



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 | 31981014.300 |
| Date of issue | 04/27/2020 |
| Total number of pages | 88 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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| 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. | |

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| Test Item description | Power supply | |
| Trade Mark | TDK-Lambda | |
| Manufacturer..... | Same as applicant | |
| Model/Type reference | TPF45000-385-xxx (x = A-Z, 0-9 or blank; denoting number of modules, minor cosmetic changes or for marketing purposes, no affecting product safety) | |
| Ratings | Input: 3 Phase ~ 400 – 480 V, 80A / Phase, 50-60 Hz, 46400 Watts max. Output: 45000W max., 385VDC, 117A (See Output Ratings Table) | |
| 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)..... | | |
| Testing procedure: TMP/CTF Stage 1 | | |
| Testing location/ address | | |
| Tested by (name + signature) | | |
| Approved by (name + signature)..... | | |
| <input checked="" type="checkbox"/> | Testing procedure: WMT/CTF Stage 2 | TDK-Lambda Americas, Inc |
| Testing location/ address | | 401 Mile of Cars Way, Suite 325 National City, CA 91950 |
| Tested by (name + signature) | | Anthony Villasenor <i>A Villasenor</i> |
| Witnessed by (name + signature) | | Dan Aquino |
| Approved by (name + signature)..... | | James Howell |
| Testing procedure: SMT/CTF Stage 3 or 4 | | |
| Testing location/ address | | |
| Tested by (name + signature) | | |
| Approved by (name + signature)..... | | |
| Supervised by (name + signature) | | |

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| <p>List of Attachments (including a total number of pages in each attachment):</p> <p>Attachment 1: National Differences (33 pages) Attachment 2: Photos (6 pages) Attachment 3: Mechanical Drawings (6 pages) Attachment 4: Schematics (14 pages) Attachment 5: PCB Layouts (6 pages) Attachment 6: Product Documentation (2 pages) Attachment 7: User Manual (16 pages) Attachment 8: Transformer/Inductor Construction Sheet (6 pages) Attachment 9: 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 31981014.001 and 31981014.003 which is in accordance with IEC 60950-1 for the model TPF45000-385-xxx.</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>31981014.300</u> Electrical Strength Test (5.4.9) Safeguards Against Capacitor Discharge after Disconnection of a Capacitor (5.5.2.2) Protective Conductor Current (5.7.5)</p> <p><u>31981014.003</u> Safeguards Against Capacitor Discharge after Disconnection of a Capacitor (5.5.2.2) Humidity Conditioning (5.4.8) Maximum operating temperatures for materials, components and systems (5.4.1.4, 6.3.2, 9.0, B.2.6) Ball Pressure Test (5.4.1.10.3) Touch Current Test (5.7.2) Electrical Strength Test (5.4.9) Simulated Abnormal operating condition tests (B.3) Simulated single fault conditions (B.4)</p> <p><u>31981014.001</u> Maximum Output Voltage, Current, and Volt-Ampere Measurement Test (1.2.2.1) Input Test (B.2.5) Safeguards Against Capacitor Discharge after</p> | <p>Testing location:</p> <p><u>31981014.003</u> TDK-Lambda Americas, Inc. 401 Mile of Cars Way, Suite 325 National City, CA 91950</p> <p><u>31981014.003</u> TDK-Lambda Americas, Inc. 401 Mile of Cars Way, Suite 325 National City, CA 91950</p> <p><u>31981014.001</u> TDK-Lambda Americas, Inc. 401 Mile of Cars Way, Suite 325 National City, CA 91950</p> |

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| <p>Disconnection of a Capacitor (5.5.2.2)</p> <p>Resistance of the protective bonding system (5.6.6)</p> <p>Humidity Conditioning (5.4.8)</p> <p>Determination of working voltage (5.4.1.8)</p> <p>Maximum operating temperatures for materials, components and systems (5.4.1.4, 6.3.2, 9.0, B.2.6)</p> <p>Ball Pressure Test (5.4.1.10.3)</p> <p>Touch Current Test (5.7.2)</p> <p>Electrical Strength Test (5.4.9)</p> <p>Simulated single fault conditions (B.4)</p> <p>Simulated Abnormal operating condition tests (B.3)</p> <p>Transformer Abnormal Operation (G.5)</p> <p>Power Supply Output Short-Circuit / Overload Test (5.3.7)</p> | |
| <p>Summary of compliance with National Differences:</p> <p>List of countries addressed</p> <p>EU Group Differences, EU Special National Conditions, CA, DK, US, AU, NZ, IT, JP</p> <p>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> | |

| 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 checked="" type="checkbox"/> pluggable equipment type B - <input type="checkbox"/> non-detachable supply cord <input type="checkbox"/> appliance coupler <input type="checkbox"/> permanent connection <input checked="" 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 checked="" type="checkbox"/> stationary <input 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: | 60°C at max. 45,000W or 70°C at max. 31,500W |
| 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"/> 20 m |
| Mass of equipment (kg) | <input checked="" type="checkbox"/> 25 kg |
| 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..... | 3/12/2020 (31981014.300) 8/12/2019 (31981014.003) 05/20/2018, 08/08/2018, 10/24/2018 (31981014.001) |
| Date (s) of performance of tests | 3/12/2020 (31981014.300) 8/12/2019 (31981014.003) 06/19/2018 - 11/14/2018 (31981014.001) |
| 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:**Product Description:**

The TPF non-isolated series is a 45kW 3Phase input 385VDC industrial power supply for distributed architecture for the semiconductor test market.

Unit is Class I, evaluated for use in Installation Category II and Pollution Degree 2 environments. The units have Hazardous Energy Level output and intended application is to be determined in end installation access location. Units consist of a steel box-type frame enclosure and steel cover.

Input range = 400/440/480VAC, 50/60Hz (nominal) 3 phase delta or wye

-40°C (start up) to +70°C operation

10 PSs in 2U 19" rack (not hot swap)

98% efficiency

OVP (Over Voltage Protection), OCP (Over Current Protection), OTP (Over Temperature Protection)

I2C option (PMBus communication protocol compatible)

ORing FET for redundancy

Output Ratings Table:

| Output Ratings (DC) | | | |
|---------------------|-----------------|---------------|------------------|
| Voltage (V) | Current (A) Max | Power (W) Max | Ambient (°C) Max |
| 385 | 117 | 45,000 | 60 |
| 385 | 82 | 31,500 | 70 |

History of CB report:

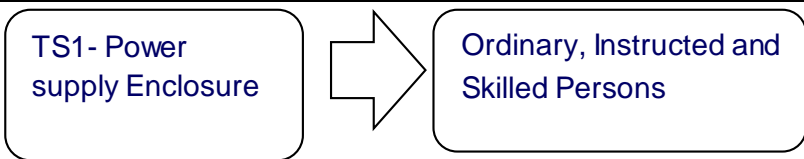
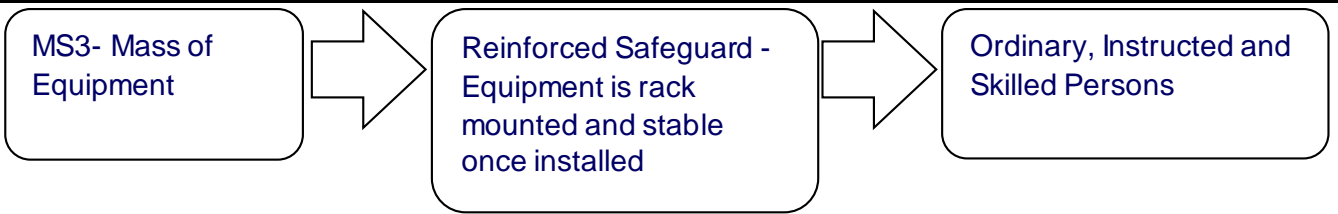
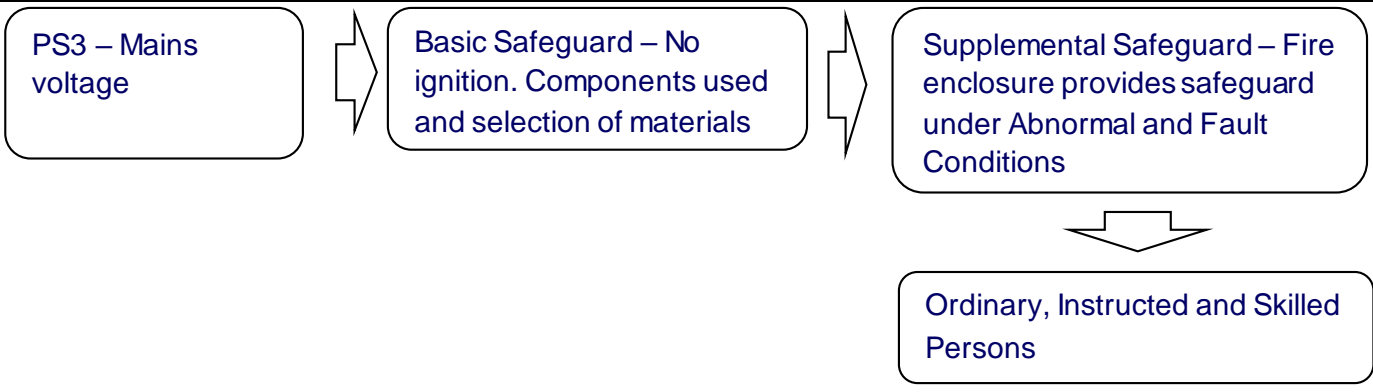
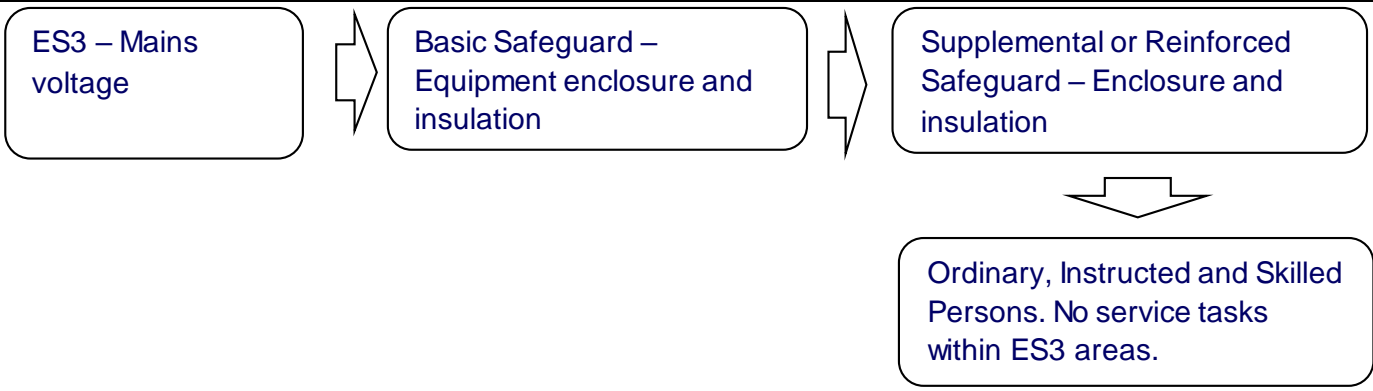
31981014.300 - Original IEC/EN 62368-1 CB report

| 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



| OVERVIEW OF EMPLOYED SAFEGUARDS | | | | |
|--|---|--|------------------------|---------------------------|
| Clause | Possible Hazard | | | |
| 5.1 | Electrically-caused injury | | | |
| Body Part (e.g. Ordinary) | Energy Source (ES3: Primary Filter circuit) | Safeguards | | |
| | | Basic | Supplementary | Reinforced (Enclosure) |
| Ordinary | ES3: primary circuit | Enclosure | Earth | Insulation/ Enclosure |
| Ordinary | ES3: power supply output | Enclosure | Earth | Insulation/ Enclosure |
| 6.1 | Electrically-caused fire | | | |
| Material part (e.g. mouse enclosure) | Energy Source (PS2: 100 Watt circuit) | Safeguards | | |
| | | Basic | Supplementary | Reinforced |
| Input | PS3: Mains circuits | Components and selection of materials | Equipment Enclosure | Insulation/ Enclosure |
| Output | PS3: Output | Components and selection of materials | Equipment Enclosure | Insulation/ Enclosure |
| 7.1 | Injury caused by hazardous substances | | | |
| Body Part (e.g., skilled) | Energy Source (hazardous material) | Safeguards | | |
| | | Basic | Supplementary | Reinforced |
| No hazardous substances present in the product. | - | - | - | - |
| 8.1 | Mechanically-caused injury | | | |
| Body Part (e.g. Ordinary) | Energy Source (MS3:High Pressure Lamp) | Safeguards | | |
| | | Basic | Supplementary | Reinforced (Enclosure) |
| Ordinary | MS3: Mass of Equipment | Enclosure | - | - |
| Ordinary | MS1: Sharp Edges | Enclosure | - | - |
| 9.1 | Thermal Burn | | | |
| Body Part (e.g., Ordinary) | Energy Source (TS2) | Safeguards | | |
| | | Basic | Supplementary | Reinforced |
| Ordinary | TS1: Accessible surfaces | Enclosure | - | - |
| | | | | |
| 10.1 | Radiation | | | |
| Body Part (e.g., Ordinary) | Energy Source (Output from audio port) | Safeguards | | |
| | | Basic | Supplementary | Reinforced |
| No ionizing radiation produced in the product. | - | - | - | - |
| Supplementary Information: (1) See attached energy source diagram for additional details. (2) "N" – Normal Condition; "A" – Abnormal Condition; "S" Single Fault | | | | |