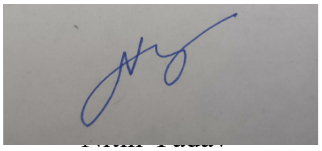
RAIL COACH FACRTORY, KAPURTHALA

MD35131 **Dated: 23/10/2024**

Sub: Issue of MDTS-24401 Rev-01 "Mechanical Design Technical Specification for Modular Toilets and Interior Panels from Sheet Moulding Compound (SMC) using compression moulding process".

Please find enclosed copy of following specification for information and necessary action at your end.

S. No	Description	Specification No.
1.	MECHANICAL DESIGN TECHNICAL SPECIFICATION FOR MODULAR TOILETS AND INTERIOR PANELS FROM SHEET MOULDING COMPOUND (SMC) USING COMPRESSION MOULDING PROCESS	MDTS-24401 Rev -01



(Dy. CME/Fur Design)

CME/QA	CPLE	CWE/Fur	CMM/HSQ	Dy. CME/LHB/HSQ
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Name	Designation	Signature	Level
T P Singh	SSE/FUR-II	TIJENDER PAL SINGH Digitally signed by TIJENDER PAL SINGH Date: 2024.10.18 16:18:06 +05'30'	Prepared
Nitin Yadav	Dy.CME/Design Fur	NITIN YADAV Digitally signed by NITIN YADAV Date: 2024.10.18 17:24:27 +05'30'	Agreed
Lalit Kishore	Chief Design Engineer	LALIT KISHORE Digitally signed by LALIT KISHORE Date: 2024.10.18 18:07:04 +05'30'	Approved

LIST OF AMENDMENTS

SN	Amendment Date	Revision	Details
1	8-Aug-24	Nil	First Issue
2	18-Oct-24	1	Second Issue

Table of Contents

1 INTRODUCTION:

This specification covers the schedule of technical requirements for manufacture, supply and installation of modular toilets from sheet moulding compound (SMC) using compression moulding process for Indian Railway coaches.

2 FOREWORD & SCOPE:

2.1 This specification is divided into two sections i.e. A & B. Section-A covers the technical requirements/provisions relating to materials, constructions and inspection. Section-B covers the infrastructural and system requirements for manufacturing the modular toilet.

2.2 This schedule draws reference to a number of relevant specifications & drawings. The latest version of these specifications & drawings shall be taken as a reference.

3 LIST OF STANDARDS REFERRED:

S. No.	Designation	Description
1.	ASTM D 3171 – 99	Standard Test Methods for Constituent Content of Composite Materials
2.	ASTM C 1425 – 05	Standard Test Method for Interlaminar Shear Strength of 1–D and 2–D Continuous Fiber-Reinforced Advanced Ceramics at Elevated Temperatures
3.	ASTM D3171 − 15	Standard Test Methods for Constituent Content of Composite Materials
4.	ASTM D2863 – 12	Standard Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
5.	ISO 62:2008-05	Plastics – Determination of water absorption
6.	ISO 180:2000(E)	Plastics — Determination of Izod impact strength
7.	ISO 14130:1997(E)	Fiber-reinforced plastic composites —Determination of apparent interlaminar shear strength by short-beam method
8.	ISO 527-1:2012(E)	Plastics — Determination of tensile properties
9.	BS EN ISO 14125:1998	Fiber-reinforced plastic composites —Determination of flexural properties
10.	ISO 5658-2:2017	Fire Performance of Fibre-Reinforced Polymer Composites
11.	ISO 5659-2-2017	Specifies a method of measuring smoke production from the exposed surface of specimens of materials or composites.
12.	ISO 5660-1:2015	Method for assessing the heat release rate and dynamic smoke production rate of specimens exposed in the horizontal orientation to controlled levels of irradiance with an external igniter.

13.	ASTM D 523	Global ASTM standard test method to measure the specular gloss of non-metallic samples
14.	ISO 62	Plastics - Determination of Water Absorption
15.	ISO 1183-1 A	Methods for determining the density of non-cellular plastics
16.	ASTM D 2244	Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
17.	ASTM D 2565	Standard Practice for Xenon-Arc Exposure of Plastics Intended for Outdoor Applications
18.	ASTM D 2583	Method for conducting the Barcol Hardness Test, a non-destructive technique primarily used to evaluate the hardness of plastics, particularly thermosetting plastics, and softer metals like aluminum and its alloys
19.	ISO 4589-2	Plastics — Determination of burning behavior by oxygen index
20.	ISO 1172:2023	Textile-glass-reinforced plastics — Prepregs, moulding compounds and laminates — Determination of the textile-glass and mineral-filler content using calcination methods
21.	EN 45545-2	Railway Applications – Fire Protection on Railway Vehicles – Part 2: Requirements for Fire Behaviour of Materials and Components
22.	ISO 1889:2009	Reinforcement yarns — Determination of linear density
23.	ISO 3344-1997	Reinforcement products — Determination of moisture content
24.	ISO 1887:2014	Textile glass — Determination of combustible-matter content
25.	ISO 1183-1:2019	Plastics — Methods for determining the density of non-cellular plastics, Part 1: Immersion method, liquid pycnometer method and titration method
26.	ASTM-D-2583-81	Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
27.	ISO 9854-1:2023	Thermoplastics pipes for the transport of fluids — Determination of Charpy impact properties
28.	ISO 180:2023	Plastics — Determination of Izod impact strength
29.	IS:2046-1995 Annexure-M	Decorative Thermosetting synthetic Resin Bonded Laminated Sheets- Specification (Resistance to staining)
30.	ISO 1172:2023 Method B/ ASTM D3171	Determination of the textile-glass and mineral-filler content using calcination methods Standard Test Methods for Constituent Content of Composite Materials
31.	IS: 15450-2004	Polyethylene/aluminium/polyethylene composite pressure pipes for hot and cold-water supplies – Specification

32.	ISO 14130:1997/ ASTM C 1425	Fiber-reinforced plastic composites — Determination of apparent interlaminar shear strength by short-beam method
33.	UIC 564-2 Appendix-4	Test method for determining the fire-resistance of rigid non-thermoplastic materials
34.	UIC 564-2 Appendix-15	Test method for determining deterioration of visibility due to smoke released on combustion of materials
35.	IS:101-4-4(Part-4/Sec-4)-1988	Methods of sampling and Test for Paints, Varnishes and Related Products, Part 4: Optical Test, Section 4: Gloss
36.	ASTM-D792/ISO 1183	Density and Specific Gravity of Plastics
37.	ISO 527-1	Plastics — Determination of tensile properties
38.	ISO 14125	Fiber-reinforced plastic composites — Determination of flexural properties
39.	IS: 1998	Methods of test for thermosetting synthetic resin bonded laminated sheets
40.	EN10204	This document specifies the different types of Inspection documents supplied to the purchaser, in accordance with the requirements of the order, for the delivery of all metallic products e.g. plates, sheets, bars, forgings, castings, whatever their method of production.
41.	RDSO SPEC. C-K207	Specifications for Stainless Steel Sheets/Plates for coaches of Indian Railways
42.	RDSO/PE/SPEC/0027	PVC insulated single core multistrand copper cable and Aluminium Cables for AC & Non-AC coaches.
43.	ICF/MD/SPEC.-107	Specification For Fibre Glass Reinforced Plastic Panels For Interior Paneling
44.	RCF SPEC.-MDTS-118 REV-01	Spec For Painting System For FRP Components
45.	MDTS-092	Spec for Granular Corundum Particles for anti-skid surfaces
46.	MDTS-094	Spec for Painting System for Passengers Coaches
47.	EN 45545-2	Fire Protection on Railway Vehicles

Table 1:List of standard Referred

4 ABBREVIATION/TERMINOLOGY:

S.No.	Abbreviation /Terminology	Expansion/Explanation
1	FRP	Fibre Reinforced Plastic
2	SMC	Sheet moulding compound
2	FAI	First Article Inspection
3	QAP	Quality Assurance Plan
4	RCF	Rail Coach Factory
5	KXH	Indian Railways station code for Kapurthala
6	LHB	Linke-Hofmann-Busch the transfer of technology partner for RCF/KXH.

7	CDE	Chief Design Engineer
8	NABL	National Accreditation Board for Testing and Calibration Laboratories

Table 2:Abbreviation/Terminology

SECTION-A

1.0 SCOPE

This specification covers general requirements for design, manufacture, supply and installation of modular toilet units from Sheet Moulding Compound (SMC) to be used for AC and Non-AC Coaches.

2.0 GENERAL ARRANGEMENT OF LAVATORY

The space envelope of lavatories shall be as per tendered drawing (for reference, overall dimensions, coach interface and mountings). The firms are required to submit their General Arrangement drawings with comprehensive analysis from a reputed company, clearly indicating the process adopted for design validation including the thickness of the panel, conforming to the above drawing along with details for toilet assembly, water piping, discharge piping and all the interior fittings for approval by RCF.

3.0 MATERIAL AND PERFORMANCE PROPERTIES:

3.1 SMC Resin:

SMC resin may be unsaturated Polyester or Vinyl ester or Epoxy or Phenolic type to be reinforced with suitable reinforcements. Resin shall be procured from M/s Scott Bader or M/s DSM or any other make approved by CDE/RCF.

3.2 Filler Material:

Filler powder shall be added to the SMC formulation to achieve Fire Retardancy, surface finish and rigidity etc. as per the final material physical requirement of the product as per specifications.

3.3 Reinforcing material:

The Manufacturer is allowed to use any of the following reinforcing materials with 25 mm to 50 mm cut strands of Glass rovings. For Glass base filaments Only Low Alkaline Aluminium boron silicate glass (SMC Rovings) is to be used as per the ASTM D 578 and for Carbon Fibre it shall be complying with DIN 52332.Glass roving shall be procured from M/s Owens Cornings or M/s Jushi or any other make approved by CDE/RCF.

3.4 Additives:

Following additives shall be used in right proportion to achieve required properties specified in specification (Table no:3) :-

1) Dispersion & processing additives,
2) Catalysts, inhibitors,
3) Releasing agent

4) Thickening agent
5) Lubricating agent

Note: All raw material used for the manufacturing shall be traceable to their original sources. The chain of documents establishing the traceability shall be provided with each consignment. This chain shall be verifiable

3.5 Coloring Pigment / Painting:

Colour pigment can be added to the SMC compound in the right percentage, it is optional. The panel surface shall be coated with FR PU paint which meets the HL3 criteria and the PU painting should be to RCF/Spec. MDTS-118 Rev: 01 . The final colour scheme with glossy finish shall be approved by CDE/RCF. The paint finished surface shall be abrasion resistant and anti-graffiti with anti-bacterial properties.

4.0 GUIDELINE FOR MANUFACTURING SMC SHEETS & PARTS:

4.1 SMC Resin, Fillers, Resin Additives, Hardeners , release agents , dispersion & processing additives and lubricating agents shall form a slurry.

4.2 Slurry & glass fiber shall be compacted in SMC line to form SMC sheet. Compacting should ensure uniform & air free distribution.

4.3 Curing of SMC sheet shall be done for 3 to 7 days in controlled Humidity 50-60% RH at 24-28° C.

4.4 Cured SMC sheets shall be pressed in a suitable capacity hydraulic press in heated metal dies (at 130-150°C) for manufacturing the SMC parts as per design.

4.5 After removal the part shall be de-flashed & kept in proper fixture for a minimum half an hour.

5.0 CONSTRUCTION OF LAVATORY MODULE:

5.1 SMC parts shall be assembled to form lavatory modules. The SMC parts must be designed with proper ribbing to ensure proper stiffness and with the target to reduce weight from the existing lavatory module.

5.2 The Mainline passenger coaches generally have 4 toilets each, of both western commode and Indian squat-pan types. The modular toilet system is required for both designs, to meet the following objectives:

a) Sharp edges should be avoided completely
b) Proper ribbing should be ensured to bears all load conditions
c) Toilet should be ready to assemble resulting in lower manpower requirement from existing design
d) Reduction in weight of coaches.

e) All the parts must be assembled in such a way that no crevice for dirt accumulation is there
f) To reduce the extent of corrosion in the bottom portion of the toilets. Bottom plate for anchoring should be of SS 304.
g) To provide for a clean, odourless, hygienic and aesthetically pleasing toilet.
h) To have a toilet which is easy to clean and refurnish.
i) To have a long life with easy maintainability.
j) The SMC laminates shall be free from defects such as delamination, cavities, discontinuities etc. The panel surface shall be smooth, uniform and free from visual defects or any other surface defect.

6.0 PROPERTIES OF FINAL SMC LAMINATE:

The properties of the laminate shall be as per the values specified in the table below:

SN	Properties	Specified Value	Evaluation Standard
1	Specific gravity	1.6-2.0	ASTM-D792
2	Tensile strength (MPa)	74	DIN EN ISO 527-1
3	Tensile modulus (GPa)	9.45	DIN EN ISO 527-1
4	Flexural Strength (MPa)	124	DIN EN ISO 14125
5	Flexural modulus (GPa)	7.8	DIN EN ISO 14125
6	Inter laminar shear strength- min (N/mm2)	7.5	ISO 14130/ ASTM C1425
7	Hardness Barcol-min	>35	ASTM –D-2583-81
8	Cross breaking strength (N/mm^2)-min	120	IS: 1998
9	Izod impact strength (joule/mtr.)	550	ISO 180/ ASTM D254
10	Fibre content by weight (w/w) - min (%)	25-30	1172 Method B / ASTM D3171
11	Water absorption-max	0.1%	ISO 62
12	Limiting Oxygen lndex	>35 %	ASTM D 2863
13	Maximum Average Rate of Heat Emission (MARHE)	Maximum 60 KW/m^2	ISO 5660-1 @50 kW/m^2
14	Ds (4) (Optical Density at 4th minute)	Maximum 150 R1 (HL3)	EN45545-2 ISO 5659-2
15	VOF4 (Cumulative Optical Density at 4th minute)	Maximum 300 R1 (HL3)	EN45545-2 ISO 5659-2

16	ClTG (Conventional lndex of Toxicity)	Maximum 0.75 R1 (HL3)	EN45545-2 ISO 5659-2
17	Spread of Flame (CFE)	Minimum 20	EN45545-2 ISO 5658-2

Table 3: PROPERTIES OF FINAL LAMINATE

a. Colour Fastness and Aging Test Method(Durability Test)

One specimen shall be tested for 1000 hours in accordance with ASTM: D2565. The black panel temperature shall be maintained at 63 ± 5 °C. The irradiance shall be adjusted to 0.35 W/m^2 at 340 nm. The filter combination shall be outer and inner Type "S" High Borate Borosilicate. (Atlas Xenon Arc Fade-O-meter is used in this test method.) Humidity need not be controlled. One specimen shall be retained as a control specimen.

b. Typical Performance Requirement

Tested specimens shall not show any cracking, crazing, blistering or significant change in surface texture when compared to the control specimen. The tested specimens shall be inspected for colour change by the method stated in ASTM D2244 and the average colour difference between tested specimens and the untested control specimen shall not exceed ± 2CIE units (Illuminant D 65, 10° specimen) when using a light source (Illuminant D 65, 10° CIE Standard Observer), and CIE LAB colour scale.

7.0 QUALITY ASSURANCE, TESTS & DOCUMENTS:

The following table provides the overview of the system for quality assurance.

Requirement Description	Requirement Detail	Remarks
Quality Assurance plan	The manufacturer shall have a detailed quality assurance plan. The Plan shall be submitted for the approval by RCF/KXH. The QAP document shall clearly document the following and control the test record formats. **1.** Control over outsourced products and processes **2.** Testing of raw material and establishing its traceability **3.** Sampling Plan **4.** Type Tests **5.** Routine Test **6.** Acceptance tests **7.** Raw Materials	The QAP shall be submitted in PDF soft copy digitally signed by the head of Quality department of the manufacturer for approval.
Type Tests	These tests are required to verify the functional working of the system. These may require simulated in-puts for testing the operation under a full range of inputs. These tests shall be done by the manufacturer during manufacturing and record maintained for inspection. These tests are to be repeated after every 12 months or as specified. ▪ Durability Test: Out-door accelerated weathering test exposure As laid down in Para 7	The records of the type tests shall be maintained by the manufacturer and shall be made available upon demand. These records shall be traceable and verifiable

Routine Tests	All the tests laid down in Table in para 7 have to be routinely tested for each batch of SMC being compounded. Two SMC test panels of 300 mm x 300 mm to be manufactured from each batch and clearly marked with batch number and date of manufacture. One panel of each batch will be for testing and the other after being duly marked shall be stored till the material is tested and accepted at the consignee end. This is for cross checking and traceability and to maintain highest standards of quality.	The records of the type tests shall be maintained by the manufacturer and shall be made available upon demand. These records shall be traceable and verifiable.
Acceptance Tests	All tests as laid down in para 7 shall be tested by the consignee from every lot of the supply made by the vendor by picking any of the toilets. The cutting of sample for testing at consignee end will be done from the extended piece of the SMC part without damaging the part. This provision will be made in the part drawing to cut test samples for testing at consignee end. However, for testing, the testing agency can take samples from any location of toilet.	The records of the acceptance tests shall be enclosed along with the supply consignment. These records shall be traceable and verifiable.

Table 4 Quality Assurance, Tests & Documents:

1) All testing except for fire retardant tests as per EN 45545 -2 must be carried out by laboratory accredited by the NABL for the specific test, if any test not fall under NABL scope then test may be conducted from Government lab or lab accredited for NABL test for any other test(s) mentioned in Specification .
2) The fire retardant tests as per EN 45545 -2 shall be conducted by only RDSO approved labs for EN 45545-2 tests.

NOTE- If any Vendor opts for test(s) from Government Lab instead of NABL accredited laboratory in that case, the firm must submit the declaration that the test(s) are not covered under NABL accreditation at the time of bid. Later, if the claim made by the firm is found incorrect/false, the bid of the firm shall be summarily rejected and the firm may be disqualified from participation in the tender.

8.0 FABRICATION OF TOILET MODULE:-

The modular toilet unit shall be made by SMC compression moulding process.The firm received PO against these specification shall Follow following procedure for approval of design

a. Firm shall initially submit the render of the lavatory design , 3D model having all details for review and approval to PO placing Unit.

b. Following approval of the 3D model, a mock-up will be created based on the approved 3D model design. Subsequently, a prototype will be developed using Sheet Molding Compound (SMC), incorporating all improvements suggested during the mock-up phase. Concurrently, the firm will submit the final 3D model & all relevant 2D drawings along with .prt files with thorough analysis, to the design office prior to prototype manufacturing. These drawings will adhere to RCF's designated format, and each will be assigned a unique drawing number by the Design RCF team.

NOTE – Firm have to submit all the 3D model, DOT(.)Prt files & 2D drawings on NX platform drawing & model submitted on any other platform will not be acceptable

9.0 ASSEMBLY OF TOILET MODULE IN THE COACH

9.1 The components of the module shall be assembled using Aluminium extrusions specially designed for the purpose.

9.2 Flat square head inserts (Blind rivet Nuts) of (brass/SS)shall be provided on the panels at the relevant locations. It shall be ensured that all the fasteners have a metal backup of molded threaded brass inserts wherever fastening is done.

9.3 Assembled module shall meet the internal dimensions as is present in the coach layout internal dimensions. There shall be no damage to the surface in terms of cracks or deep scratches on the surface in course of assembly.

10.0 DIMENSION AND TOLERANCES

The dimensions and tolerances shall be as per relevant drawings submitted by the firms for approval and should adhere to the internal dimensions of the coach for proper interface.

11.0 SCOPE OF SUPPLY OF TOILET MODULES:

11.1 The scope of supply shall include all the items shown in the respective general arrangement drawings.

11.2 PLUMBING:

KiTEC (PE-AL-PE) or similar flexible pipe as approved by CDE/RCF and connections with aluminium core encased within 2 HDPE layers with strong adhesive tie layer on both sides of the aluminium core shall be used for plumbing including the connection from water tanks. The material used for the piping system shall conform to IS-15450-2004. The connecting fittings of the system shall be made of non-corroding materials. Line valves shall be located to facilitate easy accessibility for maintenance. The complete plumbing arrangement shall be leak-proof and maintenance free. It shall be possible to isolate different water circuits/fittings for repairs without total dismantling.

11.3 WATER TAPS

All the water taps fitted shall be of self closing type. Atomized nozzles to be fitted for taps to save upto 96% water. The taps shall be of high quality with aesthetic appearance and shall provide trouble free service. Anti-pilferage devices shall be provided for water taps. Make & model shall be approved by CDE/RCF.

11.4 WASH BASIN

The wash basin shall be made of high-quality Corian material or approved by CDE/RCF with good finish on the working surface. Wash basin discharge pipe shall be devoid of sharp bends to avoid choking.

11.5 LAVATORY PAN & WALL PROTECTOR

The lavatory pan and wall protector shall be similar to IRS type and shall be of high-quality stainless steel to specification. AISI-304 and with mirror finish on the working surface., Lavatory pan and wall protector shall also be suitable for the Bio Vacuum toilet discharge system.

11.6 COMMODE:

The commode should be SS 304 and the provided commode shall be similar to the commode used on Indian Railways.

11.7 FLOOR:

Floor shall be anti skid /non attaching dirt with easy to clean and water should not stagnate.

11.8 TOILET PAPER HOLDER

The commode lavatory shall be provided with sunk-in type stainless steel toilet paper holder for AC coaches.

11.9 MIRROR:

The frame shall be aesthetically finished as approved by RCF. Due care shall be taken in the fitment of mirror assembly to avoid water ingress and pilferage.

11.10 LIQUID SOAP CONTAINER

Lavatories of AC coaches shall be provided with stainless steel liquid soap containers devoid of sharp edges.

11.11 SOAP DISH:

Stainless steel soap dishes devoid of sharp edges shall be provided at suitable locations.

11.12 AIR PURIFIER:

Lavatories of AC coaches shall be provided with stainless steel containers for air purifiers.

11.13 HANDLES:

Stainless steel 304 handles shall be provided at convenient locations.

11.14 COAT HOOKS:

Three pronged swiveling type stainless steel coat hooks shall be provided at convenient locations which will not cause any injury to the passengers.

11.15 SUNK IN TYPE SHELF:

Sunk-in type shelf shall be provided in each lavatory.

11.16 HEALTH-FAUCET:

Brass with SS Braided shall be provided at suitable location.

11.17 LITTER BIN:

Litter bin below the outside wash basin shall be provided. Features to be added:

- Separate Dustbin encased creates gap between casing and dustbin leads the overflow for garbage. It should be integral.
- Drain pipes should not get damaged during the operation of the dustbin.
- Should be light in weight to make the operation easy. Hanging arrangement of biodegradable bags to be provided.
- Material of the dustbin shall be Stainless Steel for fire safety.

11.18 LAVATORY DOOR WITH TOILET OCCUPATION INDICATOR:

Lavatory door shall be in the scope of supply along with door closer and Toilet “occupied”/ “vacant” Indicator along with stainless steel door latch.

Wherever required branded latches/panel locks/hinges of make Southco, Industrialas, Dirak, Dorma or any make approved by CDE/RCF to be used.
For door opening & closing arrangement recommended makes are Dorma, Diral, Southco or any make approved by CDE/RCF

Note -All the Bath fittings shall be of Jaquar/Hindware/CERA/Parryware or brand approved by PO placing unit (CDE/RCF in case of PO placed by RCF only)

11.19 LIGHT FITTINGS:

11.19.1 LED light fittings shall be provided, one above the washbasin inside the toilet unit and one above the window on the side wall.

11.19.2 Three LED light fittings (TS/MC-7-6-022) shall be provided in the ceiling of each lavatory similar to Vande Bharat lavatories

11.19.3 One LED light fitting shall be provided above the outside wash basin.

11.19.4 The Electronic lamp ballast 110 V DC/11 W suitable for LED fitting shall be procured from approved sources only. The sources shall be ascertained to RCF before commencing the supplies.

11.19.5 Good engineering practices shall be adopted for fitment of light fittings to meet the rolling stock service and maintenance conditions.

11.19.6 The modular toilet shall be supplied in pre-wired condition with E- beam cable for lights, fans and switches. The cables and wiring fittings shall be procured as per spec. RDSO/PE/Spec/TL/0027 or latest IR spec as advised by RCF from RCF approved sources. The electrical wiring looping between the light fittings and fans (toilet fan and exhaust fan) shall be restricted as minimum as possible. This shall be finalized in consultation with RCF.

11.19.7 All lights to be flushed in. Code of Practice for wiring for 110V DC Self Generation Train Lighting System **as** perRDSO Specification no. EL/TL/48 (Rev.1)-2005 or latest needs to be followed. Code of Practice for Train Lighting Maintenance on Prevention of fires on 110V DC Self generating coaches as per RDSO Specification no. EL/TL/56-1992 or latest needs to be followed. Code of Practice for Prevention of fire in AC coaches **as** per RDSO specification no.RDSO/PE/0/0008-2005 (Rev.0) or latest needs to be followed.

Note: Any other lavatory fitting if required shall be in the scope of the supplier

Note -Firm have to comply with the features listed above, in addition to firms liable to to add any additional Features as advised by Po placing authorities.

11.20 DISPOSAL OF WASTE

The supplier at his own cost shall collect all off-cuts and grinding dust (to be done in a closed enclosure) generated during installation of modular toilets from RCF and dispose of observing the Pollution Control Board norms in this regard.

12.0 MARKING (QR CODE As per RCF Specification MDTS 49398 (Latest Rev)

Each lavatory module shall be affixed with Lifetime ID Code as detailed in RCF Specification No. MD49398.

13.0 INSPECTION

13.1 100 % of the lot offered for inspection shall be visually examined for colour and surface finish.

13.2 Dimensional checks as per drawing shall be carried out on 25 % of the lot offered for inspection subject to a minimum of 8 nos.

13.3 One in ten pieces of the bottom trough shall be subjected to a load of 1000 N over an area of 250 X 250 mm at any location with support as provided in the drawing and the deflection shall not exceed 1 % of the maximum span of the trough. The same trough shall be subjected to the same load as given above at two different locations (total 2000 N). There shall be no sign of deformity under such loads.

14.0 PACKING

The product shall be supplied in eco-friendly packing material.It shall comply with the guidelines of packing issued by RCF.

15.0 WARRANTY

The warranty period shall be 6 years for all items from the date of installation of the composite modular toilet unit for functioning.

16.0 SPARES:

The following Quantity of spares shall be supplied with per 10 Coach Set of Modular Toilets.

#	**Description of Item**	**Qty**
1	Spring aided door closer	1
2	Tissue paper Holder	2
3	Health faucet	1
4	Tap	2
5	Latches	2

Table 5 SPARES

17.0 TRAINING

The firm shall conduct training of Zonal Railway staff for installation, operation, trouble-shooting, repairs and preventive maintenance of the toilet system free of cost. The firm shall supply a comprehensive maintenance manual to all user railways.

18.0 Any deviation from the specification/drawing shall be clearly brought out separately in their offer.

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SECTION-B

REQUIREMENTS OF INFRASTRUCTURE FACILITIES TO MANUFACTURE SMC MODULAR TOILET FOR INDIAN RAILWAY COACHES (BG)

1.0 SCOPE

1.1 This Section covers the infrastructural requirements for manufacture of SMC Modular Toilet for Indian Railway Coaches (BG).

2.0 PLANT, MACHINERY AND INFRASTRUCTURE REQUIREMENTS

2.1 The manufacturers shall have adequate space and covered area with cemented floor to accommodate the following:

a) Damp free place for storage of powder, chemicals, reinforcement and other raw materials including bought out items.

b) Finishing, Assembly and Inspection area.

c) The manufacturer shall have at least one SMC Compacting/ manufacturing Line Machine of 1m width minimum and to meet a larger volume of SMC requirements in a controlled temperature, dust and humidity in an air-conditioned atmosphere. The SMC machine should be using Glass Rovings as reinforcements and not CSM. The temperature shall be maintained at 26_+2 and humidity at 50%. Temperature and Humidity indicators shall be provided inside the SMC Compacting cabin. The manufacturer shall have AC / Cold Storage for liquid chemicals, Initiators, PC control mixing station, Automatic / PLC control SMC Line, maturation room with the temperature from 32˚C to 35˚C.

2.2 HYDRAULIC PRESS

2.2.1 Minimum one 2000T Hydraulic Press with minimum bed size of 3000 mm x 2000 mm to press all large components and with proper heating arrangement required for SMC of up to 160 deg C.

2.2.2 Minimum one 500T Hydraulic Press with minimum bed size of 2000 mm x 1800 mm to press components like bottom and top and with proper heating arrangement required for SMC of upto 160 deg C.

2.2.3 One 150T Hydraulic press for manufacturing test laminates and smaller components like covers.

2.3 Manufacturer shall have at least one drilling machine with provision for drilling, different diameter holes and at least two portable hand grinders for finish grinding of components.

2.4 Manufacturer shall have one air compressor of minimum capacity 126 Cfm/200 Cfm, 25 to 30 HP with Air dryer attachment.

2.5 The firm shall have suitable tools, cutters, fine polishing files, Buffing Machine for de-flushing the moulded products.

2.6 The manufacturer shall have a system to ensure that, dies are checked at regular intervals. They shall have adequate dies handling facilities like chain pulleys or electric hoist or any other suitable method for lifting and movement of heavy dies.

2.7 Prior to release of dies for production, it shall be ensured that these are checked dimensionally in all respects. Proper records of die inspection checking showing the date of checking shall be available.

2.8 The manufacturer shall have at least one number die for each item. The dies shall be made using high quality tooling grade steel, buffed and polished to mirror finish.

2.9 Proper weighing facilities for measuring various raw material constituents shall be available. One electronic weighing balance with a minimum of 10 mg. accuracy and one mechanical weighing balance of 100 kg. capacity with 0.2% accuracy shall be available.

2.10 It shall be ensured that the weighing machines are calibrated regularly and frequency of calibration shall be specified.

3.0 BOOTH PAINTING SYSTEM:

3.1 The painting shall be done in a booth system. The Min. size of the Painting booth and oven shall be big enough to paint all the components of the Toilet Module. The Painting Booth shall have the following facilities.

3.1.1 Full Roof air inlet supply system ensures down draught of filtered fresh air which flows to enhance painting finish quality free from dust with over-sprayed paint being sucked at the bottom of the booth thereby avoiding floating of over-sprayed paint particles in the booth.

3.1.2 Maintain an adequate velocity of clean air at the operator's breathing level in Booth and Oven.

3.1.3 Discharge the solvents and solids outside the building through a solvent extraction blower system with bottom suction and solvent exhaust duct of 10 m. height from ground level. The system shall be provided in such a way that it will not cause either nuisance or hazard.

3.1.4 Hi-lux, shadow free lighting shall ensure even illumination with minimum glare from roof to floor, for better quality painting.

3.1.5 User friendly external control panel for management of system Blowers, lightings, emergency Oven Control, Temperature and Duration Control, etc.

3.1.6 Centrifugal blower for solvent extraction and reduction of noise level.

4.0 TESTING FACILITIES:

4.1 The manufacturer shall have one digital tensile testing machine of 1 MT capacity having a least-count of 2.0 Kg with adequate speed of testing required for SMC components.

4.2 The firm shall have one Barcol impressor (Model No.934-1) for conducting hardness test.

4.3 The firm shall have an electronic balance (least count-0.0001 gm) with density determination kit.

4.4 The firm shall ensure that arrangements are available for conducting the impact test

4.5 The firm shall ensure that the arrangements are available for measuring water absorption percentage.

4.6 One muffle furnace (800°C) with digital temperature controller and indicator required for glass content determination shall be available.

4.7 Bunsen burner and necessary stand/holder required for flame test shall be available. A hot plate for boiling water test of SMC shall also be available.

4.8 One Critical Oxygen Index Testing Apparatus designed as per ASTM D- 2863/IS-13501: 1992./IS-694

4.9 One number Water Absorption tester

4.10 The manufacturer shall have at least 3 Nos. of silica crucible of 4" size for glass content test and two Nos. of glass desiccators. Other glassware like beakers, watch plate, funnel etc. shall also be available.

4.11 The firm shall ensure that measuring instruments like steel scales (300, 600 & 1000 mm), and vernier calipers (0-200 mm) are available.

4.12 The manufacturer shall have test sample preparation arrangements like vice, cutter, polishing files etc. for preparation of various samples for tests for tensile strength, hardness, specific gravity etc.

4.13 All measuring and checking gauges for different components of the modular toilet to ensure the dimensions as per drawings shall be available.

4.14 Digital Gloss meter with 60 deg. gloss head as per IS:101 (Part-4/Section-4)-1998 to measure gloss value of the surface of the products shall be available.

4.15 Manufacturer shall have at least one Flow cup B-4. (Ford) or Brookfield Viscometer for measuring the viscosity of Resin.

4.16 Manufacturer shall have necessary arrangements for measuring the gel time for resin like beakers, pipette, conical flask etc. Manufacturer shall have a device to measure the gel time, curing time and exothermic value.

4.17 Manufacturer shall have one Lab stirrer for mixing the different chemicals & filters.

4.18 Jigs & fixtures for conducting load test, tensile test etc. shall be available.

4.19 The firm shall ensure that one full-scale fixture for fitment of bottom tray with the Rail Coach body is available.

5.0 QUALITY CONTROL REQUIREMENTS

5.1 The manufacturer shall have their own valid Quality Control Document to be approved by RCF prior to mass manufacture.

5.2 There shall be a system to ensure 'first-in first-out' for all raw materials and intermediate stages to finish products.

5.3 It shall be ensured that there is a Quality Assurance Plan for the product detailing the following various aspects:

a. Organization chart
b. Process flow chart
c. Stage inspection details from raw materials stage to finish product stage
d. Various parameters to be checked and level of acceptance of such parameters indicated and method to ensure control over them.

e. Disposal system of rejected raw material and components.

5.4 The quality manual of the firm for ISO:9000 shall clearly indicate the control over manufacturing at every stage and testing of the said Railway product.

5.5 It shall be ensured that proper analysis is being done on a monthly basis to study the rejection at various stages of production and is documented.

5.6 Latest version of all the relevant specification IS, BS, ISO, ASTM, UIC, NCD, RDSO standards/ specifications and drawings with latest alterations shall be available with the firm.

5.7 The firm shall have a system for traceability of the raw materials used, especially the liquid resins. Each drum of the resin shall be traced to a finished product. Similarly, each finished product shall be traced back to the drum of resin from which it was manufactured.

6.0 INFORMATION TO BE PROVIDED BY BIDDER / SUPPLIER:

The following information shall be provided by the bidder / supplier.

6.1 Information to be supplied upon release of letter of acceptance / purchase order:

The following information shall be supplied prior to the supply of the ordered material:

S. No.	Information to be provided	Important Note
1.	Copy of the detailed QAP for the SMC components ordered.	The document must contain the details as specified in the clause on quality assurance in this specification.
2.	Test Certificates for all tests conducted by the manufacturer or third-party agencies.	The test certificates shall be traceable and verifiable.
3	ISO / IRIS Certification as available.	

Table 6 supplied prior to the supply of the ordered material

6.2 Information to be supplied with the material consignment:

S. No.	Information to be provided	Important Note
1.	Copy of the detailed QAP	The document must contain the details as specified in the clause on quality assurance in this specification.
2.	Test Certificates conducted by the manufacturer or third-party agencies as specified in para 8 in section A of Specification.	The test certificates shall be traceable and verifiable.
3.	Technical data-sheet of all parameters mentioned in the spec. & material safety data sheet	

Table7 supplied with the material consignment:

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