



Test Report issued under
the responsibility of:



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

Report Reference No : E135494-A113-CB-1
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CB Testing Laboratory : UL International Polska Sp. z o.o.
Address : Aleja Krakowska 81, 05-090 Sekocin Nowy, Poland

Applicant's name : TDK-LAMBDA UK LTD
KINGSLEY AVE
Address : ILFRACOMBE
EX34 8ES UNITED KINGDOM

Test specification:

Standard : IEC 60950-1:2005 (Second Edition); Am1:2009 + Am2:2013
Test procedure : CB Scheme
Non-standard test method : N/A

Test Report Form No. : IEC60950_1F
Test Report Form originator : SGS Fimko Ltd
Master TRF : Dated 2014-02

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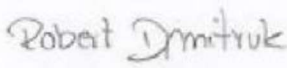
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| | |
|------------------------------------|--|
| Test item description | AC-DC Power Supply |
| Trade Mark | TDK-Lambda  |
| Manufacturer | TDK-LAMBDA UK LTD KINGSLEY AVE ILFRACOMBE EX34 8ES UNITED KINGDOM |
| Model/Type reference | CUS100ME CUS150M (see model differences for details of nomenclature) |
| Ratings | Input AC rated models: 100-240Vac; 47-63Hz or 47-440Hz; 2.2Arms max. Input DC rated models (CUS150M only): 133 - 318Vdc; 1.8A max. Output: 12, 15, 18, 24, 28, 36 or 48Vdc nominal, max. 100 or 150W (see model differences for full details) |

| | |
|---|--|
| Testing procedure and testing location: | |
| <input checked="" type="checkbox"/> CB Testing Laboratory | Testing location / address: UL International Polska Sp. z o.o. Aleja Krakowska 81, 05-090 Sekocin Nowy, Poland |
| <input type="checkbox"/> Associated CB Test Laboratory | Testing location / address: |
| | Tested by (name + signature): Hubert Koszewski (Project Handler)  |
| | Approved by (name + signature).....: Robert Dmitruk (Reviewer)  |
| <input type="checkbox"/> Testing Procedure: TMP/CTF Stage 1 | Testing location / address: |
| | Tested by (name + signature): _____ |
| | Approved by (name + signature).....: _____ |
| <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) .: _____ |
| <input type="checkbox"/> Testing Procedure: RMT | Testing location / address: |
| | Tested by (name + signature): _____ |
| | Approved by (name + signature).....: _____ |
| | Supervised by (name + signature) .: _____ |

| | |
|---|------------------------------------|
| List of Attachments | |
| National Differences (2 pages) | |
| Enclosures (104 pages) | |
| Summary Of Testing | |
| Unless otherwise indicated, all tests were conducted at UL International Polska Sp. z o.o. Aleja Krakowska 81, 05-090 Sekocin Nowy, Poland. | |
| Tests performed (name of test and test clause) | Testing location / Comments |
| General Guidelines | |

Power Supply Reference Page

Input: Single-Phase (1.6.2)

SELV Reliability Test Including Hazardous Voltage
Measurements (2.2.2, 2.2.3, 2.2.4, Part 22 6.1)

Determination of Working Voltage; Working Voltage
Measurement (2.10.2)

Heating (4.5.1, 1.4.12, 1.4.13)

Touch Current (Polyphase; TN/TT System) (5.1, Annex D)

Electric Strength (5.2.2)

Component Failure (5.3.1, 5.3.4, 5.3.7)

Transformer Abnormal Operation (5.3.3, 5.3.7b, Annex
C.1)

Power Supply Output Short-Circuit/Overload (5.3.7)

Summary of Compliance with National Differences:

Countries outside the CB Scheme membership may also accept this report.

List of countries addressed: AR, AT, AU, BE, BG, BY, CA, CH, CN, CS, CZ, DE, DK, ES, EU, FI, FR, GB,
GR, HU, IE, IL, IN, IT, JP, KR, MY, NL, NO, NZ, PL, PT, RO, SA, SE, SG, SI, SK, UA, US, ZA

The product fulfills the requirements of: EN 60950-1:2006 + A1:2010 + A11:2009 + A12:2011 + A2:2013

Copy of Marking Plate - Refer to Enclosure titled Marking Plate for copy.

| | |
|---|--|
| Test item particulars : | |
| Equipment mobility | for building-in |
| Connection to the mains | not directly connected to the mains |
| Operating condition | continuous |
| Access location | for building-in |
| Over voltage category (OVC) | OVC II |
| Mains supply tolerance (%) or absolute mains supply values | +10%, -10% |
| Tested for IT power systems | Yes |
| IT testing, phase-phase voltage (V) | 230Vac (Norway) |
| Class of equipment | to be determined in the end-product (may be used in Class I or Class II application) |
| Considered current rating of protective device as part of the building installation (A) | 20 A |
| Pollution degree (PD) | PD 2 |
| IP protection class | IP X0 |
| Altitude of operation (m) | up to 5000 meters |
| Altitude of test laboratory (m) | less than 2000 meters |
| Mass of equipment (kg) | 0.2 |
| 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(s) of receipt of test item | 2018-01-03, 2018-01-12, 2018-01-15, 2018-02-12 |
| Date(s) of Performance of tests | 2018-02-19 to 2018-03-07 |
| 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 point is used as the decimal separator.</p> | |
| Manufacturer's Declaration per Sub Clause 4.2.5 of IEC 60950-1: | |
| Yes | |
| <p>The application for obtaining a CB Test Certificate includes more than one factory 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</p> <p>When differences exist, they shall be identified in the General Product Information section.</p> | |
| Name and address of Factory(ies): | TDK-LAMBDA UK LTD KINGSLEY AVE ILFRACOMBE EX34 8ES UNITED KINGDOM |

PANYU TRIO MICROTRONIC CO LTD
SHIJI INDUSTRIAL ESTATE
DONGYONG
NANSHA
GUANGZHOU
GUANGDONG CHINA

GENERAL PRODUCT INFORMATION:

Report Summary

The original report was modified on 2018-03-16 to include the following changes/additions:

The original test report was modified due to the following changes:
technical amendment

- Added CUS100ME models.
 - Added CUS150M with the following output voltages: 15, 18, 28 and 36Vdc.
 - Added DC input rating option for CUS150M models.
 - Critical component list updated to include the new models.
- Based on the new test results and the results from the previous investigation limited testing was necessary.

Product Description

The product is a power supply for building in to end equipment. It is available as open frame, U chassis, U chassis and lid, Base plate and with a top fan version (CUS150M model only).

The power supply can be used as either a Class I or a Class II construction.

- For Class I construction, the power supply will need to be reliably earthed, professionally installed and fixed with suitable, metal screws.
- For Class II construction no earthing connection is required. The power supply needs to be fixed so that it is insulated from any unearthed accessible conductive part by reinforced insulation.

The power supply provides two fuses for input protection. One in the Live line and one in the Neutral line. Option E uses one fuse only. This is fitted in the live line only.

The power supply can be forced air (top fan or customer air), convection or conduction cooled. Due to the fact that air flow for cooling depends on end product use, only convection cooling and top fan configurations were considered during temperature measurement.

The component temperatures listed in the additional information shall not be exceeded.

Model Differences

The CUS has two ranges of 100W and 150W each with seven nominal output voltages of 12, 15, 18, 24, 28, 36 and 48 Vdc. Each output has a range shown in the table below which is factory configurable only.

CUS models as described below:

Units may be marked with a Product Code: CUSZ-xxVx/yyyy where Z is 100ME or 150M and x may be any number of numbers or left blank to indicate the output voltage. V represents a decimal place when required or can left be left blank. y can be any number of numbers or letters (excluding M, E, U, A, F, B, H) when indicating non-safety related model differences. y can be M, E, U, A, F, B, H when indicating the standard options as listed below.

Unit Product Code may be prefixed by K, SP # and/or NS # followed by / or - (where # may be any number of characters indicating non-safety related model differences).

Unit Product Code:

CUSZ-xxVx/yyyy

Where

Z = 150M for 150W model (May be followed by 'D' for DC input)
100ME for 100W model

xxVx = Channel 1 output voltage from within the output voltage adjustment range from the Output Parameters Table below.

yyyy = Unit options from list of standard unit options below, or non-safety related model differences

/M = Molex connectors

/E = Single fuse in the live line

/U = U chassis

/A = Cover and U chassis

/F = Top fan, cover and U chassis (CUS150M model only)

/B = Baseplate

/H = alternate link wire and discharge resistors (60335-1 compliant, 60950-1 approved

only)

Non standards

KCUS150MKCUSZ-xx-yyyy/H

Where:

Where

Z = 150M for 150W model (May be followed by 'D' for DC input)
100ME for 100W model

xxVx = Channel 1 output voltage from within the output voltage adjustment range from the Output Parameters Table below.

yyyy = Unit options from list of standard unit options below, or non-safety related model differences

/M = Molex connectors

/E = Single fuse in the live line

/U = U chassis

/A = Cover and U chassis

/F = Top fan, cover and U chassis (CUS150M model only)

/B = Baseplate

Followed by

/H = alternate link wire and discharge resistors (60335-1 compliant, 60950-1 approved only)
CUS150M model and 60950-1 only)

Input Parameters

| Standard | 60601-1 | 60950-1/61010-1 | 60950-1/61010-1/60601-1* |
|-----------------------|--------------|-----------------|--------------------------|
| Nominal input voltage | 100 - 240Vac | 100 - 240Vac | 133 - 318Vdc |
| Input voltage range | 85 - 264Vac | 85 - 264Vac | 120 - 350Vdc |

| | | | |
|-----------------------|-----------|------------|------|
| Input frequency range | 47 - 63Hz | 47 - 440Hz | DC |
| Maximum input current | 2.2A rms | 2.2A rms | 1.8A |

* 60601-1 2nd ed, 300Vdc input max.

All ratings apply for ambient temperatures up to 50°C. (see Variations and Limitations below)
 Output power is reduced linearly by 10% for input voltages from 90 to 85Vac

Output Parameters

There are seven CUS150M and CUS100ME standard models as shown in the tables below. All of these models may be fan(CUS150M model only), forced air, conduction or convection cooled. The output parameters are shown in the tables below.
 Outputs are not user adjustable but can be factory set.

CUS150M

| Model | Vout Range (V) | *Fan Vnom (V) | Max | | *Fan Output ratings | |
|-------|----------------|---------------|----------|----------|---------------------|----------|
| | | | lout (A) | Pout (W) | Inom (A) | Pnom (W) |
| 12 | 12-13.2 | 11.6 | 12.5 | 150 | 0.5 | 5.8 |
| 15 | 15-16.5 | 9.8 | 10 | 150 | 0.5 | 4.9 |
| 18 | 18-19.8 | 11.6 | 8.33 | 150 | 0.5 | 5.8 |
| 24 | 24-26.4 | 11.6 | 6.25 | 150 | 0.5 | 5.8 |
| 28 | 28-30.8 | 10.8 | 5.4 | 150 | 0.5 | 5.4 |
| 36 | 36-39.6 | 11.6 | 4.2 | 150 | 0.5 | 5.8 |
| 48 | 48-50 | 11.6 | 3.125 | 150 | 0.5 | 5.8 |

* Fan output tracks Vout Range

Variation and Limitations:

Customer Forced Air Cooling max ambient 85°C (note 1)
 Convection and conduction/cold plate Cooling (U chassis with lid-Option A) max ambient 75°C (note 1)
 Convection and conduction/cold plate Cooling (U chassis and open frame) max ambient 80°C (note 1)
 Fan supplied ratings/Option F max ambient 70°C, from 50°C to 70°C the output power is de-rated by 0.5°C per watt
 Note 1. Maximum output power and current ratings are dependent on the ambient used in the end equipment.

CUS100M

| Model | Vout Range (V) | Max | |
|-------|----------------|----------|----------|
| | | lout (A) | Pout (W) |
| 12 | 12-13.2 | 8.33 | 100 |
| 15 | 15-16.5 | 6.66 | 100 |
| 18 | 18-19.8 | 5.55 | 100 |
| 24 | 24-26.4 | 4.16 | 100 |
| 28 | 28-30.8 | 3.57 | 100 |
| 36 | 36-39.6 | 2.77 | 100 |
| 48 | 48-50 | 2.08 | 100 |

Variation and Limitations:

Customer Forced Air Cooling max ambient 85°C (note 1)
 Convection and conduction/cold plate Cooling (U chassis with lid-Option A) max ambient 75°C (note 1)
 Convection and conduction/cold plate Cooling (U chassis and open frame) max ambient 80°C (note 1)

Note 1. Maximum output power and current ratings are dependent on the ambient used in the end equipment.

Additional Information

Cooling for units with forced air cooling.

The product can also operate at input voltage lowered to 85Vac with linear output de-rating to -10%.

The following method must be used for determining the safe operation of PSUs.

The components listed in the following table must not exceed the temperatures given. To determine the component temperatures the heating tests must be conducted in accordance with the requirements of the standard in question. Consideration should also be given to the requirements of other safety standards. Test requirements include: PSU to be fitted in its end-use equipment and operated under the most adverse conditions permitted in the end-use equipment handbook/specification and which will result in the highest temperatures in the PSU. To determine the most adverse conditions consideration should be given to the end use equipment maximum operating ambient, the PSU loading and input voltage, ventilation, end use equipment orientation, the position of doors & covers, etc. Temperatures should be monitored using type K fine wire thermocouples (secured with cyanoacrylate adhesive or similar) placed on the hottest part of the component (out of any direct airflow) and the equipment should be run until all temperatures have stabilized.

Cooling for unit temperature table:

CUS150M Cooling for Unit Temperature Table:

| Circuit Ref. | Description | Max. Temperature (°C) |
|----------------------|-------------------------|-----------------------|
| L1 | Common Mode Choke | 110 (130) |
| L2 | PFC choke | 125 (130) |
| L3 | Differential mode choke | 125 (130) |
| C1 | Film capacitor | 105 |
| C2, C110 | Electrolytic Capacitors | 86 (105) |
| C6, C102, C104, C105 | Electrolytic Capacitors | 92 (105) |
| C3 | X Capacitor | 100 |
| C5, C100, C101, C103 | Y Capacitors | 105 |
| TX100 | Transformer Winding | 110 |
| XU101, XU102 | Opto-Coupler | 100 (110) |
| XD8 | Diode | 130 |
| J1 | Input Connector | 105 |
| J100 | Output Connector | 105 |

CUS100ME Cooling for Unit Temperature Table:

| Circuit Ref. | Description | Max. Temperature (°C) |
|--------------|-------------------------|-----------------------|
| L1 | Common Mode Choke | 110 (130) |
| L2 | PFC choke | 125 (130) |
| L3 | Differential mode choke | 125 (130) |
| C1 | Film capacitor | 105 |
| C2 | Electrolytic Capacitors | 90 (105) |
| C104, C105 | Electrolytic Capacitors | 92 (105) |
| C6, C102 | Electrolytic Capacitors | 93 (105) |
| C3 | X Capacitor | 100 |

| | | |
|-----------------------|---------------------|-----------|
| C5, C100, C101, C103, | Y Capacitors | 105 |
| TX100 | Transformer Winding | 110 |
| XU101, XU102 | Opto-Coupler | 100 (110) |
| XD8 | Diode | 130 |
| J1 | Input Connector | 105 |
| J100 | Output Connector | 105 |

Higher temperature limits (in brackets) may be used but product life may be reduced.

Amendment 1

The original test report was modified due to the following changes:

- touch current test repeated per the client's request, new measurements replaced the previous test results.

No construction changes in the product.

Based on the new test results and the results from the previous investigation the product continues to comply with the requirements of the Standard.

Correction 1

The original test report E135494-A113 was modified due to minor typographical corrections.

No testing deemed to be necessary.

Amendment 2

The original test report was modified due to the following changes:

- Added CUS100ME models
- Added CUS150M with the following output voltages: 15, 18, 28 and 36Vdc
- Added DC input rating option for CUS150M models
- Critical component list updated to include the new models

Based on the new test results and the results from the previous investigation limited testing was necessary.

Technical Considerations

- The product was submitted and evaluated for use at the maximum ambient temperature (T_{ma}) permitted by the manufacturer's specification of: 50°C
- The means of connection to the mains supply is: to be determined in the end-product
- The product is intended for use on the following power systems: DC mains supply (CUS150M DC-rated only), IT (Norway), TT, TN
- The equipment disconnect device is considered to be: determined in the end-product
- The product was investigated to the following additional standards: EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011 + A2:2013 (which includes all European national differences, including those specified in this test report).
- The following accessible locations (with circuit/schematic designation) are within a limited current circuit: Load side of the C101-C103 capacitors
- The following are available from the Applicant upon request: Installation (Safety) Instructions / Manual
- Above 50°C the total output power and current ratings are both de-rated to ensure power curves are met. Refer to Handbook in Enclosures 6-01 and 6-02 for the power curves. --
- For Class I construction, the power supply will need to be reliably earthed, professionally installed and fixed with suitable, metal screws. For Class II construction no earthing connection is required. The power supply needs to be fixed so that it is insulated from any unearthed accessible conductive part by reinforced insulation. --
- The component temperatures listed in the Additional Information shall not be exceeded. --

- The minimum CLEARANCE is multiplied by the factor 1.48 corresponding altitude of 5000m given in IEC 60664-1. --

Engineering Conditions of Acceptability

When installed in an end-product, consideration must be given to the following:

- The following Production-Line tests are conducted for this product: Earthing Continuity, Electric Strength
- The end-product Electric Strength Test is to be based upon a maximum working voltage of: Primary-SELV: 268 Vrms, 480 Vpk, Primary-Earthed Dead Metal: 350 Vrms, 410 Vpk
- The following secondary output circuits are SELV: PSU output
- The following secondary output circuits are at non-hazardous energy levels: PSU output
- The following secondary output circuits are Limited Current Circuits: Load side of the C101-C103 capacitors
- The following output terminals were referenced to earth during performance testing: Output negative
- The power supply terminals and/or connectors are: Not investigated for field wiring
- The maximum investigated branch circuit rating is: 20 A
- The investigated Pollution Degree is: 2
- The following magnetic devices (e.g. transformers or inductor) are provided with an OBJY2 insulation system with the indicated rating greater than Class A (105°C): TX100 (class B)
- The following end-product enclosures are required: Mechanical, Electrical, Fire
- Fans: The fan provided in this sub-assembly is not intended for operator access.
- The power supply can be forced air (top fan or customer air) or convection cooled. Due to the fact that air flow for cooling depends on end product use, only convection cooling and top fan configurations were considered during temperature measurement --

Abbreviations used in the report:

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

Indicate used abbreviations (if any)