



**HONEYCOMB
INTERNATIONAL INC.**



● Core Specification

: This specification covers all metallic Honeycomb Floor Panels (This has been prepared as an equivalent to Boeing specification BMS-4-10N).

- a) Metetrial 3003- -Aluminum Foils
- b) Aluminum Foil Thickness .068mm
- c) Cell size 6.3mm
- d) Core Density 85-100 kg/m³

● Panel Specification

(Equivalent to Boeing BMS-4-10N Specification)

- a) Panel Thickness 10.4 mm
- b) Face Sheet Aluminum Alloy 202-T3(USA)
- c) Face Sheet Thickness:
 - i) Top Sheet .6 mm
 - ii) Bottom Sheet .35 mm

● Face Material

: For both top and bottom face, material specified in Section -2 shall be used.

● Sandwich Construction

BEAM TYPE	MAXIMUM FORCE V	MAXIMUM BENDING MOMENT M
SPAN LENGTH - CENTER LOAD	P/2	PL/8
SPAN LENGTH - CENTER LOAD	P/2	PL/12
SPAN LENGTH - CENTER LOAD	P/2	PL/4
SPAN LENGTH - CENTER LOAD	P/2	PL/8
SPAN LENGTH - CENTER LOAD	P	PL/2
SPAN LENGTH - CENTER LOAD	P	PL
SPAN LENGTH - CENTER LOAD	P	PL/3
SPAN LENGTH - CENTER LOAD	SP/8	PL/8

Deflections are testing, actual deflections should be multiplied by ten.

● 5.1 Weight

: Kg/mf² : 3.42 Lb/ft² : 0.80

● 5.2 Panel Thickness:

- i) Determine the thickness in accordance with ASTM C366 [Substitute the word 'Panel' for 'Core']
- ii) Measure the thickness around periphery as inward as possible with the tester.

● 5.3 Warpage

: When tested in accordance with section 6-3 of the panel shall not exceed 0.635 mm (0.025 in) per 305 mm (12in) of panel length or width.

● 5.4 Peel Strength

: When tested in accordance ASTM1781 of the minimum 5 specimens tested at least 3 individual peel values shall not be less than 23.1 kg-mm [15lb-in] per 76 mm [3 in] width.

Peel Climber: [Kg cm]: 36.88

● 5.5 Resistance to Water Absorption

: After immersion in water in accordance with Section 6.3 the minimum peel strength value shall not be less than 70% of value reported in Section 5.4.

● 5.6 Core Flatness

: The test shall be carried in accordance with ASTMC 366. The bonding face of the core shall be flush within .5mm [.02in] across the splice for the full length of splice.

● 5.7 Core Shear Strength

: Test shall be carried out in accordance with MIL-STD 401 core shear in bending. Use a span of 305 mm (12") with quarter point loading.

b) Short Beam Shear Strength kg/mm²: 0.173 Lb/in²: 246.0

● 5.7 Core Shear Strength

- : Test shall be carried out in accordance with MIL-STD 401 core shear in bending. Use a span of 305 mm (12") with quarter point loading.
b) Short Beam Shear Strength kg/mm²: 0.173
Lb/in²: 246.0

● 5.8 Long Beam Bending

- : Test shall be carried out in accordance with MIL-STD 401 Flexure of 508 mm [20"] long specimen with quarter point loading a cross head speed of 12.5mm [.5"]/minute. Specimen width shall be 76mm + _ 1.3mm (3"+- 0.05").
b) Flexural Strength. Kg/cm²: 28.39
Lb/in²: 41*103

● 6. Material Test Methods

- : All tests are carried out at ambient room temperature [16c to 29c]

● 6.1 Panel Weight

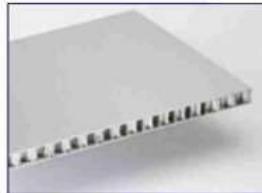
- : i) Weight the panel on a scale accurate to 4.5 gms (0.01-lb) and record the weight.
ii) Determine and record the area of the panel in mtr²(lb/ft²).
iii) Determine and record the weight in kg/mtr² (lb/ft²).

● 6.2 Warpage

- : i) Place the panel on flat, rigid surface with concave side up.
ii) Place straight edge across the concave side of the panel, from one edge to the other. The straight edge shall extent not more than 1.3 kg[3lb] per 305 mm[12"] of the panel width [the dimension perpendicular to the edge of the straight edge].

● 6.3 Resistance to Water

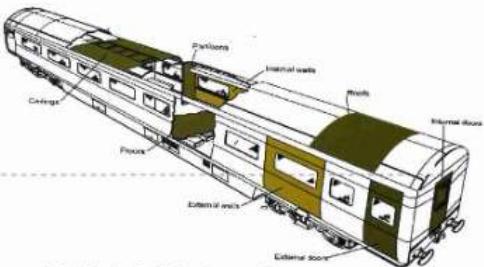
- : i) Five transverse and longitudinal each of peel test specimens (to the dimension specified by ASTMD 1781) shall be submerged in distilled water at 21C to 26.6 for 30 Days + - 2 hours. The depth of the water above the specimen shall not be more than 25 mm (1"). The specimens shall then be removed, blotted dry and tested for peel strength in accordance to section 6.4 within 6 hours after removal from water.



HONEYCOMB Sandwich Structural advance concept in Railway Industry for A/C Coaches

● A. Core Specification:

1. Material : 3003 + Aluminum Foils.
2. Aluminum Foil Thickness : 0.068 mm
3. Cell size : 6.3mm
4. Core density : 85-100 kg /m³.



● B. ADHESIVES :Aircraft Quality 'Epoxy' adhesives are used.

Specification

- a) Viscosity at 20 deg c: 1400
- b) Shear Strength after curing (24 hours at 1200c) 3.0 kg/ mm².
- c) After curing in water at RT for 10 days: 2.6 kgf/mm².

C. Panel Specification

- a) Panel Thickness :20MM, SIZES:As per drawings.

- b) Face Sheet : HPL Sheet

- c) Colour : Suede Finish of shade

- d) Face Sheet Thickness

- i) Top Sheet : 1.6mm
- ii) Bottom Sheet : 1.6mm

- e) MFG. Card No. : 2531 of M/s. Golden Laminates Limited, Chandigarh.

● **D. HPL Sheet Specification**

Sl. No.	Test Conducted	Specified Values	Observed Result
1.	Immersion in Boiling water	11.5%	3.52%
a)	Increase in thickness	Shall not be visible	No blistering
b)	Blistering & Delamination		
2.	Flame Test	30 second Max.	25 second.
3.	Flexural Strength	80 MPa Min	110 MPa

● **E. Panel Strength (MIL-STD-401B)**

- a) Compression (Stabilised)
(Distributed load): 9.6 Mpa.
- b) Peel Strength (Metallic): 36.88 Kg / Cm.

ALU Honeycomb Panels used as Partition Walls, Flooring in Railway Interiors

● **Advantages Of Honeycomb in Railway coaches are :**

- | | |
|---------------------|-----------------------------------------------------|
| Very Low Weight | - Reduces Fuel Consumption /Reduces Wear & Tear |
| High Stiffness | - Reduces/ Eliminates supporting framework. |
| Improved appearance | - Smooth surface & allows use of decorative sheets. |
| Long life | - Excellent fatigue & corrosion Resistance. |
| Safety | - Fire resistance. |
| Rapid Fitting | - Modular Construction & Interchangeable. |
| Versatile | - Wide range of Shapes feasible. |

Honeycomb International Inc. sandwich structures which are used in modern train construction, provide significant cost reductions. The reduction in the weight of the frame allows high speeds, whilst reducing energy consumption. It also allows a low center of gravity, giving enhanced stability and reduces the starting and stopping inertia. The high stiffness of the materials means that supporting framework becomes unnecessary, increasing the passenger room in the train. The railway coach partitions which are made from panels, are quick to fit and interchangeable. Therefore if there is any damage to the panels they can be replaced easily. The use of Honeycomb Structures allows for higher speed, improvements in ride comfort, ease in maintenance, reduction of energy consumption, effective manufacturing cost.

Research and Development

Honeycomb International Inc maintains research & development facilities, including highly trained and experienced professionals formerly headed by Mr. B.M Rakshit who was a design structures engineer on Super Sonic Aircraft "Concorde" at British Aircraft Corporation, Bristol, England. Later stages handed over to the next generation team headed by Mr. Pramod KR, BE, Senior Architect holding a modern design experience working with Global Clients, bought a lot of innovative thoughts and belief in automation is key to success in the Indian manufacturing sector, along with Mrs. Kushal Ramesh (BE, MS [US]) holding strong knowledge on the supply chain management while having work experience in Ford United States, and Mr. Manish Ramesh (BBM, MBA) who always believe and work towards Client success and believe in Agile methodology in all the project deliverable.

Technologies and Processes allied to the development of Honeycomb sandwich construction such as resin and adhesive utilization, foil printing, and resin impregnation of synthetic fibres, are subject to constant study and advancement by the company's research and development staff, Generally, Honeycomb International Inc Solicit to act as a source of supply for Finalised Honeycomb sandwich structures for its customers, assisting them needed in the adoption of lightweight structural concept to customers manufacturing operations and product design.



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