# Rolling Stock requirements and their codal life:

Rolling stock is the vital asset of Railway which is used for transportation of freight, passenger and live stock from one place to another place to cover its journey. It is the safest mode which moves over rail path spread over different parts of India. Due to enhancement of industrial growth and demand of industries different type of rolling stock is being introduced by Indian Railway. As per requirement, rolling stock is divided into different groups. Those are as under:

i. **Freight / wagon stock:** Such type of stock is used for transportation of freight from one place to another place to deliver the same. At present it includes BOXN, BOXNCR, BOXNHL, BOXNR, BOXNHA, BCN, BCNHL, BOBRN, BOBYN, BTPN, BTPGLN, BLC, etc. These wagons are designed to take axle load between 22.9 ton to 25 ton to run on higher speed. At present freight stock is running with a maximum speed of 100 kmph.

ii. **Coaching Stock:**
   a. **Passenger Coaching Vehicle (PCV):** Such type of stock is used for transportation of passengers from one place to another place to cover their comfortable journey. At present ICF and LHB two types of coaching stock is being utilized over Indian Railways. Maximum speed of coaching stock is 160 kmph for LHB coaches and 130 kmph for ICF coaches. Trial has already been conducted for 180 kmph of LHB coaches.
   b. **Other Coaching Vehicles (OCV):** Coaching stock used to transport other than passenger is known as Other Coaching Vehicle. It includes VPH, RA, CT, RE, WCB, PC, WCD, etc.

iii. **Locomotive:** Locomotive is utilized to haul the freight as well as coaching stock for the purpose of train operation. At present diesel locomotive and electrical locomotive are being utilized by Indian Railways for this purpose. It includes WDM2, WDG4, WAM4, WAP7, WAG2, WAP4, etc.

**Codal life of rolling stock / different type of machines:** Codal life of any machine/asset is term as working life/normal life criteria for deciding Codal life of any asset/machine is based on utilization of particular machine/asset. It may be

1. Working of machine may be based on single and double shift utilization.
2. Working of machine may be based on round o clock utilization.

When any machine/asset is utilized round o clock. Its codal life will be 0.6 times of normal life .Normal average life of machine/Equipments as per working shift is known as the codal life of assets. The normal life of the various classes of railway assets are given below

| s. no. | Class of Asset | Average life in years |
|---|---|---|
| 1 | I. R. S. Coaches | 30 |
| 2 | Steel body ICF coaches | 25 |
| 3 | Steel body light utilization coaches | 40 |
| 4 | LHB coaches | 30 |
| 5 | Bogie Open Wagons fitted with CASNUB bogie | 30 |
| 6 | Bogie Covered Wagons fitted with CASNUB bogie | 35 |
| 7 | BTPN wagons | 40 |
| 8 | Diesel / Electric locomotive | 36 |
| 9 | Steam Locomotives | 40 |
| 10 | Power generation machinery and switches | 15 |
| 11 | General purposes light machinery e.g. band saws nibbling. air comp., floor grinder etc | 15 |
| 12 | Cranes<br>EOT<br>Steam<br>Diesel | <br>30<br>10<br>15 |
| 13 | Light mobile machinery (tractors fork lifts, portable compressors and welding sets etc). | 10 |
| 14 | Boiler | 20 |
| This life span of 15 years is for single and double shifts, for round the clock working the life recommended is 15X0.6=9years. | | |

**Introduction**

An attempt for standardisation of manufacturing of passenger coaches led to development of IRS design of steel body coaches. In 1954 Steel body coach design was taken from M/S Schlieren Switzerland for manufacturing of ICF Coaches at Perambur.

Initially original speed of ICF coach was 96 kmph since secondary suspension was laminated spring. The design was modified to all coil bogies with longer suspension hanger and weight transfer through side bearers, thereby enabling speed potential to 105 kmph on mainline coaches and gradually enhanced to 140 kmph for Shatabdi, Rajadhani and Janshatabdi coaches. as per RDSO report No CWI Vol 1

Initial coaches manufactured were with Vacuum brake and later modified into twin pipe graduated release air brake system - under frame mounted.

Due to frequent failure of SAB and heavy vibrations of pull rod this was further modified into Bogie Mounted Brake System. Brake rigging pins were reduced from 104 Nos to 82 Nos.

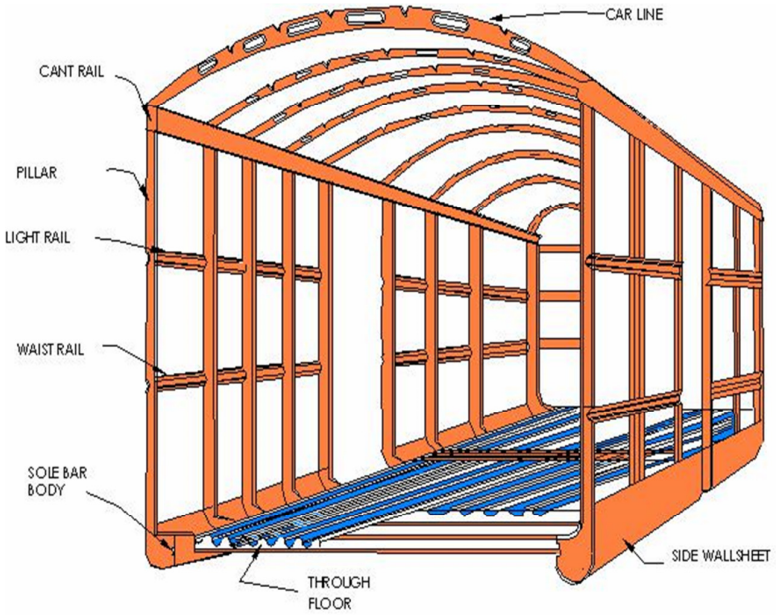
Drawbar capacity is enhanced from 36t to 75t.

The Codal life of ICF coaches of normal utilisation coaches is 25 years and light utilisation coaches are 40 years

| Dimensions of Coach | |
|---|---|
| Description | Dimension |
| | |
| Length Over Buffer | 22296 mm |
| Length Over Head Stock | 21336 mm |
| Width | 3245 mm |
| | |
| Height From Rail Level | 3886 mm (old), 4025 mm (new) |
| | |
| Codal Life | 25 Years |
| | |

## ICF COACH SHELL / BODY

Construction of coach body which forms big tubular hollow construction which is light in weight.



**Salient Features of ICF Coach Shell / Body**

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

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

**Integral Construction:-**The shell of ICF coach is formed by welding together body side pillars, roof carlines, waist rail, light rail, cant rail & sole bar. 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

**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 is so designed that it is more strong at end portion as well as in passenger seating portion and less at the doorway and toilet. Due to which maximum kinetic energy during accident is absorbed by the end portion and get damaged and balance kinetic energy is also shared by the corrugated flooring and other members of body shell, resulting in keeping the passenger accommodation area of middle portion of shell safe with minimum damage.

As a result of these properties, telescoping of one coach into adjacent coach is avoided during accident. Hence the above type of shell construction is known as anti telescopic construction.

**Stressed Skin Construction:-** During the construction the side panel is welded to side pillars, waist rail, light rail and cant rail by means of CO2 welding which results in accumulation of stress in the panel. The stress is relieved by spot welding on the panels at different location after completion of the construction. 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.

**Aerodynamic shell: -** The shell is constructed with the curved roof at the corners and curved turn under to minimise the air resistance during the run of the coach at high speeds

**Anti corrosive:-**To achieve anti corrosive property to the shell, Corten steel IRSM - 41 (max at turn under and lavatory portions) is being utilized for paneling purpose. During manufacturing the process of sand blasting, grit blasting is also given on panel sheet which is helpful to prepare rough surface for painting resulting in less chances of corrosion. Three coats of bituminous anti-corrosive paints are given at welded portion and for other portion red- oxides paint is applied for anti-corrosive treatment. The Trough floor is provided with holes for proper drainage of water. 200 x 135 mm size elliptical holes are given in turn under portion for proper drainage of seeped water coming from window shell. The flooring inside is made of 19 mm thick ply or 12 mm thick COMPREG sheet and 2 mm PVC flooring is layed over it avoiding the seepage of water from the

floor below to the corrugated sheets. The above precautions and provision of facilities minimises the incidence of corrosion.

**Heat resistance:-** To improve thermal insulation property in coach shell following precaution or facilities has been provided:-

Silver / Aluminium paint coat is provided on roof out side which reflects the sun rays.

Further the ceiling is provided with layers of insulating materials like Asbestos / Glass wool which is bad conductor of heat resulting in minimum transmission of heat to interior of the coach.

The carlines are designed with elliptical holes for proper air circulation from one compartment to another.

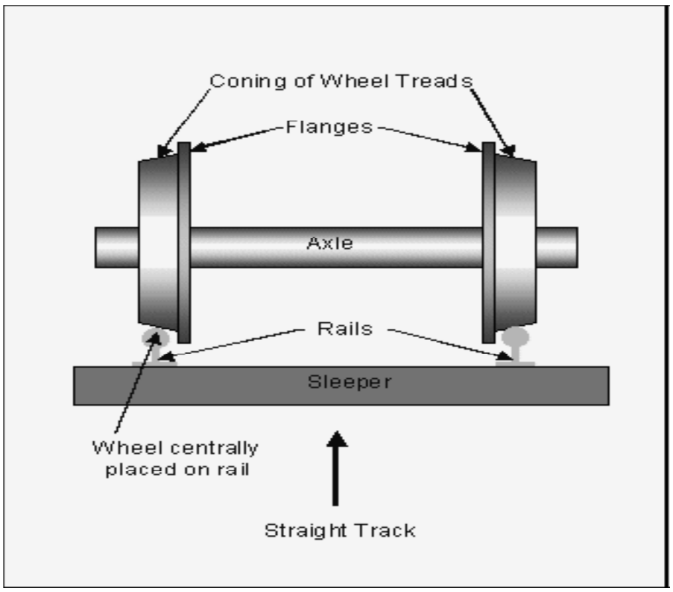
Sufficient no of ventilators are also provided on top of roof for exhausting the stale and hot air from the coach and to circulate fresh air.

Limpet sheet is used for inside ceiling (2mm thick) which is bad conductor of heat.

# WHEEL & AXLE MAINTENANCE

**Introduction**

The moment of Coaches on the track is possible only with help of wheels. Railway wheels sit on the rails without guidance except for the shape of the flange in relation to the rail head. Flanges to prevent the wheels becoming derailed - they're a safety feature.




**The shape and location of wheels and rails on straight track.**

This diagram is exaggerated to show the principal of the wheel/rail interface on straight track. Note that the flanges do not normally touch the rails.

**Components of A Wheel Set Axle**

An axle is a component of a wheel set to hold the wheel discs in position. The axle box is also mounted on the journal of the axle.

**Wheel discs**

The solid wheel disc is manufactured with wheel profile flange.

**Axle boxes with roller bearings**

The axle boxes used on ICF coaches are with **Spherical Roller Bearings No. 22326/C3.** These roller bearings are with **130 mm** parallel bore on the inner ring and are directly shrunk on the axle journals.

**Wheel Maintenance Procedure in the Workshop**

**Pre-inspection of wheels**

1. During pre-inspection of incoming wheels, the wheel-set is inspected for assessing the condition of the components.
2. Following measurements are carried out on all the wheels, received in shop for repairs.

**Tools required for inspection**

| S.no | Tool | Purpose |
|---|---|---|
| 1. | Adjustable Pi gauge | To check the distance between the two wheel flanges. (1600mm + 2 - 1mm) |
| 2. | Trammel Gauge | To check the diameter of wheel. |
| 3. | Profile gauge | To check the wheel flanges. |
| 4. | Outside micrometer | To check the diameter of the journal of Axle. |

| | | |
|---|---|---|
| 5. | Thread plug gauge | To check the tapped holes. (M16) |

**Measurement of a wheel gauge (distance between two wheels flanges on the same axle)**

1. The distance between two wheel flanges on the same axle should be 1600 mm + 2/-1 mm. This measurement should be taken at three locations 120 degree apart with the help of an adjustable pi gauge.
2. If wheel gauge is not within permissible limits, then the wheel disc (s) has to be pressed off and then pressed on.

**Measurement of Wheel Diameter (Tread Diameter)/Wheel Flanges**

1. The wheel diameter is measured with the help of a trammel gauge least count of 0.1 mm.
2. The difference in tread diameter of the two wheels on the same axle should not exceed 0.5 mm after tyre turning.
3. There is no 'In service' limit for this variation and rejection shall be decided by tyre defect gauge
4. The profile is to be turned 1 mm above the condemning limit groove. The maximum diameter and last shop issue size for ICF type wheels are 915mm and 837 respectively.

**Inspection of Wheel Flanges**

The wheel flanges should checked with the help of wheel profile gauge for the following defects.

| **S. No** | **DEFFECT** | **EFFECT** | **Standard** | **Condemn** |
|---|---|---|---|---|
| Em n | Sharp Flange | Sharp flange mounts over the rail on curves.<br>Split open slightly gaping points while travelling in facing direction | R14.5 mm | 5 mm |
| 2. | Thin Flange | Developing lurching & increases flange force. Cannot sustain the side thrusts | 28.5 mm | 5 mm |
| 3. | Deep flange | Damages the fish plates, bolts, points & crossings | 35 mm | 25.5 mm |

| | | | | |
|---|---|---|---|---|
| 4. | Less Root radius | Increases friction between wheel & rail.<br>Causes to develop of other wheel defects | 16 mm | 13 mm |
| 5. | Hollow tyre: | Moves with the angularity and increases flange force.<br>Difficult to negotiate curve | 1 in 20 mm | 5 mm (depth) |
| 6. | Thin tyre: | Cannot withstand heavier loads.<br>Causes low Buffer height. | 63.5 mm | 23.5 mm |
| 7. | Flat tyre: | Gives unusual sound on run.<br>Damages the roller bearing & permanent way. | 1 in 20 mm | 5 mm (depth) |

**Category of Repairs**

After pre- inspection the wheel set are nominated for below category wise repairs

**Normal repair wheels**

If all the components of wheel set are within the acceptable range of limits, these are taken directly for wheel profiling and servicing of roller bearings.Normal repair wheels are of two categories.

a. With roller bearings mounted

b. With roller bearings removed

**The activities involved in Normal Repair Wheels are as follows:**

1. Pre-inspection of incoming wheels.
2. Drop axle boxes, clean and inspect axle boxes. If required, repair them.
3. Carry out Ultrasonic Flaw detection test of axle.
4. If required, dismount roller bearings from journals. (In any case dismount roller bearings in alternate attention)
5. If the wheels are sent for re-profiling without dismounting roller bearings from the journals, special protective covers should be fitted on the bearings on either side of a wheel to avoid entry of chips / dust or damage to the bearing during machining.

6. Machine wheel profiles to the prescribed dimensions. The wheel tread should be checked and machined to the worn wheel profile.
7. Clean roller bearing and assemble components in position, if not dismounted.
8. Inspect roller bearing and assembly in position.
9. Check radial clearance and confirm it to be within permissible limits.
10. Pack fresh grease
11. Mount cleaned and inspected axle boxes.
12. Fit front cover with new sealing ring.

**Wheels requiring replacement of an axle (RA wheels)**

The wheel is taken for replacement of an axle for the following:

1. A bent axle,
2. Dimensional deviations on a journal / wheel seat
3. Dents, corrosion, pitting marks on the surface of the axle
4. Axles found flawed in the ultrasonic flaw detection test

**Procedure for RA wheels**

1. The wheel is taken on the wheel press for separating the rejected axle from the wheels.
2. Press in the suitable axle to a wheel(details of pressing operation in Para )

**Wheels requiring replacement of solid discs (RD wheels)**

The wheel is taken for replacement of discs if found

1. It is not possible to turn the wheel to the last shop issue size(837 mm)
2. There is a rejectable defect as per CMI-K003.

**Procedure for RD wheels**

1. The wheel is taken on the wheel press for separating the rejected discs from the axle.
2. Press in the suitable disc to a axle (details of pressing operation in Para 3.4 )

**Pressing wheel disc on axle**

1. Before pressing on operation, wheel seats on the axle and bore of the wheel centres should be carefully cleaned to remove rust, grit, swarf, dirt etc

2. Apply lubrication (a mixture of white lead and boiled linseed oil) on wheel seat portion.
3. Wheels should be mounted within the prescribed pressure limits. Pressing pressure should be **400 to 600 kg/mm** of diameter of wheel seat. For ICF 16t axle with wheel seat diameter from **176mm** to **178mm**, the pressing pressure should be **71t to 108t**.
4. Wheels should be mounted (pressed in) carefully on the axle such that the wheel gauge distance (1600 -1+2 mm) is maintained.
5. The axle end should be stamped with the shop code, date of mounting, pressing in pressure, axle no., cast no., cons. no. to enable identification of wheels. Care should be taken to ensure that wheel disc number is preserved
6. The wheel gauge should be checked by gauging at three or more equi-angular points around the circumference.

**Machine tools required for wheel pressing**

| S.No | Machine/Tools | Purpose |
|---|---|---|
| 1. | Hydraulic wheel press | To press out and press in of wheel discs. |
| 2. | Wheel distance gauge | To check the distance between two wheel flanges |
| 3. | Trammel gauge | To check the wheel diameter |

**Machining of Axle & wheels**

The following Machining process is required for wheel & Axles for achieve the standard RDSO specifications.

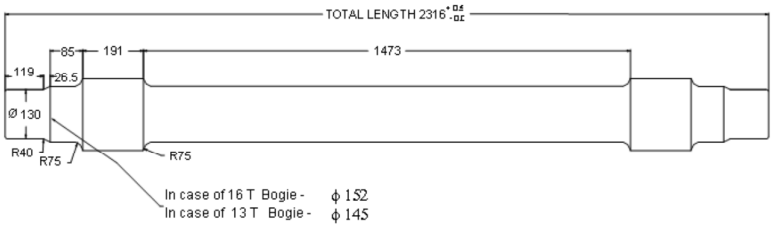
**Prerequisite for New Axle Turning**

1. Ensure that the axle supplied by firm, conforming ICF/RDSO‟s drawing specification and U/T pass.
2. A check to be made to ensure that the axle is not bent or damaged during transportation.

**Machining of new axles**

1. New axles should be machined to the correct drawing dimensions.
2. Journal, journal fillets and shoulders should be finished smooth, concentric and without ridges, burrs or chatter marks.
3. The axle should burnished for required surface finishing (journal portion -0.8 microns, wheel seat portion – 1.6 microns and body portion – 3.2 microns) on the burnishing machine.

**Inspection of machined axles for Dimensional checks**




1. A machined axle should be inspected for dimensional accuracy with the help of a micrometer with least count of 0.01 mm.
2. Journal diameters should be measured at three points along the length of journals both on the vertical and horizontal axis.
3. The ovality/Out of roundness must not exceed 0.015 / 0.020 mm and taper must not exceed 0.015 / 0.010 mm.

| S.no | Tool | Purpose |
|---|---|---|
| 1. | Outside micrometer | To check the diameter of the journal of Axle. |
| 2. | Thread plug gauge | To check the tapped holes. (M16) |
| 3. | Surface finishing tester | To check the surface machine. |

**Prerequisite for New Wheel discs**

1. Ensure that he U/T pass discs have been taken for pressing.
2. Ensure that there is no damage or hit mark on the wheel discs taken for boring
3. Check and align the face of the rim and boss of the disc and face if required to achieve perpendicularity of wheel disc on axle.

**Machining of New Wheel disc**

1. Bore the disc the boring machine as per prescribed size given in RDSO/ICF‟s drawing to obtain the permissible interference fit on the axle. ( interference must 1 micron for 1mm diameter of axle)
2. Disc hub should be bored properly and rounded off on edges.
3. The out side dia of the hub to be turned(machined) slightly on the same centre of wheel discs bore, to check and prevent HUB eccentricity.

4. Record wheel discs dimensions (both for LH & RH) picked up for new axle.

**Machining of serviceable wheel disc**

1. The serviceable wheel discs are re-bored on the vertical boring machine.
2. Care should be taken that the finished bore is straight, concentric to the tread of the wheel and has a smooth surface free from ridges, scores and chatter marks.
3. A radius of 2.5 mm is provided on the hub to facilitate mounting. It must be made after the finishing cut.

| S.no | Machine/Tools | Purpose |
|---|---|---|
| 1. | Vertical turning lathe | To re- bored the wheel disc |
| 2. | Inside micrometer | To check the bored diameter of the wheel disc |

**Inspection of bored wheel disc**

1. The bored wheel disc should be inspected with the help of an inside micrometer to ensure consistent results.
2. Each wheel bore must be checked at not less than three points in its length and on the different diameters at each of these points to ensure roundness and absence of tapers.
3. The variation for any of these measurements must not exceed 0.05 mm.
4. If any taper does exist, the small diameter must be outside ends of the hub (a reverse taper is not allowed).
5. The surface finish of the bore should be within the permissible limits.

| S.No | Tool | Purpose |
|---|---|---|
| 1. | Inside micrometer | To check the bored diameter of the wheel disc. |
| 2. | Trammel gauge | To check the diameter of the wheel disc |

**Machining of wheel seats for matching of wheel disc bores**

1. The wheel seat of the axle to be used for re-axling is machined to suit the bore of the wheel disc keeping interference allowance as specified.
2. The bore of wheel disc and wheel seat on the axle should be maintained to the specified surface finish and diameters to achieve correct interference ( 1 micron for 1 mm Dia.) fit and pressing in pressure

**Tools required for matching of wheel set**

| S.No | Tool | Purpose |
|---|---|---|
| 1. | Outside micrometer | To check the diameter of the journal of Axle. |
| 2. | Inside micrometer | To check the diameter of the wheel disc |
| 3. | Surface finishing tester | To check the surface machine. |

**Rolling Gear Maintenance Precautions**

**Dos**

1. Check for due date for last attention. For every alternate attention, extract the roller bearings irrespective of their condition.
2. Check each wheel bore of re-bored/new wheel disc at least three points in its length and on the different diameters.
3. Clean axle journals thoroughly for better inspection
4. Use only 16.25t axles for wheel sets under 13t bogie also.
5. During machining, use protective covers on the bearings on either side of a wheel to avoid entry of chips / dust or damage to the bearing.
6. Ensure the small diameter of the taper must be outside ends of the hub bore (a reverse taper is not allowed).
7. Before pressing on operation, clean the wheel seats on the axle and bore of the wheel centres and remove rust, grit, swarf, dirt etc. if any.
8. Before pressing on operation, ensure proper alignment of the wheel and axle on the wheel press.
9. Ensure the distance between two wheel flanges on the same axle within permissible limits i.e. 1600±2/0 mm.
10. Clean the probes and probe cable of the Ultrasonic testing kit daily after completion of the work.
11. Check the characteristics of probe at regular intervals.

**Don'ts**

1. Never use crow bar for extracting axle box. Use only axle box extractor.
2. Do not cross prescribed pressure limits when Wheels are mounted on Axles.
3. Don't allow the low pressure while pressing.

# ROLLER BEARING

**Introduction**

In passenger coaches (ICF design) of the Indian Railway system, an only single bearing type axle box arrangement is used. The spherical roller bearings have self-aligning properties and therefore can automatically adjust to any deviation in the centre line of the axle.

| Roller Bearing | Application in Indian Railways | Axle Load |
|---|---|---|
| 22320 C/C3 | MG Passenger coach | 10.25t |
| 22326 C/C3 | BG Passenger coach | 16.25t |
| 22328 BL1C3 | B.G. EMU | 20.0t |

Meanings of suffix/prefix

C = Type C Roller (Symmetrical), C3 = Radial internal clearance

B = Type B Roller (Asymmetrical), L1= High Strength machined brass cage

**Purpose / functions**

1. The spherical roller bearings have self-aligning properties and therefore can automatically adjust to any deviation in the centre line of the axle.
2. Spherical roller bearings has high capacity for radial loads, axle loads in either direction, and complex loads.
3. They are suited for the applications such as railway rolling stocks where vibrations and shock loads are encountered

**Construction feature of Roller Bearings**

a. Spherical Roller Bearings are named according to the shape of rollers.

b. Spherical Roller bearing no. 22326/C3 with **130 mm** parallel bore on the inner ring are being used on ICF type coaches. They are directly shrunk fit on the axle journals.

c. Spherical roller bearing consist of an outer ring having a continuous spherical raceway within which operate, two rows of barrel shaped rollers, which in turn are guided by an inner ring with two raceways separated by a centre rib.

**Bearing Components**

**Outer ring**

Outer ring for spherical roller bearings are manufactured from forged and rolled rings from bearing quality steel. It is through hardened and precision ground all over. The track or roller surface of bearing outer ring is spherical in shape for self-aligning.

**Inner Ring**

Inner ring for spherical roller bearing are also made from bearing quality steel which is forged and rolled. Inner rings are also precision machined heat-treated and precision ground. Inner ring have two rolling surface which are ground together with high accuracy.

**Roller**

Roller are either forged or machined from bearing quality steel bars & then through hardened and ground to high degree of accuracies. In bearing 22320 and 22326, symmetrical design rollers are used and for bearing 22328, asymmetrical design rollers are used.

**Cage**

Spherical roller bearings are fitted with machined brass cages. These cages are made from brass centrifugal castings and then precision machined. Brass cages have advantage of assuring positive lubrication and cooler running of the bearing therefore are best recommended for railway applications.

**Inspection of Roller Bearings in Mounted Position**

Following procedure should be adopted for carrying out inspection of roller bearings in mounted position.

1. Clean the exterior of axle box, front cover, axle box housing.
2. Remove axle box with the help of mechanical screw type puller, by taking care to protect axle centre with the use of pad not allowing the screw to rest on the axle centre. The end locking plate should be removed.
3. Examine the grease for consistency, colour, contamination with water, foreign particles, etc.
4. If the grease is in good condition, the bearing should not be dismounted, provided its felt sealing ring and rear cover do not require renewal.
5. Remove old grease. Roller bearing and its components should be thoroughly washed and cleaned with kerosene and then petrol/white spirit. All components viz., rollers, cage, outer and inner rings (races), roller track of outer ring should be examined after swiveling the outer ring.

**Bearing should be rejected for the following defects: -**

a. Pitted or flaked roller tracks and rollers.

b. Cracked or deformed or badly worn out cage

c. Cracked inner or outer ring

d. Scored or damaged outer surface of the outer ring

e. Indentation or rings or rollers

f. Scoring of roller tracks or rollers

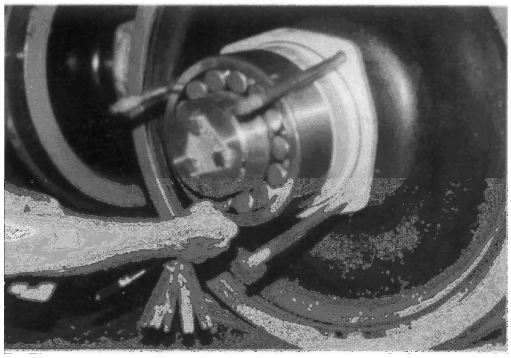
g. Rust/corrosion, damage or excessive fretting corrosion

h. Brinelling or false brinelling

i. Rings exhibiting deep straw or blue or purple colour indicating heat effect

j. Excessive or less radial clearance.

6. Radial clearance should be measured in a mounted position with a long feeler gauge simultaneously over both the rows of roller**.** The blades of the feeler gauge should be inserted between the outer ring and the unloaded rollers. While measuring the radial clearance, the rollers should not be allowed to roll over the blade. The acceptable range of radial clearance for bearing in mounted position on journal for different makes of roller bearings is given in table.



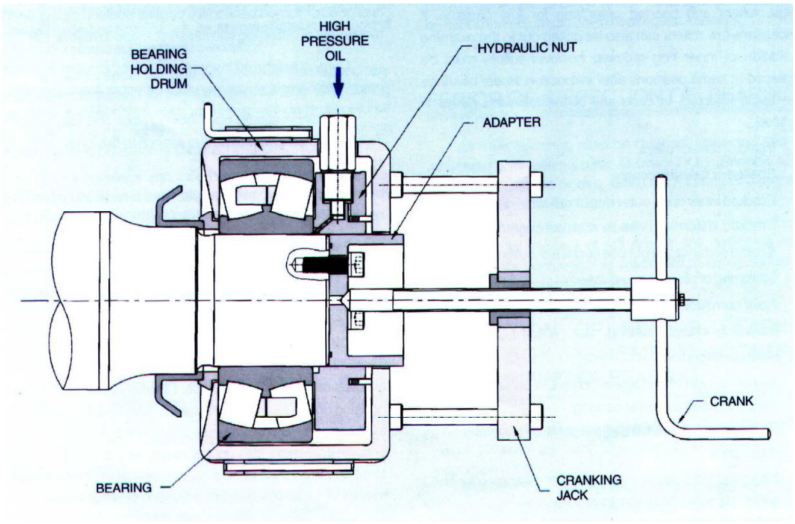
| **Bearing make** | **Radial clearance in mm** |
|---|---|
| SKF | 0.105 to 0.296 mm |
| FAG/NORMA | 0.080 to 0.185 mm |
| NEI/NBC | 0.080 to 0.190 mm |

**Equipment/Tool required**

| S.No | Tool/ Equipment | Purpose |
|---|---|---|
| 1. | Axle box extractor | To extract the axle box |
| 2. | Torque wrench | Securing of the end locking bolts. |
| 3. | Thread Plug gauge (M16) | Inspection of the end tapper holes. |
| 4. | Thread Ring gauge (M16) | Inspection of the locking bolts |
| 5. | Feeler gauge | To check the radial clearance |

**Dismounting of Bearing**

For dismounting roller bearings, a special hydraulic dismounting equipment is used. Oil is injected between the journal and bore of the inner ring with high pressure, which expands inner ring resulting in breaking of interference. The bearing becomes loose on the journal and slides over it. The bearing is then removed from the journal and sent to the cleaning plant.




**Inspection of dismounted Bearings**

Bearing after cleaning is thoroughly inspected for defects.

1. All bearing components such as inner ring, outer ring, rollers, cage are examined for cracks, damage and breakage.

2. Roller (track of outer ring) is examined by swiveling the outer ring. Roller track of inner ring is examined by mechanically pulling out a few rollers from the cage.
3. Inspection of roller bearings should be carried out under sufficient light, using magnifying glass.
4. If the bearing is found free from all the defects mentioned above, the radial clearance is measured with proper feeler gauge and compared with the permissible limits prescribed by RDSO in the maintenance manual for different makes of roller bearings.
5. Recommended limits of radial clearance for bearings in dismounted condition are as follows:

| | |
|---|---|
| **New bearings** | 0.145 to 0.190 mm |
| **Maximum permissible clearance for bearing in service** | |
| SKF make | 0.33 mm |
| FAG/NORMA makes | 0.270 mm |
| NBC makes | 0.295mm |

If any of the components is found to be defective or radial clearance is not within prescribed limits, the bearing is rejected and discarded from service.

**Tool/Equipment used for inspection of dismounted bearings.**

| S.No | Tool/ Equipment | Purpose |
|---|---|---|
| 1. | Magnifying Glass with light | Visual inspection of dismounted roller bearings. |
| 2. | Long feeler gauge set | Measuring/ checking of radial clearance. |
| 3. | Outside Micrometer | Measurement of journal/ shoulder diameter. |
| 4. | Inside Micrometer | Measurement of bored diameter. |

**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 hole**

The axle end holes should be checked with GO–NO GO thread plug gauge for correct size and thread condition.

**End locking plate**

End locking plates should be replaced every time its folds are opened to unscrew bolt.

**End locking bolt**

1. The condition of their threads should be checked with GO-NO GO thread ring gauges and worn out bolts replaced.
2. The bolt head should be free from any damages and should have proper spanner grip. The length of the bolt should be less than that of tapped axle end holes.
3. Bolt while fitting should have no radial or axial play.

**Retaining ring**

1. The retaining ring should be cleaned and inspected for flatness and correct dimensions.
2. The mating surfaces must be free from burr, sharp edge, rust or any other type of defect that will prevent proper seating with mating part.

**Collar**

1. The collar should not be dismounted unless it is damaged or the interference fit with the axle is lost.
2. Once dismounted, it should be invariably replaced.

**Felt ring**

1. Whenever the rear cover is removed from the roller bearing axle box, the felt ring should be replaced.
2. New felt ring should be soaked in warm cylinder oil to IS-1589-60 type I Gr. 3 heated to **40 o to 50o C for 30 minutes** and smeared with the same grease as used in the axle box before fitting in the rear cover.

**Rear and front cover**

1. These covers should be cleaned and inspected for any crack, correct dimensions and concentricity of bolt holes. The height should be **61+/- 0.1 mm** in the as cast condition and may be checked with the help of a gauge.
2. In case the cover is worn out, it should be replaced.

**Axle box housing**

1. The axle boxes should be thoroughly cleaned in the axle box cleaning plant and inspected.
2. Check for any mechanical damage or distortion.
3. The housing should be free from score marks, excessive corrosion and any wear.
4. The dimensions of the bore and width should be within specified tolerance limits.

5. The axle box should be checked for distortion, particularly at the spring seat.
6. Use cylindrical gauge fitted with dial indicator to check housing bore diameter at bearing seat .Check the bore at several places and it must be within specified tolerances.
7. Housings not conforming to the limits or otherwise found unsatisfactory must be rejected.

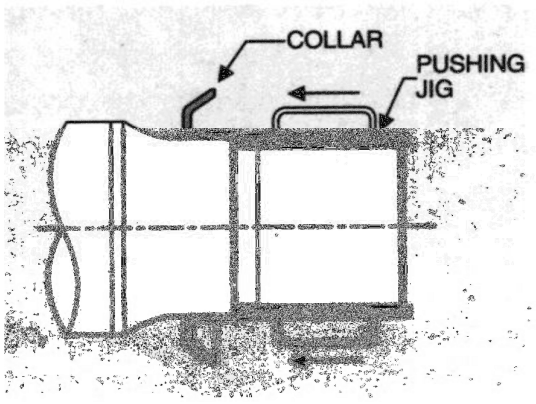
**Assembly of Roller Bearing Components**

**Mounting of spherical roller bearings and axle box components**

1. Before mounting the bearings, it is checked that journal and shoulder diameters are within permissible limits as per respective drawing.
2. End holes are checked for elongation with the help of thread plug gauge.
3. Mounting and maintenance work must be done by qualified personnel as per laid down procedures.

**Mounting of Labyrinth Ring (Collar)**

1. The labyrinth ring has an interference fit on the journal, and therefore requires heating for shrink fitting.
2. Heat the labyrinth ring upto a temperature of **1000 C max**. Heating time should be between **5-7 minutes**.
3. Clean the seating area of the axle, and push the heated labyrinth ring on the seating and hold it in position for few seconds when labyrinth ring has been cooled sufficiently to have a fairly firm fit on its seating, drive it home against the shoulder by tapping it with pushing jig, to avoid any possible gap.
4. When tapping produces clear metallic sound, it shows that the part has seated correctly.
5. After cooling, coat the labyrinth ring with grease of recommended brand to prevent any damage due to moisture, dirt or other foreign matter.



**Mounting of Rear cover, felt seal & O-Ring (Collar)**

1. Wipe and clean the rear cover and insert 4 nos. bolts. Fill "V" grooves of rear cover with grease and fit rubber O-ring in it's position.
2. Now soak the felt seal in warm cylinder oil (IS:1589 type 1 grade 3), heated to **40o C to 50o C for about 30 minutes**. Smear the felt seal by hand with same grease as used in axle box and fit into the groove at rear cover. Always use new felt seal of specified quality.
3. Slide and push in the rear cover in position against the labyrinth ring along with bolts and rubber O-ring. Fill approximately **50%** of sealing collar cavity with grease. Fill the space between rear cover and the neck of collar with grease and align.

**Mounting of Ring**

Clean and wipe the ring. Ensure that faces are parallel, flat and free from burr, rust etc. Insert the ring it is position. Fill grease in the cavity in the rear cover up to the face of the ring.

**Mounting of Spherical Roller Bearing**

1. New bearings should be taken out from original packing only just before mounting. The spherical roller bearings are coated with rust preventive oil prior to dispatch. There is no need to wash new bearings before installation.
2. All direct mounted spherical roller bearing for passenger coach have interference fit with axle journal**,** therefore it requires heating and shrink fitting. Heating of bearings can be done by using an induction heater. Usually, temperature range of **100 to 1200 C** give sufficient expansion for easy sliding of bearing over journal.
3. Heating time required in induction heating system largely depends upon the weight of the bearings. It is recommended to set the machine in such a way that it takes 5 to 7 minutes to attain the temperature of **1200 C** maximum of bearing. Overheating (**beyond 1200 C**) or rapid heating may result in dimensional instability or change in material properties due to change in microstructure, which may initiate cracks in bearings races in due course.
4. Heated bearing should be handled with the help of hook, tong or asbestos gloves and mounted on the journal. Push the heated bearing on the axle.
5. During mounting, installer must be careful to keep the bearing bore aligned with the axle to avoid the scoring marks.
6. Bearing position must be corrected by giving light taps with plastic hammer. Keep the bearing pressed by hand towards rear cover side for new minutes, till it has acquired sufficient grip on its seat.
7. The stamp face of bearing should be kept towards outside so that stamping can be seen during inspection.

**Re-assembling of Axle box**

1. The locking plate should be fitted in position, the end locking bolts tightened with a torque wrench to a correct torque value (**11 to 12 m kg**. For M16 bolts.)
2. Torque wrenches should be periodically checked for accuracy with torque wrench tester.
3. Bend all tabs of locking plate against the sides of the bolt using adjustable rib joint plier.
4. The date, the month, and the year of attention and workshop code should be punched on the locking plate.
5. Fresh grease should be packed between the rollers and the space between rear cover and the roller bearing. Correct quantity of grease is filled in each axle box .
6. A truncated cone of grease should be formed to in from of the bearing. The „V" grooves in the rear cover should also be filled with fresh grease after thorough cleaning. The quantity of grease filled per axle box

   SKF make bearing **2.00 kg**

   Other make bearings **1.75 kg**

   Only lithium base grease of approved brands should be used.
7. The axle box housing, front cover and „V" grooves on their faces should be thoroughly cleaned and checked for damages, distortion and trueness of dimensions.
8. After filling the fresh grease in the grooves, the axle box housing should be carefully pushed on the bearing and the front cover tightened in position.
9. The nuts of the axle box should be secured with the split pin. Month, year and workshop code should be stenciled on the front cover and the axle box sealed.
10. The free rotation of the axle box should be checked by hand.

**Some of common damages caused due to incorrect mounting are as below**

| **Damage during mounting** | **Possible Cause** |
|---|---|
| Score marks on rings | Bearing inner ring not properly aligned with axle during mounting.<br>Forcible entry on axle box during mounting |
| Surface cracks | Rapid or excessive heating of bearing<br>(temperature more than 120 OC) |
| Discolorated surface | Excessive heating temperature (more than 120OC) |
| Axial cramping of bearing | Faces of bearing and associated part not flush with one other. |
| Radial cramping of bearing | Oversize or undersize journal diameter |
| Excessive fretting of outer race | Improper fit between housing and outer ring |
| Grease oozing from rear cover | Used or poor quality of felt seal |

**Roller Bearing Defects and Remedial Measures**

| Defect | Effect on Bearing | Remedial Measures |
|---|---|---|
| 1. Felt ring perished | 1. Grease may ooze out from rear cover<br>2. Dust and water may enter the axle box | Renew the felt ring every time the bearing is dismounted in workshop.<br>Felt ring should be as per schedule of requirement laid down by RDSO. |
| 2. Rubber „O‟ rings of cover perished | Dust and water may enter the axle box | Renew the rubber „O‟ ring every time the bearing is attended in workshop. The material of the ring should conform to the specifications laid down by RDSO. |
| 3. „V‟ grooves on rear cover , front cover and axle box faces not filled with grease. | Dust and water may enter the axle box. | At the time of maintenance clean out the old grease and apply fresh grease. |
| 4. Improper and/or excessive / inadequate grease. | Excessive temperature , seizing or complete failure of Roller Bearing. | 1. Use only approved brands of grease.<br>2. Use specified quantity of grease. |
| 5. Bearing clearance not within prescribed limits. | Excessive wear of rollers and races leading to bearing failure. | Check bearing clearance during attention to roller bearing axle boxes in workshops and scrap bearings with clearances outside prescribed limits. |
| 6. Fitment of substandard/ improper size end locking bolts/ screws. | Bolt may fail in service cause damage to front cover and bearings | Check the end locking bolts /screws and if worn/sub standard, replace |
| 7. Improper locking of end locking screws. | Screw may get loose in service and cause damage to front cover and bearings | Follow correct procedure. |
| 8. End locking screws not tightened properly. | End locking arrangement may fail. | Tighten screws with torque wrench at specified torque value. |
| 9. Journal finish and Diameter not as prescribed in the drawing. | Bearing may become loose/inner ring cracks causing serious damage to the bearing leading to bearing failure. | Journal should be to the size , tolerance and finish shown on the relevant drawings. |
| 10. Excessive or inadequate lateral clearance between axle box covers and bearings. | Excessive clearance may damage roller bearings or covers. | Maintain correct lateral clearance as indicated in the drawings. |

**Rolling Stock Maintenance Precautions**

**Dos**

1. Work with clean tools in clean surroundings.
2. Keep bearings wrapped in polythene sheet when not in use.
3. Install new bearings as removed from packet without washing.
4. Apply clean grease and keep grease container closed when not in use.
5. Use volumetric container for filling correct amount of grease.
6. Use clean, lint free towels if bearings are wiped
7. Tools should be clean in good condition and dust free.
8. Store bearing horizontally and room should be dry and clean.
9. Journal and axle box housing dimensions should be maintained within the specified limits.
10. Calibration of measuring instruments and gauges should be done timely
11. Bearing should be unwrap at the time of mounting only.
12. Felt seal & locking plate should invariably be replaced at the time of POH it should be ensured that heating temperature is within 120 degree C and the minimum heating time should be between 5-7 minutes RDSO approved brand of grease should be used and grease must be changed at the time of POH
13. Use clean solvents and flushing oil.

**Don'ts**

1. Don't work in dirty surroundings.
2. Don't expose bearings to moisture or dirt at any time.
3. Don't remove oil from new bearings.
4. Don't use incorrect brand or amount of grease and also Don'tkeep grease in open condition.
5. Don't use cotton waste and dirty clothes to wipe bearings.
6. Don't use dirty and rusty tools.
7. Don't store bearings vertically, in uncleaned and in humid environment.
8. Don't compromise with the journal and axle box housing dimensions.
9. Don't use faulty measuring instrument and gauges.
10. Don't unnecessarily unwrap the bearing from its original packing.
11. Don't use components like felt seal, locking plate.

12. Don’t raise the bearing temperature more than 120 degree centigrade and also rapid heating should be avoided.
13. Don’t recycle the used grease. Never Mix up the greases of different grades or even different makes of same grade.
14. Don’t use compressed air for cleaning the bearings

# SUSPENSION SYTEM

## Main Components of ICF Bogie

Bogie Frame; Side Frame, Head stock, Transom, Longitudinal bar

## Primary Suspension;

Dash pot, Dash pot spring, Dash pot protection tube, Air vent screw, Axle box safety bolt, Axle box wing & lug, Safety strap & safety loop, Axle box & axle box cover

## Secondary Suspension;

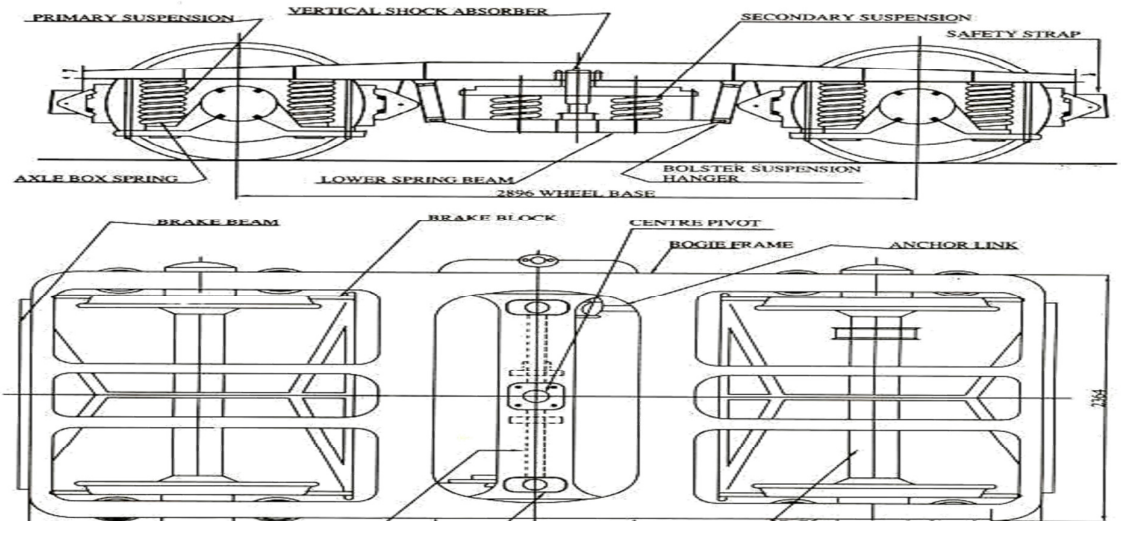
Bogie bolster, Lower Spring plank, Bolster Suspension Hanger (BSS), BSS pin & Hanger block, Bolster spring, Vertical shock absorber, Safety strap & safety loop

## Force Transmission components;

Equalizing stay, Anchor link, Centre pivot, Silent block, Side bearer housing, Side bearer metal wear plate, Side bearer bronze wearing piece

## Brake Gear;

Brake beam, Brake beam hanger & safety bracket, Brake safety wire rope, Brake shoe & key, Floating lever, Curved pull rod, Palm end



**Features of ICF All Coil Bogie**

The Bogie is designed to run on Indian Broad Gauge Track (1676 mm).Since coil springs are provided both in primary & secondary suspension, the bogie is known as All Coil Bogie.

Bogie Head Stock is manufactured with pressed T- section and Side Frame is with pressed I-section, but at the location of link brackets it is box type construction.

The Transom was C -section previously, presently it is of Box section which is more robust. Wheel Base of bogie is 2896 mm. Weight Transmission of the body to bogies is through 2 side bearers located at distance of 1600 mm on the bolster.

Lateral and Longitudinal Guidance of bogie is with the use of Centre Pivot pin located at the centre of bolster.

Lateral and longitudinal Wheel Guidance is with the use of 2 nos. of Dash Pot guides per Axle Box Wing welded on the side frame. Axle Capacity - 13 T – For Non A/C coach

16 T – for A/C coach and WLRRM coach

Roller Bearing – Double Row Self Aligned Spherical Roller Bearing.

Axle – Solid and Straight

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)

Shock Absorbers – Provided on Secondary suspension between Bolster and Lower plank (2 nos. per Bogie).

Presently 2 nos. of lateral shock absorbers are provided in Hybrid Coach Bogies.

Dash pots – 2 nos. per Axle Box Vertical telescopic hydraulic Dashpots are provided.

Fitment of brake block - Clasp type brake block arrangement is provided with the use of brake shoe head and brake beam.

2 nos. equalizing stays per bogie are utilized to maintain the distance between both the lower planks and to minimize lateral thrust occurring during run.

Provision of Anchor link – 2 nos. per bogie are provided diagonally between bogie transom and bolster with the provision of silent bushes to work as a media to transmit the draw and braking forces from trolley to body and body to trolley vice versa.

**Provision of Running Clearance: -**

'A'-Clearance- It is a clearance to be provided between Axle box crown & Crown pad.

'B'-Clearance: - It is a clearance to be provided between bolster top & bottom of sole bar that should be 40 $\pm$5 mm to all type of bogies.

Riding index: - ICF bogie – 3.25 to 3.50

Truss beam Hanger: - Modified by increasing the length. New length -235 mm, Old length – 205 mm

Journal Size: Dia.– 120 x 130.5 mm (direct mounted) Journal Centre: - 2160 mm

Speed: - Fit to run up to 110 kmph, for Main line coaches, 130 kmph for Garib Rath & 140 kmph for JaJanshatabdi

## Weight Transmission of ICF Coach

Body Floor

Body Bolster

Top side bearer

Bottom Side bearer

Bogie Bolster

Lower spring plant through secondary springs

Bogie Side frame through BSS hangers

Axle Box wings through Primary springs

Journal through Bearing

Wheel

Track

## Draft Force Transmission of ICF Coach

Screw coupling

Head stock

Centre Pivot

Bogie Bolster

Anchor Links

Bogie Frame

Axle Guide

Dash pot

Wheel

## Braking Force Transmission of ICF Bogie to Body

Wheel

Dash pot

Axle Guide

Bogie Frame

Anchor Links

Bogie Bolster

Centre Pivot

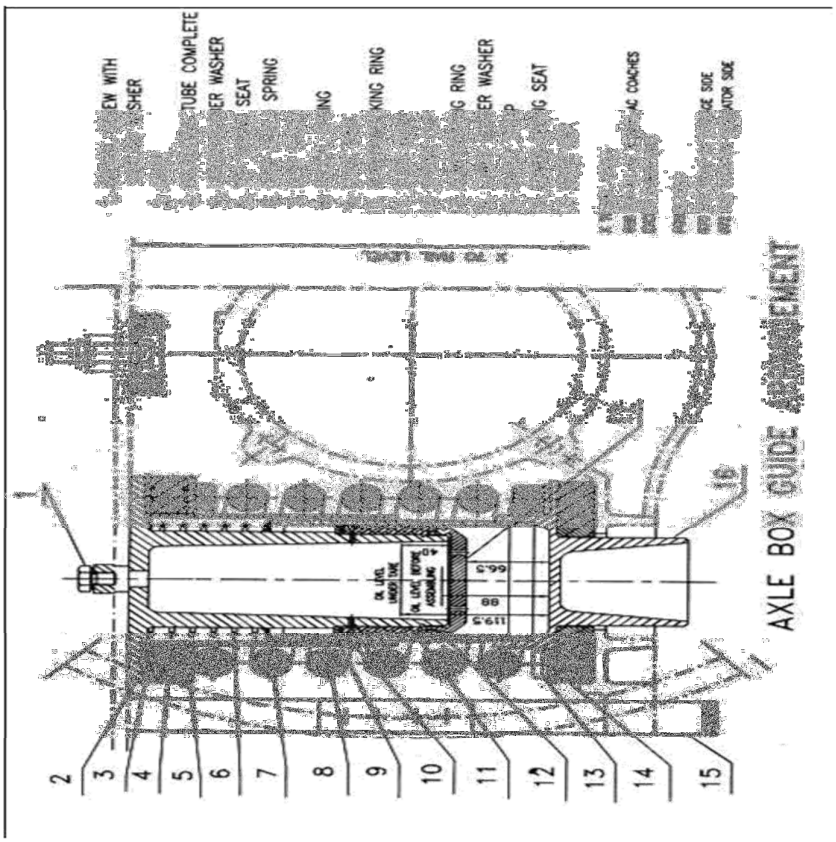
Under frame

Body

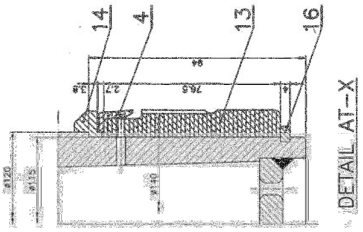
## Axle Box Guide with Dashpot Arrangement

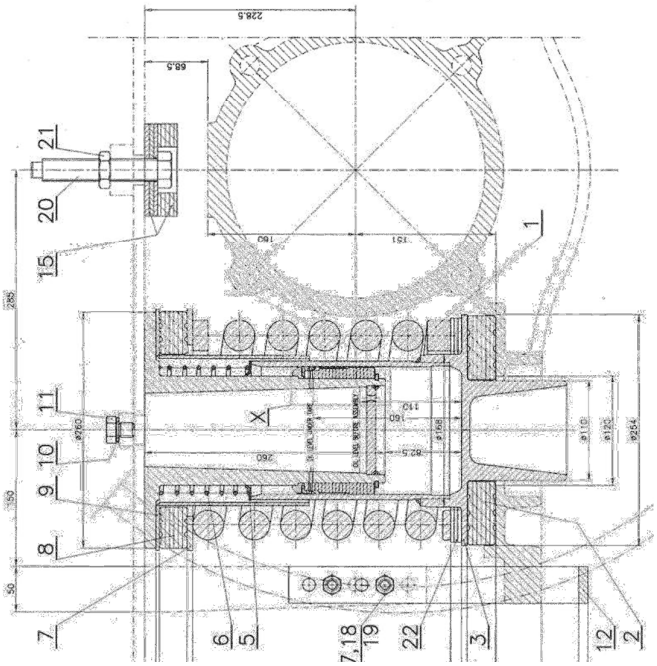
Axle box guides are of cylindrical type welded to the bottom flanges of the bogie side frame with close dimensional accuracy. These guides together with lower spring seats located over the axle box wings house the axle box springs and also serve as shock absorbers. These guides are fitted with guide 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 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 for maintaining 40 mm oil level above the guide cap in modified arrangement is approximately 1.6 litres and in unmodified arrangement is approximately 1.4 litres. As it is not possible in open line to distinguish between modified and unmodified arrangements, 40 mm oil level is standardized for both.




**Modified Dash Pot**



| Sl. No. | Description & dimension | No. per Coach | Ref. Drg |
|---|---|---|---|
| 1 | Helical Spring | 16 | F-0-1-006 |
| 2 | Lower rubber washer | 16 | T-0-1-601 |
| 3 | Lower spring seat | 16 | DL-0-1-103 |
| 4 | Rubber packing ring | 16 | T-0-1-632 |
| 5 | Dust shield | 16 | T-0-1-619 |
| 6 | Dust shield spring | 16 | T-0-1-607 |
| 7 | Top spring seat | 16 | T-0-1-608 |
| 8 | Upper rubber washer | 16 | T-0-1-609 |
| 9 | Protective tube complete | 16 | T-0-1-610 |
| 10 | Sealing washer | 16 | T-0-1-629 |
| 11 | Special screw | 16 | T-0-1-616 |
| 12 | Safety strap | 16 | T-0-1-631 |
| 13 | Guide bush | 16 | T-0-1-634 |
| 14 | Guide ring | 16 | T-0-1-640 |
| 15 | Rubber stopper arrangement | 2 | ICF/SK 0-1-193 |
| 16 | Circlip 115 X 4N | 16 | IS: 3075-86 Part 1 |
| 17 | Spring washer | 32 | IS: 3063-94 Tab 1A, Type B |
| 18 | Hex Head Bolt M12 x 65 | 32 | IS: 1364 (P-1) – 92 4.6 tab 1 & 2 |
| 19 | Hex Nut M12 | 32 | IS: 1364 (P-1) – 92 4 tab 1 |
| 20 | Hex Head Screw | 8 | ICF/SK 0-0-196 |

| | | | |
|---|---|---|---|
| 21 | Hex Thin Nut M24 RH (Chamfered) | 8 | IS: 1364 (P-4) – 92 4.6 tab 1 & 2 |
| 22 | Compensating Ring | | ICF/SK 0-0-042 |

**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.

**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.

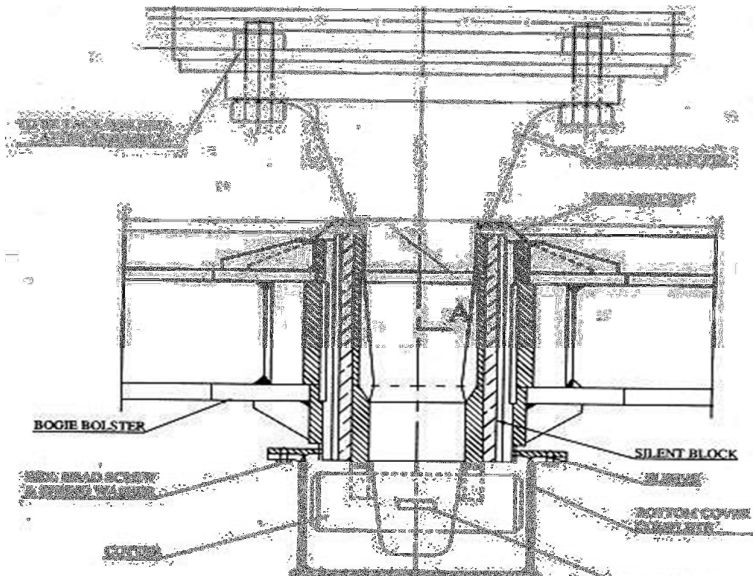
**Springs:**

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.

**Centre pivot arrangement:**

The centre pivot pin joins the body with the bogie and transmits the tractive and braking forces. 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.

Centre pivot arrangement



**Side Bearers:**

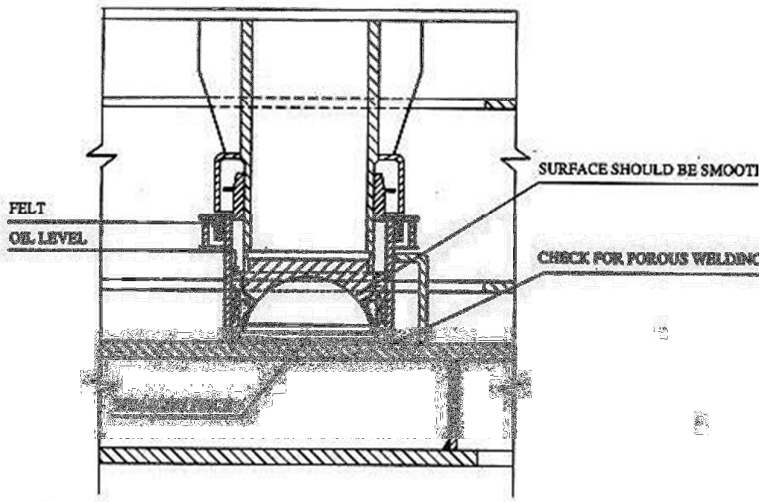
The side bearer arrangement consists of a machined steel wearing plate immersed in an oil bath and a floating bronze-wearing piece with a spherical top surface, kept on both sides of the bogie bolster. The coach body rests on the top spherical surface of these bronze-wearing pieces through the top side bearer at 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:

| | | | |
|---|---|---|---|
| | Condemning | : | 8.5 |
| New size: 10 mm | size | | mm |

Wear limit for wearing piece:

| | | | |
|---|---|---|---|
| | Condemning | : | 42 |
| New size: 45 mm | size | | mm |




SIDE BEARER ARRANGEMENT

**Anchor Links:**

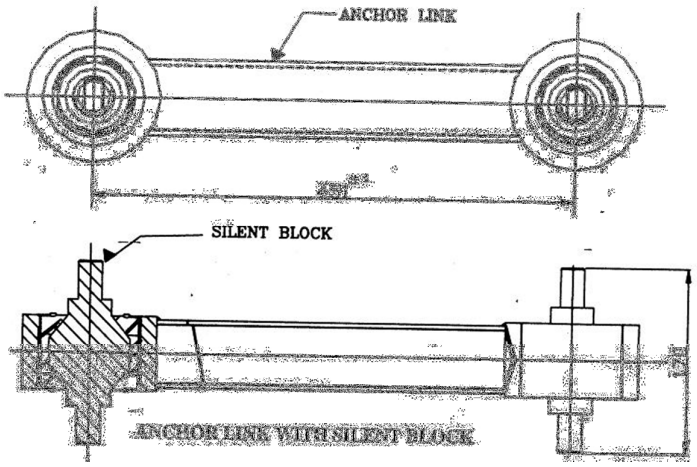
The floating bogie bolster which supports the coach body is held in position longitudinally by the anchor links which are pinned to the bolster sides and the bogie Transoms.

One anchor link is provided on each side of the bolster diagonally. The links can accommodate vertical movement to permit the bolster to rise and fall. They are designed to take the tractive and braking forces. The anchor links are fitted with silent block bushes

**Silent Block:**

The two anchor links diagonally positioned are provided with silent block bushes. The links prevent any relative longitudinal movement between the bogie frame and coach body.

This is a synthetic rubber bush fitted in anchor link and centre pivot of ICF bogies to transmit force without shock and reduce noise.

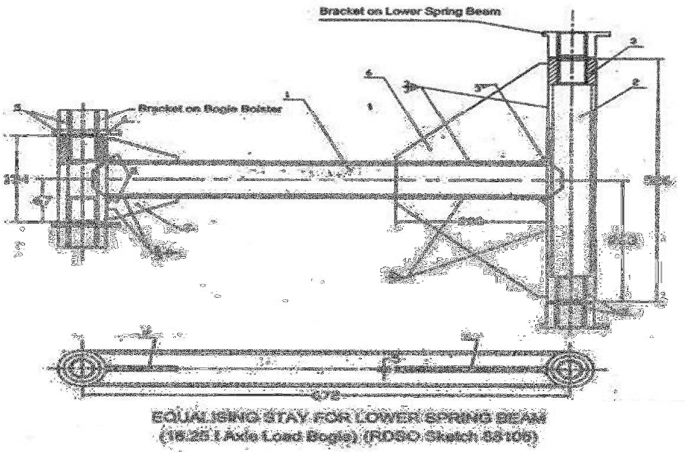



**Bolster Spring Suspension (BSS) Hangers:**

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.

Shock Absorbers:

Hydraulic shock absorbers with capacity of 600 kg at a speed of 10 cm/sec. are fitted on 13 ton bogie & 900 kg at a speed of 10 cm/sec. are fitted on 16 ton bogie work in parallel with the




**bolster springs to provide damping for vertical oscillations. 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 as these springs are not designed to take the lateral forces. These links have pin connections at both ends and, therefore, can move vertically

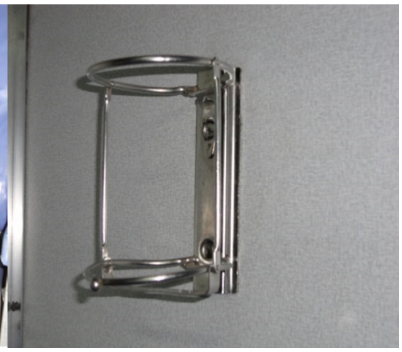
# SAFETY AND AMENITY FITTINGS

Amenity fittings have been provided in coaches to have a comfortable & safe train journey to passengers.

- Cushioned Seats
- Cushioned Berths
- Folding table
- Bottle holders
- Dust bins
- Mirrors
- Coat hooks
- Magazine pouches
- Wash basins
- Ward robe with fixed hangers
- Thali racks
- Rings below berths for securing luggage
- Towel rail
- Flushing commode
- Push cock for lotah filler
- Commode rail
- Mirror shelf
- Soap liquid container
- Reservation display plates
- Destination boards
- Number plates
- Alarm chain pull
- Internal latches at top on body side doors
- Fire extinguishers
- Latches for window shutters of body side doors

- Safety bars on all window opening
- Glass shutters
- Louvre shutters
- Frosted single glass sealed window

Cushioned berthsBottle holder

Cushioned back restMagazine pouch


Wash basinsLiquid soap container


Mirrors 110V Laptop/Cell phone charging points


PU coated ladders to climb upper berths Ward robe with fixed hangers


No amenity item should be pooled from the coaches booked for P

# MAINTENANCE PRACTICE IN COACHING STOCK

## COACH POH – AN OVERVIEW

| Coach Basic Data Coaches | Over Buffers (mm) | Over Body (mm) | Overall Width (mm) | Height from Rail Level (mm) |
|---|---|---|---|---|
| ICF/RCF | 22297 | 21337 | 3245 | 4025 |
| BEML | 22296 | 21336 | 3250 | 3991 |
| LHB | 24000 | 23540 | 3240 | 4039 |

Codal Life for Different Coaching Stock.

| | |
|---|---|
| Steel bodied coaches (including dining/pantry cars) | 25 years |
| All Converted coaches ART/ARMV, Engineering camping coaches etc. | 10 years from the date of conversion of total of 35 years whichever is earlier |
| Light utilisation categories of coaches which are manufacture at production units | 40 years |

**Transportation codes**
**ICF/RCF Coaches**

| S. No | TRANSPORT-ATION CODE | DETAILS |
|---|---|---|
| 1 | ART | ACCIDENT AND TOOL VAN OR RELIEF VAN |
| 2 | CT | TOURIST CAR |
| 3 | CTS | TOURIST CAR FOR 2ND CLASS PASSENGERS |
| 4 | CZACEN | AIR CONDITIONED CHAIR CAR WITH END ON GENERATION |
| 5 | ERR | FOUR / SIX WHEELER |
| 6 | ERU | FOUR / SIX WHEELER SELF PROPELLED TOWER VAN |
| 7 | FCS | FIRST CLASS COUPE AND SECOND CLASS |
| 8 | FSCN | FIRST CUM II CLASS 3-TIER SLEEPER |
| 9 | GS | SECOND CLASS FITTED WITH SELF GENERATING EQUIPMENT |
| 10 | LR | LUGGAGE WITH BRAKE VAN |
| 11 | NMG | NEW MODIFIED GOODS |
| 12 | OHE | OVER HEAD EQUIPEMNT INSPECTION CAR |
| 13 | PPS | FULL BOGIE POSTAL VAN |
| 14 | RA | INSPECTION CARRIAGE ( ADMINISTRATIVE) |
| 15 | RAAC | AIR CONDITIONED INSPECTION CAR |
| 16 | RD | INSPECTION CARRIAGE (SUBORDINATE) |
| 17 | RE | INSTRUCTION VAN (MOBILE TRAINING CAR) |
| 18 | RH | MEDICAL VAN |
| 19 | RHV | AUXILIARY MEDICAL VAN |
| 20 | RK | DYNAMOMETER CAR |
| 21 | RN | GENERATING VAN |
| 22 | RS | STORES VAN |
| 23 | RT | ACCIDENT AND TOOL VAN OR RELIEF VAN |

| | | |
|---|---|---|
| 24 | RZ | TRACK RECORDING CAR |
| 25 | SLR | SECOND CLASS LUGGAGE AND BRAKE VAN |
| 26 | SMN | POWER CAR WITH MID ON GENERATION |
| 27 | VP | PARCEL VAN |
| 28 | VPC | PARCEL VAN CONVERTED |
| 29 | WACCNEN | VESTIBULED AC 3-TIER WITH END-ON–GENERATION |
| 30 | WCB | VESTIBULED PANTRY CAR |
| 31 | WSCZACEN | VESTIBULED AC CHAIR CAR WITH END-ON-GENERATION |
| 32 | WCD | VESTIBULED DINING CAR |
| 33 | WCRAC | VESTIBULED AIR CONDTIONED TWIN CAR |
| 34 | WCTAC | VESTIBULED AIR CONDITIONED TOURIST CAR |
| 35 | WFACEN | VESTIBULED AIR CONDITIONED FIRST CLASS WITH END ON GENERATION |
| 36 | WFC | VESTIBULED FIRST CLASS |
| 37 | WGACCN | VESTIBULED AIR CONDITIONED THREE TIER WITH SELF GENERATING ELECTRICAL EQUIPMENT |
| 38 | WGACCW | VESTIBULED AIR CONDITIONED TWO TIER WITH SELF GENERATING ELECTRICAL EQUIPMENT |
| 39 | WACCWEN | VESTIBULED AIR CONDITIONED TWO TIER SLEEPER WITH END ON GENERATION |
| 40 | WGFAC | VESTIBULED AIR CONDITIONED FIRST CLASS WITH SELF GENERATING ELECTRICAL EQUIPMENT |
| 41 | WGFACCW | VESTIBULED FIRST CUM AC 2-TIER SLEEPER |
| 42 | WGSCN | VESTIBULED SECOND CLASS THREE TIER SLEEPER WITH SELF GENERATING EQUIPMENT |
| 43 | WGSCNLR | VESTIBULED SECOND CLASS THREE TIER SLEEPER WITH LUGGAGE AND BRAKE VAN |
| 44 | WGSCZ | VESTIBULED SECOND CLASS CHAIR CAR WITH SELF GENERATING ELECTRICAL EQUIPENT |
| 45 | WGSCZAC | VESTIBULED SELF GENERATING SECOND AC CHAIR CAR |
| 46 | WGSD | VESTIBULED SECOND CLASS DOUBLE DECKER WITH SELF GENERATING ELECTRICAL EQUIPMENT |
| 47 | WLRRM | POWER CAR END-ON-GENERATION |
| 48 | WSCZACEN | VESTIBULED AIR CONDITIONED SECOND CLASS CHAIR CAR WITH END ON GENERATION |
| 49 | WSLRN | VESTIBULED SECOND CLASS, BRAKE CUM LUGGAGE AND POWER CAR |

**LHB Coaches**

| S. N. | TRANSPORT-ATION CODE | DETAILS |
|---|---|---|
| 1 | LWFAC | AC FIRST CLASS SLEEPER (EOG) |
| 2 | LWGFAC | AC FIRST CLASS SLEEPER (SG) |
| 3 | LWACCW | AC SECOND CLASS SLEEPER (EOG) |
| 4 | LWGACCW | AC SECOND CLASS SLEEPER (SG) |
| 5 | LWACCN | AC THREE TIER CLASS SLEEPER (EOG) |
| 6 | LWGACCN | AC THREE TIER CLASS SLEEPER LACCN (SG) |
| 7 | LWCBAC | AC HOT BUFFET CAR |
| 8 | LGS | NON AC SECOND CLASS GS |

| | | |
|---|---|---|
| 9 | LWGSCN | NON AC SECOND CLASS THREE TIER (SG) |
| 10 | LGSLR | NON AC – LUGGAGE CUM GUARD VAN (SG) |
| 11 | LWFCZAC | AC CHAIR CAR EXECUTIVE CLASS |
| 12 | LWSCZAC | AC CHAIR CAR |
| 13 | LWLRRM | GENERATOR CUM LUGGAGE & BRAKE VAN |

**POH/IOH Schedule periodicity**

PVC and OCV rakes

| | |
|---|---|
| POH in workshop | 18 months |
| IOH of bogie in workshops | 9 months |

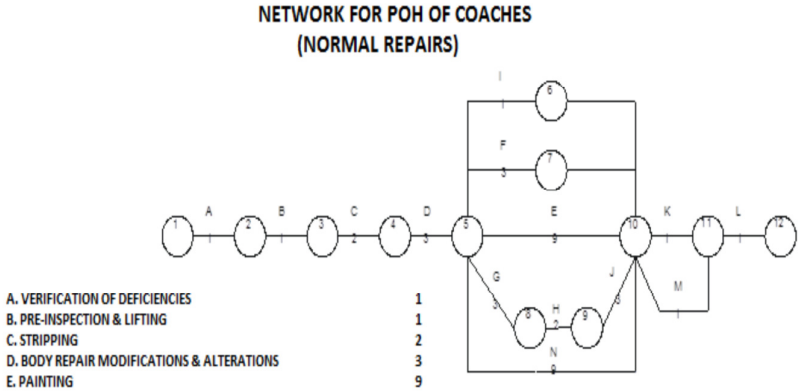
OCV's on other than mail and express rakes

| | |
|---|---|
| POH in workshop | 24 months |

Rajadhani and Shatabdi express coaches and all LHB Coaches

| | |
|---|---|
| POH in workshop | 4 lakhs kms or 18 months whichever is earlier |
| IOH of bogie in workshop | After 2 lakhs kms or 9 months whichever is earlier. |

Sequence of operations for POH of coach




| | |
|---|---|
| A. VERIFICATION OF DEFICIENCIES | 1 |
| B. PRE-INSPECTION & LIFTING | 1 |
| C. STRIPPING | 2 |
| D. BODY REPAIR MODIFICATIONS & ALTERATIONS | 3 |
| E. PAINTING | 9 |
| F. FITTING OF WATER TANK, PLUMBING & LEAKAGE TESTING | 3 |
| G. REPAIRS TO INTERIOR PANELS | 3 |
| H. FITMENT OF SHUTTERS | 2 |
| I. FITIMENT OF DOORS | 1 |
| J. FITMENT OF BERTHS & SEATS | 3 |
| K. AIR BRAKE TESTING & FINAL WORKS | 1 |
| L. FINAL INSPECTION & DESPATCH | 1 |
| M. FITMENT OF AXLE PULLEY, TENSION ROD & TESTING OF COACH WIRING | 1 |
| N. TESTING OF BRANCH WIRING & FITMENT OF ELECTRICAL EQUIPMENT | 9 |
| TOTAL DURATION | 18 DAYS |

**Receiving of coaches:**

On arrival of coach at the workshop, a careful check be made out jointly by the representatives of the Mechanical/ Electrical Department in presence of RPF staff in four copies. In case of any additional deficiency being noticed, a list of such additional deficiencies is made out in four copies jointly by all the three staff.

**Pre - Inspection**

The received coaches are first thoroughly cleaned with high pressure water jet. Roof testing is done by spraying water. Then the coach is inspected for corrosion repairs at vulnerable and not so vulnerable areas and asses the quantum of work. If the corrosion work is more, it is nominated for

**Lifting the Coach Body**
The coach body should be lifted uniformly without jerks with the help of two overhead electric cranes of 25 tonnes capacity each and should remain horizontal during the lifting. Coach should not be lifted from any point other than at the lifting pads. After the coach body is lifted, it should be kept on trestles.

**Body corrosion repairs and furnishing.**
All furnishing and other components from coach shell, which are stripped, are to be set to the respective sections from maintenance. Nominated corrosion repairs should be attended at body corrosion repair section.
Interior fittings of the coach consisting of panels, seats, berths, windows, sanitary fittings etc are attended.

**Bogie repairs**
The entire bogie should be checked and attention should be done as per POH schedules.

**Repairing of Wheel sets**
The wheel sets are checked and attention should be done as per POH schedule.

**Painting of coaches**
In paint shop the coach is cleaned and painted as per their schedules.

**Lowering the coach**
After all the repairs are carried out, refit all repaired sub- assemblies which are removed for maintenance and lower the coach body on the overhauled and tested bogies.

**Inspection of Coach by NTXR**
After completion of outgoing shop work (final fitment work) of all shops, the NTXR is offered for inspection .The important dimensions like buffer height, bolster clearance, crown clearance, bogie corner height, table height, „A‟ & „E‟ dimensions etc are to be checked by NTXR and air brake testing is doing, After passing, the coach is giving fir for traffic by NTXR.

**Dispatching the coaches to Traffic**
After getting fitness, the coach inside is thoroughly cleaned. The doors & windows are closed and one door is pad locked outside. Then the coaches are sent to their base depots in rake form.

Must Change Items during POH of Coach

- Roller bearing grease (when opened)
- Locking plates (when opened)
- Rubber sealing ring of axle box front & rear cover (when opened)
- Rubber packing ring
- Guide ring
- Guide bush
- Circlip for dash pot guide bush
- Wearing piece
- Wearing plate

- Side bearer oil
- Dashpot oil
- Brake gear bushes (as a set)
- Brake shoe key
- Brake beam bush collared
- All bulb type cotters (when opened)
- Sealing washer for air vent screw
- Rubber stopper & crown bolt
- Centre pivot locking plate
- Bush for equalising stay
- Silent block for anchor link
- Centre pivot bushing sleeve
- Dirt collector filters
- Buffer bolts
- Centre pivot bolts
-

**BODY CORROSION REPAIRS**

**Introduction**

Corrosion is a chemical phenomenon of oxidation of steel surfaces which results in loss of section and therefore of strength. Oxidation takes place only when steel surfaces are exposed to atmosphere in the presence of moisture. Unless water is drained out quickly no paints except those that are based on epoxy resin could stand long under accumulation of water and dust as eventually the film of paint would break down resulting in water seeping to the metal surface and causing corrosion.

**Corrosion on coaches**

The coaches incorporate a number of pressed steel sections made out of thin sheets (1.6, 2.0/2.5,3.15 and 4mm) and plates of thickness 5 to 16mm in the construction of the shell. These sheets/plates are considerably stressed, as the design of the coach is based on the principle of a self-supporting structure and it is, therefore essential that these coaches are maintained in good condition free from corrosion. Corrosion when once started spreads rapidly and this would be dangerous in so far as stress bearing members of the shell are concerned. It is therefore, essential to stop the initiation of corrosion and attempts made to arrest the spread of corrosion particularly in places which are not easily accessible for inspection and attention. Immediate attention should therefore be paid by the maintenance staff to arrest corrosion when once noticed, so that the strength of the body shell is not impaired. Even slight corrosion when once noticed if not attended to immediately may eventually result in perforations necessitating heavy repairs.

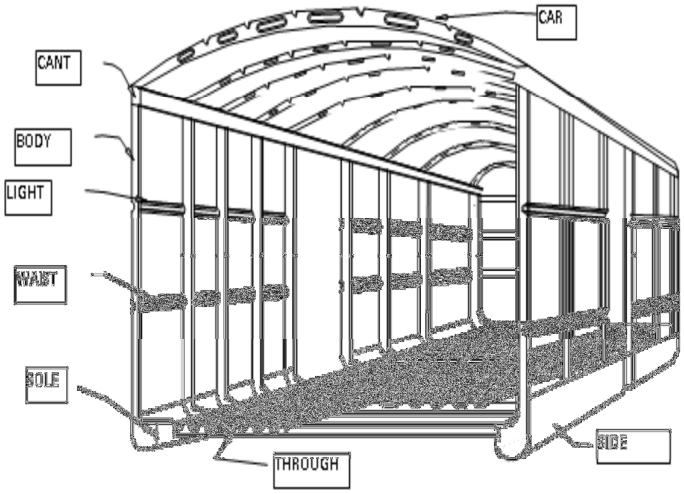
**Constructional features of ICF Shell**

The integral shell is made of a framework of series of hoops, consisting of floor crossbeams, body side pillars and roof carlines located transversely at regular intervals, to suit

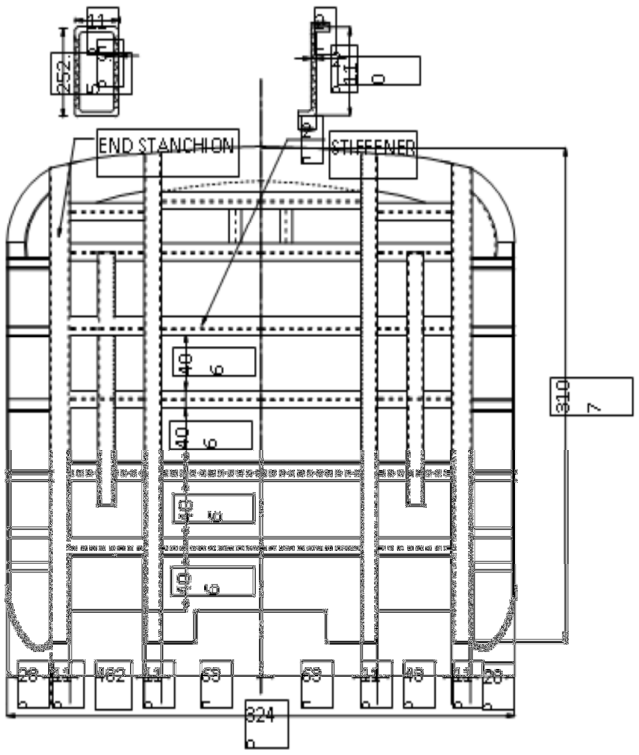
door and window openings. These hoops are connected together by sole bars, waist rails, light rails, cant rails and carlines longitudinally. This frame work is sheathed all over by 2 mm thick corten steel (IRS-M-41) on the side walls and 1.6 mm thick corten steel on the roof. At the bottom 2-mm thick corten steel corrugated trough floor is provided between the sole-bars and running over the length between the head stocks of underframe. The whole forms a tubular shell of integral construction in which the sides and roof panels also share the load. The corrugated trough floor with its corrugations running longitudinally from one head stock to the other takes up the buffing loads. Below lavatory the tubular constructions are provided in place of trough floor to avoid corrosion due to seepage of water. In coaches with stainless steel trough floor, no tubular structure is used.

The head stock of BG integral coaches consists of outer and inner head stocks connected by two rigid center buffer stiffeners, which transmits all the buffing forces to the under frame structure.

Under-frame acts as support for mounting equipment like air or vacuum brake system (brake cylinders, DV, BP & FP pipes, auxiliary reservoirs, control reservoirs, etc.), air-conditioning system (Compressor unit, Battery, Control rectifier, etc.), train lighting battery boxes, under slung water tank, etc.




SHELL FOR ICF COACHES (CROSS SECTIONAL




END CONSTRUCTION OF BROAD GAUGE
ALL METAL LIGHT WEIGHT COACH ICF

End wall consists of four vertical pillars of box section connected transversely by `Z' sections and are welded to the head stock at the bottom and to the roof at the top.

**Body Repairs of ICF Shell**

**Inspection:**
On set of corrosion is indicated by flaking of paints, flaking of metal, pitting and rusting components like sole bar, trough floor etc. The areas/ surfaces which are not visible from both sides should be examined by tapping with a spiked hammer.

Sole Bar Repairs
Inspection
1. Clean the sole bar
2. Hammer the sole bar to remove rust
3. Check for any visible cracks
4. Check by hammering for dull sound
5. Check for any visible corroded holes
6. If the thickness of sole bar at any location(s), is / are reduced by 20% than that section requires replacement.

**Cutting the Sole bar**
1. Mark the length of the sole bar to be cut
2. Clean the surface to be cut
3. Support both sides of the sole bar with suitable jacks

4. Cut off the trough floor, cross bearers and body side pillars at the locations where the sole bar portion is to be renewed

5. Cut the sole bar at one end, joints between sole bar and cross channels, inner head stock if required

6. Sole bar cutting should be done in parts if the length is more than 1 meter.

**Fitment of the Sole bar**

1. Take the new sole bar piece of required length
2. Prepare the new sole bar piece with edges suitable for a „V" butt joint
3. Tack weld the new sole bar piece at both ends
4. Check and ensure straightness of the sole bar and overall alignment
5. Tack weld cross bearers, if any, to the new sole bar piece
6. Weld both ends of the sole bar
7. Weld cross bearers, support piece and trough floor
8. Weld new body pillar part, side wall sheet and turn under.
9. After completion of welding grind the surface of the sole bars.

**Head Stock Repairs**

**Inspection**

1. Dismantle the buffers and check the head stock for corrosion.

2. Examine visually inner head stock, outer head stock, centre stiffeners, "Z" channels and drag box assembly immediately behind the buffers and the junction of the sole bar at the head stock for incidence of corrosion.

3. Examine carefully the base of buffer seat portion as corrosion has been primarily noticed at this location.

4. Examine carefully the buffer base of head stock by chalk test or sound test for cracks and dents. Buffer fixing holes should not be elongated and no minor cracks to be allowed. Replace head stock if the wear is more than 4 mm

4. If the thickness of Head Stock at any location(s), is / are reduced by 20% than that section requires replacement.
5.

Head stock repairs procedure

1. Support the anti-telescopic stanchions at the bottom and sole bar on suitable wooden stands

2. Gas cut the head stock beam along with the vestibule sill and other corroded components and the end wall sheet at distance of 746mm.

3. Cut the stiffener tube, sole bars and floor stiffeners and guide angles.

4. Remove the floor molding end wall panel, flooring and compreg to a distance of 300 mm from the end wall

5. Grind sole bar flanges to match with the head stock.

6. Prepare a new head stock piece of 8 mm thick and insert the same between end stanchions and stiffener tubes and tack weld the same in position

7. Check for straightness and alignment

8. Full weld the new head stock to the sole bars, stiffener tubes and the stanchions

9. Weld a new end wall sheet as required

10. Clean and paint

**Trough floor repairs**

Inspection

1. Examine the trough floor in the bays adjoining the lavatories and under the luggage compartments of SLRs and parcel vans for signs of corrosion, supplemented by tapping with a spiked hammer.

2. If signs of corrosion are noticed in the above examination, the part should be thoroughly cleaned by scraping and an intensive inspection should be carried out to detect the extent of corrosion in the trough floor.

3. Compreg with PVC overlay flooring in the lavatories and bays adjacent to lavatories of all coaches over six years old should be broken and trough floor thoroughly examined for incidence of corrosion.

4. If the thickness of trough floor at any location(s), is / are reduced by 20% than that section requires replacement.

**Trough floor repairs**

1. Cut off the corroded trough floor to the length and width required.
2. Weld isolating plate of 0.5 mm thick transversely after grinding the edge of the trough floor
3. Prepare a new trough floor to the dimensions required and tack weld the same to the isolating plates on either side
4. Ensure proper alignment of the replaced part with that of adjoining parts
5. Ensure the alignment in the longitudinal direction by suitably cutting off the trough floor to match with the new trough floor.
6. Full weld the trough floor to the isolating plates both at top and bottom
7. Weld intermittently the trough floor longitudinally to the supporting piece and adjoining trough floor
8. Drill 19 mm diameter holes in the valleys between two isolating plates.
9. Clean and paint

**Turn under repairs**

Inspection

1. Examine visually, supplemented by tapping with a spiked hammer, sole bars, body pillars and turn under in the bays under and adjoining lavatories from below the coach and through the elongated holes in the turn under after removing the accumulated dirt and cleaning the surface through the holes.

2. If incidence of corrosion is noticed in the bottom half of the sole bar, the trough floor should be cut to a width of 300 mm examine the requisite length for examination of inside top half.

3. If heavy corrosion is noticed, the side wall should be cut to a height of 500 mm. from the bottom of turn under covering sufficient length. All the exposed parts, after scraping and cleaning, should be examined to determine the extent of corrosion.

4. If the thickness of Turn under at any location(s), is / are reduced by 20% than that section requires replacement.

**Fitment of Turn under**

1. Support the coach body on the bolsters
2. Cut off side wall sheet also to a height of 500 mm to the required length
3. Clean the surface of the sole bar thoroughly to bare metal
4. Prepare a new turn under to the required length with edges prepared for a v butt joint
5. Check the turn under for straightness
6. Weld intermittently the body pillars to the turn under
7. Replace the side wall sheets
8. Whenever longer length of sidewall sheet or turn under is replaced, the skin should be properly tensioned by spot heating
9. The new turn under part should be compatible with the existing viz. coach with 5 mm thick turn under, new part should also be 5 mm thick and for coach with 2 mm thick turn under, new part also should be 2 mm thick.
10. Clean and Paint.

**Body Bolster**

Inspection

Examine the body bolster for corrosion, breakage, wear, etc. If the corrosion is light, scrap off the rust to bare metal, clean well and re-paint. If the corrosion, breakage or wear are beyond repair, replace the body bolster. Check the area surrounding centre pivot pin mounting holes for cracks.

The reject able defects of Body bolster are :

1. Thin edge of bottom plate due to wear and tear (Thickness reduces from 16 mm to 12.8 mm)
2. Bent of bottom plate due to hitting of bogie sole bar
3. Crack develops in Body Bolster
4. If the thickness of body bolster at any location(s), is / are reduced by 20% than that section requires replacement.

After completion of inspection, if body bolster found defective required to be replaced them sequence of operation for changing the body bolster are as under:

**Fitment of Body Bolster**

1. Lift the coach and placed it on trestles
2. Weld suitable supports with rail, in both ends in the following locations

a. Both side of inner and outer head stock b. One side of sole bar in the location where the bolster is to be change.

3. All supports is to e welded in such a way that while removing old bolster and putting new one the geometry of the coach should not be disturbed. Measure the distance from the head stock to the centre of the body bolster which is to be removed and record it.
4. Cut and remove the trough floor above the bolster is to be change.
5. Provide suitable weld support to both ends of the sole bar and cut one side of sole bar not less than four feet of the bolster location.
6. Cut the bolster from other side.
7. Remove the bolster.
8. Weld a suitable support matching the bottom flange of the sole bar where it was cut.

9. Put the new bolster into the coach as per the dimension recorded earlier and also ensure the end bottom of the bolster should be properly seated with sole bar bottom flange.

10. Check dimension and ensure it

11. Fit the sole bar that was cut

12. Full weld the bolster with both side of the sole bar

13. Fit trough floor above the bolster

# Maintenance

## CLASSIFICATIONOFCOACHING 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:-**

Pitline for examination and repairs of coaches

Sick line with covered accommodation

Office & store facilities

Machinery & plants

**COVERED ACCOMMODATION:**

Length of track under covered accommodation for any type of sick line must be at least 4% of the holdings of the depot (based coaches). The working space required for each coach is 35 m Track length should not be less then 140m for any type of sick line. It is essential to provide 50% track length under a covered area with pit examination facilities with proper light arrangement inside the pit. The pit also be ensured that it is provided with drainage facilities with 1% inclination & required number of man holes. Electric hoist of capacity 3 to 5 tones should be made available to cover the sick line across the track.

The width of the covered accommodation should be normally 15 meters covering two tracks under it. The distance between two centreline of tracks should not be less than 7.5 meters.

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.

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

**MACHINERY AND PLANT:**

To avoid heavy manual labour, wastage of manpower and to provide efficient working environment in depot, suitable adequate machinery and plant is required as under:

Synchronised whiting jacks, Coach shunter, Welding plant 200 amp capacity, Gas cutting & welding equipment, Vacuum exhauster, Air compressor (350cfm), 2 tones tram beam hoist, Sewing machine, Light Commercial Vehicle, Wood cutting saw machine, Fork lifts, Hand shearing machine, Portable furnace, Centre lathe, Wheel lathe, Manipulator/fixture for bogie, Ultrasonic testing apparatus, Tool post grinder.

**TOOLS:**

Pneumatic hand tools

(a) Grinder (b) Drill (C) Chipper/buster (d) Riveter Electric power tools.

(a) Pop riveting tool gun (b) Drill (c) Bolt tighter/torque wrench. Hand tools including torque wrenches as required.

**TEST BENCHES AND MISCELLANEOUS ITEMS.**

Single Car test rig, D.V. Testing bench, Air Brake cylinder overhauling testing bench, Water tank test rig.

**Maintenance Schedules to be Followed in Coaching Depots**

Schedule is a work which is to be carried out at a prescribed interval of time

Schedule attention is required to keep the rolling stock in good serviceable condition without any failures during its life cycle for effective utilisation.

The different schedules that are carried on the primarily maintained coaching stock are:

| | | | |
|---|---|---|---|
| a) | Trip Schedule | : | After every trip |
| b) | 'A' Schedule | : | 1 month ± 3 days |
| c) | 'B' Schedule | : | 3 months ± 7 days |
| d) | Intermediate overhaul (IOH) | : | 9 months + 30 days |
| e) | Periodical overhaul (POH) | : | Once in 18 months (After 24 months for newly |

| | | |
|---|---|---|
| | | built) |
| f) | Special Schedule | : As prescribed by each railway |

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

**TRIP SCHEDULE:-**

Trip schedule attention is given after completion of every trip. It has to be attended both by primary and secondary depots. The coach need not be detached from the rake during trip schedule attention. Following items are given attention during the trip schedule:-

All under gear parts are thoroughly examined, All moving parts are lubricated, Complete examination of buffing & draw gear for its proper functioning. Ensure easy operation of coupling, Properly examine the primary and secondary suspension arrangement. Ensure there is no leakage in dash pot and maintain prescribed oillevel.

Ensure intactness of safety strap and safety loop. Examine the condition of springs and shock absorber. Properly examine suspension link bracket, BSS hangers, pin& hanger blocks. Examine the equalizing stay for its proper securing. Examine the proper securing of bolts & cotters & silent bushes of centre pivot. Ensure the required level of oil in side bearer. Changing of worn out brake blocks & pins and adjust the brake rigging to ensure prescribed piston stroke. Conduct Rake test as per the procedure, and ensure 100 % brake power. Alarm chain apparatus to be tested. Wheel profile and thickness should be visually examined and gauged in case they appear to be near condemning limits. Thorough cleaning of coach from inside & outside.Disinfection of toilets after cleaning. Examination of all pipe joints & other fittings for leakages & ensure filling of water tank after attention of leakages. Examine for proper opening & closing of vestibule doors and proper fitment of fall plates. Ensure intactness of all amenity & safety items. Preparation of DRS card & brake power certificate.

**SCHEDULE – A:**

Schedule `A' attention is required to be given every month with a tolerance of 3 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. Following items are given attention during 'A' schedule:

All items of trip schedule.

Thorough inspection of brake pipe, feed pipe and branch pipes connecting brake cylinder, distributor valve, Auxiliary reservoir and also hose coupling for leakage and give required attention.

Carry out manual brake release test on every coach to ensure proper functioning of release lever of distributor valve.

Micro switch of ACP should be tested by electrical staff for proper functioning.

Clean Dirt collector filter with kerosene and refit.

Test the working of slack adjuster in under frame mounted air brake system. Repair/Replace the defective slack adjuster. Examine loops/ brackets and their securing devices and rectify. Examine for wear of brake hanger pins, brake blocks and brake heads and replace if required.

Thorough check and repairs of SLR doors for easy and smooth operation and correct alignment of all wearing parts, loose screws etc.

Intensive cleaning of coaches.

Intensive cleaning of lavatory pans and commode with specified cleaning agent.

Thorough flushing of tanks.

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

Thorough dis-infection of all compartments. Thorough inspection and repairs of draw gear. Thorough inspection and repairs of buffers.

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, if the oil is below the plug, replenish with specified grade of oil so that wear plate is fully covered by oil.

Inspection and repairs of commode chute.

Thoroughly check sliding doors and vestibule doors for easy and smooth operation and correct alignment, lubricate all moving parts. Thorough cleaning of chimneys of dining cars, buffet cars, tourist cars and inspection carriages by wire brushes.

**SCHEDULE – B:**

Schedule `B' is required to be given every three months with tolerance of 7 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. All items of A schedule

Painting of lavatories from inside.

Thorough inspection and repairs of brake gear components. Examination overhauling and testing of alarm chain apparatus. Thorough checking of trough floor, turn under, etc., from underneath for corrosion.

Touching up of painted portion, if faded or soiled. Testing of guard van valve.

**NEW**

**POLICY(RECOMMENDATIONS)FORENHANCEMENTSOFPOH/IOHSCHEDULESOF COACHING STOCK.**

The revised POH periodicity from 12 to18 months is applicable to all Mail/Express coaches also. A marking on the coach below return date shall be specified to distinguish 18 months periodicity.

The general sequence of Schedule will remain as per existing coaching maintenance manual.

The items of trip schedules; 'A' and 'B' schedules will remain same.

The coach will be given 2 quarterly schedules (B Schedule) 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/1.0 in jan-2008 shall be followed.

Technical circulars/pamphlets issued by RDSO with regard to schedules on time to time shall be followed for necessary modification and replacements.

The requirement of bogies for unit exchange shall be planned as per the arising of IOH keeping two bogies spare considering the transportation time from the workshop.

The periodicity of overhauling of DV is changed from 24 months to 18 months (during every POH)

Work shop to switch over to PU painting during POH in workshop as advised by RDSO.

**INTERMEDIATE OVERHAULING (IOH):**

IOH is required to be given every nine months +30 days at the nominated primary depot. Coaches have to be detached from the rake and taken to Sick line for IOH attention. Coach that is detached for IOH is taken over to the washing line for cleaning, lubrication and minor maintenance.

The following items of work should be attended for newly built/passenger coaches at the depot during IOH;

**All items of Schedule `B'**

Thorough repairs of running gear duly running out of bogies. After lifting and running out of bogies, the 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 give attention to such heavy repairs or are prohibited to be done in the maintenancedepots, the bogies should be sent to the shops for carrying out these repairs.

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

Touching up damaged paint on coaches both outside as well as inside.

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

Thorough examination and repairs of upholstery, cushions, curtains, etc.

Thorough examination and attention of all Doors and window shutters, for safety catches, safety latches, staples and hasps for ease of operation.

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

Thorough checking and attention to all cracks and worn out portions of flooring in 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 its adjoining areas, corridor portion etc., special concentration shall be given to SLRs which are more prone for corrosion as it is used in transportation of 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 given for the following:-

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.

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

## Air brake system maintenance;

Check brake cylinder for loose rocker arm plate on Bogie mounted Brake Cylinder and change if found defective.

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

Guard's van valve should be tested for operation.

Test BP & FP air pressure gauges with master gauge and replace if found defective (all the gauges to be calibrated once in 6 months). 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 workshops for testing, repairs and calibration.

Thoroughly clean filter of Dirt collector in kerosene or replace on condition basis.

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.

Conduct Single car test of the coach with Single car test rig and record the parameters in the prescribed proforma

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

Note:

Intermediate Overhauling of Shatabdi / Rajdhanni Exp. Coaches are to be attended in nominated workshop only.

Intermediate overhauling of newly built coaches are to be attended after 12 months in the depot duly replacing the wheels with repaired/UT tested wheels from work shop

**LIFTING OF THE BODY FROM THE BOGIE:-**

The coach body shall be lifted by using;

a) 4 no. of Mechanical Jacks (capacity of 10 T each) OR

b) 4 no. of Hydraulic jacks (capacity of 10 Ton each) OR
c) 2 no. of Electrical Operated Travelling Crane (capacity of 20 T/25 T each) OR
d) 4 no. of Whiting jacks (capacity of 20/25 T each)

**OTHER TOOLS REQUIRED:-**

Trestles.

Complete set of Spanners.

Complete set of Gas cutting & welding equipment. Different types of hammers.

Wooden Wedges & Packing. Tool kit

**ITEMS TO BE DISCONNECTED BEFORE LIFTING OF THE BODY:**

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

Unscrew and remove centre pivot studs [If lifting is being done be mechanical/hydraulic jacks]

Unscrew air vent screw of dash pot. Disconnect Dynamo belt.
Disconnect S.A.B pull rod.

Disconnect lateral shock absorber if connected Disconnect axle box safety
loops.

Remove commode chute if it is infringing. Remove foot board if required.

Remove dummy carrier if infringing.

Insert required thickness of wooden packing between upper portion of bolster & Bogie frame

Following are the causes of low buffer height in ICF coaches; Wear of wheel.

Loss in stiffness of coil springs provided in primary and secondary suspension.

Wear in Bronze wearing piece and wear plate of side bearer.

Wear on link brackets, stone & pin provided on secondary suspension arrangement.

Procedure for buffer height adjustment in ICF coaches.

To achieve required buffer height standard size of wooden packing pieces are used which are provided below the coil springs of primary suspension as given under.

New Wheel dia :- 915 mm Condemning: - Solid Wheel: 825 mm.

| Sr No. | 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 825 | 38 |

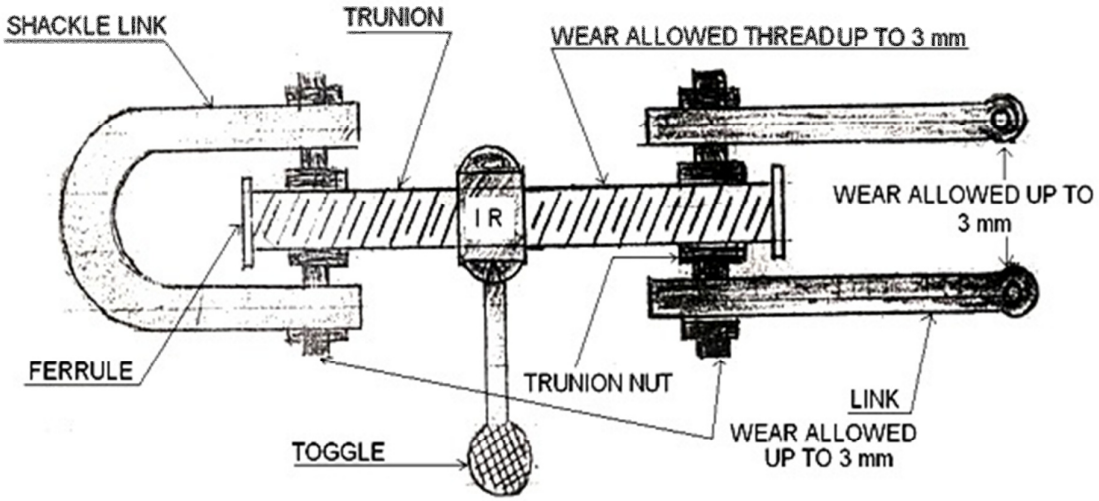
Note:-

6 mm compensating metallic ring can also be used if required. Further requirement can be managed by utilising wooden packing which comes in two halfs of size 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.

After buffer height adjustment the safety loop of axle box also to be adjusted to ensure a gap of 40 mm between the Axle box lug & safety loop.

Running clearances i.e. ‘A’ & ‘B’ also should be ensure

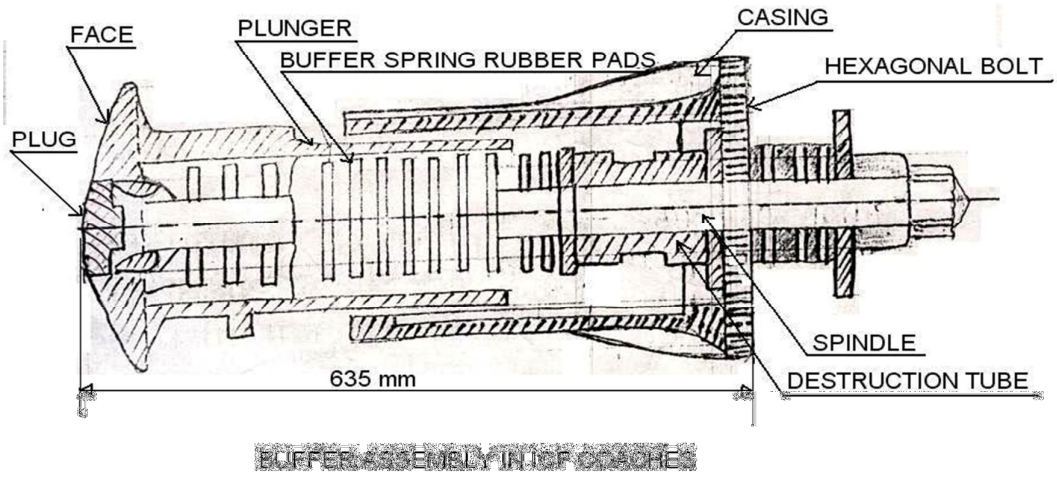
## COUPLING AND BUFFERS



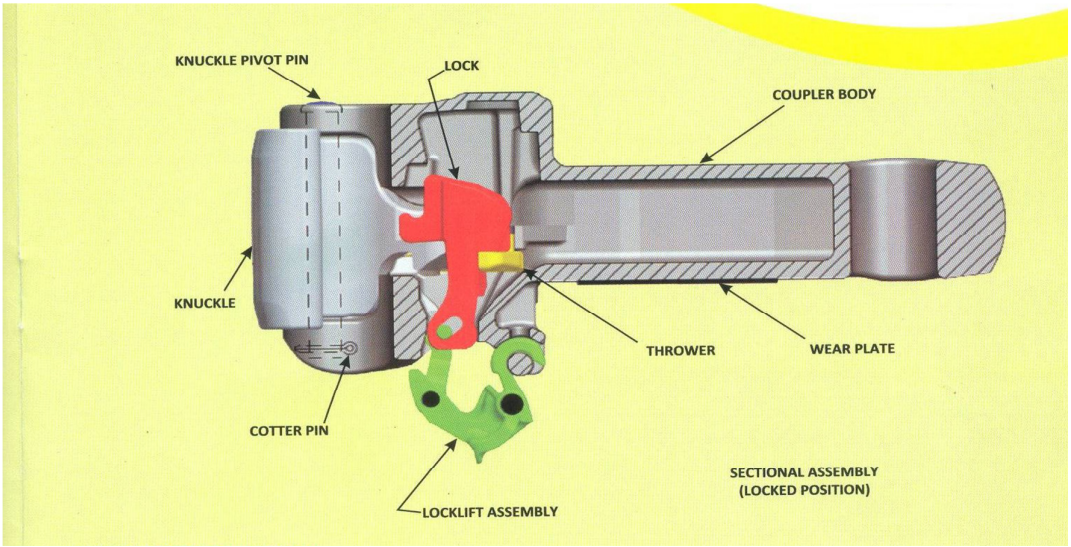

| S. No. | Types Of Coupling | Length in open condition | Length in closed condition | Working load in Ton | Proof load in Ton | | Breaking load in Ton | |
|---|---|---|---|---|---|---|---|---|
| 1. | | | I.R.S. WA/BD-125 | 1902 (Old) 1083 (New) | 897 (Old) 823 (New) | 22.3 | 36 | 71.2 |
| 2. | | | I.C.F. | 968 (Old) 1000 (New) | 786 (Old) 751 (New) | 22.3 | 36.5 | 67.2 |
| 3. | | | Transition | 610 | 460 | 22.3 | 36 | 71.2 |
| 4. | | | Enhence | 997 | 751 | 36 | 60 | 108-Draw Gear 118-Screw Coupling |

| | | | | | | |
|---|---|---|---|---|---|---|
| 5. | Modified Enhence I.S. 5517 | 997 | 751 | 36 | 70 | 130 (Both) |

**Benefits from Draw & buffing gear**




BUFFER ASSEMBLY IN ICF COACHES




The draw & buffing gear play a vital role in protecting the entire wagon against damages due to impacts. The springs absorb impact and transmit gradually to the underframe.

In earlier design, the draft or draw load is transmitted through screw coupling arrangement and the buffing load is transmitted through side buffers. With the present design, knuckle type Centre Buffer Coupler (CBC) capable of transmitting both draft and buffing load is used. Indian Railway uses AAR type CBC conforming AAR specification M-201, M-205, M-211.The draft capacity of this coupler is 180 ton. The energy absorption capacity is 1030 kg-mt

**PARTS OF CENTRE BUFFER COUPLER ASSEMBLY**

The main parts of Centre Buffer Coupler are as under:-

i) Coupler body
ii) Knuckle
iii) Knuckle pivot pin with washer
iv) Lock
v) Knuckle thrower
vi) Toggle
vii) Universal lock lift lever connector
viii) Lock lift lever hook
ix) Lock lift rivet
x) Lock lift lever rivet
xi) Top lifter hole cap
xii) Yoke pin
xiii) Yoke
xiv) Yoke pin support.
xv) Striker casting
xvi) Striker casting wear plate
xvii) Shank wear plate
xviii) Yoke support plate
xix) Draft Gear arrangement with front follower
xx) Safety bracket with anchor plate
xxi) Uncoupling gear arrangement
xxii) Back stop
xxiii) Clevis for Transition type coupler only

xxiv) Screw coupling for Transition type coupler only

xxv) Clevis pin for transition type coupler only

All parts of non-transition coupler are identical and therefore inter- changeable with those of the transition type coupler except striker casting with wear plate and coupler body with shank. In transition CBC coupler body with shank is longer and provided an arrangement to fit clevis with the help of clevis pin.

**2. Functional Features of CBC**

- Effective utilization of inter-coach space to accommodate more coaches
- Anti-climbing features to prevent excess damage to life and property during accident
- Automatic coupling type, making it safe for shunting staff for shunting staff & reducing time required or coupling/decoupling
- Jerk free motion to improve comfort
- Absorb energy 45 kilo-joules per coupler
- Withstand coupling forces in most adverse situation like emergency application, ACP while accelerating in up gradient etc
- Comparatively Maintenance-free
- Slack-less is possible to avoid jerks during stopping & starting
- Ultimate strength 150 t

**3. Design requirement**

- Capable to negotiate minimum radius of curves
- Must not infringe side buffer, if provided in adjacent coaches , during curve negotiation
- Provision for automatic wear compensation mechanism
- Maintaining gathering range considering vehicle dynamics
- Capable to withstand coupling forces of 150 t in most adverse situation like emergency application, while accelerating in up gradient etc
- Provision of anti-climbing features to prevent excess damage to life and property during accident

**4. Factors for design of CBC**

•Coupling mechanism system

•Gathering range

•Working range

•Slack

•Creep

•Strength

•Coupling speed

•Automatic/semi automatic coupling

•Stroke

•End pressure

•Capacity at half-travel

•Initial pre-compression

•Amount of recoil

**5. COUPLER SYSTEM**

The draft capacity of the AAR coupler depends on the strength of knuckle, which is weakest link in the assembly. The yield strength of knuckle of material AAR M-201 Grade `C' & Grade `E' is 132t and 180t respectively.

**Few terms associated with Coupler system:**

**Gathering range:**

It is defined as the maximum deviation from the horizontal (*vertical deviation*) and vertical (lateral *deviation*) axes of the coupler within which two couplers would, on contact, automatically align themselves and couple.

**Lateral deviation caused by**:

- Lateral clearance between track and wheel gauge
- Lateral clearance between wheel se and vehicle
- Curvature of trackVertical deviation caused by:
- Variation in load
- Wheel wear
- Variation in spring deflection

- Support plate wear

A restriction in lateral gathering range in a particular coupler will lead to a design in which bogies have to be placed very near the headstocks to limit the lateral deviation.
Such design has consequential disadvantage that bending moment in the under frame between the pivots is increased, thereby requiring a stiffer and heavier section.
The length of coupler from its swivel point to its face is important. When buffing and draw loads are being transmitted through couplers on curve, some portion of this is transferred to the vehicle frame as a side thrust due to lateral inclination of the line of action of the thrust to the vehicle center line.
In claw couplers, greater angularity is obtained than in case of rigid couplers

**Working range:**
It is defined as the capability to permit movement of extreme alignments of the track after coupler has been locked.
(Note that gathering range pertains only to its capability of aligning itself for coupling)

**Lateral Working Range:**
•It should be such thatit allows free movement over the smallest curves
Vertical Working Range
•The working range in the vertical direction is determined by the contour of humps, track conditions under dynamic conditions.
**Slack:**
Some slack is necessary in knuckle type to permit sliding-in of the un-machined surfaces to effect coupling.
The only advantage is that it facilitates movement of one vehicle at a time and normally adjust itself to the decreased pull required to keep the vehicle moving.
The disadvantages are:
•Movement of successive vehicle produces oscillation and may produce harmful resonance.
•Successive movement will produce jerk. The jerking action is equivalent to series of hammer blows that drive the drive gear on the first vehicle nearer to closure.
•The slack promotes wear of the coupling contours and further promotes impact between outer knuckle face and guard arm
**Creep:**

Creep is severe vertical oscillations that may tend to dislodge the lock from behind the knuckle and thus causing TRAIN PARTING

Anti creep device is required to restrict the unintentional movement of lock due to severe vertical oscillation during run.

**6. Coupler composition:**

| | Gr.'E | | 'Gr.'C' | Gr.'B' |
|---|---|---|---|---|
| CARBON MAX. % | 0.32 | 0.32 | 0.32 | |
| MANGANESE MAX. % | 1.85 | | 1.85 | 0.90 |
| PHOSPHOROUS MAX. % | 0.03 | 0.03 | 0.03 | |
| SULPHUR MAX. % | 0.03 | 0.03 | 0.03 | |
| SILICON MAX. % | 1.50 | 1.50 | 1.50 | |

**Advantages of AAR center buffer coupler**

- Coupler and buffing gear are both located together at the centre of the wagon.
- Centre buffer coupler is identical at either end of the wagon and hence wagon direction is immaterial.
- Coupling action between wagons is automatic.
- With transition arrangement, coupling with screw coupling is possible.

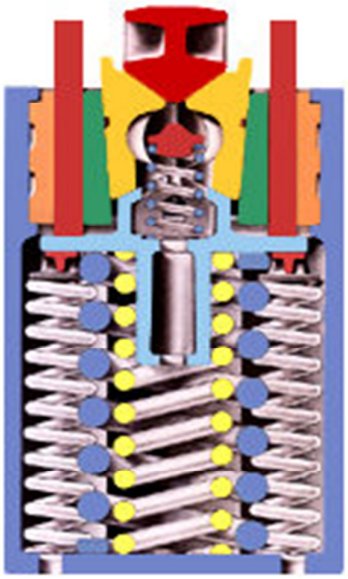
**7. Development of high tensile coupler & high capacity draft gear**

On BG system, to minimize the maintenance problem and to run heavy hauled freight train, the existing grade `C' type coupler have been replaced to grade `E' type coupler known as high tensile coupler. A comparative chart of grade `C' and grade `E' coupler is given below:

| Material | Ultimate | Yield strength |
|---|---|---|
| AAR M-201 & | Tensile strength | ( in tonnes) |
| AAR M-211 | (in tonnes) | |

| | | | STD. | HT. | STD. | HT. | STD. | HT. |
|---|---|---|---|---|---|---|---|---|
| Coupler body | Gr.B | Gr.E | 290 | 330 | 169 | 205 | | |
| Knuckle. | Gr.C | Gr.E | 251 | 295 | 132 | 180 | | |

Standard CBC and high tensile CBC are identical in dimension hence no problem to couple each other. Draft capacity of the high tensile coupler also depends on the weakest link i.e. knuckle. The yield strength of the knuckle is 180t compared to 132t in standard coupler. The draft capacity of HT coupler is 36% higher.




The standard draft gears are to be replaced by high capacity draft gears vide Rly. Board`s letter No.84/M(N)/172/3 Vol. I dt. 11.1.90 and 84/M(N)/172/3 dt. 5.7.90. And new freight stocks would be fitted with high capacity draft gears.

- **Mark-50**
- **RF-361**

i. All bogie wagons manufactured prior to 1984-85 are fitted with HR-40-I or MF-400-I - IR draft gears.

ii. At present freight stock are fitted with high capacity draft gear i.e. **RF-361**&**MK-50**.

**Comparative Data of Different Type's Couplers**

| Sr. No | Specification | H. Type | NHT | HT | HTE | HTEA |
|---|---|---|---|---|---|---|
| 1 | Working Capacity | | 85.T | 120 T | 120 T | 120 T |
| 2 | Proof Load | | 132 T | 170 T | 170 T | 170 T |
| 3 | Hauling Cap | | 6500 T 7000 T | 9000 T | 9000 T | 9000 T |
| 4 | Draft Gear | | HR-40-1 | MK-50, RF-361 & SL -76 | MK-50, RF-361 & SL -76 | MK-50, RF-361 & SL -76 |

**DRAW & BUFFING GEAR**

**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.

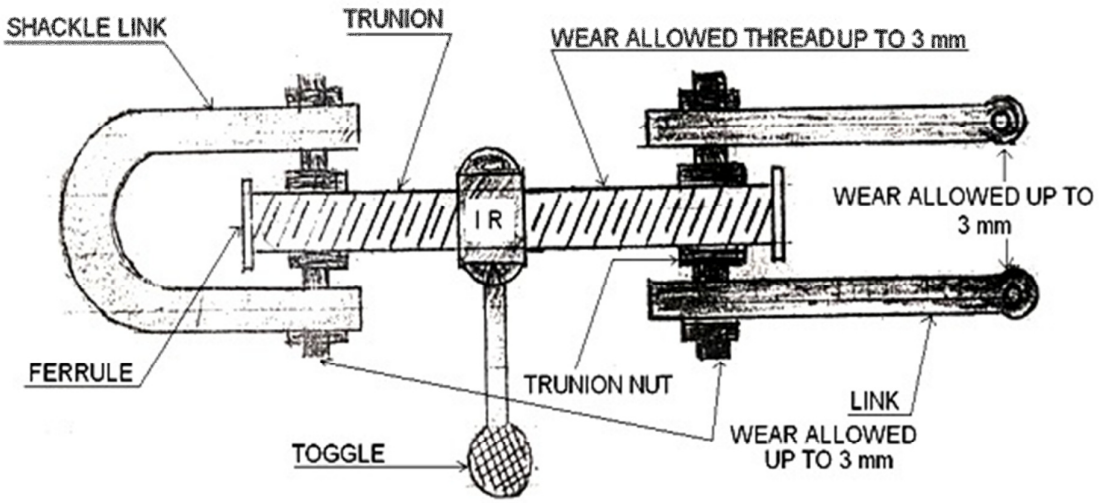
i. Conventional Draft Gear
ii. Centre Buffer Coupler

Main components of conventional draw gear are as under:-

I. Draft Hook.
II. Draft Links
III. Draft Key
IV. Draft Spring/ Draft Pad.
V. Cotter
VI. Washer
VII. Bent Pin( U-Pin)
VIII. Hexagonal Nut.
IX. 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 Dumbal 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:

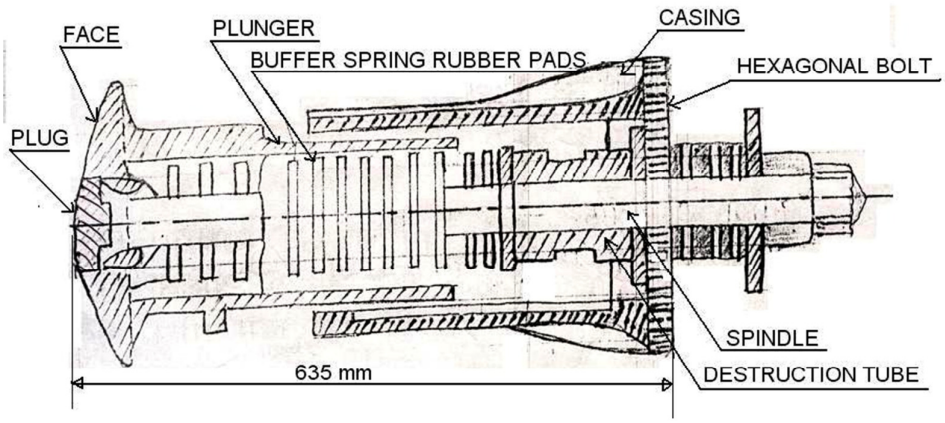
| Sl. No. | Description | Non Modified | Modified | Remark |
|---|---|---|---|---|
| 1 | Working Capacity | 36 Tonnes | 36 Tonnes | |
| 2 | Proof Load Capacity | 60 Tonnes | 70 Tonnes | |
| 3 | Breakage Capacity | Draw Bar – 108 T<br>S/ Coupling – 112 T | 130 T for both | |
| 4 | Stamping Mark | C –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

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

BUFFING GEAR: - Two numbers of buffers are provided on body head stock to absorb the longitudinal impacts 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
6. Recoil rubber Washer
7. Washer
8. Nut

4. Buffing Pad
5. Destruction Tube
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 |
| Number of Buffing Pads in each Buffer | – 14 to 16 Nos. |
| Capacity of Buffing Pads | – 1030 kg m (New Type) |

# IMPORTANT PARAMETERS OF WAGONS

The important dimensions and sketches of main type of wagons stock used over Indian Railways are enclosed at the end of this chapter.

Details of UIC/ Vacuum Brake/ Four wheeler and Meter Gauge/ NG stock have been omitted. For maintenance of these stocks, wagon maintenance manual ver. 2001 may be referred. Details of following new type of wagon stock have been added.

Regarding latest position of axle load, spring configuration and permissible speed RDSO's instructions may be referred. The speed certificates of these wagons are available on RDSO 's website.

**OPEN WAGONS**

| **Designation** | **Axle Load** | **Bogie** | **Springs** | **Permissible Speed Loaded/Empty** | **Remarks** |
|---|---|---|---|---|---|
| BOY | 22.9 t | Casnub 22 NLB (modified) | O – 14<br>I – 10<br>S – 4 | 65/ 75 Kmph | It has no doors. Designed for heavy minerals. |
| BOYEL | 25.0 t | Casnub 22 NLC | O – 14<br>I – 14<br>S – 4 | 50/ 65 Kmph | Min. wheel tread dia. 950 mm. |
| BOXN | 20.32 t | Casnub 22 NLB | O – 12<br>I – 8<br>S – 4 | 75/ 80 Kmph | Operation at CC +6 +2/ CC +8 +2 allowed as interim measure, with speed restriction 60/80 |
| BOXN M1 | 22.82 t | Casnub 22 NLB (Modified) | O – 14<br>I – 10<br>S – 4 | 70/ 80 (CC +6 +2)<br>60/ 80 (CC +8 +2)<br>Kmph | On specified routes the speed is 75/80 Kmph with CC +8 +2 |

| | | | | | |
|---|---|---|---|---|---|
| BOXNEL | 25.0 t | Casnub 22 NLC | O – 14<br>I – 14<br>S – 4 | 50/ 65 Kmph | Min. wheel tread dia. 950 mm |
| BOXNHS | 20.32 t | Casnub 22 HS | O – 14<br>I – 12<br>S – 4 | 100/ 100 Kmph | - |
| BOXNHS M1 | 22.82 t | Casnub 22 HS<br>(Modified) | O – 14<br>I – 14<br>S – 4 | 75/ 90 (CC +6 +2)<br>60/ 90 (CC +8 +2)<br>Kmph | On specified routes the speed is<br>75/80 Kmph with CC +8 +2 |
| BOXNHA | 22.1 t | IRF 108 HS | O – 14<br>I – 14<br>S – 4 | 100/100 Kmph<br>(20.32 & 22.1 t)<br>75/100Kmph(22.82<br>t) | - |
| BOXNLW | 20.32 t | Casnub 22 HS | O – 14<br>I – 12<br>S – 4 | 100/ 100 Kmph | Stainless steel (IRS: M44) and<br>Corton Steel (IRS: M41) used in<br>body & under frame |
| BOXNLW M1 | 22.82 t | Casnub 22 HS<br>(Modified) | O – 14<br>I – 14<br>S – 4 | **60/ 65** Kmph | **-** |
| BOXNHL | 22.9 t | Casnub 22 HS | O – 14<br>I – 14 | 75/ 100 Kmph | IRS: M44 (Body), Flat centre<br>Pivot, K type CBB, Improved |

| | | | | | |
|---|---|---|---|---|---|
| | | | S – 4 | | Coupler & draft gear Br. Cyl, 300<br>mm, IRSA 750 Slack Adj., A.R. 75<br>litres, PU Painting (Phirozi colour) |

| **Designation** | **Axle Load** | **Bogie** | **Spring** | **Permissible Speed Loaded/Empty** | **Remarks** |
|---|---|---|---|---|---|
| BOST | 20.32 t | Casnub 22 HS | O – 14<br>I – 12<br>S – 4 | 75/ 80 Kmph | Operation at CC+ 6 + 2 allowed as<br>an interim measure with speed<br>restriction to 50/ 80 |
| BOSTM1 | 22.32 t | Casnub 22 HS<br>(modified) | O – 14<br>I – 14 | 60/ 65 Kmph | High Axle load version of BOST |

| | | | | | |
|---|---|---|---|---|---|
| | | | S – 4 | | |
| BOSTHS | 20.32 t | Casnub 22 HS (mod- I) | O – 12<br>I – 12<br>S – 4 | 100/ 100 Kmph | High Speed version of BOST |
| BOSTHS M1 | 22.32 t | Modified Casnub 22 HS (Mod- I) | O – 14<br>I – 14<br>S – 4 | 60/ 80 Kmph | High Axle load version of BOST HS |
| BOSTHS M2 | 22.32 t | Modified Casnub 22 HS (Mod- II) | O – 12<br>I – 12<br>S – 4 | 60/ 100 Kmph | Design of suspension is different than BOSTHS M1. |
| BOXNHAM | 22.82 t | IRF 108 HS | O – 14<br>I – 14<br>S – 4 | 75/ 100 Kmph | - |
| BOXNR | 22.9 t | IRF 108 HS | O – 12<br>I – 8<br>S – 4 | 75/ 80 Kmph | - |

## COVERED WAGONS

| Designation | Axle Load | Bogie | Springs | Permissible Speed ( in Kmph) | Remarks |
|---|---|---|---|---|---|
| BCN | 20.32 t | Casnub 22 NLB | O – 12<br>I – 8<br>S – 4 | 75/ 80 Kmph | Permitted with CC +6 +2 also. |
| BCN M1 | 22.82 t | (Modified)<br>Casnub 22 NLB | O – 14<br>I – 10<br>S – 4 | 75/ 80 (CC +6 +2)<br>65/ 80 (CC +8 +2)<br>Kmph | High axle load version of BCN |
| BCNHS M1 | 22.82t | Modified)<br>Casnub 22 HS | O – 14<br>I – 14<br>S – 4 | 75/ 90 (CC +6 +2)<br>75/ 90 (CC +8 +2)<br>Kmph | High axle load version of BCNHS |
| BCNA | 20.32 t | Casnub 22 NLB | O – 12<br>I – 8<br>S – 4 | 80/ 80 Kmph | Permitted with CC +6 +2 also. |
| BCNA M1 | 22.82 t | (Modified)<br>Casnub 22 NLB | O – 14<br>I – 10<br>S – 4 | 75/ 80 (CC +6 +2)<br>65/ 80 (CC +8 +2)<br>Kmph | High axle load version of BCNA |

| | | | | | |
|---|---|---|---|---|---|
| BCNAHS | 20.32 t | Casnub 22 HS | O – 14<br>I – 12<br>S – 4 | 100/ 100 Kmph | Variant of BCNA with Casnub bogie 22 HS bogie |
| BCNAHS M1 | 22.82 t | (Modified)<br>Casnub 22 HS | O – 14<br>I – 14<br>S – 4 | 75/ 100 (CC +6 +2)<br>75/ 100 (CC +8 +2)<br>Kmph | High axle load version of BCNA<br>HS |
| BCNHL | 22.9 t | Casnub 22 HS | O – 14<br>I – 14<br>S – 4 | 65/ 65 Kmph | Length reduced, width and height increased than BCNA.<br>No. of wagons/ rake = 58<br>IRS: M44 body, Flat centre Pivot, K-type<br>CBB, improved coupler & draft gear, Brake<br>cylinder300 mm, IRSA 750 slack adjuster A.R. 75 liters, PU painting(Phirozi). |
| BCCN<br>End wagon A | 10.425 | IRF 106 HS | O – 14<br>I – nil | 100 Kmph | Maruti Car Double decker |

| | | | | | |
|---|---|---|---|---|---|
| Middle Wagon B | t<br><br>10.50 t | | S – 4 | | |
| BCCW | 20.32 t | Casnub 22 NLB | O – 12<br>I – 8<br>S – 4 | 70 Kmph<br>(Specific Route) | Cement Wagon |
| BCCW | 21.82 t | Casnub 22 HS | O – 14<br>I – 14<br>S – 4 | 65 Kmph | Cement Wagon |
| BCBFG | 21.82 t | Casnub 22HS<br>(Mod.1) | O – 14<br>I – 14<br>S – 4 | 75 Kmph<br>(Specific Route) | Food Grain hopper wagon |

**FLAT WAGONS**

| **Designation** | **Axle Load** | **Bogie** | **Springs** | **Permissible speed** | **Remarks** |
|---|---|---|---|---|---|
| BRN | 20.32 t | Casnub 22 NLB | O – 12<br>I – 8<br>S – 4 | 75/ 80 Kmph | Designed for rails and heavy steel<br>products. |
| BRNA | 20.32 t | Casnub 22 NLB | O – 12 | 75/ 80 Kmph | Improved version of BRN, Higher |

| | | | | | |
|---|---|---|---|---|---|
| | | | I – 8<br>S – 4 | | pay to tare ratio. |
| BRNAHS | 20.32 t | Casnub 22 HS | O – 14<br>I – 12<br>S – 4 | 100/ 100 Kmph | High speed variant of BRNA |
| BFNS | 20.32 t | Casnub 22 HS | O – 14<br>I – 12<br>S – 4 | 100/ 100 Kmph | Designed for transportation of steel coils, plates, sheets & billets etc. |
| BRHNEHS | 20.32 t | Casnub 22 HS | O – 14<br>I – 12<br>S – 4 | 65/ 65 Kmph | Bogie rail wagon designed for Trac Relaying trains (TRT) specially for loading RCC sleepers. |

**HOPPER WAGONS**

| **Designation** | **Axle** | **Bogie** | **Springs** | **Permissible Speed** | **Remarks** |
|---|---|---|---|---|---|

| | **Load** | | | | |
|---|---|---|---|---|---|
| BOBSN | 22.9 t | (modified)<br>Casnub 22 NLB | O – 14<br>I – 10<br>S – 4 | 75/ 75 Kmph | Designed in 1994 For transportation of Iron ore, side discharg e. |
| BOBSN M1 | 25 t | Casnub 22 NLC | O – 14<br>I – 14<br>S – 4 | 50/ 60 Kmph | High axle load variant of BOBSN. Casnub 22 NLC Bogie. |
| BOB R | 20.32 t | Casnub 22 NLB | O – 12<br>I – 8<br>S – 4 | 80/ 80 Kmph | Designed in 1986 for coal. Bottom discharge. No. of wagons/ rake = 53. |
| BOBR M1 | 22.32 t | (Modified)<br>Casnub 22 NLB | O – 14<br>I – 10<br>S – 4 | 70/ 75 Kmph | (CC + 6 + 2) version of BOBR. |
| BOB RN | 20.32 t | Casnub 22 NLB | O – 12<br>I – 8 | 70/ 75 Kmph | Designed in 1991 by reducing the length of BOBR. No. of wagons/ |

| | | | | | |
|---|---|---|---|---|---|
| | | | S – 4 | | rake = 58. |
| BOBRN M1 | 22.32 t | (Modified) Casnub 22 NLB | O – 14<br>I – 10<br>S – 4 | 70/ 80 Kmph | (CC + 6 + 2) version of BOBRN. |
| BOBRNHS M1 | 22.32 t | (Modified) Casnub 22 HS | O – 14<br>I – 14<br>S – 4 | 60/ 65 Kmph | -- |
| BOBRNEL | 25 t | Casnub 22 NLC | O – 14<br>I – 14<br>S – 4 | 50/ 65 Kmph | 25 t axle load. Wheel dia 1000 mm. POH–6 years, ROH–2 years. |
| BOBYN | 20.32 t | Casnub 22 NLB | O – 12<br>I – 8<br>S – 4 | 75/ 75 Kmph | Air Brake version of BOBY. Designed in 1996 |
| BCBFG | 21.82 t | Casnub 22 HS (Mod-I) | O – 12<br>I – 12<br>S – 4 | 75/ 75 Kmph | Bogie covered Hopper Wagon for food grains. Designed With automatic LSD. |

**TANK**

**WAGONS**

| Designation | Axle Load | Bogie | Springs | Permissible Speed | Remarks |
|---|---|---|---|---|---|
| BTALN | 20.32 t | UIC Bogie | -- | 65/ 65 Kmph | Bogie Ammonia Tank Wagon |
| BTPN | 20.32 t | Casnub 22 NLB | O – 12<br>I – 8<br>S – 4 | 80/ 75 Kmph(Loaded) | Bogie POL Tank Wagon |
| BTPGLN | 19.8 t | Casnub 22 NLB | O – 12<br>I – 8<br>S – 4 | 75/ 80 Kmph | Bogie LPG Tank Wagon. Variant of BTP GL with Air Brakes / Casnub 22 NLB bogie. |
| BTCS | 20.32 t | Casnub 22 W | O – 12<br>I – 8<br>S – 4 | 65/ 65 Kmph | Bogie Caustic Soda Tank Wagon. Provisional speed certificate is with casnub 22W bogie. In 2007, bogie altered to NLB in the drawing. |
| BTAP | 20.32 t | Casnub 22 NLB | O – 12 | 65/ 65 Kmph | Bogie Alumina Tank Wagon. |

| | | | | | |
|---|---|---|---|---|---|
| | | | I – 8<br><br>S – 4 | | |
| BTFLN | 20.32 t | Casnub 22 HS | O – 14<br>I – 12<br>S – 4 | 65/ 65 Kmph<br>(Provisional) | Bogie POL Tank Wagon |

**BRAKE VAN**

| **Designation** | **Axle Load** | **Bogie** | **Springs** | **Permissible Speed** | **Remarks** |
|---|---|---|---|---|---|
| BVZI | 5.875 t | ICF Bogie | - | 100 Kmph | Designed in 2000 with ICF Bogie<br>to achieve comfortable ride, 5 m<br>longer than BVZC. |
| BVZC | 14.0 t | 4- wheeler | - | 100 Kmph | RDSO Drg. No. WD-81035/S-2 |

# STANDARD FEATURES OF WAGONS

Important features and lay out of the wagons are given in the following appendix-A. Technical data and other important parameters are also available in this appendix for ready reference.

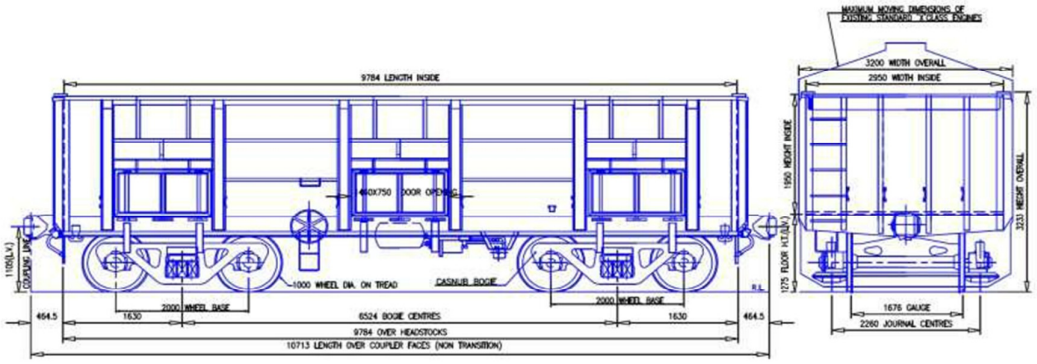



**FIG.BOXN WAGON (RDSO Drg. No. WD- 80007/ S-2)**

**INTRODUCTION**: - BOXN wagon has been designed for transportation of iron ores, coal etc. either fitted with Casnub-22W/ Casnub-22W(M)/Casnub 22 NLB bogies, non-transition center buffer couplers and single-pipe graduated release air brake system.

| PARTICULARS | Parameter | PARTICULARS | Parameter |
|---|---|---|---|
| Length over head stock (mm) | 9784 | Cubic Capacity (Cu.M) | 56.29 |
| Length over couplers (mm) | 10713 | Maximum axle load (tonne) | 20.32 |
| Length inside (mm) | 9784 | Tare Weight (tonne) | 23.2 |
| Width inside/Width Overall (mm) | 2950/3200 | Pay load (tonne) | 58.08 |
| Height inside/Height (max.) from RL. | 1950/3233 | Gross load (Pay+Tare) (tonne) | 81.28 |
| Bogie centers (mm) | 6524 | Ratio gross load/Tare | 3.5 |

| | | | |
|---|---|---|---|
| Journal length × dia. (mm) | 144x278 | Ratio (Pay load to tare) | 2.5 |
| Journal centers (mm) | 2260 | Track Loading density (tonnes/meter) | 7.59 |
| Wheel dia. on tread (New/Worn) (mm) | 1000/906 | No. of wagons per train | 58 |
| Height of C.B.C. from R.L. (mm) | 1105 | Brake System | Air Brake |
| C.G. from R.L. (empty) (m) | 1.016 | Coupler | C.B.C. |
| C.G. from R.L. (loaded) (m) | 1.974 | Bearing | CTRB |
| Floor area (Sq.M) | 28.87 | Maximum Speed (Loaded)/ Empty | 75 kmph /80 kmph |

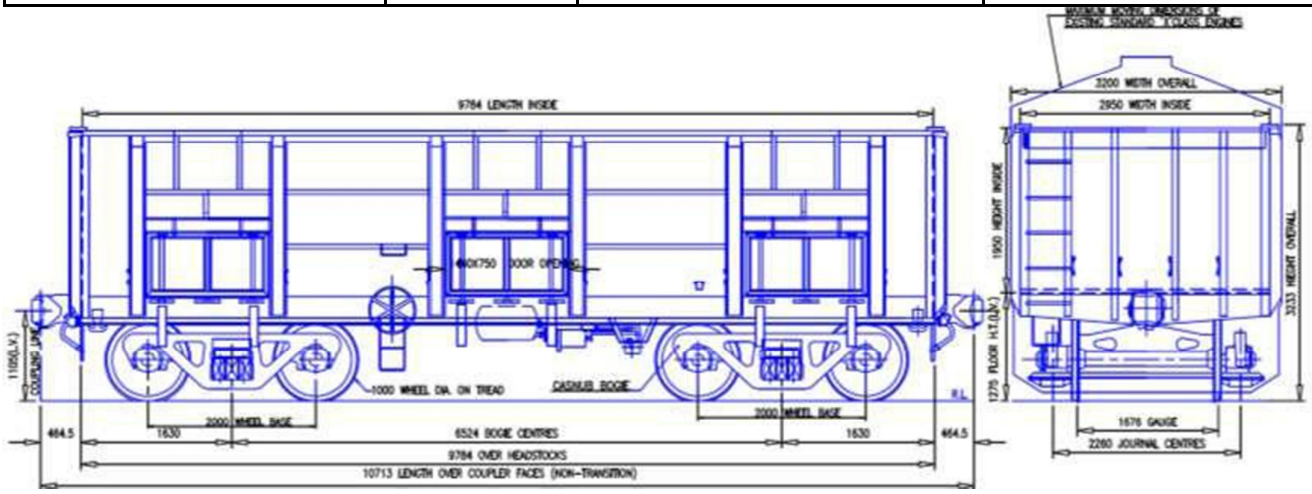



**FIG.BOXNCR WAGON (RDSO Drg. No. WD- 80007/ S-2)**

**INTRODUCTION: -** The wagon is a variant of BOXN wagon with its body in IRS M-44 steel. It's under frame is however made of mild steel. This hasbeen done to provide better corrosion resistance to wagon body. All parameters of this wagon are same as that of BOXN wagon.

***STANDARD FEATURES OF 'BOXNCR' WAGON***

| PARTICULARS | Parameter | PARTICULARS | Parameter |
|---|---|---|---|
| Length over head stock (mm) | 9784 | Cubic Capacity (Cu.M) | 56.29 |
| Length over couplers (mm) | 10713 | Maximum axle load (tonne) | 20.32 |
| Length inside (mm) | 9784 | Tare Weight (tonne) | 23.2 |
| Width inside/Width Overall (mm) | 2950/3200 | Pay load (tonne) | 58.08 |
| Height inside/Height (max.) from RL. | 1950/3233 | Gross load (Pay+Tare) (tonne) | 81.28 |
| Bogie centers (mm) | 6524 | Ratio gross load/Tare | 3.5 |
| Journal length × dia. (mm) | 144x278 | Ratio (Pay load to tare) | 2.5 |
| Journal centers (mm) | 2260 | Track Loading density (tonnes/meter) | 7.59 |
| Wheel dia. on tread (New/Worn) (mm) | 1000/906 | No. of wagons per train | 58 |
| Height of C.B.C. from R.L. (mm) | 1105 | Brake System | Air Brake |
| C.G. from R.L. (empty) (m) | 1.016 | Coupler | C.B.C. |
| C.G. from R.L. (loaded) (m) | 1.974 | Bearing | CTRB |
| Floor area (Sq.M) | 28.87 | Maximum Speed (Loaded)/ Empty | 75 kmph / 80 kmph |

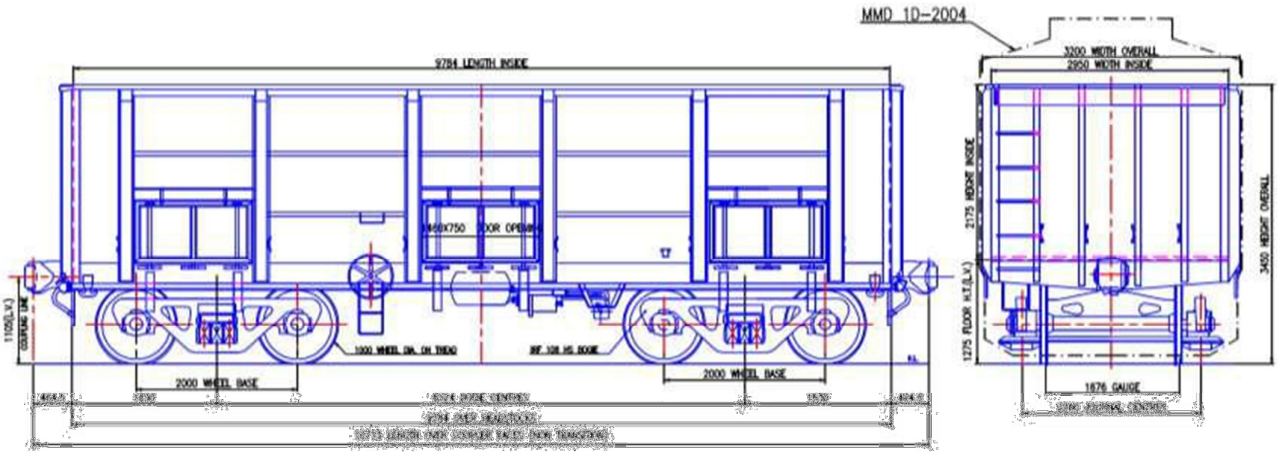



**FIG.BOXNNHA WAGON (RDSO Drg. No. WD- 98015 - S- 02)**

**INTRODUCTION: -** This wagon has been designed for transportation of coal to axle load of 22.1t. It has higher sidewalls compared to BOXN wagon.

***STANDARD FEATURES OF 'BOXNHA' WAGON***

| PARTICULARS | Parameter | PARTICULARS | Parameter |
|---|---|---|---|
| Length over head stock (mm) | 9784 | Cubic Capacity (Cu.M) | 62.8 |
| Length over couplers (mm) | 10713 | Maximum axle load (tonne) | 22.1 |
| Length inside (mm) | 9784 | Tare Weight (tonne) | 23.17 |
| Width inside/Width Overall (mm) | 2950/3200 | Pay load (tonne) | 65.23 |
| Height inside/Height(max.) from RL. | 2175/3450 | Gross load (Pay+Tare) (tonne) | 88.4 |
| Bogie centers (mm) | 6524 | Ratio gross load/Tare | 3.82 |
| Journal length × dia. (mm) | 144x278 | Ratio (Pay load to tare) | 2.82 |
| Journal centers (mm) | 2260 | Track Loading density (tonnes/meter) | 8.25 |
| Wheel dia. on tread (New/Worn) (mm) | 1000/906 | No. of wagons per train | 58 |

| | | | |
|---|---|---|---|
| Height of C.B.C. from R.L. (mm) | 1105 | Brake System | Air Brake |
| C.G. from R.L. (empty) (m) | - | Coupler | C.B.C. |
| C.G. from R.L. (loaded) (m) | - | Bearing | CTRB |
| Floor area (Sq.M) | 28.87 | Maximum Speed (Loaded)/ Empty | 75 kmph / 80 kmph |

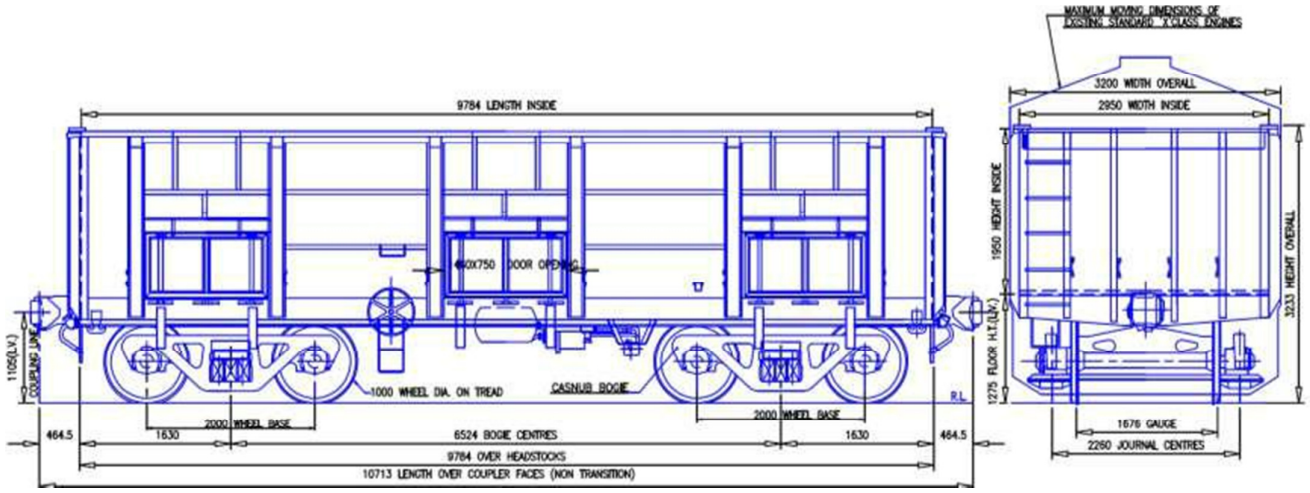



**FIG. BOXNHS WAGON (RDSO Drg. No. WD – 80007/S- 2)**

**INTRODUCTION: -** The wagon is variant of BOXN wagon with operating speed of 100 kmph in empty and 100 kmph in loaded condition. In thiswagon high speed bogies have been provided. The other parameters of this wagon are same as of BOXN wagon.

***STANDARD FEATURES OF 'BOXNHS' WAGON***

| PARTICULARS | Parameter | PARTICULARS | Parameter |
|---|---|---|---|
| Length over head stock (mm) | 9784 | Cubic Capacity (Cu.M) | 56.29 |
| Length over couplers (mm) | 10713 | Maximum axle load (tonne) | 20.32 |
| Length inside (mm) | 9784 | Tare Weight (tonne) | 23.2 |
| Width inside/Width Overall (mm) | 2950/3200 | Pay load (tonne) | 58.08 |

| | | | |
|---|---|---|---|
| Height inside/Height (max.) from RL. | 1950/3233 | Gross load (Pay+Tare) (tonne) | 81.28 |
| Bogie centers (mm) | 6524 | Ratio gross load/Tare | 3.5 |
| Journal length × dia. (mm) | 144x278 | Ratio (Pay load to tare) | 2.5 |
| Journal centers (mm) | 2260 | Track Loading density (tonnes/meter) | 7.59 |
| Wheel dia. on tread (New/Worn) (mm) | 1000/906 | No. of wagons per train | 58 |
| Height of C.B.C. from R.L. (mm) | 1105 | Brake System | Air Brake |
| C.G. from R.L. (empty) (m) | 1.016 | Coupler | C.B.C. |
| C.G. from R.L. (loaded) (m) | 1.974 | Bearing | CTRB |
| Floor area (Sq.M) | 28.87 | Maximum Speed (Loaded)/ Empty | 100 kmph / 100 kmph |

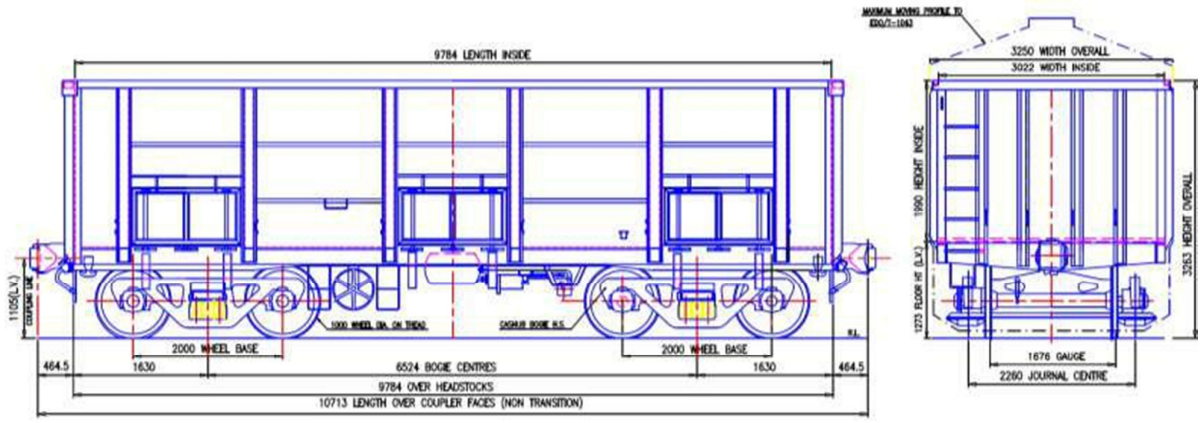



**FIG.BOXN (LW) WAGON (RDSO Drg. No. WD –88088- S - 02)**

**INTRODUCTION: -** To meet the requirement of higher pay to tare ratio, this bogie open wagon was designed in 1988. Cold Rolled Formed (CRF)sections and stainless steel/carton steel are used in design to reduce the tare weight of the wagon.

***STANDARD FEATURES OF 'BOXN (LW)' WAGON***

| PARTICULARS | Parameter | PARTICULARS | Parameter |
|---|---|---|---|
| Length over head stock (mm) | 9784 | Cubic Capacity (Cu.M) | 61.09 |
| Length over couplers (mm) | 10713 | Maximum axle load (tonne) | 20.32 |
| Length inside (mm) | 9784 | Tare Weight (tonne) | 18.26 |
| Width inside/Width Overall (mm) | 3022/3250 | Pay load (tonne) | 63.02 |
| Height inside/Height (max.) from RL. | 2066/3341 | Gross load (Pay+Tare) (tonne) | 81.28 |
| Bogie centers (mm) | 6524 | Ratio gross load/Tare | 4.45 |
| Journal length × dia. (mm) | 144x278 | Ratio (Pay load to tare) | 3.45 |
| Journal centers (mm) | 2260 | Track Loading density (tonnes/meter) | 7.59 |
| Wheel dia. on tread (New/Worn) (mm) | 1000/906 | No. of wagons per train | 58 |
| Height of C.B.C. from R.L. (mm) | 1105 | Brake System | Air Brake |
| C.G. from R.L. (empty) (m) | - | Coupler | C.B.C. |
| C.G. from R.L. (loaded) (m) | - | Bearing | CTRB |
| Floor area (Sq.M) | 29.57 | Maximum Speed (Loaded)/ Empty | 100 kmph / 100 kmph |

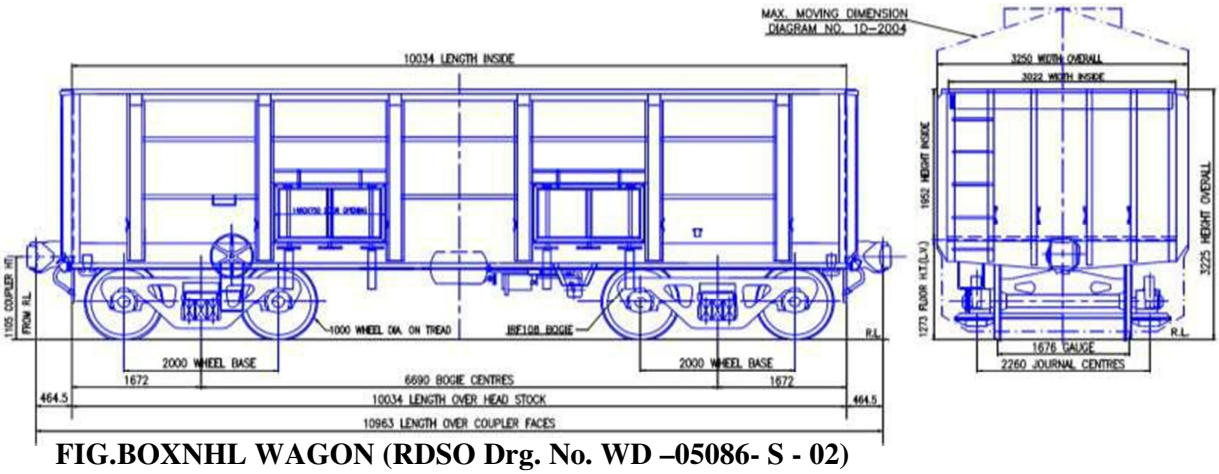



**FIG.BOXNHL WAGON (RDSO Drg. No. WD –05086- S - 02)**

**INTRODUCTION : -** This bogie open wagon was designed at 22.9t axle load and 250mm longer than BOXNHS wagon. The wagon is manufactured byusing stainless steel and cold rolled sections.

***STANDARD FEATURES OF 'BOXNHL' WAGON***

| **PARTICULARS** | **Parameter** | **PARTICULARS** | **Parameter** |
|---|---|---|---|
| Length over head stock (mm) | 10034 | Cubic Capacity (Cu.M) | 61.05 |
| Length over couplers (mm) | 10963 | Maximum axle load (tonne) | 22.9 |
| Length inside (mm) | 10034 | Tare Weight (tonne) | 20.6 |
| Width inside/Width Overall (mm) | 3022/3250 | Pay load (tonne) | 71.0 |
| Height inside/Height (max.) from RL. | 2028/3301 | Gross load (Pay+Tare) (tonne) | 91.6 |

| | | | |
|---|---|---|---|
| 8 | Bogie centers (mm) | Ratio gross load/Tare | 4.45 |
| 9 | Journal length × dia. (mm) | Ratio (Pay load to tare) | 3.45 |
| 10 | Journal centers (mm) | Track Loading density | 8.35 |

| | | | |
|---|---|---|---|
| | | (tonnes/meter) | |
| 11 | Wheel dia. on tread (New/Worn) (mm) | No. of wagons per train | 58 |
| 12 | Height of C.B.C. from R.L. (mm) | Brake System | Air Brake |
| 13 | C.G. from R.L. (empty) (m) | Coupler | C.B.C. |
| | C.G. from R.L. (loaded) (m) | Bearing | CTRB |
| | Floor area (Sq.M) | Maximum Speed (Loaded)/ Empty | 75 kmph / 100 kmph |

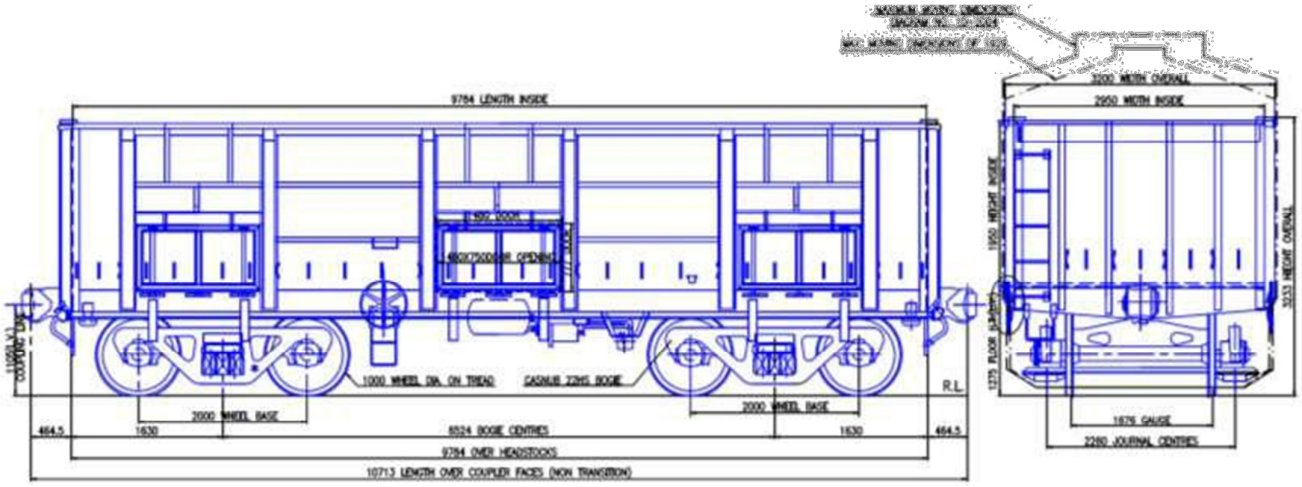



**FIG.BOXNEL WAGON (RDSO Drg. No. WD –06083/ S - 01)**

**INTRODUCTION : -** This wagon has been designed for transportation of iron ores, coal etc. BOXNEL wagons fitted with Casnub-22NLC bogies with amaximum axle load 25 t., non-transition center buffer couplers and single-pipe graduated release air brake system.

***STANDARD FEATURES OF 'BOXNEL' WAGON***

| PARTICULARS | Parameter | PARTICULARS | Parameter |
|---|---|---|---|
| Length over head stock (mm) | 9784 | Cubic Capacity (Cu.M) | 56.29 |
| Length over couplers (mm) | 10713 | Maximum axle load (tonne) | 25 |
| Length inside (mm) | 9784 | Tare Weight (tonne) | 23.1 |

| | | | |
|---|---|---|---|
| Width inside/Width Overall (mm) | 2950/3200 | Pay load (tonne) | 76.9 |
| Height inside/Height(max.) from RL. | 1950/3233 | Gross load (Pay+Tare) (tonne) | 100 |
| Bogie centers (mm) | 6524 | Ratio gross load/Tare | 4.33 |
| Journal length × dia. (mm) | 144x278 | Ratio (Pay load to tare) | 3.33 |
| Journal centers (mm) | 2260 | Track Loading density (tonnes/meter) | 9.33 |
| Wheel dia. on tread (New/Worn) (mm) | 1000/906 | No. of wagons per train | 58 |
| Height of C.B.C. from R.L. (mm) | 1105 | Brake System | Air Brake |
| C.G. from R.L. (empty) (m) | 1.016 | Coupler | C.B.C. |
| C.G. from R.L. (loaded) (m) | 1.737 | Bearing | CTRB |
| Floor area (Sq.M) | 28.87 | Maximum Speed (Loaded)/ Empty | 45+5 kmph / 60+5 kmph |

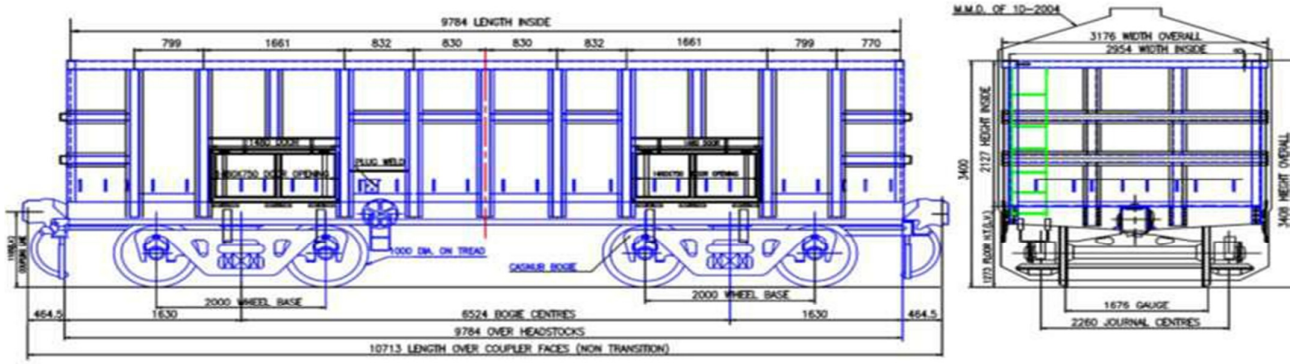


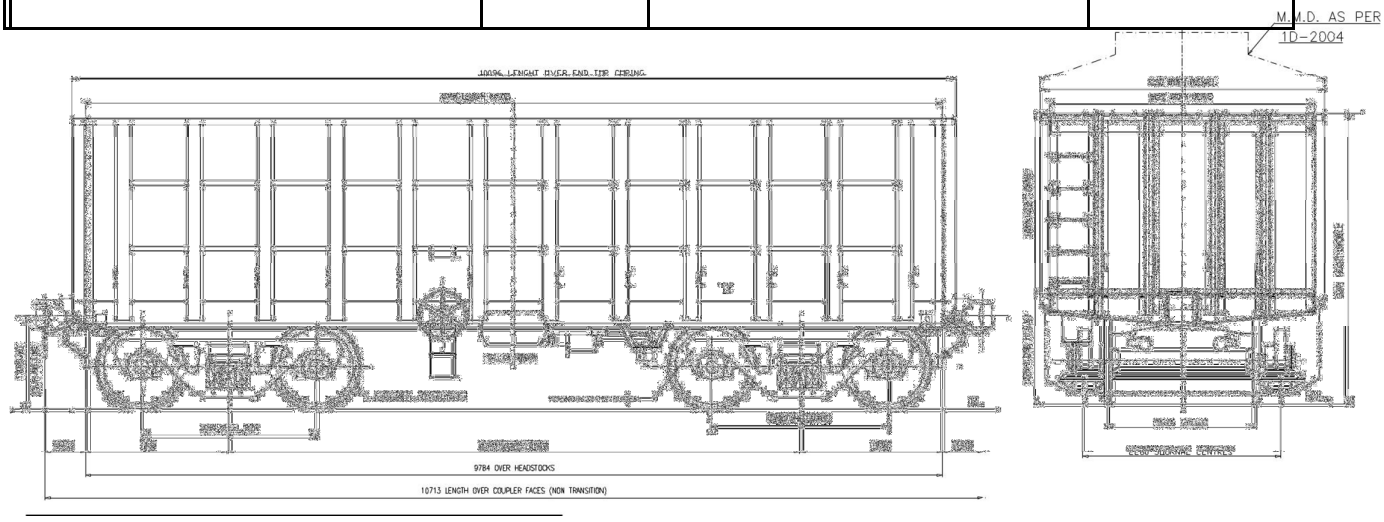

**FIG.BOXNR WAGON (RDSO Drg. No. WD –07001- S - 02)**

**<u>INTRODUCTION</u>: -** This wagon has been designed for transportation of iron ores, coal etc. BOXNR wagons either fitted with Casnub-22W (withoutElastomeric pads) or Casnub-22W (with Elastomeric pads) bogies with a maximum axle load 22.9 t., non-transition center buffer couplers and single-pipe graduated release air brake system.

***STANDARD FEATURES OF 'BOXNR' WAGON***

| PARTICULARS | Parameer | PARTICULARS | Parameter |
|---|---|---|---|
| Length over head stock (mm) | 9784 | Cubic Capacity (Cu.M) | 61.47 |
| Length over couplers (mm) | 10713 | Maximum axle load (tonne) | 22.9 |
| Length inside (mm) | 9784 | Tare Weight (tonne) | 21.2 |
| Width inside/Width Overall (mm) | 2954/3176 | Pay load (tonne) | 70.04 |
| Height inside/Height(max.) from RL. | 2127/3408 | Gross load (Pay+Tare) (tonne) | 91.6 |
| Bogie centers (mm) | 6524 | Ratio gross load/Tare | 4.32 |
| Journal length × dia. (mm) | 144x278 | Ratio (Pay load to tare) | 3.32 |
| Journal centers (mm) | 2260 | Track Loading density (tonnes/meter) | 8.55 |
| Wheel dia. on tread (New/Worn) (mm) | 1000/906 | No. of wagons per train | 58 |
| Height of C.B.C. from R.L. (mm) | 1105 | Brake System | Air Brake |
| C.G. from R.L. (empty) (m) | 1.027 | Coupler | C.B.C. |

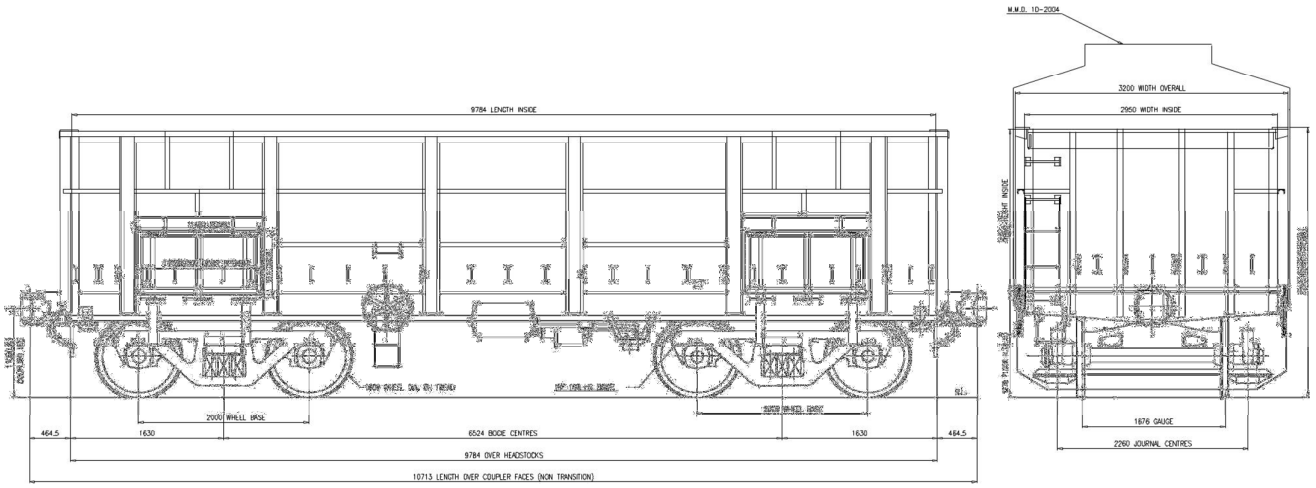
| | | | |
|---|---|---|---|
| C.G. from R.L. (loaded) (m) | 2.033 | Bearing | CTRB |
| Floor area (Sq.M) | 28.90 | Maximum Speed (Loaded)/ Empty | 60 kmph / 80 kmph |




**STANDARD FEATURES OF BOXNAL WAGON**

| PARTICULARS | Parameter | PARTICULARS | Parameter |
|---|---|---|---|
| Length over Hd. Stock | 9784 mm | Pay load | 63.02 t |
| Length over buffer/couplers | 10713 mm | Ratio pay load /tare | 3.45 |
| Length inside | 9784 mm | Gross load | 81.28 t |
| Width inside/overall | 3022/3250 mm | No. of wagons per rake | 58 |
| Height inside/from rail | 2066/3341 mm | Throughput per rake | 3655 t |
| Bogie centres | 6524 mm | Loading density | 7.59 t/m |
| Journal centres | 2260 mm | Cubic capacity | 61.09 $m^3$ |
| Wheel dia. On tread | 1000 mm | Speed (empty/ loaded) | -- |

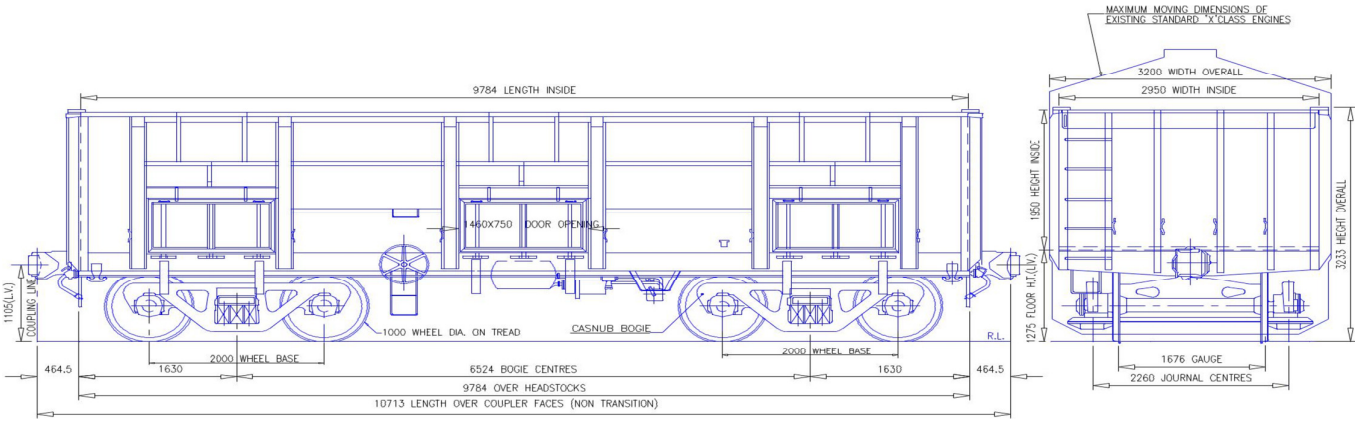
| | | | |
|---|---|---|---|
| Nominal max. axle load | 20.32 t | Type of coupler | CBC |
| Tare | 18.26 t | Type of bearing | CTRB |




**STANDARD FEATURES OF BOXNHAM WAGON**

| PARTICULARS | Parameter | PARTICULARS | Parameter |
|---|---|---|---|
| Length over Hd. Stock | 9784 mm | Pay load | 68.18 t |
| Length over buffer/couplers | 10713 mm | Ratio pay load /tare | 2.95 |
| Length inside | 9784 mm | Gross load | 91.28 t |
| Width inside/overall | 2950/3200 mm | No. of wagons per rake | 58 |
| Height inside/from rail | 1950/3233 mm | Throughput per rake | 3954 t |
| Bogie centres | 6524 mm | Loading density | 8.52 t/m |
| Journal centres | 2260 mm | Cubic capacity | 56.29 $m^3$ |
| Wheel dia. On tread | 1000/906 mm | Speed (empty/ loaded) | 100/75 |

| | | | |
|---|---|---|---|
| Nominal max. axle load | 22.82 t | Type of coupler | CBC |
| Tare | 23.1 t | Type of bearing | CTRB |




**STANDARD FEATURES OF BOXN/BOXNHS WAGON**

| PARTICULARS | Parameter | PARTICULARS | Parameter |
|---|---|---|---|
| Length over Hd. Stock | 9784 mm | Pay load | 58.18 t |
| Length over buffer/couplers | 10713 mm | Ratio pay load /tare | 2.52 |
| Length inside | 9784 mm | Gross load | 81.28 t |
| Width inside/overall | 2950/3200 mm | No. of wagons per rake | 58 |
| Height inside/from rail | 1950/3233 mm | Throughput per rake | 3374 t |
| Bogie centres | 6524 mm | Loading density | 7.59 t/m |
| Journal centres | 2260 mm | Cubic capacity | 56.29 $m^3$ |
| Wheel dia. On tread | 1000 mm | Speed (empty/ loaded) | 80/75 |

| | | | |
|---|---|---|---|
| | | | 100/100 BOXNHS |
| Nominal max. axle load | 20.32 t | Type of coupler | CBC |
| Tare | 23.1 t | Type of bearing | CTRB |

**STANDARD FEATURES OF BOXNHL (MBS) WAGON**

| PARTICULARS | Parameter | PARTICULARS | Parameter |
|---|---|---|---|
| Length over Hd. Stock | 10034 mm | Pay load | 71.08 t |
| Length over buffer/couplers | 10963 mm | Ratio pay load /tare | 3.46 |
| Length inside | 10034 mm | Gross load | 91.6 t |
| Width inside/overall | 3022/3250 mm | No. of wagons per rake | 58 |
| Height inside/from rail | 2028/3301 mm | Throughput per rake | 4123 t |
| Bogie centres | 6690 mm | Loading density | 8.35 t/m |
| Journal centres | 2260 mm | Cubic capacity | 61.50 $m^3$ |
| Wheel dia. On tread | 1000 mm | Speed (empty/ loaded) | 100/75 Kmph |
| Nominal max. axle load | 22.9 t | Type of coupler | CBC |
| Tare | 20.52 t | Type of bearing | CTRB |

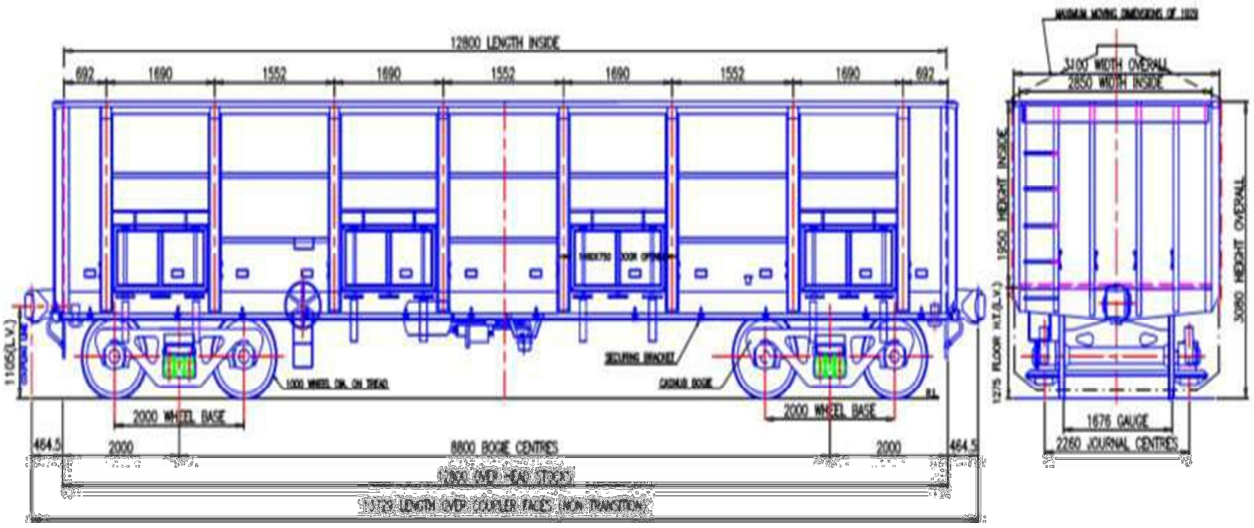



**FIG.BOST WAGON (RDSO Drg. No. WD - 00012 - S- 01)**

**INTRODUCTION :-**This bogie open wagon was designed for transportation of coal as well as steel products. The under frame has been strengthenedduring the design to sustain point loading of steel consignment. The payload remains the same as BOX N wagon.

***STANDARD FEATURES OF 'BOST' WAGON***

| PARTICULARS | Parameter | PARTICULARS | Parameter |
|---|---|---|---|
| Length over head stock (mm) | 12800 | Cubic Capacity (Cu.M) | 65.79 |
| Length over couplers (mm) | 13729 | Maximum axle load (tonne) | 20.32 |
| Length inside (mm) | 12800 | Tare Weight (tonne) | 25.5 |
| Width inside/Width Overall (mm) | 2850/3100 | Pay load (tonne) | 55.78 |
| Height inside/Height (max.) from RL. | 1950/3080 | Gross load (Pay+Tare) (tonne) | 81..28 |
| Bogie centers (mm) | 8800 | Ratio gross load/Tare | 3.19 |
| Journal length × dia. (mm) | 144x278 | Ratio (Pay load to tare) | 2.19 |
| Journal centers (mm) | 2260 | Track Loading density (tonnes/meter) | 5.92 |

| | | | |
|---|---|---|---|
| Wheel dia. on tread (New/Worn) (mm) | 1000/906 | No. of wagons per train | 45 |
| Height of C.B.C. from R.L. (mm) | 1105 | Brake System | Air Brake |
| C.G. from R.L. (empty) (m) | 1.036 | Coupler | C.B.C. |
| C.G. from R.L. (loaded) (m) | 1.792 | Bearing | CTRB |
| Floor area (Sq.M) | 36.45 | Maximum Speed (Loaded)/ Empty | 75 kmph/ 80 kmph |

| PARTICULARS | Parameter | PARTICULARS | Parameter |
|---|---|---|---|
| Length over head stock (mm) | 12800 | Cubic Capacity (Cu.M) | 65.79 |
| Length over couplers (mm) | 13729 | Maximum axle load (tonne) | 20.32 |
| Length inside (mm) | 12800 | Tare Weight (tonne) | 25.5 |
| Width inside/Width Overall (mm) | 2850/3100 | Pay load (tonne) | 55.78 |
| Height inside/Height (max.) from RL. | 1950/3080 | Gross load (Pay+Tare) (tonne) | 81.28 |
| Bogie centers (mm) | 8800 | Ratio gross load/Tare | 3.19 |
| Journal length × dia. (mm) | 144x278 | Ratio (Pay load to tare) | 2.19 |
| Journal centers (mm) | 2260 | Track Loading density (tonnes/meter) | 5.92 |
| Wheel dia. on tread (New/Worn) (mm) | 1000/906 | No. of wagons per train | 45 |
| Height of C.B.C. from R.L. (mm) | 1105 | Brake System | Air Brake |
| C.G. from R.L. (empty) (m) | 1.036 | Coupler | C.B.C. |
| C.G. from R.L. (loaded) (m) | 1.792 | Bearing | CTRB. |
| Floor area (Sq.M) | 36.45 | Maximum Speed (Loaded)/ Empty | 100 kmph / 100 kmph |

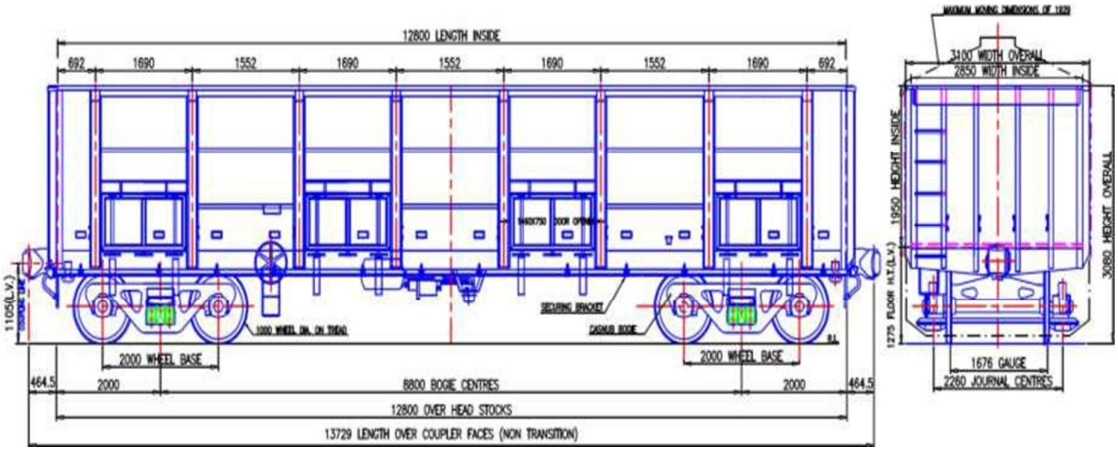



**FIG. BOSTHS WAGON (RDSO Drg. No. WD - 00012 - S- 01)**

**INTRODUCTION: -** This wagon is variant of BOST wagon with high-speed casnub bogie.

***STANDARD FEATURES OF 'BOSTHS' WAGON***

| PARTICULARS | Parameter | PARTICULARS | Parameter |
|---|---|---|---|
| Length over Hd. Stock | 12800 mm | Pay load | 63.78 t. |
| Length over buffer/couplers | 13729mm | Ratio pay load /tare | 2.5 |
| Length inside | 12800 mm | Gross load | 89.28 t. |
| Width inside/overall | 2850/3100 mm | No. of wagons per rake | 45 |
| Height inside/from rail | 1805/3080 mm | Throughput per rake | 2870.1 t. |
| Bogie centres | 8800 mm | Loading density | 6..50 t/m |
| Journal centres | 2260 mm | Cubic capacity | 65.79 m3 |

| | | | |
|---|---|---|---|
| Wheel dia. On tread | 1000 mm | Speed (empty/ loaded) | 80/60 |
| Nominal max. axle load | 22.32 t. | Type of coupler | CBC |
| Tare | 25.5 t. | Type of bearing | CTRB |

**STANDARD FEATURES OF BOSTHSM2 WAGON (CC+6t.+2t.)**

| PARTICULARS | Parameter | PARTICULARS | Parameter |
|---|---|---|---|
| Length over Hd. Stock | 12800 mm | Pay load | 63.78 t. |
| Length over buffer/couplers | 13729mm | Ratio pay load /tare | 2.5 |
| Length inside | 12800 mm | Gross load | 89.28 t. |
| Width inside/overall | 2850/3100 mm | No. of wagons per rake | 45 |
| Height inside/from rail | 1805/3078 mm | Throughput per rake | 2870.1 t. |
| Bogie centres | 8800 mm | Loading density | 6.50 t/m |
| Journal centres | 2260 mm | Cubic capacity | 65.79 m3 |
| Wheel dia. On tread | 1000 mm | Speed (empty/ loaded) | 100/60 |
| Nominal max. axle load | 22.32 t. | Type of coupler | CBC |
| Tare | 25.5 t. | Type of bearing | CTRB |

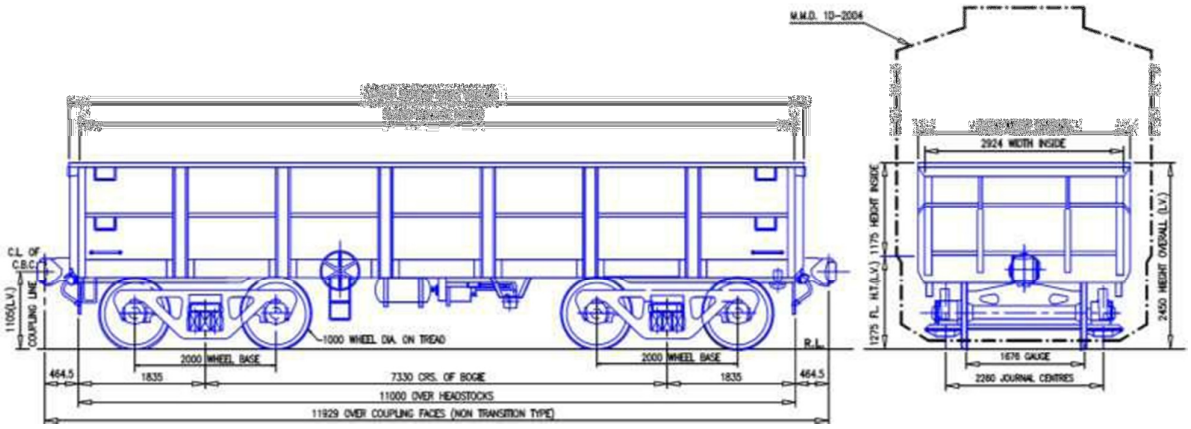



**FIG.BOYEL WAGON (RDSO Drg. No. WD –06084- S / 01)**

**INTRODUCTION**: - This wagon has been designed for transportation of iron ores, coal etc. BOYEL wagons fitted with Casnub-22NLC bogies with amaximum axle load 25 t., nontransition center buffer couplers and single-pipe graduated release air brake system.

***STANDARD FEATURES OF 'BOYEL' WAGON***

| PARTICULARS | Parameter | PARTICULARS | Parameter |
|---|---|---|---|
| Length over head stock (mm) | 11000 | Cubic Capacity (Cu.M) | 37.8 |
| Length over couplers (mm) | 11929 | Maximum axle load (tonne) | 25 |
| Length inside (mm) | 10990 | Tare Weight (tonne) | 20.7 |
| Width inside/Width Overall (mm) | 2924/3134 | Pay load (tonne) | 79.3 |
| Height inside/Height(max.) from RL. | 1175/2450 | Gross load (Pay+Tare) (tonne) | 100 |
| Bogie centers (mm) | 7330 | Ratio gross load/Tare | 4.83 |
| Journal length × dia. (mm) | 144x278 | Ratio (Pay load to tare) | 3.83 |

| | | | |
|---|---|---|---|
| Journal centers (mm) | 2260 | Track Loading density (tonnes/meter) | 8.38 |
| Wheel dia. on tread (New/Worn) (mm) | 1000/906 | No. of wagons per train | 52 |
| Height of C.B.C. from R.L. (mm) | 1105 | Brake System | Air Brake |
| C.G. from R.L. (empty) (m) | 0.972 | Coupler | C.B.C. |
| C.G. from R.L. (loaded) (m) | 1.613 | Bearing | CTRB |
| Floor area (Sq.M) | 32.13 | Maximum Speed (Loaded)/ Empty | 45+5 kmph / 60+5 kmph |

# AIR BRAKE SYSTEM

## Introduction

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

The earlier Vacuum Brake had its own limitations like brake fading, increased application and release timings etc. In practice was is not reliable to run trains in higher altitudes due to insufficient atmospheric pressure levels.

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

## Types of Air Brake System

### Direct Release System (Mainly used on American Rail Road):

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 brake is initiated.

**Graduated Release System (Used on Indian Railways):**

In this system the brake cylinder pressure can be reduced gradually in steps in proportion to the increase in brake pipe pressure. The inherent inexhaustibility feature in Graduated release system facilitates in locking of air pressure in the brake cylinder, during brake application. This helps the driver to control the train effectively over gradients irrespective of repeated brake application.

**Types of Graduated Release Air Brake System**

**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 and release of brakes. This system is used only in Goods Stock.

**Twin pipe air brake system**

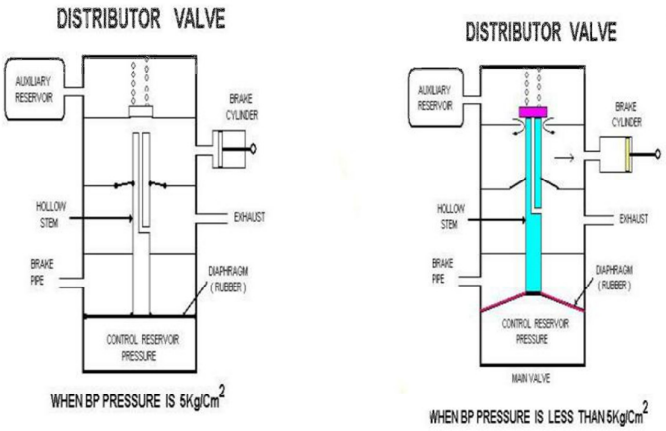
In addition to the brake pipe, there is one more pipe called feed pipe, running from loco to the brake van to charge the auxiliary reservoir continuously to 6 Kg/cm2. . This system is used only in Coaching Stock.

**The working principle of Air Brake System:**

Under normal conditions the Brake pipe is charged with 5 kg/cm2 from the Loco. The control reservoir is charged with 5 kg/cm2 from BP through Distributor valve. The auxiliary reservoir is charged to 6 kg/cm2 through feed pipe.

When the brake pipe is 5 kg/cm2, the brake cylinder is connected to atmosphere through distributor valve in order to keep the brakes 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:**

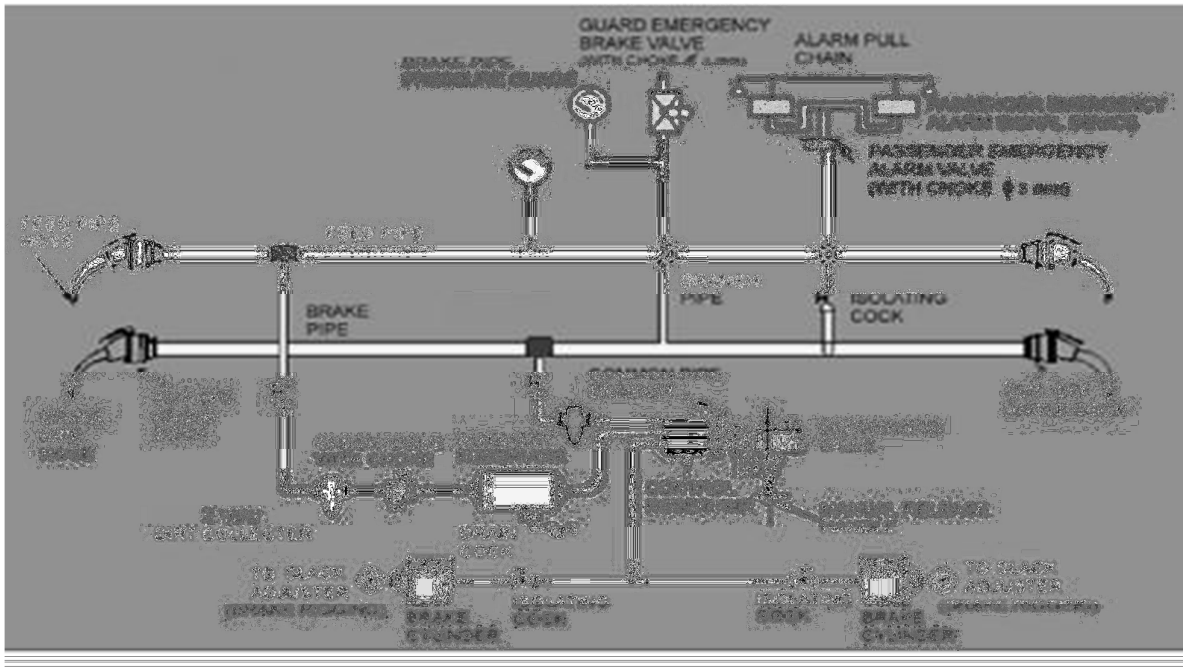
The processes involved in working of Air brake are,

Charging

Application

Release.

Manual Release




**Schematic Diagram of Graduated Release Twin Pipe Air Brake System**

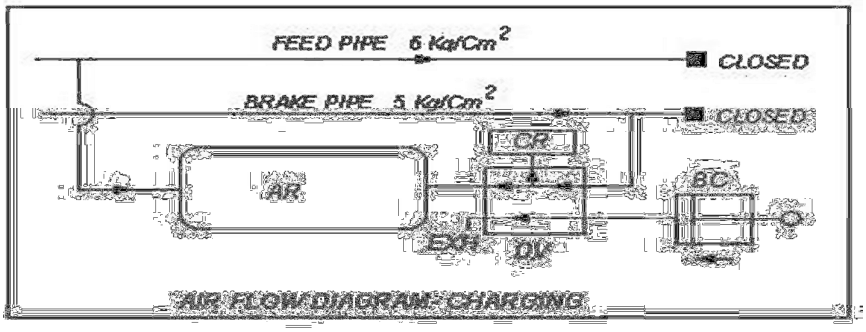
**Charging:**

During charging,

Brake pipe is charged with 5 Kg/Cm2 by the drivers brake valve from the Loco
Feed pipe is charged with 6 Kg/Cm2.

c. AR is charged with 6 Kg/Cm2.( Up to 5 Kg/ Cm2 it is charged by both brake pipe and feed pipe. Beyond 5 Kg/Cm2 & up to 6 Kg/Cm2 it is exclusively charged by feed pipe.)

The CR is charged through the distributor valve to 5 Kg/sq cm from BP
During charging Brake cylinder is connected to exhaust through distributor valve, to keep the brakes in released condition.




**Application:**

During Brake Application.

The brake pipe is reduced in steps as given below.

| Stages | BP pressure is reduced by |
|---|---|
| Minimum Reduction | 0.5 to 0.8 Kg/$Cm^2$. |
| Service application | 0.8 to 1 Kg/$Cm^2$. |
| Full service application | 1 to 1.5 Kg/$Cm^2$. |
| Emergency application | Above 1.5 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 Kg/ cm2, 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.

Note:

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

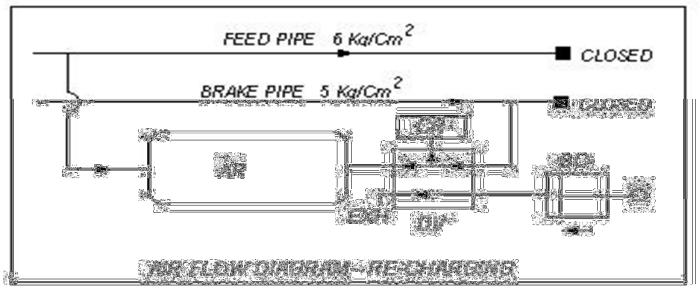
The AR is continuously charged to 6 Kg/cm2 during brake application by Feed pipe.

The CR pressure should remain at 5 Kg/cm2. However there may be a little drop in CR pressure during brake application, due to the design.

**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 Kg/Cm2 the air from 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 provided at the bottom of the DV is given a brief pull. 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.

**The important components of air brake system:**

| **Sl. No** | **Description** | **Twin pipe system** **COACHING STOCK** |
|---|---|---|
| 1. | Brake pipe and Feed pipe | 01 |
| 2. | Cut off angle cocks | 04 |
| 3. | Brake cylinders | 04 |
| 4. | Distributor valve | 01 |
| 5. | Auxiliary reservoir Capacity | 01 (200 lts) |
| 6. | Isolating cock | 05 |
| 7. | Centrifugal dirt collector | 02 |

| | | |
|---|---|---|
| 8. | Check valve | 01 |
| 9. | Air hoses with Palm ends | 04 |
| 10. | Control Reservoir | 01 |
| 11. | Passenger Emergency Alarm Valve | 01 |
| 12. | Passenger Emergency Alarm Signal Device | 01 |

**Brake Pipe and Feed Pipe**

Brake pipe and Feed pipe run through the length of the coach. These are the main pipe lines of the Air Brake System. Air supply for the both Brake Pipe and Feed Pipe originates from the locomotive. Brake pipe is fed at the pressure of 5kg/cm$^2$ and this pressure can be manipulated by driver's brake valve in the loco to any value between 0 -5 kg/cm$^2$. Feed Pipe is supplied from the locomotive at a pressure of 6kg/cm$^2$ which continuously charges the auxiliary reservoir. The ends of the main pipe lines are fitted with cut off angle cocks and hose couplings to enable consecutive coaches in a train to be coupled to one another.

**Inspection and Overhauling**

Clean the brake pipe and feed pipe underneath the coach with wire brush thoroughly.

Inspect the brake pipe and feed pipe visually by tapping with spiked hammer for corrosion, dents & cracks. If found defective replace with new ones.

Inspect all connections over brake pipe and feed pipe. If found defective replace/ renew the same.

Inspect visually for cracks, dents and for its proper function. If found damaged, replace with new ones.

**Cut-off Angle Cock:**

Cut off angle cocks are provided on either ends of the brake pipe and feed pipe. These cocks are used at the time of uncoupling of coaches. This has a vent feature. Once the cock is closed it allows the air trapped in the air hose to atmosphere. When MU washer or hose assembly

itself has to be changed, the cut off angle cocks are closed which isolates the brake/feed pipe from further charging and allows the entrapped air in the hose to flow out, to carry out the repairs easily. It also serves as dummy for the rear of the wagon/coach and the front of engine.

**Inspection and Overhauling**

All must change items should be replaced at POH.

Check body for cracks/wear.

Check stem for thread wear.

Check ball for indentation marks.

Check threads on both ends for damage.

Check lock clip for tension.

**Function Test:**

1. Connect an air line to the rear adaptor (inlet port) and supply air at 10 kg/cm$^2$
2. Move the handle a few times alternatively to open and close positions.
3. Keep the handle in closed position for check for leakage at the outlet port and flange joints using soap water. No leak is permissible.
4. Plug the outlet port and move the handle to “open position”.
5. Check for leakage from flange joints, vent and all over the body using soap water. No leak is permissible

6.Move the handle to close position and note a short blast of air through vent.

**Brake Cylinder:**

The brake cylinder receives compressed air from auxiliary reservoir after being regulated by the distributor valve and develops mechanical brake power by outward movement of its piston assembly. The compression spring provided in the brake cylinder brings back the rigging to its original position when brake is released.

**Inspection and Overhauling**

All rubber items to be changed.

1. Check adjuster tube end lock for proper function.
2. Check trunion bracket for breakage/damage.
3. Check screw rod for bend and condition of threads.
4. Check dome cover for breakage/crack.
5. Check rocker arm plate for wear/crack.
6. Check cylinder body for dents.
7. Check cylinder body for condition of threads provided for nipple.
8. Check piston for condition of threads.
9. Check ratchet for crack/wear/damage.
10. Check ratchet sleeve for wear. Ensure free movement.
11. Check condition of profile of pawl.
12. Check piston strunk for crack/damage.

13. Check rocker arm rollers and pins for wear/damage.

Ensure to provide grub screw for piston locking nut.

**Leakage Test**

| S.No | Leakage Test | Parameter | Observation |
|---|---|---|---|
| 1) | Charge the MR to 7 Kg/cm$^2$ pressure | | |
| 2) | Charge the BMBC to 0.7 Kg/cm$^2$ | Piston stroke must be limited to 32 mm | Wait for one minute. No drop should be there. |
| 3) | Charge the BMBC 3.8 Kg/cm$^2$ | Stroke limited to 95 mm | Leakage does not exceed 0.1 Kg/cm$^2$ in 10 minutes |
| 4) | Exhaust the exhaust Cock | | All the pressure should vent out |

**Function Test**

| S.No | Function Test | Parameter | Observation |
|---|---|---|---|
| 1) | Full stroke | Charge the cylinder 3.8 Kg/cm$^2$ | The full stroke should be between 94 mm to 96 mm |
| 2) | Take up stroke | Allow air slowly to operating pawl<br>Measure the take up stroke must be 32 mm<br><br>for BG and SGC of 95 mm stroke operate for 18 times to test the ratchet | Hear the chick over sound of pawl.<br><br>While return hear the chick sound in position |
| | Take up length | 1). Remove pin on cross head unscrew adjusting tube. | Check the red resetting. Mark on the adjuster tube |

| | | | |
|---|---|---|---|
| 3) | (without quick resetting gear) | 2). Disengage resetting latch and screw in adjuster up the resetting latch.<br>3). Re engage retting latch<br>4). Dust excluder collar is free | is visible.<br>It does not twist when the adjuster tube is being rotated |
| 4) | Take up length (with quick resetting) | 1). Remove pin from cross head, resetting screw.<br>2). Screw in the adjuster tube with the resetting screw.<br>3). Dust excluder collar is free. | Check the read mark on the adjuster tube is visible.<br>It does not twist when the adjuster tube is rotated |

**Distributor Valve:**

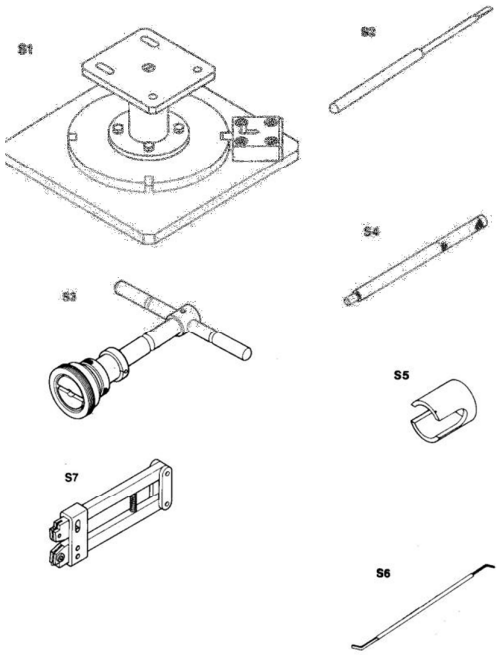
The distributor valve assembly consists of a valve body, a common pipe bracket, and a control reservoir. All the pipe connections from brake cylinder, auxiliary reservoir and brake pipe are connected to distributor valve through the common pipe bracket. The common pipe bracket remains on the coach when the distributor valve is removed for overhaul and maintenance without disturbing the pipe connections.

The control reservoir is directly connected to distributor valve through common pipe bracket. An isolating cock is provided either on the distributor valve or on the adaptor to isolate the distributor valve when found defective. A manual release valve is provided at the bottom of the distributor valve by which the brakes in a particular vehicle can be released manually by pulling the handle

**Special Tools and Fixtures for KE Distributor Valve**

| Reference | Name of the Tool | Purpose |
|---|---|---|

| | | |
|---|---|---|
| S1 | Clamping Fixture | Disassembly and assembly of distributor valve |
| S2 | Diaphragm Lifter | Removal of diaphragms |
| S3 | Wrench | Removal / tightening of screwed plug of maximum pressure limited |
| S4 | Installation Tool | Fitment of K Ring, toothed ring of three pressure valve.<br>Fitment of grooved ring and toothed ring in the R Charger |
| S5 | Thrust Piece | Installation of diaphragm |
| S6 | Installation Hook | Removal/ fitting of K – rings. |
| S7 | Adjusting Key | For adjusting ring. |



**Inspection and Overhaul**

Distributor valve POH periodicity 5 years. During every coach POH, trouble shooting is done on DV.

1. Must change items to be changed once in 5years.

2. Check main valves stem for wear.

3. Check DV body for crack/damage.

4. Check studs area for crack/damage.

    i. Check diaphragm holder for dent marks.

5. Check R-charger handle for breakage/damage.

6. During trouble shooting check the problematic area rubber items for cut, crack and damage.

7. Check valve head of maximum pressure loader, minimum pressure loader and A-controller for wear.

8. Check grooved ring for wear.
9. Check QRV lever for bend/damage.

10. During trouble shooting ensure to clean all the filters before fitting.

11. Check bonded rubber on valve plate for indentation.

12. Check Control sleeve for over size.

13. Check all seating areas for indentation wear and disfigure.

14. Ensure proper fitment of rubber seal between intermediate pipe and distributor valve.

**Auxiliary Reservoir:**

In air brake system, the brake cylinder should get compressed air during brake application. But in case of accident such as train parting, it is not possible for the brake cylinder to get compressed air. So it has become necessary to ensure sufficient quantity of compressed air with required pressure is always available. That is why all the rolling stocks are provided with Auxiliary reservoirs to store the compressed air.

Coaching Stock - 200 Ltrs

**Inspection and Overhauling**

- During overhaul, clean the exterior with wire brush and cloth.
- Drain the interior and dry with an air jet.
- Apply rust preventive coat to the interior and paint exterior with black paint.

**Leakage Test:**

1. Reservoir is subjected to hydraulic pressure at 16 kg/cm$^2$ and weld seams are lightly hammered. There should be no leak.
2. The pressure is released and increased and maintained for a period of 5 minutes. No leak is permitted.
3. Reservoir is subjected to an air pressure of 10kg/cm$^2$ and no leak is permitted.

**Isolation Cocks**

There are five isolation cocks provided in the coaching stock. Locations of these cocks are given below.

| Location | Nos. | Remarks |
|---|---|---|
| Between brake pipe and DV | 01 | |
| Between Distributors valve and brake cylinders. | 02 | (2 Cylinders) |
| Between feed pipe and auxiliary reservoir. | 01 | |
| Between passenger emergency valve and brake pipe | 01 | |

**Inspection and Overhauling**

All must change items should be replaced at POH.

Check body for cracks and wear.

Check stem for thread wear.

Check ball for indentation marks.

Check for Foley in handle.

**Function Test:**

1. Handle „OFF" position – check leakage at outlet port at air pressure 10kg/cm$^2$. No leak is permissible.

2. Close the outlet port using a blank plate and check leakage all over the body at air pressure 10 kg/cm$^2$. No leak is permissible

**Centrifugal Dirt Collector:**

Dirt collectors are provided on the pipes branching out from both, Feed pipe and Brake pipe. These are meant for removing dust, moisture and scale particles from the compressed air before it enters the distributor valve and auxiliary reservoir. This is achieved by centrifugal action.

**Inspection and Overhaul**

1. All must change items should be replaced at POH.

2. Check body for cracks/wear.

3. Check seating surface for scoring/indentation.

4. During overhaul, the dirt collector should be dismantled and thoroughly cleaned using wire brush and kerosene.

**Leakage Test:**

After overhaul block the outlet port and feed air through the inlet port at 10 kg/cm$^2$. Check for leak all over the body and joint. No leak is permitted.

**Check Valve with Choke (NRV):**

This is a one way valve (non-return valve) which allows the compressed air from feed pipe to auxiliary reservoir and it prevents the back flow of air from auxiliary reservoir to the feed pipe to avoid fall in auxiliary reservoir pressure in the event of failure of air supply from feed pipe. The choke provided in the check valve controls flow of air so that auxiliary reservoirs on the entire train can be filled uniformly. This is provided between the feed pipe and auxiliary reservoir.

**Inspection and Overhauling**

1. During overhaul, the check valve should be dismantled and all the metal parts should be thoroughly cleaned using wire brush and kerosene.
2. All must change items should be replaced at POH.
3. Inspect valve seat on body for any minor scratch marks and lap the seat to remove such scratch marks.
4. Check springs for kinks or crack marks.
5. Check valve assembly for marks/ depressions.

6. Replacement valve seats should be fixed to the housing in valve assembly using a small quantity of Araldite.

**Function Test:**

1. Connect air supply at 10 kg/cm$^2$ to the inlet port air should flow freely through the outlet port.
2. Block outlet port and permit air at 10 kg/cm$^2$ through the inlet port. Check for leakage all over the body and joints by soap water. There should be no leak.
3. Connect air supply at 2kg/cm$^2$ to the outlet port. There should be no air flow/ leak through the inlet port. Repeat the test at air pressure 5 kg/cm$^2$.

**Air hoses with Palm ends**

Air Brake Hose Couplings are used in between two coaches for continuation of brake pipe and feed pipe lines.

Each Air Brake Hose Coupling consists of a specially manufactured rubber hose clamped over a nipple on one end and a coupling head on the other end. Rubber sealing washers are provided on the outlet port of coupling head. The coupling heads of BP and FP types are of opposite design so that they cannot be inadvertently coupled to one another. For ease of identification, the respective couplings heads have integrally cast letters BP and FP and the hose couplings are painted green for BP and white for FP.

**Inspection and Overhauling**

1. Check for manufacturing date. If it is more than 3 years old they should not be used.
2. Check palm ends for wear, breakage and cracks.
3. Check treads of hose pipe for damage/wear.
4. Check whether lock nut is provided and is rotating freely.
5. Remove the sealing washer and thoroughly clean the coupling head especially the internal groove for housing sealing washer.
6. Assemble a fresh sealing washer.

**Leakage Test**

1. Use a dummy coupling head to block the outlet port of Hose Coupling and subject the Hose coupling to an air pressure of 10 kg/cm$^2$.
2. Check for the leak through the sealing washer joint and all over, by immersing the Hose Coupling in tube of water. No leak is permitted.

**Control Reservoir:**

Control reservoir is mounted on the common pipe bracket. It always maintains a pressure of 5 Kg/Cm2. It works as a reference pressure to operate the different sub-assemblies/valves provided in the distributor valve to facilitate application and release of brakes. The brake pipe pressure acts in the top of the diaphragm and control reservoir pressure acting at the bottom of the diaphragm in the DV.

**Inspection and Overhauling**

1. Control Reservoir should be thoroughly cleaned with a wire brush and then with kerosene.
2. After wiping inside and outside dry, inside should be coated with rust preventive coat and outside should be painted black.

**Leakage Test**

The reservoir should be checked for air tightness at a pressure of 10 kg/cm$^2$, taking due safety precaution.

**Passenger Emergency Alarm Valve**

The passenger emergency alarm valve consists of a spring loaded hollow piston fitted with a check valve at the bottom. It has also got a control chamber at the bottom of the piston and a brake pipe chamber at the top of the piston. An 8mm diameter exhaust port is provided at the bottom of the valve to release the air from main brake pipe. The brake pipe chamber available at the top of the piston is connected with the PEASD through 10mm dia. pipes.

**Inspection and Overhauling**

1. During periodical overhaul of the coach the Relay Valve should be removed from the coach and dismantled thoroughly.
2. All metal parts must be cleaned using suitable solvents, blow with a jet of low pressure air and then wiped dry with lint free cloth.
3. All parts must be inspected for cracks, deformations etc., and must be renewed if found defective.
4. Valve seating on body should be devoid of any scratch or roughness, if so must be rectified.
5. The spring must be thoroughly inspected for cracks, kinks pitted marks or permanent set, if so must be changed."
6. All rubber parts including diaphragms must be changed.
7. Cover Body, Valve and Piston must be free of sharp edges particularly at the diaphragm mating portions.
8. Cavities in piston and valve must be thoroughly cleaned with jet of low pressure air to ensure the passages are absolutely clear.
9. Test the emergency valve for proper function on the test bench.

**Functioning Test**

1. Connect one end of a 110 cu. in. volume reservoir to the BP control air port of the relay valve. The other end of the reservoir to a ½´drian cock via a pressure gauge. Also connect 5kg/cm$^2$ compressed air supply to BP inlet of the relay valve. Remove the choke from the exhaust passage of the valve.
2. With the ½´drain cock closed, open the 5 kg/cm$^2$ air supply to the relay valve. Note that the pressure gauge of the reservoir quickly register 5 kg/cm$^2$ pressure and no leakage in the Exhaust Port.
3. Apply soap suds all over body. No leakage is permissible.

4. Open the ½" Drain cock and note the reservoir pressure quickly drops to zero, and at the same time the relay valve starts exhausting the BP.

5. Close the Drain Cock and note as the reservoir pressure builds up and tends to equalize with the supply pressure, the relay stops exhausting.
6. At close of test and before installation of the Relay Valve on the coach for back the choke on the exhaust passage.

**Passenger Emergency Alarm Signal Device**

The PEASD consists of a pilot valve which can be operated by pulling of the chain by the passenger. It is also provided with two numbers of exhaust ports to facilitate the removal of air from the top of the piston (Brake pipe chamber) in the passenger emergency valve by pulling the chain.

**Inspection and Overhauling**

1. The device should be thoroughly dismantled and all metal parts cleaned using kerosene oil or equivalent.
2. After cleaning, all parts dry the components using compressed air
3. Inspect all moving parts for abnormal wear and tear, cracks, deformation etc., and if found defects must be replaced.
4. "O" Ring and Joint should be placed.
5. Springs for Ramp must be free of cracks, kinks or permanent set. During assembly coast all moving metal parts including rollers, pins, "o" Ring groove and bush with shell MP2 Lithium Grease or equivalent.
6. Test the emergency valve for proper function on the test bench.

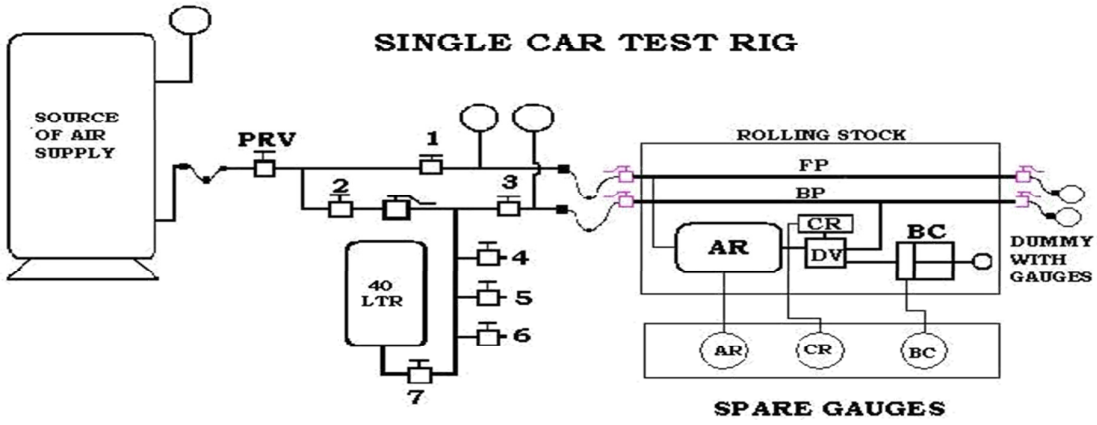
**Functioning Test**

1. Hold the Passenger Emergency Alarm Signal Devices suitably with a pulling handle attached to operating spindle. Connect air supply of 5 $kg/cm^2$ to port A and port B dummied suitably.
2. With the lever assembly at the bottom position check for leakage at the exhaust port and body all over with soap suds. There should be no leakage
3. With air supply on operate the device by pulling down the handle and note heavy blow of air through the Exhaust port.
4. Quickly rest the device by using the suitable spline key and rotating the lever assembly clock wise, and note the exhaust of air stops completely.

**Single Car Test**

The different tests that should be conducted for an Air brake Rolling stock with a single car test rig are,

1. Leakage in Feed pipe and Brake Pipe
2. Brake cylinder filling time.
3. Brake cylinder releasing time.
4. Sensitivity test.
5. Insensitivity test.
6. Emergency application test.
7. Piston Stroke.
8. Leakage in the Brake cylinder.
9. Graduated Application test.
10. Graduated release test.
11. Working of PEASD.
12. Working of GEV.
13. Manual release Test.




Sketch of Single Car Test Rig and procedure for conducting the various tests for the air brake Rolling stock:

**Leakage in FP and BP**.

1. Charge the system fully.

2. Close the Cock No. 1 and 3.

3. Observe the pressure drop in FP and BP for three minutes. The leakage rate in the FP and BP should not be more than

| |
|---|
| 0.2Kg/cm$^2$ in one minute in FP |
| 0.2 Kg/cm$^2$ in one minute in BP for coaching stock |
| 0.3 Kg/cm$^2$ in one minute in BP for goods stock |

**BC Filling Time.**

1. Charge the system fully

2. Bring the A-9 valve to full service application position.

3. Observe the BC pressure.

4. The BC pressure should reach to 3.6 Kg/cm2 within

5. Observe the maximum pressure. It should be 3.8 Kg/cm2.

| |
|---|
| 3 to 5 seconds for Coaching stock |
| 18 to 30 seconds for Goods stock. |

**BC Releasing Time**

1. Bring the A-9 valve to release position.

2. Observe the BC pressure.
3. The BC should drop from 3.8 Kg/cm2 to 0.4 Kg/cm2 within 15 to 20 seconds for Coaching stock 45 to 60 seconds for Goods stock

**Sensitivity Test**

1. Open the cock No.7 and Charge the system fully.

2. Close the Cock No.2 and Open the cock No.4.

3. Wait for 6 seconds and close the cock No.4. (This will reduce the BP pressure by 0.6 Kg/cm2 in 6 sec automatically)

4. Observe the Brake cylinder. The brake should be in applied condition.

**Insensitivity Test**

1. Open the cock No.7 and Charge the system fully.

2. Close the cock No.2 and Open the cock No.5.

3. Wait for 60 seconds and close the cock No.5. (This will reduce the BP pressure 0.3 Kg/cm2 in 60 seconds automatically)

4. Observe the Brake cylinder. The brake should not be in applied condition.

5. Observe the **BP and CR pressure. Both should be at 4.7 Kg/cm2**

**Emergency Application Test**

1. Close the cock No.7 and Charge the system fully.

2. Close the cock No.2 and Open the cock No.6.

3. Observe the Brake cylinder pressure. The maximum BC should be 3.8Kg/cm2.

**Piston Stroke**

After the emergency or full service application measure the piston stroke. It should be within

| |
|---|
| 90 ± 10 mm for under slung cylinder |
| 25 to 32 mm for BMBC |

**Leakage In BC**

1. After the emergency brake application observe the leakage in the Brake cylinder.

2. The leakage in the BC should not be more than 0.1 KG/cm2 in 5 minutes.

**Graduated Application Test**

1. Charge the system fully.
2. Reduce the BP pressure in steps through A-9 valve.
3. Observe the BC pressure. The pressure should increase in steps. For Example

| BP | BC |
|---|---|
| 5.0 | 0 |
| 4.5 | 1.25 |
| 4.2 | 2.0 |
| 4.0 | 2.5 |
| 3.8 | 3.0 |
| 3.5 | 3.8 |

**Graduated Release Test**

Increase the BP pressure in steps through A -9 valve.

a. Observe the BC pressure. The pressure should decrease in steps.

For Example

| BP | BC |
|---|---|
| 3.5 | 3.8 |
| 3.8 | 3.0 |
| 4.0 | 2.5 |
| 4.2 | 2.0 |
| 4.5 | 1.25 |
| 5.0 | 0 |

**Working of PEASD**

b. Charge the system fully.

c. Pull the alarm chain from inside the coach.

d. Observe the BP pressure and BC.

e. BP pressure should drop and brake should apply.

f. Reset the PEASD.

g. Observe the BP pressure and BC.

h. BP pressure should reach to 5 KG/cm2 and brake also should release.

**Working Of GEV (Guard Emergency Valve)**

i. Charge the system fully.

j. Operate the GEV handle.

k. Observe the BP pressure and BC.

l. BP pressure should drop and brake should apply.

m. Bring back the GEV to normal position.

n. Observe the BP pressure and BC.

o. BP pressure should reach to 5 KG/cm2 and brake also should release.

**Manual Release Test**.

p. Disconnect the test rig from the rolling stock.

q. Pull the release valve handle.

r. Observe the CR pressure and BC.

d. The CR pressure should drop to 0 KG/cm2 and Brake should release without any jerks.

# LHB – COACHES

Introduction to LHB Coaches

(Linke Hoffmann Busch GMBH – German)


Indian railways have been manufacturing passenger coaches of "Schlirien" design for more than 50 years. Although continuous efforts were being put to upgrade these coaches, due to constraints/limitations in the design, we could not cope up with quality and speed of the Railway transport in the developed countries.

It was felt to imbibe technology in-use, in the developed countries so as to effect a quantum jump in quality and speed of Railway coaches.

"M/s Alstom and Linke Holfmann Busch (LHB)" are one of the leading manufacturers in transport sector having presence in most of the European countries. Coaches manufactured by them are running in many countries across the world.

LHB coach body is designed and manufactured by leading German company Linke Holfmann Busch GMBH and Bogies for these coaches is designed and made by M/s FIAT, Switzerland which is now a part of Alstom group.

Indian Railways entered into a TOT agreement with M/s. Alstom Germany for manufacture of LHB type of Coaches. Accordingly, their inception and mass production in Railways started in 2002 and population is growing day by day.

**BENEFITS TO RAILWAYS**

A longer coach: LHB coaches are approximately 1.7 meters longer than the conventional ICF type coaches. This means "more travel space", "increased seating capacity", "wider bays and doorways" etc.

A lighter coach: Weight per meter length of LHB coach is approximately "10%" lesser than the conventional coach. This not only means lower haulage costs but also less wear and tear of the coaches and track.


A higher speed coach: LHB coaches are designed to run at a maximum speed of 180 kmph. Even for speeds of 200 kmph, no major changes are required.

Lesser maintenance, due to use of superior materials with longer life.Wheel slide protection (WSP) system based on microprocessor. It detects the variation of speed between the 4 wheels of the coach and if any wheel is rotating at a lower speed, the particular wheel brake is released automatically. This protects the wheel from skidding.

Bogie with less moving parts.

Items of wear & tear do not require replacement/renewal before 10 lakh km.

Entrance doors flush with side wall allowing automatic car washing.

**BENEFITS TO THE PASSENGER**

Better ride quality with improved ride comfort - ride index

reduced from over 3. 0 to 2. 5 at a speed of 160 kmph.

Plush interiors comparable to international standards.

Improved air-conditioning through better duct designing &

humidity control.

Bigger size sealed windows filled with “argon” gas for a

panoramic view & better heat insulation.

Modular “oriental” & “western” style toilets with Controlled

system (CDTS) This system works on
discharge toilet electro-

pneumatic principle where in, the waste generated from the coach lavatories during run is collected in a retention tank and is disposed

off away from the station limits and avoid soiling of station

premises.

Well equipped pantry with hot cases, deep freezer, bottle coolers etc.

Flush type swiveling berth reading light.

**SAFETY RELATED PROVISIONS;**

Four emergency exit windows for faster passenger evacuation during emergencies.Wider vestibule designs for smooth inter coach movement with luggages.Convenient to operate emergency alarm pull operation. Fire - retardant furnishing.

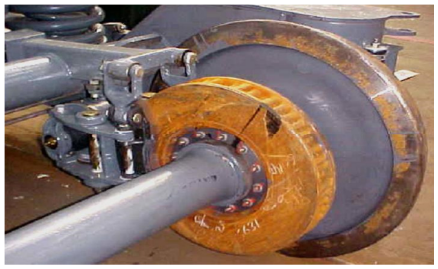
Tight lock centre buffer coupler gives anti-climbing feature, during accident.

Crashworthiness, leading to lesser injury to the occupants of the coach during accidents.

**Salient Features of LHB Coaches**

These coaches are longer by 1.7 meters than the ICF coaches and hence more number of passengers can be accommodated in a given coach. As the length of the coach is longer the number of coaches required to form a formation is reduced and hence over all cost of maintenance becomes less.

These coaches are fitted with Axle Mounted Disc brakes to have an effective brake power to stop the train within the short braking distance. As the brake forces are acting on the Discs which are mounted on the Axles, the wear on the wheel tread caused due to brake application on tread is eliminated and hence the life of the wheels are considerably increased.



These coaches are fitted with Wheel slide protection device to prevent the wheel from getting skid. Due to various reasons it is possible for any one of the wheel to have lesser speed when compared to the other three wheels and in such a case it releases the air from the brake cylinder of the affected wheel automatically to prevent the wheels from getting skid

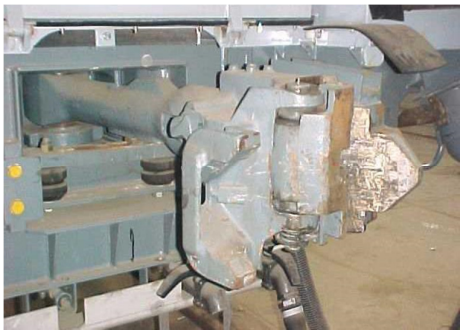
These coaches are fitted with Brake accelerator in the Brake pipe to bring BP pressure to zero during emergency brake application. The brake accelerator connects the Brake pipe with exhaust during emergency application to facilitate faster exhaust of air from the brake pipe.

These coaches are provided with FIAT bogies, which are designed to run at a speed of 160 KMPH. The wheelbase of Bogie is 2560 mm

These coaches are fitted with earthling device to prevent damages to the Roller bearings.

These coaches are fitted with roof mounted AC package units. These coaches are fitted with Controlled discharge Toilet system designed to discharge the human waste when the speed reaches above 30 KMPH. The objective of this toilet system is to keep the station premises clean and hygienic.

These are fitted with tight lock AAR centre buffer coupler with anti-climbing feature to prevent the climbing of one coach over another in case of accidents.



The following equipment's are operated by Microprocessor controlled system

Wheel slide protection device. Controlled discharge toilet system.
Water pumping device.

Roof mounted AC package units

The riding index of LHB coach is 2.75 when compared to 3.25 in case of ICF Coaches.

Up-graded design for passenger safety/comfort like; Ergonomically designed seats as per Indian anthropometrics data, Large windows with good visibility, Luggage racks with in-built reading lamps, Insulation against noise, No visible screws in the interior, Use of fire retardant materials, Hand – safe feature in all automatic sliding doors, Anti – skid PVC flooring, UIC vestibules and auto - closing vestibule door, Functionally designed pantry area, Easily accessible AC unit controls.

The passenger emergency alarms signal devices (emergency alarm pull box) are provided inside passenger compartment. This is to avoid operation of PEASD by unauthorized persons from outside. There is no mechanical linkage like a chain and this handle directly operates the PEA valve for venting the brake pipe pressure.

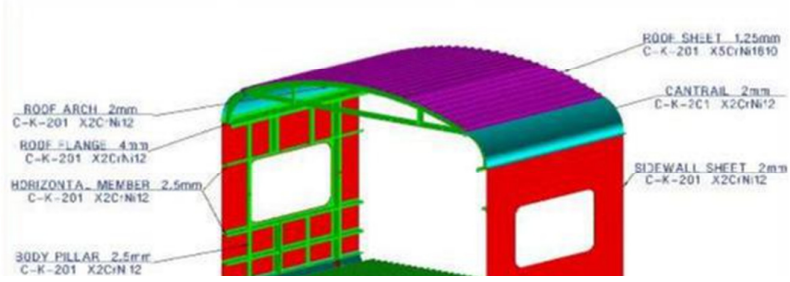

**DESIGN FEATURES OF LHB COACHES**

| Description | LHB Coach | ICF Coach |
|---|---|---|
| Length over body | 23540 mm | 21337 mm |
| Length over buffers | 24000 mm | 22297 mm |
| Overall width | 3240 mm | 3245 mm |
| Overall height | 4039 mm (AC 3 tier 4250 mm) | 4025 mm |
| Max distance between inner Wheels | 12345 mm | 11890 mm |
| Distance between centre pivots | 14900 mm | 14783 mm |
| Window opening | 1180 x 760 mm | 1200 x 550 mm |
| Height of compartment floor from Rail level under tare | 1303 mm | |
| Max CBC drop under gross load and worn conditions | 75 mm | |
| Minimum height from Rail Level | 102 mm | |

| | | |
|---|---|---|
| Max height (empty) | 1105 mm | 1105 mm |
| Minimum buffer height (loaded) | 1030 mm | 1030 mm |
| Wheel base | 2560 mm | 2896 mm |
| Wheel dia (New) | 915 mm | 915 mm |
| Wheel dia (Cond) | 845 mm | 825 mm |
| Speed potential in kmph | 160 upgradeable to | 140 max |
| Max Axle load permissible | 16 t | |
| Ride index | 2.5 to 2.75 | 3.25 |
| Speed Potential (Kmph) | 160 | 140 |
| Axle Box Guidance | Articulated | Rigid |
| Dampers-Primary | Hydraulic | Dashpot |
| Bogie Frame | Without Headstock | With Headstock |

COACH SHELL

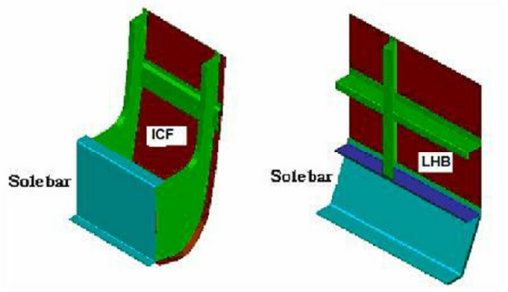
The entire shell is made from stainless steel and low corrosion steel. All the structural elements with section thickness above 5mm and more are made from Corten steel. Trough floor and roof panels are made from Austenitic stainless steel. Other structural members and side members and sidewall panels are made from ferritic stainless steel. The shell design eliminates turn-under and other pockets causing corrosion in conventional coaches.



Various types of steels used in construction of LHB Coaches

| Shell Assemblies | Steels Used | Composition |
|---|---|---|
| Side Wall, End Wall And Roof structure | Ferritic Steel X2 Cr8 | C-.03%, Cr-10 to12% Si-1%, Mn-1.5% |
| Roof Sheet and Trough floor | Austenitic Steel X5 CrNi18-10 | C-.07%, Cr-18% Ni-10%, Si-1%, Mn-2% |
| Under Frame | Corten Steel IRS-M-41 | C-.01%, Cr-.35 to.6% Ni-2 to 4 %,Si-0.3to0.7%, Mn-0.25% |

The C – Shaped section Sole bar is used in the LHB coaches when compared to Z-shaped in ICF coaches




**Special Design feature of LHB coach flooring;**

16 mm composite board made from cork panels glued to "Makore" wood have been used. Flooring panels are lightweight, strong, warp resistant and also resistant to vibrant/impact forces. These floors are specially treated for fire resistance; these are also resistant to moisture, cigarette burns, staining, aging etc. The intermediate cork layer imparts nice insulation characteristics to the floor panel. The "floating" floor is supported by rubber - metal decoupling elements, for absorption of structural vibrations.

Inter-locking joints of vertical & horizontal members is adopted for structural joints

**FIAT BOGIE.**

The LHB coaches are provided with the FIAT bogies to run at a speed of 160 KMPH.

**Limitations of ICF all Coil Bogie**

The longitudinal and lateral movements of the wheels cannot be controlled independently as generally required for High-speed bogies.

Since there is vertical space constraint between the top and bottom bolster, it is not possible to provide softer secondary suspension springs which are required for the high speed trains to control the dynamic movements of the bogie bolster and coach body.

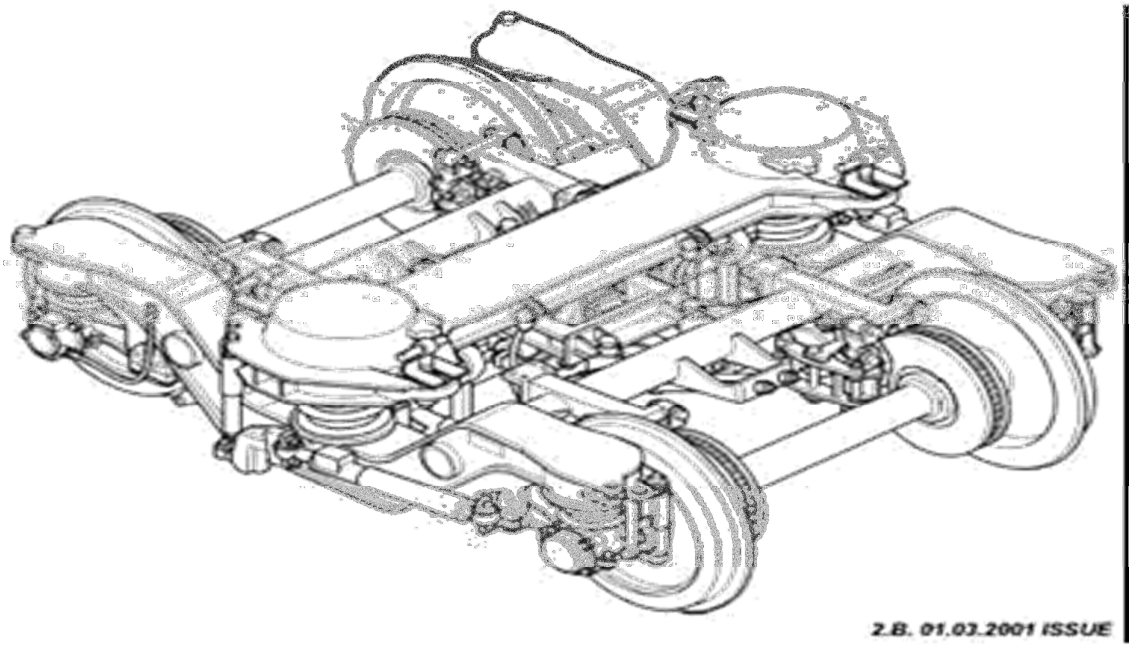
Headstocks increase the yaw inertia of the bogie frame and thereby, influence the tendency for hunting.

The wheelbase of ICF all coil bogie is 2896 mm. This large wheelbase affects curve negotiations and thereby increases wheel flange wear.

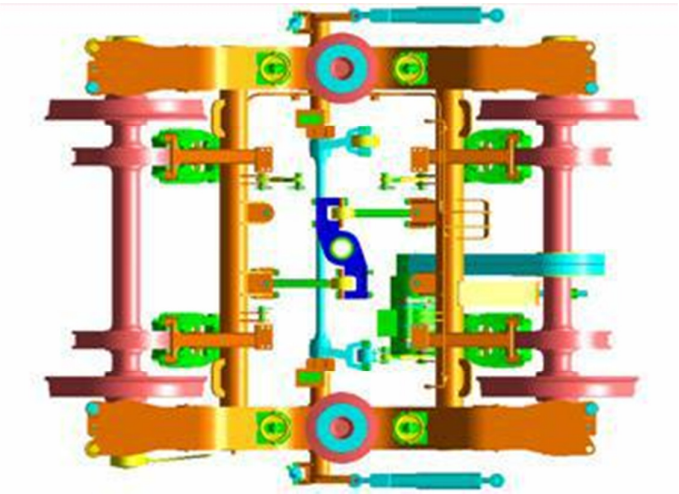
Since the brake forces are offered on the wheel tread by clasp brake, it could not give sufficient retardation during brake application which in turn increases the emergency braking distances. The life of the wheel is also reduced due to tread wear.

**Technical parameters of FIAT Bogie**

| | |
|---|---|
| Bogie width | 3030 mm |
| Bogie length | 3534 mm |
| Bogie weight | 6300 Kgs |
| Wheel base | 2560 mm |
| Wheel diameter (New) | 915 mm |
| Wheel diameter (Cond) | 845 mm |
| Wheel distance | 1600 +/- 1 mm |




This is a two axle bogie with both primary and secondary suspension. The Bogie frame is made of two longitudinal solid welded component connected by 2 cross beams which also supports the brake units. This frame rests over the primary suspension and the weight of the coach body is taken by the bogie through the bolster beam and the secondary suspension.



On two outer corners of the Bogie Frame nylon roller is fitted by a pin, which prevents excessive rotation of the bogie with respect to body.

Anti roll bar is fitted between the bogie frame and the Bolster Beam to maintain the Coach body always parallel with the bogie, even while negotiating curves.

Dampers Used in the FIAT Bogies

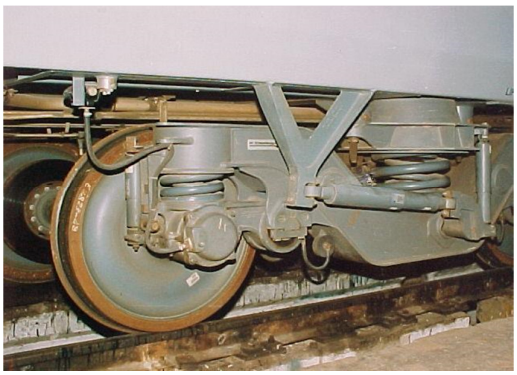
Dampers used in FIAT bogies are hydraulic shock absorbers (confirming to UIC 515-4) to damp the oscillations caused due to track irregularities.

**Following dampers are provided on each bogie:**

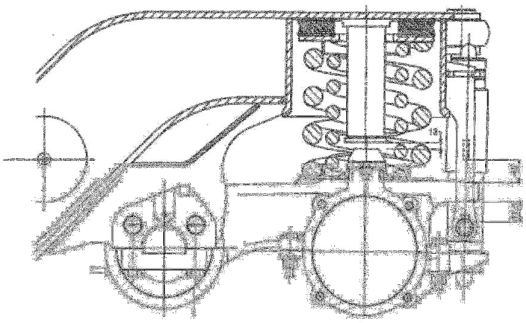
Four vertical dampers are provided in primary suspension between axle box and bogie frame for absorbing the shocks between the wheel and the bogie frame.

Two vertical dampers are provided in secondary suspension between bogie frame and bolster to cushion the vertical movement and one lateral damper is provided to cushion lateral movement.

Two numbers of Yaw dampers are provided between bogie frame and coach body to cushion the yaw and longitudinal movement.



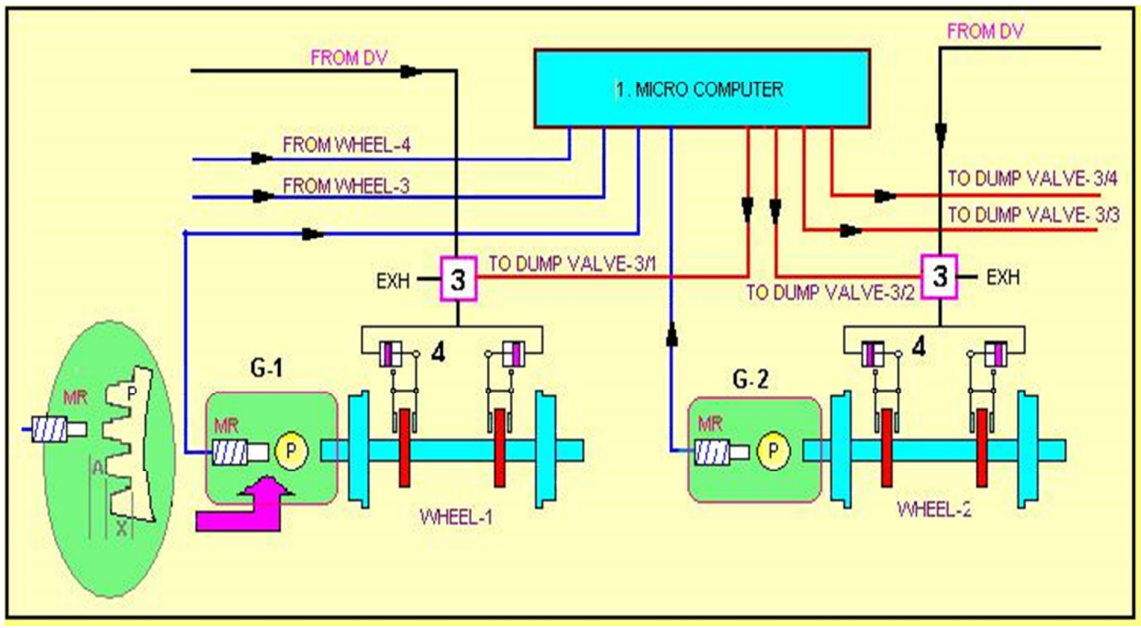
Primary suspension is at 4 points over the axle-bearing box. Each unit has 2 coil springs (inner and outer) with a vertical damper and a control arm fitted with twin-layer elastic joints connecting the bearing to the bogie frame.



Secondary suspension enables lateral and vertical displacements and also bogie rotation with respect to body when negotiating curves. It is provided on both the bogie frame longitudinal. Each unit of suspension has 2 steel coil springs (internal and external), which carries the Bolster beam with a vertical damper and a lateral damper. 4 nos. of safety cables are connected between the bolster beam and the cross beam. 2 YAW Dampers are also connected between Bogie frame and the Coach Body.

Traction centre transmits both tractive and braking force between the body and the bogie. It comprises of a Traction Lever which is connected to the cross beam of the bogie frame by means of 2 Traction Rods diagonally with elastic bushed joint. For limiting the longitudinal and lateral displacement of the bolster beam, there are 2 Lateral and 2 Longitudinal Bump stops fitted on a support frame and the support frame is fitted to the Bogie Frame.The wheels are provided with Catridge type tapered roller bearings. On each axle 2 discs (640 mm dia) are fitted between the

wheels for brake application. Brake calliper assembly along with brake cylinders are fitted on the cross beam and brake pads are used to have contact with the discs for brake application. One end of each axle is fitted with speed sensor used for the Microprocessor input of Wheel Slip Protection device.




**Wheel Slide Protection device:**

In LHB coach pneumatically controlled Disc brake system is used. During brake application, factors like variation of co-efficient of friction (due to composition of brake pads and disc) and adhesion between rail and wheels and various other factors may cause difference in RPM (rotation per minute) of axles on the same coach. This may lead to wheel skidding/ flat tyres. To prevent this, a Wheel Slide Protection (WSP) device is provided in these coaches

Main Components and their functions:

| Part No | Name | Qty | Function |
|---|---|---|---|
| 1. | Micro Computer | 1 Per Coach | Gets input from speed sensors, compares with reference speed and gives output signal to Rapid Discharge Valve to open or close in case of variations. |
| G-I & G-2 | Speed Sensor | 1Per Axle | It consists of a fixed Magnetic Resistor (MR) and a Phonic Wheel (P) having 80 teeth, fitted on the axle. It gives tachometric pulse signal to Micro Computer due to variation in air gap (A and A +X) between the phonic wheel and the magnetic resistor. |
| 3. | Rapid discharge valve (dump valve) | 1 Per Axle | It is an Electro-Pneumatic Valve which is connected in series with the Brake Cylinder (BC). It regulates the BC (Part No-4) Pressure by disconnecting the DV from BC and also by connecting the BC with atmosphere when the output signal is received from Micro Computer. |

**Principle of working;**

The rotation of each axle is constantly measured and compared with a reference speed (The RPM of the fastest wheel of the coach) for that coach. In case there is a variation in RPM among the wheels, WSP automatically releases the brakes of the wheel with slower speed accordingly, so that the RPM of all the wheels become uniform.

**Working:**

The limit of variation of speed and acceleration are defined as threshold values. The Micro Computer constantly compares the signals from the speed sensor mounted on each axle with the reference speed. If the speed/ acceleration of any axle is crossing the present threshold values, it gives signal to the respective Rapid Discharge Valve to release the BC pressure accordingly, thus maintaining the speed/acceleration with in the threshold level.

## Advantages of LHB coaches

Better payload to tare ratio. Better safe guard for corrosion.

Increased coach availability due to reduced maintenance Higher carrying capacity of 78 passengers in chair car

**Air Brake Testing Procedure for LHB Coaches:**

On arrival of the rake on pit line, completely drain the AR tank (125 litres & 75 litres) of all the coaches by opening the drain cock, to remove the water in air.

Initially, couple the BP hose of the test rig with the BP hose of the rake & then charge the BP pressure to 5.0 kg/cm$^2$. Keep the FP angle cock of both end power cars in close position. Check the FP gauge fitted in the power car, if the gauge does not show any pressure, the NRV of all the coaches are ok. If, FP gauge shows any pressure, the NRV of some coach in the rake is defective. Inthis condition, check the rake for NRV defective by taking the coaches in parts. NRV found defective in particular coach should be replaced.

Open all the four cocks of rake, couple BP & FP hose pipe of test rig with the BP & FP hose pipe of the rake. Charge the BP & FP to 5.0 kg/cm$^2$& 6.0 kg/cm$^2$ respectively. After building of pressure in BP & FP, disconnect the test rig BP & FP hose pipe from the rake hose pipes & open both the angle cocks, due to which air pressure will be exhausted in atmosphere & brake will be applied. Wait for 20 to 25 minutes.

After 20 to 25 minutes, check the complete rake from one end. Note down the coach nos. found with released brake cylinder. Check whether, AR tank of the coach is charged or empty. If AR tanks found empty, write down Empty AR on the respective coach. If found charge, pull manual release of DV to check whether CR tank is charged / empty. If CR found empty, write down Empty CR on respective coach. With this, all the defects in the rake can be checked.

Again, connect BP & FP hose pipe of the rake & test rig & then charge BP to 5.0 kg/cm$^2$& FP to 6.0 kg/cm$^2$. Connect BP & FP gauges with dummy on free end of other end power car.

Check the BP & FP pressure gauges in front power car, BP pressure should show 5.0 kg/cm$^2$& FP pressure should show 6.0 kg/cm$^2$. If there is any difference in any pressure, check by fitting master gauge if still the pressure is not showing 5.0 kg/cm$^2$ in BP & 6.0 kg/cm$^2$ in FP, check for leakage & attend.

Close the BP & FP angle cock of test rig for 03 minutes. Monitor the leakage in both BP & FP. The leakage should not be more than 0.6 kg/cm$^2$ in 03 minutes.

Attend the coaches in which AR empty & CR empty are found. Check the AR tank & pipe line from the back of the brake panel for leakage. Similarly, check CR tank & pipe line & dummy plug on the brake panel. If defect is still noticed after attending the leakage, then mark the coach sick for detailed investigation & single car testing in sick line.

Start the pressure & charge the BP to 5.0 kg/cm$^2$& FP to 6.0 kg/cm$^2$. Drop the BP pressure by 1.6 kg/cm$^2$, brake should apply in all coaches. Start the leakage checking with the help of soap solution from one end. During soap solution testing, check all the BP & FP hose pipe, all hose pipe connectors, Main pressure pipe line, Angle cocks, Brake cylinder pipe line, CDTS pipe line.

Similarly, check & attend leakage in components on Brake panel like DV, FP & BP filter, NRV, all isolating cock, brake indicator, brake accelerator & brake cylinder with soap solution.

Isolate the isolating cock on Brake panel & check all brake callipers & brake pad of all cylinders. In isolated condition, all brake pads should be released simultaneously. Similarly, on opening of isolating cock all Brake cylinder should operate & brakes should apply.

Check the brake indicator when brakes are applied, indicator should display red colour. However, when the brakes are released from isolating cock the brake indicator should display green colour. If on brake release condition, brake indicator is not showing green or on brake applied condition brake indicator is not showing red, then the brake indicator is defective. Repair / replace the brake indicator.

The BP & FP pressure gauges in the others end power car should show pressure 3.4 kg/cm$^2$& 5.8 - 6.0 kg/cm$^2$ respectively. If any difference in above pressure is noticed that means there is any

cross connection in BP & FP connection. Attend the same & ensure BP pressure 3.4 kg/cm$^2$& FP pressure 5.8 - 6.0 kg/cm$^2$.

Charge the BP & FP pressure to 5.0 kg/cm$^2$& 6.0 kg/cm$^2$ respectively. Check the brake indicator of complete rake, all coaches should be in released condition. If any coach is not released, it means that the CR of that particular coach may be overcharged & there is an internal defect in DV. Mark the coach sick for detailed investigation.

Check PEASD of at least 03 coaches. During PEASD checking, brakes should apply in all coaches & the brake accelerator should operate. Coach numbers should be noted in maintenance diary.

Now close the pressure supply from the test rig. Operate the emergency guard van valve of front power car guard van. BP pressure should become 0.0 kg/cm$^2$ in approx. 25 to 30 sec in front power car & approx. 40 to 50 sec in rear power car. Open the pressure supply & charge BP & FP to 5.0 kg/cm$^2$& 6.0 kg/cm$^2$ respectively. Now again close the pressure supply from the test rig. Operate the emergency guard van valve of rear power car guard van. BP pressure should become 0.0 kg/cm$^2$ in approx. 25 to 30 sec in rear power car & approx. 40 to 50 sec in front power car.

Check for any significant difference in time for droppage of BP pressure to 0.0 kg/cm$^2$ between front & rear power cars. If any, there may be blockage in BP line of any coach. If found, attend the same. Continuity test of the rake is now completed.

In both the power cars, check the condition & mounting of hand brake cables fitted on both the brake cylinders. Rotate the hand wheel fitted in guard van clockwise to apply the brakes, after full rotation brake should apply in both the brake cylinders & hand brake indicator should show red. Rotate the hand wheel anticlockwise, now brakes of both the cylinders should get release & hand brake indicator should show green.

Charge the BP & FP to 5.0 kg/cm$^2$& 6.0 kg/cm$^2$ respectively. Close the BP & FP angle cock of test rig for 03 minute. Monitor the leakage in both BP & FP. The leakage should not be more than 0.6 kg/cm$^2$ in 03 minutes.Isolate the isolating cock of BP & FP of the test rig & angle cock of BP & FP of the cock. Uncouple both hose pipes & open both the angle cocks of coach. After draining of pressure from both the BP & FP hose, release the complete rake by pulling the manual release handle of the DV of each coach & ensure the brake indicator of all coaches should display green colour. Ensure that all BP, FP & BC gauges fitted in power car are calibrated & showing correct reading.

**WSP Testing**

Initially with no pressure, the WSP processor in all the coaches should be OFF. If any processor is in ON condition, there is problem in any of pressure switch, wiring or K-05 relay. Attend the same.Start the BP & FP pressure. The processor should automatically ON when BP pressure reaches 1.6 to 2.0 kg/cm$^2$ in M/s KNORR WSP system & when FP pressure reaches in M/s FTIL WSP system.Check & attend for loose/proper fitment of WSP components like speed sensor, junction box, dump valve, dump valve connector & pressure switch.

Drop the BP pressure by 1.6 kg/cm$^2$, brake should apply in all the coaches. Now check the WSP processor for correct reading '99' onthe electrical panel inside the coach. If the reading shows '99', it means that the WSP system is OK. Operate the test button on the processor to check the proper working of dump valves. The dump valve should operate in a sequence & pressure should be exhausted from brake cylinder. If the dump valve is not operated in proper sequence attend the same. Similarly, check & attend the WSP system of all the coach. All the WSP system should be in operating condition in the rake.

**PATTERN OF FREIGHT TRAIN EXAMINATION**

Comprehensive instruction regarding the pattern of freight train examination and issue of brake power certificate have been issued by railway board jointly signed by CRSE and CFTM.

The subject of train examination is divided into four categories-

- Closed Circuit Rake
- Premium Intensive End to End
- Non-closed circuit Intensive (End-to-End) Rake
- Departmental Rolling stock

**CLOSED CIRCUIT RAKE:**

- Formation and replacement shall be done predominantly by off POH/ off ROH wagons,
- Examination done at respective base depot only,
- Rake offered for examination in empty condition,
- Time provided for the intensive repairs is 5– 6 hrs,
- All rakes will have nomenclature name Ex: RED RUBY , CONSTAR,
- Brake power after intensive examination is 100%,
- Enroute brake power of cc rake is 90%.

**BRAKE POWER CERTIFICATE**:

- Colour of BPC is **YELLOW**, BPC is mentioned with circuit,
- BPC is valid for 6000km or 30 days,6500km or 35days whichever is earlier from the date of issue of BPC,
- If the rake is stabled for more than 24 hrs in TXR point ,the BPC will become invalidIf the rake integrity is disturbed by more than 4 wagons , the BPC become invalid,

- Incase the record of distance covered by the rake is discontinuous or not mentioned properly ,the BPC will be deemed to be valid for 20days from the date of issue of BPC.

**Monitoring of CC rakes:**

- The chief traffic controller and the C&W controller keep closed watch on day to day basis of movement of rake.
- The movement of rakes shall also be monitored through FOIS, C&W,TI/HQ ATM(FREIGHT).
- The authority to give deviation of cc circuit is CRSE and CFTM.
- The km earned by the rake as logged in the BPC is related to the chief traffic controller by the traffic/promotion staff at each loading / unloading stations**.**

# Premium end-end rake:

- Rakes formed out of nominated air brake stock only(all type of BOXN,BCN,BRN and BTPN).
- Examination is done only in empty condition.
- Only nominated depot can issue BPC.
- The minimum brake power of after examination is **95%.**

**BRAKE POWER CERTIFICATE:**

- Color of BPC is GREEN.
- Validity of BPC is 12+3 days.
- All individual wagon should be mentioned in BPC.
- Movement of premium end to end rakes will be monitored through FOIS by traffic and mechanical departments.

# End-end rake:

**VACUUM BRAKE** :

- Rake should be normally examined in empty condition except when back loading of rake has to be done at stations /sidings,
- Time taken for examination and issue of BPC is 4 to 5hrs,
- Brake power required is **80%,**
- Color of BPC is **PINK.**
- All the individual number of wagons should be mentioned in BPC.
- After the issue of BPC , the empty rake should be moved to the loading point within 4 days including the day of issue of BPC.

- The BPC of the empty rake may not have the destination mentioned.
- At the train examination point ,the C &W
- Engineer should write “up to loading point further to unloading point on the BPC.”
- After loading at loading point the SM /Commercial staffshould enter the destination on the BPC with station seal.

**AIR BRAKE :**

- All conditions mentioned for vacuum stock except the 4 days limit for loading.
- Brake power required is 85%.
- Color of BPC is **GREEN**.
- Enroute Brake power is 75%.

## Departmental stock:

- Examination done at respective base depot only,
- Validity of BPC is 30 days,
- Brake power required is 100%,
- Colour of BPC is GREEN,
- Run within the Division only

# IMPORTANT SYSTEMS IN DIESEL LOCOMOTIVE

## FUEL OIL SYSTEM

*PURPOSE OF THE SYSTEM*

The nerve centre of the diesel engine is fuel oil system and fuel injection system. This consists of fuel oil tank, filters, feed pumps and the pipelines. This is provided to introduce a measured quantity of fuel exactly at the right moment in the cylinders of the diesel engine. The fuel oil must be finely atomized and distributed through out the combustion chamber in a manner so that each particle of fuel mixes with the air in the cylinders.

*DESCRIPTION OF THE FUEL OIL SYSTEM*

The required quantity of the fuel is stored in the tank. Its capacity is 5000 liters in $WDM_2$ locos, 6000 liters in WDG3/WDM3D locos. When the fuel pump motor is started, the fuel booster pump works and a partial vacuum is created in the pump. So the fuel is sucked from the tank through the suction pipe, suction trap and primary filters. The fuel oil reaches the pump and is delivered under certain pressure. This fuel passes through a pressure relief valve which is set at 5.3 Kg/sq. $cm^2$. This valve protects the pump and motor from getting over loaded. The oil is passed through the secondary filter, where the remaining particles of dust and dirt are filtered again.

The filtered oil enters the fuel oil main header to the right side and then, through a flexible cross over pipe at the power takeoff end to the left side fuel main header. Hence the fuel is simultaneously available on the both side fuel headers.

From the fuel oil main headers, the oil is conducted to the fuel injection pumps on both sides i.e., on both the banks of the engine block, through fuel jumper pipes.

The pressure of the fuel oil in the headers is constantly maintained between 3.5 Kg/sq.$cm^2$ and 4.2 Kg/sq. $cm^2$ by fuel pressure-regulating valve. According to the setting of the valve, the pressure will be indicated by the gauge in the Loco pilot's cabin. Fuel oil, that was taken to the injection pumps and is waiting there, is sent under very high pressure (approximately) ranging from (**8000 PSI** to **9000 PSI)** through the high-pressure pipeline. This will be done by the FIP's, which are operated by the center cam, just before the completion of the compression stroke, into the combustion chambers of the engine cylinders. At the time of fuel injection in the cylinders, the oil pressure varies between **3600 PSI** and **4050 PSI**. This is called as "breaking pressure". The breaking pressure for a new nozzle is in between **3800 PSI** and **4050PSI,** and for a reconditioned nozzle it will be between **3600** and **3800 PSI**.

The balance of the fuel oil from the fuel injection nozzles and the injection pumps are taken back through "leak off pipes" and are collected in the common drain gallery inside the engine block. From there, it will be taken to the tank through a return pipe.

**MINIMUM OIL LEVEL BALANCE IN THE TANK**

The fuel is continuously consumed during working. So the level of oil is to be checked. The oil level should not be allowed to go below 900 liters. This is the minimum balance that should always be maintained in the tank. So while taking over charge for working a train, the Loco pilot require the minimum balance of 900 liters + trip ration for working the train + 10% of the trip ration for any emergency. The Loco pilot should ensure this before starting the train.

**COMPONENTS INVOLVED IN THE FUEL OIL SYSTEM**

**a)FUEL OIL TANK**

This is a steel fabricated tank located between the two trucks of the loco. The tank capacity is 5000 liters in WDM 2 and 6000 liters in $WDG_{3A}$. The tank has got oil filling holes, with caps on both sides which are fitted with strainers to prevent foreign particles entering into the tank. Two special type gauges, called glow rod gauge are provided on both sides for reading the fuel oil level. Also both side scales are provided with marking to read exact quantity of fuel oil available. Vent pipes/pipe are provided to maintain air pressure on the top surface of oil, when the pump is working. When the tank is being filled, air will escape out through the vent pipe. The fuel oil tank is under slung. Baffle plates are welded inside the fuel oil tank to avoid turbulence.

**b) FUELTRAP**

This is provided on the right side of the engine blockbetween fuel tank and fuel primary filter. This is a metallic mesh provided to arrest heavy particles in fuel such as paper, cloth etc.

**c) PRIMARY FILTER**

This is provided on the right side of the engine block at the free end. This is provided on the suction side between the fuel trap and the booster pump. Mesh type paper filters are used WDM2 / WDM3A / WDG3 locos.

**d) FUEL BOOSTER PUMP**

This pump is located at the Expressor room. An electrical motor drives this pump. When the pump starts working a partial vacuum is created in the pump and so the fuel oil will be sucked from the tank. The capacity of the fuel pump is 14 liters/min, at **70 PSI** pressure.

**e) PRESSURE RELIEF VALVE**

This valve is provided between the fuel booster pump and the secondary filter. This is located on the delivery side of the booster pump and at the free end of the engine block. This valve is set at **5.3** Kg/sq. $cm^2$. This is provided to protect the pump and motor from over load whenever the secondary filter is choked or due to any blockage in the system. The excess oil pressure will cause opening of the relief valve, due to the backpressure developed. The excess oil is released through a return pipe to the tank.

**f) SECONDARY FILTER**

Secondary filter is provided between the booster pump and the fuel oil main header. This is also located on the right side of the engine block near the free end. Paper type filters are used in this. This will filter very minute particles and floating ingredients in the fuel before going in to the system.

**g) FUEL MAIN HEADER**

This is the portion of the fuel oil system in which the fuel oil is always stored with certain pressure, before being supplied to the fuel injection pumps. The header runs along the engine block there will be two main headers on both sides of the engine block and this will be extending from free end to the power take off end. Both side fuel oil main headers are connected at the power take off end by flexible cross over pipe, which should be well protected by proper wooden cleats so as to prevent contact with the engine block. Otherwise the heat of engine block will cause damage to the flexible cross over pipe, when it comes in contact with the engine block, which may cause fire hazard.

**h) PRESSURE REGULATING VALVE**

This valve is provided for the purpose of maintaining the pressure in the fuel main header constantly. The supply of equal quantity of fuel oil will be ensured to each cylinder. This valve will be set at a pressure between 3.5 Kg/sq.cm and 4.2Kg/sq.cm.This is located on the left side of the engine block at the free end and connected to the left side main header. The gauge in the Loco pilot's cab indicates the pressure setting of this valve.

**i) DRAIN GALLERY**

The drain gallery is a fabricated channel inside the engine block. This is provided for collecting the unused leak off oil from the injectors and the injection pimps. Arrangements are made to carry the leak off oil from these places to this channel through leak off pipes. The collected oil is taken back to the tank through a common pipe.

**j) HIGH PRESSURE PIPE LINE**

These pipelines are provided for carrying the fuel oil from the injection pumps to the injectors. These pipelines are made very strong and sturdy since the pressure of fuel oil flowing will be high (approx from 7000PSI to 9000 PSI) they are able to with stand the high pressure of fuel oil.If any one of the high-pressure pipelines is broken or cracked, the fuel oil under very high pressure will be spilled on the hot engine block and that may cause fire. Therefore, closing the fuel rack should lock the particular fuel injection pump

k) **FUEL INJECTION EQUIPMENTS**

There are 16 fuel injection pumps. These pumps are employed to send the fuel oil into the combustion chamber under high pressure, against the compression pressure and also in order to break the fuel oil into extremely fine particles. These pumps are of constant stroke, lapped, plunger type having adjustable tappet arrangements. The fuel injection pumps are operated by cams of the camshaft through an adjustable cross head in the fuel pump supports. The pressure of the fuel oil is raised to a limit by the FIPs, necessary for the accomplishment of the atomization. The fuel oil is finely distributed in a vaporous form, throughout the combustion chamber at a definite point in the engine cycle within the limited number of degrees of the engine crank shaft rotation. The fuel injection pumps introduce the fuel oil in the diesel engine cylinders accurately, in a measured quantity at the right moment The oil from the FIP's passes through **"Snubber valve"** and high-pressure pipeline before entering the fuel injection nozzles.

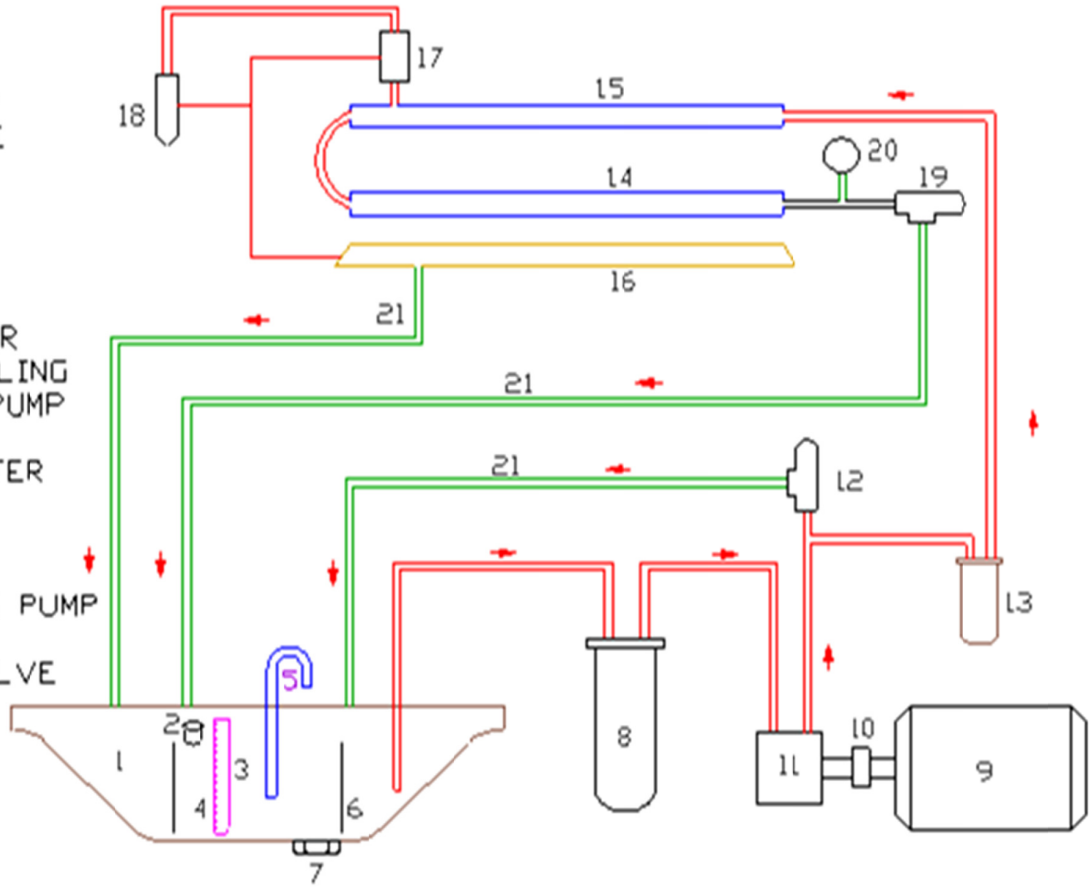
**FUEL INJECTORS**

The metered/measured quantity of fuel oil from the FIPs passes through the snubber valve, which is provided at the beginning of the high-pressure pipeline, to the fuel injectors. Drilled passage in the nozzle holder conducts the fuel oil into the pressure chamber. When the pressure of oil acting on the spring loaded nozzle valve exceeds the spring pressure, the valve is forced off its seat. So the fuel flows through the spray holes until the fuel injection pump ceases to deliver the fuel. Then the flow of fuel is instantaneously cut off, as the spring snaps shut when the pressure drops.

The fuel injectors inject fuel oil at the right moment in the right manner. The nine finely drilled spray holes at the tip of the injector gives the right pattern so as to distribute the oil throughout the combustion chamber.

# FUEL OIL SYSTEM-WDM2

1. FUEL TANK
2. OIL FILLING CAP
3. GLOW ROD GAUGE
4. SCALE
5. VENT PIPE
6. BAFFLE PLATE
7. DRAIN PLUG
8. PRIMARY FILTER
9. FUEL PUMP MOTOR
10. LOVE JOY COUPLING
11. FUEL BOOSTER PUMP
12. RELIEF VALVE
13. SECONDARY FILTER
14. LEFT HEADER
15. RIGHT HEADER
16. DRAIN GALLERY
17. FUEL INJECTION PUMP
18. INJECTOR
19. REGULATING VALVE
20. FOP GAUGE
21. RETURN PIPE



**TROUBLES IN THE FUEL OIL SYSTEM**

**FPM IS WORKING - BUT THE FUEL BOOSTER PUMP IS NOT ORKING:**

| CAUSES | REMEDIES |
|---|---|
| 1.LoveJoy coupling has given up | Check the Allen's screw, secure it. If not possible then inform shed. |
| 2.Coupling joint is too tight on mechanical binding or any foreign particles attached | Check the joint for easy running. Remove the obstruction, if found any. Rotate the pump manually; see if it's tight. |

**FPM AND THE FUEL BOOSTER PUMP ARE WORKING - BUT FUEL OIL PRESSURE IS NOT BUILDING UP WHEN THE FUEL TANK IS FULL**

| CAUSES | REMEDIES |
|---|---|
| 1. Suction pipe is blocked inside the tank. | Feel the pipe hole to find the blockage. Remove it by air blow through. |
| 2. Air drawn in the suction pipe (side), pipe joints, primary filter and gasket joints. | Attend to the portion through which air is being drawn, by bandaging or tightening the joints/ replacing the gasket. Then slacken the delivery side pipe nut, run the motor. Gently tap the delivery pipe the air lock will be now released. If the pump is working with a grunting sound, the air lock is not released. The sound is changed to normal when the air lock is released. Then tighten the delivery side pipe nut |
| 3. Primary filter is dirty or clogged. | Remove the primary filter. The colour will be greyish black. Then throw the filter and put back the container without damaging the gasket. This is called as bypassing the primary filters |
| 4.Relief valve or regulating valve got stuck up or defective | If stuck up, tap the valve gently and watch the pressure gauge, which rises. If the valve is defective or broken, blank the valve by blocking the return pipe passage- screwing down the valve stem and working onwards. |

| | |
|---|---|
| 5.Secondary filter is blocked | Contact shed and take advice. On no account should the filter be bypassed |
| 6.Heavy leakage in the delivery side pipe lines | Arrest the leakage by duly bandaging. You must take care not to allow the oil to be spilled on the hot engine block on no account. |
| 7. Pressure gauge pipe cracked or given up. | Dummy the pipeline or the case may be. |
| 8. Fuel oil pressure gauge is defective. | In this case the performance of the loco will not be affected. So the BAP gauge will guide you during your working. |
| 9. Water contamination fuel oil. | In this case the FOP will not build up. You will have to fail the loco. But before doing it, Collect sample oil from primary filter. Conduct crackling test to ascertain water is mixed with fuel oil. |

**WATER CONTAMINATION IN THE FUEL OIL**

Presence of water in the fuel oil can be found from the primary filter. The filter will become very heavy and the color will be changed to brownish yellow. After seeing, collectsome sample oil and conduct-crackling test.

*CRACKLING TEST*

Take a handful of oil and sprinkle it on the hot plate. Crackling sound will be heard due to water getting vaporized. However water presence must be confirmed correctly by testing in the lab. On line, when the Loco pilot suspects water contamination, he must inform PRC through a message by giving information about this crackling test. The lab in the home shed will test the sample oil collected by the Loco pilot. They will find whether the contamination is with the raw water or chromated water.

**IF THE CONTAMINATION OF THE FUEL IS WITH THE RAW WATER, IT IS DUE TO SOME EXTERNAL SOURCES AS:**

1.Water finding entry into the storage tank due to seepage during rainy season. Inspectors at all fueling points periodically test this.

2.Water may enter into the loco fuel tank in the absence of filling caps during rain or during filling operation in the rain.
3.Deliberate mixing of water by some miscreants.

**IF THE CONTAMINATED WATER IS CHROMATED WATER, THERE ARE TWO POSSIBILITIES FOR INTERNAL CONTAMINATION.**

1. If the fuel injector nozzle sleeve is not expanded properly, chromate water in the cylinder will enter the fuel leak off passage and the fuel tank. To identify the particular cylinder, sample oil has to be collected separately from the individual leak off pipes.

2. When the water jumper joints with the cylinder head is leaking, this water falls down into the FIP cover and is collected at the bottom. When the level rises to be inline with the level of the drain gallery entry, water goes into the gallery and then into the tank.

**NOTE:** When water contaminates, it will cause rusting in the fuel injection equipment, Plunger barrel, nozzles and valves. That is why; fuel oil is tested periodically in the lab. Not more than 0.1% of water is allowed to be present in the fuel oil.

**ABNORMAL SOUND FROM THE ENGINE BLOCK**

Sometimes unusual sounds may be heard from the Engine Block due to defective pump or injector. The sound will be at regular intervals. Thick black smoke will also be coming through the exhaust. Locking of defective pump is the remedy. One must lock the pumps one by one. When the sound is stopped after locking a particular pump, it can be assumed to be the defective one.

Locking can also be done on other occasions:

a. Whenever a high-pressure pipeline is cracked.
b. Whenever a particular pipeline is running hot.
c. When one injection nozzle tip is cracked or the valve is stucked.

**WHITE SMOKE THROUGH EXHAUST**

When the turbo casing is cracked and the cooling water coming to the turbine side is expelled in the form of vapour. This may give the appearance as white smoke. If there is water contamination in fuel oil white smoke will be emitted through engine exhaust.

**GREENISH BLUE SMOKE THROUGH EXHAUST**

This indicates the lubricating oil is burning in the combustion chamber and is also escaping through the chimney.

1.Sometimes when the piston rings are weak or fluttered, the lube oil from the cylinder can find its path into the combustion chamber, burn and escape through the chimney.

2.When the valve guide is worn out, the lube oil from the cylinder head can enter into the combustion chamber.

In both the cases, the exhaust gases will be greenish blue in colour.

**THICK BLACK SMOKE THROUGH THE ENGINE EXHAUST**

| CAUSES | REMEDIES |
|---|---|
| 1. Injection nozzle spray holes enlarged. | Make an entry in the repair book for attention in the shed. |
| 2. Insufficient booster air pressure. | Check the air intake system and find the reason for drop in BAP. |
| 3. Due to very fast advancing of throttle handle. | Ease the throttle or advance notch by notch. There must be a pause at every stage. |

**NOTE:** Locking of fuel injection pumps can be done only one pump on each side and two pumps in total.

**LUBE OIL CONTAMINATION IN THE FUEL OIL**

Whenever the fuel injector 'o' rings, which seals the entry of lube oil from the valve assembly, are worn out, the lube oil goes to the leak off channel and then into the tank to mix with the fuel oil. When the lube oil mixed with the fuel oil is burning in the combustion chamber, during working of the engine the engine temperature will go abnormally high and continuous Hot Engine Alarm will be experienced.

So when the exhaust through chimney is blue or green or both, it will be the first symptom or signal for "LUBE OIL THROW". Oil levels in the sump have to be checked very frequently.

**FLUCTUATION OF FUEL OIL PRESSUER GAUGE NEEDLE**

The term "fluctuation" means when you are working in higher notches - the FOP will drop and whenever you are easing the throttle the FOP will rise. This is caused by a defect in the pump.

There is a rubber seal on the coupling side of the pump, this if damaged will contribute to the FOP drop when there is a greater demand by the engine when working on full load condition. When you experience Fluctuation on run, you must check on the coupling side of the fuel pump. You will find oil around the seal. If the seal is damaged the oil will be dripping. If there had been trouble at the start itself, while switching ON, the building up of FOP will be sluggish. On run if the FOP fluctuates heavily the Loco pilot can work if there is a favorable section ahead by managing the trouble by frequently easing the throttle. But if the section ahead is very shift and a lengthy

gradient, the Loco pilot may not be in a position to manage. So immediately contact shed and seeks proper notice. The Loco pilot must act, using the discretion. Otherwise it may lead to mid-section failure.

## LUBE OIL SYSTEM

*PURPOSE OF LUBRICATION*

1. To reduce the friction and enable smooth operation between two moving surfaces.
2. To reduce wear and tear.
3. To reduce the temperature developed due to friction.
4. To clean and wash away the metal particles caused by wear and tear from the bearing surfaces

**DESCRIPTION OF LUB OIL SYSTEM**

In Diesel loco lubricating oil is stored in the sump located at the bottom of the crankcase. The capacity of the sump is 910 litersin WDM2 and 1260 liters in WDG3A.

The lube oil pump is mounted at the free end of the engine and is driven by the main crankshaft through gears. When the engine starts working the lube oil pump also works. It draws the oil from the sump and delivers it to the lube oil filter, which is located at radiator room. A pressure relief valve is provided in between pump and filter to release the excess pressure and control the discharge pressure at **7.5 Kg/cm$^2$** in order to protect the pump.

From the filter, the oil next flows through lube oil cooler where cooling water cools it. A bye–pass valve is fitted between inlet and outlet of the filter. This valve bye passes the lube oil when the difference in pressure between inlet and outlet of filter exceeds **1.4 Kg/cm$^2$**. It also bye-pass the lube oil during cold start.

**Note**: In some locos the by pass valve is not provided. In its place a pre lubrication pump driven by motor is provided which will work with battery supply before cranking.

The outlet of the lube oil cooler is connected to lube oil strainer. Before the strainer two connections are taken. One connection is for regulating valve, which is set at **4.2 Kg/cm$^2$**. Second connection is to Turbo super charger for lubrication of rotor bearings. The oil then returns to sump.

The oil filtered in the strainer is then enters into the lube oil main header inside the engine block. Three branch pipes are taking off at a point after the strainer.

i. One pipe for lube oil pressure gauge and OPS available in the cabin.

ii second pipe to left side auxiliary header.

iii third pipe to right side auxiliary header.

From Left auxiliary header two more pipe connections are taken to supply lube oil to **Vibration Damper** and **left side camshaft bearing**. From Right auxiliary header one branch pipe is taken off and is given to **right side camshaft bearing /OSTA** for lubrication.

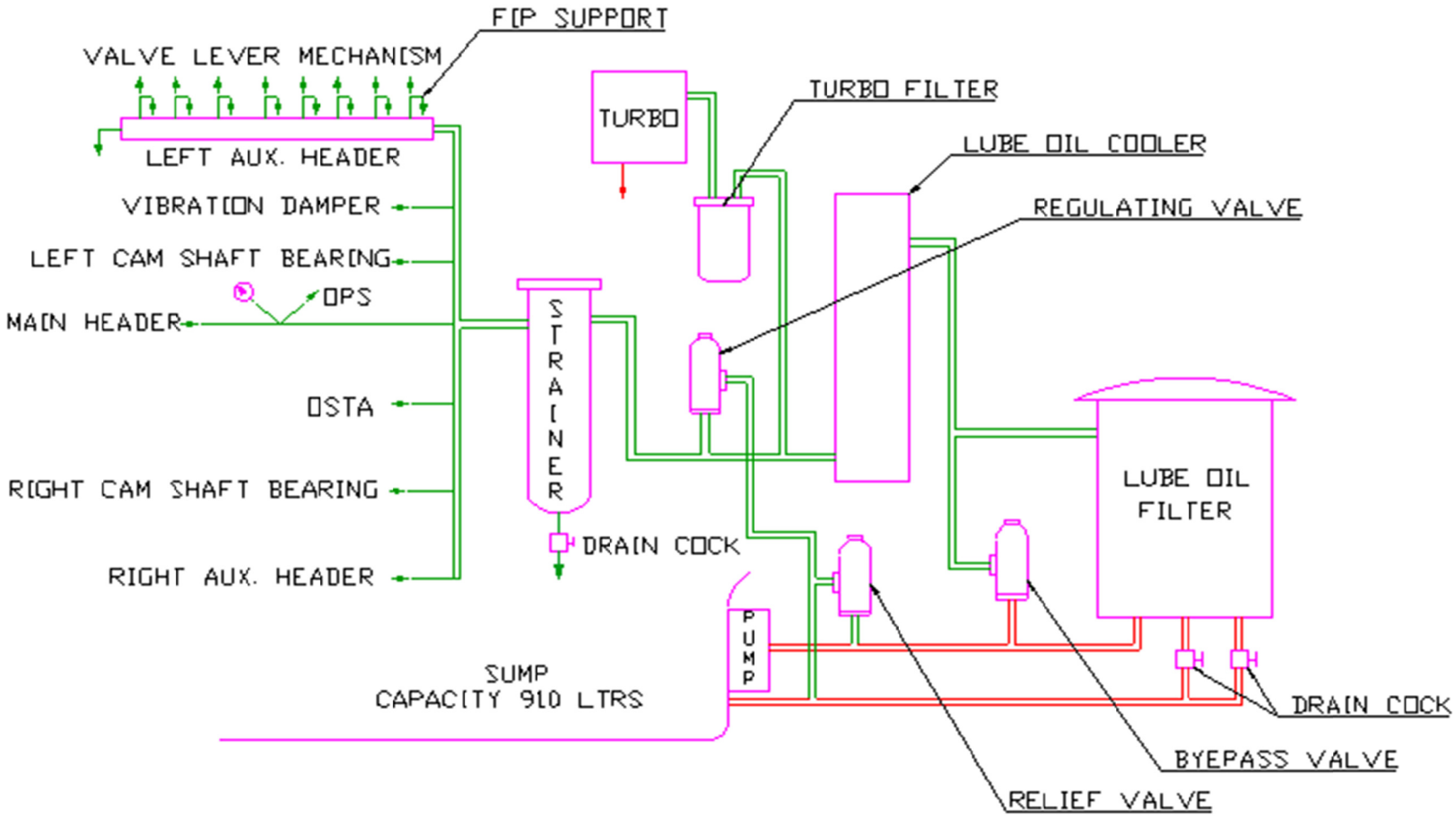
From Left/Right auxiliary headers for each cylinder two-branch pipes are taken to lubricate valve lever mechanism and FIP support. At the end of both auxiliary headers connection is given to cam gears for lubrication (Spray nozzle)

**LUBRICATION TO MAIN BEARINGS**:

The lube oil from the 'Main Header' is taken to the Crankshaft main bearing (9 Nos) through individual pipes called **'S'** pipes. After lubricating the main bearings, through drilled passage inside the crankshaft the oil reaches the crank pins and big end bearings. From there through '**RIFLE DRILLED** ' holes in the connecting rod, the oil goes to the piston pin and then goes to the piston crown through the internal holes available in piston called ' Cooling Grooves'. On circulating inside the piston crown the lube oil cools the piston crown since they are exposed to very high heat during combustion.

After cooling the piston crown, the oil drops down. The rotating crankshaft and connecting rod big end splash the oil all over the cylinder liners. Thus the inner surface of the cylinder liners is lubricated and the carbon deposits are washed. The oil control rings evenly spread the splashed oil and then oil scrapper rings during down ward movement of piston scrap oil down. Certain quantity of lube oil is always retained in "**HONEY COMB HOLES**" of cylinder liner for better lubrication. The lube oil falls on base screen is then goes to the sump. The lube oil filter, and strainer are connected to sump by vent pipes so as to carry the Vapour into the sump.

# LUBE OIL SYSTEM-WDM2



## MAJOR COMPONENTS OF LUBE OIL SYSTEM

### 1. LUBE OIL PUMP

This is located at free end of engine slightly towards the right. Supply of oil in, adequate quantities and at the desired pressure is vitally depending upon the pump. A gear driven type pump has been provided. The gear pump is mounted on the free end of the engine base and is driven by the crankshaft gear. The suction line is in built into the engine base and the discharge is into the external piping.

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