Date: 10-09-2025

ADDENDUM -3

BEML SRM Tender Ref : 6300039843 dated 14/08/2025

Tendered Item : EXTERNAL COVERS / CLADDINGS

Project : Standard Gauge High Speed Train Project.

1) Revision in Procurement Technical Specification of Underframe External cover/Cladding. Revised PTS document No: FPIIC/TD/057 **dated 10/09/2025 (Rev. No. 01)** is enclosed.

2) Tender closing date for the above tender extended **from 10.09.2025 @ 15:00 HRS to 17.09.2025 @ 17:00 HRS**

TRAIN B28

High Speed Rail Project
Procurement Technical Specification of Underframe External cover/Cladding

Approved	10-09-2025	Mahanthesh G M	
Reviewed	10-09-2025	Krishna Prasad B N	
Prepared	10-09-2025	Santosh Kumar S	
	Date	**Name**	**Signature**

REVISION HISTORY:

Rev. No.	Clause No.	Page No.	Changes	Revision Date
Nil	-	-	First Issue	28-07-2025
01	4 (vi), 6.1 (v), 7.2(v, vi), 7.3(iv, v) ,7.9(ii, iii) , 8.4 (ii) & 11	8, 10,15 ,17, 22, 23,28	Density values are updated, R1 changed to R7, and bottom panels structural details added. Fig. 5 & 6 added. Changes are made ITALIC	10-09-2025

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1. Introduction

1.1. General

(i) This document specifies the technical requirements of underframe External Cover/Cladding to be supplied for High speed 8 car Trainset (Chair car) designed to operate at 249 kmph and test speed of 280 kmph. External Cover/Cladding shall comply in all respects to this PTS. BEML will carry out all required works and activities as Contractor to the Employer for this project, while the subcontractor shall be responsible for all works required in this PTS with regard to External Cover/Cladding and shall be responsible for supporting the BEML activities as contractor for ICF project.

(ii) BEML will carry out all required works and activities as Contractor to the Employer for this project, while the subcontractor shall be responsible for all works required in this PTS with regard to External Cover/Cladding and shall be responsible for supporting the BEML activities as contractor for ICF project.

(iii) The scope of work covers design, development, tooling, manufacture, testing, supply of the External Cover/Cladding and the training of Operation and Maintenance personnel of the NHSRCL/ICF on the External Cover/Cladding. Also, includes all items of work which will be required to meet the performance requirements, reliable and efficient operation of trains and meeting the best international practices even if not specifically mentioned in this PTS.

1.2. Trainset Configuration

The trainset configuration (tentative) is as follows:

For 8-Car formation: 2 basic units, each unit consisting of 4 cars.

* DTC1 + MC1 + TC1(PRM)+ MC1 + MC1 + TC2(Ex)+ MC1 + DTC2 *

DTC1/DTC2: Driving Trailer Car,

MC1: Motor Car,

TC1(PRM): Trailer Car with PRM seat

TC2(Ex): Trailer Car (Executive Car with PRM)

“ * “: Automatic Coupler

“ + “: Semi-permanent Coupler

2. General Requirements

2.1. Climatic and Environmental Conditions

The car shall operate reliably and safely under the climatic and environmental conditions as specified below. Accordingly, the External Cover/Cladding 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 5 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^3.
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/m2. [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: • In the event of flooding at any level below Rail Level, the Train shall operate in full compliance with these Specifications and Standards. • In the event of flooding at a height between Rail Level and 50 mm above Rail Level, the Train shall operate in full 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. 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.
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

[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 subcontractor 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.

2.2. Performance Requirements of Train

The performance requirements of the train shall be governed according to following table.

Item	Values
Maximum operational speed during service	249 kmph
Maximum Design speed	280kmph
Minimum deceleration during full service braking followng jerk limit as specified	0.8 m/s^2
Maximum deceleration at any speed	1.2 m/s^2
Jerk rate (Maximum)	0.7 m/s^3 during full service braking (for all speed range) 1 m/s^3 during emergency braking (for speeds >10kmph)
Averaage running distance of a rake	2,000 km/day

3. 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 External Cover/Cladding for High speed 8 cars project.

(iv) **"Subcontractor"** means the Subcontractor who supplies the required External Cover/Cladding to BEML for High-speed Rail project. Subcontractor shall carry out the works in accordance with this PTS with regard to External Cover/Cladding.

(v) "**Contract**" means the contract between Subcontractor and BEML in relation to the supply of External Cover/Cladding 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.

3.1. Abbreviations

ICF: Integral Coach Factory, Chennai, Indian Railways

NHSRCL: National High Speed Rail Corporation Limited

4. Qualification Criteria

(i) Subcontractor shall be an Original Equipment Manufacturer (OEM) of GFRP Honeycomb sandwich/ semi-sandwich panels, preferably with glass epoxy laminates or Epoxy Aluminium honeycomb sandwich panels or any other suitable light weight material (proposed by supplier) for high-speed train (Test speed of 280 kmph and operating speed ≥ 250 kmph) underframe External Covers/cladding panels, having experience in design, manufacturing and testing of such panels.

(ii) Subcontractor should have supplied underframe external covers/cladding and locking system which is proven to withstand the pressure loads acting on covers at test speed of 280 kmph, supporting documents for the same shall be submitted along with technical offer.

(iii) The sub-contractor shall have manufactured and supplied GFRP Honeycomb sandwich/ semi-sandwich with Epoxy Aluminium honeycomb sandwich covers or Epoxy laminate covers or any other suitable light weight materials for underframe external covers, such supplies should have been in use and have established their satisfactory performance and reliability in train set operating at speed of 250kmph and above, in at least **two projects** for minimum 3 years prior to the bid opening date.

(iv) Satisfactory revenue service performance certificates for a period of 3 years or more from high-speed train operators/rolling stock manufacturers for the above shall be submitted along with the technical offer.

(v) The subcontractor shall have in-house manufacturing and testing facilities for all the parts including the big parts like side skirts, front panels, bottom panels and bogie covers. The details of the company profile, infrastructure details including paint booth and testing facility details shall be submitted along with the technical offer. The Subcontractor shall have NABL accredited in-house testing facility or can avail services from any NABL accredited laboratory/testing facility.

(vi) The density of Epoxy laminate covers supplied above shall be approximately 1.8 ± 0.1 g/cm3 and for Epoxy Aluminium honeycomb sandwich covers shall be approximately 0.4 ± 0.05 g/cm3 or any other suitable material proposed by subcontractor shall be light weight and have high strength to weight ratio.

(vii) The subcontractor shall hold ISO 9001/ IRIS certification and shall manufacture the products accordingly. The subcontractor shall submit QAP, ITP, company profile with infrastructure facilities, product range etc, along with technical offer.

(viii) The subcontractor should undertake to provide the support during Testing & Commissioning, service trials and revenue service either by themselves or through sister company or a partner in India. The subcontractor shall submit detailed proposal in this regard.

(ix) The firm should give an undertaking to supply spares for a minimum period of 15 years from the date of commercial operation of each trainset.

5. Applicable Standards

The design, testing and manufacturing of the external Cover/Cladding shall conform to the latest editions of internationally recognized Standards viz., Indian, American, European, Japanese, ISO, etc. Subcontractor shall accord to following standards as a minimum.

Sl No	Standard No./ Code No.	Title
1	EN45545-2	Railway applications - Fire protection on railway vehicles
2	EN 12663-1:2010+A1:2014	Railway applications - Structural requirements of railway vehicle bodies - Part 1: Locomotives and passenger rolling stock (and alternative method for freight wagons).
3	ASTM D 638	Standard test method for tensile properties of plastics
4	ASTM D 790	Standard test methods for flexural properties of unreinforced and reinforced plastics and electrical insulating materials
5	ASTM D 695	Standard test method for compressive properties of rigid plastics
6	ASTM D 5420	Standard Test Method for Impact resistance of flat, Rigid plastic specimen by means of striker impacted by falling weight (Gardener impact)
7	ASTM D 1781	Standard Test Method for Climbing Drum Peel for Adhesives
9	ASTM C 393	Standard Test Method for Flexural Properties of Sandwich Constructions
10	EN17460	Railway applications - Adhesive bonding of rail vehicles and their components
11	IEC 61373	Railway applications- rolling stock equipment -Shock and Vibration test
12	ISO 2813	Paint and varnish gloss level determination.
13	ASTM D2563	Standard Practice for Classifying Visual Defects in Parts Molded from Reinforced Thermosetting Plastics
14	ASTM C 365	Standard Test Method for Flatwise Compressive Properties of Sandwich Cores
15	EN 15085	Railway applications - Welding of railway vehicles and components
16	JIS G4305	Cold-rolled Stainless Steel Plate, Sheet And Strip.

6. Design Criteria

6.1. External Cover/Cladding

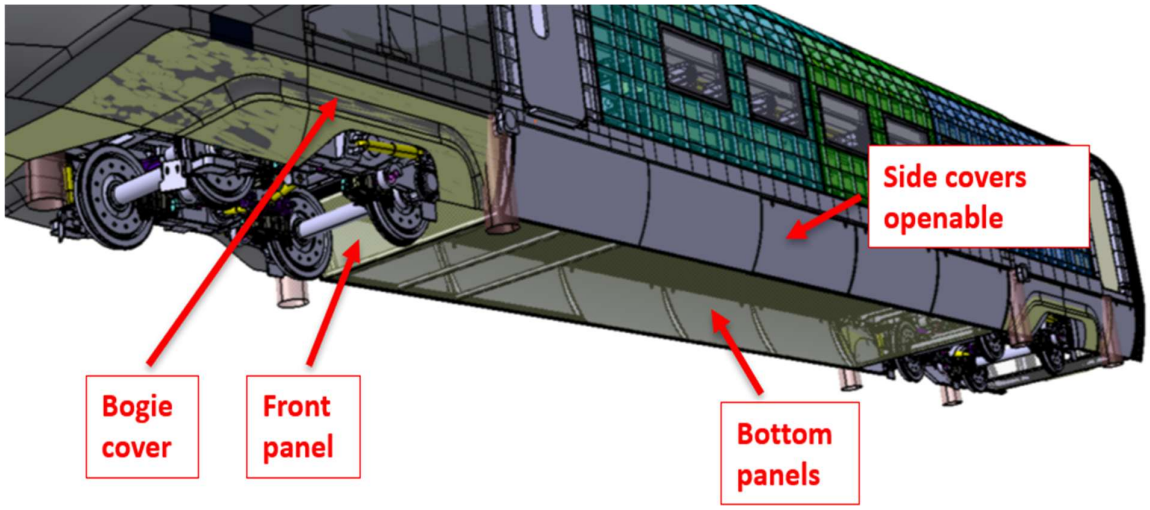


Figure 1: Different types of External Covers/ Cladding panel

The sub-contractor shall comply with the following Design criteria:

(i) The External Covers/Cladding shall be Best-In-Class and shall be equivalent to latest High-Speed Trainsets running globally.

(ii) The exterior covers/cladding shall incorporate a modern aesthetic approach with considering safety , security and minimal noise due to vibrations.

(iii) All External Cover/Cladding surfaces shall be robust, slow ageing properties to provide a pleasant appearance, resistant to physical damage by vandalism, fading, scouring, acid etching, and shall be easy to clean and maintain. No material shall degrade or stain when exposed to food, drink, graffiti, or any cleaners used by the Maintenance Personnel. No material shall produce any odour that would be noticeable or irritating to passengers.

(iv) External Cover/Cladding shall be designed to withstand static pressure loads of negative -6200 (Pa) and positive 2900 (Pa), also to withstand fatigue pressure loads of ± 1605 (Pa).

(v) The density of Epoxy laminate covers supplied above shall be approximately 1.8 ± 0.1 g/cm3 and for Epoxy Aluminium honeycomb sandwich covers shall be approximately 0.4 ± 0.05 g/cm3 or any other suitable material proposed by subcontractor shall be light weight and have high strength to weight ratio.

(vi) All External Cover/Cladding surfaces shall be hard wearing, resistant to physical damage by vandalism, fading, scouring, acid etching, and shall be easy to clean and maintain.

(vii) All External Cover/Cladding surfaces shall be smooth finished with modern low flammability, low smoke emission, and low toxicity materials. Proposed materials shall conform to EN 45545-2 for HL2 requirement.

(viii) All non-metallic materials used in the External Cover/Cladding shall satisfy the fire property requirements specified in EN 45545-2, for HL2 requirement.

(ix) All External Cover/Cladding shall conform to ASTM D2563- level 1 standard (if applicable). The colour of painted surface shall not fade or discolour with time or change due to rubbing.

(x) Sub-contractor shall submit details of processes and raw materials proposed to be used in manufacturing of External Cover/Cladding for approval of BEML during design stage.

(xi) Sub-contractor must furnish details for different type of panels of External Cover/Cladding but not limited to properties such as Glass Content, Ultimate Tensile Strength, Tensile Modulus, Ultimate Flexural Strength, Flexural Modulus, Compression Strength, Compression Modulus and Impact Test complete with the test methods in compliance of relevant ISO standards.

(xii) The design should be such a way that there shall be no visual screws.

(xiii) It should be possible to easily remove the covers for maintenance without any tool requirement.

(xiv) The External Cover/Cladding should be tightly secure by enough brackets so that there shall not be any drumming sound and vibrations during run.

(xv) Fitment should be simple and should take care of variations in the shells i.e the fixing brackets shall have the adjustability.

(xvi) All inspections doors shall be designed with concealed aluminium extrusion hinge profiles or any other hinges and locks which is capable of withstanding pressure loads acting on these covers of proven make from – Cohama/ South Co / Dirak / Sugatsune. If any other make is being used it shall be approval of BEML design. Such alternatives will only be accepted if they are type tested products with proven reliability records.

(xvii) Suitable rubber profiles shall be suggested by the suppliers for External covers application.

(xviii) External Cover/Cladding detail designing developed by the subcontractor will be reviewed by BEML/ NHSRCL/ICF for approval. Remarks given by BEML/NHSRCL/ICF will be incorporated by the contractor.

(xix) All the External Cover/Cladding shall be made from GFRP Honeycomb sandwich/ semi-sandwich with Epoxy Aluminium honeycomb sandwich and Epoxy laminate material any other suitable material proposed by subcontractor as per the concept design to avoid any undulations occurring during the revenue services. Final approval will be taken from BEML.

(xx) All the material shall be as per the concept design. Subcontractor shall modify/ implement the changes without any additional cost.

6.2. Maximum Speed

This trainset is designed to operate at a maximum service speed of 250 kmph and test speed of 280 kmph, Hence, all External Cover/Cladding shall be designed to withstand the following dynamic conditions of the running train.

a) Tolerance of Vehicle dimensions,
b) Tilting due to cant,
c) Vehicle roll and Vehicle bounce,

6.3. Design Life

The Train are designed for a life of 30 years. Throughout the design life of 30 years, the External Cover/Cladding material shall not degrade or be etched by the environmental conditions that exist in India, to the extent that the original appearance does not deteriorate to the extent that it cannot be restored by normal cleaning. Subcontractor shall decide cleaning process and cleaning agent accordingly.

6.4. General safety requirements

The Train shall present a safe, hazard-free environment to users, crew members and the general public. Users and crew shall not be exposed to tripping hazards, exposed electrical voltage, toxic materials or similar hazards. Normal and emergency equipment and controls which the users or crew may operate, shall be clearly identified, and operating procedures shall be presented in both text and graphic formats. Passenger emergency signs shall also be embossed in Braille raised typeface.

6.5. Environmental Protection

The materials likely to cause environmental damage during the manufacture, maintenance, operation and disposal of Train shall be avoided. The material listed in this Clause are a minimum list of restricted material and the Subcontractor shall provide adequate evidence to the Purchaser that all materials used shall not cause environmental damage. The material viz. asbestos; chlorofluorocarbons; polychlorinated biphenyls; Exposed lead and paints containing lead; chromates; cadmium, except in nickel cadmium batteries; and cyanide shall not be used. Use & disposal of all material should be governed by norms set by Government of India (Central Pollution Control Board). No chemicals or materials mentioned in the UNIFE Railway Industry Substance List (RISL) for prohibited chemicals, Restriction of Hazardous substances Directive (RoHS), Regulation, Evaluation, Authorization and Restriction of Chemicals (REACH) shall be used.

7. Technical Requirements

7.1. Side Covers (Openable & Fixed cover)

(i) Side covers shall be of openable type and fixed type, refer to the layout drawings enclosed as attachments for details regarding to location, dimension and quantity of these covers.

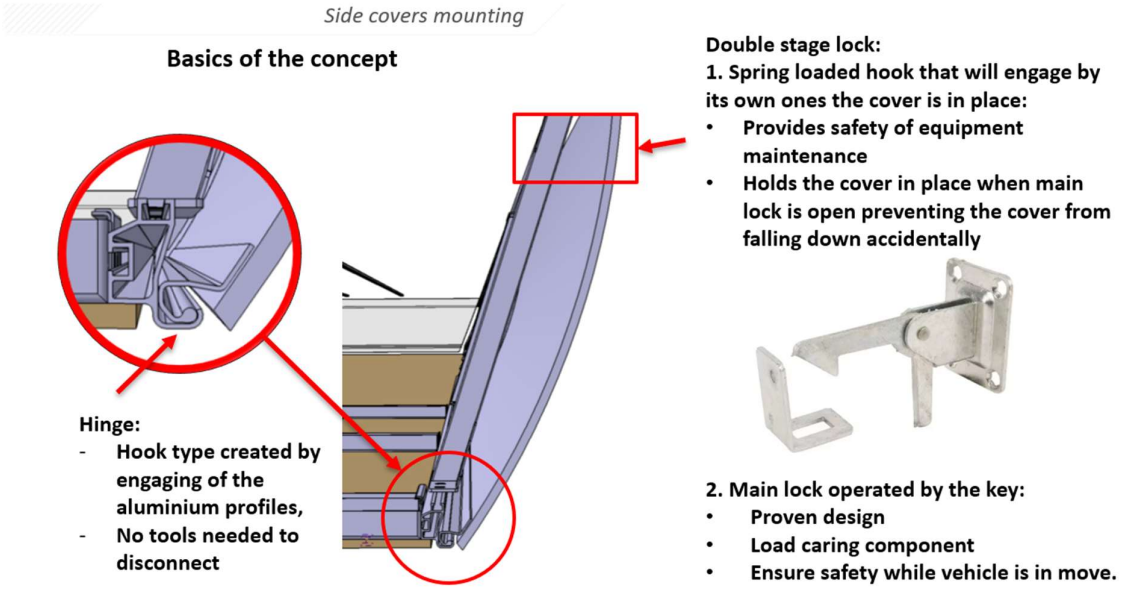
(ii) Side cover of fixed type shall be mounted using fasteners and will not be removed for regular maintenance activity, whereas openable type side cover shall be provided with hinge and locking mechanism.

(iii) The side cover and locking mechanism shall be designed to withstand the pressure load specified in the clause-6.1(iv).

(iv) Epoxy Aluminium honeycomb/ Epoxy laminate or any other suitable material and thickness shall be proposed by the subcontractor to meet the design criteria specified at clause 6.1(iv).

(v) Subcontractor may propose or change the dimensions of these covers based upon their manufacturing feasibilities and easy handling during maintenance activity.

(vi) Side covers opening and dismantling concept is shown below. Subcontractor shall adopt below concept for opening, locking and removal of side cover or may propose suitable proven opening/locking and removal mechanism.



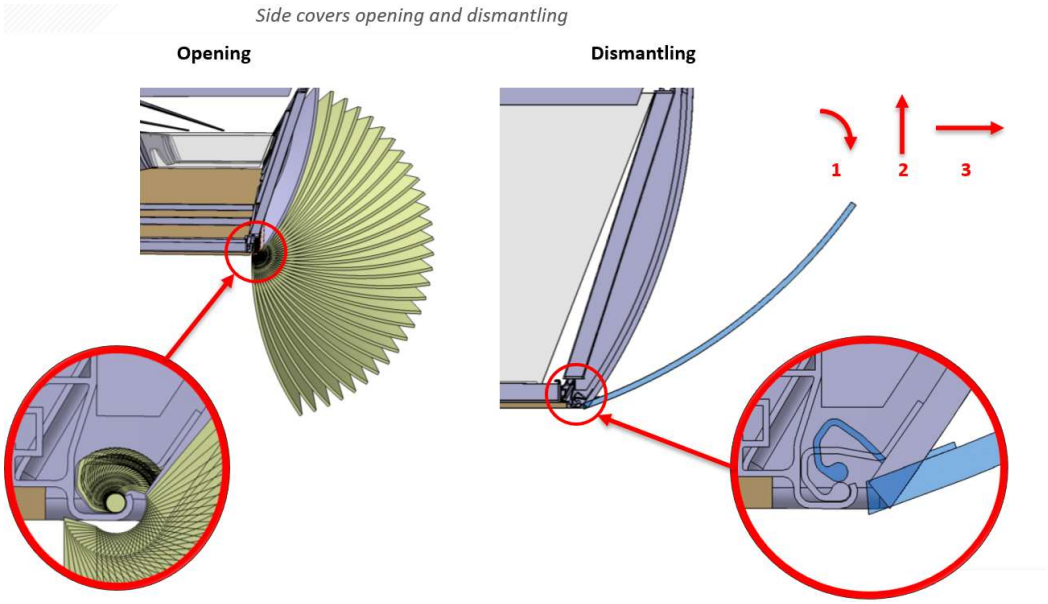


Figure 2: Side Covers mounting, opening and dismantling

(vii) The double stage locks/main lock shall be openable by special key and by authorized personal only. Main lock / Double stage lock shall be procured from proven make of Cohama/ South Co / Dirak / Sugatsune. If any other make is being used, approval shall be obtained from BEML design team.

(viii) Design shall require no tool requirement for dismantling the covers for Car body frames. It shall be easy to disconnect and assemble as and when required for maintenance and service.

(ix) Subcontractor shall propose suitable design or concepts on these openable covers to meet these air intake with integrated mesh filters requirements based on their previous experience and manufacturing feasibilities.

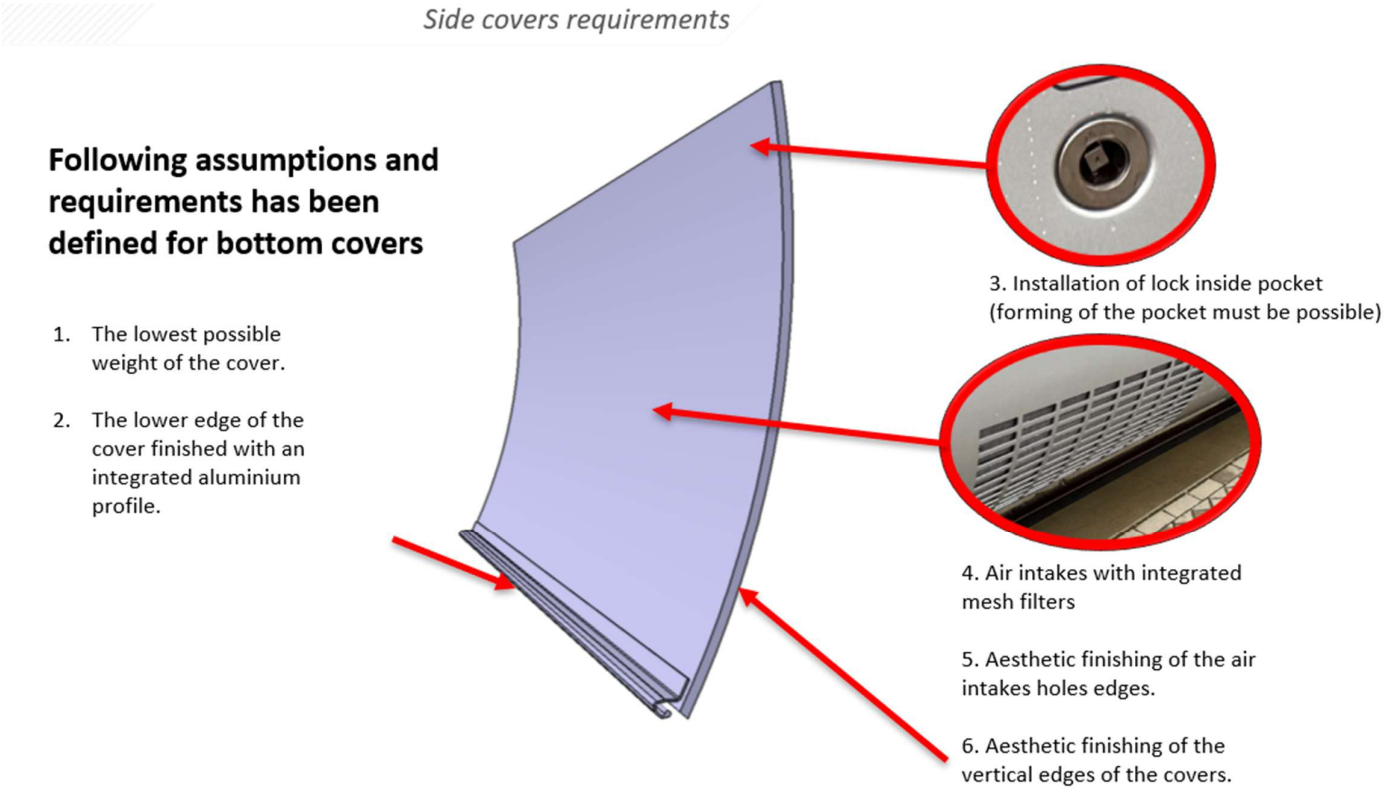


Figure 3: Side Covers requirements

(x) Suitable stiffener to provide rigidity for side cover shall be proposed by the subcontractor based upon strength criteria, if required.

(xi) Subcontractor shall ensure smooth opening and closing operations of these covers and no squeezing or metal rattling sounds shall be observed while train is running.

7.2. Front and Bottom panels

(i) Epoxy Al honeycomb/ Epoxy laminate or any other suitable material and thickness shall be proposed by the subcontractor to meet the design criteria specified at clause 6.1(iv).

(ii) Front and Bottom panels shall be impact-resistant panels, these covers shall be designed to avoid damage from stones and any other object hitting these panels.

(iii) Subcontractor may consider the below shown concept for mounting of front and bottom panels or may propose fixing methodology of these panels with Car body frames according to proven design, manufacturing feasibilities and strength criteria.

Bottom/front panels requirements

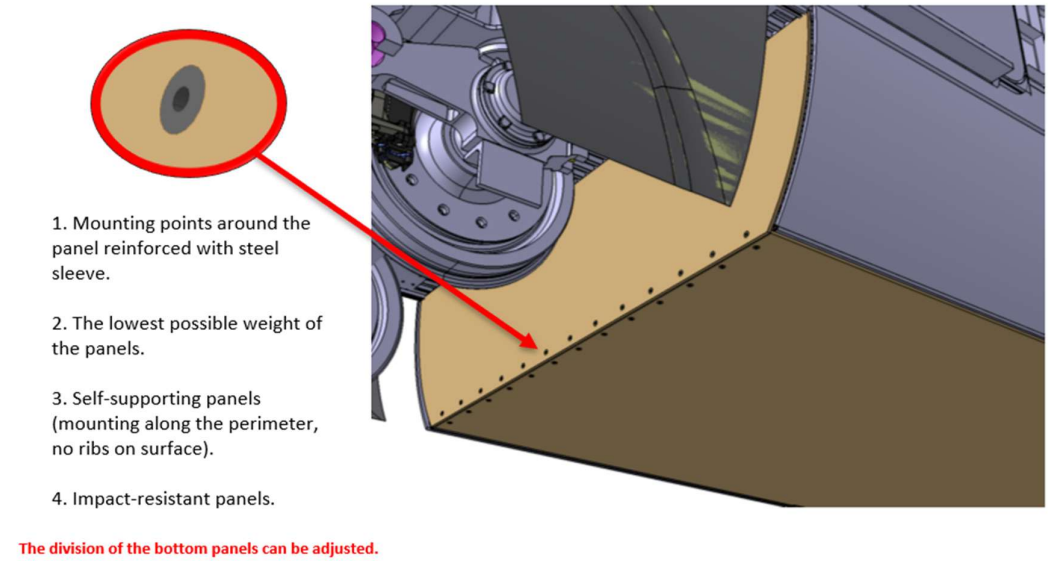


Figure 4: Front and Bottom Panel requirements

(iv) Number of divisions of these panels can be adjusted based upon manufacturing feasibility and easy handling.

(v) Bottom panels shall be provided with structural frames for rigidity to withstand the pressure loads specified at clause 6.1 (iv) and Aluminiuml extrusion shall be provided at the corners of each panel to fix with car body structure and also to mount side skirt hinge profiles. Additional structural frames may be provided as stiffeners, if needed (based on FEA analysis).

(vi) Materials for structural frames shall be proposed by the sub-contractor to withstand the pressure load criteria specified in clause 6.1(iv).

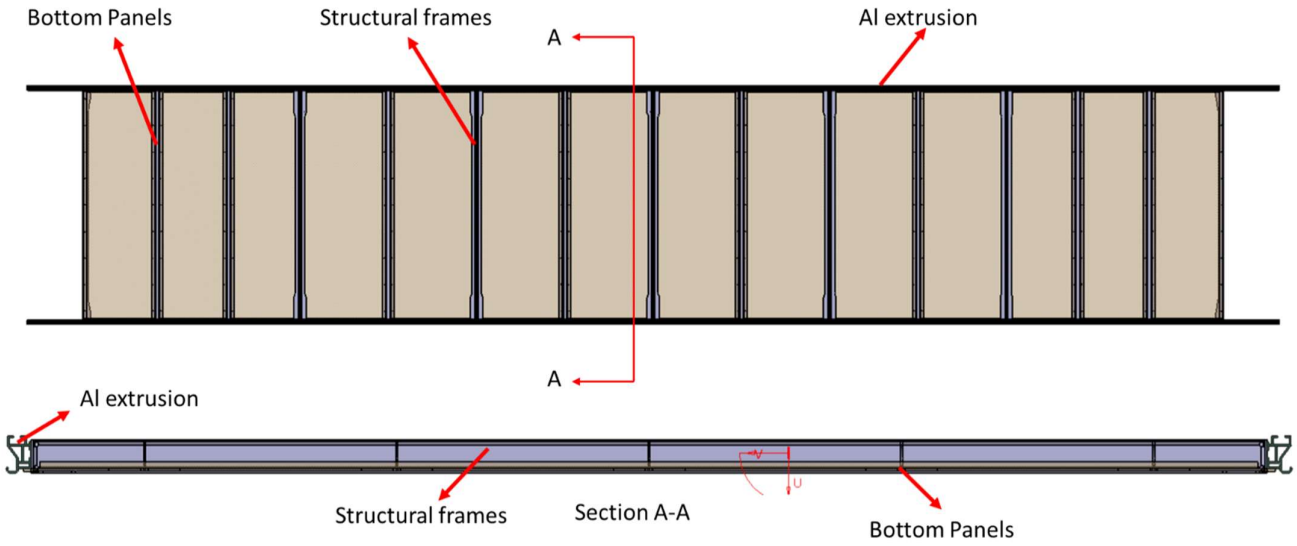


Figure 5: Detail view of Bottom panel requirements

7.3. Bogie covers

(i) Epoxy Al honeycomb/ Epoxy laminate or any other suitable material and thickness shall be proposed by the subcontractor to meet the design criteria specified at clause 6.1(iv).

(ii) Bogie covers shall be in uniform with nose cone profiles and subcontractor shall ensure rigidity of the covers by proposing suitable metal stiffener or any other suitable material proposed by subcontractor for stiffness of these covers.

(iii) Subcontractor may propose fixing methodology of these panels with Car body frames according to proven design, manufacturing feasibilities and strength criteria

(iv) Stiffener/Reinforcement may be provided for strengthening Bogie covers, if required (based on FEA analysis) and mounting brackets shall be provided to integrate bogie covers with car body structures. Materials for stiffeners and mounting brackets shall be proposed by the sub-contractor to withstand the pressure load criteria specified in clause 6.1(iv).

(v) Subcontractor may propose other alternative methodology or technology for reinforcing the bogie covers matching with profile/contour of 3D model of bogie cover (will be shared during detail design stage).

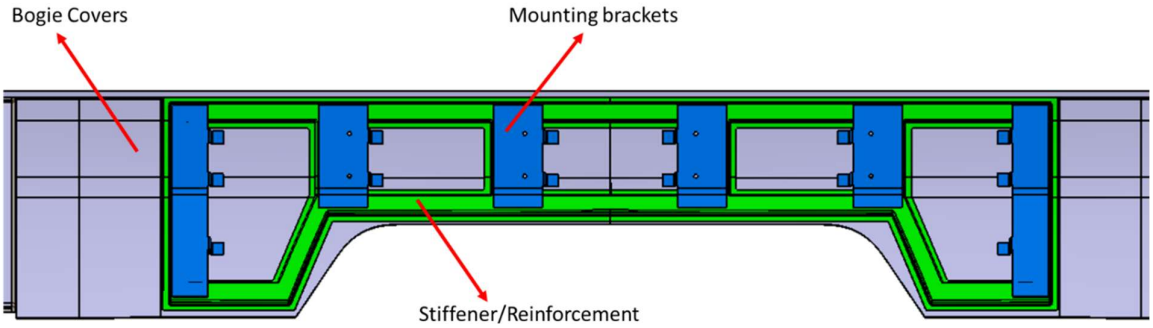


Figure 6: Bracket and stiffener requirement for Bogie covers

7.4. Test requirements for Exterior cover/cladding

Subcontractor shall submit the test requirements of epoxy laminate /epoxy Al. honeycomb panels or for any other material proposed.

The test requirements shall include acceptable values and standards for tensile strength & modulus, flexural strength & modulus, compression strength & modulus, drum peel strength, fire performance test, etc.,

The applicable tests details will be submitted along with technical offer.

7.5. Metal brackets /Metal Nut Inserts

(i) In case, if any metal brackets are proposed for fixing panels on to carbody, such brackets shall strongly bonded/Bolted to panels, preferably in molding stage itself. If not possible, then bonding of metal brackets or any item on the FRP panels shall comply with DIN 6701/EN 17460.

(ii) The metal bracket shall be aluminium or stainless steel or aluminium extrusions based on load bearing application of the such brackets.

(iii) As an alternate method, nutserts can also be used in the panels and shall be designed to withstand the pressure load specified at clause-6.1(vi). The Metal nut inserts shall be of M/s. Southco/ M/s. Cohama make or any proven make shall be supplied.

(iv) The glue for fixing bracket/ metal insert shall be a two-component, 100% reactive, toughened structural methacrylate adhesive suitable for bonding wide variety of metals, thermoplastics, thermosets, and composite assemblies. The adhesive shall offer very strong structural bond between GFRP and metal or metal and metal. The adhesive shall offer extremely durable bonds in harsh environments with excellent weathering properties and bonding shall confirm to DIN 6701/EN 17460.

(v) The Subcontractor shall submit the technical data sheet of metal insert & adhesive and the MSDS of the adhesive proposed to be used for fixing the metal inserts, along with the offer.

7.6. Accessories and fittings

(i) All the fittings including hinges, locks, rubber profiles, brackets, sealants, fasteners, etc required to mount the panels to carbody shall be suitably designed and will be supplied by the sub-contractor.

(ii) All hinges and locks shall be stainless steel and from reputed suppliers namely, Dirak/Southco/Sugatsune/Cohama or any other proven source shall be considered for design will be supplied by the sub-contractor and all the accessories and fittings shall be capable to withstand the pressure loads specified in clause 6.1 (vi) of this document.

7.7. Painting

(i) The exposed surface of the epoxy laminate or epoxy Aluminium honeycomb panel or any other material proposed by the subcontractor shall be painted with paint system proven in High-speed rail application.

(ii) The Subcontractor shall propose the paint system which is proven in high-speed rail Exterior application. The Paint system shall will be with anti-graffiti properties.

(iii) The paint systems shall have excellent substrate and intercoat adhesion, outstanding long term corrosion protection, good resistance to oils and cleaning agents, very high order of abrasion, chip, impact and scratch resistance.

(iv) The paint system shall display a uniformity of colour throughout its service and shall not fade. The paint preparation and finish shall be such as to enable a satisfactory re-coat of part of the vehicle body in the event of localized repair.

(v) The paints shall withstand frequent use of various cleaning products (alkaline or acid detergents, petroleum solvents, mechanical action of brushes) without losing their colour or noticeable deterioration of their surface aspect.

(vi) The paint system shall meet Fire safety requirement of EN45545-Part 2, HL2 condition for External Cover/Cladding applications.

(vii) Paint system used for Exterior applications shall have excellent UV and weather resistance characteristics.

(viii) Painted surfaces shall have a service life of at least 15 years.

(ix) The sub-contractor shall submit the details of the Proven Paint system he proposes to adopt and obtain BEML/NHSRCL approval. The details of the high-speed rail project in which the proposed system is used for GFRP and Aluminium honeycomb parts and its satisfactory performance in revenue service shall be submitted.

(x) The supporting mechanical and fire performance test reports for adopted painting system shall be submitted along with offer.

7.8. Painting performance requirements

The paint system shall comply with following mechanical property requirements, as a minimum. However, subcontractor shall propose other suitable painting performance requirements applicable for exterior cover/cladding viz., salt spray resistance, cupping test etc.,

Property	Test result	Standard
Chip Resistance	Class 2	BS AU 148 Part 15
Scratch Resistance	No failure (for 2kg)	BS 3900 Part E2, BS EN ISO 1518:2001
Impact test (Falling ball)	No failure	BS 3900 Part E7/ASTM D 3170
Abrasion resistance	Max 29 mg	ASTM D 4060 CS10 wheel 500 cycles – 1000 gm load
Adhesion	5B	ASTM D 3359 (Method B)
Gloss Level	Semi-gloss/high gloss	BS 3900 D5, EN ISO 2813:2000
Film Hardness	H	ASTM D 3363
Anti-graffiti	Level 8	ASTM D 6578
Acid & Alkali Resist ance	No defect	ISO 2812-3
Accelerated Weathe ring Test (QUV x 500 hrs)	Gloss (60º)>90% DE < 2	ASTM G154
Colour Difference	ΔE< 1	ASTM D 6578

7.9. Fire Safety

(i) The GFRP & Al honeycomb panels shall be selected to reduce to the maximum extent practical the heat load, rate of heat release, propensity to ignite, rate of flame spread, smoke, emission and toxicity of combustion gases.

(ii) The GFRP & Al. honeycomb panels shall comply to fire safety requirements of EN 45545, Category 3 (HL2) *R7* requirements.

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

Property	Test Method	Parameter (units)	Criteria For HL2
Lateral flame spread	T02 ISO 5658-2	CFE kW/m^2	Minimum 20
Heat release rate	T03.01 ISO 5660-1: 50kW/m^2	MARHE kW/m^2	Maximum 90
Smoke generation	*T10.04 EN ISO 5659-2, 50 kW/m^2*	*Ds (4) dimensionless*	*Maximum 600*
Toxicity	*T11.01 EN 17084, Method 1m 50kw/m^2*	*CIT_G dimensionless*	*Maximum 1.8*
Gross Heat of Combustion value	ISO 1716	MJ/ Kg.	Achieved value to be shared in the report format.

(iv) The fire performance deliverables shall be provided in accordance with following table.

Sl. No.	Deliverables	Remarks
1	Fire safety Test Reports including heat release rate and gross heat of combustion as per ISO 1716	As per EN45545
2	Fire safety test reports as per EN 45545 of GFRP Panels/Al. panels supplied to previous projects	To be submitted along with offer

7.10. Noise Attenuation

The noise insulation index (Rw) of the GFRP/ Aluminium honeycomb or any other material proposed by the subcontractor , shall be submitted during the design phase.

7.11. Thermal insulation

The heat transfer co-efficient (U) of the GFRP/ Aluminium honeycomb or any other material proposed by the subcontractor , shall be submitted during the design phase.

7.12. Repair procedure

The subcontractor shall submit detailed repair procedure for epoxy laminate/ epoxy Aluminium honeycomb panels or any other material proposed by the subcontractor along with technical offer.

7.13. Workmanship and Finish

The subcontractor shall ensure that the epoxy laminate/ epoxy Aluminium honeycomb panels or any other material proposed by the subcontractor shall be free from undulation, twist, pinholes, blisters, porosity, blow holes, tear, wrinkles and other visual defects. The visible surface of epoxy laminate/ epoxy Aluminium honeycomb panels or any other material proposed by the subcontractor shall be made smooth and suitable for application of paints.

7.14. Service Life

The sub-contractor shall ensure a guaranteed revenue service life of 30years for the Epoxy Aluminium honeycomb or any other material proposed by the supplier.

7.15. Quality Assurance Program

(i) The subcontractor shall hold ISO 9001:2018/ IRIS certification and shall manufacture the product accordingly. The subcontractor shall submit a copy of ISO 9001:2018 / IRIS certification along with the offer. The subcontractor shall monitor and control the Quality systems as per ISO 9001/IRIS guidelines. BEML

and/or ICF's representative may periodically conduct compliance audits of the Subcontractor's Quality management system.

(ii) The subcontractor shall submit Quality Assurance Plan (QAP) based on ISO 9001: 2018 / IRIS guidelines.

8. Scope of Supply

8.1. Design & Development activity

The sub-contractor will be provided with the External Cover/Cladding concept models in 3D surface file for following coaches by BEML.

a) DTC – Driving Trailer Coach,

b) MC1 – Motor Car,

c) TC1(PRM) – Trailer Car with PRM seat

d) TC2(Ex) – Trailer Car (Executive Car with PRM)

The sub-contractor shall be responsible for following activities:

(i) The subcontractor shall get involved with BEML nominated design consultant for detail designing of External Cover/Cladding.

(ii) The complete External Cover/Cladding components and its fittings shall be designed by subcontractor in line with concept design and in co-ordination with design consultant. The design includes 3D model and 2D drawings.

(iii) Subcontractor shall develop full 3D model (namely component level GFRP/AL items, installation/mounting methodology viz., bracket, hinges, locks, rubber profiles, extrusions etc.,) and 2D manufacturing drawings of all GFRP/Al External Cover/Cladding components including mounting brackets, hinges and installation drawings with carbody.

(iv) Sub-contractor shall submit all 3D models and 2D drawings to BEML/NHSRCL for approval before taking up for manufacture.

(v) The quantity of the External Cover/Cladding, accessories and miscellaneous fittings/items shall be arrived as per the layout drawings and finalized concept design. BOM to submitted before proto production.

(vi) All the fittings including hinges, locks, rubber profiles, brackets, sealants, fasteners, extrusions etc required to mount the panels/covers to carbody shall be supplied by Subcontractor.

(vii) Develop required tooling for manufacturing of all type of External Cover/Cladding.

(viii) Shall carryout Type tests at any NABL approved laboratory and routine tests and submit the reports.

(ix) Manufacture and supply all types of External Cover/Cladding.

(x) Installation of External Cover/Cladding on the car at BEML Ltd will be in BEML scope. Subcontractor shall support BEML team in installation of panels to carbody, for first proto train set.ai

8.2. External Cover/Cladding

(i) External cover layout drawings for each car are provided in appendices. Total area of External covers are also mentioned in the drawings. Subcontractor shall decide the thickness, number of partitions of these covers based on feasibility of manufacturing and handling of the cover, covering the total area and accordingly submit the quotation.

(ii) Subcontractor shall propose any other material as equivalent to Epoxy Al honeycomb/Epoxy laminates to meet the requirements as specified in design criteria at clause 6.1(iv).

Note: There may be minor variation in External cover size and dimensions during the detail design phase, such Modifications / corrections, if any in the External covers, shall be carried out by the subcontractor without cost implication.

8.3. Process and Raw material

Sub-Contractor shall submit details of process and raw materials, proposed to be used in manufacturing of External Cover/Cladding for approval.

8.4. Weight

(i) The subcontractor shall submit estimated weights of each cover along with the technical offer.

(ii) The density of Epoxy laminate covers supplied above shall be approximately 1.8 ± 0.1 g/cm3 and for Epoxy Aluminium honeycomb sandwich covers shall be approximately 0.4 ± 0.05 g/cm3 or any other suitable material proposed by subcontractor shall be light weight and have high strength to weight ratio and corresponding weights shall be submitted along with offer.

8.5. PTS Compliance

(i) The subcontractor shall offer a valid and fully compliant proposal for the External Cover/Cladding as detailed in PTS.

(ii) The subcontractor shall submit, along with the technical offer, the Clause by Clause Compliance for PTS:

Offers with Non-compliance and deviations to any of the in PTS clauses with regard to External Cover/Cladding, are liable for rejection.

8.6. Training

(i) The subcontractor shall provide comprehensive training to BEML/NHSRCL/ ICF staff for fitment and removal of panels for maintenance activity and repairing of the panels/covers. The aim of training is to enable the BEML/NHSRCL/ICF personnel to effectively carry all aspects of the operation and maintenance activity during normal, failure and emergency situation.

(ii) Contractor shall depute personnel to impart training to operation and maintenance staff at depot.

8.7. Submission of Documents

The Sub contactor shall submit the following documents, as a minimum, as per the timelines specified by BEML.

(i) Complete 3D Models of the proposed Exterior Cover including all the locks, brackets, hinges, rubber components, etc.

(ii) The 3D model and 2D detail drawings of all the part level components, panels, assemblies and installation drawings.

(iii) Bill of material (BOM) of complete Exterior Cover, to obtain BEML/NHSRCL/ICF approval.

(iv) Bill of materials of all bought out items shall be submitted with make and part number.

(v) Technical Description document including detail description of all the parts in the Exterior Covers.

(vi) Type test procedure & FAI reports

(vii) Fire safety test reports on the Exterior Covers produced for this project.

(viii) Weighment document with Actual weights of each of the Exterior Cover

(ix) Raw Material test certificates and technical data sheets

(x) Dimensional check sheets for each of the panels

(xi) Operation & Maintenance manual. Maintenance manual shall include maintenance schedule, tools, grease or any other items required during maintenance.

(xii) The sub contactor shall submit the following documents conforming to the Technical Specification along with every batch of supplies.

- Material test certificates
- Dimensional check sheets

8.8. Packing

The Subcontractor shall pack properly in order that in transit and after supply of the Exterior Covers to the place allocated by BEML, no damage to the Exterior Covers shall occur.

9. Inspection of Exterior Cover/Cladding

All Epoxy Aluminium honeycomb/Epoxy laminate or any other proposed material by the subcontractor shall be inspected to meet the technical requirements and the test reports shall be submitted.

9.1. Stage Inspection

Stage inspection and final inspection will be carried out by BEML/NHSRCL/ ICF at sub-contractor's premises. The sub-contractor should demonstrate all its process capability/parameters by producing one prototype sample successfully using the process as specified, in the presence of BEML/NHSRCL//ICF during stage inspection.

9.2. Dimension Inspection

The dimensions shall be checked on 50% of the lot cleared in above point subject to a minimum of two numbers. All the samples checked for dimensions shall pass.

9.2.1. Visual Inspection of panels

(i) The Epoxy Aluminium honeycomb/Epoxy laminate covers or any other proposed material by the subcontractor shall be visually inspected and shall comply with Level-1 of ASTM D2563.

(ii) The surface of the panels shall be smooth and without any defects and pin holes. The panels shall be free from any harmful defects such as Chip, Crack, Surface Crack, edge De-lamination, internal De-lamination, Dry spot, foreign inclusion (metallic & nonmetallic), Fracture, Air bubble, Blister, Burned, Fish-eye, Lack of fill out, Orange peel, Pimple, Porosity, Pre-gel, Resin-pocket, Resin -rich edge, Shrink-mark, Wash, Worm hole, wrinkles, scratch, etc., and any other defects.

(iii) The colour and surface finish shall be visually inspected on 20 % of the lot subject to a minimum of two numbers. All the samples must pass the test for the lot to be accepted

9.3. Type Tests & Routine Tests

(i) The Epoxy Aluminium honeycomb/Epoxy laminate covers or any other proposed material by the subcontractor shall be type and routine tested in accordance with relevant standards and specification.

(ii) All such tests shall be carried out at the sub-contractor’s cost, wherever performed, in the presence of and to the satisfaction of BEML and NHSRCL, who reserves the right to witness any or all of the tests and to require submission of any or all test specifications and reports.

(iii) BEML and NHSRCL reserve the right to reasonably call for additional tests, if necessary.

(iv) The type test procedure document shall be prepared by the sub-contractor and BEML/NHSRCL approval shall be obtained before conducting the tests.

(v) Subcontractor shall carry out the following type test and routine tests as a minimum.

a) For GFRP panels/sandwich panels

Test Details	TYPE TEST for GFRP	ROUTINE TEST
Visual Inspection	●	● (100 % supplies)
Dimensional Inspection	●	● (100 % supplies)
Weight	●	
Tensile Strength & Modulus	●	
Flexural Strength & Modulus	●	
Compression Strength & Modulus	●	
Impact Strength	●	
Drum Peel	●	
Bending Load	●	
Fire Performance Test	●	
Paint performance test	●	● (for every batch of supplies)

b) Paint performance test

Test Details	TYPE TEST	ROUTINE TEST
Scratch Resistant	●	
Chip resistance	●	
Impact Resistance	●	
Abrasion Resistance	●	
Paint Thickness(DFT)	●	● (for every batch every day)
Paint Adhesion	●	● (for every batch every day)
Film hardness	●	
Gloss Level	●	● (for every panel painted)
Anti-graffiti resistance	●	
Acid & Alkali Resistance Test	●	
Accelerated Weathering test	●	

Fire performance test	●	
Colour Difference	●	● (for every panel painted)

9.4. First Article Inspection (FAI)

(i) The subcontractor shall offer the GFRP and aluminium honeycomb panels for First Article Inspection by BEML/NHSRCL/ ICF with the BEML/NHSRCL/ICF approved FAI plan prior to serial production in order to confirm that the item produced fully complies with the technical specifications, System design and manufacturing process.

(ii) The Subcontractor shall ensure that the produced Epoxy Aluminium honeycomb/Epoxy laminate covers or any other proposed material by the subcontractor is compliant to all requirements prior to inviting for testing and FAI. The pre-test result prior to official testing/FAI shall be submitted with the invitation letter to request BEML/ NHSRCL/ICF witness.

(iii) At the FAI, the subcontractor shall make available all pertinent design and manufacturing process documentation, test records, material certifications, etc.

(iv) During FAI, if any inspections or tests indicate that specific hardware or documentation does not meet the specified requirements, the appropriate items shall be repaired, replaced, upgraded, or added by the Subcontractor at their own cost, as necessary to correct the noted deficiencies. After correction of deficiency, all tests necessary to verify the effectiveness of the corrective action shall be repeated.

(v) If FAI has to be repeated due to non-compliances/ deficiencies noticed, the cost towards the same and the cost towards BEML/NHSRCL/ICF visit to subcontractor's place for witness of re-FAI shall be to subcontractor's responsibility.

(vi) Upon acceptance of the FAI by BEML/NHSRCL/ICF, the subcontractor can proceed to manufacture all pertinent hardware. The hardware must meet or exceed the quality standards set at the FAI, and must incorporate any comments made by BEML/ICF at the FAI.

(vii) Subcontractor shall note that BEML/NHSRCL/ICF FAI clearance will not relieve the subcontractor's responsibility towards design, development, testing, manufacture and supply during the revenue service.

(viii) At any point of time, during the execution of the contract, if BEML/NHSRCL/ICF has any concerns about the quality of the product supplied, BEML/NHSRCL/ICF reserves the right to randomly draw samples from any of the supply lots and the sub-contractor shall carryout the type tests at accredited outside labs and shall submit the reports.

10. Warranty

Please refer to GTC.

11. Appendices

I. Drawings of Exterior Cover/Cladding layout of DTC, MC, TC1 and TC2

II. Technical offer Submittals Check List.

12. Submittals with Technical Offer

The Subcontractor shall provide as a minimum, the following along with the technical offer.

(i) Complete Technical Offer for Epoxy Aluminium honeycomb/Epoxy laminate covers or any other proposed material by the subcontractor including technical description and technical data sheet for proposed material.

(ii) Supporting documents for Qualification Criteria compliance including QAP, company profile with infrastructure facilities, product range, supply credentials etc., (Clause 4)

(iii) Proposed manufacturing process details and the reference of projects in which the same has been adopted, manufactured and supplied.

(iv) Technical Data Sheet (TDS) & Material Safety Data Sheet of Epoxy Aluminium honeycomb/Epoxy laminate covers, honeycomb, or any other proposed material by the supplier, aluminium extrusions, metal brackets, nut-insert and adhesive used to bond nut insert, etc.

(v) Repair procedure for proposed material.

(vi) Estimated weight of Epoxy Aluminium honeycomb/Epoxy laminate covers or any other proposed material by the supplier.

(vii) Type Test reports (Mechanical & Fire performance) of similar earlier projects.

(viii) Clause-by- Clause compliance for PTS.

--- End of Document---

MODEL	NEXT ASS'Y	QTY

MACHINING DEVIATIONS FOR LINEAR DIMENSIONS CLASS - MEDIUM	RANGE	0.5 - 3	3 - 6	6 - 30	30 - 120	120 - 400	400 - 1000	1000 - 2000	2000 - 4000
	TOLERANCE	±0.1	±0.1	±0.2	±0.3	±0.5	±0.8	±1.2	±2

GENERAL TOLERANCES FOR LINEAR & ANGULAR DIMENSION SHALL BE AS PER ISO 2768-1 | GENERAL GEOMETRICAL TOLERANCES SHALL BE AS PER ISO 2768-2

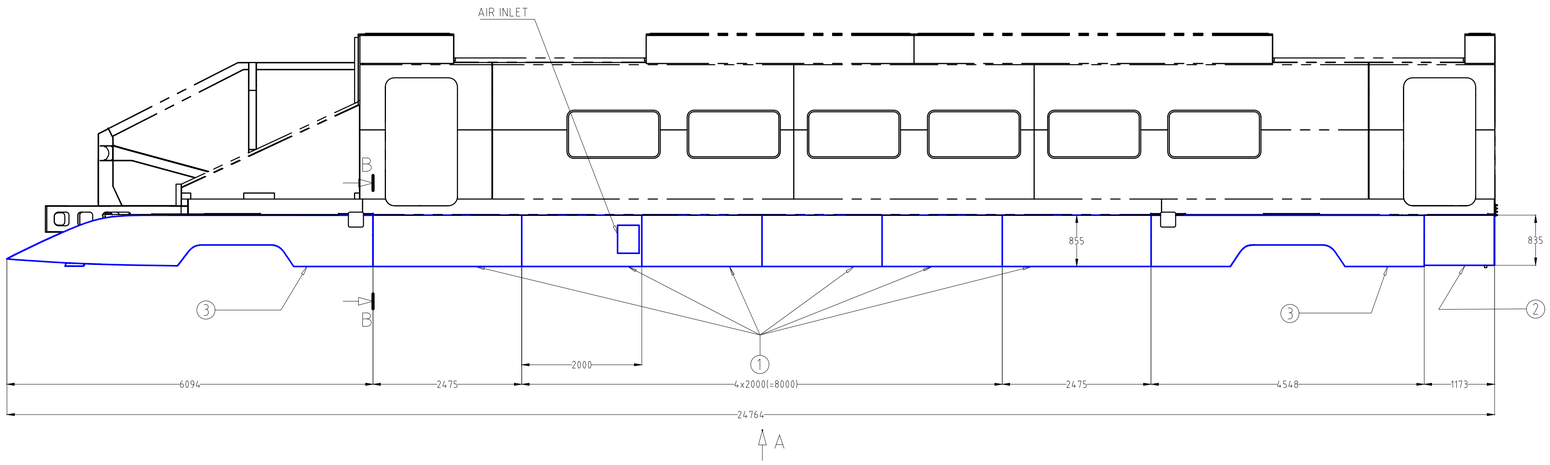
GENERAL TOLERANCES FOR WELDED STRUCTURE SHALL BE AS PER ISO 13920 | VALUES OF SURFACE TEXTURE SHALL BE AS PER ISO 1302.

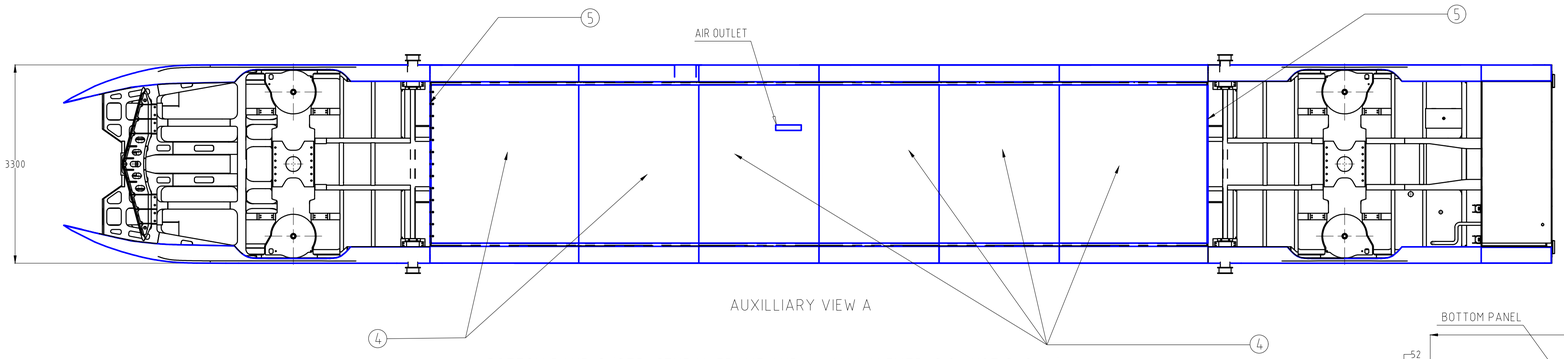
WELDING SHALL BE CARRIED OUT AS PER EN 15085-3 | WELDING PROCESS SHALL BE AS PER EN ISO-4063

WELDING SYMBOLS SHALL BE AS PER EN ISO-2553 | WELDING POSITIONS SHALL BE AS PER EN ISO 6947 | STATUS: PROTO

QUALITY LEVELS FOR IMPERFECTIONS IN FUSION WELDED JOINTS SHALL BE AS PER EN ISO 5817

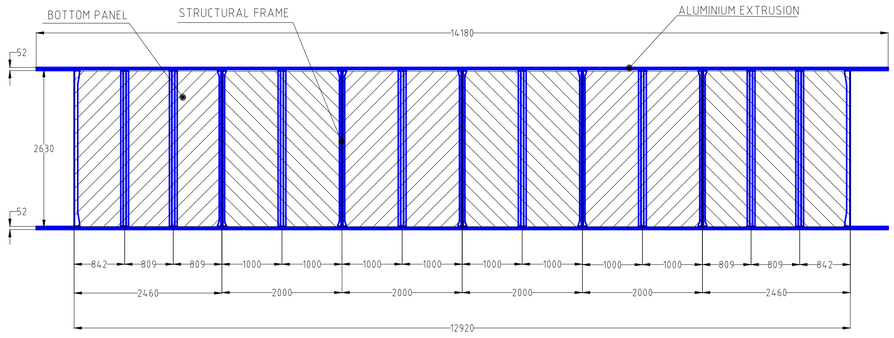
WELD JOINT PREPARATIONS SHALL BE AS PER EN ISO 9692 & EN 15085-3 | INSPECTION & TESTING OF WELDED JOINTS SHALL BE AS PER EN 15085-5



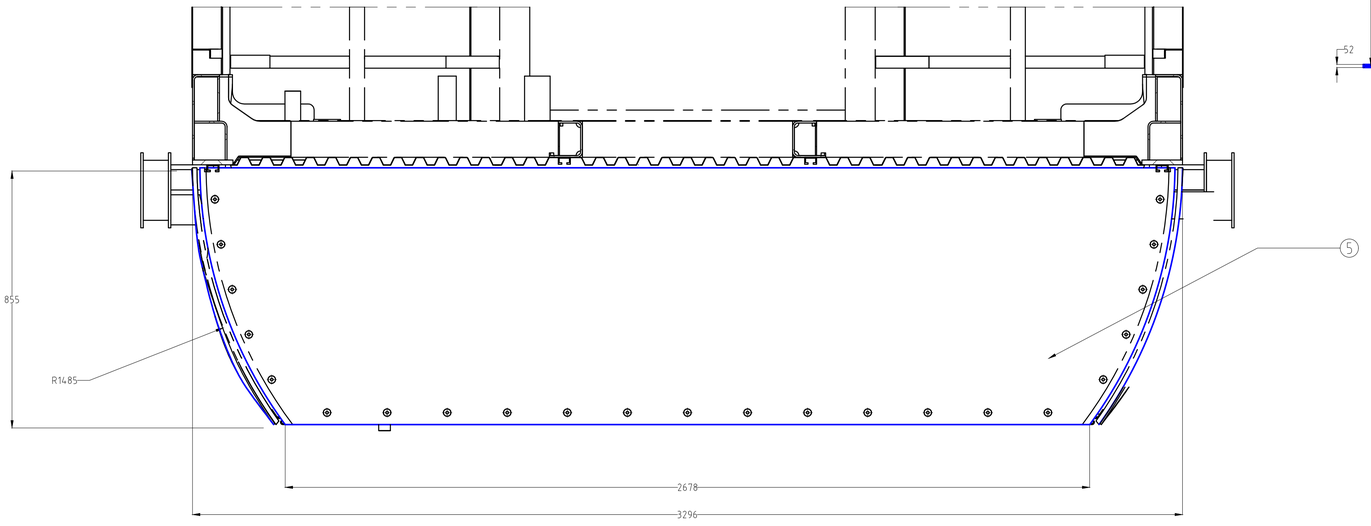


AUXILLIARY VIEW A

BOTTOM PANELS (STRUCTURAL FRAME AND ALUMINIUM EXTRUSION NOT SHOWN)



1 BOTTOM PANELS WITH STRUCTURAL FRAMES AND ALUMINIUM EXTRUSION



SECTION VIEW B-B

SCALE: 1:10

SL.NO	QTY	PART / STOCK NO.	DESCRIPTION	TOTAL SURFACE AREA in m2	PROPOSED THICKNESS in mm	PROPOSED MATERIAL
5			FRONT PANEL	4.92	15	EPOXY AL HONEYCOMB
4			BOTTOM PANEL WITH STRUCTURAL FRAMES AND AL. EXTRUSION	33.95	15	EPOXY AL HONEYCOMB
3			BOGIE COVERS	13.93	8	EPOXY LAMINATE
2			SIDE COVERS- FIXED	2.51	20-25	EPOXY AL HONEYCOMB
1			SIDE COVERS- OPENABLE	24.2	20-25	EPOXY AL HONEYCOMB

NOTES:
1. ALL DIMENSIONS ARE IN mm.
2. ITEMS HIGHLIGHTED IN BLUE COLOUR " _____ " ARE IN THE SCOPE OF EXTERNAL COVER/CLADDING SUPPLIER.
3. TOTAL SURFACE AREA FOR EACH EXTERNAL COVERS IS GIVEN IN BOM, SUPPLIER SHALL ARRIVE THE NUMBER OF PARTITIONS OF THESE COVERS BASED UPON THE MANUFACTURING FEASIBILITY & HANDLING AND ACCORDINGLY SUBMIT THE QUOTATION.

**LAYOUT AND SIZE IN THIS DRAWING ARE FOR REFERENCE PURPOSE ONLY AND ARE SUBJECTED TO CHANGE. THE FINAL LAYOUT WILL BE PROVIDED IN THE DESIGN STAGE.

ALT.NO.	ECN NO/CHANGES	DATE	BY	CHKD	APPD
1	ADDED BOTTOM PANEL VIEWS WITH STRUCTURAL FRAMES AND AL. EXTRUSION	08/09/2025	SK	RKR	KP

PRODUCT	TRAIN B28			
REF. DRG.	---			
MATERIAL				
HEAT TREAT.	--	APPD	KRISHNA PRASAD	28/07/2025
SURFACE TREAT.	--	REVD	KRISHNA PRASAD	28/07/2025
TITLE	DTC- EXTERNAL COVER/CLADDING	CHKD	RAJPUT	28/07/2025
		DRWN	SANTOSH KUMAR	28/07/2025
SCALE	1:50	SHEET	1 OF 1	WT.(Kg) -
DRG No.	843COVERDTC	ALT	1	

BANGALORE COMPLEX

GRADE No.	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12
VALUE	0.025	0.05	0.1	0.2	0.4	0.8	1.6	3.2	6.3	12.5	25	50
SYMBOL												
SURFACE ROUGHNESS												

MODEL	NEXT ASS'Y	QTY

MACHINING DEVIATIONS FOR LINEAR DIMENSIONS CLASS - MEDIUM	RANGE	0.5 - 3	3 - 6	6 - 30	30 - 120	120 - 400	400 - 1000	1000 - 2000	2000 - 4000
	TOLERANCE	±0.1	±0.1	±0.2	±0.3	±0.5	±0.8	±1.2	±2

GENERAL TOLERANCES FOR LINEAR & ANGULAR DIMENSION SHALL BE AS PER ISO 2768-1 | GENERAL GEOMETRICAL TOLERANCES SHALL BE AS PER ISO 2768-2

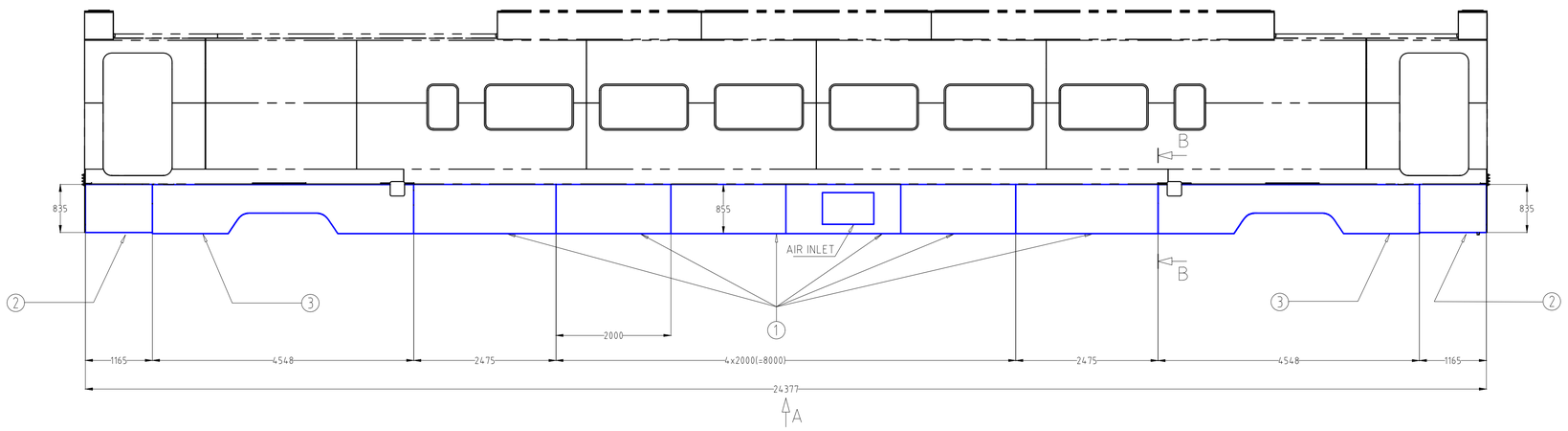
GENERAL TOLERANCES FOR WELDED STRUCTURE SHALL BE AS PER ISO 13920 | VALUES OF SURFACE TEXTURE SHALL BE AS PER ISO 1302.

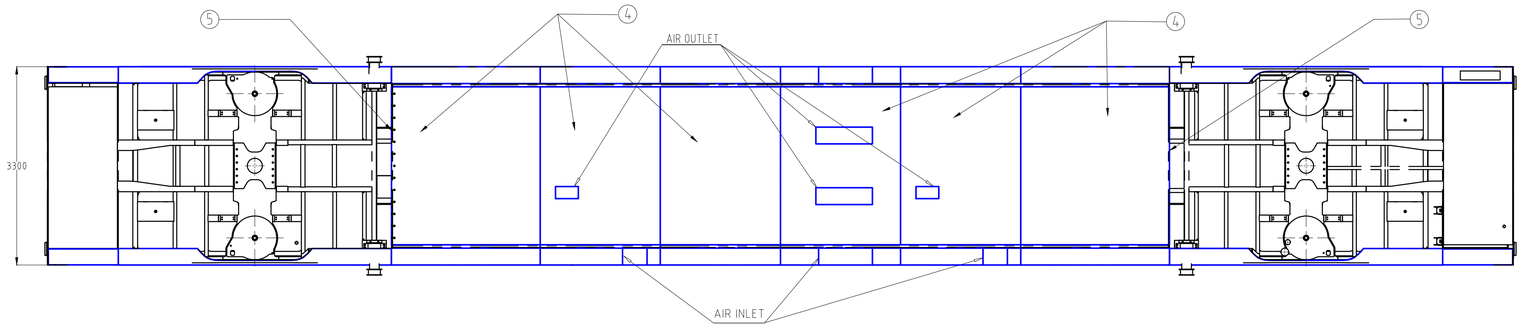
WELDING SHALL BE CARRIED OUT AS PER EN 15085-3 | WELDING PROCESS SHALL BE AS PER EN ISO-4063

WELDING SYMBOLS SHALL BE AS PER EN ISO-2553 | WELDING POSITIONS SHALL BE AS PER EN ISO 6947 | STATUS: PROTO

QUALITY LEVELS FOR IMPERFECTIONS IN FUSION WELDED JOINTS SHALL BE AS PER EN ISO 5817

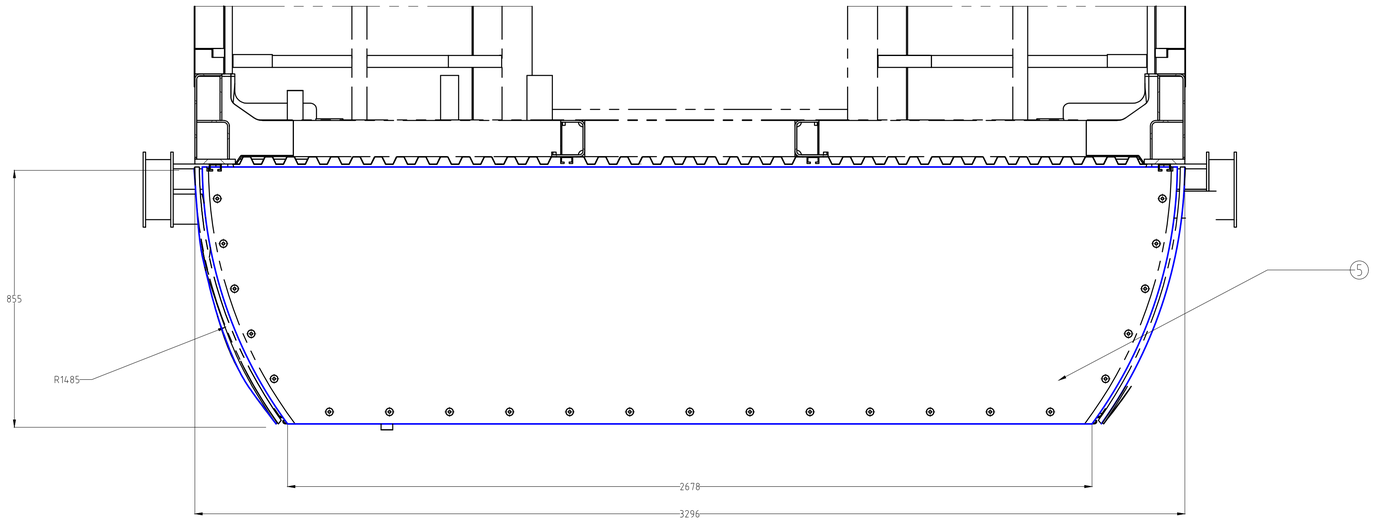
WELD JOINT PREPARATIONS SHALL BE AS PER EN ISO 9692 & EN 15085-3 | INSPECTION & TESTING OF WELDED JOINTS SHALL BE AS PER EN 15085-5





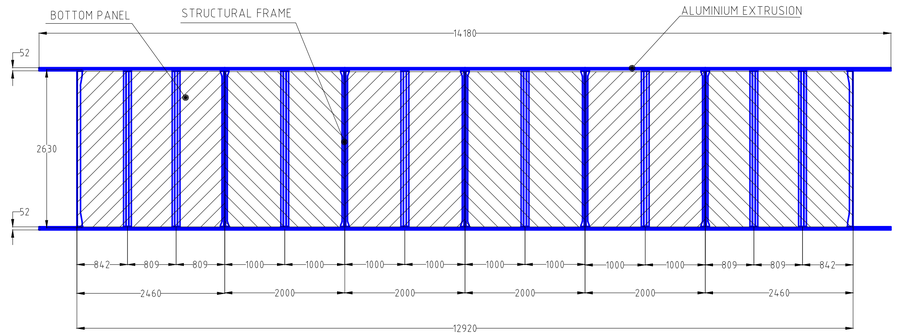
AUXILLIARY VIEW A

BOTTOM PANELS (STRUCTURAL FRAME AND ALUMINIUM EXTRUSION NOT SHOWN)



SECTION VIEW B-B

SCALE: 1:10



1 BOTTOM PANELS WITH STRUCTURAL FRAMES AND ALUMINIUM EXTRUSION

SL.NO	QTY	PART / STOCK NO.	DESCRIPTION	TOTAL SURFACE AREA in m2	PROPOSED THICKNESS in mm	PROPOSED MATERIAL
5			FRONT PANEL	4.92	15	EPOXY AL HONEYCOMB
4			BOTTOM PANEL WITH STRUCTURAL FRAMES AND AL. EXTRUSION	33.95	15	EPOXY AL HONEYCOMB
3			BOGIE COVERS	13.14	8	EPOXY LAMINATE
2			SIDE COVERS- FIXED	2.51	20-25	EPOXY AL HONEYCOMB
1			SIDE COVERS- OPENABLE	24.2	20-25	EPOXY AL HONEYCOMB

NOTES:
1. ALL DIMENSIONS ARE IN mm.
2. ITEMS HIGHLIGHTED IN BLUE COLOUR " ____ " ARE IN THE SCOPE OF EXTERNAL COVER/CLADDING SUPPLIER.
3. TOTAL SURFACE AREA FOR EACH EXTERNAL COVERS IS GIVEN IN BOM, SUPPLIER SHALL ARRIVE THE NUMBER OF PARTITIONS OF THESE COVERS BASED UPON THE MANUFACTURING FEASIBILITY & HANDLING AND ACCORDINGLY SUBMIT THE QUOTATION.

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ALT.NO.	ECN NO/CHANGES	DATE	BY	CHKD	APPD
1	ADDED BOTTOM PANEL VIEWS WITH STRUCTURAL FRAMES AND AL. EXTRUSION	08/09/2025	SK	RKR	KP

PRODUCT: TRAIN B28
REF DRG: ---
MATERIAL:
HEAT TREAT.: --
SURFACE TREAT.: --
TITLE: TC2- EXTERNAL COVER/CLADDING

APPD	KRISHNA PRASAD	28/07/2025
REVD	KRISHNA PRASAD	28/07/2025
CHKD	RAJPUT	28/07/2025
DRWN	SANTOSH KUMAR	28/07/2025

SCALE: 1:50 | SHEET: 1 OF 1 | WT.(Kg): -

BANGALORE COMPLEX

DRG No.: 846COVERTC2 | ALT: 1 | A1

GRADE No.	N12	N11	N10	N9	N8	N7	N6	N5	N4	N3	N2	N1
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SYMBOL	▽	▽	▽	▽	▽	▽	▽	▽▽	▽▽	▽▽	▽▽	▽▽

SURFACE ROUGHNESS

MODEL	NEXT ASS'Y	QTY

MACHINING DEVIATIONS FOR LINEAR DIMENSIONS CLASS - MEDIUM	RANGE	0.5 - 3	3 - 6	6 - 30	30 - 120	120 - 400	400 - 1000	1000 - 2000	2000 - 4000
	TOLERANCE	±0.1	±0.1	±0.2	±0.3	±0.5	±0.8	±1.2	±2

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WELDING SHALL BE CARRIED OUT AS PER EN 15085-3 | WELDING PROCESS SHALL BE AS PER EN ISO-4063

WELDING SYMBOLS SHALL BE AS PER EN ISO-2553 | WELDING POSITIONS SHALL BE AS PER EN ISO 6947 | STATUS: PROTO

QUALITY LEVELS FOR IMPERFECTIONS IN FUSION WELDED JOINTS SHALL BE AS PER EN ISO 5817

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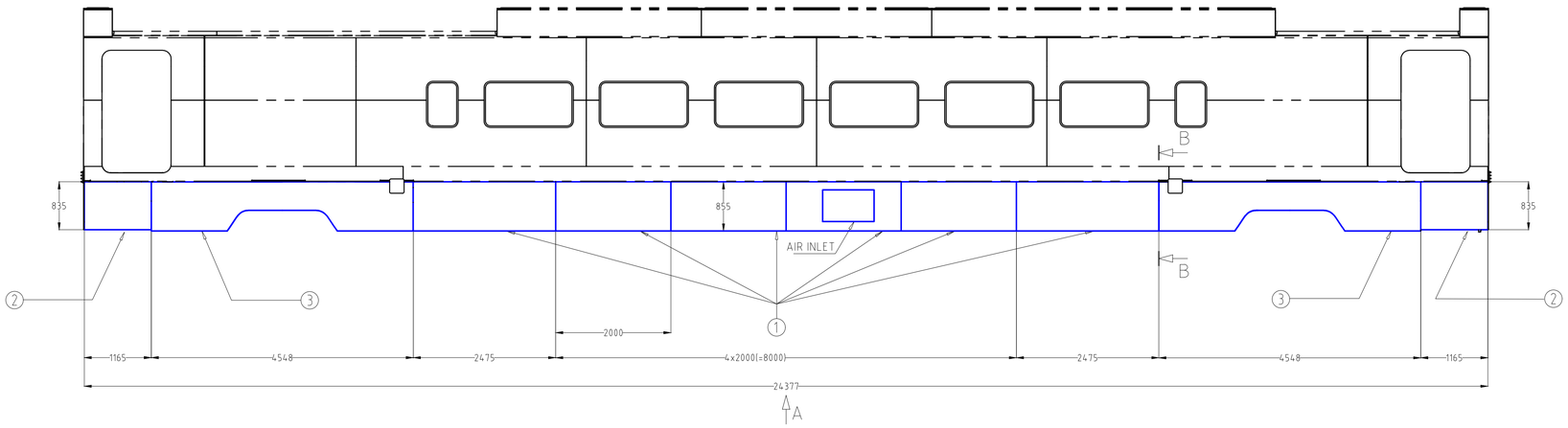
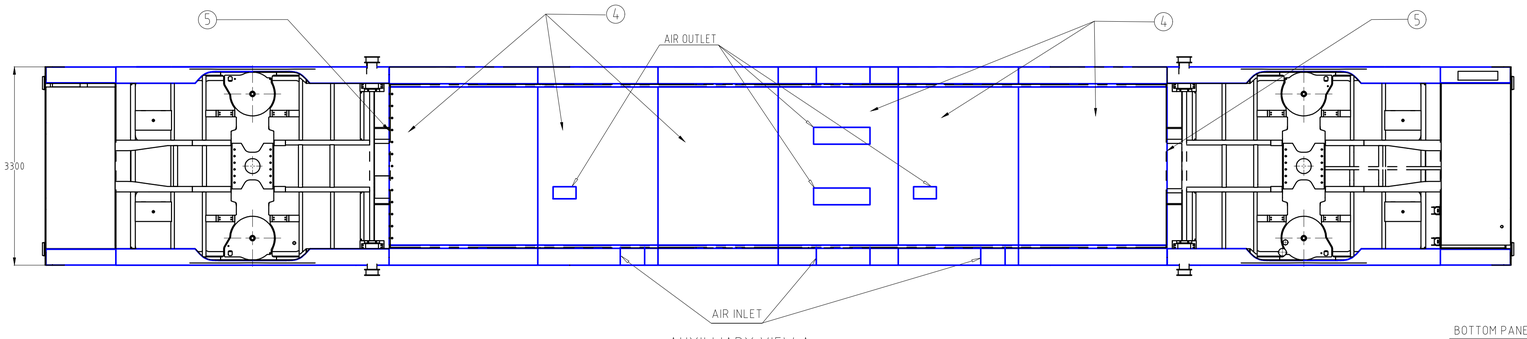
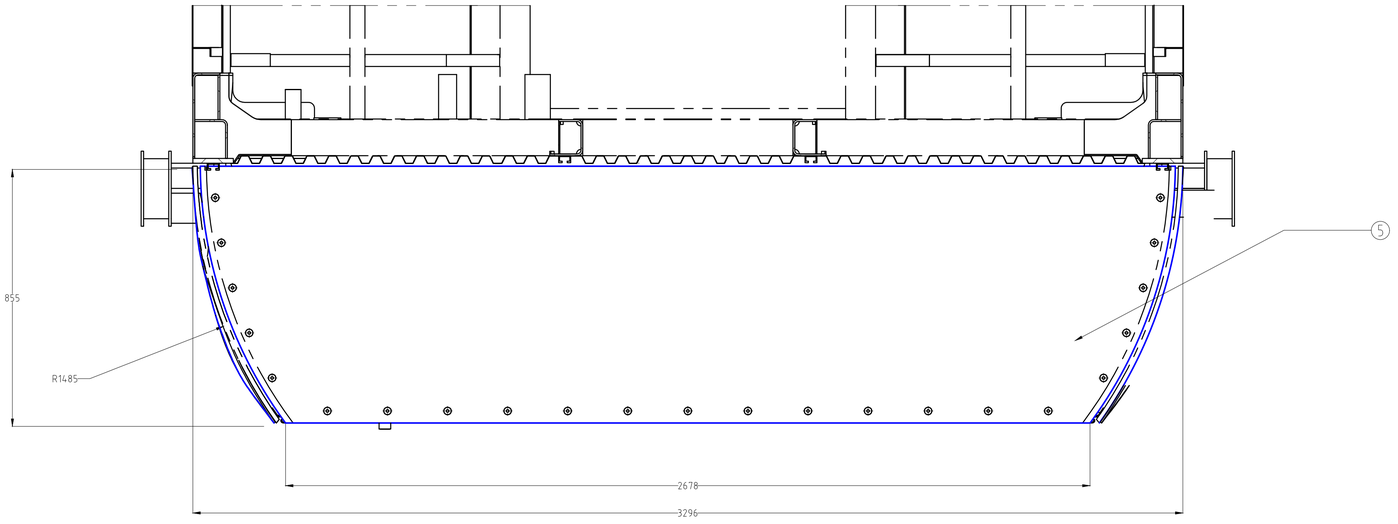




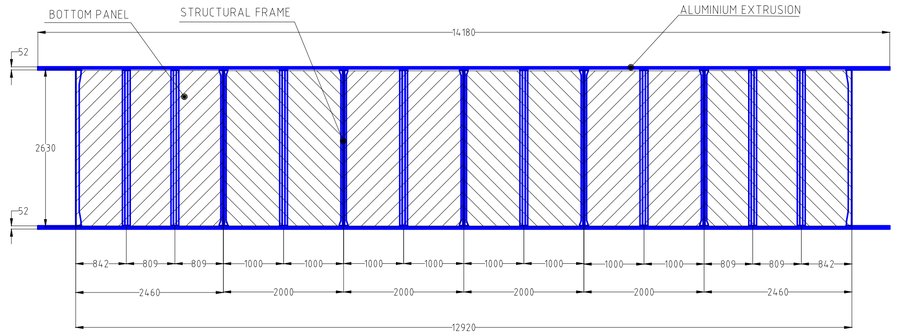
AUXILLIARY VIEW A

BOTTOM PANELS (STRUCTURAL FRAME AND ALUMINIUM EXTRUSION NOT SHOWN)



SECTION VIEW B-B

SCALE: 1:10



1 BOTTOM PANELS WITH STRUCTURAL FRAMES AND ALUMINIUM EXTRUSION

SL.NO	QTY	PART / STOCK NO.	DESCRIPTION	TOTAL SURFACE AREA in m2	PROPOSED THICKNESS in mm	PROPOSED MATERIAL
5			FRONT PANEL	4.92	15	EPOXY AL HONEYCOMB
4			BOTTOM PANEL WITH STRUCTURAL FRAMES AND AL. EXTRUSION	33.95	15	EPOXY AL HONEYCOMB
3			BOGIE COVERS	13.14	8	EPOXY LAMINATE
2			SIDE COVERS- FIXED	2.51	20-25	EPOXY AL HONEYCOMB
1			SIDE COVERS- OPENABLE	24.2	20-25	EPOXY AL HONEYCOMB

NOTES:
1. ALL DIMENSIONS ARE IN mm.
2. ITEMS HIGHLIGHTED IN BLUE COLOUR " ____ " ARE IN THE SCOPE OF EXTERNAL COVER/CLADDING SUPPLIER.
3. TOTAL SURFACE AREA FOR EACH EXTERNAL COVERS IS GIVEN IN BOM, SUPPLIER SHALL ARRIVE THE NUMBER OF PARTITIONS OF THESE COVERS BASED UPON THE MANUFACTURING FEASIBILITY & HANDLING AND ACCORDINGLY SUBMIT THE QUOTATION.

**LAYOUT AND SIZE IN THIS DRAWING ARE FOR REFERENCE PURPOSE ONLY AND ARE SUBJECTED TO CHANGE. THE FINAL LAYOUT WILL BE PROVIDED IN THE DESIGN STAGE.

ALT.NO.	ECN NO/CHANGES	DATE	BY	CHKD	APPD
1	ADDED BOTTOM PANEL VIEWS WITH STRUCTURAL FRAMES AND AL. EXTRUSION	08/08/2025	SK	RKR	KP

PRODUCT	TRAIN B28		
REF DRG	---		
MATERIAL			
HEAT TREAT.	--	APPD	KRISHNA PRASAD 28/07/2025
SURFACE TREAT.	--	REVD	KRISHNA PRASAD 28/07/2025
TITLE	TC1- EXTERNAL COVER/CLADDING	CHKD	RAJPUT 28/07/2025
		DRWN	SANTOSH KUMAR 28/07/2025
		SCALE	1:50
		SHEET	1 OF 1
		WT.(Kg)	-
	BANGALORE COMPLEX	DRG No.	845COVERTC1
		ALT	1
			A1

SURFACE ROUGHNESS	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12
GRADE No.	0.025	0.05	0.1	0.2	0.4	0.8	1.6	3.2	6.3	12.5	25	50
V.VALUE												
SYMBOL												

MODEL	NEXT ASS'Y	QTY

MACHINING DEVIATIONS FOR LINEAR DIMENSIONS CLASS - MEDIUM	RANGE	0.5 - 3	3 - 6	6 - 30	30 - 120	120 - 400	400 - 1000	1000 - 2000	2000 - 4000
	TOLERANCE	±0.1	±0.1	±0.2	±0.3	±0.5	±0.8	±1.2	±2

GENERAL TOLERANCES FOR LINEAR & ANGULAR DIMENSION SHALL BE AS PER ISO 2768-1 | GENERAL GEOMETRICAL TOLERANCES SHALL BE AS PER ISO 2768-2

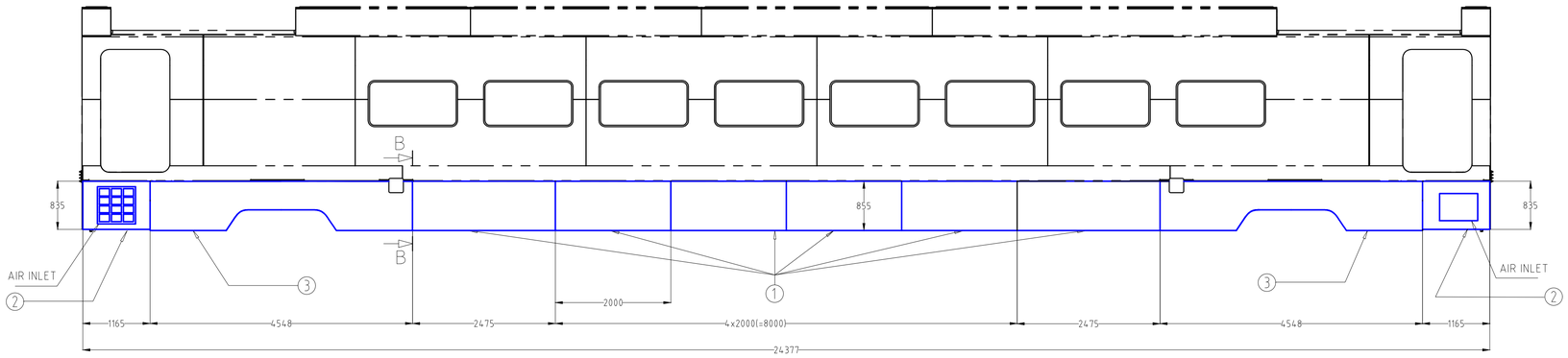
GENERAL TOLERANCES FOR WELDED STRUCTURE SHALL BE AS PER ISO 13920 | VALUES OF SURFACE TEXTURE SHALL BE AS PER ISO 1302.

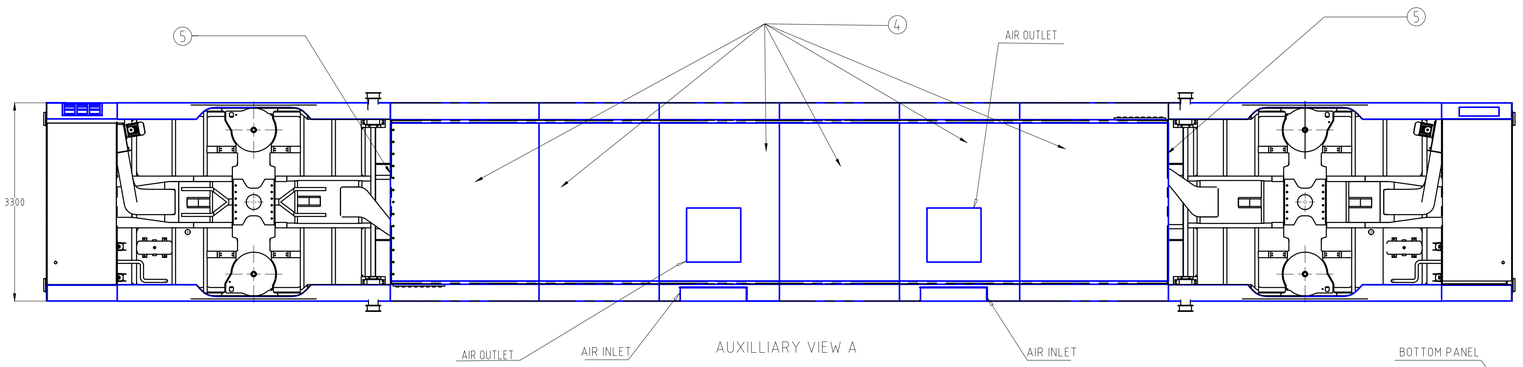
WELDING SHALL BE CARRIED OUT AS PER EN 15085-3 | WELDING PROCESS SHALL BE AS PER EN ISO-4063

WELDING SYMBOLS SHALL BE AS PER EN ISO-2553 | WELDING POSITIONS SHALL BE AS PER EN ISO 6947 | STATUS: PROTO

QUALITY LEVELS FOR IMPERFECTIONS IN FUSION WELDED JOINTS SHALL BE AS PER EN ISO 5817

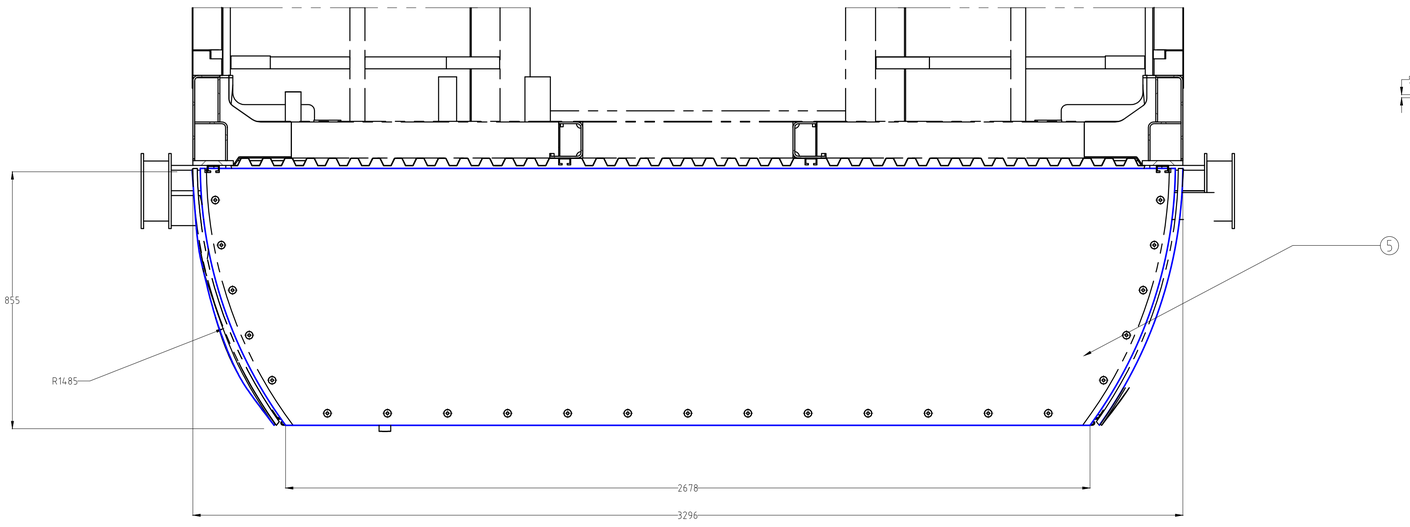
WELD JOINT PREPARATIONS SHALL BE AS PER EN ISO 9692 & EN 15085-3 | INSPECTION & TESTING OF WELDED JOINTS SHALL BE AS PER EN 15085-5





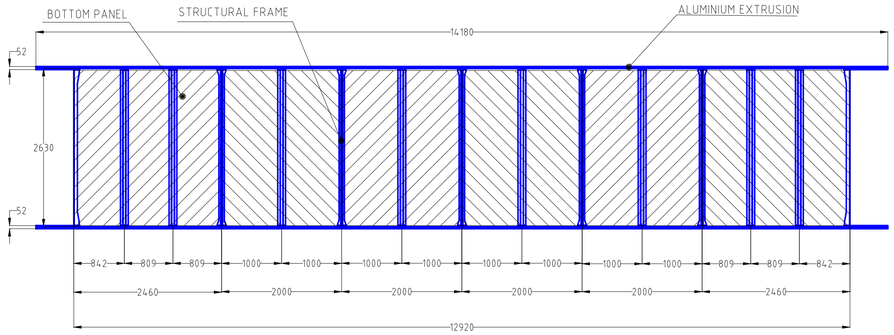
AUXILLIARY VIEW A

BOTTOM PANELS (STRUCTURAL FRAME AND ALUMINIUM EXTRUSION NOT SHOWN)



SECTION VIEW B-B

SCALE: 1:10



1 BOTTOM PANELS WITH STRUCTURAL FRAMES AND ALUMINIUM EXTRUSION

SL.NO	QTY	PART / STOCK NO.	DESCRIPTION	TOTAL SURFACE AREA in m2	PROPOSED THICKNESS in mm	PROPOSED MATERIAL
5			FRONT PANEL	4.92	15	EPOXY AL HONEYCOMB
4			BOTTOM PANEL WITH STRUCTURAL FRAMES AND AL. EXTRUSION	33.95	15	EPOXY AL HONEYCOMB
3			BOGIE COVERS	13.14	8	EPOXY LAMINATE
2			SIDE COVERS- FIXED	2.51	20-25	EPOXY AL HONEYCOMB
1			SIDE COVERS- OPENABLE	24.2	20-25	EPOXY AL HONEYCOMB

NOTES:
1. ALL DIMENSIONS ARE IN mm.
2. ITEMS HIGHLIGHTED IN BLUE COLOUR " ____ " ARE IN THE SCOPE OF EXTERNAL COVER/CLADDING SUPPLIER.
3. TOTAL SURFACE AREA FOR EACH EXTERNAL COVERS IS GIVEN IN BOM, SUPPLIER SHALL ARRIVE THE NUMBER OF PARTITIONS OF THESE COVERS BASED UPON THE MANUFACTURING FEASIBILITY & HANDLING AND ACCORDINGLY SUBMIT THE QUOTATION.

**LAYOUT AND SIZE IN THIS DRAWING ARE FOR REFERENCE PURPOSE ONLY AND ARE SUBJECTED TO CHANGE. THE FINAL LAYOUT WILL BE PROVIDED IN THE DESIGN STAGE.

ALT.NO.	ECN NO/CHANGES	DATE	BY	CHKD	APPD
1	ADDED BOTTOM PANEL VIEWS WITH STRUCTURAL FRAMES AND AL. EXTRUSION	08/09/2025	SK	RKR	KP

PRODUCT: TRAIN B28
REF. DRG: ---
MATERIAL:
HEAT TREAT.: --
SURFACE TREAT.: --
TITLE: MC1- EXTERNAL COVER/CLADDING

APPD	KRISHNA PRASAD	28/07/2025
REVD	KRISHNA PRASAD	28/07/2025
CHKD	RAJPUT	28/07/2025
DRWN	SANTOSH KUMAR	28/07/2025

SCALE: 1:50 | SHEET: 1 OF 1 | WT.(Kg): -

BANGALORE COMPLEX

DRG No.: 844COVERMC1 | ALT: 1 | A1

	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12
GRADE No.												
VALUE	0.025	0.05	0.1	0.2	0.8	1.6	3.2	6.3	12.5	25	50
SYMBOL												

SURFACE ROUGHNESS

APPENDIX-II OF PTS

बी ई एम एल BEML	**TECHNICAL OFFER SUBMITTALS CHECK SHEET**	**Project High Speed Rail (B28) project**
Aggregate:	**External Cover/Cladding**	**PTS DOC No.:** FPIIC/TD/057
BEML Enquiry/ RFQ Reference:		

SL.NO.	DETAILS	SUBMITTED	NOT SUBMITTED
1	Complete Technical Offer for Epoxy Aluminium honeycomb/Epoxy laminate covers or any other proposed material by the subcontractor including technical description and technical data sheet for proposed material.	☐	☐
2	Supporting documents for Qualification Criteria compliance including QAP, company profile with infrastructure facilities, product range, supply credentials etc., (Clause 4)	☐	☐
3	Proposed manufacturing process details and the reference of projects in which the same has been adopted, manufactured and supplied.	☐	☐
4	Technical Data Sheet (TDS) & Material Safety Data Sheet of Epoxy Aluminium honeycomb/Epoxy laminate covers, honeycomb, or any other proposed material by the supplier, aluminium extrusions, metal brackets, nut-insert and adhesive used to bond nut insert, etc.,	☐	☐
5	Repair procedure for proposed material.	☐	☐
6	Estimated weight of Epoxy Aluminium honeycomb/Epoxy laminate covers or any other proposed material by the supplier.	☐	☐
7	Type Test reports (Mechanical & Fire performance) of similar earlier projects	☐	☐
8	Clause-by- Clause compliance for PTS.	☐	☐

Note: Incomplete submissions are liable for Rejection.

Signature of the Bidder with Seal