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No. EL /2.2.25

Dated 19.09.2013

Chief Electrical Engineer

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- Eastern Railway, Fairlie Place, Kolkata - 700 001
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- South Central Railway, Rail Nilayam, Secunderabad -500 071
- East Coast Railway, Chandrashekharapur, Bhubaneswar- 751 016.
- South Eastern Railway, Garden Reach, Kolkata-700 043
- Southern Railway, Park Town, Chennai-600 003
- Western Railway, Churchgate, Mumbai-400 020
- West Central Railway, Jabalpur-482001
- South East Central Railway, Bilaspur-495004
- East Central Railway, Hazipur-844101 (Bihar)
- Chittaranjan Locomotive Works, Chittaranjan- 713 331

Sub:- Revised Technical Specification No: RDSO/2009/EL/SPEC/0097 Rev. "1"
September-2013.

Revised Technical Specification No: RDSO/2009/EL/SPEC/0097, Rev. "1" September-2013 for metalised carbon strips for pantographs of 25 kV A.C. Electric Locomotives and EMU / MEMU is attached for your kind information and necessary action.

(A K Goswami)

for Director General/Elect.

Encl: As above.

Copy to:

1. M/s. Assam Cabron Products Ltd., 2, IDA, Phase - I, Patancheru - 502319
DIST. MEDAK (A.P.)
2. M/s. Mersen India Pvt. Ltd., 98/5 Wheeler Road Extension, Cook
Town, Bangalore-560084
3. M/s. SCHUNK Metal & Carbon (India) Pvt. Ltd., No. 54/2, White Field
Road, Mahadevapura, P.O. Bangalore - 560 048

(A K Goswami)

for Director General/Elect.

Encl: As above.



GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

**TECHNICAL SPECIFICATION ON
METALLISED CARBON STRIPS FOR PANTOGRAPH
OF 25 KV A.C. ELECTRIC LOCOMOTIVES AND EMU
/ MEMU**

Specification No: RDSO/2009/EL/SPEC/0097, Rev. '1'

Approved by	Signature
Sr. EDSE	

Issue Date /Year September 2013

**RESEARCH DESIGNS AND STANDARDS ORGANISATION
MANAK NAGAR, LUCKNOW-226011**

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Status of Revision

S.N.	Date of Revision	Page no.	Revision	Reasons for Revision
1.	-	All	0	First Issue
2.	12.09.2013	4, 9,10 & 14	1	Change has been made to update specification. Date effective: 12.09.2013

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Prepared by <i>Abudav</i>	Checked by <i>gym</i>	Issued by <i>dy</i>
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0.0 FOREWORD:

This specification is intended to serve as a guide line to the manufacturers of Metallised Carbon Strip for Pantograph on 25 kV, A.C., 50 Hz, of A.C. Electric Locomotives and EMU/MEMU for the existing OHE as well as OHE of dedicated freight corridor on IR. This specification should be read in conjunction with related drawings of products meant for use on various types of Pantographs.

1.0 SCOPE:

On Indian Railways, 25 KV AC electric locomotives / motor coaches of EMUs draw current from OHE through the Metallised carbon Strips fitted on pantographs of electric locomotives / EMUs /MEMUs to reduce the wear of contact wire thereby increasing its life.

Metallised carbon strip is a current collector which is fitted on top of the Panto pan. Metallised Carbon Strip contains approximate 15% to 30% copper by weight, 10% other materials and remaining carbon. The length of the strip shall be approximate 1049±2 mm having a flat zone of 520 ± 20 mm in the middle and both the ends are tapered. This Metallised Carbon Strip shall be either of three pieces or of single piece design.

This specification applies to Metallised carbon Strips for use on 25 kV, A.C., 50 Hz, electric locomotives pantographs for satisfactory operation up to speeds of 250 Kmph under catenary heights varying from 4.65 meters to 7.5 meters from the rail level.

The purpose of this Specification is to make available a unified Specification of Metallised carbon strips with the Railways and Production Units. This Specification covers manufacturing and

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testing of Metallised carbon Strips used on Pantograph of A.C. electric locomotives and EMU/MEMU. It also covers properties and testing of various components used in manufacturing of Metallised carbon Strips, viz. metal jacket and hardware. The Metallised carbon Strips grades used in manufacturing of the strips shall be as per approved list of grades issued by RDSO periodically.

This design of Metallised carbon strip for Pantograph shall be suitable for present fleet of WAM-4, WCAM-1(AC), WCAM-2(AC), WCAM-3(AC), WAG-5, WAG-7, WAG-9, WAG-9H, WAP-1, WAP-4, WAP-5 & WAP-7 class of Electric locomotives and AC EMU/MEMU.

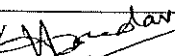
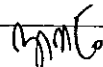

2.0 REFERENCES:

STANDARDS:

- (i) IS: 13466 – 1992, Reaffirmed 1997
“Brushes for Electrical Machines”
- (ii) IS: 13584-1993, Reaffirmed 1999
“Brush Material for Electrical Machinery.”
- (iii) RDSO’s Technical Circular No. ELRS/TC/0071-2001 (Rev.'0') dated 06.07.2001 with Amendment No.1 dt.26.2.2003.
- (iv) Latest version/revision of the standards and specifications etc shall be followed, unless specifically mentioned otherwise.

3.0 SUPPLIER’S RESPONSIBILITY

3.1 The Metallised carbon strip of pantographs offered shall be complete with all parts and accessories necessary for its efficient operation. All such parts and accessories shall be deemed to be within the scope of this specification whether specifically mentioned or not.

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- 3.2 Technical guidance and assistance for proper operation, investigation and generally all aspects of technical liaison that may be required during the service trials period of one year shall also be organized by the Contractor.
- 3.3 Supplier shall engrave/emboss/pad printing identification marks indicating their monogram/brand names and the month and year of manufacture at a conspicuous place on all the components. Pad printing shall be application on metallised carbon strip portion for identification of condemning limit and grade.
- 3.4 Supplier is advised to familiarize themselves with pantographs and roof equipments layout on the existing locomotives.
- 3.5 Once a prototype is approved, no Supplier shall change his source of supply or sub-Supplier for purchased components and sub-assemblies without RDSO approval.

4.0 INFRINGEMENT TO PATENT

Indian Railway shall not be responsible for infringement of patent rights arising due to similarity in design, manufacturing process, components used in design, development and manufacturing of Metallised Carbon Strips and any other factor which may cause such dispute. The responsibility to settle any issue lies with the Supplier.

5.0 TERMINOLOGY:

Terms/abbreviations used frequently in the document are explained below:

IR	Indian Railways
RDSO	Research Designs & Standards Organisation.
CLW	Chittaranjan Locomotive Works
Tenderer	Firm/companies participating in the tender.

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Supplier	The person, firm or company on whom the order for supply of the work has been placed
Sub Supplier	Any person, firm or company from whom the Supplier may obtain any materials or fittings to be used for the Pantograph.
Inspecting Officer	Nominated person to inspect the Metallised carbon strips.
OEM	Original Equipment Manufacturer
BG	Broad Gauge 1676 mm used in IR
IS	Indian Standard
IRS	Indian Railways Standard
IEC	International Electro technical Commission
ISO	International Standards Organization
OHE	Overhead Equipment
AC	Alternating Current
EMU / MEMU	Electrical Multiple Unit / Mainline Electrical Multiple Unit

6.0 CLIMATIC, ENVIRONMENTAL AND OPERATING CONDITIONS:

Atmospheric temperature	Under Sun: 75°C max. In shade: 55°C max. Minimum temperature: -10°C (also snow fall in certain areas during winter season)
Humidity	100% saturation during rainy season.
Altitude	1776 Mts. above mean sea level.
Rain fall	Very heavy in certain areas.
No. of Rainy days per annum	May be as high as 120 days.
No. of thunderstorms	May be as high as 85 days

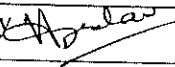

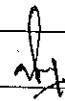
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days/ year.	
Coastal area	Metallised carbon Strips shall be designed to work in coastal areas in humid and salt laden atmosphere with maximum pH value of 8.5, sulphate of 7 mg per liter, max. Concentration of chlorine 6 mg per liter and maximum conductivity of 130 μ Siemens/Cm, wind pressure reaching 150 kg/cm ² .

7.0 SCOPE OF SUPPLY:

The deliverables include complete Metallised carbon Strips along with all its components including the hardware.

- (a) Operating and maintenance manual containing essential technical information like composition of material, hardware details, and tightening torque etc. shall be supplied. The manual shall be in A4 size sheet printed on one side in suitable folder in English. Drawings/sketches shall be in A4 /A3 size sheets only.
- (b) The Bill of material indicating drawing no, material, sub Supplier etc.
- (c) Tests reports of Metallised Carbon block.
- (d) If TOT with the firm outside India is involved, then the supply experience of collaborator shall be furnished.
- (e) The Supplier shall list out the special tools, if any which shall be required for inspection and maintenance of the Metallised Carbon Strips.

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8.0 PROPERTIES

The properties of Metallised carbon strips are as under:-

Parameters	Unit	Requirements
Hardness	BHN 5/100 Or HRB 5/100	95±10% Or 105±10%
Bulk density	gm/cm ³	Min. 2.0
Copper content	by weight	15% to 30%
* %age of other metal	by weight	Max. 10%
Bending strength	M N / m ²	Min. 45
Resistivity	μΩ- m	Max. 11.0
Dimensions	mm	SKEL/4303 (Rev. '6')

Note:

*Lead being a hazardous material shall be avoided. If considered absolutely necessary, its percentage to be kept minimum.

9.0 DRAWINGS & OHE PRAMETERS:

8.1 RDSO's Drg. NO. SKEL-4303 (Rev.'6') indicates the constructional and fitment features in brief is enclosed as **Annexure II.**

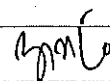
8.2 Physical Design of Metallised Carbon strip

The Metallised Carbon Strip shall be of single piece design or three pieces design. In case of three pieces design, each of the Metallised Carbon pieces shall be encased in a separate metal sheath. While assembling the complete strip on the panto pan, it is necessary to ensure that there should not be any gap between the three pieces.

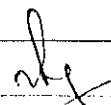
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8.3 Technical details existing OHE of Indian Railway is enclosed as **Annexure I**.

10.0 INSPECTION AND TESTS

The tests to be carried out on finished Metallised Carbon Strips at the manufacturers' works are classified as Type, Routine & Acceptance tests shall be conducted as per table given below:

The following Table gives the details of tests to be carried out on finished Metallised Carbon Strips:

S. NO.	PARAMETER	TYPE	ROUTINE	ACCEPTANCE	TEST METHOD
1.	Hardness	✓	✓	✓	BHN 5/100 or HRB 5/100
2.	Bulk Density	✓	-	-	As per IS: 13584 Clause 6.2
3.	** Copper Content	✓	-	✓	Chemical Analysis
4.	Percentage of Other Metal	✓	-	✓	Chemical Analysis
5.	Transverse Strength	✓	-	-	As per IS: 13584 Clause 9
6.	Resistivity	✓	-	-	As per IS: 13584 Clause 8
7.	Dimension Check	✓	✓	-	As per SKEL Drg. No. 4303 (Rev. 6)

** For notification of copper content of carbon strip grade, the testing shall be carried out after removing the copper plating/spray at the bottom of the bare metallised carbon strip.

10.1 TYPE TESTS

To be carried out on prototype samples of carbon strips of the given design. Complete type tests shall be organised and

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conducted by the manufacturer in presence of the authorised representative of RDSO. The test results of any grades once approved by RDSO shall be valid for a period of Five (05) years.

10.2 ROUTINE TESTS

To be carried out by the manufacturer on each lot. The manufacturer shall maintain record of test results to be produced as and when required by the authorized inspecting agency.

10.3 ACCEPTANCE TEST

To be carried out by the manufacturer at the time of acceptance of supplies. The sampling procedure and criteria for acceptance shall be as per Annexure C of IS 13466-1992. Acceptance test shall be conducted on 0.5% subject to a minimum of 2 samples (drawn at random) against each order.

In addition to above, the purchaser shall have right to carry out stage inspection also at firm's premises particularly with reference to manufacturing process, quality control and compliance with various clauses of the specification.

11.0 TESTS ON RAW MATERIALS/ BOUGHT OUT ITEMS

The manufacturers shall maintain Quality Assurance Plan of all raw materials/bought out items used in the manufacture of Metallised carbon strips to ensure the quality and compliance to prescribed standards.

(a) Type tests:

To be carried out on prototype samples of raw materials/bought out items.

(b) Acceptance tests:

To be carried out on each batch of supply. The manufacturer shall maintain record of test results to be produced as and when required by the authorized inspecting agency.

12.0**CORROSION PROTECTION OF METAL SHEATH**

To protect of metal sheath due to corrosion and loosening of their grip / disengaged from the sheath. The gaps between strips shall be filled with a suitable adhesive to avoid water ingress between the Metallised Carbon Strips and the sheath.

13.0**MARKING:**

Condemning limit of 3.5 mm mark line and grade shall be pad printed on each metalised carbon strips and the following particulars shall be legibly and engraved/embossed/pad printed on each Metal sheath/carrier of Metalised carbon Strips

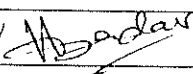
- Grade of carbon strips.
- Identification of source of manufacturer, and
- Batch number, month and year of manufacture.

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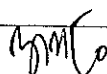
ANNEXURE - I**TECHNICAL DETAILS EXISTING OHE OF INDIAN RAILWAY)**

Sl.No.		PARAMETERS
1.0	OHE	Simple Polygonal OHE (regulated)
2.0	Span	72M (Max.) on tangent track suitably reduced on curves. Maximum variation between two adjoining span is 18 Mtrs.
3.0	Tension	1000 kgf. for catenary and 1000 kgf. for contact wire.
4.0	Contact wire	107 mm ² Hard drawn grooved copper (HDGC)
5.0	Catenary	95 mm ² Cadmium copper
6.0	Maximum blow off	415 mm
7.0	Stagger of contact wire	200 mm on straight track & 300 mm on curves.
8.0	Relative movement of pantograph with reference to contact wire.	
i)	Dynamic	Normally the contact wire is within the 520 mm zone on either side of the track centre line i.e., 1040mm which is the flat zone of the pantograph. However, during wind conditions the contact wire may go beyond this flat zone extending up to 800 mm on either side of the centre line i.e., to cover a range of 1600 mm. (Taking into account other factors such as oscillations, loose joints etc.
ii)	Static	For heavy wind conditions 860mm from the centre line of pantograph is taken in to account.
9.0	Mid span sag	Partly 50mm to 100mm varying from span 27 Mts. to 72 Mts.
10.0	Condemnation size of contact wire	74mm ² (reduction in vertical height from 12.24mm to 8.25mm)
11.0	Gradient of contact wire	The maximum contact wire gradient is 3mm per meter and permissible variation in gradient over 2 consecutive spans is 1.5 mm per meter. (Variation of 1.5mm/m on consecutive span.)
12.0	Spacing of droppers	First dropper 2.25m from support, second one is 4.50m/6.75m and thereafter the droppers are at 9m spacing.
13.0	Permissible uplift of contact wire	60 mm (at registration arm)

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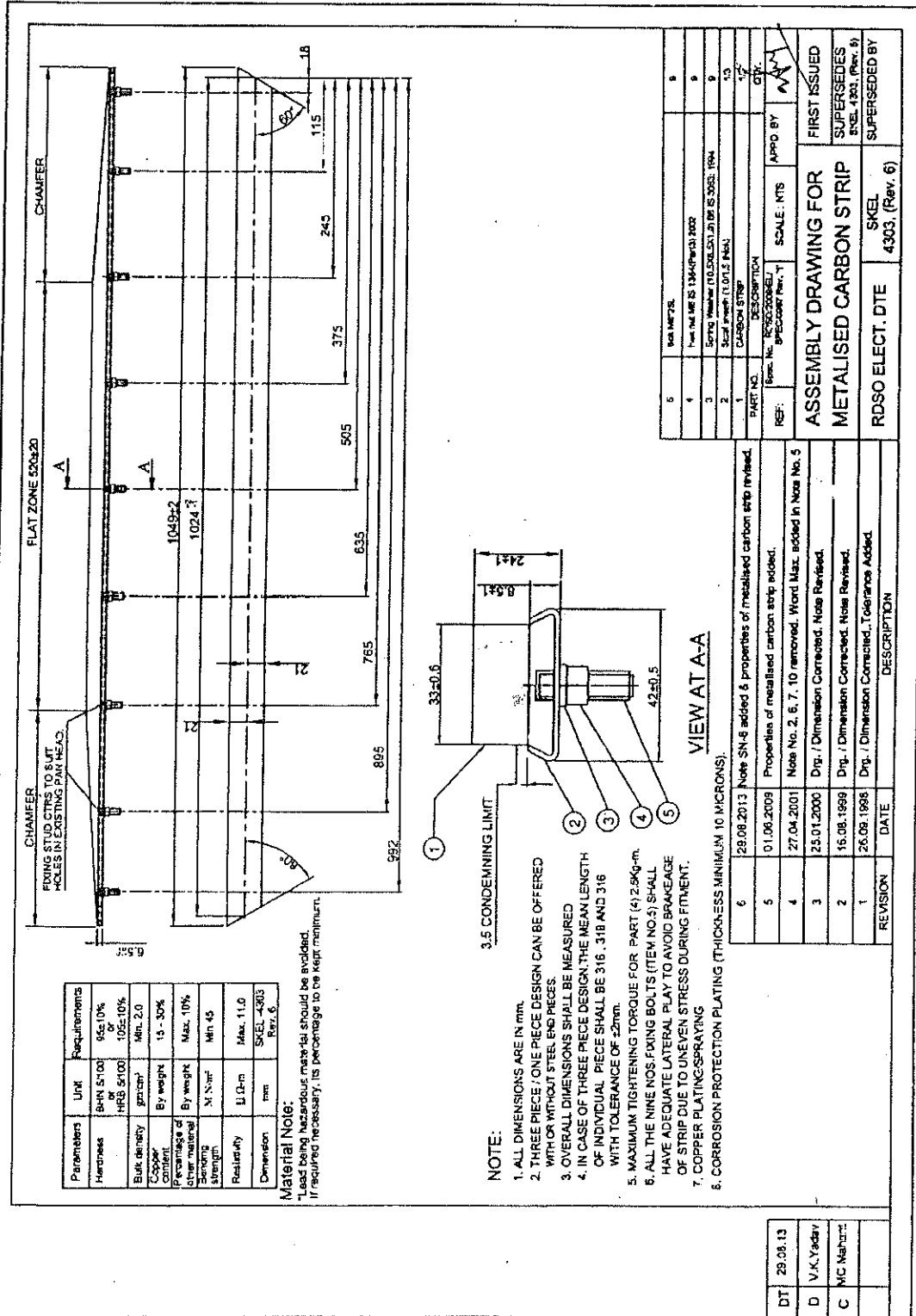


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