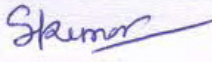
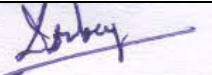





## **SPECIFICATION FOR 2000 AMP DC BREAKER FOR DEFENCE APPLICATION**

**Project** : DC BREAKER FOR DEFENCE APPLICATION  
**Document number** : PS 407226  
**Revision** : 01  
**Date** : 19/05/2017  
**Classification** : Controlled Copy

	Name:	Designation	Signature:
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
01	Type test details is modified



# Bharat Heavy Electricals Limited, Bhopal

## Control Equipment Engineering Division

---

### 1.0 Introduction

This specification lays down the general requirements of 2000 Amp DC breaker with Cradle/Enclosure for Defence Application.

### 2.0 General Requirements

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

- 1) 2000 Amps, 250 Nominal Volts DC (Working Range is 175 to 320V DC) double pole DC Air Circuit Breaker natural cooled.
- 2) 5NO + 3NC Auxiliary contacts.
- 3) Continuous Current Rating is 1600 Amps at 55 °C.
- 4) Breaking Capacity 35kA
- 5) Setting Range for short circuit tripping is 2200 Amps within a time of 0.63 sec. (May need to change during system testing)
- 6) Aux Control supply voltage for closing/tripping is 24 V DC.
- 7) Operating mechanism : Both Electrical and manual. In the absence of control circuits, DC Air Circuit Breaker should be capable of switching ON/OFF by means of spring charged mechanical elements.
- 8) Application and Environmental Conditions : DC Air Circuit Breaker are required to be used on a moving platform. All moving and stationary parts of the breakers should be suitable for vibration and shock.
- 9) The Breaker supplied shall be of good quality, rugged, reliable and capable to withstand environmental and use conditions. Breaker shall comply the test given in Clause 6 of this Specification.
- 10) The breaker conforms to EED-Q 264 and compliant to JSS55555 as well as MIL STD 461E
- 11) Long term product support for minimum of 20 years

### 3.0 Scope of Work

Supplier has to manufacture, test and supply Breaker as per BHEL Specification No.PS407226. QAP and Test protocol shall be submitted for approval before testing and inspection. Item shall be dispatched after getting clearance from BHEL Bhopal.



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

### 4.0 Warranty

To provide a warranty of 18 months from date of supply or 12 months from date of commissioning whichever is earlier. Any problems arising in the Breaker even at customer sites shall be addressed.

### 5.0 Documentation

To provide the following documents along with the equipment:

- Guarantee Certificate
- Test Certificate
- Type Test Certificate from NABL Approved Lab.

### 6.0. Acceptance Test

Following type tests shall be conducted on the breaker for acceptance (For Submarine Category Class N3) :

Sl no	Test Description	Remarks
1	High Temperature Test	JSS-55555 Ver 2012 Test 17, Test Condition K (In Case if breaker with similar structure and same electronic components has undergone this test earlier then its test report may be accepted.)
2	Low Temperature Test	JSS-55555 Ver 2012 Test 20, Test Condition H (In Case if breaker with similar structure and same electronic components has undergone this test earlier then its test report may be accepted.)
3	Tropical Exposure	JSS-55555 Ver 2012 Test 27 Test Condition C (In Case if breaker with similar structure and same electronic components has undergone this test earlier then its test report may be accepted.)
4	Damp Heat Test	JSS-55555 Ver 2012 Test 10 (In Case if breaker with similar structure and same electronic components has undergone this test earlier then its test report may be accepted.)
5	Mould Growth Test	JSS-55555 Ver 2012 Test 21 (In Case if breaker with same material has



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

		undergone this test earlier then its test report may be accepted.)
6	Corrosion (Salt) Test	JSS-55555 Ver 2012 Test 9 (In Case if breaker with same material has undergone this test earlier then its test report may be accepted.)
7	Vibration	JSS-55555 Ver 2012 Test 28 (In Case if breaker with similar structure and weight has undergone this test earlier then its test report may be accepted.)
8	EMI/EMC Test	As per MIL-STD 461E, DND/SDG/24/EMC-1, List of EMI Test given in Clause 6.1 of BHEL Spec PS 407226 (In Case if breaker with similar structure, same electronic components and current rating has undergone this test earlier then its test report may be accepted.)
9	Shock Test	JSS-55555 Ver 2012 Test 24, Refer Clause 6.2 of BHEL Spec PS 407226 (In Case if breaker with similar structure and weight has undergone this test earlier then its test report may be accepted.)
10	Inclination /Tilt	CL 0563 Sec19 (In Case if breaker with similar structure and weight has undergone this test earlier then its test report may be accepted.)
11	Short Circuit Test	
12	Temperature Rise Test	

Type Test shall be carried out at NABL approved Labs or valid type test report shall be furnished.

### 6.1 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).

<u>REQUIREMENT</u>	<u>TYPE OF TEST</u>	<u>DESCRIPTION</u>	<u>FREQUENCY RANGE</u>
CE-101	Conducted Emissions	Power Leads	25 Hz – 10 KHz
CE-102	Conducted	Power Leads	10 KHz – 10



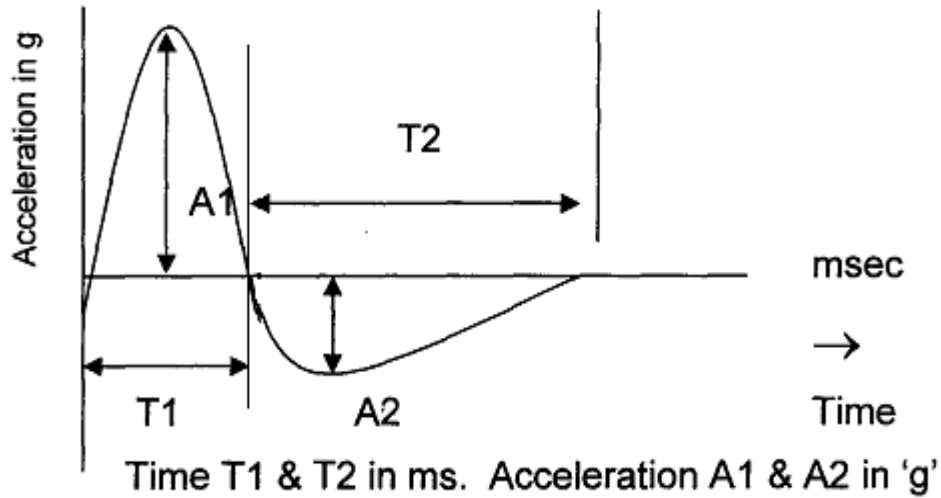
## Bharat Heavy Electricals Limited, Bhopal Control Equipment Engineering Division

<u>REQUIREMENT</u>	<u>TYPE OF TEST</u>	<u>DESCRIPTION</u>	<u>FREQUENCY RANGE</u>
	Emissions		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 – 18 GHz
RS-101	Radiated Susceptibility	AC Magnetic Field	25 Hz – 100 KHz
RS-103	Radiated Susceptibility	Electric Field	2 MHz – 40 GHz

For more details, refer MIL-STD 461E

### **6.2 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



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 Resistance :** 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 2g

### 7. Inspection

Supplier to offer equipment for inspection by BHEL after submitting internal test report and giving an advance notice of minimum 7 days. BHEL may choose to waive off the inspection.