


**Rail Coach Factory, Kapurthala**

**MD35131**

**Date: 23.09.2019**

**Sub: Issue of Specification no. MDTS-213 Rev. 04 for supply of Fabricated and Machined FIAT type Bogie frames.**

Please find enclosed copy of Specification no. MDTS-213 Rev. 04 for supply of Fabricated and Machined FIAT type Bogie frames for information and necessary action at your end.

  
25/09/2019  
(Pardeep Luthra)  
ADE/Shell & Bogie

CQM, CPLE, CWE (Shell), CMM/HSQ, CMM/TKJ,

Dy. CMM/LHB/Shell, Dy. CMM/G, CMT, Dy. CPLE-III, Dy. CME/Bogie

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CDE



<b>Technical Specification For Supply of Fabricated and Machined Fiat Type Bogie Frames</b>		
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Name	Designation	Signature	Date	Level
Aman Bhardwaj	SSE/BD		30.08.2019	Prepared
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Kamal Kumar	Dy CME/D-1		31.08.2019	Reviewed
Manish Bhimte	CDE		03.09.2019	Approved

Issue/Rev.	Detail of changes	Date
Rev-01	Para 3.3.1-Keeping the bogie frame added. Para 3.3.2-Added (Earlier machining in only horizontal position was permitted. Now machining in vertical position has also been added in response to CDE noting on PP-4 of MD44121 Volume- 57) Para 13.1- 3.3.2 Para 13.2- Vertical added	13.05.2011
Rev-02	Para 3- Eligibility criteria modified & para 3.3 added. Para 3.3.8, 3.3.11 & 3.3.14 deleted. Para 3.4.1 & 3.4.3 modified. Para 3.4.2, 3.4.4, 3.4.5, 3.4.6 deleted. Para 3.4.8 to 3.4.12 deleted. Para 4.1, 5.2, 7.1 & 8 modified. Para 10.2 & 10.2.1- magnetic particle test deleted Para 17 & 18 modified. Serial numbers updated accordingly.	08.08.2013
Rev-03	Para 3.4.14 added. Stress relieving at Para 11 added and Serial numbers updated accordingly.	20.03.2018
Rev-04	Para 22 "waranty Period" modified as 84 months from date of supply or 72 months from date of installation whichever is earlier.	30.08.2019

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**1. General:**

This specification covers the technical requirements to be complied by the tenderer for manufacture, testing and supply of fabricated & machined FIAT type bogie frames.

**2. Scope of supply:**

- 2.1. The fabricated and machined bogie frames are to be supplied conforming in all respects to the relevant drawings & specification of tender.
- 2.2. The tenderer is required to coordinate and liaise with the purchaser during manufacture of the first two-bogie frames, which shall be the prototype bogie frames.
- 2.3. This is a general specification required for fabrication & machining of all type of Fiat type bogie frames used in mainline coaching stock.

**3. Eligibility Criteria:**

- 3.1. The tenderer must submit detailed clause-wise comments on the specification. In absence of above, offers shall be deemed as incomplete and may not be considered.
- 3.2. Since Fiat bogie have complexity in manufacturing/machining and requires development time for setting-up in-house infrastructure/Jigs and fixtures, bulk or regular procurement orders should only be given to the firms who have successfully supplied fabricated and machined Fiat bogie frame to RCF/ICF/IR in past and have the infrastructure as mentioned in para # 3.4 of this specification.
- 3.3. Developmental order can be placed on those tenderer having in-house infrastructure as mentioned in para # 3.4.
- 3.4. **The manufacturer shall have following minimum infrastructure facility at their works for manufacture of FIAT type bogie frames.**
  - 3.4.1. Minimum 5-axis CNC Machining center with probing facility (for reference and inspection), minimum Bed size 3Mx4M suitable for machining of Bogie frame in single setting **keeping the bogie frame in the horizontal position**. Machine should have 3-axis movement of X, Y, Z Axis & two rotational movements of milling head for drilling and facing in

  
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range of  $\pm 96^\circ$  with least count of  $2^\circ$ . The minimum movement of tool head shall be 1.2 M.

Or

Minimum 5-axis CNC Machining center with probing facility (for reference and inspection), minimum Bed size 2.5Mx4M suitable for machining of Bogie frame in single setting **keeping the bogie frame in the vertical position**. Machine should have 3-axis movement of X, Y, Z Axis & two rotational movements of milling head for drilling and facing in range of  $\pm 96^\circ$  with least count of  $2^\circ$ . The minimum movement of tool head shall be 1.2 M.

- 3.4.2. Robot for welding major straight welds of bogie side frames.
  - 3.4.3. High definition plasma or Laser profile cutting machine with capacity upto thickness of 12mm.
  - 3.4.4. CNC Press brake of capacity 400 ton with back gauging for accurate bending of bogie side frame bottom and top plate.
  - 3.4.5. Hydraulic press for straightening of components.
  - 3.4.6. Degreasing/ De-rusting plant.
  - 3.4.7. Shot blasting plant or equivalent facility for surface preparation in house.
  - 3.4.8. Painting facility in house (closed chamber).
  - 3.4.9. Manipulator for down hand welding of bogie frame components.
  - 3.4.10. Minimum two MAG welding sets (400A or more) & suitable shielding media.
  - 3.4.11. Level surface table of size 4000mmX3500mm.
  - 3.4.12. Certified weider for precision & heavy fabrication from accredited labs/ RDSO.
  - 3.4.13. Vernier caliper size 2.6M with dial gauge accuracy 0.01mm.
  - 3.4.14. Furnace with temperature controllers for stress relieving of bogie frame members of FIAT bogie.
- 3.5. **The manufacturer shall have tie-up arrangement for following tests with NABL certified labs:**
- 3.5.1. The firm shall be ready for carrying out spectrographic analysis of the material from NABL certified Lab at their own expense as and when required.
  - 3.5.2. The firm shall be ready for carrying out testing for UTS, Yield strength, impact strength from NABL certified Lab at their own expense as and when required.

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3.6. The manufacturer shall be an ISO-9001-2000 certified company.

**4. Raw material:**

- 4.1. The chemical composition and mechanical properties of steel plates to be used shall conform to specification mentioned in the drawings.
- 4.2. The steel plates to correct chemical composition shall be procured from SAIL/TISCO or other reputed global manufacturers along with their test certificates. These test certificates shall be co-related with the stamping on the plates to be taken up for manufacture prior to commencement of work.
- 4.3. Wherever test certificates are not available, sample shall be drawn and tested both for chemical composition and physical properties in the presence of Inspecting Agency.
- 4.4. All records of physical, chemical and impact tests shall be made available to Inspecting Agency. All plates to be taken up for manufacture shall be visually checked for surface defects such as cracks, dents, pitting, bend, rust, scales etc. and they shall be free from all these defects. Straightening of the plates shall be done with the help of either straightening machine or Hydraulic press. Hammering shall not be done to straighten the plates.
- 4.5. The firm shall produce ultrasonic test certificate of OEM.

**5. Procurement of Major Bought outs:**

- 5.1. It is desirable that the following bought out components are procured only from approved sources of RCF, Kapurthala:
  - i) Brake Support
  - ii) Control Arm support bracket
  - iii) Spring pot
- 5.2. Brake Beam & other two seamless tubes shall be procured from M/s ISMT, Pune or reputed suppliers to be approved by RCF.

**6. Cleaning, Marking and cutting:**

- 6.1. All the plates shall be degreased and de-rusted before commencing manufacturing operations.
- 6.2. All the plates shall be marked properly to achieve the specified dimension given in the drawing keeping the required allowance for proper welding and margin for machining.

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6.3. Plates shall be cut either by CNC LASER profile cutting machine or high definition PLASMA profile cutting machine. All nicks/cuts on the plates during cutting shall be finish ground before using them for sub-assembly/ assembly.

### 7. Edge preparation:

- 7.1. Edge preparation of Bogie side frame outer & inner web and other similar items shall conform to drawings and to be carried out on 5-axis machining center or on CNC milling machine.
- 7.2. The weld joint dimensions/edge preparation shall be as per the relevant drawing/IS specification.
- 7.3. The surfaces and edge to be welded shall be ground smooth and uniform and shall be free from cracks, undercuts, slags, gauges etc. that would adversely affect the quality and the strength of the weld.
- 7.4. Plates shall be inspected for dimensional accuracy. Any distortion that occurs during cutting shall be straightened before tack welding.

### 8. Fixtures and Manipulators:

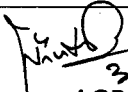
The manufacturer shall prepare minimum following fixtures before commencement of prototype manufacture of Bogie frame and to be got approved from CDE/RCF:

- i. Bogie Side frame tack welding
- ii. Bogie side frame full welding fixture having rotating facility for down hand welding.
- iii. Brake Beam tacking & full welding
- iv. Bogie frame tacking, full welding, rectification
- v. Bogie frame machining fixture

### 9. Welding procedure:

- 9.1. **Shielding gas:** MAG welding process using mixture of 82% Argon & 18%CO<sub>2</sub> gas shielding media shall be used for fabrication of Bogie frame.
- 9.2. **Filler metal:** Filler material should be used as per spec: EN440-G3Si1.
- 9.3. **Welder qualifications:** Qualified welder as per EN-287-1 shall be employed for fabrication work as per FIAT's welding procedure specification 22.026 part document 100 03. The welding shall reveal high standard of workmanship. However, if welders employed are qualified to any other international approved standard, prior approval of RCF is to be taken.
- 9.4. The edge preparation shall be in accordance with their drawing.

  
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- 9.5. As far as possible, all the weld joints shall be welded in down hand position, manipulators to be used if necessary.
- 9.6. Weaving bead Technique and Inter-pass cleaning technique shall be adopted by grinding and using wire brushes.
- 9.7. Robotic welding be used wherever possible. Manual MAG welding may be done for the areas which are not accessible.

**10. Quality of Weld Joints:**

**10.1. Visual (By using magnifying glass if required)**

- 10.1.1. Weld joints shall have uniform beadings and smooth change over from weld deposited to the parent metal and thorough fusion between adjacent layers of weld metal and between weld metal and parent metal.
- 10.1.2. They shall be free from cracks, craters, undercuts, overlaps, porosities, inclusions, blow-holes etc.
- 10.1.3. Members distorted by welding shall be straightened by carefully supervised application of heat. The temperature of heating areas shall not exceed 650 degree centigrade. Mechanical method may also be used with application of heat.

**10.2. Dye Penetrant Test**

- 10.2.1. All the fillet weld joints shall be subjected to Dye Penetrant Test and all the butt weld joints (100%) shall be subjected to Dye Penetrant Test for detection of weld flaws. The procedure and acceptance standard shall be as per specification no. IS:5334/3658 respectively.
- 10.2.2. **Evaluations:** Discontinuities and defects shall be indicated by rise of Dye Penetrating after applying developer on the surface of welds. All such indications are not necessarily the defect, since excessive surface roughness, and the heat affected zones etc. may produce similar indications. Even if indications are believed to be non-relevant, each type of indication shall be explored to determine if linear discontinuities are present.

**10.3. Acceptance Standard**

- 10.3.1. All linear discontinuities are un-acceptable and shall be removed and repaired by chipping or grinding and subsequent welding.

  
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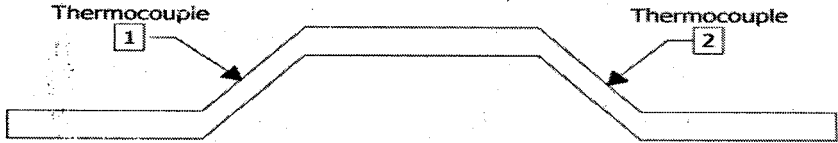
  
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- 10.3.2. When defects appear, they shall be rectified and the area shall be re-examined by the same method to verify that they have been rectified completely.
- 10.3.3. All test reports of Dye Penetrant Test will be submitted for review to the Inspecting Agency.

**11. Stress Relieving:** Finished side members and tubular cross members are to be separately stress relieved in furnace to eliminate any residual stress introduced by welding. The detailed process for stress relieving after welding of the bogie frame members is as under:

- 11.1.1. The temperature of the furnace shall not exceed 315°C at the time the welding assembly is placed in it.
- 11.1.2. Above 315 °C, the rate of heating shall not exceed 220 °C per hour. During the heating period, variation in temperature through the portion of the part being heated shall not be greater than 50°C. The same shall be monitored by measurement of temperature using suitable thermocouples. For bogie side frame, 2 thermocouples shall be fixed at the two locations of the side beams as shown in Figure.



- 11.1.3. Soaking temperature shall be between 600°C and 650°C. On reaching the temperature, the assembly shall be held within specified limits for a time not less than 15 minutes per 6mm thickness of the plates. In addition, for determining the soaking time, the thickness of the thickest part of the assembly shall be considered. During the soaking period, the difference between the highest and lowest temperature of the assembly shall not be greater than 50°C.
- 11.1.4. During cooling cycle up to 315°C, cooling of the job shall be done in a closed furnace at a rate not greater than 260°C per hour. From 315°C, the assembly may be cooled in still air.
- 11.1.5. During stress relieving operation for maintaining the critical dimensions, the assembly shall be kept in the furnace, bottom side up (inverted

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position) as shown in the Figure. No tie-bars are required if bogie frame is heat treated in inverted position.

11.1.6. The assembly shall be suitably supported while loading in the furnace to avoid any permanent deformation during stress relieving operation.

11.1.7. The heat treating furnace temperature shall be effectively controlled by using thermocouples having associated recording equipments.

**12. Shot Blasting:**

The entire bogie frame shall be subjected to shot blasting for cleaning of rust, scales, spatters etc. before painting of the Bogie frames.

**13. Painting:**

Immediately after shot blasting, the bogie frame shall be coated with primer & fully painted with High Build Epoxy paint as per RCF specification no. MDTS-166.

**14. Machining of Bogie frame:**

14.1. Machining of bogie frame to be done on 5-axis CNC machining center as indicated in para 3.4.1 and 3.4.2.

14.2. Bogie frame should be suitably fixed on Machining center using proper fixture in such a way that machining shall be done in single setting in horizontal / vertical position to achieve the dimension tolerances and the surface roughness as per drawing of tender. Tolerance for un-toleranced dimension should be followed as per IS:2102 (medium).

14.3. Single setting, means that a particular reference is taken by probe and machining is completed according to that reference taken and the program fed without any change in bogie frame position.

**15. Stage Inspection:** The stage inspection shall be carried out by manufacturer as indicated below and records should be made available to the inspecting agency.

**Stage Inspection of major sub-assemblies consisting of:**

15.1. Side frame

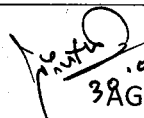
15.2. Brake Beam Assembly

15.3. Bogie frame Assembly before machining

15.4. Inspection of bogie frame complete after machining.

15.5. The Purchaser/ Inspecting Agency shall have access at all reasonable times to the works where bogie frame is manufactured and material is stored and shall have the right to inspect die, jig and fixtures and measuring instruments being used by the manufacturer. All the facilities, labour, appliances, gauges,

  
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measuring instruments etc. necessary for testing and inspection shall be provided by the manufacturer free of cost.

- 15.6. Dimension Control Charts, Chemical and mechanical properties test certificates, DPT and stage inspection reports etc. shall be supplied along with the Bogie Frames to the purchaser.

### 16. Dimensions and Tolerances:

- 16.1. All dimension/tolerances shall be as per details given in the drawings.  
16.2. Detailed dimension control charts/sheets shall be prepared for each bogie frame in which measurements of critical dimensions shall be recorded and kept for evaluation and verification by the inspecting agency.  
16.3. All the un-toleranced dimensions shall be in accordance with IS: 2102 (Medium).  
16.4. Gauges, fixtures and templates and accurate measuring instruments shall be used to ensure the correctness of the dimensions.  
16.5. Drawing no. 1267505 to be referred for preparation of measurement sheet.

### 17. Pilot sample approval:


- 17.1. Before manufacture of pilot sample, Jigs & fixtures to be got approved from CDE/RCF, Kapurthala.  
17.2. Manufacturer should get pilot samples approved from CDE/RCF, Kapurthala before start of series manufacture and bulk supply.

18. **Quality Assurance Plan:** Firm has to comply manufacturing processes and inspection as per Quality Assurance Plan enclosed as annexure-A.

### 19. Code of Practice for Quality Control and Inspection:

- 19.1. Regular inspection shall be done by inspecting agency as per Quality Assurance Plan enclosed as annexure-A.  
19.2. The manufacturers shall furnish to the purchasing/ inspecting authorities information in respect of quality control systems in force at their works on various materials used in the manufacture of components.  
19.3. The manufacturers shall furnish to the Purchasing/ Inspecting authorities the details of tests and inspection records and other relevant records as required under the quality control systems in force.

  
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- 19.4. These records and reports shall be maintained by the Competent Technical Authority of the manufacturer and shall be open to examination by the Purchasing/ Inspecting Authorities at all reasonable time.
- 19.5. Purchasing/ Inspecting Authorities at their discretion may draw samples of products at any stage of production for conformity tests at the works of the manufacturer or in an approved laboratory. In case the samples do not conform to the requirements of the specification, double the number of samples from the same lot/batch shall be drawn for re-tests. If any of the re-test samples do not conform to the requirements, the entire lot/batch shall be rejected.
- 19.6. RCF may carry out in-process inspection of manufacturing of bogie frame at the firm premises.
20. **Identification Marking:** Each bogie frame shall be stamped with an easily visible identification indicating the bogie frame serial number, year of manufacture and manufacturer's name to facilitate identification/correlation with the inspection/ test results.
21. **Packing:**
- 21.1. All machined surfaces shall be applied with suitable rust preventive which shall prevent it from corrosion & oxidation for a minimum period of one year of storage.
- 21.2. The packing shall be such that all the machined surfaces shall be properly protected against rubbing/ impact/scratches with other bogie or with mode of transportation i.e. wagon/truck/trailers etc.
22. **Warranty:**
- The manufacturer shall warrant the bogie frame for conformance to quality for a period of 84 months from date of supply or 72 months from date of installation which ever is earlier.

  
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### Annexure-A

#	Description	Parameter	By Vendor	Inspecting Agency
1	Raw material / other components	Chemical & Mechanical Tests as per Specification/ drawings.	One sample of all sizes of sheets/other components, for each lot of material to be tested for chemical and mechanical properties.	Material will be tested for chemical and mechanical properties as per sampling plan.
2	Welding consumables	Shielding gas and filler material for welding of sub-assemblies and bogie frame assembly as defined in specification.	Accountal of welding consumable used to be maintained by manufacturer.	Welding consumable quality to be checked as per sampling plan.
3	Sources for Major Bought out components e.g. Brake Support, Control Arm support bracket and Spring pot.	To mention RCF approved sources or other sources	(Chemical & Mechanical Tests to be carried out as detailed in para #1 above). Maintain details of sources from where bought out components have been procured.	Material will be tested for chemical and mechanical properties as per sampling plan.
4	Brake beam and Seamless tubes.	Procured from M/s ISMT, Pune or other source	Maintain details of procurements alongwith test certificates. Other sources than M/s ISMT, Pune to be got approved from CDE/RCF in advance.	<ul style="list-style-type: none"> <li>Verify the procurement from M/s ISMT alongwith test certificates.</li> <li>For other sources than M/s ISMT, Pune, CDE/RCF approval to be verified.</li> </ul>
5	Cutting of components	Use of high definition plasma or laser for cutting. Ensure edge preparation as per applicable drawings.	Ensure cutting and edge preparation as per drawings.	<ul style="list-style-type: none"> <li>Check proper working of high definition plasma or laser cutting for each inspection lot. If possible in-process working of machine to be verified.</li> </ul>
6	Welding Fixture	Fixtures and manipulators for welding side frame sub-assembly, brake beam sub-assembly and bogie frame assembly.	To get approval of fixtures and manipulator from CDE/RCF and do calibration for each 50 bogie frames.	<ul style="list-style-type: none"> <li>Check availability of CDE/RCF approval for fixture and manipulator.</li> <li>Verify calibration records of fixtures.</li> </ul>
7	Welding of side frame	Welding to be done on robotic machine only as per drawings/specification.	Ensure welding is done on robotic machine.	<ul style="list-style-type: none"> <li>Check proper working of Welding Robot for each inspection lot</li> <li>Inspect quality of welding as per drawings and specification.</li> </ul>
8	Welding and dimensions of Bogie Frame	Welding and dimensions to be checked as per tendered drawing	Ensure quality for welding and dimensions	<ul style="list-style-type: none"> <li>Check dimensions and availability of welding as per tendered drawings/specification as per sampling plan.</li> </ul>
9	Qualification of welders	Qualified welder shall be employed for fabrication work, evaluation of welders to be done on yearly basis	To be ensured	To be verified.
10	Fixture for machining of bogie frame	Suitable fixture for machining of bogie frame	Ensure suitable fixture	Check availability of suitable fixture

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#	Description	Parameter	By Vendor	Inspecting Agency
11	Machining of bogie frame	Machining of frame to be done on single setting on five axis CNC machining centre as defined in the specification.	To be ensured  Ensure all five axis of the machine are working, specially milling head and probe facility	<ul style="list-style-type: none"> <li>• Check proper working of 5-axis CNC machine center as per specification for each inspection lot.</li> <li>• Inspect quality of machining as per drawings and specification.</li> </ul>
12	Surface protection	Proper surface preparation (shot blasting), primer and top coat application as per specification/drawing	Ensure that per specification/drawing	Inspect quality of surface protection process and material as per specification/drawings.
13	Dimensional check of bogie frame	As per drawings and specification	Ensure as per specification/drawing during process of manufacture and final product.	Product will be inspected as per drawings/speciation in conformance to sampling plan.

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