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Amendment History:

Issue/Rev.	Date	Changes in brief
Rev.-01	04.10.2019	Complete specification revised.
Rev.-02	10.10.2019	<ol style="list-style-type: none"> 1. Section-A, Clause 2.4.1., Table 1, Sr.no.12-EN 45545-2, R21 (HL3) (Sample size as per clause 2.4.2 below). 2. Section-B, Clause 4.2-The firm should have suitable facility/ Machine to test as per Sr. no. 1 to 11(except Sr. no. 8, which can be tested outside testing at NABL accredited laboratory or any International laboratory) of Table 1.
Rev.-03	21.11.2019	<ol style="list-style-type: none"> 1. Section-A, Clause 2.4.2, (specimen sample of PU Foam for testing as per note added), 2. Section-A, Clause 4- Marking (amended), 3. Section- A, Clause 7- Criteria for Regular order (Clause 7- iv added), 4. Section-B, Clause 5- Quality Control Requirement (Clause 5.9 added).
Amendment-1	02.12.2019	Section A, Clause 3.1.3, Heat Release Rate added in Type test.
Rev.-04	05.08.2022	Section-A, Clause 7- Criteria for Regular order deleted.
Rev.-05	01.03.2023	<ol style="list-style-type: none"> 1. Section -A, Clause 4 for marking revised. 2. Warranty period increased from 6 years to 10 years.
Rev.-06	03.08.2023	<ol style="list-style-type: none"> 1. S.N-1 of Table-1 clause no. 2.4.1, density of PU foam reduced from $95 \pm 10 \text{ Kg/m}^3$ to $65 \pm 5 \text{ Kg/m}^3$. 2. S.N-12 of Table-1 clause no. 2.4.1- Test method for Toxicity changed from "ISO 5659-2" to "EN 17084 Method 1" as given in latest version of EN45545-2. 3. Clause no. 2.4.2-Table- "EN ISO 5659-2" changed to " EN 17084 Method 1" as given in latest version of EN45545-2. 4. Clause no. 3.1.3 changed "any lab advised by RDSO vide letter no. MC/Testing, dated 24.06.2022 or as per latest advise of RDSO regarding such labs or at any laboratory which is assessed by "CERTIFER" Railway Certification Agency". 5. Clause no. 4-Marking-" Manufacturer's registration ID/PAN number" deleted and " Manufacturer's name" changed by adding "Manufacturer's name/initial /trade mark".

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Foreword:

1. This schedule is intended to cover the technical requirements/provision relating to PU foam to be used as cushion for Seats & Berths. It also covers the tentative process and test protocol but does not include all the necessary provisions of the contract.
2. This schedule draws reference to some of the relevant ISO/EN/IS specifications. Unless otherwise specified, the latest version of the relevant specification shall be taken as reference.
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:2-1960.
4. This schedule consists of two Sections i.e. Section-A and Section-B. Section-A covers the technical requirements, method of sampling and test of flexible load bearing Polyurethane Foam cushions for coaching stocks and Section-B covers infrastructure requirements for manufacture, testing and quality control at the works of the manufactures.

Section-A

1. Scope:

This specification covers the technical requirements of Flexible Load Bearing Polyurethane Foam cushions with FST properties conforming to EN 45545-2, R21, HL3 for passenger coaches, to be necessarily used along with Fire Barrier cloth to MMDTS19021(latest version) also separately meeting FST properties to EN 45545 HL3.

2. Requirement:

2.1. Material: The material shall be uniform cellular product produced by the interaction of Polyol, Additives and Isocyanate from reputed raw material manufacturer. The foam material is to be produced without the use of environmentally harmful foaming agent (i.e. Chlorofluorocarbons). Material should have a homogeneous open cellular foam structure and has to be well de-aerated/vented, clean and physiologically unobjectionable.

2.2. Construction, Workmanship and Finish:

2.2.1. Slab Stock Foams: The foam shall be manufactured as block foam or continuous foam, which should be processed in the desired shape and size of the berth/seat for the use in Indian Railways. Alternatively, the foam shall be manufactured as per clause 2.2.2 below.

2.2.2. Cold Cure Moulded Foam: The foam shall be manufactured as moulded in the required shape of seat/berth for the application in Indian Railways.

2.3. Dimensions & Tolerance: The dimension and tolerance of the Seats / Berths shall be strictly as per the relevant drawing or as specified by the purchaser.

2.4. Physical Properties:

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2.4.1. Tests shall be conducted from the product as per the methods indicated for the respective tests shall conform to the following requirements:

Table-1

SN	Property	Unit	Value	Method of Test	Minimum Test Specimen
1	Density	Kg/m ³	65 ± 5	EN ISO 845	03
2	Tensile Strength	KPa	> 60	ISO 1798	03
3	Elongation at break	%	≥ 45	ISO 1798	03
4	Comfort Factor on 50mm thickness	-	> 1	IS:7888 Cl.6	03
5	Hardness Index @25% @40%	N/cm ²	>0.5 >1	IS:7888 Cl.6	03
6	Compression Set (50%,70°C,22h)	%	≤ 10	ISO 1856	03
7	Compression	kPa	7-11	EN ISO 3386	03
8	Humidity Ageing (%) Hardness loss	%	≤ 25	ISO 2440	01
9	Dynamic Fatigue Test Loss of Thickness Loss of Force Deflection	%	≤ 5 ≤ 10	DIN EN ISO 3385	01
10	Tear Strength (Kg/cm)	kg/cm	> 0.1	ISO 8067	03
11	Resilience (%) Minimum	%	> 35	ISO 8307	03
12	Fire property (without Fire Barrier Cloth) • Heat Release Rate- ISO 5660-1 • Smoke Density-ISO 5659-2 • Toxicity - EN 17084 Method 1	EN 45545-2, R21 (HL3) (Sample size as per clause -2.4.2 below)			03

2.4.2. PU Foam sample size for Fire property Test:

Test Specification	PU Foam Sample Size (In mm)	Thickness (In mm)
EN ISO 5659-2: Smoke generation – Single chamber test (Ds max.)	75 × 75	25
EN 17084 Method 1: Smoke generation – Single chamber test (CITG)	75 × 75	25
ISO 5660-1: Heat release rate – Cone calorimeter method	100 × 100	50

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The sample of PU foam along with test reports, should be got approved from MCF Design, before start of supply.

Note:

The sample of PU foam provided to the test laboratory shall be in one single full sheet in minimum thickness of 100 mm from the same sheet from which all physical tests have been performed for conformance. Laboratory will draw the sample by cutting the foam from all 6 sides to ensure the testing of only PU foam meeting the requirement EN 45545-2 HL3, not treated/coated PU foam with any fire retardant coating etc.

Test lab should clearly mention the following point in final test report:

This is confirmed that the draw samples for testing of all three tests (Heat Release rate, smoke and Toxicity) of EN 45545-2 HL3 have been cut from single PU foam sample sheet submitted for testing and size was 1500 mm Length X 800 mm Width X 100 mm Thick.

All the three tests (Heat Release rate, Smoke and Toxicity) of EN 45545-2 HL3 should be in single test report. **No separate test reports will be acceptable.**

3. Sampling Criteria For Conformity

3.1. Tests

3.1.1. The test shall constitute type and acceptance tests. The testing charges, as applicable, shall be borne by the manufacturer.

3.1.2. Acceptance Test:

All the tests mentioned in Sr. no. 1 to 11 & Heat Release Rate test of Sr. no. 12 of Table-1 of clause no. 2.4.1 will be acceptance tests.

3.1.3. Type Test:

Heat Release Rate, Smoke density and Toxicity test for FST properties, as per Sr. no. 12 of Table-1 of clause 2.4.1 will be Type test for one year or earlier till a time sufficient laboratories in India as well as with firm's premises are developed. Fire property test shall be conducted by any lab advised by RDSO vide letter no. MC/Testing, dated 24.06.2022 or as per latest advise of RDSO regarding such labs or at any laboratory which is assessed by "CERTIFER" Railway Certification Agency (list enclosed), to perform test as per EN 45545-2 HL3 initially first time and after every 500 coach sets or if there is any change made to their tested formulation. In this regard report to be submitted to consignee. The cost of testing will be borne by the manufacturer.

MCF reserves the right to get FST property tested for any lot, for which charges will be borne by the firm. This type test has been provisional till a time sufficient laboratories are not available in the country.

3.1.4. The number of pieces to be selected from the lot for acceptance test shall as under.

Visual observation	100%
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Dimensional check	5% of the Supply quantity or 10 samples whichever is more
For remaining tests	Three samples

3.1.5. 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 inspection authority.

3.1.6. Each of the test samples undertaken for tests shall conform to the requirements as laid down in Table-1 of clause no. 2.4.1. Should the samples fail to meet the requirements double the no. of samples from the same lot shall be drawn for retesting. Should any of the retest samples fail to comply with the requirements, the entire lot shall be rejected.

3.1.7. In case of non-compliance in regard to dimensional check as per relevant drawings, the manufacturer may be given one chance to segregate the lot for dimensional conformity.

3.1.8. 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.

4. Marking:

PU foam shall have an RFID tag containing following information.

- i) Manufacturer's name/initial /trade mark
- ii) Batch No.
- iii) Month & Year of manufacture.

5. Packing:

The material shall be suitably packed by using biodegradable or recyclable packing material to avoid distortion, damage and to provide protection against fire hazard etc. during its transit and storage.

6. Warranty:

PU foam shall have warranty for 10 years from the date of dispatch of coach, for any kind of performance related failure including permanent compression set, breakage of cushion, loss in resilience etc and to be replaced with new cushion which shall again have warranty of 10 years from the date of replacement. The performance should not deteriorate for loss of height & loss of hardness should not exceed 20% for reserve coaches & should not exceed 30% for un-reserved coaches during warranty period.

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Section-B

1. Scope

1.1 This Section covers the infrastructural requirements for manufacture of flexible load bearing Polyurethane foam cushions used in coaching stock.

2. Requirements

All vendors seeking registration with MCF shall comply all the requirements mentioned below.

3. Plant, Machinery and Infrastructure requirements

3.1 The manufactures shall 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 flexible load bearing PU foam cushions.
- c) Inspection area.

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

3.3 The firm should have PU foam machine of high pressure piston metering type for processing filler/additives in PU close loop type systems.

Or

Followings Machinery & Plant should have available for Slab Stock Foam –

- Tank storage and tank unloading area
- Mixing with dust separator
- High pressure block plant
- Block storage with aeration
- Vertical and horizontal cutting machines
- Stamping, packing, labelling machinery
- CNC Cutting machine
- Universal testing machine (UTM)
- Ball resilience tester
- Shear fatigue machine
- Foam pounding machine
- Compression set equipment
- Weighing Balance
- Metrohm Titrator
- Conditioning of Polyol and Isocyanates
- CNC Contour cutting Machine
- Compress packing Machine
- Fire Safety esp ESFR sprinklers/CO2 total flooding system.

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4. Testing Facilities:

- 4.1 Suppliers should provide the Technical data sheet and Material data sheet of raw material and Material testing report with every supply.
- 4.2 The firm should have suitable facility / Machine to test as per Sr. no 1 to 11(except Sr. no. 8, which can be tested outside testing at NABL accredited laboratory or any International laboratory) of Table-1 of clause no. 2.4.1.
- 4.3 **Testing Facilities available in-house**
- Chemical test lab for incoming raw material inspection
 - Hardness tester
 - Tear resistance tester
 - Dynamic fatigue tester
 - Moisture content (ASTM D4672)
 - Hydroxyl (OH) Value (ASTM D4273)
 - Density (EN ISO 845)
 - Compression (EN ISO 3386)
 - Tensile Strength (ISO 1798)
 - Elongation at break (ISO 1798)
 - Compression Set (ISO 1856)
 - Dynamic fatigue test (ISO 3385)
 - Hardness
 - Tear Strength (ISO 8067)
 - Resilience (ISO 8307)
- 4.4 The firm should have arrangement for periodical calibration of all the gauges & instruments.

5. Quality Control Requirements:

- 5.1 The firm should have acquired ISO: 9001-2015 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: 9001-2015 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:
- Organization chart
 - Process flow chart

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- 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 in charge 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 of all the relevant specifications, IS standards are available with them.

5.9 Companies sourcing Raw Material used for manufacturing of PU Foam will be preferably under Make in India policy of Government of India.

6. Documentation:

Firm shall maintain following documents/records:

- 6.1 A well documented Quality Plan.
- 6.2 Incoming raw material register with Test Certificate, 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-à-vis action plan.
- 6.5 Records of final products inspection by external agencies (like RITES/ GCTC of OEM), Non-conformity 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 organized and imparted on maintenance of machines, quality assurance, safety parameters etc.
