RAIL COACH FACTORY, KAPURTHALA

MD46111

Date: 02.09.2025

Sub: Specification no. MDTS_214 Rev_13 for FRP Modular toilets for LHB Coaches.

Please find attached a copy of Specification no. MDTS_214 Rev_13 for in FRP Modular toilets for LHB Coaches for your necessary action and information please. Specification has been updated to incorporate the special design features of Mechanical items and electrical items.

04/09/25

(Nitin Yadav)
Dy CME/Design-Fur

Dy CPLE-II

Copy to:

CQM, CPLE, CWE/Fur, CMM/RCF, CMT, CMM/TKJ
SSE/Record
SSE/Lib/Design
SSE/Design/RCF/TKJ

4219547/2025/O/O SSE-39/FUR-2/DESIGN/RCF/KXH

भारत सरकार
रेल मंत्रालय
रेल डिब्बा कारखाना
कपूरथला
पंजाब 14460
स्थापित :1986

RCF
KAPURTHALA

Government of India
Ministry of Railways
Rail Coach Factory
Kapurthala
Punjab 144602
E S T T : 1 9 8 6

एफआरपी मॉड्यूलर शौचालय
FRP MODULAR TOILET

Specification Number	MDTS-214		
Revision Number	13	Date of Issue	28 August 2025

© RCF/KXH 2025

FOREWORD

This technical requirement laid down general / technical, testing requirements of FRP modular toilet of passenger coaches of Indian Railways.

DISCLAIMER

This specification is based on the studies, trials& experience by RCF/KXH. Although every care is taken in specifying details adequately and unambiguously, RCF/KXH shall not liable for any kind of damages / losses incurred by any and all due to errors or omissions in this document. When using the information described herein, the user is ultimately responsible for their own actions, as well as the actions of subordinates and assistants, and the consequences arising there from.

This document may mention numerous commercial and proprietary trade names, registered trademarks and the like (not necessarily marked as such), patents, production and manufacturing procedures, registered designs, and designations. RCF wishes to state clearly that the present legal situation in respect of these names or designations or trademarks must be carefully examined before making any commercial use of the same.

Names of industrially produced apparatus and equipment may be included to a necessarily restricted extent only and any exclusion of products not mentioned in this document does not imply that any such exclusion has been based on quality criteria or any other qualifying consideration.

COPYRIGHT

RCF/KXH has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission of RCF. Enquires relating to the copyright should be addressed to Public Relations Officer, RCF/KXH.

ADDRESS FOR COMMUNICATION

Public Relations Officer
Government of India - Ministry of
Railways,Rail Coach Factory
Kapurt
hala
Punjab
India
Pin: 144602
Website: www.rcf.indianrailways.gov.in

4219547/2025/O/O SSE-39/FUR-2/DESIGN/RCF/KXH

RAIL COACH FACTORY KAPURTHALA	SCHEDULE OF TECHNICAL REQUIREMENTS FOR FRP MODULAR TOILET FOR LHB COACHES	MDTS-214 REV-13 DATE: 28.08.2025 Page 1 of 15

DOCUMENT CONTROL

Name	Designation	Signature	Level
T.P.SINGH	SSE/FUR-2	TIJENDER PAL SINGH Digitally signed by TIJENDER PAL SINGH Date: 2025.08.28 15:47:12 +05'30'	Prepared
NITIN YADAV	Dy CME/D-FUR	nitin yadav Digitally signed by nitin yadav Date: 2025.08.29 11:35:55 +05'30'	Agreed/Reviewed
LALIT KISHORE	CDE	LALIT KISHORE Digitally signed by LALIT KISHORE Date: 2025.08.29 17:37:17 +05'30'	Approved

LIST OF AMENDMENTS

SN	Amendment Date	Revision	Details
1.	15. 02.2011	01	1. S.No. 03 (b) of the table of Clause '3' revised for QPC from 01 to 02. 2. S.No. 06 of the table of Clause '3' deleted to eliminate the applicability of pre assembled toilet in Power car as it is not feasible to fit pre-assembled toilet in Power Car. 3. Drawing no. LE63159 for piping arrgt of Exe. C/Car added in clause '4'. 4. Stainless wash basin inside Lavatory for Exe C/Car to Drg. No.l 10112.0.30.000.014 instead of FRP wash basin added at S.No. 03 of table - H of Clause '3'
2.	25. 05.2011	02	1. Table of Clause '3 (I) modified to rectify the QPC of Euro-2 Toilet as per drawing no. 1 10113.0.30.000.015 from 02 to 01 for AC /Chair Car. 2. Outside FRP Dust bin & Out side wash basin added in the table of clause 3(1) to clarify the QPC of the same for different coaches. 3. Scraper matting on Lavatory Floor Added as item '6' of Annexure 'A'
3.	19/03/13	03	1. Table of Clause '3 **(I)** modified to incorporate the requirements of Drop Down pre assembled FRP lavatory module with amenities for Double Decker Coach. 2. Table -4 and Table-5 of annexure 'B' and annexure 'C' updated. 3. Specifications for bib cock, scrapper matting and soap dispenser updated.
4.	02/05/13	04	1. S. no. 06 of Table 01 of Clause '3' modified to change the drawing no. of attachment wall LW6143 and LW64144 to LD63294 and LD63295 respectively for Double Decker Coach.
5.	22/05/15	05	1. Item no. 7,8 and 9 are deleted from Table-3 (Annexure 'A') as these items are not to be supplied by Supplier. 2. Note 2. below Table-3 (Annexure 'A') added for the fittment of the loose items by RCF.
6.	29.05.18	06	1. Tejas and Humsafar Coach added in scope of supply in Table No. 1. 2. Different drawing no of attachement wall for Tejas and Humsafar coach added. 3. Additional special features added for Tejas and Humsafar Rake. 4. S.No 9 of additional feature of Tejas rake for LED light is deleted.

SN	Amendment Date	Revision	Details
7.	30.09.19	07	1. Specification revised for addition of salient features of modular toilet for 1st AC, Executive CC, and other AC coaches. 2. Specification revised to add modular toilet system for Non AC coaches.
8.	25.09.20	08	1. As per Railway Board's instructions vide letter 2001/M (C)/137/ 1 vol dated 15/03/2019 , 02 nos of western toilet should be in all reserved coaches and 01 western toilet in unreserved coaches, table-1 updated accordingly. 2. Interior gel coated finish panels with granite granular finish/pattern for AC coaches and only gel coated surface finish for panels of Non AC coaches in clause 5 (a). 3. Painting has been deleted. 4. Semi cylindrical shape for outside washbasin is added in clause 5(g). 5. Semi cylindrical shape for inside waste bin to suit the profile of inside washbasin is added clause 5(f). 6. Automatic Hygiene & Odour Control System deleted from Clause 5 (i)-II 7. Razor socket is deleted from Clause 8 (ii) 8. Jaquar make Faucet deleted in Clause 4(d) & 5 (d) 9. Baby diaper change stand deleted. 10. First Article Inspection and warranty clause added. 11. Title for clause 10 and 11 changed and renumbered as 9 & 10. 12. Scrapper mat made applicable for all coaches.
9.	27.11.20	09	1. B2 is added to rectify Table-1 as the same was omitted by misprinting. 2. Sanitary Facilities to LZ63104 edited to Sanitary Facilities for ref. only in S.no. 'A' of Table-1.
10.	11.01.21	10	1. K9 is added in Table-1 for Fire Extinguisher FRP stand cum Drain pipe arrgt for Water Purification system. 2. S.No. 'N' from N1-N10 is added in Table-1 for scope of supply for HOG compliant SLRD. 3. Clause 5(l) added for Lavatory Window panel for HOG compliant SLRD added.
11.	12.04.2023	11	1. Format changed and clauses re-arranged. 2. Scope, loose items and applicable/referred drawings attached as Annexure 'A' 'B' and 'C' 3. Water purifier deleted from Antyodaya Deendayalu GS coaches. 4. Sub Clause 'h' in Clause '6' for Fire Barrier coating application on inside of walls of Enclosure of Waste Bin to prevent fire. 5. Clause '7' for Electrical Requirements updated. 6. Scope of supply for GS AC Coach, 1st AC with Flat Roof, Double Decker Cargoliner (with 02 Lavatories) and Double Decker AC Chair Car with 04 Lavatories added in Annexure 'C'. 7. Scope of supply for Hot Buffet, AC2T, AC3T and 1st AC for USBRL Coach is also added in Annexure 'C' at 'E', 'I' and 'T'.

SN	Amendment Date	Revision	Details
12.	23.11.2023	12	1. In Annexure 'A ': a) (Drawing no at S.No. L4 & L 10 changed to LS43153 from LG43165 and LE63157 from LE64157 respectively in SCN Coach. b) Drawing nos at N6 changed to instead of (for SCN Coach) and LR64146 instead of LR63146 (for SLR HOG Coach. c) Qpc for S.N. Q6 (Outside wash basin with dust bin below) for 1st AC Coach with Flat roof changed to 02 from 01. 2. Remark for "Geyser will be procured and fitted by RCF/Electrical" for USBRL Coaches added. 3. **Clause '6 (f) for** Inside Waste Bin Arrangement below Wash Basin **changed to** "as per drawing mentioned in the drawing of BOM of Assembly drg of Lavatory Module for all AC/Non-AC Coaches" **instead of "**Semi-cylindrical stainless steel waste bin of suitable capacity with brushed finish to match the profile of wash basin" for all AC/Non AC Coaches". 4. **For ACCN (Turnkey) Coach Drawing for Outside Wash Basin and Dust Bin arrgt** shall be **LE63100 with LW63163 or alternatively MI007920.**
13.	28.08.2025	13	1. Clause 1&2 updated for 03-piece design (Module to be assembled inside the coach) 2. Clause 4 & 5 modified. 3. Annexure 'A' updated for Scope of supply and electrical items. Electrical items updated as per 598 Alt-a . 4. All plumbing items added in **List of items to be supplied loose by the supplier**, in loose condition instead of fitted. 5. Drawings in Scope of supply updated.

4219547/2025/O/O SSE-39/FUR-2/DESIGN/RCF/KXH

CONTENTS

FRP MODULAR TOILET 1

1 Introduction 5

2 Forward and Scope: 5

3 List of standards Referred: 5

Table 1: List of referred standards 6

4 Abbreviation/Terminology: 6

Table 2: Abbreviations & Terminology 6

5 Material & other relevant specification: 6

6 Salient features for AC and Non-AC Coaches : 6

7 Key infrastructure requirements: 7

8 Approval of prototype sample: 8

9 First Article Inspection : 8

10 Information to be provided by bidder / supplier: 8

Table 3: Information to be provided with the bid 9

Table 4: Information to be provided upon release of letter of acceptance / purchase order 9

Table 5: Information to be provided upon release of letter of acceptance / purchase order 9

Annexure 'A' 10

1 Introduction

This specification covers the general and technical requirements of FRP composite modular toilet (for AC and Non-AC Coaches) which can be dismantled in 03 pieces with some selected pre-fitted amenities and then to be assembled inside the coaches for the final fitment

2 Forward and Scope:

This specification covers the general and technical requirements of FRP composite modular toilet which can be dismantled in 03 pieces with some selected pre-fitted amenities and then to be assembled inside the coaches for the final fitment for all LHB AC coaches and non-AC coaches. Modular Toilet must have 02 vertical joints and to be supplied in three walls which will be assembled inside the coach.

List of standards Referred:

SN	Standard	Title
1	IS:11551 -1996	Glass fibre chopped strand mat for the reinforcement of epoxy, phenolic and polyester resin systems.
2	IS :11273-1992	Woven roving fabrics of 'E' glass fibre
3	IS:2500-2000	Sampling procedures for inspection
4	ASTM-D792	Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
5	IS: 1998-1962	Methods of test for thermosetting synthetic resin bonded laminated sheets
6	BS:4994	Specification for Design and Construction of Vessels and Tanks in Reinforced Plastics
7	ASTM–D-2583-81	BARCOL Hardness
8	EN 62262	Resistance or impact strength
9	IS: 13411	Glass reinforced polyester dough moulding compounds
10	ASTM D-570-2018	Test Method for Water Absorption of Plastics
12	ASTM –D-2863	Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics
15	MDTS-092	Granular corundum particles
16	MDTS-118	Painting system for FRP components
17	MDTS-115	3D Glass Fabric

18	MDTS-094	Painting System
19	IS:101	Methods of sampling and test for paints
20	EN 10204	Inspection documents for steel (and other) product
21	MDTS-133	FRP components for all passenger coaches

Table 1: List of referred standards

3 Abbreviation/Terminology:

S.N.	Abbreviation /Terminology	Expansion/Explanation
1	FRP	Fibre Reinforced Plastic
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.

Table 2: Abbreviations & Terminology

4 Material & other relevant specification:

a. Material specification shall be as given in concerned component /assembly drg.

b. FRP (hand lay-up/ Vacuum Bagging process) components shall be as per RCF's technical specification for hand lay-up / Vacuum Bagging process FRP components for all passenger coaches to MDTS-133.

c. Scope of supply shall be as per Annexure A.

5 Salient features for AC and Non-AC Coaches:

a) All interior surface finish should be good of blending with interior fittings to provide a pleasant look and shall have ease of cleaning and maintenance.

b) Painting: -

The panels shall be thoroughly cleaned and ground before painting to achieve an excellent painted surface. Surface should be clean, grease free. The gel coat shall be grounded suitably to provide good adhesion. Polyester putty shall be applied on the surface wherever required and shall be sanded and smoothened with a proper grade emery paper. The paint system used should primarily be suitable for application by spraying. It may also be applied by brush for touching up small areas.
All Interior area of lavatories of all AC & Non-AC coaches shall be painted with 2-component polyurethane-based primer (DFT-30-35 µm) and 2-component polyurethane

based direct gloss Anti-graffiti paint (DFT- 50-70 µm) and the surface finish shall be as per colour Scheme issued.
Interior panels should be coated with anti graffiti as per RDSO specification no. M&C/PCN/127-2009.Anti graffiti coating activity shall be done by the firm at their premises itself.

The surface of FRP components painted with Anti-Graffiti coating shall meet the parameters as laid down in Table-6 as described below:

SN	Characteristics	Requirements	Test Method
1	Gloss value	60 to 70 measured at 60°.	Gloss Meter
2	Scratch hardness (1.5 kg load for 25 µrn)	1.5 Kg load on 25-30 microns No such scratch so as to show bare metal	IS: 101-88(Part 5 Sec.2)
3	Anti-Graffiti Properties	Graffiti resistance score (Average) 7.6 (Min) without Not- cleanable OR shadow OR gloss loss.	ASTM-D-6578 / D6578M13 (2018) Table-2

c) Lavatory wall panel should have double side finish i.e. there is no HPL pasted outside.

d) It shall be ensured that SS Back pieces for every amenity are provided (even if it is not mentioned in concerned drawing).

e) Necessary clearance should be provided between the toilet floor (with covering of 3-M Scrapper mating) and lavatory door, so that door shall not infringe. Toilet Door should be replaceable by opening of mounting screws.

f) Loose items (To avoid breakage during transportation) are to be fitted by RCF at shop floor.

g) The color scheme for Lavatory Area shall be as per interior color scheme, issued for particular coach type.

h) The design and drawings of any item other than RCF/LHB design shall be got approved from CDE/RCF.

6 Key infrastructure requirements:

The tenderer shall have plant, machinery, infrastructure requirements, testing facilities for FRP components and quality control requirements as per MDST-139. Separate paint booth is essentially required for painting.

7 Approval of prototype sample:

8.1 The supplier shall submit WTC (along with supply) from OEM for different constituents used for manufacture of FRP panels of lavatory module.

8.2 The supplier shall submit details about warranty, purchase bills for fittings purchased from OEM and supplied with the lavatory modules.

8.3 The supplier shall submit WTC for anti graffiti paint.

8.4 Testing of the prototypes shall be done in the same condition as fixed in the coaches.

8.5 The following test shall be applied to prototype samples:

a) Dimensional checking.
b) Fitment interface of window cowl and lavatory window
c) Fitment interface of lavatory pans and S- trap of Bio Retention Tank.
d) Fitment interface of Attachment wall with door post.
e) Fitment of plumbing items and Exhaust pipe arrgt.
f) Back pieces for the fitment of mirror, Inner Attachment wall, SS Euro bowl and other amenities, shall be insured.
g) Fitment interface of FRP module with end wall sliding door for graze check.
h) Fitment interface of Lavatory door to checked.
i) Material testing by RCF CMT lab.

8 First Article Inspection:

9.1 First article inspection will be carried out by RCF as per ISO/TS 22163:2017 requirement prior to submission of pilot sample to RCF, Kapurthala.

9.2 Validation of special processes (including outsourced processes) will preferably be carried out as per ISO/TS 22163:2017 requirement.

9.3 The tenderer must submit quality assurance plan (QAP), work instructions and audit report of special processes along with pilot sample.

9.4 The sample shall undergo following tests to assurance:

a) Dimensional checking.
b) Tests to be conducted on FRP components as per MDTS-133

9 Information to be provided by bidder / supplier:

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

9.1 Information to be provided at the time of the bid:

The following information shall be included with the bid. These documents shall be used to determine suitability for placement of purchase orders.

S. No.	Information to be provided	Important Note

1.	Previous supply credentials / testimonials containing the list of supplies as per tender.	The document shall contain the contact details (phone number / email-ID) of the purchasers. These may be contacted by RCF for performance feedback.
2.	Any other document required as per tender.	

Table 3: Information to be provided with the bid

9.2 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 FRP modular toilet ordered.	The document must contain the details as specified in the clause on quality assurance in this specification.
2.	Test Certificates for all tests (as detailed in the QAP) conducted by the manufacturer or third-party agencies.	The test certificates shall be traceable and verifiable.

Table 4: Information to be provided upon release of letter of acceptance / purchase order

9.3 Information to be supplied with the material consignment:

S. No.	Information to be provided	Important Note
1.	Copy of the detailed QAP for the FRP modular toilet ordered.	The document must contain the details as specified in the clause on quality assurance in this specification.
2.	Test Certificates for routine tests (as detailed in the QAP) conducted by the manufacturer or third-party agencies.	The test certificated shall be traceable and verifiable.
3.	Test Certificates for acceptance tests (as detailed in the QAP) conducted by the manufacturer or third-party agencies.	
4.	Certificates / documents establishing compliance and traceability of raw material used for the consignment.	
5.	Complete packing list for the consignment.	

Table 5: Information to be provided upon release of letter of acceptance / purchase order

Annexure 'A'

Scope of Supply:

1. **Applicable Drawings**: Applicable drawings for FRP lavatory module for different types of coaches as tabulated below:

S.No.	Description	Drawing No.	Type Of Coach
A.	Layout of lavatory modules	LZ63001	**AC/chair car & AC/Exe Chair car** (Sanitary Facility to LZ63104 for ref. only)
B.	Layout of lavatory modules	LA63013	**First class AC (Flat End Roof)** (Sanitary Facility to LA63156 for ref. only)
C.	Layout of lavatory modules	LA63014	**First class AC (**Flat End Roof) for USBRL Coaches (Sanitary Facility to LA63157 for ref. only)
D.	Layout of lavatory modules	LE63010	**2-Tier AC & 3-Tier AC** (Sanitary Facility to LE63001 for ref. only)
E.	Layout of lavatory modules	LE63008	**2-Tier AC & 3-Tier AC (USBRL)** (Sanitary Facility to LE63277 for ref. only)
F.	Layout of lavatory modules	LE63012	**2-Tier AC & 3-Tier AC (Flat End Roof ICF)** (Sanitary Facility to LE63011 for ref. only)
G.	Layout of lavatory modules	LH63006	**Hot Buffet** (Sanitary Facility to LH63192 for ref.) # For USBRL Coaches to supply hot water in wash basins and Lota filler in each Lavatory as one instant geyser per two lavatories will be fitted, minor changes in the piping layout to be done by supplier at site.
H.	Layout of lavatory modules	LJ63005	**Non AC Chair Car** (Sanitary Facility to LJ63004 for ref. only)
I.	Layout of lavatory modules	LG63005	**Antyodaya/ Deendayalu (GS coaches)** (Sanitary Facility to LG63288 for ref. only)
J.	Layout of lavatory modules	LS63008	**SCN with Wider Window** (Sanitary Facility to LS63006 for ref. only**)**
K.	Layout of lavatory modules	LR63011	**SLRD HOG** (S. F. to LR63008 & LR63315 ref. only**)**
L.	Layout of lavatory modules	LG63008	**AMRIT BHARAT GS** (Sanitary Facility to LG63284 for ref. only**)**

M.	Layout of lavatory modules	LS63010	**AMRIT BHARAT SCN** (Sanitary Facility to LS63146 for ref. only)
N.	Layout of lavatory modules	LR63012	**AMRIT BHARAT SLRD** (Sanitary Facility to LR63307 for ref. only
O.	Layout of lavatory modules	LH63008	**AMRIT BHARAT HOT BUFFET** (Sanitary Facility to LH63195 for ref. only
P.	Sanitary facilities for power car	LP63154 (**Item 1,7,10,14 ,15,16 only)**	**Sanitary Facilities** LP63154 (for ref)
		LP63216 (**Item 1,7,10,14 ,15,16 and 17 only)**	**Sanitary Facilities** LP63216 (**USBR for ref)**

Table 6: Applicable drawings

Note: List of items to be supplied loose by the supplier.

S. NO.	Item Description
1.	Inside Mirror Assembly
2.	Outside mirror Assembly
3.	Inner attachment wall
4.	Lavatory Ceiling flap mounting
5	Scrapper Mating
6.	Soap Dispenser with Cage
7	All items of Pipe laying for water in Lavatory
8	Other items which may break during transportation or not feasible to be supplied in assembled form

2. **Electrical Requirements**:

Following Electrical items should be procured only from the sources as per RCF's approved vendor directory:

a. Lights in the Lavatory shall be supplied in the light as per drawing mentioned in BOM of Lavatory Module. The supplier shall provide indelible marking of its own in addition to

OEM's identification at a location which is normally not visible but can be viewed for identification in fitted condition.

b. Terminal connector to EDML-037 Rev 'A' of quantity 01 per toilet to be provided.

c. Polyamide flexible conduits NW-12 (in meters) to spec. no. RDSO/PE/SPEC/AC/0138-2009(Rev- 01) Table-A-1, Item-2 to be provided for wiring of lavatory light, and limit switch etc.

d. Clamping arrangement of for double conduits to be provided over the lavatory area to drg. no. LP76001 Item-8.

e. Cable jacket system, item-8 to EDTS138 to be provided.

f. Cable duct A45, Standard Slot Grey to Cat. No. CDA4545SG to be provided.

g. Cable duct cover A45, standard slot gray to cat. No. CCA45SG.

h. Cable binder 3.6 x 200 to drawing no.CC 76129 shall be provided.

i. The single core cables used for electrical wiring shall be E-beam copper cable conforming to RDSO Spec. No. ELRS/SPEC/ELC/O019 Rev.04 or PTFE cable conforming to Specification JSS 51034.

Mult-core cable shall be E-beam cable comply to RCF specification EDTS 132 Rev. C Amdt 1, 2 &3 (latest) or PTFE cable to Specification JSS 51038.

The control cable size shall be of minimum 1.5 sq.mm for single core cable and shall be 1 sq.mm for multi core cable. Multicore cable shall comply to RCF specification No. EDTS 132, Rev.C, Amdt.1, 2 &3 (latest). Mounting arrangement for Terminal connector to be provided on wall of Module.

j. All cables in the system shall be pre-harnessed duly securing the cable bunches with appropriate accessories like Cage clamp type connectors, conduit clamps, fire retardant (UL 94 VO) cable ties protective cable jackets, heat shrinkable sleeves flexible conduits etc. End stopper shall be used for every set of terminal block assembly and separator shal be used for +ve &-ve terminal blocks. Cable jackets shall be conforming to specification EDTS-138 (latest). Flexible conduits
and end fittings shall be conforming to specification RDSO/PE/SPEC/0138 (latest), approved by PUs shall be used.

k. For AC Coaches Limit switch in the lavatory door frame & its wiring to be provided.

l. For non- AC Coaches Limit Switch is not required.

m. The route and BOM of Electrical wiring shall be as per Sked no. 598 Alt-a (except item1)

n. Electrical connection of every amenity to be taken trough MCB.
The firms shall supply schematic diagram and logic diagram for scrutiny before approval of the product.

o. Positive & negative segregation of wires shall be ensured during installation.

p. All cable termination shall be used with wire end ferrules/crimping lugs with proper fire-retardant cable markers/heat shrinkable sleeves. The wire end ferrules/crimping lugs approved by PUs shall be used.

q. Code of practice for prevention of fire shall be followed as per RDSO Spec. No. RDSO/PE/O/0008-2005 Rev.0.

r. The electronic items used shall be suitable to rolling stock applications. These items shall comply to IEC 60571/EN 50155 or equivalent EN/IEC standards & materials shall comply to HL2/HL3 property of EN 45545 standard.

s. As per clause no. 9.7 of IEC 60571 (electronic eqpt. used on rail vehicles)

- All printed board assemblies shall be protected on both sides with a protective transparent coating, in order to prevent deterioration or damage due to such cases, as moisture and atmospheric contaminants. The coating shall not have any adverse reaction with any other materials or components used.
- The protective coating shall not be applied to lC sockets, test points or to Connector contact mating surfaces etc.
- It shall be possible to repair a coated printed board assembly without the need for complete removal of the coating.
- After repairing, the printed board shall be locally recoated.

t. As per clause no. 9.9 of IEC 60571, the following shall be adopted for mounting arrangement of equipment:
   - For major equipment: a cubicle. a number of racks, sub racks and printed board assemblies:
   - For smaller, localized equipment: individual sealed enclosures.
   - In each case, the enclosure shall provide the necessary protection (I code according to IEC 60520) from the service conditions, and permit dismantling and repair of the contained equipment.
   - Encapsulation (the covering of, for example, a printed board assembly with silicone rubber, resin or other material) to provide additional protection is not preferred and shall only be used, where (tor example in the case it a remotely mounted transducer) special environmental conditions dictate it.

u. Positive and Negative wires to be segregated with separate conduits/partition inside the duct /separate routing etc.

v. Adequate earthing arrangement shall be made wherever required.

w. EPDM based edge protection sleeves/ grommets cable entry arrangement shall be provided for protection of cables against sharp edges wherever required.