

Item No. 15.0 - Guidance for filling of accident proforma circulated vide Railway Board letter No.2018/Safety(A&R)/1/8 dated 25.01.2019, on "Revision and Standardization of Observation/ Measurement of Accident Investigation / Inquiry" added.



ज्ञान ज्योति से मार्गदर्शन
To Beam As A Beacon of Knowledge

MONOGRAPH ON CASNUB BOGIE



June 2016

(Updated - May 2019)

INDIAN RAILWAYS INSTITUTE OF CIVIL ENGINEERING
PUNE 411001

Published By
Indian Railways Institute of Civil Engg.
11-A, South Main Road, Koregaon Park, Pune 411 001.

FIRST EDITION

June 2016

Price ₹ 60/-

Design by :
HUMA ADDS
PUNE

Printed by :
KALYANI CORPORATION
PUNE



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FOREWORD

It has been endeavour of IRICEN to bring out publications which are useful to field staff. The book published by IRICEN on the subject of “Investigation of Derailment” is hugely popular amongst field staff of various disciplines. IRICEN is now issuing series of Monographs for various Rolling Stock commonly used for Coaching, Freight and Loco operations for the guidance of field staff. First Monograph in the series for ICF All-Coil Coach has already been published. Second in this series is the Monograph on CASNUB Bogie.

The purpose behind bringing out these Monographs is to educate the field staff and increase their awareness level as present day Accident Proforma of Accident Manual do not have adequate measurements for various Rolling stock components which may be required to determine cause of accident. I hope that the Railwaymen from various disciplines would find this publication useful.

Pune,
June 2016

Vishwesh Chaubey
Director
IRICEN, PUNE

PREFACE

With the view to educate field officials and increase their awareness, it is proposed to issue series of Monographs for Rolling stock commonly used in Coaching, Freight and Loco operations.

Second Monograph in this series is for CASNUB Bogie which is the main stay of freight operations on Indian Railways. The contents in the Monograph are mainly from existing “Maintenance Manual for Wagons”, “IRCA Part III” and text book on the subject of “Investigation of Derailment” published by IRICEN. For more detailed knowledge on the subject readers are advised to refer to Maintenance Manual for Wagons and IRCA Part III.

I am grateful to Shri Vishwesh Chaubey, Director, IRICEN for giving me the opportunity for preparation of this Monograph and also for his encouragement and guidance from time to time for bringing out this publication. Thanks are also due to Shri Nilmani, ex. Professor (Track) IRICEN, now CPDE, N.F.Rly for checking the drafts and for giving his valuable suggestions. I am thankful to faculty and staff of IRICEN who have contributed immensely for this publication. Efforts taken by Shri Mathew Varughese SI (M)-I in correcting the draft and scrutinizing the manuscript are also appreciated.

Suggestions from readers to improve the contents are welcome and can be sent to mail@iricen.gov.in which will be taken into account while bringing future editions.

Pune
June 2016

Gautam Birhade
Professor (Works)

MONOGRAPHS PUBLISHED

1. ICF All-Coil Coach
2. CASNUB Bogie

FORTHCOMING MONOGRAPHS

3. LHB Coach
4. WDM3A (Co-Co Tri-Mount Bogie, similar to WAG5)
5. WDG3A (High Adhesion Bogie, similar to WAG7, WDM3D)
6. WDP4 (HTSC Bogie, similar to WDG4)
7. WAP7 (Co-Co Flexi-coil Fabricated Bogie, similar to WAG9)
8. WAP5 (Bo-Bo Flexi-coil Fabricated Bogie)

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1.1 General Description

The CASNUB bogie was first fitted in BOXN wagons and was designated as CASNUB 22W. This was later modified as CASNUB 22W(M) to take care of high wheel wear reported on earlier version. Subsequently CASNUB 22NL (Narrow jaw) and CASNUB 22 NLB (Narrow jaw with fish belly bolster) versions were introduced. The CASNUB 22 HS and CASNUB 22HS (Mod-I) bogies have been developed for high-speed operation with maximum permitted speed up to 100 kmph at 20.32t axle load.

1.2 CASNUB bogies are now used in the following wagons:-

Bogie	Axle load	Type of wagon
CASNUB -22 NLB	20.32t & 22.9t	BOXN, BCN, BCNA BOBR, BOBRN, BRN, BRNA, BTPN, BTPGLN, BOBYN, BOBSN, BOY etc and M1 variant of above
CASNUB -22 HS	20.32t & 22.82	BOXNHS, BCNHS, BCNAHS BOBRNHS, BRNHS, BOST, BOXNHL BOXNLW etc and M1 variant of above
CASNUB -22 (Mod-1)	20.32t & 22.32t	BOSTHS, BOSTHS M1
CASNUB -2HS (Mod-II)	22.32t	BOSTHS M2
CASNUB-22 NLC	25.0t	BOBRNEL, BOYEL, BOXNEL
IRF-108HS	22.82t	BOXNHAM

1.3 Construction Details

The CASNUB bogie comprises of two cast steel frames and a floating bolster. The bolster is supported on the side frame through groups of nested helical springs. This also provides a friction damping proportional to load. A fabricated mild steel spring plank connects the side frames. A photograph of BCNA M1 Wagon is as shown in Figure 1. Figure 2 and 3 shows the CASNUB bogie general arrangement.



Figure 1: Photograph of BCNA M1 Wagon

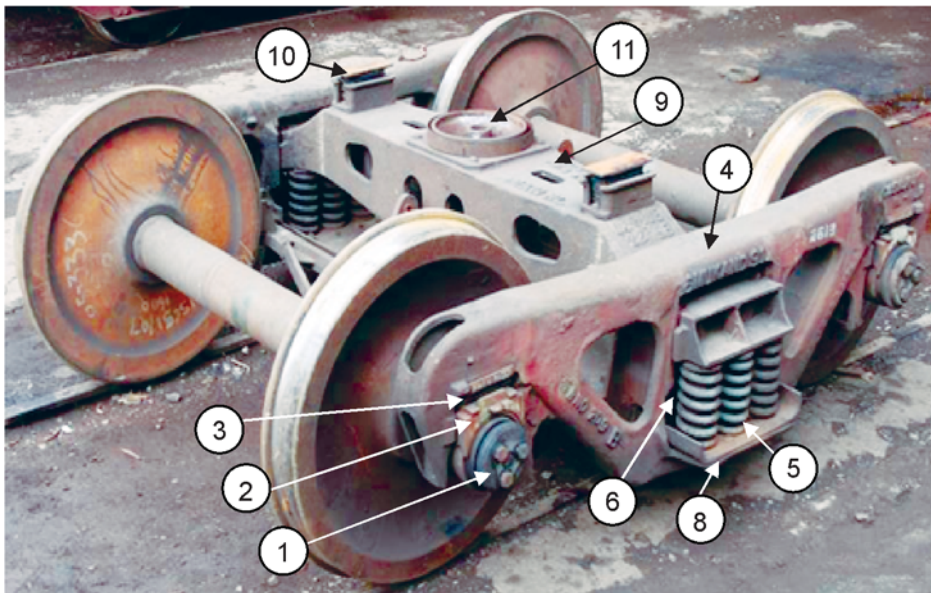
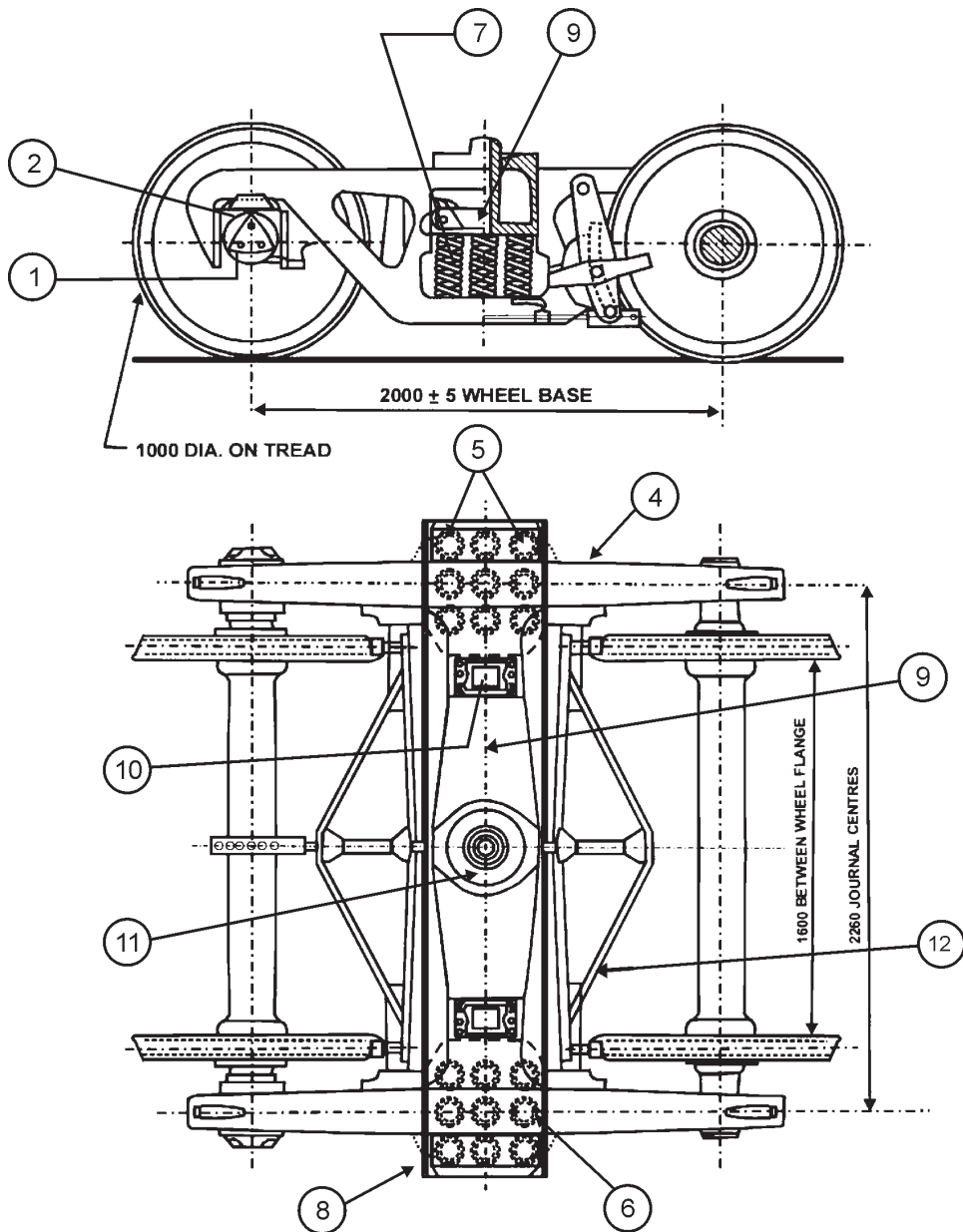


Figure 2: CASNUB Bogie



- | | | |
|------------------------|-------------------------|--------------------|
| 1. Bearing | 2. Bearing Adapter | 3. Elastomeric Pad |
| 4. Side Frame | 5. Load Bearing Springs | 6. Snubber Springs |
| 7. Friction Shoe Wedge | 8. Spring Plank | 9. Bolster |
| 10. Side Bearer | 11. Centre Pivot | 12. Brake Beam |

**Figure 3: CASNUB Bogie – General Arrangement
(CASNUB 22W Bogie)**

1.4 The salient features of CASNUB Bogie:-

SN	Feature	Description
1	Gauge	1676 mm
2	Axle load	20.3 t, However all bogies except CASNUB 22HS can be upgraded up to 22.9 t
3	Wheel diameter	<ul style="list-style-type: none"> • 1000 mm (New) • 956 mm (New) for Retrofitted CASNUB 22 W • 906 mm (Condemn) for all types.
4	Wheel base	2000mm (+/- 5mm)
5	Type of Axle Bearing	Standard AAR Tapered Cartridge Bearing Class E suitable for 144.5 x 277.8 mm wide jaw or narrow jaw as per different variants.
6	Distance between journal centres	2260 mm
7	Distance between side bearers	1474 mm
8	Type of side bearers	<ul style="list-style-type: none"> • <u>Retrofitted CASNUB 22W, CASNUB 22W(M), 22NL, 22NLB</u>:- Constant contact type (Metal bonded rubber pad, housed inside side bearer housing) • <u>CASNUB 22HS</u>: Spring loaded constant contact type side bearer.
9	Type of pivot	<ul style="list-style-type: none"> • <u>CASNUB 22W</u>:- IRS Type Top Pivot - RDSO Drg. No. W/BE-601 Bottom Pivot– RDSO Drg. No. W/BE-602 or similar mating profile integrally cast with bolster. • <u>CASNUB 22W(M), 22NL, 22NLB, 22 HS</u> :- Spherical Type to RDSO Drg. No. WD-85079-S/2
10	Pivot pin	<ul style="list-style-type: none"> • <u>CASNUB 22 W, WR</u> : Head less pin • <u>CASNUB 22WM</u> : Castle nut pin • <u>CASNUB 22NL, WM</u> : Shackle type with 173mm height • <u>CASNUB 22NLM, NLB & HS</u> : Shackle type with 149mm height
11	Anti rotation features	Anti rotation lugs have been provided between bogie bolster and side frame

12	Type of brake beams	<ul style="list-style-type: none"> • <u>CASNUB 22W, 22NL, 22NLB, 22 HS</u>: Unit type fabricated brake beam supported and guided in the brake beam pockets. • <u>CASNUB 22W(M)</u> : Unit Type Cast Steel brake Beam suspended by hangers from side frame bracket.
13	Suspension details.	Long travel helical spring
14	Speed Potential/limit.	90 Kmph for all types except CASNUB 22 HS which is 100 Kmph. Operating speed is governed by type of wagon, in empty or in loaded condition and axle load.

2.0 Adapter, Elastomeric Pad, Retainer Bolt and Side Frame Key Assembly

2.1 Adapter

Adapter is to be thoroughly inspected for soundness and wear. Wear at Thrust shoulder, Adapter bore (bearing seat), Adapter crown lugs, Adapter crown seat, Adapter side lugs and Adapter sides is to be checked by corresponding gauges. Wear limits are given in Table 4

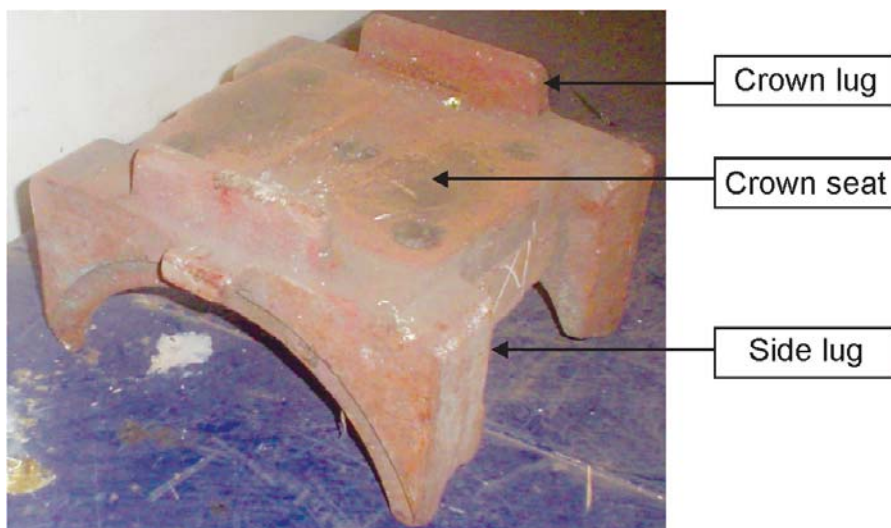


Figure 4: Adapter

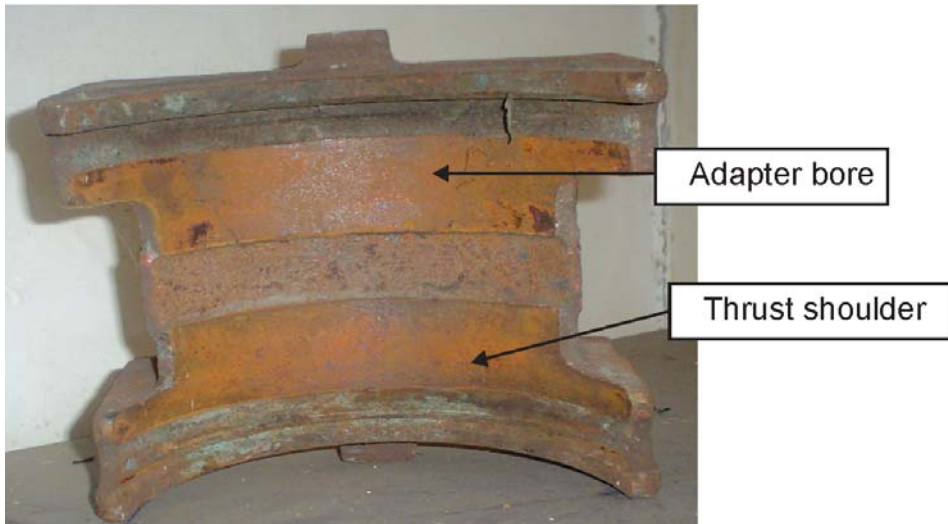


Figure : 5 Adapter

Defects in Adapter:

- i. Check for crack, twist or distortion.
- ii. Check for soundness and wear.

2.2 Elastomeric Pad (EM Pad)

Elastomeric pads are provided in all versions of CASNUB bogie except CASNUB 22W. The main purpose of providing elastomeric pad is to reduce wheel flange wear.

Defects in Elastomeric pads

(to 95005-S/4, Wd-92058-S/8 (for HS) & WD-95005-S-1) :-

- i. If the top of the bottom plates show any crack in service.
- ii. If any crack of more than 50 mm is developed at any surface of rubber.
- iii. If a bond failure giving way more than 40 mm in any direction is developed in service.
- iv. If any sign of crushing of rubber is noticed.
- v. When in free condition, the pad has taken a permanent set of the order given in Table 4.



Figure 6: Elastomeric Pad

2.3 Retainer Bolt

Adapter retainer bolt of design WA/WL-4902/WD-89025-S/1 is provided in CASNUB 22W(M) bogie having wheel set with wide jaw adapter and cartridge roller bearing as shown in figure below.



Figure 7: Retainer Bolt

2.4 Side Frame Key

In order to hold the wheel set in position during the derailment, side frame key is provided. It is fitted from bottom of jaw as shown in figure below.

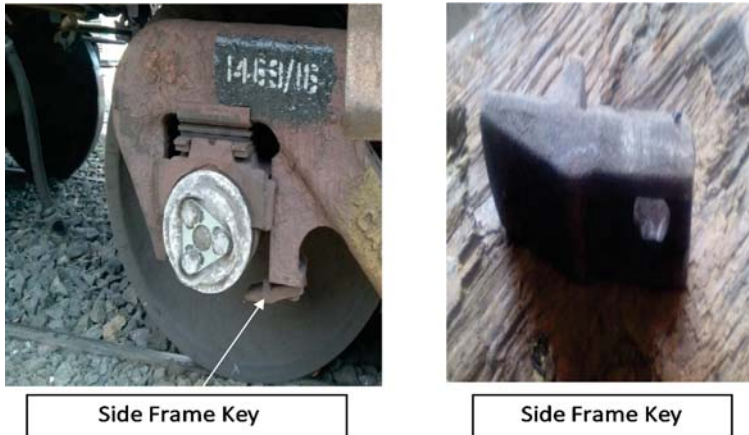


Figure 8: Side Frame Key Arrangement

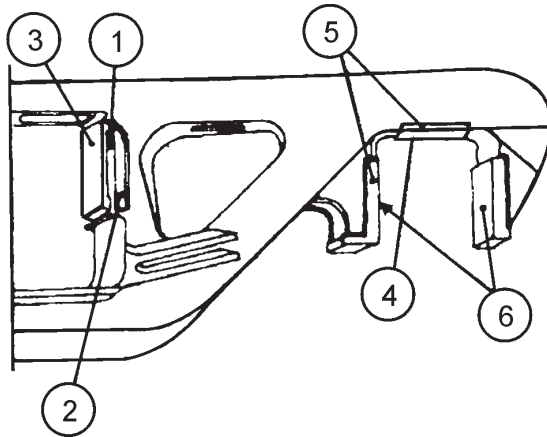
3.0 Side Frames with Friction Plates

Wearing surfaces of side frame are shown in Figure 10. The wear limits are given in Table 4. Side frame column has been provided with 10 mm thickness Silico Manganese Steel wear liners to IS: 3885 Pt.-I Gr. IV welded on the columns. It must be ensured that the liners permitted in service up to a thickness of 6 mm only. Photograph showing Side Frame and Spring Plank arrangement is as shown in Figure 9.

Amount of wear on the outside and inside of the Side frame Column Sides is determined by placing the gauge centrally and inserting shims of appropriate thickness.



Figure 9: Side Frame and Spring Plank.



- | | | |
|----------------------------|---|-------------------------------|
| 1. Side frame column sides | 2. Anti-rotation lugs | 3. Side frame friction liners |
| 4. Pedestal crown roof | 5. Pedestal crown side and pedestal sides | |
| 6. Pedestal jaw | | |

Figure10: Locations of wear on side frame

In a similar manner, wear of Pedestal Crown Roof, Pedestal Crown Side and Sides of Pedestal and Pedestal Jaw is determined by use of appropriate gauges and shims. Side frame should be checked for its wheel base (distance between centre lines of the jaw openings) and ensure whether the correct button marking is left on the side frame.

Defects in Side Frame:

- i. Side Frame cracked/broken/bent /corroded.
- ii. Side frame friction liner crack/thin.
- iii. Pocket liner crack/thin.
- iv. Check if there is any difference between the numbers of buttons on the two-side frames of a bogie.

4.0 Bolster with Wear Liners

Cast iron floating bolster, nested springs, spring plank and friction wedge assembly forms the secondary suspension system. Load transmission takes place from the wagon to side frames through bolster. Photograph of Bolster is as shown in Figure 11 and various surfaces are as shown in Figure 12.

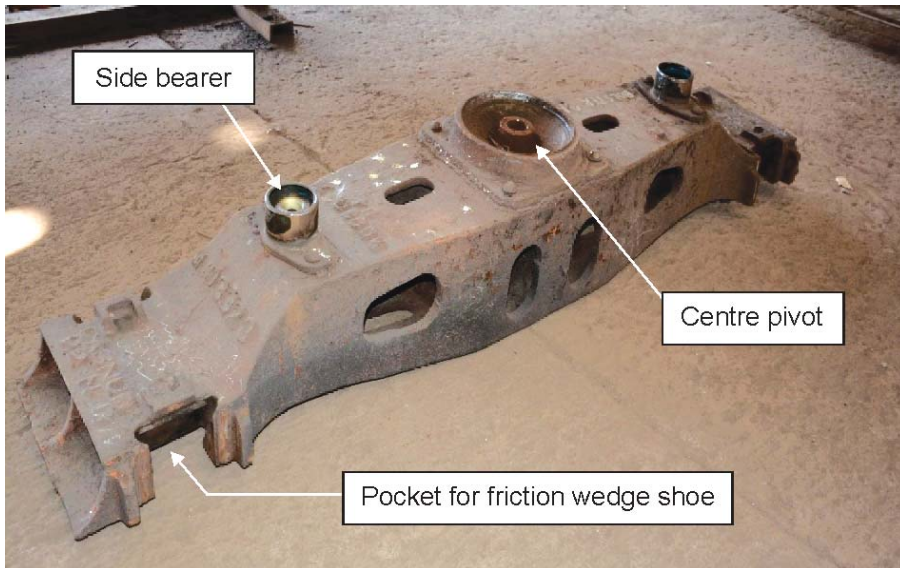


Figure 11: Bolster



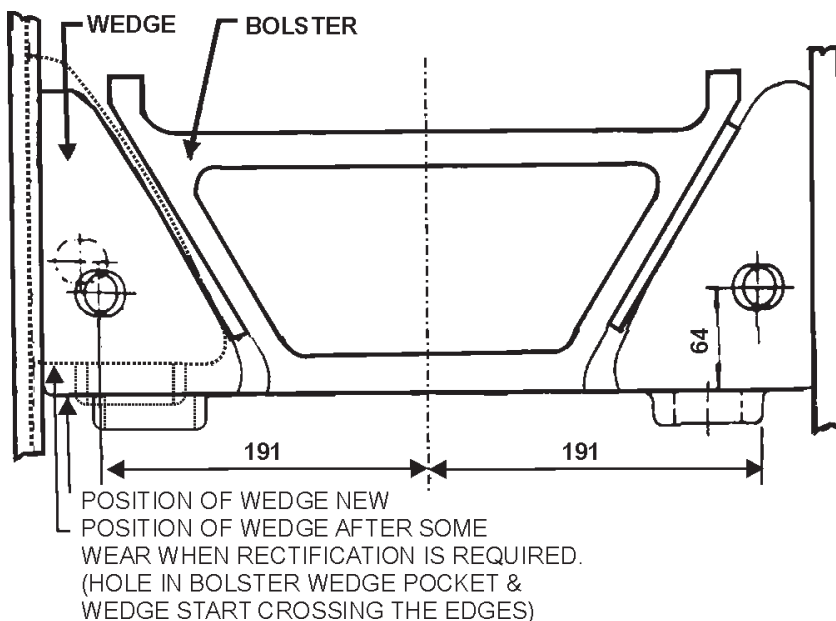
Figure 12: Bolster Pocket for Friction Wedge Shoe

Bolster pocket has been provided with 8 mm thick Silico Manganese Steel Liners welded with pocket slope. The liners may be permitted in service up to a thickness of 3 mm. No paint or grease should be applied on the plate.

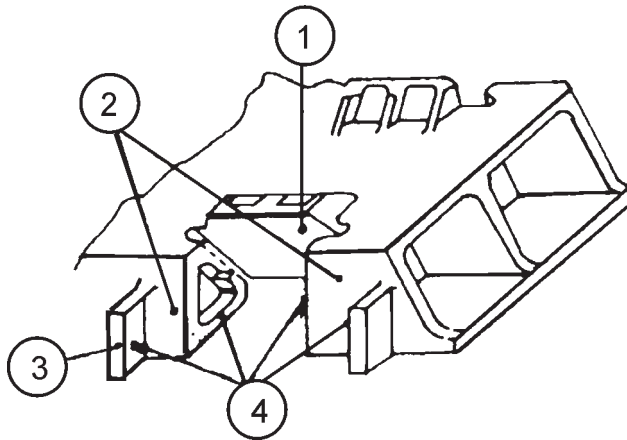
The wearing surfaces of the bolster are shown in Figure 13 and 14. The wearing surfaces are Bolster pocket, Bolster Land Surface and Rotation Stop Lug and Bolster Column Gibs. The wear limits are given in Table 4. Excess wear affects the damping mechanism and may cause resonance due to oscillations. Some bogie bolsters such as those of CASNUB 22NLB and 22HS bogies have been provided with 5 mm thick wear liners on land surfaces and the same are required to be replaced after 3 mm wear.

Defects in Bolster:

- i. Check combined wear of bolster side frame liners and wedges
- ii. Check condition of bolster pocket slope surface liner.
- iii. Bolster cracked/broken



**Figure 13: Friction Shoe Wedge Arrangement
(All Dimensions in mm)**



1. Bolster Pocket Slope Surface Liner
2. Bolster Land Surfaces
3. Rotation Stop Lugs/Liner
4. Bolster Columns Gib (Inner and Outer)

Figure 14 : Locations to be reclaimed

5.0 Spring Plank, Fit Bolts and Rivets

Spring plank is a member made of solid steel (flanging quality). It joins two side frames of CASNUB bogie by eight 24 dia rivets and four M24 fit bolts to keep bogie frame square (Figure 9). Two cast steel frames are held in square position by spring plank plates, fit bolts and rivets. Main helical springs are resting on spring plank. It transfers the loads from bolster to cast steel side frame. Spring plank provides rigidity to bogie frame.

If cast steel side frames are not held in square position, then axle's longitudinal axis is not at right angle to the track, causing persistent positive angular run as a consequence of which the derailment may occur.

Defects in Spring Plank:

- i. Spring plank broken, cracked or bent.
- ii. Loosening of rivets/bolts, welding failure of spring spigot etc.
- iii. Lack of squareness of the two cast iron frames.

6.0 Load Bearing Springs and Snubber Springs

The bogies are fitted with two groups of long travel helical spring nests. The spring details are shown in WD-83069-S/1 (Common for all versions except CASNUB-22HS Bogie). The spring details of CASNUB 22HS are shown in WD-92058-S/5. Figures 15 and 16 shows the group of springs provided at secondary suspension.

These springs are provided to transfer the load from the bolster to side frame. Bogie during movement on the track may have to pass through track irregularities causing more impact load. Moreover rocker action of bogie due to twist in the track can be avoided by providing springs.

Excessive variation in the height of springs within the same group would result in unequal load on springs, resulting in Off-loading, adversely affecting safety. Spring is condemned on the basis of free height.

Table 1: Nominal and condemning Free Heights

Type of Bogies	Spring Location	Free Height (Nominal) (mm)	Recommended Free Height(Condemning) (mm)
All	Outer	260	245
versions	Inner	262	247
except CASNUB 22 HS	Snubber	294	279
CASNUB	Outer	260	245
22 HS	Inner	243	228
	Snubber	293	278

Defects in Springs:

- Any coiled bearing spring cracked, broken or twisted
- Free heights of all the springs should be within tolerance of + /- 3 mm.
- Spring should be subjected to scrag test and load deflection test.
- Pairing of springs should be same.
- Mixing of old and new springs to be avoided.

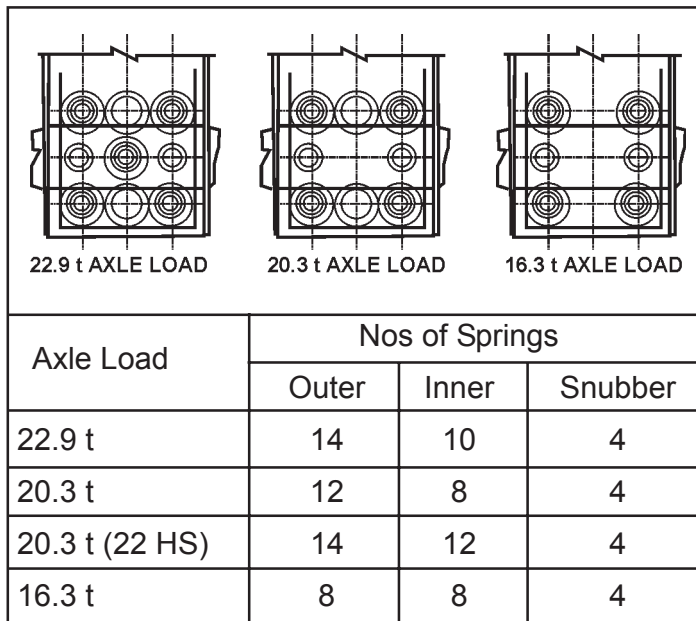
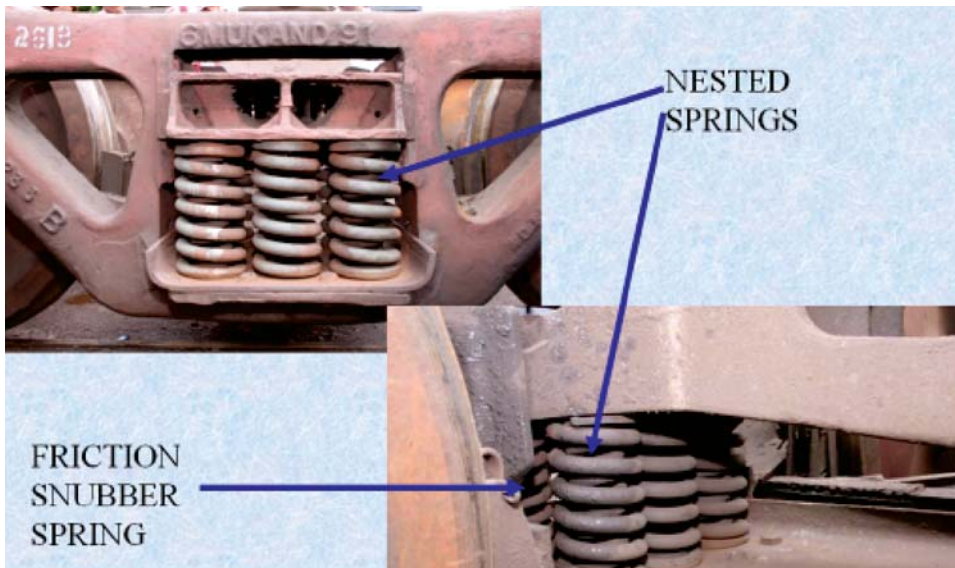


Figure 15 : Details of Spring Group Arrangement



Figure 16: Arrangement of Spring



**Figure 17: Load Bearing and Snubber Springs
(Secondary Suspension)**

7.0 Damping System: Friction Shoe Wedges and Snubber Springs

The suspension is provided with load proportional friction damping arrangement with the help of manganese steel cast wedge supported on the snubber springs. Friction shoe wedges are fitted on snubber springs. The arrangement is shown in Figure 13. Vertical surface of the wedge is in contact with side frame and slope surface is in contact with bolster pocket liners. The dimensions are such that the snubber spring is under compression and, in turn, it presses the wedge upwards. This results in normal forces at both vertical and sloping surfaces. Relative movement due to oscillation generates friction at these surfaces, which causes damping. Increased wagon load results in increased compression of bearing springs. This increases compression of snubber spring as well, resulting in increased magnitude of frictional forces and higher damping.

Wear limits of friction shoe wedge on vertical surface/ slope surface and nominal / recommended condemning dimensions are given in Table 4. Extent of wear and need of reclamation can be assessed in the bogie in the assembled condition by observing the relative position of the hole in the bolster wedge pocket and the opening in the wedge (Figure 13).

Defects in the Assembly of Friction Shoe Wedges and Snubber Springs:

- i. Defective snubber spring.
- ii. Wedge cracked/broken.
- iii. Wear of bolster pocket slope surface liner in excess of 3mm.



Figure 18: Measurement of Vertical Wear of Friction Shoe Wedge

8.0 Centre Pivot Arrangement

Load from wagon is transferred to bolster through central pivot which is provided at the centre of bolster. Bogie rotates about central pivot when wagon negotiates a curve and turnout. Central pivot provides relative rotation of bogie frame in the horizontal plane of wagon which avoids development of flange forces causing persistent angular run. Braking and tractive forces are transferred to bogie through pivot pin.



Figure 19 : Centre Pivot Bottom



Figure 20: Centre Pivot Top

Hindrance to bogie rotation is an important defect to look for in the event of any bogie stock being involved in a derailment. During derailment of bogie stock it should always be checked to see defects which hinder the free bogie rotation.

To determine the seat wear, the gauge should be placed in position (Figure 22). Touching of the pivot surface (vertical wall top) with the surface on the gauge at any point indicates wear at that point. The gauge should be moved on the complete worn surface to be measured.

Wear of the vertical wall is checked by measuring the gap between the wall and the gauge in position. If a 9 mm thick shim in CASNUB 22W bogie (7 mm thick for other bogies) can be inserted for the full depth between the worn surface and the gauge at any point on the vertical wall of the bowl, it indicates wear of vertical wall.



Figure 21: Centre Pivot Gauge

Defects in Centre Pivot:

- i. Top/Bottom pivot cracked/broken
- ii. Excess uneven wear of hemispherical surface.
- iii. Lack of lubrication on mating surface.
- iv. Presence of any foreign material hindering free rotation of bogie.
- v. Any bent in pivot pin.

9.0 Side Bearer

Oscillations are developed due to unevenness of the track as a consequence of which bolster also oscillates. During oscillations, load is eccentric which is taken

by side bearers. Bogie while negotiating curve rotates about pivot pin, therefore side bearers provides for smooth rotation of bogie in horizontal plane. Different types of Side Bearers used are shown in Figure 22 and 23. Condemning of Side Bearers is decided based on its physical condition.

Defects in Side Bearers:

- i. Side bearer housing cracked/broken
- ii. Side bearer housing securing bolts/rivets worked out or improperly secured.
- iii. Shearing of rubber pads
- iv. Deformation of rubber pads/PU rings.
- v. Unequal wear of surface of side bearer
- vi. Side Bearer Rubber Pads to WD-85076-S/1 : Criteria for condemning the Rubber Pad is as mentioned in para 2.2 under “Defects in Elastomeric pads”



Figure 22: Side Bearer (Metal Bonded Rubber Pad)



Figure 23: Side Bearer (PU Type)

10. Bogie Brake Gear Assembly

On application of brakes, the brake pressure on the two wheels of an axle should be more or less equal; otherwise, the wheel which is braked less would tend to travel more, causing the axle to become angular. The axle would, thus, run persistently angular during the brake application.

Conditions which could cause the above situation to occur are:

- Brake block deficient,
- Incorrect centralization and adjustment of brake rigging and brake blocks,
- Uneven application of brake power and wear in gear,
- Uneven wear of brake blocks on the same axle.

The brake gear mainly consists of Brake Beam (with brake head and brake block assembly), equalizing levers, Push rod, End pull rod, Brake Beam hangers (in CASNUB 22W(M) bogies).

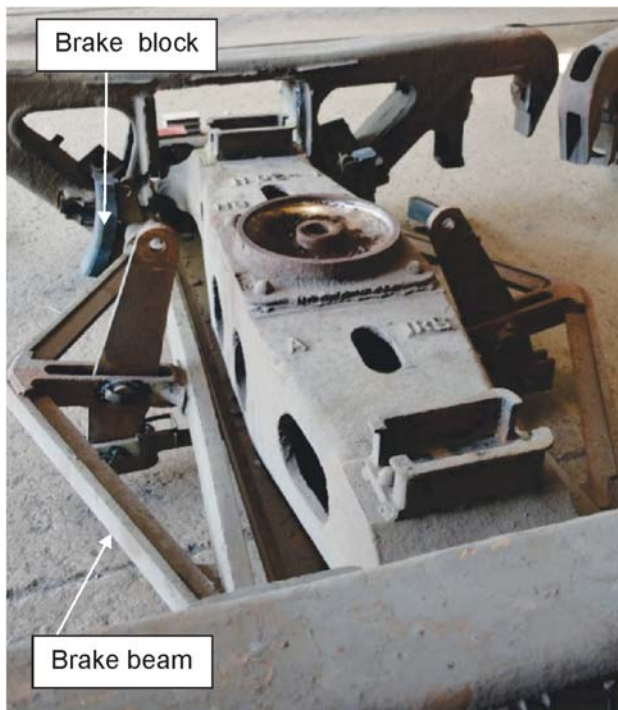


Figure 24: Brake Beam Assembly

Defects in Brake Gear Assembly:

- i. Check the weak and damaged brake shoe key, if any.
- ii. Brake block deficient (on wagons with operative brake cylinder) or thickness of brake block is less than 10 mm.
- iii. Any safety strap/bracket/hanger nut missing in accordance with para 2.12.1.4 of IRCA Part III.
- iv. Any pin deficient/broken or free to work out in the brake gear.
- v. Brake blocks worn-out/crack.
- vi. Brake block key missing or improper fitment.
- vii. Brake gear adjustment not according to wheel dia.
- viii. Condition of brake rig frame causing eccentric braking force.
- ix. Check wear on the pin diameter and bush inside diameter. The maximum permissible wear is limited to 1.5 mm.

- x. Check brake shoe wear. The brake shoes should be replaced when worn to 48 mm thickness i.e. when 10 mm metal is left from the base of the shoe.

11. Draw and Buffing Gear: Centre Buffer Coupler

(a) Buffer Height:



Figure 25: Measurement of Buffer Height

- Maximum buffer height = 1105 mm (In empty condition)
- Minimum buffer height = 1030 mm (In loaded condition)
- For checking irregular loading:
 - Maximum permitted buffer height difference with adjacent wagon is 75mm
 - Flange of any wheel should not be within 25mm of bottom of vehicle.

(b) Buffer Projection (Distance Between Striker Casting & Shoulder of CBC)

Standard	108mm
Maximum	133mm
Minimum	83mm

Causes for low height buffer:

- i. Over loading
- ii. Uneven loading
- iii. Weak or defective springs
- iv. Less dia of wheel

Defects in CBC

- i. Knuckle pin broken, bent or incorrect size and its improper fastening arrangement.
- ii. Body visibly cracked or with any part broken off and/ or missing.
- iii. Yoke pin support plate missing, broken or its wear plate worn out.
- iv. Shank cracked or bent or out of alignment.
- v. Cracks in knuckle side wall/broken knuckle.
- vi. Coupler operating mechanism not working properly.

12.1 Wheel Set and Axle Box with Cartridge Bearing

Wheel diameter for new wheel is 1000 mm. However, for CASNUB 22W (retrofitted), maximum permissible wheel diameter is 956 mm. Condemning wheel dia is 906 mm for all versions but with suitable packing.

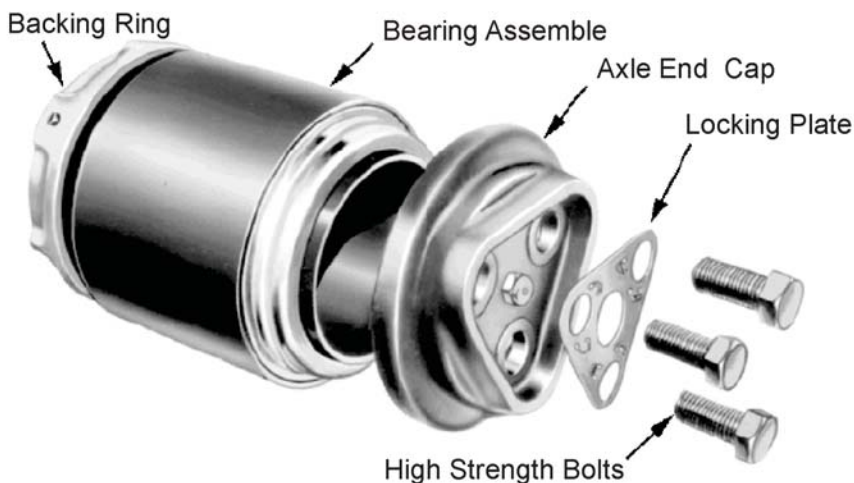


Figure 26: Axle Box



Figure 27: Cartridge Bearing

Axle box consists of cartridge tapered bearings. Axle bearings are provided for free rotation of axles. Axle bearings should be in good condition. If anyone axle box of axle is not working well, it causes persistent positive angular run of axle which may finally leads to derailment. The wear limits are given in Table 4.

Defects in Cartridge Bearings:

- i. Bearing running hot/hot axle.
- ii. Bearing jammed/giving abnormal sound of broken cage or roller
- iii. Outer cup broken or cracked, causing leakage of grease
- iv. Front/Rear seal leakage or seal damaged or leakage of grease on any account
- v. End cap screw loose or locking plate missing or tabs of locking plate not properly bent against the face of cap screw head
- vi. Missing side frame key or adapter retaining bolts
- vii. Cracked or broken axle box
- viii. Axle cap screw loose or locking plate tabs not properly bent against the axle cap screw face
- ix. Condition of bearing inside Axle bearing, defects (if any) causing hindrance to free rotation of wheel set.

12.2 Wheel Defects



Figure 28.1 : Tyre Defect Gauge

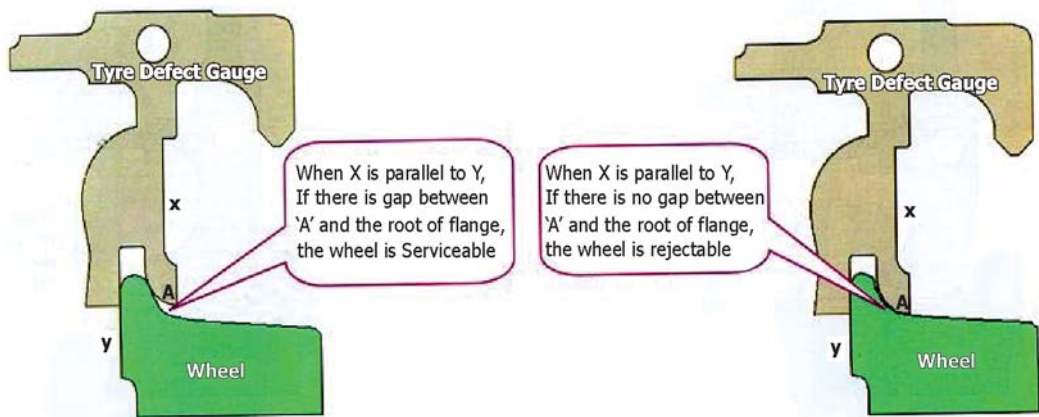


Figure 28.2 : (i) Thin flange

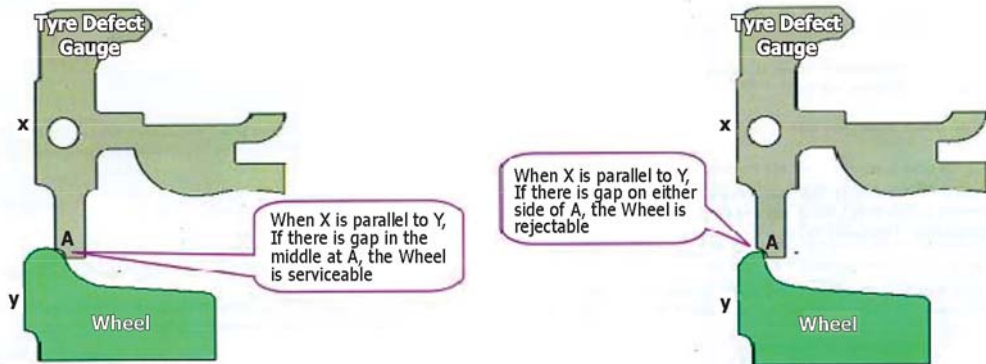


Figure 28.3 : (ii) Sharp flange

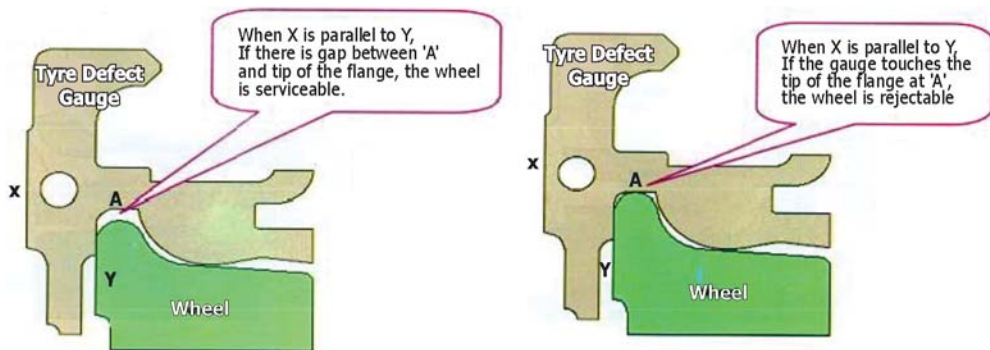


Figure 28.4 : (iii) Deep flange

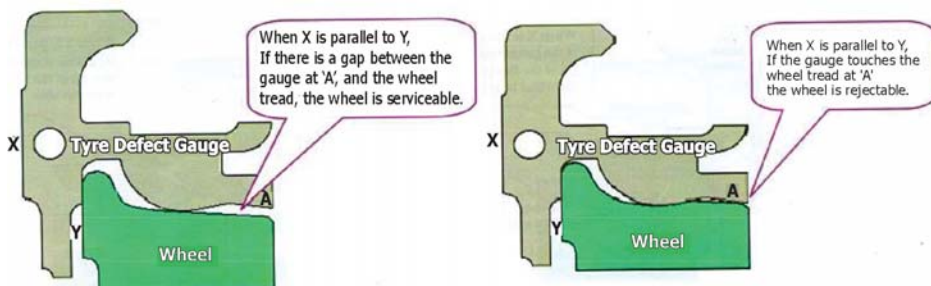


Figure 28.5 : (iv) Hollow Tyre / False Flange

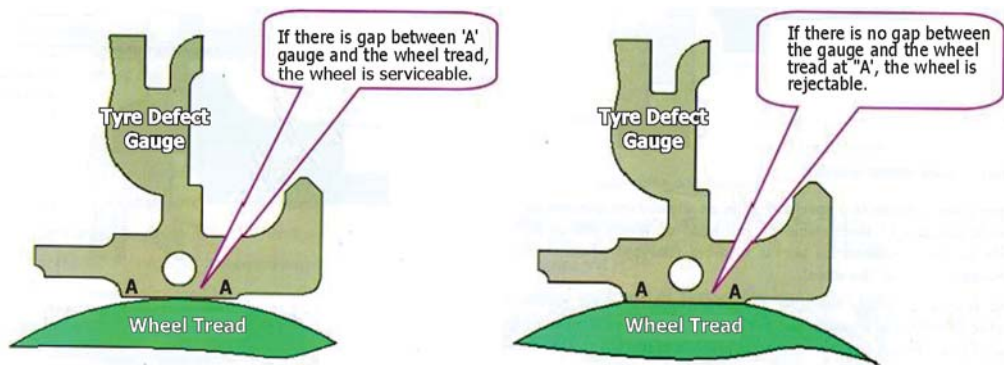


Figure 28.6 : (v) Flat Tyre

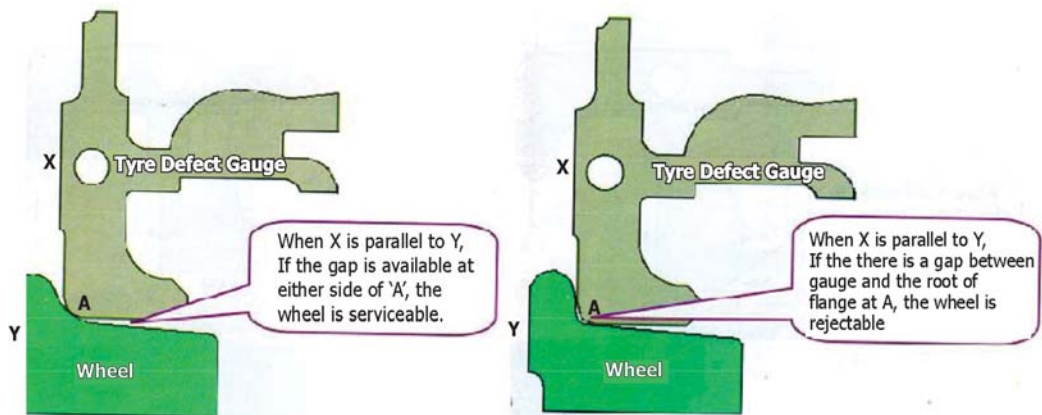


Figure 28.7 : (vi) Worn Root

Table 2 : (a) Wheel Tread Defects

Wheel Defects	Causes
(i) Thin Flange	<p>When the flange thickness reduces from 28.5mm (New) to less than 16 mm (Condemn), then the flange is called thin flange. Flange thickness is measured at a depth of 13 mm from the tip of the flange.</p> <p>Repercussion: - Thin flange requires greater flange-way gap which may not be available resulting in possibility of damage to the tongue rail.</p>
(ii) Sharp Flange	When the radius given at the tip of flange is worn out from

Wheel Defects	Causes
	<p>14.5mm (New) to less than 5 mm (Condemn) is called Sharp Flange.</p> <p>Repercussion: - Chances of bursting of point due to entering of sharp flange between Tongue rail and stock rail.</p>
(iii) Deep Flange	<p>The New height of the flange is 28.5mm, when it increases to greater than 35mm is called Deep Flange</p> <p>Repercussion: - Shearing of fish plate bolts at rail joints.</p>
(iv) Hollow Tyre/ False Flange	<p>When the projection of outer edge of the wheel tread below the hollow of tyre exceeds 5mm then the worn tread is called Hollow Tyre and outer edge of wheel is called False Flange</p> <p>Repercussion: - A False Flange may split open points while travelling in trailing direction as the False Flange may tend to get wedged in between the tongue and the stock rail. Wheel with the false flange may also mount on nose of crossing in facing direction.</p>
(v) Flat Tyre	<p>Flatness on wheel circumference is called Flat Tyre. For Goods Stock it is allowed up to 60 mm</p> <p>Repercussion: - Chances of rail fracture due to hammering effect on rail.</p>
(vi) Worn Root	<p>New Radius of flange at the root is 16R, when it is reduced to less than 13R, the condition is called as Worn Root.</p> <p>Repercussion: - Excessive lateral play result in chances of mounting of flange over rail.</p>

-Wheel Sets should be free from defects such as Wheel shifted on axle, Tyre loose, cracked or broken. Wheel should also be free from defects such as crack in web portion, thermal crack and shelling on tread surface, spread Rim.

(b) Wheel Gauge:

There should be no variation in the values of wheel gauge -measured at four points 90 degrees apart on a wheel set. However, the actual value of the wheel gauge can vary as per tolerances given in Table (IRCA Part III Para. 2.8.7)

Standard	1600mm
Maximum	1602mm
Minimum	1599mm

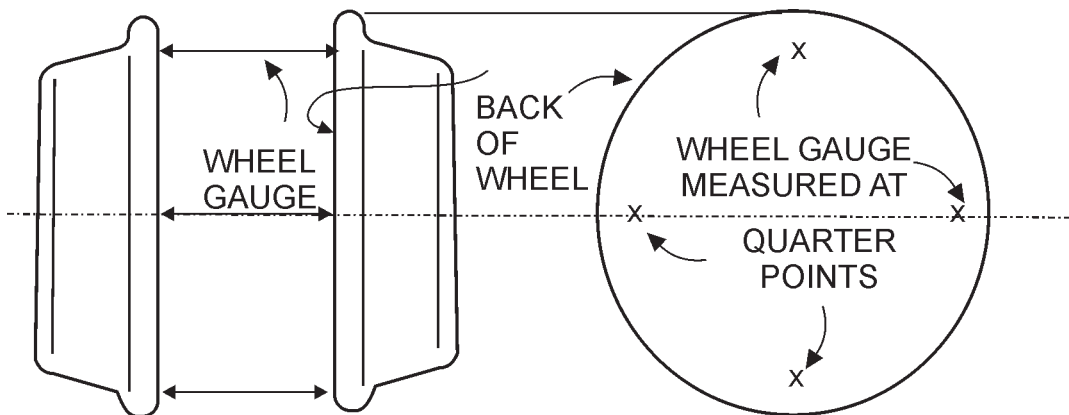


Figure 29: Wheel Gauge

Measurement of Wheel Gauge and recorded duly indicating the following:

- Tightness or slackness of gauge
- Whether any indication exists about shifting of wheel on the axle.

Note: It must be ensured that the back surfaces of wheels are cleaned thoroughly before measuring the wheel gauge in order to avoid erroneous readings.

- If the wheel gauge is more than permissible limit, there exists a possibility of a relatively newer wheel hitting the nose of crossing.
- If the wheel gauge is less than minimum value, there is a possibility of wheel hitting at the back of a tongue rail while passing through the switch and thus damaging the tongue rail.
- Wheel gauge to be checked in no load condition.

(c) Bent Axle:

A bent axle starts wobbling during motion causing severe vibrations. In order to confirm whether an axle is bent or not, it must be checked carefully on a sensitive machine or measuring table.

(d) Wheel Diameter on Tread.

Wheel diameter is measured on the tread at a distance of 63.5 mm from the inside face of the wheel. Two measurements 180 degrees apart should be taken for each wheel.

Same axle	Same bogie	Same Wagon
0.5mm	13mm	25 mm

Note: Variation in tread diameter on the same axle as specified is at the time of tyre turning. Effect on safety of any variation beyond this limit should be analysed on case to case basis.

13.0 Bogie Clearances

Lateral and Longitudinal clearances between the Adapter and Side Frame and between Side Frame and Bolster are very important from maintenance point of view (curve negotiability and rail/ wheel wear) as well as for safety (lateral forces and angularity).

Values of Nominal Clearances are given in Table 3. Maximum value of these Clearances would be worked out considering the Limit of wear of the relevant surfaces, as specified in Table 4. The Clearances should be measured using a Feeler Gauge.



Figure 30 : Longitudinal and Lateral Clearance between Side Frame and Bolster

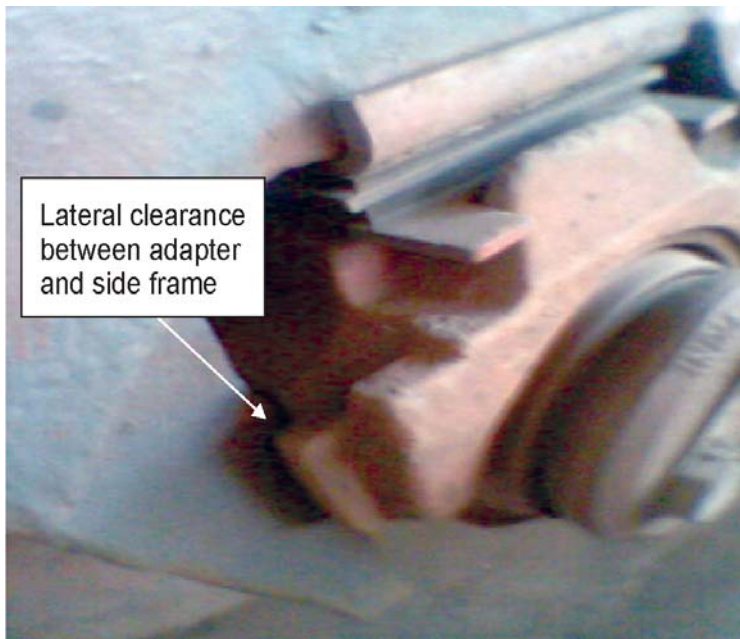


Figure 31: Lateral clearance between Adapter and Side Frame



Figure 32 : Longitudinal clearance between Adapter and Side Frame

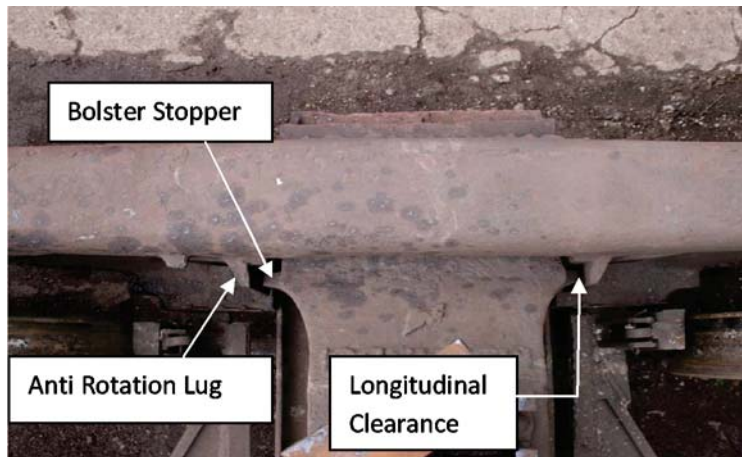


Figure 33: Longitudinal Clearance between Anti-Rotation Lug and Bolster

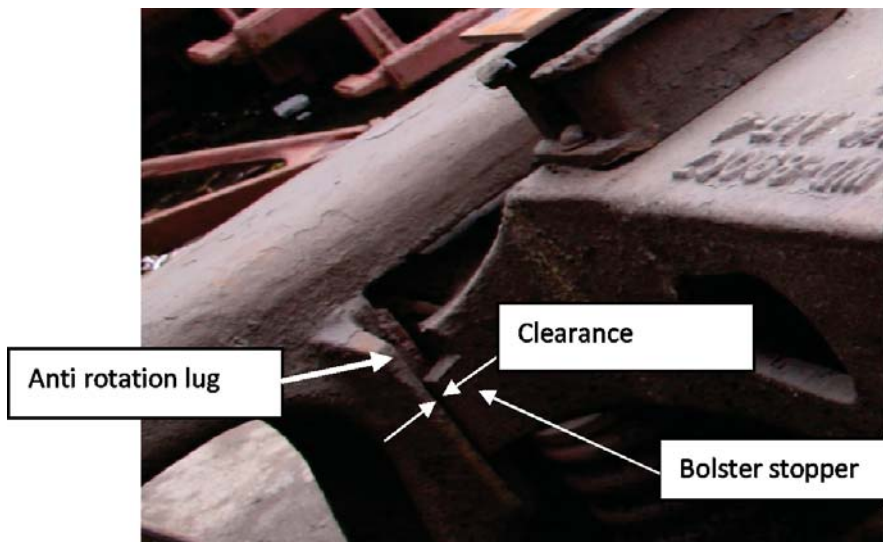


Figure 34 : Longitudinal Clearance between Anti-Rotation Lug and Bolster

**Table 3: NOMINAL CLEARANCES
(Dimensions in mm)**

The nominal clearances and the tolerances of the bogie assembly are given below.

SN	Description	Type of CASNUB Bogie			
		22W & 22W(Retro)	22W(M)	22NL, NLB	22HS
1	Lateral clearance between side frame & bolster	18	18	18	25
2	Lateral clearance between side frame & adapter	25	25	16	16
3	Longitudinal clearance between side frame & adapter	2	10	9	9
4	Longitudinal clearance between side frame & bolster	6	6	6	6
5	Longitudinal clearance between anti-rotation lug & Bolster	4	4	4	4

**Table 4: Wear Limits for Bogie Components
(Dimensions in mm)**

Sr. No	Description	New or renewed	Worn	Wear limit
1	AXLE BOX			
	Axle Box Crown lugs (Cylindrical Roller Bearings)	159	167	4
	Axle Box Crown seat (Cylindrical Roller bearings)	36.5	33	3.5
	Axle Box Side lugs (Cylindrical Roller bearings)	130	136	3
	Axle Box Sides (Cylindrical Roller bearings)	268	262	3
2	ADAPTER			
	Adapter Crown lugs (Wide Jaw)	156	164	4

Sr. No	Description	New or renewed	Worn	Wear limit
	Adapter Crown lugs (Narrow Jaw)	155.5	163.5	4
	Adapter Crown seat	3.5		
	Adapter bore seat to crown seat			
	Wide jaw adapter	48.5	45	3.5
	Modified wide jaw adapter	25.5	22	3.5
	Narrow jaw adapter	26.2	22.7	3.5
	Adapter side Lugs			
	Wide Jaw	130	136	3
	Narrow Jaw Adapter sides	97	103	3
	Wide Jaw	268	262	3
	Narrow Jaw	181	175	3
3	Side Frames			
	Side frame wear friction plate	10	6	4
	Side frame column sides	216	206	10
	Side frame and rotation lug	522	528	6
4	Pedestal Crown roof			
	Key Seat to pedestal Crown:			
	Roof 22W	273	278	5
	Roof 22W(M)	318	323	5
	Roof 22NL/NLB/HS	323	328	5
5	Pedestal Crown sides and Sides of the pedestal			
	All Bogies – Crown Sides	152	144	4
	Pedestal Sides 22W,22W(M)	105	101	2
	Pedestal sides 22NL,NLB,HS	81	77	2
6	Distance between Outer & Inner Pedestal Jaw of CASNUB Bogies			
	22W & 22W(Retrofitted)	270	278	4
	22W(M)	278	286	4
	Pedestal Jaw (Short) for 22NL/NLB/HS	190	198	4
	Pedestal Jaw(Long)for 22NL/NLB/HS	236	244	44

Sr. No	Description	New or renewed	Worn	Wear limit
7	BOLSTER			
	Pocket	35 degree on slope		
	Liner	8	3	5
	Bolster land surface	444	438	3
	Rotation stop lug	518	512	3
8	BOLSTER			
	Outer gib	234/241	244/251	5
	Inner gib	136	146	5
9	Centre Pivot			
	Wear limit vertical side			
	CASNUB 22W	-	-	5.5
	Others	-	-	4
10	SEAT			
	CASNUB 22W	-	-	4
	Others	-	-	4
11	FRICTION SHOE WEDGE BLOCK			
	Vertical surface from			
	Centre line of spigot	61	54	7
	Slope surface by gauge	-	-	3
12	ELASTOMERIC PADS			
	Type of pad	Nominal Dimension	Dimension after Permanent set	
	Elastomeric pad	46	42	
	Side bearer rubber pad	114	109	

14.0 Check-List of Important Items for Derailment Investigation

SN	Item of Inspection	Measurement Equipment/ Method	Permitted Range/Condition to be observed
1	Adapter	Visual Inspection/ Adapter gauges	<ul style="list-style-type: none"> • Check the adapter for crack, twist or distortion • Check for soundness and wear.
2	Elastomeric Pad	Visual Inspection steel rule of sufficient length	<ul style="list-style-type: none"> • If the top of the bottom plates show any crack in service. • If any crack of more than 50 mm is developed at any surface of rubber. • If a bond failure giving way more than 40 mm in any direction is developed in service. • If any sign of crushing of rubber is noticed. • When in free condition, the pad has taken a permanent set of the order given in Table 4.
3	Side Frame	Visual Inspection/ Side Frame Gauges	<ul style="list-style-type: none"> • Side Frame cracked/broken/bent /corroded. • Side frame friction liner crack/thin. • Pocket liner crack/thin. • Side frame should be checked for its wheel base (distance between centre lines of the jaw openings) and ensure whether the correct button marking is left on the side frame. • Check if there is any difference between the numbers of buttons on the two-side frames of a bogie.
4	Bolster	Visual Inspection / Bolster Gauges	<ul style="list-style-type: none"> • Check combined wear of bolster side frame liners and wedges • Check condition of bolster pocket slope surface liner. • Bolster cracked/broken
5	Spring Plank	Visual Inspection	<ul style="list-style-type: none"> • Spring plank broken, cracked or bent. • Loosening of rivets/bolts, welding failure of spring spigot etc. • Lack of squareness of the two cast iron frames.

SN	Item of Inspection	Measurement Equipment/ Method	Permitted Range/Condition to be observed
6	Springs	Visual Inspection/ Measuring with Height Gauge/Go No Go Gauge.	<ul style="list-style-type: none"> • No Broken/ weak springs permitted • Free height of all springs should be within the tolerance of +/-3mm • Groups of spring: All the springs should be from the same category (A, B, C). • Mixing of old and new springs not allowed
7	Friction Shoe Wedges and Snubber Springs	Visual Inspection/ Measuring with Height Gauge/Go No Go Gauge.	<ul style="list-style-type: none"> • Defective snubber spring • Wedge cracked/broken • Wear of bolster pocket slope surface liner in excess of 3mm
8	Centre Pivot	Visual Inspection/ Centre pivot gauge.	<ul style="list-style-type: none"> • Check the wear of the seat and sides of centre pivot using Centre Pivot gauge. • Check for uneven wear • Check for lack of lubrication in the pivot. • Check for bend in pivot pin.
9	Side Bearers	Visual Inspection / Steel rule	<ul style="list-style-type: none"> • Shearing of rubber pad in constant contact type. • Side bearer housing cracked/broken • Side bearer housing securing bolts/rivets worked out or improperly secured. • Deformation of rubber pads/PU rings. • Unequal wear of surface of side bearer • Side Bearer Rubber Pads to WD-85076-S/1 : Criteria for condemning the Rubber Pad is as mentioned in SN 2 above under Elastomeric pads

SN	Item of Inspection	Measurement Equipment/ Method	Permitted Range/Condition to be observed
10	Brake Gear Assembly	Visual Inspection	<ul style="list-style-type: none"> • Check the weak and damaged brake shoe key, if any. • Brake block deficient (on wagons with operative brake cylinder) or thickness of brake block is less than 10 mm. • Any safety strap/bracket/hanger nut missing in accordance with para 2.12.1.4 of IRCA part III • Any pin deficient/broken or free to work out in the brake gear • Brake blocks worn-out/crack or thickness of brake block less than 10 mm. • Brake block key missing or improper fitment • Brake gear adjustment not according to wheel dia. • Condition of brake rig frame causing eccentric braking force. • Check the wear on the pin diameter and bush inside diameter. The maximum permissible wear is limited to 1.5 mm. • The brake shoes should be replaced when worn to 48 mm thickness i.e. when 10 mm metal is left from the base of the shoe. (to be checked)
11	Buffer Height	Visual Inspection/ Buffer Height Gauge.	<ul style="list-style-type: none"> • Check that buffer bolts are tight and buffers are not drooping. • Buffer Height: <ul style="list-style-type: none"> - Minimum = 1030mm (under load) - Minimum=1090mm (under tare) - Maximum 1105mm (under tare) • Knuckle pin broken, bent or incorrect size and it's improper fastening arrangement. • Body visibly cracked or with any part broken off and/ or missing. • Yoke pin support plate missing, broken or its wear plate worn out. • Shank cracked or bent or out of alignment. • Cracks in knuckle side wall/broken knuckle. • Coupler operating mechanism not working properly.

SN	Item of Inspection	Measurement Equipment/ Method	Permitted Range/Condition to be observed
12	Cartridge Tapered Roller bearings	Visual Inspection	<ul style="list-style-type: none"> Feeling temperature of Axle Box for Hot Axle. (The temperature is more than 90degree centigrade the wheel set to be changed.) Check the condition of end cap and screws Check any end cap screws are missing. Check the condition of locking plates. Check for grease leakage Rotate the bearing manually to check the freeness of the rotation and un usual sound.
13	Wheel defects. (Thin Flange, Sharp Flange, Deep Flange, Hollow Tyre/False Flange, Flat Tyre, Worn s Root.)	Tyre Defect Gauge (Go No Go Gauge)	<p>Check wheel tyre profile with Tyre Defect Gauge as shown in Para 12.2:-</p> <ul style="list-style-type: none"> Thin Flange- Flange thickness reduces to less than 16mm. Sharp flange- Radius at flange tip reduces less than 5mm. Deep flange-Height of the flange becomes greater than 35mm. Hollow Tyre/False Flange- Projection of outer edge of the wheel tread below the hollow of tyre exceeds 5mm then the worn tread is called Hollow Tyre and outer edge of wheel is called False Flange. Flat Tyre- Flatness of wheel circumference more than 60mm. Worn Root: Root radius reduces less than 13mm.
14	Wheel Gauge	Wheel Gauge	<ul style="list-style-type: none"> Maximum =1602mm Minimum =1599mm No variation in the values of wheel gauge measured at four points 90 degrees apart on a wheel set.
15	Wheel Tread Diameter	Wheel Diameter Gauge	<ul style="list-style-type: none"> 1000mm (New) 956mm (New) for Retrofitted 906mm (Condemn) for all types
16	Difference in Wheel Tread Diameter	Wheel Diameter Gauge	<ul style="list-style-type: none"> On the same axle=0.5mm Same bogie=13mm Same wagon=25 mm

Item No.15.0 - Guidance for filling of accident proforma circulated vide Railway Board letter No.2018/Safety(A&R)/1/8 dated 25.01.2019, on "Revision and Standardization of Observation/ Measurement of Accident Investigation/Inquiry".

SN as per latest performa for Wagon	Item of Inspection	Measurement Instrument/method	Permitted Range/conditions to be observed.	Reference in this book.
2	Date of incident & time	As per actuals	As per actuals	-----
3	Train No	As per actuals	As per actuals	-----
4	Details of BPC along with the name of the station, where issued and engineer (C&W) who issued.	As per actuals	Maximum validity for CC rake is 7500 km or 35 days which ever is earlier, and for Premium Rake 12 + 3 days.	-----
5	Wagon No	As per actuals	As per actuals	-----
6	Type	As per actuals	As per actuals	-----
7	Mech Code	As per actuals	As per actuals	-----
8	Tare in tonnes	As per actuals	As per actuals	-----
9	Carrying capacity and axle load.	As per actuals	As per actuals	-----
10	Built date	As per actuals	As per actuals	-----
11	Return date	As per actuals	As per actuals	-----
12	POH Particulars-Date	As per actuals	Check for overdue POH. It is generally vary 3 years to 6 years depending upon type of wagons & its built date.	-----
13	POH Particulars-Shop	As per actuals	As per actuals	-----
14	ROH Particulars -Date	As per actuals	Check for overdue ROH. It is generally vary from 12 months to 24 months depending on the type of wagon & it's built date	-----

SN as per latest performance for Wagon	Item of Inspection	Measurement Instrument/method	Permitted Range/conditions to be observed.	Reference in this book.
15	ROH Particulars -Depot	As per actuals	As per actuals	-----
16	Pay load in Tonnes from labels	As per actuals	As per actuals	-----
17	Pay load in Tonnes from Actual weightment	As per actuals	Check for over loading (To be done at weigh bridge).	-----
18	Commodity loaded and remarks regarding uneven loading (Give sketch for details of uneven loading.)	As per actuals	As per actuals	-----
19	Station-from	As per actuals	As per actuals	-----
20	Station-to	As per actuals	As per actuals	-----
21	Position from Engine	As per actuals	As per actuals	-----
22	(i). Measure Buffer/ coupler height after uncoupling & re-railing on uncanted level track (ii)Record whether there is buffer entanglement (Yes/No) End 1L, End 1R, End 2L, End 2L, End 2R.	Buffer Height gauge/ Measuring tape	Visual observation Max buffer height-1105mm Min Buffer height-1030 mm	Page No.22 Item 11(a), Item 11 Page no. 38

SN as per latest performa for Wagon	Item of Inspection	Measurement Instrument/method	Permitted Range/conditions to be observed.	Reference in this book.
23	Wheel and axle face particulars in case of breakage of wheel/axle. Axle face particulars, in case of breakage of any axle/wheel. 1L-1R,2L-2R,3L-3R, 4L-4R	Visual observation	Actual conditions to be recorded	-----
24	Ultrasonic particulars on the hub of the disc in case of breakage of any axle/wheel 1L-1R,2L-2R,3L-3R, 4L-4R	Visual observation	Actual conditions to be recorded	-----
25	Stamping particulars on wheel disc regarding manufacturer RA/RD in case of breakage of any axle/wheel.1L-1R,2L-2R,3L-3R, 4L-4R	Visual observation	Actual conditions to be recorded	-----
26	Wheel Diameter (i)Measurement	Wheel Diameter gauge	New wheel Dia-1000mm New wheel Dia for Retro fitted CASNUB 22W-956 mm	Page No.4, Item1.4,SN.3
	(ii)Record whether below condemning size ((yes/No)	Wheel Diameter gauge	Condemning size-906mm for all types.	

SN as per latest performance for Wagon	Item of Inspection	Measurement Instrument/method	Permitted Range/conditions to be observed.	Reference in this book.
27	Wheel Gauge in mm (taken at three places) 1,2,3,4	Wheel Gauge	Max-1600+2 Min-1600-1	Page No.28 Item No.12.2(b)
28	Observation after measuring the profile with Tyre defect gauge (Good/ Rejectable) 1L-1R, 2L-2R, 3L-3R,4L-4R Thin flange, Sharp flange, Worn out root, Deep flange, Hollow tyre, Flat tyre.	Tyre Defect Gauge.	Check wheel tread profile with Tyre Defect Gauge.	Page No.25,26,27,28, Item No 12.2
29	Roller bearing (to be recorded in case of any abnormalities observed in roller bearings /Axle box.) - Condition of face cover plate.	Visual observation	Actual conditions to be recorded	Page No.23, Item 12.1
30	Roller bearing (to be recorded in case of any abnormalities observed in roller bearings /Axle box.) - Condition of locking plates and studs.	Visual inspection	Actual conditions to be recorded	Page No.23, item 12.1, item 12 Page No. 39

SN as per latest performance for Wagon	Item of Inspection	Measurement Instrument/method	Permitted Range/conditions to be observed.	Reference in this book.
31	Roller bearing (to be recorded in case of any abnormalities observed in Roller bearings /Axle box.) - Condition of Roller bearing and its components.	Visual inspection	Actual conditions to be recorded	Page No.23, Item 12.1 and Item 12 Page No. 39
32	Axle box (for IRS stocks/UIC) (To be recorded only when failure of plain bearing is involved as a cause)-Brass thickness in mm	NA	NA	NA
33	Axle box (for IRS stocks/UIC) (To be recorded only when failure of plain bearing is involved as a cause)-Condition of Box and brass	NA	NA	NA
34	Axle box (for IRS stocks/UIC) (To be recorded only when failure of plain bearing is involved as a cause)-Condition sole plates.	NA	NA	NA

SN as per latest performance for Wagon	Item of Inspection	Measurement Instrument/method	Permitted Range/conditions to be observed.	Reference in this book.
35	Axle box (for IRS stocks/UIC) (To be recorded only when failure of plain bearing is involved as a cause) -Condition of journals	NA	NA	NA
36	Axle box (for IRS stocks/UIC) (To be recorded only when failure of plain bearing is involved as a cause)-Clearance between brass and collar of journal in (mm)	NA	NA	NA
37	Axle guard (for IRS/UIC Stocks Lateral clearance between axle box and axle guard in mm	NA	NA	NA
38	Axle guard (for IRS/UIC Stocks. Whether axle guard can work clear of axle box	NA	NA	NA

SN as per latest performance for Wagon	Item of Inspection	Measurement Instrument/method	Permitted Range/conditions to be observed.	Reference in this book.
39	Axle guard (for IRS/UIC Stocks. Are the axle guard bent or otherwise damaged to prevent free movement of axle box	NA	NA	NA
40	Axle guard (for IRS/UIC Stocks. Remark regarding bridle bar	NA	NA	NA
41	Clearance for CASNUB bogie (Corresponding measurements to be taken for IRS/ UIC Bogie) Type of bogie		As per actuals	-----
42	Clearance for CASNUB bogie (Corresponding measurements to be taken for IRS/UIC Bogie -Lateral clearance between Side frame and Bolster in mm	Filler gauge	22W & 22W(Retro)-18 mm 22W(M) - 18 mm 22NL/ NLB - 18 mm 22HS - 25 mm	Page No.33. item 13.0, Table 3 S.No.1

SN as per latest performance for Wagon	Item of Inspection	Measurement Instrument/method	Permitted Range/conditions to be observed.	Reference in this book.
43	Clearance for CASNUB Bogie (Corresponding measurements to be taken for IRS/UIC Bogie -Lateral clearance between Side frame and Axle box adapter in mm	Filler gauge	22W & 22W(Retro)- 25 mm 22W(M) - 25 mm 22NL/ NLB - 16 mm 22HS - 16 mm	Page No.33 item 13.0, Table 3 S.No.2
44	Clearance for CASNUB Bogie (Corresponding measurements to be taken for IRS/ UIC Bogie) -Longitudinal clearance between Side frame and axle box adapter in mm	Filler gauge	22W & 22W(Retro)- 02 mm 22W(M) - 10 mm 22NL/ NLB - 09 mm 22HS - 09 mm	Page No.33 item 13.0, Table 3 S.No.3
45	Spring and spring gear- Any broken, cracked, missing /clearance of shackle and shackle pin and general condition. (For UIC/IRS)	NA	NA	NA
46	Spring and spring gear- Thickness of packing plate under spring seat in mm	NA	NA	NA

SN as per latest performance for Wagon	Item of Inspection	Measurement Instrument/method	Permitted Range/conditions to be observed.	Reference in this book.
47	Spring and spring gear- Remarks whether any spring eye touches sole bar (for Laminated spring only)	NA	NA	NA
48	Spring and spring gear- Condition of suspension springs, i.e. normal, broken/fresh, and old fractured or deformities occurred after derailment due to sudden impact	Visual observation measuring with Height Gauge/ Go-NoGo Gauge	Actual conditions to be recorded	Page No 13, item 6.0 and item 6 on Page No. 37
49	Camber of spring in mm after re-railing on a level uncanted track (For laminated springs only)	NA	NA	NA
50	Deflected height of coil spring after re-railing on level uncanted track (For CASNUB)	Steel measuring tape	As per actual measurement after re-railing.	-----
51	Condition of Elastomeric pad above adapter (For CASNUB)	Visual Inspection	Cracks in top/bottom plates, crack more than 50mm, developed on any surface of the rubber, Bond failure more than 40 mm, any sign of crushing of the rubber.	Page 6, item 2.2 and item 2 on Page No. 36

SN as per latest performance for Wagon	Item of Inspection	Measurement Instrument/method	Permitted Range/conditions to be observed.	Reference in this book.
52	Bogie -Condition of center pivot including Lubrication and wear (for CASNUB)	Visual inspection, Center pivot Gauge.	Top/ bottom pivot cracked /broken. Excess/uneven wear of hemispherical surface, lack of lubrication on mating surface, presence of any foreign material hindering free rotation of bogie, any bent in pivot pin.	Page No 18, item 8.0 and item No. 8 on Page No. 37
53	Bogie -Condition of Side bearer including Vertical clearance at side bearers. (For stock having clearance type side bearers only)	NA- Since constant contact type in CASNUB Bogie	NA	NA
54	Condition of friction snubber wedge Assembly (for CASNUB)	Visual inspection. Friction shoe wear gauge, measuring with Gauge/ Go-NoGo Gauge	Defective snubber spring, cracked/ broken wedge, wear of bolster pocket slope surface liner in excess of 3 mm	Page No.16, item.7.0 and item No. 7 on Page No. 37
55	Whether the load is placed on more than one wagon	As per actuals.	As per actuals	-----
56	Any other defect in vehicle which may have contributed to or caused the derailment.	As per actuals.	As per actuals.	-----

SN as per latest performance for Wagon	Item of Inspection	Measurement Instrument/method	Permitted Range/conditions to be observed.	Reference in this book.
57	Details of Broken parts giving location w.r.t point of mount and drop.	As per actuals.	As per actuals.	-----
58	List of damages to the wagon due to accident.	As per actuals.	As per actuals	-----
59	Other observations	As per actuals.	As per actuals.	

For any suggestions, errors etc, please contact

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Published by :
INDIAN RAILWAYS INSTITUTE OF CIVIL ENGINEERING, PUNE
11-A, South Main Road, Koregaon Park, Pune - 411001.

Price ₹ 60/-