



INDIAN RAILWAYS
SPECIFICATION
FOR
CASNUB- 22 NLB/CASNUB -22 NLB (M)
CAST STEEL BOGIES
WITH FRICTION DAMPING ARRANGEMENT FOR BROAD
GAUGE WAGONS

WD-21-CASNUB-22NLB-BOGIE-93
(Revision –3)

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1.0 GENERAL

- 1.1 Before the introduction of CASNUB bogies, Indian Railways used 4-wheel wagons fabricated bogies (diamond frame / UIC type). The limitation of these bogies are Low axle load capacity , Poor riding quality and High maintenance and wear which unsuitable for increasing freight demand. Around **1969-70**, Indian Railways initiated development of Cast Steel Snubber Spring Bogie which comprises cast steel three-piece bogie with friction damping arrangement. It was designed to provide increase axle load, Improve ride quality and stability and reduce maintenance requirements.
- 1.2 IR was introduced 8-wheel freight wagons with CASNUB 22W bogies. CASNUB 22W was the standard freight bogie with load proportional damping, widely adopted across IR. First Bogie Manufactured at Chittaranjan Locomotive Works in 1969-70 with IRS Type spherical Center Pivot, Bottom Pivot integral to bolster and Roller Bearing. After introduction of CASNUB 22W, major issues were observed in service such as excessive wheel flange wear , high liner and wedge wear, Poor damping characteristics and Uneven load sharing. These bogies are further modified by Fitment of EM Pad, roller type Side Bearer replaced to Constant contact metal bonded rubber side bearer and introduced CASNUB 22W (M) bogie was an improved and more reliable version of the original 22W, addressing key operational issues such as wear and poor damping.
- 1.3 These bogies were further improved by enhancing the bolster, which was given a fish belly profile. The depth of the bolster section was increased while the wall thickness was reduced. For the side frame and bolster, special alloy cast steel was used instead of IS: 1030. This superior metallurgy allowed for a reduction in the wall thicknesses of both the side frame and the bolster, enhancing the overall performance and durability of the bogie. The modified Bogie was called as CASNUB 22 NLB.
- 1.4 The CASNUB 22 NLB bogie was further improved by incorporating Long travel CCSB to RDSO Specification WD-62-Misc-17, improved damping with Specified Coefficient of friction Wedge to RDSO specification CONTR-02-MISC-2007, Enhanced suspension characteristics, better reliability and track friendliness. The modified Bogie was called as CASNUB 22 NLB (M) Cast Steel Bogies. Difference between CASNUB 22 NLB BOGIE and CASNUB 22 NLB (M) BOGIE is attached at Annexure XI.
- 1.0 This Specification covers the technical requirements for the manufacture and supply of the CASNUB 22 NLB/ CASNUB 22 NLB (M) Cast Steel Bogies fitted

with a spring plank, long travel helical springs and load proportionate friction damping arrangement for Broad Gauge (1676 mm) Wagons. Both Centre Pivot assemblies 'Flat Centre Pivot' to RDSO Drg. No. WD-97049-S/3 and conventional spherical Centre pivot to RDSO Drg. No. WD-85079-S/2 are used in CASNUB 22 NLB/ CASNUB 22 NLB (M) Cast Steel Bogies as per CP-SB arrangement drawing of the Wagon.

- 1.1 These bogies shall be suitable for fitment of standard wheel sets to RDSO's drawings No. WD-89025-S/1, Cartridge bearings to AB/RB-39-2002 (Rev. Latest) and Elastomeric pads to Specification No. WD-20-Misc.-95 (Latest Version). The constant contact side bearer (CCSB) assembly shall be as per CPSB arrangement drawing of wagon where the CASNUB 22 NLB/ CASNUB 22 NLB (M) Bogie is to be fitted and shall be manufactured as per the relevant RDSO specification of the CCSB. RDSO Technical Pamphlet G-115 for fitment of Side Bearer and CPSB arrangement drawings may also be referred.

2.0 SCOPE OF SUPPLY

- 2.1 The bogies shall be supplied complete with center pivot assembly components as per relevant drawings, constant contact side bearer approved by RDSO and brake rigging including brake shoes, elastomeric pads etc., but without wheel sets, bearing, narrow jaw adapters, side frame key and side frame key bolt, nut and washer which shall be supplied by the purchaser free of cost for fitment on the bogies. The bogie center pivot top and other bogie components should be properly secured with the bogie during delivery.
- 2.2 The bogie manufacturer must adhere strictly to the specifications outlined in the relevant Center pivot and Side Bearer arrangement (CPSB) drawing of the Wagon. RDSO Technical Pamphlet G-115 may be referred for fitment of Side Bearer and CPSB arrangement drawings. Additionally, the Firm shall approach RDSO for latest drawings and details. The Constant Contact Side Bearer (CCSB) must be manufactured in accordance with the drawing and specifications provided in Annexure-IIIB.
- 2.3 Since, these bogies are to be used under different types of wagons with different tare weights, to maintain designed load sharing requirement, the center pivot and side bearer arrangement drawings pertaining to the particular wagons are required to be referred to and the following dimensions are to be strictly maintained under tare condition.
 - a. Bogie bolster top to center pivot top = $120^{+2.0}_{-0}$
Centre pivot top to side bearer seat on bogie bolster – as per relevant Centre pivot and side bearer arrangement drawing of the wagon.

- b. The difference between top of the Top Centre pivot to bottom of Body side bearer (this dimension may change after shim adjustment as per relevant drawings).

This specification contains list of the construction drawings in Annexure – VI.

3.0 SPECIFICATION

- 3.1 The bogies and its components shall conform to this specification, relevant drawings with latest alteration number, and latest relevant specifications. In case of conflict among the STR/Drawings/Other Specifications, the drawings shall take precedence over the STR and the Specification. The specification shall take precedence over the STR.
- 3.2 The foundry should satisfy the requirements of Class “A” foundry as per IS: 12117:2023 (latest) specified for all the cast steel items and updated by the Bureau of Indian Standards/RDSO from time to time.
- 3.3 For Infrastructure, manufacturing, testing and quality control requirement of cast steel components and other components included in this specification, the suppliers should comply the technical requirement as laid down in the following table:

S.No.	Component	STR No. (Latest)
1	Cast steel components of CASNUB bogies	QMS-09:2015
2	Metal Bonded Rubber Components-Elastomeric pad	QMS-05:2000
3	Spring steel rounds to RDSO Spec. No. WD-01-HLS-94	QMS-16:2000
4	Hot/Cold coiled helical spring for freight, coaching & Locomotives	QMS-17:2000
5	Silico manganese liners	QMS-22:2009
6	Spring plank	QMS-23:2009
7	Side frame key	QMS-24:2009
8	Brake beam	QMS-25:2009
9	Narrow jaw/wide jaw & Modified adapter	QMS-26:2017
10	Metal bonded rubber components	QMS-06:2000
11	Center pivots, End piece & Strut casting, wedge.	QMS-20:2009

- 3.4 Firm shall generally follow the infrastructure, manufacturing, testing and quality control requirement mentioned in this specification. However, the supplier can also offer alternate process infrastructure, manufacturing, testing facilities. Firm shall submit the detailed test report, documentary evidences, and the

justification/ evidence to establish that the same can provide consistent output to desired level of output/ accuracy/ performance of the offered solution vis-à-vis specified in the specification to Director General (Wagon)/RDSO, Lucknow for obtaining approval before use.

4.0 **GROUPING OF COMPONENTS**

Various components, which form the bogie assembly, are grouped as given below. Details of components in each group are detailed in relevant Annexure as indicated below against each group.

Group	Components	Reference details
I	Cast components	Cast steel - Side frame, bolster, top & bottom Centre pivots, brake beam strut and end pieces, wedges (Annexure No. I and IX).
II	Spring Steel	Outer, inner, snubber springs, Brake Wear Plate, Brake beam liners, side frame/bolster liners & center pivot liners (Annexure No.-II and IX).
III	Rubber Components	Elastomeric pads and Centre pivot washer, (Annexure No. III).
IV	Forged Components & Fasteners	Side frame key, rivets and various types of cotter pins, lock bolts (Annexure No. IV.)
V	Fabricated Components	Various types of steel components, machined, formed, welded and pre-assembled like brake beam, spring plank etc. (Annexure No. V).
VI	Composite material Components	Brake block (Annexure III A).

5.0 **BOGIE ASSEMBLY REQUIREMENTS**

The detailed procedure of bogie assembly is given below –

5.1 **Gauging of Bolster & Side frame:**

This is to be done on 100% of Bolster and Side frame. Only those castings which are found within the specified dimensions should be taken up for assembly and the rest rejected. Investigations should be made for the reasons of dimensional inaccuracies; causes arrived at, remedial action introduced and defect rectified.

Bolster and Side frame should be inspected for all the important dimensions as per the gauging scheme approved by RDSO before offering for inspection or taking up for assembly and results recorded.

5.2 Welding of Liners:

Welding of all the liners on side frame shall be done before taking up side frames for riveting. Welding of liners on bolster shall also be completed before taking them up for assembly. Welding procedure to be followed as indicated in Drawing No.WD-89067-S/4(latest) & SK-69594(latest) in CASNUB 22NLB/CASNUB 22 NLB (M) bogie. Following steps have to be taken to ensure proper quality:

- i) Welds shall be visually inspected for any weld defects. Use of correct electrodes, welding current setting, welding voltage, welding speed and correct welding procedure has to be ensured. Welding parameters should be standardized and its implementation ensured.
- ii) Welding of liners shall be carried out on suitable fixtures so that down hand welding can be ensured.
- iii) Surface on which liners are welded shall be smooth and flat providing proper seat. Also, Pocket for Side frame liner shall be correctly formed in the casting. Castings having imperfect pockets on the Side frame shall be rejected.
- iv) Welders or weld operators must be qualified in the specific welding positions that will be used, for the materials, processes, and procedures in accordance with AWS D15.1 or an equivalent standard. Relevant drawings of the components must be referred to for details on welding procedures, materials, and other requirements. The complete welding process, material specifications, and quality parameters, including all checks and measures, must be incorporated into the Quality Assurance Plan (QAP).

5.3 Matching of Side frame:

Side frames which have been duly inspected, gauged and passed shall be taken up for assembly. These shall be matched for wheel base according to RDSO's Drawing No.WD-89067-S/3. Crack detections (Annexure-I) and weld reclamation (Annexure- I A) should also be completed before proceeding to next stage. No welding is permissible after this stage on Side frame as well as on bolster.

5.4 Riveting:

After selecting the side frames, these should be taken up for riveting with spring plank. Before riveting it shall be ensured that pop marks are placed on the side frames as per Drawing No.WD-89067-S/3. Stepwise procedure of assembly of H-frame is given below:

- i) Side frame holes shall be drilled using accurate jigs.
- ii) The two side frames of same number button head shall only be chosen for assembly of bogie and spring plank should be positioned on a fixture and

fastened rigidly.

- iii) Four holes shown in Item No. 1 in drawing no. SK-69594 should be reamed along with the side frame and secured by M-24 fit bolts as per IS: 3640. In case any mismatch between spring plank holes and side frame holes is observed visually, detailed check of side frame, drilling Jig and spring plank shall be made before proceeding further. Riveting should be done as per IS: 7215 Group –B.
- iv) The riveted H-frame shall be gauged and dimensions recorded for diagonals and side frame –to-side frame over pop-marks on the fixture and again after removing from the fixture as per Para 5.
- v) Regular calibration of jigs and fixtures by an authorized agency shall be ensured. Coordinate Measuring Machine or an alternate approved system is necessary to maintain the accuracy of the product and gauges at specified intervals (Prescribed by OEM or six months whichever is less).
- vi) Alternatively, manufacturer can use suitable size lock bolts in lieu of riveting with prior approval of DG(Wagon)/RDSO.

5.5 Gauging of H-Frame:

After completing the riveting, the side frame – spring plank assembly (H-Frame) should be gauged on the fixture as per Drawing No. WD-90042-S/1 and results recorded. It has to be ensured that all dimensions are within the specified limits otherwise the assembly should be dismantled, re-inspected to find the causes of any variation and then redone after eliminating those causes.

The gauging shall again be done on the assembly after removing the side frame-spring plank assembly (H-Frame) from the fixture. This is to be done on 100% of H-frames.

5.6 Assembly:

Assembly of bogie shall be taken up after completing the activities specified in Para 5.5. It has to be ensured that all components have been checked as specified in respective Annexures.

5.7 Dimensions:

The leading dimensions and tolerances of the bogies shall be in accordance with RDSO's Drawing No.WD-90042-S/1 (latest).

5.8 Load Testing of Bogie Assembly:

The bogies shall be tested for the loads representing tare, gross load and 50 % overload conditions as per the details given below:

CASNUB 22 NLB

Test load on bogie pivot in tons (7-5-2)	Tare	Gross	50% overload
	6.0 T	40.5 T	60.8 T
Height of center pivot from RL in mm	933	894.5	872
	+3\ -8	+3/-8	+3/-8

CASNUB 22 NLB (M)

Test load on bogie pivot in tons (6-4-2)	Tare	Gross	50% overload
	6.0 T	40.5 T	60.8 T
Height of center pivot from RL in mm	932	887	861
	+3\ -8	+3/-8	+3/-8

Frequency of this test shall be as detailed below:

- i) 100% checking of Assembled Bogies under tare.
- ii) 5% checking of Assembled Bogies under gross load and 50 % overload.

RDSO Inspector/ inspection authority shall carry out random load testing to the extent of 5% of Assembled Bogies under tare, gross load and 50 % overload conditions. These bogies shall be other than mandatorily tested as mentioned above.

- 5.9 Bogie fitted with brake gear components of BMBS to drawing no. WD-08093-S/2 does not require the existing brake gear components to drawing no. WD-89067-S/5 (except wear plate at Item S.No.-8).

5.10 Painting:

Inspected bogies shall be thoroughly cleaned to remove rust, scale dirt etc. In case the time gap between the last shot blasting of the component and painting is more than 24 Hours or there is a sign of surface deterioration due to rusting etc, a final round of shot blasting shall also be carried out prior to the painting and apply paint on each surface as per following schedules:

- (a) Each bogie shall be given red oxide zinc chromate primer to Specification IS: 2074 followed by one coat of ready mixed paint to IS: 13607 color Jasmine yellow to code no. 397 of IS: 05 2007 (For CASNUB 22 NLB Bogie/CASNUB 22 NLB (M). The CASNUB 22 NLB (M) Bogie shall further be marked with Zebra marking on the side frame as indicated in the Wagon Marking Diagram/ Bogie General Arrangement (GA) Drawing. Mating faces of pivots and liners will not be painted.
- (b) Bogie components shall be spray painted by use of electrostatic spray run / Spray / normal spray. The finishing coat shall be applied when the priming coat has dried. The dry film thickness of the primer shall not be less than 40 microns and the complete system inclusive of finishing coat not less than 80 microns. Record of painting process and DFT shall be

maintained.

- (c) The inspecting officials shall check the quality of paints that will be used as per relevant specifications once in two months or after painting of every lot of 200 bogies.

6.0 DRAWINGS

CASNUB 22 NLB Bogie/CASNUB 22 NLB (M) shall be manufactured according to latest RDSO's Drawings No. WD- 89073-S/2 and relevant drawings listed in Annexure VI.

7.0 DEVIATIONS

Where deviations from the original design, material specifications, dimensions etc., are desired, specific proposals shall be submitted for prior approval of the DG (Wagon), RDSO/Lucknow before commencement of manufacture.

8.0 CHEMICAL COMPOSITION & MECHANICAL PROPERTIES

The bogie side frame & bolster shall conform to the Material specification and properties as laid down in Annexure-VIII. Class I tolerances to IS: 4897 shall be followed on wall thickness wherever the tolerances are not specified.

9.0 INSPECTION

- 9.1 Inspecting authority shall mean RDSO or any other agency decided by the Purchaser in accordance with the requirements of this schedule, approved drawings and relevant IS specification. IS specifications other relevant specification referenced are listed in Annexure VII. The list is, however, not exhaustive.

- 9.2 Firm shall at his own cost supply all labour, appliances, details and gauges necessary for the testing and inspection of the bogies. Firm will design his own gauges for the bogie and its components wherever necessary. These gauges shall be approved by the RDSO before commencing series production.

One complete set of gauges embossed 'RDSO' shall be kept at the Firm premise and shall be handed over to inspecting official at the time of inspection.

- 9.3 The purchaser's inspecting official, auditor or any authorized representative shall have access to all quality related documents i.e. manufacturing process details, quality control, procedures, records, test results, standardized proforma etc.

- 9.4 Quality of all the castings produced and its workmanship shall be appropriate to

the importance of these castings and any aspect considered by the inspecting officer as detrimental to the safety and efficient performance of the components shall be sufficient reason for rejection of the castings.

- 9.5 The inspection of Side Frame and Bolster shall be carried out before painting. It shall be a part of stage inspection. The painting of the side frame and bolster shall be completed within 24 Hours of the final shot-blasting. The bogie shall be offered for final inspection after painting.
- 9.6 Following inspections shall be done by the inspecting officer and results recorded in addition to any other inspection which may be done by him.
 - 9.6.1 Inspection of side frame and bolster – steel castings- shall be governed by Annexure-I and also details given under para on “Bogie assembly requirements” (Para 5).
 - a) Each cast has to be cleared by the Inspecting Officer on the basis of tests indicated at para 1.10, 1.11, 2.0, 6.0, 8.0 of Annexure-I. In addition to above each cast shall also be checked/tested for chemical composition, mechanical properties and hardness test to conform the requirements/parameters as given in Annexure –VIII.
 - b) Tests indicated at Para 7.0, 9.0, 10.0, 11.0 & 12.0 of Annexure-I are in the nature of audit check and reflect on the quality of manufacturing process.
 - 9.6.2 Gauging of H frame shall be done on 10% of the frames assembled, as per para 5 of this specification.
 - 9.6.3 All components as per Annexure-IX are to be inspected as per details given in the respective Annexures of the component. This is to be done by random sampling on components received by Bogie Manufacturer. If any sample among the test pieces drawn fails, then double the number of test pieces drawn earlier shall be again selected and tested. If the ‘Double’ sample passes the tests, lot shall be considered acceptable. Should any of the samples fail in the “Double” sampling, the complete lot shall be rejected. No further inspection shall be carried out until the firm has investigated and come up with satisfactory reason for the failure as well as the remedial action to improve the quality of material and also implemented the same. A certificate to the effect that the remedial measures suggested by the firm have been implemented must be furnished by the Inspecting official to the DG (Wagon), RDSO, Lucknow for approval before undertaking inspection again.
 - 9.6.4 In the event of rejection, the entire lot offered for inspection shall be made unusable for Railway application in the presence of the inspecting /purchasing authority. The methodology of making such lot unserviceable shall be part of approved QAP.
 - 9.6.5 The Inspecting officials shall also conduct Process/Stage inspection on monthly

basis or as decided by DG/wagon, of different Process/Stages of production as per the approved QAP. The approved QAP/stage inspection shall cover but not limited to following process/stage of manufacturing.

- i) Incoming Raw Material
- ii) Methoding and Mould-Core Preparation
- iii) Melting and Pouring of Molten Metal
- iv) Knock-out
- v) Fettling
- vi) Shot-blasting
- vii) Weld Reclamation if any as per guidelines in this specification
- viii) Heat Treatment
 - a) Rate of Heating
 - b) Soaking Time
- ix) Painting
- x) Testing and Gauging
- xi) Finished Side frames and Bolsters
- xii) Drilling of Side frames and riveting with Spring Plank
- xiii) Welding of liners
- xiv) Matching of springs
- xv) Constant contact side bearer assembly
- xvi) Record keeping by the vendor at different stages of manufacture

10.0 DISPATCH

- 10.1 Manufacturer shall ensure that assembled bogies are handled carefully so that no distortion of spring planks takes place. The bogie shall be loaded carefully on the trucks/wagons and properly strapped so that no shifting can take place. Loading scheme shall be got approved by DG (Wagon)/RDSO.

Care shall also be taken while unloading the bogies to ensure that no damage takes place.

- 10.2 The items which are dispatched loose along with the bogie i.e. Elastomeric pad, etc. shall be properly secured to ensure that no damage takes place during transit. Bogies shall be sent in assembled condition with all components (CP top, CP pin, CP washer, shackle lock and lock pin etc.) as per drawing to avoid possibilities of missing/mixing of components and also ensure to avoid any damage during transit.
- 10.3 Manufacturer shall ensure that Constant contact side bearer assembly is properly secured to avoid the springs and side bearer seat falling off during transit.

- 10.4 Methodology of packing and securing for transport shall be part of approved QAP.

11.0 “AS MADE” DRAWINGS

- 11.1 The bogie suppliers shall supply of CAD drawings of “As Made” drawings followed in the manufacture of the bogies where deviations from the original design, material specifications and dimensions etc. have been adopted.

12.0 PROCESS FOR VENDOR REGISTRATION AND PROTOTYPE TESTING

All manufactures seeking approval for supply of CASNUB 22NLB/CASNUB 22 NLB (M) bogie assembly covered under this specification, to Indian Railways shall follow the procedure outlined below:

- 12.1 RDSO document ‘Vendor application processing’ ISO QO-D-8.1-6 (latest) shall be followed for the registration and approval of the firm. For document scrutiny the firm shall refer the ISO document No QO-F-8.1-1 and No QO-F-8.1-7. For Capability assessment the firm shall refer the ISO document No ISO QO-F-8.1-8, RDSO Document No STR (QMS-09:2015 latest), this specification and QAP.
- 12.2 Based on successful completion of above, prototype testing shall be undertaken. Decision conveyed to the manufacturer regarding permission to manufacture two nos. of prototype bogies (one set of assembled bogie and other set in loose condition) to this specification along with provisionally approved QAP.
- 12.3 On receipt of permission for casting of prototypes, the manufacturer shall then give 15 days’ notice to DG (Wagon)/RDSO for witnessing of melting, pouring testing etc. as specified in ANNEXURE – 1 and provisionally approved QAP for process inspection of prototypes manufacturing. Besides witness by RDSO complete process shall be video graphed and submitted to RDSO in a hard drive duly labeled.
- 12.4 The manufacturing of proto samples of bogies shall be done strictly as per relevant drawings, specification and provisionally approved QAP. The components fitted on proto bogies shall be duly inspected by concerned inspecting authority. Quality conformance shall be checked with respect to the requirements of this specification. All tests listed in Annexure-I of the specification shall be done. Components shall be checked as per the scheme given in their respective relevant Annexures.

- 12.5 During prototype testing if any sample fails/not meeting requirements, the manufacturer has to review the process and report has to be submitted to the approving authority (DG(Wagon)/RDSO) for consideration. Sample type testing will be carried out as per QO-D-8.1-10 (latest) & other related documents that are applicable.
- 12.6 Based on the satisfactory prototype test results and manufacturing facilities found to be meeting the requirements in respect of infrastructure and other requirements as covered in specification, the firm shall be considered for approval as a RDSO vendor for Developmental Orders for the manufacture and supply of CASNUB-22NLB/CASNUB 22 NLB (M) bogie as per the relevant and applicable RDSO procedure (s) for the same.
- 12.7 A manufacturer shall be considered from "RDSO approved vendor for Developmental order" to "approved" for manufacture and supply of CASNUB-22NLB/CASNUB 22 NLB (M) bogie after satisfactory supply for a minimum quantity as specified in item master on UVAM of any type of CASNUB Bogie i.e. CASNUB 22 NLB or/and CASNUB 22 NLB (M) or as specified in the relevant RDSO document, in accordance to RDSO document no. QO-D-8.1-11 (latest).
- 12.8 The firm has to apply to RDSO for up gradation of their status from "RDSO vendor for developmental order" to "approved" and the same shall be processed as per relevant procedures applicable time to time.
- 12.9 All the provisions contained in RDSO's ISO procedures laid down in document No. QO-D-8.1-11 (Latest version) (titled "Vendor-Changes in approved status") and subsequent versions/amendments thereof, shall be binding and applicable on the successful vendor/vendors in the contracts floated by Railways to maintain quality of products supplied to Railways.
- 12.10 All terms and conditions for vendor registration/approval of foreign firms shall be applicable as stipulated in RDSO ISO document QO-D-8.1-5 (latest version) title "Application for registration of vendor". In case of any contradiction between the clauses of this specification and ISO document QO-D-8.1-5 regarding the vendor registration/approval of foreign firms, the clauses of ISO document shall prevail.

13.0 QUALITY ASSURANCE PROGRAMME

The manufacturer shall prepare a quality assurance program (QAP) as per the relevant ISO Document i.e. QO-F-8.1-7 (latest) of Annexure-A7 and submit it for approval to the DG(Wagon)/RDSO and shall obtain his approval before commencing the manufacture of CASNUB 22 NLB/CASNUB 22 NLB (M) Bogie. Besides other aspects, the following salient points shall be taken into consideration for the preparation of QAP to be submitted to the Inspecting Authority.

- 13.1 In the Incoming Raw Material and In process/Final Inspection Section (Section-E), the Firm shall clearly mention all the Test Parameters, Parameters for inspection, testing frequency, the mode/methodology of testing, equipment/machinery involved for testing, testing standard, acceptance criteria/limit etc. Section- (E) of the QAP shall include but not limited to following parameters:
- a) Type of raw material including scrap to be used
 - b) Internal specification of scraps to be used and charge-mix
 - c) Moulding Practice.
 - d) Selection of sands to be used.
 - e) Sand binder additives.
 - f) Preparation of sand and its testing.
 - g) Design of mould box and core boxes (Use of Wooden Core Box is prohibited)
 - h) Pattern and core making. (Use of Wooden pattern is prohibited)
 - i) Preparation of moulds.
 - j) Material, size and identification of chaplets shall be specified. (Refer IS-5904)
 - k) Melting process.
 - l) Argon purging technique.
 - m) Stages of testing of molten metal before tapping and at the end of pouring.
 - n) Shot blasting.
 - o) Fettling i.e. knocks out and removal of risers, ingate, fins, etc.
 - p) Grain refining technique/ Heat treatment process.
 - q) Removal of protruded metal if any, with the help of air arc/gas cutting.
 - r) Chemical and Mechanical test, hardness test, radiographic test, solidity test, MPI test, D.P. test etc. at the various stages of manufacture in reference to relevant spec.
 - s) Maintenance of records of tests at various stages.
 - t) Intensity of internal inspection at different stages by Inspector/Quality Head
 - u) Painting.
 - v) Packing and dispatch.
- 13.2 Following details shall also be included in QAP
- i) Source/Brand of Incoming Sand
 - a) Resin
 - b) Additives
 - c) Any other material required for preparation of moulding sand
 - ii) Properties of above sand
 - a) Clay content
 - b) Purity/LOI (major constituents %)
 - c) AFS and grain fineness number
 - d) Shape of grains (round, semi-angular, angular)
 - e) Silica Content (98% Min.)

- iii) Mould wash
 - a) Name
 - b) Base
 - c) Consistency
 - d) Size of particles
- iv) Properties of prepared sands (mould, core and facing)
 - a) System of Sand Preparation (No-Bake/High Pressure moulding)
 - b) Compression strength
 - c) Shear Strength
 - d) Collapsibility
 - e) Gas Content
- v) Feeding system (to be shown on sketch/drawing)
 - a) Size and position of ingate
 - b) Size and position of runners
 - c) Size and position of risers
 - d) Yield percentage of castings
- vi) Pouring start temperature of each Mould & method of measurement
- vii) Pouring end temperature of each Mould & method of measurement.
- viii) Knock out time after pouring
- ix) Weight of casting

All activities relating to quality assurance shall be the responsibility of Quality Head who shall form the interface with the RDSO inspecting officer. The relevant records for maintaining quality for each of the following items shall be maintained and made available to the inspecting officer.

14.0 QUALITY AUDIT

The quality audit of the firm shall be carried out to ensure the adherence to its quality assurance, and its general quality consciousness as per extant RDSO ISO procedures and special emphasize shall be given on the process audit as per Annexure-XII. This quality audit may also be carried out on the need basis in case of reports of severe premature failures of the product are received from Railways. For establishing this, the samples shall be collected from Railways and sent to RDSO, Lucknow as and when required for carrying out the tests mentioned in this Specification followed by fatigue testing as per AAR guidelines/test regime at RDSO, Lucknow.

15.0 OTHER REQUIREMENTS

- 15.1 The accuracy of gauges shall be checked by the Inspecting Authorities before the commencement of manufacture. Re-calibration shall subsequently be made at the frequency stipulated in internal Quality Assurance Program. This shall also be done during stage inspection randomly. Gauge drawings in original, shall also be made available for checking the tolerances of these gauges. Firm shall have sufficient sets of gauges for his own use. Firm shall install suitable Coordinate Measuring Machine (CMM) or any other suitable system to carry out the inspection of Gauges, Fixtures and random dimensional measurements of Bolster and Side Frame etc. Prior approval of DG (Wagon)/RDSO shall be obtained on use of alternate system.
- 15.2 In case the offer does not correspond to this specification in any respect, a DEVIATION STATEMENT shall be submitted by the Tenderer. This statement shall give the deviations clause wise with technical reasons for the same. Change in drawings, if any, shall be explained and accompanied by THREE copies of revised drawings. In case the tenderer does not require any deviation from this specification, a NO DEVIATION CERTIFICATE shall be submitted.
- 15.3 All bogie and its components should have clear and legible manufacturers name in short code and month & year of manufacturing etc., which shall remain legible throughout the entire service period as specified in RDSO Drawing no. WD-86038-S/1 (latest Alteration).
- 15.4 Any bogie components found having illegible markings at the time of fitment in Railway Workshops, Maintenance Depot or at Wagon Builder premises, shall be treated as rejected and shall be replace by the manufacturers free of cost. The cost of transportation shall also be borne by manufacturer.
- 15.5 All manufacturer foundries, material and manufacturing process must be approved by RDSO. The basis for such approval shall be satisfactory compliance with all relevant provisions of Association of American Railroads (AAR) Specifications including AAR Specifications M-201, M-202, M-203, M-210, M-1003 and this specification.
- The foundry shall satisfy the requirements for Class "A" foundries (IS: 12117 latest) specified and updated by the Bureau of Indian Standards/RDSO from time to time.
- 15.6 Manufacturer shall have a proper house-keeping system to ensure that components are not damaged during storage. Critical components like springs, center pivot, elastomeric pad, side bearers etc. must be stored under cover and be protected against corrosion.

16.0 CLARIFICATIONS

Any further clarification required by the supplier can be obtained from the Director General (Wagon), Research Designs and Standards Organization, Ministry of Railways, Manak Nagar Lucknow – 226 011 (India).

17.0 WARRANTY

The firm shall stand warrantee for complete bogie/ components (such as side frame, bolster, center pivots, spring plank, brake beam), unless otherwise specified in the specification of individual component/ sub-assembly, for a period of 72 months from the date of manufacture or 60 months from the date of fitment/commissioning of the wagon, whichever is earlier.

In case of pre-mature failure of any component/sub-assembly, the firm will be liable to make free replacement of failed component/sub-assembly to the depot where failure has been reported within reasonable time. Decision of purchaser/ RDSO on warranty failure shall be final and binding on the vendor.

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CAST COMPONENTS

1.1 REQUIREMENTS OF STEEL CASTINGS AND MANUFACTURING PROCESS

- i) All basic foundry processes e.g. moulding, core making, heat treatment, fettling, shot blasting, heat treatment and weld reclamation shall be done in house with adequate facilities and infrastructure for all steel castings.
- ii) The steel shall be made by electric arc process or such other process as approved by the DG (Wagon), RDSO, Lucknow. Keeping the limitation of operational aspects in view, use of induction furnace for melting is not permitted.
- iii) Firms shall have NABL accreditation for their lab facilities required as per this specification.
- iv) Firm shall have a system of complete process control plan to control all the critical activities specified in this specification. Firm must maintain records of each process meeting the requirements of the desired values/standards. These records shall be kept for minimum three (3) years.

1.2 Ladle analysis:

- i) An analysis of test samples taken during the initial 25% of the castings poured from each ladle must be made by the manufacturer to determine the percentage of carbon, manganese, phosphorus, sulfur, and silicon and of the intentional alloying elements. The result of this analysis shall be recorded and reported to the inspecting official upon request and shall conform to the requirements as per AAR M 201 Gr B+ material as detailed in Annexure-VIII and/or approved QAP.
- ii) Apart from the above, for each heat of steel, a sample representing the last metal going into, or taken after the pouring of, the last acceptable casting must be used by the manufacturer to determine the chemical composition. The results of this analysis shall be reported to the inspecting official upon request and shall conform to the requirements of AAR M 201 Gr B+ material as detailed in Annexure-VIII and/or approved QAP.

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1.3 Raw material quality – General:

- i) The foundry shall lay down the specification of all raw materials used in the manufacture of castings and follow the same.
- ii) The castings shall be manufactured from appropriate quality of raw materials i.e. silica sand, steel scrap, foundry returns & ferro-alloys, whose quality shall be ensured through relevant tests. Care should be taken to ensure that the scrap selected is free from rust, grease, oil and other prohibited contaminants.
- iii) Pig iron as raw material shall be restricted below 5% and preferably Calcined lime shall be used instead of lime stone.
- iv) Quality of all additives to sand, molten metal and mould/core wash shall be standardized, checked and only acceptable quality raw material and additives shall be used.
- v) Record of all raw materials and additives, their quality characteristics shall be maintained which shall be made available to inspecting officer to facilitate scrutiny and establish traceability.
- vi) The Complete detail of raw material and additives used for melting shall be incorporated in QAP.

1.4 Methoding:

- i) Casting solidification software must be used to evaluate castings for potential defects, standardize running, gating, risering system including use of appropriate chills & chaplets and for verification of casting solidity. It should be evaluated on the standard Software such as MAGMA and validated through proto-type testing. In this regard the Firm is required to submit a certificate from an authorized government agency/IIT/CSIR/Certified third-party agency that the methoding system meets the requirements of International/National standard and best foundry practices for the manufacturing **or** to submit detailed Simulation report along with casting proto-testing report (with same methoding) to RDSO for approval. This analysis shall also be part of ITR submitted as prerequisite of prototype testing.
- ii) Any alteration in the methoding system shall be intimated immediately for obtaining approval.

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- iii) Knock-off riser shall be used wherever possible, to eliminate damage to the castings during finishing operation. All surface of the core coming in contact with the molten metal and where surface finish is important to ensure proper seating of the mating components shall be provided with core wash.
 - iv) Entire methoding system shall be part of QAP of the vendor.
- 1.5 Moulding:**
- i) Moulding shall be carried out by employing either of the following process given below:
 - a) High Pressure Moulding Line with Intensive Mixture for Green sand mould with automatic Moisture Control and addition of Binder in fixed rates. It shall be equipped with intensive mixture with automatic dosing, water liter flow along with SCADA control to make the moulding sand. Any deviation will require prior approval from DG (Wagon)/RDSO.
 - OR**
 - b) Articulated Mixer (continuous type) with fume extraction facility & Compaction Table for No-Bake System. It shall be equipped with automatic resin charge having calibration facility , compaction table , and sand reclamation system along with SCADA control. Any deviation will require prior approval from DG(Wagon)/RDSO.
 - OR**
 - c) Any other better process as approved by DG (Wagon, RDSO, Lucknow.
 - ii) For High pressure moulding line mould hardness shall be minimum 85 and the same should be uniform at all the surfaces (within + 5% at all the surface including vertical), and for No – Bake System scratch hardness of mould shall be minimum 60 and same should be uniform at all the surfaces (within + 5% at all the surface including vertical) so as to get good dimensional accuracy in castings.
 - iii) Proper cleaning of moulds/cores by using T – suction pipe or any other better process as approved by DG (Wagon)/RDSO shall be ensured before mould closing.

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- iv) Suitable arrangement shall be made in the mould to obtain manufacturer's identity, month and year of manufacture, casting Sr. No., Drg. No. for each side frame and bolster casting, center pivot top and brake beam end piece & strut casting and other castings as indicated in drawings.
- v) Minimum four test lugs of size 25 X 25 X 8 mm shall be provided in all castings to facilitate micro-examination.
- vi) To facilitate mechanical testing and chemical analysis, all side frames and bolster castings shall have integrated test bars from which samples for tests shall be prepared.
- vii) On all moulds and cores, an "alcohol/water-based zircon paint" of appropriate quality shall be applied to the entire surface that comes into contact with molten metal. This application is crucial for ensuring a proper surface finish and mitigating undesirable metal/mould reactions. The process and methodology for this application, as well as the associated quality control measures, shall be incorporated into the Quality Assurance Plan (QAP).

1.6 Sand Preparation & Sand Lab:

- i) The foundry shall lay down the characteristics of all sand mixes i.e. moulding sand, core sand, facing sand and shall have proper arrangement for sand drying & preparation of sand mix of consistent quality and the characteristics of each batch shall be checked to ensure conformance to standard arrived at by the foundry. Sand mix of unacceptable quality shall not be processed.
- ii) The foundry shall be equipped with a full-fledged sand testing lab. Testing facilities shall comprise incoming sand tests like active clay content, acid demand value, loss on ignition, mechanical grading (grain fineness number) and sand mix tests like moisture content, green & dry strength, permeability, shatter index, surface hardness, scratch hardness, bench life, strip time, hot distortion, high temperature properties. Outsourcing of this lab shall not be permitted.

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1.7 Core-Making:

- i) All cores shall be produced by No-bake process or any other better process (with prior approval of DG/Wagon/RDSO) for which continuous mixer with compaction table/ batch mixer shall be available in-house.
- ii) Minimum number of cores, preferably single core shall be used in each mould to achieve the desired quality of castings. Nos. of cores proposed to be used shall be clearly specified in the QAP.

1.8 Melting:

- i) Oxygen lancing process with oxygen purity level of 99% minimum shall be used for carbon boiling.
- ii) A sufficient carbon boil must be accomplished with a minimum 20 point carbon reduction. Double slag process for proper removal of sulphur and phosphorus shall be followed.
- iii) Argon Purging shall be carried out to ensure freedom from harmful gases, time and quantity of argon purging as per ladle size shall be specified in QAP. Electronic display of spectrometer results near arc melting furnace shall be installed.
- iv) Ladle pre-heating at 600°C to 700°C shall be carried out. Temperature checking in furnace and in ladle by immersion pyrometer shall be done before pouring in Mould.

1.9 Pouring:

- i) Metal should be poured by bottom pouring ladle. Mould filling time, Pouring start and pouring end temperatures shall be recorded, ensuring that all castings from first to last are sound & no adverse effect are noticed due to high or low pouring temperature.
- ii) Electronic display of pouring ladle weight shall be used to check amount of metal pouring and remaining molten metal quantity.
- iii) During pouring in mould, temperature checking by Laser Beam/Infrared Type Optical Pyrometer shall be done. After pouring castings shall be allowed to cool to a temperature below 540°C, at a rate that will not be injurious to the castings.
- iv) Moulding boxes shall be opened to remove the castings only after they have cooled down sufficiently (100°C - 250°C). Left over metal/slag in ladle shall be specified in QAP.

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1.10 Fettling and shot blasting:

- i) Risers, runners and ingates shall be removed from the castings. Use of knock-off risers shall be preferred for improving the surface condition of the castings. All castings shall thereafter be properly cleaned, dressed and shot blasted to ensure freedom from surface imperfections, loosely adherent sand, scale etc.
- ii) Preferably, shot blasting shall be done in three cycles (before heat treatment, after heat treatment and before painting).

1.11 Heat treatment:

- i) All castings shall be heat treated after fettling and Shot Blasting. Shot Blasting shall also be carried out after heat treatment process.
- ii) SOTA (State of the Art) heat treatment furnaces along with SCADA control shall be employed and must be capable of throughout even temperature distribution within $\pm 10^{\circ}\text{C}$.
The heat treatment furnace preferably shall be an electric type. Manufacturer can use alternative furnace giving similar or better heat treatment properties with prior approval of DG(Wagon)/RDSO. Oil fired furnace for heat treatment shall not be deployed.
- iii) All heat treatment furnaces shall be equipped with adequate number of thermocouple's and recorders. Facility for output chart indicating heat number, date and time verses temperature shall be available for each furnace.
- iv) Optimum uses of heat treatment furnace (not more than 70% - 80% of total volume) shall be ensured. Sketch depicting space, covering arrangement and stacking procedure for bogie components shall be specified in QAP. The stacking diagram shall be approved by RDSO. Plan for placement of castings in the furnace shall be standardized to ensure uniformity of heat treatment for each casting of a particular batch and the same shall be followed without any deviation.
- v) The Castings for heat treatment shall be cleaned / dressed sufficiently to respond the heat treatment. The castings shall be normalized tempered as detailed below to achieve properties as detailed in Annexure-VIII. However, only normalizing can also be followed subject to condition that it meets all the requirements of this specification with prior approval of DG(Wagon)/RDSO.
- vi) Loading temperature of bogie components in heat treatment furnace shall not be more than 250°C . The process of heat treatment shall be as follows.

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- A. Process of Normalizing castings shall be followed in following order:**
- a) Heat to proper uniform temperature above the transformation range and hold for the proper time to achieve complete austenization and to refine the grain structure. Generally, the rate of Heating shall be at the rate of $100^{\circ}\text{C} \pm 20^{\circ}\text{C}$ per hour and soaking at $920 \pm 10^{\circ}\text{C}$ for minimum 4 hours. In case of any deviation, the firm shall submit the intended process with details to RDSO for approval of DG (Wagon)/RDSO. This shall be clearly indicated in QAP.
 - b) Withdraw from the furnace and cool in still air until temperature of entire casting reach below 370°C .
- B. Process of Normalized and tempered castings shall be followed in following order:**
- c) Heat to proper uniform temperature above the transformation range and hold for the proper time to achieve complete austenization and to refine the grain structure. Generally, the rate of Heating shall be at the rate of $100^{\circ}\text{C} \pm 20^{\circ}\text{C}$ per hour and soaking at $920 \pm 10^{\circ}\text{C}$ for minimum 4 hours.
 - d) Withdraw from the furnace and cool in still air until entire casting temperature reach at least 60°C below the tempering temperature.
 - e) Temper by reheating to proper uniform temperature below the transformation range, but not less than 320°C and hold for the required time (Preferably for 4 Hours). Remove castings from the furnace and allow it to cool at desired rate. In case of any deviation, the firm shall submit the intended process with details to RDSO for approval of DG (Wagon)/RDSO. The complete heat treatment process shall be clearly indicated in QAP.
 - vii) All the stages of heat treatment with various time & temperature ranges of processes, acceptable limits of rate of heating, shall be clearly brought out in QAP. Inspecting Authority shall examine it with actual heat treatment process being followed during quality audit.

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1.12 Heat-Treatment Documentation:

- i) The manufacturer is required to develop and document heat-treating standards that describe the processes, process control procedures, and record keeping requirements. These documents are to be presented and reviewed as part of the Foundry Approval Process and are intended to ensure that products are properly heat treated. Furnace temperatures for heat treatment shall be controlled by thermocouples having associated recording equipment that produce time-temperature record charts that are identified by date and furnace number.
- ii) A log sheet for each load of castings heat treated (batch) should show all information pertinent to each heat-treat load including the following:
 - a) Type of casting
 - b) Prescribed heat treatment
 - c) Serial numbers and the heat numbers of the castings
 - d) Actual time of heat treatment.
- iii) Thermocouples shall be calibrated every 6 months. Records of time-temperature charts, furnace log sheets, and thermocouples calibrations will be maintained for 3 years and made available to the purchaser/inspecting authority upon request.

1.13 On completion of heat treatment, the castings shall again be shot blasted.**2.0 VISUAL EXAMINATION**

- i) All castings shall be examined visually and in the event of doubt by using a magnifying glass. Final examination has to be done by magnetic particle testing method as indicated in Para 7.2.
- ii) The castings shall be free from harmful surface defects, inclusions, sand fusion, blow holes, folds, cracks, misruns, surface imperfections, unfused chaplets and porosity. The acceptable limit for surface defects as per specification ASTM – A -802 SCRATA comparators is indicated below.

Surface Quality Parameters	Critical Areas as Specified in the relevant drawing	Non Critical Area Other than specified locations
Surface roughness	A1 / A2	A3
Inclusions	B3	B4
Gas/Porosity	C2	C3
Wrinkles	D2	D4

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Scabs	E2	E2
Chaplets	F2	F4
Thermal Dressing	G2	G3
Gauges (1/8 in. max. depth)	H3	H4
Welds	J2	J3

- iii) Castings having freedom from defects shall only be processed for machining and assembly.

3.0 WELD RECLAMATION

- i) Weld Reclamation shall only be carried out prior to the heat treatment process. Any deviation shall require prior approval of DG (Wagon)/RDSO before use.
- ii) The cracks up to a depth of 2 mm shall be ground and blended with surrounding surfaces.
- iii) In case defects are observed in the castings, a sketch showing the location, approximate dimension and nature shall be prepared. Weld repair possibility shall be considered after careful examination of the castings on a case-to-case basis and specific approval of inspecting officer shall be obtained. The defect must be removed completely and its elimination ensured prior to weld repair. The weld reclamation shall be carried out as per procedure outlined at Annexure-IA.
- iv) All castings reclaimed by welding after heat treatment shall be subjected to normalizing in the same manner as outlined for castings manufactured in the first instance.
- v) Welding repair on Zone-1 as indicated in Annexure-IA shall not be done.

4.0 DISPOSAL OF REJECTED CASTINGS

- i) All castings which have been rejected either by the internal inspecting officer or by purchaser's inspecting officer shall be promptly marked with a red paint as 'REJECTED'.
- ii) Gas cutting or other methods should be used to divide the castings into at least two pieces to prevent mixing. These pieces must be kept stacked separately until they are verified by the inspecting official. A record of such castings, including their serial numbers, shall be maintained.

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5.0 FEED BACK MECHANISM

- i) The foundry shall have a mechanism for identifying and control of defects through feedback obtained from inspecting and quality control personnel. Suitable remedial action shall be introduced in the manufacturing process with the consent of purchaser's inspecting officer wherever the same is necessary.
- ii) Record of all improvements, modifications, and alterations shall be maintained to assess their effect and subsequent scrutiny. A report listing these shall be submitted to DG (Wagon)/RDSO half yearly interval.
- iii) One sample per heat shall be retained for retests or cross checks of chemical and mechanical properties. These shall be retained for period of 3 years.

6.0 TESTS FOR CHEMICAL COMPOSITION AND MECHANICAL PROPERTIES

- i) All the side frames and bolsters shall be cast with integral test bars.
- ii) Chemical analysis each heat for each type of casting is to be recorded.
- iii) Test shall be conducted in accordance with standard Methods and Definition for mechanical testing of steel products, ASTM standard A 370, latest revision/equivalent standard as approved by DG (Wagon)/RDSO.
- iv) Test bars for each heat & heat treatment batch of the same grade will be tested for mechanical properties. Test results will be recorded.
- v) Re-tests will be governed by the relevant IS Specification.
- vi) One sample per heat shall be retained for re-tests or cross checks of chemical and mechanical properties when required by inspecting officer. These shall be retained for period of 3 years.

7.0 NON-DESTRUCTIVE TESTS

The following non-destructive tests shall be carried out:

7.1 Radiographic Tests:

- 7.1.1 One side frame and one bolster casting in every 100 bogies or part thereof shall be subjected to radiographic examination for the initial supply of 1500 bogies. Frequency of testing shall be reduced to 1 in 250 bogies after the successful supply of initial 1500 bogie sets. Different contracts will be treated as if in continuation irrespective of contract size-unless there is a gap of 3 months between execution of two consecutive contracts or there is a major design change.

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7.1.2 The sketches showing locations for radiographic examination are enclosed WX 24003A (for bolster) and WX 24003B (for side frame). All radiographs shall clearly reveal the image of penetration at appropriate locations to enable correct interpretation of radiographic classification. Radiographically examined with sensitivity of minimum 2% and satisfy the requirement of ASTM designation E-446 – Reference Radiographs for Steel Casting – Level 3 in respect of blow holes, slag, sand inclusion and shrinkage. No cracks/hot tears shall be permitted.

7.2 Magnetic particle test

7.2.1 Magnetic particle test shall be conducted on all side frame and Bolster casting at locations indicated in sketches no. WX 24003A (for bolster) and WX 24003B (for side frame) in accordance with IS: 3703.

7.2.2 The equipment consumables shall meet RDSO specification no. M&C/NDT/15/91 and M&C/NDT/8/91 or latest. No cracks are permitted. The cracks up to a depth of 2 mm shall be ground and blended with surrounding surfaces. Magnaflux test shall again be done after grinding to ensure removal of crack. Deeper cracks shall be rectified as per Annexure IA.

7.2.3 Inspecting officer shall witness 10% of the bogies checked.

8.0 MICROSTRUCTURE & SURFACE ROUGHNESS

- i) Microstructure of heat treated castings representing each cast shall be conducted from the lugs provided in side frame, bolster and center pivot castings and the grain size shall be uniform and of size ASTM 6 or better. The microstructure shall not reveal cast dendritic structure.
- ii) The surface roughness of each cast of side frame, bolster and other cast component after shot blasting shall be ensured in accordance with the surface roughness parameters as indicated in the relevant drawings of respective cast components and as specified in this specification.
- iii) The inspector shall check record and verify the 5% of offered lot of each heat during the inspection.

9.0 WEIGHT

- i) Castings shall be rejected if their weight is above the limits specified below:

Side frame	430 kg +5%/-3%
Bolster	565 kg +5%/-3%
Brake beam	75 kg \pm 6.0%

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- ii) To ensure the weight of the bogie side frame and bolster within the limit as specified above, inspector shall check the record of each lot and verify the weight of 5% of bolster and side frame from a offered lot during inspection

10.0 LOAD TESTING

- i) Castings shall be selected at random for load test by the inspector/inspecting Authority. Different contracts will be treated as if in continuation irrespective of contract size-unless there is a gap of 3 months between executions of two consecutive contracts or there is a major design change. In such cases, tests will be carried out as if on a new contract.
- ii) Casting will be checked by magnetic particle test and at corners and radii with dye-penetrant test both before and after the load tests. In case of any cracks two more castings from the same lot shall be tested. If any one of the latter castings fails in the load test, the complete lot stands rejected. In case of rejection, the manufacturer shall review his foundry practices and take whatever steps necessary to satisfy the inspector of the adequacy of the process of manufacture.

10.1 Proof load & destructive load Testing of bolster & Side frame

- i) The bogie bolster and side frame shall comply with following static proof tests as detailed in below para 10.1.1, 10.1.2 and 10.1.3.
- ii) All bogie manufacturer shall have in house facilities for static proof load testing of bogie side frame and bolster with necessary fixture and suitable load deflection measuring device to carry out the tests as detailed below.

10.1.1 Application of test load:

10.1.1.1 The side frame casting shall have the test load applied in the direction of the vertical axis at the plank seat surface of side frame and supported at the side frame pedestal crown roof at each end.

10.1.1.2 The bolster castings shall be loaded in the direction of the vertical axis at the center pivot, the supports being at the spring seat at each end.

10.1.2 Static proof load test for bogie side frame and bolster:

This test will be conducted on side frame and bolster. The frequency of testing and load applied shall be as below:

Item	Frequency of Testing	Load Applied	Maximum Deflection	Permanent set max. at center
Side frame	1 in 50	117 t	--	0.4 mm
Bolster	1 in 50	117 t	--	0.7 mm

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10.1.3 Destruction Test:

10.1.3.1 This test will be conducted on side frame and bolster The frequency of testing and load applied shall be as indicated at para 10.1.4:

10.1.3.2 The sample castings selected for destruction test shall be subjected to loads specified below. No fracture/cracks should take place at these loads. The test is to be discontinued if the casting begins to fracture or show cracks at less than the specified loads.

a)	Side frame	234 t
b)	Bolster	254 t

10.1.3.3 Digital gauges shall be used for measurement of actual load applied and deflection/permanent set measurement. Least count shall be 100 kg for load application and 0.01 mm for deflection/permanent set measurement or better.

10.1.4 Sample Size for proof and destruction load testing:

10.1.4.1 One side frame and one bolster casting in every 100 bogies or part thereof shall be tested for the initial supply of 1500 bogies. Subsequent frequency of testing shall be reduced to 1 in 300 bogies after the successful supply of initial 1500 bogie sets. The selection of side frame/bolster for this test shall be made at random by the inspector from the lot.

10.1.4.2 For determining frequency of tests, different contracts shall be treated as if in continuation irrespective of the size of contract unless there is a gap of 3 months between execution of two consecutive contracts or there is a major design change. Casting used for destructive test shall not be used except for sectioning test/scrap.

11.0 SECTIONING TEST

11.1 Castings subjected to destruction tests shall be sectioned to establish moulding practices. Sketches showing the location for sectioning are enclosed as No. WX-24003 C (for sectioning location of bolster) & WX- 24003D (for sectioning location of side frame). Sample size of this test shall be same as para 10.1.4.

11.2 Following items are to be specifically checked :

11.2.1 Wall thickness

11.2.2 Internal Solidity

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11.3 Permitted variation in wall thickness of the castings is as given below :

Wall thickness dimension	Permissible variation
6 mm up to 11 mm (not including 11mm)	+ 3 mm to –1 mm
11 mm and above	+ 3 mm to –2 mm

11.4 Each sectioned face on examination; Defects such as blow holes, slag inclusions, shrinkage, etc. are not acceptable. Porosity to a level of 2% of the cross section may be considered acceptable. The defect shall not be clustered at any particular location and shall be uniformly distributed throughout. Defect connected with the outside and presence of cracks/hot tears shall be cause for rejection. Dye-penetrant test shall be carried out on sectioned faces for detection of shrinkage and chequered cracks. These tests shall be carried out in the physical presence of inspecting official.

11.5 The firm should have a machine shop equipped with appropriate size Power saw for sectioning sides frame/Bolster as per the requirement of this specification. Outsourcing of this activity shall be prohibited.

11.6 The Firm shall maintain complete record of sectioning including measurement of wall-thickness, internal solidity and photographs with DPT tests.

12.0 INSPECTION OF WALL THICKNESS

- i) Wall thickness check shall be made at specified locations as per mentioned in enclosed sketches of bolster and side frame nos. WX-24003C and WX-24003D on minimum 25% the castings using ultrasonic thickness gauge or better.
- ii) Any rejection will mean defect in pattern, core, mould setting or process and appropriate investigation shall be made.

ANNEXURE -IAWELDING REPAIR PROCEDURE FOR CAST STEEL SIDE FRAME AND BOLSTER

1. This procedure covers the steps to be followed for weld repair of casting defects considered repairable by the inspecting officer. The complete welding and post welding heat treatment as per the procedure given in this specification shall only be done in the supervision of inspecting/competent official. Complete record of the welding reclamation and its traceability shall be maintained.
2. Before conducting weld reclamation, a sketch showing the nature, size and location of defects shall be prepared and written permission of inspecting officer shall be obtained on case-to-case basis.
3. While decision regarding weld reclamation shall be taken by the inspecting officer, the following guidelines shall be followed.
 - 3.1 Through thickness cracks shall not be considered for welding.
 - 3.2 Misrun shall not be repaired by welding.
 - 3.3 Defects which are located at vulnerable locations (Zone-1 as specified in enclosed sketches nos. WX-2400E and WX-24003F) shall not be repaired and shall be considered as rejected. Defects which are located at locations (Zone-2) as specified in enclosed sketches nos. WX-2400E and WX-24003F shall not be repaired if their depth exceeds 25% of the wall thickness. At other locations defects up to 50% of the wall thickness shall be considered for weld reclamation.
 - 3.4 The total length of the weld seam in one casting shall not exceed 100 mm and no single weld seam length shall exceed 50 mm. If more than 2 castings reach or exceed the stipulated defect limit, a thorough process audit as per Annexure-XII by an RDSO inspecting official shall be necessary.
 - 3.5 All castings repaired by welding shall be subject to same heat treatment process as being followed for the casting (Normalized/Normalized-Tempered).
 - 3.6 The welding shall be conducted by qualified welders with valid certificate.
 - 3.7 The foundry must have a procedure to mark castings for repair, to ensure that the proper repair procedure is used, and to identify castings for which repairs have been completed.
 - 3.8 Complete weld reclamation procedure shall be the part of QAP.
 - 3.9 Welding repair as per this specification shall only be carried out prior to the heat treatment of the casting. Any deviation shall require prior approval of DG(Wagon)/RDSO before use.

4.0 **Repair procedure**

- 4.1 The extent of crack of defect shall be judged by visual or magnetic particle examination by qualified inspector or welder. Use of crack depth meter is also mandatory for precise crack depth determination. The defect shall be eliminated by pneumatic gauging, arc gauging, grinding, chipping and its elimination ensured by MPI/dye penetrant testing.
- 4.2 The method of defect removal must not hide the defect.
- 4.3 Appropriate shaped groove shall be prepared with the help of portable pencil grinder and entire surface cleaned properly to ensure freedom from heavy scale, oil, grease, paint, dirt etc.
- 4.4 Welding electrodes AWS A5.5 –E-8015, E-8016, E-8018, E-10018 or better shall be used for welding repair. Current, polarity and OCV shall be as per recommendation of the electrode manufacturer. Welding shall be done in down hand position maintaining an interpass temp of 250-300 Deg. C, de-slagging and peening after each run.
Alternatively, GMAW welding wire consumable having class III to IRSM M 46/2020 can also be used for weld repairs. However, prior approval of DG (Wagon)/RDSO shall be obtained before use.
- 4.5 Welders/weld operators must be qualified in position welding that to be performed for the materials, processes, and procedures being used in accordance with AWS D15.1 or equivalent.
- 4.6 The electrodes shall be preheated before use as recommended by electrode manufacturer (OEM).
- 4.7 Preheat of base metal before putting of weld bead shall be carried out within range of 150 – 250 °C. In case of multi run weld, the inter pass weld temperature shall not be less than preheat temperature. The OEM instructions on time duration for preheating shall also be followed.
- 4.8 The weldment shall be examined for presence of cracks by dye penetrant testing. Weldments free from cracks shall be considered acceptable.
- 4.9 All weld must be inspected visually, MPI tested and all finished weld repairs must meet AAR M-201, M-210. Porosity must not exceed the AWS D15.1 for class 2 welds. Weld repairs must be checked by qualified inspectors.

ANNEXURE -IISPRING STEEL COMPONENTS

- i) The helical springs shall be manufactured as per RDSO specification no. WD-01-HLS-94 (Latest) and drawing no. WD-83069-S/1.
- ii) Material for Helical Springs: shall be manufactured out of steel conforming to RDSO's specification no. WD-01-HLS- 94 (Latest).

ANNEXURE –III

METAL BONDED RUBBER COMPONENTS

- i) Elastomeric pads: The Elastomeric pads as per the RDSO specification No. WD-20-Misc-95 (Latest) shall be provided between adapter and side frame pedestal roof.
- ii) Centre pivot washer: The washer shall be as per RDSO drawing no. WD-97049-S/3 & WD-85079-S/2.

ANNEXURE –IIIACOMPOSITE MATERIAL COMPONENTS**1.0 Brake Blocks:**

- i) 'L' type brake block shall be manufactured as per the RDSO Specification No. WD-13-ABR-2006 (latest version) by manufactures approved by RDSO.
- ii) 'K' type brake block shall be manufactured as per the RDSO Specification No. WD-14-ABR-2019 (latest version) by manufactures approved by RDSO.

ANNEXURE –IIIBCONSTANT CONTACT SIDE BEARER**A. CASNUB 22NLB Bogie**

S.No.	Specification No.	Variant/Type	Approved Drawing/s	To be fitted in
1.	WD-38-Misc-2004 (Rev-1) or Latest	Design-‘B’	AAL-021101 / N or Latest	All Wagons fitted with A & B Suspension group of Bogie General Arrangement drawing.
2.	WD-62-Misc-17 (Latest)	Variant-‘A’	WD-17025-S/1 Alt-1 or Latest	Generally applicable for wagons having empty body Weight up to 9.4t.
		Variant-‘B’	WD-12008-S/1 Alt-3 or Latest	Generally applicable for wagons having empty body Weight between 9.4t to 12.7t.
		Variant-‘C’	WD-12007-S/1 Alt-3 or Latest	Generally applicable for Wagons having empty body weight over 12.7t.

B. CASNUB 22 NLB (M)

S.No.	Specification No.	Variant/Type	Approved Drawing/s	To be fitted in
1.	WD-62-Misc-17 (Latest)	Variant-‘A’	WD-17025-S/1 Alt-1 or Latest	Generally applicable for wagons having empty body weight up to 9.4t.
		Variant-‘B’	WD-12008-S/1 Alt-3 or Latest	Generally applicable for wagons having empty body weight between 9.4t to 12.7t.
		Variant-‘C’	WD-12007-S/1 Alt-3 or Latest	Generally applicable for wagons having empty body weight over 12.7t.

Note:-

Any deviation if required shall be mentioned in Centre pivot side bearer arrangement drawing of that wagon.

ANNEXURE –IVFORGED COMPONENTS AND FASTENERS

S.N	Description	Drg. No. (latest)	Specification(latest)
1.	Centre Pivot Pin	WD-85079-S/2, item 5	IS: 2062
2.	Shackle lock	WD-85079-S/2, item 7	IS: 1875
3.	Lock pin	WD-85079-S/2, item 8	IS: 1875
4.	Rivets – 12, 20 and 24 dia.	---	IS: 1929 IS: 1148
5.	Bulb cotter	WD-94068-S/1	IS: 1079-73 St-42 Or IRS: M-41-74
6.	Split pins/R-clip	---	IS: 549/DIN 11024
7.	Hexagonal Fit bolt (M-24) with washer and castle nut.	---	IS: 2232 IS:3640 IS: 2016
8.	Side frame key	WD-92058-S/4, item –2	IS: 1875 Cl. IV
9.	End piece & strut	WD-89033-S/1	For Forge IS: 1875 CL.IIIA or Grade B+ (for Casting)
10.	Lock bolt (22.2 mm dia) 24 mm dia snap head rivets Collar	As per relevant CP-SB drawings of wagon.	Medium carbon steel to SAE 15836 IS:1929,IS:1148 Low carbon steel to BS 970 040A04 OR SAE 1008 OR DIN 1654 OR Qst 34.3

ANNEXURE –V

FABRICATED COMPONENTS

S.No	Description	Drg. with Alt. No.	Specification
1.	Equalizing lever with bushes	SK-69597 Item 1,5,6 & 7	IS: 2062 IS: 5517, 45C-8 Hardened & tempered
2.	Bogie End Pull Rod	SK-69597 item 2	IS: 2062
3.	Bogie Brake Push rod	SK – 69597 item 3	IS: 2062
4.	Pin 28 dia. with washer	SK-69597 item 8	IS: 2062, IS-5517
5.	Pin 40 dia. with washer & bulb cotter	SK-69597 item 14	IS: 2062, IS-5517
6.	Washer (OD 56, ID 31 dia. X 5 thk)	---	IS: 2062
7.	Washer (OD 80, ID 43 X 6 thk)	----	IS: 2062
8.	Brake beam	WD-89033-S/1	IS: 2062
9.	Brake Shoe Key	W/BG-6150	IS: 3885 OR IS: 3195
10.	Center pivot washer	WD-97049-S/3 Item 5 & WD-85079-S/2 Item 4	IS: 2062 & IS: 5192
11.	Spring Plank CASNUB-22NLB/NLB(M) Bogie	SK-69594 Item I	IS: 5986
12.	Side frame friction liner	SK-69594 Item 7	IS: 3885,Part-I,Gr. 4
13.	Bolster liner	WD-89067-S/4, Item 2	IS: 3885,Part-I,Gr. 4
14.	Centre pivot liner	WD-97049-S/3 Item 3 & 4	IRS : R 65 – 78

ANNEXURE –VILIST OF CONSTRUCTION DRAWINGS

(For BOXNHS with CASNUB 22 NLB Bogie/ CASNUB 22 NLB (M) Bogie)

S.No.	Description	Drawing No. (Alteration latest)
1	Index	WD-90096-S/1
2	General Arrangement (with spherical center pivot & constant contact side bearer)	WD-89073-S/2
4	Cast steel side frame	WD-89067-S/3
5	Cast steel bolster	WD-89067-S/4
6	Bogie details	SK-69594
7	Spring details	WD-83069-S/1
8	Bogie Brake gear arrangement.	WD-89067-S/5
9	Centre pivot assembly & details (spherical type)	WD-85079-S/2
10	Centre pivot assembly & details (flat type)	WD-97049-S/3
11	Centre pivot & Side Bearer Arrangement (with spherical pivot & constant contact side bearer)	As per relevant CP-SB Drawing of wagon.
12	Centre pivot & Side Bearer Arrangement (with flat pivot & constant contact side bearer)	As per relevant CP-SB Drawing of wagon.
13	Brake beam details	WD-89033-S/1
14	Bogie brake gear details	SK-69597
15	Leading dimensions and tolerances	WD-90042-S/1
16	Assembly procedure	WD-85054-S/7
17	Wedge / COF Wedge	SK-77579, WD-22055-S/5/ WX-10046
18	Narrow jaw adapter	WD-89067-S/9
19	Modified Elastomeric pad	WD-95005-S/1
20	Constant contact side bearer assembly & details	Annexure-IIIB of the specification
21	BG, MG & NG coil spring drawing codes	WD-89006-S/1
22	Marking scheme for cast steel side frame & bolster	WD-86038-S/1
23	Bulb cotter	WD-94068-S/1
24	Brake Gear General Arrangement for BMBS	WD-08093-S/2
25	Brake shoe key	W/BG-6150
26	Pin	W/PN-90

REFERENCE SPECIFICATIONS (LATEST) FOR BOGIE COMPONENTS

Description		Specification No.
S.No.	Rules for round off numerical values	IS:2 2022
1	Wedge/ Friction Wedge with specified range of coefficient of friction	IS:276 Gr. 1/ Specification No.CONTR-02-MISC-2007
2	SF friction liners, Bolster friction liners, Brake beam wear plate, Brake wear plate, Brake block key	IS: 3885 Pt. I Gr. 4
3	Centre Pivot Liner	IRS-R: 65 -78
4	Spring plank	IS: 5986-2017
5	Push rod, pull rod & lever	IS:2062
6	Rivets	IS:1929 : IS:1148
7	Key bolt with 4.0 dia. Split pin	IS:2585 & IS: 549
8	Primer paint	IS:2074
9	Jasmine Yellow paint	IS:05 ; IS:13607
10	Welding	IS:9595
11	Bulb cotter	IS:1079-73 St. 42/IRS-M 41-74
12	forged components	IS:1875
13	Riveting	IS:7215
14	Helical springs	IS:3195 / IS 4454 Part 2
15	Qualification for welders	IS: 7318 Pt. I
16	Deviation for un-tolerance dimensions and mass of steel casting	IS:4897
17	Allowable deviations for dimensions without specified tolerance	IS:2102
18	Weight, quantity and dimensioning tolerances on forgings	IS: 3469 Pt. I, II & III
19	Surface finish	IS:3073
20	Hexagonal fit bolts	IS:3640
21	Code of procedure for rectification of steel castings by metal arc welding process	IS:5530
22	Standard for radiographic analysis	ASTM-E-446-84 or E-71
23	Top & Bottom Centre pivots, side frame , bolster	AAR-M-201Gr.B+&C, M-202, M-203
24	Bushes & pins	IS:5517
25	Specification of BMBS Brake System	WD-23-BMBS-2008 Latest
26	Standard test methods and definition for mechanical testing of steel products	ASTM-A-370
27	Standards for Chaplets	IS-5904

ANNEXURE –VIIICHEMICAL COMPOSITION AND MECHANICAL PROPERTIES

The material for side frame and bolster shall conform to the chemical composition and physical properties as per AAR spec. M – 201 Gr. B+ and also detailed below:

1.0 Chemical Composition (%)

C	0.32 % (Max.)
Mn	0.90 % (Max.)
P	0.03 % (Max.)
S	0.03 % (Max.)
Si	1.50 % (Max.)

Note: Manufactures must specify range of each element and alloying elements (if any) in chemical composition in QAP.

For each reduction of 0.01% carbon below the max. specified, an increase of 0.04% manganese above the max. specified amount may be permitted to a max. of 1.2%.

The content of elements other than those designated above shall be selected by the manufacturer to obtain the physical properties specified. Each manufacturer shall establish requirements for tramp elements that can have an adverse effect on impact properties or welding. The requirements shall account for contribution of tramp elements to the carbon equivalency (CE) of the finished casting. For Grade B+, a CE of 0.72 max. is allowable based on the following formula given below and the max. Values of C, Mn, and Si.

$$CE = C + \frac{Mn + Si}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$

2.0 Mechanical Properties

Ultimate Tensile strength (UTS)	551 Mpa (Min.)
Yield Strength (YS)	344.4 Mpa (Min.)
Elongation in 50 mm (%)	24 (Min.)
Reduction of Area (%)	36 (Min.)
Impact Charpy V notch (ft - lb)	15 ft-lb (20.34 joules) at 20° F/ (- 7 ° C) Minimum

3.0 Hardness

Hardness	137 – 228 BHN
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ANNEXURE –IX(Sheet 1 of 17)LIST OF BOGIE COMPONENTS AND THEIR INSPECTION PROCEDURE

Various components which form the bogie assembly are grouped below. Details of inspection requirement are shown against each group.

1.	Centre pivot & its assembly	Annexure –IX (sheet 2 & 3 of 17)
2.	Friction wedges - Manganese steel castings, ADI Castings/Wedges with composite liner – with specified range of COF	Annexure –IX (sheet 4 of 17)
3.	Outer, Inner, Snubber Springs (CASNUB 22 NLB/CASNUB 22 NLB (M)	Annexure –IX (sheet 5 of 17)
4.	Liners	Annexure –IX (sheet 6 & 7 of 17)
6.	Brake block key	Annexure –IX (sheet 8 of 17)
7.	Rubber components	Annexure –IX (sheet 9 of 17)
8.	Spring Plank(CASNUB 22 NLB/CASNUB 22 NLB (M)	Annexure –IX (sheet 10 of 17)
9.	Other forged components- Side-frame key, bulb cotter, hexagonal fit bolt, shackle lock,	Annexure –IX (sheet 11 of 17)
10.	Brake beam	Annexure –IX (sheet 12, 13 & 14 of 17)
11.	Centre pivot retaining ring	Annexure –IX (sheet 15 of 17)
12.	Pull rod, equalizing lever, push rod, bushes, Centre pivot pin & lock pin	Annexure –IX (sheet 16 & 17 of 17)

ANNEXURE –IX
Sheet 2 of 17)

CENTRE PIVOT & ITS ASSEMBLY

1. Top & Bottom centre pivots are to be manufactured as per AAR spec. no. M-201 Gr. C. Center pivot castings shall be furnished normalized and tempered as per para 1.10 (b) of Annexure-I of this specification.
2. Integral test bars, test lugs shall be cast for these castings. Specified chemical tests and Mechanical properties shall be conducted for these castings as per AAR specification M-201 Gr. C, representing each cast and results recorded for clearing a cast.
3. Each center pivot casting shall be provided with at least one test lug of size 25 X 25 X 8 mm at suitable location to judge the quality of heat-treated casting.
4. Manufacturing process and quality assurance process shall be as per the details given in this specification.
5. Inspecting officer shall witness gauging of Centre pivot on sample basis for 1 in every 100. In case of any rejections, Para 9.6.3 shall apply.
6. Gauging of these castings is to be done for the dimensions given below on 100% castings by the manufacturer.

Top Pivot-Flat (Drg. No.WD-97049-S/3)		Top Pivot-Spherical (Drg. No.WD- 85079-S/2)	
S.No	Dimensions to be checked	S.No.	Dimensions to be checked
1.	270 + 0.5mm -0.0	1.	270 + 0.5 mm -0.0
2.	82 + 0.6mm (Height) -0.0	2.	20 + 0.5 mm -0.0
3.	20 R ± 1.5	3.	102 + 1 mm -0
4.	Top wall thickness 28 + 0.4mm -0.0	4.	20 ± 1.5
5.	328mm (outside dia.)	5.	Top wall thickness 26 mm
6	Dia. 60 mm	6.	315 mm (Outside dia)
		7.	R 330 ± 0.5 mm
		8	Dia. 60 mm

ANNEXURE –IX

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Bottom Pivot-Flat (Drg. No. 97049-S/3)		Bottom Pivot-Spherical (Drg. No. 85079-S/2)	
1.	30 + 0.4 mm -0 (wall thickness)	1.	Height 76 mm (22 + 54)
2.	350 mm (Inside dia)	2.	8 mm
3.	390 mm (Outside dia)	3.	325 mm Dia
4.	40 mm (height)	4.	Wall thickness 30mm & 19mm
5.	76 mm (center stem dia.)	5.	R 331 \pm 0.5 mm
6.	Dia. 60	6.	18 + 1 mm -0
		7.	Dia. 60

Top & Bottom Pivot Assembly-Spherical (Drg. No. WD-85079-S/2)	
S.No.	Dimension to be checked
1	120 + 2 (Assembled height of center pivots) - 0
2	Minimum area of contact 75%.

Top & Bottom Pivot Assembly-Flat (Drg. No. WD-97049-S/3)	
S.No.	Dimension to be checked
1	120 + 2 (Assembled height of centre pivots) - 0
2	Minimum area of contact 75%.

Note :

- Top pivot & bottom pivot manufactured by same manufacturer should be used on a particular wagon. Intermixing of pivots of different manufacturers is not permitted.
- The dimensions indicated are critical dimensions, which are to be gauged. The other dimensions are required to be maintained as per the drawings.
- The gauges have to be developed by the Manufacturer and approval obtained from the RDSO, wherever necessary.
- To achieve the hardness of CP Top as per the specification suitable Induction hardening facility shall be installed.
- Unspecified tolerances on casting dimensions shall be as per IS: 4897 class -1 and Unspecified tolerances on machined dimensions shall be as per IS: 2102 class – medium.

ANNEXURE –IX

(Sheet 4 of 17)

FRICTION WEDGE

Manganese Steel /ADI Castings Wedges/ with composite liner friction wedges**Drag. No. SK-77579/WX-10046/WD-22055-S/5 (CASNUB 22 NLB / CASNUB 22 NLB (M))**

1. Wedges are to be manufactured as per IS: 276. Gr.1 /Specification No. CONTR-02-MISC-2007 (Rev. Latest)
2. Wedges manufactured as per IS: 276 Gr.1 shall suitably be heat treated to render them tough. This treatment shall consist of uniform heating of the wedges to a suitable temperature holding it at that temperature till uniformly heated throughout and quenching in water within 60 seconds from a minimum temperature of 1050°C. **The complete heat treatment process shall be specified in QAP.**
3. Integral test bars, lugs shall be cast for these castings as specified. Chemical analysis shall be done for each cast before clearing the same. Hardness and bend test should be tested & recorded, as per material supply for each cast.
4. Gauging of these castings is to be done for the dimensions given below. Gauging of all the wedges manufactured shall be done by the manufacturer.
5. It has to be ensured that the name of manufacturer, month, year of manufacturing, drawing no. and heat number to be cast in depressed letters on each wedge/Friction wedge on non-wearing surface.
6. Inspecting officer shall witness gauging on wedge on sample basis 1 wedge /Friction wedge from a lot of 50 wedges. In case any rejection, Para 9.6.3 shall apply.

S.No.	Dimensions to be checked
1	69 \pm 0.5, 150.6 \pm 1
2	Perpendicularity between spring seat & vertical surface, butting against column liner, 940 R & angle 55 degrees.
3	Wedge wing profile

Note :

1. The dimensions indicated are critical dimensions which are to be gauged. The other dimensions are required to be maintained as per the drawings.
2. The gauges have to be developed by the manufacturer and approval obtained from the RDSO.

ANNEXURE –IX
(Sheet 5 of 17)

OUTER, INNER & SNUBBER SPRINGS
(Drg. No. WD-83069-S/1)

1. The springs shall be manufactured as per RDSO spec. No. WD-01-HLS-94 (Latest).
2. Contractor shall purchase springs from RDSO approved sources only. All tests as specified in specification no. WD-01-HLS-94 (Latest) and relevant drawing are to be conducted at manufacturer's premises.
3. Care shall be taken to ensure that springs of a particular group are only used under a bogie.

ANNEXURE –IX

(Sheet 6 of 17)

LINERS

1. Bolster liners, side frame liners, brake wear plate & brake beam liners are to be manufactured as per IS 3885, Pt.-1 Gr.-4, of hardness value 380-420 BHN. Centre pivot liners are to be manufactured as per IRS-R: 65 -78 (Drg. No. WD- 97049-S/3)
2. Contractor shall purchase these liners from RDSO approved sources only with proper certification. Contractor to check parameters listed in para 4 on 1 in 100 Nos. For all types of liners.
3. Manufacturers initial, month and year of manufacturing shall be marked by metal laser engraving/dot peen in 6 mm size and 0.1 mm depth minimum. Liners shall be fitted in such a way that marking lies on opposite to wearing surface.
4. Following tests are to be done on the liners –
 - a) Liners shall be visually inspected and must be free from scale, cracks, fins, or other injurious defects
 - b) These shall be correctly heat treated as per established heat treatment procedure to obtain a hardness indicated above & recorded.
 - c) The liners must be flat within 0.5mm. This should be checked using a straight edge and feeler gauge.
 - d) Chemical and hardness tests shall be done.
 - e) Dimensional checks if liners is to be done as given below.
5. Inspecting officer shall check and record these parameters on a sample basis on 1 in 100. In case of any rejection, para 9.6.3 shall apply.
6. **Side frame and bolster Liners**
(Drg. No. WD-89067-S/4 & SK- 69594)

S.No.	Dimensions to be checked
1	Dimensions (i.e. length tolerance ± 1.5 mm), (width tolerance ± 1.5 mm) and thickness tolerance as per IS: 1852 clause 8.

7. **Brake Beam Pocket Liner (Brake wear plate)**

(Drg. No. SK 69597)

S.No.	Dimensions to be checked
1.	39 ± 0.8 mm
2.	245 ± 1 mm
3.	$69 + 0$ mm/ -2 mm
4.	Thickness – tolerances as per IS: 1852 clause 8

ANNEXURE –IX

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8. Brake Beam End Piece Casting Wear Plate (Drg. No.WD-89033-S/1) - Dimensions (i.e. length tolerance + 1.5 mm), (width tolerance + 1.5 mm) and thickness tolerance as per IS: 1852 clause 8.
9. Centre Pivot Liner (Flat Type)
 - a) Horizontal wear liner (WD-97049-S/3)

S.NO.	DIMENSIONS TO BE CHECKED
1.	322 mm (Outside Dia)
2.	98 mm (Inside Dia)
3.	8 mm (Thickness)

- b) Vertical wear liner (WD-97049-S/3)

S.NO.	DIMENSIONS TO BE CHECKED
1.	350 mm (Outside Dia)
2.	8 mm (Thickness)

Note:

1. The dimensions indicated are critical dimensions, which are to be gauged. The other dimensions are required to be maintained as per the drawings.
2. The gauges have to be developed by the contractor and approval obtained from the RDSO Engineer.

ANNEXURE –IX
(Sheet 8 of 17)**BRAKE BLOCK KEY**
(Drg. No. W/BG-6150)

1. Key is to be manufactured a per IS: 3885 Pt.1 Gr. 4 or IS: 3195, Gr. 55 Si 7.
2. Contractor shall purchase these keys from RDSO approved sources only with proper certification. Manufacturer of item to check parameters listed in Para 3.
3. Following tests are to be done –
 - a) Key shall be visually inspected and must be free from scale, cracks, bins or other injurious defects.
 - b) These shall be correctly heat-treated as per established heat –treatment procedure to obtain a hardness of 310 to 370 BHN. Hardness shall be tested and recorded.
 - c) Dimensional check and profile of the key is to be checked.
4. Contractor to check and record these parameters on a sample basis on 1 in 100, which shall be witnessed by Inspecting Officer. In case of any rejection, Para 9.6.3 shall apply.

S.NO.	DIMENSIONS TO BE CHECKED
1.	Profile is to be gauged
2.	Thickness to be checked.

Note :

1. The dimensions indicated are critical dimensions which are to be gauged. The other dimensions are required to be maintained as per the drawings.
2. The gauges have to be developed by the contractor and approval obtained from the RDSO.

ANNEXURE –IX
(Sheet 9 of 17)

RUBBER COMPONENTS

1. Elastomeric pad shall be manufactured as per specification No. WD-20-Misc.-95, Rev.-Latest.
2. Constant contact side bearer shall be as per Annexure-IIIB.
3. Contractor shall source these items from RDSO approved vendors only.
4. These shall be visually inspected for cuts, cracks, or bond failure by Contractor. Cases of rejection shall be reported to RDSO.

ANNEXURE –IX
(Sheet 10 of 17)

SPRING PLANK

(Drg. No. SK-69594)

1. This shall be manufactured as per IS: 5986 for material.
2. Contractor shall purchase these spring planks from RDSO approved sources only with proper certification.
 - a) Spring plank manufacturer to conduct bend test on raw material as per Para 9 of IS: 5986.
3. Contractor to check and record these parameters on a sample basis on 1 in 50 which shall be witnessed by Inspecting Officer. In case of any rejection, Para 9.6.3 shall apply.

S.No.	Dimensions to be checked
1.	Outer profile to be gauged.
2.	Thickness of 12 mm tolerances as per clause 8 of IS:1852.
3.	Height 75 + 0/ -3 of spring plank
4.	2260 \pm 1.5
5.	Arrangement, size & locations of holes for rivets and fit bolts including orientation.
6.	Size of fit bolt holes (25 dia + 0.020/+ 0.007)
7.	Profile of top edge of flange (6R & finish of N10)
8.	Arrangement, size & location of spring spigot.
9.	Flatness to be checked with straight edge as per note of Drg. No. SK-69594.

Note:

1. The dimensions indicated are critical dimensions which are to be gauged. The other dimensions are required to be maintained as per the drawings.
2. The gauges have to be developed by the contractor and approval obtained from the RDSO.

ANNEXURE –IX
(Sheet 11 of 17)

**OTHER FORGED COMPONENTS –SIDEFRAME KEY, BULB COTTER,
HEXAGONAL FIT BOLT, SHACKLE LOCK**

1. These are important components. 1 in 50 sample check of each lot shall be inspected and recorded at bogie contractor's premises for dimensional check and visual defects. In case of any rejection on inspected parts para 9.6.3 shall apply

2. Side frame Key (WD-SK-69594 Item No.5)

S.No.	Dimensions to be checked
1.	54 + 1.5 - 0.0
2.	Size of hole 21 + 1/-0.0

3. Hexagonal Fit Bolt

S.No.	Dimensions to be checked
1.	Dia. of M-24 fit bolt & length (as per IS:3640)

4. Bulb Cotter (Drg. No. WD-94068-S/1)

S.No.	Dimensions to be checked
1.	Width (tolerance + 0.0/-0.5 mm, thickness (tolerance + 0/-0.2 mm)

5. Shackle Lock (Drg. No. WD-85079-S/2) latest version

S.No.	Dimensions to be checked
1.	34.5 + 0.5/ -0.0
2.	17 + 0.5/ -0.0 dia. hole
3.	35 + 0.0/-0.5

Note :

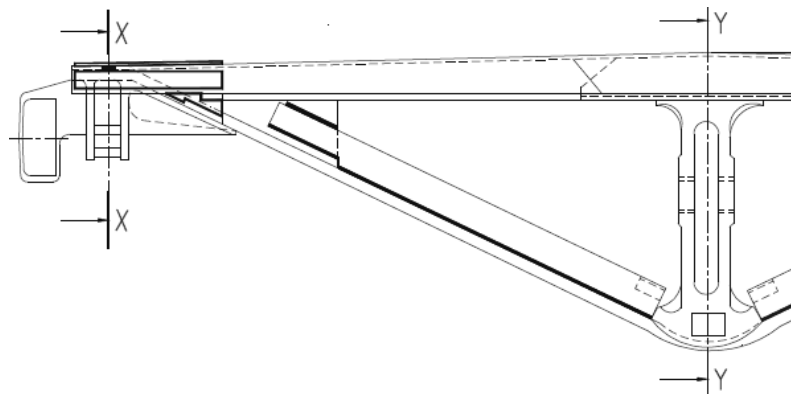
- The dimensions indicated are critical dimensions which are to be gauged. The other dimensions are required to be maintained as per the drawings.
- The gauges have to be developed by the contractor and approval obtained from the RDSO.
- Unspecified tolerances on dimensions shall be as per IS:2102 class – medium.

ANNEXURE –IX
(Sheet 12 of 17)

BRAKE BEAM

(Drg. No. WD-89033-S/1 & WD – 07052 – S/1)

1. Brake beam to be manufactured as per Drg. No. WD-89033-S/1 (For L –Type brake block) OR WD – 07052 – S/1 (For K –Type brake block).
2. Contractor shall purchase these brake beams from RDSO approved sources only with proper certification.
3. Following items to be checked on brake beam:-
 - a) Dimensional check
 - b) Visual check of welding and dye penetrate test.
 - c) Load test as per para –5.
 - d) Sectioning of brake beam as per para –6.
4. Contractor to check and record these parameters on a sample basis on 1 in 50 which shall be witnessed by Inspecting Officer. In case of any rejection, Para 9.6.3 shall apply.
5. Load Test of Brake Beam:
The brake beams shall be tested for 12 t load applied at pin centre and 3 mm deflection is permitted under load, 0.2 mm permanent set is permitted when the load is released. The brake beam shall be load tested 1 in 20.
6. Sectioning check of Brake Beam Welding :
Break beam selected at random shall be sectioned at plane XX and YY respectively to check whether welding has been done as per drawings. This test shall be as instructed in drawing.



ANNEXURE –IX
(Sheet 13 of 17)

S.No.	Brake beam assembly dimensions to be checked
1.	35 (Centre line of face of brake head at centre to centre line of hole in strut).
2.	187
3.	1762 + 2/ - 0
4.	52 + 0.083 / + 0.053 (OD of bush)
5.	41 + 0.2/- 0.1 (ID of bush)
6.	36 + 0.0 / - 1.0
7.	Camber of 20mm
8.	Dim. 35 (width of slit for lever)
End Piece and Strut Part	
9.	550 \pm 7 R
10.	260 \pm 4.5
11.	60 \pm 2.5
12.	30 \pm 3
13.	26 + 0.0/ - 1.0 (thickness of ends) – to be achieved by machining
14.	12 \pm 2
15.	40 \pm 3.5
16.	300 \pm 4.5
17.	Angle 64°

ANNEXURE –IX

(Sheet 14 of 17)

MANUFACTURING OF END PIECE AND STRUT FOR BRAKE BEAM

1. End piece and strut are to be manufactured as per material AAR M – 201 Gr. B+ for castings or IS: 1875 Class 3A or higher grade for forging. It has to be ensured that proper heat treatment is done.
2. Integral test bars and test lugs shall be cast for castings, for forging to be taken from finished product. Chemical tests & mechanical properties test shall be conducted on the test bars representing each cast and results recorded for clearing a cast.
3. Manufacturing process and quality assurance process shall be as per the details given in this specification.
4. Inspecting officer shall witness gauging on sample basis for 1 in every 50. In case of any rejections, Para 9.6.3 of this specification shall apply.
5. The tolerances, if not indicated, are as per IS: 4897 for castings and IS: 3469 for forgings.

Note :

- (i) Centre lines of end piece castings, brake beam strut, brake beam channel and truss flat must be co-planer.
- (ii) The dimensions indicated are critical dimensions which are to be gauged. The other dimensions are required to be maintained as per the drawings.
- (iii) The gauges have to be developed by the contractor and approval obtained from the RDSO.
- (iv) Unspecified tolerances on casting dimensions shall be as per IS: 4897 class -1 and Unspecified tolerances on machined dimensions shall be as per IS: 2102 class – medium.

ANNEXURE –IX
(Sheet 15 of 17)CENTRE PIVOT RETAINING RING
(DRG. NO. WD-80007-S/15)

1. This shall be manufactured as per Drg. No. WD-80007-S/15.
2. This item to be sourced from any reputed manufacturers duly inspected by suppliers and internally inspected by the bogie manufacturers.
3. Bogie manufacturer should check & recorded for following parameters during receipt inspection of items on a sample basis for min 10 per 100 and the record shall be produced & get it verified from the RDSO Inspecting officials. In case of any rejection, para 9.6.3 shall apply:-

S. No.	Dimensions to be checked
1.	270 + 0/- 0.1 dia.
2.	20 + 0/- 0.5

Note:

1. The dimensions indicated are critical dimensions which are to be gauged. The other dimensions are required to be maintained as per the drawings.
2. The gauges have to be developed by the contractor and approval obtained from the RDSO.

ANNEXURE –IX
(Sheet 16 of 17)

**END PULL ROD, EQUALIZING LEVER, PUSH ROD, PINS AND
BUSHES, CENTRE PIVOT PIN & LOCK PIN**

1. This item to be sourced from any reputed manufacturers duly inspected by suppliers and internally inspected by the bogie manufacturers.
2. Bogie manufacturer should check & record for following parameters during receipt inspection of items on a sample basis for min 1 per 100 and the record shall be produced & get it verified from the RDSO Inspecting officials. In case of any rejection, para 9.6.3 shall apply.
3. Following parameters are to be checked by the manufacturer –
 - 3.1 Pull rod and push rod
 - a) Dimensional check
 - b) These shall be tested for a load of 18 t applied axially, without any permanent set.
 - 3.2 Equalizing lever
 - a) Dimensional check
 - 3.3 Pins and Bushes
 - a) Dimensional check
 - b) Surface finish
 - c) Clearance not to exceed 0.75mm
 - d) Hardness

4. **End Pull Rod (Drg. No. SK- 69597)**

S.No.	Dimensions to be checked
1.	800 mm
2.	35 mm (opening in forks)
3.	Hole spacing of 57 mm
4.	29 mm dia. holes
5.	Weld to be examined visually. These are critical & should be as per drawing.

5. **Push rod (Drg. No. SK-69597)**

S.No.	Dimensions to be checked
1.	1070 mm
2.	35 mm (opening in forks)
3.	44 mm (spacing of holes)
4.	29 mm dia. hole size
5.	Weld to be examined visually. These are critical & should be as per drawing

ANNEXURE –IX
(Sheet 17 of 17)

6. Equalizing Lever (Drg. No. SK-69597)

S.No.	Dimensions to be checked
3.	356 mm
4.	178 mm
5.	Hole dia for bushes (Dia 52 + 0.046 / -0.00 & 41 + 0.039/ -0.00)

7. Bushes (Drg. No. SK-69597)

S.No.	Dimensions to be checked
1.	Outside Dia, inside Dia – Surface finish to be checked visually along with dimensional check. The hardness shall be also check as per drawing.

8. Centre Pivot Pin (Drg. No. WD-85079-S/2 and WD – 97049 S/3)

S.No.	Dimensions to be checked
1.	36 + 0.5/ +0.2
2.	36 + 0.0/ -0.5
3.	149 mm (Length of Pin)
4.	Ø 55 (Dia of Pin)

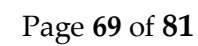
9. Load testing of Pull rod/Push rod

These components shall be tested for a load of 18 t applied in axial direction. The components shall withstand this load without any fracture. 2 % of pull rods as well as push rods shall be load tested as above

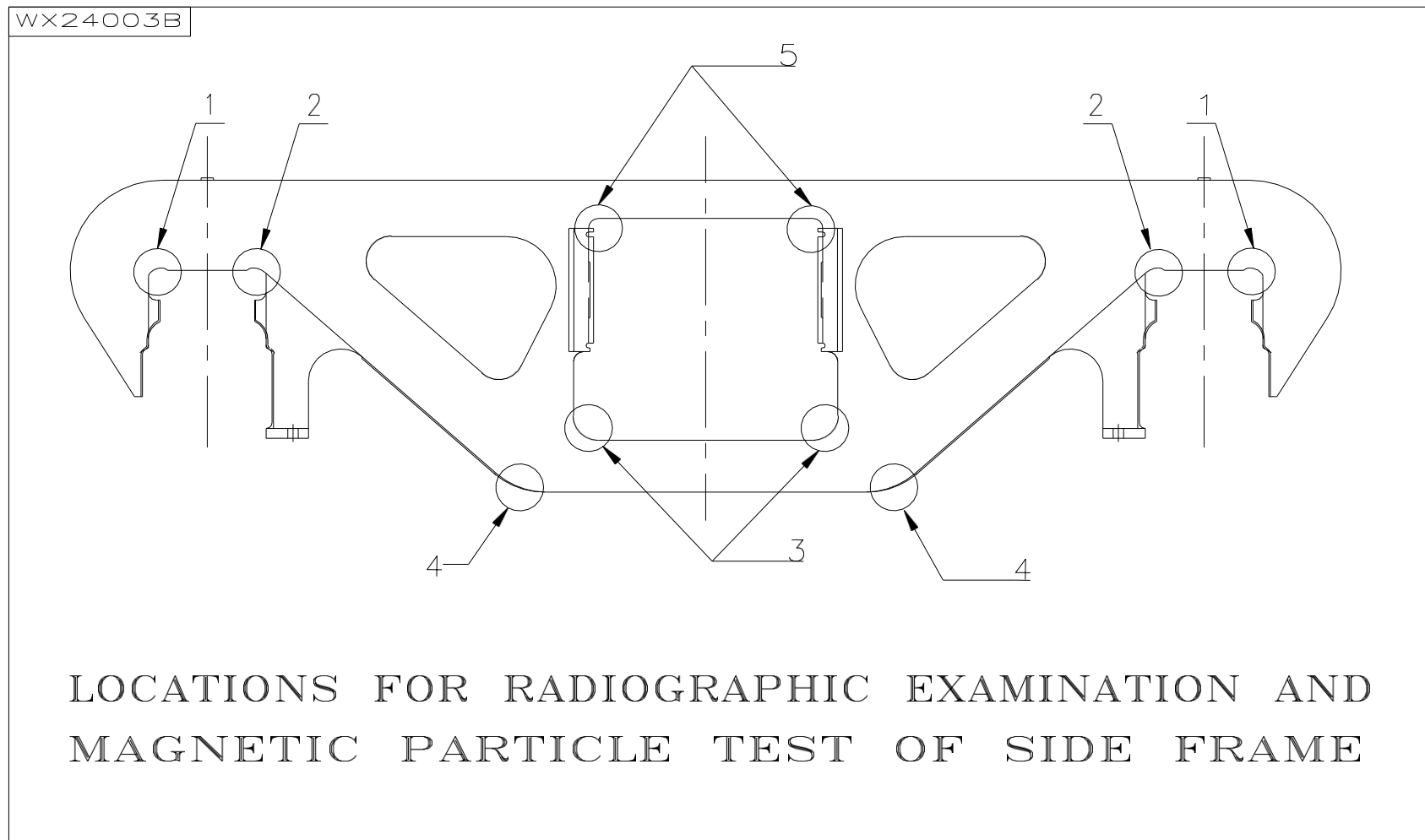
Note:

- The dimensions indicated are critical dimensions which are to be gauged. The other dimensions are required to be maintained as per the drawings.
- The gauges have to be developed by the contractor and approval obtained from the Engineer.
- Unspecified tolerances on dimensions shall be as per IS:2102 class –coarse.

LOCATION FOR RADIOGRAPHIC, MPI, SECTIONING, HRRDNESS AND WELDING PROCEDURE

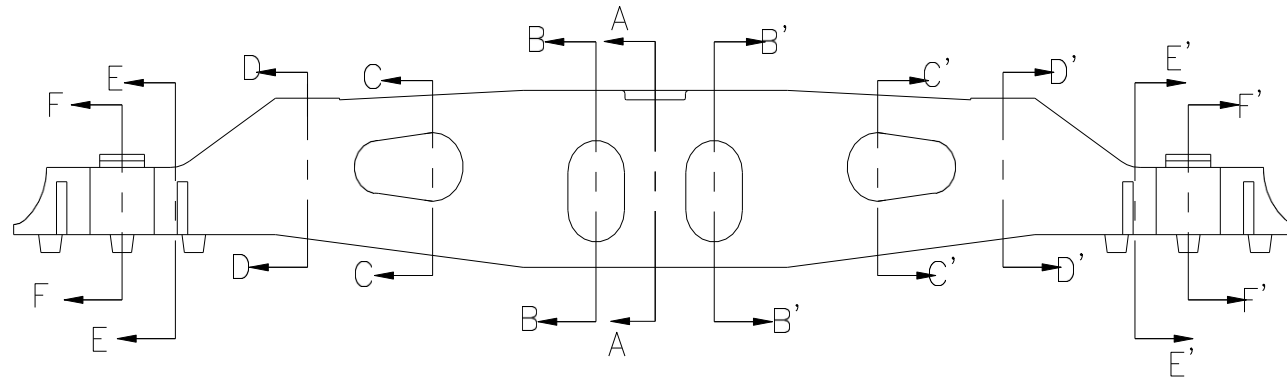


ANNEXURE -X
(Sheet 2 of 6)

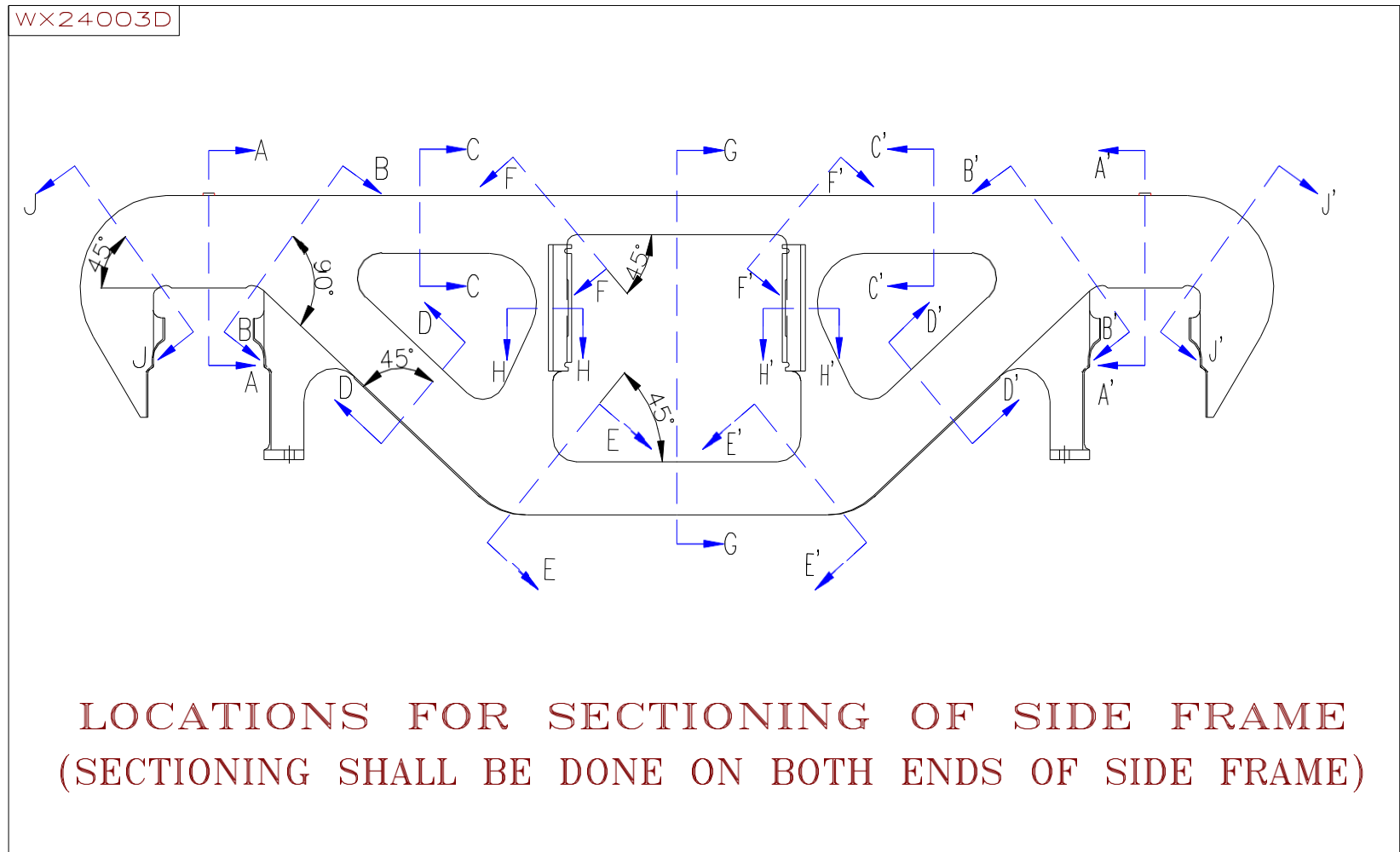


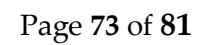
ANNEXURE -X
(Sheet 3 of 6)

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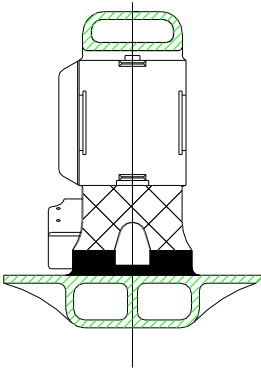
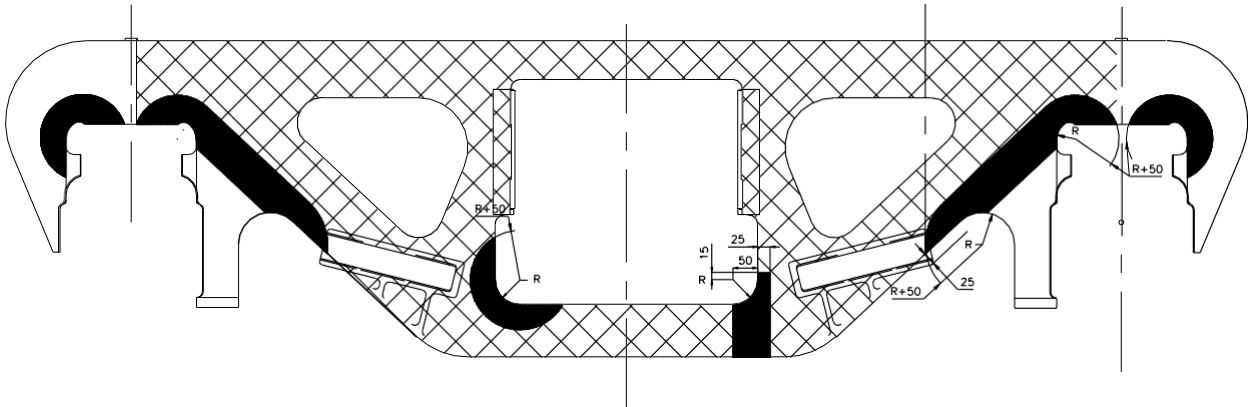
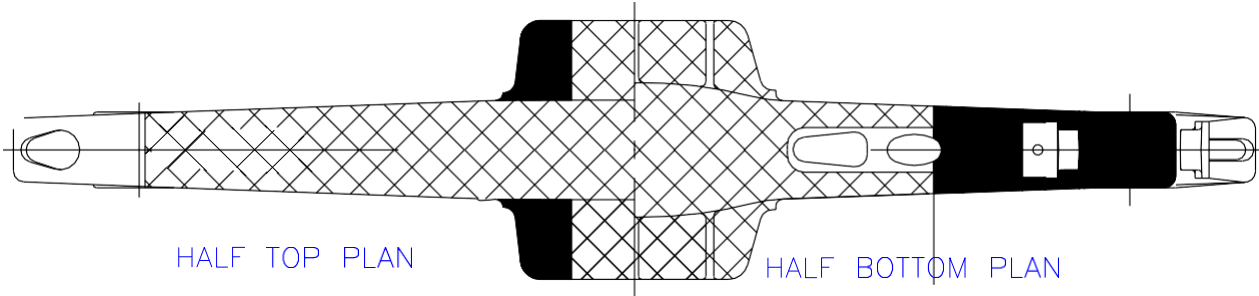
LOCATIONS FOR SECTIONING OF BOLSTER
(SECTIONING SHALL BE DONE ON BOTH ENDS OF BOLSTER)





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ANNEXURE -X
(Sheet 6 of 6)



WELDING REPAIR PROCEDURE FOR SIDE FRAME

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ANNEXURE -XIDIFFERENCE BETWEEN CASNUB 22HS BOGIE AND CASNUB 22HS (M) BOGIE

Sr. No.	Description		CASNUB 22NLB Bogie			CASNUB 22NLB (M) Bogie		
1	Secondary suspension details	Spring Details Drg.	WD-83069-S/1			WD-83069-S/1		
		No. of spring per bogie	Outer	Inner	Snubber	Outer	Inner	Snubber
			14/12	10/8	4	12	8	4
		Stiffness per bogie	900.7 kg/mm or 767.7 kg/mm			767.7 kg/mm		
2	Side Bearer		Spec No. WD-38-MISC-2004 (Design B)			Spec. No. WD-62-MISC-17		
3	Friction Wedge		SK-77579 (WD-21-CASNUB-22NLB-BOGIE)			WD-22055 S/5 (CONTR-02-Misc-2007)		
4	Marking		CASNUB-22NLB Ready mixed paint to IS: 13607 color Jasmine yellow to code no. 397 of IS: 05 2007.			CASNUB-22NLB(M) Ready mixed paint to IS: 13607 color Jasmine yellow to code no. 397 of IS: 05 2007 Note: Bogie shall further be marked with Zebra marking on the side frame as indicated in the Wagon Marking Diagram		

ANNEXURE-XIICHECKLIST FOR FOUNDRY AUDIT/OUT OF TURN AUDIT OF PROSPECTIVE
BOGIE MANUFACTURER

During Quality Audit/any audit of the facility, apart from the requirements of ISO Document No QO-F-8.1-9 Quality Audit Report, foundry shall also be audited on the following requirements;

S.No.	The parameter to be checked at the time of the Foundry audit /out of turn audit	Status of firm
1.0	Critical Processes and their outputs shall be reviewed by the auditor.	
1.1	A. Pattern and Core Box i) Pattern and core box design, dimensions, and rigging arrangements ii) Pattern and core box maintenance practices	
1.2	B. Core Making Practices i) Core making and finishing system ii) Sand testing procedure	
1.3	C. Molding Practices i) Sand testing procedure ii) Mold making and core setting process to avoid shifts and offsets during mold movement and pouring	
1.4	D. Melting Practices i) Raw material composition & quality parameters ii) Chemistry control including tramp elements iii) Heat and pouring temperature control	
1.5	E. Pouring Practices i) Casting pouring time control ii) Pouring temperature control iii) Control of manganese reversion testing on the last casting poured iv) Control of chemistry v) Chemical and physical tests on representative castings vi) Positive method for determining last casting	

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1.6	<p>F. Cleaning/Shot blasting Process</p> <ul style="list-style-type: none"> i) Cleaning equipment must provide clean castings for proper inspection. ii) Observe welding operations to ensure quality workmanship and conformance to written procedures defined in this specification. Welding equipment must be well maintained and show proof of periodic checking (at least annually) for correct amperage and voltage readings. Welding rods and wire must be properly identified and stored according to AWS standards. Welding materials should be sourced from an approved or authorized source. iii) Workmanship of grinding operations should be evaluated. iv) Facilities for performing welding according to temperature requirements of this specifications should be available. It is mandatory that all weld repairs be made in the green condition prior to heat treating. Normally, there should not be any requirements of weld repair or it should be minimal. v) Inspection should be made of facilities and procedures for installing wear plates and other fixtures to castings. 	
1.7	<p>G. Heat-Treating Practices</p> <ul style="list-style-type: none"> i) Proper temperature control of furnace with adequate recording capabilities must be evident. ii) Procedures should be in place to periodically verify (as defined in this Specification) uniform temperature throughout furnaces. iii) Proper records must be kept to positively identify castings that have received heat treatment. 	
1.8	<p>H. Casting Quality</p> <ul style="list-style-type: none"> i) A random sample of castings should be selected from the inspection area and dimensionally and visually inspected. The object of this should be to evaluate the overall quality of the finished casting. Pattern quality, core setting, and dimensional control should be evaluated. ii) Availability and accuracy of gauges should be determined and the calibration system for gauges should be evaluated. 	

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	<p>iii) All physical test apparatus should be inspected for general operating condition and calibrations. All equipment requiring calibration should have current certification.</p> <p>iv) Records of internal solidity must be verified in this specification.</p> <p>v) All tests as per the requirements of prototype testing may also be conducted if required.</p>	
2.0	Specifications, STR & Drawings	
2.1	Are there adequate procedures to ensure that obsolete drawings and documents are destroyed or isolated from use?	
2.2	Are there adequate procedures for distributing new and revised drawings to the shop in force?	
2.3	System for raw materials inspected upon receipt and marked for permanent identification?	
2.4	System for all other purchased materials checked for conformance with the purchasing document upon receipt?	
2.5	Is the system for raw material test reports kept on file?	
3.0	Quality Control	
3.1	Does the quality control organization include a quality control supervisor who can demonstrate an adequate knowledge of the foundry/ casting process?	
3.2	Does Quality Control have the authority to stop and responsibility to inform operating supervision of nonconforming work?	
3.3	Are there adequate procedures for correcting nonconforming material or work in process rejected by Quality Control forces?	
3.4	Are there adequate procedures for the inspection of purchased materials and manufactured items?	
4.0	Maintenance of Equipment	
4.1	Is there an adequate plan for the systematic maintenance of equipment?	
4.2	Are the equipment and tools periodically inspected and restored to intended tolerance?	
5.0	Engineering and Drafting	
5.1	Do personnel have adequate knowledge of the applicable codes and specifications?	
5.2	Is there a current reference library of specifications, including the latest revisions of all relevant RDSO/IS/AAR/UIC codes/manuals	
5.3	Does the bogie manufacturer have access to engineering testing support facilities? A list of major testing equipment should be	

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	provided.	
6.0	Production, Inspection, and Test Planning	
6.1	Check as per QAP and this specification, each inspection and test point and its relative location in the processing cycle, including incoming inspection, preservation of items, packaging, and site inspection and testing.	
6.2	Check inspection and test points where measurement and test records are maintained.	
6.3	Check mandatory hold points that require witnessing or verification of selected characteristics of an item or process and that beyond which the work shall not proceed.	
7.0	Measuring and Testing Equipment	
7.1	Check whether the firm maintains documented procedures to control, calibrate, and maintain all measuring and test equipment and devices used to verify item quality and to monitor special processes.	
7.2	Check whether the firm has a mechanism to Identify measuring and testing equipment with a tag, sticker, or other suitable indicator to show the calibration status.	
7.3	Check whether the firm Maintains calibration records for measuring and test equipment.	
8.0	Incoming Inspection	
8.1	Check whether the firm Inspect, test, and identify incoming items as required in this specification and test plans mentioned in QAP.	
8.2	Check whether the firm Holds incoming items until the required inspection and tests are completed or the necessary inspection and test reports are received and verified.	
9.0	In-Process Inspection	
9.1	Check whether the firm Holds items until the required inspections and tests are complete or necessary reports are received and verified.	
9.2	Check whether the firm Maintains documented procedures for the verification, storage, and preservation of the supply of each component.	
10.0	Final Inspection	
10.1	Check whether the firm Inspect, test, and identified the final items as required as per this specification and QAP.	
10.2	Review all inspection and test records and verify that the item has been inspected at all points shown in the inspection and test plan and that these records are complete	
10.3	Check whether the firm Retain all inspection records for Minimum three years.	

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11.0	Process Control	
11.1	Check whether the firm is Complying with applicable codes, standards, specifications, documented procedures, and/ or inspection and QAP.	
11.2	Ensuring that special processes (including but not limited to methoding, melting, mould preparation, shot blasting, heat treatment, gauging, plating, welding and non-destructive testing) are performed under controlled conditions in accordance with this specification, standards, and contractual requirements by qualified personnel using qualified equipment and procedures.	
11.3	Check whether the qualification of personnel, procedures, and equipment complies with the requirements of applicable codes, standards, and specifications.	
11.4	Check that documentation for currently qualified personnel, processes, or equipment is maintained in accordance with the requirements of pertinent codes, standards, and specifications.	
12.0	Preservation, Packaging, and Shipping	
12.1	Check whether the firm Controls packing, packaging, and marking processes (including materials used) to the extent necessary to ensure conformance to specified requirements.	
12.2	Check the mechanism for the protection of the quality of the product after the final inspection and test. Where contractually specified, this protection shall be extended to include delivery to destination.	
12.3	Check whether the firm has control of nonconforming conditions and continuously improve the effectiveness of the quality program through the use of corrective action, preventive action, and internal audit results.	
12.4	Check the mechanism for segregating nonconforming items to prevent unauthorized use, shipment, or mixing with conforming items.	
12.5	Check the mechanism of Handling of customer complaints and reports of product/service nonconformance.	
12.6	Investigation of the root cause of the nonconformity relating to product, process, and quality program and recording of the results of the investigation. Determination of the corrective action needed to permanently eliminate the root cause of the nonconformity.	
13.0	Training	
13.1	Check the procedures for identifying training needs, providing the training, and evaluating the effectiveness of that training for all personnel involved in activities affecting quality.	
13.2	Check the Job descriptions is created and maintained. Basic job responsibilities and qualification requirements must be defined.	

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13.3	Check whether the Personnel involved in special or key processes (welding, heat treating, painting, pressure treating, product inspection, internal quality auditing, etc.) are being imparted both function-specific training and applicable work experience to be considered qualified.	
13.4	Check whether the Training records are maintained for qualified personnel as long as they remain qualified or as required by other regulatory requirements.	
13.5	Check the measures to ensure that personnel are aware and knowledgeable of their specific responsibilities for quality.	
14.0	Management and Line Supervision Status of the firm	
14.1	Does Bogie Manufacturer's quality assurance policy/ quality assurance plan indicate recognition of separation of responsibility for production and quality control supervision functions?	
14.2	Does the organizational chart clearly show the lines of plant management authority and responsibility, which are down to principal plant departmental supervisors?	
14.3	Are assigned personnel for key positions in manufacturing qualified by training and experience?	
14.4	Are assigned personnel for key positions in manufacturing qualified by training and experience?	
