

SPECIFICATION	TECHNICAL SPECIFICATION FOR MANUFACTURING, TESTING, QUALITY CONTROL, INSPECTION AND THE SUPPLY OF COMPLETE ASSEMBLED SHELL OF A LHB COACH SUITABLE FOR OPERATION ON BROAD GAUGE (1676 MM) ROUTES OF INDIAN RAILWAYS	MMDTS 23003 Rev.: 00 Page 1 of 12 Date: 25.04.2024
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1. Objective

Shell of a LHB Broad gauge Coach is broadly an assembly of underframe, side walls, roof and the end walls. This document is prepared to specify the technical requirements for manufacturing, testing, quality control, inspection and the supply of complete assembled shell of a LHB Coach suitable for operation on Broad Gauge (1676 mm) routes of Indian Railways as per the specifications/ Drawings mentioned in the subsequent Para's of this document.

2. Scope of the specification

- 2.1 The scope of this specification is manufacturing, testing, quality control, inspection and the supply of complete assembled shell of a LHB Coach suitable for operation on Broad Gauge (1676 mm) routes of Indian Railways.
- 2.2 The applicable specification and variant wise drawings of shell under the scope of this specification are given in Annexure-1 and Annexure-2 respectively. The Shell includes the following main sub-assemblies:

S.No.	Sub-assemblies
1.	Roof assembly including roof end part
2.	Side Walls assembly including lavatory side walls
3.	End wall assembly
4.	Underframe complete
5.	Door cut outs (both sides)
6.	SS AC trough for RMPU
7.	Steel partition walls and WTCC (if applicable as per coach GI drawing)

- 2.3 Variants of LHB Coaches covered in the scope of this specification:

S. No.	Type of Coach	S. No.	Type of Coach	S. No.	Type of Coach
i.	LWFAC	ii.	LWFCWAC	iii.	LWACCW
iv.	LWACCN	v.	LWFCZAC	vi.	LWSCZ
vii.	LWSCZAC	viii.	LWS AC	ix.	LWS
x.	LWSCN	xi.	LWLRRM	xii.	LWCBAC
xiii.	LSLRD	xiv.	LVPH		

- 2.4 The list of jigs and fixtures required for fabrication and assembly of the complete body shell and its sub-assemblies is given in Annexure-3.

3. Manufacturing Infrastructure

- 3.1 The manufacturer shall possess minimum infrastructure as per the latest version of specifications for schedule of technical requirements as given in Annexure-1.
- 3.2 Apart from above, necessary infrastructure required for manufacturing, handling, inspection and testing (except chemical and physical testing of the material, which can be done at NABL accredited lab) of complete shell assembly is to be developed in house by the manufacturer.
- 3.3 In house availability of Jig and fixtures to be ensured by the firm before prototype inspection in firm premises.

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3.4 Availability of infrastructure facility and testing equipment's at manufacturer's premises in working order as per annexure-4

4. Scope of Supply

The scope of supply shall include manufacture, assembly and supply of completely assembled shell as per specification and drawings (Annexure-1 & 2) and duly meeting the requirements mentioned in this specification. Design of fixtures for transportation of the assembled shell assembly from the manufacturer's premises to the consignee at MCF shall be in the scope of shell manufacturer. Transportation (suitable and protective) from manufacturer's premises to the consignee at MCF shall be in the scope of firm.

5. Technical Requirements

- 5.1 Proper Gauges, jigs and fixtures are to be used to maintain the geometry of the total assembly. Jigs and fixtures shall be available with the shell manufacturer for each & every sub-assembly like under frame, roof, side wall, end wall, partition wall (if applicable) etc and also for assembly of the shell (Annexure-3).
- 5.2 Geometry to be maintained according to drawings and holes to be drilled by drilling jigs. Jigs & Fixtures prepared for the subject work to be duly calibrated.
- 5.3 Technical requirements/ processes/ practices contained in specifications referred in Annexure-1 and general instructions for MIG/ MAG welding given in RCF document No. PLW 0102 or latest are applicable under the scope of this specification. Changes duly supported with proper justification can be accepted with the approval of CDE/ MCF.
- 5.4 Firm shall comply the requirements of welding activities as per schedule of infrastructure requirements for stainless steel fabrication items No. MDST-102 latest version.
- 5.5 Finished assembly shall be free from cracks, flaws, lamination, rough jogged and imperfect edges and other harmful defects. Complete shell will be leak proof from water except the holes/ cut outs shown in drawing.
- 5.6 All sharp edges, burrs and slag to be removed by suitable grinders.
- 5.7 The Metal part of the shell should not be affected/eroded/corroded, when exposed in extreme climatic conditions of 100% relative humidity, or in wet weather, high ambient temperature of 60°C or heavy rainfall.
- 5.8 Any gouging crack or detrimental defects in the products will not acceptable.
- 5.9 Pickling and passivation treatment of all weld joints shall be done as per RCF MDST-102.
- 5.10 Skin tensioning process, procedure and surface finish/ undulation requirement of side walls sheets will be as done for LHB Body shell to RCF Work Instructions No. PLW0105. Concavity or convexity for exterior of side wall shall be as per MDTs-21327.

6. Quality Control Requirements:

- 6.1 The firm should have acquired ISO 9001 series certification having at least one of the sub-assemblies of the full assembled shell (from Para 2.2) in the scope of certification.
- 6.2 It is desirable that the tenderer is accredited with ISO-3834 certificate.
- 6.3 The firm shall have accredited with IRIS as per ISO/TS 22163 guidelines.
- 6.4 The firm should have a system of traceability of the product from raw material stage to finished product stage. The system should also facilitate to identify the raw material composition from the finished product stage.
- 6.5 The firm shall have a Quality Assurance Plan (QAP) for shell assembly covering the following.:
 - Process flow chart
 - Stage wise inspection details from raw material stage to finished product.

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- Check list for critical monitoring of stages (to be prepared and followed).
- Various parameters to be checked and level of acceptance of such parameters indicated and method to ensure and control over them.
- Disposal system of rejected raw material and components.
- The format of QAP is available on link <<https://mcf.indianrailways.gov.in/uploads/Format%20of%20QAP.pdf>>. QAP to be submitted in the above format. Copy of the current version of format is attached as Annexure-4 for reference.

QAP to be submitted to CDE/ MCF for approval.

7. Documentation:

Documents as per the QAP are to be maintained.

8. Acceptance Criteria:

8.1 For individual sub-assemblies of the complete assembled shell- As per the relevant specification and the drawing given in Annexure-1 and Annexure-2.

8.2 For complete Shell Assembly:

8.2.1 Availability of all the sub-assemblies, components as per the relevant drawings.

8.2.2 Dimensional conformance as per the relevant drawing.

8.2.3 Quality of weld check and conformance as per PLW 0102.

8.2.4 Concavity or convexity as per PLW 0105 (latest).

8.2.5 Shower Testing- Complete shell shall be leak proof from water except the holes/ cut outs shown in drawing.

9. Inspection and Prototype approval.

9.1 Inspection of various sub-assemblies of the complete shell assembly shall be carried out at different stages in order to ascertain use of proper quality material, geometry, symmetry, dimensional accuracy of the assemblies in accordance with drawings, quality of welding during fabrication work and overall workmanship. The agency for inspection shall be as decided by MCF, who will be deputed at manufacture/ firm premises for stage and final inspection. Two stage inspection (including final inspection) shall be carried out as follows:

S. No.	Stages of inspection	Inspection Activity
1	Stage-1	Inspection of sub-assemblies and components viz. <ul style="list-style-type: none"> • Complete under frame with all under slung mounting • Roof • side walls • End Walls and • other components
2	Stage-2	Inspection of complete fabricated shell assembly and leakage testing

Only after clearance of Stage-1 inspection of all sub-assemblies, firm should proceed to shell assembly work.

9.2 Prototype Approval

9.2.1 Contractor shall manufacture the shells as per the requirements defined in this specification and offer the same to CDE/ MCF for approval.

9.2.2 The prototype inspection shall be carried out by the authorized representative of CDE/MCF at firm's premises.

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- 9.2.3 The inspection shall be carried out in two stages as above.
- 9.2.4 All the modalities for prototype approval are to be facilitated by the shell manufacturer. If, any of the facility, within the ambit of this specification is to be carried out at third party location/ lab, the same shall be arranged by the shell manufacturer at their own cost and expense.
- 9.2.5 Physical & chemical test of raw materials will be done at any NABL accredited test house. However, MCF reserves the right to carry out testing of samples at their own lab or NABL accredited lab at firm's cost.
- 9.2.6 Use of raw material to the specification and its sources shall be verified during stage inspections.
- 9.2.7 Final prototype clearance will be given after successful fitment and assembly of the Shell to manufacture the complete coach.
- 9.2.8 After supply of first shell, the deficiencies/any shortfall shall be checked and if any further modification/addition of new item is required, the same shall be implemented in first shell by the shell manufacturer at his own cost and expense.

9.3 Bulk supply of shells

The modifications advised during the prototype approval or design changes planned in the preceding activity shall be implemented and the supply of remaining shells shall be made accordingly.

9.4 Regular Orders: -

- 9.4.1 QAP approval by MCF.
- 9.4.2 Prototype approval by MCF.
- 9.4.3 Inspection of balance quantity by Third Party Inspection Agency.

9.5 For Developmental orders:

- 9.5.1 Capability cum Capacity Assessment
- 9.5.2 QAP approval by MCF.
- 9.5.3 Prototype approval by MCF.
- 9.5.4 Inspection of balance quantity by Third Party Inspection Agency.

10. Provisioning of facilities for working for rectification/modification work at MCF

- 10.1 MCF shall provide the following provisions, free of costs, for enabling the contractor working at MCF premises only.
1. MCF will provide suitable crane, material handling equipment and fork lifters with driver for handling of sub-assemblies/body shells at MCF/RBL.
 2. Power supply, Compressed Air and water etc. as available at MCF for working at site shall be provided by MCF/RBL. These shall be put to judicious use and only for activities related to the project.
 3. Access to toilets and drinking water facilities shall be provided at MCF/RBL.
- 10.2 All the other facilities for rectification/modification work at MCF shall be arranged by the shell manufacturer at his own cost and expense.

11. General Terms & Conditions

GCC terms and conditions shall be applicable for the project. These are considered in addition to statutory, regulatory requirements and IRS standard conditions.


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12. Guarantee/Warranty

The expected life of the shell structures is 35 years. The suppliers shall provide a warranty for all supplied items for a period of 10 (ten) years from date of fitment or 11 (eleven) years from the date of supply whichever is earlier for material, manufacture and workmanship as regards to trouble-free and satisfactory service performance. If any defects are noticed during service, with regards to manufacture/ welding quality/material/workmanship of the complete shell including its sub-assemblies and components, action shall be taken by the manufacturer of the shell to carry out any repair/ rectification or replacement at his own cost.

The warranty clause given in the various specifications of assemblies/ sub-assemblies / components mentioned in this specification (Annexure-1) is superseded by the above para of warranty clause.

13. Intellectual Property Rights (IPR)

All the drawings/specification provided in tender shall be the property of IR. Bidder shall not share the same to third party without prior permission of Chief Design Engineer/MCF or shall not use the same for any other purpose other than the work related to the tender.


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Annexure-1

List of applicable specification

S/no	Sub-assemblies	Specification Description	Specification no.
1.	Roof assembly	Schedule of technical requirement for supply and manufacture of stainless-steel roof assembly	MDTS21323 Rev-03 or latest
2.	Side Wall assembly	Schedule of technical requirement for supply and manufacture of stainless-steel side wall assembly	MDTS21327 Rev-02 or latest
3.	End wall assembly	Schedule of technical requirement for supply and manufacture of stainless-steel End wall assembly	MDTS21332Rev-01 or latest
4.	Underframe complete	Schedule of infrastructure requirement for Underframe complete for LHB coach	MDTS21320 Rev-02 or latest
5.	Front part/End part	Schedule of infrastructure requirement for Front part/End part	MDTS21261 Rev-03 or latest
6.	Fabrication item	Schedule of infrastructure requirement for stainless steel fabrication item	MDST102 Rev-04 or latest
7.	Partition frames and chair Pillers	Schedule of infrastructure requirement for all types of stainless-steel partition frames and chair Pillers	MDST159 Rev-00 or latest
8.	CRF items (Solebar, carline, roof sheet, roof flange, connection sheet, trough sheet)	Schedule of infrastructure requirement for cold rolled formed (CRF) product for passenger coaches	MDTS11273Rev-00 or latest


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Annexure-2

Details of variants of LHB Stainless Steel coach Shells and their applicable drawings

S No	Type of Coach	Drawing nos. (Latest Alteration shall be used)	
		Body Shell Assembly Stage-I	Body Shell Assembly Stage- II
i.	LWFAC	LA10158	LA10006
ii.	LWFCWAC	WA10149	WA10150
iii.	LWACCW	LW10196	LW10203
iv.	LWACCN	LE10112	LE10113
v.	LWCBAC	LH10100	LH10122
vi.	LWSCZAC	1.10113.1. 20.000.002	---
vii.	LWFCZAC	1 10112.0. 20.000.001	---
viii.	LWS AC	LG10426	LG10466
ix.	LWSCN	LS10272	LS10226
x.	LSLRD	LR10561	LR10562
xi.	LWLRRM	LP10372	---
xii.	LWSCZ	LJ10233	---
xiii.	LWS	LG10343	---
xiv.	LVPH	VP10146	---

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Annexure-3

List of applicable drawings of Jigs and fixtures

Sl. No.	Description	Drawing no. (Latest Alteration shall be used)
1.	Welding Fixture for Body Shell Stage-I	XM006401
2.	Welding Fixture for Body Shell Stage-II	XM006601
3.	Welding Fixture for Body Shell Stage-III	93.10.71.6281 93.10.88.112
4.	Welding Fixture for Underframe Stage-I	XM006501
5.	Welding Fixture for Underframe Stage-II	93.10.71.6257
6.	Holding fixture for console	93.10.71.6318 (for coil spring) XW043001 (for air spring)
7.	Welding Fixture for Front Part	XW024401 XW024501
8.	Welding Fixture for Main cross member	93.10.71.6114 93.10.71.6115
9.	Welding Fixture for head stock assembly	93.10.71.6143
10.	Welding Fixture for End wall Assembly	XW024301
11.	Welding Fixture for Roof Assembly for AC & Non-AC coaches	XM004101
12.	Welding Fixture for Roof Assembly for AC-3Tier only	XM003301
13.	Welding Fixture for final Roof element	93.10.71.6327
14.	Welding Fixture for Final roof arch assembly for L2T	93.10.71.6328
15.	Welding Fixture for Final roof arch assembly for L3T	XW021901
16.	Welding Fixture for Cross brace assembly for L2T	93.10.71.6254
17.	Welding Fixture for Roof acceptance stand	93.10.71.6255
18.	Welding Fixture for Sidewall Assembly	XW019001
19.	Welding Fixture for Sidewall and Carline	XM004301
20.	Welding Fixture for Lav. Sidewall	93.10.71.6225
21.	Welding Fixture for door cut out complete	93.10.71.6197
22.	Welding Fixture for WTCC (Non-AC coaches)	XW037901

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Annexure-4

Availability of infrastructure facility and testing equipment's at manufacturer's premises in working order

Sl. No.	Description	Required for sub-assembly /Shell assembly
1	Straightening machine for Straightening of sheets	Side wall, End wall, Roof, Underframe, Front Part & End part
2	Laser cutting machine of effective bed size (min. 1.5 M width x 3M length) and Laser welding machine of effective bed size (min. 2.5M width x 3M length) with handling arrangement of 18-meter length OR Laser cutting cum welding machine of effective bed size (min.2.5M width x 3M length).	Side wall, End wall, Roof
3	Cold roll forming machine with suitable rollers. This Cold roll forming machine is required for single piece manufacturing of carline, roof flange and corrugated side wall sheet of approx. 19-meter length.	Side wall, Roof (21 meter), Underframe (10mm thickness capacity)
4	Hydraulic press with suitable capacity	Side wall (min 500T), Roof (min 200T), Underframe, End wall, Front Part & End part
5	Automatic/CNC/robotic Spot-welding machine of min. 2.5-meter arm length with adequate clear space to handle 19 mtr. Long subassemblies with handling arrangement.	Side wall, Roof (18 meter), End wall
6	CNC Press brake of at least 200 Tone capacity with min. bed length of 3 meter	Side wall, End wall
7	At least one shearing machine of cutting capacity up to 5mm and drilling machine for drilling and tapping capacity up to 20 mm thick stainless-steel plates.	Side wall, Roof(4mm), End wall,
8	Roll bending machine/ Tool & die	Side wall, End wall, Roof
9	Adequate numbers of hand grinders for removal of fibs & burrs shall be available. Grinding wheels shall be free from iron, iron oxide, zinc or other undesirable materials that may cause contamination on the surface.	Side wall, End wall, Roof, Underframe
10	Adequate numbers of TIG and MIG welding sets with calibrated digital display (400Amp. or more) and suitable shielding media. TIG with only Argon Gas and MIG welding shall be used only with try mixture (90% argon +5% O ₂ 5 %CO) gas.	Side wall, Roof, Underframe (MAG/MIG), Front Part & End part
11	Level surface table of size 2mx3m.	Side wall, Roof,

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			Underframe (size 2mx3m), Front Part & End part (size 1mx3m)
12	One surface table to handle 19 mtr. Long subassemblies with handling arrangement		Side wall,
13	Min. Four Torque wrenches having. Capacity 120Nm		Side wall
14	Suitable de-greasing/de-rusting facilities for items other than Stainless Steel.		Side wall, End wall, Roof, Underframe, Front Part & End part
15	CNC High-definition PLASMA or CNC LASER profile cutting machine with suitable capacity up to thickness of 16mm.		Underframe, Front Part & End part
16	Minimum 4 axis CNC machining centre with probing facility (for reference and inspection) for machining of hub flanges and guides of main cross member complete is required. Minimum bed size 1.5M x3.0M x0.8M suitable for machining of main cross member complete in single setting. Machine should have 3-axis movement in X, Y, Z axis and one rotational movement of milling head for drilling and facing in range of $\pm 90^\circ$ with least count of 2°. [This facility is applicable for machining of main cross member of front part complete of LHB type coaches.]		Underframe, Front Part & End part
17	Milling machine for edge preparation of suitable capacity.		Underframe, Front Part & End part
18	Sand blasting plant or equivalent facility for surface preparation.		Underframe, Front Part & End part
19	Suitable Painting facility with gun sand air compressor		Underframe, Front Part & End part
20	Adequate numbers of Potable drilling machining of suitable capacity up to dia 12mm		Underframe, Side wall, End wall, Roof, Front Part & End part
21	Suitable Material handling facilities such as Over-head cranes, Fork Lifters, Hoist and mobile cranes of suitable capacity.		Underframe, Side wall, End wall, Roof, Front Part & End part
22	Stress relieving facilities suitable for minimum assembly size 3500 max 1000 mm		Underframe, Front Part & End part

MEASURING AND INSPECTION AND TESTING EQUIPMENTS:

1	Calibrated measuring instruments like digital Vernier caliper, digital Micrometre, Measuring tape, Steel scale, welding gauges, thread gauges and straight edge etc.
2	Spot welding indentation should be measured using digital depth gauge.
3	Dye penetration testing for welding joints.
4	Macro etch test for fusion of fillet weld.
5	Peel test and Chisel test of spot weld as per DIN 8.1. M.2007
6	Root bend, Face bend test for butt welds.

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7	Each completed assembly shall be tested for water leakage at the works of the manufacturer.	
8	Tensile testing machine having minimum 40T capacity with necessary jig & fixture for tensile and bend test for ensuring the weld quality of laser welding.	
9	The manufacturer shall have in house /tie-up arrangement for carrying out Spectro and mechanical analysis of the material with NABL accredited labs at their own expense as and when required.	
10	Firm should have adequate gauges to ensure the dimensions (width, height & length)	
11	Firm should have adequate arrangement (calibrated straight edge, filler gauge etc.) to measure the undulation after complete fabrication.	
12	Digital Vernier Caliper 0-300 mm, range, height gauge.	
13	Digital micrometre 0-150 mm, range.	
14	Measuring tape at least 3 M range.	
15	Steel Scale-0-300mm, 0-1 meter.	
16	Go &No-Go gauge	
17	Profile gauge	
18	Filler gauge and welding gauge.	
19	Thread gauge.	
20	Bevel protractor.	
21	Universal Testing Machine	
22	Impact Testing Machine	
23	Hardness Testing Machine	
24	Dry film thickness tester	


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