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# INDIAN RAILWAYS

# SPECIFICATION

# FOR

# CASNUB 22 HS CAST STEEL BOGIES WITH FRICTION DAMPING ARRANGEMENT FOR BROAD GAUGE

## WD-17-CASNUB-22HS-BOGIE-92

## (Revision –4)

**Issued by:**

**Research Designs and Standards Organization**
**Ministry of Railways**
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**1.0 General:**

**1.1** This Schedule covers the technical requirements for the manufacture and supply of light weight CASNUB 22 HS Cast Steel Bogies fitted with a spring plank, long travel helical springs and load proportionate friction damping arrangement for Broad Gauge (1676 mm) Wagons. It has been kept optional to assemble `Flat Centre Pivot` to RDSO Drg. No. WD-97049-S/3 in place of conventional hemispherical centre pivot to RDSO Drg. No. WD-85079-S/2.

**1.2** 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) (Rev. Latest). The constant contact side bearer (CCSB) assembly shall be as per CPSB arrangement drawing of wagon where the CASNUB HS Bogie is to be fitted and shall be manufactured as per the relevant RDSO specification of the CCSB.

**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, 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 Constant Contact Side Bearer (CPSB) drawing of the Wagon. Additionally, the CPSB must be manufactured in accordance with the drawing and specifications provided in Annexure-IIIB.

**2.3** Since, this bogie is 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 the referred to and the following dimensions are to be strictly maintained under tare condition.

1. Bogie bolster top to top center pivot top = 120 + 2 /-0
   Centre pivot top to side bearer seat on bogie bolster – as per relevant centre pivot and side bearer arrangement drawing of the wagon.

2. The difference between top of top centre pivot to bottom of body side bearer (this dimension may change after shim adjustment as per relevant drawings).

The bogie general arrangement may also be different for different type of wagons as the heights are to be adjusted by means of packings. However this specification contains list of the construction drawings and load testing methods with BOXNHS wagons (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 :

| **S. No.** | **Component** | STR No. (Latest) |
|---|---|---|
| 1 | Cast steel components of CASNUB bogies | QMS –09:2015 |
| 2 | Metal Bonded Rubber components-Elastomeric pad | QMS–05:2009 |
| 3 | Spring steel rounds to RDSO Spec. No. WD-01-HLS-94 | QMS–16:2014 |
| 4 | Hot coiled helical spring for freight, coaching & Locomotives | QMS–17:2009 |
| 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–26:2009 |
| 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 and 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, top & bottom side bearer housings, 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 L & K type (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 – WD-92058-S/3 (latest) & WD – WD-92058-S/4 (latest) respectively. 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) It will be preferable to weld the liners 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.

**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 /Lock bolting**

After selecting the side frames, these should be taken up for riveting/lock bolting with spring plank. Before riveting/lock bolting 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) Sideframe 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 sketch WD-92058-S/4 (spring plank) should be reamed along with the sideframe and secured by M-24 fit bolts as per IS:3640.
iv) 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/lock bolting should be done as per IS:7215 Group –B.
v) The riveted/lock bolted 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.
vi) Regular calibration of jigs and fixtures, either conducted in-house or by an external agency, is necessary to maintain the accuracy of the product at specified intervals ( Prescribed by OEM or one year whichever is less)

**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-92058-S/7and 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-92058-S/7 (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

| Test load on bogie pivot in tonne | Tare | Gross | 50% overload |
|---|---|---|---|
| | 6.0 T | 35.30 T | 53.0 T |
| Height of centre pivot in mm | 932 + 3 - 8 | 895 + 3 - 8 | 875 +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 be 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 S.No.-8).

**5.10 Painting:**

Inspected bogies shall be thoroughly cleaned to remove rust, scale dirt etc., 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 red oxide to IS:123. Mating faces of pivots and friction plates will not be painted.

(b) The paint shall be applied by spray painting. The priming coat shall be applied within four hours after cleaning etc. 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 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.

(d) Quality of painting shall be checked at random once in a month as and when inspecting official is available in shop floor.

**6.0 Drawings:**

The bogies shall be manufactured according to latest RDSO's Drawings No. WD-04038-S/2 or WD-04078-S/1 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 and Tolerances:**

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 tolerance has not been 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** The contractor shall at his own cost supply all labour, appliances, details and gauges necessary for the testing and inspection of the bogies. The contractor 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 handed over to inspecting official for his exclusive use. This shall remain under the custody of inspecting officer.

**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 bogie shall be offered for inspection before 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, 10.0, 9.0, 11.0 & 12.0 are in the nature of audit check and reflect on the quality of manufacturing process.

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**9.6.2** Gauging of H frame shall be done on 5% of the frames assembled, as per para 5.

**9.6.3** All components as per Annexure-IX to be inspected as per details given in the respective Annexures. 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, the complete lot shall be rejected. Failure of the "double" sample will, however, result in the rejection of the complete lot. 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.

9.6.4 The Inspector shall also conduct random Process/Stage inspection of different Process/Stages of production as per the approved QAP.

i) Incoming Raw Material
ii) Methoding and Mould-Core Preparation
iii) Meting and Pouring of Molten Metal
iv) Know-out
v) Fettling
vi) Shot-blasting
vii) Heat Treatment
viii) Painting
ix) Testing and Gauging
x) Finished Side frames and Bolsters.
xi) Drilling of Side frames.
xii) Welding of liners.
xiii) Matching of springs.
xiv) Constant contact side bearer assembly.
xv) 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 the Engineer.

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

10.2 The items which are dispatched loose alongwith 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.

**11 "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 Prototype approval procedure (Process for approval, vendor registration and vendor progression):**

All manufactures seeking approval for supply of CASNUB 22HS 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. After satisfactory compliance of STR (QMS-09:2015 latest) and QAP of the product and capability assessment, the firm shall be conditionally approved as a developmental source for manufacturing and supply of CASNUB 22HS Bogies or as per the extant ISO procedure.

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 RDSO for witnessing of melting, pouring and tests specified in ANNEXURE – 1 for inspection of prototypes. 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) 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-22HS 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-22HS bogie after satisfactory supply for a minimum quantity 500 nos. of bogies 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 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 inspecting authority and shall obtain his approval before

commencing the manufacture of CASNUB 22 HS 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 Following parameters to be included in QAP, Section- (E)

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.
h) Pattern and core making.
i) Preparation of moulds.
j) Melting process.
k) Gas purging technique.
l) Grain refining 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) Heat treatment process
q) Removal of protruded metal if any, with the help of air arc.
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 Works Inspector/Quality Head
u) Painting.
v) Packing and dispatch.

13.2 Following details also to be included in QAP

**1. Source of**

a) Moulding sand
b) Core sand
c) Facing sand

**2. Properties of above sand**

a) Clay content
b) Purity (major constituents %)
c) AFS and grain fineness number
d) Shape of grains (round, semi-angular, angular)

**3. Mould wash**

a) Name
b) Base

c) Consistency
d) Size of particles

**4. Properties of prepared sands (mould, core and facing)**

a) System of sand ($CO_2$, resin bond etc.)
b) Compression strength
c) Shear Strength
d) Collapsibility

**5. 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 good castings

**6. Pouring start temperature/method of measurement**

**7. Pouring end temperature/method of measurement.**

**8. Knock out time after pouring**

**9. 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 Quality Audit :

The quality audit of the firm shall be carried out to ensure the adherence to its quality assurance plan and its general quality consciousness as per extant RDSO ISO procedures. 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.

## 15 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 Programme. Gauge drawings in original, shall also be made available for checking the tolerances of these gauges. Contractor shall have sufficient sets of gauges for his own use.

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 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 The 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 the provision of AAR Specifications M-201, M-202, M-203, 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, centre pivot, elastomeric pad, side bearers etc. must be stored under cover and be protected against corrosion.

**16 Clarifications :**

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

**17 Warranty:**

The firm shall stand warrantee for complete bogie/ components, 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.

**ANNEXURE –I**
**(Sheet 1 of 12)**

## CAST COMPONENTS

### 1.0 Requirements of steel castings and manufacturing process:

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.

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.

### 1.1 Ladle analysis

The ladle analysis of steel when carried out by spectrometer to determine the percentage carbon, manganese, phosphorus, sulphur, silicon etc. shall conform to chemical compositions as per AAR M 201 Gr B+ material as detailed in Annexure-VIII.

### 1.2 Raw material quality – General

The foundry shall lay down the specification of all raw materials used in the manufacture of castings and follow the same. 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.

Quality of all additives to sand, molten metal and mould/core wash shall be standardised, checked and only acceptable quality raw material and additives shall be used. 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.

**1.3 Methoding**

i) Casting solidification software must be used to evaluate castings for potential defects, standardize running, gating, risering system 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 for the same along with simulation analysis and results that the methoding system meets the requirements of International/National standard and best foundry practices for the manufacturing.

ii) Any alteration in the system shall be intimated immediately for obtaining approval.
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.

iii) Entire methoding shall be part of QAP of the vendor.

**1.4 Moulding**

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

**OR**

(b) Articulated Mixer (continuous type) with fume extraction facility & Compaction Table for No-Bake System.

**OR**

(c) Any other better process as approved by DG (Wagon_, RDSO, Lucknow.

For High pressure moulding line mould hardness shall be minimum 85 and the same should be uniform at all the surfaces (Within ± 5% at the entire 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 so as to get good dimensional accuracy in castings.

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.

Two lugs of size 25 X 25 X 8 mm shall be provided in all castings to facilitate micro-examination.

To facilitate mechanical testing and chemical analysis, all side frames and bolster castings shall have integrated test piece from which samples for tests shall be prepared.

All moulds shall be given a `wash' of appropriate quality on the entire surface coming in contact with the molten metal to ensure proper surface finish and undesirable metal/mould reaction.

1.5 **Sand Preparation & Sand Lab**

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.

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.

1.6 **Core-Making**

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. 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.

1.7 **Melting**

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. Argon Purging may be carried out to ensure freedom from harmful gases. Ladle pre-heating at 600 to 700°C shall be carried out. Temperature checking in Furnace and in Ladle by Immersion Pyrometer shall be done before pouring in Mould.

1.8 **Pouring**

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.
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 500°C, at a rate that will not be injurious to the castings. Moulding boxes shall be opened to remove the castings only after they have cooled down sufficiently to room temperature. Left over metal/slag in ladle shall be specified in QAP.

1.9 **Fettling and shot blasting**

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.
Use of knock-off risers shall be preferred for improving the surface condition of the castings.

1.10 **Heat treatment**

- All castings shall be heat treated after fettling and Shot Blasting. Shot Blasting shall also be carried out after heat treatment process.
- SOTA (State of the Art) heat treatment furnaces shall be employed and must be capable of throughout even heat distribution of ±10°C.

All heat treatment furnaces shall be equipped with adequate number of pyrometers and recorders. Facility for output chart indicating time verses temperature shall be available for each furnace.

Plan for placement of castings in the furnace shall be standardised to ensure uniformity of heat treatment for each casting of a particular batch and the same shall be followed without any deviation.

Castings for heat treatment shall be cleaned / dressed sufficiently to respond the heat treatment. The castings shall be normalized or normalized tempered as detailed below to achieve properties as detailed in Annexure-VIII.

i) Process of Normalizing shall be followed in following order:

- 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.
- Withdraw from the furnace and cool in still air until temperature_of entire casting reach below 371 Degree Celsius (Tempering temperature).

ii) Process of Normalized and tempered shall be followed in following order:

- 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.
- Withdraw from the furnace and cool in still air until entire casting temperature reach at least 38 Degree Celsius below the tempering temperature.
- Temper by reheating to proper uniform temperature below the transformation range, but not less than 316 Degree Celsius and hold for the required time. Remove castings from the furnace and allow it to cool at desired rate.

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.

1.11 **Heat-Treatment Documentation**

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 pyrometers having associated recording equipment that produce time-temperature record charts that are identified by date and furnace number. A log sheet for each load of castings heat treated (batch) should show all information pertinent to each heat-treat load including the following:

- Type of casting
- Prescribed heat treatment
- Serial numbers and the heat numbers of the castings
- Actual time of heat treatment.

Pyrometers shall be calibrated every 3 months. Records of time-temperature charts, furnace log sheets, and pyrometer calibrations will be maintained for 3 years and available to the purchaser upon request.

1.12 **On completion of heat treatment, the castings shall again be shot blasted.**

**2.0 Visual examination**

All castings shall be examined visually and in the event of doubt by using a magnifying glass. Finish of cast surface shall be maintained as per specification ASTM – A -802 SCRATA comparators of not more than Class A2. Final examination has to be done by magnetic particle testing method as indicated in Para 7.2. The castings shall be free from harmful surface defects, inclusions, sand fusion, blow holes, folds, cracks, misruns, surface imperfections, unfused chaplets and porosity. Castings having freedom from defects shall only be processed for machining and assembly.

**ANNEXURE –I**
**(Sheet 7 of 12)**

**3.0 Weld reclamation**

The cracks up to a depth of 2 mm shall be ground and blended with surrounding surfaces. Deeper cracks shall not be rectified and casting shall be rejected.

~~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. It shall be carried out only after the approval of inspecting official.~~

~~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.~~

~~All castings reclaimed by welding shall be subjected to normalizing in the same manner as outlined for castings manufactured in the first instance.~~

**4.0 Disposal of rejected castings**

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'. Gas cutting or by any other means into minimum two pieces in order to avoid mixing up and kept stacked separately till their verification by inspecting official. Record of such castings including Sr. No. shall be maintained.

**5.0 Feed back mechanism**

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. 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 Engineer half yearly interval.

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 bars for each heat & heat treatment batch of the same grade will be tested for mechanical properties. Test results will be recorded.
iv) Re-tests will be governed by the relevant IS Specification.
v) 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:**

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 300 bogies. Frequency of testing shall be reduced to 1 in 500 bogies after the successful supply of initial 300 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.

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 2 in respect of blow holes, slag, sand inclusion and shrinkage. No cracks/hot tears shall be permitted.

**7.2 Magnetic particle test**

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. The equipment consumables shall meet RDSO specification no. M&C/NDT/15/91 and M&C/NDT/8/91or latest. No



cracks are permitted. The cracks up to a depth of 2 mm shall be ground and blended with surrounding surfaces. ~~Deeper cracks shall be rectified as per Annexure IA. Magnaflux test shall again be done after grinding to ensure removal of crack.~~

Inspecting officer shall witness 5% of the bogies checked.

## 8.0 Microstructure & Surface roughness

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.

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. The inspector shall check record and verify the 5% of offered lot of each heat during the inspection.

## 9.0 Weight

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

| | |
|---|---|
| Side frame | 430 ± 5.5% kg |
| Bolster | 565 ± 4.5% kg |
| Brake beam | 75 ± 6.0% kg |

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

## 10.0 Load testing

Castings shall be selected at random for load test by the inspector/**inspection 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

**ANNEXURE –I**
**(Sheet 10 of 12)**

consecutive contracts or there is a major design change. In such cases, tests will be carried out as if on a new contract.

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 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**

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. 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:**

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.

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 centre |
|---|---|---|---|---|
| Side frame | 1 in 50 | 117 t | -- | 0.4 mm |
| Bolster | 1 in 50 | 117 t | -- | 0.7 mm |

**ANNEXURE –I**
**(Sheet 11 of 12)**

**10.1.3 Destruction Test**

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

**10.1.4 Sample Size for proof and destruction load testing :**

One side frame and one bolster casting in every 100 bogies or part thereof shall be tested for the initial supply of 200 bogies. Subsequent frequency of testing shall be reduced to 1 in 1000 bogies after the successful supply of initial 200 bogie sets. The selection of side frame/bolster for this test shall be made at random by the inspector from the lot.
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.

**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. WX24003C (for sectioning location of bolster) & WX24003D (for sectioning location of side frame). Sample size of this test shall be same as para 10.1.3.

11.2 Following items are to be specifically checked :

a) Wall thickness

b) Solidity

**ANNEXURE –I**
**(Sheet 12 of 12)**

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 11 mm) | + 3 mm to –1 mm |
| 11 mm and above | + 3 mm to –2 mm |

11.4 Each sectioned face on examination, shall not show a total defective area of more than 2% of the cross-sectional area. The defect shall not be clustered at any particular location and shall be uniformly distributed throughout. Defects within 10mm from the surface and defects 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 physically in the presence of inspecting official representative.

11.5 Any failures in these parameters will indicate deficiencies in the manufacturing process. One more casting shall be taken and subjected to load test as per para 10 and sectioning test as explained in this para. If any deficiency is again found then the foundry shall be subjected to complete review of manufacturing process to find out the cause of such failure and manufacturing shall be recommended after eliminating such cause.

11.6 A report on the load testing and sectioning test (para 10 & 11) shall be sent to the DG (Wagon).

**12.0** Wall thickness check shall be made at specified locations as per mentioned in enclosed sketches of side frame and bolster nos. WX 24003C and WX 24003D on 5% the castings using ultrasonic thickness gauge. This gauge may be obtained from any RDSO approved ultrasonic equipment manufacturer.

Any rejection will mean defect in pattern, core, mould setting or process and appropriate investigation shall be made.

**ANNEXURE – I A**

## ~~WELDING 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.~~

~~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 & Zone 2 as specified in enclosed sketches nos. WX 24003E 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, audit by inspector shall be necessary.~~

~~3.5 All castings repaired by welding shall be normalized.~~

~~3.6 The welding shall be conducted by qualified welders with valid certificate.~~

**~~Repair procedure~~**

~~The extent of crack of defect shall be judged by visual or magnetic particle examination. Use of crack depth meter is also recommended for precise crack depth determination. The defect shall be eliminated by pneumatic gauging and its elimination ensured by magnetic/dye penetrant testing.~~
~~Appropriated 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.~~

~~RDSO approved class E2 electrodes to RDSO specification no. IRSM 28/2012 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.~~

~~The weldment shall be examined for presence of cracks by dye penetrant testing. Weldments free form cracks shall be considered acceptable.~~

**ANNEXURE –II**

## SPRING STEEL COMPONENTS

1. Material for Helical Springs: The springs to drawing No. WD-92058-S/5 shall be manufactured out of steel conforming to RDSO's specification No. WD-01-HLS-94 (Latest)

2. The helical springs shall be manufactured as per RDSO specification No. WD-01-HLS-94 (Latest) and the relevant RDSO drawing of the helical spring.

******

**ANNEXURE –III**

## METAL BONDED RUBBER COMPONENTS

1. 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.

2. Centre pivot washer: The washer shall be as per RDSO drawing no. WD-97049-S/3 & WD-85079-S/2.

******

**ANNEXURE –III A**

## COMPOSITE MATERIAL COMPONENTS

**1. Brake Blocks:**

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

- 'K' type brake blocks shall be manufactured as per the RDSO Specification No. WD-14-ABR-2007 (latest version) by manufactures approved by RDSO.

******

## Annexure-IIIB

## List of Constant Contact Side Bearer

| S.No. | Specification No. | Variant/Type | Approved Drawing/s | To be fitted in |
|---|---|---|---|---|
| 1. | WD-38-Misc-2004 (Rev-1) or Latest | Design-'A' | AAL-021101 Alt-8 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 to12.7t. |
| | | 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 –IV**

## FORGED COMPONENTS AND FASTENERS

| S.No. | Drg. No. (latest) | Description | Specification(latest) |
|---|---|---|---|
| 1. | WD-97049-S/3 & WD-85079-S/2 | Centre Pivot Pin | IS: 2062 |
| 2. | WD-97049-S/3 & WD-85079-S/2 | Shackle lock | IS: 1875 |
| 3. | WD-97049-S/3 & WD-85079-S/2 | Lock pin | IS: 1875 |
| 4. | --- | Rivets – 12, 20 and 24 dia. | IS: 1929<br>IS: 1148 |
| 5. | WD-94068-S/1 | Bulb cotter | IS: 1079-73 St-42<br>Or IRS: M-41-74 |
| 6. | --- | Split pins | IS: 549 |
| 7. | | Hexagonal Fit bolt (M-24) with washer and castle nut. | IS: 2232<br>IS:3640<br>IS: 2016 |
| 8. | WD-92058-S/4, item –2 | Side frame key | IS: 1875 Cl. IV |
| 9. | WD-89033-S/1, WD-07052-S/1 | End piece & strut | IS: 1875 CL.III A |
| 9. | WD-04038-S/3 & WD-04078-S/2 | Lock bolt pin (22.2mm dia)<br><br>Collar | Medium carbon steel to SAE 15836<br><br>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<br>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 40 dia. with washer & bulb cotter | SK-69597 item 14 | IS: 2062, IS-5517 |
| 5. | Washer (OD 56, ID 31 dia. X 5 thk ) | --- | IS: 2062 |
| 6. | Washer (OD 80, ID 43 X 6 thk ) | ---- | IS: 2062 |
| 7. | Brake beam | WD-89033-S/1 &<br>WD- 07052-S/1 | IS: 2062 |
| 8. | Brake Shoe Key | W/BG-6150 | IS: 3885 OR<br>IS: 3195 |
| 9. | Center pivot washer | WD-97049-S/3 Item 5 &<br>WD-85079-S/2 Item 4 | IS: 2062 & IS: 5192 |
| 10. | Spring Plank | WD-92058-S/4 Item 1 | IS: 5986 |
| 11. | Side frame friction liner | WD-92058-S/4 Item 3 | IS: 3885 |
| 12. | Bolster liner | WD-92058-S/3 Item 2 | IS: 3885 |
| 13. | Centre pivot liner | WD-97049-S/3 Item 3 & 4 | IRS : R 65 – 78 |

**Annexure –VI**

## ( A) LIST OF CONSTRUCTION DRAWINGS

**(For BOXNHS with CASNUB 22 HS Bogie )**

| Drawing No. (Alteration latest) | Description |
|---|---|
| WD-92058-S/1 | Index |
| WD-04038-S/2 | General Arrangement (with spherical centre pivot & constant contact side bearer) |
| WD-04078-S/1 | General Arrangement (with flat centre pivot & constant contact side bearer) |
| WD-89067-S/3 | Cast steel side frame |
| WD-92058-S/3 | Cast steel bolster |
| WD-92058-S/4 | Bogie details |
| WD-92058-S/5 | Spring details |
| WD-89067-S/5 | Bogie Brake gear arrangement. |
| WD-85079-S/2 | Centre pivot assembly & details (spherical type) |
| WD-97049-S/3 | Centre pivot assembly & details ( flat type) |
| WD-04038-S/3 | Centre pivot & Side Bearer Arrangement (with spherical pivot & constant contact side bearer) |
| WD-04078-S/2 | Centre pivot & Side Bearer Arrangement (with flat pivot & constant contact side bearer) |
| WD-89033-S/1 | Brake beam details |
| WD- 07052 – S/1 | Brake beam (Suitable for `K' type brake block) |
| SK-69597 | Bogie brake gear details |
| WD-92058-S/7 | Leading dimensions and tolerances |
| WD-85054-S/7 | Assembly procedure |
| SK-77579 | Wedge |
| WD-89067-S/9 | Narrow jaw adapter |
| WD-95005-S/1 | Modified Elastomeric pad |
| Annexure-IIIB of Spec. No. WD-17-CASNUB 22HS-BOGIE-92(Rev.3) | Constant contact side bearer assembly & details |
| WD-89006-S/1 | BG, MG & NG coil spring drawing codes |
| WD-86038-S/1 | Marking scheme for cast steel sideframe & bolster |
| WD-94068-S/1 | Bulb cotter |
| WD-08093-S/2 | Brake Gear General Arrangement for BMBS |
| W/BG-6150 | Brake shoe key |
| W/PN-90 | Pin |

**ANNEXURE –VII**

**REFERENCE SPECIFICATIONS (LATEST) FOR BOGIE MANUFACTURE**

| Specification No. | Description |
|---|---|
| IS:2 – 2011 | Rules for round off numerical values |
| IS:276 Gr. 1/ As per Specification No.CONTR-02-MISC-2007 (Latest Revision) | Wedge/ Friction Wedge with specified range of coefficient of friction |
| IS:3885 Pt. I Gr. 4 | SF friction liners, Bolster friction liners, Brake beam wear plate, Brake wear plate, Brake block key |
| IS: 5986-2017 | Spring plank |
| IS:2062 | Push rod, pull rod & lever |
| IS:1929<br>IS:1148 | Rivets |
| IS:2585 & IS: 549 | Key bolt with 4.0 dia. Split pin |
| IS:2074 | Primer paint |
| IS:123 ; IS:5 | Red oxide paint |
| IS:9595 | Welding |
| IS:1079-73 St. 42/IRS-M 41-74 | Bulb cotter |
| IS:1875 | forged components |
| IS:7215 | Riveting |
| IS:3195 | Helical springs |
| IS: 7318 Pt. I | Qualification for welders |
| IS:4897 | Deviation for untoleranced dimensions and mass of steel casting |
| IS:2102 | Allowable deviations for dimensions without specified tolerance |
| IS:3469 Pt. I, II & III | Weight, quantity and dimensioning tolerances on forgings |
| IS:3073 | Surface finish |
| IS:3640 | Hexagonal fit bolts |
| IS:5530 | Code of procedure for rectification of steel castings by metal arc welding process |
| ASTM-E-446-84 or E-71 | Standard for radiographic analysis |
| AAR-M-201 Gr. B+ & C, M – 202, M - 203 | Top & Bottom Centre pivots, side frame , bolster |
| IS:5517 | Bushes & pins |
| WD-23-BMBS-2008 Latest | Specification of BMBS Brake System |
| IRS – R - 65 - 78 | Centre pivot liners |

**ANNEXURE –VIII**

**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:**

## 1.1 Chemical Composition (%)

| | |
|---|---|
| C | 0.32 % (Max.) |
| Mn | 0.90 % (Max.) |
| P | 0.04 % (Max.) |
| S | 0.04 % (Max.) |
| Si | 1.50 % (Max.) |

Note: Sum of P and S shall not be more than 0.07%

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.

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

## 1.2 Mechanical Properties

| | |
|---|---|
| Ultimate Tensile strength (UTS) | 551 Mpa (Min.) |
| Yield Strength (YS) | 344.4 Mpa (Min.) |
| Elongation in 2 Inch (%) | 24 (Min.) |
| Reduction of Area (%) | 36 (Min.) |
| Impact Charpy V notch (ft - lb) | 15 ft-lb (20.33 joules) at 20° F/ (-7 ° C ) Minimum |

## 1.3 Hardness

| | |
|---|---|
| Hardness | 137 – 228 BHN |

**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. | Manganese steel castings- wedges **ADI Castings/Wedges with composite liner – Friction wedges with specified range of COF** | Annexure –IX (sheet 4 of 17) |
| 3. | Outer, inner, snubber springs | 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 | 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 with proper heat treatment.
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 centre 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** (Drg. No.WD-97049-S/3)

| S.No. | Dimensions to be checked |
|---|---|
| 1. | 270 + 0.5mm -0.0 |
| 2. | 82 + 0.6mm (Height) -0.0 |
| 3. | 20 R |
| 4. | Top wall thickness 28 + 0.4mm -0.0 |
| 5. | 328mm (outside dia.) |
| 6 | Dia. 60 mm |
| | |
| | |

**Top Pivot** (Drg. No.WD-85079-S/2)

| S.No. | Dimensions to be checked |
|---|---|
| 1. | 270 + 0.5 mm -0.0 |
| 2. | 20 + 0.5 mm -0.0 |
| 3. | 102 + 1 mm -0 |
| 4. | 20 R |
| 5. | Top wall thickness 26 mm |
| 6. | 315 mm (Outside dia) |
| 7. | R 330 ± 0.5 mm |
| 8 | Dia. 60 mm |

**ANNEXURE –IX**
**(Sheet 3 of 17)**

**Bottom Pivot** (Drg. No. 97049-S/3) **Bottom Pivot** (Drg. No. 85079-S/2)

| | | | | |
|---|---|---|---|---|
| 1. | 30 + 0.4 mm<br>-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 (centre stem dia.) | | 5. | R 331 ± 0.5 mm |
| 6 | Dia. 60 | | 6. | 18 + 1 mm<br>-0 |
| | | | 7 | Dia. 60 |

**Top & Bottom Pivot Assembly** (Drg. No. WD-85079-S/2)

**S.No. Dimension to be checked**

1. 120 + 2 (Assembled height of centre pivots )
   - 0
2. Minimum area of contact 75%.

**Top & Bottom Pivot Assembly** (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 :**

1. Top pivot & bottom pivot manufactured by same manufacturer should be used on a particular wagon. Intermixing of pivots of different manufacturers is not permitted.

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

**ANNEXURE –IX**
**(Sheet 4 of 17)**

**Manganese Steel /ADI Castings Wedges/ with composite liner friction wedges**
(Drg. No. SK-77579)

1. Wedges are to be manufactured as per IS: 276. /Specification No. CONTR-02-MISC-2007 (Rev. Latest)

2. 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.

3. 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.

4. It has to be ensured that the name of manufacturer, month and year of manufacturing to be cast on each wedge/Friction wedge.

5. 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. |
| 1. | 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 form the RDSO.

## Outer, Inner & Snubber Springs

(Drg. No. WD-92058-S/5 )

1. The springs shall be manufactured as per RDSO spec. No. WD-01-HLS-94 (Latest).

2. Contractor shall purchase springs form RDSO approved sources only. All testes 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.

*****

## 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 liner 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 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.

4. 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.

**Side frame and bolster Liners**

(Drg. No. WD-92058-S/3 & WD-92058-S/4)

**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.

**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 |

**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.

**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) |

**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. 20-Misc.-95, Rev. Latest.

2. Constant contact side bearer shall be as per Annexure- IIIB'.

3. Contractor shall source these item s 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 Engineer.

*****

**ANNEXURE –IX**
**( Sheet 10 of 17 )**

## Spring Plank

( Drg. No. WD-92058-S/4)

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. WD-92058-S/4. |

**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

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

**Side frame Key** ( WD-92058-S/4 )

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

**Hexagonal Fit Bolt**

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

**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) |

**Shackle Lock**( Drg. No. WD-85079-S/2 )

| S.No. | Dimensions to be checked |
|---|---|
| 1. | 40.5 + 0.5/ -0.0 |
| 2. | 17 dia. hole |
| 3. | 35 + 0.0/-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 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.

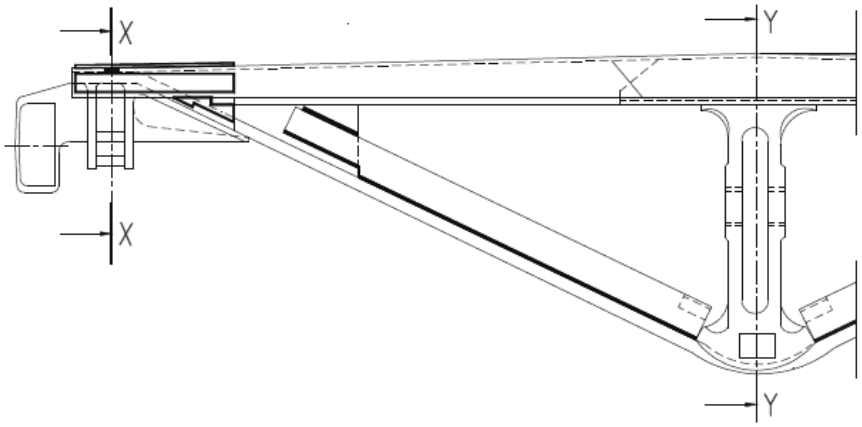
**4.** Contractor to check and record these parameters on a sample basis on 1 in 50 which shall be witnessed by Inspecting Officer. In case of any rejection, Para 9.6.3 shall apply.

**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 ( OD of bush )/ + 0.053 |
| 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 ±7 R |
| 10. | 260 |
| 11. | 60 |
| 12. | 30 |
| 13. | 26 + 0.0/ - 1.0 (thickness of ends ) – to be achieved by machining |
| 14. | 12 |
| 15. | 40 |
| 16. | 300 |
| 17. | Angle 64° |

## 7. Manufacturing of end piece and strut for brake beam

7.1 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.

7.2 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.

7.3 Manufacturing process and quality assurance process shall be as per the details given in this specification.

7.4 Inspecting officer shall witness gauging on sample basis for 1 in every 50. In case of any rejections, Para 9.6.3 shall apply.

7.5 The tolerances, if not indicated, are as per IS: 4897 for castings and IS: 3469 for forgings.

**Note :**

1. Centre lines of end piece castings, brake beam strut, brake beam channel and truss flat must be co-planer.

2. The dimensions indicated are critical dimensions which are to be gauged. The other dimensions are required to be maintained as per the drawings.

3. The gauges have to be developed by the contractor and approval obtained from the RDSO.

**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 Engineer.

**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 & 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.

**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 Equalising lever

a) Dimensional check

3.3 Pins and Bushes

a) Dimensional check
b) Surface finish
c) Clearance not to exceed 0.75mm
d) Hardness

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

| S.No. | Dimensions to be checked |
|---|---|
| 4. | 800 mm |
| 5. | 35 mm (opening in forks ) |
| 6. | Hole spacing of 57 mm |
| 7. | 29 mm dia. holes |
| 8. | Weld to be examined visually. These are critical & should be as per drawing. |

**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)**

**Equalising 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 ) |

**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. |

**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) |

**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:**

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 Engineer.

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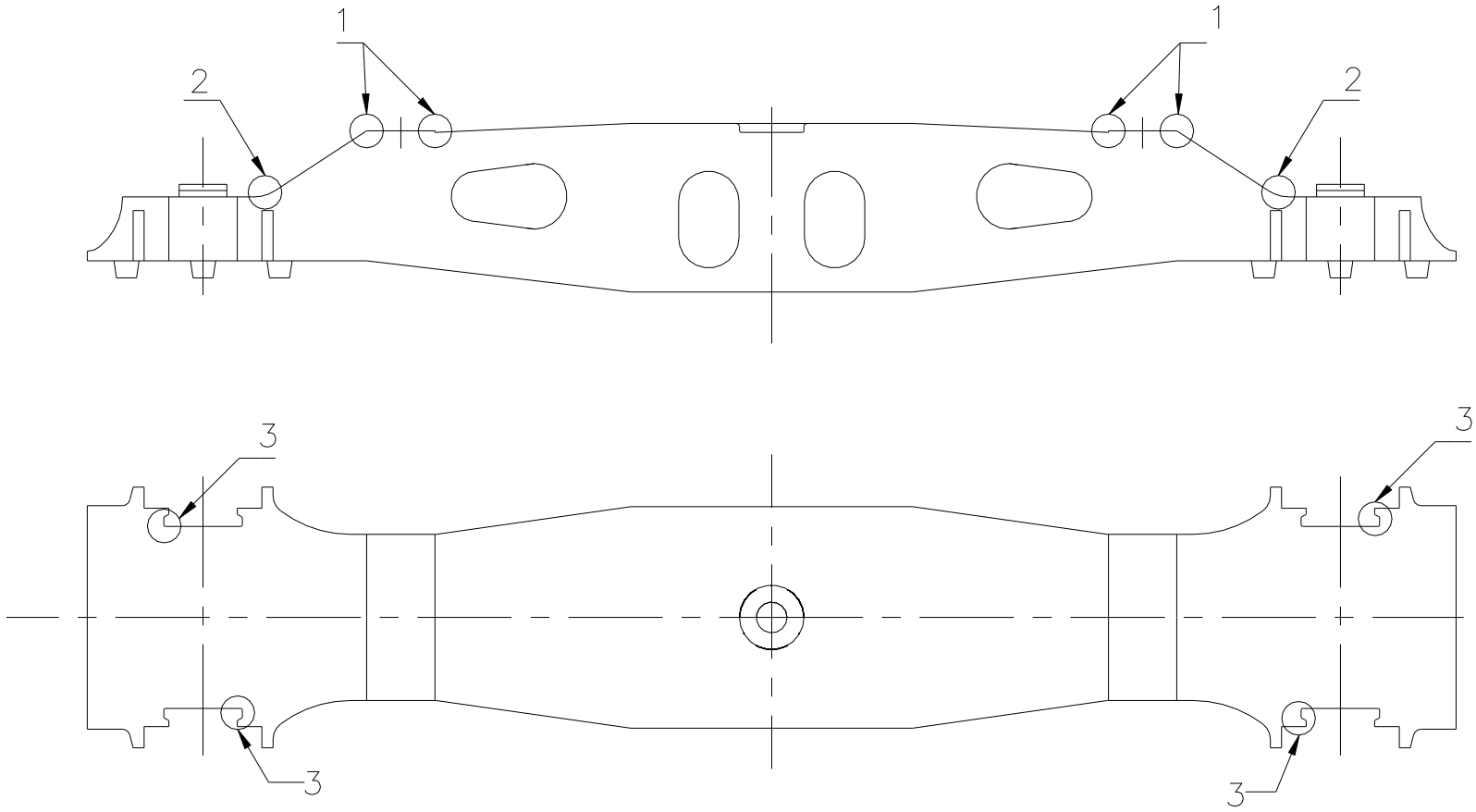
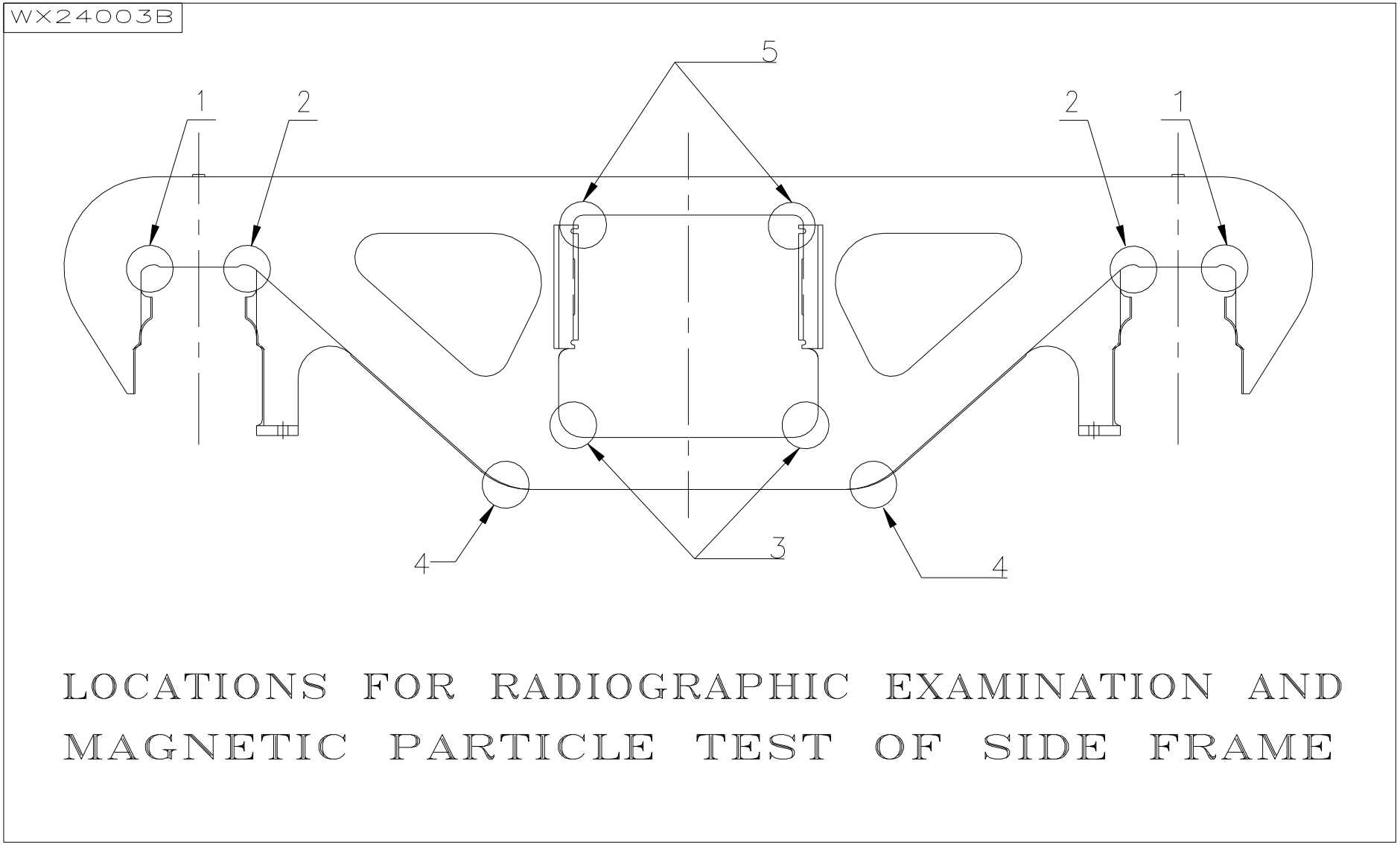



LOCATIONS FOR RADIOGRAPHIC EXAMINATION AND MAGNETIC PARTICLE TEST OF BOLSTER

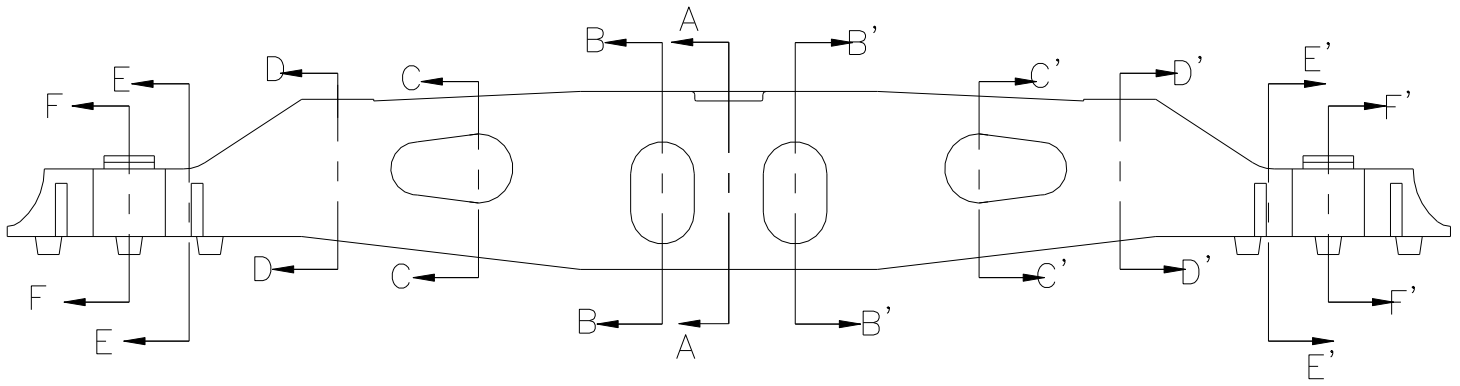
**ANNEXURE –X**
**( Sheet 2 of 6 )**




LOCATIONS FOR RADIOGRAPHIC EXAMINATION AND MAGNETIC PARTICLE TEST OF SIDE FRAME

**ANNEXURE –X**
**( Sheet 3 of 6)**

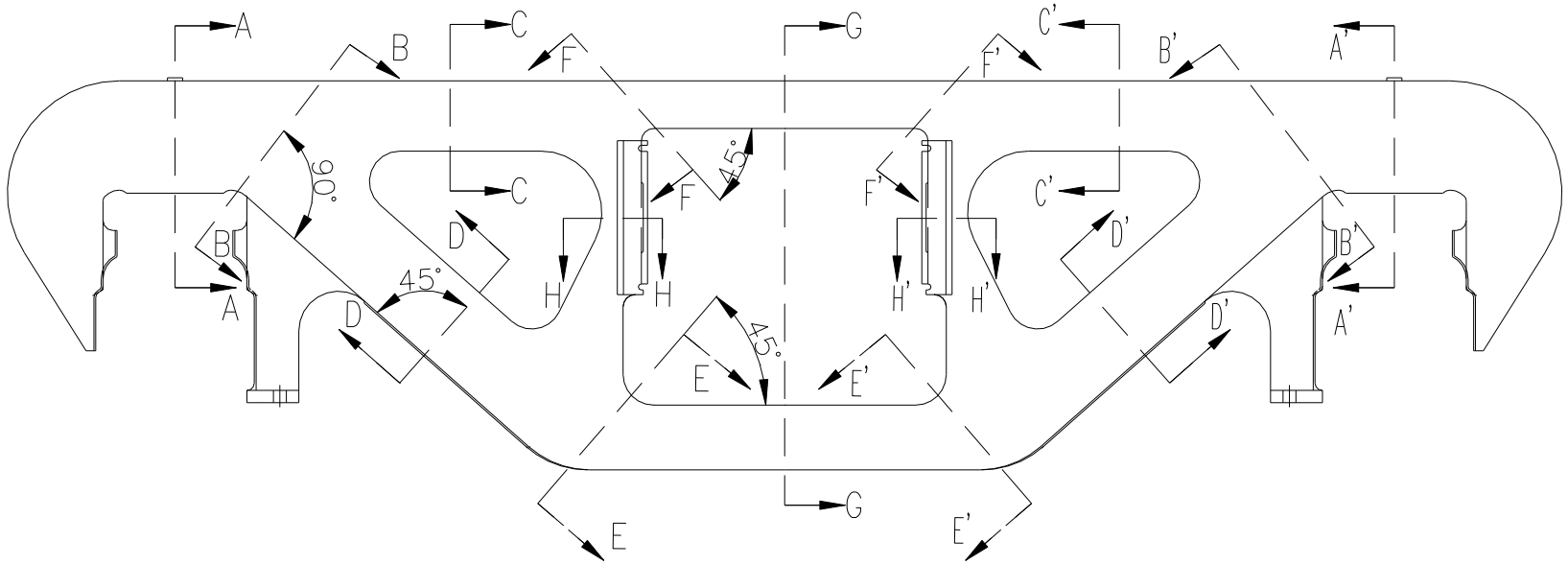
WX24003C




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

**ANNEXURE –X**
**( Sheet 4 of 6 )**

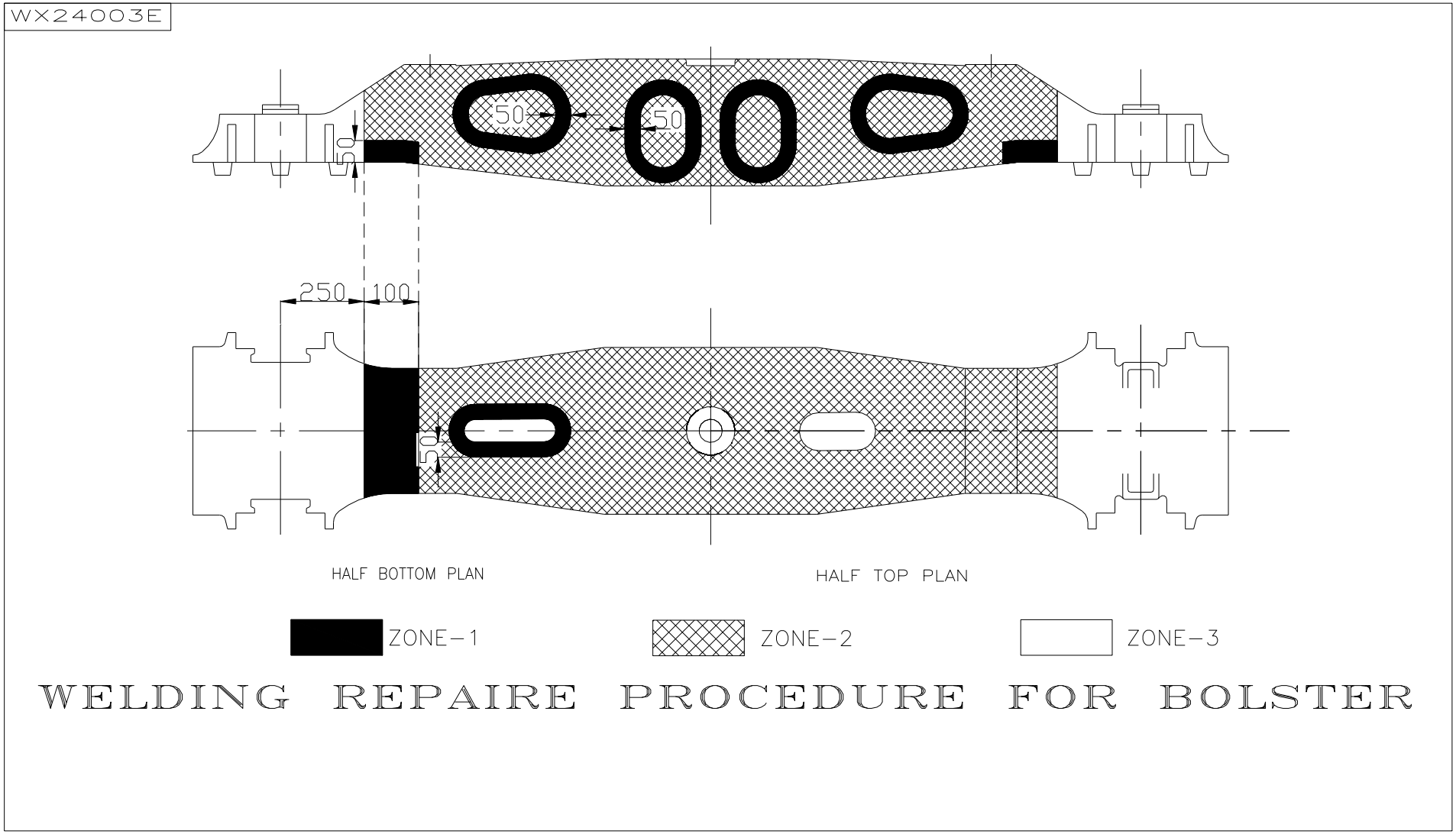
WX24003D




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

**ANNEXURE –X**

**( Sheet 5 of 6 )**




# WELDING REPAIRE PROCEDURE FOR BOLSTER

**ANNEXURE –X**
**( Sheet 6 of 6 )**

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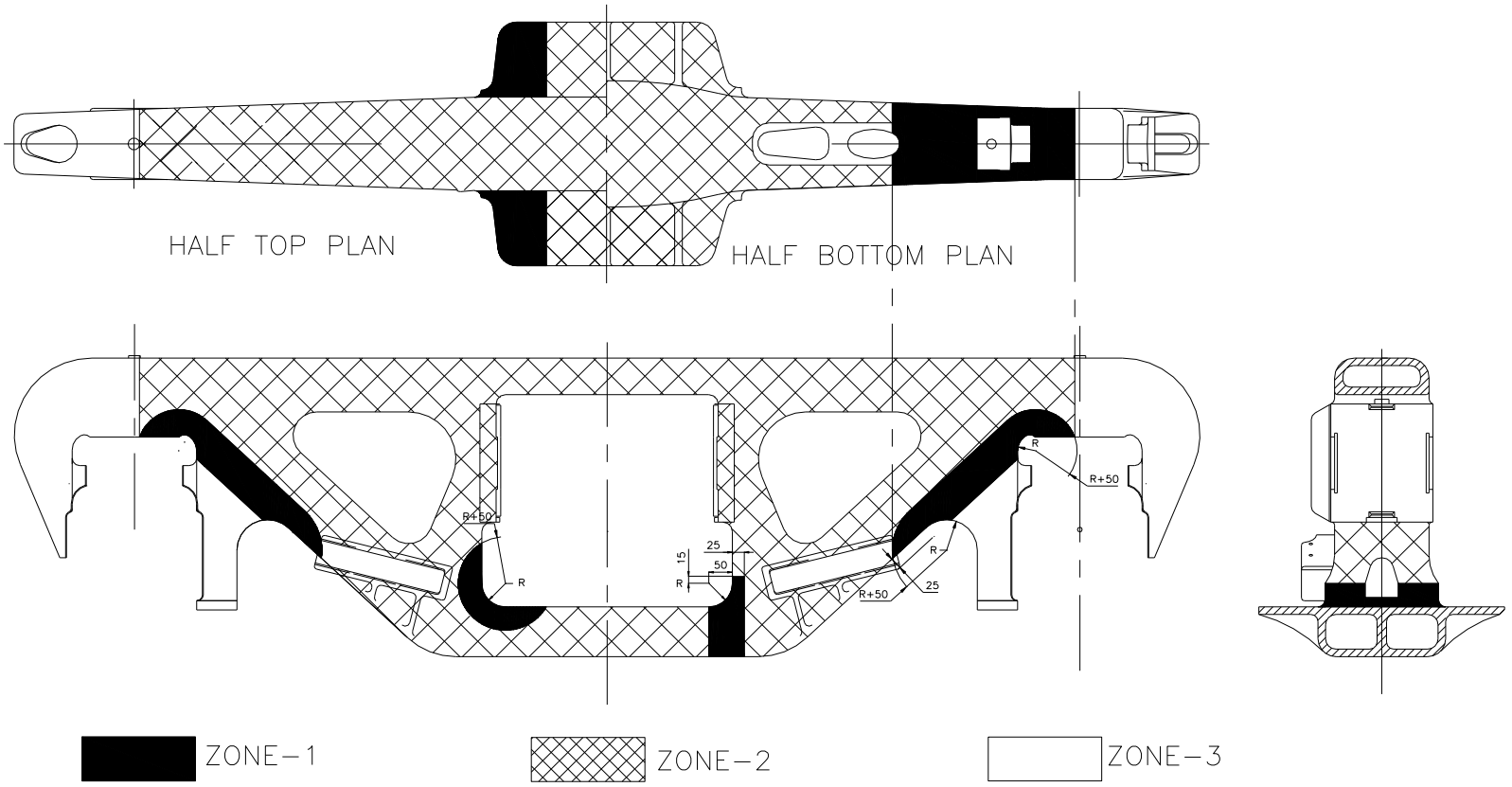


WELDING REPAIRE PROCEDURE FOR SIDE FRAME