UL TEST REPORT AND PROCEDURE

Standard:	UL 60950-1, 2nd Edition, 2014-10-14 (Information Technology Equipment - Safety - Part 1: General Requirements) CAN/CSA C22.2 No. 60950-1-07, 2nd Edition, 2014-10 (Information Technology Equipment - Safety - Part 1: General Requirements)
Certification Type:	Component Recognition
CCN:	QQGQ2, QQGQ8 (Power Supplies for Information Technology Equipment Including Electrical Business Equipment)
Product:	Switch Mode Power Supply
Model:	Vega 450, Vega 650, Vega 900, Vega Lite 550 and Vega Lite 750 models (see Model Differences for details of models and nomenclature)
Rating:	Vega 450 and Vega Lite 550. PSUs with cooling option F and without xEW and xFW options: Input voltage: 94.5-240 V ac nom., 85-264 V ac max., 47-63 Hz, 8.5 A rms max. All other PSUs: Input voltage: 100-240 V ac nom., 90-264 V ac max., 47-63 Hz, 8.5 A rms max. Vega 650, Vega Lite 750 and Vega 900. PSUs with cooling option F and without xEW and xFW options: Input voltage: 94.5-240 V ac nom., 85-264 V ac max., 47-63 Hz, 12 A rms max. All other PSUs: Input voltage: 100-240 V ac nom., 90-264 V ac max., 47-63 Hz, 11 A rms max. Input voltage for Vega 650 may also be rated 133-318V dc nom., 120-350V dc max., 10A max., for models described within Products covered, custom models. (See Model Differences for details of ratings)
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.

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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

Vega 450, Vega 650, Vega 900, Vega Lite 550 and Vega Lite 750 are switch mode power supply units for building into host equipment.

Model Differences

Vega 450, Vega 650, Vega 900, Vega Lite 550 and Vega Lite 750 are switch mode power supply units for building into host equipment. There are essentially 2 converters (450 and 650) and all units use the same modules. The Vega 450 and 550 use the 450 converter whilst the Vega 650, 750 and 900 use the 650 converter.

PRODUCTS COVERED

Vega models as described below:

Units may be marked with a Product Code: Ky*, KVy* or Vy* where y may be 4, 5, 6, 7 or 9 and * may be any series of numbers from 0 to 9 and/or any letters from A to Z.

a) V4, V5, V6, V7, V9, Vega 450, Vega 650, Vega 900, Vega Lite 550, Vega Lite 750, Vega Smart or Vega Smart Plus

where V4 = Vega 450 range
V5 = Vega Lite 550 range
V6 = Vega 650 range
V7 = Vega Lite 750 range
V9 = Vega 900 range
Vega Smart = Vega 450 or 650 PSU with primary digital option fitted
Vega Smart Plus = Vega 450 or 650 PSU with primary and secondary digital options fitted

(may be prefixed by NS - # / or - where # may be
up to any four letters and may be followed by - $ where $ may be any number between 000 to 999, indicating non-safety related model differences.

b) followed by: C, D, E, F, R, Q or P

where F = Standard fan, forward airflow
R = Standard fan, reverse air

Q = Quiet fan, forward airflow
P = Quiet fan, reverse air
C = Customer air
A = Custom models only
D* = Ruggedised fan, forward airflow
E* = Ruggedised fan, reverse air

* These fans must not be used for user accessible applications.

c) optionally followed by: F, I or S

where F = Fast-on or quick connect input terminals
S = Screw input terminals
I = IEC input

d) followed by: S, M, G, L, R, or T

where S = Standard Leakage (Class B Filter)
M = Medium Leakage
G = Moderate Leakage
L = Low Leakage
R = Reduced Leakage
T = Tiny Leakage

e) optionally followed by: E, F, EV, FV, EY, FY, xEW, xFW or D

where E = AC fail with PSU & fan enable and 5V aux supply
F = AC fail with PSU & fan inhibit and 5V aux supply
EV = AC fail with PSU & fan enable and 5V/300mA aux supply
FV = AC fail with PSU & fan inhibit and 5V/300mA aux supply
EY = AC fail with PSU & fan enable, 5V/300mA aux supply and fan fail signal
FY = AC fail with PSU & fan inhibit, 5V/300mA aux supply and fan fail signal
xEW = AC fail with PSU & fan enable and 5-15V/1A aux supply, where x = voltage setting
xFW = AC fail with PSU & fan inhibit and 5-15V/1A aux supply, where x = voltage setting
D = Primary digital option. Provides PSU inhibit and enable, fan monitor, standby supply, hours of operation, serial numbers, mains fail, over temperature warning. When secondary digital options fitted also provides status bytes, unit and module IDs, grouping, digital voltage and current limit programming, secondary inhibit and enable, secondary turn on delay, global and secondary module good, module monitoring.

Modules

B@, C@, C1Y, D@, E@, F1, F2, H@/@ or @_@, L@, W2, W5, W8 & W9.

where the letter represents a module and @ is a number between 1 and 5, which represents the number of turns on the transformer secondary. By reference to the following table, this in turn defines the permitted voltage range of the module.

@ may optionally be followed by the letter L or H, where L and H indicate the low or high output voltage variants of the module.

For W2, W5, W8 & W9 modules only: @ is followed by F, T, E or S
where F = Fixed OVP

T = Tracking OVP
E = Fixed OVP, high current output
S = Tracking OVP, high current output

Followed by F or S, where F indicates fast-on output terminals and S indicates screw output terminals.

or Z#

where # is a number between 1 and 99. This code represents any two of the above modules that have had their outputs paralleled together. The number # is a module reference number and does not represent the number of turns. May optionally followed by F or S, where F indicates fast-on output terminals and S indicates screw output terminals.

or BB@, CC@, DD@, EE@, HH@/@ or @_@, JJ@/@ or @_@, LL@, C5B4 or B5B4

where @ is a number between 1 and 5, which represents the number of turns on the transformer secondary. For HH@/@ or @_@ the code represents one H module that has had its two outputs connected in series. For all other variants this code represents two modules, selected from those listed above, that have had their outputs connected in series. May optionally followed by F or S, where F indicates fast-on output terminals and S indicates screw output terminals.
Note: Series outputs may make all outputs hazardous, see Electrical & Thermal Ratings section for details. JJ@/@ or @_@ modules are HH@/@ or @_@ modules with reduced OVP and/or current ratings.

or X1, X2, X4, X8, XR1, XR2, XR4 & XR8

where the number relates to the maximum voltage capability of the X or XR module (voltage rating is 10 multiplied by the number). The X or XR modules are connected to the output terminals of B, D, E or W modules, which may be connected in series or parallel. The X and XR modules contains diodes in series with their output (for paralleling use). The X module also has additional circuitry for remote sense, paralleling with other X modules and module inhibit. A maximum of two X or XR modules may be fitted in a PSU.

or B/S where B/S indicates that a blanking plate is fitted in place of a module.

Any of the above modules (except the X and XR modules) may have the module letter preceded with # or #/# where # is represents the module output voltage.

Module Options:

N, E, P, R, T, L, K, D, V‡ or R‡

where N = Inhibit, module good and remote sense.
E = Enable, module good and remote sense
P = Parallel with current share
R = Remote sense (twin output modules only)
T = Remote sense (one output of twin output modules only)
L = Module good using LED indication
K = Allows for Vega products to be paralleled with Omega products
D = Secondary digital option (may only be fitted to single output modules). Provides analogue voltage and resistive programming, current limit modes, inhibit output, enable output, turn on delay, module good, N+1 paralleling.
V‡ = Voltage programmable output voltage
R‡ = Resistance programmable output voltage

where ‡ represents a number between 1 and 99. Each number indicates an option variant which does not affect safety, of these the following are standard variants:
1 = Inhibit, fixed current limit
2 = Inhibit, programmable current limit
3 = Enable, fixed current limit
4 = Enable, programmable current limit

May additionally be marked with K4x, K5x, K6x or V4x,V5x,V6x,V7x,V9x where x can be up to five digits of any letter or number between 0 and 9 indicating non-safety related model differences.

ELECTRICAL & THERMAL RATINGS:

Output modules:

Module	O/P V	Rated I	P	Slots	Turns	A/T
B1L	1 - 3.8V	20A	76W	1	1	20
B1H	2 - 5.5V	20A	110W	1	1	20
B2	3 - 9V	25A	225W	1	2	50
B3	9.1 - 16.2V	12A	195W	1	3	36
B4	16.3 - 21.5V	10A	215W	1	4	40
B5	21.6 - 31V	6A	186W	1	5	30
C1	1 - 4.1V	35A	144W	1	1	35
C1Y	1 - 4.1V	40A	164W	1	1	40
C3	9.1 - 16.2V	18A	292W	1	3	54
C4	16.3 - 21.5V	14A	301W	1	4	56
C5	21.6 - 31V	10A	310W	1	5	50
D1L	1 - 3.8	50A	190W	1.5	1	50
D1H	3.9 - 5.5	50A	275W	1.5	1	50
D2	3.8 - 9V	45A	405W	1.5	2	90
D3	8 - 16.5V	24A	396W	1.5	3	72
D4	14 - 21.5V	18A	387W	1.5	4	72
D5	21 - 28V	15A	420W	1.5	5	75
E1	1 - 3.8V	60A	228W	2	1	60
E2	3.8 - 8V	60A	480W	2	2	120
E3L	8 - 13.9V	40A	556W	2	3	120
E3H	14 - 15V	36A	540W	2	3	108
E4	14 - 19.9V	30A	597W	2	4	120
E5L	20 - 24V	27A	648W	2	5	135
E5H	24 - 28V	25A	650W	2	5	125
F1	1 - 3.8V	80A	640W	2	1	80
F2	3.8 - 8V	80A	640W	2	2	160
H1L/1L	1-3.8/1-3.8V	12A/8A	46W/31W	1	1/1	12/8
H1L/1H	1-3.8/3.9-5.5V	12A/8A	46W/44W	1	1/1	12/8
H1H/1L	3.9-5.5 /1-3.8V	12A/8A	66W/31W	1	1/1	12/8
H1H/1H	3.9-5.5 /3.9-5.5V	12A/8A	66W/44W	1	1/1	12/8
H1L/2	1-3.8/5-9V	12A/6A	46W/54W	1	1/2	12/12
H1H/2	3.9-5.5/5-9V	12A/6A	66W/54W	1	1/2	12/12
H1L/3	1-3.8/9.1-16.2V	12A/6A	46W/98W	1	1/3	12/18
H1H/3	3.9-5.5/9.1-16.2V	12A/6A	66W/98W	1	1/3	12/18
H1L/4	1-3.8/16.3-25V	12A/4.5A	46W/113W	1	1/4	12/18
H1H/4	3.9-5.5/16.3-25V	12A/4.5A	66W/113W	1	1/4	12/18
H2/1L	5.6-9/1-3.8V	10A/8A	90W/31W	1	2/1	20/8
H2/1H	5.6-9/3.9-5.5V	10A/8A	90W/44W	1	2/1	20/8
H2/2	5.6-9/5.6-9V	10A/6A	90W/54W	1	2/2	20/12

H2/3	5.6-9/9.1-16.2V	10A/6A	90W/98W	1	2/3	20/18
H2/4	5.6-9/16.3-25V	10A/4.5A	90W/113W	1	2/4	20/18
H3/1L	9.1-16.2/1-3.8V	10A/8A	162W/31W	1	3/1	30/8
H3/1H	9.1-16.2/3.9-5.5V	10A/8A	162W/44W	1	3/1	30/8
H3/2	9.1-16.2/5.6-9V	10A/6A	162W/54W	1	3/2	30/12
H3/3	9.1-16.2/9.1-16.2V	10A/6A	162W/98W	1	3/3	30/18
H3/4	9.1-16.2/16.3-25V	10A/4.5A	162W/113W	1	3/4	30/18
H5/1L	16.2-31/1-3.8V	5A/8A	155W/31W	1	5/1	25/8
H5/1H	16.2-31/3.9-5.5V	5A/8A	155W/44W	1	5/1	25/8
H5/2	16.2-31/5.6-9V	5A/6A	155W/54W	1	5/2	25/12
H5/3	16.2-31/9.1-16.2V	5A/6A	155W/98W	1	5/3	25/18
H5/4	16.2-31/16.3-25V	5A/4.5A	155W/113W	1	5/4	25/18

Module	O/P V	Rated I	P	Slots	Turns	A/T
L1	4.2 - 5.5V	35A	193W	1	1	35
W2	0.25 - 7.5V	30A	225W	1	2	60
W5 (standard)	0.25 - 32V	8.5A	272W	1	5	42.5
W5 (high current o/p)	0.25 - 15V	10A	272W	1	5	50
	15.01 - 32V	8.5A				
W8	1 - 48V	5A	240W	1	8	40
W9	1-30V	2A	60W	1	5	10
X1	10V (see Note 1)	90A	See Note 2	1	-	-
X2	20V (see Note 1)	64.5A	See Note 2	1	-	-
X4	40V (see Note 1)	32.4A	See Note 2	1	-	-
X8	80V (see Note 1)	16.2A	See Note 2	1	-	-

Note 1: Actual voltage and current output of X and XR modules is dependent, and limited by, the ratings of the modules from which it is fed. The ratings given above are additional rating limitations imposed by the X module itself.

Note 2: The maximum power output of PSUs fitted with X or XR modules is reduced from its normal rated value by the following power: 0.55 x (total X1 & XR1 current) + 0.7 x (total X2, X4, XR2 & XR4 current) + 0.9 x (total X8 & XR8 current)

Additional module limitations:

E2 module fitted in slots 4/5 is limited to 55A.
C1Y module can only be fitted in slot 1.
F2 module may only be fitted in slots 1/2 and is limited to 75A for ambient temperatures of greater than 45°C.
F1 module may only be fitted in slots 1/2.

For PSUs with three D modules fitted:
D1L & D1H in slots 2/3 is limited to 42A and in slots 4/5 is limited to 47A
D2 in slots 2/3 is limited to 40A

For 900W PSUs:
W2 module not permitted.
F1 and F2 modules not permitted.

PSUs fitted with a W2 module are limited to a maximum ambient of 45°C.

All the above ratings and limitations apply to the individual modules from which a series or paralleled pair is

made.

SELV and Outputs Connected In Series:

Outputs are SELV except as described below:
Non-earthed outputs that have secondaries with 2 or more turns are non-SELV as a single fault in the secondary may make them exceed the SELV limit between output and earth.
Non-earthed outputs that are connected in series are non-SELV unless all the series outputs use 1 turn secondaries and there are no more than 3 outputs connected in series.
Outputs connected in series are non-SELV if the total output voltage + 20% of the max. rated output voltage of the output with the highest rated voltage exceeds 60Vdc (the 20% addition allows for a single fault in any one individual channel).
The total voltage of a series output must not exceed 160V.
If any output or series output is non-SELV then all the outputs in the PSU must be considered non-SELV.
Note:
Non-SELV outputs must be guarded or a deflector fitted during installation to avoid a service engineer making inadvertent contact with the output terminals, or dropping a tool onto them.
All outputs have operational spacings to earth, and due consideration must be given to this in the end product design.

When the IEC inlet option is fitted (option I) together with a plastic fan grill then the end face of the PSU with the fan grill may be operator accessible.

Ratings Specific to Vega 450 and Vega Lite 550 Ranges:

PSUs with cooling option F and without xEW and xFW options:
Input voltage: 94.5-240 V ac nom., 85-264V ac max., 47-63 Hz, 8.5 A rms max.

All other PSUs:
Input voltage: 100-240 V ac nom., 90-264V ac max., 47-63 Hz, 8.5 A rms max.

Permitted orientations: Horizontal with chassis lowest, on either side or vertical with the airflow upwards.

Cooling Option	Max. Amb(°C)	Dual Width Modules Fitted	P(W)	Max AT (total)	Max AT in adj	Max Module I Rating regions (note 1)
F	See table below	No	See table below	180	n/a	100%
		Yes		180	180	100%
D	50	No	450	180	n/a	100%
		Yes	450	180	180	100%
R, E	50	No	450	180	n/a	100%
		Yes	450	180	162	90%
Q	50	No	450	180	n/a	100%
		Yes	450	180	180	100%
P	50	No	450	180	n/a	100%
		Yes	450	180	180	85%
C	50	See Customer Air Cooling section for ratings				

Note 1: The PSU main transformer has three regions for module secondaries separated by two primary windings. Starting nearest slot 1, region A, primary winding, region B, primary winding, region C. The total ampere turns (AT) in any two adjacent regions is limited to that in the table above column, “Max AT in adjacent regions (note 1)”. See Mains transformer regions table page 16 for modules allowed in each region. The table uses module widths with a twin output module being single width. For PSUs fitted with F2 modules “Max AT in adjacent regions” does not apply.

n/a = not applicable

Ampere Turns (AT) is the sum of (output amps x secondary turns)

Power ratings for cooling option F:

I/P V (Vrms)	O/P P (w)		
	Max. Amb 40°C	Max. Amb 50°C	
		xEW or xFW option fitted	xEW and xFW options not fitted
85	425	not permitted	425
90	470	450	450
100	520	450	500
110-149.9	570	450	550
150-264	630	450	560

Linear interpolation may be used to determine the permitted output power for input voltages between 85 and 110V.

Ratings Specific to Vega 650 and Vega 750 Lite Ranges:

PSUs with cooling option F and without xEW and xFW options:
Input voltage: 94.5-240 V ac nom., 85-264V ac max., 47-63 Hz, 12 A rms max.

All other PSUs:
Input voltage: 100-240 V ac nom., 90-264V ac max., 47-63 Hz, 11 A rms max.

Permitted orientations: Horizontal with chassis lowest, on either side or vertical with the airflow upwards.

Cooling Option	Max. Amb(°C)	Dual Width Modules	P(W)	Max AT (total)	Max AT in adj	Max Module I Rating
F	See table below	No	See table below	220	n/a	100%
		Yes		220	180	100%
D	50	No	650	220	n/a	100%
		Yes	650	220	180	100%
R, E	40	No	530	212	n/a	100%
		Yes	550	212	158	90%
	45	Yes	500	212	158	90%
	50	No	575	180	n/a	100%
		Yes	600	210	162	90%
		No	500	200	n/a	100%
Q	50	Yes	550	180	140	100%
		No	650	220	n/a	100%
		Yes	610	220	180	95%
		Yes	650	145	115	95%
P	40	Yes	500	203	152	85%
	45	Yes	420	203	152	85%
	50	No	500	180	n/a	100%
		Yes	450	190	162	85%
C	50	See Customer Air Cooling section for ratings				

Note 1: The PSU main transformer has three regions for module secondaries separated by two primary windings. Starting nearest slot 1, region A, primary winding, region B, primary winding, region C. The total ampere turns (AT) in any two adjacent regions is limited to that in the table above column, “Max AT in adjacent regions (note 1)”. See Mains transformer regions table page 16 for modules allowed in each region. The table uses module widths with a twin output module being single width. For PSUs fitted with F2 modules “Max AT in adjacent regions” does not apply.

n/a = not applicable

Ampere Turns (AT) is the sum of (output amps x secondary turns)

Power ratings for cooling option F:

I/P V (Vrms)	O/P P (w) Max. Amb 40°C	Max. Amb 50°C xEW or xFW option fitted	xEW and xFW options not fitted
85	650	not permitted	615
90	720	650	650
100	830	650	720
110-149.9	900	650	770
150-264	900	900	900

Linear interpolation may be used to determine the permitted output power for input voltages between 85 and 110V.

Ratings Specific to Vega 900 Range:

PSUs with cooling option F and without xEW and xFW options:
Input voltage: 94.5-240 V ac nom., 85-264V ac max., 47-63 Hz, 12 A rms max.

All other PSUs:
Input voltage: 100-240 V ac nom., 90-264V ac max., 47-63 Hz, 11 A rms max.

Permitted orientations: Horizontal with chassis lowest, on either side or vertical with the airflow upwards.

For input voltages equal to or greater than 150V ac ratings are as follows:

Cooling Option	Max. Amb(°C)	Dual Width Modules	P(W)	Max AT (total)	Max AT in adj	Max Module I Rating
F, D	50	No	900	220	180	100%
		Yes	900	220	180	100%
		No	650	220	n/a	100%
Q	50	No	750	180	n/a	100%
		Yes	750	180	140	100%
C	50	See Customer Air Cooling section for ratings				

For input voltages less than 150V ac ratings are as follows:

Cooling	Max.	Dual Width	Max	Max	Max Module

Option	Amb(°C)	Modules	P(W)	AT (total)	AT in adj	I Rating
F	See table below	No	See table below	220	n/a	100%
		Yes		220	180	100%
D	50	No	650	220	n/a	100%
		Yes	650	220	180	100%
R, E	40	No	530	212	n/a	100%
		Yes	550	212	158	90%
	45	Yes	500	212	158	90%
	50	No	575	180	n/a	100%
		Yes	600	210	162	90%
		No	500	200	n/a	100%
Q	50	Yes	550	180	140	100%
		No	650	220	n/a	100%
		Yes	610	220	180	95%
		Yes	650	145	115	95%
P	40	Yes	500	203	152	85%
	45	Yes	420	203	152	85%
	50	No	500	180	n/a	100%
		Yes	450	190	162	85%
C	50	See Customer Air Cooling section for ratings				

Power ratings for cooling option F:

I/P V (Vrms)	O/P P (w) Max. Amb 40°C	Max. Amb 50°C xEW or xFW option fitted	xEW and xFW options not fitted
85	650	not permitted	615
90	720	650	650
100	830	650	720
110-149.9	900	650	770

Linear interpolation may be used to determine the permitted output power for input voltages between 85 and 110V.

Note 1: The PSU main transformer has three regions for module secondaries separated by two primary windings. Starting nearest slot 1, region A, primary winding, region B, primary winding, region C. The total ampere turns (AT) in any two adjacent regions is limited to that in the table above column, “Max AT in adjacent regions (note 1)”. See Mains transformer regions table page 16 for modules allowed in each region. The table uses module widths with a twin output module being single width. For PSUs fitted with F2 modules “Max AT in adjacent regions” does not apply.

n/a = not applicable

Ampere Turns (AT) is the sum of (output amps x secondary turns)

Main transformer regions table:

REAR VIEW OF TRANSFORMER

SLOT 5 SLOT1

PRIMARY PRIMARY

REGION C			REGION B			REGION A		
Slot 1		Slot 5.5				Slot 1		Slot 5.5
Region A	Region B	Region C				Region A	Region B	Region C
S	D	D				1.5	1.5	-
Blank	D	D				S	S, S	D
S	D, S	S				1.5	1.5	D
S	D	S				-	F,M,S	S, S
S	D	-				-	F,M,S	S
-	D	-				-	F,M,S	-
S	S, S, S	S				-	F,M	-
S	S, S	S				-	F,M,S	D
S	S	-				-	F,M	D
-	S	-				-	F,M,S	1.5
1.5	D	1.5				-	F,M	1.5
S	D	1.5				-	F,M 1.5	1.5
-	D	1.5				-	F,M 1.5	S
S	1.5, S	S						
S	1.5	S				Combined Modules		
S	1.5	-				S	D	D
1.5	1.5	1.5				-	D	D
S	1.5, 1.5	S				1.5	D	1.5
S	1.5	1.5				S	D	1.5
-	1.5	1.5				-	D	1.5
-	1.5	-				S	1.5, 1.5	S
-	S, S	D				S	1.5, 1.5	-
-	1.5, S	S				-	1.5, 1.5	-
1.5	1.5, S	S				1.5	1.5, D	-
-	D, S	S				1.5	1.5	1.5
1.5	D	S				1.5	1.5, S	S

D = Dual. S = Single, M = Module

Custom Models:

All ratings as per standard models unless otherwise stated.

Model: V6 RSF 3/1HS C3S B/S E2S
Maximum outputs: 12V, 2A; 5V, 1.5A; 12V, 10A; 5V 52A
Maximum Power: 411.5W
Maximum ambient: 40°C
Orientation: Horizontal only
Cooling: Reverse air, Papst 612NM.

Model: V6 FISFV 5.1F2SP 12B3F 3.4E1SP
Maximum outputs: 5.1V, 80A; 12V, 3A; 3.4V, 60A
Maximum power: 648W
Maximum ambient: 50°C
Orientation: Horizontal only
Cooling: Forward air

Model: V6FSS 24C5S 24D5S
Maximum outputs: 24V, 10A; 24V, 15A
Maximum Power: 600W

Maximum ambient: 65°C
Orientation: All except upside down and vertical with the airflow downwards
Cooling: Forward air

Model: Vega 450 AFT B/S 24D5S 21D5S (K40054, NS-CLE-010)
Input: 85-264Vac, 47-63Hz
Maximum outputs: 24V, 12.5A; 21V, 7.143A
Orientation: All except upside down and vertical with the airflow downwards
Cooling: Papst 612NML or 612NGML or 612NMLE fan fitted with up to 66 ohms total resistance in series.
Comments: Forward air.

Model: Vega 650 BFTF B/S 24.5E5HFN
Input: 90-264Vac, 47-63Hz
Maximum output: 24.5V, 18.37A
Maximum output power: 450W
Orientation: All except upside down and vertical with the airflow downwards
Cooling: Papst 612NML or 612NGML fan fitted with up to 64 ohms total resistance in series.
Comments: Reverse air.

Model: Vega 450 AFT B/S 24E5HS (NS-CLE-011)
Input: 85-264Vac, 47-63Hz
Maximum outputs: 24V, 14.59A
Maximum output power: 350W
Orientation: All except upside down and vertical with the airflow downwards
Cooling: Papst 612NML or 612NGML fan fitted with up to 64 ohms total resistance in series.
Comments: Forward air.

Model: NS-WKR/V4AFS 5/5H1H/1HFN 12/12H3/3F 5/5H1H/1HFN 25/25H5/4F (K40072)
Input: 90-264Vac, 47-63Hz
Maximum outputs: 5.5V, 2.5A; 5.5V, 2.5A; 12.5V, 2.5A; 12.5V, 2.5A; 5.5V, 2.5A; 5.5V, 2.5A; 26V, 1.5A; 26V, 1.5A
Maximum output power: 195.5W
Orientation: All except upside down and vertical with the airflow downwards
Cooling: Papst 612NML or 612NMLE fan.
Comments: Forward air.

Model: NS-THE/V9FSSF B/S 28E5HS (K90036)
Input: 90-264Vac, 47-63Hz
Maximum outputs: 28V, 25A
Maximum output power: 700W
Orientation: All except upside down and vertical with the airflow downwards
Cooling: Standard fan, forward airflow

Model: Vega 450 ASS5FW 12.1C3S 3.33C1S 5.05B1HS 5.25/12.1H1H/3SR (K40089)
Input: 90-264Vac, 47-63Hz
Outputs: 12.1V, 9.5A; 3.3V, 9A; 5.05V, 20A; 12.1V, 2A; 5.25V, 4.7A (294.53W)
Orientation: All except upside down and vertical with the airflow downwards
Cooling: Papst 612NMLE fan, reverse air

Model: Vega 650 ASS5FW 3.35C1Y5S 12.6/5.1H3/1HSR 6.1/12.6H2/3SR 5.1/5.3H1H/1HSR (K60162)
Input: 90-264Vac, 47-63Hz
Maximum outputs: 3.35V, 22A; 5.1V, 3.5A; 12.6V, 7A; 12.6V, 1A; 6.1V, 3A; 5.3V, 3A; 5.1V, 6.5A (259.7W)
Orientation: All except upside down and vertical with the airflow downwards

Cooling: Papst 612NMLE fan, reverse air

Model: NS-MEL/V4FSS B/S 12/12H3/3S 6.7B2S 3.3C1SN (K40110)
Input: 90-264Vac, 47-63Hz
Maximum output: 12V, 10A; 12V, 6A; 6.7V, 25A; 3.3V, 35A
Maximum output power: 450W
Orientation: All except upside down and vertical with the airflow downwards
Cooling: Standard fan, forward airflow.
Comments: Fan grill not fitted.

Model: NS-WKR/V4AFS 5/5H1H/1HFN 12/12H3/3F 5/5H1H/1HFN 28/25H5/4F (K40107)
Input: 90-264Vac, 47-63Hz
Maximum outputs: 5.5V, 2.5A; 5.5V, 2.5A; 12.5V, 2.5A; 12.5V, 2.5A; 5.5V, 2.5A; 5.5V, 2.5A; 28V, 1.5A; 26V, 1.5A
Maximum output power: 198.5W
Orientation: All except upside down and vertical with the airflow downwards
Cooling: Papst 612NML or 612NMLE fan.
Comments: Forward air.

Model: NS-TLG/V6RFS 3.3F1SV5 24C5S W5FSV3 W8FSV8 (K60221*) where * may be any number of letters and/or numbers indicating non-safety related differences.
Input: 100-240Vac nom, 120-350Vdc max
Maximum output power: As standard model
Orientation: As standard model
Cooling: Reverse air.

Model: NS-TLG/V6RFS12FW 3.3F1SV5 24C5S W5FSV3 W8FSV8 (K60220*) where * may be any number of letters and/or numbers indicating non-safety related differences.
Input: 100-240Vac nom. May also have 120-350Vdc.
Maximum output power: As standard model
Orientation: As standard model
Cooling: Reverse air.

Model: NS-LAM/V6RFS 3.3F1SV5 12/12H3/3S W5FSV3 W8FSV8 (K60184*) where * may be any number of letters and/or numbers indicating non-safety related differences.
Input: 100-240Vac nom. May also have 120-350Vdc.
Maximum output power: As standard model
Orientation: As standard model
Cooling: Reverse air.

Model: NS-TLC/V9QSLF 24C5SN 12Z20S (K90064*) where * may be any number of letters and/or numbers indicating non-safety related differences.
Input: 100-240Vac nom. See table below for details
Maximum output power: See table below for details
Orientation: As standard model.

OP1 V	OP1 A max	OP2 V	OP2 A max	AMB max	LINE V min	STBY V	STBY mA	POWER W max
24	7	12	50	40	150	5	100	773
24	2.084	12	50	40	90	5	100	655
24	7	12	46.67	50	150	5	100	733
24	3.75	12	46.67	50	90	5	100	655
24	7	12	60	40	150	5	100	893

24	0	12	60	40	90	5	100	725

Model: NS-TLU/V9FSLF 5.2/5.2H1H/1H 24D5SN 24D5SN (K90056*) where * may be any letter (except A or B) indicating non-safety related differences.
5.2/5.2H1H/1H channel 1 current limit increased to 150% (18A).

Technical Considerations

- Equipment mobility : for building-in
- Connection to the mains : Connection to mains via host equipment.
- Operating condition : continuous
- Access location : For building in
- Over voltage category (OVC) : OVC II
- Mains supply tolerance (%) or absolute mains supply values : See Ratings on page 2 and Model Differences for details
- Tested for IT power systems : Yes, Norway only.
- IT testing, phase-phase voltage (V) : 230Vac
- Class of equipment : Class I (earthed)
- Considered current rating of protective device as part of the building installation (A) : 20A branch circuit
- Pollution degree (PD) : PD 2
- IP protection class : IP X0
- Altitude of operation (m) : 5000m excluding IEC60320 inlet and/or cooling option D or E (Papst fan 622HH) which has a 3000m rating
- Altitude of test laboratory (m) : 64m
- Mass of equipment (kg) : 2.5kg maximum
- The equipment was evaluated for operation at a maximum of 5000m, excluding the IEC60320 inlet and cooling options d and e which are rated up to 3000m. The requirements of table IEC60664-1 table A.2 were applied for calculating the required clearances.
- The product was submitted and evaluated for use at the maximum ambient temperature (Tma) permitted by the manufacturer's specification of: 50°C
- The product is intended for use on the following power systems: IT (Norway only), TN
- The product was investigated to the following additional standards: EN 60950-1:2006+A1:2010+ A11:2009+A12:2011 (which includes all European national differences, including those specified in this test report). UL 60950-1 2nd Ed. Revised 2011-12-19, CSA C22.2 No. 60950-1-07 +A1:2011.
- 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

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:

- The following Production-Line tests are conducted for this product: Electric Strength Earthing Continuity

- The end-product Electric Strength Test is to be based upon a maximum working voltage of: AC mains supply Primary-Earthed Dead Metal: 298Vrms, 392Vpk , Primary-SELV: 328Vrms, 504Vpk. DC mains supply:- Primary to earth 560Vpk, 383Vrms. Primary to secondary, 563Vpeak, 350Vrms
- The following secondary output circuits are SELV: See SELV and outputs connected in series comment under model differences.
- The following secondary output circuits are at hazardous energy levels: O/P Modules B2, C3, C4, C5, D1H, D2, D3, D4, D5, E1, E2, E3L, E3H, E4, E5L, E5H, F1, F2, W5, W8, HH5/3, C5B4, Z2, Z3, Z4, Z6, Z7, Z18, ,
- The power supply terminals and/or connectors are: Suitable for factory wiring only
- 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 magnetic devices (e.g. transformers or inductor) are provided with an OBJY2 insulation system with the indicated rating greater than Class A (105°C): Main barrier transformer OBJY3: Class F. Primary option transformer OBJY3: Class F.
- The following end-product enclosures are required: Mechanical, Fire, Electrical

Additional Information

Customer Air Cooling (option C):

The following method must be used for determining the safe operation of PSUs when C option (Customer Air) is fitted, i.e. fan not fitted to PSU.

For PSUs cooled by customer supplied airflow the components listed in the following table must not exceed the temperatures given. Additionally ratings specified for units with an internal fan must still be complied with, e.g. mains input voltage range, maximum output power, ampere turns, module voltage / current ratings and maximum ambient temperature. To determine the component temperatures the heating tests must be conducted in accordance with the requirements of the standards this report complies with. 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 stabilised.

Circuit Ref.	Description		Max. Temp. (°C)
-	Power transformer.		130
T1, TX101, TX201	Module (I) transformer		130
XT1, XQ1, XTR1	D, E, EV, F & FV		
	Option transformers	90	
TX1	xEW and xFW		
	Option transformer		130
L1, L2, XT601	Choke winding		130
L4, T2	Choke winding		120
Various	All other choke &		

	transformer windings	130
RLY1	Relay	100
Various	X capacitor	100
Various	Electrolytic capacitors	105

Marking labels are representatives of all models covered by this report.

This report is a reissue of CBTR Ref. No. E135494-A80-CB-2 dated 2012-07-30 with E135494-A80-CB-2 amendment 1 dated 2013-10-31, CB Test Certificate Ref. No. DK-27313-A1-UL dated 2013-10-31, due to upgrade to IEC 60950-1 2nd Edition + Amd 2.

Based on previously conducted testing and the review of product construction, only limited testing of the Vega AC was considered necessary for the following revisions:
1. Enclosures updated;
2. Adding/removing alternates, making corrections and updating component Certificates in the Critical Components list;
3. Adding non-standard model K90064x. (thermal testing).

Additional Standards

The product fulfills the requirements of: CSA C22.2 No. 60950-1-07 + A1+ A2 :2014, EN 60950-1:2006 + A1:2010 + A11:2009 + A12:2011 + A2:2013, UL 60950-1 2nd Ed. Revised 2014-10-14

Markings and instructions

Clause Title	Marking or Instruction Details
1.7.1 Power rating - Ratings	Ratings (voltage, frequency/dc, current)
1.7.1 Power rating - Company identification	Listee's or Recognized company's name, Trade Name, Trademark or File Number
1.7.1 Power rating - Model	Model Number
1.7.6 Fuses - Non-operator access/soldered-in fuses	Unambiguous reference to service documentation for instructions for replacement of fuses replaceable only by service personnel

Special Instructions to UL Representative

Both full assemblies and sub-assemblies of the Vega AC series as described below, are made at either TDK-Lambda UK Ltd. or TRIO Engineering Co. Ltd, .

Sub-assemblies built at TRIO Engineering Co. Ltd. are to be constructed in accordance with this Follow-Up Service Procedure. Sub-assemblies sent to final assembly locations shall be marked with a yellow dot. This identification code is to indicate to the field representative at the final assembly locations that the sub-assemblies were inspected in TRIO Engineering Co. Ltd.. If variations are found, the code shall be removed