

## REVISION OF SPECIFICATION / STR

**Ref:**Current Spec. No. RDSO/2006/CG-12(Rev.-1) Corrigendum-1, Amendment-4, STR for Flexible Poly Vinyl Chloride (PVC) Flooring for use in Coaching Stock.

3. RDSO is reviewing the specification/STR to cater to the latest technological developments in the field, modify clauses not relevant in the present context and making them more enabling with focus on functional requirements.
4. It is requested that your comments / suggestions with regard to improvements / modifications in specification / STR of this item may be submitted in the following format alongwith the justification for the changes required.

### Part A: Basic Information

| SN | Particulars   | Information |
|----|---|-------------|
| 1  | Name  |             |
| 2  | Designation   |             |
| 3  | Professional Qualification  |             |
| 4  | Organization / Firm's Name  |             |
| 5  | Address for Correspondence  |             |
| 6  | Contact No.   |             |
| 7  | Email ID  |             |
| 8  | <b><u>In case of Firm / Individual:</u></b> Manufacturing experience of item (or similar Item) on which comments are offered              |             |
| 9  | <b><u>Where relevant:</u></b> Whether any technical document to support suggested changes is available / enclosed for better appreciation |             |

### Part B: Comments / suggestions on the specification

| SN | Clause No. of RDSO STR / Spec | Clause, as exists in RDSO STR / Spec | Clause , as it should read after incorporation of comments / suggestions in the RDSO Spec / STR | Justification for changes |
|----|-------------------------------|--------------------------------------|---|---------------------------|
|    |                               |                                      |   |                           |
|    |                               |                                      |   |                           |
|    |                               |                                      |   |                           |
|    |                               |                                      |   |                           |

**Comments may be sent to:**

Director/SS/Carriage  
Research Designs and Standards Organization  
Manak Nagar, Lucknow – 226011

Email: edcar.rdso@gmail.com Or dirssrdso@gmail.com

**INDIAN RAILWAYS**

सत्यमेव जयते

|                          |                |
|--------------------------|----------------|
| <b>MASTER COPY</b>       |                |
| Controlling Officer..... | <i>S.P.</i>    |
| Signature.....           | <i>27.8.18</i> |
| Designation.....         | <i>Dur/TS</i>  |

**SCHEDULE OF TECHNICAL REQUIREMENTS  
FOR  
FLEXIBLE POLY VINYL CHLORIDE (PVC) FLOORING  
FOR USE IN COACHING STOCK**

| S.No. | Month / Year of issue | Revision / Amendment | Page No.  | Reason for Amendment   |
|-------|-----------------------|----------------------|-----------|--|
| 1.    | December, 2006        | Nil                  | -         | First Issue  |
| 2.    | August-2008           | Rev-1                | -         | All amendments incorporated. Glass - fibre web as re-enforcement included, mass and dimensional stability value modified.                        |
| 3.    | April, 2015           | Amendment-1          | 6, 7 & 15 | <ul style="list-style-type: none"> <li>• Fire Worthiness Properties upgraded.</li> <li>• Heat Release Rate test specified in Table-1.</li> </ul> |
| 4.    | June, 2015            | Crrigendum-1         | 7         | Clause no. 3.1.1.6 of Section-A deleted from Amendment Slip No.-1  |
| 5.    | September, 2015       | Amendment-2          | 7         | New Clause no. 3.1.1.6 added in Section-A  |
| 6.    | August, 2016          | Amendment-3          | 3         | To include ISO Document No: QO-D-7.1-11 new sub Clause 1.2 in Scope of section- A  |
| 7.    | August, 2018          | Amendment-4          | 8         | <ul style="list-style-type: none"> <li>• Clause 4.1, Marking method modified.</li> </ul>   |

Issued By:

**Carriage Directorate  
Research Designs and Standards Organization  
Manak Nagar, Lucknow - 226011**

|                    |  |   |   |
|--------------------|--|---|---|
| Signature          | <i>C.M. Prasad</i>                             | <i>Praveen Kumar</i><br>27/8/18                       | <i>S.P.</i><br>27.8.18                            |
| Name & Designation | Prepared By:- C.M Prasad<br>JE(Design)Carriage | Checked By:-Praveen Kumar<br>Dy. Director/SS/Carriage | Approved By- Sanjeev Garg<br>Director/SS/Carriage |

**Amendment slip No. 4** of August, 2018 to STR No. RDSO/2006/CG-12 (Rev.-1) schedule of technical requirements for Flexible Poly Vinyl Chloride (PVC) flooring for use in Coaching Stock.

**Clause 4.1 of section-A modified as under:**

**4.1** Each roll/sheet shall be legibly marked on back at a distance of 1 meter (Maximum) along length by engraving / embossing with the following details: -

- i) Manufacture's initial/trade mark
- ii) Batch No.
- iii) Month and Year of manufacture

*MSD*

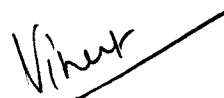
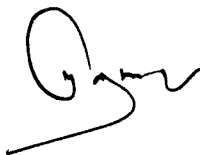
*Y. D. S.*  
27/8/18

*SL*  
27.8.18

**Amendment slip No. 3** of August, 2016 to STR No. RDSO/2006/CG-12 (Rev-1) schedule of technical requirements for Flexible Poly Vinyl Chloride (PVC) flooring for use in Coaching Stock.

- **Add new para 1.2 added in Scope of section- A, as under:**


All the provisions contained in RDSO's ISO procedures laid down in Document No. QO-D-7.1-11 dated 19.07.2016 (titled "**Vendor – Changes in approved status**") and subsequent versions/amendments thereof, shall be binding and applicable on the successful vendor/vendors in the contract floated by Railways to maintain quality of products supplied to Railways.

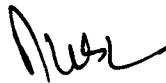


**Amendment No - 2** of September, 2015 to STR No. RDSO/2006/CG-12 (Rev-1) schedule of technical requirements for Flexible Poly Vinyl Chloride (PVC) flooring for use in Coaching Stock.

**Section – A (New clause i.e. 3.1.1.6 added);**

**3.1.1.6** The test for Heat release rate (HRR) is type test. Heat Release Rate (HRR) test is to be done at every six months till 31.03.2016. Thereafter it will be the part of acceptance test

  
17.9.2015





**Corrigendum No -1** of June, 2015 of Amendment slip No. 1 of April, 2015 to STR No. RDSO/2006/CG-12 (Rev-1) schedule of technical requirements for Flexible Poly Vinyl Chloride (PVC) flooring for use in Coaching Stock.

**Clause no. 3.1.1.6 of Section – A deleted from Amendment slip No. 1 of April, 2015**

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**Amendment slip No. 1** of April, 2015 to STR No. RDSO/2006/CG-12 (Rev-1) schedule of technical requirements for Flexible Poly Vinyl Chloride (PVC) flooring for use in Coaching Stock.

- Read 'IS: 13360 Part-6, Section-19' instead of 'IS 13501' wherever it appears in the specification.
- In Table-1(section-A) of Clause No. 2.8.1.1, property at S. No. 22 amended & property at S. No. 25 added and shall be read as under:

**TABLE-1**

| S. No. | Property   | Value     | Method of Tests               |
|--------|--|-----------|-------------------------------|
| 21.    | Resistance to Spread of Flame  | Class A   | Appendix - 12 of UIC 564-2 OR |
| 22.    | Deterioration of visibility due to smoke   | Class B   | Appendix-15 of UIC 564-2 OR   |
| 23.    | Limiting Oxygen Index Appendix- 7 of UIC 564-2 OR (Minimum)  | 35        | IS:13360 Part-6, Section-19   |
| 24.    | Toxicity   | <1        | NCD:1409                      |
| 25.    | Heat Release Rate (MARHE i.e. Maximum Average Rate of Heat Emission in KW/m <sup>2</sup> ) as specified in EN 45545-2:2013 | R1 (HL3)* | ISO 5660-1                    |

\* The method for testing to be carried out as per R-10 and properties will be HL3 as per R-1.

**Section – A (New Para i.e. 3.1.1.6 added);**

**3.1.1.6** The test for Heat release rate (HRR) is type test. Heat Release Rate (HRR) test is to be done at every six months till 01.01.2016. Thereafter it will be the part of acceptance test.

**Section – B (New Para i.e. 4.16 added);**

**4.16** The firm should have in-house testing facilities as per ISO 5660-1 for conducting test for Heat release rate (HRR) w.e.f. 01.01.2016. Till such time, firm should arrange testing at reputed laboratory as decided between IR/Inspecting Authority and manufacturer. The cost of testing will be borne by the manufacturer.

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## **SCHEDULE OF TECHNICAL REQUIREMENTS FOR FLEXIBLE POLY VINYL CHLORIDE (PVC) FLOORING FOR USE IN COACHING STOCK**

### **0. FOREWORD**

- 0.1 This schedule is intended to cover the technical requirements/provisions relating to materials, construction and tests and does not include all the necessary provisions of the contracts.
- 0.2 This schedule draws reference to some of the relevant IS and other International Specifications. Unless otherwise specified, latest versions of these specifications shall be taken as reference.
- 0.3 For the purpose of deciding whether a particular requirement of this schedule is complied with, the final value observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with the IS: 2 (with latest revision). The number of significant places retained in the rounded off value should be the same as that of the specified value in this schedule.
- 0.4 In this schedule, due consideration has been given to the development in the field of polymeric materials & process technologies, serviceability requirements of the Indian Railways & the practices followed in advanced countries in this field.
- 0.5 Procurement of PVC welding electrode shall be made along with the flooring as per clause 2.7 of this schedule.
- 0.6 This schedule consists of two sections i.e. Section-A and Section-B. Section-A covers the technical requirements, methods of sampling and tests of flexible Poly Vinyl chloride (PVC) flooring used in coaching stock and Section-B covers infrastructure requirements for manufacture, testing and quality control at the works of the manufacturers.

### **SECTION - A**

#### **1. SCOPE**

- 1.1 This section covers the technical requirements, methods of sampling and testing of antiskid quality of flexible Poly Vinyl chloride (PVC) flooring sheets to be used as floor covering for Indian Railway coaches.

#### **2. REQUIREMENTS**

##### **2.1 MATERIAL**

- 2.1.1 Poly Vinyl Chloride (PVC) shall be suitably compounded so as to conform to the requirements of this schedule.

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## 2.2 Construction

The flooring shall be homogeneous single layer or heterogeneous as per definitions given below. Both types of flooring are acceptable as long as they meet other requirements of this STR.

### a) Homogeneous single layer

Material consisting of a single sheet or layer manufactured directly to its final thickness (except for a possible sanding down) from a mixture of uniform composition. The sheet composition shall be composed of pure PVC and silicon carbide particles or any other anti-skid property enhancing material. Same composition, colour and pattern will extend throughout the thickness.

### b) Heterogeneous

Material consisting of single layer sheet or two layers sheet with antiskid property of minimum 1.1mm thick wear layer. The wear layer shall be composed of pure PVC, chips and silicon carbide or any other anti-skid property enhancing material. Other layers should be homogeneous and have a combined thickness of maximum 1.0mm. The composition of each layer will be uniform and homogeneous throughout its thickness. Between wear layer and bottom layer, glass fibre web (Glass Scrims) should be provided as re-enforcement.

## 2.3 Dimension & Tolerances

- 2.3.1 The length & width of the rolls/sheets shall be as specified by the purchasing authority. The tolerance in length shall not be less than the nominal value specified. Tolerance in width shall be + 10/-0 mm. The nominal thickness shall be 2 mm or as specified by the purchaser. The variation between any two measurements at different places on the same roll/sheet shall not exceed 0.15 mm. The method of test of thickness & width shall be as per Clause 3 of IS: 3464.

## 2.4 Colour and Surface Characteristics

- 2.4.1 The flooring shall have a uniform wearing characteristics and antiskid property throughout the thickness in case of homogeneous single layer and throughout the wear layer thickness in case of heterogeneous PVC flooring. The colour, pattern, marbling or mottling, if present, shall extend throughout the full thickness in case of homogeneous single layer and throughout wear layer thickness in case of heterogeneous PVC flooring. The colour and pattern shall be similar to samples standardized by RDSO or that is agreed upon by purchaser and manufacturer.

In case of chip design flooring, the chip density on top of wear layer shall be 100-160 chips per 100 cm<sup>2</sup> and shall be calculated by taking a sample piece of size 10cm x 10cm from any place from offered roll.

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## 2.5 Workmanship and Finish

2.5.1 The top surface shall be smooth, free from pinholes, blisters, porosity, blow holes, lamination and other visual defects. The bottom surface should be suitable for enhancing sub floor adhesion.

## 2.6 Weldability and Shear strength

### 2.6.1 Weldability

2.6.1.1 The flooring shall be welded by 'V' butt weld joint as per procedure given in IS: 8002. The weld joint shall be capable of withstanding a minimum tensile load of 24 kg per 30 mm (Minimum value of tensile load for any test piece shall be 18 kg per 30 mm).

### 2.6.2 Shear strength

2.6.2.1 The flooring shall be pasted with adhesive to ICF specification No. ICF/M/D/Spec.-075 on compreg and ICF/M/D/Spec.-093 on stainless steel. The dry shear strength with compreg/stainless steel shall not be less than 25kg/6.25 sq.cm (average). The wet shear strength shall not be less than 25kg/6.25 sq.cm, in case of pasted with adhesive on compreg and shall not be less than 20kg/6.25 sq.cm. on stainless steel.

## 2.7 Supply of PVC welding electrodes

It shall be obligatory on the part of supplier of PVC flooring to supply electrodes for welding of PVC. The supplier shall workout the quantity of electrodes required and shall separately quote for this item while submitting the tender. The purchaser may however, amend the quantity of electrodes depending on his requirement.

## 2.8 Properties of the material

### 2.8.1 Tests

2.8.1.1 Tests shall be conducted from the finished product as per the methods indicated for the respective tests and shall conform to the following requirements: -

**TABLE-1**

| S. N. | Property                                    | Value   | Methods of tests     |
|-------|---|---|----------------------|
| 1     | Sound absorption (Minimum)                  | 4dB   | ISO-140-8            |
| 2     | Weight                                      | 3000 gm/m <sup>2</sup> Max.   | EN 430               |
| 3     | Total thickness                             | 2mm +0.2mm  | IS: 3464             |
| 4     | Abrasion: Loss of thickness*                | < 0.12mm  | EN: 660 Part-II      |
| 5     | Tensile strength at 1% elongation (Minimum) | <ul style="list-style-type: none"> <li>• Along the machine direction-10 kgs</li> <li>• Perpendicular direction -10 kgs</li> </ul> | Annexure -I          |
| 6     | Tear strength (Minimum)                     | a) Along the machine direction - 40N/mm<br>b) Transverse direction - 50N/mm   | ISO-34-1 method A    |
| 7     | Curling (Maximum)                           | 0.75mm  | Clause 8 of IS: 3464 |
| 8     | Indentation (mm) (Maximum)                  | a) At 27 ± 2°C  | To pass the test     |
|       |   | b) At 46 ± 2°C  | To pass the test     |

|    |   |   |                             |
|----|---|---|-----------------------------|
| 9  | Residual Indentation (Maximum)  | 0.05mm  | Clause 10 of IS:3464        |
| 10 | Flexibility   | Shall not break, crack or show any other sign of failure.   | Appendix 'A' of IS: 3462    |
| 11 | Heat ageing and exudation   | No exudation of plasticizer shall be apparent nor shall there be any change in appearance. The mandrel test shall not produce surface cracking. | Appendix 'C' of IS: 3462    |
| 12 | Moisture movement (%) change in linear dimensions - Maximum   | 0.4   | Appendix 'B' of IS: 3462    |
| 13 | Dimensional stability   | Change in any linear dimension shall not exceed 0.25%. After the test, the specimen shall not show any signs of curling.                        | Clause –5 of IS: 3464       |
| 14 | Colour fastness to daylight   | Not less than standard 7  | Para 5.3 of IS: 9766-92     |
| 15 | Abrasion resistance (with H18 abrasion wheel, 1000 gms load and 1000 cycles with tabor equipment) (Volume loss max. in cubic cm)* | 0.25 cm <sup>3</sup>  | ISO: 9352                   |
| 16 | Wear layer thickness (Minimum)  | a) 2mm for Homogeneous single layer<br>b) 1.1mm for Heterogeneous   | EN 429                      |
| 17 | Homogeneity   | To pass the test  | Annexure-III                |
| 18 | Ply adhesion (KN/m) Minimum (For each layer of laminated product)   | 1.05 or no separation   | Clause 12 of IS: 3464       |
| 19 | Elongation at break (percentage) Minimum  | 150   | Appendix 'D' of IS: 3462    |
| 20 | Slip Resistance (Minimum)   | R-10  | DIN: 51130                  |
| 21 | Resistance to spread of flame   | Class A   | Appendix 12 of UIC-564-2 OR |
| 22 | Deterioration of visibility due to smoke (Minimum)  | Class B   | Appendix 15 of UIC-564-2 OR |
| 23 | Limiting Oxygen Index (Minimum)   | 35  | IS: 13501                   |
| 24 | Toxicity  | Less than 1   | NCD – 1409                  |

\*Abrasion resistance shall be measured in terms of mass loss. Volume loss shall be calculated by dividing mass loss by the density.

### 3. SAMPLING & CRITERIA FOR CONFORMITY

#### 3.1 Tests

##### 3.1.1 No. of tests:

3.1.1.1 The tests for all the requirements as laid down in this schedule are mandatory for product approval.

3.1.1.2 All the tests given in table–1 except Sound absorption, Abrasion loss of thickness, Slip resistance, Heat ageing and exudation, Colour fastness to daylight and Curling shall be carried out on each lot.

- 3.1.1.3 The tests for Heat ageing and exudation & Colour fastness to daylight and Curling shall be done once in six months. However, manufacturers shall carry out these tests for each lot and maintain the records of tests results. Records of test results should be furnished by the manufacturer to inspecting agency at the time of inspection.
- 3.1.1.4 The tests for Sound absorption, Abrasion loss of thickness and Slip resistance shall be carried out once in a year.
- 3.1.1.5 RDSO may draw the samples for quality checks at its discretion and firm shall arrange the testing of these samples in a reputed outside laboratory as decided between RDSO and manufacturer. Testing charges should be borne by the manufacturer.

**TABLE-2**

|     |                          | Sheet     |           | Rolls    |            |
|-----|--------------------------|-----------|-----------|----------|------------|
| i   | Lot size                 | Upto 1000 | 1001-3000 | Upto 500 | 501 - 1000 |
| ii  | No. of samples           | 20        | 32        | 13       | 20         |
| iii | No. of samples for tests | 3         | 5         | 2        | 3          |

- 3.1.3 All the samples selected depending upon the lot size shall be examined for visual observation and dimensional check. Six test specimens shall be tested for the properties of Tensile test at 1% elongation, Indentation, Residual indentation, Elongation at break, Flexibility and Weld ability. Three specimens shall be tested for the properties of Abrasion resistance & Homogeneity and two specimens for Dimensional stability. The samples for other tests shall be taken as per relevant test methods specified in table-1.
- 3.1.4 Minimum one test specimen shall be prepared from each sample selected for tests, where the number of specimens is equal to the number of samples or exceeds the number of samples. In case number of test specimen is less than the number of samples, selection of the samples for preparation of specimen shall be at the discretion of the inspecting authority.
- 3.1.5 Each of the test specimens undertaken for tests shall conform to the requirements as laid down in Table-1. Should the samples fail to meet the requirements, double the number of samples from the same lot shall be drawn for retesting. Should any of the re-test samples fail to comply with the requirements, the entire lot shall be rejected.
- 3.1.6 In the event of rejection after re-testing of the samples, the entire lot offered for inspection shall be marked 'REJECTED' on the backside at suitable location by hot stamping.
- 3.1.7 In the case of rolls, for acceptance test, a sample size of 300 mm shall be cut along the length to cover the entire width from one end. The rolls from which the sample has been taken for acceptance test shall be acceptable to the railways. In case of sheets, the number of sheets mentioned in Table-2 shall be selected. The cost of short supply shall be borne by the supplier/manufacturer.

|                             |              |                                 |  |
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#### **4. MARKING**

4.1 Each roll/sheet shall be legibly marked on back at a distance of 2 Metres by hot stamping or indelible ink with the following details: -

- i) Manufacture's initial/trade mark
- ii) Batch No.
- iii) Month and Year of manufacture.

#### **5. PACKING**

The material shall be suitably packed to avoid distortion damage etc. during transit.

#### **6. WARRANTY**

6.1 The PVC supplied shall be deemed to bear a warranty against defective materials/workmanship and performance for a minimum a period of 6 years from the date of supply or 5 years from the date of fitment whichever is earlier. The product shall be warranted against any cracking, discolouring/fading and deformation during service. The thickness of PVC flooring should not decrease by more than 10% of original thickness in every year of service of 5 years. In case, the material shows any defect/fails within the warranty period, it shall be replaced by new one without any cost.

|                             |              |                                 |  |
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## ANNEXURE-I

### TENSILE STRENGTH AT 1% ELONGATION

#### 1. Definitions - Principles

##### **Tensile strength:**

The higher the tensile strength of a material, the higher the stress required to produce a given elongation (1% for instance).

##### **Tensile modulus (for x% of elongation):**

The linear stress (in relation to the width of the test piece) required to produce an elongation of x% (generally 1% if x is not defined).

**Principles:** To determine the characteristics of the material: Plotting of the elongation/load graph under specified conditions with regard to the dimensions of the test piece and the speed of deformation followed by the measurement of the stress required to produce a given elongation (= modulus).

In addition, for materials with reinforcement the measurement of the breaking point characteristics which by convention corresponds to the first maximum value (or peak) on the graph.

#### 2. Apparatus:

A tensometer with a recording device, which permits the elongation of the test piece to be multiplied by a factor of at least 2 and on which each centimeter of the load scale does not represent more than 3 daN.

- Gauge length:  $250 \pm 1$  mm
- Speed of separation:  $50 \pm 2$  mm per min.
- Speed of deformation: 20% per min.

#### 3. Test Pieces:

Six test pieces per sample, three in the direction of manufacture and three in the transverse direction: width  $50 \pm 0.5$  mm, length  $\geq 300$  mm.

#### 4. Procedure:

- The scale of loads used and the ratio of paper speed to moving grip speed are checked.
- The test piece is positioned between the grips, taking care that it remains straight after the grips are closed.
- The tensometer including the recording device is set in operation.
- The test is stopped when 5% elongation is reached. Where necessary, the first peak is considered as being the first point of which the graph levels out corresponding to an

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increase of at least 1 mm in the elongation of the test piece before further increase of the load.

- Presentation of results - Check test.

The load corresponding to an elongation of 1% (2% for unreinforced materials) is read from the elongation against load graph, and plotted against the test piece width in N per 50mm to one decimal place.

Where necessary, the elongation of breaking point of the reinforcement and the corresponding linear stress are also determined.

The mean values of the three results obtained are determined for each direction. The lowest of the two mean values (direction of manufacture or transverse direction) is reported for the sample.



|                             |               |                                 |  |
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## ANNEXURE-II

### INDENTATION

#### INTRODUCTION

1. Object - To determine the amount of indentation obtained at  $27 \pm 2^\circ\text{C}$  and  $46 \pm 2^\circ\text{C}$  for PVC floor sheets/rolls.

2. Indentation at  $27 \pm 2^\circ\text{C}$

#### 2.1 Apparatus

2.1.1 **Indentation tester** - Consisting essentially of a rod with a hemispherical end of 6.35 mm diameter through which a load of mass 9 N (0.9 Kgf) and a load of mass 136 N (13.6 kgf) can be applied to the surface of the test piece and a dial gauge from which the amount of indentation can be read.

2.1.2 **Flat rigid plate** - At least 6.35 mm thick for supporting the test piece during the test.

2.1.3 **Water bath** - That can maintain the required temperature.

2.2 **Test Specimen** - The test pieces shall be 150 mm x 150 mm

2.3 **Procedure** - The test piece together with the indenting rod shall be maintained at a temperature of  $27 \pm 2^\circ\text{C}$  for at least 60 minutes in air or 10 minutes in water prior to testing. The test piece shall then be placed on the horizontal flat rigid plate with the base of the indentation tester resting on its surface. The hemispherical end of the indenting rod shall be applied to the surface of the test piece under a load of 9 N (0.9 kgf) and the reading of the dial gauge noted. An additional load of 127 N (12.7 kgf) shall then be applied to the indenting rod within 5 seconds and the reading of the dial gauge 1 minute and 10 minutes after the application of this load shall be noted. The difference between these readings and the original one shall be the 1 minute and 10 minutes indentations respectively.

2.4 **Report** - Readings shall be taken at three scattered points on the test piece and the average shall be reported.

Average indentation at the end of one minute shall not exceed 0.65mm and no individual reading shall deviate from the average by more than 0.05mm. In relation to the one minute indentation figure, the average indentation at end of 10 minutes shall not exceed 0.85 mm and no individual reading shall deviate from the average by more than 0.05mm.

#### 3. Indentation at $46 \pm 2^\circ\text{C}$

3.1 Apparatus -same as 2.1

3.2 Test Specimen - Same as 2.2

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**3.3 Procedure:** - The procedure shall be the same as in 2.3 except that the test piece and the indenting rod shall be maintained in the water bath at a temperature of  $46 \pm 2^{\circ}\text{C}$  for at least 15 minutes prior to testing and the additional load of 127 N (12.7 kgf) shall be applied to the indenting rod within 5 seconds, and reading of the dial gauge shall be taken 30 seconds after the application of this load.

**3.4 Report:** - Readings shall be taken at three scattered points on the test piece and the average shall be reported.

Average indentation shall not exceed 1.05 mm and no individual reading shall deviate from the average by more than 0.05mm.

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### **Annexure-III**

#### **Test for Homogeneity:**

1. This test shall be carried out to check the homogeneity of the PVC Sheets/Rolls for full thickness in case of homogeneous single layer and for full wear layer in case of heterogeneous PVC.
2. **Test Specimen:**  
  
Two test specimen for single layer homogeneous PVC and three test specimen in case of heterogeneous PVC of size 100x100mm. The test specimen shall be cut from the rolls/sheets randomly selected from the offered lot.
3. **Test Procedure:**
  - a. The wear layer thickness of one test specimen shall be removed up to depth of 300 micron (0.30mm) and 600 micron (0.60mm) of other test specimen by machining/grinding. Homogeneity shall be visually examined after removal of material by machining/grinding.
  - b. Wear layer of one test specimen shall be delaminated in case of heterogeneous PVC and delaminated surface shall be visually examined.
4. **Report:**
  - The ground/machined surface of the test specimen should show uniform shade similar to top layer and at least 60 chips should be visible on the ground/machined surface.
  - In case of heterogeneous PVC at least 60 chips should be visible on the backside of wear layer after de-lamination.

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## SECTION-B

### 1. SCOPE

- 1.1 This section covers the infrastructural requirements for manufacture of flexible vinyl (Poly Vinyl chloride - PVC) flooring used in coaching stock.

### 2. REQUIREMENTS

- 2.1 All vendor seeking registration with RDSO shall comply all the requirements mentioned below.

### 3. PLANT, MACHINERY AND INFRASTRUCTURE REQUIREMENTS

- 3.1 The manufacturers shall have adequate space and a covered area with cemented floor to accommodate the following.

- a) Damp free place for storage of raw materials
- b) Independent manufacturing area for PVC Flooring.
- c) Inspection area.

- 3.2 The firm should have at least one No. Banburry Mixer.

- 3.3 The firm should have at least one No. two roll mill.

- 3.4 The firm should have at least one No. Calendar machine.

- 3.5 The firm should have at least one No. Laminating machine in case the firm is manufacturing heterogeneous PVC flooring.

- 3.6 The firm should have at least one No. Printing/Embossing machine.

- 3.7 The firm should have at least one No. Extruder.

### 4. TESTING FACILITIES:

- 4.1 The testing lab should have facility for temperature and humidity control.

- 4.2 The firm should have suitable tensile testing machine with suitable arrangement for 1% elongation measurement.

- 4.3 The firm should have suitable testing facility for testing of tear strength and Homogeneity.

- 4.4 The firm should have suitable mandrel for testing the properties of flexibility and heat aging and exudation tests.

- 4.5 The firm should have suitable Indentation tester.

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- 4.6 The firms should have a suitable tensometer with a recording device, suitable curl gauge equipped with dial gauge and suitable traveling microscope.
- 4.7 The firms should have suitable testing facility for testing moisture movement and Dimensional stability tests.
- 4.8 The firms should have suitable testing machine to test abrasion resistance.
- 4.9 The firms should have suitable colour fastness apparatus to test colour fastness to day light.
- 4.10 The firm should have a suitable water bath to test Curling and indentation tests.
- 4.11 The firm should have testing facility to measure the weight of PVC in gm/m<sup>2</sup>.
- 4.12 The firm should have suitable facilities for testing of Ply adhesion and wear layer thickness in case the firm is manufacturing heterogeneous PVC flooring.
- 4.13 The firm should have suitable testing facilities for the testing of Sound absorption, Abrasion: loss of thickness, Slip resistance and Wear layer thickness as per test methods specified in table-1. In case in house testing facilities for above tests are not available, the same may be carried out from any reputed laboratory as decided between IR/Inspecting Authority and manufacturer. The cost of testing will be borne by the manufacturer.
- 4.14 The firm should have testing facility for conducting test for Resistance to spread of flame as per Appendix-12 of UIC – 564-2 OR, Deterioration of visibility due to smoke as per Appendix-15 of UIC – 564-2 OR, Limiting Oxygen Index as per IS:13501 and Toxicity index as per NCD:1409.
- 4.15 The firm should have the following instruments.
- a) Micro meters with Digital display/Dial Thickness Gauge
  - b) Measuring scale
  - c) Measuring tape
  - d) Dessicator
  - e) Shallow tray

The firm should have arrangement for periodical calibration of all the gauges & instruments.

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## **5 QUALITY CONTROL REQUIREMENTS**

- 5.1 The firm should have acquired ISO: 9001- 2000 certification and the product for which the approval is sought should be broadly covered in the scope of the certification for manufacture and supply.
- 5.2 The Quality manual of the firm for ISO: 9001- 2000 should clearly indicate at any stage the control over manufacturing and testing of the said railway product.
- 5.3 There should be a system to ensure the traceability of the product from raw material stage to finished product stage. The system should also facilitate to identify the raw material composition from the finish product stage.
- 5.4 It should be ensured that there is a Quality Assurance Plan for the product detailing the following various aspects:
- Organisation chart
  - Process flow chart
  - Stage inspection details from raw materials stage to finish product stage
  - Various parameters to be checked and level of acceptance of such parameters indicated and method to ensure control over them.
  - Disposal system of rejected raw material and components.
- 5.5 There should be at least one full time technologist having a minimum bachelor's degree in relevant field with experience of at least 5 years or a person with diploma in relevant field with 12 years experience. He should be free from day-to-day production, testing and quality control responsibilities. He should be mainly responsible for development of a product, analysis of products, control over raw material, and corrective action in case of difficulties in achieving the parameters.
- 5.6 Ensure that the incharge of the Quality Control Section is having a qualification of minimum bachelor's degree in the relevant field and has a minimum of 5 years experience. Alternatively he should be a diploma holder with minimum of 12 years experience. He should be actively involved in day-to-day activities of quality control / stage inspection / compliance of QAP etc.
- 5.7 The firm must ensure that proper analysis is being done on monthly basis to study the rejections at various internal stages and it is documented.
- 5.8 The firm should ensure that latest version all the relevant specifications, IS standards are available with the firm.

## **6. DOCUMENTATION**

Firm shall maintain the following documents/records:

- 6.1 A well documented Quality Plan.
- 6.2 Incoming raw material register with Test Certificates references of suppliers and internal test results.

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- 6.3 Stage inspection results including finished products results.
- 6.4 Records of internal rejection and its analysis vis-a-vis action plan.
- 6.5
- 6.6 Records of final products inspection by external agencies (like RDSO), Non-conformity reports and case analysis as well as action taken thereof.
- 6.7 Records for maintenance of dies/moulds.
- 6.8 Ensure that proper systems are available for dealing with customer complaint.
- 7 TRAINING**
- 7.1 Training needs should be identified for all concerned officials and regular training shall be organised and imparted on maintenance of machines, quality assurance, safety parameters etc.