

INDIAN RAILWAYS



SCHEDULE OF TECHNICAL REQUIREMENTS FOR VINYL COATED UPHOLSTERY FABRIC (ARTIFICIAL LEATHER) FOR COACHING STOCK

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2.	June, 2020	Revision. 01	5, 6, 7, 10, 11 &12	<ul style="list-style-type: none"> • Amendment 1 to 5 & Corrigendum-1 have been incorporated. • The value of "Adhesion of coating" has been upgraded. • The tests "Flexing Endurance", "Resistance to Bacteria" & "Resistance to Fungi" have been added. • In Table-II, Lot size has been modified. • Clauses 4.5, 4.6, 5.1, 5.2, 5.5 & 5.6 of Section-B have been modified.

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SCHEDULE OF TECHNICAL REQUIREMENTS FOR VINYL COATED UPHOLSTERY FABRIC (ARTIFICIAL LEATHER) FOR COACHING STOCK

0. FOREWARD

- 0.1 This schedule covers the technical requirement/provisions relating to materials, manufacture and tests and does not include all the necessary provisions of the contracts.
- 0.2 This schedule draws reference to some of the relevant Naval, DIC and other Indian Standard specification. The latest version of the relevant 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. 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 and process technologies, serviceability requirements of the Indian Railways and the practices followed in advance countries in this field.
- 0.5 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 vinyl coated upholstery fabric 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 vinyl coated upholstery fabric to be used as seat/berth covering for Indian Railway coaches.
- 1.2 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.

2. REQUIREMENTS

- 2.1 **Description** - The Vinyl coated upholstery fabric shall consist of polyvinyl chloride or vinyl copolymer composition, which is either, calendared and laminated or is spread on to textile material.

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- 2.2 **Base Fabric** - The base fabric shall be polyester Heat set knitted fabric.
- 2.3 **Appearance**- The material shall be of uniform surface finish and shall contain no bubbles and blisters. It shall be substantially free from pin holes, creases or streaks and shall be reasonably free from foreign matter when a test piece one metre long and having the full width of the material shall be cut and placed on a flat illuminated surface suitable for showing up the defects. The edges shall be smooth and free from cuts and should not curl.
- 2.4 **Colour, Grain Embossing and Finish** - The colour, grain embossing and finish of the coated upholstery fabric shall be uniform throughout and shall be as agreed to between the Purchaser and the manufacturer or as per the sample standardized by RDSO.
- 2.5 **Dimensions**- Usable width of the finished coated upholstery fabric shall be minimum 127 cm or as specified by the Purchaser.
- 2.6 **Coating** - The material for coating shall be made from suitably compounded vinyl chloride polymer or copolymer. It shall be pigmented to meet specified colour requirements. The surface shall be non-blooming and free from disagreeable odour. The coating shall be uniformly applied on one side of the base fabric and shall be substantially free from pinholes, cracks and other flaws. Cadmium, Lead and other toxic element should not be used in either free form or in a compound in the coating.
- 2.7 **Resistance to Spread of flame**- The coated fabric shall satisfy the requirement of resistance to spread of flame as stipulated in Table-I. The fire resistance property shall be inherent quality of the coating and no subsequent treatment after the manufacture shall be permitted to achieve this property.
- 2.8 **Conditioning**: Unless otherwise stated in the individual test procedure, condition the test pieces at 27 ± 2 °c and at 65 ± 5 % relative humidity for 16 hours.
- 2.9 The coated fabric shall comply with the requirement given in Table-I. Unless otherwise stated in the individual test procedure, the tests shall be conducted at 27 ± 2 °c and at 65 ± 5 % relative humidity.

TABLE-I

S.N	Property	Value	Method of Test
1	a) Mass of coated fabric (g/m ²) Minimum b) Mass of coating (g/m ²) Minimum	700 600	IS: 7016 (Part 1) IS: 7016 (Part 1)
2	Thickness of coated fabric	0.75±0.1 mm	IS: 7016 (Part 1)
3	Breaking strength (kg/5cm width) Minimum a) Direction 'A' b) Perpendicular to direction 'A'	55 40	IS: 7016 (Part 2)
4	Resistance to damage by flexing (No. of flexing cycles in thousands) Minimum (None of the specimen should show any signs of cracking i.e. stage Nil of IS: 7016)	1000	IS: 7016 (Part 4) (De Mattia Method)

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5	Tearing strength(load in kg) minimum in both direction (Calculation of results to get value in kg/cm should not be done)	4	Method C2 of Appendix C of IS: 2076
6	i) Resistance to heat and ii) Loss of mass of coating (Maximum) I on heating for a) 24 hrs. at 100 ±2 °C b) 100 hrs. at 120 ±2 °C c) 400 hrs. at 120± 2 °C	No sign of exudation or stickiness 4% 5% 10%	Appendix B of IS: 1259
7	Colour fastness to dry and wet rubbing.	Shall not stain	Appendix C of IS: 1259
8	Colour fastness to day light Or Accelerated fading test	Not less than No.4	Appendix D of IS: 1259 or Appendix E of IS: 1259
9	Dimensional change - Maximum (Shrinkage in warp or weft direction)	2%	Appendix F of IS: 1259
10	Surface resistance to chemicals	No deterioration in shade & fastness No tackiness	Para 4.12 of IS: 1259
11	Adhesion of coating - Minimum	2-0 3.0 kg/5cm	ASTM D 751
12	Resistance to spread of flame	Class B	Appendix-5 of UIC-564-2 OR
13	Deterioration of visibility due to smoke	Class A	Appendix-15 of UIC-564-2 OR
14	Limiting Oxygen Index	Minimum 32	IS: 13501
15	Toxicity	Less than 1	NCD 1409
16	Soiling & Cleanability Test with house hold chemicals	Min. Rating 3 (After cleaning)	Appendix-A
17	Taber Abrasion Resistance (CS10 abrasion wheel 4.9 N for 1000 cycles with taber equipment) mass loss - maximum	0.1%	ISO 9352
18	Stretch Warp Weft	17-30% 20-55%	SAE J 855
19	Set Warp Weft	Maximum 15%	SAE J 855
20	Blocking	No Blocking	ASTM D751
21	Adhesion of print (Applicable for printed design)	Greater than 5	Appendix-G of IS: 1259
22	Heat Release Rate (MARHE i.e. Maximum Average Rate of Heat Emission in KW/m ²) as specified in EN 45545-2:2013	R21(HL3)	ISO 5660-1: 25 KW/m ²

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23	Flexing Endurance-Minimum (Bally flex)	10 000 cycles	IS: 5914
24	Resistance to Bacteria- Minimum (Reduction of bacteria at 24 hrs.)	99%	ASTM E2180
25	Resistance to Fungi	Growth observed- None	ASTM G21

Note: For S.N 2 and 4, samples along the length and width shall be tested. The direction with higher value shall be taken as direction 'A' and the other direction shall be perpendicular to it.

3 TESTS

3.1 Tests shall be conducted as prescribed in appropriate relevant standards mentioned in this schedule.

3.2 Test Specimens

3.2.1 Test pieces shall be cut from the samples in the required number and in the appropriate manner as specified in the individual methods of test and in accordance with figure 4 of Appendix K of IS: 1259. Samples for tear strength, Deterioration of visibility due to smoke, Limiting Oxygen Index, Toxicity, resistance to spread of flame Soiling & Cleanability Test with Ketch-up, Orange Juice, Coffee, turmeric stains & ink-mark, Stretch & Set, and Blocking as stipulated in Table-I shall be cut as per test methods prescribed, from additional length of the coated fabric.

3.2.2 In case where less than one metre sample is to be tested, the number of test specimens may be reduced at the discretion of the purchaser.

4 SAMPLING AND CRITERIA FOR CONFORMITY

4.1 Scale of Sampling

4.1.1 **Lot** - In any consignment, all the rolls of vinyl coated fabrics of the same grade, colour and finish shall be grouped together and each such group shall constitute a lot.

4.1.2 The conformity of the lot to the requirements of the specification shall be ascertained for each lot separately. The number of rolls to be selected from lot shall depend on the size of the lot and shall be at random in accordance with Table -II.

TABLE-II
SCALE OF SAMPLING

Lot size (in rolls)	No. of rolls to be selected
1 upto 20	1
2 21 to 100	2
101 to 200	3
201 to 300	4
301 and above	5

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4.1.3 The rolls shall be selected at random and to ensure randomness of selection, the procedure recommended in IS: 4905 may be followed.

4.2 Number of Tests

4.2.1 All the tests laid down in this schedule are mandatory for product approval.

4.2.2 Each of the lengths obtained from a lot shall be examined for visual defects and coating and if found satisfactory, further tests as specified shall be carried out.

4.2.3 From each of the rolls selected according to 4.1.3, suitable length (measure between two weft threads) of vinyl coated fabric shall be cut, care being taken to exclude not less than 0.25 m length of upholstery fabric from either end. The test specimens necessary for the various tests specified in the standard shall be cut, from the lengths of vinyl coated upholstery fabric thus obtained. Scheme of selection of test specimens from the sample length is given in clause 3.2. All the samples shall be kept out of contact from one another or any other material that may cause contamination.

4.2.4 All the tests given in Table-I shall be carried out on each lot except the test for "Colour Fastness to day light", "Resistance to heat and loss of mass of coating (Maximum) on heating for 100 hrs. at 120±2°C and for 400 hrs. at 120±2°C", "Resistance to Bacteria" and "Resistance to Fungi".

4.2.5 The test for Colour Fastness to day light and Resistance to heat and loss of mass of coating (Maximum) on heating for 100 hrs. at 120±2°C and for 400 hrs. at 120±2°C are type tests and shall be carried out at the time of approval/renewal of firm and also once in a year. The test for "Resistance to Bacteria" & "Resistance to Fungi" are type test and shall be carried out at the time of approval/renewal of firm and also once in Six months. However, manufacturer shall carry out these tests for each lot and maintain the records of test results. Records of test results should be furnished by the manufacturer to the inspecting agency at the time of inspection. RDSO may pick samples randomly from consignee end for quality check at any time. In case the samples do not conform to this schedule, the inspection of material will be taken as per extent procedure.

4.2.6 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 shall be borne by the manufacturer.

4.3 Criteria for Conformity

4.3.1 The lot shall be declared as conforming to specification for various characteristics referred in Table-I, if for each of the characteristics the test results of all the individual specimen are found to be within limits of the specification.

4.3.2 If the specimen fails in one or more tests, each such tests shall be repeated twice. For this purpose, two more samples shall be taken from the same rolls(s), other than those from which the earlier samples had been drawn and

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the specimens cut from them so that duplicate tests may be conducted in respect of each failure. If all the specimens pass the duplicate test, the lot shall be declared conforming to the specification, otherwise not.

5. MARKING

Marking shall be done as per RDSO Sketch-68060 (latest alteration) on fabric side. In addition, Month and year shall also be legibly marked with indelible ink at a spacing of approximately 500mm x 500mm by any suitable method. No marking shall be done on coating side. Manufacturer's name shall be marked just below the Railway crest on fabric side of the coated fabric. In place of name of the Manufacturer, trademark can be printed with prior approval of RDSO/Purchaser.

6. PACKING

- 6.1 The material shall be securely packed in the form of rolls so as to ensure safe transportation.
- 6.2 The material shall be so packed that there is no chance of picking up moisture during transportation. For ensuring this, the material may be packed in 1 mm thick polyethylene sheets and then in gunny bag covering or any other moisture resistant materials as agreed between the manufacturer and the purchaser.
- 6.3 The material shall be packed in 127 cm width in rolls of minimum 30-meter length. Short lengths of less than 30 meter shall be permitted but the number of such short lengths shall not be more than 2 per roll. Shorter length pieces (not less than 5 meter) may, however, be permitted in exceptional circumstances, provided the total supply of short length pieces is less than 10% of the consignment.

7. STORAGE

The rolls of vinyl-coated upholstery fabric shall be stored vertically on dry, clean, firm and level surface. The rolls shall be protected from dust, moisture, direct sunlight, corrosive and solvent fumes.

8 WARRANTY

The vinyl coated upholstery fabric shall be deemed to bear a warranty against defective materials/workmanship and the performance for a period of 54 months from the date of supply or 48 months from the date of fitment whichever is earlier. The product shall be warranted against any cracking, discoloring/fading and delamination of coating during service arising out of manufacturing defects. In case, the material shows any defects/fails within the warranty period, it shall be replaced by new one without any cost.

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ANNEXURE-A

Purpose:

To determine the resistance of the surface of the coated fabrics to staining by common household chemicals and/or different staining compounds.

Reference:

ASTMD-1308-02 -Standard Test Method for effect of household chemicals on clear and pigmented organic finishes.

Apparatus:

Template of stainless steel or rust & stain free cold-rolled polished steel flat having thickness of min 0.5mm with opening size of 125mm x 7.5mm.

Stain Reagents:

Ketch-up, Coffee/Tea, Vegetable Oils, Turmeric Stain and Ink marks.

Cleaning Reagents:

Iso Propyl Alcohol

Procedure:

Cut a piece of the vinyl coated fabric of size above 210mm x 300mm to be tested. Using the template, apply stain materials through the opening in a continuous line across the width. It could be necessary to use a cotton swab to apply the stain materials and distribute along the opening. When cleaning, to eliminate cross contamination, a space between stain is recommended. Allow staining agents to set at Atmospheric Conditions. Remove the excess of the staining material. Clean the stain using a dry, clean cotton swab. These stains will be cleaned after 5 minutes and will be examine for effects after the interval of 15minutes. Use one cotton swab per cleaner to avoid contamination.

Expression of Results:

The ratings for stain resistance are based on the following scale:

- 4- Excellent cleanability, no stain mark in the material.
- 3- Good cleanability, slight stain.
- 2- Poor cleanability, stain is almost intact.
- 1- Non cleanable, no stain remove.

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SECTION-B

1. SCOPE

1.1 This section covers the infrastructural requirements for manufacture and testing of vinyl coated upholstery fabric (Artificial Leather) for seats and berths of coaching stock.

2. REQUIREMENTS

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

3. MANUFACTURING FACILITIES

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 Vinyl coated upholstery fabric.
- c) Inspection area.

3.2 The firm should have complete manufacturing facilities as per this schedule at their works.

4 TESTING FACILITIES:

The firm should have the following testing facilities at their works.

4.1 The testing lab should have facility for temperature and humidity control as per clause - 2.9 of section - A.

4.2 The firm should have Flat illuminated surface suitable for showing up the defects as specified under clause 3.5 of section A.

4.3 The firm should have suitable delaminating chemicals for testing the mass of coating.

4.4 The firm should have suitable tensile testing machine for testing the breaking strength, tearing strength and stretch & set test.

4.5 The firm should have flex-testing machine/machines with ~~six~~ suitable digit counter for testing the resistance to damage by flexing with facilities to test 30 samples from five rolls as specified in IS: 7016 (Part-4).

4.6 The firm should have at least one No. hot air circulating oven with ~~four~~ suitable digit minute counter along with temperature display for testing resistance to heat and blocking tests.

4.7 The firm should have one weighing device with digital display of suitable capacity and a minimum accuracy of 1mg.

4.8 The firm should have suitable apparatus to test colour fastness to day light test or accelerated fading test.

4.9 The firm should have suitable apparatus to test colour fastness to dry and wet rubbing.

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- 4.10 The firm should have the testing facility for surface resistance to chemical.
- 4.11 The firm should have a suitable water bath to test dimensional change.
- 4.12 The firm should have suitable facilities for testing the adhesion of coating.
- 4.13 The firm should have in-house testing facilities for conducting tests for fire properties i.e. Resistance to spread of flame as per Appendix-5 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, Toxicity Index as per NCD: 1409 and Heat Release Rate (HRR) as per ISO 5660-1.
- 4.14 The firm should have suitable facilities for testing the Soiling & Cleanability Test with Ketch-up, Orange Juice, Coffee & turmeric stain.
- 4.15 The firm should have the following instruments.
- Measuring tape
 - Measuring scale
 - Magnifying Glass
 - Thickness Dial gauge as referred under clause 5.1.1 of IS: 7016 Part-I
- 4.16 The firm should have suitable facilities for testing the "Flexing Endurance" as per IS: 5914. Until this test facility is not available with the manufacture, the manufacture should arrange testing of the item from NABL/NABCB accredited lab or reputed lab as decided between IR and manufacturer. The cost of the testing shall be borne by the manufacturer.

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

5 QUALITY CONTROL REQUIREMENTS

- 5.1 The firm should have acquired ISO: 9001- ~~2000~~ 2015 (Latest) 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~~ 2015 (latest) 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.

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- 5.5 There should be at least one full time technologist **qualified** ~~having a minimum bachelor's degree~~ in relevant field with experience of at least **5 2** 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 2** 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.
- 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 Records of final products inspection by external agencies (like RDSO), Nonconformity reports and case analysis as well as action taken thereof.
- 6.6 Records for maintenance of dies/moulds.
- 6.7 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.

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