



## **SPECIFICATION FOR FIELD FLASHING RESISTOR BOX FOR 500kW MMG**

**Project** : 500kW MMG  
**Document number** : PS407218  
**Revision** : 00  
**Date** : 12/12/2016  
**Classification** : Controlled Copy

	Name:	Designation	Signature:
Prepared By:	Dinesh Dubey	Dy.Manager (D)	
Approved By:	Rajesh Kumar Sharma	DGM(D)	

### **HISTORY OF REVISIONS**

---

Issue	Description
00	Concept release, original version



# Bharat Heavy Electricals Limited, Bhopal

## Control Equipment Engineering Division

### 1. SCOPE

Supplier has to design, develop, manufacture, test & supply the Field Flashing Resistor box as per the requirements called in this specification.

Resistance box to house the following Nickel Chrome (80:20) material resistor grids for 660 V grade:

Field Flashing Resistance shall be of 2.5ohm with  $\pm 5\%$  tolerance, tapping at 2.1 ohm, rated for 30 Amps continuous current. 120 Amps current shall flow for 10 second in every 10 minutes.

### 2. Technical Requirements

2.1	Resistance grids shall be robust, corrosion resistant, unbreakable, suitable for natural air cooled, saline atmosphere & withstanding vibration & shock as per clause 10.7 of this specification.
2.2	The limiting dimensions of enclosure are 300 mm wide x 600 mm deep x 300 mm height for accommodating resistance grid. The enclosure shall be provided with 4 nos. mounting holes at the bottom. Smaller design size of the box shall be accepted.
2.3	The enclosure of the resistance boxes shall be stainless steel (SS316L Marine grade) welded structure of standard size preferably 50 x 50 x 5 mm. Four numbers lifting holes to be provided at the top four corners for lifting and slinging arrangement.
2.4	The Element length, dia and end support etc. shall be so designed that buckling, sagging etc do not restrict / hamper the performance of resistors over the entire range of operating temperature and load.
2.5	Material for insulators shall be temperature resistant, non-hygroscopic, shock proof ceramic material capable of withstanding 500 °C continuously and resistance to thermal shock at 300 °C.
2.6	Ceramic material used for insulators should be free from sulphur to prevent corrosion of resistor grid due to emission of sulphur dioxide at high temperature.
2.7	All materials other than grid element material & ceramic insulators used for assembly of Resistance Box shall be suitable to withstand temperature of at least 500°C continuously.
2.8	Adequate clearance and creepage distance shall be maintained to avoid flash over. The clearance through air shall not be less than 25 mm and creepage distance along the surface shall not be less than 25 mm. The electrical clearance between the live parts & the body shall be minimum 25 mm.
2.9	Bolted terminations shall be with adequate locking.
2.10	Precautions shall be taken to give adequate protection against corrosion for all components.
2.11	Suitable Earthing Terminal shall be provided on the Box.
2.12	Terminals shall be brought out at lower back side for connecting copper cable. The care shall be taken so that the heat generated in the resistances



## Bharat Heavy Electricals Limited, Bhopal Control Equipment Engineering Division

	does not affect the resistance materials and also the connecting cables.
2.13	The Inter connections required to be made among the elements to obtain the desired resistor values shall be made using Electrolytic grade copper.
2.14	All the Copper Connections shall be Electro Tin plating.
2.15	The size of Copper busbar used for copper connections shall be minimum 3mm x 10mm.
2.16	The terminal numbers to be punched on the terminals and shall be marked clearly on insulating support bar.
2.17	<b>Material:</b> The basic structure is expected to be made of Stainless Steel material.
2.18	The Resistor Box should be suitable for working in saline atmosphere for long time without any corrosion and function deterioration.
2.19	The equipment design shall be suitable for shock value of 51g for 36ms

### 3. Welding and Brazing Process

The welding and brazing process is suggested as per the following standard.

Brazing by using silver bearing brazing rods

(RUPTAM16)	:	IS 4667
Electric Arc Welding	:	IS 6008
TIG Welding	:	1. IS10186 Cu to Cu 2. IS 2811 Stainless Steel

### 4. Surface finish

Outer structure shall be mat finish of Stainless steel and no painting is envisaged.

### 5. Temperature rise

The maximum temperature rise of resistor elements shall not be more than 400 °C above an ambient of 45 °C in either continuous operation mode or intermittent mode as defined in SI No. 1 scope of this specification.

### 6. Environmental conditions

Ambient Temperature	-10 to 85° C
Humidity	98% , Continuous condensing
Atmosphere	The equipment shall be designed to work in Humid, salt laden and corrosive atmosphere



**7. Equipment Availability**

The probability that the equipment will be available (i.e., not undergoing corrective maintenance) at any instant during the operational period is to be not less than 99.85%.

**8. Equipment Reliability**

The probability that the equipment will survive a period of 2500 hours continuous operation without a failure is to be greater than 99%.

**9. Quality & Workmanship**

The workmanship and quality of the material shall be in accordance with the relevant national/international standards.

**10. Testing**

Following tests shall be carried out on fully assembled resistance box with resistor elements. The test certificate in duplicate shall be supplied against each test.

S.No	Test Description
1	Visual Inspection/Dimensional Check
2	IR Value test
3	Dielectric test
4	Resistance Value Test
5	Temperature rise test
6	Check on material characteristics

**10.1 Visual Inspection/Dimensional Check**

Units shall be checked as per the approved OGA drawings before and after the temperature rise test.

**10.2 Insulation Resistance (IR) Value test**

IR value between the resistor elements and the enclosure should not be less than 100M ohm when measured with 1000V meggar.

**10.3 Dielectric test**

Dielectric test shall be carried out at 3.3 KV AC / 50Hz voltage as per IEC 60332. The test voltage is applied progressively in 10 seconds, maintained at the prescribed value i.e. 3.3KV AC for 60 sec and then decreased progressively to zero. There shall not be any flashover or sparking during the test.



## **Bharat Heavy Electricals Limited, Bhopal Control Equipment Engineering Division**

---

### **10.4 Resistance Value Test**

The measured value of the required resistors shall be within  $\pm 5\%$  of the specified value at 25°C. Micro-ohm meter with a valid calibration and of Basic Accuracy  $>/ = 0.02\%$  to be used for measurement of resistance values.

### **10.5 Temperature rise test**

The resistor values shall be measured and recorded at room temperature before the temperature rise test. It should be within  $\pm 5\%$  of the specified value.

The required current as specified in the SNo. 1 “scope” shall be flown through the element and temperature of the element shall be monitored using thermocouples. The maximum temperature rise allowed for each element at the specified rating shall be  $\leq 400^\circ\text{C}$ .

The above test shall be carried out on each element and results should be tabulated in Table form. The resistors shall be allowed to cool at room temperature and value of each element will also be measured after temperature rise test. It should be within 3% of the value measured before the test.

BHEL may choose to witness this test at vendor’s works.

### **10.6 Check on material characteristics**

Test certificate of the original material supplier is to be submitted against this test. The supplier has to test the Element material for the desired compositions or else has to supply test certificate of the supplier for the same supported by relevant copies of original purchase documents.

### **11. Drawings & Approvals**

The complete assembly drawing of the Resistance Box shall be submitted to BHEL for approval and only after written approval, manufacturing action shall be taken. Approval of documents from BHEL does not absolve supplier from the responsibility of desired performance of the equipment supplied by them. Since this is the development item, alterations in design are expected due to very stringent testing requirements of system. Those changes are to be incorporated at BHEL Bhopal by the vendor free of cost.

### **12. Warranty**

The supplied equipment shall be guaranteed for the period of 12 months after commissioning at customer place or 18 months after supply whichever is earlier. The supplier shall replace/ repair all failed equipments during warranty at his own expenses. Further if any design modification is required to be made on any part of the equipment for the design in the scope of supplier, the equipment shall be guaranteed for further 18 months. Also, the modification shall be carried out in all the equipments supplied till that time free of cost and at place wherever equipment is made available within India.