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# TRAIN B28

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## High Speed Rail Project Procurement Technical Specification of Rubber Profiles & Rubber Packings

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## 1. Introduction

### 1.1. General

This document specifies the technical requirements of Rubber Profiles and Rubber packings to be supplied for High speed 8 car Trainset (Chair car) designed to operate at 249 kmph and test speed of 280 kmph. The Supplier shall be responsible for all works required in this PTS with regard to manufacture, inspection and supply of Rubber profiles and Rubber packing and shall be responsible for supporting the BEML activities as contractor for manufacture of Train B28.

### 1.2. Climatic and Environmental Conditions

The car shall operate reliably and safely under the climatic and environmental conditions as specified below. Accordingly, the rubber profiles and rubber packings shall be designed to operate with satisfactory performance under the following conditions.

Description	Limiting Values
Atmospheric temperature [Note-1]	Minimum temperature: - 5°C Maximum temperature: 50°C Maximum touch temperature of metallic surface under the sunlit and shade shall be considered and calculated as per ASHRAE 2021.
Humidity	100% saturation during rainy season
Solar radiation	Value and calculation method shall be based on ASHRAE 2021.
Altitude	1000 meter above mean sea level
Rainfall	Very heavy and continuous rainfall in certain areas (heavy continuous rainfall up to 2500mm, rainy season is as long as 6 months in some stretches)
Atmospheric conditions	Extremely dusty and desert terrain in certain areas. The dust concentration in air may reach a high value of 1.6 mg/m <sup>3</sup> .
Coastal area	Humid, salt laden and corrosive atmosphere as prevailing in coastal region.
Wind speed	High wind speed in certain areas, with wind pressure reaching 216 kg/m <sup>2</sup> . [Note-2]
Flood level	The Train shall function in accordance with these Specifications and Standards in the event of flooding up to 50 mm above Rail Level as follows: <ul style="list-style-type: none"> <li>In the event of flooding at any level below Rail Level, the Train shall operate in full compliance with these Specifications and Standards.</li> <li>In the event of flooding at a height between Rail Level and 50 mm above Rail Level, the Train shall operate in full</li> </ul>

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	<p>compliance with these Specifications and Standards with the exception that it is permissible to restrict the operation of the Train to a maximum of 10 km/h.</p> <p>Allowance is to be made in addition for increase in the height of water level due to the “bow wave” effect of the Train passing through the water.</p>
Design Life	Train is designed for min.30 year of life. Accordingly, the subject items & accessories shall also not deteriorate in their performance for 30 years

Table 1: Climactic Conditions

[Note-1] Ambient temperature for HVAC calculations shall be based on the highest temperature of the Indian region specified in ASHRAE-2021.

[Note-2] Depending on the operational rule, special speed limits shall be imposed on the Train Sets in conditions where wind speed is 20 m/s or greater. Train Set operation shall cease at wind speeds of 30 m/s or greater.

In developing the detailed design, the supplier shall acquaint himself and take note of the environmental operating conditions prevailing on the Trial Section during Heavy monsoon, track flooding conditions, saline, humid and dusty atmosphere etc.


## 2. Definitions

The following definitions and abbreviations are applicable to the PTS.

- (i) **“Employer”** means ICF -Chennai, its legal successors and assignees
- (ii) **“Nominated Agency”** shall mean NHSRCL and its representatives including an ISA (if any) deployed by NHSRCL for the purpose of carrying out Design approvals, Tests, Trials etc.
- (iii) **“BEML”** means the Contractor to procure the rubber profiles and packing rubber for High speed 8 cars project .
- (iv) **“Subcontractor”** means the Subcontractor who supplies the required rubber profile and packing rubber to BEML for High-speed Rail project. Subcontractor shall carry out the works in accordance with this PTS with regard to Interior and Exterior panels.
- (v) **“Contract”** means the contract between Subcontractor and BEML in relation to the supply of rubber profiles and rubber packing for High-speed Rail project.
- (vi) **“Engineer”** means any person nominated or appointed from time to time by the Employer to act as the Engineer for the purposes of the Contract and notified as such in writing to the Contractor.

### 2.1. Abbreviations

ICF: Integral Coach Factory, Chennai, Indian Railways

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NHSRCL: National High Speed Rail Corporation Limited

### 3. General Requirements

The Supplier shall supply the rubber profiles & rubber packing as per tender drawing requirements and this PTS. The Supplier shall be responsible and shall ensure that the rubber items supplied meet the environmental conditions specified at Clause 2.1 and do not deteriorate / fail during the life time of the cars.

#### 3.1. Defining of unclear aspects

If any term or clause described in the specification is not clear, Supplier shall discuss those with the design team in BEML, prior to making contract, to confirm their definitions and opinions. After making a contract, Supplier shall follow the definition and opinions of Design team in BEML.

#### 3.2. Responsibility of Supplier

Supplier shall have responsibility for manufacturing, defined performance testing with regard to rubber profiles and rubber packing.

### 4. Standards

Test and inspection standard applicable for the Rubber shall conform to the national and international standards as per the technical requirements at Clause 8.

### 5. Scope of Supply

Generally, the Rubber used as packing rubber/ profiles shall be of Silicon/ EPDM rubber and shall conform to the technical requirement at Clause 6.

#### 5.1. Submission of documents

The Supplier shall submit the technical specification, previous projects type test reports and fire safety test reports along with the offer. Supplier shall submit the dimensional check sheets and routine test reports along with every batch of supplies.

#### 5.2. Submission of samples

For new suppliers, the supplier shall submit 2 nos. A4 size samples of each of the EPDM/ Silicon rubbers along with material test certificate and type test reports as per this PTS and obtain approval, before bulk production.

#### 5.3. Packing

Supplier shall pack properly in order to ensure that no damage occurs during transit

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## 5.4. Quality assurance program

### 5.4.1. General

The supplier shall hold ISO 9001-2015 certification and shall manufacture the product accordingly. The supplier shall submit a copy of ISO 9001 certification along with the offer. The supplier shall monitor and control the Quality systems as per ISO 9001 guidelines. BEML's and/or Customer's Representative may periodically conduct compliance audits of the supplier's Quality management system

### 5.4.2. Quality Assurance Plan

The supplier shall develop and submit a Quality assurance plan (QAP) to BEML for review and approval based on ISO 9001-2015 guidelines

## 6. Technical Requirements

### 6.1. Technical Requirements for Rubber

The Rubbers supplied shall be to the highest quality and shall conform to the requirements specified in the drawings, this PTS and Purchase order. The physical and mechanical properties shall generally conform to Table-3 below and fire performance to clause 6.2.

Material / Physical Properties	Silicone	EPDM	Test Methods
Hardness, Shore "A"	70±5	85±5 55±5	ASTM D2240
Tensile Strength (Min), MPa	6	8	ASTM D412 Type A dumb-bell test
% Elongation (Min), %	200	100	ASTM D412 Type A dumb-bell test
Tensile Set (Max), %	20	15	ASTM D412 Type A (A strain of 50% shall be applied. The straining period shall be 10 min, followed by relaxation for 10 min, prior to measurement)
Compression Set (Max), %	9	14	ASTM D395 (Type A the temperature of the test shall be 70°C for 22 hrs. The recovery time after compression shall be 60 min)
Tear Strength (min), kN/m	20	25	ASTM D624 Type-C

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Density, kg/m <sup>3</sup>	1500 Max	ASTM D1817
Accelerated ageing	Max. Hardness change $\pm 5$ BS	ASTM D573 (Method B 100 $\pm$ 1°C for 3 days)
Outdoor exposure resistance	Shall not show cracks	ASTM D1171
Low temperature resistance	Shall not crack at 40°C	ASTM D2137
Staining test (where applicable)	No staining	ASTM D925
Ozone resistance (50 pphm, 40°C, 20%, 72 hrs)	Shall not show crack with a rating greater than 1	ASTM D 1149 Method B

Table 2: Physical & Mechanical Properties

## 6.2. Fire Safety

The Rubber Profiles & packing shall confirm to fire safety requirements as per EN 45545-HL3, R22 requirements.

### 6.2.1. Fire Performance Test Procedure and Criteria

The Fire Performance Test Procedure and Criteria shall be met, but not be limited to, the following requirements:

Property	Test Procedure	Parameter(units)	Criteria for HL3	Criteria for HL2
Burning Behavior	T01 EN ISO 4589-2	T01 EN ISO 4589-2	Minimum 32	Minimum 28
Smoke generation	T10.03 EN ISO 5659-2, 25kWm-2	Ds Max (dimensionless)	Maximum 150	Maximum 300
Toxicity	T12 NFX 70-100-1 and -2 600o-C	CITNL <sub>P</sub> (dimensionless)	Maximum 0.75	Maximum 0.9
MARHE (Maximum Average Rate of Heat Emission)	T03.01 ISO 5660-1	MARHE (kW/m <sup>2</sup> )	-	-
Gross Heat of	ISO 1716	MJ/ Kg.	EPDM: 25 max.	



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Combustion value		Silicone: 15 max.
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Table 3: Fire Safety Criteria

Fire performance tests as said above shall be performed for both minimum and maximum thicknesses of the material specified in the tender requirement according to the standard EN 45545-2, clause 4.2 point (d) & (e) as shown in below extract.

- d) where a product has a continuous aluminium or steel substrate and where the thickness of the substrate metal is equal to or greater than defined in Table 7, it is sufficient to test the product with the thickness given in Table 7;
- e) A) a product, other than an electric cable, meeting a requirement at two different thicknesses with identical formulations shall be considered to comply with the requirement at all intermediate thicknesses. A product meeting a requirement at the maximum testable thickness shall be considered to comply with the requirement at greater thicknesses. Electric cables meeting a requirement at two different diameters with identical formulations shall be considered to comply with the requirement at all intermediate diameters; B)

### 6.3. Dimensional Tolerance

The dimensional tolerances shall conform to ISO 3302-1 for unspecified tolerances in the drawings. The dimensions shall conform to the most stringent grade of tolerance for each of the types (moldings/ extrusions/ sheets) specified in ISO 3302- 1.

## 7. Inspection & Testing

### 7.1. General

The Supplier shall perform all tests in accordance with the Standards specified in the drawing, this PTS and purchase order. BEML's and/or Customer's Representative have the right to witness any of these tests at any stage of test progress.

### 7.2. Visual inspection

The rubber items shall be uniform in quality and condition, clean, smooth and free from foreign matter and imperfections detrimental to the performance of the items.

### 7.3. Type Test & Routine Test

Rubber Profiles and Rubber Packings shall be type and routine tested in accordance with relevant standard and specifications at an ISO 17025 accredited laboratory (subcontractor own laboratory or external laboratory) at subcontractor cost.

Submission of test report of another project will not be accepted. Subcontractor to be very clear that the other project test report will be considered only as a reference. For the given contract the subcontractor has to carry out all tests as new and to comply accordingly for the type tests and routine tests. Subcontractor

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failing to comply for new type tests and routine tests will be liable for tender disqualification

#### Type Test

Type tests shall be performed by the supplier under BEML and Customer Representative Participation.

#### Routine Tests

Routine test shall be performed by the supplier and during the test, the criteria shall be observed and results shall be recorded. Routine test reports shall be furnished along with the supplies.

The supplier shall perform, as a minimum, the following tests:

Sl. No.	Description	Test Method	Type test	Routine test
1.	Visual inspection	-	•	•
2.	Dimensional inspection	-	•	•
3.	Hardness	ASTM D2240	•	•
4.	Tensile Strength	ASTM D412	•	
5.	% Elongation	ASTM D412	•	
6.	Tensile Set	ASTM D412	•	
7.	Compression Set	ASTM D395	•	
8.	Tear Strength	ASTM D624	•	
9.	Density	ASTM D1817	•	
10.	Accelerated ageing	ASTM D573	•	
11.	Outdoor exposure resistance	ASTM D1171	•	
12.	Low temperature resistance	ASTM D2137	•	
13.	Staining test	ASTM D925	•	
14.	Ozone resistance	ASTM 1149	•	
15.	Peel Adhesion (wherever applicable)	EN 1939	•	
16.	Fire Safety	EN 45545 HL3/HL2	•	

Table 4: List of tests

#### 7.4. First Article Inspection

Before mass production, each type of EPDM and silicon rubber profiles and sheets shall be subjected to First Article Inspection by BEML and/or Customer's Representative. After clearance from BEML only, mass production shall be taken

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up. After formal approval has been given, no change in the compound or processing conditions shall be made without the consent of BEML.

## 8. Submittals with Technical Offer

The Supplier shall provide as a minimum, the following along with the technical offer:

1. Complete technical offer for rubber packing and rubber profiles.
2. Technical data sheet of EPDM, Silicone and the self-adhesive.
3. Copy of Type test reports of earlier similar projects.
4. Clause-wise comments against this PTS
5. Fire safety test report copies of earlier similar projects.