

UL TEST REPORT AND PROCEDURE

Standard:	UL 60601-1, 1st Edition, 2006-04-26 (Medical Electrical Equipment, Part 1: General Requirements for Safety) CAN/CSA-C22.2 No. 601.1-M90, 2005 (Medical Electrical Equipment - Part 1: General Requirements for Safety)
Certification Type:	Component Recognition
CCN:	QQHM2, QQHM8 (Power Supplies, Medical and Dental)
Product:	Switch mode Power Supplies
Model:	Series: Alpha 800, Alpha 800W. Models: CA800 (followed by various letters and numbers as defined in the model differences) Series: Alpha 1000, Alpha 1000W. Models: CA1000 (followed by various letters and numbers as defined in the model differences), CA1250 12C_MF_PP 12F_PP 12F_PP 12F_PP, CA1250 12C_MF 12FF 12FF 12FF
Rating:	94.5 Vac to 240 Vac, (85-264Vac max. tolerance), 16A, 47-63 Hz Class I
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.

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

Prepared by: Krzysztof Wasilewski

Reviewed by: Jakub Sobolewski

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

The subject units are switch mode power supply sub-assemblies incorporating semiconductor components. They are provided with isolating transformers and associated circuitry mounted on printed wiring boards, in addition to input connectors for connection to mating connectors or wiring within the end use equipment.

Model Differences

The Model Alpha 800 and Alpha 1000 Series Power Supplies are nearly electrically and mechanically identical. The difference between the two series relates to the fact that the Alpha 800 Series has a 800 W maximum output and the Alpha 1000 Series has a 1000 W maximum output. CA1250 models are special custom units which are identical to CA1000 except that they have a restricted input voltage range and 1250W output power.

Units may be marked with a Product Code: J1x or H1x for Alpha 1000 and J8 or H8 for Alpha 800, where x may be any number of characters.

Unit Configuration Code (Description :) may be prefixed by NS # followed by / or - (where # may be any number of characters indicating non- safety related model differences).

RATINGS & LIMITATIONS:

Max power & per converter	720W
Max. Ampere Turns per converter	120
Max. Ampere Turns (total)	200
Max number of secondary windings per converter	10
Max ambient	50°C
Maximum operating altitude	3000m

Input voltage range/ frequency	Max input Current	Max. ambient	Operating mode	Max. output power
90-99.9Vac, 47-63Hz	16A	45°C	Continuous	1000W
100-264Vac, 47-63Hz	16A	50°C	Continuous	1000W
85-264Vac, 47-63Hz	16A	50°C	Continuous	800W
120-360Vdc	11A	45°C	Continuous	800W
85-90Vac, 47-63Hz	16A	50°C	Intermittent	1000W

Intermittent: Duty cycle is 30 sec. max at up to 1000W output followed by 60 sec. min. at up to 800W output. Ampere Turns is sum of (Amperes x Number of Secondary Turns) for all outputs. There are two converters in the psu: one for module slots 1-5 and the other for slots 3-7.

The above ratings apply for all PSU mounting orientations. The ratings also apply whether or not input and/or output connector housings are fitted. Ratings apply to Alpha 800 and 1000 ranges unless otherwise stated.

When an MFPF option is fitted input voltage range is limited to 180 - 264Vac only.

The Alpha 800 or CA800 or Alpha 1000 or CA1000 Series shall be followed by: LL, RL, or TL.

Where:

- LL = Low Leakage Input filter (Components C101, C106, C107, C108 = 2.2nF max.)
- RL = Reduced Leakage Input filter (Components C101, C106, C107, C108 = 1nF max.)
- TL = Tiny leakage input filter (Components C101, C106, C107, C108 = 470pF max.)

followed by up to seven of any of the following:

@ followed by AA, A, AL, BB, B, CC, C, CL, CM, CH, DD, D, FF, F, GG, G, JJ, J, KK, K, LL, L, MM, M, NN, N, QQ, Q, RR, R, SS, S, TT, T, UU, U, WW, W, ZZ or Z.

or B/S optionally followed by:

_MF, _X, _XL, MFL, MFE, MFU, MFV or _MFV, MFPF, MFT, _PA, _IN, _PP, _RP, RPA, RPB, RPC, RPD, _D, _MG or _CD

@/@ (/ can be replaced with a _) followed by: E, EB, EQ, EL, EH, H, P or PL:

where:

- @ and @/@ = applicable voltage range and the following one or two letters are the module type.
- _MF, MFE = Mains fail option (may also be called X).
- MFU = Mains fail option with uncommitted output connections.
- MFV = Mains fail option with VME bus
- MFPF = Mains fail, module parallel, PSU/fan inhibit and 5V, 50mA auxiliary output
- MFT = Mains fail, PSU/fan inhibit and 12V, 150mA auxiliary output
- MFL, _XL = Mains fail latch
- B/S = Blanking slot which occupies one 23mm slot.

Only up to seven 23 mm slots may be filled up per unit, noting that all modules occupy one 23 mm slot except for AA, A, F, FF, G, J, K, R, S or T modules which occupy two 23 mm slots.

Valid voltage ranges for @ and @/@ for each module are as follows:

Module	Voltage (V)	Current (A)	Width (mm)	Occupied Slots	Turns	Ampere Turns
A	@4.5 - 6	60	46	2	1	60
AA	@4.5 - 7	60	46	2	1	60
AL	@4.75 - 5.3	60	46	2	1	60
BB	@4.5 - 7	25	23	1	1	25
B	@4.5 - 6	25	23	1	1	25
C, CC	@5 - 16	16	23	1	2	32
CL	@4.6 - 5.6	16	23	1	2	32
CM	@5 - 7	16	23	1	2	32
CH	@11.4 - 13.5	16	23	1	2	32
D, DD	@18 - 29	9	23	1	4	36
E	@/@5 - 16 / 5 - 16	8/8	23	1	2/2	16/16
EL	@5 - 7 / 11 - 13	8/8	23	1	2/2	16/16
EH	@11 - 13 / 11 - 13	8/8	23	1	2/2	16/16
EB	@/@4.5 - 5.5 / 4.5 - 5.5	9/9	23	1	1/1	9/9
EQ	@/@4.5 - 5.5 / 2.7 - 3.9	9/9	23	1	1/1	9/9
F	@9 - 16	33	46	2	2	66
FF	@9 - 16	34.5	46	2	2	69
G, GG	@17.5 - 29	25	46	2	4	100
H	@/@18 - 32 / 18 - 32	5/5	23	1	4/4	20/20
J, JJ	@30 - 48	10	46	2	8	80
K, KK	@18 - 31	15	35	2	4	60
L, LL	@1.8 - 3.2	25	23	1	1	25

M, MM	@5 - 16	8	23	1	2	16
N, NN	@18 - 32	5	23	1	4	20
P	@/18 - 29 / 5 - 16	5/8	23	1	4/2	20/16
PL	@22 - 26 / 5 - 7	5/8	23	1	4/2	20/16
Q, QQ	@2.7 - 3.9	25	23	1	1	25
R, RR	@2.7 - 3.9	60	46	2	1	60
S, SS	@1 - 5.7	85	46	2	1	75
T, TT	@1.8 - 3.2	60	46	2	1	60
U, UU	@10 - 21	16	23	1	3	48
W, WW	@4.5 - 5.5	15	23	1	1	15
Z, ZZ	@4.5 - 5.7	25	23	1	1	25

A, AA and AL modules can be used up to 37A in slots 6 and 7 and used up to 60A in all other slots.

B and BB modules can be used up to 15A in slot 7 and used up to 25A in all other slots.

(a) C CC, CL, CM & CH modules can be used up to 16A for outputs up to 12V. For 15-16V outputs C modules can be used at up to 12A. Maximum module output current derates linearly between 12V and 15V.

(b) C, CC, CL, CM & CH modules can be used up to 10A in slot 7 and up to 16A in all other slots, subject to the limitations of (a).

D & DD modules can be used at up to 9A at up to 24V in all slots. At greater than 24V D & DD modules can be used at up to 8A in all slots.

E, EL & EH modules can be used up to 5A in slot 7 and up to 8A in all other slots.

EQ and EB modules can be used up to 5.6A in slot 7 and up to 9A in all other slots.

F modules can be used up to 20A in slots 6 and 7 and up to 33A in all other slots.

FF modules can be used up to 34.5A in all slots.

G & GG modules can be used up to 15A in slots 6 and 7 and up to 25A in all other slots.

H modules can be used up to 3A in slot 7 and up to 5A in all other slots. For 29.01 - 32V output current is limited to 1A max for all slots.

J & JJ modules can be used up to 6A in slots 6 and 7 (for 30-48V). For all other slots the max. permitted current is limited to 8A at 48V and 10A at 41V. For intermediate voltages interpolation is used to determine the max. permitted current. For outputs in the range 36-41V max. current is 10A.

K & KK modules can be used up to 10A in slot 6/7 and up to 15A in all other slots.

L & LL modules can be used up to 15A in slot 7 and used up to 25A in all other slots.

M & MM modules can be used up to 5A in slot 7 and up to 8A in all other slots.

(a) N & NN modules can be used up to 5A for outputs up to 29V. For 29-32V output current is limited to 1A max.

(b) N & NN modules can be used up to 3A in slot 7 and up to 5A in all other slots.

P and PL modules can be used up to 5A in the 18-29V channel in slots 1 to 6 and up to 3A in slot 7.

P and PL modules can be used up to 8A in the 5-16V channel in slots 1 to 6 and up to 5A in slot 7.

Q & QQ modules can be used up to 25A in any slot.

R & RR modules can be used up to 60A in any slot.

S & SS modules can be used up to 75A in slots 1/2, 76A in slots 2/3; 51A in slots 6/7 and up to 85A in all other slots. When the psu is operated in a horizontal orientation (with the ratings label uppermost) the S & SS modules may be used up to 85A in slots 2/3.

T & TT modules can be used up to 37A in slot 6 and 7 and used up to 60A in all other slots.

U & UU modules can be used up to 16A in all slots.

W & WW modules can be used up to 15A in all slots.

Z & ZZ modules can be used up to 15A in slot 7 and used up to 25A in all other slots.

Secondary Options:

Option	Description
_MG	Provides a module good signal with indicates output voltage is within limits.

_PA Forces paralleled modules to share load current. Additionally it also provides the module good signal.

_PP Provides either of the following functions:
a) Reduces module current limit and caters for paralleled modules with busbar linking. For use with modules providing a max output of up to 16V only; or
b) Identical to **_PA** except that the module is paralleled at the output of the module with busbar linking.

_IN Provides an external signal which may be used to inhibit the output of the module.

_EN Provides a delay in the turn on time of a module output. Additionally allows an external signal voltage to enable a module output (output off when no signal applied).

_RP Provides remote programming of the module output voltage.

RPA Provides voltage programming of the module output voltage only.

RPB Provides voltage programming of the module output voltage and has an output VA limiting circuit.

RPC Provides an output VA limiting circuit

RPD Provides voltage programming of the module output voltage and has an output VA limiting circuit.

_D Delay option. Provides a delay in the turn on time of the output.

Note:

The RPA option can only be used on modules with output voltages rated up to 32V.
The RP, RPB, RPC and RPD options can only be used on modules with output voltages rated up to 16V.
Not for use with a module voltage range of 18-29V or twin output modules.

Custom Models:

Model: CA1000LSF 5.25B 12.7C 16/16E 24G 18D 18D (NS-FOSS-002)

Input: 90 - 264Vac, 47-63Hz

Max. Output(s): 6V, 3A; 13.7V, 9A; 16V, 0.5A; 16V, 0.5A; 25V, 25A; 19V, 2.5A; 19V, 2.5A (877.3W)

Max. Ambient: 40°C

Orientation: Vertical with airflow upwards

Cooling: Papst 612 fans. Forward direction airflow.

CA1000RA B/S_MF 5S_PP 5B_PP 12F (NS-AMD-001)

Input voltage range: 198 - 264Vac.

Outputs: S Module: 5.5V max., 80A max.

B Module: 5.5V max., 25A max.

F Module: 12.5V max., 33A max.

All orientations are permitted.

CA1000 B/S_MF 24G_PP 24D_PP 15/15E 5M_IN

Input voltage range: 90 - 264Vac.

Outputs: G Module: 24V max., 20A max.

D Module: 24V max., 8A max.

E Module: 15/15V max., 8/6A max.

N Module: 5V max., 8A max.

Permitted orientation: Vertical with the fans lowest.

Fans: Papst 612NGM (lower airflow than fans fitted to standard Alpha 800/1000 PSUs).

CA1000 LSF B/S_MF 24G 15/15E 5M_IN (NS-TEG-010)

Input voltage range: 85 - 264Vac.

Outputs: G Module: 24V max., 20A max.

E Module: 15/15V max., 4/4A max.

M Module: 5V max., 8A max.

Permitted orientation: Horizontal

Fans: Papst 612NML or 612NGML (lower airflow than fans fitted to standard Alpha 800/1000 PSUs).

CA1000 LSF B/S_MF 24G 15/15E 5M_IN 36J (NS-TEG-011)

Input voltage range: 85 - 264Vac.

Outputs: G Module: 24V max., 18A max.
E Module: 15/15V max., 3/3A max.
M Module: 5V max., 8A max.
J Module: 36V max., 5.5A max.

Permitted orientation: Horizontal

Fans: Papst 612NML or 612NGML (lower airflow than fans fitted to standard Alpha 800/1000 PSUs).

CA1250 12C_MF_PP 12F_PP 12F_PP 12F_PP (NS-AMD-002)

Input voltage range: 207 - 264Vac.

Outputs: C Module: 13V max., 16A max.
F Module: 13V max., 30A max.
F Module: 13V max., 30A max.
F Module: 13V max., 30A max.

Permitted orientation: All except vertical with airflow downwards.

CA1250 12C_MF 12FF 12FF 12FF (NS-AMD-005)

Input voltage range: 207 - 264Vac.

Outputs: C Module: 13V max., 16A max.
F Module: 13V max., 30A max.
F Module: 13V max., 30A max.
F Module: 13V max., 30A max.

Permitted orientation: Horizontal only.

CA1000 LSFL 22K_IN 12C-IN 48J-IN 24N_IN 24N_IN (J10077A)

Input voltage range: 90 - 264Vac.

Outputs: K Module: 22V max., 15A max.
C Module: 12V max., 10A max.
J Module: 48V max., 5A max.
N Module: 24V max., 5A max.
N Module: 24V max., 5A max.

Permitted orientation: Horizontal only.

Max. Ambient: 40°C

Fans: Papst 612NGME or 612NME (lower airflow than fans fitted to standard Alpha 800/1000 PSUs).

Technical Considerations

- Classification of installation and use : for building-in
- Supply connection : for building-in
- Accessories and detachable parts included in the evaluation : None
- Options included : None
- The product was investigated to the following additional standards:: UL 60601-1, 1st Edition, 2006-04-26 (includes National Differences for USA) CAN/CSA-C22.2 No. 601.1-M90 (R2005) (includes National Differences for Canada) EN 60601-1: 1990 + A1:1993 + A2:1995 This product has been assessed for Class 1, Pollution Degree 2, Material Group IIIB, Overvoltage Category II, Altitude up to 3000 meters, maximum ambient 50 degrees C (higher ambient permitted for specific custom models).
- The product was not investigated to the following standards or clauses:: Clause 52.1, Programmable Electronic Systems (IEC 601-1-4), Clause 48, Biocompatibility (ISO 10993-1), Clause 36,

Electromagnetic Compatibility (IEC 601-1-2)

- The product is Classified only to the following hazards:: Shock, Fire, Casualty
- The mode of operation is:: Continuous
- Software is relied upon for meeting safety requirements related to mechanical, fire and shock:: No
- The product is suitable for use in the presence of a flammable anesthetics mixture with air or oxygen or with nitrous oxide:: No
- The primary sub-assembly, including the primary windings of the main barrier transformer, is common to all products in this family. The secondary regulators are built into separate modules.
- These products have been assessed for Class 1, Pollution Degree 2, Material Group IIIB, Overvoltage Category II, Altitude 3000 metres, maximum ambient 50 degrees C.
- Testing Environment: An ambient temperature in the range 15 degrees C to 30 degrees C. A relative humidity in the range of 25 % to 75 %. And finally, an air pressure in the range of 86 kPa to 106 kPa.
- Testing was carried out on the basis of 7 slots being filled, each slot being one 23 mm module space wide. This is the maximum number of slots allowed under this approval, and provides the worst case situation. Heating tests were carried out with the maximum number of slots filled, but with numerous loading conditions to cover any condition of loading in any slot position. Also, the models tested under Clause 4.5 represent the least efficient, highest current module configurations. Abnormals were carried out on the expected worse case situation for that abnormal and on as many configurations as considered necessary to represent the entire range of products covered by this approval. For other tests, the conditions and configurations used were the expected worst case.
- These products were considered to be a component part of Class 1 equipment. Full compliance with the standards will therefore depend on the installation in the final application. Some modules could present an energy hazard. Additionally, outputs can be connected in series thus producing non-SELV levels, or in parallel thus producing new energy hazards, and this must be taken into account in the end-use application. When non-seriesed outputs are earthed in the end use equipment they are SELV. If the outputs are not earthed, they must be considered hazardous, as a single fault in the secondary may make them exceed SELV limits between output and earth. If any output is non-SELV, then all outputs become non-SELV.

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:

- These units are forced-air cooled. They require a minimum of 50 mm clearance in the vicinity of the ventilation holes. Whilst relatively orientation insensitive, operation of these units when mounted vertically with air flow in a downward direction is affected by convection acting against the cooling airflow, and results in slightly hotter temperatures than if operated in the horizontal position. As a consequence of this, heating tests were carried out in the vertical orientation with airflow downwards to give the worst case temperatures, unless otherwise stated.
- In general, no tests have been conducted on polymeric materials used in the construction of these products. Information was provided by the Client with regards to the classification of the polymeric materials. Acceptance of these materials is based on these declarations. All critical polymeric materials are UL Recognized as indicated in the Critical Components Table and where appropriate, have been tested in the application to verify that they are used within their RTI's.
- This equipment has only been evaluated for Basic Insulation from Primary to Secondary across the main transformer.
- A fire, electrical and mechanical enclosure is required for this equipment.
- Leakage current measurements with non-frequency weighted measuring device according to

Japanese national differences clause 19.4e shall be performed during end product evaluation.

Additional Information

The enclosed label sample represents all Models in the Series.

Additional Standards

The product fulfills the requirements of: UL 60601-1, 1st Edition, 2006-04-26 (includes National Differences for USA) CAN/CSA-C22.2 No. 601.1-M90 (R2005) (includes National Differences for Canada) EN 60601-1: 1990 + A1:1993 + A2:1995