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 .....:	E135494-A6083-CB-1
Date of issue .....:	2024-01-18
Total number of pages .....:	144
Name of Testing Laboratory preparing the Report .....:	UL VS Limited
Applicant's name.....:	**TDK-LAMBDA UK LTD**
Address .....:	**KINGSLEY AVE** **ILFRACOMBE** **DEVON** **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.

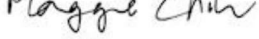
This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

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 .....:	AC-DC Power Supply
Trade Mark(s) .....:	TDK·Lambda
Manufacturer.....:	TDK-LAMBDA UK LTD KINGSLEY AVE ILFRACOMBE DEVON EX34 8ES UNITED KINGDOM
Model/Type reference .....:	EFE300M Series or EFE-300M Series may be prefixed by NS - # or SP followed by / or – where # may be any characters indicating non-safety related model differences or additionally be marked with U5x or Y5x where x can be any characters indicating non-safety related model differences. may be followed by xy-a-b-cdef-ghijk. See model differences for details of models and nomenclature.
Ratings .....:	100-240Vac nom, 4.9Arms max, 45-440Hz 133-318Vdc nom, 3.5Adc max (See model differences for details of ratings)

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
☒ **CB Testing Laboratory:**		
Testing location/ address .....:	UL VS Limited Unit 1-3 Horizon, Wade Road, Kingsland Business Park, Basingstoke RG24 8AH, United Kingdom	
Tested by (name, function, signature).....:	Maggie Chiu / Project Handler	Maggie Chiu
Approved by (name, function, signature) ..:	David Snook / 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 ..... :		TDK-LAMBDA UK LTD KINGSLEY AVE ILFRACOMBE DEVON EX34 8ES UNITED KINGDOM	
Tested by (name, function, signature)..... :		M. Gisbey / Tester	
Witnessed by (name, function, signature) . :		Jan J. Jensen / Witness Engineer	See GPI for detail
Approved by (name, function, signature) .. :		David Snook / Reviewer	
Supervised by (name, function, signature) :		Maggie Chiu / Project Handler	

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

National Differences (49 pages)
Enclosures (202 pages)

Summary of testing:

Tests performed (name of test and test clause):	**Testing Location:** **CTF Stage 3: TDK-LAMBDA UK LTD** **KINGSLEY AVE** **ILFRACOMBE** **DEVON** **EX34 8ES UNITED KINGDOM**
5.2.2.1-5.2.2.6 – CLASSIFICATION OF ELECTRICAL ENERGY SOURCES	Test data accepted based on CBTC#DK-90514-M2-UL, CBTR# No E135494-A6010-CB-1 with Amendment 1-3 according to IEC62368-1:2014 (2nd edition)
5.4.1.8 – DETERMINATION OF WORKING VOLTAGE	Test conducted under current evaluation to evaluate the product according to IEC62368-1:2018 (3rd edition).
5.4.9.1 – ELECTRIC STRENGTH TEST – TYPE TESTING OF SOLID INSULATION	Some of the test data accepted based on CBTC#DK-90514-M2-UL, CBTR# No E135494-A6010-CB-1 with Amendment 1-3 according to IEC62368-1:2014 (2nd edition). Additional testing conducted under current evaluation to evaluate the product according to IEC62368-1:2018 (3rd edition).
5.5.2.2 – CAPACITOR DISCHARGE AFTER DISCONNECTION OF A CONNECTOR	Test data accepted based on CBTC#DK-90514-M2-UL, CBTR# No E135494-A6010-CB-1 with Amendment 1-3 according to IEC62368-1:2014 (2nd edition)
5.6.6.2 – RESISTANCE OF THE PROTECTIVE BONDING SYSTEM	Test data accepted based on CBTC#DK-90514-M2-UL, CBTR# No E135494-A6010-CB-1 with Amendment 1-3 according to IEC62368-1:2014 (2nd edition)
5.7.5 – TOUCH CURRENT MEASUREMENT – EARTHED ACCESSIBLE CONDUCTIVE PARTS – SINGLE-PHASE EQUIPMENT ON TN OR TT SYSTEM	Test data accepted based on CBTC#DK-90514-M2-UL, CBTR# No E135494-A6010-CB-1 with Amendment 1-3 according to IEC62368-1:2014 (2nd edition)
B.2.5 – INPUT TEST: SINGLE PHASE	Test data accepted based on CBTC#DK-90514-M2-UL, CBTR# No E135494-A6010-CB-1 with Amendment 1-3 according to IEC62368-1:2014 (2nd edition)
B.2.6, 5.4.1.4, 6.3, 9.3, B.1.5 – NORMAL OPERATING CONDITIONS TEMPERATURE MEASUREMENT	Test data accepted based on CBTC#DK-90514-M2-UL, CBTR# No E135494-A6010-CB-1 with Amendment 1-3 according to IEC62368-1:2014 (2nd edition)
B.3 – SIMULATED ABNORMAL OPERATING CONDITIONS	Test data accepted based on CBTC#DK-90514-M2-UL, CBTR# No E135494-A6010-CB-1 with Amendment 1-3 according to IEC62368-1:2014 (2nd edition)
B.4 – SIMULATED SINGLE FAULT CONDITIONS	Test data accepted based on CBTC#DK-90514-M2-UL, CBTR# No E135494-A6010-CB-1 with Amendment 1-3 according to IEC62368-1:2014 (2nd edition)
G.5.3.3 – TRANSFORMER OVERLOAD	Test data accepted based on CBTC#DK-90514-M2-UL, CBTR# No E135494-A6010-CB-1 with Amendment 1-3 according to IEC62368-1:2014 (2nd edition)

G.5.4.6.3 – ALTERNATIVE LOCKED-ROTOR OVERLOAD TEST FOR DC MOTORS	Test data accepted based on CBTC#DK-90514-M2-UL, CBTR# No E135494-A6010-CB-1 with Amendment 1-3 according to IEC62368-1:2014 (2nd edition)
R.1-R.4 - LIMITED SHORT CIRCUIT TEST	Test data accepted based on CBTC#DK-90514-M2-UL, CBTR# No E135494-A6010-CB-1 with Amendment 1-3 according to IEC62368-1:2014 (2nd edition)
T.2, 5.4.2.6, 5.4.3.2, G.15.2.6 – STEADY FORCE TEST, 10 N	Test data accepted based on CBTC#DK-90514-M2-UL, CBTR# No E135494-A6010-CB-1 with Amendment 1-3 according to IEC62368-1:2014 (2nd edition)

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

Australia - AU, New Zealand - NZ, China - CN, EU Group Differences, Japan - JP, Saudi Arabia - SA, Singapore - SG, United States of America - US, Canada - CA

United Kingdom (per customer request shown separately)

☒ **The product fulfils the requirements of** EN IEC 62368-1:2020+A11:2020, J62368-1(2023), CSA/UL 62368-1:2019, BS EN IEC 62368-1:2020+A11:2020, AS/NZS 62368.1:2022, , GB 4943.1-2022, National standard SASO-IEC 62368-1:2020

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)

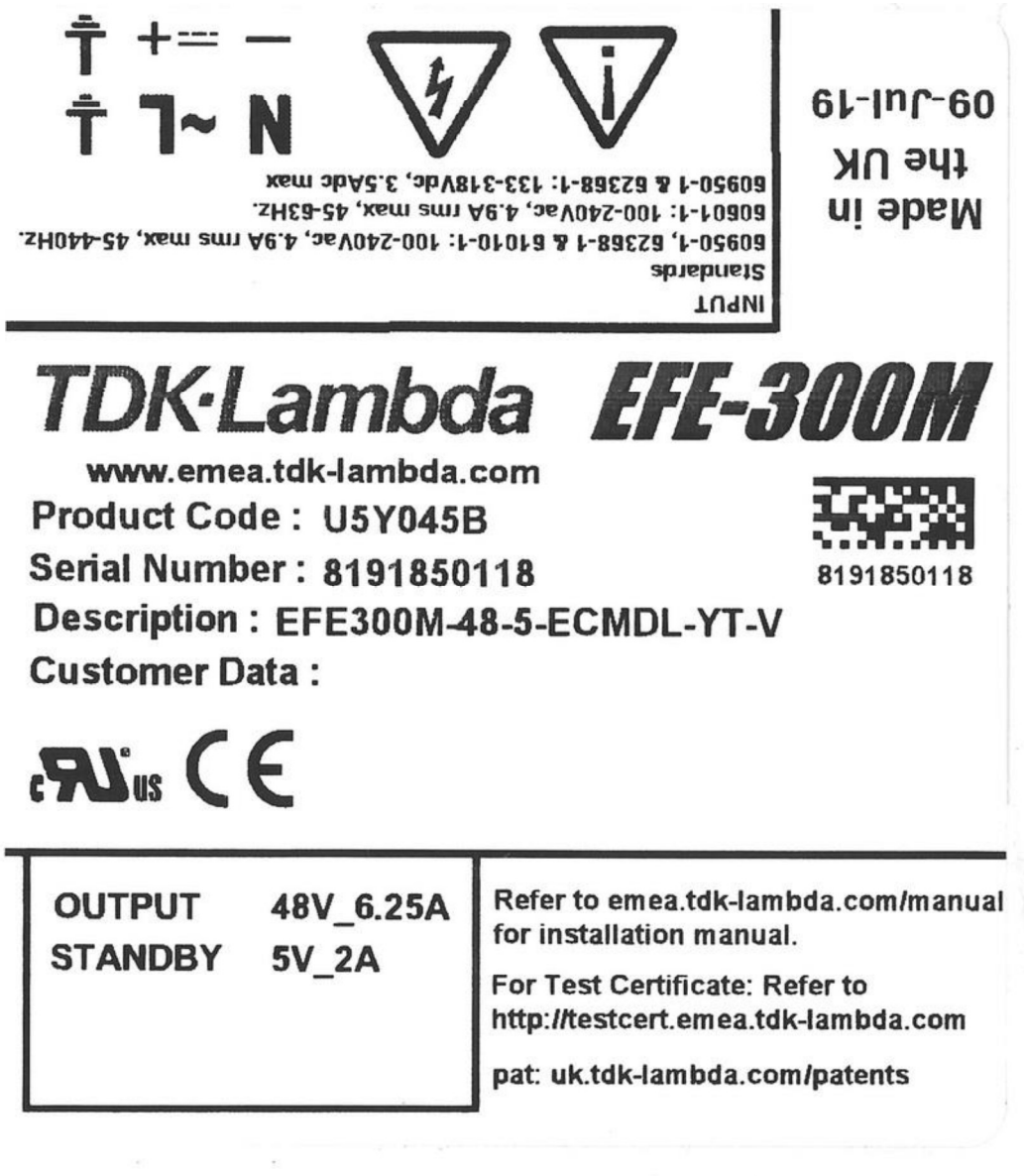
Information on uncertainty of measurement:

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.



Note: The above markings are the minimum requirements required by the safety lab. For the final production samples, the additional markings which do not give rise to misunderstanding may be added.

Test item particulars:	
Product group	built-in component
Classification of use by	Skilled person
Supply Connection	AC Mains DC Mains
Supply tolerance	+10%/-10%
Supply connection – type	mating connector
Considered current rating of protective device	20 A; Location: building
Equipment mobility	for building-in
Over voltage category (OVC)	OVC II
Class of equipment	Class I
Special installation location	N/A
Pollution degree (PD)	PD 2
Manufacturer's specified Tma (°C)	50°C (Full Load); 70°C (Output power decreased linearly by 2.5%/°C above 50°C)
IP protection class	IPX0
Power systems	TN
Altitude during operation (m)	5000 m
Altitude of test laboratory (m)	2000 m or less
Mass of equipment (kg)	0.5
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 .....:	2022-08-08, 2022-09-05, 2022-11-18, 2022-12-04, 2023-05-04, 2023-07-26
Date (s) of performance of tests .....:	2022-08-08 to 2023-07-27, 2023-08-03, 2023-08-07
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
DEVON
EX34 8ES UNITED KINGDOM

Panyu Trio Microtronics Co Ltd
SHIJI INDUSTRIAL ESTATE
DONGYONG
NANSHA
GUANGZHOU
Guangdong Sheng 511453 CHINA

TDK-LAMBDA CORP
2704-1 SETTAYA-MACHI
NAGAOKA-SHI
Niigata 940-1195 JAPAN

Trio-Tronics (Thailand) Ltd
7/295 Mu. 6
Map Yang Phon Sub-District
Pluak Daeng District Rayong THAILAND

General product information and other remarks:

Product Description

EFE300M or EFE-300M Series. Switch mode power supplies for building into end equipment.

Model Differences

Nominal Input Voltage Range 100 – 240Vac or 133 – 318Vdc
Maximum Input Voltage Range 90** – 264Vac or 120 – 350Vdc
Input Frequency 45 – 440*Hz Maximum or DC
Maximum Input Current 4.9Arms or 3.5A dc

** Channel 1 output is linearly derated from 90Vac to 85Vac, 4W per volt to 280W

All ratings apply for ambient temperatures up to 50°C. From 50 to 70°C the output power is derated at 2.5% per °C.

EFE300M or –EFE300M models as described below:

(may be prefixed by NS - # / where # may be any characters indicating non-safety related model differences) Products may additionally be marked with U5x or Y5x where x can be any characters indicating non-safety related model differences excluding itemized models shown below.

May be prefixed by SP followed by / or – (SP represents a sales code)

Unit Configuration Code: EFE300Mxy-a-b-cdef-ghijk

Where:

x = Nothing or J for Japanese models (may have non-safety differences).

y = Blank for Y2 capacitors from output to earth, P for Y1 capacitors from output to earth.

a = Channel 1 output voltage: see Ch1 in the outputs table below, adjustment range column.

b = Standby voltage: see standby voltage table below or 0 for omitted.

c = HN for open frame, no fan, 12V/1A fan supply. HU for U-chassis, no fan, 12V/1A fan supply. HC for cover + chassis, no fan, 12V/1A fan supply. EC for cover + chassis, end fan (temp controlled). NN for open frame, no fan, no fan supply. NU for U-chassis, no fan, no fan supply. NC for cover + chassis, no fan, no fan supply. CN for open frame, no fan, 12V/0.25A fan supply. CU for U-chassis, no fan, 12V/0.25A fan supply. CC for cover + chassis, no fan, 12V/0.25A fan supply.

d = M for Molex input connector or equivalent, J for JST connector or equivalent.

e = D for dual fused input or L for single fuse in the live line.

f = S for standard leakage, L for low leakage, R for reduced leakage, T for tiny leakage.*

g = Y for Oring FET included or N for nothing.

h = E for enable, T for inhibit, N for no inhibit, no enable.

i = Nothing for horizontal output connector, -V for vertical output connector, -S for screw terminal.

j = Nothing for standard channel 1 output voltage, -xD or -xPD where D is for units with programmed negative load regulation, PD is for units with programmed positive load regulation, x is the voltage of the regulation in 100mV and is within the output adjustment range (example, 7D = 0.7V of negative load regulation, 24PD = 2.4V of positive load regulation.

k = Nothing or -x where x is three numbers from 0 to 9 which denotes various output voltage/current settings within the specified ranges of each output for a particular unit or blank for standard output settings (may define non-safety related parameters/features e.g. reduced primary current limit, reduced OVP).

Output Parameters:

O/P Channel	Vout nom (V)	Range (V)	Max O/P (A)	Max O/P (W)
CH1	12	11.4 – 13.2*	25	300 (400**)
	24	22.8 – 26.4*	12.5	300 (400**)
	28	27 – 32*	10.72	300 (400**)
	40	36 – 42*	7.5	300 (350***)
	48	47 – 50*	6.25	300 (350***)
	50	50.1 – 54*	6.0	300 (350***)
Standby	5	Fixed	2	10
	12	12	1	12
	13.5	12 – 13.5*	1	13.5
Fan output	12	Fixed	0.25	3
	12	Fixed	1	12

* Can be adjusted from nominal at the factory only.

** Peak power of 400W for 10 seconds maximum, maximum RMS power of 300W

*** Peak power of 350W for 10 seconds maximum in any 1 minute cycle, maximum RMS power of 300W:

Where T1 = peak power time on and T2 = reduced power time on

Maximum continuous power output 300W (excluding fan output)

Output Limitations

All standard outputs are ES1 up to and including 40V. Voltage variants above the 40V variant are ES2 and must not be accessible to an end operator.

All outputs have basic spacing to earth and due consideration must be given to this in the end product design except for Y50029# which has functional spacing to earth.

Series connection

It is possible to connect two EFE300M units in series. Doing so changes the working voltages and also changes the Energy Source Classification. Refer to Conditions of Acceptability.

Non-standard Models.

(These are P/Ns created for customer specific applications. This can be EFE300Mxy-a-b-cdef-ghijk or same as EFE300M series or EFE-300M series under Model and Ratings section of this report).

Model: Y5J008# (where # can be any letter) or EFE300MJ-12.1-5-008 or EFE300MJ-12.1-5-008-SGP

Maximum Outputs: 12.1V, 21.49A plus 5V, 2A standby

Maximum Ambient: As standard model

Orientations: As standard model

Comments: Fan speed is controlled at 6600rpm up to and between 45 to 50 degrees C ambient after which the fan resumes its normal nominal voltage rating. Can be fitted with or without fan guard.

Model: Y5J006# (where # can be any letter) or EFE300MJ-12-5-006

Maximum Outputs: 11.4V to 13.2V*, 25A (300W max) plus 5V, 2A standby

Maximum Ambient: As standard model

Orientations: As standard model

Comments: Longer version than standard model to accommodate additional reservoir capacitor for a greater hold up time

Model: Y5J015# (where # can be any letter) or EFE300MJ-12.1-5-009 or EFE300MJ-12.1-5-009-SGP

Maximum Outputs: 12.1V, 24.79A plus 5V, 2A standby. Main output may also be 11.4V to 13.2V at 25A max. Limited to 300W max.

Maximum Ambient: As standard model

Orientations: As standard model

Comments: Model is the same as Y5J008# but is an NN

Model: Y50016# (where # can be any letter), NS-TLA/EFE300M-48.5-12-HNMDL-YE-V

Maximum Outputs: 47V – 54V, 6.25A 300W plus 12V, 1A standby plus 12V, 1A fan output

Maximum Ambient: As standard model

Orientations: As standard model

Comments: OCP raised by 5% compared to standard model

Model: Y50018# (where # can be any letter), NS-TLG/EFE300M-54-5-ECMDL-YT
Maximum Outputs: 54V, 5.5A plus 5V, 2A standby
Maximum Ambient: As standard model
Orientations: As standard model
Comments: Extended U-chassis with non-standard OVP to maintain SELV/ES1

Model: Y50029# (where # can be any letter except E), EFE300M-13-5-HNMDS-NT-S/NS-TLA
Maximum Outputs: As standard model
Maximum Ambient: As standard model
Orientations: As standard model
Comments: Elongated PWB to accommodate additional filtering components

Model: Y50029E, EFE300M-13-5-HNMDS-NT-S/NS-TLA
Maximum Outputs: As standard model
Maximum Ambient: As standard model
Orientations: As standard model
Comments: Based on Y50029# but with a larger value boost capacitor, up to a values of 220 micro-farads for a better hold up time

Additional Information

This report is a reissue of CBTR Ref. No. E135494-A6010-CB-1 Amendment 3 , CB Test Certificate Ref. No. DK-90514-M2-UL based on previously conducted testing and the review of product construction, only 5.4.1.8 – DETERMINATION OF WORKING VOLTAGE and 5.4.9.1 – ELECTRIC STRENGTH TEST – TYPE TESTING OF SOLID INSULATION tests were deemed necessary.

Single sided or double sided boards refer to Daughter and IMS boards while Multi-layer boards refer to Main board.

The manufacturer submitted representative production sample(s) of EFE300M. The following samples ID 2348251 were used for construction review.

EFE300M-48-12-ECMDL-YT was used for test purposes and is considered representative of the entire series.

The following tests were selected as representative of the test program applicable to model covered by this CBTR:

5.4.1.8 DETERMINATION OF WORKING VOLTAGE, 5.5.2.2 CAPACITOR DISCHARGE AFTER DISCONNECTION OF A CONNECTOR, 5.6.6 RESISTANCE OF THE PROTECTIVE BONDING SYSTEM, B.2.5 INPUT TEST, B.2.6 NORMAL OPERATING CONDITIONS TEMPERATURE MEASUREMENT

These tests have been witnessed for models selected as representative of the standard covered by this report and the applicable test program.

Technical Considerations

- The product was submitted and evaluated for use at the maximum ambient temperature (Tma) permitted by the manufacturer's specification of : 50°C (full load); 70°C (output power decreased linearly by 2.5%/°C above 50°C).
- The product is intended for use on the following power systems : TN, IT (Norway Only)
- Considered current rating of protective device as part of the building installation (A) : 20
- Mains supply tolerance (%) or absolute mains supply : +10%/-10% , DC Mains: +20%/-15%
- The equipment disconnect device is considered to be : Provided by the end equipment.
- The following were investigated as part of the protective earthing/bonding : Printed wiring board trace (refer to Enclosure - Schematics + PWB for layouts)
- The following are available from the Applicant upon request : Installation (Safety) Instructions / Manual
- Equipment was evaluated for a maximum supply range of 85-264Vac and 120-350Vdc.
- Capacitors are rated for 230V due to the IT power system used in Norway. Further evaluation may be required in the end use product.

Engineering Conditions of Acceptability

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

- The following product-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-Secondary: 408Vrms/880Vpk, Primary – Earthed Dead Metal: 392Vrms/668 Vpk
- The following output circuits are at ES1 energy levels : All standard models up to and including 40V nominal. Voltages above 48V nominal are ES2 and must not be accessible to an end operator.
- The following output circuits are at ES3 energy levels : All series connection models
- The following output circuits are at PS3 energy levels : All circuits
- The maximum investigated branch circuit rating is : 20 A
- The investigated Pollution Degree is : 2
- Proper bonding to the end-product main protective earthing termination is : Required
- An investigation of the protective bonding terminals has : been conducted
- The following input terminals/connectors must be connected to the end-product supply neutral : J1 connector, pin 5
- The following end-product enclosures are required : Mechanical, Electrical, Fire
- The following components require special consideration during end-product Thermal (Heating) tests due to the indicated maximum temperature measurements during component-level testing : J1 (75°C); L1,L2 (140°C); C7,C8 (100°C); C9 (105°C); L3 (140°C); TX1 (130°C); TX2 (130°C); U2, U4, U5, U6 (100°C); Q1, Q2 or Q5 (125°C, min. coating rating); XU3 (125°C, min. coating rating); All other electrolytic capacitors (105). Customer air configurations considered for abnormal and single fault conditions through test data in this report.
- When operated at the frequencies in excess of 63Hz, the requirements of clause 5.7 must be considered in the end use equipment as the leakage current for input frequencies above 63Hz may exceed 5mA. --
- Fans: The fan provided in this sub-assembly is provided with a fan guard to reduce the risk of operator contact with the rotor. The fan provided in this sub-assembly is not intended for operator access.
- Rating in end-product needs evaluation due to input-voltage-dependent de-rating is used
- Products are restricted to connection to DC Mains conditioned power supply system with narrower tolerance +10%, -10%.
- Marking for equipment provided with fuses located in both line and neutral of a single phase mains to be considered in end-product.
- Series connection: The end-product Electric Strength Test is to be based upon a maximum working voltage of : Primary-Secondary: 482Vrms, 880Vpk; Primary-Earthed Dead Metal: 392Vrms, 668Vpk
- The following magnetic devices (e.g. transformers or inductor) are provided with an OBJY3 insulation system with the indicated rating greater than Class A (105°C) : Transformers TX1 & TX2: Class F (140°C) – See table 4.1.2 for details of insulation system used.
- Power Supplies is provided with Multilayer PWB. PWBs are accepted under CBTR Ref. No.: E349607-A23 dated 2014-07-31 and letter report included under Enclosure, Miscellaneous