



A4 – 12

**PURCHASE SPECIFICATION FOR
SOFT CROWBAR RESISTOR
GROUP: TRACTION ENGINEERING**

P.S NO. : PS4452542

REV. NO: 01

PAGE 00 OF 08

REVISION HISTORY SHEET

REV. NO.	DATE	NATURE OF CHANGE	REASONS	PREPARED BY	APPROVED BY
00	27.11.2015	FIRST ISSUE	--	Purushottama	R.SHEKAR
01	06.01.2016	Typographical errors corrected	--	Purushottama	R.SHEKAR

THIS DOCUMENT IS A SPECIFICATION CUM DATA SHEET. VENDOR TO GIVE CONFIRMATIONS AND DATA AS REQUIRED AND SUBMIT THE SAME TO BHEL / EDN, BANGALORE. ANY DEVIATIONS TO THIS DOCUMENT TO BE BROUGHT OUT CLEARLY BY VENDOR.

Note:

Reference document :
Material Code :

REVISIONS 01 DT: 06.01.2016

APPROVED BY: R.SHEKAR

PREPARED BY:

ISSUED BY

DATE

Purushottama Rao

TRACTION ENGG

06.01.2016

COPYRIGHT AND CONFIDENTIAL
The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED.
It must not be used directly or indirectly in anyway detrimental to the interest of the company.



A4 – 10

**PURCHASE SPECIFICATION FOR
SOFT CROWBAR RESISTOR
GROUP: TRACTION ENGINEERING**

P.S NO. : PS4452542

REV. NO: 01

PAGE 01 OF 08

SPECIFICATION FOR SOFT CROWBAR RESISTOR

Brief description

The soft crow-bar is used to limit the DC-link voltage during dynamic conditions. The soft-crow bar resistor is controlled by a step-down chopper operating at an average switching frequency of 150 Hz.

**WIRING
DIAGRAM**

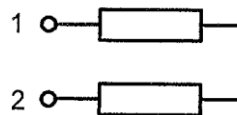


Fig1: Wiring Diagram



A4 – 11

**PURCHASE SPECIFICATION FOR
SOFT CROWBAR RESISTOR
GROUP: TRACTION ENGINEERING**

P.S NO. : PS4452542

REV. NO: 01

PAGE 02 OF 08

Detailed Specification

1. Technical Parameters

a)	Nominal Resistance Value at 20°C (1-2)	:	2.71 Ω $\pm$ 5%
b)	Minimum Resistance	:	2.5 Ω
c)	Maximum Resistance at operating temperature and manufacturing tolerance	:	3.65 Ω
d)	Nominal Voltage	:	DC 2800V
e)	Maximum Voltage	:	DC 3300V
f)	Maximum Peak Voltage	:	DC 3800V
g)	Insulation Test Voltage	:	AC 6900V/50Hz/1min
h)	Maximum Current	:	DC 1360A
i)	Continuous Power Rating	:	20KW
j)	Maximum Temperature of the Resistive Material:		520°C
k)	Minimum Creeping Distance	:	85 mm
l)	Minimum Air Clearance	:	32 mm
m)	Cooling	:	Natural Convection
n)	Inductance	:	$\leq$ 10μH
o)	Energy Rating	:	3*0.475 MWs
p)	Duty Cycle	:	As per Appendix I

COPYRIGHT AND CONFIDENTIAL

The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED.
It must not be used directly or indirectly in anyway detrimental to the interest of the company.



A4 – 11

**PURCHASE SPECIFICATION FOR
SOFT CROWBAR RESISTOR
GROUP: TRACTION ENGINEERING**

P.S NO. : PS4452542

REV. NO: 01

PAGE 03 OF 08

q)	Degree of Protection	:	IP 20
r)	Total Weight of the Resistor	:	30 Kg ± 10%
s)	Thermal Capacity	:	2.73 KJ/K
t)	Thermal Resistance	:	0.018 K/W
v)	Cooling Time Constant	:	44 s
u)	Material of Resistor Element	:	AISI 310S
w)	Material of Enclosure	:	AISI 304 (1.4301)

2. Standards

Standard	Description	Notes
EN50125-1	Environmental conditions	
EN50124-1	Railway applications Isolation co-ordination, Basic requirements.	
IEC60077	Electric equipment for rolling stock	
IEC61287	Power converters	
IEC61376	Creepage and clearance	
IEC61373	Shock and vibration test	
IEC60322	Rules for ohmic resistors	

3. Functional requirements

Description	Value	Unit	Notes
operating hours traction converter	8640	hours/year	
operating hours resistor	<7300	hours/year	normal operation

COPYRIGHT AND CONFIDENTIAL
The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED.
It must not be used directly or indirectly in anyway detrimental to the interest of the company.



A4 – 11

**PURCHASE SPECIFICATION
SOFT CROWBAR RESISTOR
GROUP: TRACTION ENGINEERING**

P.S NO. : PS4452542

REV. NO: 01

PAGE 04 OF 08

4. Ambient conditions / operating conditions

Description	Value	Unit	Notes
operation	-25..+75	°C	
temperature distribution over the year	+75	°C	10 days/year
	+65	°C	20 days/year
	+55	°C	90 days/year
	+40	°C	100 days/year
	< +40	°C	130 days/year
storage	-25..+70	°C	
average year temperature	+ 40	°C	
relative humidity	< 95	%	during app 3 - 4 months (rainy season) per year frequent condensation can occur
altitude	<1200	m	
pollution levels			
operation in coastal areas			
maximum PH	8.5		of water damp
max. concentration of sulphate	7	mg/liter	of water damp
max. concentration of chlorine	6	mg/liter	of water damp
maximum conductivity	130	µS/cm	of water damp
operation in desert terrain			
dust content in air	1.6	mg/m3	

COPYRIGHT AND CONFIDENTIAL

The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in anyway detrimental to the interest of the company.



A4 – 11

**PURCHASE SPECIFICATION
SOFT CROWBAR RESISTOR
GROUP: TRACTION ENGINEERING**

P.S NO. : P4452542

REV. NO: 01

PAGE 05 OF 08

5. Dimensional details

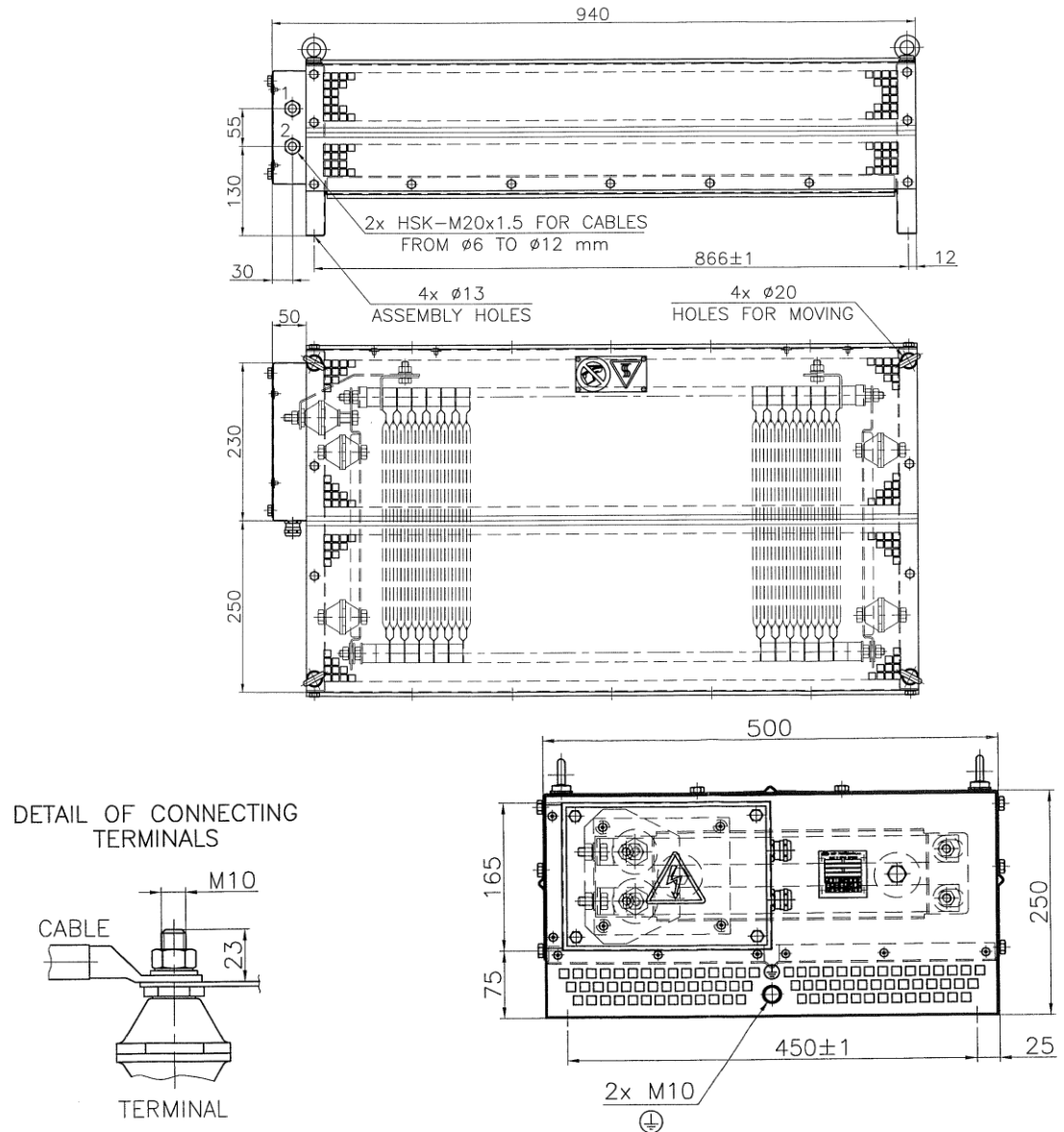


Fig 3: Dimensional Drawing

COPYRIGHT AND CONFIDENTIAL
The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED.
It must not be used directly or indirectly in anyway detrimental to the interest of the company.



**PURCHASE SPECIFICATION
SOFT CROWBAR RESISTOR
GROUP: TRACTION ENGINEERING**

P.S NO. : PS4452542

REV. NO: 01

PAGE 06 OF 08

6. Testing

List of tests to be performed on prototype as follows

Sl No	Test	Acceptance criteria
1	Dimensional check	Dimensions to comply with the drawing
2	Check on creepage and clearance distances	Min. creepage 85mm and clearance 36mm
3	Check on rating label	Rating plate to have Make, Type no, Rated voltage, Rated Resistance, Sl no, year of manufacture and weight
4	Check on Ingress protection	The enclosure is IP 20 that means the cover protects against the incursion of foreign objects and is also used as a protection against accidental touch
5	Check on weight	30 Kg $\pm$ 10%. i.e. within range of 27 Kg to 33 Kg
6	Measurement of Resistance	
6.1	Measurement of cold Resistance before temperature rise test	2.71 Ω $\pm$ 5% i.e. within range of 2.5745 Ω - 2.8455 Ω at an ambient temperature of 20 Deg.
6.2	Measurement of cold Resistance after temperature rise test	Readings should not differ from the first values Indicated in clause 6.1 by more than 3%.
6.3	Measurement of Hot Resistance IMMEDIATELY AFTER temperature rise test	$\leq$ 3.65 Ω
7	Check on Inductance	$\leq$ 10 μ H
8	Dielectric test (Ref: 60077)	Carried out between the connection and earth terminals of the resistor with a voltage of AC 6900 V/ with a frequency of 50 Hz, for a period of 1 minute. No disruptive discharge or breakdown occurred during the test
9	Insulation resistance test	The measurement to carried out with 1000 V megger tester connected across terminals and frame of the resistor. Required minimum value: 5 M Ω
10	Temperature rise test ^{A)B)}	
10.1	Continuous power of 20 KW (Ambient Temp of 25 Deg)	Max temp of Active Material $\leq$ 520 Deg
		Max temp of the connection terminals $\leq$ 115 Deg
		Max Air temp 200mm above the resistor $\leq$ 210 Deg
10.2	Repeated duty cycles (ref: APPENDIX I) (Ambient Temp of 25 Deg)	Max temp of Active Material $\leq$ 490 Deg
		Max temp of the connection terminals $\leq$ 80 Deg
		Max Air temp 200mm above the resistor $\leq$ 200 Deg



**PURCHASE SPECIFICATION
SOFT CROWBAR RESISTOR
GROUP: TRACTION ENGINEERING**

P.S NO. : PS4452542

REV. NO: 01

PAGE 07 OF 08

11	Vibration and shock withstand test ^{A)}	To be done as per the standard IEC 61373. No visual damage and no change in resistance value should occur. Also the specimen has to pass insulation test.
----	--	---

- A) Visual inspection, Di electric test needs, measurement of cold resistance to be performed before and after the test.
- B) Critical hot spot points needs to be identified before the test to monitor and record the temperature during the test.

COPYRIGHT AND CONFIDENTIAL
The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED.
It must not be used directly or indirectly in anyway detrimental to the interest of the company.



A4 – 11

**PURCHASE SPECIFICATION
SOFT CROWBAR RESISTOR
GROUP: TRACTION ENGINEERING**

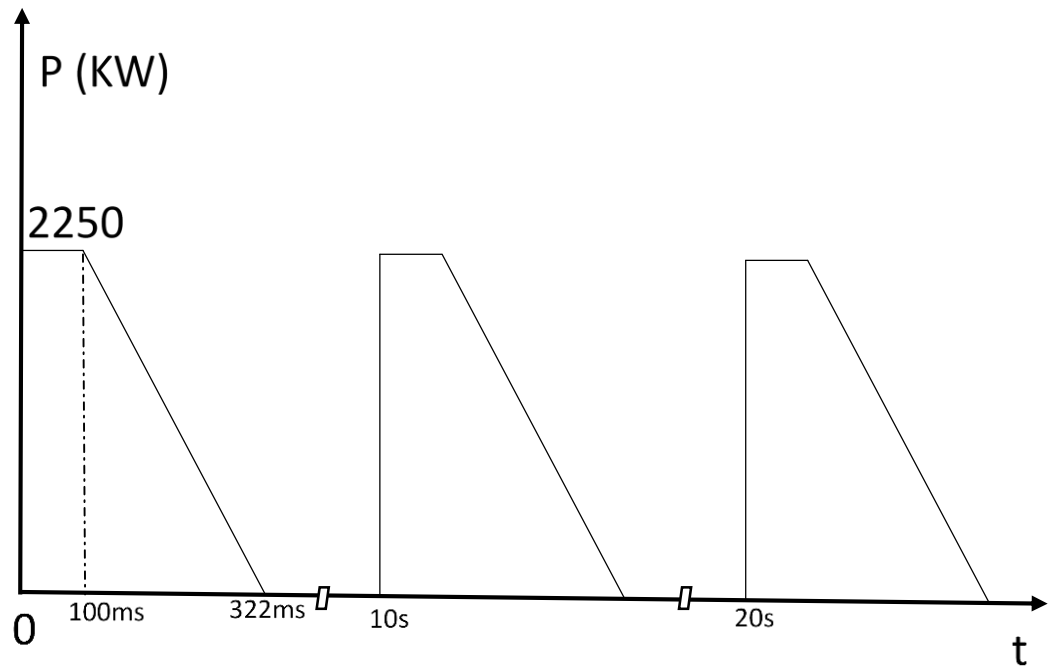
P.S NO. : PS4452452

REV. NO: 01

PAGE 08 OF 08

APPENDIX-I

Duty cycle Requirement for Temp rise test:



After 3 pulses there's a cooling down time of 10 minutes

COPYRIGHT AND CONFIDENTIAL

The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED.
It must not be used directly or indirectly in anyway detrimental to the interest of the company.