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APPLICATION		REVISIONS			APPROVALS	
NEXT ASSY	PROJ NO.	ECN NO.	REV	DESCRIPTION	DATE	APPROVED
	13196		A	PRODUCTION RELEASE	1/9/24	HENRY HSIEH
			A1	- EFFICIENCY - 2D DRAWING UPDATED - LED circuit (TBD)	1/12/24	HENRY HSIEH

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	DRAWN	HENRY HSIEH	1/12/24			
	CHECKED			CAPPY 65W USB-C AC ADAPTER, NPFC		
	DSGN ENGR	HENRY HSIEH	1/12/24			
	ENG					
	MFG					
	QA					
UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES [MILLIMETERS]. TOLERANCES ARE:  FRACTIONS    DECIMALS    ANGLES ± 1/32        .XX ± .02            ±1° [0.5] .XXX ± .010 [0.25]	LEGAL			SIZE	DRAWING NO.	REV
	AGENCY			<b>A</b>	N99074	A1
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## TABLE OF CONTENTS

<b>1. SCOPE</b>	<b>4</b>
<b>2. REFERENCE DOCUMENTS</b>	<b>4</b>
2.1 APPLICABLE DOCUMENTS	4
2.2 ORDER OF PRECEDENCE	6
<b>3. GENERAL FUNCTION DESCRIPTION</b>	<b>6</b>
<b>4. ELECTRICAL</b>	<b>7</b>
4.1 INPUT	7
4.1.1 Voltage	7
4.1.2 Power Factor	7
4.1.3 Range Switching	7
4.1.4 Frequency	7
4.1.5 Current	7
4.1.6 Input Power Rating	7
4.1.7 Inrush Current	7
4.1.8 Protection	7
4.1.9 Energy Efficiency	9
4.1.10 Eyes Diagram	10
4.2 OUTPUT	11
4.2.1 Voltage	11
4.2.2 Current	11
4.2.3 Power	11
4.2.4 Transient Response	11
4.2.5 Output Regulation	12
4.2.6 Protection	12
4.2.7 Over Voltage	12
4.2.8 Over Current	12
4.2.9 Short Circuit	12
4.2.10 Outputs/Ripple/Noise	12
4.2.11 Stability	13
4.2.12 Overshoot	13
4.2.13 Power-On Time	13
4.2.14 Rise Time	13
4.2.15 Hold Up	14
4.2.16 Acoustic Test	14
4.2.17 System Capacitive Load	14
4.2.18 Thermal Shutdown	14
<b>5. ENVIRONMENTAL REQUIREMENTS</b>	<b>14</b>
5.1 TEMPERATURE	14
5.1.1 Operating	14
5.1.2 Non-Operating	14
5.2 COOLING	14
5.3 HUMIDITY	14
5.4 ALTITUDE	14
5.4.1 Operating	14
5.4.2 Non-Operating	14
5.5 MECHANICAL SHOCK	14
5.5.1 Operating	15
5.5.2 Non-Operating	15
5.5.3 UL Safety	15



SIZE  
**A**

DRAWING NO.

N99074

REV  
A1

DRAWN

SCALE 1/1

SHEET

2

OF

28

5.5.4	Shipping .....	15
<b>5.6</b>	<b>VIBRATION .....</b>	<b>15</b>
5.6.1	Operating .....	15
5.6.2	Non-Operating .....	15
<b>5.7</b>	<b>ELECTROSTATIC DISCHARGE (ESD).....</b>	<b>15</b>
<b>5.8</b>	<b>ECO ENVIRONMENTAL .....</b>	<b>16</b>
5.8.1	General Requirement .....	15
5.8.2	Supplemental Environmental Specification .....	16
5.8.3	Other ECO Requirements.....	17
<b>6.</b>	<b>AGENCY APPROVALS.....</b>	<b>18</b>
<b>7.</b>	<b>RELIABILITY .....</b>	<b>18</b>
7.1.1	Derating Guidelines .....	18
7.1.2	E-Caps life time.....	19
7.1.3	E-Caps Charge / discharge cycles .....	19
7.1.4	Critical Components.....	19
<b>8.</b>	<b>INTERCONNECTION .....</b>	<b>20</b>
<b>9.</b>	<b>CABLE WRAPPING .....</b>	<b>24</b>
<b>10.</b>	<b>MARKINGS.....</b>	<b>25</b>
<b>11.</b>	<b>MECHANICAL .....</b>	<b>25</b>
11.1	DIMENSIONS.....	25
11.2	MATERIAL .....	25
11.3	COLOR.....	25
11.4	TEXTURE.....	25

#### LIST OF FIGURES

FIGURE 1	OUTPUT CABLE.....	20
FIGURE 2	OUTLINE DRAWING(LITEON).....	27
FIGURE 3	OUTLINE DRAWING(DELTA).....	28

#### LIST OF TABLES

TABLE 1	REFERENCE TABLE .....	4
TABLE 2	POWER LINE TRANSIENT REQUIREMENTS.....	8
TABLE 3	EPS CRITICAL COMPONENTS CRITERIA .....	19



SIZE  
**A**

DRAWING NO.

N99074

REV  
A1

DRAWN

SCALE 1/1

SHEET

3

OF

28

## 1. SCOPE

This document defines the functional requirements for an enclosed **65 WATT AC-TO-DC AC ADAPTER** intended for worldwide use in Information Technology Equipment. The power supply unit shall be convection cooled.

The information in this document must be used in accordance with HP policies about the use and disclosure of HP Confidential information. Signed Confidential Disclosure Agreements (CDA's) must be on file prior to the disclosure of this Document with any external supplier.

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
N99074-001	CAPPY 65W USB-C AC ADAPTER, LITEON	TQGA	N99217-001	TPN-LA33	PA-1650-62HT
N99074-003	CAPPY 65W USB-C AC ADAPTER, DELTA	TQGC		TPN-DA34	ADP-65CG BA

## 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.

	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."



SIZE  
**A**

DRAWING NO.

N99074

REV  
A1

DRAWN

SCALE 1/1

SHEET

4

OF

28

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: <a href="http://www.acma.gov.au">http://www.acma.gov.au</a> .
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.
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)



SIZE  
**A**

DRAWING NO.

N99074

REV  
A1

DRAWN

SCALE 1/1

SHEET 5

OF 28

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: <a href="http://www.bsmi.gov.tw">http://www.bsmi.gov.tw</a> .
UL 60950-1 2nd	"Safety of Information Technology Equipment Including Electrical Business Equipment, 2 <sup>nd</sup> 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.

## 2.2 ORDER OF PRECEDENCE

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

### NOTE:

1. **Environmental Sustainability Compliance:** All products, components, and materials shall comply with the latest revision of HP Standard 011 General Specification for the Environment (GSE) (Document ID HX-00011-00) 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>



HX-00011-00.pdf

2. **Supplemental Environmental Specification:** All commodity, component, and part materials shall comply with the HP Standard HX-00025-01 Supplemental Environmental Specification for Personal Systems Commodities and PC Accessories requirements. Component categories are created to allow different material restriction requirements for each category. The Supplemental Environmental Specification is a supplement to the HP GSE.



SIZE  
**A**

DRAWING NO.

N99074

REV  
A1

DRAWN

SCALE 1/1

SHEET 6

OF 28

The Supplemental Environmental Specification takes precedence over the GSE in all cases for component or PC accessory being specified, where requirements are more restrictive than the GSE.

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

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

The Supplier shall provide the required data to HP's System Integrator for HP compliance obligations.

Access to the Supplemental Environmental Specification (HX-00025-01) requires access to the HP Supplier Handbook, Restricted Access. Register or sign in from the URL.

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



HX-00025-01\_D.p  
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### 3. **GENERAL FUNCTION DESCRIPTION**

(For reference only.) This specification describes a self-contained **65Watt USB PD AC-TO-DC AC PD Adapter**, powered from the AC Mains, and supplying a single direct current, constant voltage output. There is no power switch. Output power is supplied upon application of AC input through the line cord. The output cable is 1.8m long with 3 conductors - one for output power positive and one for return. The third conductor will provide a "CC" pin to communicate system power delivery.

### 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.

##### 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.



SIZE  
**A**

DRAWING NO.

N99074

REV  
A1

DRAWN

SCALE 1/1

SHEET 7

OF 28

#### 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<sub>2t</sub> 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
- g) Chemical leak outside the case

##### 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.



SIZE  
**A**

DRAWING NO.

N99074

REV  
A1

DRAWN

SCALE 1/1

SHEET 8

OF 28



**TABLE 2 POWER LINE TRANSIENT REQUIREMENTS**

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

4.1.8.4 AC Leakage Current:

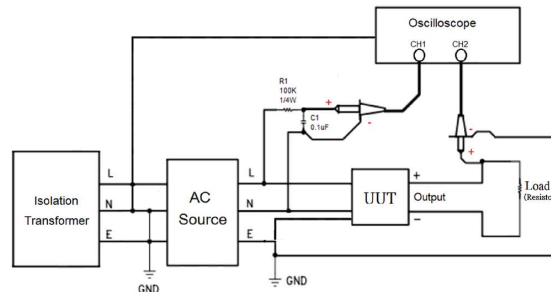
Class I Equipment

The total combined leakage current when measure in accordance with IEC 60950-1, 2nd Edition shall not exceed 30 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



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.



SIZE  
**A**

DRAWING NO.

N99074

REV  
A1

DRAWN

SCALE 1/1

SHEET 9 OF 28

#### 4.1.9 Energy Efficiency

The device shall conform to the EPA Energy Star Requirements **Level VII** 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	<b>81.84%</b>
9 V	27 W	<b>87.3%</b>
15 V	65W	89.0%
20 V	65W	89.0%

#### No Load/Light Load

Output Load	Maximum Input Power
<b>0W</b>	<b>0.070W</b> <b>(5V output)</b>
<b>0.15W</b>	<b>0.3W</b>
<b>0.5W</b>	<b>1.0W</b>
<b>1.0W</b>	<b>1.7W</b>
<b>1.5W</b>	<b>2.4W</b>



SIZE  
**A**

DRAWING NO.

N99074

REV  
A1

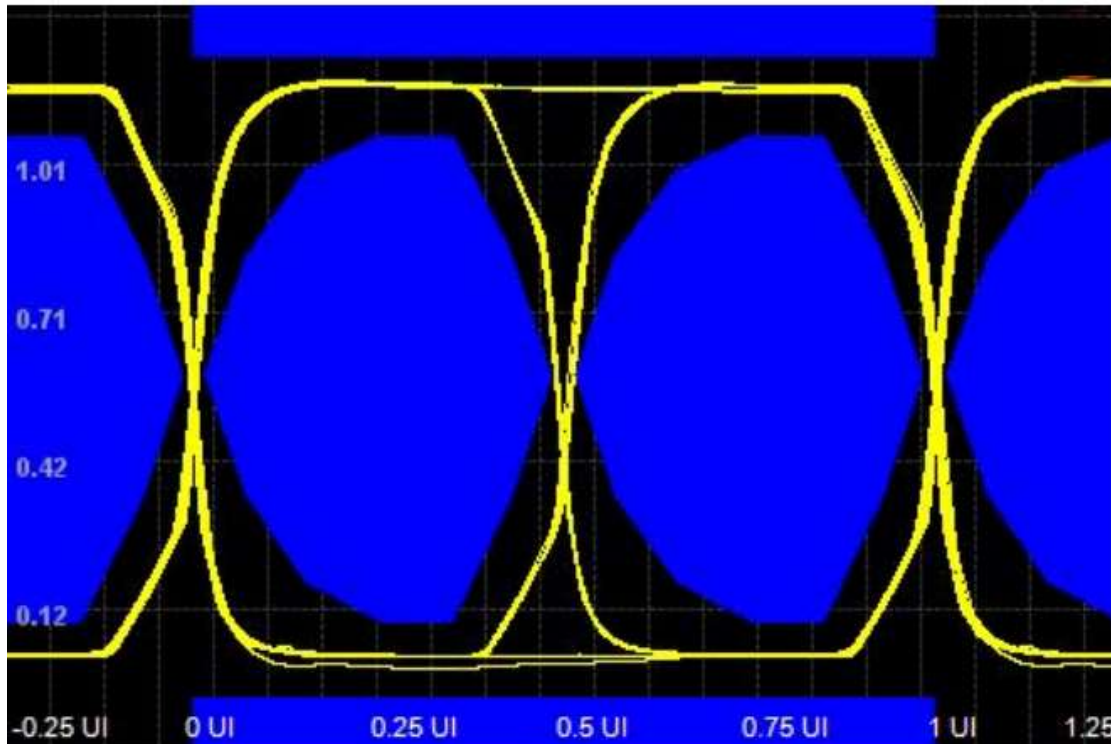
DRAWN

SCALE 1/1

SHEET 10 OF 28

#### 4.1.10 BMC EYES DIAGRAM

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



#### 4.1.11 PD3.1 Compliance Test

- Follow Ellisys to ran compliance testing for PD protocol validation
- Shall be apply and compliance USB-IF certification

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



SIZE  
**A**

DRAWING NO.

N99074

REV  
A1

DRAWN

SCALE 1/1

SHEET 11 OF 28

#### 4.2.2 Current

NOMINAL VOLTAGE (V)	Load Current (A)	
	MIN.	MAX.
5 V	0 A	3 A
9 V	0 A	3 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 220uF/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 A	1.5 A	4.50V – 5.50V
		1.5 A	3.0 A	
		0A	2.7A	
	9 V	0A	1.5 A	8.10V – 9.90V
		1.5 A	3.0 A	
		0A	2.7A	
	15 V	0A	2.165 A	13.50V - 16.50V
		2.165 A	4.33 A	
		0A	3.897A	
	20 V	0A	1.625 A	18.0V – 22.0V
		1.625 A	3.25 A	
		0A	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.



SIZE  
**A**

DRAWING NO.

N99074

REV  
A1

DRAWN

SCALE 1/1

SHEET 12 OF 28

#### 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 250milliseconds.

NOMINAL OUTPUT VOLTAGE (V)	OVER VOLTAGE MAX.
5V	7.25V
9V	13.05V
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 8.0 Amperes.

OUTPUT VOLTAGE (V)	CURRENT LIMIT (A)
5 V 9 V 15 V 20 V	<b>115%~125%</b>

- Fixed Power Source Peak Current Capability
  - o Shall be meet "01" level.

Bits 21...20	Description
00	Peak current equals I <sub>oc</sub> (default) or look at extended Source capabilities (send <a href="#">Get_Source_Cap_Extended</a> Message)
01	Overload Capabilities: 1. Peak current equals 150% I <sub>oc</sub> for 1ms @ 5% duty cycle (low current equals 97% I <sub>oc</sub> for 19ms) 2. Peak current equals 125% I <sub>oc</sub> for 2ms @ 10% duty cycle (low current equals 97% I <sub>oc</sub> for 18ms) 3. Peak current equals 110% I <sub>oc</sub> for 10ms @ 50% duty cycle (low current equals 90% I <sub>oc</sub> for 10ms)
10	Overload Capabilities: 1. Peak current equals 200% I <sub>oc</sub> for 1ms @ 5% duty cycle (low current equals 95% I <sub>oc</sub> for 19ms) 2. Peak current equals 150% I <sub>oc</sub> for 2ms @ 10% duty cycle (low current equals 94% I <sub>oc</sub> for 18ms) 3. Peak current equals 125% I <sub>oc</sub> for 10ms @ 50% duty cycle (low current equals 75% I <sub>oc</sub> for 10ms)
11	Overload Capabilities: 1. Peak current equals 200% I <sub>oc</sub> for 1ms @ 5% duty cycle (low current equals 95% I <sub>oc</sub> for 19ms) 2. Peak current equals 175% I <sub>oc</sub> for 2ms @ 10% duty cycle (low current equals 92% I <sub>oc</sub> for 18ms) 3. Peak current equals 150% I <sub>oc</sub> for 10ms @ 50% duty cycle (low current equals 50% I <sub>oc</sub> 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 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/15V/20V; Maximum Load & Minimum Load)



SIZE  
**A**

DRAWING NO.

N99074

REV  
A1

DRAWN

SCALE 1/1

SHEET 13 OF 28

#### 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
15 V	15.75V
20 V	21.0V

#### 4.2.13 Power-On Time

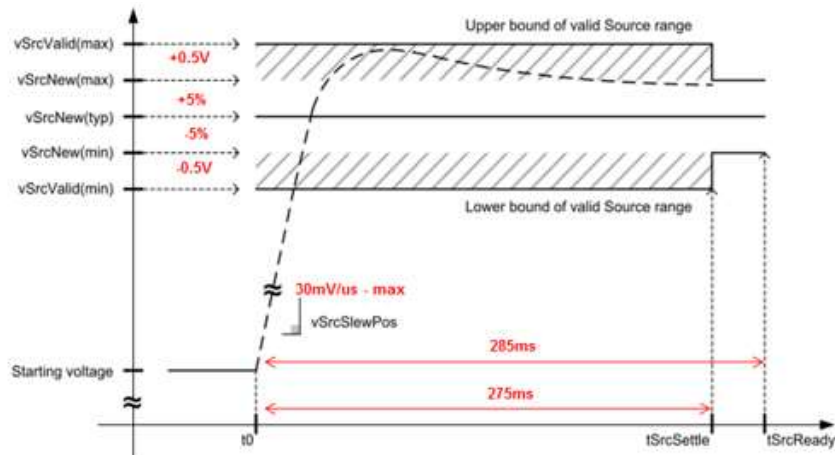
- Output Regulation: The +5V output shall be in regulation within five (5) seconds after valid input power (90 VAC) has been applied.

#### 4.2.14 Rise Time

Output Voltage

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

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



#### 4.2.15 Hold Up

- The power supply output voltage: 5V/9V/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.



SIZE  
**A**

DRAWING NO.

N99074

REV  
A1

DRAWN

SCALE 1/1

SHEET 14 OF 28

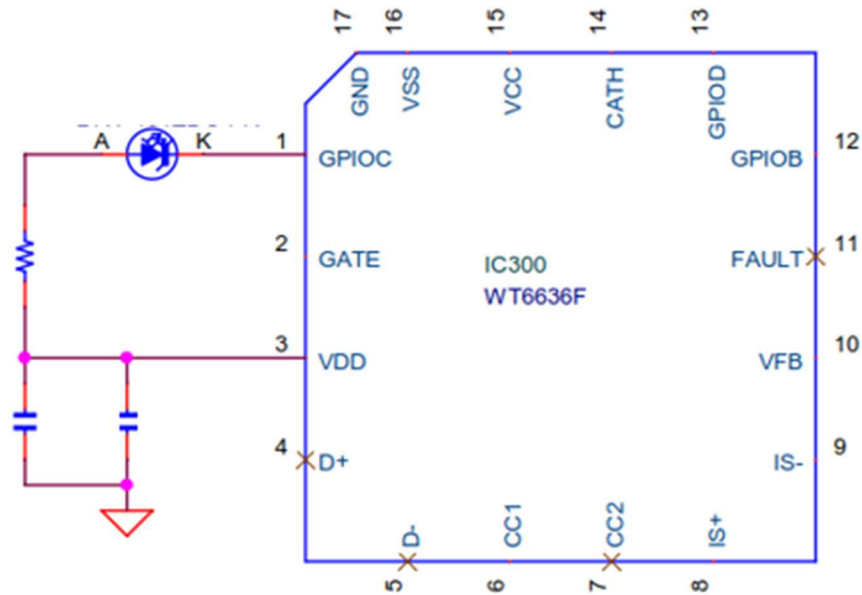
#### 4.2.16 Acoustic Test

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). (Follow latest Test Plan)

#### 4.2.17 Thermal Shutdown

- The power supply shall incorporate over temperature protection to prevent catastrophic failure from overheating.
- Thermal throttling function:
  - o Surface temperature **above 85C**, output power decrease from 65W to 55W.
  - o Surface temperature below 75C(78C~72C), output power increase back to 65W
- **Surface temp mitigated below 94C based on thermal throttling or OTP.**
- Thermocouples wire type: T-type, 30 AWG

#### 4.2.18 LED Indicator



## 5. ENVIRONMENTAL REQUIREMENTS

### 5.1 TEMPERATURE



SIZE  
**A**

DRAWING NO.

N99074

REV  
A1

DRAWN

SCALE 1/1

SHEET 15 OF 28

5.1.1 Operating

The supply shall operate from 0 to 35°C. The maximum temperature rise of any surface shall **not exceed 45°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.)

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

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

5.6 **VIBRATION**

(Supply inside assembly.)



SIZE  
**A**

DRAWING NO.

N99074

REV  
A1

DRAWN

SCALE 1/1

SHEET 16 OF 28



#### 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:

- a)  $\pm 15$  kV with no abnormal operation, but test to 20kV and report results
- b)  $\pm 15$  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**

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.

#### 5.8.1 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>

#### 5.8.2 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.



SIZE

**A**

DRAWING NO.

N99074

REV

A1

DRAWN

SCALE 1/1

SHEET

17

OF

28

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>

### 5.8.3 Other ECO Requirements

#### **Energy Requirements**

##### 6. **KOREA EPS-MEPS**

- 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



SIZE  
**A**

DRAWING NO.

N99074

REV  
A1

DRAWN

SCALE 1/1

SHEET 18 OF 28

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.

#### 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 HP Specification 481605(Rev. L).



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.



SIZE  
**A**

DRAWING NO.

N99074

REV  
A1

DRAWN

SCALE 1/1

SHEET 19 OF 28

#### 10.1.1 De-rating Guidelines

The following component de-rating requirements shall be followed:

- 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

#### 10.1.2 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


#### 10.1.3 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.

#### 10.1.4 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.

**TABLE 3**  
**EPS CRITICAL COMPONENTS CRITERIA**

	SIZE <b>A</b>	DRAWING NO. N99074			REV A1
	DRAWN	SCALE 1/1	SHEET 20	OF 28	

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 $\geq 420\text{Vdc}$ / $105\text{degC}$ minimum. Anode foil withstand voltage $\geq 640\text{V}$ . Capacitance tolerance $\pm 20\%$
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 $\geq 600\text{V}$ Active PFC MosFET $\geq 600\text{V}$ PWM MosFET for Fly-back topologies $\geq 600\text{V}$ MosFET for LLC topologies $\geq 600\text{V}$ GaN MosFET
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 $385\text{Vrms}$



SIZE  
**A**

DRAWING NO.

N99074

REV  
A1

DRAWN

SCALE 1/1

SHEET 21 OF 28

Part Description	Application	Notes
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
PCR	PCR	30%
PACKAGE	PACKAGE	Tracing paper package
USB Type-C Cable	USB Type-C Cable	Lotes; Singatron; Linetek; JVE
USB Type-C Plug (FULL PIN)	USB Type-C Plug TID#	Lotes: TBD; Singatron: TBD; ChengShuo: TBD



SIZE  
**A**

DRAWING NO.

N99074

REV  
A1

DRAWN

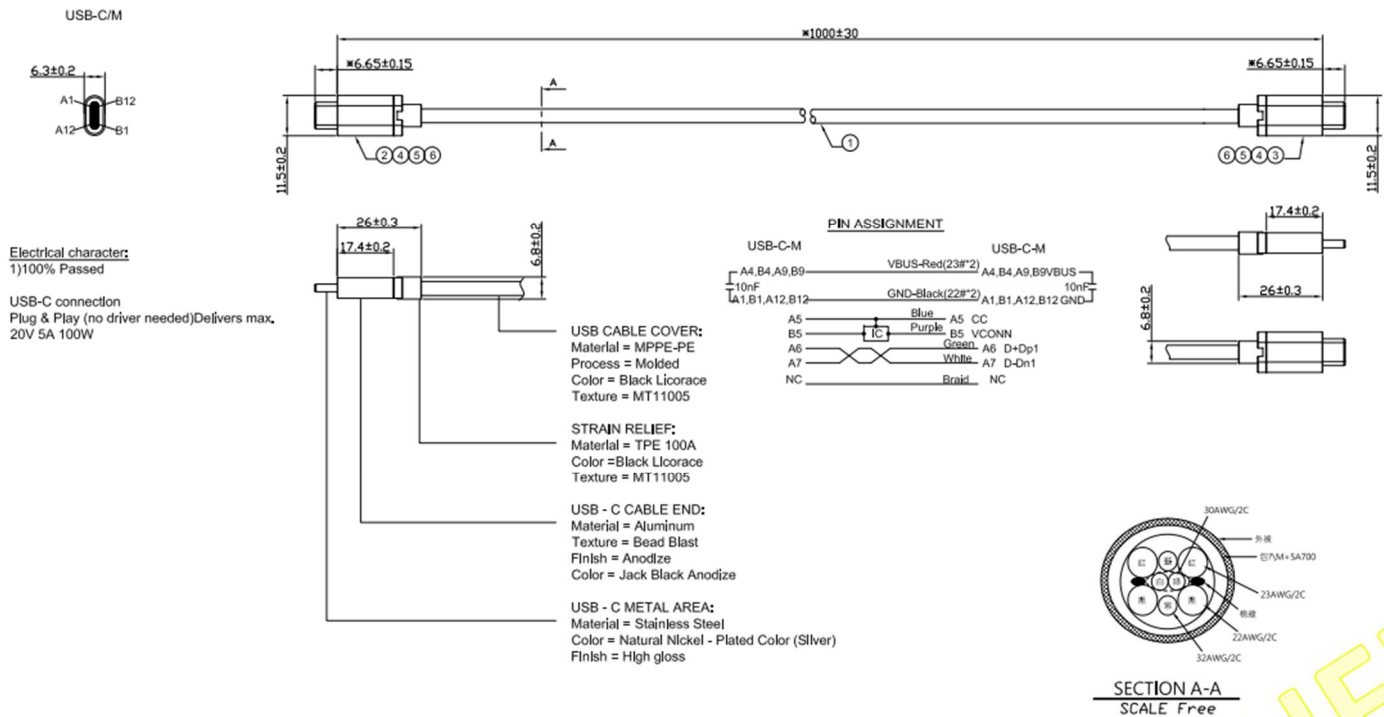
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SHEET 22 OF 28

11. **INTERCONNECTION**

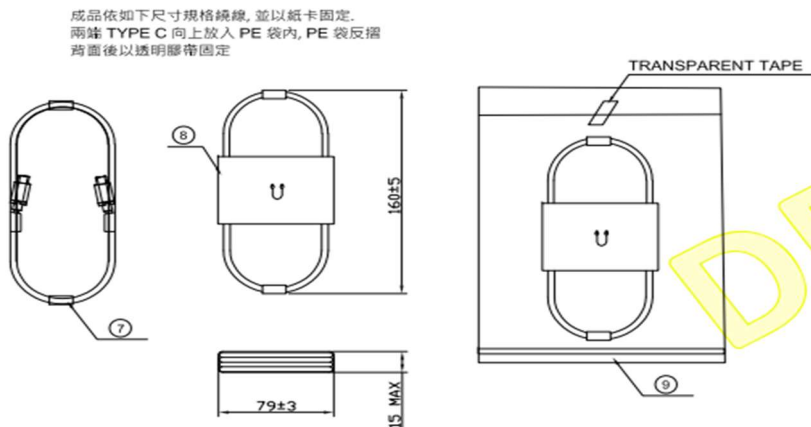
The output cable shall meet the electrical and MTBF requirements of this specification and comply with the HP DC Cable Flexibility test Specification. Following GP file. **(DESIGN by HP)**

**FIGURE 1 OUTPUT CABLE**  
**OUTPUT CABLE**



**CABLE WRAPPING**

The output cable shall meet the wrapping requirement following drawings.



SIZE  
**A**

DRAWING NO.

N99074

REV  
A1

DRAWN

SCALE 1/1

SHEET

23

OF

28



NOTES:

1. MATERIAL:

- a. WIRE:EXTERNAL USE WIRE, CABLES MUST BE A UL/CSA OR CUL RECOGNIZED COMPONENT RATED AT A MINIMUM VW-1 AND/OR FT1

\*WIRE:

1. UL 21476 #30 AWG 1P, 80°C 30V, COPPER WIRE TIN PLATED, HARDNESS:  
Ø0.10X7C, COLOR: GREEN/WHITE, OD=0.55±0.05mm
2. UL 21476 #32 AWG 2C, 80°C 30V, COPPER WIRE TIN PLATED, HARDNESS:  
Ø0.08X7C, COLOR: Purple/BLUE, OD=0.45±0.05mm
3. UL 21476 #23 AWG 2C, 80°C 30V, COPPER WIRE TIN PLATED, HARDNESS:  
Ø0.08X52C, COLOR: RED/RED OD=0.95±0.05mm
4. UL 21476 #22 AWG 2C, 80°C 30V, COPPER WIRE TIN PLATED, HARDNESS:  
Ø0.08X65C, COLOR: BLACK/BLACK OD=1.05±0.05mm

b. PLUG:

TYPE: SEE TABLE1

VENDOR: JVE

c. MOLDING:

\* HARDNESS:

PLUG INNER MOLDING : PE, COLOR:TRANSPARENT
PLUG'S OVERMOLD: 100A, TPE, COLOR: SAME AS CABLE.

e. MATERIAL: POLYOLEFIN HEAT SHRINKABLE TUBING

RATING: UL/CSA RECOGNIZED RATED VW-1, 125°C MINIMUM, 600V MINMUM.

a. HEAT-SHRINKABLE TUBE: MUST BE DELTA APPROVE SOURCE.(125°)

b. ADHESIVE HEAT-SHRINKABLE TUBE:MUST BE DELTA APPROVE SOURCE.(125°)

VENDOR CYG-ZHP.

c. HEAT-SHRINKABLE TUBE(THIN WALL):MUST BE DELTA APPROVE SOURCE.(125°)

\*\*FLAME RETARDANT CAN NOT HAVE RED PHOSPHORUS COMPONENT. \*\*

f. CABLE ASS'Y MUST BE MEET DELTA GENERAL SPEC.:10000-0162 AND 10000-0010.

g. USB TYPE-C CONNECTOR MUST MEET DELTA GENERAL SPEC. 10000-0053-2 USB TYPE-C CABLE AND CONNECTOR SPECIFICATION.

\*2. RESISTANCE: MUST MEET DELTA GENERAL SPEC. 10000-0010

3. CONDUCTOR & PVC JACKET MUST BE MADE BY APPROVED VENDOR

4. PLUG'S INSULATOR MUST BE WITHSTAND 80°C MIN.

5. CRIMPING CABLE TERMINAL SHALL BE BRASS WITH TIN PLATED , TENSILE

6. CHARACTERISTICS AND TEST METHOD:MUST MEET DELTA GENERAL SPEC. 10000-0010

7. POWER CORD MUST BE APPROVED BY DESIGN ENGINEER.

8. DIMENSIONS WITH \* MARK MUST BE INSPECTED AND CONTROLLED STRICTLY BY IQC.

9. S/R MUST BE WITHSTANDED PULL FORCE 10 kgf/MIN.

10. MARKED \* MARK MUST BE INSPECTED AND CONTROLLED STRICTLY BY QA.

11. COPPER RING MUST BE WITHSTANDED PULL FORCE 5~10 kgf/MIN.(WITH PVC)

12. ELECTRICAL PERFORMANCE:(MEET USB TYPE\_C REQUIREMENTS)

a. OPEN/SHORT/INTERMITTENCE: 100%.

b. CONDUCTIVE RESISTANCE:2.0 Ohm MAX.

c. INSULATION RESISTANCE: 10M Ohm/DC300V/0.01s(MIN)

13. TYPE-C CONNECTOR NEED TO BE APPROVED BY DELTA ENGINEERING, CE, AND VQA TEAM.

14. ALL SUBSTANCES OF A MIXTURE SHALL BE ACCOUNTED FOR. NON-ACCEPTED COMPONENTS SHALL NOT EXCEED CONCENTRATION LEVELS OF 0.1% BY WEIGHT OF THE FLAME RETARDANT OR PLASTICIZER.

15. FOR EPEAT 4.1.8.1, ALL ASSESSED SUBSTANCES LIKE FLAME RETARDANTS AND PLASTICIZERS USED IN DC CABLE MUST BE MET BENCHMARK 3 OR 4. PLASTIC PART WHICH USES PLASTICIZERS WEIGHT < 25 GRAM. PLASTIC PART WITHOUT PLASTICIZERS CAN BE EXCLUDED.



SIZE

A

DRAWING NO.

N99074

REV

A1

DRAWN

SCALE 1/1

SHEET

24

OF

28



12. **MARKINGS**

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

- a) HP
- b) Series Number
- c) HP 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.

13. **MECHANICAL**

13.1 **DIMENSIONS**

The nominal external dimensions of the power supply should not exceed **68x53x22mm**.

13.2 **MATERIAL**

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

13.3 **COLOR**

- Following GP file

13.4 **TEXTURE**

- Following GP file

13.5 **USB-C CONNECTOR**

- Lotes and Singatron



SIZE  
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DRAWING NO.

N99074

REV  
A1

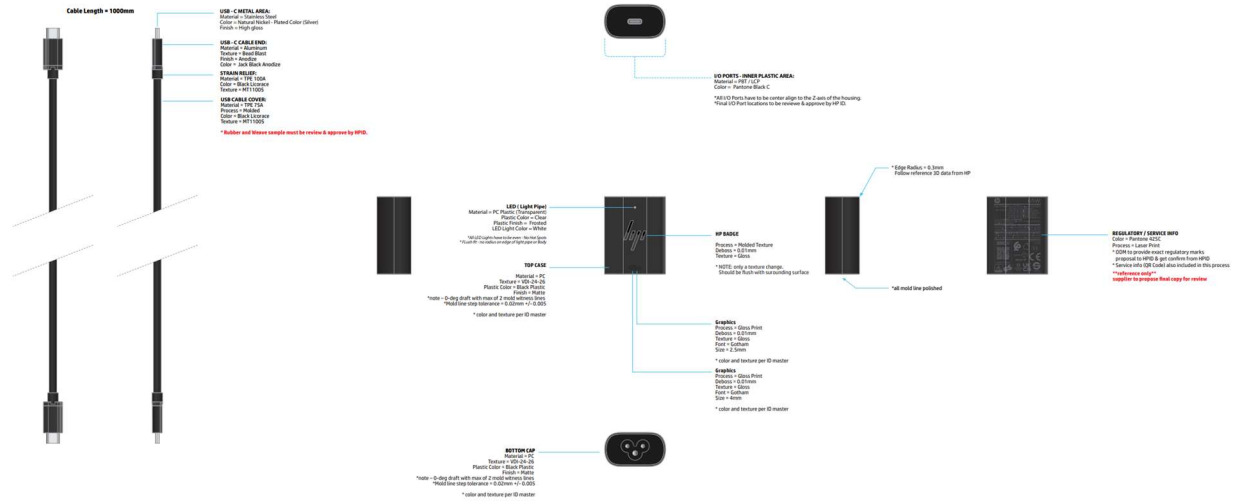
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SCALE 1/1

SHEET 25 OF 28

**[FIGURE 2 CAPPY 65W USBC GP FILE]**

Scale = 1:



**\*\*\*Preliminary subject to change\*\*\***



SIZE  
**A**

DRAWING NO.

N99074

REV  
A1

DRAWN

SCALE 1/1

SHEET 26 OF 28

# OUTLINE DRAWING (LITEON)

NOTE: UNLESS OTHERWISE SPECIFIED.

1. ALL DIMENSION ARE IN mm.

2. PARTS SPECIFIED AS FOLLOWS:

2-1. ENCLOSURE:

MATERIAL: PCR 30%

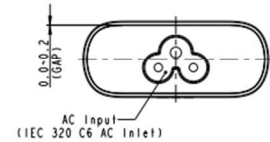
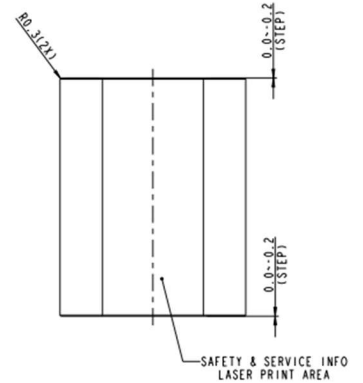
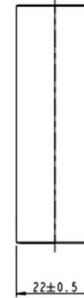
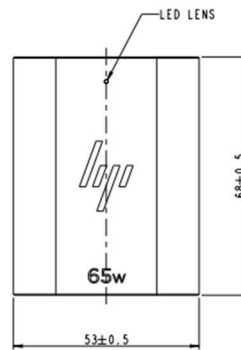
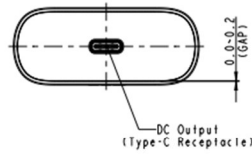
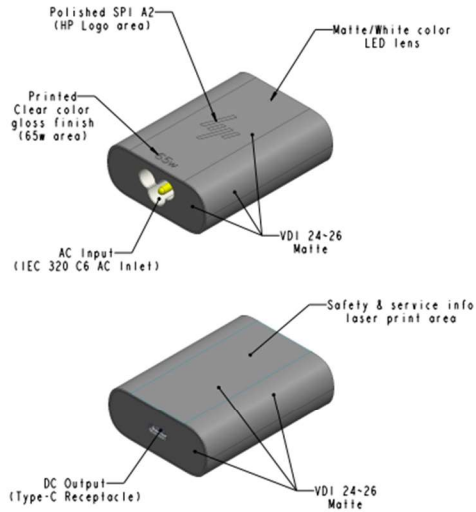
MUST BE UL94 V-0 RATED FLAMMABILITY.

COLOR: BLACK

TEXTURE: VDI 24-26(MAT) & POLISHED SPI A2

2-2. AC INPUT: IEC 320 C6 TYPE AC INLET

2-3. DC OUTPUT: TYPE-C RECEPTACLE



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SIZE  
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DRAWING NO.

N99074

REV  
A1

DRAWN

SCALE 1/1

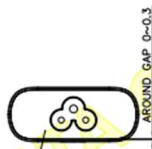
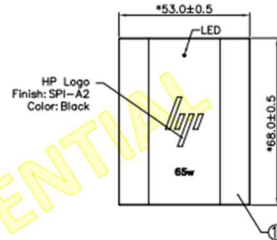
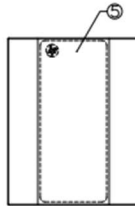
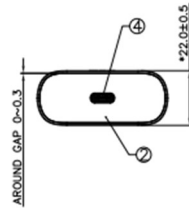
SHEET 27 OF 28

# OUTLINE DRAWING (DELTA)

## Diagram Description

A4,B4,A9,B9	Vbus PIN
A5	CC PIN
A6	D+
A7	D-
A1,B1,A12,B12	GND PIN
SHELL	

\*\*OTHER PIN IS N/C.(CAN NOT SHORT)



ITEM	PART NAME	COLOR
①	TUBE CHASSIS	BLACK
②	DC COVER	BLACK
③	SOCKET ASS'Y	BLACK
④	USB C	---
⑤	LABEL AREA	---

## NOTES:

1. THE COLOR OF DC JACK'S INSULATOR: BLACK .
2. DC JACK'S SHAPE: USB TYPE C.
3. PLUG'S POLARITY: SEE Diagram Description (A1).
4. MARKED \* MARK MUST BE INSPECTED AND CONTROLLED STRICTLY BY QA.
5. AC SOCKET TYPE: C6 TYPE.

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<small>PHYSICAL DIMENSION</small>		Part No. ADP-65CG BA	
A2 SIZE		SHEET 2 OF 2 ISSUE DATE: 01/11/24	



SIZE  
**A**

DRAWING NO.

N99074

REV  
A1

DRAWN

SCALE 1/1

SHEET 28 OF 28