

REVISION OF SPECIFICATION / STR

Ref: Final Draft Spec. No. C-9407 (Rev.4), STR for Wood Based Impregnated Compressed Laminate for use in Railway Coaches.

1. 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.
2. 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	<u>In case of Firm / Individual:</u> Manufacturing experience of item (or similar Item) on which comments are offered	
9	<u>Where relevant:</u> 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,
Carriage Directorate,
Research Designs and Standards Organization
Manak Nagar, Lucknow – 226011

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

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INDIAN RAILWAYS



SCHEDULE OF REQUIREMENTS FOR WOOD-BASED IMPREGNATED COMPRESSED LAMINATES FOR USE IN RAILWAY COACHES

S.No.	Month / Year of issue	Revision / Amendment	Page No.	Reason for Revision/ Amendment
1.	November, 1994	Nil	-	First issue
2.	August, 2020	Rev.4	7, 11, 12 & 13	<ul style="list-style-type: none"> • Amendment 1 to 4 & Corrigendum-1 of Rev-3 have been incorporated. • In section A, Clause 1.2 replaced with clause 8.1 and has been modified. • New Clause 8.2 has been added in section A • Clause 1.1.6, 1.2.4, 1.3.3, 1.3.4, 1.3.5 & 1.3.6 of Section-B have been modified.

Issued By:

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

Signature-			
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SCHEDULE OF REQUIREMENTS FOR WOOD-BASED IMPREGNATED COMPRESSED LAMINATES FOR USE IN RAILWAY COACHES

FOREWORD

- (i) 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.
- (ii) This schedule draws reference to some of the relevant IS and other International Specifications. Unless otherwise specified, the latest versions of these specifications shall be taken as reference.
- (iii) 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.
- (iv) In the formulation of this standard due consideration has been given to the development in the field of wood-based impregnated compressed laminates & process technologies, serviceability requirements of the Indian Railways.
- (v) 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 wood-based impregnated compressed laminates and Section-B covers infrastructure requirements for manufacture, testing and quality control at the works of the manufacturers.

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SECTION-A

1. Scope

- 1.1 This section covers the technical requirements, method of sampling and testing of resin impregnated compressed laminates (Compreg) to be used in Railway coaches.

2. Type

- 2.1 Wood based Resin impregnated compressed laminates shall be of two types:
- Type-I For use as slats and as sheets used in berths/seats and backrests etc. where chances of water accumulation are limited.
- Type-II For use as chequered sheet or board for floor or other applications where there are chances of water accumulation.

3. Requirements

3.1 Material and construction

- 3.1.1 Any non-resinous hard species of timber may be used for the manufacture of veneers required for making compreg. The individual thickness of veneer shall not be more than 2mm. Veneer shall be smooth, free from knots, splits, dry rot or any other type of rot and resin pockets. The veneer shall be of uniform thickness with a tolerance of ± 5 percent and dried to suitable moisture content not exceeding 8 percent.
- 3.1.2 Unless otherwise specified, the grains of the outer plies in a board shall run parallel to the length of the board.
- 3.1.3 In selecting the species for the manufacture of compreg, as far as possible, a single species of timber be used in a pack and where combination of different species is unavoidable, care shall be taken to prevent in compatibility of various species in physical and mechanical properties, such as density, Modulus of elasticity, shrinkage etc.
- 3.1.4 Each veneer shall be treated / impregnated throughout the surface and cross section with resin system conforming to IS: 848. Such veneers after drying shall be so assembled in such a grained configuration and hot-pressed at suitable temperature and pressure to comply with the physical and chemical and other requirements of the specification.

3.2 Workmanship and finish

- 3.2.1 The product shall be of uniform quality and free from surface defects like checks, splits, blisters, warps discolouration, overlap, gap, open joints etc. likely to affect the aesthetics and end-use of the material. The edges and surfaces shall be given a protective coat with suitable varnish compatible with resin system used for treating / impregnating the veneers so that they can be readily used without any further protective coating.

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3.3 Dimensions and tolerances

3.3.1 The dimensions of compreg boards shall be in accordance with the relevant drawings or as specified in purchase order. The thickness of compreg board shall be uniform and within the specified tolerance limits given in 3.3.2 and shall be measured in accordance to clause 5.2 of IS: 12049.

3.3.2 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 : $\pm 5\%$

3.4 Colour

3.4.1 The colour shall be as agreed between the purchaser and supplier. Unless otherwise specified by the purchaser it shall be similar to rosewood and should be uniform.

3.5 General requirements

3.5.1 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.

4. Sampling and acceptance

4.1 **Lot:** All the compreg boards of the same type and size shall constitute a lot.

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

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

4.4 **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.

4.5 **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.

4.6 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.

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4.7 Retest

If any pieces fail to fulfill the test requirements specified under 4.6, double the number of original samples on the basis prescribed under 4.6 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.

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

5. Tests

5.1 The samples shall comply with the requirements given in Table-I.

Table-1

S. No.	Characteristics		Requirements Type-II ($\geq 10\text{mm}$)	Requirements Type-I ($< 10\text{mm}$)	Method of test
1.	Sp. Gravity		1.1-1.25	1.1-1.25	Appendix – A
2.	Water Absorption, Maximum		5.0%	7.5%	Appendix – B
3.	Resistance to boiling water		To pass the test	Not Applicable	Appendix – C
4.	Bending strength (Kg/cm ²) Minimum	Along the grain	1200	1200	IS: 1658
		Across the grain	600	600	
5.	Resistance to impact		To pass the test	Not Applicable	Appendix – D
6.	Resistance to chemicals		To pass the test	To pass the test	Appendix – E
7.	Resistance to ageing		To pass the test	To pass the test	Appendix – F
8.	Resistance to spread of flame		Class A	Class B	Appendix – 4 of UIC-564-2 OR
9.	Deterioration of visibility due to smoke		Class A	Class A	Appendix – 15 of UIC-564-2 OR
10.	* Limiting Oxygen Index		Minimum 35	Minimum 30	IS: 13360 Part-6, Section-19
11.	Toxicity		Less Than 1	Less Than 1	NCD – 1409
12.	Heat Release Rate (MARHE i.e. Maximum Average Rate of Heat Emission in KW/m ²) as specified in EN 45545-2:2013		** R1 (HL3)	R1 (HL3)	ISO 5660-1: 50 KW/m ²

* The material will be tested on its original thickness.

** The method of testing to be carried out as per R-10 and properties will be HL3 as per R1.

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5.2 No. of Test: -

All the tests given in Table – 1 except Resistance to ageing ~~and Toxicity~~ shall be carried out on each lot. The test for Resistance to ageing ~~and Toxicity~~ is type test and shall be carried out once in six months.

5.3 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.

6. Marking

6.1 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 of manufacturer
- (ii) Month & year of manufacture
- (iii) Batch number

7. Warranty

7.1 The warranty period will be 84 months from the date of supply or 72 months from the date of fitment of the Sheets. In case Sheets cracks / breaks / delaminated within the warranty period, it shall be replaced by new one without any cost.

8. General

8.1 ~~Following shall be applicable when this item appears in RDSO's vendor directory:~~

~~“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”.~~

8.2 ~~The Govt. of India policy on ‘Make in India’ shall apply.~~

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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:

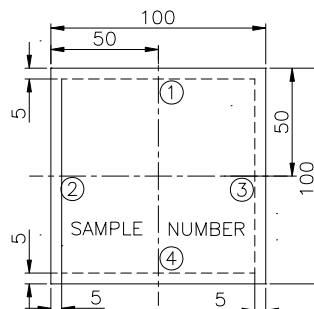
Specimen of size 50mm X 50mm X t* with cut edges, shall be weighed and kept suspended in distilled water at the temperature of 27 ± 1 °C for 24 hrs. It shall then be removed, surface and edges dried in folds of blotting paper and weighed. Increase in weight expressed, as percentage of original weight shall give water absorption. Water absorption shall not be more than 7.5% for type-I and 5% for type-II.

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.

This test is applicable for type II only.



ALL DIMENSIONS ARE IN MILLIMETERS

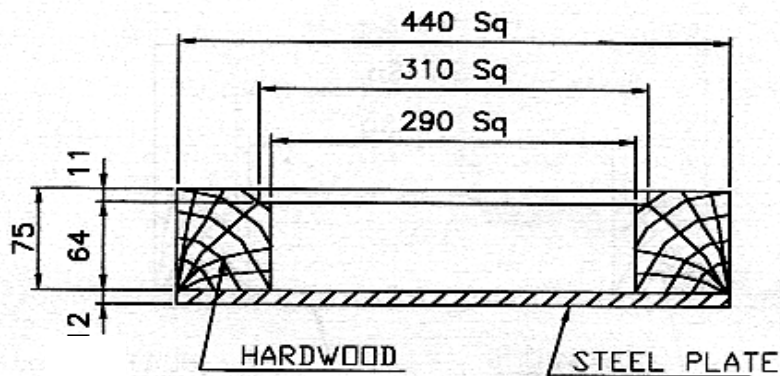
Fig.1

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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 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.



All dimensions in millimetres.

Fig.2

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 24 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) &
- (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.

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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 ±1 deg.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* = refers to thickness of the actual component in mm.

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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 four daylight heavy duty hydraulic hot press to manufacture floor boards of final size 2850 mm x 1220 mm x 12 mm with adequate margin of trimming. The press should have heating and cooling facilities with temperature, pressure and time control.
- 1.1.6 ~~Firm should have 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 the veneer.
- 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 lathe, drilling machine etc. for minor repair of machineries.
- 1.1.10 The firm should have weighing machine, platform type, for measuring up to 1000 kg. of weight.

1.2 Testing Facilities: - The firm should have the following testing 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 electronic 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.

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1.2.4 The firm should have one ~~universal testing machine of 10t capacity testing equipment for Bending strength test as per IS 1658.~~

1.2.5 The firms should have facility for impact testing as per Appendix 'D'.

1.2.6 The firm should have a chemical laboratory for conducting test to Resistance to chemicals as per Appendix 'E' of this STR.

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.

1.2.9 The firm should have in-house testing facility for conducting the test for Resistance to spread of flame as per Appendix – 4 of UIC – 564-2 OR, Deterioration of visibility due to smoke as per Appencix-15 of UIC 564-2 OR, Limiting oxygen index as per IS: 13360, Part-6 Section 19 and Toxicity as per Naval specification No. NCD 1409 and Heat release rate (HRR) as per ISO 5660-1.

1.2.10 The firm should have the following instruments:

- a) Vernier caliper with digital display
- a) Micro meter with digital display
- b) Moisture meter with digital display
- c) Thermometer with digital display
- d) Hydrometer
- e) Measuring scale
- f) Measuring tape

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

1.2 QUALITY CONTROL REQUIREMENTS

1.3.1 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.

1.3.2 It should be ensured that there is a QAP for the product detailing 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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- 1.3.3 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.
- 1.3.4 the firm should 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.
- 1.3.5 The firm should have acquired ISO: 9001- ~~2000~~ 2015 (or 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.
- 1.3.6 The Quality manual of the firm for ISO: 9001- ~~2000~~ 2015 (or latest) should clearly indicate 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 stages and it is documented.
- 1.3.8 The firm should ensure that latest version all the relevant specifications, IS standards are available with the firm.

1.3 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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