SPECIFICATION FOR AC-DC POWER SUPPLY FOR DEFENCE APPLICATION

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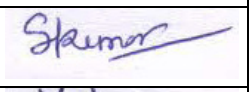
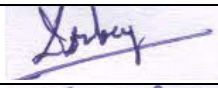
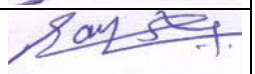
Prepared By:	Santosh Kumar	Design Engineer	
Checked By	Dinesh Dubey	Dy.Manager (D)	
Approved By:	Rajesh Kumar Sharma	DGM	

HISTORY OF REVISIONS

Issue	Description
00	Concept release, original version

1.0 Introduction

This specification lays down the general requirements of the design for Power Supply for Defence Application.

2.0 Working conditions

The equipment supplied against this specification shall meet the following general requirements:

1. The equipment supplied shall be of good quality, rugged, reliable and capable to withstand environmental and use conditions. Equipment shall comply the test given in Clause 9 of this Specification.
2. All printed board assemblies shall be protected on both sides with a protective transparent coating, in order to prevent deterioration or damage due to moisture and atmospheric contaminants. The coating shall not have any adverse reaction with any other materials or components used. Components used shall be of Military grade.

3.0 Scope of Work

Supplier has to manufacture, test and supply following Power Supply

S.No	Power Supply	Input Voltage Range	Output Voltage With very low ripple content	Output Current in Amps	Quantity	Remarks
1	± 15V AC-DC Power Supply	100 – 180 V AC, 3 Phase, 50Hz	± 15V (In the absence of Input power, the output power shall be available for 1 second	5	6	Power Factor at Input of Power Supply shall be close to unity
2	+ 24 V AC-DC Power Supply	100 – 180 V AC, 3 Phase, 50Hz	+24V (In the absence of Input power, the output power shall be available for 1 second	10	3	Power Factor at Input of Power Supply shall be close to unity
3	+ 5 V AC-DC Power Supply	100 – 180 V AC, 3 Phase, 50Hz	+5V (In the absence of Input power, the output power shall be available for 1 second	7	3	Power Factor at Input of Power Supply shall be close to unity

4.0 REQUIREMENT OF PCB FABRICATION

<table>
<tr><td>4.1</td><td>All PCBs shall be made of flame retardant epoxide woven Glass fabric copper clad laminate sheet. The dimensions of the PCBs shall be as per drawings.</td></tr>
<tr><td>4.2</td><td>The artwork shall employ the shortest possible routes for interconnections. The tracks shall be 1mm wide (or greater and minimum track width should be 0.25mm) with minimum gap between track 0.64mm. The artwork shall be approved by BHEL prior to PCB fabrication.</td></tr>
<tr><td>4.3</td><td>The PCB shall be tinned with solder containing at least 70% Sn (Tin metal).</td></tr>
<tr><td>4.4</td><td>Thickness of copper plating in a hole should not be less than 25 microns. Coating of all PTH holes should be uniform.</td></tr>
<tr><td>4.5</td><td>Solder resist mask on bare copper (SMOBC) is to be provided. The average coating thickness of Mask is as below depending on the process employed (Photo image-able type liquid film process is preferred)
<table>
<tr><td>i)</td><td>Dry Film</td><td>100 microns</td></tr>
<tr><td>ii)</td><td>Liquid Film</td><td>25 microns</td></tr>
<tr><td>iii)</td><td>Photo image-able type liquid film</td><td>25 microns</td></tr>
</table>
There should not be any solder resist mask on the solder pads and PTH holes & there should not be any evidence of cracking of solder mask after soldering and chemical cleaning operations and no evidence of breaking, lifting or degeneration of the solder mask.</td></tr>
<tr><td>4.6</td><td>To identify each component, a legend in white color along with polarity of the components wherever applicable shall be printed after green masking.</td></tr>
<tr><td>4.7</td><td>All PCB’s shall be uniquely identified indicating vendor code, PCB</td></tr>
</table>

	Drg No, year of manufacture. This may be printed on atleast one side of the PCB.
4.8	BHEL logo shall be etched/screen printed on each card at suitable location.
4.9	All PCB's shall be 100% bare board tested at PCB manufacturer's Work and necessary test certificate correlating the lot of PCB should be submitted to BHEL
4.10	IR test on bare PCB : With 500VDC megger the IR value shall be more than 500 M ohms between two adjacent tracks having minimum separation.
4.11	High Voltage test on bare PCB : With test voltage of 500VAC, 50Hz applied between two adjacent tracks having minimum separation for One minute, no flashover/spark/breakdown should occur.

5.0 SELECTION OF COMPONENTS AND THEIR ASSEMBLY ON THE PCB

The following criteria shall apply for selection of the components and the Assembly of the PCB.

5.1	All components shall be of MIL grade.
5.2	All resistors shall be metal film type unless otherwise mentioned.
5.3	All Components shall only be procured from reputed suppliers. The source of each component shall be informed to BHEL prior to procurement.
5.4	All components shall be soldered using the wave soldering technique.
5.5	Heavy Components shall be supported in a clamp or other device such that soldered connections are not solely relied upon for mechanical strength.
5.6	Solder print used for special connectors, wires and other components where only hand soldering is to be done shall be

	blocked with proper tape to avoid filling of solder in these holes.
5.7	Qualification of soldering process is to be carried out by soldering PCB's after adopting optimal parameter setting recommended by the manufacturer or used during previous process qualification study. The quality of the output is to be visually checked for following points with a magnification of 4 to10X :

i)	Clean, bright, smooth undisturbed surface.
ii)	Complete wetting as evidenced by a low contact angle between solder and pad surfaces.
iii)	Proper and even distribution of the solder.
iv)	The solder shall form complete fillet between the lead and the solder pad and show evidence of complete solder wetting around the lead and on the pad.
v)	No damaged, charred, burnt, melted, discoloured, cracked insulation on parts or base material is observed.
vi)	No track is separated from the PCB or damaged
vii)	No abnormal short between the leads of ICs or other components is observed.

5.8	After soldering, PCBs to be cleaned for removal of grease, oil, dirt, and flux etc.
5.9	The PCBs shall be given a conformal coating using CHEM-VERSE make PCB-500 aerosol spray or equivalent or superior.

6. Metal Housing

- All the PCBs shall be housed in a Magnetic Stainless Steel Box. All the fasteners used shall be of metric size and shall be galvanized.
- Exact dimension will be finalized at design stage mutually between supplier and BHEL.

7. Warranty

To provide a warranty of 18 months on the product from the date of commissioning.

Any problems arising in the cards even at customer sites shall be addressed.

8. Documentation

To provide the following documents along with the equipment:

- Guarantee Certificate
- PCB Layout and Schematic
- PCB Gerber Data
- Test Report
- Type Test Certificate from NABL Approved Lab.

9. Acceptance Test

Following tests shall be conducted on the equipment for acceptance:

Sl no	Test Description	Routine test	Type test	Remarks
1	Visual Inspection	√	√	
2	Functional Test	√	√	
3	High Temperature Test		√	
4	Low Temperature Test		√	
5	Damp Heat Test		√	
6	Mould Growth Test		√	
7	Corrosion (Salt) Test		√	
8	Vibration Resistance Test	√	√	
9	Thermal Shock Test	√	√	
10	EMI/EMC Test		√	
11	Shock Test		√	

Type Test shall be carried out at NABL approved Labs.

9.1 High Temperature Test

The equipment shall be subjected to the following test conditions.

(a) Test condition K : Operation at 55℃ ± 3 ℃ followed by storage at 70℃ ± 3℃

For more details, refer Procedure 6, Test Condition K, Page no.4-73 of Defence Standard JSS 55555 : 2012 Rev03

9.2 Low Temperature Test

The equipment shall be subjected to the following test conditions

(a) Test condition H : Operation at -10℃ ± 3 ℃ for a period of 16 hours

For more details, refer Procedure 4, Test Condition H, Page no.4-84 of Defence Standard JSS 55555 : 2012 Rev03

9.3 Damp Heat Test

This test is to be performed prior to Corrosion (Salt) test and Mould growth test.

The equipment shall be subjected to the following test conditions

(a) The damp heat chamber shall be capable of maintaining at any point in its working space a temperature, with a tolerance of ± 0.5 ℃, of any value up to 40℃ ± 2 ℃ with a relative humidity of 98±1%.

For more details, refer Test No.10, Page no.4-48 of Defence Standard JSS 55555 : 2012 Rev03

9.4 Mould Growth Test

This test is to determine the resistance of equipment against mould growth.

Refer Test No.21, Page no.4-87 of Defence Standard JSS 55555 : 2012 Rev03

9.5 Corrosion (Salt) Test

This test is to be performed after Mould growth test.

This test is to determine the suitability of equipment for use and/or storage in salt laden atmosphere. This test is intended mainly for evaluating the quality and uniformity of protective coatings.
Refer Test No.9, Procedure 1, Page no.4-44 of Defence Standard JSS 55555 : 2012 Rev03

9.6 Vibration Resistance Test

The equipment should be able to withstand vibration levels as specified below, with equipment rigidly installed (without shock mounts) :-

(a) 01 Hz to 5 Hz – Acceleration of 0.1g
(b) 05 Hz to 50 Hz – Acceleration of 2.0 g

For more details, refer Test No.28, Page no.4-125 of Defence Standard JSS 55555 : 2012 Rev03

9.7 Thermal Shock Test

This test is to determine the suitability of electronic equipment to withstand rapid changes of temperature in air, as may be encountered during storage, transportation and use.

Refer Test No.22, Procedure 1, Page no.4-92 of Defence Standard JSS 55555 : 2012 Rev03

9.8 EMI/EMC Test

Equipment should provide satisfactory operation in the presence of electromagnetic emissions prevalent in the vicinity of the equipment. The equipment is required to undergo tests as per DND/SDG/24/EMC-1 specifications (mentioned in table below). The equipment will undergo RS06 test (The equipment under test shall not exhibit any malfunction, degradation of performance as listed in specifications when subjected to DC magnetic field of 400 A/m) in addition to other applicable tests. The summary of the tests is given below -

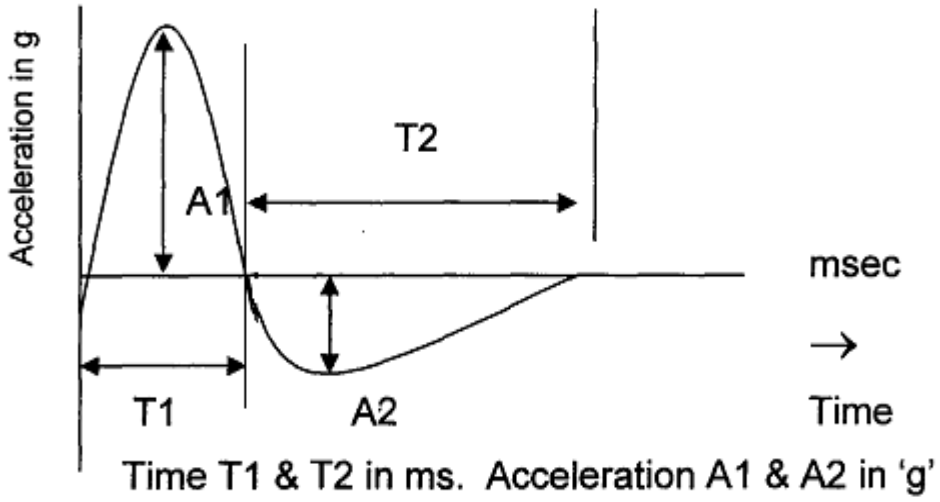
REQUIREMENT	TYPE OF TEST	DESCRIPTION	FREQUENCY RANGE
CE-101	Conducted Emissions	Power Leads	100 Hz – 10 KHz
CE-102	Conducted Emissions	Power Leads	10 KHz – 10 MHz
CS-101	Conducted Susceptibility	Power Leads	25 Hz – 150 KHz
CS-114	Conducted Susceptibility	Bulk Cable Injection	10 KHz – 200 MHz
CS-115	Conducted Susceptibility	Ground - Bulk Cable Injection	Impulse Excitation
RE101	Radiated Emissions	Magnetic Field (Cables & equipment)	25 Hz – 100 KHz
RE102	Radiated Emissions	Electric Field	10 KHz – 40 GHz
RS-101	Radiated Susceptibility	AC Magnetic Field	25 Hz – 100 KHz

REQUIREMENT	TYPE OF TEST	DESCRIPTION	FREQUENCY RANGE
RS-103	Radiated Susceptibility	Electric Field	2 MHz – 40 GHz
RS-06	Radiated Susceptibility	DC Magnetic Field	400 A/m

For more details, refer MIL-STD 461E

9.9 Shock Test

Shock. Equipment is to be designed to be capable of withstanding shock and vibration of a high order. Shock Test on the equipment is to be carried out to ensure the proper functioning of the equipment under the shock loading. The requirement of shock strength are as follows



Time T1 & T2 in ms. Acceleration A1 & A2 in 'g'

Weight in Kgs	Vertical				Longitudinal				Horizontal			
	A1	T1	A2	T2	A1	T1	A2	T2	A1	T1	A2	T2
0-60	180	3	83.5	6.5	220	2.5	59.5	9	280	3	94	9.0
60-140	170	2	36	9.5	245	2.5	54	11.5	300	2	34	17.5
140-200	130	2.5	35	9	280	2.5.	90.5	7.5	280	2	34	16.5

Vibration Levels. Vibration levels in 1/3 Octave band frequency range from 25 Hz to 8 KHz with a reference to 1 x 10^{-5} m/sec^2 when measured above shock absorbers should not exceed the straight line joining the values as specified : -

(a) At 5 Hz -- 48 db

(b) At 8 KHz-- 80 dB

10. Inspection

Supplier to offer equipment for inspection by BHEL after submitting internal test report and giving an advance notice of minimum 7 days.
First Stage of testing will be done at supplier's workplace witnessed by BHEL Engineer. Item will be delivered from the supplier's workplace only after successful testing of card in the First Stage.

Final stage of testing will be done at BHEL Bhopal.

11. Confidentiality clause to be added with standard terms & conditions of the purchase

Supplier shall furnish unconditional confidentiality agreement in the format given on Non judicial stamp paper of Rs 100/-. Any information received from BHEL in the form of document, drawing etc against the formal enquiry, budgetary enquiry or purchase order(if placed) would not be shared in full or in part with any other party without written permission of the competent authority of BHEL, Bhopal. We agree that any documents generated during the process of execution of the

contract like design document, drawing, Gerber, software, PCB design etc would be the property of BHEL and shall be provided to BHEL free of charge. Supplier also agrees that parts developed/manufactured against the order will not be offered/ supplied to any other party and is fully aware that the signing of this agreement is necessary to qualify for consideration in technical scrutiny of tender and for purchase order placement.