Suite 325 National City, CA 91950</p>
<p>Summary of compliance with National Differences: List of countries addressed</p> <p>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</p> <p><input checked="" type="checkbox"/> The product fulfils the requirements of EN 62368-1:2014+A11:2017.</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.

TDK-Lambda
TPS3000-24

INPUT: 3 PHASE ~ 400 - 480 V
6A / PHASE, 50 - 60 HZ
INPUT POWER : 3640W MAX.
DC OUTPUT POWER: 3200W MAX.
19.2 - 28.5 VDC (---) @ 133.3A MAX.


cULus
CE

 Type Approved
Safety
Regular Production
Surveillance
www.tuv.com
ID: 1234500074


SEE MANUAL FOR
CONNECTIONS AND
OTHER INPUT/OUTPUT
DE-RATING INFORMATION

REV. **A**

MADE IN
XXXXXXXXXX



XXXXXXXXXXXXXXXXXX


FW: XX

TDK-Lambda
TPS3000-48

INPUT: 3 PHASE ~ 400 - 480 V
6A / PHASE, 50 - 60 HZ
INPUT POWER : 3640W MAX.
DC OUTPUT POWER: 3200W MAX.
38.4 - 58.0 VDC (---) @ 62.5A MAX.


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ID: 1234500074


SEE MANUAL FOR
CONNECTIONS AND
OTHER INPUT/OUTPUT
DE-RATING INFORMATION

REV. **X1**

MADE IN
XXXXXXXXXX


XXXXXXXXXXXXXXXXXX

FW: XX

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

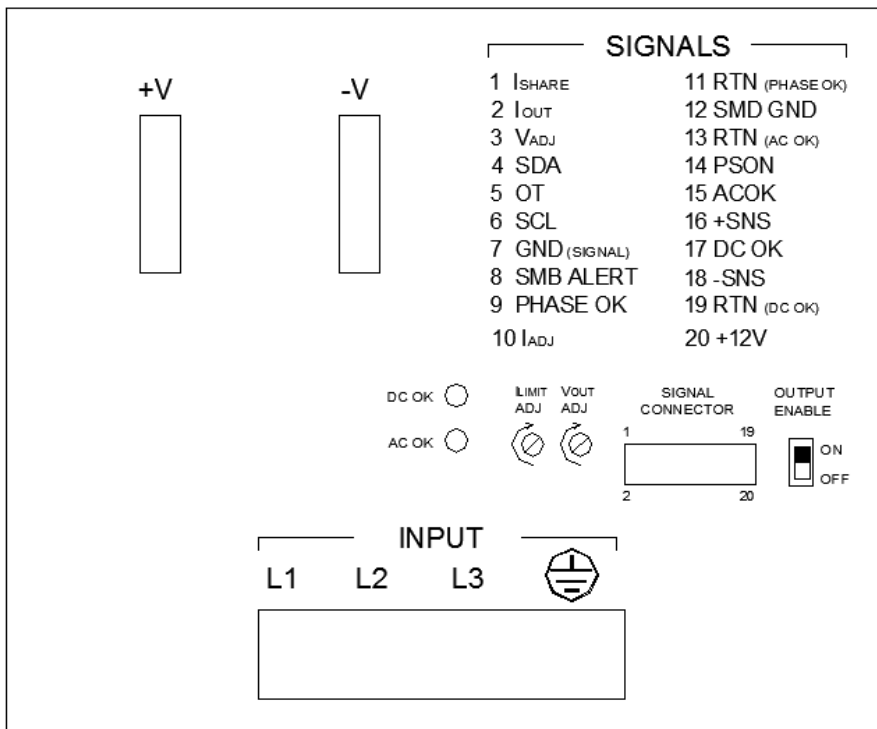
REV. **X2**

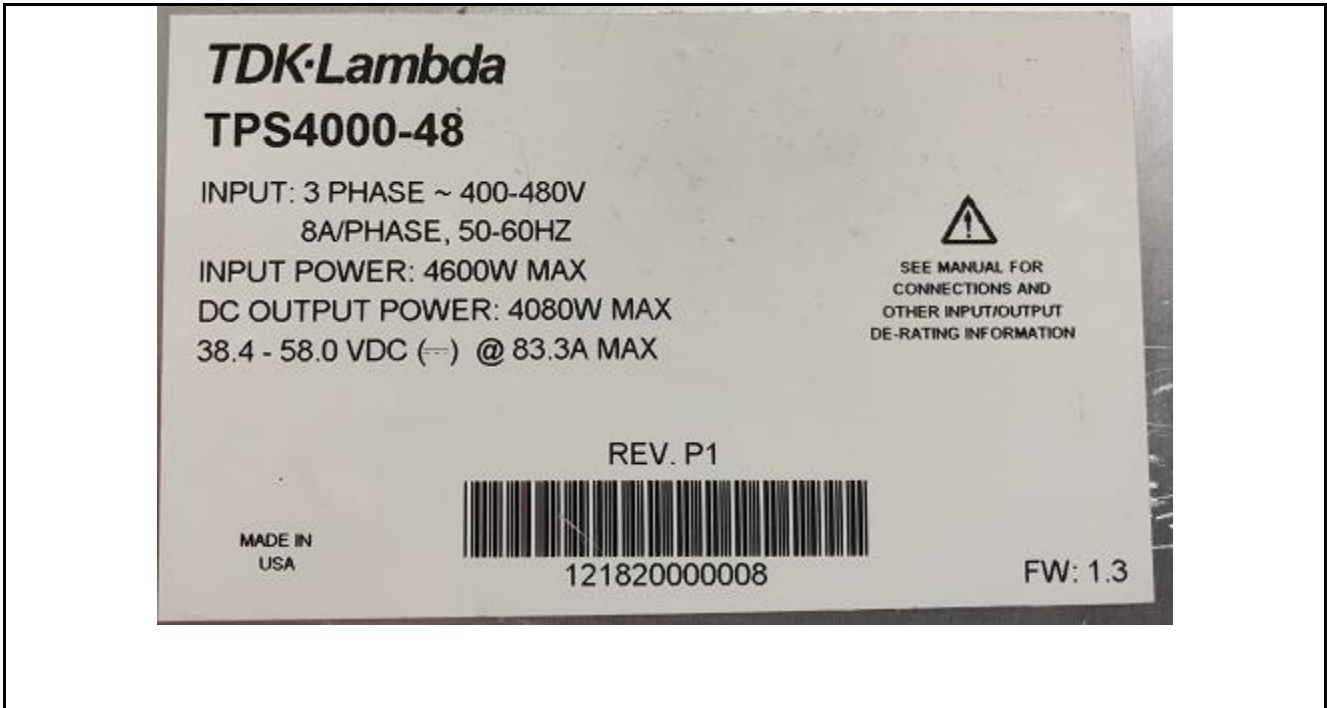


MADE IN
 XXXXXXXX

XXXXXXXXXXXXX

FW: 1.3





TEST ITEM PARTICULARS:	
Classification of use by	<input checked="" type="checkbox"/> Ordinary person <input checked="" type="checkbox"/> Instructed person <input checked="" type="checkbox"/> Skilled person <input type="checkbox"/> Children likely to be present
Supply Connection.....	<input checked="" type="checkbox"/> AC Mains <input type="checkbox"/> DC Mains <input type="checkbox"/> External Circuit - not Mains connected - <input type="checkbox"/> ES1 <input type="checkbox"/> ES2 <input checked="" type="checkbox"/> ES3
Supply % Tolerance	<input checked="" type="checkbox"/> +10%/-10% <input type="checkbox"/> +20%/-15% <input type="checkbox"/> +____%/ -____% <input type="checkbox"/> None
Supply Connection – Type	<input type="checkbox"/> pluggable equipment type A - <input type="checkbox"/> non-detachable supply cord <input type="checkbox"/> appliance coupler <input type="checkbox"/> direct plug-in <input type="checkbox"/> mating connector <input type="checkbox"/> pluggable equipment type B - <input type="checkbox"/> non-detachable supply cord <input type="checkbox"/> appliance coupler <input checked="" type="checkbox"/> permanent connection <input type="checkbox"/> mating connector <input type="checkbox"/> 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: <input checked="" type="checkbox"/> building; <input type="checkbox"/> equipment
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 <input type="checkbox"/> rack-mounting <input type="checkbox"/> wall-mounted
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: _____
Class of equipment	<input checked="" type="checkbox"/> Class I <input type="checkbox"/> Class II <input type="checkbox"/> Class III
Access location	<input type="checkbox"/> restricted access location <input checked="" type="checkbox"/> N/A Operator Accessible.
Pollution degree (PD)	<input type="checkbox"/> PD 1 <input checked="" type="checkbox"/> PD 2 <input type="checkbox"/> PD 3
Manufacturer's specified maximum operating ambient:	50°C at full load, 60°C at 80% load, 70°C at 60% load
IP protection class	<input checked="" type="checkbox"/> IPX0 <input type="checkbox"/> IP____
Power Systems	<input checked="" type="checkbox"/> TN <input type="checkbox"/> TT <input type="checkbox"/> IT - ____ V _{L-L}
Altitude during operation (m)	<input type="checkbox"/> 2000 m or less <input checked="" type="checkbox"/> 4000 m
Altitude of test laboratory (m)	<input type="checkbox"/> 2000 m or less <input checked="" type="checkbox"/> 50 m
Mass of equipment (kg)	<input checked="" type="checkbox"/> 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:	
<p>"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report.</p> <p>Throughout this report a <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.</p>	
Manufacturer's Declaration per sub-clause 4.2.5 of IEC62368-1:	
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..... :	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> 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

