GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

DRAFT
(For Revision)

SCHEDULE OF TECHNICAL & INFRASTRUCTURAL REQUIREMENTS FOR MANUFACTURE OF SELF LUBRICATING GUIDE BUSH FOR AXLE BOX GUIDE OF ICF BIOGIES

(TENTATIVE)

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1.	December- 2006	New issue		
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SCHEDULE OF TECHNICAL & INFRASTRUCTURAL REQUIREMENTS FOR SELF LUBRICATING GUIDE BUSH FOR AXLE BOX GUIDE ARRANGEMENT OF ICF BG BOGIES (TENTATIVE)

0 FOREWORD

0.1 This schedule consists of two parts viz. Section A and Section B. Section A covers the technical requirements / provisions relating to material, manufacture and tests and does not include all the necessary provisions of the contract. Section B covers the infrastructural, testing and quality control facilities required for manufacture of Self Lubricating Guide Bush (further referred as Guide bush in this specification) at the vendor's premises.

0.2 These Guide bushes are used for axle box guide arrangement of ICF BG bogies.

0.3 This schedule draws reference to some of the relevant ASTM / ISO specifications. Latest version of these specifications shall be taken as reference unless mentioned otherwise.

0.4 References:- ASTM D 792, ASTM D 785 , ASTM D 638, ASTM D 695, ASTM D 256, BS: 2782 Part1 (method 123B), ASTM D 1238.

0.5 For the purpose of deciding whether a particular requirement of the schedule is complied with, the final value observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS:2-1960. The number of significant places retained in the rounded off value shall be the same as that of the specified values in this schedule.

0.6 While preparing this specification, due consideration has been given to the latest developments in the field of polymeric material and process technologies, service requirements of the Indian Railways, and practices followed in advanced countries.

SECTION –A

SCHEDULE OF TECHNICAL REQUIREMENTS FOR SELF LUBRICATING GUIDE BUSH

1. SCOPE

This schedule covers the technical requirements, sampling and method of tests for injection moulded Self Lubricating Guide bush used for Axle box guide arrangement of ICF BG Bogies.

2. TYPE

2.1 The Self Lubricating Guide bush for Axle box guide arrangement of ICF BG BOGIES shall dimensionally conform to the RDSO drawing no. CGK6103.

3. REQUIREMENTS

3.1 Raw Material

The material used in the manufacture of Self Lubricating Guide bush shall have Self Lubricating with properties specified in table no.1. Use of regenerated / reconstituted material is not permitted.

Self Lubricating Guide bush will be subjected to field trials on at least 100 coaches for 18 months. Approval will be given only after satisfactory performance of Self Lubricating Guide bushes

3.1.2 The colour of material should be gray matching to RAL 7035.

Table 1: Properties to be measured on prepared test specimen for Type Test

S. No.	Property	Method	Units	Value
Physical				
1.	Specific Gravity	D 792	N/A	1.37 to 1.47
2.	Melting Point	BS:2782 Part-1 Method 123B)	ºC	175± 8 Deg C
3.	HDT	ASTM D 648	ºC	Min. 87 ºC (Load 264 psi, Position-Edgewise ramp rate 120 C/Hr)
Mechanical				
4.	Tensile strength at yield	D 638	MPA	34 Minimum

5.	Izod Impact cut knotch (1/8"), min.	D 256	J/M	37.432 Minimum
6.	Rig Test	As per Annexure-"B"		
7.	Hardness (Rockwell R), min.	D 785		115
8.	Melt Flow Index (Is) @ 190 & 2.16 kg. load (g/10 min.) max.	D 1238		2.5
9.	Tensile strength (MPa) min.	D 638		60
10.	Elongation at break (%) min.	D 638		60
11.	Compressive strength for 1% deflection(MPal) min.	D 695		30
12.	Wear factor	***Will be decided***		
13.	Dynamic COF	***Will be decided***		
14.	Static COF	***Will be decided***		

(Type test shall be repeated after a maximum period of two years from the first instance or earlier at the discretion of RDSO)

3.2 Manufacturing, Workmanship and Finish

3.2.1 The Self lubricating Guide bush shall be manufactured using a microprocessor controlled, fully automatic, screw type injection Moulding Machine having a minimum locking tonnage of 350 MT.

3.2.2 The surface of Self lubricating Guide bush shall be smooth, free from moulding defects such as bubbles, surface streaks, splash marks, voids, surface sinking, crazing and blistering of the surfaces, cracks etc. All edges shall be neatly finished and free from flash.

3.3 Dimensions & Tolerances

3.3.1 Self lubricating Guide bush shall be manufactured as per RDSO drawing no. CG –K6103. The dimensions and tolerances of the Guide bush shall be as indicated in the drawing.

4. Properties of Self lubricating Guide Bush

4.1 Unless otherwise specified all tests shall be carried out at a temperature of 23±2ºC and relative humidity 65±5%.

4.2 Tests shall be carried out on "Dry as Moulded (DAM) Specimen" defined as those, which upon immediate removal from the mould, are sealed in containers impermeable to water vapor/moisture.

4.3 Self lubricating Guide bush shall conform to the requirements as given in Table-2.

Table 2: Properties to be measured on finished product for acceptance test

S. No.	Property	Test Method	Unit	Value
1	Specific Gravity	ASTM D792	N/A	1.37 to 1.47
2	Melting Point	BS:2782 Part-1 Method 123B)	ºC	175± 8 Deg C
3	Ash Content	As per Annexure -III	% %	<12% at 375±10 ºC <2% at 600+10 ºC
4	Flexural Modulus	ASTM D790	Mpa	Min. 1900 Mpa @ 1.8 Mpa 2 mm/min

5. SAMPLING CRITERIA FOR CONFORMITY

5.1 Tests

5.1.1 The tests in table 1 shall constitute type test performed on the raw material specimen.

5.1.2 The type test, for all the requirements laid down in this schedule is mandatory or product approval. However approving Authority reserves the right to repeat the tests at their discretion. The vendors manufacturing this component must provide the raw material LOT test certificate for the lot, from the raw material manufacturer.

5.2 Acceptance Test

5.2.1 The acceptance test shall consist of the following:

I) Visual Inspection
II) Dimensional Check
III) Specific Gravity
IV) Melting Point
V) Ash Content as per Annexure “A”
VI) Flexural Modulus

5.2.2 The inspection lot shall consist of 500 Nos. of Self lubricating Guide bush or part thereof.

5.2.3 The numbers of Self lubricating Guide bush to be selected from the lot for acceptance test shall be as under:

A	Visual Inspection	5 % of the lot
B	Dimensional Check	2% of lot size or min. 10 samples shall be drawn at random from each lot
C D E F	Specific Gravity Melting Point Ash Content Flexural Modulus	4 Samples shall be drawn at random from each lot. Out of these samples selected, 2 nos shall be tested for items nos C,D,E and remaining 2 nos shall be tested for F.

5.2.4 Each sample selected for acceptance test shall confirm to the requirements as laid down in table 2. If any one of the test samples fail to meet the requirements of acceptance test, double the number of the samples from same lot shall be drawn for re-testing. If any of these samples fail, the entire lot shall be rejected.

5.2.5 In case on non-compliance in regard to dimensional check, the manufacturer may be given one chance to segregate the lot for dimensional conformity.

5.2.6 In the event of rejection of the lot, all Self lubricating Guide bush constituting the lot shall be made unusable in the presence of the inspection authority.

5.2.7 During inspection, purchasing / inspecting Authority, at their discretion may conduct type test and the samples shall confirm to the values specified in Table1 of this schedule.

6. PROCEDURE OF PROCUREMENT

6.1 Self lubricating Guide bush shall be processed from firms whose designs are evaluated by RDSO and found suitable for trials.

6.2 The firms should have written NDA (Non Disclosure Agreement) / Confidentiality Agreement with M/s. SABIC Innovative plastics India. Ltd.

6.3 During bulk production, the firm shall not alter any material or process after having successfully undergone the approval process.

6.4 The firm shall have all the facilities mentioned in Section B of this STR.

6.5 A request for the evaluation for the item shall be made to RDSO. The request for evaluation shall be accompanied with in-house test result of the product.

6.6 Self Lubricating guide bush shall be subjected to in-service trials for a minimum period of 18 months on 100 coach sets.

7. INSPECTION

7.1 During evaluation of a firm by RDSO, for purpose of ensuring quality of purchased product may carry out quality audit, inspection and testing of the equipment at the premises of manufacturer.

7.2 Purchase inspection shall be done at the premises of manufacturers by the representative of the Research Design and Standard Organisation or an agency authorised by RDSO.

8. MARKING

8.1 Self lubricating Guide bush shall be marked as per RDSO drawing no. CG-K6103.

9. PACKING

9.1 Self lubricating Guide bush shall be securely packed 32 nos. in bags/ carton strong enough to resist damage in transit / storage.

10. STORAGE

10.1 Self lubricating Guide bush shall be stored in a cool and dry place, free from constraints, in the original packing.

10.2 Self lubricating Guide bush shall be kept covered and free from exposure to bright light, particularly sunlight.

10.3 Self lubricating Guide bush shall be stocked and arranged in such order as to ensure use of old stock first.

SECTION-B

INFRASTRUCTURE & TESTING FACILITIES REQUIRED FOR MANUFACTURE OF Self lubricating GUIDE BUSH

1. SCOPE

1.1 This Section covers the infrastructure requirements for manufacture of Self lubricating Guide bush used for Axle box guide arrangement of ICF BG Bogies.

2. REQUIREMENTS

2.1 All vendors seeking registration with RDSO must fulfill the requirements of this schedule.

3. PLANT, MACHINERY & INFRASTRUCTURE REQUIRMENTS

3.1 The manufacturer shall have adequate space and covered area with cemented floor to accommodate the following & for smooth logistics

a) Dump free place for storage of raw material
b) Adequate manufacturing Area
c) Finishing, Assembly and Inspection Area
d) Storing and Dispatch of Finished Products

3.2 The Manufacturer shall have at least one microprocessor controlled injection moulding machines of minimum locking tonnage of 350 Metric Tons.

Each Machine shall be equipped with the following ancillaries:

A) PLC Electrostatic Oil Cleaning Machines
B) 6 Stage oil filtering machine

The above ancillaries are required for

i) to maintain the quality of the machine oil
ii) to ensure that the oil used in the machine is free from contamination
iii) to maintain viscosity of the oil

Clean oil is required to ensure that valve do not get chocked as this leads to inconsistent performance of the injection moulding machine

C. PLC Controlled Mould Temperature Controller (MTC)
D. PLC Controlled Hopper Dryer
E. Oil Testing equipment

3.3 The Firm shall have at least one set of moulds, in addition to the following equipments:

1. Overhead crane / Electrically operated Hoist of 10 Metric ton or above.
2. Hot air oven.
3. Cooling Water tank
4. Cooling Tower of 40 TR or above.
5. Cooling Tower Pumps (Two)
6. Dehumidifier.

3.4 Manufacturer shall have an air Compressor of suitable capacity.

3.5 The manufacturer shall have suitable tools, cutter, polishing files, and buffering machines for de-flashing of moulded products.

3.6 The Manufacturer shall have a system to ensure that mould are checked at regular intervals and adequate mould handling facilities like chain pulleys or electric Hoists or other suitable equipments for moving heavy moulds.

3.7 Prior to release of dies/moulds for production, these are to be checked dimensionally and records containing details of such inspection and date, maintained.

3.8 One Electronic weighing machine of reputed make, of maximum 3 Kg capacity with an accuracy of 1% shall be provided.

3.9 Weighing machines shall be calibrated regularly and the frequency of calibration specified.

3.10 In-house availability of minimum infrastructure for maintenance and polishing of dies and moulds shall be ensured.

4. TOOL ROOM MACHINES

4.1 The Manufacturer shall have the following machines:

1. Lathe minimum 2 nos.
2. Milling Machine
3. Surface Grinder
4. E.D.M. of reputed make
5. Power Hacksaw
6. Pantograph

5. TESTING FACILITIES

5.1 The Manufacturer shall have the following testing and other equipment installed in a laboratory set up.

1. Tensile Testing Machines
2. Melting Point Apparatus
3. Weighing balance with specific gravity determination Kit.
4. Muffle Furnace of capacity up to minimum 1000 degree centigrade.
5. Testing facilities for Flexural Modulus

5.2 The Manufacturer shall have dies/ moulds for preparation of various test specimens for the relevant tests.

5.3 All Gauges required to ensure that the dimensions of Guide bush are as per drawings shall be available.

5.4 The manufacturer shall have arrangements like vice, cutter, polishing files etc. for preparation of various samples for tests such as tensile strength, hardness, specific gravity etc.

6. QUALITY CONTROL REQUIREMENTS

6.1 The Manufacture shall have valid ISO:9001-2000 .

6.2 There shall be a system to ensure first-in, first-out for all stages of manufacturing.

6.3 It shall be ensued that proper analysis, on a monthly basis to study rejection at various stages of production, is carried out and documented.

6.4 Latest version of relevant specifications and drawings shall be available with the firm.

6.5 QAP & STR should be available at manufacturer's end at any given point of time for checking by inspecting authority.

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Annexure "A "

ASH CONTENT % TEST BY MUFFLE FURNACE:

Equipment required –

a) Muffle furnace of capacity up to 1000 degree centigrade.
b) Crucible.
c) Sample weight 6 gm +/- 2 gms.

x) Weighing – Weigh a clean, dry porcelain crucible to nearest 0.0001 gms. Record the resulting value as W1.

y) Weigh approximately 6gms +/- 2gm sample of self lubricating guide bush & put it in pre weighed crucible & now weigh the crucible containing the sample & Record the resulting value as W2.

On set temperature 375 +/- 10 deg. Centigrade Required value less than 12%.

Switch on the muffle furnace & set temperature to 375 degree centigrade, on reaching temperature at 375 deg. C place the crucible containing the sample into a muffle furnace.

Keep the sample in muffle furnace at 375 deg C for a period of minimum 30 minutes.

z) Weigh the cooled crucible containing ash, and record the resulting value as W3.

Calculate the Ash content % by using formula as below.

$$\text{Ash content \%} = \frac{(W3 - W1)}{(W2 - W1)} \times 100.$$

On set temperature 600 +/- 10 deg. Centigrade Required value less than 2%.

Repeat the test procedure as above & record the test results at a temperature 600 ºC Calculate the Ash content % by using formula as below.

$$\text{Ash content \%} = \frac{(W3 - W1)}{(W2 - W1)} \times 100.$$

Annexure "B "

Rig test :

The endurance test will be carried out in a suitable rig, the Self lubricating Guide bush will be held on a shaft & its outer periphery will be rubbed on a Pipe having its inner dimensions as below to access wear and breakage .

Conditions for endurance test Rig.

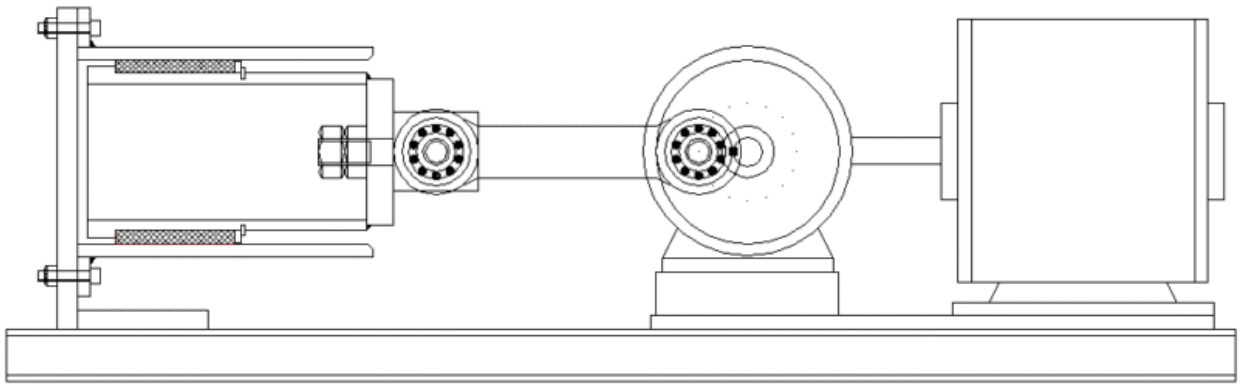
1) Pipe dimension : Inner diameter 139. 85 mm + 0.05 / -0.0 (turned finish) & Pipe Inner length: – 200 mm.
2) Amplitude for test : 75 mm.
3) Frequency : 2 hertz
4) No. of cycles to be tested: 100,000 cycle.

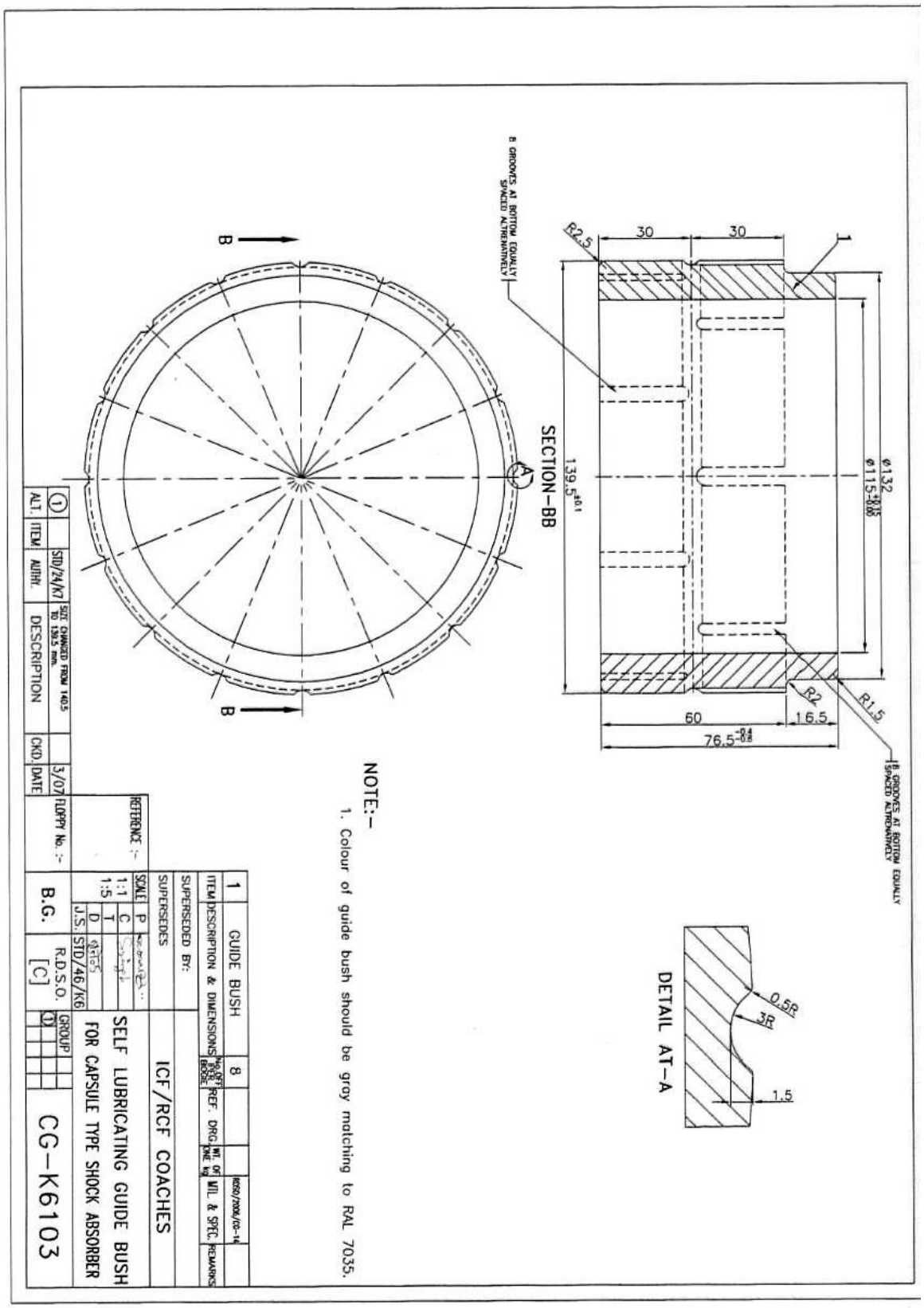
The endurance test will be done on Self lubricating Guide bush for 100,000 cycle.

During the Endurance test, the Rig should be stopped after every 20 / 30 minutes in order to allow the pipe to get cooled for approx. 30 minutes & than again continue the test by repeating same procedure till completion of 100,000 cycles.

Conclusion:

After completion of endurance test the rubbed Self lubricating Guide bush shall be removed from the test Rig & checked visually for cracks / damage ; There should be not be any cracks or damage on the tested Self lubricating Guide bush and the outer diameter should not be less than specified lower limit of Guide bush .





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