

# CERTIFICATE OF COMPLIANCE

**Certificate Number** 20180425-E139109  
**Report Reference** E139109-A6008-UL  
**Issue Date** 2018-APRIL-25

**Issued to:** XP POWER L L C  
15641 RED HILL AVE, SUITE 100  
TUSTIN CA 92780

**This is to certify that  
representative samples of**

COMPONENT - POWER SUPPLIES FOR USE WITH  
AUDIO/VIDEO, INFORMATION AND COMMUNICATION  
TECHNOLOGY EQUIPMENT


See addendum page for models.

Have been investigated by UL in accordance with the  
Standard(s) indicated on this Certificate.

**Standard(s) for Safety:** UL 62368-1 and CAN/CSA C22.2 No. 62368-1-14,  
(Audio/video, information and communication technology  
equipment Part 1: Safety requirements)

**Additional Information:** See the UL Online Certifications Directory at  
[www.ul.com/database](http://www.ul.com/database) for additional information

Only those products bearing the UL Certification Mark should be considered as being covered by UL's  
Certification and Follow-Up Service.

The UL Recognized Component Mark generally consists of the manufacturer's identification and catalog  
number, model number or other product designation as specified under "Marking" for the particular  
Recognition as published in the appropriate UL Directory. As a supplementary means of identifying products  
that have been produced under UL's Component Recognition Program, UL's Recognized Component Mark:  
, may be used in conjunction with the required Recognized Marks. The Recognized Component Mark is  
required when specified in the UL Directory preceding the recognitions or under "Markings" for the individual  
recognitions.

Recognized components are incomplete in certain constructional features or restricted in performance  
capabilities and are intended for use as components of complete equipment submitted for investigation rather  
than for direct separate installation in the field. The final acceptance of the component is dependent upon its  
installation and use in complete equipment submitted to UL LLC.

Look for the UL Certification Mark on the product.



Bruce Mahrenholz, Director North American Certification Program  
UL LLC

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contact a local UL Customer Service Representative at <http://ul.com/aboutul/locations/>



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This is to certify that representative samples of the product as specified on this certificate were tested according to the current UL requirements.

**Models:**

AC-DC Power Supply, model: HPD4K5TSXXX Series, where XXX can be 025, 050, 075 or 150.



Bruce Mahrenholz, Director North American Certification Program  
UL LLC

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## UL TEST REPORT AND PROCEDURE

<b>Standard:</b>	UL 62368-1, 2nd Ed, 2014-12-01 (Audio/video, information and communication technology equipment Part 1: Safety requirements) CAN/CSA C22.2 No. 62368-1-14, 2nd Ed (Audio/video, information and communication technology equipment Part 1: Safety requirements)
<b>Certification Type:</b>	Component Recognition
<b>CCN:</b>	QQJQ2, QQJQ8 (Power Supplies for Use in Audio/Video, Information and Communication Technology Equipment)
<b>Complementary CCN:</b>	QQGQ2, QQGQ8(Power Supplies for Information Technology Equipment Including Electrical Business Equipment)
<b>Product:</b>	AC-DC Power Supply
<b>Model:</b>	HPD4K5TSXXX Series, where XXX can be 025, 050, 075 or 150. Input: 200-240 Vac, 3-Phase (3W+PE), 50/60 Hz, 17.5A Max Per Phase
<b>Rating:</b>	Output: See model differences for Output Ratings by Model.
<b>Applicant Name and Address:</b>	XP POWER L L C 15641 RED HILL AVE, SUITE 100 TUSTIN CA 92780 UNITED STATES

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.

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Prepared By: Gregory Ray / Project Handler      Reviewed By: Walid Beytoughan / Reviewer

Issue Date: 2018-04-23  
2018-07-31

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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**

HPD4K5TSXXX Series is a 3-Phase AC to DC isolating power supply for building-in. The power supply employs three PSUs (HPD1K5PSXX) with up to a 4500 watt rated output is provided with a metal enclosure housing and several PWBs with various critical components intended for use in Information Technology Equipment. The main output is considered ES3 and PS3 circuits. Standby output for all models is 5Vdc and is considered ES1, PS1 circuit.

**Model Differences**

All models provided within the series are identical with exception to the output rating, mains transformer windings and minor secondary components.

Model HPD4K5TSXXX Series, where XXX can be 025, 050, 075, or 150, designating max. output voltage.

Model No.	Voltage (Vdc)	Max. Current (A)	Max. Power (W)
		Input Rated: 200-240Vac	
HPD4K5TS025	5-25	188	4500.0
HPD4K5TS050	10-50	94	4500.0
HPD4K5TS075	7.5-75	62.5	4500.0
HPD4K5TS150	15-150	31.5	4500.0

Stand-by Output for all models: 5Vdc, 1A.

**Test Item Particulars**

Classification of use by:	Skilled Person
Supply Connection:	AC Mains
Supply % Tolerance:	+10%/-10%

Supply Connection – Type:	Other : For Building-In
Considered current rating of protective device as part of building or equipment installation:	30 A; Installation location: building
Equipment mobility:	for building-in
Over voltage category (OVC):	OVC II
Class of equipment:	Class I
Access Location:	N/A
Pollution degree (PD):	PD 2
Manufacturer's specified maximum operating ambient:	The product was submitted and evaluated for use at the maximum ambient temperature (Tma) permitted by the manufacturer's specification of: 50°C for 100% load at forced air cooling condition and 70°C for 50% load.
IP protection class:	IPX0
Power Systems:	TN
Altitude during operation (m):	5000 m
Altitude of test laboratory (m):	17 m
Mass of equipment (kg):	8.5kg

**Technical Considerations**

- Considered current rating of protective device as part of the building installation (A) : 30
- The product is intended for use on the following power systems : TN
- Mains supply tolerance (%) or absolute mains supply values : +10%/-10%
- The equipment disconnect device is considered to be:  
: N/A
- The product was submitted and evaluated for use at the maximum ambient temperature (Tma) permitted by the manufacturer's specification of : The product was submitted and evaluated for use at the maximum ambient temperature (Tma) permitted by the manufacturer's specification of: 50°C for 100% load at forced air cooling condition and 70°C for 50%load.
- According to IEC60664-1, Table A2, required Clearances have been adjusted by multiplying the clearance at sea level by a factor of 1.48 for operating at an altitude of 5000 meters for all countries. The correction factor is based on barometric pressure of 70kPa and Overvoltage Category II. If the calculated Clearance exceeded the Creepage, the Creepage was adjusted to the value of clearance. No other additional requirements were considered at this time as they are not explicitly addressed in UL/IEC 60950-1.
- The internal wiring is certified Appliance Wiring Material rated VW-1 and/or FT-1 which were considered equivalent to the tests of IEC60332-1-2 and IEC60332-1-3. The final acceptability of the internal wiring may be determined under the discretion of the receiving NCB.
- The power supply in this equipment was previously Certified to IEC 60950-1 and EN 60950-1. For Model HPD1K5PSXXX Series see Table 4.1.2 for details and Miscellaneous Enclosure 7-02 and 7-03 for CBTR.

**Engineer 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 output circuits are at ES1 energy levels : 5Vsb, 25Vdc, 50Vdc
- The following output circuits are at ES3 energy levels : 75Vdc, 150Vdc
- The following output circuits are at PS1 energy levels : 5Vsb
- The following output circuits are at PS3 energy levels : 25Vdc, 50Vdc, 75Vdc, 150Vdc
- The maximum investigated branch circuit rating is:  
: 30 A
- The investigated Pollution Degree is:  
: 2
- The power supply was evaluated to be used at altitudes up to:  
: "5,000 m"
- The equipment is suitable for direct connection to:  
: AC mains supply
- The following end-product enclosures are required:  
: Mechanical, Electrical, Fire
- The following product-line tests are conducted for this product : Earthing Continuity and Electric Strength
- The end-product Electric Strength Test is to be based upon a Mains Transient Voltage of 2500Vdc for Basic and 4000Vdc for Reinforced.
- The fans provided in this sub-assembly are provided with fan guards that are integral to the chassis to reduce the risk of operator contact with the stator.
- An investigation of the protective earthing connection has been conducted. All units must be connected directly to the building mains protective earthing connection.
- Suitable 20A, 250V rated external current protective devices shall be provided as part of the end-product installation.
- To provide a suitable mains input for units installed outside the U.S., a step down transformer shall be considered for the rated input voltage.

#### **Additional Information**

Component licenses provided may be older than 3 years old. Manufacturer to provide updated license upon request.


Nameplate markings provided were considered representative of the entire series. Testing of the marking label for durability was conducted previously for this manufacturer as part of CBTR E139109-A141, CBTC US-24246-UL.

Correction 1 - No testing was considered necessary to correct this report as follows

- 1 - Correction - added the previously omitted Condition of Acceptability that a suitable 20 A 250 V fuse must be provided as part of the end product installation
- 2 - Correction - added the previously omitted Condition of Acceptability that states a suitable transformer shall be provided outside of the US/Canada in order to provide the correct voltage to the device
- 3 - Correction - revised Clause 5.6.4.3 to state that two 20 fuses are provided on each of the previously certified component power supplies utilized
- 4 - Correction - revised the frequency on the Minimum Clearance/Creepage table from 0.006 to 0.06 kHz.
- 5 - Correction - revised the voltage on the Earthed Accessible conductive part table from 528Vac to 264Vac
- 6 - Correction - revised the photos of the unit due to a publishing error, the photos now represent the EUT.
- 7 - Correction - revised the critical components table due to various errors
- 8 - Correction - revised report to say additional evaluated to EN62368-1:2014+A11:2017
- 9 – Correction – Added missing enclosures

#### **Additional Standards**

The product fulfills the requirements of: EN 62368-1:2014+A11:2017, UL 62368-1 2nd Ed, Issued December 1, 2014, CSA CAN/CSA-C22.2 NO. 62368-1 2nd Ed, Issued December 1, 2014, UL 60950-1, 2nd Ed, Revised October 14, 2014, , CSA CAN/CSA-C22.2 NO. 60950-1 2nd Ed, Revised October 14, 2014

<b>Markings and Instructions</b>	
<b>Clause Title</b>	<b>Marking or Instruction Details</b>
F.3.2.1 Equipment identification marking – Manufacturer identification	Listee's or Recognized company's name, Trade Name, Trademark or File Number
F.3.2.2 Equipment identification marking – model identification	Model Number
F.3.3 Equipment rating marking – ratings	"Input Ratings (voltage, frequency/dc, current/power)", "Output Ratings (voltage, frequency/dc, current/power)"
F.3.5.3 Fuses – replaceable by skilled person	F1, F2 and F3, Ratings , "Ratings (____A, ____V)", and (symbol of required characteristics) located on or adjacent to fuse or fuseholder or in service manual.
F.3.6.1.1 Class I equipment - Terminal for main protective earthing	Provided adjacent to the main protective earthing terminal  (IEC 60417-5019)
<b>Special Instructions to UL Representative</b>	
N/A	



<b>BD1.0</b>	<b>TABLE: Product-Line Testing Requirements</b>						—
<b>BD1.1</b>	<b>Electric Strength Test Special Constructions – Refer to Generic Inspection Instructions, Part AC for further information.</b>						
Model	Component	Removable parts	Test probe location	Test V rms	Test V dc	Test Time, s	
HPD4K5TSXX X Series	N/A	N/A	Primary/Chassis	1770	2500	1	
HPT5K0TSXX X Series	N/A	N/A	Primary/Secondary	2800	4000	1	
<b>BD1.2</b>	<b>Earthing Continuity Test Exemptions – This test is not required for the following models:</b>						
	-						
<b>BD1.3</b>	<b>Electric Strength Test Exemptions – This test is not required for the following models:</b>						
	-						
<b>BD1.4</b>	<b>Electric Strength Test Component Exemptions – The following solid-state components may be disconnected from the remainder of the circuitry during the performance of this test.</b>						
	GT101						
<b>Sample and Test Specifics for Follow-Up Tests at UL</b>							
Model	Component	Material	Test	Sample (s)	Test Specifics		

4.1.2	TABLE: List of critical components					Pass
Object / part No.	Manufacturer/ trademark	Type / model	Technical data	Product Category CCN(s)	Mark(s) of conformity	Supplement ID
Model HPD4K5 Series	-	-	Consists of an Input/EMI Board, employing three Main PSU with a Control Board (PSU3 is located next to the Output Logic Board), and Output Logic Board mounted inside a metal Enclosure.	-	-	

Chassis	Interchangeable	Metal	<p>Galvanized steel sheet. Overall 38.2 by 16.7 by 10.8 cm, min 1 mm thick. Top cover secured to bottom enclosure by screws.</p> <p>Provided with the following openings:</p> <p>Front Panel: Provided with Ventilation Openings; numerous hexagonal ventilation openings, max 7 mm diagonal, spaced min. 1.4 mm apart. Provided with earth stud, min. 3.7 mm O.D.; provided with Front Busbar Opening: Approx. 49.3 by 42 mm; provided with Terminal Block (TB1) opening, approx. 45.8 by 22.8 mm; provided with Signal Connector (J1) opening, approx. 24 by 10 mm.</p> <p>Rear Fan Openings: Two provided. Consists of three concentric circular openings, outer circular opening dia. approx. 57.5 mm, middle circular opening dia. approx. 37.6 mm, and inner</p>	-	Evaluated as part of this investigation	
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Fan	Sunon Inc	VF60381B1 Series (VF60381B1-000U-G9H)	Two provided, rated 12Vdc, 12W (min. 54.1 CFM). Fan wire provided with insulated sleeving.	GPWV2, GPWV8 (E77551)	UL	
Fan – Alternate	Interchangeable	Interchangeable	Two provided, rated 12Vdc, 12W (min. 54.1 CFM). Fan wire provided with insulated sleeving.	GPWV2, GPWV8	UL	
Input/EMI PWB	Interchangeable	Interchangeable	Rated V-0, 130°C, rated for direct support of live parts	ZPMV2	UL	
Insulator Sheet	Formex	Formex GK	Rated V-1, min. 115°C, min 0.25 mm thick. provided between Input/EMI PWB and Chassis Enclosure bottom. See Enclosure 4-02 for details.	QMFZ2 (E121855)	UL	
Terminal Block (TB1)	Dinkle Enterprise Co Ltd	DT-7C Series (DT-7C-B14W-03)	Rated min. 600V, min. 40A, 3 position	XCFR2 (E102914)	UL	
Y-Capacitors (C1,C2,C3)	Murata Mfg Co Ltd	KX Series	Rated max. 22 pF, min. 250V, marked "Y1".	FOWX2 (E37921)	UL, cUL	
Y-Capacitors (C1,C2,C3) - Alternate	TDK-EPC Corp	CD Series	Rated max. 22 pF, min. 250V, marked "Y1".	FOWX2, (E37861)	UL, cUL	
Y-Capacitors (C1,C2,C3) - Alternate	Vishay Electronic GMBH	VY1 or VKP Series	Rated max. 22 pF, min. 250V, marked "Y1".	FOWX2, FOWX8 (E183844)	UL, cUL	
Bleeder Resistors (R1,R2,R3,R4,R5,R6)	Interchangeable	Interchangeable	Rated min. 150k ohm, 1W.	AZOT2	UL	

X-Capacitors (C4,C5,C6)	Xiamen Faratronic Co Ltd	MKP61R (C40 Series) or MKP62 (C42 Series)	Rated 1uF, min. 250V, marked "X2".	FOWX2, FOWX8 (E186600)	UL, cUL	
X-Capacitors (C4,C5,C6) - Alternate	Illinois Capacitor Inc.	MKP Series	Rated 1uF, min. 250V, marked "X2".	FOWX2, FOWX8 (E317135)	SEMKO (Lic.# SE/07119)	
Inductor (Common Mode) (L1)	XP Power	1000xxxx (where x can be any number from 0 to 9). Part no. 10021971 represents entire series	Toroidal. Copper Magnet Wire, (OBMW2), rated min. 130°C, wound on ferrite core. Overall approx. 33.2 dia x 19.3 mm wide. Secured to PWB using Toroid base, plastic, (QMFZ2), rated min. V-0, min. 105°C and wire ties. See Enclosure 4-03 for details. Provided with insulated sleeving. See Insulating Sleeving/Tubing for details. Provided with outer wrap. See Inductor – Outer Wrap for details.	-	-	
Inductor Outer Wrap	3M Corp	1350F Series	Rated 130°C. Polyester film tape, min. 0.25mm thick.	OANZ2 (E17385)	UL	
Inductor Outer Wrap - Alternate	Jingjiang Yahua Pressure Sensitive Glue Co Ltd	CT (CT286)	Rated 130°C. Polyester film tape, min. 0.25mm thick.	OANZ2 (E165111)	UL	
Main PSU (3 provided)	-	-	-	-	-	

Base Panel	Interchangeable	Interchangeable	U-shaped, approx. 28.9 by 9.9 by 4.3 by 3.9 cm by min. 1.2 mm thick. Secured to bottom of Enclosure by screws.	--	--	
Main Board	Interchangeable	Interchangeable	Rated V-0, 130°C, rated for direct support of live parts	ZPMV2	UL	
Inductor (L9)	-	-	Not used.	-	-	
Inductor (L3)	XP Power	10010647	Toroidal. Copper Magnet Wire (OBMW2), rated min. 130°C, wound on ferrite core. Overall approx. 13.1 mm by 10.4 mm. See Enclosure 4-20 for details.	-		
Inductor (L3) - Outer Wrap	3M	1350 or 1298	Rated min. 130°C.			
Y-Capacitors (C1,C2) - Optional	Murata Mfg Co Ltd	KX Series	Rated max. 150 pF, min. 250V, marked Y1.	FOWX2 (E37921)	UL, cUL	
Y-Capacitors (C1,C2) – Optional - Alternate	TDK-EPC Corp	CD Series	Rated max. 150 pF, min. 250V, marked Y1.	FOWX2, (E37861)	UL, cUL	
Y-Capacitors (C1,C2) - Optional - Alternate	Vishay Electronic GMBH	VY1 or VKP Series	Rated max. 150 pF, min. 250V, marked Y1.	FOWX2, FOWX8 (E183844)	UL, cUL	
X-Capacitor	Okaya Electric Industries Co Ltd	LE Series	Rated max. 1 uF, min. 250V, marked X2.	FOWX2, FOWX8 (E47474)	UL, cUL	

Fuses (F1, F2)	Littelfuse Inc	324 series	Type 3AB, Fast acting, rated 20 A, 250V, 125°C. Provided with sleeving, see Insulating Sleeving for details, over the fuse body.	JDYX2, JDYX8 (E10480)	UL, cUL	
Fuses (F1, F2) - Alternate	Hollyland Co. Ltd	65TS (P) series	Slow acting, rated 20 A, 250V, 125°C. Provided with sleeving, see Insulating Sleeving for details, over the fuse body.	JDYX2, JDYX8 (E156471)	UL, cUL	
Fuses (F1) - For Models with -SF suffix.	-	-	Not provided.	-	-	
Bleeder Resistors (R1, R2)	Interchangeable	Interchangeable	Rated 150 kohm, 1.0W. Secured to bottom of the Printed Wiring Board.	-		
Y-Capacitors (C5,C6,C8,C9) - Optional	Murata Mfg Co Ltd	KX Series	Rated max. 680pF, min. 250V, 125°C, marked Y1.	FOWX2 (E37921)	UL, cUL	
Y-Capacitors (C5,C6,C8,C9) Optional – Alternate	Kemet Electronics OY (Evov Rifa)	ERP (ERP610 Series)	Rated max. 3300 pF, min. 250V, marked Y1.	FOWX2 (E73869)	UL, cUL	
Y-Capacitors (C5,C6,C8,C9) – Optional - Alternate	TDK-EPC Corp	CD Series	Rated max. 3300 pF, min. 250V, marked Y1.	FOWX2, (E37861)	UL, cUL	
Y-Capacitors (C5,C6,C8,C9) – Optional - Alternate	Vishay Electronic GMBH	VY1 or VKP Series	Rated max. 3300 pF, min. 250V, marked Y1.	FOWX2, FOWX8 (E183844)	UL, cUL	

X-Capacitor(C4,C10)	Okaya Electric America Inc	LE Series (LE225-M-XT)	Rated max. 2.2uF, min. 250V, marked "X2"	FOWX2, FOWX8	UL, cUL	
X-Capacitor (C4,C10) - Alternate	Epcos Electronic Components S A	B3292 Series	Rated max. 2.2uF, min. 250V, marked "X2"	FOWX2, FOWX8 (E97863)	UL, cUL	
X-Capacitor (C4,C10) - Alternate	Panasonic Corp	ECQUA or ECQUL	Rated max. 2.2uF, min. 250V, marked "X2"	FOWX2, FOWX8 (E62674)	UL, cUL	
X-Capacitor (C4,C10) - Alternate	Vishay Capacitors Belgium N V	F1772 or F1778 MKP336, MKP338 Series	Rated max. 2.2uF, min. 250V, marked "X2"	FOWX2, FOWX8 (E354331)	UL, cUL	
X-Capacitor (C4,C10) - Alternate	Vishay Capacitors Belgium N V	F1774	Rated max. 2.2uF, min. 250V, marked "X2"	FOWX2, FOWX8 (E100682)	UL, cUL	
X-Capacitor (C4,C10) - Alternate	Xiamen Faratronic Co Ltd	MKP61R (C40 Series)	Rated 2.2uF, min. 250V, marked "X2"	FOWX2, FOWX8 (E186600)	UL, cUL	
X-Capacitor (C4,C10) - Alternate	Xiamen Faratronic Co Ltd	MKP62 (C42 Series)	Rated max. 2.2uF, min. 250V, marked "X2"	FOWX2, FOWX8 (E186662)	UL, cUL	
Inductor (L1,L2) (Common Mode)	XP Power LLC	Interchangeable (1000xxxx, where x can be any number from 0 to 9). Part no. 10006980 represents entire series	Toroidal. Copper Magnet Wire (OBMW2), rated min. 130°C, wound on ferrite core. Overall approx. 32 mm by 18 mm. See Enclosure 4-21 for details.	-		
Inductor (L1,L2) - Outer wrap	3M	1350	2 layers minimum. Rated min. 130°C.	OANZ2 (E17385)	UL	



Heatsink (HS3)(PRI)	Interchangeable	Copper Alloy	L-shape, one provided. Overall 14.6 cm by 36.2 mm by 12.9 mm, min. 2 mm thick, secured to Printed Wiring Board using screws and bonded to Chassis. Provided with insulating tape to provide Basic insulation between RT1 and the heatsink, see HS3 Insulating tape for details. Provided with Insulating Sheet, see Heatsink (HS3) Insulating Sheet for details, between mounted components and heat sink. See Enclosure 4-26 for details.	-		
Heatsink (HS3) – Insulating Tape	Interchangeable	Interchangeable	Min V-1	OANZ2	UL	
Heatsink Insulating Sheet (HS3)	Bergquist Co.	K4 (Sil-pad) or SPT1000	Overall 25.4 by 114 mm, min. 0.18 mm thick, V-0, min. 150°C. Provides Basic insulation between Heatsink and primary components.	QMFZ2 (E59150)	UL	

Diode Bridge (BR1)	Rectron	RS3505 Series	Rated 35A, min. 600V, 150°C max. V-0 (Component body evaluated for isolation voltage up to 2500 Vac). Secured to Heatsink (HS3) using washer and screw.	QQQX2 (E252754)	UL	
Diode Bridge (BR1) - Alternate	Interchangeable	Interchangeable	Rated 35A, min. 600V, 150°C max. V-0 (Component body evaluated for isolation voltage up to 1500 Vac). Secured to Heatsink (HS3) using washer and screw.	QQQX2	UL	
Relay (K1)	Tyco Electronics	RTD34012	SPST, rated min. 16A, min. 250Vac contact, min. ambient 85°C (single contact).	NLDX2 (E214025)	UL	
Thermistor (RT1)	Interchangeable (Ametherm)	Interchangeable (SL18 Series)	Rated 16 ohms, 4A, 180°C. (Not relied for safety)	-	-	
Inductors (L4, L5) (PFC)	XP Power LLC	Interchangeable (1000xxxx, where x can be any number from 0 to 9). Part no. 10007715 represents entire series	Toroidal. Copper Magnet Wire (OBMW2), rated min. 155°C, wound on ferrite core. Overall dimension 30 by 26 by 25.5 mm. See Enclosure 4-19 for details.	-		

Inductor (L6) (Resonant)	XP Power LLC	Interchangeable (1000xxxx, where x can be any number from 0 to 9). Part no. 10005406 represents entire series	Toroidal. Copper Magnet Wire (OBMW2), rated min. 155°C, wound on ferrite core., overall dimension 20.0mm by 7mm. See Enclosure 4-18 for details.	-		
Heatsink (HS1,HS2)(PRI)	Interchangeable	Copper alloy	L-shape, 2 provided. Overall 9.15 cm by 3.4 cm by 1.3 cm, min. 2.6 mm thick, secured to main PWB by screws. Provided with Insulating Sheet, see Heat Sink Insulating Sheet for details, between mounted components and heat sink.	-		
Heat Sink Insulating Sheets (HS1,HS2)	Bergquist Co.	PPK-4 (K4) (Sil-pad) or SPT1000	Overall 25.5 by 93 mm, min. 0.18 mm thick, V-0, min. 150°C. Provided between Heatsink (HS1, HS2) and Q5-Q8, Q2, Q3; D5, D6)	QMFZ2 (E59150)	UL	
Transistors (Q2, Q3, (Primary)	Infineon Tech	SPW47N60C3X	Rated min. 47A, min. 600V. Secured to Heatsink (HS2) with screw	-		
Transistor (Q2, Q3, (Primary) - Alternate	Interchangeable	Interchangeable	Rated min. 47A, min. 600V. Secured to Heatsink (HS2) with screw.	-		

Diodes (D5, D6) (Primary)	Diodes Inc	1N5406-B	Rated min. 6A, min. 600V. Secured to Heatsink (HS2) with screw.	-		
Diodes (D5, D6) (Primary) - Alternate	Interchangeable	Interchangeable	Rated min. 6A, min. 600V. Secured to Heatsink (HS2) with screw.	-		
Transistor (Q5-Q8, (Primary) - Alternate	Interchangeable	Interchangeable	Rated min. 47A, min. 600V. Secured to Heatsink (HS1) with screw.	-		
Transistor (Q4) (Primary)	Interchangeable	Interchangeable	Rated min. 2.16 A, min. 600V. Secured to HS1 by screw.	-		
Y-Capacitor (C107) - Optional	Murata Mfg Co Ltd	KX series	Rated max. 4700 pF, marked "Y1". Body and lead provided with Insulating Sleeving, see Insulating Sleeving for details.	FOWX2 (E37921)	UL, cUL	
Y-Capacitor (C107) - Optional - Alternate	Panasonic Corp	TS (ECK Series)	Rated max. 4700 pF, marked "Y1". Body and lead provided with Insulating Sleeving, see Insulating Sleeving for details.	FOWX2 (E62674)	UL	
Y-Capacitor (C107) - Optional - Alternate	Kemet Electronics OY (Evov Rifa)	ERP (ERP610 Series)	Rated max. 4700 pF, marked "Y1". Body and lead provided with Insulating Sleeving, see Insulating Sleeving for details.	FOWX2, FOWX8 (E73869)	UL, cUL	

Y-Capacitor (C107) - Optional - Alternate	TDK-EPC Corp	CD Series	Rated max. 4700 pF, marked "Y1". Body and lead provided with Insulating Sleeving, see Insulating Sleeving for details.	FOWX2, FOWX8 (E183844)	UL, cUL	
Y-Capacitor (C107) - Optional - Alternate	Vishay Electronic GMBH	VY1 Series	Rated max. 4700 pF, marked "Y1". Body and lead provided with Insulating Sleeving, see Insulating Sleeving for details.	FOWX2, FOWX8 (E183844)	UL, cUL	
Electrolytic Capacitor (C22,C23,C24,C33) (PRI)	Interchangeable	Interchangeable	Provided with integral pressure relief, rated min. 400V, min. 105°C	-		
Fuse (F5)	Littelfuse Inc.	R251 series	Rated 7A, 125V, Type Pico II, fast acting, min. 125°C. (Not relied upon for safety)	JDYX2 (E10480)	UL	
Transformer (T1) (Bias)	XP Power LLC	Interchangeable (1000xxxx, where x can be any number from 0 to 9). Part no. 10005437 represents entire series	Open type. Rated Class F (155°C), see Insulation System for details. See Enclosure 4-14 for details.	-		
Power Transformer (T2) - For Model HPD4K5TS025 and HPD4K5TS075	XP Power LLC	10008320	Rated Class F (155°C), see Insulation System for details. See Enclosures 4-15, 4-22 for details.	-		

Power Transformer (T2) - For Models HPD4K5TS050 and HPD4K5TS150	XP Power LLC	10006304	Rated Class F (155°C), see Insulation System for details. See Enclosures 4-15, 4-22 for details.	-		
Insulation System (T1, T2, Control Board Transformers: T1, T3, T4)	XP Power	Class F	Class (155)F	OBJY2 (E324960)	UL	
Insulation System - Bobbin (Main board T1, T2 only)	DuPont	FR530 (Rynite)	Rated V-0, 155°C, min. 0.8 mm thick.	QMFZ2 (E41938)	UL	
Insulation System - Bobbin (Main board T1, T2 only) - Alternate	Sumitomo	Sumikon PM9820, Sumikon PM9630, Sumikon PM9380, or Sumikon PM9750	Rated V-0, 155°C, min. 0.8 mm thick.	QMFZ2 (E41429)	UL	
Insulation System - Bobbin (Main board T1, T2 only) - Alternate	Chang Chun Co.	Longlite PMT373J	Rated V-0, 155°C, min. 0.8 mm thick.	QMFZ2 (E41429)	UL	
Insulation System - Insulating Tape	Permacel	256 (P256)	Rated 130°C (Evaluated as suitable in this Class F insulation system).	OANZ2 (E20392)	UL	
Insulation System - Triple Insulated Wire	Rubadue Wire Co Inc.	T-AA-X-XX-T-XXX-L (TXXA01TXXX-1.5, or TXXAXXTXXX-1.5)	Rated min. 600 V, 155°C, nominal 4.5 mil total insulation thick	OBJT2 (E206198)	UL	
Secondary Heatsinks (HS4, HS5)	Interchangeable	Copper Alloy	L-shape, 2 provided. Overall approx. 6 by 3.3 by 1.8 cm, by min. 2 mm thick, secured to Main PWB by screws.	-	-	

<p>Output Inductors (L7, L8, L10, L11) (SELV) - For Model HPD4K5TS025 and HPD4K5TS075</p>	<p>XP Power LLC</p>	<p>Interchangeable (1000xxxx, where x can be any number from 0 to 9). Part no. 10014056 represents entire series.10014056</p>	<p>Copper magnet wire wound on toroid core. Rated min. 130°C. Overall approx.. 3.1 by 1.4 cm. Provided with Inductor Base, FR-4 (QMFZ2) overall approx.. 28 by 16.5 mm by min. 0.8mm thick. .. See Enclosures 4-17, 4-23 for construction details.</p>	<p>-</p>		
<p>Output Inductors (L7, L8, L10, L11) (SELV) - For Model HPD4K5TS050 and HPD4K5TS150</p>	<p>XP Power LLC</p>	<p>Interchangeable (1000xxxx, where x can be any number from 0 to 9). Part no. 10017991 represents entire series.10017991</p>	<p>Copper magnet wire wound on toroid core. Rated min. 130°C. Overall approx.. 3.1 by 1.4 cm. Provided with Inductor Base, FR-4 (QMFZ2) overall approx.. 28 by 16.5 mm by min. 0.8mm thick. .. See Enclosures 4-17, 4-23 for construction details.</p>	<p>-</p>		
<p>Electrolytic Capacitors (C36,C41,C43,C50, C75,C89,C90,C91) (SELV)</p>	<p>Interchangeable</p>	<p>Interchangeable</p>	<p>Rated min. 16V. Provided with integral pressure relief, rated min. 105°C.</p>	<p>-</p>		
<p>Control Board</p>	<p>-</p>	<p>-</p>	<p>Consists of Transformers, Printed Wiring Board and Connectors, see Connectors and Receptacles.</p>	<p>-</p>		

Control Board PWB	Interchangeable	Interchangeable	Rated V-0, 130°C, rated for direct support of live parts	ZPMV2	UL	
Drive Transformer (T1, T3)	XP Power LLC	Interchangeable (1000xxxx, where x can be any number from 0 to 9). Part no. 10006894 represents entire series.	Toroidal Type. Rated Class F (155°C), see Insulation System for details. Secured to Control Board using RTV, see RTV for details. See Enclosures 4-29 for details.	-	Evaluated as part of this investigation	
Control Board - Current Transformer (T4)	XP Power LLC	Interchangeable (1000xxxx, where x can be any number from 0 to 9). Part no. 10006895 represents entire series.	Toroidal Type. Rated Class (155)F (130°C), see Insulation System for details. Secured to Control Board using RTV, see RTV for details. See Enclosure 4-30 for details.	-	Evaluated as part of this investigation	
Output Busbars (Main PSU)	Interchangeable	Interchangeable	Aluminum or copper, two provided. Overall (NEG) 10.5 by 2.2 cm by, min. 1.3 mm thick; (POS) 5.8 by 2.2 cm by 1.3 mm thick. Busbars are mounted to printed wiring boards using screws and spaced, min. 12 mm from each. See Enclosures 4-04, 4-05, 4-06 for construction details.	-	Evaluated as part of this investigation	



Output Busbar Series Connector – for Series Configured Main PSUs	Interchangeable	Interchangeable (P/N 10020936)	Aluminum or copper. U-shaped, overall approx. 6.4 by 4.7 cm by min. 2 mm thick. Secured to PSU Output Busbars by screws.	-		
Output Busbar Extender (PSU1) (POS) – for Series Configured Main PSUs	Interchangeable	Interchangeable (P/N 10020937)	Aluminum or copper, provided on PSU1, (POS) Bus Bar. Overall approx. 4.7 by 2.5 cm by min. 2 mm thick. Secured to PSU1 Output Busbar (POS) by screws.	-		
Output Busbar Extender (PSU3) (POS) – for Series Configured Main PSUs	Interchangeable	Interchangeable (P/N 10020938)	Aluminum or copper, provided on PSU3, (NEG) Bus Bar. Overall approx. 3.7 by 3.4 cm by min. 2 mm thick. Secured to PSU3 Output Busbar (POS) by screws.	-		
Braided Wire Busbar (POS) – for Series Configured Main PSUs	Interchangeable	Interchangeable (P/N 10020943)	Copper, overall approx.. 13.4 by 1.2 cm. Provided with Insulated Sleeving.			
Braided Wire Busbar	Interchangeable	Interchangeable (P/N 10021066)	Copper, overall approx.. 7.6 by 1.2 cm. Provided with Insulated Sleeving.			

Output Busbar Parallel Connector (POS) – for Parallel Configured Main PSUs	Interchangeable	Interchangeable (P/N 10020939)	Aluminum or copper. E-shaped, overall approx. 10.8 by 4.7 cm by min. 2 mm thick. Secured to PSU1, PSU2, PSU3 Output Busbar (POS) by screws.	-		
Output Busbar Parallel Connector (NEG) – for Parallel Configured Main PSUs	Interchangeable	Interchangeable (P/N 10020940)	Aluminum or copper. E-shaped, overall approx. 12.5 by 4.7 cm by min. 2 mm thick. Secured to PSU1, PSU2, PSU3 Output Busbar (NEG) by screws.	-		
Output Logic Board	Interchangeable	Interchangeable	Rated V-0, 130°C, rated for direct support of live parts	ZPMV2	UL	
Insulator Sheet	Formex	Formex GK	Rated V-1, min. 115°C, min 0.25 mm thick. provided between Output Logic Board and Chassis Enclosure. See Enclosure 4-01 for details.	QMFZ2 (E121855)	UL	
MOSFETs (Q1,Q2)	Interchangeable	Interchangeable	Rated min. 20A, min 500V. Provided with plastic (QMFZ2) insulator. Secured to Heatsink Plate by screws.	-	-	

Heatsink Plate	Interchangeable	Interchangeable	Aluminum, overall approx. 58 by 23 mm by 4.8 mm thick. Secured to Enclosure bottom by screw and nut.	-	-	
Busbar (INT -VO) (BB3)	Interchangeable	Interchangeable (P/N 10020927)	Aluminum or copper. Rectangular-shaped, overall approx. 38 by 19 mm by min. 2 mm thick. Provided with threaded stud. Secured to Output Logic Board by screws.	-		
Output Busbars (+Vout and -Vout) (BB1, BB2))	Interchangeable	Interchangeable	Aluminum or copper. U-shaped, overall approx. 44 by 36 by 19 mm by min. 2 mm thick. Secured to Output Logic Board by screws.	-		
RTV	Momentive Performance Materials	RTV-128	Rated HB, 105°C	QMFZ2 (E36952)	UL	
Insulating Sleeving	Tyco Electronics Corp	Versafit	Rated 600 V, 125°C, VW-1, min. 0.4 mm thick.	YDPU2 (E35586)	UL	
Insulating Sleeving - Alternate	Sumitomo Electric Fine Polymer Inc.	Sumitube F32 or B2	Rated 600 V, 125°C, VW-1, min. 0.4 mm thick.	YDPU2, YDPU8 (E48762)	UL	
Insulating Sleeving - Alternate	Interchangeable	Interchangeable	Rated 600 V, 125°C, VW-1, min. 0.4 mm thick.	UZFT2, YDPU2, YDRY2, YDTU2	UL	

Connectors and Receptacles (SELV)	Interchangeable	Interchangeable	(QMFZ2), rated min. 15 Vdc or copper alloy pins mounted in plastic, (QMFZ2), rated min. V-2.	ECBT2, RTRT2 or copper alloy pins mounted in plastic.	UL	
Printed Wiring Board	Interchangeable	Interchangeable	Rated V-0, 130°C, rated for direct support of live parts	ZPMV2	UL	
Label	Brady Worldwide Inc.	B-423	150°C, for application to aluminum	PGJI2 (MH17154)	UL	
Label – Alternate	3M	7816 or 7818	150°C, for application to aluminum. Printed with Brady R6000 ribbon and Subjected to the Durability of Markings Test	PGJI2 (MH16411) (MH17154)	UL	
Label – Alternate	Interchangeable	Interchangeable	150 °C, for application to aluminium	PGJI2 or PGDQ2	UL	
Label – Alternate	-	-	Pressure sensitive label secured by adhesive.. Subjected to the Durability of Markings Test, for application to aluminium.	-	-	
Wire Positioning Device	Interchangeable	Interchangeable	Rated min. 110°C	ZODZ2	UL	

PWB – Conformal Coating - Optional	Dow Corning	1-2577	Rated V-0, min. 130, min. 60- 120 microns. (not relied upon for reduced creepage and clearances.)	QMJU2 (E81611)	UL	
PWB – Conformal Coating – Optional – Alternate	Interchangeable	Interchangeable	Rated V-0, min. 130, min. 60- 120 microns. (not relied upon for reduced creepage and clearances.)	QMJU2	UL	

## Enclosures

Type	Supplement Id	Description
Photographs	03-01	Front Top View
Photographs	03-02	Rear Top View
Photographs	03-03	Corner View
Photographs	03-04	Internal View
Photographs	03-05	AC Input PWB Component Side
Photographs	03-06	AC Input PWB Solder Side
Photographs	03-07	Internal AC/DC Power Supply
Photographs	03-08	Output PWB Component Side
Photographs	03-09	Output PWB Solder Side
Diagrams	04-01	Insulator Output Control PWB
Diagrams	04-02	Insulator AC Input PWB
Diagrams	04-03	L1 (AC Input PWB)
Diagrams	04-04	Output Busbar (Series)
Diagrams	04-05	Output Busbar (Series) Extender
Diagrams	04-06	POS Output Busbar (Series) Extender
Diagrams	04-07	Braided Wire Busbar (POS) Series
Diagrams	04-08	Braided Wire Busbar (Parallel)
Diagrams	04-09	(POS) Busbar (Parallel)
Diagrams	04-10	(NEG) Busbar (Parallel)
Diagrams	04-11	Heatsink Plate (Output Control PWB)
Diagrams	04-12	Busbar (NEG) Control PWB INT
Diagrams	04-13	Busbar (POS/NEG) Terminals
Diagrams	04-14	Main Board T1
Diagrams	04-15	Main Board T2
Diagrams	04-16	Main Board L9
Diagrams	04-17	Main Board L7, L8, L10, L11
Diagrams	04-18	Main Board L6
Diagrams	04-19	Main Board L4 L5
Diagrams	04-20	Main Board L3
Diagrams	04-21	Main Board L1 L2
Diagrams	04-22	Main Board Alternate T2
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Diagrams	04-24	HS1
Diagrams	04-25	HS2
Diagrams	04-26	HS3
Diagrams	04-27	HS4
Diagrams	04-28	HS5
Diagrams	04-29	Control Board T1 T3
Diagrams	04-30	Control Board T4
Schematics + PWB	05-01	AC Input PWB Layouts
Schematics + PWB	05-02	Output Control PWB Layouts
Schematics + PWB	05-05	PWB layout Main Board
Schematics + PWB	05-06	PWB layout Control Board
Miscellaneous	07-01	Letter of Assurance