SCHEDULE OF REQUIREMENTS FOR NATURAL FIBRE THERMOSET COMPOSITE FLOOR BOARD AND CHEQUERED BOARD FOR USE IN FLOORING OF PASSANGER COACHES

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SCHEDULE OF REQUIREMENTS FOR NATURAL FIBRE THERMOSET COMPOSITE FLOOR BOARD AND CHEQUERED BOARD FOR USE IN FLOORING OF PASSENGER COACHES

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 For the purpose of deciding whether a particular requirement of 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 IS: 2-1980. The number of significant places retained in the rounded value should be the same as that of the specified value in this schedule.

0.3 In this schedule due consideration has been given to the development in the field of polymeric materials, process technologies and serviceability requirements of the Indian Railways and the practices followed in advanced countries in this field.

1. **Scope**

   This schedule prescribes the requirements and methods of tests of natural fibre thermoset composite floor board and Chequered board used in railway passenger coaches.

2. **Requirements**

2.1 **Method of Manufacture**

2.1.1 The board shall be manufactured by compression moulding. Any other recognized method can also be used subject to prior approval of RDSO.

2.1.2 These boards shall be made from natural fibre and thermoset resin with or without fillers. The boards may also contain inorganic materials and colouring agents.

2.2 **Workmanship and finish**

2.2.1 The surface of the boards shall not show blisters, porosity or cracks. The surface shall be reasonably smooth and even.

2.2.2 The board shall be sufficiently robust to withstand the normal handling during assembling on coaches. The boards shall not crack or fracture when worked on by ordinary wood working tools or machinery.

2.2.3 The design of Chequer of Chequered board shall be as agreed to between the manufacturer and purchasing authority.
2.3 Dimensions and tolerances

2.3.1 Unless otherwise specified, the thickness of the floor board and the Chequered board shall be 12 mm.

2.3.2 The dimensions of NFTC boards shall be in accordance with the relevant drawings or as specified in purchase order. The thickness of NFTC board shall be uniform and within the specified tolerance limits given in 2.3.3 and shall be measured in accordance to clause 5.2 of IS: 12049.

2.3.3 Unless otherwise specified, the following tolerance on the nominal sizes of finished board shall be permissible:

i) Length : + 6.0 mm
      - 0.0 mm

ii) Width : + 3.0 mm
       - 0.0 mm

iii) Thickness : ± 5%

General requirements

2.4.1 The protective film in the material shall have adequate resistance against scratch by small tools, nails, etc. The material shall not show any cracks, split or delamination when sawn, screwed, riveted, nailed, bolted or drilled.

2.4.2 The board shall be weather proof and shall not loose shape or not in service. They shall also withstand attack by vermin. The boards shall not warp, split, delaminate or blister. Expansion or contraction due to thermal changes shall be negligible.

3. Sampling and acceptance

Lot: All the NFTC boards of the same type and size shall constitute a lot.

Batch: Boards manufactured from the resin of same kettle shall constitute a batch.

Sample shall be selected and tested separately from each lot for determining its conformity or otherwise to the requirements of the specification.

Scale of sampling: The number of boards to be selected from a lot shall be 0.50 percentage or minimum of 3 (three) drawn at random.

Conditioning of test samples: unless otherwise specified in respective test methods, the samples shall be conditioned at relative humidity of 65 ± 5 percent and at a temperature of 27 ± 2 °C for 16 hrs.

Testing of samples and criteria for conformity.

Test specimen cut from each of the boards selected shall be tested by the appropriate method specified in table–1. The lot shall be considered to conform to the specification when it passes in the tests indicated.
Retest:
If any pieces fail to fulfill the test requirements specified under 3.6, double the number of original samples on the basis prescribed under 3.6 shall be selected from the same lot for testing in the same manner. Should any one of the retest samples fail to meet the requirements, entire lot shall be rejected.

The manner of distribution of the test samples for different tests prescribed shall be at the discretion of the inspecting officer / purchaser.

4. Tests
4.1 The samples shall comply with the requirements given in Table-I.

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<td>Resistance to boiling water</td>
<td>% water absorbed Max</td>
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<td></td>
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<td>Increase in thickness (%) max</td>
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<td>Bending strength (kg/cm²)</td>
<td>Along the grain</td>
<td>1200</td>
</tr>
<tr>
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<td></td>
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<td>600</td>
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<td>Toxicity</td>
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Note: - The test for resistance to abrasion is applicable to chequered board only.

4.2 No. of Test: -

All the tests given in Table – 1 except Resistance to ageing shall be carried out on each lot. The test for Resistance to ageing is type tests. The test for Resistance to ageing shall be carried out once in six months.
4.3 RDSO may draw the sample for quality check at its discretion and firm shall arrange testing of these samples in a reputed outside laboratory as decided between RDSO and manufacturer. Testing charges shall be borne by the manufacturer.

5. **Marking & Packing.**

5.1 Each board shall be legibly and indelibly marked or stamped with the following particulars along with such other marks specified by the purchaser.

(i) Name/Trade mark of manufacturer

(ii) Month & year of manufacture

(iii) Lot or Batch number

5.2 **Packing**

After inspection and approval, boards shall be suitably packed to prevent damage in transit. The method of packing used shall be as agreed to between purchaser/inspector and the supplier.

6.0 **Warranty**

The NFTC floor board supplied shall be deemed to bear a warranty against defective materials/workmanship and performance for a minimum a period of –

(a) 60 months from the date of supply or 54 months from the date of fitment whichever is earlier for flooring application under PVC sheet.

(b) 24 months from the date of supply or 18 months from the date of fitment whichever is earlier flooring application other than PVC cover.

7. **Storage**

The NFTC floor board should be stored in a covered place without direct exposure to rain water and sun light.

**APPENDICES**

A. **Determination of specific gravity:**

Specimen of size 50mm X 50mm X t*, free from major defects shall be taken and specific gravity determined using standard method by taking weight in air and in water at the temperature of 27±1 °C.

B. **Determination of water absorption:**

Specimen of size 50mm X 50mm X t* with cut edges, shall be weighed and kept suspended in distilled water at the temperature of 27±1 °C for 24 hrs. It shall then be removed, surface and edges dried in folds of blotting paper and weighed. Increase in weight expressed, as percentage of original weight shall give water absorption.

C. **Resistance to boiling water:**

Specimen of 100mm X 100mm X t* with cut edges, smoothened with fine emery shall be taken for test. Measure the thicknesses of specimen at the centres of its four edges
and with the external edge of the micrometer anvil approximately 5mm from each edge (Fig.1). Mark the measuring points so that the subsequent measurement can be made in the same places. It shall then be kept suspended in boiling distilled water at 100±1 °C for 8 hrs. Then the specimen shall be transferred from boiling water and kept submerged in water at the temperature of 27±1 °C for one hour. Specimen shall be removed and dried in folds of blotting paper. Measure the thickness at measuring points already marked. Calculate the percentage increase in thickness at measuring points and their average shall be taken as percentage increase in thickness. It shall also be examined for any delamination, deterioration of surface appearance, appreciable softening, etc. The specimen have passed the test if:

i) It does not show any of the defects mentioned above.

ii) The increase in thickness is within the 10% of original thickness.

D. **Resistance to impact**

Specimen of size 300mm x 300mm x t* is supported in a suitable square as per Fig.-2 given below. The steel ball of 1 kg. is dropped from a height of 2 metres by a suitable device to strike the board within 25mm from its centre. Test shall be repeated on 2 more specimens. After the test, the specimen shall not develop any cracks in or around the area of impact or on the under surface or show any defects such as delamination, split etc. This test is applicable only for thicker section of 10 mm and above.
E. Resistance to chemicals

Specimens each size of 50mm X 50mm X t* shall be kept immersed separately in following solutions, in clean glass beakers for 48 hours,

(i) In dilute hydrochloric acid (5 vol. Of conc. HCL to IS: 265-1962 in 100 vol. of distilled water),

(ii) Sodium carbonate solution (1% by weight),

(iii) Soap solution (1% by weight of soap to IS: 285-1964 in distilled water) and

(iv) Detergent solution (1% by weight distilled water at 27 ±1 °C)

The specimens when withdrawn and examined shall not show any surface defects indicated in clause 3.2.

F. Resistance to ageing

(i) **Dry Heat Test:** -

3 specimens of size 200mm x 100mm x t* shall be kept in an air oven at 70 ± 1deg.C for 168 hours followed by cooling at 27 ±1 deg. C for 3 hours. They shall be examined after the above test. The specimens are considered to have passed the test if no surface defects likely to mar the aesthetic value or protective coating or no warping could be seen.

(ii) **Ageing test:** -

3 specimens of size 200mm x 100mm x t* with all four edges smoothly trimmed shall be subjected to seven cycles successively, each cycle consisting of the following operations:

a) Age at 70 ±1deg. C for 8 hours in an air oven

b) Immerse in cold water 27±1 deg C for 16 hours.

After completion of 7 cycles the specimen shall be dried in folds of blotting paper and examined.

The aged specimen shall not show any surface defects likely to mar the aesthetic value or protective coating or warping.

\[ t^* = \text{refers to thickness of the actual component in mm.} \]

G. The test shall be conducted with H-18 calibrated wheel using 100mm O.D. sample with original thickness and load on each wheel shall be 500gms. The weight loss after 1000 revolution shall be measured.

Three test specimens shall be subjected to this test and average value shall be taken into consideration as given in Table- 1.
SECTION B

1. **Requirements**

The vendor seeking approval of impregnated compressed laminates shall comply all the requirements mentioned below:

1.1 **General and Manufacturing facilities:**

1.1.1 There should be a provision of covered area, with adequate space underneath for storage of raw material i.e. wooden logs, resin chemicals, etc. and finished board. The covered area should have display board showing different colour shades nominated for different chemicals and raw materials to avoid mix-up of store.

1.1.2 The firm should have resin manufacturing plant with at least one number of resin kettle of 1 tonne capacity each

1.1.3 The firm should have resin impregnation plant of adequate capacity.

1.1.4 The firm should have at least one boiler of adequate capacity with all its accessories.

1.1.5 The firm should have at least one number heavy duty hydraulic hot press to manufacture floor boards of final size 2850mm x 1220mm x 12 mm with adequate margin of trimming. The Press should have heating facilities with temperature, pressure and time control.

1.1.6 Two numbers moulding press of appropriate capacity for moulding other sizes of slats, sheets and seat cum backrest required for Indian Railways.

1.1.7 The firm should have at least two indirectly heated drying chamber for drying.

1.1.8 The firm should have at least one number of heavy duty double dimension saw.

1.1.9 The firm should have a small machine shop consisting of cutting, drilling machine, etc. for minor repair of machineries.

1.1.10 The firm should have weighing machine, platform type, for measuring at least 300 kg. of weight.

1.2 **Testing Facilities:-** The firm should have a following facilities.

1.2.1 The testing lab should be air conditioned to control the temperature and humidity.

1.2.2 The firm should have an electrical balance.

1.2.3 The firm should have hot water bath complete with thermostatic controller and thermometer. The controller should be calibrated once in three month.

1.2.4 The firm should have suitable testing machine for bending strength.

1.2.5 The firm should have facility for impact testing as per Appendix ‘D’.

1.2.6 The firm should have a chemical laboratory for concluding tests of resistance to
1.2.7 The firm should have at least one hot air oven for checking resistance to ageing with thermostatic controller and thermometer. The controller should be calibrated once in three months.

1.2.8 The firm should have facility for conducting tests for resistance to spread of flame as per Appendix – 4 of UIC-564-2 or, Deterioration of visibility to smoke as per Appendix -15 of UIC-564-2 OR, Limiting Oxygen Index as per IS: 13501 and Toxicity as per Specn. NCD-1409.

1.2.9 The firm should have the following instruments:
   a) Vernier caliper with digital display.
   b) Micrometer with digital display.
   c) Moisture meter with digital display.
   d) Thermometer with digital display.
   e) Hydrometer
   f) Measuring Scale
   g) Measuring Tape

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

1.3 Quality Control Requirements

1.3.1 There should be a system of ensure the traceability of product from raw material stage to finish product stage. The system should also facilitate to identify the raw material composition from the finish product stage.

1.3.2 The firm must ensure that there is a QAP for product detailing various aspects:-
   - Organization 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 of ensure control over them.
   - Disposal system of rejected raw material and components.

1.3.3 There should at least one full time technologist having minimum bachelor’s degree in relevant field and 5 years experience or a person diploma in relevant field with 12 years experience. He should be free from day-to-day production, testing and quality control responsibility. He should be responsible for development of a product, analysis of products, control over raw material, and corrective action in case of difficulties in achieving the parameters.

1.3.4 The firm should have ensure that 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.

1.3.5 The firm should have acquired ISO: 9001:200 certification and the product for which the approval is sought should be broadly covered in the scope of the certification for manufacture and supply.

1.3.6 The Quality manual of the firm for ISO:9001-2000 should clearly indicate that at any stage the control over manufacturing and testing of the said railway product.

1.3.7 The firm must ensure that proper analysis is being done on monthly basis to study the rejections at various internal stage and it is so documented.

1.3.8 The firm should ensure that all the relevant specifications, IS standards are available with the firm.

1.4 DOCUMENTATION

Firm shall maintain the following documents/records.

1.4.1 A well documented Quality Plan.

1.4.2 Incoming raw material register with Test Certificates reference of suppliers and internal test results

1.4.3 Stage inspection results including finished products results.

1.4.4 Records of internal rejection and analysis vis-à-vis action plan.

1.4.5 Records of final products inspection by external agencies (like RDSO), Non conformity reports and case analysis as well as action taken thereof.

1.4.6 Records of maintenance of press etc.

1.4.7 Ensure that proper systems are available for dealing with customer complain.

1.5 TRAINING

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.