REVISION HISTORY SHEET

REV. NO.	DATE	NATURE OF CHANGE	REASONS	PREPARED BY	APPROVED BY
00	**04.08.2015**	**FIRST ISSUE**	**--**	**SADAT**	**R.SHEKAR**
01	**22.12.2015**	**MAJOR**	***TYPE TEST CLAUSES MODIFIED***	**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: 22.12.2015

APPROVED BY: R.SHEKAR

PREPARED BY:	**ISSUED BY**	**DATE**
	TE	22.12.2015

SPECIFICATION FOR DISCHARGE/EARTHING RESISTOR

Brief description

This resistor has two functionalities:

1. Global passive discharge of DC-link HV-capacitor
2. Earth fault detection

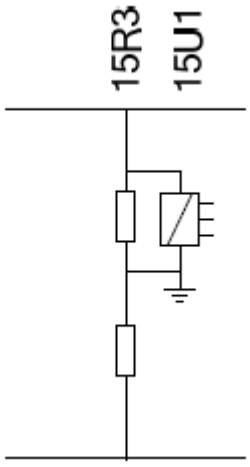


Fig1: Circuit Diagram

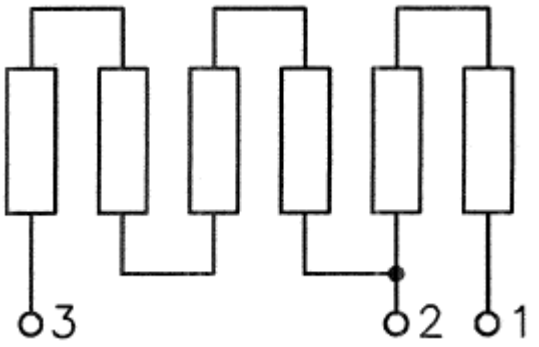


Fig2: Wiring Diagram

Detailed Specification

1. Technical Parameters

a)	Nominal Resistance Value at 20˚C (1-2)	**:**	**10KΩ ± 5%**
b)	Nominal Resistance Value at 20˚C (1-3)	**:**	**30KΩ ± 5%**
c)	Maximum Voltage per Resistor	**:**	**DC 3500 V**
d)	Rated Voltage per Resistor	:	**DC 2800V**
d)	Insulation Test Voltage	**:**	**AC 6900V/50Hz/1min**
e)	Rated Power	**:**	**3000W**
f)	Maximum Temperature of the Resistive Material	**:**	**415˚C**
g)	Minimum Creeping Distance	**:**	**75 mm**
h)	Minimum Air Clearance	**:**	**36mm**
i)	Cooling	**:**	**Natural Convection**
j)	Degree of Protection	**:**	**IP 20**
k)	Total Weight of the Resistor	**:**	**12 Kg ± 10%**
m)	Thermal Capacity	**:**	**5025 J/K**
n)	Thermal Resistance	**:**	**0.073 K/W**
o)	Cooling Time Constant	**:**	**360 s**
p)	Material of Resistor Element	**:**	**NiCr8020**
q)	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	

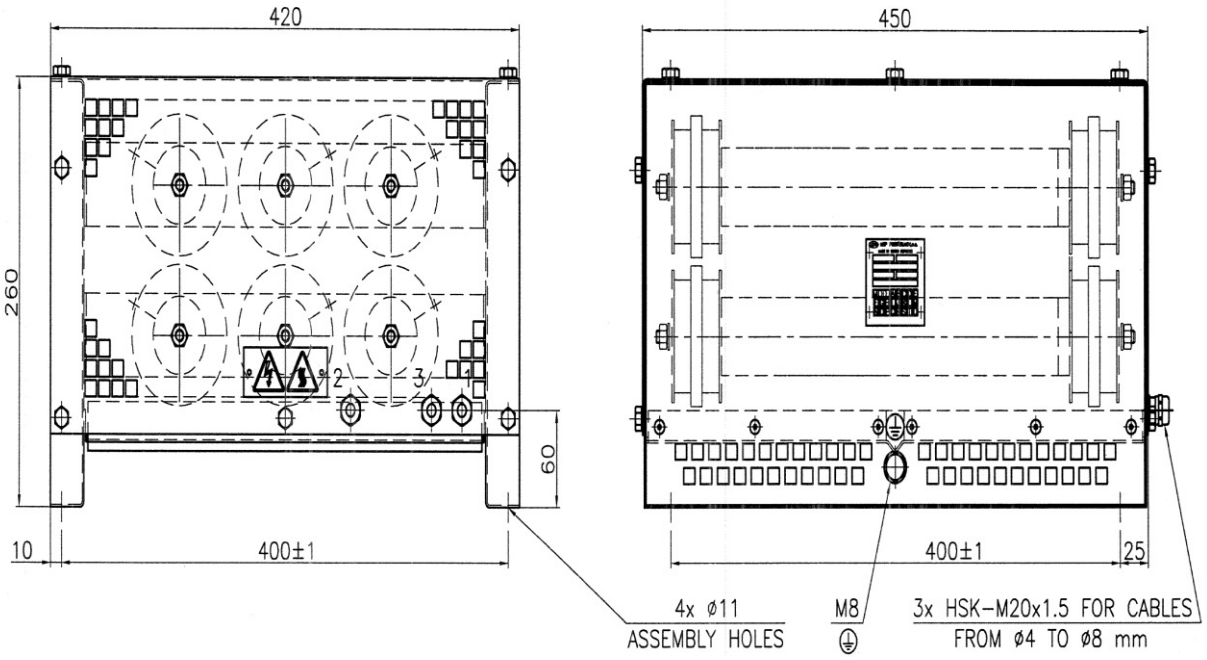
3. Functional requirements

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

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	

5. Dimensional details



DETAIL OF CONNECTING
TERMINAL
(part of resistor element)

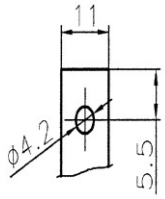


Fig3: Dimensional Drawing

6. Testing

List of tests to be performed on prototype as follow

Sl No	Test	Acceptance criteria
1	Dimensional check	Dimensions to comply with drawing
2	Check on creepage and clearance distances	Min creepage 75mm 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	12 Kg ± 10%. i.e. within range of 10.8 to 13.2 Kg
6	Measurement of Resistance	
6.1	Measurement of Resistance before temperature rise test	Between 1-2 10KΩ +/- 10% Between 1-3 30KΩ +/- 10%
6.2	Measurement of Resistance after temperature rise test	Readings should not differ from the first values indicated in clause 6.1 by more than 3%.
7	Check on Inductance	Measured inductance should be less than 5mH
8	Dielectric test	Carried out between the connection and earth terminals of the resistor with a voltage of AC 6900 V/ 50Hz/1 min. No flashover 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 MΩ
10	Temperature rise tests B)C)	
10.1	Continuous power 3000W	Maximum Temperature of Active material ≤415 Deg
		Max temp of the connection terminals ≤ 125Deg
		Max Air temp 200mm above the resistor ≤ 95 Deg
10.2	Constant power at 2800 V and final single pulse of 5s A)	Between 1-2: Maximum Temperature of Active material ≤ 400Deg Between 2-3: Maximum Temperature of Active material ≤ 210Deg
		Between 1-2: Max temp of the connection terminals ≤ 135Deg Between 2-3: Max temp of the connection terminals ≤ 90Deg
		Between 1-2: Max Air temp 200mm above the resistor ≤ 100 Deg Between 2-3: Max Air temp 200mm above the resistor ≤ 100 Deg

Sl No	Test	Acceptance criteria
11	Vibration and shock withstand test B)	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) This test has to be done in line with the procedure given below separately for terminals 1-2 and 2-3.
For conducting the test, constant power at 2800V needs to be applied between 1-2 terminals till the temperature stabilizes. During this time 2-3 terminals are open. After stabilization of temperatures, voltage will be increased to 3500V for 5sec.
The same procedure is repeated for the terminals 2-3 with 1-2 open terminals

B) Visual inspection, Di electric test needs, measurement of cold resistance to be performed before and after the test.

C) Critical hot spot points needs to be identified before the test to monitor and record the temperature during the test.

	PREQUALIFICATION CRITERIA (PQC)	Ref: 445/PQ_ER/21
	FOR EARTH RESISTOR	Rev. No.: 00
	GROUP: TRACTION ENGINEERING	Page 1 of 1

1.0 PRE QUALIFICATION CRITERIA (PQC)

1. The Bidder should be Supplier of Power Resistor used in Traction applications.
2. BHEL shall approach and submit credentials/details furnished by vendor with their offers to customer and await customer's decision for a maximum of one month from the date of tender opening. If approval is not received within the above period, BHEL shall treat the offer as "Not meeting" Pre-qualification criteria and offer shall be rejected.
3. It is preferred that the bidder is the manufacturer of this item. If the bidder is importing some portion of the components, then minimum value addition shall be 20%. Bidder to confirm this in the offer. Value addition less than 20% is not acceptable

2.0 DOCUMENTS SUBMISSION

1. Bidder to submit clause by clause compliance to complete technical specification (Technical specification no. PS4452544 Rev. No.01, dated 22-12-2015) along with copy of type test report.
2. Should possess a valid type test report, not older than five years, conducted at a NABL accredited laboratory as per relevant standards mentioned in the specification with respect to time during the bid submission.
3. Proof of supply of Power Resistor used in traction applications directly or through any agency to Indian Railways during the last 5 years to be submitted.

3.0 REFERENCE DOCUMENTS

a) Purchase Specification No PS4452544, Rev. No. 01 for Earth Discharge Resistor.

REVISION 00	APPROVED AGOSH CHANDRAN R S		
	PREPARED SUNITHA L	ISSUED TRACTION ENGG	DATE 05.01.2020