



**GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS**

**INDIAN RAILWAY
STANDARD SPECIFICATION**

FOR

**RAIL PADS
FOR PLACING BENEATH RAILS**

**Serial No. T- 55-2025
(Revision-01)**

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0.0 **FOREWORD**

- 0.1 As a part of system improvement in procurement of track items, track items of similar functional requirements and basic material viz. Grooved Rubber Sole plates (GRSP), Composite Grooved Rubber Sole plates (CGRSP) and Nylon Cord Reinforced GRSP are clubbed together into one single item, hereby known as '**Rail Pad**'. In this context following present specifications have been merged in the present specification:

- i) IRS specification for 6mm thick Grooved Rubber Sole Plate, Sl. no. IRS/T-47
- ii) IRS specification for 10 mm thick Grooved Rubber Pad (Provisional)-1989
- iii) IRS Specification for 6.2mm Composite Grooved Rubber Sole Plate, no. M&C/RP-198/2006
- iv) IRS Specification for 10mm Composite Grooved Rubber Sole Plate, no. M&C/RP-200/2007
- v) IRS Specification for 6mm thick Nylon Cord Reinforced Grooved Rubber Sole Plate, no. M&C/RP-201/2020 (Rev-1)

10 mm thick Nylon Cord Reinforced Grooved Rubber Sole Plate has further been added to the above list through Amendment 01.

- 0.2 For the purpose of deciding whether a particular requirement of this standard is complied with the final value observed and calculate expressing the results of a test or analysis, shall require to be rounded off in accordance with IS:2. The number of significant places retained in the rounded off value shall be the same as that of the specified value in this standard specification.

1.0 **SCOPE**

- 1.1 This specification covers the requirements, method of tests, sampling and scheme of testing for Rail Pads for placing beneath rails, at rail seat of the PSC sleepers i.e. Grooved Rubber Sole Plate (6mm & 10mm thick), Composite Grooved Rubber Sole plates (6.2mm & 10mm thick) & Nylon Cord Reinforced GRSP (6mm & 10mm thick).
- 1.2 All the provisions contained in RDSO's ISO apex documents (latest versions) subsequent versions/amendments thereof, shall be binding and applicable on the successful vendor(s) in the tenders floated by Railways to maintain quality of products supplied to Railways.

2.0 **REFERENCE DOCUMENTS**

- 2.1 The latest versions of BIS specification as follows and the RDSO drawing of the Rail pads under manufacture shall be available at the manufacturer's works premises.
- 2.1.1 IS: 7503(Part I to IV): Glossary of terms used in Rubber Industry.
 - 2.1.2 IS:3400(Part 1):2021: Methods of test for vulcanized rubbers : Part 1 Tensile stress strain properties (3rd revision).

- 2.1.3 IS:3400(Part II): 2014(Reaffirmed 2019): Methods of test for vulcanized rubbers : Part II Determination of Hardness
- 2.1.4 IS:3400(Part IV): 2012(Reaffirmed 2017): Methods of tests for vulcanized rubbers: part IV Accelerated ageing and Heat resistance
- 2.1.5 IS:3400(Part IX): 2020: – Methods of test for vulcanized rubbers: Part IX Determination of Density
- 2.1.6 IS: 3400(Part X)-1977 (Reaffirmed 2019): Methods of tests for vulcanized rubbers: part X compression set at constant strain (first revision).
- 2.1.7 IS: 3400(Part XIII)-1983(Reaffirmed 2019): Methods of tests for vulcanized rubbers: part XIII Tension Set
- 2.1.8 IS: 3400(Part XV)-1971(Reaffirmed 2019): Methods of tests for vulcanized rubbers: part XV volume resistivity of electrically conducting and antistatic rubbers.
- 2.1.9 IS: 3400(Part 22):1984(Reaffirmed 2019) - Methods of test for vulcanized rubber: Part 22 Chemical analysis.
- 2.1.10 IS: 2-1960(Reaffirmed: 2021): Rules for rounding off numerical values
- 2.1.11 IS: 4905: 2015(Reaffirmed: 2020): Random sampling and Randomization procedure (First revision)
- 2.1.12 ASTM-D-945-Method of test for mechanical properties of Elastomeric vulcanizates under compressive or shear strain by mechanical oscillographs.
- 2.1.13 ASTM-D-2138: Method of test for Adhesion between Cord and Rubber (H-Pull test)
- 2.1.14 ASTM-E1131- 08: Standard Test Method for Compositional Analysis by Thermogravimetry
- 2.1.15 ISO 11358-1: Plastics — Thermogravimetry (TG) of polymers Part-1 General principles
- 2.1.16 IS: 3400 Part-20:2021, Resistance to Ozone Cracking (Static Strain Test)
- 2.1.17 IS: 3400 Part-3:2021, Abrasion Resistance using a Rotating Cylindrical Drum Device.
- 2.1.18 IS: 3400 Part-11:2021, Determination of Rebound Resilience.
- 2.2 IS: 7151: 1991(Reaffirmed :2018): Corrugated Fibreboard Boxes for para dropping of supplies.
- 2.3 The specific provisions in this standard specification over-ride those in the above BIS specifications where these are not in conformity with one another. The specific requirement given in the drawing of the Rail pads will over-ride the relevant provision of this specification.

3.0 RAW MATERIAL

- 3.1 The Rail Pad shall be manufactured from virgin base material only i.e. using Natural Rubber, Ribbed Smoked Sheet (RSS) either of grade RSS1, RSS2 or RSS3 or a blend with

Styrene Butadiene Rubber (SBR) and/or Poly Butadiene Rubber (PBR). The Rail Pad shall not be manufactured using reclaimed/ re-refined/ recycled/ regenerated rubber.

- 3.2 For Rail Pad made of natural rubber with a particular grade RSS1, RSS2 or RSS3, the manufacturer should have valid license from Rubber Board for procurement of the natural rubber and to be used for manufacturing of Rail pads.
- 3.3 During inspection of Rail pads, the supplier should submit invoice with e-way bill in support of procurement of natural rubber of grades RSS1, RSS2 or RSS3 from the sources having valid license from Rubber Board with proof of filing annual return with Rubber Board.

Further, invoice of carbon blacks as per ASTM D 1765, silica (particle size < 20 microns) procured from the primary manufacturing sources or their authorized dealers shall be submitted at the time of inspection. A record shall be maintained showing procurement and consumption of natural rubber and carbon blacks used for the production of Rail pads.

- 3.4 For Nylon Cord Reinforced GRSP, the supplier should submit the purchase invoice along with e-way bill, in support of procurement of nylon cord of style 1680/2 with minimum 3200 Denier.

4.0 MANUFACTURE

- 4.1 Each mix/batch of compound shall be prepared with natural Rubber blended with SBR and / or Poly Butadiene Rubber (PBR). In each mix/batch, the polymer content shall not be less than 50% and the product shall conform to the requirements stipulated in relevant clauses 5.1 or 5.2 or 5.3 of this specification.
- 4.2 Each mix/batch of compound shall be tested for Relaxed Modulus (before ageing) and electrical resistance (before water immersion) and subject to their conforming to the requirement as given in relevant clauses 5.1 or 5.2 or 5.3, the manufacture of Rail pad shall be undertaken from such mix / compound.
- 4.3 The Composite Grooved Rubber Sole plates (CGRSP) shall consist of two layers of different rubber compound A & B conforming to the properties as stipulated in clause 5.2 integrally vulcanized and physically inseparable. The CGRSP thus obtained shall conform to the requirement as given in clause 5.2.
- 4.4 The thickness of layer conforming to Compound 'A' and Compound 'B' for 6.2mm & 10mm CGRSP are as under:

- | | | |
|-----|---|---------------------|
| i) | For 6.2mm CGRSP: Thickness of Compound 'A': | 3.0mm(approx.) |
| | Compound 'B': | 3.5mm(approx.) |
| | and the thickness of the Composite GRSP: | 6.2 +0.5 / -0.0 mm. |
| ii) | For 10mm CGRSP: Thickness of Compound 'A': | 7±0.5 mm |
| | Compound 'B': | 3±0.5 mm) |
| | and the thickness of the Composite GRSP: | 10+0.7 / -0.0 mm. |

- 4.5 Nylon Cord Reinforced GRSP shall consist of two layers of same compound of GRSP reinforced in between with two layers of treated Nylon Cord placed cross wise to each other in the regular section and a thin rubber layer between two layers of reinforcement. Care shall be exercised to avoid displacement and exposure of the cords during vulcanization. Nylon Cord shall conform to the requirements of the properties specified in the standard under clause 5.3.1.

- 4.6 The Rail pads shall conform to the requirements of the properties specified in this specification under relevant clause 5.1 or 5.2 or 5.3 as applicable and 7 & 9.

5.0 **PHYSICAL PROPERTIES OF RAIL PADS:**

5.1 **PHYSICAL PROPERTIES OF FINISHED 6MM & 10MM THICK GROOVED RUBBER SOLE PLATES**

| SN | Property/Test | Units | Acceptance value for 6mm thick GRSP | Acceptance value for 10mm thick GRSP | Test Method |
|----|---|--------------------|--|--|--------------------|
| 1 | Hardness | Shore 'A' | 75-85 | 70-80 | Appendix 'A' |
| 2 | Tensile Strength | | | | Appendix 'B' |
| | a) Before ageing | Kg/cm ² | 120 (min) | 120 (min) | |
| | b)After ageing at 100±1°C for 96+ 0/-2 hrs | Kg/cm ² | 100 (min) | 100 (min) | |
| | c)Retention after ageing | % | 80 (min) | 70 (min) | |
| 3 | Elongation at break | | | | Appendix 'B' |
| | a) Before ageing | % | 200 (min) | 200 (min) | |
| | b)After ageing at 100±1°C for 96 + 0/-2 hrs | % | 150 (min.) | 150 (min.) | |
| | c)Retention after ageing | % | 65 (min.) | 60 (min.) | |
| 4 | Relaxed Modulus at 100% elongation | | | | Appendix 'C' |
| | a) Before ageing | Kg/cm ² | 45-60 | 50-75 | |
| | b)Change after ageing at 100±1°C for 96 + 0/-2 hrs | % of actual value | +30(max) -10 | ±40 | |
| 5 | Compression set subjected to 50% compression at 100±1°C for 24+0/-2 hrs | % | 30(max) | 30(max) | Appendix 'D' |
| 6 | Tension set subjected to 50% stretch at 100±1°C for 24+0/-2 hours | % | 25(max) | 25(max) | Appendix 'E' |
| 7 | Load Compression Test | mm | 0.4-0.6 | 0.7-1.0 | Appendix 'F' |
| 8 | Electrical resistance | Mega Ohms | | | Appendix 'G' |
| | a) Before immersion b) After immersion | | 100(min) 100(min) | 100(min) 100(min) | |
| 9 | Ash content | % | Approved value ± 5, Subject to not exceeding 27% | Approved value ± 5, Subject to not exceeding 27% | IS: 3400 (Part 22) |
| 10 | Specific gravity | - | Approved value ± 0.03, Subject to not exceeding 1.27 | Approved value ± 0.03, Subject to not exceeding 1.27 | IS:3400 (Part IX) |
| 11 | Secant Stiffness Test | KN/mm | 150-250 | 100-170 | Appendix 'H' |
| 12 | Impact Attenuation Test | % | 30(min) | 40(min) | Appendix 'I' |
| 13 | Weight Test | gm | Should not exceed Max weight given in Appendix 'M' | Should not exceed Max weight given in Appendix -'M' | Appendix 'M' |
| 14 | Thermogravimetric Analysis (TGA) for Rubber content | % | >50 | >50 | ASTM-E1131- 08 |

| SN | Property/Test | Units | Acceptance value for 6mm thick GRSP | Acceptance value for 10mm thick GRSP | Test Method |
|----|---|-------|---|---|---|
| 15 | Inclined Repeated Load Test (Durability Test) | | 0.5 million cycle | 0.5 million cycle | Appendix 'K' |
| 16 | Resilience by Vertical Rebound | % | 30% | 30% | Appendix 'L', IS: 3400 Part-11: 2021 |
| 17 | Ozone test | | No cracks | No cracks | Appendix 'T', IS: 3400 Part-20: 2021 |
| 18 | Abrasion Test | % | Relative volume Loss / Measured Mass Loss in the range of 180 to 220 mg | Relative volume Loss / Measured Mass Loss in the range of 180 to 220 mg | Appendix 'S', IS: 3400 Part-3: 2021 |

Note:

- Impact Attenuation test shall be conducted on both types of rail pads at RDSO during initial approval.
- Impact Attenuation test shall be conducted on both types of rail pads at RDSO or firm's lab or independent lab during quality audit of firms by RDSO.
- Test for 6mm GRSP:** All the tests shall be carried out on 6 mm thick finished pad.
- Test for 10mm GRSP:** All the tests shall be carried out on 10mm thick finished pad.

5.2 **PHYSICAL PROPERTIES OF FINISHED 6.2MM & 10MM THICK COMPOSITE GROOVED RUBBER SOLE PLATE**

| S.N. | Property/Test | Units | Acceptance Value for 6.2mm thick Composite GRSP | Acceptance Value for 10mm thick Composite GRSP | Test Method |
|------|--|--------------------|---|---|--------------|
| 1. | Hardness | Shore 'A' | Harder side (Compound 'A') 75-85 & Softer side (Compound 'B') 60-70 | Harder side (Compound 'A') 75-85 & Softer side (Compound 'B') 60-70 | Appendix 'A' |
| 2. | Tensile Strength | | | | Appendix 'B' |
| | a) Before ageing | Kg/cm ² | 120(min) | 125(min) | |
| | b) After ageing at 100±1°C for 96 + 0/-2 hours | Kg/cm ² | 100(min) | 110 (min) | |
| | c) Retention after ageing | % | 80(min) | 80(min) | |
| 3. | Elongation at break | | | | Appendix 'B' |
| | a) Before ageing | % | 250(min) | 250(min) | |
| | b) After ageing at 100±1°C for 96 + 0/-2 hours | % | 180(min) | 180(min) | |
| | c) Retention after ageing | % | 60(min) | 60(min) | |
| 4. | Relaxed Modulus at | | | | Appendix 'C' |

| S.N. | Property/ Test | Units | Acceptance Value for 6.2mm thick Composite GRSP | Acceptance Value for 10mm thick Composite GRSP | Test Method |
|------|---|--------------------|---|---|--------------------|
| | 100% elongation | | | | |
| | a) Before ageing | Kg/cm ² | 25-45 | 25-45 | |
| | b) Change after ageing at 100±1°C for 96 + 0/-2 hours | % of actual value | +30 -10 | +30 -10 | |
| 5. | Compression set subjected to 50% compression at 100±1°C for 24+0/-2 hours | % | 30(max) | 30(max) | Appendix 'D' |
| 6. | Tension set subjected to 50% stretch at 100±1°C for 24+0/-2 hours | % | 25(max) | 25(max) | Appendix 'E' |
| 7. | Load Compression Test, min | mm | 0.6-0.9 | 0.9-1.2 | Appendix 'F' |
| 8. | Electrical resistance | | | | Appendix 'G' |
| | a) Before immersion | Mega Ohms | 100(min) | 100(min) | |
| | b) After immersion | Mega Ohms | 100(min) | 100(min) | |
| 9. | Ash content | - | Approved value ± 5, For Compound 'A' 27% (Max) For Compound 'B' 20% (Max) | Approved value ± 5, For Compound 'A' 27% (Max) For Compound 'B' 20% (Max) | IS: 3400 (Part 22) |
| 10. | Specific gravity | % | Approved value ± 0.03, For Compound 'A' 1.27 (max) For Compound 'B' 1.17 (Max) | Approved value ± 0.03, For Compound 'A' 1.27 (max) For Compound 'B' 1.17 (Max) | IS:3400 (Part IX) |
| 11. | Secant Stiffness | KN/mm | 100-240 | 100-170 | Appendix 'H' |
| 12. | Impact Attenuation | % | 30(min) | 40(min) | Appendix 'I' |
| 13. | Adhesion | Kgf | 8(min) | 8(min) | Appendix 'J' |
| 14. | Weight Test | gm | Should not exceed Max weight given in Appendix -'M' | Should not exceed Max weight given in Appendix -'M' | Appendix 'M' |
| 15 | Thermogravimetric Analysis (TGA) for Rubber content | % | >50 | >50 | ASTM-E1131-08 |
| 16 | Inclined Repeated Load Test (Durability Test) | | 0.5 million cycle | 0.5 million cycle | Appendix 'K' |
| 17 | Resilience by | % | 30% | 30% | Appendix |

| S.N. | Property/ Test | Units | Acceptance Value for 6.2mm thick Composite GRSP | Acceptance Value for 10mm thick Composite GRSP | Test Method |
|-----------|---------------------|-------|---|---|---|
| | Vertical Rebound | | | | 'L' IS: 3400 Part-11: 2021 |
| 18 | Ozone test | | No cracks | No cracks | Appendix 'T', IS: 3400 Part-20: 2021 |
| 19 | Abrasion Test | % | Relative volume Loss / Measured Mass Loss in the range of 180 to 220 mg | Relative volume Loss / Measured Mass Loss in the range of 180 to 220 mg | Appendix 'S', IS: 3400 Part-3: 2021 |

Note:

- i) Impact Attenuation test shall be conducted on both types of rail pads at RDSO during initial approval.
 - ii) Impact Attenuation test shall be conducted on both types of rail pads at RDSO or firm's lab or independent lab during quality audit of firms by RDSO.
 - iii) **Test for 6.2 mm CGRSP:** All the tests shall be carried out on 6.2 mm thick finished pad.
 - iv) **Test for 10mm Composite GRSP:** All the tests shall be carried out on 10 mm thick finished pad.
- 5.2.1 For tests on Specific Gravity and Ash Content for compound A & B shall be carried out from the finished pad-
- 5.2.3 **DYNAMIC PROPERTIES FOR COMPOSITE GRSP**
- 5.2.3.1 The tests as laid down in the clause shall be applicable for compound B for the purpose of product approval or approval of manufacturer and they shall, however, be repeated at specified interval by the approving / inspecting / purchasing authorities at their discretion. This method of tests shall be as per ASTM-D-945.

| S.No. | Properties | Values |
|-------|--|--------|
| 1. | Resilience at 20% deformation, min. | 80 |
| 2. | Static modulus (kg/sqcm) at 20% deformation | 55-65 |
| 3. | Effective dynamic modulus (kg/sqcm) at 20% deformation | 70-90 |
| 4. | Oscillating decay, min. | 0.35 |

- 5.2.3.2 Before testing the Dynamic properties of compound B, tests of Hardness, Ash Content and Specific gravity should be done and should conform to values mentioned in Clause 5.2
- 5.2.3.3 Dynamic Properties Test shall be conducted for compound B on both types of Composite GRSP at RDSO during initial approval and / or at firm's premises during quality audit of firms by RDSO

PHYSICAL PROPERTIES OF FINISHED NYLON CORD REINFORCED GROOVED RUBBER SOLE PLATES

| SN | Property/Test | Units | Acceptance value for 6mm thick Nylon Cord Reinforced GRSP | Acceptance value for 10mm thick Nylon Cord Reinforced GRSP | Test Method |
|-----|---|--------------------|---|--|---|
| 1. | Hardness | Shore 'A' | 75-85 | 75-85 | Appendix 'A' |
| 2. | Tensile Strength | | | | Appendix 'B' |
| | a) Before ageing | Kg/cm ² | 120 (min) | 120 (min) | |
| | b) After ageing at 100±1°C for 96 + 0/-2 hours | Kg/cm ² | 100 (min) | 100 (min) | |
| | c) Retention after ageing | % | 80 (min) | 80 (min) | |
| 3. | Elongation at break | | | | Appendix 'B' |
| | a) Before ageing | % | 200 (min) | 200 (min) | |
| | b) After ageing at 100±1°C for 96 + 0/-2 hours | % | 150 (min.) | 150 (min.) | |
| | c) Retention after ageing | % | 65 (min.) | 65 (min.) | |
| 4. | Relaxed Modulus at 100% elongation | | | | Appendix 'C' |
| | a) Before ageing | Kg/cm ² | 45-60 | 45-60 | |
| | b) Change after ageing at 100±1°C for 96 + 0/-2 hours | % of actual value | +30(max) -10 | +30(max) -10 | |
| 5. | Compression set subjected to 50% compression at 100±1°C for 24+0/-2 hours | % | 30(max) | 30(max) | Appendix 'D' |
| 6. | Tension set subjected to 50% stretch at 100±1°C for 24+0/-2 hours | % | 25(max) | 25(max) | Appendix 'E' |
| 7. | Load Compression Test | mm | 0.3-0.5 | 0.5- 0.8 | Appendix 'F' |
| 8. | Electrical resistance | | | | Appendix 'G' |
| | a) Before immersion | Mega Ohms | 100(min) | 100(min) | |
| | b) After immersion | Mega Ohms | 100(min) | 100(min) | |
| 9. | Ash content | % | Approved value ± 5 Subject to not exceeding 27% | Approved value ± 5 Subject to not exceeding 27% | IS: 3400 (Part 22) |
| 10. | Specific gravity | - | Approved value ± 0.03, Subject to not exceeding 1.27 | Approved value ± 0.03, Subject to not exceeding 1.27 | IS:3400 (Part IX) |
| 11 | Thermogravimetric Analysis (TGA) for Rubber content | % | >50 | >50 | ASTM-E1131- 08 |
| 12 | Inclined Repeated Load Test (Durability Test) | | 0.5 million cycle | 0.5 million cycle | Appendix 'K' |
| 13 | Resilience by Vertical Rebound | % | 30% | 30% | Appendix 'L' IS: 3400 Part-11: 2021 |
| 14 | Ozone test | | No cracks | No cracks | Appendix 'T', IS: 3400 Part-20: 2021 |

| | | | | | |
|----|---------------|---|---|---|-------------------------------------|
| 15 | Abrasion Test | % | Relative volume Loss / Measured Mass Loss in the range of 180 to 220 mg | Relative volume Loss / Measured Mass Loss in the range of 180 to 220 mg | Appendix 'S', IS: 3400 Part-3: 2021 |
|----|---------------|---|---|---|-------------------------------------|

Note: i) Hardness, Load-compression, Electrical Resistance & Compression Set test shall be carried out on the finished pad. All other tests shall be carried out from the prepared test slabs 6+ 0.5/-0.0mm thick and of size 200 x 130 mm using the same compound and vulcanized to the same degree. 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.

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:-

| | |
|-------------------------|--|
| Polymer identification: | Identical |
| Specific Gravity: | The results shall be within ± 0.02 |
| % Ash Content: | The results shall be within $\pm 5\%$ |

5.3.1 PHYSICAL PROPERTIES OF NYLON CORD:

The cords shall be suitably treated to ensure proper adhesion between the rubber and Cord as specified in this standard.

The Nylon Cord shall be of style 1680/2 and the physical properties of the treated Cord shall conform to the following requirements:-

| SN | Properties | Values | Method of Tests |
|----|------------------------------|--------------|---|
| 1 | Denier(gm/9000 meters), Min | 3200 | IS:4910 Part I:1989 (Reaffirmed 2018) |
| 2 | No. of ends/inch | 24 \pm 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 | 320 \pm 15 | ASTM-D-885M |

5.3.2 ADHESION BETWEEN THE CORD AND RUBBER:

5.3.2.1 Adhesion between Cord and Rubber (H-Pull test) shall be 10kgf, min. tested in a manner ASTM-D-2138. H-Pull test shall be conducted during initial approval and /or at firm's premises during quality audit of firms.

5.3.2.2 The Peel Adhesion shall be 4.0 kgf. (min.), tested as per IS: 3400 Part V:1986 (Reaffirmed 2019) with test specimen of 20mm width cut from the Nylon Cord Reinforced Grooved Rubber Sole Plate.

5.3.3 **BREAKING LOAD:**

The breaking load of Nylon Cord Reinforced Grooved Rubber Sole Plate tested at a machine speed of 300mm/minute on test specimen of 20 ± 0.5 mm width, cut from the Nylon Cord Reinforced Grooved Rubber Sole Plate shall be 350 kgf min (mid value of 5 test specimen arranged in decreasing order) and not less than 325 kgf for any individual test specimen. The test specimens shall be cut from sole plates such that the groove coincides with the central line of the test specimen.

6.0 **FINGER PRINTING OF CHEMICAL COMPOSITION (SPECIFIC GRAVITY AND ASH CONTENT):**

Specific gravity and Ash content of Rail pads shall be as per the relevant clause 5.1 or 5.2 or 5.3 as applicable.

Finger printing of chemical composition of Rail pads shall be done by measuring the values of specific gravity and ash content. The values of Specific Gravity and Ash content shall not vary from initial approved values and specified tolerance duly communicated to the firm at the time of approval so that there will be no major change in composition of Rail pads in regular supply.

The manufacturer, if so desires shall be permitted to seek changes in the specific gravity and percent ash content of the approved samples within specified tolerances subject to the maximum limits set forth for these properties in relevant clause 5.1 or 5.2 or 5.3 as applicable. Any such changes will be permitted after evaluation of fresh samples by RDSO as per the extant policy.

7.0 **DIMENSIONS AND TOLERANCES:**

Rail pads shall meet with requirement of dimensions and tolerances as per the relevant drawings. The sample pads shall be checked for the dimensions by means of approved inspection gauges as per RDSO drawings. Unless otherwise specified tolerance of ± 5 mm shall be allowed on the length, $+ 0/-2$ mm on width, and $+ 0.5/-0.0$ mm on the thickness.

8.0 **MARKING :**

Each Rail pad shall bear the following marking in 0.8mm deep raised letters/figures as shown in the respective drawings of rail pad:

- a) Manufacturers' initials or trade mark.
- b) First 2 digits for the month and last two digit for years as follows:
01-02.
02-02 etc.
- c) Drawing Number

Note: For easy identification of the 'TOP' surface of pad in field, a yellow colour un-vulcanized rubber label of minimum preferable size 25mm X 10mm shall be stick on the Compound 'A' hard layer side of Composite GRSP before vulcanization. After vulcanization, the yellow label should be distinctly visible on the 'TOP' surface of the pad. Marking should be done on Compound 'A' hard layer side of Composite GRSP.

9.0 **FREEDOM FROM DEFECTS:**

The Rail pads shall have clean cut sides and shall be free from defects such as porosity, blow holes or the presence of any other extraneous matter. The Rail pads shall also

have smooth surface and the grooves shall be unobstructed at the ends and along their whole length.

In case of Nylon Cord Reinforced GRSP, there shall be no exposure of Nylon Cord outside the pad surface and within the grooves.

10.0 PRE-ACCEPTANCE TESTS:

- 10.1 In case of unapproved and unregistered firms, prior to regular production samples of rail pad shall be approved by the approving authority as per test scheme given in Appendix- 'O'.
- 10.2 For approval/acceptance, the sample shall meet the requirements given in 5.1 or 5.2 or 5.3 as applicable and 7 & 9 of this specification.

11.0 ACCEPTANCE TESTS

11.1 LOT SIZE:

For the purpose of inspection, 10,000 numbers of rail pad or part thereof shall constitute a lot. However, for Nylon cord Reinforced GRSP, 5000 nos. or part thereof shall be counted a lot.

11.2 SAMPLE SIZE: Sampling scale for dimensional, and visual check shall be as follows:

| | |
|------------------|-------------------|
| Quantity of pads | Number of samples |
| Per lot | 25 |

The system of sampling shall be as per IS: 4905.

For Nylon cord Reinforced GRSP, Minimum 1% of the lot size, subject to minimum 10 nos. samples per lot shall be checked for dimensions and tolerances stipulated in the drawing.

Ten nos. samples of Nylon cord Reinforced GRSP shall be selected at random from each lot, and shall 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.

11.3 TESTS:

- 11.3.1 Except for dimensions and Weight Test, the scheme of testing for the inspection of a lot of Rail pads shall be as per Appendix 'O'.
- 11.3.2 The test methods shall be as per Appendix 'A' to 'O' and the criteria for acceptance and rejection of the particular test shall be as per relevant Clause 5.1 or 5.2 or 5.3 and clauses 7 & 9. However, all the values obtained shall meet the requirement of the specification.
- 11.3.3 **Weight Test:** The sample Rail pads shall be checked for the weight by means of digital weighing machine, and shall meet the requirement of maximum weight as given in Appendix-'M'.
- Sample size for weight test shall be as per IS-2500 (Part-1):2000 assuming an AQL of 2.5% and inspection level II. For weight test, the sample size and the acceptance & rejection number is summarized in Appendix 'N' of this standard.

Note: Weight test shall be done only for rail pads mentioned in Appendix-‘M’ of this specification.

12.0 RE-TEST:

- 12.1 Should the test results be not satisfactory in more than one property under test clause 11.3 (excluding dimensions) no re-testing shall be done and the entire lot is rejected and the rejected rail pads shall be cut into pieces and made unusable.
- 12.2 Should the samples fail in only one property under test clause 11.3 (other than dimensions and weight test) the particular test shall be repeated in the same manner with twice the number of samples drawn from the same lot. For acceptance of the lot, each sample should meet with the acceptance requirements of that particular test. If the samples fail again, the entire lot will be rejected.
- 12.3 Should the samples fail in dimensions, the manufacture may re-offer the Rail pads lot-wise, only once after sorting out the defectives, after written permission from the inspecting authority. The re-offered material, only if it passes the dimension test, shall be inspected for all the tests in terms of clause 11.3, if the re-offered samples fail again, the entire lot will be rejected.
- 12.4 Should the samples fail in weight test, the entire lot shall be rejected. However, this test shall be done only for rail pads mentioned in Appendix -M’ of this specification.

13.0 FINAL INSPECTION/TESTING AND DOCUMENTATION:

The manufacturer shall carryout the final inspection and testing internally in accordance with the requirement of tests under clause 11.3 and submit the internal test report along with the inspection call.

14.0 PACKING:

- 14.1 The Rail pads shall be packed such that each of pads in following packages are placed flat on top of one another and bound by rubber bands in two perpendicular directions.

- a) 50 pads of 6.2mm Composite GRSP/6mm GRSP or
- b) 25 pads of 10mm Composite GRSP/ GRSP or
- c) 50 pads for 6mm or 25 pads for 10mm or part thereof for Nylon Cord Reinforced GRSP, the rail pads for one set turnout should preferably be packed suitably for easy identification.

The rubber bands used for packing the pads shall be of 15-20 mm width and due care shall be taken to avoid any extra stress developed in such packing.

Six such packets placed flat one upon another shall then be placed in a plastic bag / HDPE bag (except PVC bag) and sealed. This bag shall be placed in a corrugated box conforming to IS:7151-91, a quality suitable for para dropping of supplies and has waterproofing property for the outer layers of the box. This corrugated box shall also be bound by two plastic straps of 15-20 mm width in two perpendicular directions using suitable strapping tensioner & sealer tool. The packing shall ensure that no displacement of rail pads should occur during transit.

Before dispatch, the corrugated boxes shall again be placed in a plastic bag / HDPE bag (except PVC bag) and stitched, to avoid any damage in transit.

- 14.2 The corrugated boxes shall be sealed and labeled bearing:
- a) Name of supplier
 - b) Purchase order number and date
 - c) Quantity
 - d) Consignee
 - e) Lot no.
 - f) Box no.

15.0 TEST FACILITIES:

The Rail pad manufacturer shall install all the necessary test facilities for inspection of Rail pad in a separate well lit, clean and properly ventilated laboratory cum inspection room provided with easily maintainable floor and platform.

16.0 INSPECTING GAUGES:

The inspection gauges for dimensional check shall conform to the respective gauge drawings. The manufacturer shall submit two sets of inspection gauges for approval by inspecting officer. One set shall be used as 'Master Gauge' and shall be preserved safely by the Rail pad manufacturer. The second set shall be for use by the inspecting officer. For internal checks the firm should use separate set of gauges.

17.0 DISPOSAL OF REJECTED GROOVED RUBBER SOLE PLATES:

The rejected Rail pads shall be cut into pieces and made unusable.

18.0 GENERAL:

- 18.1 The manufacturer shall furnish at his own cost, the Rail pads required for all tests and shall provide necessary manpower and facilities for carrying out tests at his cost.
- 18.2 Purchaser/Inspecting officer shall have free access to the works of the manufacturer at all reasonable times and shall be at liberty to inspect the manufacturing at any stage and to call for records pertaining to manufacture and testing which shall be made available within a reasonable time. All test and measuring equipments shall have valid calibration certificates to ensure accurate, reliable and reproducible test results.
- 18.3 The material shall be offered for inspection as per call letter given in Appendix -'P'.
- 18.4 The material shall be stored as per the guidelines laid down in Appendix 'Q'.

DETERMINATION OF HARDNESS

A.1 Number of test samples.

Five sample Rail pads shall be considered for hardness test.

A.2 Test Methods:

A.2.1 Apparatus: Shore 'A' durometer

A 3 Test method IS: 3400 Part II shall apply

A3.1 It is proposed that minimum 5 samples shall be checked for shore hardness 'A'. However, following method may be adopted for checking hardness of the Rail pads. The Rail pads under test shall be placed on another Rail pad of same drawing, such that the grooves at upper side of both the Rail pads are on the same line. Hardness shall be measured on the portion of the pad in which no groove exists. Five measurements shall be taken at different places on each sole plate.

A.4 Report:

A.4.1: All measurements to be reported. Each individual test value shall meet the acceptance requirement of this specification.

DETERMINATION OF TENSILE STRENGTH AND ELONGATION AT BREAK %

B.1 No. of test samples –

Five test specimens shall be tested

B.2 Test Method IS:3400 Pt.I shall apply.

B.2.1 The test specimens shall be in the shape of dumb bell. The Dumb-bell shall have the outline and dimensions as shown in Figure-3. Two test specimens shall be cut from each of the five pads such that the groove coincides with the central line of the test specimen. The part between the upper edges of the connecting shoulders shall have uniform width and thickness along its length. Gauge length ($L_0=50\text{mm}$) shall be marked on the test specimens for measuring the elongation.

B.2.2 Five test specimens, one from each of the five sample pads, shall be tested before ageing and the remaining five test specimens shall be tested after ageing at $100 \pm 1^\circ\text{C}$ for $96 \pm 0/-2$ hours in an air oven as per IS : 3400 Pt. IV. "Accelerated ageing". The specimens cut from the same pads shall bear the same number.

B.3 Tensile strength (T.S.)

B.3.1 The tensile strength shall be calculated by the formula:

$$\text{T.S. (Kg/cm}^2\text{)} = \frac{\text{Breaking load (kg)}}{\text{Initial cross-sectional area (cm}^2\text{)}}$$

Note: For calculating the initial cross-sectional area of the test specimen, sectional area of grooves shall not be deducted.

B.3.2 Percent retention of tensile strength after ageing:

B.3.2.1 Percent retention of tensile strength after ageing shall be calculated with respect to the reported values before and after ageing.

B.3.2.2 The percent retention of tensile strength after ageing shall be calculated by the formula:-

$$\% \text{ retention of T.S.} = \frac{\text{T.S. after ageing}}{\text{T.S. before ageing}} \times 100$$

B.3.3 Elongation at break

B.3.3.1 The elongation at break shall be expressed in percent and calculated by the formula:

$$\text{Elongation at break (\%)} = \frac{L - 50}{50} \times 100$$

where: L= Length in mm between bench marks at break.

B.3.4. Percent retention of elongation after ageing

B.3.4.1 Percent retention of elongation after ageing shall be calculated with respect to reported values before and after ageing.

B.3.4.2 Percent retention of the elongation at break after ageing shall be calculated by the formula:

$$\% \text{ retention} = \frac{\text{Elongation at break (\%)} \text{ after ageing}}{\text{Elongation at break (\%)} \text{ before ageing}} \times 100$$

B.4 Report:

B.4.1 All measurements to be reported. Each individual test value shall meet the acceptance requirement of this specification.

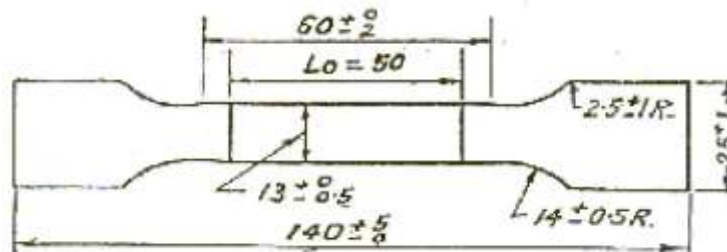


FIGURE 3
All dimensions are in millimeters

Note: The above sample shall be cut from top side of Rail pads.

DETERMINATION OF MODULUS (RELAXED) AT 100 % ELONGATION

- C.1 Number of test samples -Three test pads shall be considered for the tests.
- C.2 Test specimens.
- C.2.1 Test specimens shall be cut and marked in similar manner as indicated in clause B.2.1 of Appendix 'B'.
- C.2.2 Three dumb bell specimens, one from each of the three sample pads shall be tested before ageing and the remaining three test specimens shall be tested after ageing at $100 \pm 1^\circ\text{C}$ for $96+0/-2$ hours in an air oven, as per IS : 3400 Part IV, "Accelerated ageing".
- C.3. For test methods IS: 3400 Part I shall apply. The test specimen shall be stretched to 100% of its gauge length (i.e. upto 100mm) at the rate of 450-600 mm/mt. and then allowed to return to the normal position at the same rate. Immediately after the first stretching, the test specimen shall be re-stretched to 100% of its gauge length (i.e. upto 100mm) at the same rate, and the load shall be recorded.
- C.4 Calculations and Reporting:
- C.4.1 Calculations
- C.4.1.1 Modulus (relaxed) at 100% elongation shall be calculated by the formula:
- $$\text{Modulus (relaxed)} = \frac{\text{Load at 100 \% elongation (Kg)}}{\text{Initial cross-sectional area (cm}^2\text{)}}$$
- C.4.1.2 The initial cross-sectional area of the test specimen shall be considered in the same manner as in Clause B.3.1 of Appendix 'B'.
- C.4.1.3 Calculation of change of relaxed modulus after ageing at $100 \pm 1^\circ\text{C}$ for $96+0/-2$ hours shall be as given below:
- $$\% \text{ change} = \frac{B - A}{A} \times 100$$
- where A = Relaxed Modulus before ageing.
B = Relaxed modulus after ageing.
- C.4 Report:
- C.4.1 All measurements to be reported. Each individual test value shall meet the acceptance requirement of this specification.

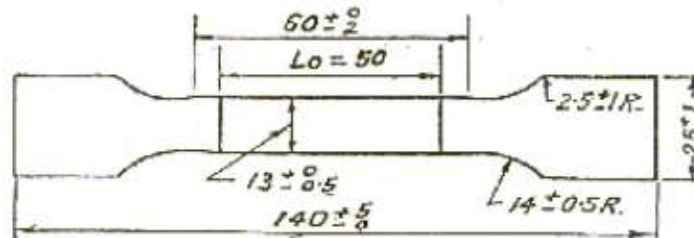


FIGURE 3

All dimensions in millimeters

Note: The above sample shall be cut from top side of Rail pads.

DETERMINATION OF COMPRESSION SET SUBJECTED TO 50% COMPRESSION

D.1 Number of test samples.

Three test pads shall be considered for the tests.

D.2 Test specimens.

D.2.1 Three round test specimens, one from each of the three sample test pads shall be cut $37 \pm 0.0/-0.3$ mm in diameter and whose axial plane coincides with that of one of the grooves.

D.3 Test Method.

D.3.1 For testing IS.3400 (Part X) shall apply.

D.3.2 Thickness of test specimen (T_o) shall be measured and it shall be compressed in a compression device to 50% of its original thickness (T_o) by using suitable spacers.

D.3.3 The assembly shall be kept at $100 \pm 1^\circ\text{C}$ for $24 \pm 0/-2$ hours in an air oven.

D.3.4 The device shall then be removed from the oven and allowed to cool at ambient temperature for 30-35 minutes. The test specimen shall then be removed from the device. The thickness (T_r) of test specimen shall be measured after 24 hours but not later than 48 hours from the time of removal from the device.

D.4 Calculation and Reporting.

D.4.1 Calculations:

Compression set (%) shall be calculated by the formula:

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

D.5 Report:

D.5.1 All measurements to be reported. Each individual test value shall meet the acceptance requirement of this specification.

DETERMINATION OF TENSION SET(%) SUBJECTED TO 50% STRETCH

E.1 Number of test samples.

Three test pads shall be considered for tests.

E.2 Test specimens.

E.2.1 Three test specimens of the type (Dumb bell) described in clause B.2.1 of Appendix 'B' shall be prepared one from each of the three sample test pads.

E.3 Test Method

E.3.1 For testing IS: 3400 part XIII shall apply.

E.3.2 The gauge length of 50 mm shall be marked on the test specimen and it shall be stretched in a suitable stretching device upto 50% of the gauge length.

E.3.3 The device shall be then kept at $100 \pm 1^{\circ}\text{C}$ for $24 \pm 0/-2$ hours in an air oven.

E.3.4 The device shall then be withdrawn from the oven and allowed to cool at ambient temperature in stretched condition for 30-35 mts and then freed.

E.3.5 The deformed length (L_r) over the gauge mark shall be measured after 24 hours but not later than 48 hours on removal from the oven.

E.4 Calculation and Reporting.

E.4.1 Calculations

Tension set (%) shall be calculated by the formula

$$\text{Tension set (\%)} = \frac{L_r - 50}{50} \times 100$$

E.5 Report:

E.5.1 All measurements to be reported. Each individual test value shall meet the acceptance requirement of this specification.

LOAD COMPRESSION TEST

- F.1 Two number samples to be tested per lot. The sample size will be same as the pad offered for inspection, only the horns (if there any) to be chopped off. The load to be applied, may be calculated as follows:-

$$\frac{t \times A}{260}$$

Where A = Area of pad under test in square cm
t = 1,5,10,15 & 20 tonne.

Note : A- If horns are present these are to be chopped off before measurement of area.

Note: B- If the actual pad size is big enough to cut a piece of size 200mm X 130mm, the test shall be done on test pieces of above said size. The size 200 mm x 130 mm i.e. area of 260 cm² is the standard reference size.

Note: C -Where area of the pad is less than 180 cm². The test shall be conducted on specially prepared test specimen of size 130 mm x 200 mm.

- F.2 Apparatus:

Compression testing machine: Capacity 50 tonne (min.) suitably fitted with two dial gauges capable of reading 1/100th of mm. The machine shall be fully automated and computerized with provision of recording of the readings of both dial gauges on applied loads.

- F.3 Test Condition:

F.3.1 Test shall be carried out at 27± 2°C and at relative humidity 65 ± 5%.

- F.4 Test Method:

The test specimen shall be placed between two rigid metal plates, the surfaces of which shall be smooth and shall absolutely flush with each other. The size of the plates shall be 210mm X 140mm (min.). A piece of '0' number emery paper shall be inserted between the test specimen and the metal plates both at the top and bottom. The measurement of thickness variation shall be carried out by means of two dial gauges of least count 0.01mm attached with hydraulic press and located in the middle of the shorter sides of the test specimen.

Note:

If required two layer of '0' number emery paper shall be inserted between the test specimen and the metal plates both at the top and bottom in case of 10mm GRSP/10mm Composite GRSP

- F.4.1 For GRSP (6mm & 10mm thick) & Nylon Cord Reinforced GRSP(6mm thick):

Two consecutive loading of $\frac{20 \times A}{260}$ t shall be applied before any deformation

readings are taken. A load of $\frac{A}{260}$ t shall be then applied and the dial gauges

shall be adjusted for '0' reading. Loads in tonnes for 5, 10 & 15 t in the formula given above, then applied and when each load is static for one minute, the dial gauge readings shall be recorded at load corresponding to 15 tonnes. The deformation to be considered for report shall be the average of the readings taken from 2 dial gauges at load corresponding to 15 tonnes, which shall not differ more than 0.3mm for a given load.

F.4.2 For Composite GRSP (6.2mm thick) :

Two consecutive loading of 15 t shall be applied before any deformation readings are taken. A load of 100 kg shall be then applied and the dial gauges shall be adjusted for '0' reading. Loads in tonnes for 1, 2, 3, 5, 10, 15 & 20 then applied and when each load is static for one minute, the dial gauge readings shall be recorded. The deformation to be considered for report shall be the average of the readings taken from 2 dial gauges at each load, which shall not differ more than 0.2mm for a given load.

F.4.3 For Composite GRSP (10mm thick) & Nylon Cord Reinforced GRSP (10mm thick):

Two consecutive loading of $\frac{27 \times A}{260}$ t shall be applied before any deformation s

Reading are taken. A load of $\frac{A}{260}$ t shall be then applied and the dial gauges shall

be adjusted for '0' reading. Loads in tonnes for 2, 3, 5, 10, 15 & 20 then applied and when each load is static for one minute, the dial gauge readings shall be recorded at load corresponding to 20 tonne. The deformation to be considered for report shall be the average of the readings taken from 2 dial gauges at each load, which shall not differ more than 0.3 mm for a given load.

F 5 - Report

F.5.1 For GRSP (6mm & 10mm thick) & Nylon Cord Reinforced GRSP(6mm thick):

F.5.1.1 Compression (mm) at a load $\frac{15 \times A}{260}$ t for the two samples to be reported.

F.5.2 For Composite GRSP (6.2mm thick) :

F.5.2.1 Calculate specific stress Kg/cm² by dividing the each applied load by the area (A) of the pad under test. Plot a graph of specific stress (Kg/cm²) as 'Y' axis and deflection (mm) as 'X' axis. The deflection (mm) shall be noted corresponding to specific stress 3.85 Kg/cm² as d1 and 57.70 Kg/cm² as d2 and the difference between (d2-d1) shall be within the specified limit. The deflection at a specified stress of $\frac{1.2 \times 260 \times 1000 \text{Kg/cm}^2}{A}$

shall not be less than 0.15 mm where the factor 260 is the area of the standard reference pad.

F.5.3 For Composite GRSP (10mm thick) & Nylon Cord Reinforced GRSP(10mm thick):

F.5.3.1 Compression (mm) at a load $\frac{20 \times A}{260}$ t for the two sole plates.

F.5.4 All measurements to be reported. Each individual test value shall meet the acceptance requirement of this specification.

DETERMINATION OF ELECTRICAL RESISTANCE

- G.1 No. of test samples.
- G.1.1 Three test samples shall be considered for the test.
- G.1.2 Samples shall be tested first as such and again after immersion in distilled water for 48 hours at ambient temperature.
- G.2 Preparation of the test specimen
The surface of the sole plate test specimens shall be gently rubbed with fine emery cloth for the purpose of removing any thin superficial layer of insulating substances with which they may be covered.
- G.3 Apparatus.
Million Mega ohm-metre or any other suitable equipment capable of measuring electrical resistance more than 500 Megaohms.
- G.4 Test Method.
- G.4.1 For testing IS:3400 (Part XV) shall apply.
- G.4.2 The test arrangement shall be as given in Figure 4. The test specimen shall be placed on a metal plate whose dimensions are not less than those of the sole plates. On the test specimen shall then be placed a metal ring of iron or brass whose outer diameter shall be 92mm, inner dia 72mm and height 30 mm. Inside the metal ring a cylindrical metallic disc of iron or brass having 62 ± 1 mm diameter & height 30 mm, shall be placed in concentric fashion & subjected to a load of about 50 kg. The measuring circuit shall be completed as given in figure 4. Measurement shall be carried out at 200-250 volts after a charge lasting for 60 seconds and measurements shall be repeated after reversing the direction of the current.
- G.4.3 In case of test specimen immersed in distilled water it shall be ensured that the sole plates before being tested on removal from water shall be wiped off with a dry cloth or blotting paper so that no apparent trace of water remains, especially in the grooves.
- G.5 - Report
- G.5.1 All the Individual test value before as well as after immersion under water shall be reported and should meet the minimum requirement laid down before and after reversal of current.

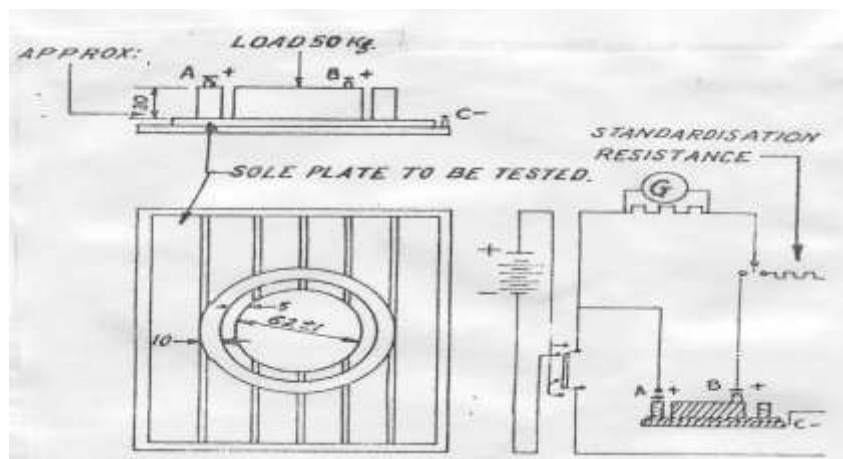


Figure-4

SECANT STIFFNESS TEST

- H.1 Place the test pad between steel platens, as shown in Figure1. A piece of '0' number emery paper shall be placed between the pad and the platens, with the abrasive side against the pad.

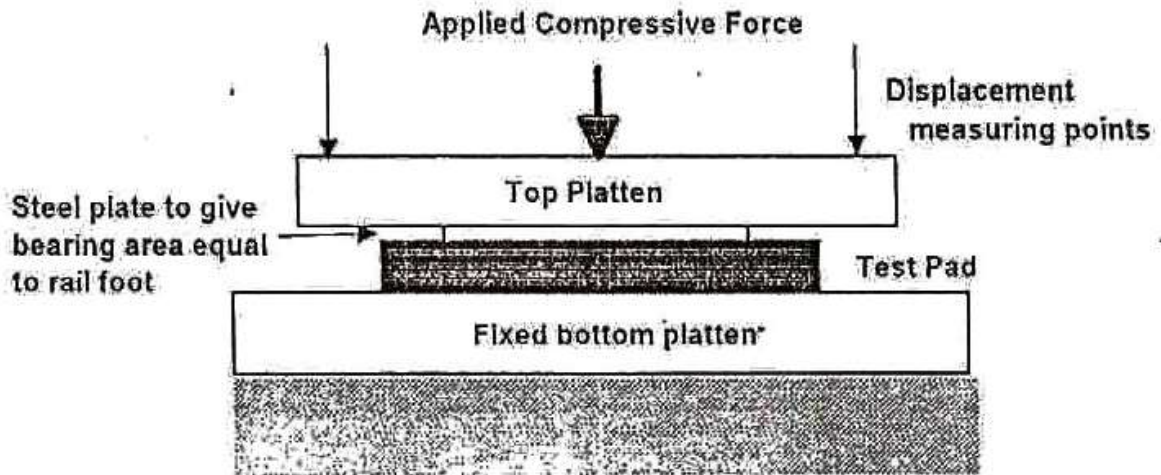


Figure 1

- H.2 Apply consecutive loading of 100 KN at a rate of 50 ± 10 KN/min and remove it, six times. The loading times at 100 KN shall each be at least 12 seconds.
- H.3 Upon release of the final pre-conditioning deformation a pre-load up to 100N shall be applied before setting deflection measuring devices to zero.
- H.4 Apply a compressive force up to 100 KN at a rate of 50 ± 10 KN/min. As the load increases, record continuously the displacement at the four corners. From this record, determine the displacements with applied loads of 20 KN and 90 KN. If the difference between the largest and smallest of the four displacement measurements is more than 30% of the mean value, the test results are invalid, and the test must be repeated, ensuring that the pad is suitably placed in the test machine. If the difference is less than 30% of the mean, calculate the mean displacement, S_{20} , with 20 KN applied, and the mean displacement, S_{90} , with 90 KN applied. For used pads drawn from service, this difference shall be considered as 40%, max.
- H.5 Two number samples to be tested per lot and each individual value shall meet the requirement of the specification.
- H.6 The static secant stiffness, k_{20-90} , is calculated from

$$k_{20-90} = 70/(S_{90} - S_{20}) \text{ KN/mm}$$

IMPACT ATTENUATION TEST

- I.1 The impact attenuation of the pad is to be measured in a drop weight test rig of the type shown in Figure 2. The drop weight has a mass of between 10 kg and 50 kg. In order to set the calibration of the rig, the rail fastening should first be assembled with 6mm thick plain hard plastic rail pad(HDPE or EVA), with stiffness not less than 750MN/m. The mass and height of the drop weight should be adjusted so that a clear impulse signal is obtained in the strain gauge, within 2 milliseconds and 5 milliseconds, with the peak strain not exceeding 2/3 of the initial cracking strain of the sleeper. Once these parameters are established for a particular test rig, a new sleeper should be strain gauged and installed for regular testing.

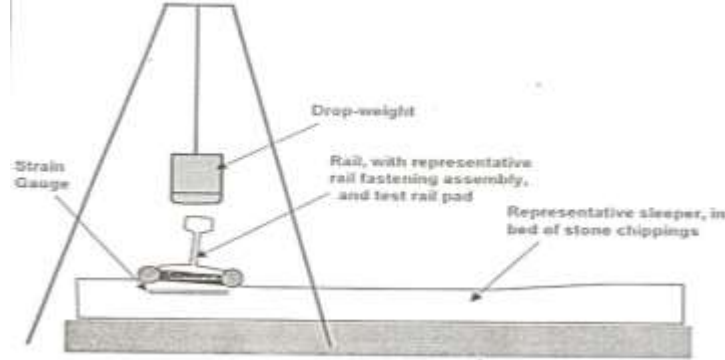


Figure 2

I.2 Test Facility:

I.2.1 For test of CGRSP 6.2mm thick or GRSP 6mm thick:

Standard rail fastening components corresponding to concrete sleeper to Drg. No. RDSO/T-2495 or RDSO/T-2496 are to be used.

I.2.2 For test of CGRSP 10mm thick or GRSP 10 mm thick:

Standard rail fastening components corresponding to concrete sleeper to Drg. No. RDSO/T-7008 or RDSO/T-8527 or RDSO/T-8746 or any relevant sleepers are to be used.

I.3 The test is carried out as follows:

- I.3.1 Place a Bed of stone/rubber mat below the sleeper for support. The support shall permit a vertical deflection in the range 0.1mm to 0.5mm during the test.
- I.3.2 With a hard plastic pad (stiffness greater than 750 MN/m) in place in the rail fastening assembly, drop the weight from the height established in the preparatory test, record the peak strain value. Repeat the test twice more. The average value of the three strains is recorded as ξ_{ref} .
- I.3.3 Dismantle the rail fastening assembly, and re-assemble it with the test pad in place. Drop the weight from the same height and record the peak strain value. Repeat the test twice more. The average of these three peak strains is recorded as ξ_{test} .

I.4 The impact attenuation of the pad A is defined by

$$A = (1 - \xi_{test} / \xi_{ref}) \times 100\%$$

I.5 Two samples shall be tested and each individual value shall meet the requirement of the specification.

ADHESION STRENGTH TEST

The adhesion strength test between layers 'A' & 'B' of Composite GRSP shall be done with specimen of 20 ± 1 mm width cut from the Composite Grooved Rubber Sole Plate.

A layer is to be separated for a distance sufficient to enable the separated ends to be held in the grips of the tensile testing machine.

Sometimes, the layers are not distinctly visible and this separation is not possible due to strong adhesion between the layers 'A' & 'B' to enable gripping of the samples in the machine, in that case, the sample shall be treated as passing the adhesion strength test and the same should be reported as 'no separation' without giving any observed value of load required to separated the layers.

But, when the layers are distinctly visible and separation is possible, the maximum load for 20mm width shall be reported at which separation occurs.

Two numbers of samples shall be tested per lot and each individual value shall meet the requirement of the specification.

INCLINED REPEATED LOAD TEST (DURABILITY TEST)

- K1. For conducting durability test, following standard rail fastening assemblies are to be used:

| SN | Components | PSC sleeper RT-2496 | Wider PSC sleeper RT-8746 |
|----|---------------|---------------------|---------------------------|
| 1. | Rail | 60kg | 60kg |
| 2. | GFN/HVN Liner | RT-3706 | RT-8751 |
| 3. | Rubber Pad | RT-6618 | RT-8747 |
| 4. | ERC | RT-5919 | RT-5919 |

- K2. **Scale of loading:**

0.5 Million cycle at frequency of 300 cycles/minute

(L/V ratio = 0.62)

Vertical load (V) = 9.375t max to 0.5t min

Lateral load (V) = 5.81t max to 0.3t min

- K3. Following tests shall be carried out initially and after completion of the accelerated durability test.

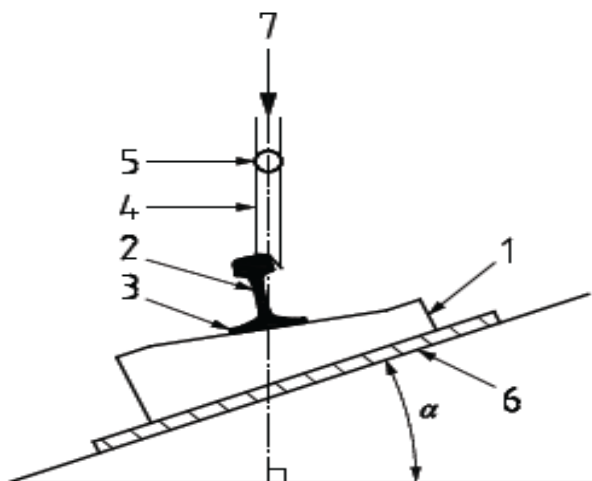
- i) Load deflection
- ii) Thickness

- K4. The change in values of Load deflection, measured after durability test (0.5 million cycles test) should be within 10% of the values measured at the beginning of the test. Reduction in the thickness shall not be more than 1 mm for 10 mm thick rail pad and 0.6 mm for 6 and 6.2 mm thick rail pads.

- K5. There should be no significant tears or holes in the pad after completion of the test.

Key

1. Sleeper, half sleeper or block
2. Short length of rail of the required section
3. Fastening assembly with sample pad
4. Loading mechanism which allows free rotation of rail under load
5. Free pivot either above or below the actuator with minimum length of strut from pivot to rail of 0.4m
6. Layer of crushable or conformable material on rigid support (e.g. gypsum board)
7. Angle $\alpha=32^\circ$



DETERMINATION OF RESILIENCE BY VERTICAL REBOUND

L1. Number of test samples:

Three pads shall be tested for Resilience by Vertical Rebound.

L2. Test temperature:

27±2°C

L3. Test Specimen:

The test shall be conducted on the rail pad.

L4. Procedure:

A hollow plunger of 28±0.5gm. weight and dimensions specified in IS 3400 Part-11 is dropped on the sample through a guiding rod passing through hole of the plunger from height of 400 ± 1 mm. The 400 mm scale is divided into 100 equal divisions of 4 mm each. Plunger is dropped with a spring release mechanism on the sample and rebound height of top of the plunger is noted. First 3 impacts are for conditioning of the sample. The rebound for 4th, 5th, & 6th impacts in terms of divisions shall be the percentage resilience.

L5. Report :

Average percentage resilience recorded for 4th, 5th, & 6th impacts shall be reported for each sample.

Note: For screening of samples for pass or fail criteria, an opaque shield may be placed below desired resilience mark on the scale. If on the rebound, the top of the plunger is seen, the sample shall be considered fulfilling the resilience criterion.

MAXIMUM WEIGHT OF DIFFERENT RAIL PADS

| Drawing No. | Type of Rail pad | Maximum weight of Rail Pad (g) |
|-------------|------------------|--------------------------------|
| 1 | 2 | 3 |
| RDSO/T-3703 | 6mm GRSP | 161 |
| RDSO/T-3711 | 6mm GRSP | 174 |
| RDSO/T-6618 | 6.2mm CGRSP | 167 |
| RDSO/T-8327 | 6.2mm CGRSP | 154 |
| RDSO/T-8528 | 10mm CGRSP | 445 |
| RDSO/T-8747 | 10mm CGRSP | 425 |

Note: Weight of special design rail pads, other than the designs mentioned above, shall not be checked.

DOUBLE SAMPLING PLAN
General Inspection Level-II

(Refer: Table I & 3A of IS 2500 Part I – 2000)

| Lot size | Sample size code letter | Sample | Sample size | Cumulative sample | Accepted quality level Percent defectives-2.5 | |
|------------|-------------------------|--------|-------------|-------------------|---|-------------------|
| | | | | | Acceptance No. (a) | Rejection No. (r) |
| 281-500 | H | First | 32 | 32 | 1 | 3 |
| | | Second | 32 | 64 | 4 | 5 |
| 501-1200 | J | First | 50 | 50 | 2 | 5 |
| | | Second | 50 | 100 | 6 | 7 |
| 1201-3200 | K | First | 80 | 80 | 3 | 6 |
| | | Second | 80 | 160 | 9 | 10 |
| 3201-10000 | L | First | 125 | 125 | 5 | 9 |
| | | Second | 125 | 250 | 12 | 13 |

Notes:

- (i) For any other lot size less than 281, reference may be made to table I & 3-A of IS-2500 (Part I)-2000 for sample size, acceptance and rejection numbers.
- (ii) In the first sample if the number of failed pieces is equal to the acceptance number (a), the lot shall be accepted. If number of failed pieces is equal to or more than rejection number (r), the lot shall be rejected.
- (iii) If the failed pieces exceed the acceptance number (a), but less than the rejection number (r), the second sample should be considered.
- (iv) If the cumulative failed pieces equal or exceed the rejection number (r), the lot shall be rejected. The cumulative failed pieces are the total number of failed pieces in the first and second samples.

SCHEME OF TESTING FOR PRE-ACCEPTANCE/ ACCEPTANCE TESTS FOR RAIL PADS

| Property | No of samples to be tested | Criteria value for acceptance/ rejection | No. of samples to be drawn |
|--|----------------------------|--|----------------------------|
| 1. Hardness shore 'A' | 5 | Individual | 5 |
| 2. Tensile strength (Kg/cm ²) | | | |
| (a) Before ageing | 5 | Individual | 5 |
| (b) After ageing at 100 \pm 1°C for 96 + 0/-2 hours | 5 | | |
| (c) Retention after ageing (%), | | | |
| 3. Elongation at break (%) | | | |
| (a) Before ageing | 5 | Individual | - |
| (b) After ageing at 100 \pm 1°C for 96+ 0/-2 hours | 5 | | |
| (c) Retention after ageing (%) | | | |
| 4. Modulus (relaxed) at 100% elongation | | | |
| (a) Before ageing (kg/cm ²) | 3 | Individual | 3 |
| b) Change after ageing at 100 \pm 1°C for 96+ 0/-2 hours | 3 | | |
| 5. Compression set subjected to 50% compression at 100 \pm 1°C for 24+ 0/-2 hours. | 3 | Individual | 3 |
| 6. Tension set subjected to 50% stretch at 100 \pm 1°C for 24 + 0/-2 hours | 3 | Individual | 3 |
| 7. Load - Compression test | 2 | Individual | 2 |
| 8. Electrical resistance test | | | |
| a) On normal Rail Pad | 3 | Individual | 3 |

b) On Rail Pad after immersion
in distilled water for 48 hours.

| | | | |
|---|---|---------------------------------------|---|
| 9. Secant stiffness Test | 2 | Individual | 2 |
| 10. Impact Attenuation Test | 2 | Individual | 2 |
| 11. Dimensional check | 8 | Individual as per relevant drawing | 8 |
| 12. Adhesion Test | 2 | Individual | 2 |
| 13. Adhesion between the Nylon Cord and Rubber | 2 | Individual | 2 |
| 14. Breaking Load on NCGRSP | 5 | Individual | 5 |
| 15 Weight Test | 8 | Individual | 8 |
| 16 Thermogravimetric Analysis | 1 | Individual | 1 |
| 17 Durability Test | 1 | Individual | 1 |
| 18 Resilience by Vertical Rebound | 3 | Individual | 1 |
| 19 Ozone test | 1 | Individual | 1 |
| 20 Abrasion Test | 1 | Individual | 1 |

Note:

1. In case of acceptance tests for dimensional check number of samples to be tested shall be as per Clause 11.2.
2. In case of acceptance tests for weight test number of samples to be tested shall be as per Clause 11.3.3.
3. The tests shall be conducted as per relevant test method of the property as given in the specification.
4. Specimen for tests before and after ageing are to be prepared from the same pads.
5. Samples shall be signed by the firm's representative and the inspecting officer drawing the samples.
6. All samples shall be free from surface defects and shall bear marking as per requirement of relevant drawing.
7. Electrical resistance tests are to be conducted on same pads before and after immersion in water.
8. Total no. of samples per lot required for physical tests shall be:
 - (i) 25 nos. of finished pads as per relevant drawing.
 - (ii) 3 Nos. for load-compression test of. Size 200mm x 130mm.
9. For Thermogravimetric Analysis, one sample shall be randomly selected for every 30000 rail pads or part thereof.
10. For Inclined Repeated Load Test (Durability Test), one sample shall be randomly selected for every 100000 rail pads or part thereof.
11. For Abrasion Test, one sample shall be randomly selected for every 100000 rail pads or part thereof.

Letter of offer from the firm

To,

(Address of inspecting agency)

Sub: Call Letter for inspection of _____
to drg. No. RDSO/T-

Ref: _____ Railway/Railway Board P.O. No-
_____ for _____ to Drg.
No- RDSO/T-

* * * *

Theas per following details are offered for inspection in terms of the above referred purchase order. These have been internally checked and found satisfactory as per drawing No. RDSO/T..... and relevant IRS specification (copy of test report enclosed).

1. Installment No.
2. Quantity on order
 - a) Against original order
 - b) Against extension
3. Quantity previously inspected and passed
4. Quantity now offered for inspection
 - a) Against original order
 - b) Against extension
5. Batch Nos.
6. Rate Per.....
7. Marking on.....
8. Delivery period.....
9.
 - a) Original.....
 - b) Extended.....
 - c) Letter No (for extension)
10. Consignee
11. Packing

Yours faithfully,

STORAGE OF RAIL PAD

The rubbers whether under storage or in use continue to deteriorate and ultimately may become unserviceable. The deterioration may be the result of one particular factor or a combination of factors viz. the action of oxygen, ozone, light, heat, humidity etc. The deleterious effects of these factors may, however, be minimised by adopting appropriate conditions of storing and duration of storage. This guide line proves suitable conditions for the storage of rubbers in all forms.

- (i) The rubber components should be stored in a cool place as far as practicable, preferably below 30 deg.C.
- (ii) They should be kept away from direct sunlight preferably in a dark place. Direct sunlight causes much faster degradation of the rubber components.
- (iii) The humidity of the storage condition should not be such that condensation of moisture takes place on the surface of the components.
- (iv) In the vicinity of these components, any loose electrical connections should be avoided, as these cause production of ozone, which adversely affects rubber.
- (v) They should be stored away from contact with materials containing copper and manganese, which act as poisoning agents and resulting in their faster degradation.
- (vi) Under no circumstances rubber components should be stressed during storage. The portion under stress undergoes deformation with permanent set and loading o degradation. They should be stacked in such a way so that any super imposed stresses are substantially avoided.
- (vii) Any contact with grease or oil should be avoided as these cause swelling, softening and deterioration of rubbers.
- (viii) French chalk or soapstone or mica should liberally be applied on the surface of rubber components.
- (ix) Great care is to be exercised so that the material is used in the order of their receipt in the stores i.e. ‘first-come-first issue basis’. The rubbers whether under storage or in use continue to deteriorate. The only difference is that under service condition, deterioration is much faster. Every moment of storing is at the cost of useful life and prolonged storage of the material may render it unserviceable due to progressive deterioration.

TESTING OF SAMPLES FROM THE LOTS ALREADY PASSED BY INSPECTING OFFICIAL/AGENCY AT THE VENDOR PREMISES / CONSIGNEE END/FIELD AND DEFECT CLASSIFICATION

- R.1 Procedure for Picking up samples from the lot already passed by inspecting official/agency in the vendor premises or from consignee end/field shall be as follows:
- R.1.1 Representative(s) of RDSO, Zonal Railway, Railway Board or Railway investigating agency shall pick up samples jointly with the field unit's representative, in case the sample is picked up from the field units/consignee end, and with the firm's representative in case the sample is picked up at the firm's premises (after the LOT has been passed by the inspecting agency, but before dispatch).
- In case, the firm does not cooperate in joint picking up of samples in firm premises, then a report is to be put up by Inspecting Railway Official to the Directorate head controlling the item at RDSO for penal action on the firm.*
- R.1.2 Two sample sets (20nos. pads in each set) shall be picked up & sealed. 'FIRST' sample is for testing and 'SECOND' sample shall be 'Standby' sample.
- The 'Standby' sample shall be kept in safe custody and sent to 'STANDBY SAMPLE STORE' at RDSO. Testing of 'Standby sample' and action thereafter shall be governed by the extant provisions of ISO Apex documents.*
- R.2 Defect classification of samples tested from the lot already passed by inspecting official/agency in the vendor premises or from consignee end/field shall be as follows:
- R.2.1 For samples tested within 3 months of manufacture, any variation from specified acceptance values would be treated as a defect.
- R.2.2 For samples tested beyond 3 months but within 4 months of manufacture, variation beyond 2% of specified acceptance values of all physical parameters (except Ash content, specific gravity and Electrical Resistance) would be treated as defect.
- R.2.3 For samples tested beyond 4 months but within 8 months of manufacture, variation beyond 6 % of specified acceptance values of all physical parameters (except Ash content, specific gravity and Electrical Resistance) would be treated as defect.
- R.2.4 For samples tested beyond 8 months but within 12 months of manufacture, variation beyond 10 % of specified acceptance values of all physical parameters (except Ash content, specific gravity and Electrical Resistance) would be treated as defect.
- R.2.5 In case of Ash content, specific gravity and Electrical Resistance, no variation is permitted and any variation from specified acceptance values would be treated a defect irrespective of age of samples at the time of testing.
- R.2.6 In case of hardness, value less than minimum specified value will be considered as a defect irrespective of age of samples at the time of testing.
- R.3 Action to be taken based on the test results shall be as follows:
- R.3.1 Defect in one physical parameter will not be considered as failure of the lot/set and no action shall be taken. However, for defect in Ash content or Specific Gravity or Electrical

Resistance alone will be considered as failure of the lot/set and the lot shall be rejected and financial recovery shall be made.

- R.3.2 Defects in two physical parameters, it will be considered as failure of the lot/set and the lot shall be rejected and financial recovery shall be made.
- R.3.3 If there is defect in more than two physical parameters, the lots shall be rejected, financial recovery shall be done and further Penal action shall also be taken against the firm by RDSO.
- R.3.4 In case of rejection of lot at consignee end/ field the material rejection advice/rejection memo should be sent by the consignee (or the authority carrying out inspection) to all concerned i.e. firm/supplier, purchaser, pre-inspecting agency, paying authority as per contract etc. without fail.
- R.3.5 Financial Recovery- In case payment has been made to the firm for material, the concerned paying authority as per contract should note the rejection advice details in the recovery register for effecting recovery of payments made, as the case may be.
- R.3.6 If the firm desires to have joint inspection, joint inspection of rejected material (only for parameters in which defect was found) will be held with previous inspecting agency and the firm. In case of failure of either of the two parties to associate with joint inspection, the inspection should be done by the consignee (or the authority carrying out inspection in the first instance) with the party comes for joint inspection. Irrespective of whether a party attends joint inspection or not, modality of joint inspection etc. will have to be completed within 21 days of communication of rejection advice to the supplier.
- R.3.7 After joint inspection, if the sample is passed in the parameters in which defect was found previously, then the lot shall be passed and no financial recovery or penal action shall be taken.
- R.3.8 After joint inspection, if the sample still fails even in any one of the parameters in which defect was found previously, then the lot shall be shall continue to be treated as rejected and financial recovery and penal action shall be taken as the case may be.
- R.3.9 Test results of joint inspection shall be communicated by the consignee (or the authority carrying out inspection) to all concerned i.e. paying authority as per contract, firm/supplier, purchaser, pre-inspecting agency with necessary instructions regarding acceptance/rejection of lot, financial recovery and penal action.
- R.3.10 In case, if both the parties don't turn up for joint inspection then no joint inspection can be done and action for rejection of lot, financial recovery and penal action shall continue ,as the case may be.
- R.3.11 The supplier/firm may be permitted to collect the rejected lot/goods only after the firm has made the payments already made by Railway (if any) to the firm or equivalent amount has been recovered for this purpose.
- R.3.12 Penal action, if any, shall be taken as per the extant provisions of ISO Apex documents.
- R.3.13 In case of rejection of a lot is done, based on samples collected at vendor premises, no further joint inspection of rejected material will be done and action for rejection of lot, financial recovery or penal action shall be taken, as the case may be.

Abrasion Resistance Test

IS 3400 Part 3: 2021 is the Indian Standard for determining the abrasion resistance of vulcanized rubber using a rotating cylindrical drum device.

Test Method: The rubber specimen is subjected to abrasion by using a rotating cylindrical drum.

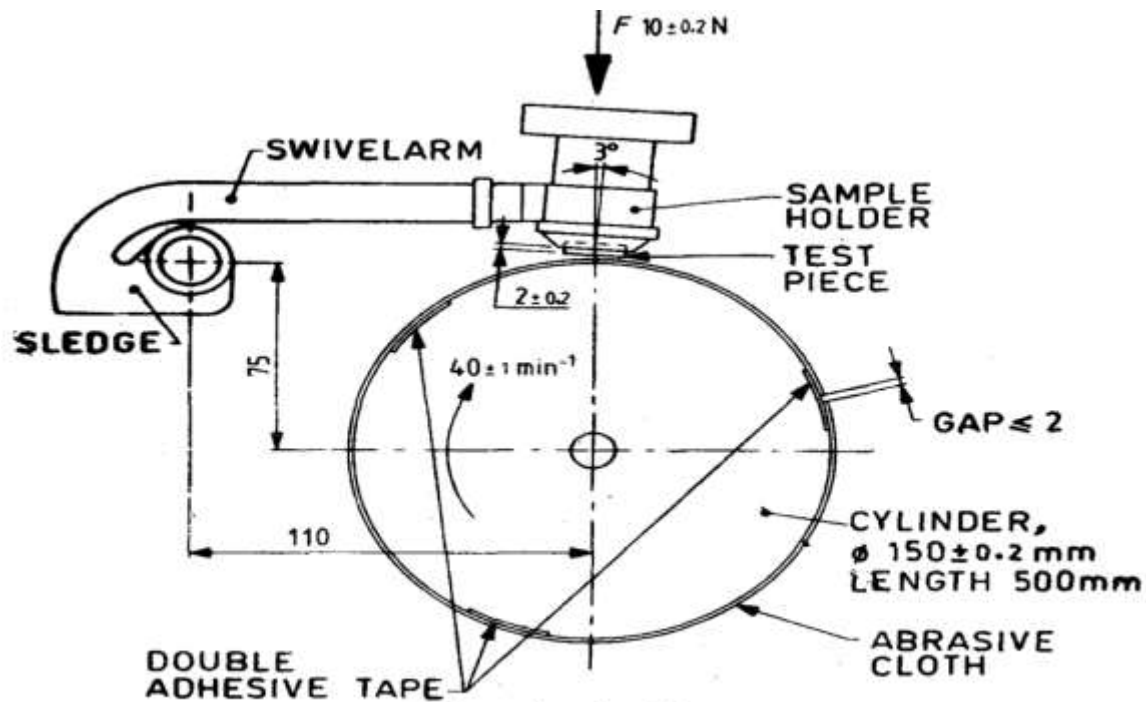
Test piece: The test pieces shall be cylindrical in shape, of diameter 16 ± 0.2 mm, cut from the rail pad.

Test Temperature: $27 \pm 2^{\circ}\text{C}$.

Test Duration: The test run is stopped automatically after an abrasion distance of 40 m.

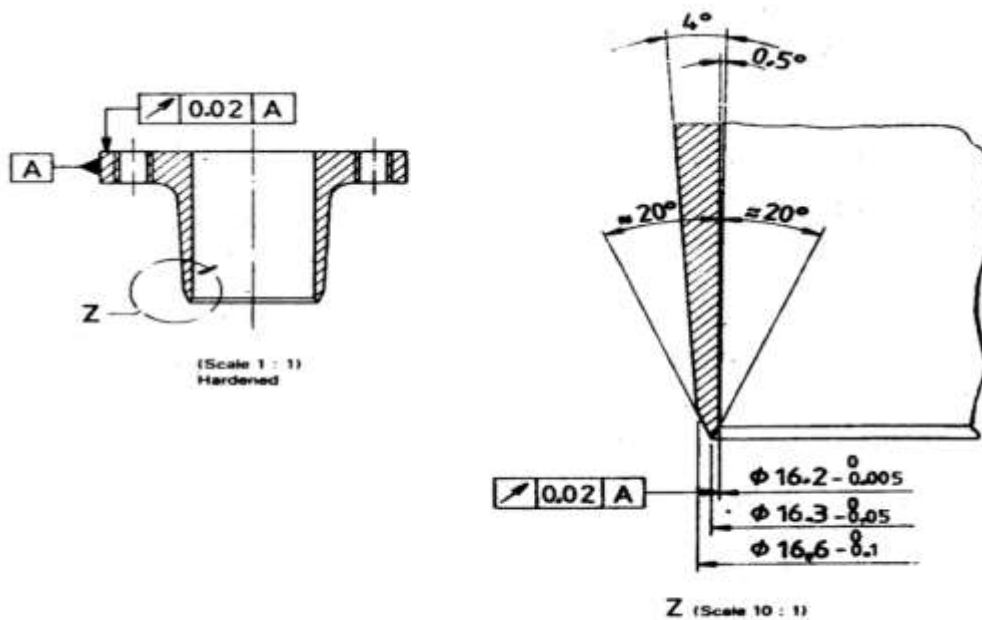
Abrasive Surface: The abrasive cloth is cleaned between tests to remove rubber debris.

The relative loss of volume / Mass shall be within the range 180 to 220 mg.



All dimensions in millimetres.

FIG. 1 SCHEMATIC ILLUSTRATION OF APPARATUS



All dimensions in millimetres.

FIG. 2 HOLLOW DRILL FOR TEST PIECE PREPARATION

Ozone Test

IS 3400 Part 20: 2018 is the Indian Standard for determining the resistance of vulcanized rubbers to ozone cracking under static strain conditions.

Test piece:

The test piece shall be cut from the rail pad in the form of a 10 mm wide strip. Length of the strip shall be 40 mm between the grips before stretching

Test Method:

The rubber specimen is subjected to a static strain of 30% and exposed to an ozone-containing atmosphere.

Exposure Conditions:

| | |
|----------------------|--|
| Ozone Concentration: | 25 50 ± 5 pphm (parts per hundred million). |
| Temperature: | $40 \pm 2^{\circ}\text{C}$. |
| Test Duration: | 96 hours with 30% elongation. |
| Evaluation: | No cracks. |

Apparatus Requirements:

| | |
|---------------------------------|---|
| Ozone Generation: | Ozone can be generated using either an ultraviolet (UV) lamp or a silent discharge tube. |
| Test Chamber: | A chamber that can maintain the specified ozone concentration and temperature. |
| Airflow: | The average velocity of ozonized air in the chamber should be between 8 mm/s and 16 mm/s. |
| Ozone Concentration Monitoring: | Methods for determining the ozone concentration in the chamber shall be as per ISO 1431-3:2017. |