Description

UL TEST REPORT AND PROCEDURE

Standard:	UL 61010-1, 3rd Edition, May 11, 2012, Revised July 19, 2019, CAN/CSA-C22.2 No. 61010-1(2012-05), 3rd Edition, with revisions through 2018-11
Certification Type:	Component Recognition
CCN:	QQHC2 / QQHC8
Complementary CCNs:	
Product:	Switch mode power supply
Model:	EFE300 or EFE-300 series. (may be followed by characters as described in Model Differences, see Model Differences for details)
Rating:	100-240 Vac nom, 45-440 Hz 4.7 Arms max (see Model Differences for details)
Applicant Name and Address:	TDK-LAMBDA UK LTD KINGSLEY AVE ILFRACOMBE DEVON EX34 8ES, UNITED KINGDOM

This is to certify that representative samples of the products covered by this Test Report have been investigated in accordance with the above referenced Standards. The products have been found to comply with the requirements covering the category and the products are judged to be eligible for Follow-Up Service under the indicated Test Procedure. The manufacturer is authorized to use the UL Mark on such products which comply with this Test Report and any other applicable requirements of UL LLC ('UL') in accordance with the Follow-Up Service Agreement. Only those products which properly bear the UL Mark are considered as being covered by UL's Follow-Up Service under the indicated Test Procedure.

The applicant is authorized to reproduce the referenced Test Report provided it is reproduced in its entirety.

UL authorizes the applicant to reproduce the latest pages of the referenced Test Report consisting of the first page of the Specific Technical Criteria through to the end of the Conditions of Acceptability as applicable.

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL.

Prepared by:	Marcin Zurek, Project Handler	Reviewed by:	Krzysztof Wasilewski, reviewer

Supporting Documentation

The following documents located at the beginning of this Procedure supplement the requirements of this Test Report:

A. Authorization - The Authorization page may include additional Factory Identification Code markings.

B. Generic Inspection Instructions -

i. **Part AC** details important information which may be applicable to products covered by this Procedure. Products described in this Test Report must comply with any applicable items listed unless otherwise stated in the body of this Test Report.

ii. **Part AE** details any requirements which may be applicable to all products covered by this Procedure. Products described in this Test Report must comply with any applicable items listed unless otherwise stated in the body of each Test Report.

iii. **Part AF** details the requirements for the UL Certification Mark which is not controlled by the technical standard used to investigate these products. Products are permitted to bear only the Certification Mark(s) corresponding to the countries for which it is certified, as indicated in each Test Report.

Product Description

EFE300 or EFE-300 range. Switch mode power supplies for building into end equipment.
Refer to the Report Modifications page for any modifications made to this report.

Model Differences

Nominal Input Voltage Range	100 - 240V AC
Maximum Input Voltage Range	85* - 264V AC
Input Frequency	45-440 Hz maximum
Maximum Input Current	4.7A rms

* 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 deg C.

Unit Configuration Code:

EFE300 or EFE-300x-a-bcde- f-g-hij

(may be prefixed by NS - # / where # may be any number of characters indicating non safety related model differences). Products may additionally be marked with U2x or Y2x where x can be any number of characters indicating non-safety related model differences.

May be prefixed by SP followed by / or - (SP indicates a sales code).

where:

x=Nothing or J for Japanese models (may have non-safety differences).
a=Channel 1 Output Voltage: any voltage within the Adjustment Range for the Vout (nom) from the Output Table below, e.g. 12.8 for 12.8V output (12Vout nom), 24.6 for 24.6V output (24Vout nom).
b=CN for Open Frame with fan output , CU for U chassis with fan output, CC for U chassis and cover with fan output, EC for U chassis and cover with fan.
c=M for Molex input connector or equivalent, J for JST connector or equivalent.
d=D for dual fused input or L for single fuse in the live line.
e=S for Standard Leakage, L for Low Leakage, R for Reduced Leakage, T for Tiny Leakage.*
f=Nothing for horizontal output connector, V for vertical output connector.
g=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 100mVolts and is within the Output Adjustment range (example, 7D = 0.7V of negative load regulation, 24PD = 2.4V of positive load regulation).
hij=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/feature, e.g. reduced primary current limit, reduced OVP).
* Input frequencies above 63Hz, leakage current must be assessed in the end use application.
* L < 300uA leakage, R < 150uA leakage and T < 75uA leakage.

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**)
Fan output	12	Fixed	0.25	3

* Can be adjusted from nominal at the factory only
** Peak power of 400W for 10 seconds maximum, maximum rms power of 300W (see handbook for details)
Maximum continuous power output 300W (excluding fan output)

Output Limitations
All outputs are SELV.

Additional Information
Customer Air Cooling (CN, CU and CC options):

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 concerned.

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 stabilised.

Circuit Ref.	Description	Max. Temperature (°C)
J1	Input connector	75
L1, L2	Common mode choke winding	115 (130)
C7, C8	X capacitors	100
C9	Reservoir capacitor (electrolytic)	60 (105)
L3	Boost choke winding	115 (140)
TX2	Transformer winding	120 (130)
TX2	Transformer core	120 (130)
TX2	Transformer braid	120 (130)
U2	Optocoupler	75 (100)
C10, C11	Channel 1 output capacitors	80 (105)
L6	Primary choke (24V model only)	120 (130)
L4	Channel 1 Output choke	115 (130)
XU8/XU2	Fan regulator	115 (130)
XQ201	Boost FET (IMS board)	115 (130)
Q1	Channel 1 output FET (adjacent to R4)	115 (130)
XU3	Primary driver IC	100 (130)
Various	All other electrolytic capacitors	80 (105)

See layouts in the handbook for components to be monitored locations.
Higher temperatures limits (in brackets) may be used but product life may be reduced.

This report is an technical amendment 2 of CBTR Ref. No. E331788-D1004-1/A0/C0-ULCB issued on 2019-

09-06, CB Test Certificate Ref. No. DK-87639-UL and CBTR Ref. No. E331788-D1004-1/A1/C0-ULCB and CB Test Certificate Ref. No. DK-87639-M1-UL . Based on the previously conducted testing and the review of product technical documentation including photos, schematics, wiring diagrams and similar, has been determined that the product continues to comply with the standard.
No tests conducted under this investigation due to reissue of CB Test Report Ref. No. E331788-D1004-1/A1/C0-ULCB. All required tests were carried out under the original investigation
This report is a reissue of CBTR Ref. No. E331788-D1004-1/A0/C0-ULCB issued on 2019-09-06, CB Test Certificate Ref. No. DK-87639-UL and CBTR Ref. No. E331788-D1004-1/A1/C0-ULCB and CB Test Certificate Ref. No. DK-87639-M1-UL. Based on the previously conducted testing and the review of product technical documentation including photos, schematics, wiring diagrams and similar, has been determined that the product continues to comply with the standard.
The original report was modified to include the following changes:
- The standard has been ugraded to the latest revision date.
- Standards were updated on critical omponent list
- Components licenses were attached to the report
- Factory TRIO-TRONICS (THAILAND) LTD.was added to the report
- Capacitor Murata SA series with the same electrical ratings has been added as alternate to critical component list.
No testing was deemed necessary.

Technical Considerations

- The product was investigated to the following additional standards: -
- The following additional investigations were conducted: N/A
- The product was not investigated to the following standards or clauses: N/A
- The following accessories were investigated for use with the product: N/A
- Equipment class: Class I
  Equipment type: For building in
  The product was submitted and tested for use at the maximum recommended ambient temperature (Tmra) of 50°C (full load): 70°C maximum (output de-rated 2.5% /°C above 50°C)
  Evaluated for a maximum altitude of 3000m
  Multilayer PWB's accepted under CBTR Ref. No.: E349607-A23 dated 2014-07-31 and letter report, Enclosure Multi-layer PWB Letter Reports of this report.

Engineering Conditions of Acceptability

For use only in or with complete equipment where the acceptability of the combination is determined by UL LLC. When installed in an end-product, consideration must be given to the following:

- This component has been judged on the basis of the creepage and clearances required in the indicated Standards, which would cover the component itself if submitted for Listing: UL 61010-1, 3rd Edition, May 11, 2012, Revised July 19, 2019, CAN/CSA-C22.2 No. 61010-1(2012-05), 3rd Edition, with revisions through 2018-11, IEC 61010-1:2010/AMD1:2016/COR1:2019, EN 61010-1:2010/A1:2019 (Edition 3.1)
  The end-product shall consider that: The enclosure does not serve as a fire/electrical/mechanical enclosure
  The need for the following shall be considered in the end-product: Bonding to protective earthing terminal (Class I construction).
  MAINS disconnect device.
  The output connectors are Not investigated for field wiring.

  Creepage and clearance distances were based on a maximum working voltage of 392 Vrms; 762 Vpeak Primary to Secondary 392 Vrms; 668 Vpeak Primary to Earth.
  Insulation between primary circuits and accessible dead metal complies with the requirements for Basic insulation.
  Insulation between primary and secondary circuits complies with the requirements for Reinforced insulation.
  The following tests shall be performed in the end-product evaluation:

- Dielectric Strength
- Temperature (customer air models)

The unit is considered acceptable for use at on a max branch circuit of 20 A.
The unit is considered acceptable for use in a max ambient of 50°C (full load): 70°C maximum (output de-rated 2.5% /°C above 50°C).
End-product temperature tests for power supplies shall consider that the following transformers employ the indicated insulation system Transformer TX2, Class F (155 °C).
End-product dielectric strength tests shall be based on the maximum working voltage of 392 Vrms; 762 Vpeak Primary to Secondary 392 Vrms; 668 Vpeak Primary to Earth.
At input frequencies above 63Hz Clause 6.4.4a requires investigation in the end application.
Customer air models must be thermally tested as described in the Additional Information.
Input connector is: Not investigated for field wiring.
Input connector J2 pin 1 was investigated as the protective bonding terminal for the product.
The risk associated with clause 5.4.5 requires assessment in the end equipment.