SPEC No.ELRS/SPEC/CB/0037 Rev '0'

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

TECHNICAL SPECIFICATION

FOR

CARBON BRUSH GRADES FOR TRACTION APPLICATIONS

May 2005

ISSUED BY

ELECTRICAL DIRECTORATE
RESEARCH DESIGNS & STANDARDS ORGANISATION
MANAK NAGAR, LUCKNOW – 226 011.

TECHNICAL SPECIFICATION FOR CARBON BRUSH GRADES FOR TRACTION APPLICATIONS

0.0 FOREWORD:

Carbon brushes used on various machines of Electric and Diesel Locomotives and EMUs on Indian Railways are manufactured using carbon brush block grades approved by RDSO. This Specification is intended to serve as a guide to the carbon brush block manufacturers (hereafter called "the firm") desirous of getting approval for a carbon brush block grade (hereafter called "the grade") for a specific application.

1.0 SCOPE:

This specification covers requirement of carbon brush grades for machines used on Electric and diesel locomotives and EMUs.

2.0 REFERENCES:

The following standards have been used while preparing this specification.

- IS 13584:1993 Brush Material for Electrical machinery- specification
- IS 9919:1999 Guide for selection and use of Carbon Brushes in Electrical rotating machines

3.0 BRUSH GRADE REQUIREMENTS:

3.1 Since all brush grades are for traction applications, factors typical to such applications like heavy vibrations, operation in dusty and polluted environment and ambient temperature variations from 0 ^{0}C to 55 ^{0}C should be considered by the firm before offering a brush grade.

3.2 While evaluating a new grade, comparison with OEM brush grade shall be a yardstick. Normally grades with performance parameters equivalent or superior to OEM grades only shall be considered.

3.3 The following shall be the brush operating parameters for various machines:

- Peripheral speed (m/s)
- Current Density (A/cm^2)
- Brush Pressure (kgf/cm^2)

The Brush Operating Parameters for various machines have been enlisted in **Annexure '1'** for reference.

4.0 OFFER FOR A BRUSH GRADE:

4.1 The application for approval of a grade for a specific application should include the following details about the grade:

i) Name of Grade
ii) Machine/ Application for which applied
iii) Bulk Density
iv) Porosity
v) Shore Hardness
vi) Resistivity
vii) Transverse strength
viii) Co-efficient of friction
ix) Ash content

4.2 The tolerances on the parameters furnished by the firm should be conforming to Table 1 of IS-13584-1993 or better.

4.3 In addition to the technical details mentioned in Clause 4.1, the firm shall submit full details about its experience with the grade on other Railways systems/industries giving full particulars of population, pressure, peripheral speeds and wear rates achieved.

4.4 Before submitting an application for a new grade for a particular machine, the firm is expected to fully study the details of the machine and satisfy themselves that the offered grade will fulfill the requirements of the machine.

5.0 APPROVAL OF A BRUSH GRADE:

The approval of an offered brush grade shall consist of the following stages:

S.N.		Clause of Spec
1.	Preliminary scrutiny of the details submitted with the application	Clause 4.0
2.	Tests of Physical properties of the grade	Clause 6.0
3.	Test of operational characteristics of the grade	Clause 7.0
4.	Black Band Tests	Clause 8.0
5.	Initial Field Trials	Clause 9.0
6.	Extended Field Trials	Clause 10.0
7.	Minimum performance criteria for approval in Developmental (Part II) category.	Clause 11.0
8.	Minimum performance criteria for approval in Regular (Part I) category.	Clause 12.0

6.0 TESTS OF PHYSICAL PROPERTIES OF A GRADE:

6.1 Tests of physical properties of the offered grade shall be carried out on the samples of the grade as per IS 13584:1993 at the firms' premises and witnessed

by RDSO's authorised representative. Possession of all facilities for the tests at the firm's premises is a necessary condition for approval.

6.2 The tests shall be carried out on the carbon blocks of different grades as per Table given below:

S. No.	Characteristics	Clause No. of IS 13584-1993
1	Bulk Density	6.0
2	Porosity	6.0
3	Hardness	7.0
4	Resistivity	8.0
5	Transverse Strength	9.0
6	Ash Content	10.0
7	Co-efficient of friction	11.2

6.3 Conformity to the declared values shall be the criteria for acceptance of the test results.

7.0 MEASUREMENT OF OPERATIONAL CHARACTERISTICS OF BRUSHES

7.1 Operational characteristics of the brushes shall be measured as detailed in Clause 11 of IS 13584:1993. For this purpose a test set up as detailed in Annexure 'C' of the said specification shall be fabricated. Measurements of the characteristics shall be made as specified in Clause C4 of the Annexure C.

7.2 The firm should take prior approval of RDSO of the Test Schedule for a grade before commencement of the tests.

7.3 The test conditions for each machine viz. Peripheral speed, brush pressure, current densities and duration of tests are specified in Annexure 2. Two separate sets of measurements, for minimum and maximum brush pressure respectively, shall be taken. The acceptable wear limits are also specified.

7.4 Criteria for Acceptance

The criteria for acceptance of the new grade would be comparison of test results of properties of new grade with values given in clause 7.3 above. RDSO's decision in the matter shall be final.

8 BLACK BAND TESTS

8.1 Black Band Tests on an actual machine shall be carried out at the premises of a motor manufacturer/ workshop nominated by RDSO. The Black Band Tests shall be carried out in accordance with Clause 10.2 of IS 9919-1999. Suitability of the

firm's grade for the specific application will be decided based on the comparison of the bands obtained on the firm's grade with the bands of OEMs brush grade.

9.0 INITIAL FIELD TRIALS

9.1 After successful completion of the type tests of the grade, initial field trials shall be carried out in accordance with Clause 10.3 of IS 9919:1999.

9.2 Initial field trials shall be carried out on three locomotives/Units each. The details of the trials shall be advised by RDSO to nominated Railways and the firm. The trial report shall be prepared as per Annexure "C" and Annexure "D" of IS 9919-1999.

9.3 Machines fitted with new grade as well as machines fitted with regular approved grade shall be provided on same locomotives/Units for comparative assessment of performance. Different brush grades shall, however, never be mixed on same machines.

9.4 The fitment and measurement of parameters of the carbon brushes of the grade under trial shall be carried out in association with RDSO and firm's representatives.

9.5 The trial shall be carried out till the brush sizes reach condemning limit. Observation and measurement of parameters offered shall be carried out in association with RDSO and firms representative.

9.6 After completion of Initial field trials, the results shall be evaluated. If the offered grade is found suitable, the grade will be recommended for extended field trials by Railways.

10.0 EXTENDED FIELD TRIALS

10.1 After successful completion of initial field trials on the firm's grade, Railways shall be advised by RDSO to conduct extended field trials by procuring the brushes of the grade in limited quantities. The Railways shall furnish regular performance feedback in the designated Proforma.

10.2 The performance feedback received from the Railways shall be evaluated. If the performance feedback meets the minimum criteria of performance, the grade shall be approved under Part II (Developmental category).

11.0 MINIMUM CRITERIA OF PERFORMANCE FOR APPROVAL IN PART-II (DEVELOPMENTAL CATEGORY)

The following minimum criteria shall be applied for approval of the offered grade under Part-II:

i) Performance feedback shall consist of wear rate/10000 km for each type of locomotive and trouble free operation of the motor from fitment of the brushes unto their sizes reaching condemning limits.

ii) At least **300 motor sets** of the brushes should have gone into service with performance feedback available from the concerned Railways.

12.0 MINIMUM CRITERIA OF PERFORMANCE FOR APPROVAL IN REGULAR PART-I) CATEGORY

The following minimum criteria shall be applied for approval of the offered grade under Regular (Part-I) category:

i) The firm has furnished regular quarterly details of supplies made by them to Railways/brush manufacturers to RDSO.

ii) The firm has furnished regular quarterly details of testing of each batch of the grade mentioning density, resistivity, hardness and transverse strength to RDSO.

iii) Performance feedback shall consist of wear rate/10000 km for each type of locomotive and trouble free operation of the motor from fitment of the brushes unto their sizes reaching condemning limits.

iv) The Minimum quantity criteria for an individual brush grade for a particular application shall be decided by RDSO based on population and nature of application. The brush grade shall become eligible for upgradation from Part-II to Part-I category after minimum quantity criteria for individual application is fulfilled.

v) For eligibility of the brush grade for upgradation from part II to Part I , the number of brushes which have gone into service and with performance feedback available from concerned Railways should exceed minimum quantity criteria as defined by RDSO.

13 MARKING:

The following particulars shall be legibly and indelibly marked on each block of brush material:

- Grade of carbon block
- Name or logo of source of manufacture
- Batch number , month and year of manufacture

Encl: Annexure-1 & 2

ANNEXURE-1

Brush Operating Parameters Of Various Machines

S. NO.	Machine	Used on stock	Drawing Ref.	Peripheral speed (m/s)	Current Density (A/cm^2)	Pressure Range (g/ cm^2)
1	HS-1050Er/ HS- 15250A	WAG5/WAG7/ WAP4	EL.3.BS.013 (mod)	45	12.5	352 - 430
2	TAO 659	WAM4	EL.3.BS.002 (mod)	50	13.6	320 - 350
3	TM MG 1580	WAG3 & WAG4	EL.3.BS.004	53	13.3	323
4	TM MG 710	WAM1	EL.3.BS.005	47	13.3	347
5	TM 253 BX (4601AZ) & TM 253 AZ (4603AZ)	AC EMU & YDM4	EL.3.BS.006	52.5	7.73	245 - 332
6	TM TDK 5442 A	MG AC EMUs	EL.3.BS.012	27.5	9	374 - 429
7	TM TDK 5620 A	DC EMUs	EL.3.BS.014	37	9.55	374 - 429
8	TM 133 AZ (3601 AZ)	DC BG EMUs	EL.3.BS.003	38	8.9	207 - 224
9	TM 165M & TM5GE752ES	WDM2	EL.3.BS.007	50	15	415 - 507

Measurement of Operational Characteristics of Brushes

ANNEXURE-2

S. NO.	Machine	Test Condition					Max. wear rate (mm/1000h)	
		Peripheral speed (m/s)	Min. Brush Pressure (g/cm^2)	Max. Brush Pressure (g/cm^2)	Current Density (A/ cm^2)	No. of hours	At Min. Brush Pressure	At Max. Brush Pressure
1	HS – 1050 Er/ HS-15250A	50	350	450	14	150		
2	TAO 659	50	315	360	14	150		
3	TM MG 1580	50	300	350	14	150		
4	TM MG 710	50	330	360	14	150		
5	TM 253 BX (4601AZ) & TM 253 AZ (4603AZ)	50	240	350	8	150		
6	TM TDK 5442 A	50	360	450	9	150		
7	TM TDK 5620 A	50	360	450	10	150		
8	TM 133 AZ (3601 AZ)	50	200	250	9	150		
9	TM 165M & TM5GE752ES	50	400	520	15	150		

137690