
APPLICATION		REVISIONS			APPROVALS	
NEXT ASSY	PROJ NO.	ECN NO.	REV	DESCRIPTION	DATE	APPROVED
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	DRAWN	HENRY HSIEH	2021-10-01			
	CHECKED					
	DSGN ENGR	HENRY HSIEH	2021-10-01			
	ENG					
	MFG					
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1. **SCOPE**

*This document defines the functional requirements for an enclosed **65 WATT GAN-BASED USB TYPE-C POWER DELIVERY ENABLED AC-TO-DC AC ADAPTER** intended for worldwide use in Information Technology Equipment, except for EM countries (India). The power supply unit shall be convection cooled (PD Controller IC should be approved by HPI).*

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This specification defines the EPS (External Power Supply) requirements. The design of this product must follow the supplier design guides (all suppliers), except where those guidelines conflict with the specified product requirements.

The HP part numbers directly influenced by this specification are defined in Table 1.

The EPS Model Numbers are identified in Table 1 the EPS manufacturer name and model name listed in this document which is for AVL (Approved Vendor List Candidate). The AVL (Approved Vendor List) firmed until production release.

In the event of a conflict between this specification and references cited herein, this specification shall take precedence.

**TABLE 1
REFERENCE TABLE**

HP P/N	DESCRIPTION	ASSY CODE	SPARES P/N	RMN P/N	VENDOR P/N
M94074-003	AC Adapter 65Watt USBC	PNDH			

2. **REFERENCE DOCUMENTS**

2.1 **APPLICABLE DOCUMENTS**

The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the document is of the issue in effect on the date of invitation to bid or request for proposal.

106163	"Specification, Cosmetic Requirements, Labels/Logos."
106231	"Standard, Barcode Symbolology."
106413	"Specification, Cosmetic Requirements for Plastics."
106840	"Specification, Corrugated Containers."
109291	"Specification, Test, Packaging for Hewlett-Packard Named Products."
109893	"Specification, Raw Material Supplier Packaging/Material Handling."
131296	"Specification, Test, Electrostatic Discharge."
481605	"Specification, Regulatory, AC Adapter."
137063	"Specification, Raw Material Supplier, Shipment Bar Codes."



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160261	"Procedure, Packing/Shipping, OEM Device."
180027	"Specification, Input Device Cosmetics"
106163	"Specification, Cosmetic Requirements, Labels/Logos."
106231	"Standard, Barcode Symbolology."
106413	"Specification, Cosmetic Requirements for Plastics."
	Mold Tech 11020 Specification
	HP AC Adapter Acoustic Noise Test Specification
100339	"Specification, Plastic Molds/Tooling."
114047	"Specification, Color Measurement, Paint/Plastic."
131296	"Specification, Test, ESD."
185411	"Standard, Label, Commodity Tracking, OEM Assembly, New."
ANSI C63.4 – 2009	"American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz." American National Standards Institute (ANSI), 2014.
AS/NZS 60950-1:2011	"Safety of Information Technology Equipment including Electrical Business Equipment" Australian Standards Association, 2015.
Australian Communications & Media Authority	"Electromagnetic Compatibility Compliance and Labelling – Information for Suppliers of electrical and electronic devices, vehicles and devices with internal combustion engines in Australia, Sept 2008, URL: http://www.acma.gov.au .
C.I.S.P.R. Pub. 22	"Limits and methods of measurement of radio interference characteristics of information technology equipment." International Special Committee on Radio Interference (C.I.S.P.R.).
C.I.S.P.R. Pub. 32	"Electromagnetic compatibility of multimedia equipment - Emission requirements" International Special Committee on Radio Interference (C.I.S.P.R.), 2012.
CAN/CSA C22.2 No. 60950-1-2nd	"Safety of Information Technology Equipment including Electrical Business Equipment, Second Edition." Canadian Standards Association, 2014.
CFR 47, Part 15	"Unintentional Radiators". Title 47 of the Code of Federal Regulations, Part 15, FCC Rules, Radio Frequency Devices, Subpart B.
CPS Scheme (PSB)	"Singapore Consumer Protection (Safety Requirements) Registration Scheme. Information Booklet" – 2002, Last updated 2014.
Denan Law (PSE)	"Electrical Appliance and Material Safety Law" Ministry of Economy, Trade and Industry.
EN 55024	"Information technology equipment - Immunity characteristics - Limits and methods of measurement." European Committee for Electrotechnical Standardization (CENELEC), 2010.



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EN 55032	"Electromagnetic compatibility of multimedia equipment - Emission requirements" European Committee for Electrotechnical Standardization (CENELEC), 2012.
EN 60320-1	"Appliance Couplers for Household and Similar General Purposes." European Committee for Electrotechnical Standardization (CENELEC), 2001.
EN 62368-1(IEC 62368-1)	"Safety of Information Technology Equipment - Safety - Part 1: General requirements", Second Edition, European Committee For Electro technical Standardization (CENELEC)
EN 61000-3-2	"Electromagnetic Compatibility (EMC) Part 3: Limits, Section 2: Limits for Harmonics Current Emissions (Equipment input current $\leq 16A$ per phase)." European Committee for Electro technical Standardization (CENELEC)
EN 61000-3-3	"Electromagnetic compatibility (EMC) - Part 3-3 Limits - Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current $\leq 16 A$ " European Committee for Electrotechnical Standardization (CENELEC)
GB4943-2011	"Information Technology Equipment – Safety – Part 1: General Issued 2010-12-1, Effective 2012-12-1.
HX-00011-00	"General Specification for the Environment."
ICES-003	"Interference-Causing Equipment Standard: Digital Apparatus" Industry Canada – Issue 6, 2016.
IEC 127	"Cartridge Fuse Links." International Electrotechnical Commission.
IEC 61000-4 Sections 2 – 6, 8, 11	"Electromagnetic Compatibility (EMC) – Part 4: Testing and measurement techniques." International Electrotechnical Commission (IEC).
IS 13252 (Part1)	Indian Standard "INFORMATION TECHNOLOGY EQUIPMENT – SAFETY", 2010, A1, A2
NOM-001-SCFI-1998	"Safety of Data-Processing Equipment" Norma Oficial Mexicana, 1998.
OSM/EE 2000	CENELEC Operational Staff Meeting for Electronic Equipment List of Decisions.
Taiwan EMC Law	"Commodity EMC Regulation" (Taiwan EMC Law), Bureau of Standards, Metrology, and Inspection under auspices of the Ministry of Economic Affairs, URL:http://www.bsmi.gov.tw .
UL 60950-1 2nd	"Safety of Information Technology Equipment Including Electrical Business Equipment, 2 nd Edition." Underwriters Laboratories, Inc., 2014
UL 62368-1 CSA C22.2 No. 62368-1	"Safety of Information Technology Equipment including Electrical Business Equipment, First Edition." Underwriters Laboratories, Inc., Canadian Standards Association

NOTE: All regulatory standards shall be judged applicable at the most recently published and agency adopted revision of the standard for the certifying country.



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2.2 ORDER OF PRECEDENCE

In the event of a conflict between this specification and references cited herein, this specification shall take precedence.

NOTE:

Compliance to the latest revision of Hewlett-Packard General Specification for the Environment (GSE Document number HX-00011-00), including the RoHS Compliance Specification in the GSE, is required.
<http://www.hp.com/hpinfo/globalcitizenship/environment/pdf/gse.pdf>.

3. **TECHNICAL REQUIREMENTS**

3.1 **DOCUMENTATION**

The following documentation is to be supplied to HP as soon as the information becomes available. All documentation is to be provided prior to release for production.


- *Product features and capabilities*
- *Block diagrams and schematics*
- *Working Flowchart of the device*
- *Bill of Material*
- *Hardware delivery roadmap and milestones*
- *Regulatory and Safety Agency submittal reports and approvals*
- *Hardware release criteria, test plan and test results. Must include at least:*
 - *Power requirements listed by source*
 - *USB-IF certification and logo*

NOTE: Supplemental figures, intended as a guideline for the production process, are provided at the end of this document.

3.2 **FEATURES**

3.2.1 **General**

- *Follow the 2D/CMF and 3D final approved artwork shown at the end of the document for any ID related comments over the below*
- *AC Adapter Design Guidelines document file*
- *1-1 pairing via*
- *Connectivity from Host PC to device:*
 - *1m USB Type-C non-captive cable (5A) from device to the host PC Type C port with e-marker*
 - *Type C guidelines:*
 - *To support platforms for PD charging via Type C*
 - *Type C will be able to charge NBs up to 65W*
 - *Will negotiate power via USB Power Delivery (PD) specifications with host NBs having the same feature supporting 5v, 9v, 12v, 15v, 20v support up to max 5A of NB/tablet hosts requirements; 10v if no cost, dimension, or efficiency concerns*
[Need to include voltage, current and thermal over protection/limiters as needed]

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- When power reaches thresholds (agreed upon ranges from the max/peak), device will need to reduce features/power as agreed upon in priority
- Micro controller to manage overall feature set of the device, PD, power, etc. similar to the Cypress HX3C PD 3.0, Microchip, STMicro, TI, VLI or alternate ARM based, etc. (REF.)
 - Cypress CCG PD solution unless otherwise approved by HP such as from: Cypress, STMicro, Weltrend, Microchip, VLI, TI, Realtek, Renesas, etc.
 - MCU should be able to manage power coming from AC or DC and manage it across all I/O ports as agreed upon in the spec
 - MCU should be able to communicate w/ any components in the AC adapter side if it's not managing it directly
 - Need to support the extended features for battery communications options to detect host PC battery levels to help decide when it's good to adjust PD contracts (i.e.: if NB battery level is 70% or higher then PD contract of 60W+ can be reduced to 45W, etc.)
- USB c Gen 1 is sufficient unless Gen2 would be provided at no extra cost adder
- Use of approved USB hubs solutions as/if needed: Cypress, TI, VLI, Genesys, etc.
 - Should not need more than a 2-port USB hub:
- I/O ports:

C1	C2	Profile list
65W	X	5V/3A; 9V/3A; 12V/5A; 15V/4.33A; 20V/3.25A
X	65W	5V/3A; 9V/3A; 12V/5A; 15V/4.33A; 20V/3.25A
45W	18W	C1: 5V/3A; 9V/3A; 12V/3A; 15V/3A; 20V/2.25A C2: 5V/3A; 9V/2A
18W	45W	C1: 5V/3A; 9V/2A C2: 5V/3A; 9V/3A; 12V/3A; 15V/3A; 20V/2.25A
30W	30W	C1: 5V/3A; 9V/3A; 12V/2.5A; 15V/2A C2: 5V/3A; 9V/3A; 12V/2.5A; 15V/2A

 - BCS charging port capability:
 - If the main chip does not provide this functionality, then using a TI or other circuit might be needed
 - All components to use as low power as possible so overall power requirement can be low
- Bundle options: preferred for bundle MCU+PD+hub+USB switch solutions for cost effectiveness if possible
- Power:
 - HP identifier needs to be included for the adapter and be PD compliant
 - Device is to be expected to be fan-less and w/o vents
 - Use thermal cooling and shielding solutions as needed and as on current HP ac adapters
 - The maximum surface temperature should not exceed 50 degrees C when measured at 100Vac and at maximum load. Details can be found later in the Temperature section of this specification.
- Recommend high efficiency solutions such as Real Graphene technology or others as such if they will help for thermals, fast charging, efficiency, etc.
- OS Support: Microsoft Windows, Chrome, Android, MAC, iOS and above (others are nice to have)
- Packaging: Retail box as defined in later sections



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- *Labeling: as defined in examples later in this document*
- *Documentation: HP will provide documentations to include in the option kit packaging to duplicate and insert such as: Warranty Manual, Product Notice, User Guide and/or Quick Setup Poster, etc.*
- *Documentation Localization Requirements: HP will manage*
- *Launch Countries (need certifications for)*
WW except where EM requirements are needed (India)

3.3 GENERAL SPECIFICATIONS

3.3.1 Hardware

3.3.1.1 *Pin Assignments*

ODM to provide during development stage

USB Type C Pinout

ODM to provide during RFQ response

3.3.1.2 *Cable Lengths*

DC cable: USB-C to NB: 1m

AC cord length: 1m (will use HP standard cables which are shipping already—no development or sourcing of this is needed)

3.3.1.3 *System Power Requirements*

ODM to provide during RFQ response

3.3.1.4 *System Block Diagram*

ODM to provide during RFQ response

4. ELECTRICAL

4.1 **INPUT**

4.1.1 Voltage

The power supply shall be capable of supplying full rated output power over the input range of 90 to 265 VAC RMS. Nominal voltage is 120 VAC. The power supply shall be capable of start-up (power-on) at 90 VAC and 50 Hz minimum.

4.1.2 Power Factor

(For reference only.) The power factor, when measured at 120 VAC and maximum load, shall be greater than 0.5. The source impedance shall be less than 0.1 ohm.



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4.1.3 Range Switching

The power supply shall accept the full input range. No range switching is necessary or possible.

4.1.4 Frequency

The supply shall operate with an input frequency of 47 – 63 Hz AC.

4.1.5 Current

Maximum steady state input current shall be less than 1.6 Amperes RMS at 90 VAC and maximum load.

4.1.6 Input Power Rating

(For reference only.) The supply true input power is less than 74 watts.

4.1.7 Inrush Current

Maximum inrush current, from power-on (with power on at any point on the AC sinewave) and including but not limited to, three line cycles, shall be limited to a 29% margin of the I_{2t} rating of the input fuse and bridge rectifier:

4.1.7.1 Cold Start

Cool the disconnected power supply long enough to ensure that all components are within 3°C of the minimum temperature as specified in Section 5.1. Apply the maximum input voltage in section 4.1.1 to the power supply.

4.1.7.2 Hot Start

Operate the power supply the maximum ambient operating air temperature as specified in Section 5.1 for 15 minutes. Cycle power to the power supply by removing and reconnecting maximum input voltage as specified in Section 4.1.1.

4.1.8 Protection

4.1.8.1 Under Voltage

The power supply shall not be damaged by applying an input voltage below the minimum specified in Section 4.1.1.

4.1.8.2 Catastrophic Failure Protection:

When any single component fails, the power supply will not exhibit any of the following effects:

- a) Startling noise*
- b) Flame*
- c) Excessive smoke*
- d) Charred PCB*
- e) Fused PCB conductor*
- f) Dielectric breakdown*



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4.1.8.3 Power Line Transient

The power supply shall operate within specifications with the transients defined in IEC 61000-4-4 and IEC 61000-4-5.

The adapter shall survive and the product in which it is installed shall continue to operate with no component failures during and after repeated applications of the following transients. In the event that an end use product is not available for these tests, the power supply shall be loaded at minimum per the load table.

HP recommends that the signal generator be used with low impedance of 12 Ohms.

TABLE 2 POWER LINE TRANSIENT REQUIREMENTS

Transient Type	Coupling mode	Test level	Phase	Repetition Rate	Acceptance Criteria
Surge immunity (Lightning) 61000-4-5	Differential	$\pm 1.5 \text{ KV}$	0° 90° 180° 270°	10 pulses 10 sec	Operating
	Common	$\pm 2.5 \text{ KV}$			No component damage, Loss of function is allowed but the PSU must be recovery with remote ON-OFF switch
	Common	$\pm 3 \text{ KV}$			
Electrical Fast Transients 61000-4-4	Coupling mode	Test level	Phase	Repetition Rate	Acceptance Criteria
	Differential	$\pm 2 \text{ KV}$	Asynchronous	5kHz repetition	Operating
	Common	$\pm 2 \text{ KV}$			

4.1.8.4 AC Leakage Current:

Class I Equipment

The total combined leakage current when measure in accordance with IEC 60950-1, 2nd Edition shall not exceed 40 microamperes when tested at 250 VAC, 50 Hz in a normal operating condition.

4.1.8.5 Common Mode Noise:

The common mode noise when measure in accordance with IEC 62684 shall not exceed follow below requirement

- AC Input Voltage: **90Vac/60Hz & 264Vac/50Hz**
- The peak-to-peak voltage measured in the frequency range of 10KHz to 400KHz shall not exceed **150mV peak-to-peak.**
- Test condition following with Full load (per step) by each 10% load



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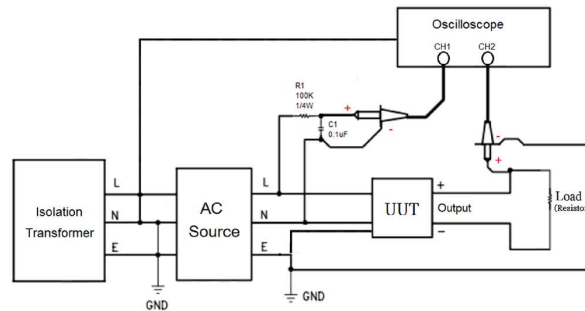
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4.1.8.6 Primary to Secondary Ground:

The power supply shall have a 1 Meg Ohm 1/4W resistor and 0.1uF/100V capacitor parallel combination between earth ground (FG) and secondary DC ground.

4.1.8.7 ISN resistors:

The power supply shall have a 470 Ohm (minimum) resistor between earth ground (FG) and secondary DC ground.

4.1.9 Energy Efficiency

The device shall conform to the EPA Energy Star Requirements Level VI for External Power Supplies:

This Adaptor shall be designed to meet DOE requirement. Average Efficiency value of 25%, 50%, 75% and 100% load condition with 115Vac/230Vac(option) input voltage shall be follow the below table:

Output Voltage (V)	Rated Max Output Power (W)	Average Efficiency (%)
5 V	15 W	81.5%
9 V	27 W	86.7%
12 V	60W	88.0%
15 V	65W	89.0%
20 V	65W	89.0%

No Load/Light Load

Output Load

Maximum Input Power

0W

0.1W (5V output)

0.25W

0.5W

0.5W

1.0W

1.0W

1.7W

1.5W

2.4W

- [Option] In order to fulfill future efficiency requirement, the PSU should have an optional design to meet the No Load requirements as specified below (measured at 115Vac/60Hz and 230Vac/50Hz):

No Load

Output Load

Maximum Input Power

0W

0.075W (5V output)



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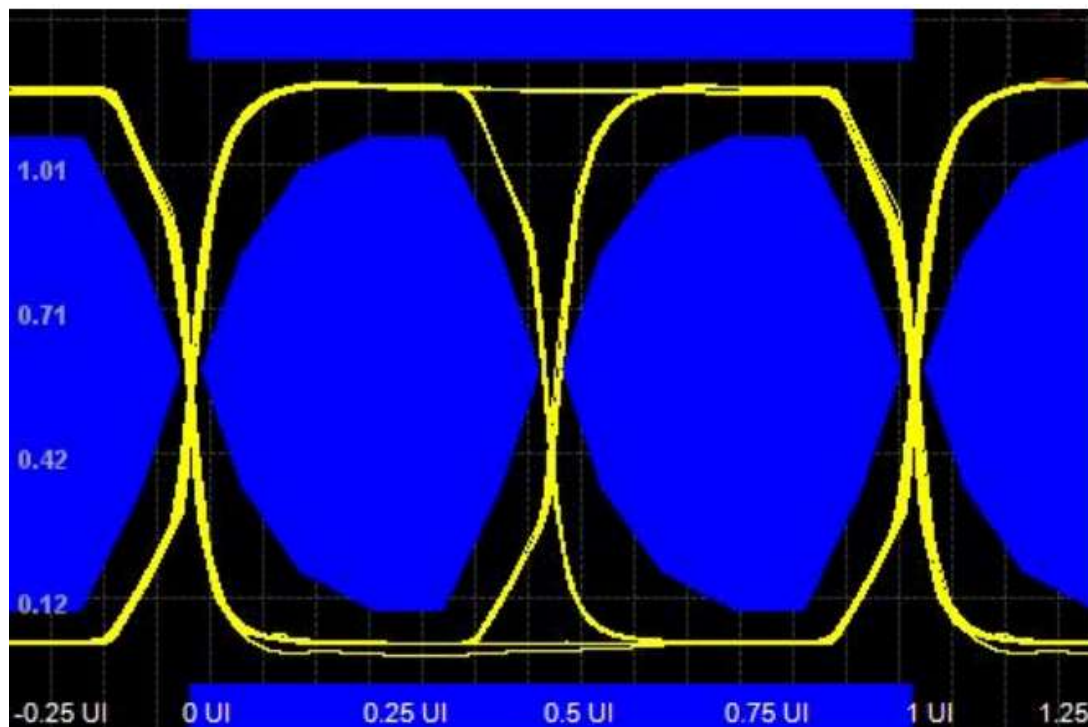
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4.1.10 BMC EYES DIAGRAM

The device shall conform to the **BMC EYES DIAGRAM** requirements for as below.



4.1.11 PD3.0 Compliance Test

- Follow Ellisys to ran compliance testing for PD protocol validation
- USB-IF certification Request

4.2 **OUTPUT**

4.2.1 Voltage

Outputs shall be provided as defined and measured at the output connector of the supply:

NOMINAL VOLTAGE (V)	REGULATION
5 V	4.750V - 5.250V
9 V	8.55V - 9.45V
12V	11.40V - 12.60V



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15 V	14.25V – 15.75V
20 V	19.0V – 21.0V

4.2.2 Current

NOMINAL VOLTAGE (V)	Load Current (A)	
	MIN.	MAX.
5 V	0 A	3 A
9 V	0 A	3 A
12V	0 A	5 A
15 V	0A	4.33 A
20 V	0 A	3.25 A

4.2.3 Power

The power supply shall be capable of continuously supplying, when installed in the end use system, 65 Watts under all specified conditions.

4.2.4 Transient Response

(Step Load) The following transient loads are to be applied to the output. The frequency range of the transient loads described shall be from 1 Hz to 5 kHz. The waveform shall be a square wave with the slope of the rise and fall at 1 A/microsecond. Measurements should be made at output cable connector. External system capacitance 1000uF/50V shall be connected to the PSU output.


TEST CONDITION				REGULATION
AC INPUT (V)	NOMINAL VOLTAGE (V)	LOAD CURRENT (A)		DESIGN REQUIREMENT (S/R=1A/US, 1HZ & 5KHZ, 50% DUTY)
		MIN.	MAX.	
90V~264V	5 V	0.1 A	1.5 A	4.50V – 6.0V
		1.5 A	3.0 A	
		0.1A	2.7A	
	9 V	0.1 A	1.5 A	8.10V – 9.90V
		1.5 A	3.0 A	
		0.1A	2.7A	
	12V	0.1 A	2.5 A	10.8V-13.2V
		2.5 A	5.0 A	
		0.1A	4.5 A	
	15 V	0.1 A	2.165 A	13.50V - 16.50V
		2.165 A	4.33 A	
		0.1A	3.897A	
	20 V	0.1 A	1.625 A	18.0V – 22.0V
		1.625 A	3.25 A	
		0.1A	2.925A	

4.2.5 Output Regulation

At nominal input line voltage (120Vac), the output shall be subjected to the load described in Section 4.2.2, and shall remain within the regulation limits as defined in Section 4.2.1.

4.2.6 Protection

The power supply shall automatically shut down under the conditions described below.

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4.2.7 Over Voltage

The power supply shall provide over voltage protection such that under single component Failure, the output channel volts with a maximum duration of 250millseconds.

NOMINAL OUTPUT	OVER VOLTAGE
VOLTAGE (V)	MAX.
5V	7.25V
9V	13.05V
12V	15.8V
15V	21.75V
20V	29.0V

4.2.8 Over Current

The power supply shall limit the maximum steady state output current to an average current of **8 Amperes**.

USB-C portion

OUTPUT VOLTAGE (V)	CURRENT LIMIT (A)
5 V 9 V 12V 15 V 20 V	8.0A Max

- Peak Current Capability (output voltage regulation min. 10%)

Table 6-10 Fixed Power Source Peak Current Capability

Bits 21...20	Description
00	Peak current equals I_{oc} (default) or look at extended Source capabilities (send Get_Source_Cap_Extended Message)
01	Overload Capabilities: 1. Peak current equals 150% I_{oc} for 1ms @ 5% duty cycle (low current equals 97% I_{oc} for 19ms) 2. Peak current equals 125% I_{oc} for 2ms @ 10% duty cycle (low current equals 97% I_{oc} for 18ms) 3. Peak current equals 110% I_{oc} for 10ms @ 50% duty cycle (low current equals 90% I_{oc} for 10ms)
10	Overload Capabilities: 1. Peak current equals 200% I_{oc} for 1ms @ 5% duty cycle (low current equals 95% I_{oc} for 19ms) 2. Peak current equals 150% I_{oc} for 2ms @ 10% duty cycle (low current equals 94% I_{oc} for 18ms) 3. Peak current equals 125% I_{oc} for 10ms @ 50% duty cycle (low current equals 75% I_{oc} for 10ms)
11	Overload Capabilities: 1. Peak current equals 200% I_{oc} for 1ms @ 5% duty cycle (low current equals 95% I_{oc} for 19ms) 2. Peak current equals 175% I_{oc} for 2ms @ 10% duty cycle (low current equals 92% I_{oc} for 18ms) 3. Peak current equals 150% I_{oc} for 10ms @ 50% duty cycle (low current equals 50% I_{oc} for 10ms)

4.2.9 Short Circuit

The power supply shall be protected such that a short from output to return shall not result in a fire hazard, shock hazard, or damage to the power supply.

4.2.10 Outputs/Ripple/Noise

Maximum allowable peak-to-peak ripple and noise (as measured at the load with 100VAC input) on the output channel shall be 380mVpk-pk (or 250 mV RMS) ripple within 10 kHz to 20 MHz bandwidth. A resistive load (non-electronic) shall be used for this measurement. The output shall be bypassed to return by 1.0 microfarad ceramic capacitor in parallel with 10 microfarad tantalum capacitor at the



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point of load. The load cable shall be the specified output cable assembly. The printed wiring board assembly shall be installed in its enclosure for this measurement or have the measurement leads properly shielded and proper earth grounds applied to power supply. (5V/9V/12V/15V/20V; Maximum Load & Minimum Load)

4.2.11 Stability

The power supply shall be unconditionally stable while operating within its normal operating specification.

4.2.12 Overshoot

During power-on or power-off, the output voltage shall be monotonically increasing or decreasing with respect to the overshoot which shall neither each output volts peak nor be outside the regulation requirements for more than 10 milliseconds.

NOMINAL VOLTAGE (V)	REGULATION
5 V	5.25V
9 V	9.45V
12V	12.60V
15 V	15.75V
20 V	21.0V

4.2.13 Power-On Time

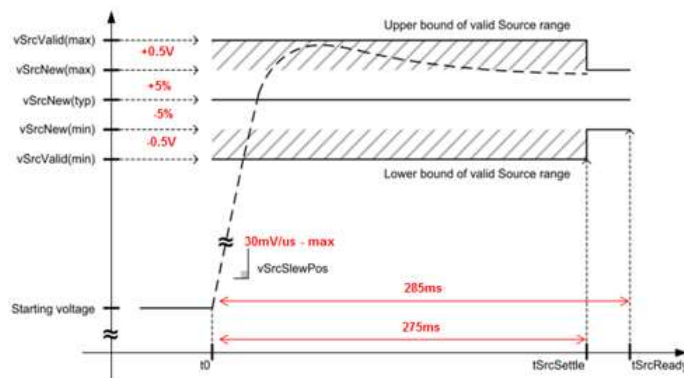
- Output Regulation: The +5V output shall be in regulation within five (5) seconds after valid input power (90 VAC) has been applied.

4.2.14 Rise Time

Output Voltage

- 0V to 5V
- 5V to 9V
- 5V to 12V
- 5V to 15V
- 5V to 20V

The output shall be in regulation within 275mS Maximum.
(Measured from 0% to 100% regulation)



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4.2.15 Hold Up

- The power supply output voltage: 5V/9V/12V/15V/20V, shall maintain voltage regulation within the specified limits in paragraph 4.2.1 for at least 5 milliseconds after loss of input voltage measured at 115 VAC and at maximum load.

4.2.16 Acoustic Test

The power supply when tested in an anechoic chamber shall not exceed the sound pressure levels per the HP AC Adapter Acoustic Noise Test Specification under all output load and ac input conditions. Acoustic noise measurements shall be conducted in accordance with ISO 7779 (or ECMA-74) and declared in accordance with ISO 9269 (or ECMA-109).

4.2.17 Thermal Shutdown

The power supply shall incorporate over temperature protection to prevent catastrophic failure from overheating.

5. **ENVIRONMENTAL REQUIREMENTS**

5.1 **TEMPERATURE**

5.1.1 Operating

The supply shall operate from 0 to 35°C. The maximum temperature rise of any surface **shall not exceed 50°C** when measured at 100Vac and at maximum load.

5.1.2 Non-Operating

The power supply can be stored from -20 to 85°C.

5.2 **COOLING**

The power supply shall be convection cooled only.

5.3 **HUMIDITY**

The power supply shall withstand without degradation with 95% relative humidity, non-condensing, both operating and non-operating.

5.4 **ALTITUDE**

5.4.1 Operating

The power supply can be operated at 5,000 m above sea level

5.4.2 Non-Operating

50,000 feet above sea level.

5.5 **MECHANICAL SHOCK**

(Power supply inside assembly.)



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5.5.1 Operating

10 G, 11ms, half sine, one shock input in each of three mutually perpendicular axes, for a total of six shock inputs.

5.5.2 Non-Operating

100 G peak, trapezoid, 180 in/s velocity change, one shock input per direction in each of three mutually perpendicular axes, for a total of six shock inputs. 240 G peak, 2 ms, half sine, one shock input in each of three mutually perpendicular axes, for a total of six shock inputs.

5.5.3 UL Safety

36-inch drop onto hardwood surface, after which no safety hazard is encountered regardless of operational capabilities.

5.5.4 Shipping

30-inch drop, all edges, surfaces — while enclosed in appropriate shipping container.

5.6 **VIBRATION**

(Supply inside assembly.)

5.6.1 Operating

0.75 G zero to peak, 5 to 500 Hz, 0.5 octaves/minute, one cycle, 5 to 500 to 5 Hz per axis in each of three mutually perpendicular axes.

5.6.2 Non-Operating

1.5 G zero to peak, 5 to 500 Hz, 0.5 octaves/minute, one cycle, 5 to 500 to 5 Hz per axis in each of three mutually perpendicular axes.

0.025 G squared/Hz, 10 to 500 Hz, nominal 3.5 G RMS level, one hour per axis, in each of three mutually perpendicular axes for a total duration of three hours.

5.7 **ELECTROSTATIC DISCHARGE (ESD)**

The AC adapter shall withstand ESD test voltage conditions at any point on the enclosure using the test setups and conditions found in Document 131296 and with transients as defined in IEC 61000-4-2. As an infrequently user touchable subassembly, the following test levels shall be used:

- ±15 kV with no abnormal operation, but test to 20kV and report results
- ±15 kV with no damage to power supply, but test to 20kV and report results

The storage capacitance shall be 150 pF and the discharge resistance shall be 330 ohms

5.8 **ECO ENVIRONMENTAL**



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5.8.1 General Requirements

This section defines environmental requirements that are applicable to all products and product components. Individual components specifications may amend or append requirements to this base set as part of their component-specific requirements, but otherwise these requirements are applicable in all cases.

5.8.2 General Requirements

All products, components, and materials shall comply with the latest revision of HP Standard 011-00 General Specification for the Environment (GSE) including all referenced documents throughout the product life cycle.

Access to the public version of GSE is available from the URL.

<http://h20195.www2.hp.com/V2/GetDocument.aspx?docname=c04932490>

5.8.3 Supplemental Environmental Specification

All commodity, component, and part materials shall comply with the HP Standard HX-00025-01 Supplemental Environmental Specification – Commodity and Component (Supplemental Environmental Spec) requirements. Component categories are created to allow different material restriction requirements for each category. The Supplemental Environmental Spec is a supplement to the HP GSE.

The Supplemental Environmental Spec references the Substances and Materials Future Requirements (HX-00011-01A), Substances and Materials Business-Specified Requirements (HX-00011-01B), Substance and Materials Requirements, All Products (HX-00011-01) and Product Requirements, EEE Products (HX-00011-11) sections of the GSE with technical material and product specifications.

The product shall comply with all requirements in Supplemental Environmental Spec at the time of release, regardless of any future regulatory effective date.

The Supplier shall provide the required data to HP's System Integrator for the completion of the HP Environmental Data Sheet (EDS), HP Recyclability Assessment Tool (RAT), and Disassembly Instructions.

Individual commodity or component specifications may exempt requirements to the Supplemental Environmental Spec as part of component-specific requirements, but otherwise the requirements in Supplemental Environmental Spec are applicable in all instances.

Low Halogen Exemption: Brominated and Chlorinated Flame Retardants; GSE section HX-00011-01B; GSE Id 090807-92, & 080715-34, & 090807-37 AND Antimony; GSE section HX-00011-01B; GSE Id 110727-47 & 110727-63 are not required.


Access to the HP Commodity/Component Spec (HX-00025-01), Substances and Materials Future Requirements (HX-00011-01A), Substances and Materials Business-Specified Requirements (HX-00011-01B), and Product Requirements (HX-00011-11) require access to the HP Supplier Handbook, Restricted Access. Register or sign in from the URL.

<https://h20168.www2.hp.com/supplierextranet/index.do>

5.8.4 Other ECO Requirements

Energy Requirements

6. KOREA EPS-MEPS

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- The External power supply must comply with the Korea Mandatory Energy Performance Specification (MEPS). The detailed requirements can be found in the HP GSE - Product Requirements.
- Please note since this requirement is now mandatory by the HP GSE, it will be deleted in future releases of the product specification.

7. **AUSTRALIA AND NEW ZEALAND EPS REGISTRATION**

- The External power supply must be registered in Australia and New Zealand. The detailed requirements can be found in the HP GSE - Product Requirements.

Accessibility

8. **SECTION 508 ACCESSIBILITY – US**

- The system must comply with the section 508 Accessibility – US requirements. Please reference: <http://www.section508.gov/index.cfm?FuseAction=content&ID=12>

EU Energy Related Products (formerly EuP)

EUP LOT 7

System must comply with EU regulation EU 1782/2019 for external power supplies. The detailed requirements will be found in the HP GSE - Product Requirements.

Belarus External Power Supply Certification

External power supplies must comply with energy efficiency standard STB 2463-2016. The detailed requirements can be found in the HP GSE – Product Requirements

Ukraine External Power Supply Certification

For products placed on market September 6th, 2020 and later: External power supplies must comply with Ukraine technical regulation No. 150. Detailed requirements will be found in the HP GSE – Product Requirements.

Deliverables:


- In country certification of each EPS – Ukraine national statement of conformity (NSoC)
- Ukraine Conformity Mark on external power supplies

NRCan (Canada) EPS certification and Registration

External power supplies must tested and registered according to Amendment 14, part 2 of the Canada energy efficiency regulation. The EPS must be certified by an accredited body and registered with the Canadian government by the supplier.

Deliverables:

- The external power supply must be marked with the roman numeral corresponding to the efficiency level met through the international efficiency protocol (VI or higher).
- A signed report and certificate issued by an ISO/EN 17025 accredited laboratory showing compliance with this requirement.
- Confirmation of registration with the applicable Canadian government agency.

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Mexico NOM-029

External power supplies must comply with the Mexico NOM-029 energy efficiency specification. Products must be tested for OFF mode at 127V/60Hz and labeled with the power consumption as required. The detailed requirements can be found in the HP GSE-Product Requirements.

Deliverables:

- In-country testing and certification of the EPS.

9. **AGENCY APPROVALS**

This product shall comply with all Regulatory requirements set forth in Hewlett Packard Specification 481605.



481605-L.pdf

10. **RELIABILITY**

LIFE EXPECTANCY: The power supply shall have a field failure rate of less than 0.1% annually within the first three years of operation.

10.1 **QUALITY ASSURANCE**

Hewlett Packard utilizes the Hewlett Packard Supplier Development Process as a tool for assessment, continuous material improvement, and supplier development. As needed, suppliers are expected to support activities such as surveys, process and machine capability studies, control plans, and correlation studies as described in the Hewlett Packard Supplier Development Process (SDP) Handbook.

10.2 **CHANGE NOTIFICATION**

Deviations from this specification are not permitted without specific written authorization from Hewlett Packard. The PCA shall meet all conditions of the specification when subjected to any combination of environmental or electrical extremes unless otherwise specified. Design changes to any portion of the PCA are not permitted without prior written approval of supplier's ENGINEERING CHANGE ORDER from Hewlett Packard Procurement.

10.3 **SUPPLIER PROCESS CHANGE REQUEST**

Hewlett Packard shall be notified of all process changes in accordance with SCR – Supplier Change Request in the Hewlett Packard Supplier Development Process Handbook.

10.4 **INTERCONNECT**

All connectors must withstand a minimum of 10 insertion cycles and maintain an average insertion force of 8 oz./pin and withdrawal force of 6 oz./pin with all approved sources.

USB 3.0 Type C connector must meet mechanical performance as specified by USB-IF specification.

10.5 **DE-RATING GUIDELINES**

The following component de-rating requirements shall be followed:

The HP logo, consisting of the letters 'hp' in a stylized, lowercase font inside a circle.	SIZE A	DRAWING NO. M94074			REV A
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- Semiconductor junction temperature shall be less than 130°C.
- Thermal De-rating at normal operation shall be <90%. Thermal measurements will be verified with the power supply mounted in a representative product enclosure. OTP shall not result in any damage and safety or reliability degradation. Need to meet HP Life time requirement is any load, Voltage and ambient temperature.
- Resistor power de-rating will be consistent with the resistor type and application
- Component voltage de-rating shall be < 95% for all continuous conditions.
- Components shall not exceed 100% of their voltage rating during start-up and transients; exception: Bulk Capacitors shall not exceed 110% during transients.
- Component current de-rating shall be <90% for all continuous conditions. Exception: Bulk Capacitors shall not exceed 100% for all continuous conditions. The effects of ripple current heating shall be accounted for in this de-rating.
- All components shall be de-rated to insure meeting the calculated MTBF
- All magnetic devices shall be rated for 130°C minimum
- All capacitors must be rated at 2000 hours or greater at maximum rated temperature, unless otherwise approved by HP. In any load, voltage and temperature, all capacitor must meet HP lifetime define

10.6 E-CAPS LIFE TIME

- All Aluminum electrolytic capacitors shall have a minimum lifetime of 8,736 hours at ambient temperature of 35degC and 80% load.
- Usage profile 8h x 52 weeks x 3 yrs = 8,736 hours

10.7 E-CAPS CHARGE / DISCHARGE CYCLES

If the design presents operational modes where sustained regular repetitive heavy E-cap charge / discharge cycles are used, the supplier has to ensure that the E-caps are suitable for such use and that these charge / discharge cycles are within the components specification limits.

10.8 CRITICAL COMPONENTS

The critical components list defines components with critical functionality, specifications, attributes, and parameters essential to the proper operation of the power supply and completed system. Once the list is complete for production, any deviation from this list requires documented completion of an agreed upon test plan. Final approval requires written HP acknowledgment. Due to the critical nature of these components, any deviation from the agreed upon BOM/AVL will jeopardize the stability, robustness and/or operation of the board. The timeframe for AVL proposals and finalization is described in the appropriate Statement of Work and schedule milestones. Specific application criteria for critical components are defined in Table 3.



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TABLE 3
EPS CRITICAL COMPONENTS CRITERIA

Part Description	Application	Notes
Bridge Diodes	AC rectification	800V breakdown voltage minimum
Capacitors	Frequency and loop compensation	X7R dielectric or better
Capacitors	High voltage primary snubber circuits	Y5S or better
Capacitors	LLC resonant capacitor	PP (polypropylene) material or better
Capacitors(Plastic CAP)	PFC and LLC circuit	MPP or MPE is recommended. The PE type is restricted.
Bulk capacitor	Dc-bus	Active PFC, Boost, Fly-back topologies bulk cap rating shall be 420Vdc / 105degC minimum.
Resistor	Primary side	High voltage type is preferred - SMD 0805 is restricted - "Thin film" and "Carbon" type are restricted
FET	DC to DC main switching, active PFC and stby circuit FET	FETs should be rated at least - 600V Active PFC MosFET - 600V PWM MosFET for Fly-back topologies - 600V MosFET for LLC topologies
By-path diode	Active PFC or Boost converter	Active PFC designs shall have a so called By-path diode in parallel to the Boost choke and output rectifier.
AC-Inrush current limiting devices	Active PFC or Boost converter	Active PFC designs shall not have an AC-Inrush current limiting device (ex: NTC) in the By-path circuit.
MOV (Metal Oxide Varistors)	EMI-filter, DC bus	If the usage of MOVs can't be avoided their voltage rating has to be greater 385Vrms
Magnetics	Main transformer and output coupled inductor	The turns ratio of the output coupled inductor must be matched to the main transformer windings
Magnetics	Inductors – powdered iron	Micrometals and Curie and Formosa Shing GA, TAF-200 are the only approved powdered iron cores
Adhesive	Component anchoring	Must be Electronics Grade and meet UL94V-0
Glue	Component anchoring	AB Glue is not allowed (fix component, thermal glue...)
Red Phosphorus	Material	Red Phosphorus must not be used as flame retardant in any part of the power supply especially AC inlet and DC cable / plug.
AC fly leads / wire	AC socket	Must use fly leads / wire to solder AC inlet to PCB
AC Prong	AC socket	Must use inject molding process to fix with AC socket plastic housing.
PCB	PCB board	Low Halogen
Shield	Heatsink or EMI shielding	Lock / fix mechanism (at least 2 on each side) is requested
Terminal material	DC output cable	Phosphor bronze or better



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11. **MARKINGS**

The OEM Power Supply Module nameplate label(s) shall have the following markings:

- a) *Hewlett-Packard*
- b) *Series Number*
- c) *Hewlett-Packard's Part Number/Spares Part Number*
- d) *Date Code*
- e) *All Required AGENCY MARKINGS (See Section 6.1)*
- f) *Country of Manufacture*
- g) *Electrical Rating: Output rating, Input rating in Volts, Amps, Hertz.*
- h) *Commodity Tracking Label*

12. MECHANICAL

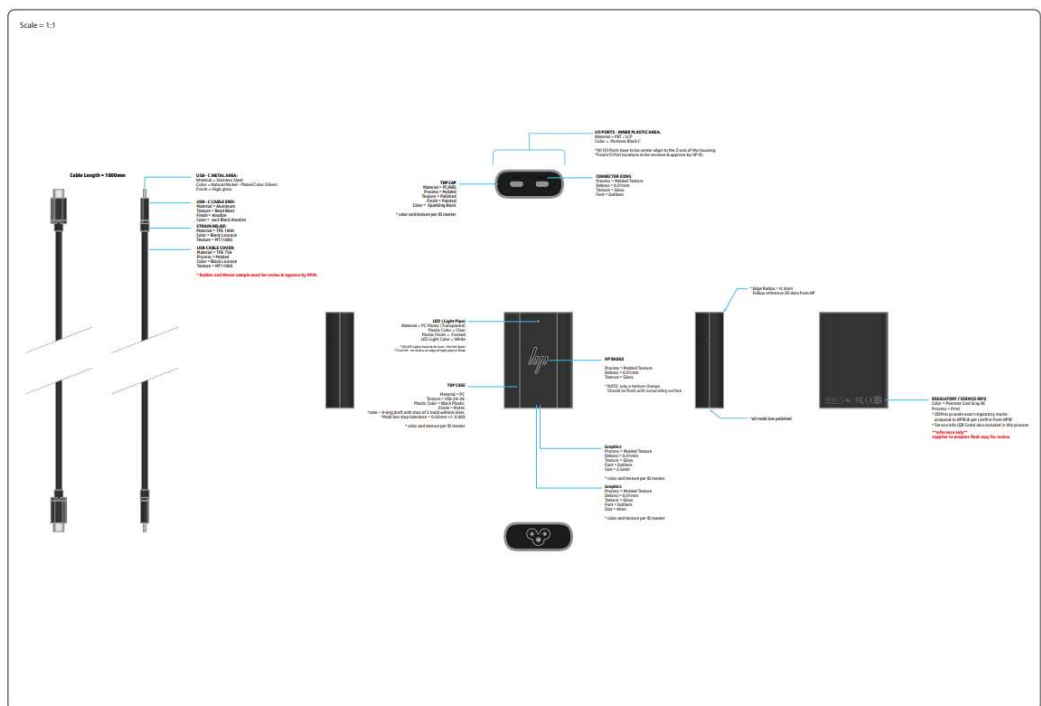
12.1 DIMENSIONS AND WEIGHT

The nominal external dimensions of the power supply should not exceed Target (in mm): 75x53x22mm

Weight target 3.0 oz(Ref.)

See GP FILE

File Name		
2022_Semelo_POR_GP_295PEZ021		
Program Name	Series	Size
SEMELO POWER	USB-C	N/A
Revision List		
Date/Init.	Comment	
27SEP2020 YI MD	Initial GP created for RFG.	
04DEC2021 12 MD	GP Created by RL	
02SEP2021	GP Updated by POR	
27SEP2021	Cable Drawing updated	
<div> <div> Part Name Part Number Rev QTY Unit </div> <div> #Part Name Description Semelo power connector USB C 1 Each </div> </div> <p>Standard assembly document version 2.0</p>		
<p>The purpose of each graphics panel (GP) is to provide a high level call out providing part break up and general material application for RFG and Manufacturing process.</p> <p>Graphics panel (GP) should be used in correlation with the "Notebook Standards Document" Within the Notebook standards document a master key will be kept to provide definition on how CMF is applied to its respective sub-assemblies.</p> <p>Along with CMF explanation the "Notebook Standards Document" will provide guidelines on how specific elements are to be placed within a given area of a notebook design. These elements include and are NOT limited to HP logo badge, speaker per pitch, power and discrete function button placement, etc.,</p>		



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12.2 MATERIAL

The enclosure material should be able to withstand the tests of Section 5.0 and conform to Document 100339.

12.3 COLOR

- BLACK

12.4 TEXTURE

- Texture shall conform to VDI-27 Specification and HP Logo polished is SPI-A2

13. **MANUFACTURING REQUIREMENTS**

13.1 PCB PLATING PROCESS

Acceptable PCB plating chemistry includes OCC (organic coated copper), Electroplated gold, and Macdermid Type 2 Silver Immersion. Other plating processes will be evaluated on a case-by-case basis.

13.2 PACKAGING REQUIREMENTS

Packing and wrapping shall be sufficient to protect against damage or loss during shipment from the supplier to destination specified in the purchase order. Packaging, identification, and palletization shall be in accordance with Hewlett Packard Document 131427. The shipping, packaging, (refer to Hewlett Packard Documents 109291 and 137114) and labeling shall meet the requirements of Hewlett Packard Document 109893. Hewlett Packard Documents 106163, 106584, and 137063 define the preferred shipping label requirements.


The method of shipment shall be agreed upon between sender and recipient. The product shall be clearly identified and packed according to prevailing regulations. It is the responsibility of the shipper to take all reasonable precautions to ensure the product arrives undamaged and on time.

Black retail artwork to meet consumer requirements.

13.3 WORKMANSHIP STANDARDS

Electrical Criteria: *Electrical assemblies and components shall meet the requirements of document 106166 or IPC-A-610 Rev. D.*

FIGURE 2 OUTLINE DRAWING (XXXXXX)

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