Supervisors Training Centre,
South Central Railway

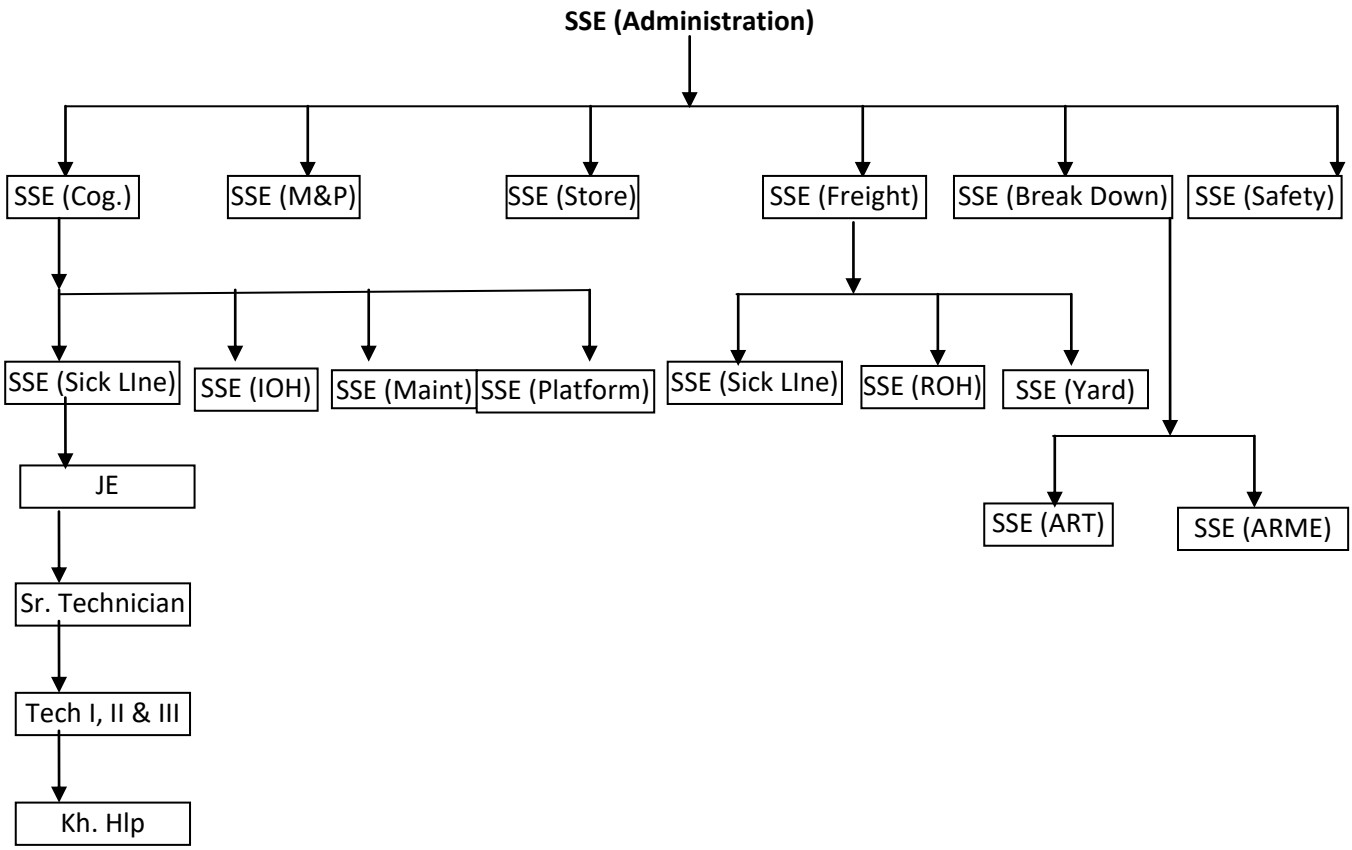
ISM-01

COACHING THEORY (MCT – 01)

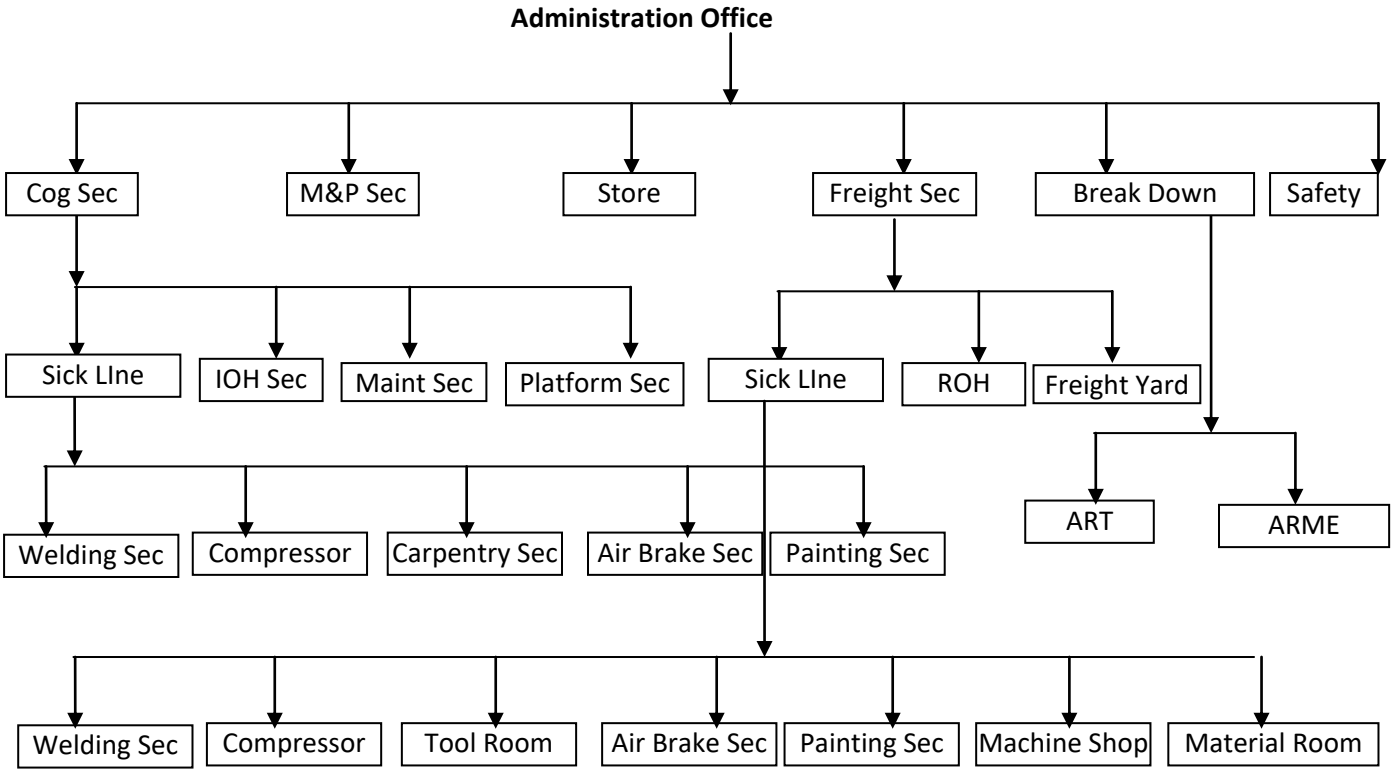
September 2017

INDEX

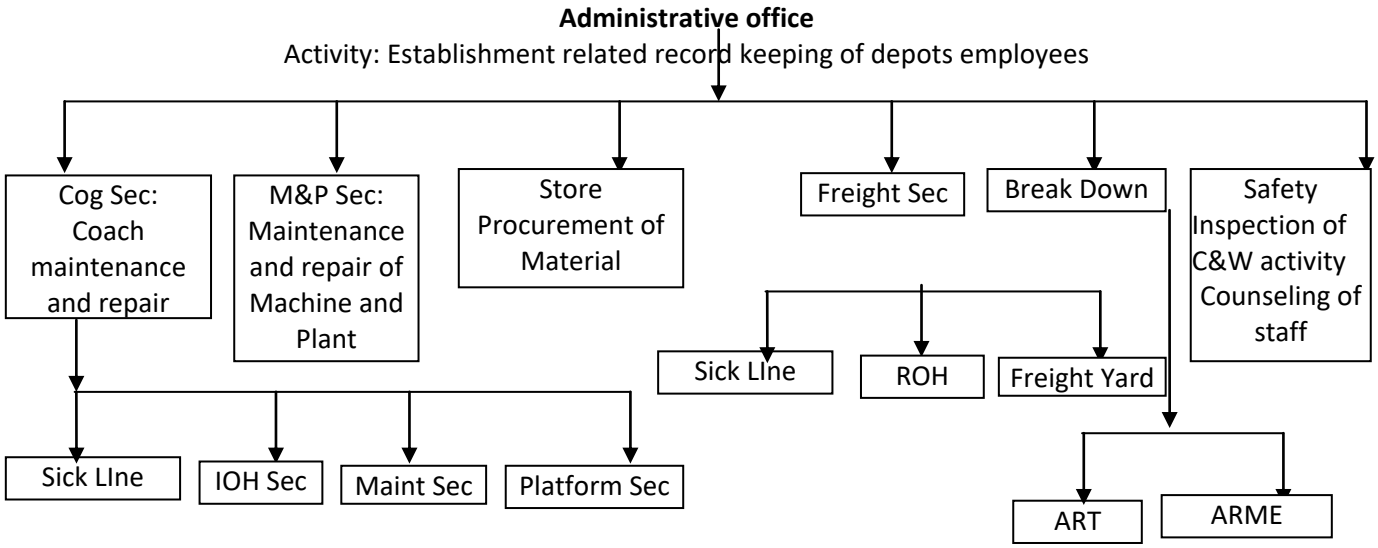
1. Overview of C&W Organization



1.1. Layout of C&W Depot



1.2. C&W depot activity section wise:



Coaching Section Activities
Sick Line Activity: Repair of unfit coaches
IOH section Activity: IOH of due / overdue coaches
Maintenance section Activity: Maintenance of primary / secondary depot based rakes.
Platform Activity:

1. Examination of through passing, terminating and origination trains.
2. Carriage watering of through passing trains
3. CTS of through passing trains
4. Trouble shooting of through passing trains
5. Any passenger complaints

Freight Section Activities
Sick Line Activity: Repair of unfit wagons
ROH section Activity: ROH of due / overdue wagons
Freight Yard Activity: Examination of freight trains (Intensive / CC / Premium)

Breakdown Section Activities
ART:

1. Maintenance of breakdown train including 140 T crane
2. Restoration work at site of accident

ARME:

1. Maintenance of Medical Van
2. Relief and Rescue operation at accident site.

1.3. Role of C&W depot

1. To maintain punctuality of trains
2. To ensure safe running of trains
3. To minimize sick marking / detachment and control of ineffective
4. Image building of Railway by providing passenger facilities i.e. Carriage watering, linen in AC coaches, cleanliness of coaches through CTS / OBHS and mechanized cleaning, Pest and Rodent control of coaches,
5. For attending en-route passenger complaint.
6. To avoid running of due / overdue IOH / POH / ROH coaches / wagons in train service.
7. To manage relief and rescue operation and restoration at the site of accident.
8. To ensure implementation of instruction regarding maintenance of coaches / wagons time to time issued by Railway Board / RDSO / Zonal HQ.

Objective of C&W depots:- Indian Railway is divided into 17 zones and each zone is divided into different division and each division is again divided into different depots At zonal level mech. Dept. is headed by CME and division level headed by Sr. DME (C&W) At division level following activities are being handled by C&W open line department.

i) To ensure maintenance and repair of carriage and wagon stock and to keep it in operational condition by providing following attention
   a) Examination of originating trains at maintenance depot and examination yards
   b) Examination of terminating trains at examination yards.
   c) Examination of through passing trains at examination yards/ station.
   d) ROH / IOH of wagon/ coach at maintenance depot.

ii) To ensure customer satisfactionby providing:-
   (a) Clean Train station services (CTS)
   (b) on board house services (OBHS).
   (c) Auto mechanized cleaning of coaches
   (d) Carriage watering of coaches.
   (e) Amenities and safety fittings in passenger coaches.
   (f) to ensure supply of superior and cleaned quality linen to the AC coaches passenger.

iii) To ensure implementation of instruction and modification regarding rolling stock, time to time issued by Rly Bd. and RDSO.

iv) To minimize ineffective of rolling stock by conducting :-
   (a) Periodical examination/maintenance at examination yard and maintenance siding.
   (b) By conducting rolling in and rolling out examination at intermediate C&W examination point.
   (c) To avoid non standard fitting/material.
   (d) To attend POH of rolling stock at nominated workshop.
   (e) Avoid to run due and overdue POH stock on train service.

2. Design & construction of Coaches

2.1 Types Of Coaches

1) ICF: - Integral Coach Factory. (Perambur, Chennai) & Rail Coach Factory, Kapurthala (Punjab)

2)**LHB COACHES:** LHB body with FIAT bogie (LinkeHolfmann Busch – German):-
Maximum Permissible Speed 160 kmph

3) **Hybrid Coach:** LHB Body on Modified ICF Bogie – Running in same of the Durontorake.

Dimensions of Coach Shell –

	ICF	LHB/ HYBRID
Length Over Buffer	22296 (mm)	24000 (mm)
Length Over Head Stock	21336 (mm)	23540 (mm)
Width	3245 (mm)	3030 (mm)
Height From Rail Level	3886 (old) 4025 (new) (mm)	4025 (mm)
Codal Life	25 (Years)	30 (Years)

MAIN COMPONENTS OF ICF BOGIE

UNDERFRAME:-

i) Sole bar
ii) Head stock
iii) Transom
iv) Longitudinal bar

PRIMARY SUSPENSION:-

i) Dash pot
ii) Dash pot spring
iii) Dash pot protection tube
iv) Air vent screw
v) Axle box safety bolt
vi) Axle box wing & lug
vii) Safety strap & safety loop
viii) Axle box & axle box plate

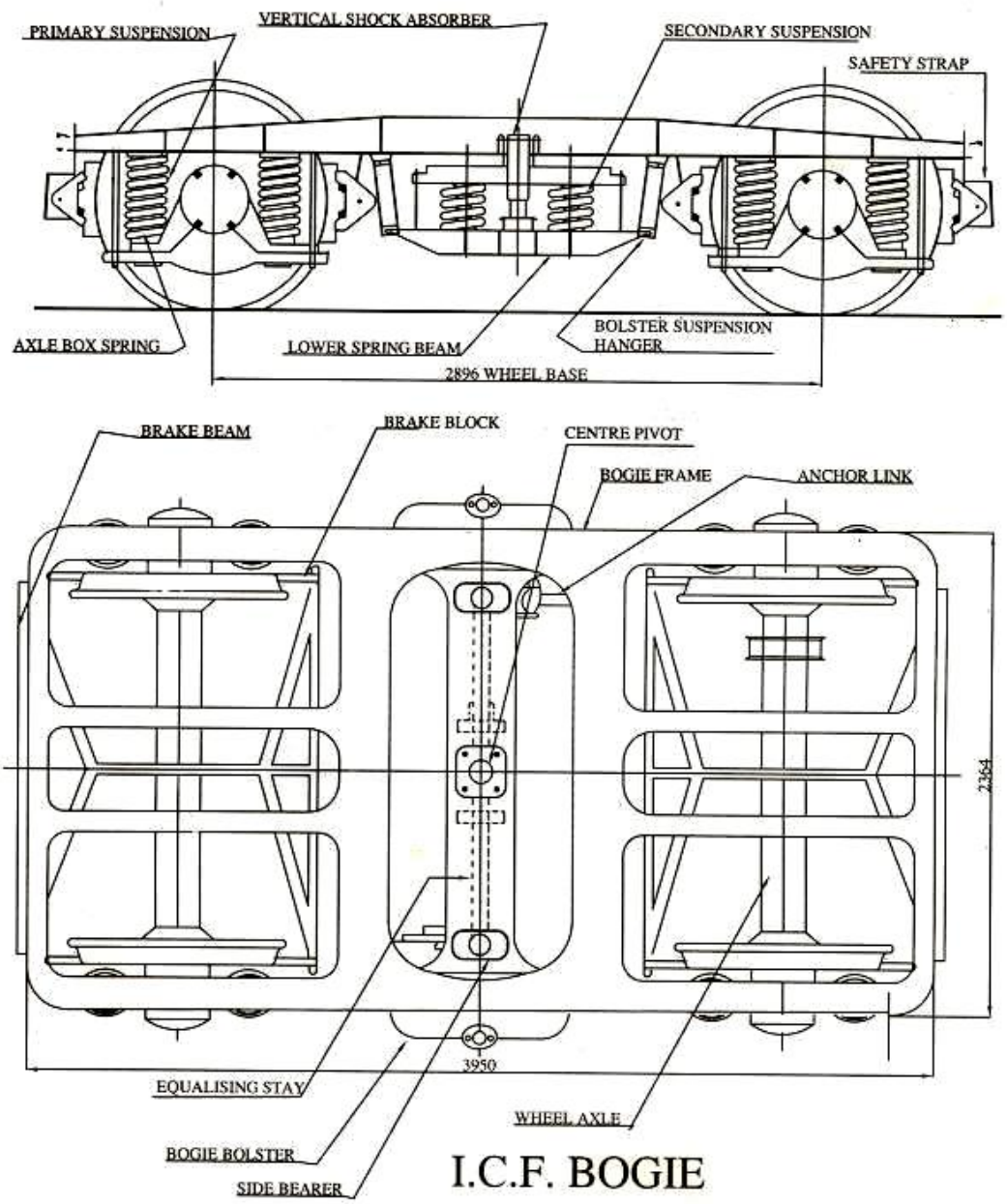
SECONDARY SUSPENSION:-

i) Bogie bolster upper plank
ii) Bogie bolster lower plank
iii) Suspension link, link pin & stone
iv) Bolster spring
v) Vertical shock absorber
vi) Safety strap & safety loop
vii) Equalizing stay rod
viii) Anchor link
ix) Centre pivot cotter, split pin & cup
x) Silent block
xi) Side bearer housing
xii) Side bearer metal plate
xiii) Side bearer bronze wearing piece

BRAKE GEAR:-

i) Brake beam
ii) Brake beam hanger & safety bracket
iii) Brake safety wire rope
iv) Brake shoe & key
v) Floating lever
vi) Curved pull rod
vii) Equalizing truss bar
viii) Palm end

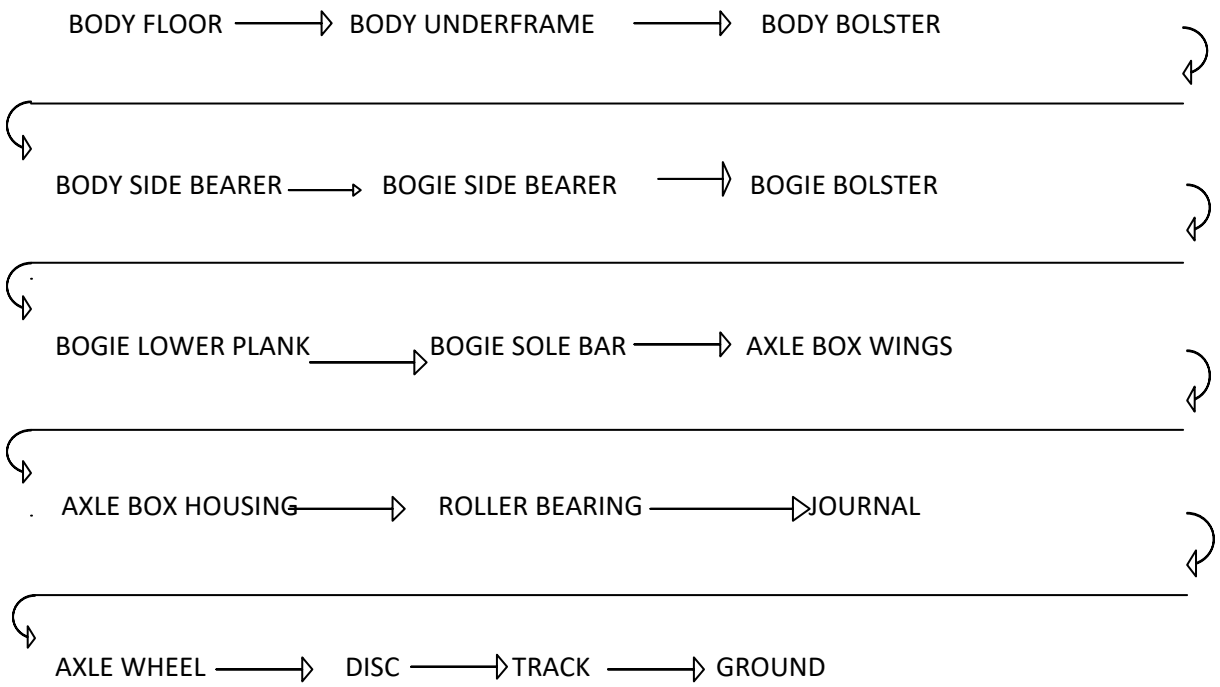
2.2 SALIENT FEATURES OF ICF A/C (ALL COIL) BOGIE



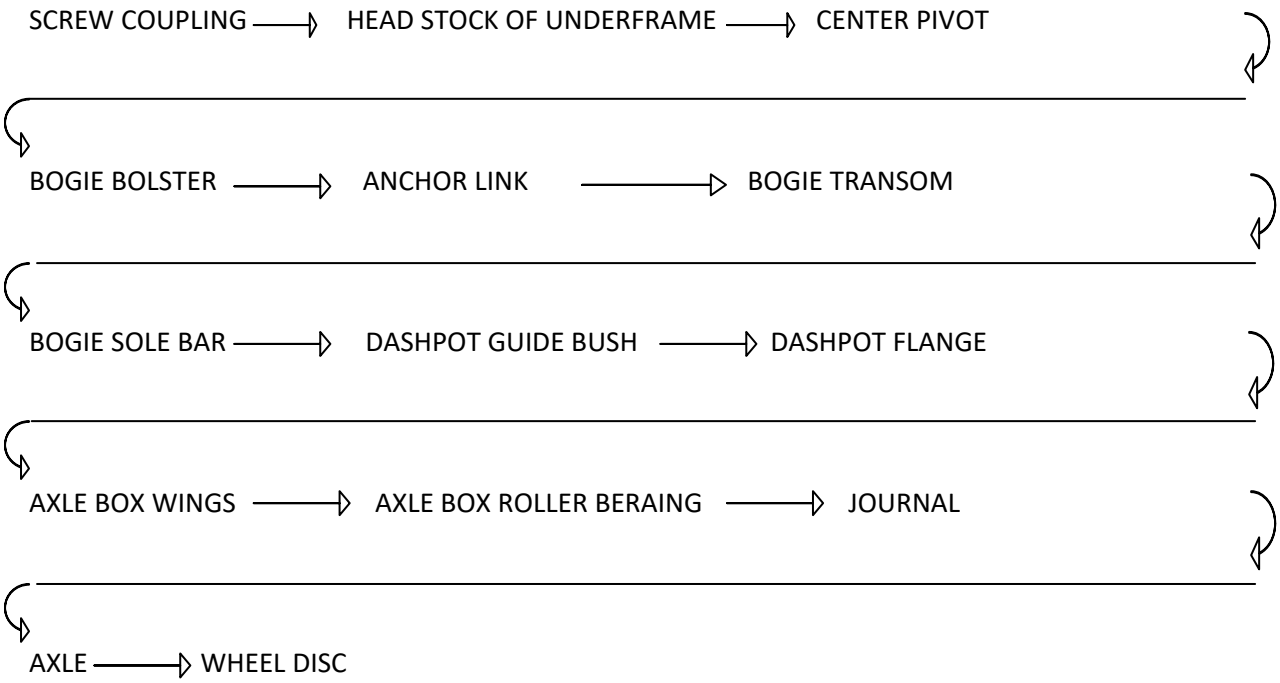
1) Bogie is designed to run on Indian Broad Gauge Track (1676 mm).
2) Provision of coil spring at primary & secondary suspension so that bogie is known as All Coil Bogie.
3) Bogie Head Stock is provided with pressed T- section and sole bar is with pressed I-section, but at the location of link brackets it is in box section.
4) Transom – Previously it was in C-section but now a days it is in Box section to be more robust.
5) Wheel Base of bogie is 2896 mm.
6) Weight Transmission - By 2 side bearer located at distance of 1600 mm.
7) Guidance of bogie Lateral and Longitudinal both with the use of Centre Pivot pin located at the center of bolster.
8) Wheel Guidance lateral and longitudinal both with the use of 2 nos. of Dash Pot guide per Axle Box Wings welded at sole bar.
9) Axle Capacity - 13 T – for Non A/C coach
   16 T – for A/C coach and WLRRM coach
10) Roller Bearing – Double Roll Self Aligned Spherical Roller Bearing.
11) Axle – Solid and Straight

12) Wheel Diameter – New – 915 mm
Condemn – 825 mm (workshop release size - 837 mm).
Ref: Rly. Board's Letter No. G2/ M(c)/151/2 vol.- V dated 25/01/2011
13) Shock Absorber – Provided on Secondary suspension between Bolster and Lower plank (2 nos. of each Bogie).
2 nos. of lateral shock absorber are being provided in ICF Bogie to be utilized for Hybrid Coach.
14) Vertical Hydraulic Dampers – 2 nos. per Axle Box Vertical telescopic hydraulic Dashpots are provided.
15) Fitment of brake block - Clasp type brake block arrangement is provided with the use of brake shoe head and brake beam.
16) 2 nos. equalizing stay rods per bogie are utilized to maintain the distance between both the lower planks and to maintain lateral thrust occurring during run.
17) Provision of Anchor link – 2 nos. per bogie with the provision of silent bushes are provided diagonally between bogie transom and bolster to work as a media to transmit the draw and braking force from trolley to body and body to trolley vice versa.
18) Piston Stroke – In conventional type Air Brake system 90 ± 10 mm and in BMBC within 32mm should be maintained.
19) Provision of Running Clearance:-
a) 'A' Clearance: - For 13 T – 43 +0/-3 mm, For 16 T – 27 +0/-3 mm
It is a clearance to be provided between axle box crown & safety bolt.
b) 'B' Clearance: - It is a clearance to be provided between bolster top & bottom of sole bar that should be 40 +/- 5 mm to all type of bogie.
20) Riding index: - ICF bogie – 3.25 to 3.50
21) Truss bar Hanger: - Strength with double eye hole.
New length -235 mm, Old length – 205 mm
22) Journal Size: - Dia. – 120x113.5 mm (sleeve mounted), 120x130.5 mm (direct mounted)
23) Journal Centre: - 2159.5 mm
24) Speed: - Fit to run up to 110 kmph. (Trial has been conducted up to 140 kmph.)

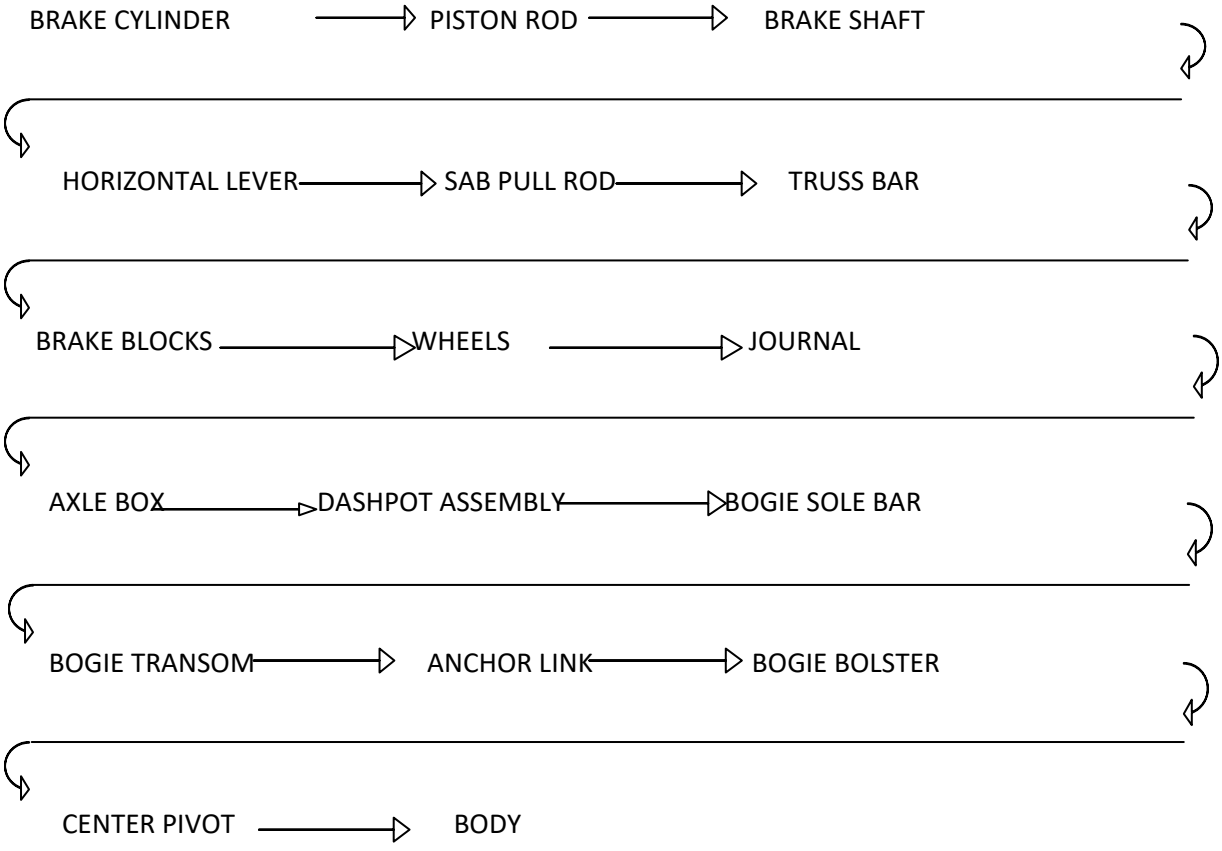
WEIGHT TRANSMISSION OF ICF COACH



DRAFT FORCE TRANSMISSION OF ICF COACH

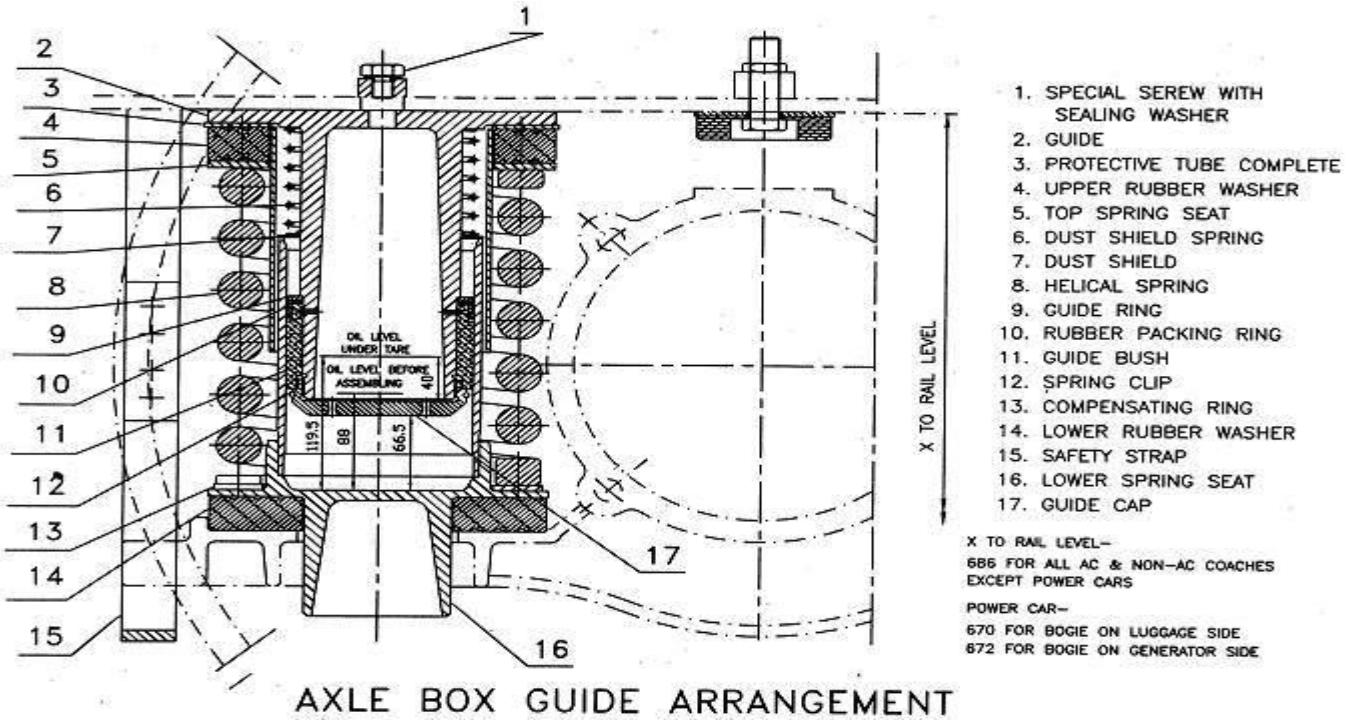


BRAKING FORCE TRANSMISSION OF ICF BOGIE TO BODY



1. AXLE BOX GUIDE WITH DASH POT ARRANGEMENT

Axle box guides are of cylindrical type welded to the bottom flanges of the bogie side frame with close dimensional accuracy. These guides together with lower spring seats located over the axle box wings



AXLE BOX GUIDE ARRANGEMENT

house the axle box springs and also serve as shock absorbers. These guides are fitted with guide caps having nine holes of diameter 5 mm equidistant through which oil in the lower spring seat passes under Pressure during dynamic oscillation of coach and provide necessary damping to primary suspension to enhance better riding quality of coach. This type of rigid axle box guide arrangement eliminates any longitudinal or transverse relative movement between the axles and the bogie frame. The quantity of oil required to achieve **40 mm** oil level above the guide cap in modified arrangement is approximately **1.6 liters** and in unmodified arrangement is approximately **1.4 liters**. As it is not possible in open line to distinguish between modified and unmodified arrangements, **40 mm** oil level is standardized for both.

Common Defects Found In Axle Guide Assembly, Causes And Their Remedial Action:

SN	Defect	Reasons	Remedies
1.	Perished rubber packing ring.	Poor quality of rubber packing ring	1. Replace rubber packing ring at every examination. 2. Use only rubber packing rings conforming to IRS specifications.
2.	Axle guide found worn on one side	Initial difference in wheel diameters on same axle more than 0.5 mm. Coach is not leveled.	1. Maintain difference in wheel diameters on same axle within 0.5 mm. Use wheel diameter gauge with minimum 0.2 mm accuracy. 2. Level the coach. 3. The squareness and alignment of axle box guides should be checked with alignment gauges and corrected.

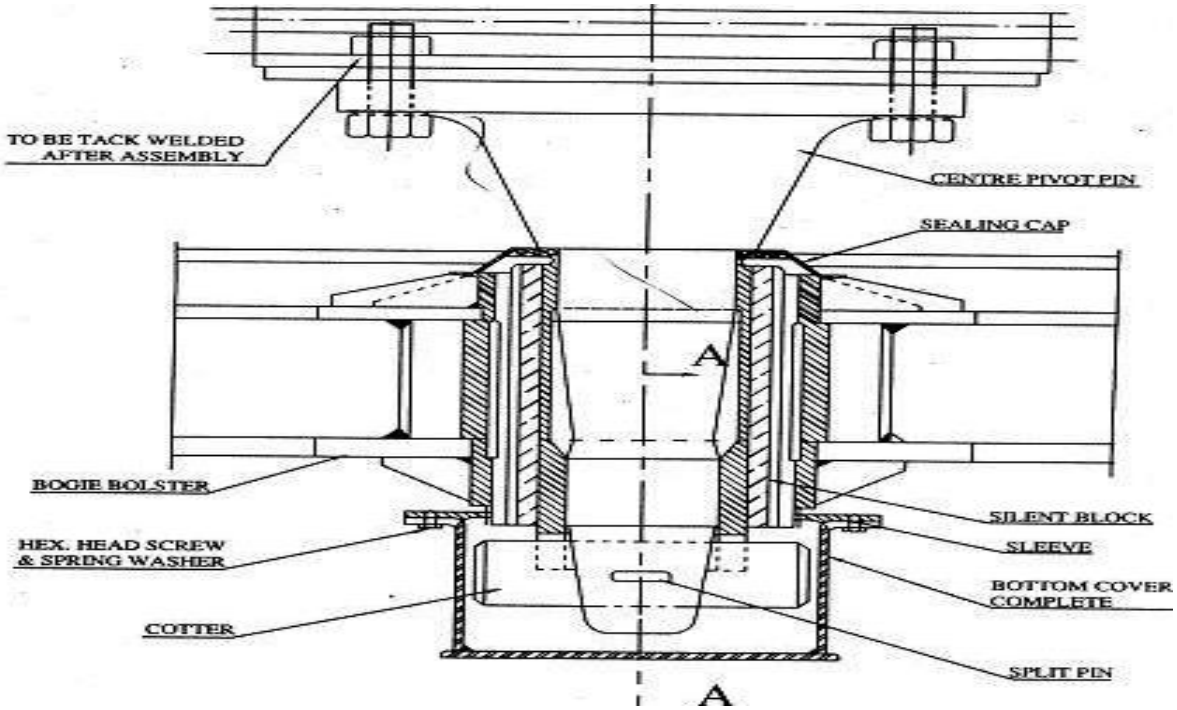
			4. Vent holes should be sealed with gaskets screw tightened well after topping.
3.	Axle box springs rubber upper spring seat (protective tube)	-do-	-do-
4.	Guide bush worn.	-do-	-do-
5.	Lower spring seat surface worn.	-do-	-do-
6.	Guide ring broken	Axle guide is hitting lower spring seat. Weld joint of lower spring seat and tube is porous or cracked.	1. Guide securing bolt should not project out of guide cap. 2. Use good quality upper and lower rubber washers and correct number of compensating rings in the axle box guide assembly. 3. Adjust ABC clearance on leveled track. 4. Strip and re-weld lower spring seat correctly.
7.	Broken/distorted spring clip of guide cap.	-do-	-do-
8.	Guide cap securing assembly broken.	-do-	-do-
9.	Lower spring seat scored and dent mark on guide cap.	-do-	-do-
10.	Dust shield spring broken/distorted.	-do-	-do-
11.	Dust shield twisted or damaged.	-do-	-do-
12.	Guide threads damaged.	-do-	-do-
13.	Leakage from lower	-do-	-do-

2. **Air Vent Screws:** On the bogie side frames, directly above the dash-pots, tapped holes are provided for replenishing oil in the dash pots. Special screws with copper asbestos washers are screwed on the tapped hole to make it air tight.

3. **Bogie Bolster Suspension:** The bolster rests on the bolster coil springs - two at each end, located on the lower spring beam which is suspended from the bogie side frame by means of bolster-spring-suspension (BSS) hangers on either side. The two anchor links diagonally positioned are provided with silent block bushes. The links prevent any relative movement between the bogie frame and coach body.

4. **Springs:** In ICF bogie, helical springs are used in both primary and secondary suspension. The springs are manufactured from peeled and centre less ground bar of chrome vanadium/chrome molybdenum steel.

5. **Centre pivot arrangement:**
The centre pivot pin joins the body with the bogie and transmits the tractive and braking forces on the bogies. It does not transmit any vertical load. It is equipped with rubber silent block bushes which tend to centralize the bogies with respect to the body and, to some extent, control and damp the angular oscillations of the bogies.



6. **Side Bearers:**
The side bearer arrangement consists of a machined steel wearing plate immersed in an oil bath and a floating bronze-wearing piece with a spherical top surface kept in it, on both sides of the bogie bolster. The coach body rests on the top spherical surface of these bronze-wearing pieces through the corresponding attachments on the bottom of the body-bolster. The whole arrangement is provided with a cover to prevent entry of dust in the oil sump.

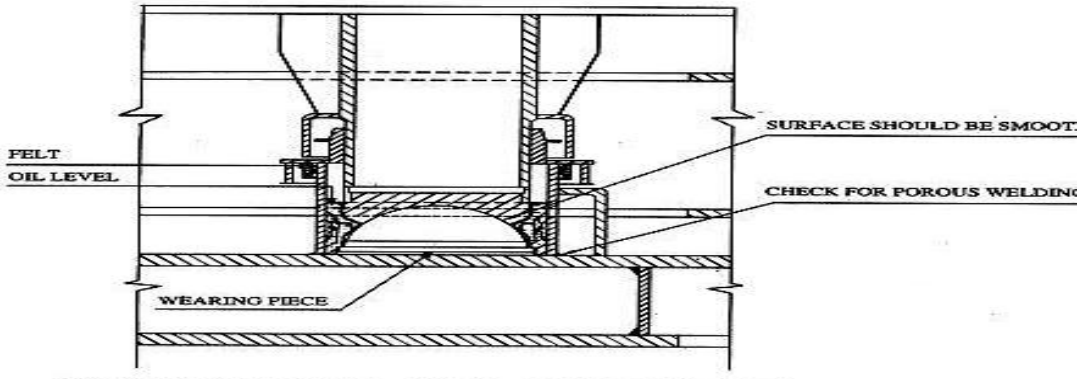
Wear limit for wearing plate:

New size : 10 mm

Condemning size : 8.5 mm

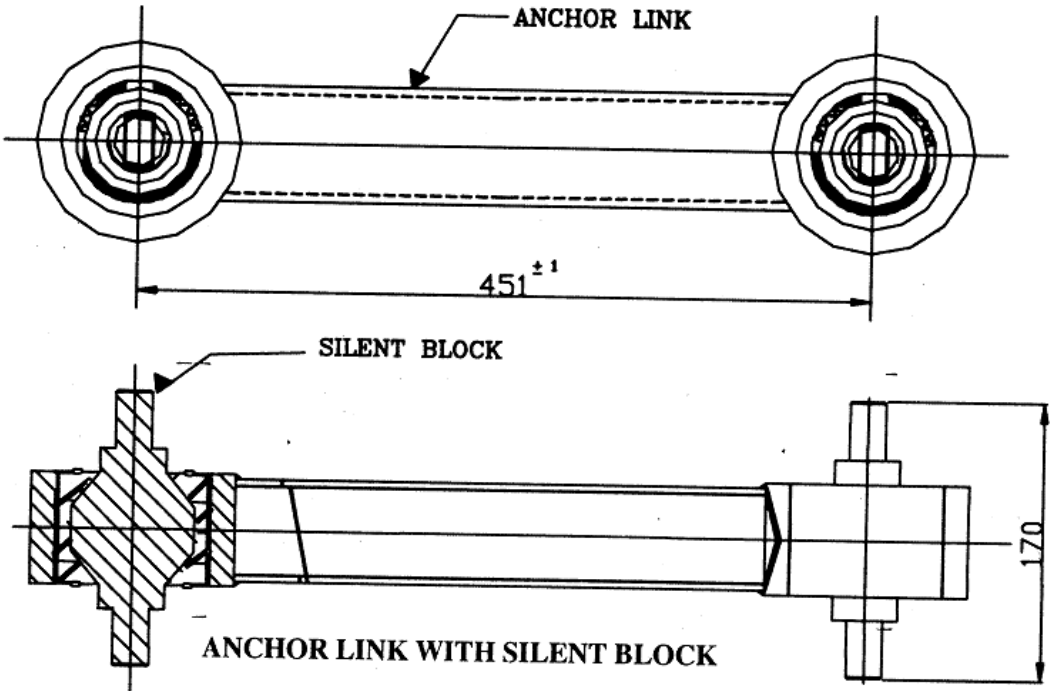
Wear limit for wearing piece:

New size : 45 mm **Condemning size** : 42 mm



SIDE BEARER ARRANGEMENT

7. **Anchor Link:** The floating bogie bolster which supports the coach body is held in position longitudinally by the anchor links which are pinned to the bolster sides and the bogie Transoms. One anchor link is provided on each side of the bolster diagonally across. The links can swivel universally to permit the bolster to rise and fall and sway side wards. They are designed to take the tractive and braking forces. The anchor links are fitted with silent block bushes



ANCHOR LINK WITH SILENT BLOCK

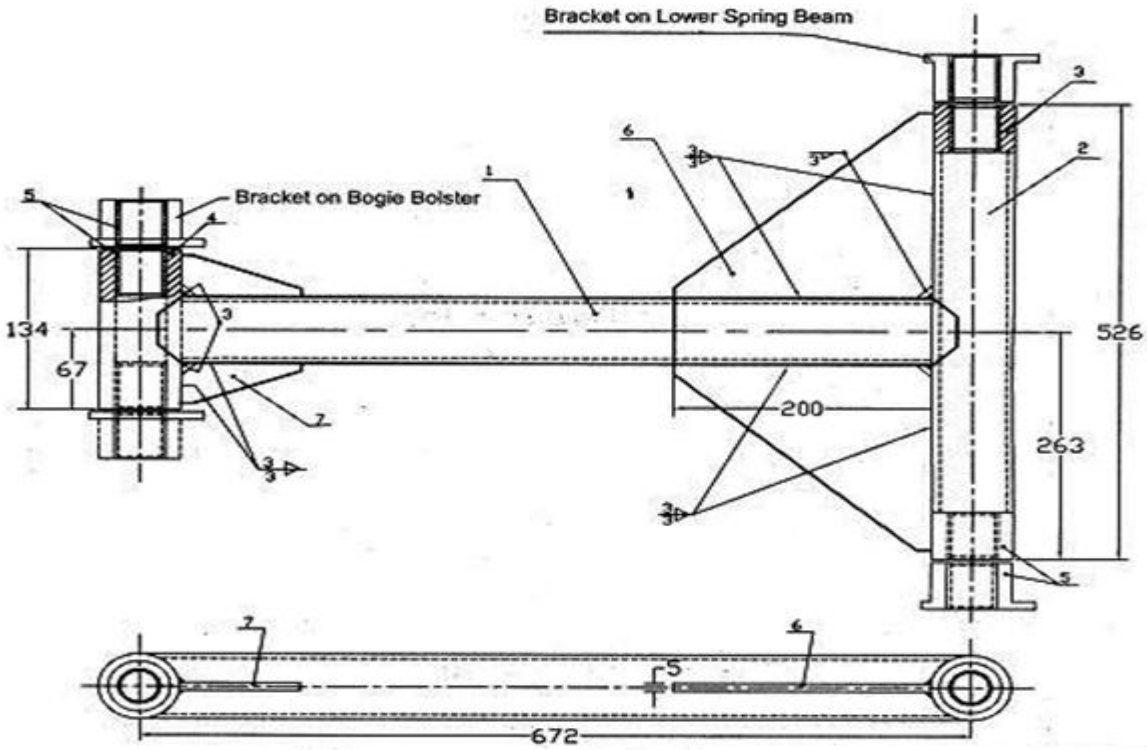
8. **Silent Block:** This is a synthetic rubber bush fitted in anchor link and center pivot of ICF bogies to transmit force without shock and reduce noise.

9. **Brake Rigging:** Brake rigging is provided to control the speed of the coach by transferring the braking force from the brake cylinder to the wheel tread. Brake rigging can be divided into two groups i.e. Bogie mounted brake rigging and coach under frame mounted brake rigging.

   A. **Coach Under Frame Mounted Brake Rigging:** In 16.25 t axle load bogie the four lever used in bogie brake rigging are each with lever ratio of **1:1.376** hence the total Mechanical advantage in a bogie is **5.504**.
   In 13 t axle load bogie the four levers used in bogie brake rigging are each with lever ratio of **1:1** hence the total Mechanical advantage in a bogie is **4**

   B. **Bogie Mounted Brake Rigging:** Bogie brake rigging has been modified to incorporate a total mechanical advantage of **7.644** per bogie for non-ac coaches and **8.40** per bogie for ac coaches

10. **Equalizing Stays:** This device has been provided on bogies between the lower spring plank and the bolster to prevent lateral thrust on the bolster springs which have not been designed to take the lateral forces. These links have pin connections at both ends and, therefore, can swivel freely.



EQUALISING STAY FOR LOWER SPRING BEAM
(16.25 t Axle Load Bogie) (RDSO Sketch 88105)

11. **<u>Bolster Spring Suspension (BSS) Hangers</u>:** In the secondary suspension, the bolster is supported on helical coil springs which are placed on the lower spring plank. The lower spring plank is suspended from the bogie side frame through BSS hangers on hanger blocks.

12. **<u>Shock Absorbers</u>:** Hydraulic shock absorbers with capacity of **600 kg** at a speed of 10 cm/sec. are fitted on 13 ton bogie & 900 to work in parallel with the bolster springs to provide damping for vertical oscillations.

2.3 LIFTING OF THE BODY FROM THE BOGIE:-

A) <u>Required Tools &Equipments</u>:-

a) With the use of 4 no. of Mechanical Jacks (having capacity of 10 T each) OR

b) With the use of 4 no. of Hydraulic jacks (Having capacity of 10 Ton each) OR

c) With the use of 02 no. of Electrical operated Traveling Crane (having capacity of 20 T/25 T each)

d) With the use of 4 no. of Whiting jacks (having capacity of 20/25 T each)

B) **<u>Other Tools:-</u>**

a) Complete set of Spanners.

b) Different types of hammers.

c) Wooden Wedges & Packing.

d) Trestles.

e) Complete set of Gas cutting & welding equipment.

f) Tool kit

C) **<u>Items to be disconnected before lifting of a body</u>:-**

1) a) Removal of centre pivot cotter [If lifting is being done by E.O.T cranes or whiting jacks].

   b) Removal of Unscrewing of centre pivot studs [If lifting is being done be mechanical/hydraulic jacks]

2) Unscrewing of air vent screw of dash pot.

3) Disconnection of Dynamo belt.

4) Disconnection of S.A.B pull rod.

5) Disconnection of lateral shock absorber if connected

6) Disconnection of axle box safety loops.

7) Disconnection of commode chute if infringing.

8) Disconnection of foot board.

9) Disconnection of dummy carrier if infringing.

10) Inserting required thickness of wooden packing between upper portion bolster & sole bar.

<u>Buffer Height Adjustment:</u>causes of low buffer height in ICF coaching stock

a) excessive wear of wheel (circumference)
b) Due to loss of proper stiffness of coil spring provided on primary and secondary suspension.
c) Due to excessive wear on side bearer's metal & bronze piece.

Piece	New size	Condemning size
Steel	10 mm	8.5 mm
Bronze	45 mm	42 mm

d) Due to excessive wear on link brackets, stone & pin provided on secondary suspension arrangement.

- Maximum buffer height = 1105 mm [In empty condition]
- Minimum buffer height = 1030 mm [In loaded condition]
- Minimum buffer height of coaching stock should not be less than 1090 mm at the time of releasing of coach from POH Workshop.

Procedure to achieve buffer height for ICF coaches.

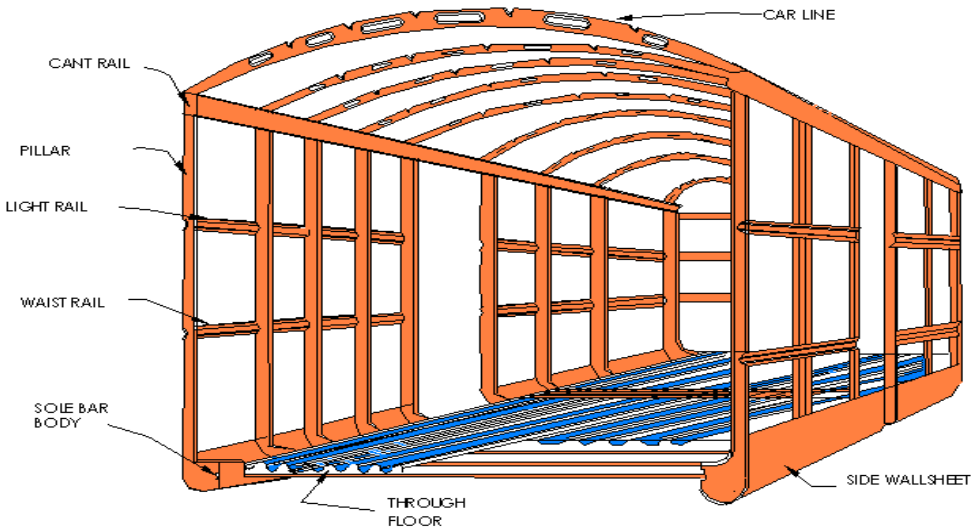
- To achieve buffer height a standard size of wooden packing pieces are used which are kept below the coil springs of primary suspension.
- New Wheel dia. :- 915 mm
- Condemning :- Solid Wheel: 813 mm.

SN	Wheel Diameter (mm)	Thickness of Wooden Packing (mm)
1.	Below 889 up to 863	13
2.	Below 863 up to 839	26
3.	Below 839 up to 819	38
4.	Below 819 & below	48

Note:-

1) If required 6 mm compensating metallic ring can also be used. If further required wooden packing in half's can be utilized in 8 mm & 12 mm thickness but, it should be ensured that total thickness of wooden half packing + compensating ring should not be more than 20 mm.
2) Gap between axle box lug & safety loop also should not to be less than 40 mm.
3) Running clearances i.e. 'A' & 'B' also should be ensured.

ICF COACH SHELL / BODY



Salient Features of ICF Coach Shell / Body

1. **All Metal:-**ICF coach shell is made up of steel channels frames of thin sections except the seats & luggage bunks which are made up of wooden members.

2. **Light Weight:-**The weight of coach shell is reduced due to less use of wooden members. Anti CorrosiveCorten Steel (IRSM 41) is used for body fabrication purpose. As thickness of roof shell is 1.6 mm, corrugated floor side panel & end panel is only 2 mm. The use of gusset plate, knee & rivets are also avoided in under frame. Hence weight of ICF shell is reduced by 26% to 32% in respect to weight of IRS coach shell which was used in the past.

3. **Integral Construction:-**The shell of ICF coach is made with frame, Body side pillars, roof carlines, doors & windows, waist rail, light rail & cant rail are welded together with sole bar through side pillars. Corrugated flooring, side panels, end panels & roof are welded together by means of homogenous welding . End pillars, stanchions and side pillars are also connected with paneling work. This type of structure gives the integral construction of coach body which forms the big tubular hollow construction which is light in weight**.**

4. **Anti telescopic construction:-**The shell of ICF Coach is designed to bear 45 tones of vertical load and 200 tones of longitudinal impact on side buffers. The coach body so designed that it is more strengthen at end portion as well as in passenger seating portion and less at the gallery portion. Due to which maximum kinetic energy can be absorbed by the end portion as get damaged during accident and rest kinetic energy also can be shared by corrugated flooring and other members of body shell, resulted passenger accommodation area of middle portion of shell is safe in view of damaging.

   With the result of these properties of shell entering of end portion of one coach shell is avoided to in adjacent coach body shell. For that shell construction is known as anti telescopic construction.

5. **Stress Skin Construction:-**The construction of the body shell in the end at side panel is multi point tag welded. As side panel is welded at waist rail, light rail, cant rail and car lines by means of CO_2 welding provided at perfect distance. 70 % of total developed stresses are absorbed by corrugated trough flooring. Thus this multi point welding property of the end & side panel is enough to minimize developed stresses of panels during run.

6. **Aerodynamic shell:-** To minimize air resistance during running , the shell body is specially constructed, the roof and turn under are made up in curved shape which minimize air resistance at high speeds.

7. **Anti corrosive:-**To achieve anti corrosive property Corten steel **IRSM - 41** (max at turn under and lavatory portions) is being utilized for paneling purpose. At the time of manufacturing sand blasting, grit blasting is also given on panel sheet which is helpful to prepare rough surface for painting resulted less chances of corrosion. Three coats of bituminous anti-corrosive paints are also given at welded portion and for other portion red- oxides paint is applied, for anti-corrosive treatment. Holes in trough flooring are also given for proper drainage of water. Especially 200 x 135 mm size elliptical holes are given in turn under portion for proper drainage of rubbish water coming from window shell. With the help of these facilities and precaution corrosion probabilities can be minimized. 19 mm thick ply or 12 mm thick compregue ply and 2.00 mm thick PVC flooring is utilized.

8. **Heat resistance :-**

   To develop heat resistance property in coach shell following precaution or facilities has been provided:-

   a) Silver / aluminum paint coat is provided on outer side of roof which reflects the sun rays coming outside the coach.

   b) In roof ceiling layers of insulting materials like asbestos / glass wool is provided which is bad conductor of heat resulted direct transmission of heat inside is minimized.

   c) In carlines, elliptical holes are also provided for proper air circulation from one compartment to another.

   d) No. of ventilators also provided on top of roof to exit smokes, gases and to circulate fresh air.

   e) Limpet sheet is also provided inside of the roof (2mm thick) which is bad conductor of heat.

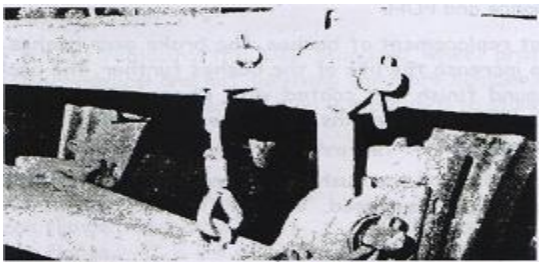
2.4 INDO – GERMAN MODIFICATIONS

Description Of Modification: These modification were adopted with the technical guidance of German team so that known as Indo- German modification are as under:-

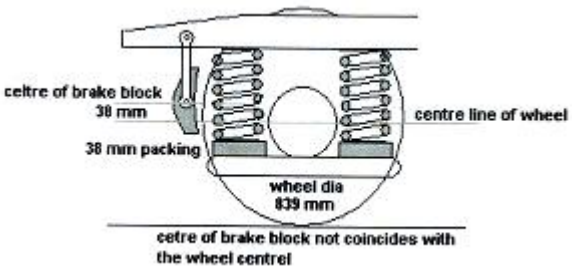
1. Use of nylon 66 bushes with case hardened N5 ground finish Class-ii pins:- previously resin bushes with N7 ground finish class -2 pin were used.

2. Modified design of brake shoe key and brake shoe head, previously width of the slot of brake shoe head was 60mm, it is reduced to 50mm .In new design of brake block key ,the camber is increased and length is decreased .

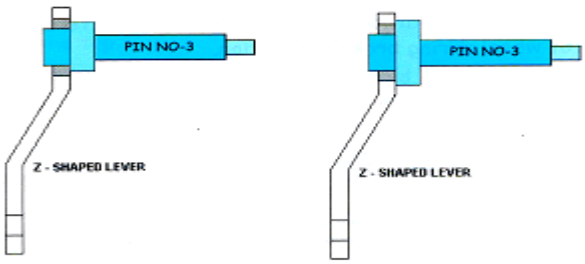
3. Provision of safety wire rope arrangement for brake beam, previously G shape safety brackets were used with brake beam but now wire rope safety brackets are used which are safe with less provability of breakage.



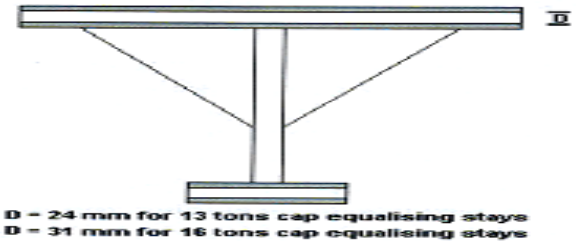
4. Fitment of modified brake block hanger in increasing length 235 mm from 205 mm. Length of the hanger is increased resulted no climbing cases of brake beam over to wheel.



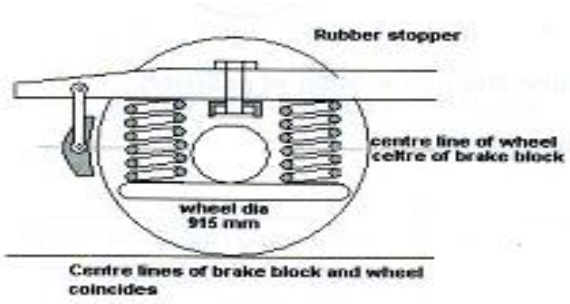
5. Provision of modified lever hanger pin. The width of the hexagonal head bolt is increased from 46mm to 51 mm to avoid inserting provability of hexagonal head bolt in z arm bushing dia.



6. Fitment of equalizing stay rod of 16 ton axle load also in 13 ton axle load bogies. With the fitment of 16 tone capacity equalizing stay rod breakage chances are reduced.



7. Provision of rubber stopper for hexagonal head bolt. Rubber pads of 10, 20, 35, 45mm with 4mm thick compensating rings are being utilized to maintain the A clearances in ICF bogie.

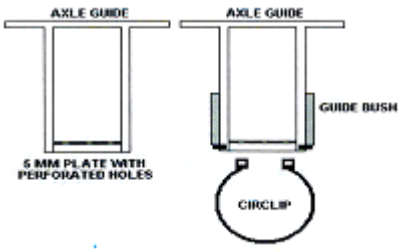


8. Slack adjuster articulation arrangement. It was the modification for vacuum brake coaches to avoid failure of due to bending effects during negotiation on curve.

SAB

9. Provision of locking arrangement of axle box guide. To prevent the dropping of guide cap in pot,now a days integral type guide with cap are being utilized.

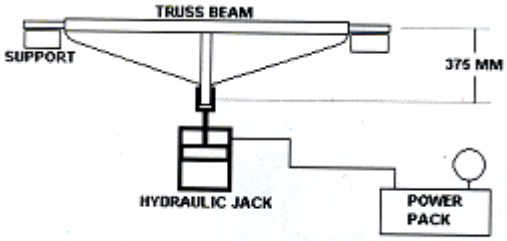
10. Use of integral type of buffer false plate for reclamation. In this modification the process of flat buffer reclamation is given.



11. Use of high capacity buffer pads. In this modification high capacity buffer pad of 1030 kg m is utilized, no use of 515 kg m capacity pads is recommended.

12. Dimensional check report for bogie covering the aspects of avoidance of welding joint under axle guide. Under this modification the squareness of bogie should be checked by work shop staff on arrival of coaches for P.O.H.

13. Modified brake beam for air brake coaches and testing procedure. Under this modification only 16 t capacity brake beams are to be used in16 & 13 t bogies.



LATEST MODIFICATION ON COACHES

1) Change in securing arrangement of anchor link, similar as in Fiat Bogie.
2) Use of Hopper type Shutters in place of foster Shutters.
3) Provision of ventilator with Arc shape fins with LAV for proper circulation of Air.
4) Provision of Resetting Handle on in panel for the resetting of ACP.
5) Increase of hole dia. in PEAV from 4 to 8 mm.
6) Provision of APD for Guard van valve and its handle.
7) Reduced of width of brake shoe head by 5 mm from inside.

2.5 Ride Index:

It has been found that human sensations are dependent on acceleration, rate of change of acceleration (impulse) and displacement. In other words, the product of these values could be used as measure of comfort/discomfort.

Riding is a quality of comfort experienced by passenger, depends not only upon acceleration, rate of change of acceleration & vibration but also some other factors as like noise, moisture temperature etc.

Calculation Formula given by Dr. Sperling,

$$\text{Ride Index} = 0.896 \sqrt[10]{\frac{\sum b^3}{\sum f} F(f)}$$

where:

b : Amplitude of acceleration

f : Frequency of acceleration

F(f) : a correction factor dependant on the frequency

Note: The accelerations referred to above are vehicle body accelerations, vertical or lateral, measured on the floor level just above the center pivot location.

The ride index is just a number with no units and its value gives us an indication of the riding comfort of a vehicle. The index is easily calculable during field trials by measuring the vertical/lateral accelerations using standard accelerometers.

Ride Index gradations are as follows :

RI	Appreciation	Fatigue Limit
1.0	Very Good	>24 Hrs
1.5	Almost Very Good	-Do-
2.0	Good	-Do-
2.5	Nearly Good	13 Hrs
3.0	Passable	5.6 Hrs
3.5	Still Passable	2.8 Hrs
4.0	Able To Run	1.5 Hrs
4.5	Not Able To Run	45 Mts.
5.0	Dangerous	15 Mts.

RI criteria applicable on Indian Railways:

	Preferred Limit	Max.
Coaches	3.25	3.5
Wagons	4.25	4.5
Loco	3.75	4.0
EMU/DMU		4.0

The ride index as described above gives the average riding quality of a vehicle over the chosen length of track (generally one kilometer). However, individual acceleration peaks also have an effect on the comfort of the passengers. Accordingly, limits for maximum acceleration values have also been laid down for coaches and locomotives. For details, the Third Criteria Committee Report of RDSO may be referred.

The Following Measures Should Be Given to Maintain Ride Index in ICF coach:-

1. By proper checking of primary suspension arrangement.
   - Checking free height &height variation.
   - Telescopic hydraulic dash pot & oil level in it (1.6 liters in modified & 1.4 liters in non-modified).
   - Gap between safety loop & axle box lug should be within limit i.e. 40 mm (old 20 mm).
2. Proper pairing of springs on secondary suspensions.
   - Free height of spring should be within limit.
   - Ensuring proper working of shock absorber.
3. Proper checking of side bearer, oil & bearing piece should be within limit.
   - Oil quantity should be 2.0 liters.
   - Thickness of bronze piece should not be less than 42 mm (45 mm – new size)
   - Thickness of metal piece should not be less than 8.5 mm (10 mm – new size)

   [6 mm dia. hole is provided at the centre of bronze piece for better lubrication /working]
4. Proper checking of silent bushes fitted in bolster for proper matching of centre pivot.
5. Proper checking of buffing gears.
   - Proper contact of buffer plunger.
   - Plunger stroke should not be more than 127 mm & less than 51 mm.
   - Wear on rubber pads should be within limit.
   - All securing bolts & nuts should be properly fitted.
6. Proper checking of draft gear.
   - Wear on rubber pads / coiled spring should be within limit.
   - Coupling should be in proper tight position.
   - Other securing nuts, washers, cotters also should be in proper position.
7. There should be proper bushing of anchor links. Checking of silent bushes therein.
8. By checking silent bushes working / clearance of self alignment double row spherical roller bearing.
9. All break gear pins should be provided with proper bushing.
10. SAB curdle roller should be lubricated.

11. Piston should be proper working condition, means piston travel should be uniformly, and it should not be sticky.

12. Berth should be provided with Dunlop cushioning.

13. Dynamo pulley & belt should not be loose.

14. It should also be ensured that there should not be any wheel defect as like flat faces (not more than 50 mm) deep flange, skidded wheel, sharp flange, thin flange.

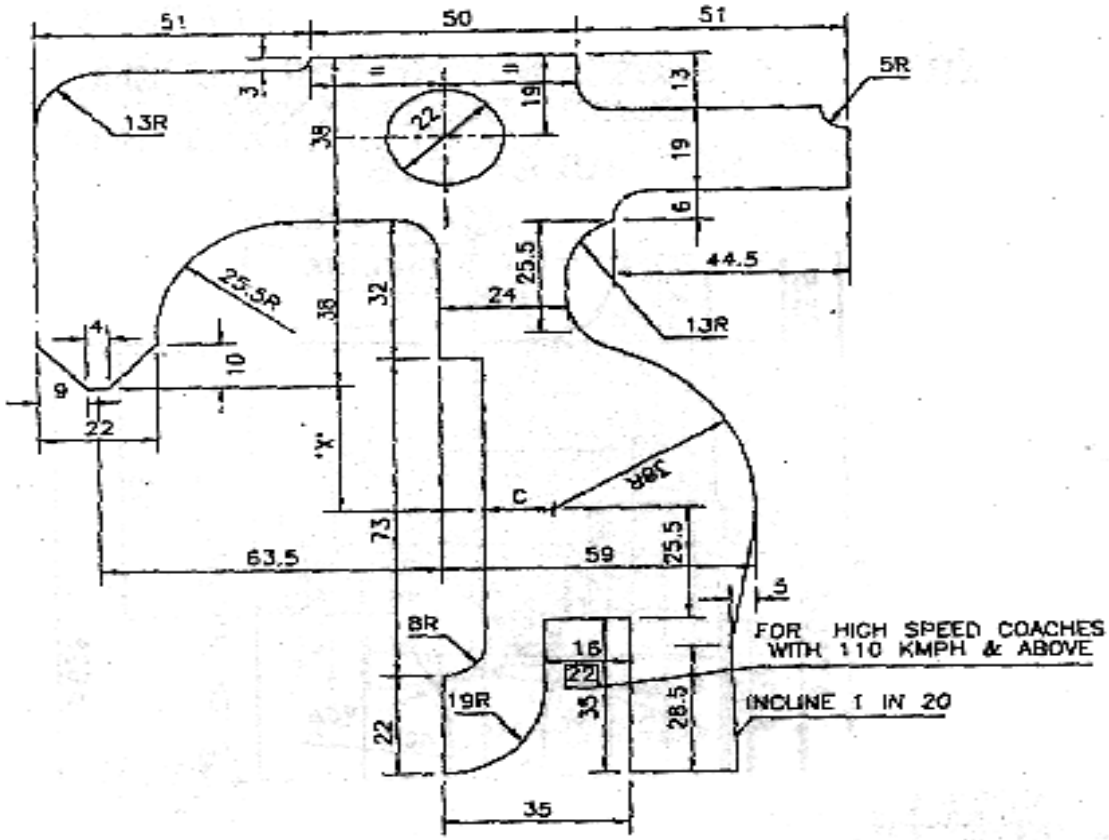
15. In excess of this the Ride Index also can be improved by ensuring p/way maintenance, signal aspects & engine man ship of the driver.

3.Wheels& its defects

1) Width of wheel – 127 mm.
2) Wheel diameter New – 915 mm, Condemn - 825 mm
3) Axle capacity – 13 T(Non AC) -16 T(AC).
4) Journal – Direct mounted 120 x 130.5 mm
5) Journal centre – 2159.5 mm
6) Permissible diameter variation in wheel
   a) On same axle – 0.5 mm (for machining purpose only)
   b) On same bogie – 5.0 mm
   c) On same coach – 13.0 mm

WHEEL PROFILE

Ref: IRCA Rule Book Part – IV (Plate 29)

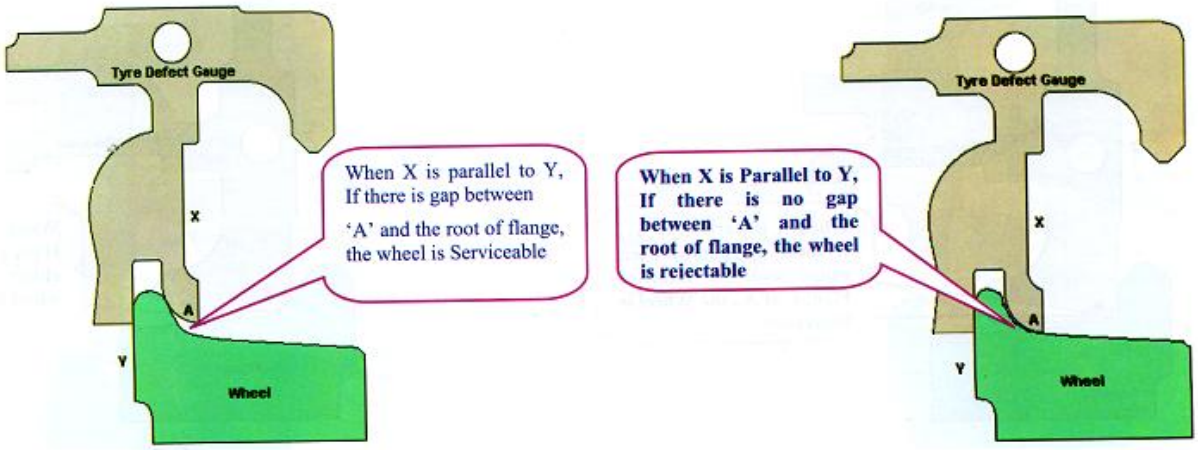


WHEEL DEFECT GAUGE

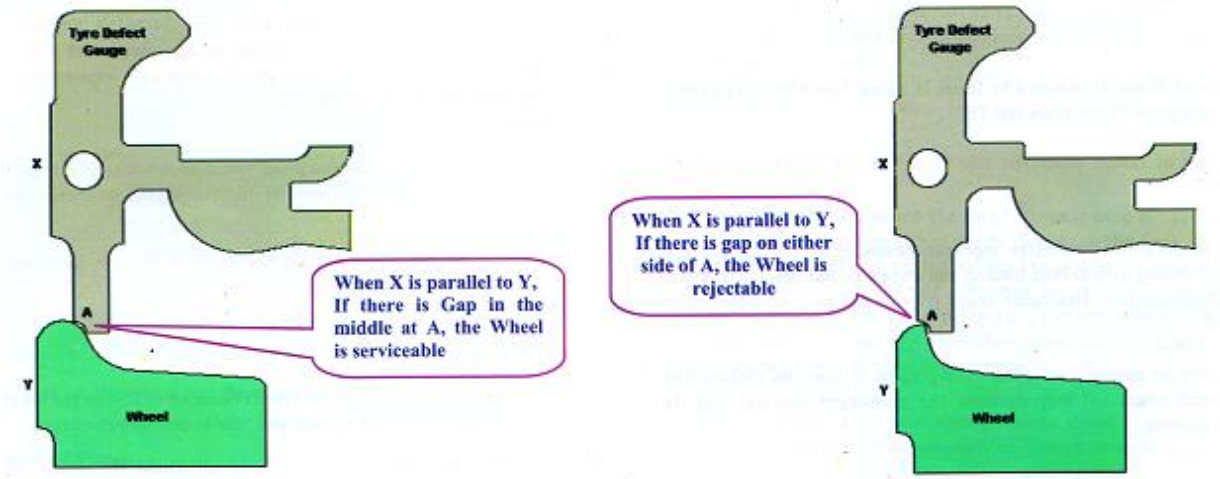
Ref: IRCA Rule Book Part – IV (Plate 39)

WHEEL DEFECTS

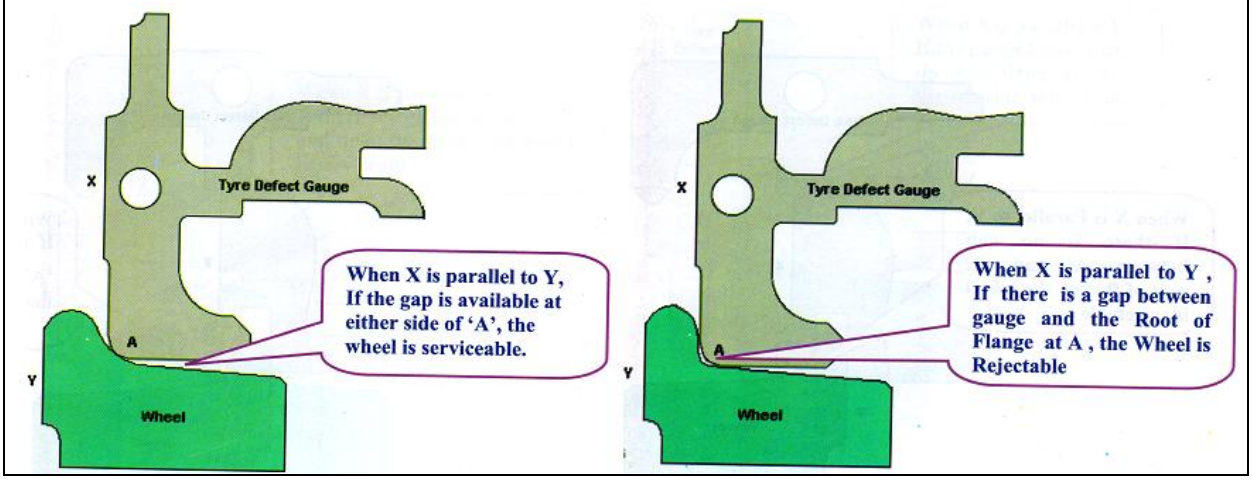
Thin Flange



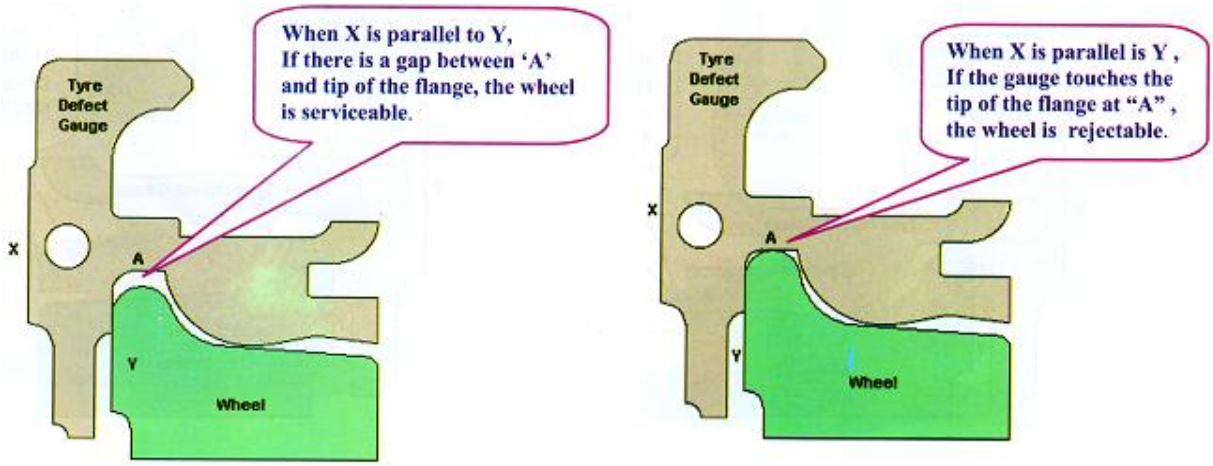
Sharp Flange



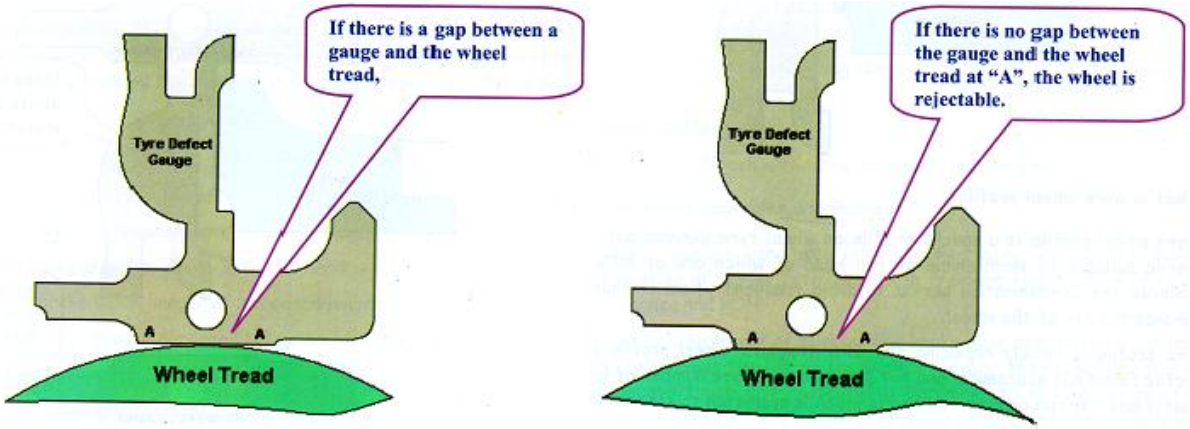
Radius too small at the root of flange



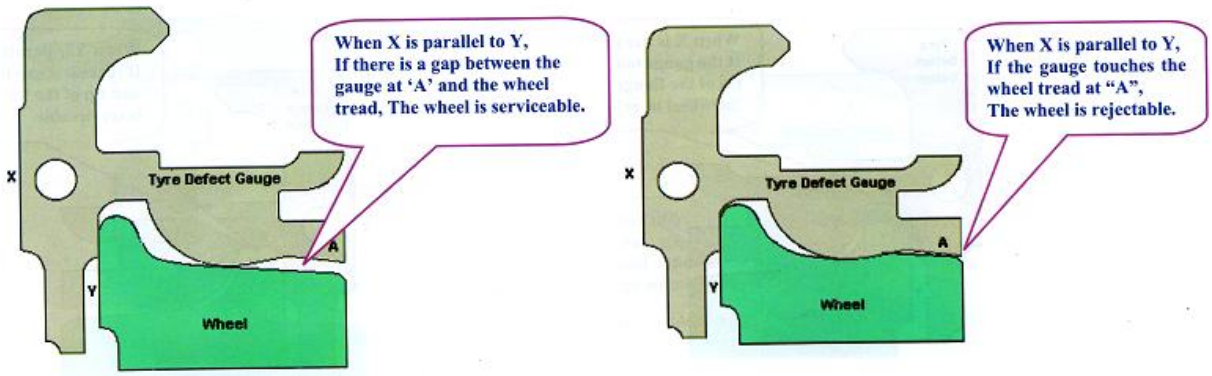
Deep Flange



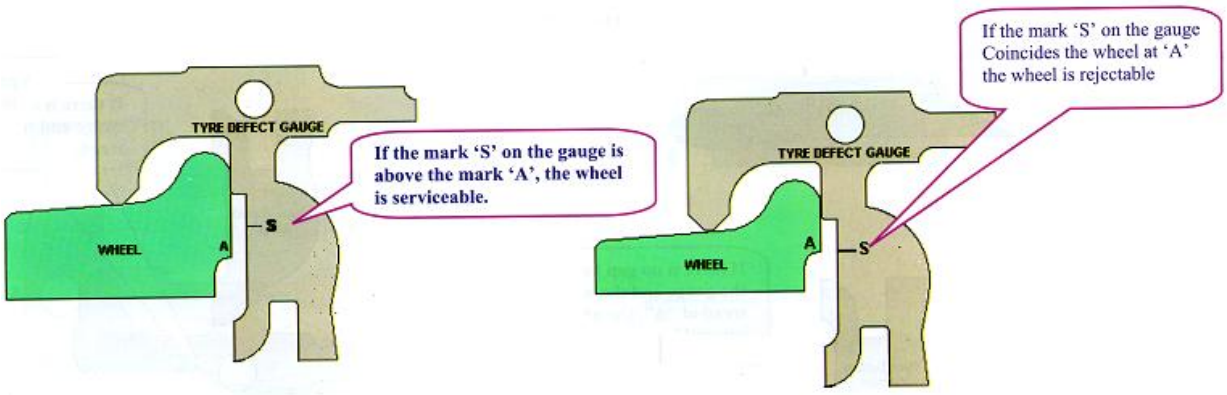
Flat faces on Tyre



Hollow Tyre



Thin Tyre



Wheel Defects	Causes
Thin Flange	When the flange thickness reduces from 28.5mm (New) to 16 mm (Condemn) or less, then the flange is called thin flange. Flange thickness is measured at a depth of 13 mm from the tip of the flange. **Repercussion**:- Chances of busting of point due to entering of flange between Tongue rail and Stock rail.
Sharp Flange	When the radius given at the tip of flange is worn out from 14.5mm (New) to 5 mm (Condemn) or less is called Sharp Flange. **Repercussion**:- Shearing of fish plate bolts at rail joints.
Radius too small at the root of flange	New Radius of flange at the root is 16R, when it is reduced to 13R or below, it is called Radius too small at the root of flange. **Repercussion**:- Excessive lateral play result in chances of mounting of flange over rail.
Deep Flange	The New height of the flange is 28.5mm, when it increased up to 35mm or more is called Deep Flange **Repercussion**:- Shearing of fish plate bolts at rail joints.
Flat faces on Tyre	Flatness on wheel circumference is called on Flat faces on tyre. 1. For Coaching Stock it is allowed up to 50 mm 2. For Goods Stock it is allowed up to 60 mm **Repercussion**:- Chances of rail fracture due hammering effect on rail.
Hollow Tyre	If the groove on the wheel tread is up to 5 mm or more, it is called Hollow tyre. **Repercussion**:- Chances of entanglement of tongue rail nose with wheel.
Thin Tyre	If the remaining thickness of tyre is less than 25 mm, it is called thin tyre. **Repercussion**:- probability of breakage of tyre.

3.1 INTERMEDIATE WORN WHEEL PROFILE FOR COACHING STOCK

Worn Wheel Profile:-Worn wheel profile is a special profile on wheel disc derived out of standard wheel profile suitable to worn shape of rail head (which are of 80% track).

This is to minimize condemnation of disc to avoid frequent wheel changing re-profiling & enhance the life of the wheel.

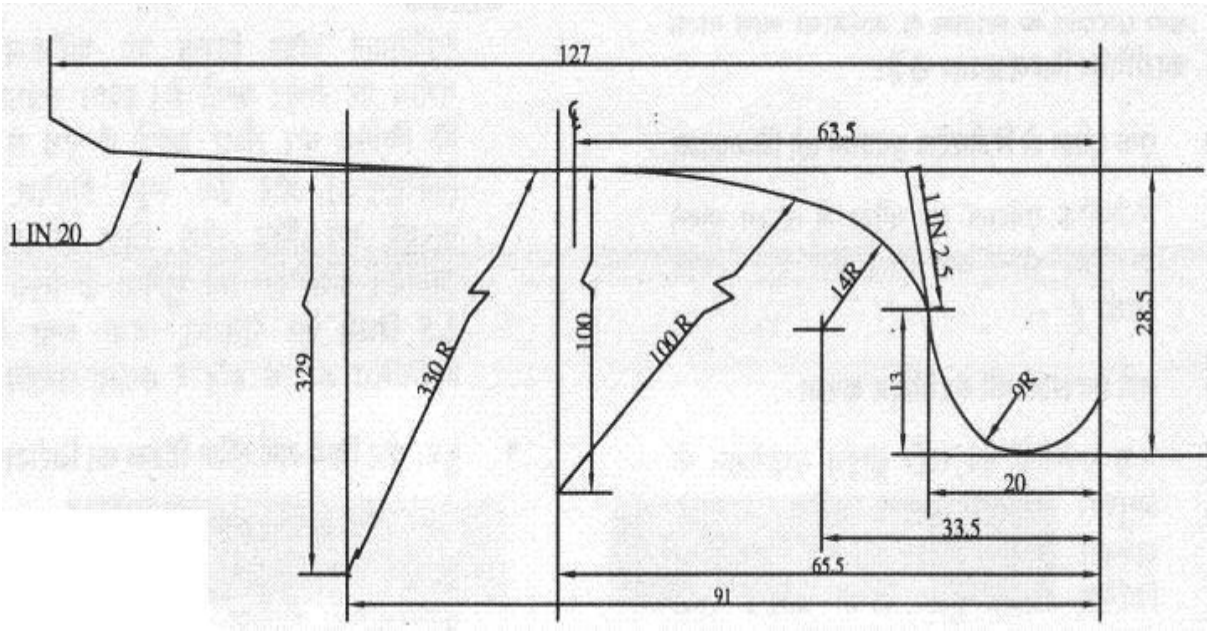
Three intermediate worn wheel profile are developed to increase the life of wheel

- 25 mm, 22 mm & 20 mm

TABLE – INTERMEDIATE WORN WHEEL PROFILE

Thickness of Flange (mm)	D1 (mm)	D2 (mm)	D3 (mm)	R1 (mm)	R2 (mm)	R3 (mm)	R4 (mm)
25	38.5	65.5	91	11.5	14	100	330
22	35.5	65.5	91	10	14	100	330
20	33.5	65.5	91	9	14	100	330

Worn Wheel Profile 20 mm flange Thickness



Benefits of Worn Wheel Profile:

- It increases the life of wheel.
- It decreases machining cost.
- Less fuel consumption of the engine.
- It increases the wheel lateral oscillation

3.2 Thermal Wheel Defects:

The following guidelines are issued to make the visual inspection of wheels during maintenance more focused and effective. The following wheel conditions should be paid special attention during the visual inspections of solid and tyred wheel discs used on coaches and EMU's.

In addition to normal checks exercised on wheel condition during primary / secondary maintenance of coaches, a detailed inspection of wheels should be done when the coaches are received in sick line for attention for either scheduled or out of course attention. The wheel sets shall be inspected for the following conditions and action taken as indicated for each condition:

1. **Shattered Rim:** a wheel with a fracture on the tread or flange must be withdrawn from service. This does not include wheels with localized pitting or flaking without presence of any other rejectable condition.


Shattered Rim

2. **Spread Rim -** If the rim widens out for a short distance on the front face, an internal defect may be present. Spreading of the rim is usually accompanied by a flattening of the tread, which may or may not have cracks or shelling on the tread. Such wheels must be withdrawn from service.


Spread Rim

This condition should not be confused with a uniform curling over of the outer edge of the rim around the entire wheel, which is called rim flow Rim flow is not a defect.

3. **Shelled Tread** -Shelling can be identified by pieces of metal breaking out of the tread surface in several places more or less continuously around the rim. Shelling takes place when small pieces of metal break out between the fine thermal checks. These are generally associated with small skid marks or "chain sliding." Such wheels should be withdrawn from service.


Shelled Tread

4. **Thermal Cracks** -Thermal cracks appear on a wheel due to intense heating of the wheel arising out of sever brake binding. Such cracks occur on the tread and generally progress across the tread in a transverse & radial direction. Whenever such a crack becomes visible on the outer face of the rim or a tread crack has reached the outer edge (non-gauge face) of the rim; the wheel should be withdrawn from service. If a crack becomes visible on the outer flange face the wheel should be withdrawn from service.
Wheels involved in sever brake binding should be

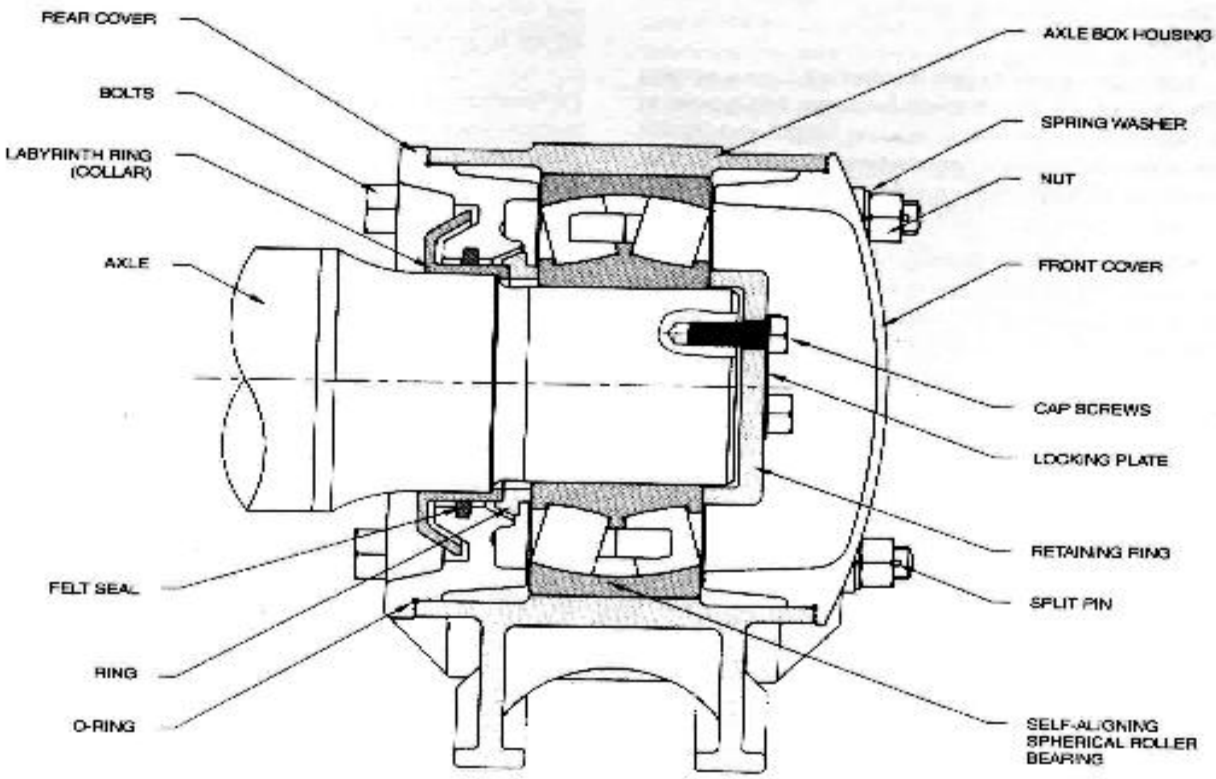

Thermal cracks

examined carefully during the maintenance to rule out the possibility of reject able thermal cracks. Such wheels may be identified by presence of flats (even within acceptable limits) and severe discoloration or blue black heating marks on the tread.

5. **Heat checks -** Thermal cracks are deeper and need to be distinguished from fine superficial cracks visible on the tread on or adjacent to the braking surface. These are called heat checks, which are usually denser than the thermal cracks. Heat checks are caused on the tread due to heating and cooling cycles undergone by the wheel during normal braking. Such wheels do not need to be withdrawn but should be carefully distinguished from the reject able thermal cracks

4. Axles& Bearings

4.1 DOUBLE ROW SELF ALIGNED SPHERICAL ROLLER BEARING



DIRECT MOUNED ROLLER BEARING ARRANGEMENT

Bearing make	Radial clearance in mm
SKF	0.105 to 0.296 mm
FAG/NORMA	0.080 to 0.185 mm
NEI/NBC	0.080 to 0.190 mm

INSPECTION OF OTHER ROLLER BEARING COMPONENTS

The following components other than roller bearing should be inspected during roller bearing maintenance in the workshop.

- Axle end holes
- End locking plates
- End locking bolts
- Retaining Ring
- Collar
- Felt ring
- Rear and Front Cover
- Axle box housing

Bearing Defects

	**Rust & Corrosion** Surface becomes partially or fully rusted. Sometimes rusted at spacing equal to distances between rolling element
Causes	**Corrective measures**
•Improper storage •Improper packaging •Insufficient rust preventative oil •Invasion of moisture, acid etc. •Handling with bare hands	•Take measure to prevent rusting while in storage •Improve sealing performance •Improve method of assembly and handling •Soak felt seal in warm oil before installation

	**Fretting** Fretting surfaces wear producing red coloured particles that forms hollows
Causes	**Corrective measures**
•Ovresize housing bore •Insufficient interference •Insufficient lubrication •Fluctuating load •Vibration during transport or when not operating conditions	•Use only those housing which have correct bore dia •Improve fit •Check surface roughness of journal and housing •Check consistency of grease •Do not use worn out or damaged housings

	**Flaking/Spalling** Flakes from on the surfaces of the race way and roller elements. When flakes fall off, the surface becomes rough and uneven
Causes	**Corrective measures**
•Excessive loads, metal fatigue, improper handling •Improper mounting •Insufficient precision of journal or housing •Insufficient clearance •Contamination •Rusting •Passing of electric current through bearing •Softening due to abnormal temperature rise	•Find the cause of heavy load •Check internal clearance regularly •Improve precision of journal and housing •Improve operating conditions •Improve method of assembly and handling •Check grease and greasing method

	**Seizure** Bearing heats up, becomes discoloured and eventually seizes up
Causes	**Corrective measures**
•Insufficient clearance (including clearances made smaller by local deformation) •Insufficient Grease •Bad quality of grease •Excessive load •Roller Skewing •Softening due to abnormal temperature rise •Slippage of inner ring over journal due to failure of End locking arrangment	•Check grease type and quantity •Check internal clearance regularly •Improve method of assembly and handling •Use specified grade fasteners •Apply specified torque

	**Cracking** Splits and cracks in bearing rings and rollers
Causes	**Corrective measures**
•Rapid heating during mounting •Excessive shock load •Improper handling, use of steel hammer and ingress of large foreign particles •Surface deformation due to improper lubrication •Excessive interference •Oversize housing bore and excessive ovality •Large flaking •Overheating due to creeping	•Avoid rapid heating of bearing during mounting •Reconsider operating condition •Improve method of assembly and handling •Prevention of creep •Do not use excessively worn out or deformed housing

	**Cage damage** Breaking or wear of cage
Causes	**Corrective measures**
•Excessive moment load •Excessive fluctuation of speed •Trapping of foreign objects •Excessive vibration •Improper mounting (misalignment)	•Investigate rigidity of system •Reconsider operating conditions •Improve method of assembly and handling •Improve sealing efficiency •Check for any grease contamination

Rolling path skewing

Roller contact path in raceway surface strays or skews

Causes	Corrective measures
•Deformation or tilt of bearing due to insufficient precision of journal or housing •Improper mounting •Insufficient rigidity of journal and housing	•Recheck internal clearance •Recheck precision of journal and housing •Investigate rigidity of system

Smearing and scuffing

Surface becomes rough with small deposits, Scuffing generally refers to roughness of bearing rings ribs and roller end faces

Causes	Corrective measures
•Improper lubrication •Ingress of foreign matter •Rollers skew due to excessive misalignment •Excessive surface roughness •Excessive sliding of rolling elements	•Check the quality/quantity of grease •Improve sealing performance •Check operating conditions •Improve method of assembly and handling •Check for any grease contamination

	**Indentations** Hollows in raceway surface produced by solid foreign objects trapped or impacts (false Brinelling)
Causes	**Corrective measures**
•Ingress of small solid foreign objects such as dirt, dust •Trapping of flaked particles •Impacts due to careless handling	•Improve sealing performance •Improvement in handling and mounting practices •Check involved bearing for flaking if dents produced by metal particles •Always use clean grease

	**Electric current damages** Pits form on raceway and develop into ripples. Further development leads to corrugated surface. Sometimes spot or localized burns are also noticed
Causes	**Corrective measures**
•Electric current flowing through raceway	•Create a bypass for current •Insulate the bearing •Follow proper instruction/procedure for welding. Current must never be allowed to pass through bearing

	**Discolouration** Change of raceways/roller colours
Causes	**Corrective measures**
•Temper colour by overheating •Deposition of deteriorated grease on surface •Improper lubrication	•Use good quality of grease •Replacement of grease after recommended intervals •Do not allow heating of bearing beyond 120° C during mounting

	**Peeling** Peeling is a cluster of very small spalls. Peeling can also include very small cracks which develop in to spalls
Causes	**Corrective measures**
•Ingress of foreign matter •Improper lubrication	•Control of surface roughness and dust •Improve sealing performance •Use only clean grease

4.2 Maintenance in Open line & precautions to avoid Hot axle

- Visually inspect axle box housing, front cover, rear cover and other parts for damages.
- During examination try to listen unusual/abnormal noise or grinding.
- If the fresh grease oozing abnormally, then the wheel set must be removed from service.
- During Rolling-in & Rolling out examination, inspect axle box for any indication of hot box.
- Check the temperature of axle box by non-contact thermometers.
- If the temp. of axle box found 80°C & above, the affected coach should be detached en-route from train service.

6.AIR BRAKE SYSTEM

Air brake: The brake system in which compressed air is used in the brake cylinder for the application of brakes is called air brake.

Necessity to introduce the Air Brake in rolling stock : The existing vacuum brake has got its own limitations like brake, fading, increased application and release timings etc., In practice it is not reliable to trains in higher altitudes due to insufficient vacuum levels in brake van and train engine.

So the overcome all these, it has become necessary to introduce Air brake system to control the speed of the train and to stop it within a reasonable distance, irrespective of length, load of the train distance covered and altitude of the train.

Advantages of air brake over vacuum brake system:

The advantage of Air brake over Vacuum brake is

1. Uniform brake power is possible throughout the train in airbrake but it is not possible in case of vacuum brake since the pressure drop at the rear of the train is up to 20%
2. The propagation rate of compressed air is 260 m/sec to 280 m/sec when compared to 60 to 80 m/sec. in the sec. in of vacuum brake.
3. The Air brake trains have potentiality to run longer than 600 meters length.
4. The air brake trains have potentiality to run heavier loads than 4500 tons.
5. Shorter breaking distance.
6. Suitable for higher altitudes.
7. Compact and easy to maintain.
8. Consumption of spare parts is very less.
9. Simple brake rigging.
10. Quicker application and release, so better punctuality can be achieved.
11. Better utilization of rolling stock since less maintenance and pre departure detention.

Types of Brake System used in Indian Railway Rolling Stock:-

1) Single pipe graduated release & application conventional air brake system utilized in Goods Stock.
2) Twin pipe graduated release & application conventional system utilized in Coaching Stock.
3) Twin pipe graduated release & application Bogie Mounted Air Brake System at present utilized in more than 98% coaches in place of conventional twin pipe air brake system.
4) Twin pipe graduated release & application Axle Mounted Disc Brake System, utilized in LHB coaches made by RCF Kapurthala.

Types of Air Brake System:-

1. **Direct Release & Application System**:- (100% creation & drop of pressure)

   In direct release system, the brake cylinder pressure cannot be reduced in steps by increasing the brake pipe pressure in steps during release. The brakes are released immediately, as soon as releasing of brakes is initiated.

2. **Graduated Release & Application System**:-

In this system the brake cylinder pressure can be reduced gradually in steps in proportion to the increase in brake pipe pressure.

NOTE: - In both the types brake application is directly proportional to the reduction in brake pipe pressure.

There are two types of Graduated Release Air Brake:-

1) Single Pipe Air Brake System.

2) Twin Pipe Air Brake System.

1) **Single Pipe Air Brake System: -**

There is only one pipe called brake pipe running from loco to the brake van in order to get continuity of air for the application & release of brakes.

i) At present running in goods stock.(Except latest developed BOX-N HL, BCN HL wagons)

ii) Releasing time is more 45– 60 sec.

2) **Twin Pipe Air Brake System :-**

i) In addition to brake pipe, there is one more pipe called feed pipe , running loco to the brake van to charge the auxiliary reservoir continuously to 6 kg/cm^2.At present running in coaching stock and also in latest developed BOX-N HL, BCN HL wagons)

ii) Releasing time is less 15 – 20 sec

MAIN COMPONENTS OF AIR BRAKE SYSTEM(SINGLE PIPE)

1) Brake pipe – dia. 32 mm (for goods) & Pressure 5 kg/cm2.

2) MU washer

3) Palm Coupling

4) Air Hose (Length: 660^{+6}_{-0}mm)

5) Cut Off Angle Cock

6) Grip Seal Joint

7) Branch Pipe (Dia.: 20 mm)

8) Isolating Cock

9) Dirt Collector

10) Common Pipe Bracket

11) Intermediate Piece

12) Distributor Valve

13) Control Reservoir

i) 6 liter (Goods): 5 kg/cm^2

ii) 9 liter (Coaching): 5 kg/cm^2

14) Auxiliary Reservoir

i) 100 liter (Goods): 5 kg/cm^2

ii) 200 liter (Coaching): 6 kg/cm^2

15) Manual Release Handle

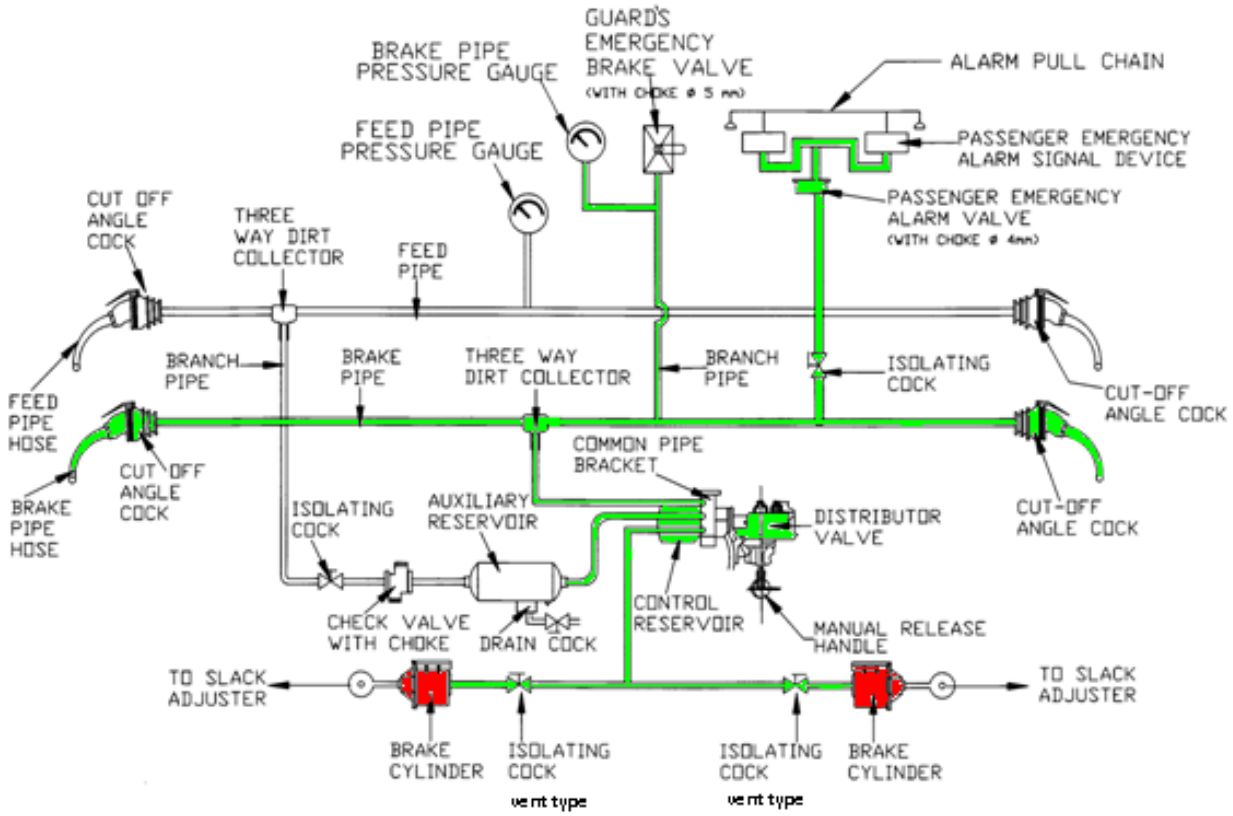
16) Isolating Handle of DV

17) Drain Cock in DV

18) Branch Pipe for BC

19) Isolating Cock for BC

20) Brake Cylinder Dia. – 355 mm (Pressure max. 3.8 ± 0.1 kg/cm^2)



SCHEMATIC LAYOUT OF TWIN PIPE GRADUATED RELEASE AIR BRAKE SYSTEM

Extra Fitting For Coaching:-

1) Feed Pipe – Dia. 25 mm & pressure: 6 kg/cm^2

2) Non Return Valve with Choke: dia. 3 mm

3) Isolating Cock & Dirt Collector for FP

4) Branch Pipe for PEAV & PEASD.

i) PEAV choke dia.: 8 mm (NEW)

ii) PEAV choke dia.: 4 mm (OLD)

5) Isolating Cock for PEAV & PEASD

6) Vertical Pipe for Guard Van Valve

7) Guard Valve with Handle & choke dia.: 8 mm

8) Guard Van Valve BP & FP gauge

Working Principle Of Air Brake System:

Under normal conditions the Brake pipe is charged with 5kg/cm^2 from the loco. The control reservoir and the Auxiliary reservoir are also charged with 5 kg/cm^2 from BP through Distributor valve in case of single pipe system. In twin pipe system the auxiliary reservoir is charged to 6 kg/cm^2 through feed pipe.

When the brake pipe is 5 kg/cm^2 the brake cylinder is connected to exhaust through distributor valve in order to keep the brake in released position fully.

Whenever the brake pipe pressure is reduced below the CR pressure, the DV connects the auxiliary reservoir with the brake cylinder and the air from AR is sent into the brake cylinder to apply the brake. Whenever the brake pipe pressure is equal to CR pressure the DV disconnects the BC from AR and in turn connects the BC with Exhaust for the release of brakes fully.

The different processes involved in working of Air brake system:

The processes involved in working of Air brake are

a) Charging

b) Application

c) Release

d) Manual Release

During Charging:

a) Brake pipe is charged with 5 kg/cm^2 by the drivers brake valve from the Loco

b) Feed pipe is charged with 6 kg/cm^2

c) AR is charged with 6 kg/cm^2 (Up to 5 kg/cm^2 is charged both brake pipe and feed pipe Beyond 5 kg/cm2 & up to 6 kg/cm^2 it is exclusively charged feed pipe.

d) The CR is charged through the distributor valve to 5 kg/cm^2 from BP

e) During charging Brake cylinder is connected to exhaust through distributor valve to keep the brakes in released condition.

During Brake Application

The brake pipe is reduced in steps as given below

SN	Stages	BP pressure is reduced by
1	Minimum Reduction	0.5 to 0.8 kg/cm^2
2	Service application	0.8 to 1.0 kg/cm^2
3	Full service application	1.0 to 1.5 kg/cm^2
4	Emergency application	5.0 kg/cm^2
5	Release stage	No reduction (BP at 5.0 kg/cm$^{2)}$

When the brake pipe pressure is reduced in steps as shown above, the air from AR is sent into BC to a maximum pressure of 3.8 $\pm$ 0.1 kg/cm^2 during full service application as well as emergency application.

During minimum reduction and service application the admission of air from AR in to BC is directly proportional to the reduction in the BP pressure. (i.e. 2.5 times charging of BC as per reduction in BP but it is applicable only up to 1.5 kg/cm^2 of pressure drop in B.P.)

NOTE : Before AR is connected to BC the AR and CR are disconnected from BP and BC is also disconnected from Exhaust.

The AR is continuously charged to 6.0 kg/cm^2 during brake application by Feed pipe. The CR pressure should constant at 5.0 kg/cm^2. However there may be a little drop in CR pressure during brake application due to the design feature.

DURING RELEASING / RECHARGING

During release the BP pressure is increased in steps. When the BP pressure is increased in steps the brake cylinder is disconnected from AR and in turn connected to exhaust. The air from Brake cylinder is released / vented progressively depending upon the increase in the brake pipe pressure. When the brake pipe pressure is brought to 5.0 kg/cm^2 from the brake cylinder is completely exhausted and the brakes are released fully.

MANUAL RELEASE

Whenever the loco is detached BP pressure is brought to zero and brake application takes place due to the existence of CR pressure at the bottom of the main diaphragm. To release the brakes manually the hollow stem in the DV should be brought to the normal position by releasing the air from CR. To facilitate this, the release valve is given a brief pull which is provided at the bottom of the DV. During this operation the air from CR is released which in turn brings the hollow stem to the normal position to connect BC with exhaust for releasing of brakes.

FEATURES OF AIR BRAKE SYSTEM:-

SN	AIR BRAKE SYSTEM
1.	Air Brake works on compressed air at 5 kg/cm^2 maintained in brake pipe.
2.	At the time of brake application compressed air is admitted into BC up to 3.8 kg/cm^2.
3.	DV is the main functioning unit in the Air Brake System.
4.	Brake application is caused by the outward movement of the Piston.
5.	BC is connected to AR during brake application & to exhaust during brake release through the DV.
6.	No brake power fading.
7.	Uniform brake power is possible throughout the train due to the higher propagation rake of compressed air (260 to 280 m/sec.)
8.	Air hoses are used to provide flexible connection between adjacent vehicles.
9.	Palm ends / coupling heads are used on the coupling side of air hoses.
10.	For any reason, if the cylinder has to be made in operative, it can be conveniently done by closing the isolation cock.
11.	MU washers are used to make air tight joints.
12.	Emergency braking distance is 632 m (4500 tones trailing load level track at 65 kmph speed).

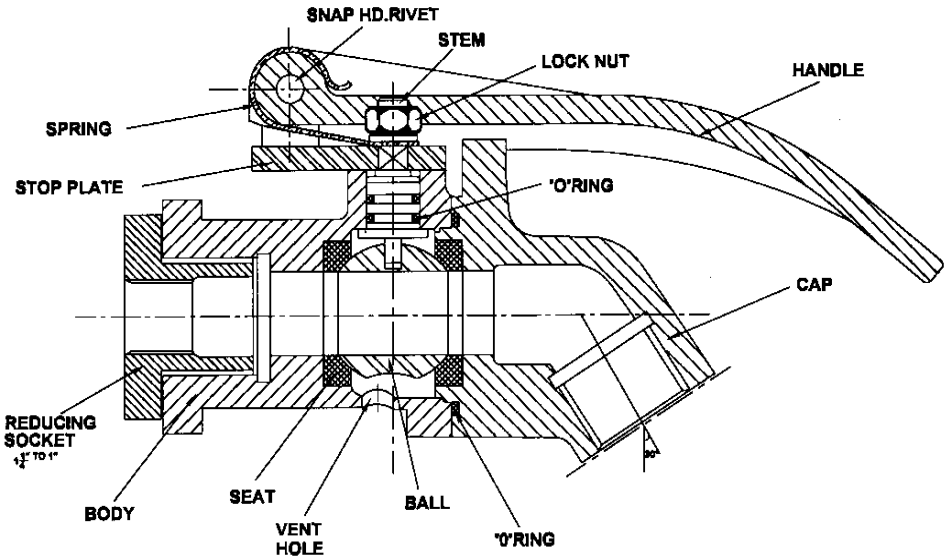
6.1 AIR BRAKE SUBASSEMBLIES

1) **Common Pipe Bracket –** Common Pipe Bracket is permanently mounted on the under frame of a vehicle. One face is mounted with distributor valve along with intermediate piece and other pace with control reservoir. The advantage of fitting a common pipe bracket is to remove the distributor valve for repair or replacement without disturbing the pipe connections.

1) **INTERMEDIATE PIECE –** Intermediate piece serves the purpose of blanking all the other parts on the common pipe bracket front face other than required for a particular make of distributor valve. Intermediate piece is mounted on the common pipe bracket face with a common gasket and the distributor valve is fastened to the intermediate piece.

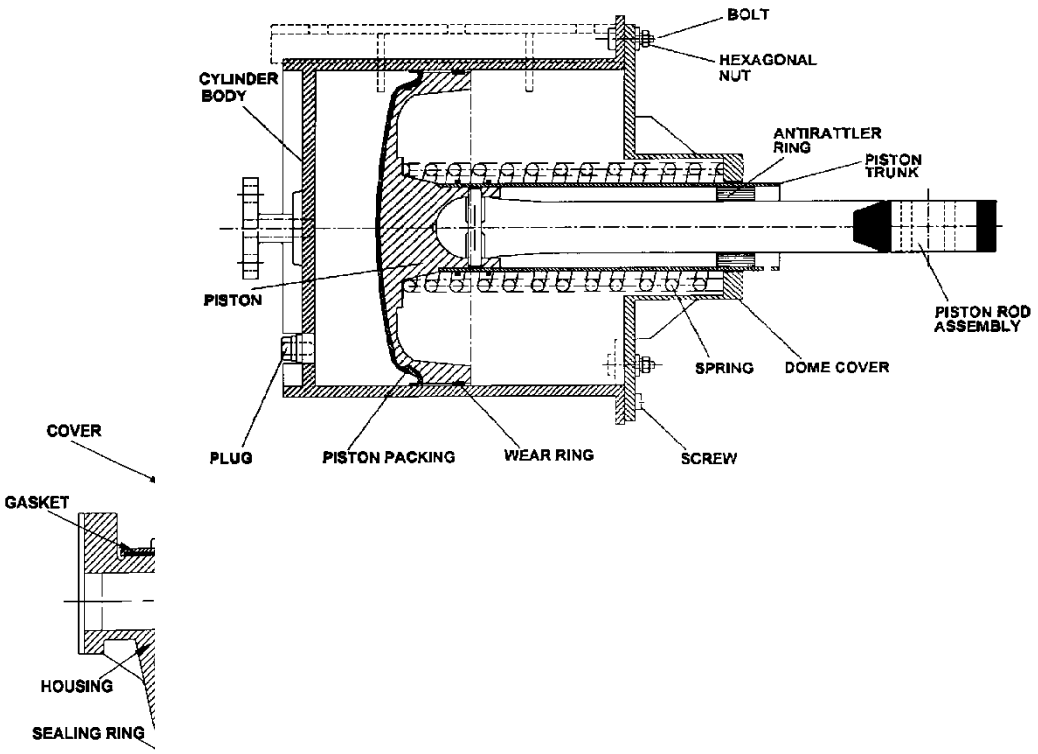
2) **BRAKE PIPE HOSES –** In order to connect two successive wagons, the brake pipes (BP) installed on the under frame are fitted with flexible hoses. Length – max 666 mm , min – 784 mm

3) **BRAKE PIPE COUPLING –** To connect subsequent wagons, the hoses of BP are screwed to coupling and hose nipple by means of stainless steel 'Bend it type clips. The coupling is designed in the form of palm end and hence also known as palm end coupling. Since a joint is formed at the coupling head, leakage may take place, through it. Therefore, it is necessary to subject the hose coupling of brake pipe to leakage test. The air brake hose coupling are provided in the brake pipe line.



4) **CUT OFF ANGLE COCK** – Cut of angle are provided on the air brake system to facilitate coupling and uncoupling of air hoses. When the handle is parallel to cut off angle cock, the air can easily pass through the cock. The position of the handle is known as open position. When the handle is placed perpendicular to the cock body, thereby closing the passage of air. This position of handle is known as closed position. The cut off angle cock is to be completely dismantled and overhauled during POH or when there is some specific trouble.

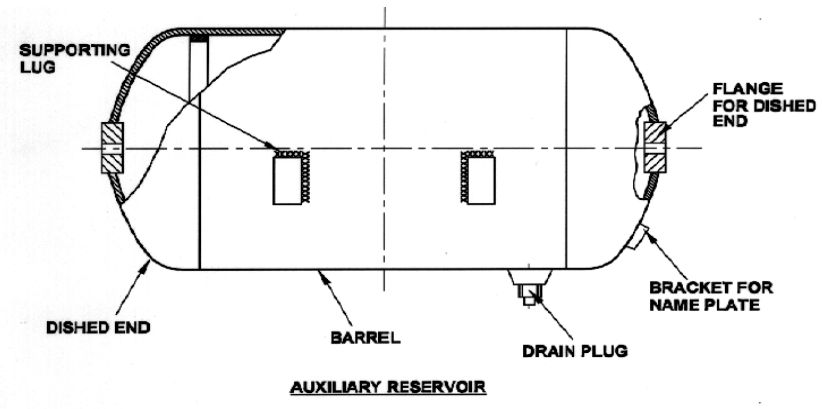
5) **BRAKE CYLINDER** – Brake cylinder is provided for actuating the brake rigging for the application and release of brakes. The brake cylinder receives compressed air from auxiliary reservoir after bring regulated by the distributor valve and develops mechanical brake power by outward movement of its piston assembly.



SECTIONAL VIEW OF DIRT COLLECTOR

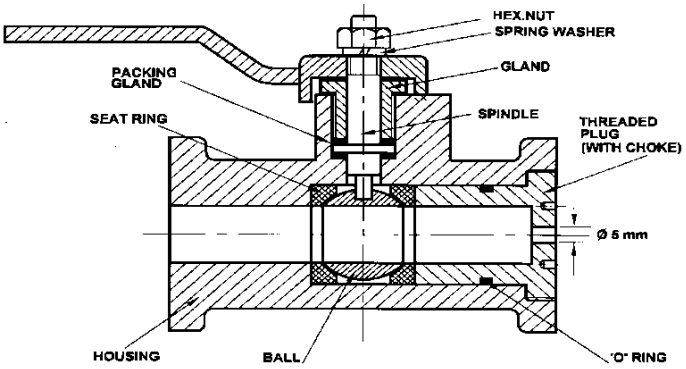
6) **DIRT COLLECTOR** – Dirt collector are provided at the junction of the main pipe and branch pipe in both feed pipe and brake pipe. These are meant for removing dust, moisture and scale practices from air before it enters the DV & AR. This is achieved by centrifugal action.

7) **AUXILARY RESERVOIR** – It's a pressure vessel and its function is to feed dry compressed air to the brake cylinder for application of brakes. AR is charged through brake pipe as well as feed pipe in coaching. Pressure in AR for goods single pipe – 5 kg/cm^2 and for Coach twin pipe 6 kg/cm^2. Capacity of AR in Goods, Coaches, BVZC are 100 ltrs, 200 ltrs, 75 ltrs respectively. No. of AR provided per wagon is 1 and No. of AR provided in Rajadhani Coaches per coach – 2 (2 x 100 ltrs. Is conventional) & 1 (1 x100 in BMBC) Charging time of AR (6000 litre or one complete rake) 180 – 240 sec.



AUXILIARY RESERVOIR

9) GUARD'S EMERGENCY BRAKE VALVE- GEBV is provided in the Guards compartment. This valve provides a facility to the guard initiate brake application in case of any emergency. Dia. of Guard van valve choke – 8 mm



10) CONTROL RESERVOIR – The control reservoir is mounted on the under frame of coach very near to the DV and connected through a small chock and a pipe with the DV. During braking operation and releasing operation through recharging operation, the air pressure inside the control reservoir remains unaltered. Only during manual release the air of control reservoir escapes to the atmosphere through release valve of DV. Capacity of CR in per wagon and Coach are 6 litre and 9 litre respectively.

11) DISTRIBUTOR VALVE – DV is most important functional component of Air Brake System and is also some time referred to as the Brain of air brake system. It is connected to brake pipe AR & BC. It senses the BP pressure variations & work automatically to provide brake application as well as brake release. The distributor valve assemble consists of a valve body, a common pipe bracket and CR.

The DV mainly performs the following functions:-

i) Chare the air brake system i.e. CR & AR to regain pressure during normal running condition charging time (0 to 4.8 kg/cm2)

Type of DV	CR Charging		AR Charging	
	KEO	C_3W	KEO	C_3W
Old timing	160 $\pm$ 10	260 $\pm$ 20	170 $\pm$ 10	270 $\pm$ 30
New timing	185 $\pm$ 25	165 $\pm$ 20	140 $\pm$ 30	175 $\pm$ 30

ii) Helps in graduated brake application, when pressure in brake pipe is reduced in steps.

iii) Helps in graduated brake release, when pressure in brake pipe is increased in steps.

iv) Quickly propagates reduction of pressure in brake pipe throughout the length of train by arranging additional air pressure reduction locally inside the DV.

v) Limits max. Brake cylinder pressure up to 3.8 $\pm$ 0.1 kg/cm^2 for full service/emergency application.

vi) Controls the time for brakes application & brake releasing depending on service condition.

ITEM	WAGON	COACH
BC Filling time (from 0 to 3.6 kg/cm^2)	18 – 30 Sec.	3 – 5 Sec.
BC Release time (from 3.8 to 0.4 kg/cm^2)	45 – 60 Sec.	15 – 20 Sec.

vii) Facilitates complete discharge of air from the air brake system manually with the help of QRV/DRV.

viii) Projects overcharging of CR when brake pipe pressure is quickly increased for releasing brake

SN	KEO	C_3W	Function
1	Three pressure valve	Main valve	Supply of requisite amount of pressure in brake cylinder, when B.P. pressure is reduced, also it provides passage for BC pressure to exhaust in atmospheres when BP pressure is raised.
2	U-controller with U chamber	Quick service valve	The function of this part is to create initial pressure drop in brake pipe pressure by allowing a sudden entry of BP pressure into large volume bulb / U chamber at the start of brake application. This ensures rapid propagation of pressure reduction in BP throughout the length of train
3	Minimum pressure limiter	Inshot valve	When application is initiated causes rapid charging of brake cylinder up to a determined pressure to overcome rigging resistances.
4	Max. pressure limiter	Limiting device	Restrict the max. BC pressure to 3.8 ± 0.1 kg/cm^2
5	Check cover	Application of release chock	Regulates application & release times.
6	A - controller	Cut off valve	Connects the B.P. to C.R. during charging & cut off the connection when B.P. pressure is reduced for brake application.
7	R - charger	AR check valve	Helps in charging the AR in addition to charging. It checks flow of F.P. into B.P. in dual pipe system &also checks back flow of air pressure when B.P. pressure when B.P. pressure is reduced for brakes application
8	Quick release valve (QRV)	Double release valve (DRV)	Allows the brakes of a coach to be released by means of single brief pull to release wire, without any loss of air in A.R.

12) Passenger Emergency Alarm System

Passenger emergency alarm system consists of two components:

A. Passenger Emergency Alarm Signal Device (PEASD).

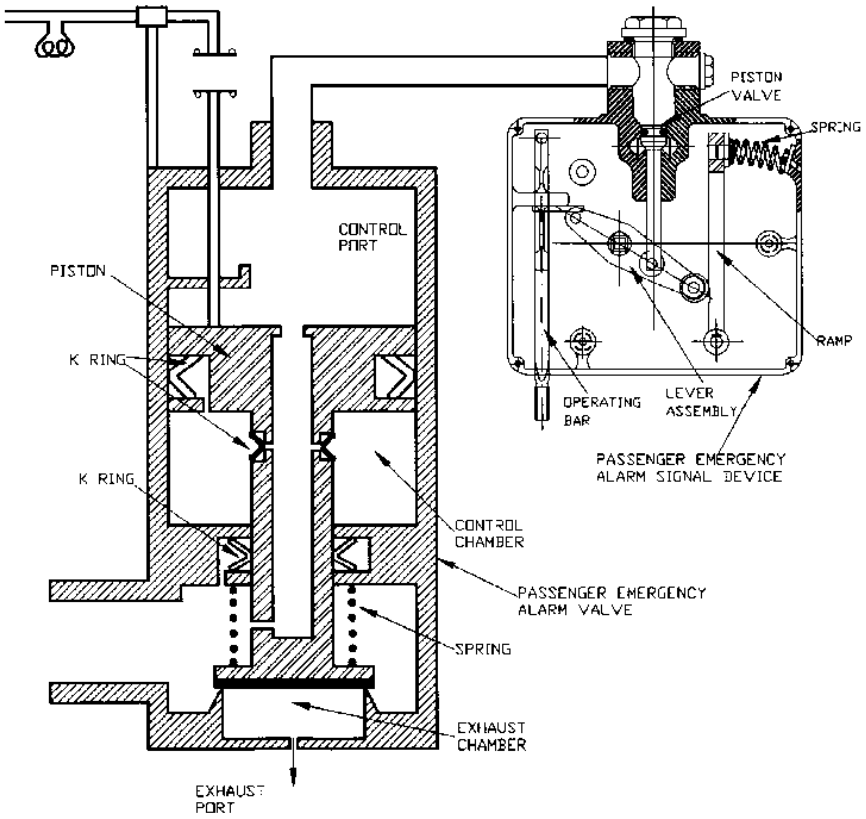
B. Passenger Emergency Alarm Valve (PEAV).

These two components in combination give an indication to the driver that some passenger is in need to stop the train. The indication is transmitted from the coach when the passenger pulls the chain

13) Passenger Emergency Alarm Signal Device

Passenger Emergency Alarm Signal Device (PEASD) is a manually operated pilot vent valve. It is operated through mechanical force exerted by pulling the alarm chain provided inside the coaches for emergency use.

The passenger emergency alarm signal device does not need any maintenance during normal service except when it is found damaged or is due for periodic overhauling.



Working: When ever chain is pulled to stop the train, the rocker arm; provided in PEASD, slides and actuate the pilot valve to open the atmospheric hole, as a result the BP pressure is reduced in PEASD. As the PEAV is connected in series with PEASD resulting BP pressure is also reduced in upper chamber of the PEAV. Due to variation of BP pressure in both the chamber of PEAV the main valve floats from its position & relate the lower chamber with the atmosphere after opening of the modified choke (8 mm dia.) this fast venting of pressure create reduction of pressure in BP pipe of the said coach & brakes take place to stop the train.

6.2 TROUBLE SHOOTING & REMEDIAL MEASURES

SN	CAUSE	REMEDY
1.	MU (Multiple Unit) washer is damaged or displaced.	Change the damaged one or reset the displaced one.
2	Brake pipe joint leakage or Drain plug leakage.	Tighten all loose joint to stop leakage.
3	Hand brake in ON condition.	Check that Hand brake is in release condition.
4	Improper setting of empty load Device.	Ensure proper setting of empty load device i. e. loaded /Empty condition.
5	Horizontal beam's guide brackets jammed.	Ensure smooth working of horizontal lever.
6	Improper working of SAB.	Replace the faulty SAB with a good working SAB.
7	Exhaust port of DV is chocked condition or DV not working properly.	Replace the faulty DV with a good working DV

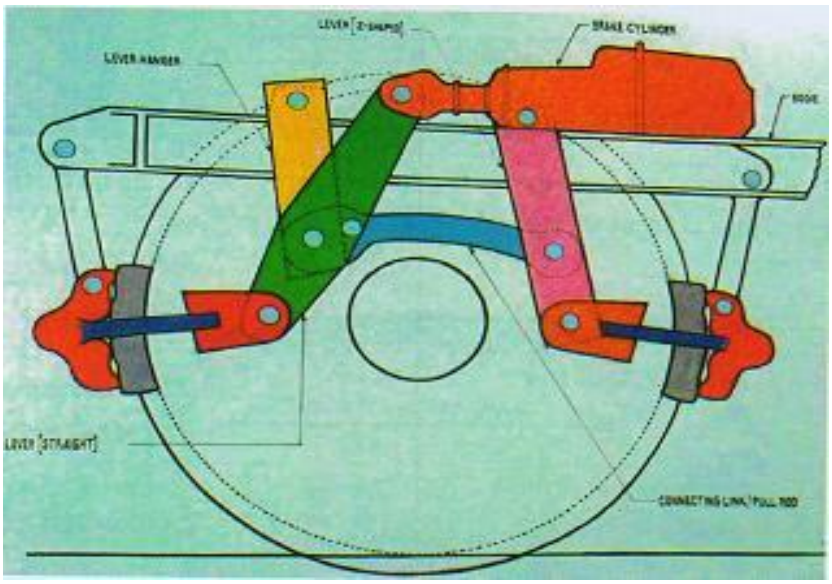
8	Brake cylinder spring stuck up (commonly) or broken (rarely)	Release brake cylinder spring in proper position using the check not at the end of brake cylinder. Replace the broken spring with a new one.
9	Any part of brake rigging is in jammed condition.	Ensure smooth operation of all parts of brake rigging.
10	Brake beam stuck up in bracket beam pocket or brake beam hanger pin jammed.	Ensure free movement of brake beam in brake beam pockets.
11	Cut off angle cock is partially closed.	Cut of angle cock is opened fully.

7.Bogie Mounted Brake System

Introduction

- In order to overcome the problem faced due to breakages and malfunctioning of SAB en-route and also due to the frequent breakages and replacement of cast iron brake blocks.
- The SAB is completely eliminated by providing the brake cylinder on the bogie itself, & frequent breakages and replacement of C.I. brake blocks are minimized by providing high friction composite 'K'-type brake blocks.

Advantages Of BMBS

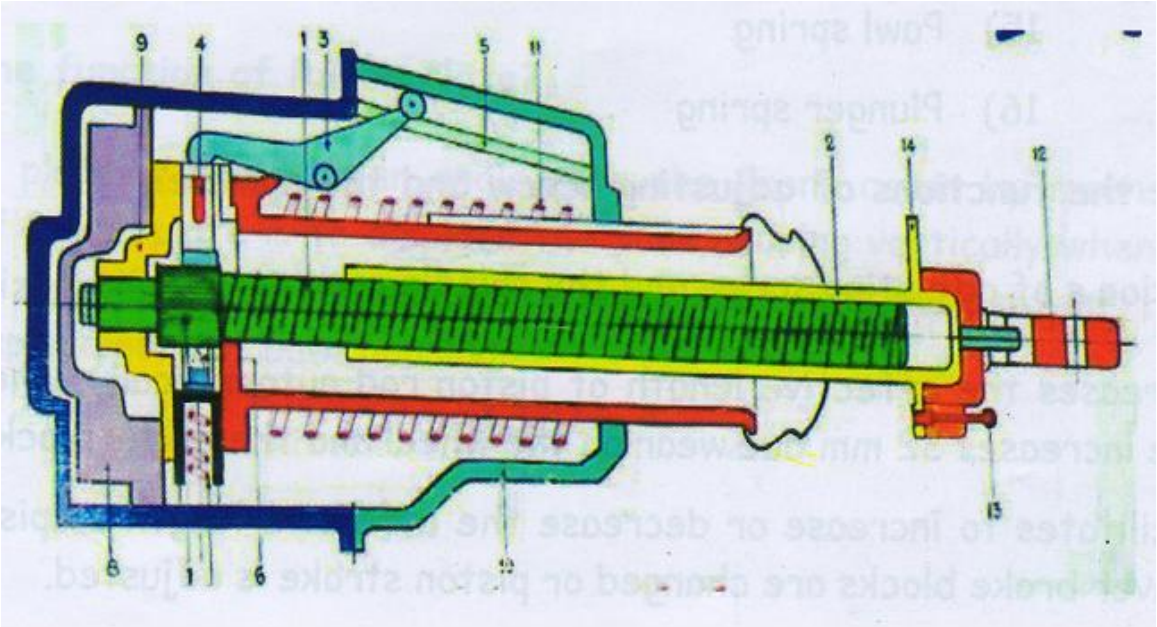


- In built single acting slack adjuster to take up a slack automatically.
- Weight is reduced and C.C. can be increased (weight is reduced 492 kg per coach as compared to conventional coaching stock)
- Number of pin joints is reduced 102 to 84.
- Fulcrum losses are reduced.
- Braking distance can be reduced at a speed of 110 km ph with 18 coaches is 800 m. (Conventional stock is 905 m.)
- Maintenance cost is low.
- Noise is reduced due to under frame mounting, SAB is eliminated.
- Mechanical efficiency is increased.
- Reliability of brake system is increased
- Speed of the train can be increased due to better controlling of train.
- Wheel Wear is reduced due to co-efficient of friction of 'K'-type brake block is 0.25.
- Mechanical advantage is increased.
- 13 T (Non-AC) 1:4 (in conventional) & 1:7.6 (In BMBC)
- 16 T (AC) 1:5.5 (In conventional) & 1:8.4 (In BMBC).
- Life of the brake block is increased. (5.5 to 6.0 times in compare to C.I.).
- Mounting and dismounting of brake cylinder is easy during IOH & POH.
- Weight of the brake block is reduced resulted transportation and handling is easy.

OTHER DATA OF B.M.B.S : -

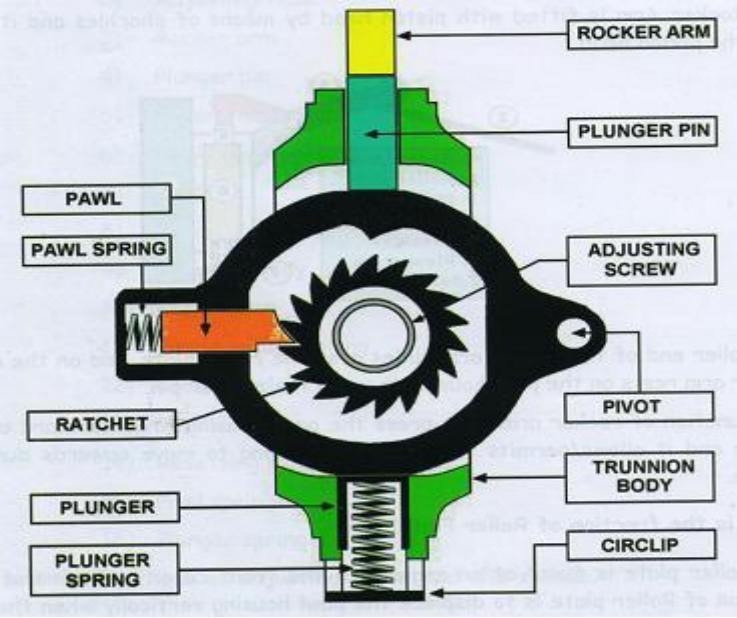
- Totally four numbers of 8" dia. (203 mm) size brake cylinders are used in place of two nos.14" (355 mm) cylinder in convention air brake system.
- It has an inbuilt single acting slack adjusting cap automatically to an extent of 305 mm slack adjustment whenever the piston stroke is increased more than 32mm(clearance increased due to wear on brake block and wheel).
- These cylinders are mounted with central longitudinal members connecting the bogie transom and head stock on either side.
- Piston stroke should be maintained within 32 mm.
- The total number of teeth on adjuster ratchet is 18 nos.

- The circumferential displacement of ratchet in one stroke is by 20 degree.
- The liner displacement of adjuster tube in one stroke is only by 0.366mm.
- The liner displacement of adjuster tube in one complete rotation of ratchet is by 6.4mm.
- As a conclusion to adjust 25 mm of slack total 72 braking strokes are required.



MAIN COMPONENTS OF BMBC

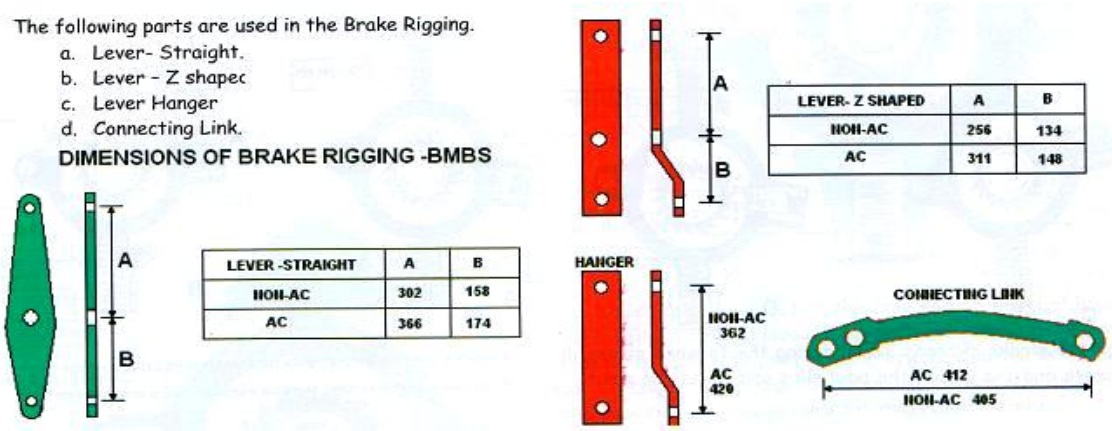
1. Adjuster screw with Ratchet
2. Adjuster tube
3. Rocker arm
4. Roller plate
5. Pawl Housing Ring
6. Pawl
7. Piston
8. Trunnion Body
9. Front Cover
10. Piston Return Spring
11. Cross Head
12. Latch
13. Resetting Plate
14. Pawl Spring
15. Plunger Spring
16. Ratchet



Precautions to be followed while maintaining the BMBC.

- Ensure the bogies are provided with high friction K type composite brake blocks.(as the coefficient of friction of Composite Brake Block L – Type is 0.17, K - type is 0.25 & for Cast Iron Brake Block it is 0.12).
- Ensure that floating lever, Z-arm are not interchanged between AC / Non-AC coaches.
- Ensure connecting link (Curved Pull-rod) is not interchanged between AC / Non-AC coaches.

- Whenever wheel dia. is reduced below 839 mm, ensure the curved pull rod hole is shifted to next inner hole.
- Ensure the pull rod is not reversed.
- Ensure 38 mm packing is given in between dash pot and axle box wing whenever wheel dia. is reduced to 839 to 813 mm.
- Whenever red mark is seen on the adjusting tubes replace all the brake blocks since further take up of clearance is not possible. If slack take up feature is not possible then adjuster tube to be extended to outside by disengaging of latch provided with resetting plate
- Snout out position should be kept on 3 O' Clock to 9 O'clock (Old 6 O' Clock to 12 O' Clock)



WORKING PRINCIPLE

- Whenever driver applied the brakes, piston is charged at 3.8 kg/cm^2 of pressure.
- Piston assembly started to move in forward direction,
- But there will no any change in the position of adjuster ratchet if the piston stroke is within 32 mm
- If the piston stroke is exceeded more than 32mm, in return stroke the fulcrum of the rocker ram is change resulted the pressure on plunger pin is released and pawl housing ring is started to rotate in clock direction due to release of pressure, mean while ratchet also rotate on its axis and change circumferential position by 20 degree (shifting by one teeth only) and then locked by pawl.
- Due to change of this clock wise position of ratchet ,the adjuster tube takes place the liner displaced outward outside at a rate of 0.366 mm per stroke and locked it in permanent feature resulted the gap between wheel and brake block is reduced.

FUNCTIONS OF MAIN PARTS

(1) ADJUSTING SCREW AND ADJUSTING SPINDLE

- The adjusting screw is connected with a ratchet and forms a single unit. The adjusting screw is provided with double starts thread with a pitch of 1/8" (3.15mm). The ratchet is provided with 18 teeth.
- The function of adjusting screw is to move the adjusting tube forward to increase the effective length of piston rod automatically and also decrease/increase the effective length of piston rod manually. When the adjusting screw completes one full rotation. It makes adjusting tube to move forward by $2\times\frac{1}{8}^{"} = \frac{1}{4}^{"}$ (6.3mm)
- If the ratchet is moved/rotated by one teeth the adjusting screw is rotated by $\frac{360^\circ}{18} = 20^\circ$, which in turn moves the adjusting tube outward/forward by $\frac{1}{4}^{"} = \frac{1}{72}^{"}$ (0.33mm). It is clear that

to move the adjusting tube forward automatically by $\frac{1}{4}$" it requires 18 return strokes or to move the adjusting tube forward by 1" it requires 72 return strokes.

(2) ROCKER ARM:-

Rocker arm is fitted with piston head by means of shackles and it moves along with y=the piston head.

The roller end of the rocker arm slides over the roller plate and the other end of the rocker arm rests on the pawl housing through plunge pin. The function of rocker arm is to press the pawl housing downward during return strokes and it allows the pawl housing to move upwards during forward stroke.

(3) ROLLER PLATE:-

The roller plate is fixed at an angle with the front cover by means of bolts. The function of roller plate is to displace the pawl housing vertically when the rocker arm moves horizontally. It converts the linear displacement of pawl housing.

(4) PAWL HOUSING RING/PAWL:-

The pawl housing ring is fitted with pivot pin of trunnion body at one end and the other end of the pawl housing ring moves freely.

A spring loaded pawl is housed at the free end of the pawl housing.

At the bottom of the pawl housing, a spring loaded plunger is kept between trunnion body and the pawl housing to move the upward during forward stroke.

The function of pawl housing, the pawl is to move the ratchet by one tooth, whenever piston stroke exceed 32mm to increase the effective length of the piston rod during return stroke.

7.1 DIFFERENCE BETWEEN SAB & INBUILT SLACK ADJUSTER OF BMBC

- It is double acting. It can both take up & pay out the clearance automatically between the wheel and brake block.
- The effective length of pull rod is decreased during take up the clearance between wheel & brake block.
- The effective length of pull rod is increased or decreased with reference to the control rod 'A' dimension.
- It maintains a uniform piston strokes for all the cylinders throughout the formation.
- Spindle is made up of triple start thread.
- To adjust the slack, the length of the pull rod is increased or decreased during forward stroke.
- When length of the pull rod increased manually the clearance between the wheel & brake block increases.
- It does not require adjustment of piston stroke every trip.
- It is a single acting. It can only take up the clearance automatically between the wheel and brake block.

- The effective length of piston rod is increased during take up the clearance between wheel & brake block.
- The effective length of piston rod is increased only when the piston stroke exceeds the pre-determined on working stroke of 60mm.

SN	Description of Test	Results Required	Observation	
1	AR Charging Time from 0 to 4.8 kg/cm^2 (Main Reservoir pressure > 7.5 kg/cm^2	270 $\pm$ 30 sec for C_3W (170 $\pm$ 10 sec for KE)		
2	CR Charging Time from 0 to 4.8 kg/cm^2 (Main Reservoir pressure > 7.5 kg/cm^2	260 $\pm$ 20 sec for C_3W (160 $\pm$ 10 sec for KE)		
3	Leakage Test (Brake Release). Check DV Leakage by Soap water only at joints.	No Leakage		
4	**FULL SERVICE APPLICATION & RELEASE**			
	BC filling time from 0 to 3.6 kg/cm2	3 to 5 seconds		
	Maximum Brake Cylinder Pressure	3.8 $\pm$ 0.1 kg/cm^2		
	Leakage Test (Application). Check DV Leakage by Soap water only at joints.	No Leakage		
	BC Release time from 3.8 $\pm$ 0.1 kg/cm^2 To 0.4 kg/cm^2	15 to 20 seconds		
5	**OVERCHARGE PROTECTION** (BP pressure 6 kg/cm^2)	CR pressure should not increase by more than 0.1 kg/cm^2 in 25 sec.		
	CR overcharge reduction test. Overcharge CR to 5.7 kg/cm^2 and pull double release lever for 3 seconds.	Overcharged CR should come to regime pressure of 5 kg/cm^2		
6	**EMERGENCY APPLICATION**		Single pipe	Twin pipe
	BC filling time from 0 to 3.6 kg/cm2	3 to 5 seconds		
	Maximum Brake Cylinder Pressure	3.8 $\pm$ 0.1 kg/cm^2		
	Leakage Test (Emergency). Check DV Leakage by Soap water only at joints.	No Leakage		
	BC Release time from 3.8 $\pm$ 0.1 kg/cm^2 To 0.4 kg/cm^2	15 to 20 seconds		
7	**SENSITIVITY & INSENSITIVITY**			
	BP pressure drop at the rate of 0.6 kg/cm^2 in 6 Seconds	Brake should start applying within 1 sec.		
	With a pressure drop stopped immediately after the operation of QRV.	Brakes must remain applied.		
	BP pressure drop at the rate of 0.3kg/cm^2 in 60 Seconds	Brakes must no apply.		
	REFEEDING			
	Create leak in BC through a 2 mm choke	BC pressure should decrease initially but re-feeding should be available and BC pressure should get stabilized at some		

		pressure	
7	**GRADUATED APPLICATION** Decrease BP pressure in steps as below BP Pressure (Kg/cm^2) 4.8 4.6 4.4 4.2 4.0 3.8 3.6		B. C. Pressure
	Continue Graduated Application until max. BC Pressure is obtained	BP pressure drop must be between 1.4 and 1.6 kg/cm^2	
	BP Pressure at maximum brake application	BP pressure drop must be between 3.4 and 3.7 kg/cm^2	
8	GRADUATED RELEASE Increase BP pressure in steps as below BP Pressure (Kg/cm^2) 3.6 3.8 4.0 4.2 4.4 4.6 4.8		BC Pressure
	Check BP Pressure when BC pressure is 0.4 kg/cm^2 (Recharging pressure to release BC Fully)	4.85 kg/cm^2 approx.	
9	**QUICK RELEASE TEST**		
	Apply emergency brake & pull briefly the double release valve lever	BC & CR are automatically exhausted to zero	
	CR check valve reset test. Start recharging of the system	CR should be isolated from atmosphere when BP pressure exceeds 0.2 kg/cm^2	
	Twin pipe operation Repeat the test : Full service application & Release. ii) Emergency application.	Fill in column against test nos. 3 & 6	

- The piston stroke of the cylinders is not uniform throughout the formation and varies up to 60mm.
- Adjusting screw (spindle) is made up of double start thread.
- To adjust the slack the length of the piston rod is increased during return stroke.
- When the effective length of piston rod is increased manually, the clearance between the wheel & brake block decreases.
- Every trip the piston stroke requires to be adjusted.

Difference between Under frame Mounted & Bogie Mounted Brake system:

SN	*Description*	*U/F Mounted brake System*	*Bogie Mounted brake System*
1	*Slack Adjuster*	*External*	*Internal*
2	*Type of Slack Adjuster*	*Double Acting*	*Single Acting*
3	*Capacity of Slack Adjuster*	*450 mm*	*305 mm*
4	*Size Brake cylinder*	*14 inches*	*08 inches*
5	*No. Of Cylinders*	*02 per coach*	*04 per coach*
6	*Brake force available on brake head*	*3 Ton (Non Modified)* *2.2 Ton (Modified)*	*1 Ton*
7	*Type of Brake Block*	*Low friction Composite L – Type Brake Block*	*High friction Composite K- Type Brake Block*
8	*Coefficient of Brake Block*	*0.16 – 0.18*	*0.28 – 0.30*
9	*Thickness of Brake Block*	*60 mm*	*50 mm*
10	*Piston Stroke*	*80 – 100 mm(Non Modified)* *60 – 70 mm (Modified H/L)*	*Working stroke – 32 mm*
11	*Capacity of Truss Beam*	*16 Ton*	*13 Ton*
12	*Weight of Brake Block*	*3.06 kg*	*2.5 kg*
13	*Anti Vibration Bracket*	*Required*	*Eliminated*
14	*Horizontal Lever*	*Required*	*Eliminated*
15	*Bogie Pull Rod*	*Required*	*Eliminated*
16	*Life of the Brake Gear Components including Wheel*	*Less*	*More*
17	*Number Brake Gear Adjustments*	*07*	*02*

7.2 Testing of Distributor Valve

AIR BRAKE TESTING:-

1) Engine Testing
2) Continuity Test
3) Rake Test
4) SWTR / SCTR

1) ENGINE TESTING :- (RDSO – Pamphlets 9408)

With the use of 7.5 mm diameter test plate (master test plate gauge) .

- **Object:-**To check the leakage in engine & compression capacity of engine.
- **When to be Conducted:-**If there is any dispute between C & W and Loco department regarding creation of requisite pressure in engine as well as in the rake.

- **Procedure:-**
  - i) Detach the engine from rake.
  - ii) Ensure -
  - a) MR pressure – 8 – 10 kg/cm2
  - b) BP pressure – 5 kg / cm2
  - c) FP pressure – 6 kg/cm2
  - iii) Ensure pressure in BP at 5 kg/cm2 & open the cut off angle cock from the both sides (front & rear) to drop the BP pressure suddenly to wash out the system.
  - iv) Close the angle cock & charge the BP again at 5 kg/cm2.
  - v) Apply master test plate gauge with rear side of the BP hose palm.

vi) Open the cut off angle cock of same BP hose & ensure the pressure in master test plate gauge. After 60 sec not to be more than 1 kg/cm2 or gauge reading should not be less than 4 kg/cm.

vii) If drop is more than 1 kg/cm2 , it indicates that said engine is leaking or having low compression capacity .

viii) Engine must be detached from the rake & other engine is required for train operation.

ix) Same procedure can be adopted to check the leakage in FP.

- **Joint Committee Members:-**

i) On examination station – LI + CWI + Dy. SS

ii) On road side station – Driver + Guard + TXR

iii) In Goods yard – SSE/ SE + LI + AYM / CYM.

2) CONTINUITY TEST:-

To be conducted by Guard & Driver.

- **Object:-** To check the continuous flow of air from engine to last vehicle (or any floating obstruction)

- **When To Be Conducted:-** Before departure of primary / secondary rake from platforms or if any attachment

- Detachment of engine or rolling stock in the road side station.

- **Procedure:-**

i) After completion of rake on plat form, before departure guard & driver jointly conducted the above test to ensure flow of air.

ii) At first guard & driver will communicate with walkie- talkie or telephone to perform the continuity test.

iii) After that guard will drop 1.0 kg/cm2 of BP pressure from last vehicle & ask driver for same pressure drop is sensed in engine.

iv) If yes, now driver will drop total amount of BP pressure in engine & same is asked by the guard.

v) After drop assistant driver & guard will come down from the train and ensure brake application especially in at least two or three vehicles near to engine and rear brake van.

vi) If brakes are applied same should be released (in two or three vehicles) & communicate each other.

vii) At last requisite pressure is created in engine and brake van & train is ready to go.

3) RAKE TESTING:-

The different activities / tests to be performed during rake test-

A Carry out visual examination

B Prepare of test rig for rake test

C Leakage, service application & release test

8.Passenger& Amenities fittings

The fittings which are provided inside the coach for Luxurious & Comfortable & also for non strenuous journey are called as “Amenity Fittings “.

Safety Fittings: - The fittings which are fitted in the coach for safety of passengers & their luggage are called as “Safety Fittings “.

Compartment:-

Amenity Fittings	**AC Coach**	**1st Class Coach**	**2nd Class Coach**	**Sleeper Coach**
Folding or Fixed Table	Y	Y	N	Y
Tumbler Holder	Y	Y	N	N
Waste Paper Basket	Y	N	N	N
Mirror with Shelf below	Y	Y	N	Y
Coat Hook	Y	Y	Y	Y
Foot rest for Upper Birth riding	Y	Y	N	Y
Fans	Y	Y	Y	Y
Upper Birth	Y	Y	N	Y
Luggage Racks	Y	Y	Y	Y
Light in Compartment	Y	Y	Y	Y
Furnishing Fittings:-				
Shower Bath	Y	Y	N	N
Wash Basin	Y	Y	Y	Y
Towel Rail	Y	Y	N	N
Push Cock &Lota Shelf	Y	Y	Y	Y
Commode Rail	Y	Y	Y	Y
Mirror & Shelf	Y	Y	Y	Y
Bottle Opener	Y	N	N	N
Liquid Soap Container	Y	N	N	N

Safety Fittings: -	**AC Coach**	**1st Class Coach**	**2nd Class Coach**	**Sleeper Coach**
Luggage locking wire	Y	Y	Y	N
Alarm Chain	Y	Y	Y	Y
Upper Birth Safety Rail	Y	Y	N	N
Doors latch & cutch	Y	Y	Y	Y
Doors	Y	Y	Y	Y
Window Shutters	Y	Y	Y	Y
Fire Extinguisher	Y	N	N	N
Commode Rail	Y	Y	Y	Y
Vestibule Safety brackets	Y	Y	Y	N
Window Safety Bars	N	Y	Y	Y

9.Suspension system

9.1 Air Spring

Air spring is a rubber bellow containing pressurized compressed air with an emergency rubber spring providing various suspensions characteristic to maintain a constant buffer height irrespective of the loaded condition.

Necessity for Introducing Air Spring in Hybrid Coaches:

In the passenger trains, the no of passengers entraining (Super Dense Crush Load) into the coach cannot be controlled and hence the payload of the coaches increases from 18 tons to 34 tons. This abnormal increase of payload reduces the riding clearance between the coaches and wayside platforms and also reduces the buffer height resulting in severe hitting of the coach on the platform.

Due to the Super Dense Crush Load the bolster springs become solid, which in-turn damages/breaks the coil spring resulting in discomfort to the passenger.

So to overcome the above problem on air suspension (air spring) is introduced in the secondary suspension to maintain a constant buffer height irrespective of loaded condition b y varying the pressure of air inside the air spring.

Comparison with existing coil suspension:

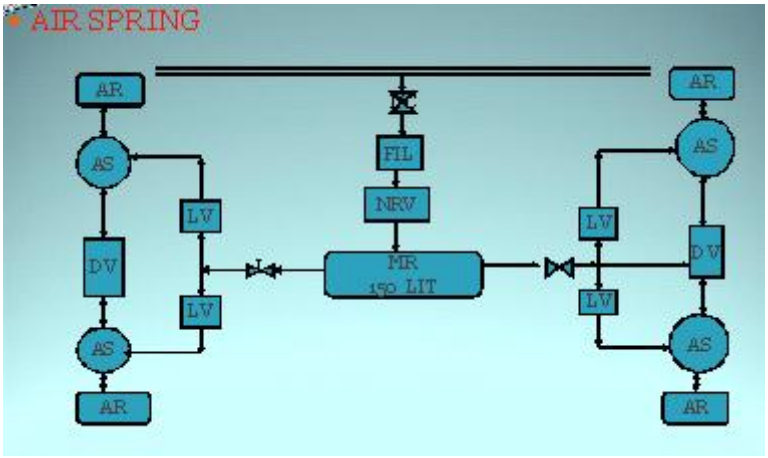
Unlike steel spring, air springs retain their height under changing loads. The low natural frequency of air spring suspension remains virtually constant. In case of coil spring , deflection is proportionate to the load , therefore, under high pay load situation, space constraint become critical , leading to the use of stiffer springs resulting in unsatisfactory ride behavior and reduced speed potential. Air springs; through their control mechanism, offer proportionate stiffness, constant floor height and prospects of better ride behavior with higher speed potential.

Working Principle: With changing loads, air spring reacts initially by changing the distance between air spring support and coach body. then actuating height monitoring valve(leveling valve),either by taking the compressed air to the air spring or releasing air pressure from it to the atmosphere. This process continues until the required height is maintained. This mechanism ensures a constant floor height on coaches provided with air springs, irrespective of the load.

Main Equipments of Air spring:

1- Air Spring	- 04 nos./coach
2- Leveling Valve	- 04 nos./coach
3- Duplex Check Valve	- 02 nos./coach
4- 40 Litre Auxl. Reservoir	- 04 nos./coach
5- Bogie suspension Isolating cock	- 02 nos./coach
6- Non-return valve	- 01nos./coach
7- Coach suspension Isolating cock	- 01 nos./coach
8- 150 Litre main reservoir	- 01 nos./coach

- **M.R.-** one no. M.R. Of 150 Litre is provided for air springs to store the compressed air from F.P. This compressed air reaches to the M.R. Through an isolating cock, filter & non return valve.
- **LV-** one leveling valve for each air spring is provided. i.e., total 04 nos. LV are used in a coach. Its main function is to control flow of compressed air to spring during loading/unloading. One installing lever is also attached with it.
- **DCV-** one DCV is provided between two air springs of the same bogie. It starts functioning when difference of air pressure between two air springs on the same bogie goes beyond 1.5kg/cm2 and transfers air from one spring to the other.
- **AR**- one AR of 40 litre capacity is provided with each air spring. It increases the effective area of the spring and it has the same pressure as that of air spring.



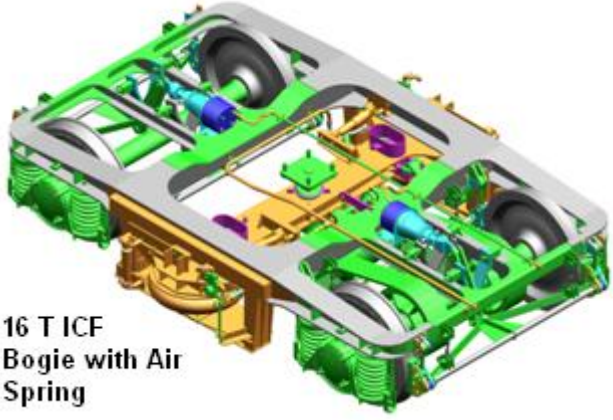
The Main Components of Air Spring are as under:

- Bellows
- Lateral shock absorbers
- Level equalizing valve with lever
- Branch pipe 20dia.
- Inner side emergency spring
- 150 liters capacity reservoir.
- 40 liters capacity auxiliary reservoir-04nos.
- Non-return valve
- Isolating cock
- Duplex check valve
- Air spring support cradle
- Air spring releasing valve

CHARACTERISTICS (AIR SPRING):

- Properties of air for cushioning effect used.
- Air Spring made up of rubber bellow & emergency spring.
- Air Spring height is controlled load leveling suspension device.
- Reduce problem of low buffer/coupler heights. Retain height under changing load thus maintain the low naturally frequency virtually constant.
- Air Springs offer a load proportionate stiffness, prospect of better ride quality and higher speed potential.
- Air spring offer soft flexibility in vertical direction by compression of air.
- Air spring absorbs lateral force by variation in effective area in lateral direction.
- Achieved reduced air consumption by designing delayed reaction Leveling Valve.

Air



16 T ICF Bogie with Air Spring

Suspension Bogie:

MERITS:

- Required pressure of 7bar is taken from F.P., no extra provision of pressure is required.
- Ride comfort is better than ICF.
- In ICF bogie coil springs are working on load proportionate deflection system some time which becomes too less (spring become solid) but in air spring a fixed deflection range is maintain having characteristics to vent and receive air as per requirement.
- Ride quality is the same in empty and loaded.
- With the use of control or leveling valve No. extra air is utilized.
- Constant floor height is maintained resulted more comfort to passengers.
- Springs are also able to except lateral thrust to act as flexi coil.
- On typical load (more load) ride quality is same.
- Improved reliability and reducing maintenance efforts.
- Choice to set deflection range during manufacturing.
- Passenger fatigues is reduced.
- The gap between bolster and bogie frame should be maintained 255+5,-0mm during running which provides more deflection range in compare to coil spring provided on old ICF coaches.

DEMERITS:

- If the pressure is reduced more than 1.5kg/cm^2 in both bellows, the automatic emergency valve will sense and there will emergency brake application resulted recharging , setting of audio visual indicating valve is required en-route also.(RDSO Trials in process)
- In rolling examination the position of leveling valve lever must be ensure to keep in horizontal position
- If lever is in vertical position, then train should be allowed with restricted speed of 60kmph or coach should be detached as decision taken by train examining staff.
- More educated supervisors and staff is required to provide more attention during rolling in and rolling out examination
- Spares leveling valve, isolating cock, duplex valve etc must be provided at en-route stations for emergency use which will be difficult to maintain.

10. Couplings & Buffers

10.1 Draw Gear: It is a vital component of rolling stock, which is utilized to connect the one rolling stock to another to form a train & also to transmit draft forces from engine to last vehicle. It is located at both the ends in the centre of the body under frame head stock. Mainly two types of draft gear are being utilized in Indian Railways.

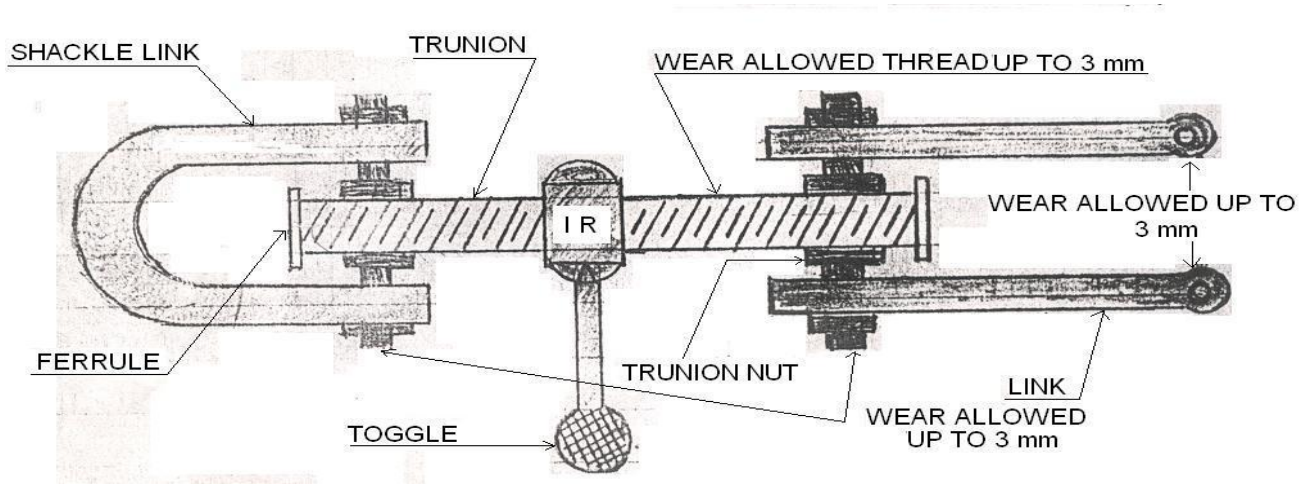
i. Conventional Draft Gear
ii. Centre Buffer Coupler

Main components of conventional draw gear are as under:-

1. Draft Hook.
2. Draft Links
3. Draft Key
4. Draft Spring/ Draft Pad.
5. Cotter
6. Washer
7. Bent Pin(U-Pin)
8. Hexagonal Nut.
9. Screw Coupling

Parts of Screw Coupling.

I. Shackle.
II. Link.
III. Trunnion Nut.
IV. Ferrule.
V. Screw Rod.
VI. Washer.
VII. Gravity Lever.



In 1984 use of Enhanced Screw Coupling was started, which is again modified in 1998.To identify this coupling a Dumbel mark is stenciled at both the side of coach end body.

Length of coupling when fully opened – 997 mm

Length of coupling when fully Tight – 751 mm

Modification:

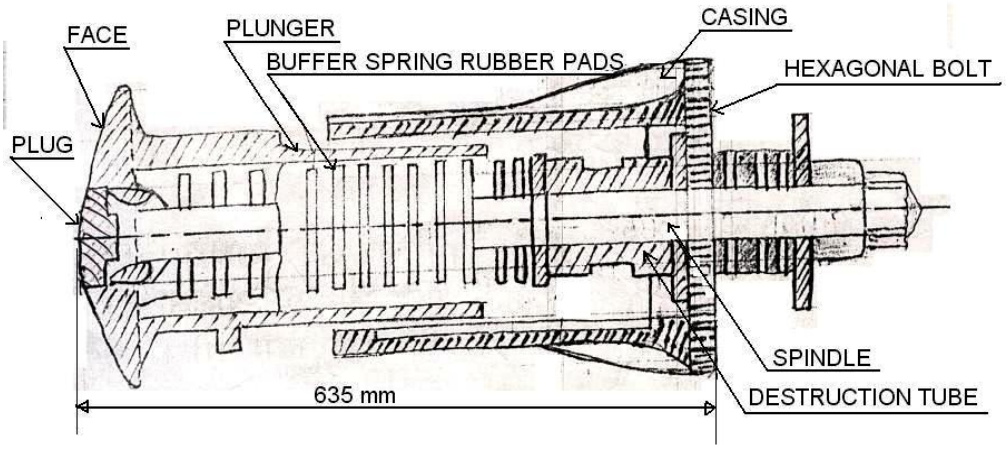
Sl. No.	Description	Non Modified	Modified	Remark
1	Working Capacity	36 Ton	36 Ton	
2	Proof Load Capacity	60 Ton	70 Ton	
3	Breakage Capacity	Draw Bar – 108 T S/ Coupling – 112 T	130 T for both	
4	Stamping Mark	C – 60.61	IS – 5517	

Note: Proof Load Capacity of Enhanced Screw Coupling is increased from 70 T to 75 T. This must be used in all coaches including 24 coach trains.

10.2 BUFFING GEAR

Two buffers are provided, on body head stock to absorb the longitudinal impact occurred during run on both ends, at a distance of 1956 mm. The role of buffers is also to transmit push impact to its trailing end stock. The main components of Buffing Gear are as under:-

1. Buffer Plunger
2. Buffer Socket with securing bolt
3. Buffer Spindle & Plug
4. Buffing Pad
5. Destruction Tube
6. Recoil rubber Washer
7. Washer
8. Nut
9. Cotter



BUFFER ASSEMBLY IN ICF COACHES

Mainly Buffers are of two types:-

Long Case Buffer – Length from head stock – 635 mm

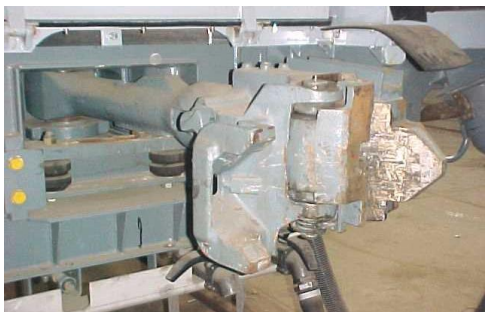
Short Case Buffer – Length from head stock – 458 mm (4 WH)

Other data:-

Max. Height in Empty condition	– 1105 mm
Min. Height in Loaded condition	– 1030 mm
Allowed variation in height at same end	– 64 mm
Allowed variation with adjacent vehicle	– 75 mm
Max. Plunger Travel	– 127 mm
Min. Plunger Travel	– 51 mm
No. Of Buffing Pads per Buffer	– 14 to 16 Nos.
Capacity of Buffing Pads	– 1030 kg m (New Type)

'H' TYPE CBC COUPLER

Coupler:



- The coupler provides a means of mechanically connecting individual adjacent vehicles in order to make a train.
- The coupler is located at both end of each vehicle.
- When connected to a coupler of an adjacent vehicle it allows the vehicle to move independently to accommodate track curvature and elevation change while remaining connected together.

Advantages of CBC:

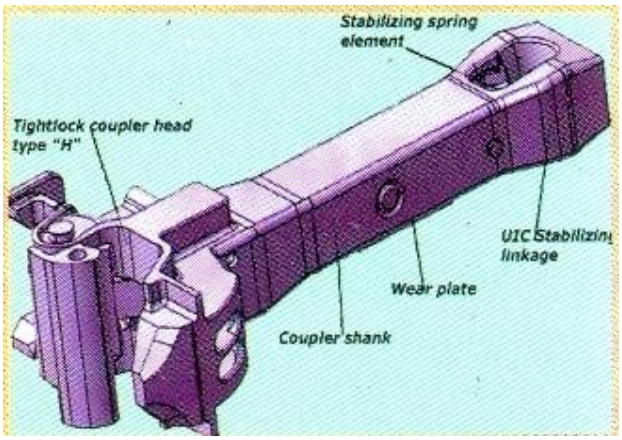
- High hauling capacity permits to attach more No. of coaches.
- Rake fitted with CBC can be run with comparatively high speed.
- No need to provide separate Buffing Gears. Hence the incidence of Buffer interlocking is avoid.
- Coupling/Uncoupling can be done easily from track side.

"H" Type Tight Lock Coupler:

- The AAR "H" type tight lock couplers are used in LHB/HYBRID coaches instead of screw coupler.
- The coupler is opened manually using the coupler operating rod and is closed automatically when the couplers on adjacent vehicle are mated.
- The coupler automatically locks when fully mated.

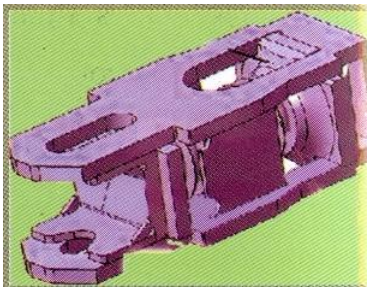
Main Parts Of "H"type CBC:

- "H" Type Tight Lock Coupler Head.
- Draft Gear.
- Supporting Device.
- Manual Uncoupling Device.



"H" Type Tight Lock Coupler Head:

- The coupler head has a shank/Draw bar cast together with the head.
- Parts like Knuckle, lock etc, are assembled in the coupler head to enable coupling and uncoupling.
- Tail end of the draw bar is provided with the UIC stabilizing link and connects to the draft gear through the central pin.
- A backlash compensation device is assembled in the shank at tail end of the coupler head.



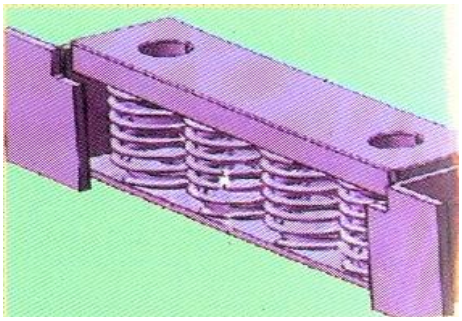
Draft Gear:

- The Draft Gear is a double acting device for energy absorption during coupling and services.
- The device is designed to fit into the draft gear pocket of the Coach and absorb the dynamic energy in both i.e. draw and

buff modes.

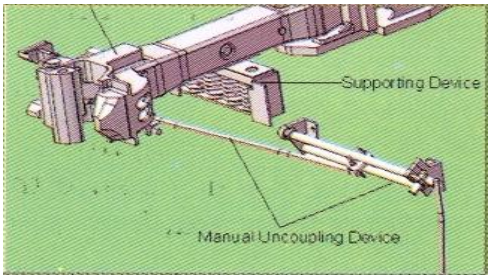
SUPPORTING DEVICE:

- Supporting device comprises of four preloaded springs.
- The device is placed on a platform and bolted to the car structure.
- The coupler head rests on the top wear plate of the supporting device and this device supports the coupler weight.
- Its main parts are- Wear plate, Frame, Compression spring, Nut & Bolts.



Manual Uncoupling device:

- The manual uncoupling device is mounted on one side near end wall of coach connecting the uncoupling mechanism on coupler head through the sliding rod.
- Handle of device is unlocked, lifted and then rotated in the clockwise direction for uncoupling.
- After coupling, locking of the handle has to be ensured to prevent unauthorized uncoupling.



TECHNICAL DATA:

- Draft Gear capacity:
  - Dynamic energy absorption capacity: 45 kj (min).
  - End force : 1600kN (max)

- Stroke: Tension- 58 mm, Compression- 80mm.
  - Pre load : 30 kN,
- Strength of Coupler Head with Draft Gear :
  Tensile load = 1000 kN, Compressive load = 2000kN.

Bending test of Coupler head: 300kN.

- Coupler length : 1030± 5mm
- Weight of coupler : 500kg.
- Gathering range: Horizontal: ± 110mm, Vertical : ± 90mm.
- Maximum horizontal swing coupler : ± 17.85 º
- Maximum vertical swing coupler : ± 7 º
- The maximum slack is restricted to 3.5 mm

Salient Features:

- Coupler head is a standard AAR 'H' type with backlash compensation device.
- 'H' type coupler provided with anti climbing feature.
- Coupling is possible under angular misalignment both horizontally & vertically.

- The coupler permits coupled trains to negotiate vertical and horizontal curves and allows rotational movement.
- Uncoupling can be achieved manually from track side by means of a combination of rod & levers.
- Draw Gear ensures cushioning effects in both buff & draft.

Check points for proper coupling:

- Knuckle and coupler head machined faces should be parallel.
- Telltale slot should be clear of Rotary Lock Lift Lever.
- Rotary Lock Lifter rib should be vertical.
- Securing Bolt of manual uncoupling device should be in locked condition. This is to prevent manual uncoupling inadvertently.

Check points for proper uncoupling:

- Securing Bolt should be in unlocked condition. Uncoupling device handle can be operated to uncouple.
- Rotary Lock Lift lever should be visible.
- Rotary Lock Lifter rib should not be vertical.
- Knuckle and coupler head machined faces should not be parallel.
- No oil grease should be applied on coupler parts such as Knuckle, Lock, and Rotary Lock Lifter etc.

Condition for coupling:

- Coupling is possible under any of the following conditions.
    - When both knuckles are in open condition.
    - When one knuckle is open & other is in closed condition.
- Condition will not permit coupling.
    - If both knuckles are in closed condition coupling will not take place.

11.Train Examination- Coaches

Ref: IRCA Rule Book Part – IV (Ch. 3)

11.1 Rolling In Examination: There are certain type of defects in rolling stock which can only be detected during motion of train. To deduct such type of defects rolling in examination is adopted.

Such type of examination is carried out on all through passing trains and terminating trains.

To carry out such type of examination C & W staff and supervisor will take position on both sides of platform / line in which train is being received.

During examination following defects are detected.

1. Unusual sound of flat faces on tyre of wheel of any vehicle of train.
2. Whistling of hot axle boxes.
3. Any hanging part or loose fitting of vehicle.
4. Any Spring broken.
5. Brake binding of any vehicle.
6. Any component or spring suspension bracket loose/broken.
7. Abnormal behavior of vehicle.
8. Any other defects by which safety infringement.

Rolling Out: Such type of examination is carried out to minimized detachment of vehicle particularly due to flat faces due to brake binding on tyre. It is carried out on all through passing trains and originating trains.

The procedure of conducting such type of examination is similar to rolling in examination. Only staff and supervisor will take position for conducting examination ahead of engine instead of last vehicle. And will ensure that the brakes of all vehicles running with train are in released condition and there is no defect during halt of examination by which safety infringement.

1. Examination of originating trains

i) All trains must be examined by the mechanical train examining staff before dispatch to ensure that all coaches on the train are in fit condition and without reject able defects (for reject able defects, please refer to IRCA Conference Rules, Part IV). On formation of a rake and after its placement for Examination, washing, cleaning and watering, the station master (SM) shall pass necessary memo to the Engineer (C&W). After carrying out all necessary work, the Engineer (C&W) shall communicate fitness of the train to Station Master. Normally, Railways have standard forms for the use of Station Masters and Engineers for this purpose. Railways, where such forms are not used, should also start using these forms as uniform practice for the guidance of both Engineer (C&W) and Station Master. The Station Master shall not dispatch the train unless the fitness certificate, in the prescribed form, is received from the Engineer (C&W).

ii) The level of the air pressure/vacuum on the train engine and the brake van gauges as well as the percentage of operative cylinders should be recorded on a prescribed certificate and signatures of the driver and the guard of the train should be obtained by the Engineer (C&W) as per the procedure laid down by each Railway. No train should be allowed to leave with an inoperative/defective Brake cylinder on any coach after pit attention. Trains which have been attended on pit line should have **100% brake power**. Trains which are attended on platform or where secondary examination has been dispensed with or en route should have minimum **90% brake power**.

2. En route/Terminating Examination of Passenger Trains

ii. Sr.DME/ DME in charge shall nominate the site for carrying out Rolling IN/Rolling OUT examination after personal inspection of site. While nominating the site following should be kept in view:

a) Site shall provide unobstructed view of under gear from both sides.
b) Speed of the train shall not be more than **30 KMPH**,
c) It should cover the entire length of train,
d) Should have adequate space for fixing the lighting arrangement and for staff.

iii. For rolling in examination of train it has to be ensured that proper lighting arrangement is provided on both the sides of the track at nominated spots for examination of under gear parts during night. Focusing of lights shall be done by keeping a coach on the line and adjusting the angle of light to illuminate under gear and bogie. C&W staff should take position at nominated rolling in place on both the sides of the track before the arrival of train.

iv. As the train passes the nominated point, C&W staff should watch out vigilantly for loose/hanging/broken under gear parts of the coaches, any unusual sound coming from the coaches or any other abnormality in the coaches.

v. After train comes to halt, it should be ensured that the train is protected from both the sides (with the stop board/red flag during day time and red lamp during night time) before commencing the examination of the train. It should be ensured that a suitable indication board is placed at conspicuous location visible to the driver indicating that C&W staff is at work.

vi. Temperature of the axle boxes should be measured preferably with the help of the electronic temperature measuring device.

vii. Brake release shall be checked by physically moving the brake beam. However, in case where train locomotive has to be detached, brakes of all coaches shall first be manually released. For checking the release of brakes the hook may be used. Other under gear parts should be examined visually to ensure that the train is safe to run further. During night the lamps/search light shall be used for illumination.

viii. Repairs if required should be carried out promptly to avoid detention to train to the extent possible.

ix. Lavatories of the coaches should be properly cleaned using High pressure water jet machine provided at nominated stations during halt of the train. Any complaint from passengers should be attended promptly to the satisfaction of the passenger

x. After attending to any required repairs stop board/red flag should be removed.

xi. Carriage controller (CCR) should be informed about any out of course work done.

xii. CCR shall repeat the out of course work done to the Primary Maintenance (PM) depot after corrective action.

xiii. At the train examination stations where locomotives are changed on through trains, the level of air pressure/vacuum created on the locomotive and brake van gauges should be recorded on the certificate to be issued to the guard and driver on prescribed form. The inoperative/blanked cylinders, if any, should also be written in the certificate for their information. This certification should be an endorsement on the original brake power certificate; no fresh brake power certificate needs to be issued.

3. Pit Examination of Passenger Trains

a. Washing and cleaning of coaches

Use recommended solutions for cleaning as per RDSO specification No. M&C/PCN/101/2001 or use cleaning agents approved by CME of the Railway.

b. Platform cleaning and washing

Wherever washable aprons are available on the platforms, the time available before the terminating trains; are pulled out into the yard, should be utilized for inside sweeping and toilet cleaning.

c. External Cleaning / Washing

i) Place the rake/coaches on the washing pit provided with equipments required for washing and cleaning. It should be ensured that the rake/coach is protected with proper board/signal for safety of the staff working on washing/cleaning job to prevent movement/disturbance in the activity. Scotch blocks with locking arrangement should protect lines and keys should be kept with Engineer (C&W) till the time rake is under maintenance.

ii) Before starting washing and cleaning of side wall, ensure that the glass shutters and louver shutters of that side are lowered. Remove dirt/dust accumulated on shutters by compressed air or duster.

iii) Remove old reservation charts/labels on the body panels. Splash water on old charts.So that they are wet for easy separation. Care should be taken to avoid any damage to the paint.

iv) The cleaning solution should be spread/rubbed with nylon brush or sponge brushes and then rubbed thoroughly to clean the panels. Extra attention should be given to oily and badly stained surfaces.

v) Destination boards may be removed and cleaned with brush/duster.

vi) Clean the external surface by high pressure jet where facilities are available.

vii) All exterior panels including end panels should be hosed with water and brushed with diluted soft soap (detergent solution). The strength of the solution may be increased or decreased according to RDSO specification M&C/PCN/101/ 2001.

d. Cleaning of Toilet

i) Before starting cleaning of toilets ensure that all repairs in the toilets have been carried out and after cleaning no employee should enter in the toilet.

ii) Doors and walls should be cleaned with water sprayed by high pressure jet up to waist level. Apply specified solution and rub thoroughly with sponge brush/ nylon bristle brush.

iii) Indian style lavatory pans have to be cleaned by thorough rubbing with concentrated solution of recommended cleaning agent.

iv) Western style commode shall be cleaned as (iii) however due care should be taken that recommended solution should not fall on commode lid which may damage/spoil it.

v) The flooring should be rubbed with nylon bristles/sponge brush and cleaned with recommended cleaning agent. The drain holes should be cleaned thoroughly for easy discharge of water.

vi) The mirrors in toilet should be cleaned with light wet cloth. Recommended solution should be used for cleaning the dirty portion of glasses.

vii) After all the washing and cleaning in the toilets mentioned above, the toilets should be thoroughly cleaned with water jets and water should be flushed out. All fittings and floor should be wiped dry with a cloth.

viii) After cleaning, spray deodorant in the toilet to remove the bad odor.

e. Internal cleaning of upper class AC and sleeper coaches

i) Collect the cigarette ends from all Ash trays, news paper from magazine bag and waste from dust bin. Sweep the whole coach with broom in sleeper coaches. Clean the floor of AC coaches with vacuum cleaner.

ii) Remove dust from floor, berths/seat, and magazine nylon wire mesh bag fitted on panels and fan guards with duster. Use of vacuum cleaner is excellent in such areas.

iii) Also remove dust/dirt from under the berths, window sill, sliding door, railing corner and all corner & crevices of coach interior with vacuum cleaner if provided.

iv) Ceiling panels, wall panels, cushion berths, fittings, table top, etc. should be cleaned with duster and stain marks on these should be removed by use of recommended soft detergent.

v) Aluminum frames, strips, and other metal fittings, etc. should be cleaned with recommended cleaning agent.

vi) FRP window frames, louvers, etc. should be cleaned with recommended solution and rubbed out by nylon brush or sponge /duster to remove stain marks.

vii) Alarm chain handle and its holding bracket should be washed and cleaned.

viii) The coach flooring should be rubbed with hard coir brush and PVC flooring should be rubbed with nylon bristles/sponge brush and cleaned with recommended cleaning agent.

ix) In AC coaches, the amenity fittings and toilet fittings such as coat hanger, stools, arm rest, foot rest, towel hanger, etc. should be cleaned with duster. Stains on these items should be removed with recommended detergent solution.

x) The compartment carpet should be cleaned with vacuum cleaner. Every month, the carpet should be cleaned thoroughly by taking it out from compartment and if necessary they should be dry cleaned in every three to four months. Before re-laying the carpet, the compartment floor should be thoroughly cleaned.

xi) Spray recommended air freshener in the coach. No employee should be allow to enter the coach for any purpose/work after complete cleaning

xii) Curtains in the AC Coaches and Tourist Cars should be removed for periodical washing and cleaning. Faded and damaged curtains should be replaced on condition basis.

xiii) Precaution should be taken to prevent nuisance of cockroaches in AC coaches and pantry cars by periodical spray of recommended insecticides

xiv) No repair works on Electrical train light/fan/AC) or Mechanical account should be left to be carried out after washing and cleaning of the coach..

f. Internal Cleaning of GS, SLR

i) Cleaning of GS, guard and passenger compartments of SLR should be done as mentioned above wherever applicable.

ii) If necessary clean the wooden seat and their frames with recommended detergent solution and water.

iii) Interior surfaces of parcel and luggage vans should be cleaned with recommended detergent and water.

g. Cleaning of buffers and screw couplings

i) Buffer plungers should be scrubbed with a scraper to remove dirt and muck. Thereafter, they should be wiped clean with cleaning oil and rubbed with coir rope.

ii) Screw coupling threads should be cleaned with wire brush to remove all dirt and dust. Thereafter, it should be cleaned and given a light coat of oil. Oiling should be done on slack adjuster also.

11.2 Brake Van Equipment: Similarly, other brake van equipment for which Mechanical Train Examining staff is responsible to supply, should be provided according to the instructions of each Railway. As per RDSO's letter no. MC/CB/28 dt 19.5.2000, racks have to be provided in the SLRS for provision of portable control telephones, portable train lighting equipments, portable fire extinguisher, wooden wedges/skids and stretcher. Railways can modify existing emergency

equipments rooms in the guard's compartment to provide racks for keeping the above mentioned items except fire extinguisher.

In view of emergency use, all originating trains should be provided following items in front & rear SLRs:-

i) Fire Extinguishers DCP type -in engine (to be supplied by Loco Shed) Fire Extinguishers DCP type in AC Coach, SLR, and Pantry car (to be supplied by C&W)
ii) Wooden Wedges (To be supplied by C & W)
iii) Wooden or Steel Ladder (To be supplied by Operating dept.)
iv) Stretcher (To be supplied by Medical dept.)
v) First Aid Box (To be supplied by Medical dept.)
vi) Electrical Box (To be supplied by ETL dept.)
vii) Field Telephone Set (To be supplied by S & T dept.)

Formation Of Block Rake: For the purpose of maintaining the coaches & rakes in good condition & to avoid public complaints the Chief Mechanical Engineer in consultation with the Chief Operating Superintendent Of The Railway shall form BLOCK RAKES for each of the long distance trains & the inter railway trains & also nominate spare of coaches adequate no. of the block rakes to replace sick block rake coaches.

Destination Board: Each coach on originated rake should be provided with destination board of approved size by the Primary Maintenance Depot.

Fire Extinguisher: Approved type of Fire Extinguishers should be provided on all originating trains according to number prescribed by railways in Brake Van , Postal Van , Dining Cars AC Coaches etc. These fire extinguishers should be periodically checked after **every 3 months & completely refilled after 1 year.**

These Fire Extinguishers should not be over due for testing & refilling.

Deficiency Rolling Stock (DRS) For Coaching Stock: Railway should devise system for detecting deficiencies. Reports of deficiencies/defects in Rolling Stock (DRS) reports in the Performa should be prepared for each mail/express/passenger originating train in duplicate by the Engineer (C & W) Electrical (TL) and should be signed jointly with the RPF representatives. Reports for mechanical deficiencies should be prepared on specified Performa and may be altered by each Railway on the basis of the items most prone to theft on their system. This should be done soon after the maintenance of the rake is complete in the sick/washing lines. In case the train starts from the platform itself, these reports should be prepared by jointly by C & W and electrical department. DRS Cards should be prepared in duplicate in which original copy is kept as a record copy and carbon copy is handed over to train guard. After the coaches have been jointly checked. And DRS reports have been made, the coaches should be pad locked/key locked and the key and report should be sent to the platform Engineer *(C & W)

Coach Maintenance History Card: Every coaching depot shall have computers for maintaining the coach maintenance history in a software programmed which should be compatible with the programmed of the coaching workshop.

The “Coach Maintenance History Card” (MHC) for each of its coaches. The card will contain records of maintenance schedules including POH and special repairs in shops. It will also show the history of the coach from the time the coach is placed in service will its condemnation and will give details of all major repairs wheel changing bogie changing etc.

The complete history book of each coach, consisting of maintenance history cards, date card, trial card etc. will however, is maintained by the base workshop. When a coach is sent for POH or special repairs, a copy of its maintenance history card should be sent by its base depot to the workshop for record in its complete history books.

12.Repair& maintenance of Coaching Stock

MAINTENANCE SCHEDULE: Periodic Maintenance Expiration And Operations Summary

In the following table the periodic expirations of the operations are summarised.

The indication in kilometers, to which said expirations make reference, is priority in comparison to those temporal. The latter are valid if the routes of the roadway correspond to the suitable period.

TIME	km (x 1000)	TYPE
daily	-	DA
1 week	8	D1
1 month	33	D2
6 months	200	D3
1 year	400	D4
2 years	800	W1
4 years	1600	W2
8 years	3200	W3
16 years	6400	R1
24 years	12800	R2

Note: 'D' stays for 'Depot', 'W' for 'Workshop', 'R' for 'Rehabilitation

Periodic maintenance expirations

In the following Table II are listed all the maintenace operations described in detail on the maintenace cards in paragraph 6.3.

MAINTENANCE OPERATION	PERIODICITY DA-D1-D2-D3-D4-W1-W2-W3-R1-R2										CARD NR.
Wheels and axle check			X	X	X	X	X	X			01
Brake disc wear check			X				X				02
Axle bearings and instruments	X	X	X		X	X	X	X	X		03
Electric equipment	X	X	X						X		04
Control arm check			X	X	X		X	X			05
Primary suspension check		X			X	X	X	X	X	X	06
Primary suspension dampers check		X			X			X			07
Brake equipment check	X	X	X			X	X				08
Check hand brake equipment		X	X	X				X			09
Pneumatic equipment check		X					X		X		10
Bogie frame check			X	X	X		X			X	11
Rotation limiter check				X					X	X	12
Anti-roll bar assembly check			X	X		X	X				13
Secondary suspension check		X			X	X	X	X		X	14
Dampers check		X			X			X			15
Traction center check			X	X			X	X			16
Rubber pads check			X	X			X	X			17
Bearing running temperature check				X							18
Bearing inspection						X		X			19

Maintenance operations summary

12.1 CLASSIFICATION OF COACHING MAINTENANCE DEPOTS

According to number of based coaches (holding Capacity), depot is classified into three categories.

Sr. No	Depot	Number of based coaches
1	Minor	50 to 100
2	Medium	100 to 250
3	Major	Above 250

Standard Facilities:-

1. Covered accommodation
2. Flooring & pit for repair & examination
3. Office & store facilities
4. Sick line yard
5. Machinery & plant

Covered Accommodation:

1. Track length of under covered accommodation for any type of sick line must be at least 4% of the holding capacity(based coaches)

   OR

   Total track length should not be less then coaches in view of repair purpose whenever working space required for each coach is 35m

   OR

   Track length should not be less then 140m for any type of sick line.

2. It is essential to provide 50% track length under a covered area with pit examination facilities.

3. In pit there should be proper light arrangement.

4. It should also be ensured that it is provided with drainage facilities with 1% inclination & required number of man holes.

5. At least hoist crane in capacity 3 to 5 tones also should be provided across the track.

6. The width of the covered accommodation should be normally 15 meters and should be normally cover two tracks under it. The gap between two adjacent track should not be less than 7.5 meters. Where overhead crane is provided, If overhead gantry is not provided the can be maintained to 6 meters.

7. It should be ensured that proper space is provided beside the track for free and easy movement of transport vehicles as like fork lift, lister, trolleys, truck, etc.

8. Entire covered accommodation must have adequate lighting arrangement for workers without eye strain.

Machinery And Plant:

To avoid heavy manual labour, wastage of manpower and to provide efficient working of depot, suitable adequate machinery and plant is required which are as under.

SR.NO. PARTICULARS

1. Self propelling whiting jacks
2. Coach shunter-portable wrench type.
3. Welding plant 200 amp capacity with double load
4. Gas cutting & welding equipment
5. Vacuum exhauster
6. Air compressor(150cfm)
7. 2 tones hoist with tram beam.
8. Sawing machine.
9. Diesel jeep with 2 trolleys.
10. Wood cutting saw machine.
11. Fork lift truck.
12. Hand shearing machine.
13. Portable furnace
14. Centre lathe 230mm (9") chuck.
15. Wheel lathe.
16. Manipulator/fixture for bogie.
17. Ultrasonic testing apparatus.
18. Tool post grinder.

TOOLS:

1. Pneumatic hand tools
   (a) Grinder (b) Drill (C) Chipper/buster (d) Riveter
2. Electric power tools.
   (a) Pop riveting tool gun (b) Drill (c) Bolt tighter/torque wrench.
3. Hand tools including torque wrenches as required.

Sr.No.	**Test benches and miscellaneous items.**
1.	D.V. Testing bench.
2.	Air Brake cylinder overhauling testing bench.

Primary Depot and Secondary Depot

Sl.No	**Primary Depot**	**Secondary Depot**
1.	Maintenance works attended by based depot is called primary depot.	Maintenance works attended by terminating depot other than based depot is called secondary depot.
2.	Preparation of DRS card is done by primary depot.	Only cross checking of items as per DRS card or only shortage, missing should be provided by secondary depot.
3.	Primary maintenance depot is responsible to prepare history card of coach.	Intimation to primary depot is essential whenever any major repair/maintenance is attended.
4.	It is duty of primary depot to ensure proper supply of brake van equipment for all originating trains.	Secondary maintenance depot is responsible to ensure only if there is any shortfall.

5.	Primary maintenance depot is responsible for all types of schedules of coaches.	Secondary maintenance does not have responsibility other than trip schedule.
6.	It is duty of primary maintenance depot to send the coaches for POH or NPOH if due or required.	It is not duty of secondary depot but it assist in sending the coaches for POH or NPOH through primary depot.

MAINTENANCE SCHEDULES TO BE FOLLOWED IN COACHING DEPOTS

a) To maintain coaching stock in good condition, the following preventive maintenance schedules are prescribed to be carried out in carriage depots on divisions where rake has been based for primary maintenance.

1. **Trip schedule**- After every trip by primary maintenance depot.
2. **Schedule A** - Monthly (**1 month ± 7 days**)
3. **Schedule B** -Quarterly (**3 months ± 15 days**)
4. **IOH** - 9 months + 30 days
5. **POH** - 18 months

b) Primary maintenance schedules are required to be carried out by the base depots to which coaches are allotted. In emergency, when due to any reason coaches cannot reach their base depots and primary maintenance schedules become due, A & B schedules should be undertaken by the carriage depots where the coaches are available. All schedules should be carried out by primary maintenance depot.

1. **TRIP SCHEDULE :-**

Trip schedule is attended per trip of the rake. The trip is being attended by Primary depots. No need to detach the coach from the rake during trip schedule. Total distance traveled by passenger rake in a trip up and down is more than 3500 km. Following procedure is adopted during the trip schedule:-

1. All under gear parts are thoroughly examined.
2. All moving parts are lubricated.
3. Complete examination of buffing & draw gear for its proper functioning. Lubrication is essential.
4. Coupling should be free in its screw i.e. ensure easy movement of coupling.
5. Proper examination of primary suspension arrangement.
6. Ensure the leakage of dash pot and oil level of dash pot.
7. Proper securing of safety strap and safety loop.
8. Proper examination of secondary suspension. Ensure the working of spring, shock absorber, safety strap & safety loop.
9. Proper examination of wear in suspension link bracket, pin & shackle stone.
10. Examine the proper function of shock absorber & securing bolt.
11. Examination of equalizing stay rod for its proper securing.
12. Examination of proper securing of bolts & cotters & silent bushes of centre pivot.
13. Ensure the proper function of side bearer or its oil level.
14. Changing of worn & wear brake blocks & pin & adjustment of brake power.
15. Proper cleaning of coach from inside & outside & disinfections.
16. Spraying of pesticides elements.
17. Checking of all points & pipe joints & other fittings & filling of water tank.
18. Proper opening & closing of vestibule doors.
19. Checking of amenity & safety items.
20. All falls plate examination of vestibule.
21. Testing of alarm signal, guard van valve & its gauge.
22. Preparation of DRS card & brake power certificate.

New Policy (Recommendations) for enhancements of POH/IOH schedules of Coaching Stock.

1. The revised POH periodicity from 12 to18 months is applicable to all Mail/Express coaches for which Railway shall arrange transportation of bogies from and to work shop.
2. A marking on the coach below return date shall be specified to distinguish 18 months periodicity.
3. The general sequence of coach will remain as per existing coaching maintenance manual.
4. The items of trip schedules; 'A' and 'B' schedules will remain same.
   The coach will be given 2 quarterly schedules B before IOH .The work specified for IOH schedule to mechanical & electrical work in appendix C & D respectively as specified by CAMTECH Pamphlet No CAMTECH 2008 coach POH/1.0in jan-2008.

5. CMIs, SMIs and technical circulars/pamphlets issued time to time by RDSO schedules followed for necessary modification and replacements.
6. As per requirement of bogie as unit exchange, the bogies should be collected from workshop considering transportation time plus two days before spare.
7. The periodicity of overhauling of DV is changed from 24 months to 18 months (during POH)
8. Work shop to switch over PU painting at workshop as advised by RDSO.

2. SCHEDULE `A' :** Schedule `A' is required to be given **every month + 7 days at the nominated primary maintenance depot within the normal primary maintenance time on a washing/pit line. A coach need not to be detached from the rake for Schedule `A' examination unless it requires such repairs which cannot be attended to on the washing line or within the prescribed maintenance time on the washing line.

'A' schedule maintenance:

(i) All items of primary/secondary maintenance schedule.
(ii) Test the working of brake cylinders for proper application and release.
(iii) Thorough inspection of brake pipe, feed pipe and their connecting pipes to brake cylinder, distributor valve, and Auxiliary reservoir and hose coupling for leakage and attention.
(iv) Carry out manual brake release test on every coach to ensure proper functioning of release lever of distributor valve.
(v) Micro switch of ACP should be tested by electrical staff for proper functioning.
(vi) Clean Dirt collector filter with kerosene and refit.
(vii) Test the working of slack adjuster in under frame mounted air brake system. Repair/Replace the defective slack adjuster.
(viii) Examine loops/ brackets and their securing devices and rectify.
(ix) Examine for wear and replace if required brake hanger pins, brake blocks and brake heads.

The following items of work should be attended during Schedule `A' examination, i.e., monthly examination:-

(i) All items of primary/secondary maintenance schedule.

(ii) Intensive cleaning of coaches.

(iii) Intensive cleaning of lavatory pans and commode with specified cleaning agent.

(iv) Thorough flushing of tanks.

(v) Checking of water pipes, flush pipe, flushing cocks, push cocks, etc., for ease of operation and free flow of water.

(vi) Thorough dis-infection of all compartments.

(vii) Thorough inspection and repairs of draw gear.

(viii) Thorough inspection and repairs of buffers.

(ix) Oil in hydraulic dash pots should be checked to detect oil leakage from them through defective seals or through vent screws. Add/replenish with specified grade of oil if oil level is below 40 mm in tare condition to ensure better riding comfort. Similarly oil in side bearer baths should be checked when the oil is below the plug and replenished with specified grade of oil so that wear plate is fully covered by oil.

(x) Inspection and repairs of commode chute.

(x) Thorough check and repairs of sliding doors and vestibule doors for easy and smooth operation and correct alignment and all wearing parts, loose screws, etc.

3. SCHEDULE `B':**Schedule `B' is required to be given every **three months + 15 days at the nominated primary maintenance depot within the normal time allowed for primary maintenance on a washing line in rake. Coach need not be detached from the rake for purpose of this examination unless it requires such repairs which cannot be attended to on the washing line or within the prescribed maintenance time on the washing line.

The following items of work should be attended.

Air brake system

(i) Same as 'A' schedule

Other assembly maintenance

(i) Besides brake system other items should be attended as given below:
(ii) All items of Schedule `A'
(iii) Painting of lavatories from inside.
(iv) Thorough inspection and repairs of brake gear components.
(v) Thorough checking of trough floor, turn under, etc., from underneath for corrosion.
(vi) Touching up of painted portion, if faded or soiled.
(vii) Overhauling & testing of alarm chain apparatus.
(viii) Testing of guard van valve.
(ix) Greasing of equalizing stay rod.

4. FOR IOH:

i) Coaches required for detachment for IOH.

ii) For maintenance of major break–down/ mal-functioning of any subassembly etc. the decision whether the coach is to be detached from the formation for attending to maintenance/replacement of major subassembly is dependent on maintenance requirements, operational convenience, time availability etc. The decision is taken by the Engineer (C&W). Coach failure report should be made.

ii) At depot, the coach that is detached for IOH is taken over to the washing line for cleaning, lubrication and minor maintenance. The coach that are detached due to a major defect in the distributor valve, brake cylinder, Auxiliary reservoir etc, is taken to the pit line for the replacement of such sub-assemblies, on unit exchange basis. The detachment of coach is carried out so as to make the maintenance or testing activities convenient and faster so that the coach is made ready for use without delay.

PROCEDURE: The activities performed to detach a coach with Air Brake system are as under-

i) Safety precautions shall be taken to prevent injury while detaching/attaching a coach.

ii) Remove the clamps on the cut-off angle cocks. Close the cut-off angle cock of both feed pipe and brake pipe on both sides of the coach that has to be detached.

iii) Close the cut-off angle cocks of the feed and brake pipe of adjacent coaches. This is to ensure that the air pressure locked up in the air hose coupling gets vented to atmosphere through the vent hole of the cut-off angle cock.

iv) Observe above mentioned safety measures to close all the four cut-off angle cocks on either side of the coach to be detached so that while opening air hose coupling, it may not cause injury due to air pressure inside.

v) Release the brake of the coach to be detached by pulling the manual release lever of the distributor valve.

vi) Open the Feed Pipe and Brake Pipe hose coupling from both sides of the coach.

vii) If the air pressure of brake cylinder does not vent by pulling the manual release valve of distributor valve, open the brake cylinder vent plug to drain the air pressure.

viii) Uncouple Screw coupling and detach the coach.

ix) Observe all other safety measures as prescribed.

5. IOH :

Air brake maintenance:

(i) IOH is required to be given **every nine months +30 days** at the nominated primary depot.

(ii) Coaches are required to be detached from the rake and taken to the sick line for examination and repairs.

The following items of work should be attended during IOH.

Air brake system maintenance:

(i) Check brake cylinder for loose rocker arm plate and change on Bogie Mounted system.

(ii) Brake cylinder should be checked for smooth functioning and prescribed stroke. Defective brake cylinders shall be sent for repairs.

(iii) Guard's van valve should be tested.

(iv) Test BP & FP air pressure measuring gauges with master gauge and replace if found defective. A set of two master gauges should be kept for this purpose at every Primary Maintenance Depot and each master gauge should be sent one after the other to the base workshops for testing, repairs and calibration.

(v) Thoroughly clean Dirt collector filter in kerosene or replace on condition basis.

(vi) Check working of PEASD & PEAV by hearing the hissing sound of exhaust air. After resetting with the help of key the exhaust of air should stop. Replace the defective PEASD/PEAV.

Other assemblies maintenance:

(i) All items of Schedule `B'

(ii) Thorough repairs of running gear including running out of bogies where considered necessary. Bogies which are working on rake links earning more than **nine months** must be run out and unit exchanged with overhauled bogie received from workshop.

(iii) Touching up damaged paint of coaches on outside as well as inside.

(iv) Thorough cleaning and removal of dust, rust, dirt, etc., accumulated at the pillars through the turn under holes, with coir brush and compressed air.

(v) Thorough examination and repairs of upholstery, cushions, curtains, etc.

(vi) Thorough checking and full repairs of all window shutters, safety catches, safety latches, staples and hasps of compartment, lavatory, body side and vestibule doors for ease of operation.

(vii) Thorough checking and repairs of UIC vestibules, their rubber flanges metal frames, doors, fall plate, locking gear, etc., for ease of operation and safety.

(viii) Thorough checking and repairs of all cracks and worn out portions of flooring of the compartments.

Engineer (C&W) of Primary Coaching Maintenance Depots should be fully familiar with the vulnerable areas of ICF coaches for corrosion, viz., sole bar at doorways, lavatories and adjoining areas, corridor sides - more so in case of those SLRs which are used for Fish, Salt, etc. For facilitating inspection of sole bars even spaced elongated holes of (215x127 mm) are already provided in the turn under.

Special attention should be taken for the following:-

i) Pocket between sole bars and turn under should be thoroughly cleaned through the inspection opening of the sole bars and inspected with the help of torch light or inspection lamps.

ii) Drain holes provided in the trough floors should be kept clean and unclogged. If during the cleaning of these drain holes any accumulation of water is observed, the affected area should be very carefully inspected for possible corrosion.

iii) A register should be maintained of the primary maintenance coaches on the subject.

i. During this lifting schedule, bogies/under frame members and body including trough floors of integral type coaches should be thoroughly examined and all parts of running gears are repaired/ replaced as necessary. The bogie frames should be particularly checked to detect damage, cracks or deformation and necessary repairs carried out. Where it is not possible for the maintenance depot to do these repairs or are prohibited to be done in the maintenance depots, the bogies should be sent to the shops for carrying out these repairs.

ii. The detailed table of maintenance activities to be carried out during IOH schedule is enclosed as appendix-G.

iii. The date of intermediate lifting should then be stenciled at the appropriate place in schedule chart on the end panel

Note:

1) **Intermediate Overhauling of Shatabdi/Rajadhani Exp. Coaches are attended in nominated workshop only.**
2) **Intermediate overhauling of newly built coaches are to be attended after 12 months only wheels are to be replaced**

RPC-4 Revision-June 2017

No. 95/M/C/141/1

Sub:- Revised maintenance pattern of coaching train- running up to 3500 km in round trip with terminal attention at the other ends.

S. N.	Category of train	Preventive maintenance at pit line	Under gear/ Brake System maintenance at pit	Internal cleaning, passenger amenity fittings and watering	External cleaning nominated line with proper facilities	En route/ terminating	Brake system check prior to start at plate form/at other end
1	Rajdhani/ Doronto train	At primary end	At both the ends	At both the ends	At both the ends	En route after every 250-350 km location to be decided by Rly for each train. Terminating examination at terminating station.	Complete air brake testing with fresh BPC at both ends
1A	Shatabdi trains	At primary end	At primary end	At both the ends	At primary end	---do---	Complete air brake testing with fresh BPC at both ends
2	Mail/Exp. Round trip >3500 kms /ICF or 4000 kms/LHB	At primary end	At both the ends	At both the ends	At both the ends	---do---	Complete air brake testing with fresh BPC at both ends
3 (a) (i)	Mail/ Exp round trip <3500 km for ICF and 4000 km for LHB (except	At primary end	At primary end	At both the ends	At primary end	---do---	Only continuity check if stabled at platform. Otherwise endorsement on original BPC is

	category 1 trains)						required
3 (a) (ii)	Mail/ Exp train touch primary station more than once in 3500 km(ICF) or 4000 km(LHB) and 96 Hrs., whichever is earlier(exclude 1, 1(a) trains)	At primary end	At primary end only once in 3500 Km (ICF) or 4000Kms (LHB)	At both ends	At primary end	---do----	Only continuity check if stabled at platform. Otherwise endorsement on original BPC is required
3b	Inter connected Mail/ Exp round trip run up to 3500 km(ICF) or 4000km(LHB)	At primary end	To be done after 3500 km or 96 hrs after issue of original BPC whichever is earlier at primary end	At primary end & each terminal	At primary end	---do----	Only continuity check if stabled at platform. Otherwise endorsement on original BPC is required
4	Passenger trains with toilet including interconnected passenger trains/ shuttles	At primary end	To be done after 3500 km or 96 hrs after issue of original BPC whichever is earlier at primary end	At primary end and each terminal	At primary end	---do----	Only continuity check if stabled at platform. Otherwise endorsement on original BPC is required
5	Passenger trains without toilet	At primary end	To be done after 3500 km or 7 days, after issue of original BPC whichever is earlier only at primary	At primary end and each terminal	At primary end	Once a day at primary end or at nominated terminal	Only continuity check if stabled at platform. Otherwise endorsement on original BPC is required

			end				
6	Dedicated parcel Trains	At primary end	To be done within 4500km or 10 days whichever is earlier	At primary end	At primary end	En route after every 250-350 km location to be decided by Rly for each train. Terminating examination at terminating station.	Only continuity check if stabled at platform. Otherwise endorsement on original BPC is required
7	Military/ Election special train	At primary end	To be done within 3500km(ICF) or 4000 km (LHB) or 96 days whichever is earlier	At primary end and each terminal	At primary end	---do---	---do---

Note:- Internal cleaning, passenger amenity attention and watering may be done at platform line or nominated stabling line provide stipulated facilities are available at such line, in case the rake is stabled in yard for more than 6 hrs, positive safety arrangements should be made for the rake and in case the security is considered inadequate, the rake should be taken to pit line for attention to under gear as given under column(4) above.

Difference Between IOH, POH& NPOH

Sl.No.	IOH	POH	NPOH
1.	It stands for intermediate overhauling.	It stands for periodic overhauling.	It stands for non periodic overhauling.
2.	IOH of coach is attended after 9 months of POH.	POH of Passenger carrying vehicle M/Exp -18 months,	Time Period is not fixed for any vehicle for NPOH
3.	IOH of coach is allowed in sick line where facility to lift the coach is available.	POH is allowed in nominated workshops only.	NPOH is done only in workshop or in nominated major sick line.
4.	During IOH all the parts of under gear thoroughly examined and replaced if necessary.	At the time of POH all parts of under gear are dismantled and should be replaced if there is any wear and tear.	Only indicated defects & safety items are attended.
5.	At the time of IOH painting of coach is not necessary, only required places are touched up.	Painting of whole coach is necessary.	Complete painting of coach is not necessary, only required places are touched up.
6.	Profiling of wheel is necessary.	Profiling of wheel is necessary.	Profiling of wheel is on need based.

CORROSION AND ITS PREVENTION

Introduction: When metals are put into use in various forms they are exposed to environment containing liquids, gases etc. As a result of this the surface of metal starts deteriorating. This type of deterioration or destruction may be direct chemical attack or electrochemical attack.

Definition: corrosion is a chemical process of oxidation with metal to its surroundings, covering it into metal oxide, carbonates, hydroxide and sulfides. Oxidation takes lace only when steel surface exposed to atmosphere or moisture. Chemical reaction is as follows:

$$4Fe + 3O2 \text{ --------} 2Fe2O3$$

Example: rusting of iron. When iron is exposed to atmospheric conditions rusting of iron takes place. During this exposure a layer of reddish scale and powder of oxide is formed and iron becomes week.

Effect of corrosion: Corrosion of materials is liable to performance of the product, loose their strength, ductility and certain other mechanical and physical properties.

With the introduction of all steel coaches corrosion has become a major problem. Once starts it is very difficult to control it. This requires replacement of the component. This is much costlier than to save the existing part by proper and timely attention.

12.2 Corrosion in ICF coaches: Corrosion in ICF coaches is very common. Corrosion repairs to coaches are mainly carried out during POH in workshops. Corrosion repairs are also done during midlife rehabilitation of coaches that are 12 to 13 years old especially at CRWS, Bhopal next POH in 24 months.

During POH all the under frame members are thoroughly inspected to locate corroded members. Corrosion is indicated by flaking of paint, flaking of metal, pitting and scale formation. Components that is not visible from both sides such as sole bar and trough floor should be examined by tapping with a spiked hammer.

Particular attention should be paid to the more vulnerable members and locations given below.

1. Sole bars, body pillars, turn under and trough floor below lavatories in all types of coaches and luggage compartments of SLRS.
2. Sole bars, body pillars, turn under and pillars above lifting pads.
3. Sole bars, body pillars behind the sliding doors of SLRS
4. Sole bars, body pillars, turn under at the door corners & near coach body bolster.
5. Headstock

Inspection of under frame member for corrosion attention should be done as per technical pamphlet no 7602(rev: 1)

Reason of corrosion in ICF Coach:

1) Accumulation of water, dust and salty discharge under luggage compartment in coaches.
2) Incorrect fitness of side panels.
3) Galvanic cell formation between steel and aluminum near window area.
4) Seepage of water at corners and ends due to water accumulation on floor.
5) In sufficient surface preparation before welding.
6) Frequent use of concentrated acids for the cleaning of toilets.
7) Leaky push cocks, flusher valves.
8) Missing/defective commode chutes resulting in splashing of toilet discharge leads to corrosion of under frame members.
9) Carrying of perishables items like fish in SLRS and Parcel vans and insufficient cleaning after unloading.
10) Entry of water through gaps in window sills.
11) Cracks in body panels and roof left unattended.
12) Painting defects left unattended.
13) Damage to under frame and trough floor due to flying ballast in dynamic condition.
14) Acid spillage from batteries.

Need of Corrosion prevention:

1) To avoid premature detachment of coaches and wagons in service.
2) Corrosion makes wagons unfit for loading. This has a bad effect on earning capacity of railways.
3) There will be a shortage of wagons fit for loading if wagons are detached for corrosion repairs.
4) Detachment of coaches for corrosion repairs has an adverse effect on the normal composition of trains.
5) In monsoon season seepage of water through corroded panels spoils the consignment and railway is forced to pay compensation for the damage.
6) Manpower material and time involved in corrosion repairs can be controlled through proper anticorrosion measures.
7) Losses of railway revenue i.e. losses to the nation.

12.3 Inspection during POH

1) **Inspection of sole bars, body pillars and turn under:**Examine visually and with the help of a spiked hammer from below the coach and the inspection holes in the turn under. If corrosion is suspected at places without inspection holes 100mm dia. hole should be cut at the bottom of turn under for examination. If corrosion is noticed in the bottom half of the sole bar the trough floor to be cut to a width of 300mm for inspection. In case of heavy corrosion the side wall to be cut to a width of 500mm.

2) **Inspection of headstock:** Examine visually inner and outer headstock, stiffening behind buffers and the junction of sole bar and the headstock for corrosion. Examine the base buffer assembly carefully.

3) **Trough floor:** Examine trough floor adjoining the lavatories and under the luggage compartment of SLRS and Parcel vans for corrosion with the hammer.

Corrosion Repairs During POH

1) Repairs to under frame members:

   Repairs to under frame members should be carried out as per RDSO pamphlet no C7602 for ICF coaches. Corrosion resistant steel sheet for trough floor, pillars, sidewalls and roof should conform to IRS M-41-97. Electrode IRS class B2 of approved brands. Paint red oxide zinc chromate primer is-2074-62. Bituminous anti corrosive solution to IRS-P30-96.

2) Repairs to Headstock: Only 8mm thick sheet is to be used headstock repairs.

3) Repairs to Sole bar: The new sole bar section to be welded from both inside and outside.

4) Repairs to Side Wall Members: For repairs to side and end wall members interior fittings interior panels & window frames are to be stripped. Repairs to be done as per RDSO sketch No. 76019.

5) Repairs to Trough Floor: For trough floor repairs plywood flooring to be stripped. Repairs to be done as per RDSO instructions.

6) Repairs to Roof: Special attention to be paid at locations where gutter moldings are welded and where ventilators are fitted. RDSO instructions to be followed

12.4 HOW TO MINIMIZE CORROSION

Corrosion in rolling stock cannot be eliminated altogether. Hot and humid conditions in our country are helpful for corrosion. A change in climate also has an adverse effect. However timely action during repairs and maintenance will minimize corrosion.

A) DURING POH

1) Thorough inspection giving extra attention to areas prone to corrosion.
2) Turn under repairs to be carried out with 5mm thick plates.
3) Only 8mm thick SS sheets to be used for head stock repairs.
4) Use stainless steel trough floor and inlays for toilets.

5) Use of 13mm comprege floor board instead of plywood.
6) Use PVC sheets for toilets and compartment floor.
7) Use stainless steel plates with drain holes in doorways.
8) Provision of tubular structure below lavatory area.
9) Corten steel is used for panel repairs.
10) Apply two coats of primer and three coats bituminous solution on all under gear members.

B) IN OPEN LINE

1) During pit line examination check thoroughly all under gear and under frame components, trough floor and headstock etc. for corrosion. If corrosion is noticed take proper anticorrosive measures.
2) Drain holes and drain pipes should be clear so that water stagnation is eliminated.
3) All water leakage to be arrested at the earliest.
4) Proper repairs to damaged PVC floor.
5) Gaps in window sills to be filled up.
6) Deficient/defective commode chutes to be made good.
7) Hosing of coach interior is to be avoided.
8) Avoid strong acids for toilet cleaning.
9) Body patches to be painted, carry out paint touchup where paint is peeled off.

During IOH all vulnerable areas are to be properly inspected after Cleaning of turn under holes.

How to apply anti corrosive paint in coaching stock.

I. 1st coat ------- zinc chromate
II. 2nd coat ------ zinc chromate, red oxide
III. 3rd coat ------- bituminous thin black solution
IV. 4th coat ------- Bituminous red brown solution
V. 5th coat ------- Bituminous primer thick black
VI. 6th coat ------- bituminous primer silver gray

Exterior paint schedule for coaches

At every 5th POH of a coach or if the condition of paint is not good adopt 9 days painting schedule. (A—schedule) otherwise choose 5days paint schedule.

A—schedule (9—days)

1st day	–	Remove old paint
2nd day	–	One coat of red oxide zinc chromate primer
3rd day	–	One coat of brush filler followed by spot putty
4th day	–	Filler 2nd coat (spot putty if necessary)
5th day	–	Rub down with silicon carbide paper
6th day	–	One coat of under coat
7th day	–	Flat with silicon carbide paper.One coat of enamel finishing.
8th day	–	Flat with silicon carbide paper. 2nd coat of enamel finish

9th day – Lettering and miscellaneous work

C --- Schedule

1st day – Washing with soap solution touchup damages with primer

2nd day – Spot putty if necessary and one coat of under coat

3rd day – Flat with silicon carbide paper apply one coat of finishing Enamel

4th day – Flat with silicon carbide paper apply second coat of Finishing enamel.

5th day – Lettering and miscellaneous work

Suggestions To Prevent Corrosion:

1) Supervisors involved in maintenance of rolling should be familiar with areas prone to corrosion.
2) Supervisors should educate their technicians about areas prone to corrosion.
3) Identify corrosion prone areas and inspect them thoroughly during pit line examination, sick line attention, ROH/IOH.
4) Suitable preventive measures to be adopted to save the affected component. In fcase of heavy corrosion replace the component.
5) Ensure painting of wagons during ROH. painting/ paint touch-up during IOH and sick line attention.
6) Supervisors should educate their cleaning staff so that they follow proper cleaning technique.
7) Ensure water tightness of covered wagons.
8) Educate Shunting staff so that they perform smooth shunting without damaging the rolling stock.
9) Ensure proper cleaning of wagons by the contract staff after Unloading.
10) Electrical staff to be counseled about the corrosive effect of acids from batteries.

These small steps will go a long way in minimizing corrosion in rolling stock

13. Maintenance Manual - Coaching

13.1 Maintenance Manual - ICF Coaches

Maintenance Manual for BG Coaches was last published in December,1995. Several changes in maintenance and operational system like Bogie Mounted Brake System, enhanced capacity drawgear, fire retardant upholstery and running of 24 coach trains etc. have taken place which have been incorporated in the manual.

Railway Board had nominated a committee of officers comprising of Executive Director Standards (Carriage)/RDSO/LKO, CRSE/W.Rly, CME/O&C/C.Rly. and Director (Mech)/CAMTECH/GWL vide letter No. 95/M(C)/141/1 dated 10-05-2000 for scrutiny and updating the "Maintenance Manual for BG coaches of ICF design". This updated manual covers ICF(BG) Coaches manufactured by Integral Coach Factory/Perambur Rail Coach Factory/Kapurthala, BEML/Banglore and Jessop/Kolkata. Maintenance of LHB, IRS or MG coaches is not covered.

The salient features of the manual are as follows.

i) Latest instructions from Board/ changes in maintenance instructions/ feedback on the previous manual and technological upgradation upto February,2001 have been incorporated.

ii) The manual has been divided into assembly-wise chapters. Maintenance practices to be followed in the workshop and depot are covered in the same chapter.

iii) Important dimensions, clearances, material specifications and references to RDSO technical instructions and drawings have been given.

iv) For convenience of reference, the paragraphs have been numbered according to a 3/4 figure "Code", in which the last two figures give the number of the paragraphs and the remaining figures the number of the chapter. Thus paragraph 101 of any code is paragraph 1 of chapter 1 of that code and paragraph 1103, paragraph 3 of chapter 11.

v) The tables/figures in each chapter consist of two numbers separated by a decimal point number before decimal point indicates the chapter number whereas the number after decimal point indicates the running serial number of the table/figure which start from 1 in every chapter.

Future Addition/Deletion/Modification to this manual will be issued through correction slips or reprints of chapters by RDSO and will require approval of the Railway Board.

13.2 Maintenance Manual - LHB Coaches

1. ICF design coaches have been the main passenger carriers of Indian Railways since their inception. It was not possible to attain higher speeds due to inherent design limitations of these coaches. To overcome this problem, Indian Railways entered into a TOT agreement with M/s. Alstom Germany for LHB type of Coaches. Accordingly, their inception and mass production in Railways started in 2002 and population is growing day by day. These coaches are quite different from ICF design coaches. The maintenance practices for these coaches are also different. Therefore, it has become imperative to prepare a separate maintenance manual specially for these coaches.

2. Railway Board had nominated a committee of officers comprising of Executive Director/CAMTECH, CRSE/Northern Railway, CRSE/Western Railway, EDS(Carriage)/RDSO/Lucknow, CWM/Jagadhari/Northern Railway & Dy. CME/RCF/Kapurthala, for preparation of "Maintenance Manual for LHB Coaches."

3. The Committee has examined the maintenance manual supplied by M/s. ALSTOM under TOT, recommendations of various committees formed earlier by the Railway Board, two man committee of W. Rly., instructions issued by RDSO, RCF and the Railway Board from time to time on this subject and various suggestions received from Zonal Railways.

4. The salient features of the manual are as under:-
   i) Latest instructions from Railway Board/CAIs issued by RCF have been included.
   ii) The manual has been divided into assembly-wise chapters. Separate chapters have been provided for electrical and mechanical schedules.
   iii) Important dimensions, clearances, material specifications and references to RDSO technical instructions are given in this manual.
   iv) For convenience of reference, the paragraphs have been numbered according to the number of chapter.
   v) The figures/tables in each chapter consist of two numbers separated by a decimal point. Number before decimal point indicate the chapter number whereas the number after the decimal point is the running serial number of the table/figure which start from 1 in every chapter.

5. Future Addition/deletion/modification to this manual will be issued through correction slips or reprint of chapter by CAMTECH in consultation with RDSO and approval of the Railway Board.

14.IRCA Part IV

IRCA- INDIAN RAILWAY CONFRENCE ASSOCIATION

1. *HEAD QUARTER- DRM Building New Delhi*
2. *WORKING: Under Rly Board(Member Traffic)*
3. *ADMINISTRATIVE CONTROL-GM/Northern Rly*
4. *HEAD: General Secretary (Traffic /Commercial Dept.)*

***AIM**:*

- *To upgrade the maintenance quality of rolling stock (carriage & wagon).*
- *Rate fixing and preparation of passenger ticket and goods charges.*
- *To dissolve the operational dispute between two interchanging point.*
- *Pre & final examination during POH &ROH to be carried out by neutral TXR (IRCA) and final fit memo to be issued to the concerning officer of the w/shop or sick line.*
- *Repair cost during POH & ROH & Other repair of carriage & wagon to be assess & repair cost sent to railway board.*
- *Suggestion and rake assessment of amount paid by commercial department. On account of railway claim to be service time to time and proposal sent to railway.*

***WORK**:*

- *Mechanical deptt. : Final fitness of off POH / NPOH, off ROH & other wagon lying in sick line for miscellaneous defects to be issued by IRCA men i.e. NTXR.*
- *Operating deptt. To dissolve the operational dispute between two railways, preparation of time table etc.*
- *Commercial deptt: Rate fixing & preparation of passenger ticket & goods stock.*
- *Accounts: Accountant assessment of the expenditure to be checked by IRCA.*

***Mechanical Deptt. Concern:** IRCA gives out the rules for the standards condemning sizes of various components used on rolling stock. They also give the guidelines for the maintenance of rolling stock in workshop and in open line. The rule books used for the carriage & wagon issued for the carriage &wagon branch of mechanical deptt. are: IRCA Part III for wagon stock & IRCA Part IV for coaching stock .*

IRCA part III & part IV contain 4 chapters

Chapter	***Details***
Chapter I	*Definitions*
Chapter II	*Workshop repair practice*
Chapter III	*Maintenance practice in open line*
Chapter IV	*Rejection Rules*

Rejectable defect in coaching stock

As per IRCA. Rule book part iv, chapter iv rejections are given from **Rule No. 4.0-4.25.2:-**

(4.1) Coaching stock must not be allowed with any chargeable, reject able and any other defects from work shop.

(4.2) Maintenance depots shall ensure the maintenance procedure givens in chapter II and III and No any reject able defects is allowed.

(4.3) Notwithstanding any provisions in the rules, coaching stock must not be allowed to run if in the opinion of a Train Examiner, it is in such a condition as if may cause an accident.

(4.4) Coaching stock must not be allowed with any defects having **'S'** marks for Guidance of staff concern.

Example:-**Axle Box Defects**;

- Axle box lug/wing broken.

'S' - Hot box;

- Over due oiling
- Due repacking.

'S' - Axle guard defects;

Axle guard bridle bar crack, deficient , broken.

- Hydraulic dash pots broken
- **Body defects;** door bent
- Alarm chain damaged/deficient.
- **Brake gear defects;**
- Brake gear fitting deficient.
- Brake gear (Air brake system)-Any defects in brake system;

'S' - Any buffer dead.

- **Draft gear + Coupling**;

'S' - Draw bar, hook draft hook broken

- Draft gear + buffing in EMU;
- Infringement of O.D.C
- **Trolley frame defects**;

'S' - Bolster spring plank broken.

- Spring gear;
- Shifted more than 13mm
- **Tyre defects**

'S' - loose tyre

Wheel defects

'S' - thin tyre, sharp flange etc

Under frame defects

Crack or bent

'S' - Under slung tank suspension bracket broken

'S' - Buffer Height Variation more than 64 mm on same end

'S' - Axle Pulley Loose.

'S' - Brake Block Deficient or excessive worn

'S' - Foot Board, Hand Hold deficient

'S' - Any Buffer Dead

'S' - Wheel Shifted on Axle

TRANSPORTATION CODES FOR COACHES

S.No	Transportation code	Details
1	W	VESTIBULE
2	G	SELF-GENERATING
3	S	SECOND CLASS
4	F	FIRST CLASS
5	L	LUGGAGE VAN
6	R	GUARD BRAKE VAN
7	Y	LADIES COMPARTMENT
8	J	ICE COMPARTMENT
9	Q	ATTENDENT
10	D	VENDORS COMPARTMENT
11	P	POSTAL VAN
12	U	KITCHEN
13	CB	PANTRY CAR
14	CD	DINING CAR
15	CN	SLEEPER CLASS THREE TIER
16	CW	SLEEPER CLASS TWO TIER
17	CZ	CHAIR CAR
18	CT	TOURIST CAR
19	AC	AIR CONDITIONED
20	FC	FIRST CLASS WITH COUPE
21	FF	UPPER CLASS
22	SC	SECOND CLASS WITH COUPE
23	GS	SECOND CLASS WITH SELF GENERATING EQUIPMENT
24	LL	LUGGAGE VAN WITH LAVOTARY
25	JJ	REFRIGERATOR COMPARTMENT
26	M	MILITARY CAR ORDINARY
27	MA	MILITARY CAR AMBULANCE
28	ML	MILITARY CAR KITCHEN
29	MF	MILITARY FIRST CLASS
30	ART	ACCIDENT & TOOL VAN OR RELIEF VAN
31	ARME	AUXILARY RELIEF TRAIN WITH MEDICAL EQUIPMENT
32	CT	TOURIST CAR
33	CTS	TOURIST CAR FOR 2^{ND} CLASS PASSENGERS
34	CZACEN	AIR CONDITIONED CHAIR CAR WITH END ON GENERATION
35	ERR	FOUR / SIX WHEELER
36	EN	END ON GENERATION
37	MN	MID ON GENERATION
38	ERU	FOUR / SIX WHEELER SELF PROPELLED TOWER VAN
39	FCS	FIRST CLASS COUPE AND SECOND CLASS
40	FSCN	FIRST CUM II CLASS 3-TIER SLEEPER
41	GS	SECOND CLASS FITTED WITH SELF GENERATING EQUIPMENT
42	LR	LUGGAGE WITH BRAKE VAN
43	NMG	NEW MODIFIED GOODS
44	OHE	OVER HEAD EQUIPEMNT INSPECTION CAR
45	PPS	FULL BOGIE POSTAL VAN
46	RA	INSPECTION CARRIAGE (ADMINISTRATIVE)

47	RAAC	AIR CONDITIONED INSPECTION CAR
48	RD	INSPECTION CARRIAGE (SUBORDINATE)
49	RE	INSTRUCTION VAN (MOBILE TRAINING CAR)
50	RH	MEDICAL VAN
51	RHV	AUXILIARY MEDICAL VAN
52	RK	DYNAMOMETER CAR
53	RN	GENERATING VAN
54	RR	TRAIN CREW AND REST VAN
55	RS	STORES VAN
56	RT	ACCIDENT AND TOOL VAN OR RELIEF VAN
57	RZ	TRACK RECORDING CAR
58	SLR	SECOND CLASS LUGGAGE AND BRAKE VAN
59	SMN	POWER CAR WITH MID ON GENERATION
60	VP	PARCEL VAN
61	VPC	PARCEL VAN CONVERTED
62	VPU	MOTOR CUM PARCEL VAN
63	VPH	HIGH CAPACITY PARCEL VAN
64	WSCZAC	VESTIBULED II CLASS AIR CONDITION CHAIR CAR
65	WCD	VESTIBULED DINING CAR
66	WCRAC	VESTIBULED AIR CONDTIONED TWIN CAR
67	WCTAC	VESTIBULED AIR CONDITIONED TOURIST CAR
68	WFAC	VESTIBULED AIR CONDITIONED FIRST CLASS
69	WFC	VESTIBULED FIRST CLASS
70	WGACCN	VESTIBULED SELF GENERATING AIR CONDITIONED THREE TIER
71	WGACCW	VESTIBULED SELF GENERATING AIR CONDITIONED TWO TIER
72	WACCW	VESTIBULED AIR CONDITIONED TWO TIER
73	WGFAC	VESTIBULED SELF GENERATING AIR CONDITIONED FIRST CLASS
74	WGFACCW	VESTIBULED SELF GENERATING FIRST CUM AC 2-TIER
75	WGSCN	VESTIBULED SELF GENERATING SECOND CLASS THREE TIER
76	WGSCNLR	VESTIBULED SECOND CLASS THREE TIER WITH LUGGAGE & BRAKE VAN
77	WGSCZ	VESTIBULED SELF GENERATING SECOND CLASS CHAIR CAR
78	WGSCZAC	VESTIBULED SELF GENERATING SECOND CLASS CHAIR CAR AIR CONDITIONED
79	WGSD	VESTIBULED SELF GENERATING SECOND CLASS DOUBLE DECKER
80	WLRRM	VESTIBULED LUGGAGE CUM BRAKE VAN WITH DIESEL GENERATING

		MOTOR CAR
81	WSCZAC	VESTIBULED SECOND CLASS AIR CONDITIONED CHAIR CAR
82	WSLRN	VESTIBULED SECOND CLASS, BRAKE CUM LUGGAGE AND POWER CAR
83	LWFAC	AC FIRST CLASS SLEEPER (EOG)
84	LWGFAC	AC FIRST CLASS SLEEPER (SG)
85	LWACCW	AC SECOND CLASS SLEEPER (EOG)
86	LWGACCN	AC SECOND CLASS SLEEPER (SG)
87	LWACCN	AC THREE TIER CLASS SLEEPER (EOG)
88	LWGACCN	AC THREE TIER CLASS SLEEPER LACCN (SG)
89	LWCBAC	AC HOT BUFFET CAR (EOG)
90	LGS	NON AC SECOND CLASS GS (SG)
91	LWGSCN	NON AC SECOND CLASS THREE TIER (SG)
92	LGSLR	NON AC LUGGAGE CUM GUARD VAN (SG)
93	LWFCZAC	AC CHAIR CAR EXECUTIVE CLASS (EOG)
94	LWSCZAC	AC CHAIR CAR (EOG)
95	LWLRRM	GENERATOR CUM LUGGAGE & BRAKE VAN (EOG)

15.AIR SPRING

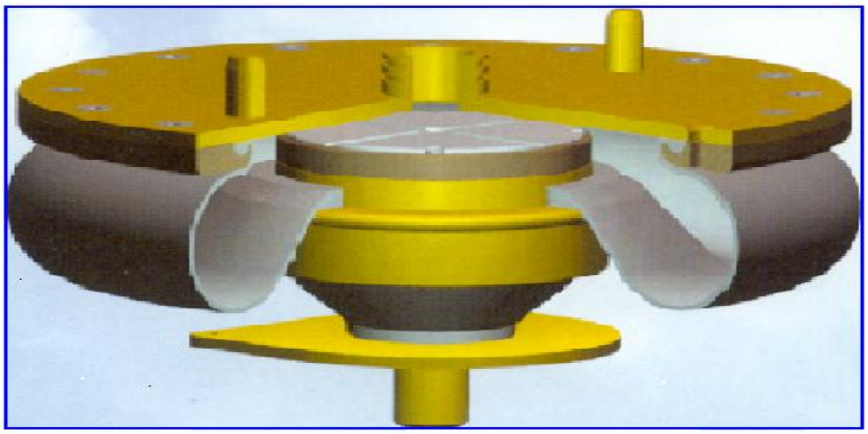
Air Spring

- The coaches fitted with Air springs in the secondary suspension is to maintain a constant buffer height irrespective of loaded condition to give comfortable riding to the passengers.

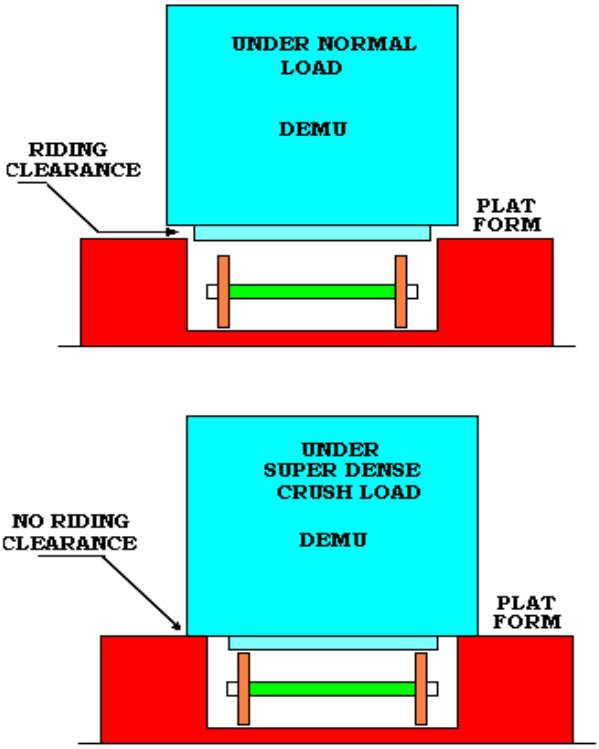
- Bottom bolsters, Stirrup links and Equalizing stays are eliminated.
- It is provided with an emergency spring inside the air spring to support the bolster in case air spring fails.

Air Spring

Air spring is a rubber bellow containing pressurized compressed air with an emergency rubber spring providing various suspension characteristics to maintain a constant Buffer height irrespective of the loaded condition.

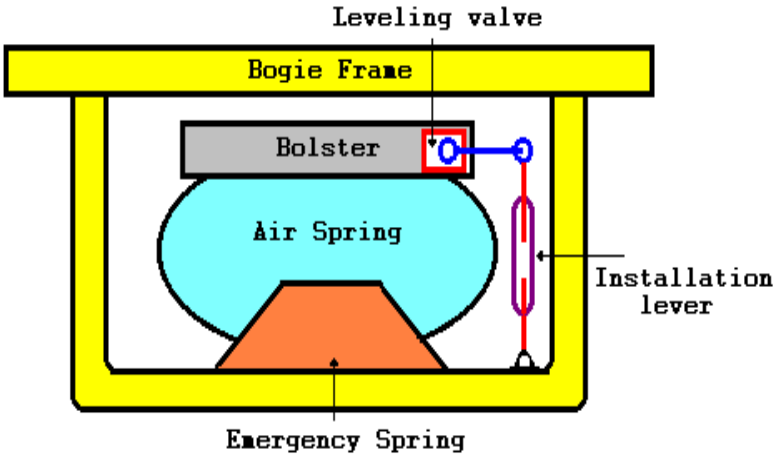


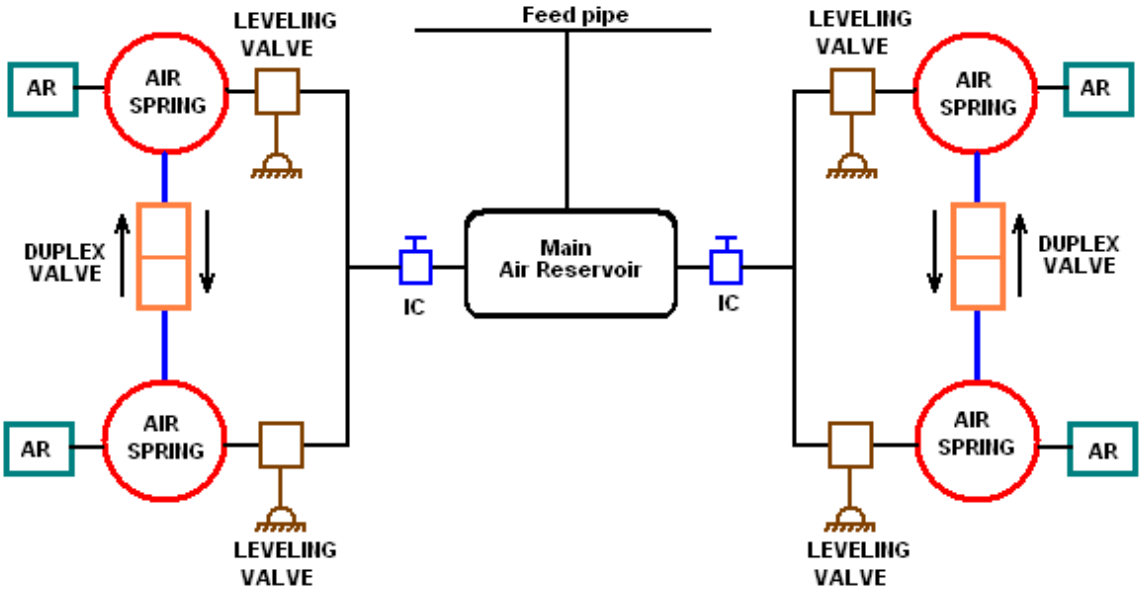
In suburban trains like DEMU, the number of passengers entraining **(Super Dense Crush Load)**in to the coach cannot be controlled and hence the payload of the coach increases from 18 tons to 34 tons. This abnormal increase of payload reduces the **Riding Clearances** between the **Coaches** and **Wayside platforms** and also reduces buffer height resulting in severe hitting of coach on the plat forms.
Due to the Super Dense Crush Load the bolster springs become solid, which in turn damages / breaks the Coil springs resulting in discomfort to the passengers. To overcome the above problems an **Air Suspension** (Air spring) is introduced in the secondary suspension to maintain a constant buffer height irrespective of loaded conditions by varying the pressure of air inside the air spring.



Components of Air Suspension

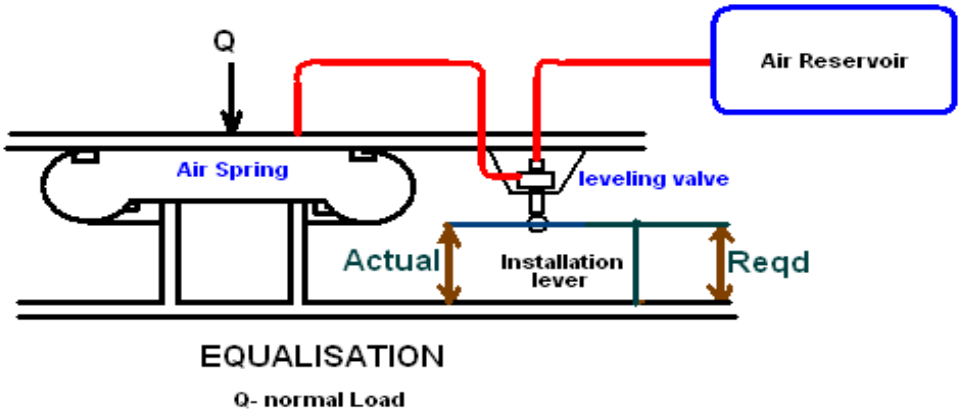
Air spring	Emergency spring
Leveling valve	Installation lever with adjusting Screw
Duplex check valve	rod
Auxiliary Reservoir	Main Air Reservoir
	Isolating cock



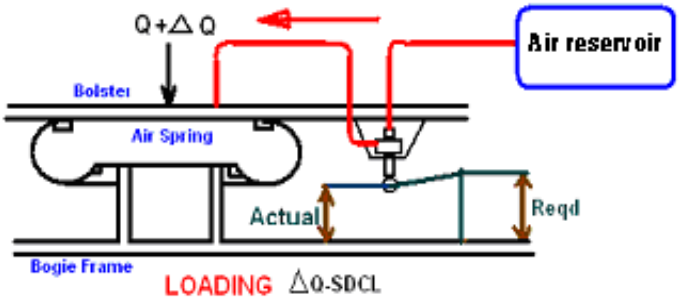


Leveling valve:

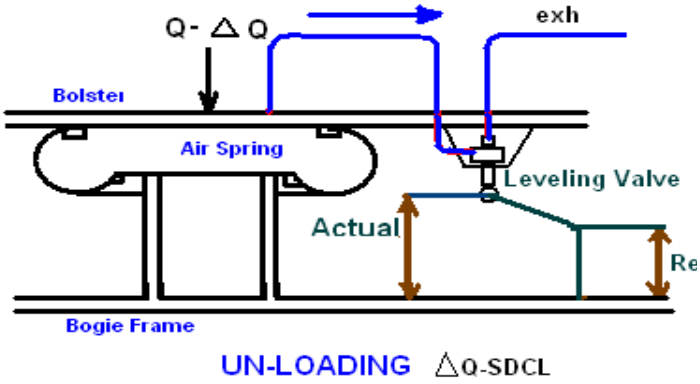
The leveling valve is fitted with Top bolster and is designed to move up and down along with bolster. Under normal condition, it is designed to take LAP position when the actual buffer height is equal to the required buffer height.



The function of leveling valve is to connect the main reservoir with the air spring to admit more air in to the Air spring, whenever the actual buffer height is less than the required buffer height due to abnormal increase in the Pay load (Super Dense Crush load).



It also connects the air springs with exhaust to release the excess air from air spring, whenever the actual buffer height is more than required buffer height due to reduction in the Pay load after detraining of passengers from the coach



Installation lever:

It is fitted between the levelling valve and bottom of the bogie frame. The function of installation lever is to operate the levelling valve automatically by moving the handle of the levelling valve up and down according to the condition of the load. The up and down movement of handle of levelling valve admits the compressed air in to the Air spring or releases the compressed air from the air spring through levelling valve in proportion to the pay load of the coach.

Duplex Valve:

It is a double check valve provided between the two Air springs of the same bogie. It operates with a Pressure differential of 1.5 bar. Basically it comprises of two check valves side by side, arranged so that air can flow in either direction whenever the air pressure differential exceeds the pre-set value of 1.5 bar. Whenever a burst of air spring occurs on one side, this valve will ensure that no severe tilt or twist occurs during movement of the coach.

Both the check valves of Duplex valve remains closed, if the pressure between the two springs is within 1.5 bars. When the differential air pressure exceeds the preset value, the air at higher pressure overcomes the spring pressure and flows to the lower pressure via the check valve. The flow continues till the differential reaches the preset value.

In case of burst of Air Spring, the air leaks to atmosphere. Due to high-pressure differential, the Duplex check valve releases the air from the intact air spring through burst air

spring. Thus complete coach will gradually come down and rest on the emergency rubber springs.

Auxiliary reservoir of Air Spring:

It isfitted with the Air spring. The capacity of this reservoir is 20 Ltrs. There is an orifice kept between air spring and additional reservoir. It acts as an Air damper to overcome vertical and lateral oscillations so as to increase the riding comfort.

Main Air reservoir:

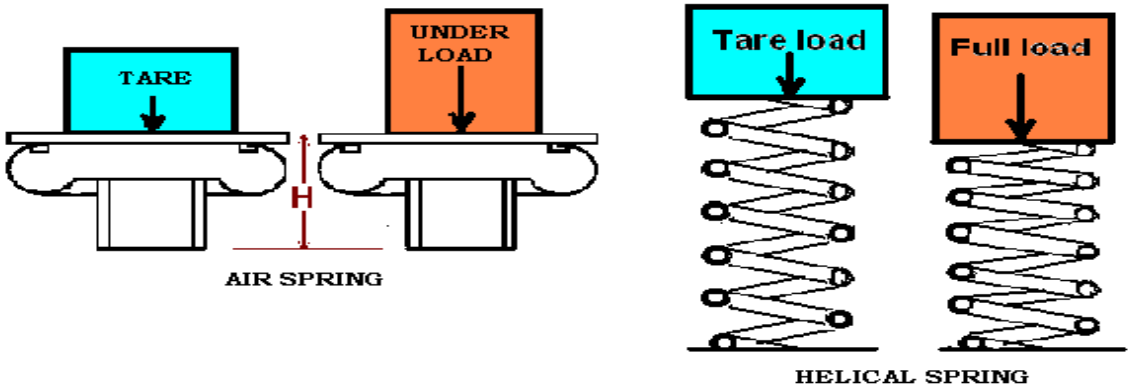
The capacity of the main reservoir is 150 ltrs and it is exclusively used for feeding the compressed air in to the Air Spring.

Emergency Springs:

The function of emergency spring is to support the top bolster to prevent tilt of coaches whenever the Air spring burst.

Comparison of Helical coil springs with Air Springs:

Unlike steel springs, air springs retain their height under changing loads. The low natural frequency of air spring suspension remains virtually constant. In case of coil spring, deflection is proportionate to the load. Therefore under high payload situation, space constraint becomes critical, leading to the use of stiffer springs resulting in unsatisfactory ride behaviour and reduced speed potential. Air springs through their control mechanism offer a load proportionate stiffness, constant floor height and better ride behaviour with higher speed.



Advantages of Air Suspensions

- Capable to sustain Super Dense Crush Load of suburban traffic at high speeds.
- It maintains a Constant floor height of coach.
- It facilitates excellent riding comfort with riding index of 2.5.
- Safe running due to the excellent Air Damping.
- Low design height.
- Unusual noise emitted due to hitting of coaches on the plat forms is eliminated.
- The Stirrup links, Coil springs and equalizing stays are eliminated and therefore easy to maintenance.

Range Spectrum

- 120KN – LHB

LHB shells are lighter in weight and softer flexi-coil springs are used in secondary suspension, so 120KN air springs are used in all types of fiat bogie.

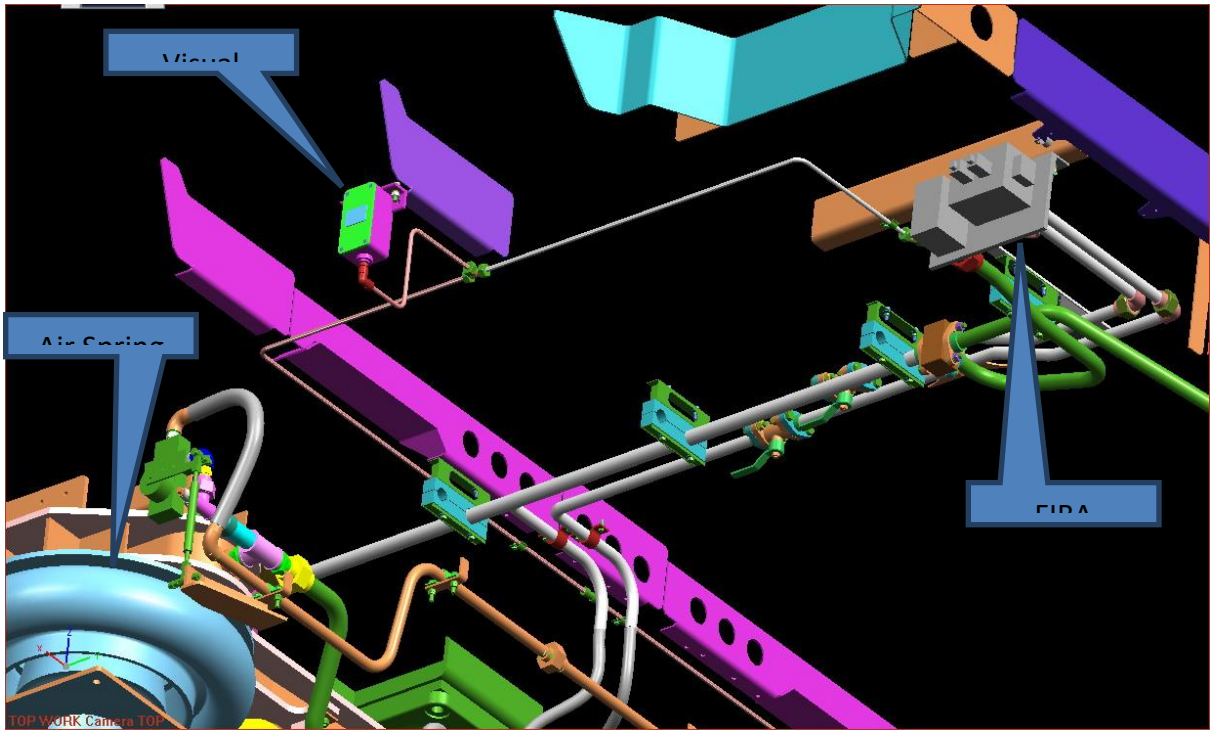
- 140KN – ICF
  As ICF shells are slightly heavier than LHB shell, but overloading is less than sub-urban trains, so air springs with medium capacity of 140KN are used in all types of ICF type bogies.
- 180KN – EMU
  Overloading in suburban trains may be upto 300%, so high capacity air springs of 180KN are used in EMU coaches.

FIBA (Failure Indication and Brake Application) device fitted in Air Spring coaches

FIBA device is introduced in the system which senses the pressure drop in any bellow of coach beyond a limit and initiates to drop brake pipe pressure, resulting in application of brakes leading to ultimate stopping of the train.

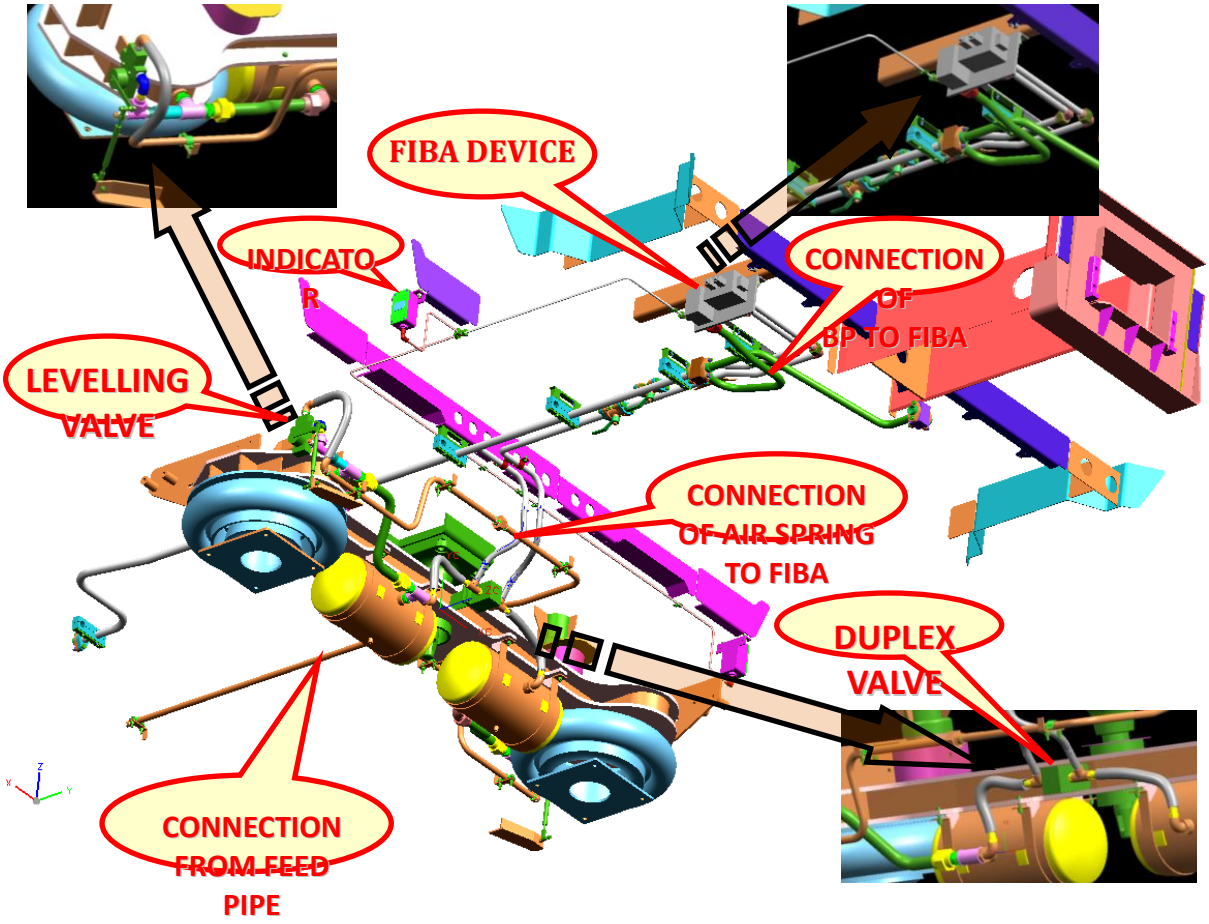
Primary objectives of the FIBA device;

1. This device is designed to indicate spring failure
2. To provide a positive indication to the driver and the crew of the train by whistling sound and indication on both sides of the train through indicators.
3. To initiate the dropping of brake pipe pressure, resulting in application of brakes leading to ultimate stopping of the train.
4. To provide suitable means to enable the train to run at a restricted speed upto the desired destination.



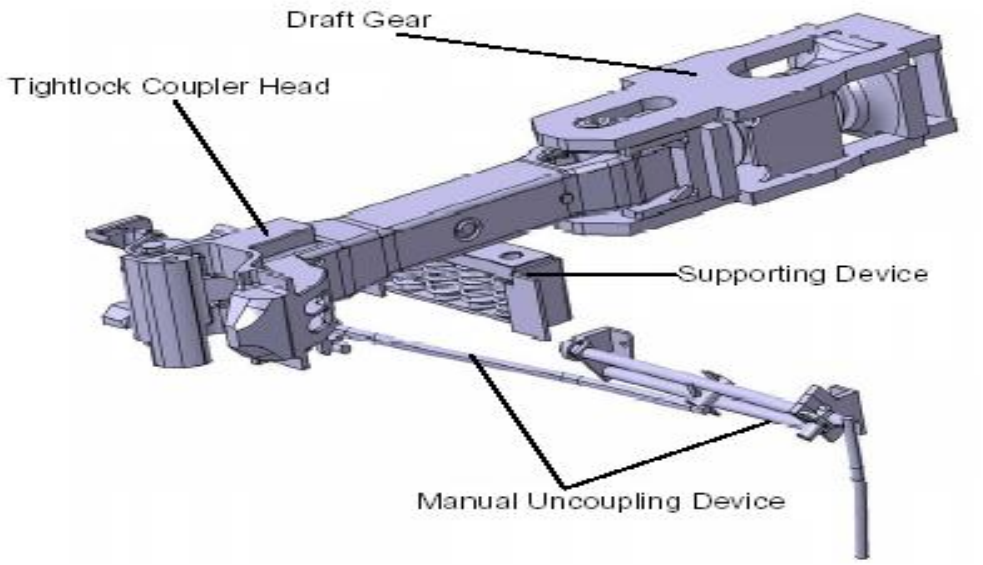
The working principle of our FIBA device is absolute pressure system. The system works without any electrical power. The equipment is designed to sense the pressure bellow pressure and actuate when the pressure in the bellows falls below a certain pressure. The equipment is designed to consist of sensor

valves to sense the pressure of compressed air in each bellow of the bogie on continuous basis and initiate dropping of brake pipe pressure in case pressure in any or both air spring bellows of the concerned bogie drops below 1 kg/cm2. It will result in application of brakes in the train and ultimate stopping of the train.



In case of bellow burst, it gives a red indication through indicators provided with FIBA device on each side of the coach along with the hissing sound of air. The system is provided with isolating cocks to stop the discharge of brake pipe pressure to enable the train to run at restricted speed upto the destination.

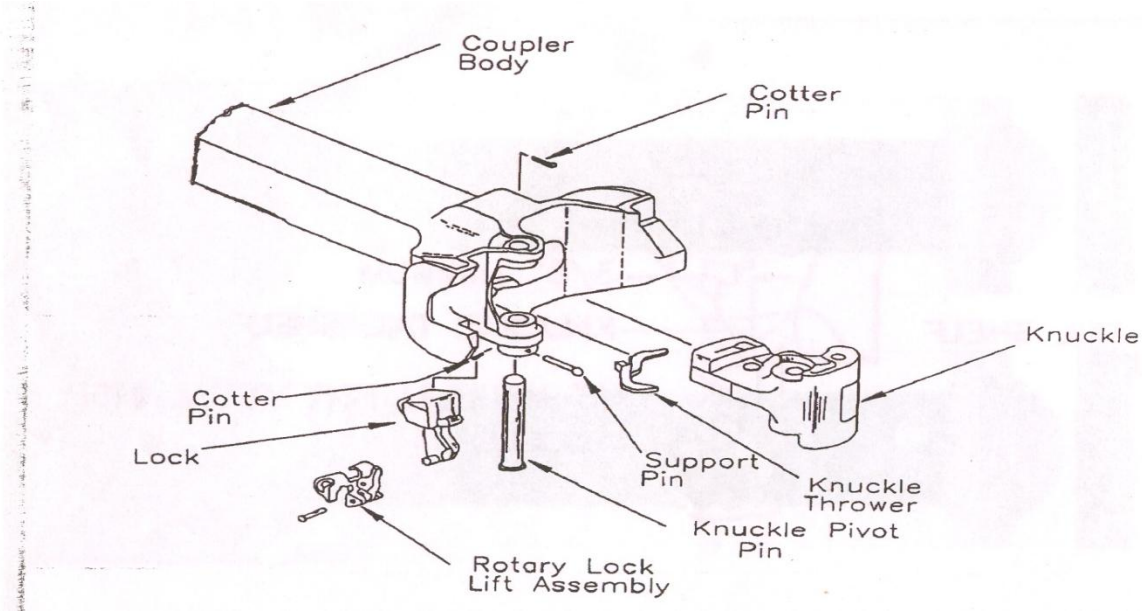
16. MODIFIED TIGHT LOCK H-TYPE CBC



1 .MAIN COMPONENTS

1. Tight lock Coupler head Type “H.”
2. Draft gear.
3. Supporting device.
4. Manual uncoupling device.

COUPLER HEAD AND PARTS

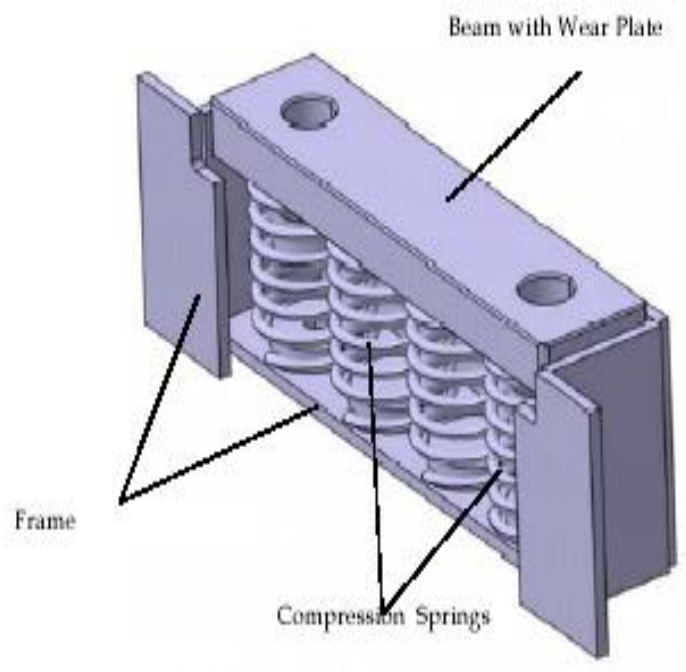


DRAFT GEAR OF CBC COUPLER

The draft gear is a double acting device for energy absorption during coupling and during servicing.

The device is fitted in to the draft gear packet of the coach and absorbs the dynamic energy in both Draw and buff modes.

SUPPORTING DEVICE



The supporting device comprises of four preload compression springs.

The device is placed on a platform and bolted to the car structure.

The coupler head rests on the top wear plate of the supporting device and this device supports the coupler weight.

MANUAL UNCOUPLING DEVICE

The manual uncoupling device is mounted on one side near end wall of the coach connecting the uncoupling mechanism on couple head through sliding rod.

Handle of the device is unlocked, lifted and then rotated in the clockwise direction for uncoupling. After coupling

locking of the handle has to be ensured to prevent unauthorized uncoupling.

CBC TYPE COUPLER FOR LHB COACHES

For LHB coaches we have a multipurpose serving coupling between the two coaches. It is called in technical terms the Center Buffer Coupling. It has got a special locking system operated by a handle.

H TYPE CBC COUPLER:

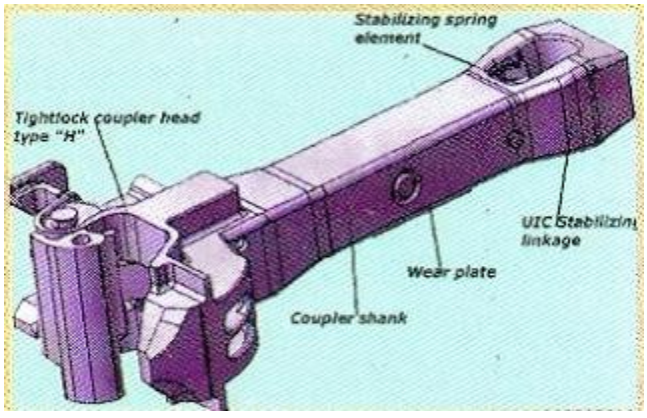
- The coupler provides a means of mechanically connecting individual adjacent vehicles in order to make a train.
- The couplers are located at both end of each vehicle.
- When connected with a coupler of an adjacent vehicle it allows the vehicle to move independently to accommodate track curvature and elevation change while remaining connected together.

H TYPE TIGHT LOCK COUPLER:

The AAR "H" type tight lock couplers are used in LHB/ HYBRID coaches instead of screw coupler.

The coupler is opened manually using the coupler operating rod and is closed automatically when the couplers on adjacent vehicle are mated.

The coupler automatically locks when fully mated.



COUPLING PROCEDURE:

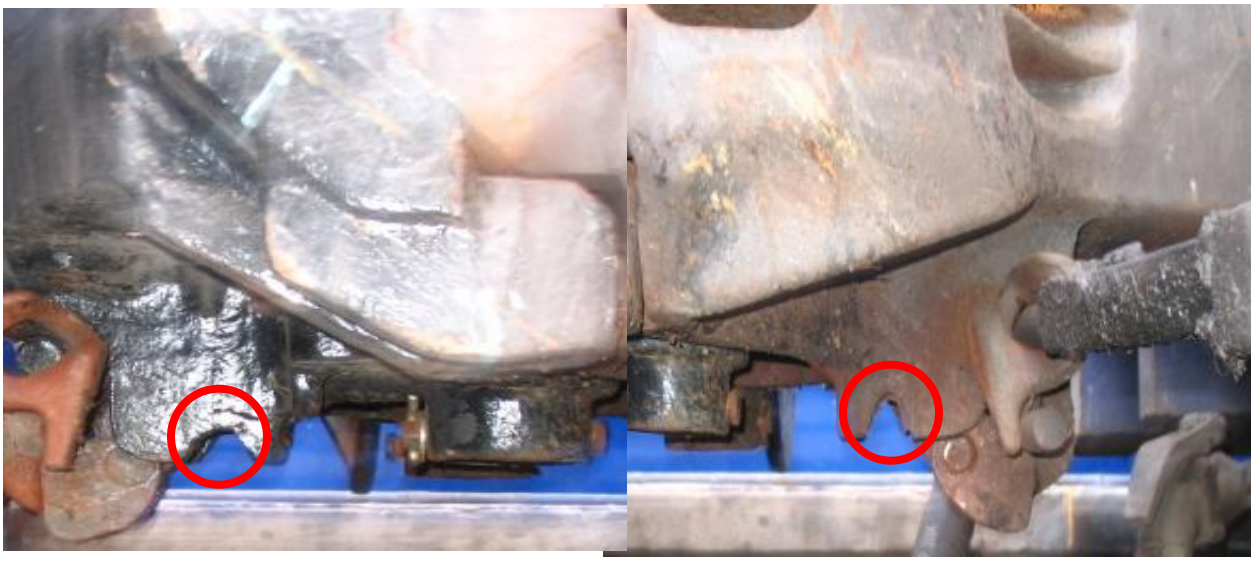
` Bring the vehicles near to each other at a slow speed (approx.2-3 km/h) and stop the vehicles at approximately 1 meter distance each other.

Check alignment and position of the coupler centers. Couplers must stand within the gathering range as given above.

If required pull the couplers manually towards each other and make sure that they are in the gathering range of the coupler geometry.

Now push the vehicles together slowly (approx.3 km/h) for coupling the two coaches.

ENSURING PROPER COUPLING:



Tell Tale View SLOT Inverted "V" at lock lifter assembly , The Clear VIEW of Inverted "V" indicates perfect locking.

UN COUPLING PROCEDURE

For uncoupling use the manual uncoupling device provided, uncoupling lever of this device is accessible form the track out side.

Unlock the handle by rotating locking screw with the special key.

Lift and turn the handle in clockwise direction to a horizontal position (min. 90) and pull the coaches apart.

Before uncoupling make sure that the couplers are not subjected to any tensile force and uncoupling lever is fairly free to run.

MAINTENANCE GAUGES

1) Inspector contour gauge – II (Jaw Gap Gauge) No. 228949W14.
2) Condemning limit Gauge – II (Jaw Gap Gauge) No. 228965W14.

3) Inspector contour Gauge – I (Profile Gauge) No. 228943W12.
4) Knuckle Nose wear and Stretch limit Gauge No. 229675W12.
5) Aligning Wing Limit Gauge No. 229673W11.
6) Vertical height Aligning Wing Pocket and Guard Arm Gauge (Go Gauge) No. 229676W11.
7) Vertical height condemning limit aligning wing pocket and Guard Arm Gauge (No Go Gauge) No. 229677W12.

1. JAW GAP GAUGE

There are two jaw gap gauges

1. Inspector contour gauge – II (No Go)

(Jaw Gap Gauge) No. 228949W14

2. Condemning limit Gauge – II (Go) (Jaw Gap Gauge) No. 228965W14

Check with condemning limit gauge, if gap exceeds the limit of gauge knuckle shall be replaced. If it dose not bring the coupler into limits the lock shall be replaced. If it dose not bring the coupler into limits then the coupler body must be replaced.

Condemning limit Gauge – II - 3 1/8 inch Inspector contour gauge – II - 3 1/2 inch

2. PROFILE GAUGE

Checks the contour of the knuckle using the contour gauge – I. shake the knuckle while passing the gauge with small vertical movements. This to ensure that slack in the assembly is included in the profile. If the gauge not passes parts must be replaced.

3. KNUCKLE NOSE WEAR AND STRETCH LIMIT GAUGE.

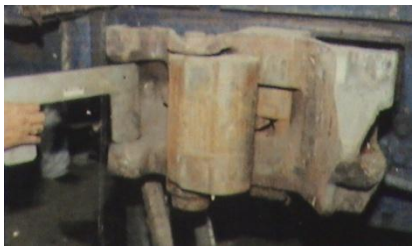
To check the Nose wear and Stretch limit of the knuckle. Permitted wear at the nose side is 6.5 mm.

4. ALIGNING WING LIMIT GAUGE

Check the distortion of the coupler head using Aligning wing limit gauge as showing,in case gauge dose not pass the coupler need to be re conditioned. Check bottom pocket with this gauge.

5. VERTICAL HEIGHT ALIGNING WING POCKET AND GUARD ARM GAUGE

(GO GAUGE)



Vertical height aligning wing pocket and guard arm gauge is primarily used to check the pocket and guard arm height of coupler in new condition.

6. VERTICAL HEIGHT ALIGNING WING POCKET AND GUARD ARM GAUGE

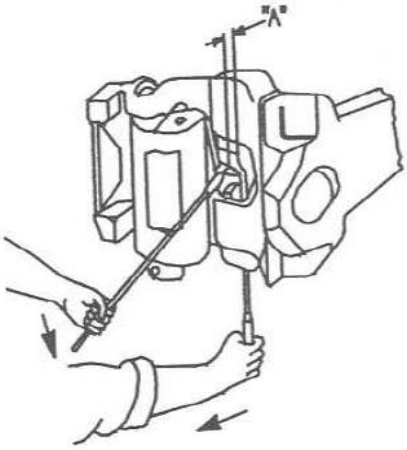
(NO GO GAUGE)

Vertical height aligning wing pocket and guard arm gauge defines the wear limit of these areas of the coupler head in service, in case the gauge fit into the given area the coupler head needs to re conditioning.

ANTI CREEP CHECK

Step- I: Inspection for anti - creep protection is made through the front of the coupler.

Step 2: With the coupler in the locked condition insert a pry bar through the front of the coupler between the knuckle tail shelf and lock, forcing lock upward.



Step3: Forcing the lock upward as far as it will go engages the top of the toggle with the bottom of the knuckle tail shelf.

Step4: Insert a pry bar between the leg of the lock and the front of the lock hole. Pull toward the front of the coupler to force the lock leg rearward.

Step 5: If the front edge of the toggle is 1/8 " or more forward of the rear corner of the knuckle tail shelf the anti- creep is unacceptable, replace the lock lift assembly.

Step6: If any actual measurement is desired, inscribe a line on top of the toggle along the rear face of the knuckle tail shelf, measurement must not be less than 3/8".

ADVANTAGES OF CBC

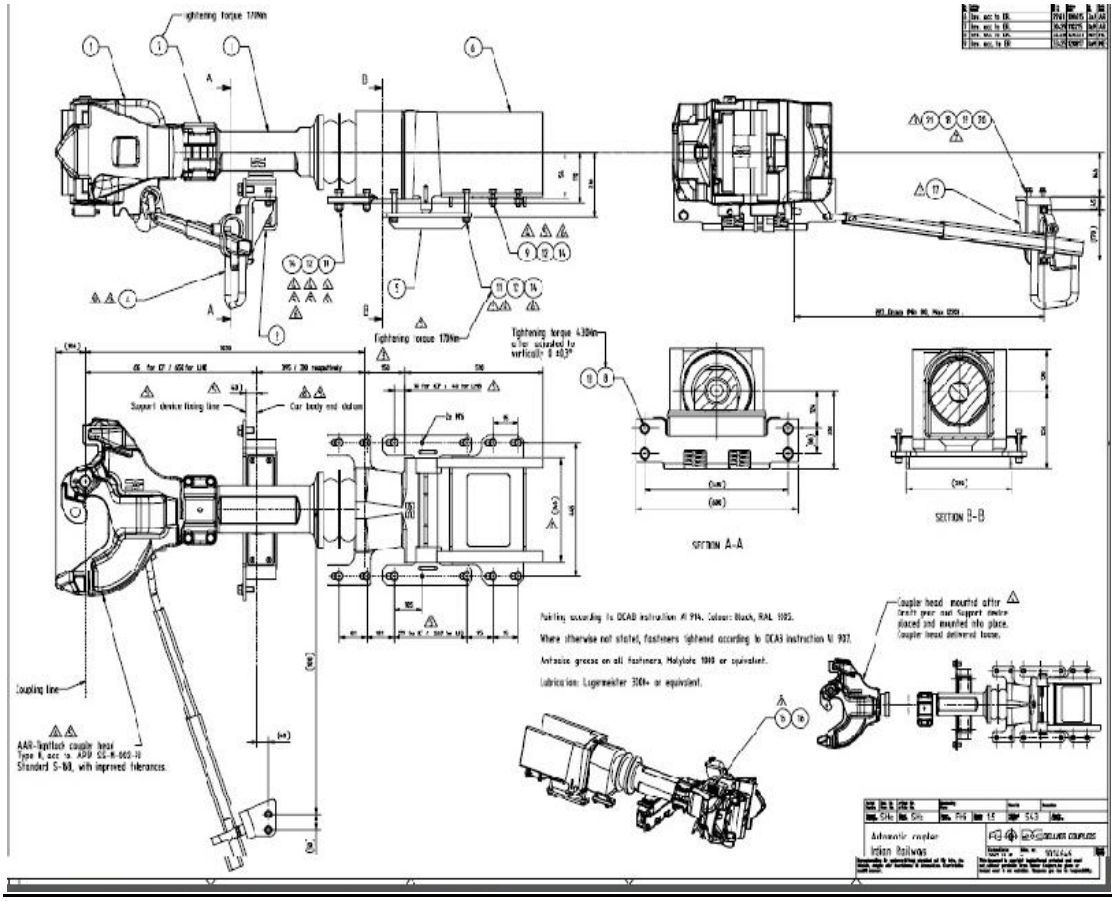
- ✓ High hauling capacity permits to attach more No. of coaches.
- ✓ Rake fitted with CBC can be run with comparatively high speed.

- ✓ No need to provide separate Buffing Gears. Hence the incidence of Buffer interlocking is avoided.
- ✓ Coupling/Uncoupling can be done easily from track side.

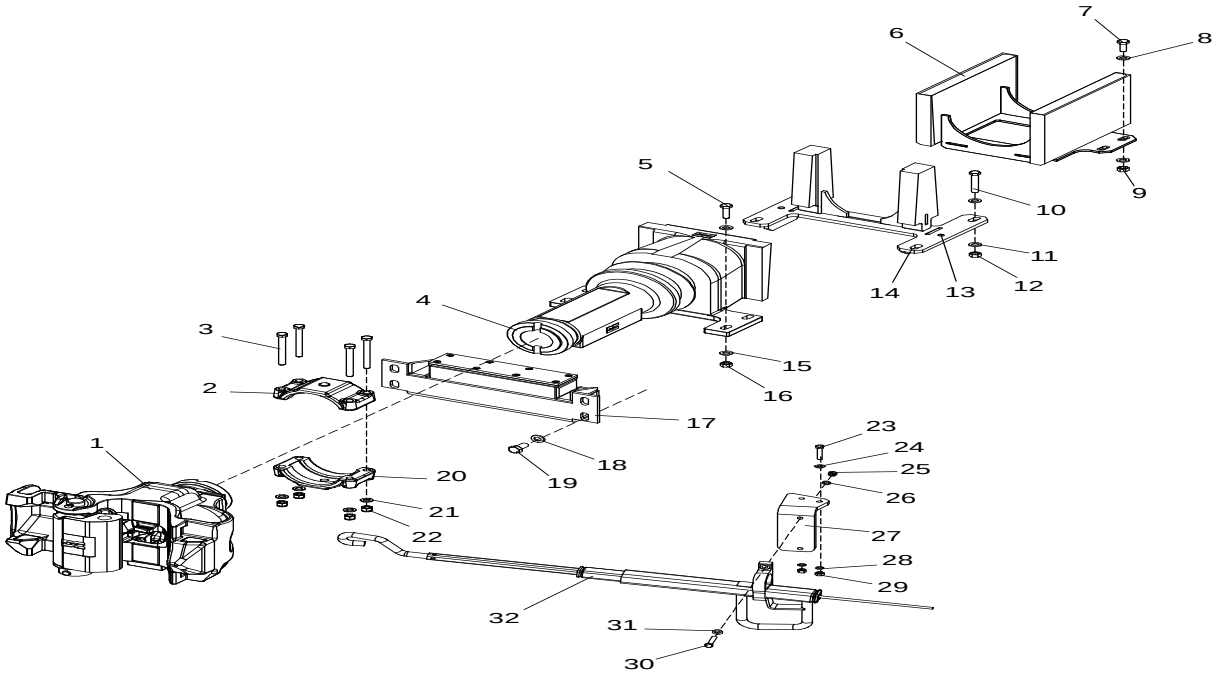
TECHNICAL DATA

- **Draft Gear capacity:**
  - Dynamic energy absorption capacity: 45 k J (min).
  - End force : 1600 kN (max)
- **Stroke :** Tension- 58 mm, Compression- 80mm.
  - Pre load : 30 k N
- **Strength of Coupler Head with Draft Gear :**
- Tensile load = 1000 kN, Compressive load = 2000kN.
- Bending test of Coupler head: 300kN.
- Coupler length : 1030 ± 5mm
- Weight of coupler : 500kg.
- Gathering range: Horizontal: ± 110mm, Vertical : ± 90mm.
- Maximum horizontal swing coupler : ± 17.85 °
- Maximum vertical swing coupler : ± 7 °
- The maximum slack is restricted to 3.5 mm.

DELLNER CBC

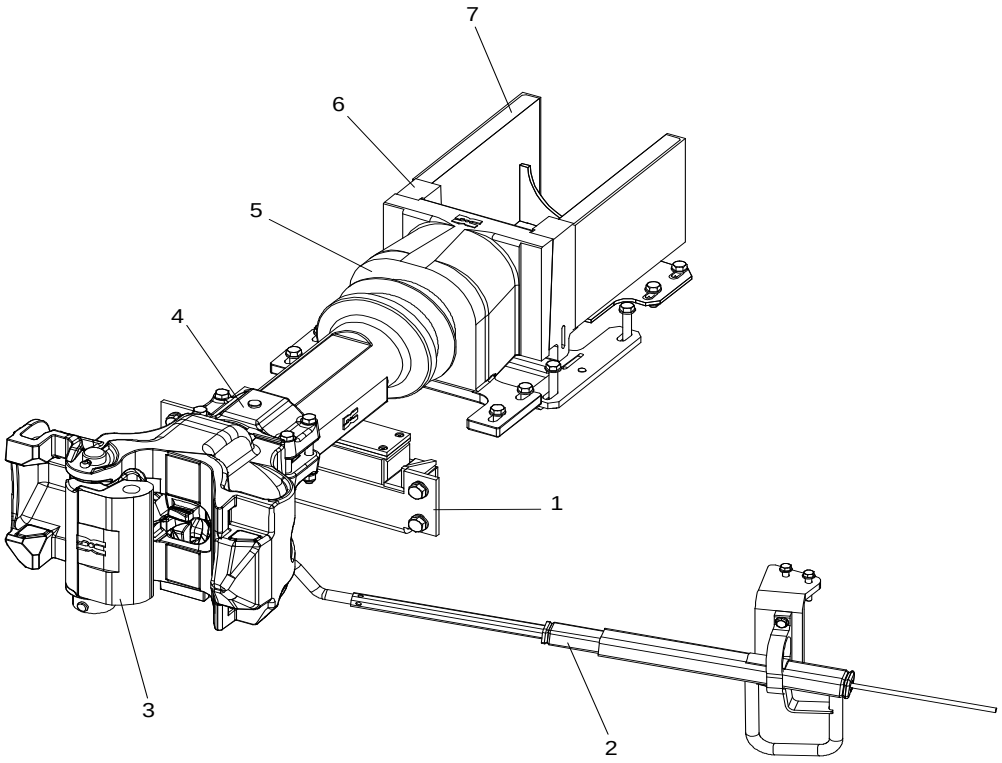


AUTOMATIC COUPLER



No.	Description	No.	Description
1	Mechanical coupler	17	Support device
2	Socket join upper	18	Washer
3	Screw	19	Screw
4	Draft gear	20	Socket joint lower
5	Screw	21	Washer
6	Clamping device	22	Nut
7	Screw	23	Screw
8	Washer	24	Washer
9	Nut	25	Nut
10	Screw	26	Washer
11	Washer	27	Bracket
12	Nut	28	Washer
13	M16 hole	29	Nut
14	Locking wedge	30	Screw
15	Washer	31	Washer
16	Nut	32	Uncoupling device

TECHNICAL DESCRIPTION:



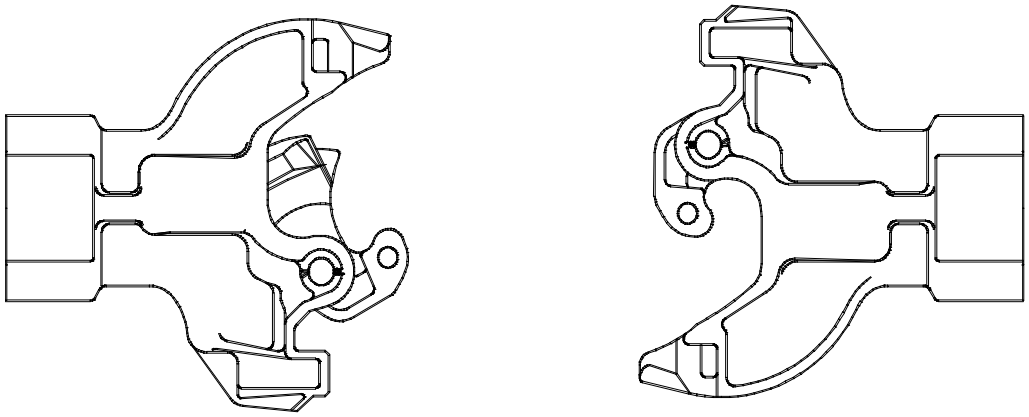
No.	Description	No.	Description
1	Support device	5	Draft gear
2	Operating device	6	Locking wedge
3	Mechanical coupler	7	Clamping device
4	Socket joint		

Mechanical Coupler:

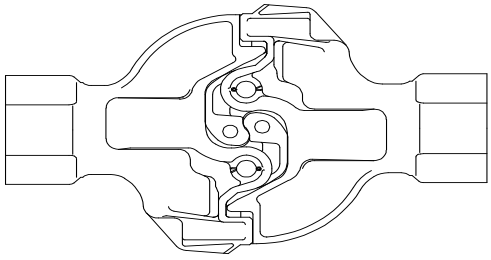
- The mechanical coupler is provided with aligning wings (2 and 5), located at both side of the coupler head. The wings serve to align the mechanical couplers during coupling. When completely coupled, the knuckle (4) and front face of mating coupler are securely locked and all buff loads are carried through the central column. Thus none if the buff stress is taken through the aligning wings.
- The mechanical coupler houses the locking/unlocking mechanism (3) consisting of the lock (7), knuckle thrower (6) and rotation lock lift assembly (8). A tell tale indicates that the lock is engaged. If is possible to see through the recess (9) the lock is engaged.
- The rotating lock lift assembly is the link between the uncoupling device and the lock in the mechanical coupler.

WORKING PRINCIPLE:

Ready to be Coupled

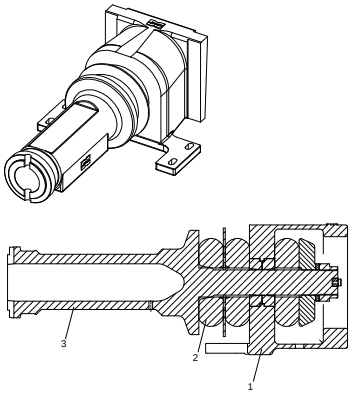


Coupled



Draft gear of Dellner CBC:

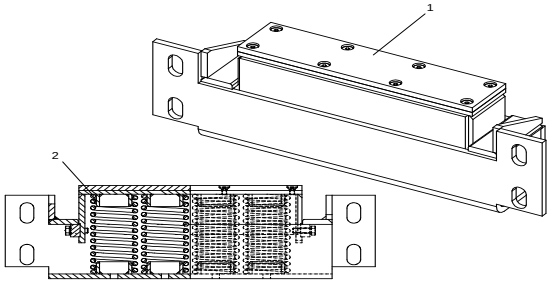
- The draft gear consists of a draw bar, an elastomer spring package and an anchor for mounting the coupler to the vehicle.
- The elastomer spring package serves to transfer buff and draft loads during normal operation as well as allowing for vertical and horizontal track variations. The spring package minimises both draft and buff forces over a stroke of +25 / -55 mm (600kN draft / 1000kN buff)



Support device:

The support device is mounted to the vehicle with 4 screws and supports the coupler horizontally. On top of the support device is a slide pad mounted on which the draft gear rests and slides.

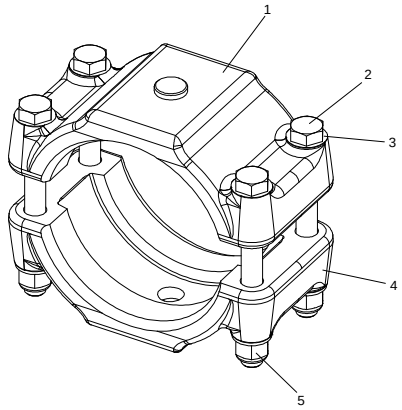
Inside the support device are 4 springs



Socket joint kit:

The socket joint kit connects the mechanical coupler and draft gear. This provides for easy removal and installation of major parts. The kit comprises two socket joints (1), screws (2), washers (3), and lock nuts (5).

When remounting a socket joint kit the screws, securing plates and nuts shall always be replaced with new ones.



Socket joint kit