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Specefication No. RDSO/M&C/RP-195/2020 (Revision 1.0)

Government of India
Ministry of Railways

Indian Railway Standard Specification for
20 mm Thick Nylon cord Reinforced Elastomeric Pad
For Steel Channel Sleepers (Revision 1.0)

M&C Directorate
Research Designs & Standards Organization
Lucknow - 226011

Indian Railway Standard Specification for 20 mm thick Nylon Cord reinforced
Elastomeric Pad for placing between channel sleeper and rail

0. FORWORD:

- 0.1 This specification is issued under fixed Serial No. RDSO/M&C/RP-195/2020 (Revision 1.0), the final number indicates year of adoption as standard or in case of revision, the year of last revision. The specification was first adopted in the year 1998.
- 0.2 This specification is intended to cover the technical provision relating to materials, manufacture and tests and does not include all the necessary provisions of the contract.
- 0.3 This specification draws reference to IS: 3400. The latest versions of these standards shall be taken as a reference.
- 0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value observed or calculated, expressing the results of a test or analysis, shall be rounded off in accordance with the IS 2: 1960 (Reaffirmed 2016). The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.
- 0.5 In framing the specification, due consideration has been given to the development in the field of elastomeric materials and process technologies, serviceability requirements of the Indian Railways and the practices followed in advanced countries in this field.
- 0.6 This specification contains a code of practice for quality control and inspection of rubber components (Appendix I) to ensure satisfactory process and quality control at the works of the manufacturers. The provisions of this code shall be applicable for all the rubber components being used on the Railways. Similarly provisions on “Sampling and criteria for conformity” and “Inspection and testing facilities” shall be applicable for all rubber components.

0.7 During the course of development, the specification shall be reviewed based on data available from testing against developmental order.

1. SCOPE:

1.1 This standard covers the requirements, methods of sampling and tests for 20 mm thick Nylon Cord reinforced elastomeric pad hereinafter referred to as 'reinforced elastomeric pad' for use with steel channel sleepers for bridges (MBG & MMG).. The reinforced elastomeric pads are subjected to compression and shear forces, both static and dynamic under extreme climatic conditions prevailing all over the country.

2. REQUIREMENTS:

2.1 MATERIALS

2.1.1 RUBBER

The rubber compound used for the manufacture of reinforced elastomeric pads shall be based on polychloroprene elastomer suitably compounded so as to conform to the requirements as specified in Clause 2.5.1.

2.1.2 NYLON CORD

The Nylon cord shall conform to the requirements as specified in Clause 2.5.2. The cords shall be suitably treated to ensure proper adhesion between the rubber and cord as specified in this standard.

2.1 CONSTRUCTION:

2.2.1 There shall be four layers of treated Nylon cord placed cross wise to each other in the regular section i.e. thickness of 20 mm. The thickness of the rubber on the top and bottom of the pad shall be minimum 4 mm and between the reinforcement minimum 3 mm. Care shall be exercised to avoid displacement and exposure of the cords during vulcanization. The reinforcement shall be confined only to the regular sections in case of pads having projections.

2.3 WORKMANSHIP AND FINISH:

2.3.1 The reinforced elastomeric pads shall have a clean cut sides. The surface of the rubber shall be smooth, free from porosity, blow holes and other moulding defects.

2.4 DIMENSIONS AND TOLERANCES:

2.4.1 Dimensions and tolerances shall be as per the relevant drawings. Unless otherwise specified, a tolerance of ± 5.0 mm on the length, $+ 0/-2$ on the width and $+0.5/-0.0$ mm on the thickness shall be permitted.

2.5 PHYSICAL PROPERTIES OF RUBBER, NYLON CORD AND REINFORCED ELASTOMERIC PAD:**2.5.1 TESTS:**

Hardness, compression set and load-compression tests shall be carried out from the finished product. All other tests shall be carried out from the prepared test slabs (Approx. 4-5 mm thick) using the same compound and vulcanized to the same degree. The method of tests shall be as laid down in the respective appendices and shall comply with the requirements stipulated in the specification. General Procedures and conditions of the tests shall be as per IS: 3400 without any infringement upon special conditions laid down in the respective appendices of this specification.

PHYSICAL PROPERTIES OF RUBBER:

	Properties	Value	Test method as per appendix.
(i)	Hardness (Shore 'A'), min.	60	A
(ii)	Tensile strength(kg/cm ²)		
	a) Before ageing, min.	140	B
	b) After ageing at 100 ± 1 °C For $96 + 0/-2$ hrs. min.	125	
	c) percentage retention after ageing, min.	85	

(iii)	Elongation at break(%)		
	a) Before ageing, min.	250	B
		185	
	b) After ageing at 100 ± 1 °C For 96 hrs. + 0/-2 min.		
	c) percentage retention after ageing, min.	70	
(iv)	Modulus(relaxed) at 100% Elongation(Kg/cm ²)		C
	a) Before ageing	20-35	
	b) Percentage change after ageing at 100 ± 1 °C For 96 + 0/-2 hrs. min.	+30/-10	
(v)	Compression set(%), subjected to 50% compression at 100 ± 1 °C For 24 + 0/-2 hrs. max.	30	D
(vi)	Tension set(%), subjected to 50% stretch at 100 ± 1 °C For 24 + 0/-2 hrs. max.	25	E
(vii)	Load compression test, mm	1.50-2.00	F

Note:- For the purpose of confirming/co-relating the composition of the rubber test slabs with that of the finish product, Inspecting/Purchasing authorities may at their discretion shall perform the following tests both on the test slabs and the products, and shall comply with the requirements as given under:-

- a) Polymer identification : Identical
- b) Specific Gravity : The results shall be within ± 0.02
- c) Percent Ash : The results shall be within ± 1.0 .
- d) Swelling by volume
percent in reference fuel 'B'
at 27 ± 1 °C For 24+ 0/-2 hrs. : The results shall be within ± 5 .

2.5.2 NYLON CORD:

The Nylon cord shall be of style 1260/2 and the physical properties of the treated cord shall conform to the following requirements:-

SNo.	Properties	Values	Method of tests
1	Denier(gms/9000 meters), Min.	2400	IS: 4910 Part I: 1989 (Reaffirmed 2018)
2	No. of ends/inch	24±2	IS: 1963 (Reaffirmed 2004)
3	Thickness(mm),min.	0.75	IS: 4910 Part VIII :1989 (Reaffirmed 2018)
4	Load at break(kg), min.	16	IS: 4910 Part II: 1989 (Reaffirmed 2018)
5	Elongation at break(%), max.	20	IS: 4910 Part II: 1989 (Reaffirmed 2018)
6	No. of twists/m	380/400	ASTM-B-885 M

2.5.3 ADHESION BETWEEN THE CORD AND RUBBER:

2.5.3.1 Adhesion between the cord and rubber (H-Pull test) tested in a manner ASTM D-2138 shall be 10 kg f , min.

2.5.3.2 The peel adhesion, tested as per IS: 3400: Part V: 1986 (Reaffirmed 2019) with test specimen of 20 mm width cut from the reinforced elastomeric pad shall be 4.0 kgf. Min.

2.5.4 BREAKING LOAD:

2.5.4.1 The breaking load of the reinforced elastomeric pad tested as per IS: 3400 at a machine speed of 300 mm/minute on test specimen of 20 ± 0.5 mm width and 10 mm approximately thick (the pad sliced into half the thickness from the mid rubber layer so that the specimen has two layers of reinforcement), cut from the reinforced elastomeric pad shall be 425 kgf.min.(mid value of 5 test specimen arranged in decreasing order) and not less than 400 kg f. for any individual test specimen.

2.5.5 LOAD DEFLECTION CHARACTERISTICS: - The test shall be conducted as per Appendix 'F' and the deflection at a load of 15 ton shall be 1.50 to 2.00 mm.

3. LOT SIZE SAMPLING & CRITERIA FOR CONFORMITY:

- 3.1 For the purpose of inspection, 1,000 numbers of reinforced elastomeric pads or part thereof, in case ordered quantity is not a multiple of 1,000 numbers, shall constitute a lot. Five numbers of reinforced elastomeric pads shall be selected at random from each lot, and out of these a maximum of three may be subjected to destructive tests as required for conducting various tests specified. However, any deviation in the distribution of the samples for different tests shall be at the discretion of the Inspecting/Purchasing authority.
- 3.2 Should the samples fail to meet with the requirements of the tests of clause 2, the tests shall be repeated in the same manner with double the number of samples from the same lot comprising two sets of tests. Should any of the set of tests fail to meet the requirements, the entire lot represented by these test samples shall be rejected.
- 3.3 In the event of rejection of the entire lot, after the retest, the lot offered for inspection shall be made unusable in the presence of Inspecting/ Purchasing authority.

4.0 DIMENSIONAL CHECK:

- 4.1 The reinforced elastomeric pads complying with requirements of clauses 2&3 shall be arranged in lots of 1000 or part quantity thereof.
- 4.2 Minimum 2% of reinforced elastomeric pads subject to a maximum of 5% shall be checked for dimensions and tolerances stipulated in the drawing.
- 4.3 If any of the sample reinforced elastomeric pads do not conform to the dimensions and tolerances as stipulated in drawing, twice the number of samples taken for check earlier, shall be checked. Should any of these samples fail to meet the requirements of dimensions, the lot represented by these samples shall be rejected and or otherwise, the batch shall be accepted.
- 4.4 If the reinforced elastomeric pads do not meet the stipulations of clauses 4.2 & 4.3, the manufacturer shall resubmit the quantity of reinforced elastomeric pads after sorting out the defective pieces. The quantities so offered shall meet the requirements of clauses 4.2 & 4.3.

5. MARKING:

5.1 Each reinforced elastomeric pad shall bear the following 0.8 mm raised letters/figures placed in a recess on one of its surfaces:-

- a) Manufacturer's initial or trade mark as approved by the purchaser.
- b) Last two digits of the year of manufacture along with the quarter
- c) of manufacture.
- d) Drawing Number.

6. PACKING:

6.1 The reinforced elastomeric pads shall be packed placed flat one upon another in stout wooden boxes to avoid any damage in transit. The packing inside the box should be such that no displacement of pads occurs during transit. The boxes shall be sealed and labeled bearing:-

- a) Name of the supplier.
 - b) Order No. and date.
 - c) Period of manufacture
 - d) Consignee.
 - e) Quantity.
7. "Firm should comply Make in India policy and Public Procurement (Preference to Make in India) order -2017 under this specification" and subsequent amendment done time to time.

APPENDIX 'A'DETERMINATION OF HARDNESS:

- A.1. No. of test specimens
- A.1.1 Three reinforced elastomeric pads shall be selected for hardness measurements.
- A.2 APPARATUS: Shore 'A' durometer.
- A.2.1 Test method IS: 3400 Part II : 2014 (Reaffirmed 2019) shall apply.
- A.2.1.1 The hardness shall be measured at a distance of at least 1 cm from the side of the reinforced elastomeric pads. Five measurements shall be taken at different places on each of the pad which is itself resting on a very smooth rigid surface.
- A.3 REPORT
- A.3.1 The median of the five measurements obtained shall be considered as result to be taken into account and reported.

APPENDIX 'B'DETERMINATION OF TENSILE STRENGTH & ELONGATION AT BREAK:

- B.1 No. of test specimens
- B.1.1 Ten test specimens shall be cut from the test slabs. Gauge length for the purpose of measuring percent elongation shall be 50 mm.
- B.3.1 Five test specimens shall be chosen for conducting before ageing test and the balance of the five test specimens for after ageing test at $100 \pm 1^\circ\text{C}$ for 96 +0/-2 hrs. in an air oven, as per IS: 3400 Pt IV : 2012 (Reaffirmed 2017) "Accelerated ageing".

B.2 APPARATUS: Tensile testing machine.

B.3 Test Method IS: 3400 Pt. I 2012 (Reaffirmed 2017) shall apply.

B.4 REPORT

B.4.1 The results to be taken into account both before and after ageing shall be the third in each series of five measurements arranged in order of decreasing values.

B.4.2 Percentage retention of tensile strength and elongation at break shall be calculated with respect to the reported values before and after ageing. The percentage retention of tensile strength and elongation at break shall be calculated by the formula:-

$$\% \text{ retention of T.S. or E.B.} = \frac{\text{T.S or E.B after ageing}}{\text{T.S or E.B before ageing}} * 100$$

APPENDIX 'C'**DETERMINATION OF MODULUS (RELAXED) AT 100% ELONGATION**

C.1 No. of test specimens

- C.1.1 Six test specimens shall be cut from the test slabs. Gauge length for the purpose of measuring percent elongation shall be 50 mm.
- C.1.2 Three test specimens shall be chosen for conducting tests before ageing and the balance of the three test specimens after ageing at $100 \pm 1^\circ\text{C}$ for 96 ± 2 hrs in an air oven.
- C.1.3 The test specimens shall be stretched upto 100 mm at a speed 450-600 mm/min. and then allowed to return to the normal position at the same speed. Immediately after the first stretching, the test specimen shall be stretched to 100% of its gauge length i.e. 100 mm at a same speed and the load recorded.

C.2 REPORT

- C.2.1 The results to be taken into account before and after ageing shall be the second in each series of three measurements arranged in order of decreasing values.
- C.2.2 Calculation of change of relaxed modulus after ageing at $100 \pm 1^\circ\text{C}$ for 96 ± 2 hrs shall be given below:

$$\% \text{ Change} = (B-A) / A \times 100$$

Where A = Relaxed Modulus before ageing.

B= Relaxed Modulus after ageing.

APPENDIX 'D'

DETERMINATION OF COMPRESSION SET % SUBJECT TO 50% COMPRESSION:

D.1 No. of test specimens

D.1.1 Three round specimens, one each from three reinforced elastomeric pads shall be cut having a diameter 37 ± 1 mm.

D.1.2 The test specimens shall be compressed in a compression device upto 50% of its original thickness(T_o) by using spacers and the assembly shall be kept at $100 \pm 1^\circ\text{C}$ for $24 + 0/-2$ hrs. in an air oven. The specimens shall be removed from the device after 30 minutes on removal from the oven. The thickness of the test specimen (T_r) shall be measured between 24-48 hrs on removal from the oven.

D.2 REPORT:

D.2.1 Compression set % shall be calculated from the following formula:-

$$\text{Compression set \%} = \frac{T_o - T_r}{T_o} \times 100$$

D.2.2 The results to be taken into account shall be the second in the series of three measurements arranged in order of decreasing values.

APPENDIX 'E'

DETERMINATION OF TENSION SET % SUBJECT TO 50% STRETCH

E.1 No. of test specimens

E.1.1 Three test specimens of shall be cut from the test slabs.
The gauge length for the purpose of measuring the tension set shall be 50 mm.

E.1.2 The test specimens shall be stretched in a suitable stretching device upto 50% of the gauge length of 50mm and then the assembly kept in an air oven at $100 \pm 1^\circ\text{C}$ for $24 \pm 0/-2$ hrs. The test specimens shall then be removed from the device after 30 minutes on removal from the oven. The deformation occurred over the gauge mark (Lr) shall be measured between 24 – 48 hours on removal from the oven.

E.2 REPORT :

E.2.1 Tension set % shall be calculated from the following formula:-

$$\text{Tension Set \%} = \frac{\text{Lr} - 50}{50} \times 100$$

E.2.2 The results to be taken into account shall be the second in the series of three measurements arranged in order of decreasing values.

APPENDIX 'F'

LOAD COMPRESSION TEST

F.1 Two numbers of samples to be tested per lot. The sample size will be half of the pad by cutting into equal halves across the width. The loaded area of the pad is $(75+75) \times 150$ mm (Reference drg: Annexure 'B', Sheet No. 3, Item No. 830).

F.2 APPARATUS:

Compression testing machine: Capacity 50 tonne, min. suitably fitted with two dial gauges capable of reading $1/100^{\text{th}}$ of mm.

F.3 TEST CONDITIONS:

F.3.1 Test shall be carried out at $27 \pm 2^\circ\text{C}$.

F.4 TEST METHOD:

F.4.1 The test specimen shall be placed between two rigid metal plates, the surfaces of which shall be smooth. The top plate shall be of such design so that the load is applied on the area $(75+75) \times 150$ mm and not on the projected profile at the center and on the edges. When the top plate is placed on the pad, the outer surface of both the top and bottom plate shall be parallel. A piece of '0' number emery paper shall be inserted between the test specimen and the bottom plate. The measurement of thickness variation shall be carried out by means of two dial gauges of least count 0.01 mm attached with hydraulic press and located in the middle of the shorter sides of the test specimen.

F.4.2 Two consecutive loading of 15 t shall be applied before any deformation readings are taken. A load of 1 t shall be then applied and the dial gauges shall be adjusted for '0' reading. A load of 15 t then applied and dial, gauge readings shall be recorded. The deformation to be considered for report shall be the average of the readings taken from two dial gauges which shall not differ more than 0.5 mm for a given load.

F.5 REPORT:

F.5.1 The average of the readings of the dial gauges shall be considered and shall be within the specified limit for both the two specimens.

Annexure- I**CODE OF PRACTICE FOR QUALITY CONTROL AND INSPECTION OF RUBBER AND PLASTIC COMPONENTS:****A.1 THE SYSTEM:**

A.1.1 The manufacturers shall furnish to the Purchasing/ Inspecting authorities information in respect of quality control systems in force at their works used in the manufacture of components.

A.2 RECORDS, TESTS & SAMPLING :

A.2.1 The manufactures shall furnish the Purchasing/Inspecting authorities the details of tests and inspection records and other relevant records as required under the quality control systems in force. These records and reports shall be maintained by the Competent Technical Authority of the manufacturers and shall be open to examination by the Purchasing/Inspecting authorities at all reasonable time. The Purchasing / Inspecting authorities at their discretion may draw samples of materials used in manufacture and products at any stage of production for conforming tests either at the works of the manufactures or in an approved Laboratory. In case the samples do not conform to the requirements of the specification double the number of samples from the same lot/batch shall be drawn for re-tests. Should any one of the re-test samples does not conform to the requirements, the entire lot/batch shall be rejected.

A.3 APPROVED MANUFACTURERS:

A.3.1 The manufacturer should have complete manufacturing & quality control facilities as per the specification at their works.

A.3.2 For reasonable quality assurance, it is desirable that the components are procured from manufacturers approved by Research Designs & Standards Organization (RDSO), Lucknow or by any other agency as assigned by the Purchasing Authority, based on evaluation of the components as per the specification, manufacturing & quality control facilities and quality/assurance programme. However, such approval does not guarantee the supply of consistent quality of material/components & therefore, every lot offered shall be subjected to inspection and testing as per the specification.

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A.3.3 The approved manufactures shall be subjected to periodical re-appraisal (periodicity for each component shall be assigned by the approving authority). In case of withdrawal of any manufacturing & quality control facilities provided at the time of approval or the component produced at the time of re-appraisal are not conforming to the specification, the manufacturers are liable to the withdrawn from the approved list. The approving authority reserves the right to withdraw the manufacturers from the approved list without assigning any reason.