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# SPECIFICATION



FSP350-60GLN(80)(F04001)

Released Date:2008/4/23-20:3:14



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# SPECIFICATION

## FSP350-60GLN(80)

9PA3508504

**Main Feature:**  
**Low Noise**  
**Meet 80plus**  
**Active PFC Circuit**  
**Full Range Input**  
**ATX2.2 Version**

**July. 18, 2007**  
**REV : 00**



全漢企業股份有限公司  
FSP TECHNOLOGY INC.

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**MODEL: FSP350-60GLN(80)**

**Revision History**

<u>Rev</u>	<u>Description</u>	<u>Date</u>	<u>Author</u>
1.00		2007/07/18	

## 1. GENERAL DESCRIPTION AND SCOPE

This is the specification of Model FSP350-60GLN(80); AC-line powered switching power supply with active PFC (Power Factor Correction) circuit, meet EN61000-3-2 and with Full Range Input features.

The specification below is intended to describe as detailedly as possible the functions and performance of the subject power supply. Any comment or additional requirements to this specification from our customers will be highly appreciated and treated as a new target for us to approach.

## 2. REFERENCE DOCUMENTS

The subject power supply will meet the EMI requirements and obtain main safety approvals as following:

### 2.1. EMI REGULATORY

- FCC Part 15 Subpart J, Class 'B' 115 Vac operation.
- CISPR 22 Class 'B' 230 Vac operation.

### 2.2. SAFETY

- NEMKO EN 60950-1
- TUV EN 60950-1
- CSA EN 60950-1
- IEC EN 60950-1
- UL EN 60950-1
- CE :
  - EN 55022:1998+A1: 2000, Class B
  - EN 61000-3-2: 2000
  - EN 61000-3-3: 1995+A1: 2001
  - EN 60950-1
- CISPR22: 1997+A1: 2000, Class B
- AS/NZS CISPR 22: 2002, Class B

### 3. INPUT ELECTRICAL SPECIFICATIONS

#### 3.1. AC INPUT

Parameter	Min.	Nom. <sup>(1)</sup>	Max.	Unit
V <sub>in</sub> (115VAC)	90	115	135	VAC <sub>rms</sub>
V <sub>in</sub> (230VAC)	180	230	265	VAC <sub>rms</sub>
V <sub>in</sub> Frequency	47	--	63	HZ

◆ Nominal voltages for test purposes are considered to be within  $\pm 1.0V$  of nominal.

#### 3.2. INRUSH CURRENT

**Maximum inrush current from power-on (with power on at any point on the AC sine) and including, but not limited to, three line cycles, shall be limited to a level below the surge rating of the input line cord, AC switch if present, bridge rectifier, fuse, and EMI filter components. Repetitive ON/OFF cycling of the AC input voltage should not damage the power supply or cause the input fuse to blow.**

#### 3.3. INPUT LINE CURRENT & POWER FACTOR (P.F.)

(At Full load)

AC input	Input line current	P.F.@ Full Load	P.F.@ Pin=75W
115V	< 4.0Amps – rms	> 0.95	> 0.8
230V	< 2.0Amps – rms	> 0.9	> 0.75

#### 3.4. EFFICIENCY

##### 3.4.1. General

**Under the load conditions defined in Table 1 and Table 2. The loading condition for testing efficiency shown in Table 1 represents a fully loaded system. a ~ 50% (typical) loaded system. and a ~ 20% (light) loaded system.**

**Table. 1 Loading Table for Efficiency Measurements**

<b>350W(loading shown in Amps)</b>						
<b>Loading</b>	<b>+12V1</b>	<b>+12V2</b>	<b>+5V</b>	<b>+3.3V</b>	<b>-12V</b>	<b>+5Vsb</b>
<b>100%</b>	<b>9.99</b>	<b>9.99</b>	<b>11.59</b>	<b>10.54</b>	<b>0.47</b>	<b>2.37</b>
<b>50%</b>	<b>4.99</b>	<b>4.99</b>	<b>5.8</b>	<b>5.27</b>	<b>0.24</b>	<b>1.19</b>
<b>20%</b>	<b>2.0</b>	<b>2.0</b>	<b>2.32</b>	<b>2.11</b>	<b>0.09</b>	<b>0.47</b>

**Table 2. Minimum Efficiency Vs Load**

<b>Loading</b>	<b>Voltage</b>	<b>100%</b>	<b>50%</b>	<b>20%</b>
<b>Required Minimum Efficiency</b>	<b>115V</b>	<b>80%</b>	<b>80%</b>	<b>80%</b>
<b>Required Minimum Efficiency</b>	<b>230V</b>	<b>80%</b>	<b>82%</b>	<b>80%</b>

### 3.5. MECHANICAL SPECIFICATIONS

The mechanical drawing of the subject power supply, which indicate the form factor, location of the mounting holes, location, the length of the connectors, and other physical specifications of the subject power supply. Please refer to the attachment drawing.

## 4. OUTPUT ELECTRICAL REQUIREMENTS

### 4.1. OUTPUT VOLTAGE AND CURRENT RATING

<b>Output</b>	<b>MINIMUM LOAD</b>	<b>NORMAL LOAD</b>	<b>MAXIMUM LOAD</b>	<b>PEAK LOAD</b>	<b>LOAD REG.</b>	<b>LINE REG.</b>	<b>RIPPLE &amp; NOISE</b>
+3.3V	0.5A	10A	20A		±5%	±1%	50mV P-P
+5V	0.3A	11A	22A		±5%	±1%	50mV P-P
+12V1	1A	7.5A	16A		±5%	±1%	120mV P-P
+12V2	1A	7.5A	16A	16.5A	±5%	±1%	120mV P-P
-12V	0A	0.25A	0.5A		±10%	±1%	120mV P-P
+5VSB	0A	1.25A	2.5A	3.5A	±5%	±1%	50mV P-P

( 1 ) +3.3V & +5V total output not exceed 130W.

( 2 ) Maximum combined current for the +12V outputs shall be 28A.

( 3 ) +12V2 Peak current is 16.5A (less then 10m Sec.),minimum voltage during peak is >11.0VDC

(4) +5VSB Peak current loading is 3.5A , shall be supported for a minimum of 500m second. Voltages and ripple are measured at the load side of mating connectors with a 0.1 uF monolithic ceramic capacitor paralleled by a 10 uF electrolytic capacitor across the measuring terminals.

#### 4.2. LOAD CAPACITY SPECIFICATIONS

The cross regulation defined as follows, the voltage regulation limits DC include DC Output ripple & noise.

LOAD	STM.	+3.3V	+5V	+12V1 DC	+12V2 DC	-12V	+5VSB
FULL LOAD	MHMMHH	6.1A	22A	8.4A	8.4A	0.5A	2.5A
FULL LOAD	HMMMHH	20A	12.8A	8.4A	8.4A	0.5A	2.5A
+3.3V MAX other MIN	HLLLLL	18A	3A	3A	3A	0A	0A
+5V MAX Other MIN	LHLLLL	0.5A	18A	1.5A	1.5A	0A	0A
+12V1&+12V2 MAX Other MIN	LLHHLL	2A	2A	10A	15A	0A	0A
-12V MAX other MIN	LLLLHL	0.5A	0.3A	1A	1A	0.5A	0A
+5VSB MAX other MIN	LLLLLH	0.5A	0.3A	1A	1A	0A	2.5A
ALL MIN	LLLLLL	0.5A	0.3 A	1A	1A	0A	0A

#### 4.3. HOLD-UP TIME (@FULL LOAD)

115V / 60Hz : 17 mSec. Minimum.

230V / 50Hz : 17 mSec. Minimum.

The output voltage will remain within specification, in the event that the input power is removed or interrupted, for the duration of one cycle of the input frequency. The interruption may occur at any point in the AC voltage cycle. The power good signal shall remain high during this test.

#### 4.4. OUTPUT RISE TIME

(10% TO 95% OF FINAL OUTPUT VALUE, @FULL LOAD)

115V-rms or 230V-rms	+ 3.3Vdc : 20ms Maximum
	+ 5Vdc : 20ms Maximum
	+ 12Vdc : 20ms Maximum
	+ 5Vsb : 25ms Maximum
	- 12Vdc : 20ms Maximum

#### 4.5. OVER VOLTAGE PROTECTION

Voltage Source	Protection Point
+3.3V	3.76V-4.3V
+5V	5.6V-7.0V
+12V	13.0V-15.6V

#### 4.6. OVER CURRENT PROTECTION

OUTPUT VOLTAGE	Max. over current limit
+3.3V	60.0A
+5V	48.0A
+12V1 DC	22.0A
+12V2 DC	22.0A

#### 4.7. SHORT CIRCUIT PROTECTION

Output short circuit is defined to be a short circuit load of less than 0.1 ohm.

In the event of an output short circuit condition on +3.3V, +5V or +12V,-12V output, the power supply will shutdown and latch off without damage to the power supply.

The power supply shall return to normal operation after the short circuit has been removed and the power switch has been turned off for no more than 2 seconds.

In the event of an output short circuit condition on -12V output, the power supply will not be damaged. The power supply shall return to normal operation as soon as the short circuit has been removed. and the power switch has been turned off for no more than 2 seconds.



#### 4.8. POWER SIGNAL

POWER GOOD @115/230V, FULL LOAD	100 – 500mSec.
POWER FAIL @115/230V, FULL LOAD	1 mSec. minimum

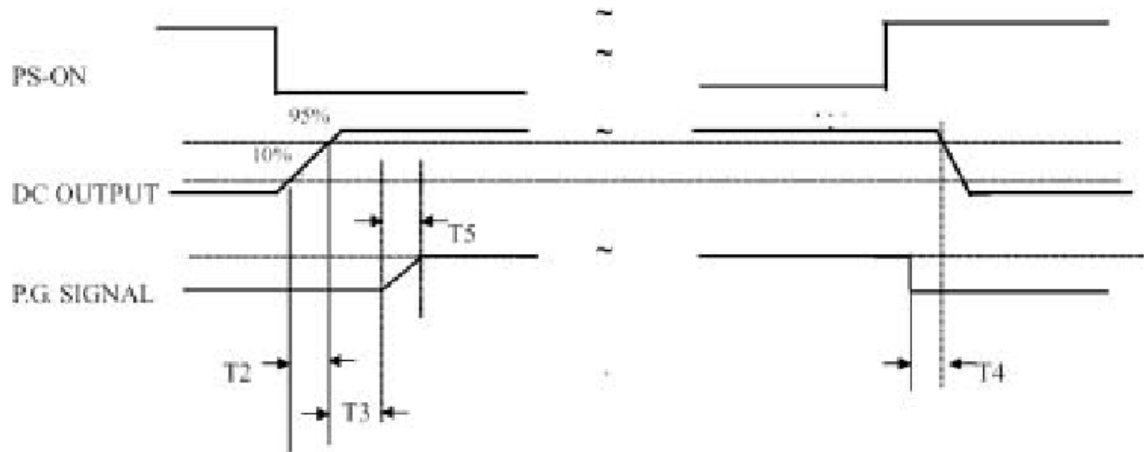


Figure 1

- T2 : RISE TIME < 20mS
- T3 : POWER GOOD DELAY TIME 100mS-500mS
- T4 : POWER FAIL DELAY TIME > 1mS
- T5 : POWER GOOD RISE TIME  $\leq$  10mS

#### 5. FAN NOISE REQUIREMENTS

5.1. The subject power supply is cooled by a self-contained, 120mm, 12VDC fan.

#### 5.2. FAN NOISE

AC INPUT	100% (Table.1)	50% (Table.1)	20% (Table.1)
115V	NOISE $\leq$ 35dB	NOISE $\leq$ 30dB	NOISE $\leq$ 25dB
230V	NOISE $\leq$ 35dB	NOISE $\leq$ 30dB	NOISE $\leq$ 25dB

#### 6. ENVIRONMENTAL REQUIREMENTS

The power supply will be compliant with each item in this specification for the following Environmental conditions.

## 6.1. TEMPERATURE RANGE

Operating	+10 to +50 deg. C
Storage	-20 to +80 deg. C

## 6.2. HUMIDITY

Operating	5 –95% RH, Non-condensing
Storage	5 –95% RH, Non-condensing

## 6.3. VIBRATION

The subject power supply will withstand the following imposed conditions without experiencing non-recoverable failure or deviation from specified output characteristics.

Vibration Operating – Sine wave excited, 0.25 G maximum acceleration, 10-250 Hz swept at one octave / min. Fifteen minute dwell at all resonant points, where resonance is defined as those exciting frequencies at which the device under test experiences excursions two times large than non-resonant excursions.

Plane of vibration to be along three mutually perpendicular axes.

## 6.4. GROUND LEAKAGE CURRENT

The power supply ground leakage current shall be less than 3.5 mA.

## 6.5. RELIABILITY

The power supply reliability, when calculated by MIL-HDBK-217; latest revision, are exceed 100,000 hours with all output at maximum load and an ambient temperature of 25°C.

## 6.6. DIELECTRIC STRENGTH

Primary to Frame Ground : 1800 Vac for 1 sec.

Primary to Secondary : 1800Vac for 1 sec

## 6.7. INSULATION RESISTANCE

Primary to Frame Ground : 20 Meg.ohms Minimum

Primary to Secondary : 20 Meg.ohms Minimum

## **7. LABELLING**

Label marking will be permanent, legible and complied with all agency requirements.

### **7.1. MODEL NUMBER LABEL**

Labels will be affixed to the sides of the power supply showing the following:

- Manufacturer's name and logo.
- Model no., serial no., revision level, location of manufacturer.
- The total power output and the maximum load for each output.
- AC input rating.



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# SPECIFICATION

## **FSP350-60GLN(80)**

**9PA3508504**

**Main Feature:**  
**Low Noise**  
**Meet 80plus**  
**Active PFC Circuit**  
**Full Range Input**  
**ATX2.2 Version**

**July. 18, 2007**  
**REV : 00**



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**MODEL: FSP350-60GLN(80)**

**Revision History**

<u>Rev</u>	<u>Description</u>	<u>Date</u>	<u>Author</u>
1.00		2007/07/18	

## 1. GENERAL DESCRIPTION AND SCOPE

This is the specification of Model FSP350-60GLN(80); AC-line powered switching power supply with active PFC (Power Factor Correction) circuit, meet EN61000-3-2 and with Full Range Input features.

The specification below is intended to describe as detailedly as possible the functions and performance of the subject power supply. Any comment or additional requirements to this specification from our customers will be highly appreciated and treated as a new target for us to approach.

## 2. REFERENCE DOCUMENTS

The subject power supply will meet the EMI requirements and obtain main safety approvals as following:

### 2.1. EMI REGULATORY

- FCC Part 15 Subpart J, Class 'B' 115 Vac operation.
- CISPR 22 Class 'B' 230 Vac operation.

### 2.2. SAFETY

- NEMKO EN 60950-1
- TUV EN 60950-1
- CSA EN 60950-1
- IEC EN 60950-1
- UL EN 60950-1
- CE :
  - EN 55022:1998+A1: 2000, Class B
  - EN 61000-3-2: 2000
  - EN 61000-3-3: 1995+A1: 2001
  - EN 60950-1
- CISPR22: 1997+A1: 2000, Class B
- AS/NZS CISPR 22: 2002, Class B

### 3. INPUT ELECTRICAL SPECIFICATIONS

#### 3.1. AC INPUT

Parameter	Min.	Nom. <sup>(1)</sup>	Max.	Unit
V <sub>in</sub> (115VAC)	90	115	135	VAC <sub>rms</sub>
V <sub>in</sub> (230VAC)	180	230	265	VAC <sub>rms</sub>
V <sub>in</sub> Frequency	47	--	63	HZ

◆ Nominal voltages for test purposes are considered to be within  $\pm 1.0V$  of nominal.

#### 3.2. INRUSH CURRENT

**Maximum inrush current from power-on (with power on at any point on the AC sine) and including, but not limited to, three line cycles, shall be limited to a level below the surge rating of the input line cord, AC switch if present, bridge rectifier, fuse, and EMI filter components. Repetitive ON/OFF cycling of the AC input voltage should not damage the power supply or cause the input fuse to blow.**

#### 3.3. INPUT LINE CURRENT & POWER FACTOR (P.F.)

(At Full load)

AC input	Input line current	P.F.@ Full Load	P.F.@ Pin=75W
115V	< 4.0Amps – rms	> 0.95	> 0.8
230V	< 2.0Amps – rms	> 0.9	> 0.75

#### 3.4. EFFICIENCY

##### 3.4.1. General

**Under the load conditions defined in Table 1 and Table 2. The loading condition for testing efficiency shown in Table 1 represents a fully loaded system. a ~ 50% (typical) loaded system. and a ~ 20% (light) loaded system.**

**Table. 1 Loading Table for Efficiency Measurements**

<b>350W(loading shown in Amps)</b>						
<b>Loading</b>	<b>+12V1</b>	<b>+12V2</b>	<b>+5V</b>	<b>+3.3V</b>	<b>-12V</b>	<b>+5Vsb</b>
<b>100%</b>	<b>9.99</b>	<b>9.99</b>	<b>11.59</b>	<b>10.54</b>	<b>0.47</b>	<b>2.37</b>
<b>50%</b>	<b>4.99</b>	<b>4.99</b>	<b>5.8</b>	<b>5.27</b>	<b>0.24</b>	<b>1.19</b>
<b>20%</b>	<b>2.0</b>	<b>2.0</b>	<b>2.32</b>	<b>2.11</b>	<b>0.09</b>	<b>0.47</b>

**Table 2. Minimum Efficiency Vs Load**

<b>Loading</b>	<b>Voltage</b>	<b>100%</b>	<b>50%</b>	<b>20%</b>
<b>Required Minimum Efficiency</b>	<b>115V</b>	<b>80%</b>	<b>80%</b>	<b>80%</b>
<b>Required Minimum Efficiency</b>	<b>230V</b>	<b>80%</b>	<b>82%</b>	<b>80%</b>

### 3.5. MECHANICAL SPECIFICATIONS

The mechanical drawing of the subject power supply, which indicate the form factor, location of the mounting holes, location, the length of the connectors, and other physical specifications of the subject power supply. Please refer to the attachment drawing.

## 4. OUTPUT ELECTRICAL REQUIREMENTS

### 4.1. OUTPUT VOLTAGE AND CURRENT RATING

<b>Output</b>	<b>MINIMUM LOAD</b>	<b>NORMAL LOAD</b>	<b>MAXIMUM LOAD</b>	<b>PEAK LOAD</b>	<b>LOAD REG.</b>	<b>LINE REG.</b>	<b>RIPPLE &amp; NOISE</b>
+3.3V	0.5A	10A	20A		±5%	±1%	50mV P-P
+5V	0.3A	11A	22A		±5%	±1%	50mV P-P
+12V1	1A	7.5A	16A		±5%	±1%	120mV P-P
+12V2	1A	7.5A	16A	16.5A	±5%	±1%	120mV P-P
-12V	0A	0.25A	0.5A		±10%	±1%	120mV P-P
+5VSB	0A	1.25A	2.5A	3.5A	±5%	±1%	50mV P-P

( 1 ) +3.3V & +5V total output not exceed 130W.

( 2 ) Maximum combined current for the +12V outputs shall be 28A.

( 3 ) +12V2 Peak current is 16.5A (less then 10m Sec.),minimum voltage during peak is >11.0VDC



(4) +5VSB Peak current loading is 3.5A , shall be supported for a minimum of 500m second.  
 Voltages and ripple are measured at the load side of mating connectors with a 0.1 uF monolithic ceramic capacitor paralleled by a 10 uF electrolytic capacitor across the measuring terminals.

#### 4.2. LOAD CAPACITY SPECIFICATIONS

The cross regulation defined as follows, the voltage regulation limits DC include DC Output ripple & noise.

LOAD	STM.	+3.3V	+5V	+12V1 DC	+12V2 DC	-12V	+5VSB
FULL LOAD	MHMMHH	6.1A	22A	8.4A	8.4A	0.5A	2.5A
FULL LOAD	HMMMHH	20A	12.8A	8.4A	8.4A	0.5A	2.5A
+3.3V MAX other MIN	HLLLLL	18A	3A	3A	3A	0A	0A
+5V MAX Other MIN	LHLLLL	0.5A	18A	1.5A	1.5A	0A	0A
+12V1&+12V2 MAX Other MIN	LLHHLL	2A	2A	10A	15A	0A	0A
-12V MAX other MIN	LLLLHL	0.5A	0.3A	1A	1A	0.5A	0A
+5VSB MAX other MIN	LLLLLH	0.5A	0.3A	1A	1A	0A	2.5A
ALL MIN	LLLLLL	0.5A	0.3 A	1A	1A	0A	0A

#### 4.3. HOLD-UP TIME (@FULL LOAD)

115V / 60Hz : 17 mSec. Minimum.

230V / 50Hz : 17 mSec. Minimum.

The output voltage will remain within specification, in the event that the input power is removed or interrupted, for the duration of one cycle of the input frequency. The interruption may occur at any point in the AC voltage cycle. The power good signal shall remain high during this test.

#### 4.4. OUTPUT RISE TIME

(10% TO 95% OF FINAL OUTPUT VALUE, @FULL LOAD)

115V-rms or 230V-rms	+ 3.3Vdc : 20ms Maximum
	+ 5Vdc : 20ms Maximum
	+ 12Vdc : 20ms Maximum
	+ 5Vsb : 25ms Maximum
	- 12Vdc : 20ms Maximum

#### 4.5. OVER VOLTAGE PROTECTION

Voltage Source	Protection Point
+3.3V	3.76V-4.3V
+5V	5.6V-7.0V
+12V	13.0V-15.6V

#### 4.6. OVER CURRENT PROTECTION

OUTPUT VOLTAGE	Max. over current limit
+3.3V	60.0A
+5V	48.0A
+12V1 DC	22.0A
+12V2 DC	22.0A

#### 4.7. SHORT CIRCUIT PROTECTION

Output short circuit is defined to be a short circuit load of less than 0.1 ohm.

In the event of an output short circuit condition on +3.3V, +5V or +12V,-12V output, the power supply will shutdown and latch off without damage to the power supply.

The power supply shall return to normal operation after the short circuit has been removed and the power switch has been turned off for no more than 2 seconds.

In the event of an output short circuit condition on -12V output, the power supply will not be damaged. The power supply shall return to normal operation as soon as the short circuit has been removed. and the power switch has been turned off for no more than 2 seconds.

#### 4.8. POWER SIGNAL

POWER GOOD @115/230V, FULL LOAD	100 – 500mSec.
POWER FAIL @115/230V, FULL LOAD	1 mSec. minimum

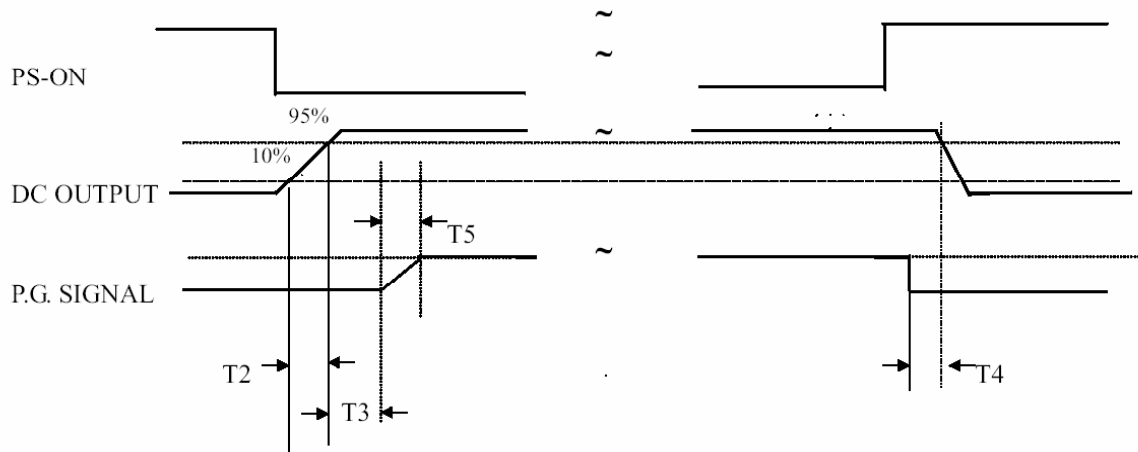


Figure 1

T2 : RISETIME < 20mS

T3 : POWER GOOD DELAY TIME 100mS-500mS

T4 : POWER FAIL DELAY TIME > 1mS

T5 : POWER GOOD RISETIME ≤ 10mS

#### 5. FAN NOISE REQUIREMENTS

5.1. The subject power supply is cooled by a self-contained, 120mm, 12VDC fan.

#### 5.2. FAN NOISE

AC INPUT	100% (Table.1)	50% (Table.1)	20% (Table.1)
115V	NOISE ≤ 35dB	NOISE ≤ 30dB	NOISE ≤ 25dB
230V	NOISE ≤ 35dB	NOISE ≤ 30dB	NOISE ≤ 25dB

#### 6. ENVIRONMENTAL REQUIREMENTS

The power supply will be compliant with each item in this specification for the following Environmental conditions.

## 6.1. TEMPERATURE RANGE

Operating	+10 to +50 deg. C
Storage	-20 to +80 deg. C

## 6.2. HUMIDITY

Operating	5 -95% RH, Non-condensing
Storage	5 -95% RH, Non-condensing

## 6.3. VIBRATION

The subject power supply will withstand the following imposed conditions without experiencing non-recoverable failure or deviation from specified output characteristics.

Vibration Operating – Sine wave excited, 0.25 G maximum acceleration, 10-250 Hz swept at one octave / min. Fifteen minute dwell at all resonant points, where resonance is defined as those exciting frequencies at which the device under test experiences excursions two times large than non-resonant excursions.

Plane of vibration to be along three mutually perpendicular axes.

## 6.4. GROUND LEAKAGE CURRENT

The power supply ground leakage current shall be less than 3.5 mA.

## 6.5. RELIABILITY

The power supply reliability, when calculated by MIL-HDBK-217; latest revision, are exceed 100,000 hours with all output at maximum load and an ambient temperature of 25°C.

## 6.6. DIELECTRIC STRENGTH

Primary to Frame Ground : 1800 Vac for 1 sec.

Primary to Secondary : 1800Vac for 1 sec

## 6.7. INSULATION RESISTANCE

Primary to Frame Ground : 20 Meg.ohms Minimum

Primary to Secondary : 20 Meg.ohms Minimum

## **7. LABELLING**

Label marking will be permanent, legible and complied with all agency requirements.

### **7.1. MODEL NUMBER LABEL**

Labels will be affixed to the sides of the power supply showing the following:

- Manufacturer's name and logo.
- Model no., serial no., revision level, location of manufacturer.
- The total power output and the maximum load for each output.
- AC input rating.