ORGANISATION OF INDIAN RAILWAYS

1.Indian Railways : Nation's Life Line:

Indian Railways have continuously influenced the social, economic, cultural and political life of the life of the people. Some of the important aspects of this influence are: increased mobility of the common man, bringing together people from all castes, communities and religions, growth of trade and commerce, development, rural development, help in spread of education, contribution to national exchequer, influence on literature, poetry, music, films etc. Thus, Railways have become Nation's life line.

2.The Biggest Organization:

Indian Railways are the biggest organization in out country with 14.71 lakhs of employees; 63,122 route kilometers traversing from Okha to Murkon Selek and Udhampur to Kanyakumari; 6,906 Railway station; a feet of 7,681 locomotives, 44,756 passengers and other coaches, 2,14,760 goods wagons; carrying 4,971 million originating passenger traffic and 542.7 million metric tones of originating goods traffic. It has a total investment of 77,915.78 crore rupees.

History of Railway: The first Railway in India was opened in 1853 from Bombay to Thane by great Indian Peninsular (GIP) Railway. The maiden trip of the first train took place on 16th April 1853 when it traversed a 21 Mile stretch between Bombay and Thane in about 4 hours time . Starting from this humble beginning, the Indian Railway system have grown up today into a giant network all over India.

The executive authority in connection with the Administration of the Railways vests with Central Government and the same has been delegated to the Railway Board as per the Indian Railway Act.

Corporate Mission : Indain Raiway's mission to make the Indian Railways a model system with sufficient capacity to met the country's transportation needs for both passenger and freight traffic based on an optimal inter model mix and to the society, while maintaining financial viability of the system.

Ministry of Railway (Railway Board): The responsibility of the administration and management of the Indian Railways rests with the Railway Board under the overall supervision of the Minister of Railways who is a Minister of Cabinet rank and is associated in this work by one or more Ministers who are of the status of Minister of State or Deputy Minister. The Rly.Bd is the Chief Administrative and Executive body assisting the Minister of Railways in the discharge of his functions. It was constituted by a resolution of Government of India dated 18th February 1905. It exercises the power of the Central Govt. in respect of regulation construction, maintenance and operation of the Railways.

Railway Board: Railway Board is the apex executive body which administers, directs and supervises the functioning of the Railway system. The Board functions under the Minister for Railways and is headed by the Chairman, who is equivalent to Principal Secretary to Government of India. The other member are:

1.Financial Commissioner
2.Member staff
3.Member Traffic
4.Member Mechanical
5.Member Engineering
6.Member Electrical

The Board has several directorates. Major directorates are handed by an Advisor. Health Services and RPF directorates have Director Generals. They are assisted by Executive Directors, Directors, Joint Directors etc.

Zonal Railways:

The Indian Railways were divided into 16 zones.

No.	Name of the Railway	Formed on	H.Q	Route Kms
1	Southern	14.04.1951	Chinni	5,231
2	Central	05.11.1951	Mumbai CST	3,766
3	Western	05.11.1951	Mumbai CG	6,559
4	Eastern	14.04.1952	Calcutta	2,383
5	Nothern	14.04.1952	New Delhi	3,398
6	North Eastern	14.04.1952	Gorakpur	3,398
7	North Eastern Frontier	01.08.1955	Calcutta	2,432
8	South Central	15.01.1958	Maligaon	3,951
9	North Western	02.10.1966	Secundrabad	5,753
10	East Coast	01.10.2002	Jaipur	5,453
11	South Western	01.10.2005	Hajipur	3,495
12	East Coast	01.04.2003	Bhuvaneswar	2,513
13	South Western	01.04.2003	Hubli	3,074
14	West Central	01.04.2003	Jabalpur	2,909
15	North Central	01.04.2003	Allahabad	3,101
16	South East Central	01.04.2003	Bilaspur	2,397

Each zones Railway is controlled by a General Manager. The General Manager is assisted by Principal HOD (Grade 22,000-525-24,500) namely: Addl. G.M, Sr.Dy.GM, Financial Advisor & Chief Accounts Officer, Chief Engineer. Chief Machnical Engineer, Chief Operating Manager, Chief Commercial Manager, Chief Electrical Engineer, Chief signal & Telecommunication Engineer, Controller of Stores, Chief personnel Officer, Chief medical Officer, Chief Security Commissioner.

Divisional Organization:

Each zonal Railway is further divided into Divisions headed by a Divisional Railway Manager who is assisted by ADRM (18,400-500-22,400) and Divisional Officers (14,300-400-18,300, 12000-375-16,500) namely : Sr. Divisional Engineer, Sr. Divisional Mechanical Engineer, Sr. Divisional Operating Superintendent, Sr. Divisional Commercial Super indent, Sr. Divisional Personnel Officer, Sr. Divisional Controller of Stores.

Reorganized Zonal Railway with their Divisions:

Western Railway : Mumbai central, Baroda*, Ratlam*, Rajkot*, Bhavnager, Ahamadabad**.

Central Railway : Mumbai CST*, Bhusaval, Nagper, Solapur*, Pune

Eastern Railway: Howrah, Sealdah, Asansol, Malda

Northern Railway: Delhi*, Moradabad, Firozpur, Lucknow, Ambala

North Eastern Railway : Izatnager*, Locknow, Varanasi

North Eat Frontier Railway : Katihar, Alipurduar*, Lumbding, Tinusukia, Rangiya

Southern Railway: Chennai, Palghat, Madurai, Trichi, Trivendrum.

South Eastern Railway: Kharagpur, Adra*, Chakradharpur*, Ranchi

South Central Railway: Secundrabad, Hyderabad*, Vijaiwada*, Guntakal*Guntur**, Nanded

East Coast Railway: Bhubaneswar, Kurdharoad, Waltair, Sambalpur

South Western Railway: Hubli, Bangalore, Mysore

West Central Railway: Jabalpur, Bhopal, Kota*

North Central Railway: Allahbad*, Jhansi*, Agra*

South East Central Railway: Nagpur, Bilaspur, Raipur**.

North Western Railway: Jodhpur, Bikanager, Jaipur, Ajmer.

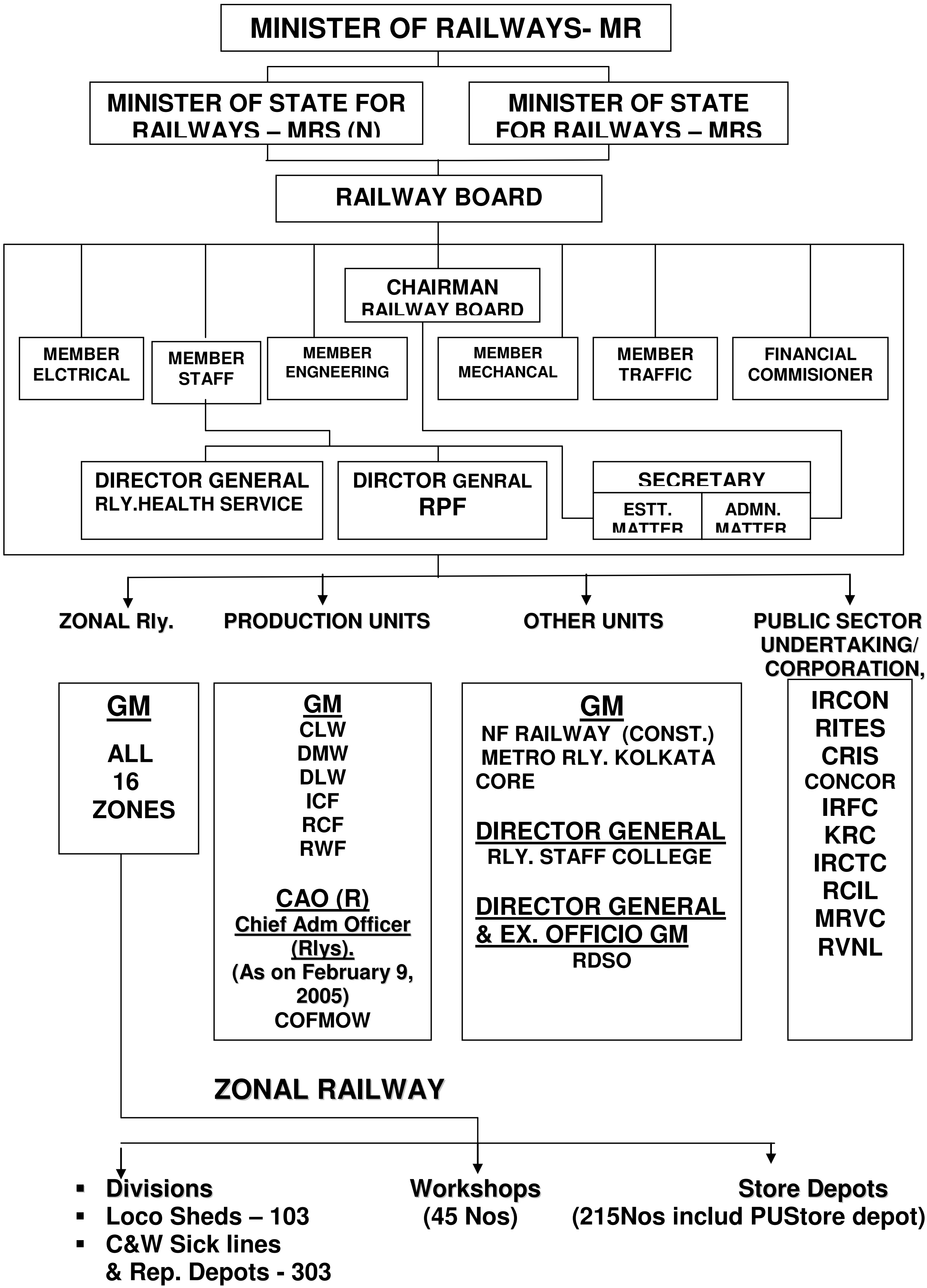
East Central Railway: Sonepur, Samstipur, Danapur, Mugalsarai, Dhanbad.

* Reorganized divisions and ** Newly created divisions.

Total No of Divisions = 59+8= 67

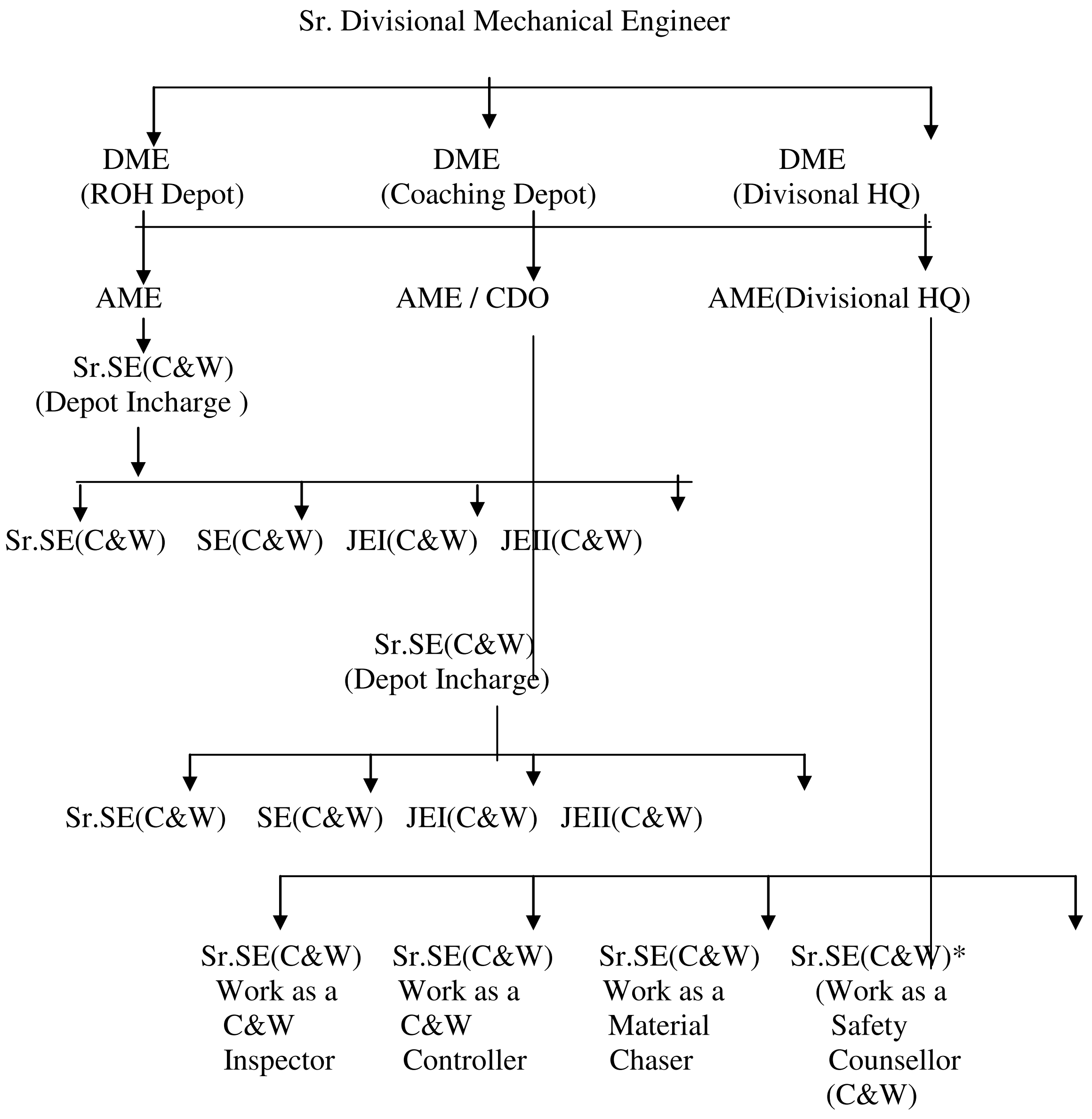
[Above noted zones recognized and created under notification No. 97/E&R/700/1/Notification, dated 04.07.2002 and divisions reorganized and new divisions created under Notification No. 98/E&R/700/1/Notification dated 04.07.2002]

ORGANISATION STRUCTURE



ORGANISATIONAL SET UP OF C&W DEPARTMENT

Organisational set up of Mechanical officers and Supervisors of C&W wing in a Division



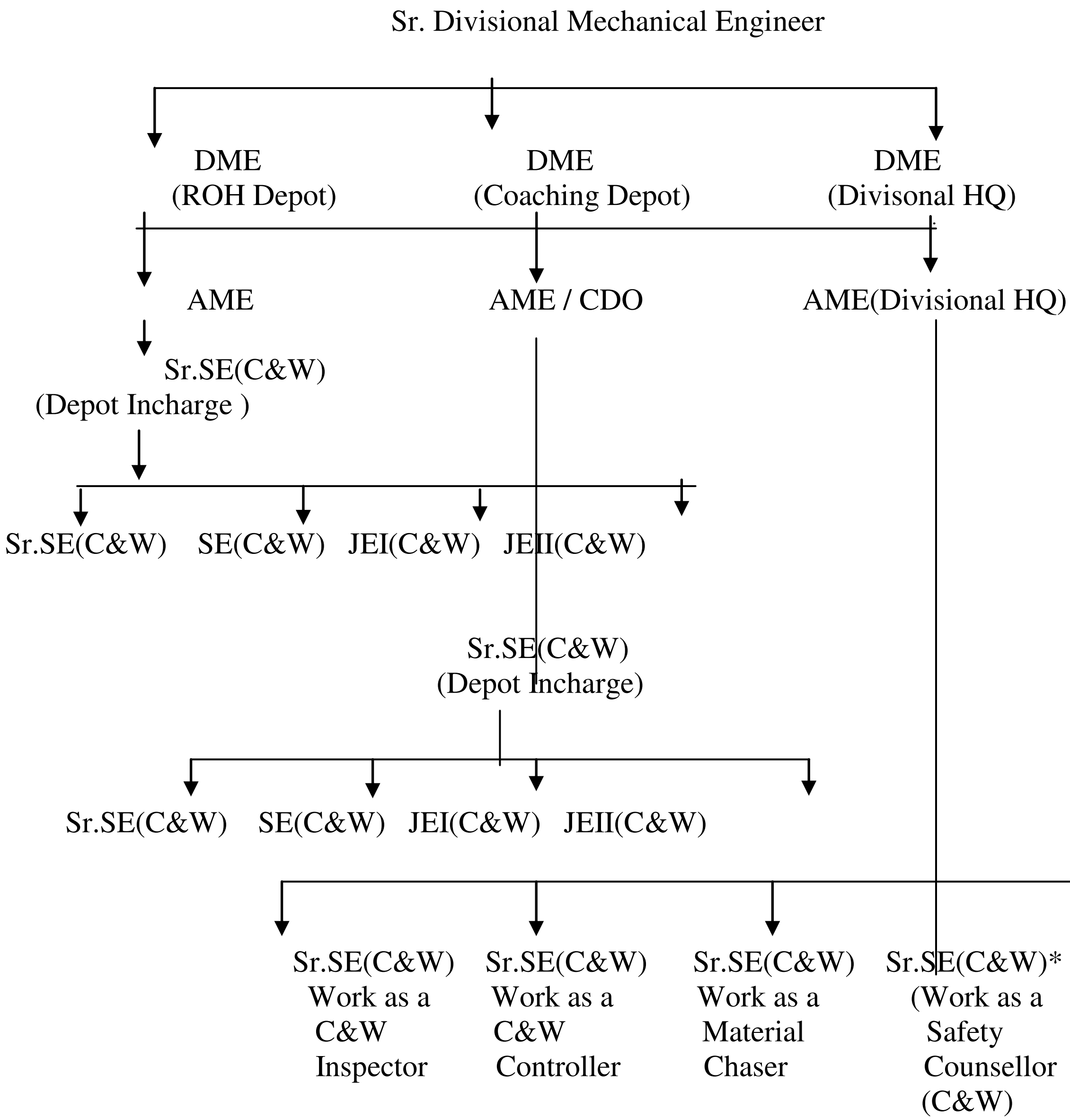
- This SSE (C&W) is under the administrative control of the Divisional Safety Officers, but is responsible to DME (C&W) for all technical matters concerned with the safety of Rolling stocks.

Important general information for maintenance in open line Depot

- C&W organisation set-up in a Division.
- Codification and Numbering of Coaches.
- Ineffective percentage.
- Yard Stick.
- Nomination of a Depot.
- Concept of a Block Rakes.
- Indication and Destination Boards.
- Fire Extinguishers.
- Brake Van Equipment.
- Integrated Maintenance.
- Rake link
- Working Timetable.

ORGANISATIONAL SET UP OF C&W DEPARTMENT

Organisational set up of Mechanical officers and Supervisors of C&W wing in a Division



- This SSE (C&W) is under the administrative control of the Divisional Safety Officers, but is responsible to DME (C&W) for all technical matters concerned with the safety of Rolling stocks.

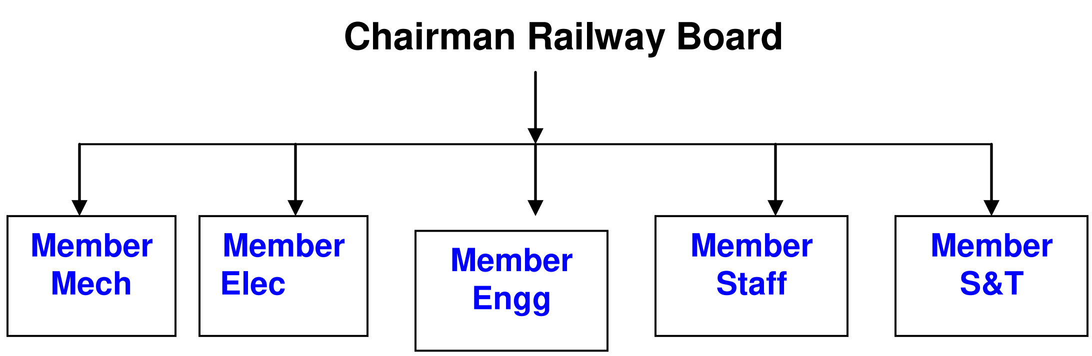
Railway Organisation for its effective control in working of trains, has an organizational setup at different levels. It can be classified into various levels as;

- Railway Board Level

- Zonal Level
- Divisional Level
- Depot level.

Sl No	Name of the Railway	Head Quarters
1	Central Railway	Mumbai
2.	Eastern Railway	Kolkota
3.	Northern Railway	New Delhi
4.	North Eastern Railway	Ghorakpur
5.	North Frontier Railway	Maligon
6.	Southern Railway	Chennai
7.	South Eastern Railway	Kolkota
8.	Western Railway	Mumbai
9.	South Central Railway	Secundrabad
10.	East Central Railway	Hajipur
11.	North Western Railway	Jaipur
12.	East Coast Railway	Bhuvaneshwar
13.	North Central Railway	Allahabad
14.	South East Central Railway	Bilaspur
15.	South Western Railway	Hubli
16.	West Central Railway	Jabalpur

2. The organizational set up at the Railway Board level is as follows;



The Security and Medical department are under a separate directorate.

To have better control over the entire Indian Railways, it is divided into zones as follows;
Further each zone has the Organisational set up as;

General Manager

Addl General Manager

CME COM CCM CPO CSO CSC CE CEE CSTE

CRSE - Chief Rolling Stock Engineer
CMPE - Chief Motive Power Engineer
CWE - Chief Workshop Engineer

The Mechanical Department is divided based on the activities as ;

- **Carriage & Wagon**
- **Locomotive (Running)**
- **Workshops**

C & W Organisation functions under the control of CME of the Zonal Railway assisted by CRSE for open line –C&W functions and CWE for Workshops – Maintenance repair of Carriage & Wagons

Functions of C & W Organisation:

i) To maintain the coaches and wagons in good fettle
ii) Ensuring availability of coaches and wagons as and when required by the traffic department.
iii) Undertaking the different repairs that can
iv) Planning for the future requirements in terms of rolling stocks, infrastructure, manpower etc.

The zones are further divided into divisions.
The total number of divisions in Indian Railways is 67 in number.

The organizational set up in the Division is as follows;

Divisional Railway Manager

Addl Divisional Railway Manager

SrDCM Sr.DOM SrDME DPO DSO DSC Sr.DEN DEE DSTE

ADME (Coaching) ADME (Wagons) ADME (Running)

Each division will have one or more Carriage & Wagon depots depending on the holding of rolling stock. The Carriage & Wagon depots are classified as;

- Super Mega depot (1000 coaches and above) headed by Sr.CDO, DME, ADME, ADEE and ACOS.
- Mega depot (500 to 1000 coaches) headed by CDO, ADME, ADEE.
- Medium depot (250 to 500 coaches) headed by ADME

In any Major Carriage & Wagon Depot, the typical organizational set up is as follows;

Depot In-charge
(Sr.DME/DME/ ADME)

↓

ADME

↓

SSE
SE
JE I
JE II
Sr Technician
Technician Gr I
Technician Gr II
Technician Gr III
Helper I
Helper II

The major areas of work involved in a depot are divided into smaller areas and a Supervisor will head each. Based on the size of the depot and availability of supervisors, the rank may vary from place to place. For Example;

SSE – *Co-ordination*
SSE – *Stores*
SSE* – *Maintenance
SSE - *ART*
SSE – *IOH, sick line and so on.*

Activities of Coaching Depot:

i. Maintenance of Coaches:

There are different types of maintenance like primary, secondary and turn round. The depot to which the rake has been allotted is termed as primary maintenance depot where the trains are examined and certified fit in all respects. In secondary maintenance, at the terminal station the trains are checked and certified fit for its return trip and in turnaround maintenance, the necessary attention will be given at the platform itself.

ii. Repairs to the defective coaches:

During service, due to wear and tear, varying load conditions and so many other factors, defects are likely to arise in a coach. Whenever a coach is diagnosed with a defect, it needs to be repaired so that the coach is made fit for traffic use. For this purpose, a sick line with sufficient infrastructure will be provided..

iii. Reception and dispatch of Trains:

The trains which have been maintained and kept ready for movement needs to be dispatched and trains, which are reaching the terminating, stations needs to be received for further work. All these activities will be undertaken in the platform.

iv. Stores:

For supplying all the spares, consumables and other items needed to maintain the rakes, a Stores with all the requisite materials are always kept ready for disposal.. As and when materials are required, they are drawn from the stores and the material is charged against that activity. As and when, the material has come to the minimum level; the stores personnel again recoup the same. The depot also has various Machineries and Plants required to undertake the different repairs in

the coaches. Periodical maintenance, repairs and replacement of these are taken care of by the stores department.

I. IOH:

Coaches which are covering more than 1.25 lakh kms in 6 ½ months must undergo Intermediate overhaul in the nominated depots which involves work like running out the bogies, overhauling all the components in the bogie, buffers, screw couplings, repairs to the interior components, overhauling and testing of the brake system, wheel reprofiling etc.

vi. ART – Accident Relief Train:

In case of any accident for faster and quicker restoration work Accident relief trains are situated at various locations in each Railway. An ART may comprise of Medical Relief Van, MFD and Crane. Depending upon the seriousness of the accident and the assistance required any of the 3 could be pressed into service. A Senior supervisor assisted by many supervisors and staffs are always kept in readiness to rise to the occasion.

vii. Data Base Management:

In every depot the data pertaining to the Coaches of their holding will be maintained. For this purpose, a history card is being maintained for each and every coach which gives the complete history of the trains in which the coach has run, when and for what reason a coach was marked sick and the different repairs which has been undertaken on the coach. The other maintenance requirements such as coaches due for different schedules, rake disturbance in enroute and at the destinations, coaches marked sick within 100 days of POH can be obtained for investigation purposes.

The different documents to be maintained in a depot are;

Register	Details
RS 1	Repairs carried out on a rolling stock
RS 2	Oiling Register
RS 3	Repacking register
RS 4	Vacuum testing and repair register
RS 5	Incoming driver's report on brake power
RS 6	Brake power Certificate
RS 7	TXRs' Dairy
RS 8	Hot Box register
RS 9	Wheel Transaction register
RS 10	POH register
RS 11	Repairs carried out on the interior components
RS 12	Leaky Wagon Register
RS 13	Fire Extinguisher Maintenance
RS 14	Passenger Emergency Tool Box
RS 15	TXRs' Hand Book
RS 16	Sick Memo
RS 17	Fit Memo
RS 18	Deficiencies in Rolling stock
RS 56	DRS Card
RS 66	Sick Label

Activities of Wagon Depot:

The different activities undertaken in a Wagon depot are;

- **Reception and dispatch of wagon stock**
- **Repairs to the sick Wagons**
- **Routine overhaul of wagons (ROH)**
- **Special repairs and modifications as prescribed by each railway.**
- **Analysis of sick stock**
- **Enroute detentions**

Reception and dispatch of wagon stock:

As per the traffic requirements, the empty wagons will be formed into a formation and offered to the train examiner for certification. After checking each and every wagon for all the components for their correct functioning and ensuring sufficient brake power, the train examiner issues the brake power certificate to dispatch the train from the yard to the loading point.

Repairs to the sick wagons:

During the course of checking of wagons, if any such repairs are found which cannot be attended in the yard, the wagon would be marked sick and sent to sick line for necessary attention. Wagons will be attended in the sick line for the defects and certified fit for use. For this, sufficient facilities and infrastructure would be made available in the wagon depots to undertake all kinds of repairs.

Routine Over Haul (ROH);

The periodicity of POH of wagons are long and it varies from one type of wagon to another. The wagons undergo routine over haul over a period of time at the nominated depots, where the wagons will be lifted, bogies are run out and all the necessary repairs in the running gear, brake gear, draw and buffing gear are attended to. The wagons undergo ROH over a fixed interval of time.

Special Repairs and modifications:

Special repairs and modifications if any, as per the railway requirements would also be undertaken in the depots as and when the need arises. This could be undertaken as per the CME's orders for their local requirements also.

Analysis of sick wagons:

Wagons, which are sick marked, are analyzed and necessary action is taken to improve the quality of work. Whatever modifications are necessary, are advised through the depot in charge to the divisional head and to head quarters also.

Enroute detention:

Wagons, which are sick marked in enroute due to mechanical defects, are attended to. For this purpose, a group of staff with necessary tools and spares will reach the place where the wagons are detained by the first available means and necessary attention is given so that the wagon can continue its course of journey to its destination. If for some reason, the defect is such that, it cannot be attended then the wagon would be moved to the nearest wagon depot with restricted speed along with accompanying staff and there after the wagon is repaired and made fit for traffic use.

Railway Workshops:

The purpose of having Railway workshops in each railway is to undertake the Periodical Over Haul (POH) of Rolling stocks both coaches and wagons and also overhauling of locomotives. Based on the work carried out, each workshop is given with a code for its identification.

Each division has its nominated workshop whichever is near by who is going to undertake the POH repairs. The POH arisings are given by each division to the workshop, which is catering to their requirements. Based on this, the individual workshop plans for the various activities it should under take. They also carry out different modifications, retro fitments which are given from time to time.

The planning activities must be so good, that the POH cycle time should not get affected by more/less arisings and also the division should not starve for want of coaches.

The Workshops also undertake NPOH on rolling stock for those vehicles for which the repair cannot be undertaken in the sick lines of the depots, like rolling stock involved in derailments or accidents.

They also undertake manufacture of certain special type of coaches/wagons and rolling stock components required for them and also for the divisions, which has asked for a specific component.

The stocks, which are POHed in workshop, are checked by Neutral Control Train Examiners and certified fit.

The organizational set up at the workshop could be;

Workshop In-charge
(CWM)
↓
Dy. CME
↓
WM
↓

APO	**AWM**	**APE**
	SSE	
	SE	
	JE I	
	JE II	
	Sr Technician	
	Technician Gr I	
	Technician Gr II	
	Technician Gr III	
	Helper I	
	Helper II	

Historical Development - Passenger Coaches

- First generations coaches
- - Fully from Timber
- - Serious consequences in accidents
- 1948- 50 Hindustan Air Crafts Ldt Banglore
- started Steel bodied coaches
- 1955 ICF Was Set - Collaboration with Swiss Car & Elevator Manufacturing Corporation, Zuric, Switzerland for integral design.
  - Fabricated bogie Coil primary springs
  - Laminated secondary springs
  - Speed potential of 96 km/h

Historical Development - Passenger Coaches

- Length of bolster hanger increased to 410 mm in place of 286 mm
- Secondary suspension modified to Coil springs
- Side bearers to transfer body weight in place of centre pivot
- 16t bogie for AC coaches
- Adoption of Air brakes
- Bogie mounted air brake system
- Composition brake blocks in place of Cast Iron

Historical Development - Passenger Coaches

- RCF set up at Kapurthala to make coaches to ICF design
- Variants developed like:
  - AC self-generating and End-on-generating
  - MG versions
  - 2-tier AC, AC chair cars, 3-tier AC

ICF coach - Speed Upgradation

Speed	Year	Remarks
96	1955	Original design of Schlieren
105	1965	All coil spring, weight transfer through side bearer
120	1969	Improved track standards to C&M 1(Vol 1)
130	1971	Trials - Introduction of Rajdhani
140	1988	Trials - Introduction of Shatabdi

Design Objectives

- Corrosion Control
- Weight Reduction
- Increase in speed potential
- Increased Payload
- Increased train length
- Passenger amenity
- Safety and Maintainability

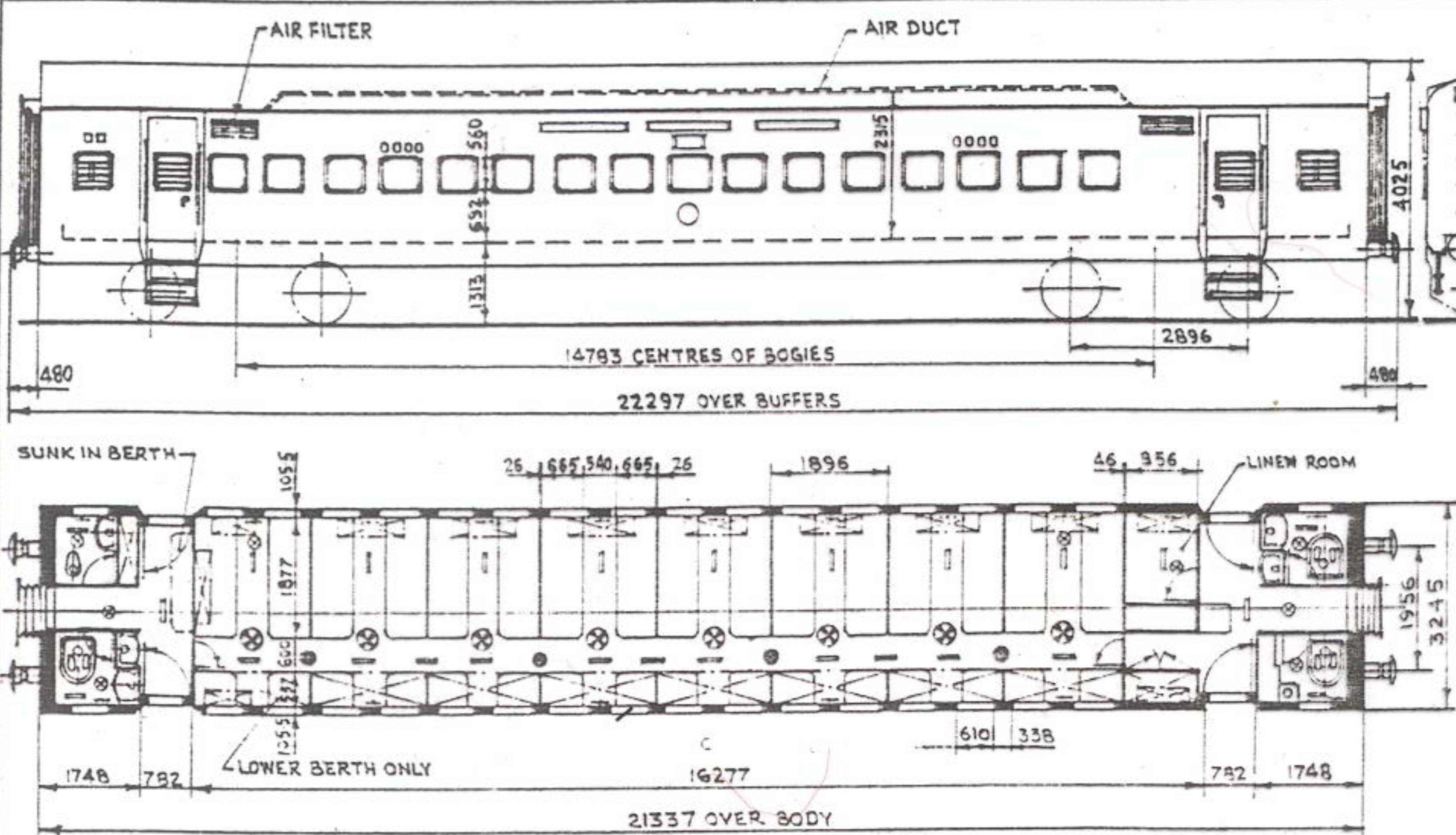
SALIENT FEATURES- ICF COACHES

- **ALL METAL**
- **ALL WELDED**
- **INTEGRAL DESIGN, SKIN STRESSED**
- **LIGHT WEIGHT**
- **ANTI TELESCOPIC**
- **BETTER BOGIE DESIGN**
- **ANTI-TELESCOPIC**
- **REDUCED WHEEL DIA**
- **REDUCED FIRE HAZARD**
- **BETTER INTERIOR**
- **STANDARDISATION**

1. No. OF PASSENGERS TO SEAT — 46
2. No. OF PASSENGERS TO SLEEP — 46
3. No. OF DOORS ASIDE — 2
4. No. OF LAVATORIES — 4
5. No. OF PASSENGERS PER DOOR — 23
6. No. OF PASSENGERS PER LAVATORY — 12

NOTE :-

1. COACH PROFILE & MAX. MOVING DIMENSIONS TO SKETCH-66064.
2. EXTERIOR MARKING TO DRG. No. CSC 970.



APPROVED VIDE RAILWAY BOARD'S LETTER No. 75/M (C) 139/1
DATED 25-5-76 (R.D.S.O. FILE REF. MC/CB/SC/BG, S.No. 714)

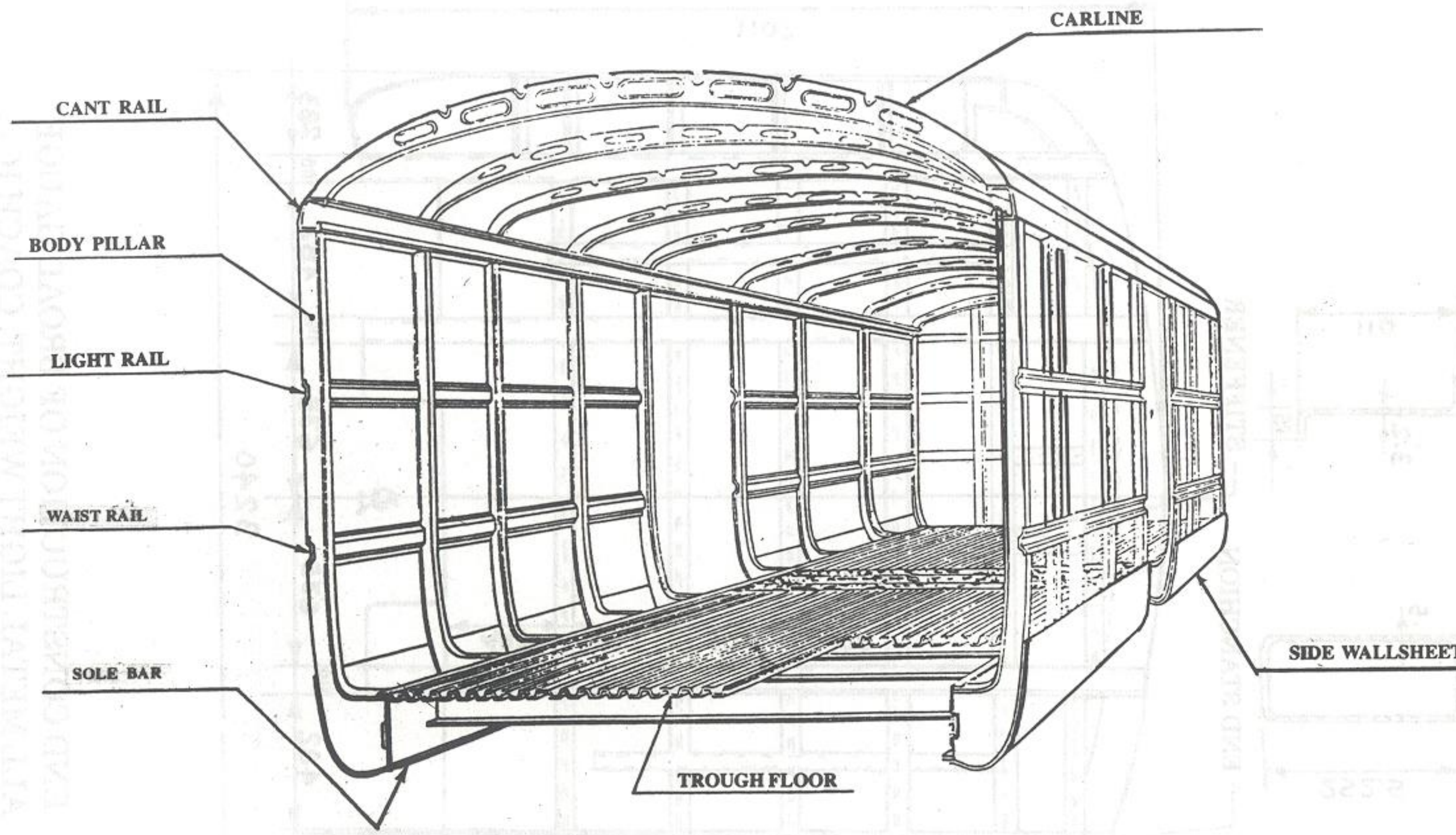
DRAWN BY	SUSHIL	LAYOUT OF SELF GENERATING A/C SLEEPER CAR I.C.F. COACHES	CODE WGACCW	B.G.	CSC 1617
CHECKED BY	[signature]				
APPROVED BY					

Construction of ICF Coach

- Coach
  - Shell - Coach Body
  - Running Gear
    - Bogie
    - Braking
  - Furnishing
  - Train Lighting & Air conditioning

Design & construction

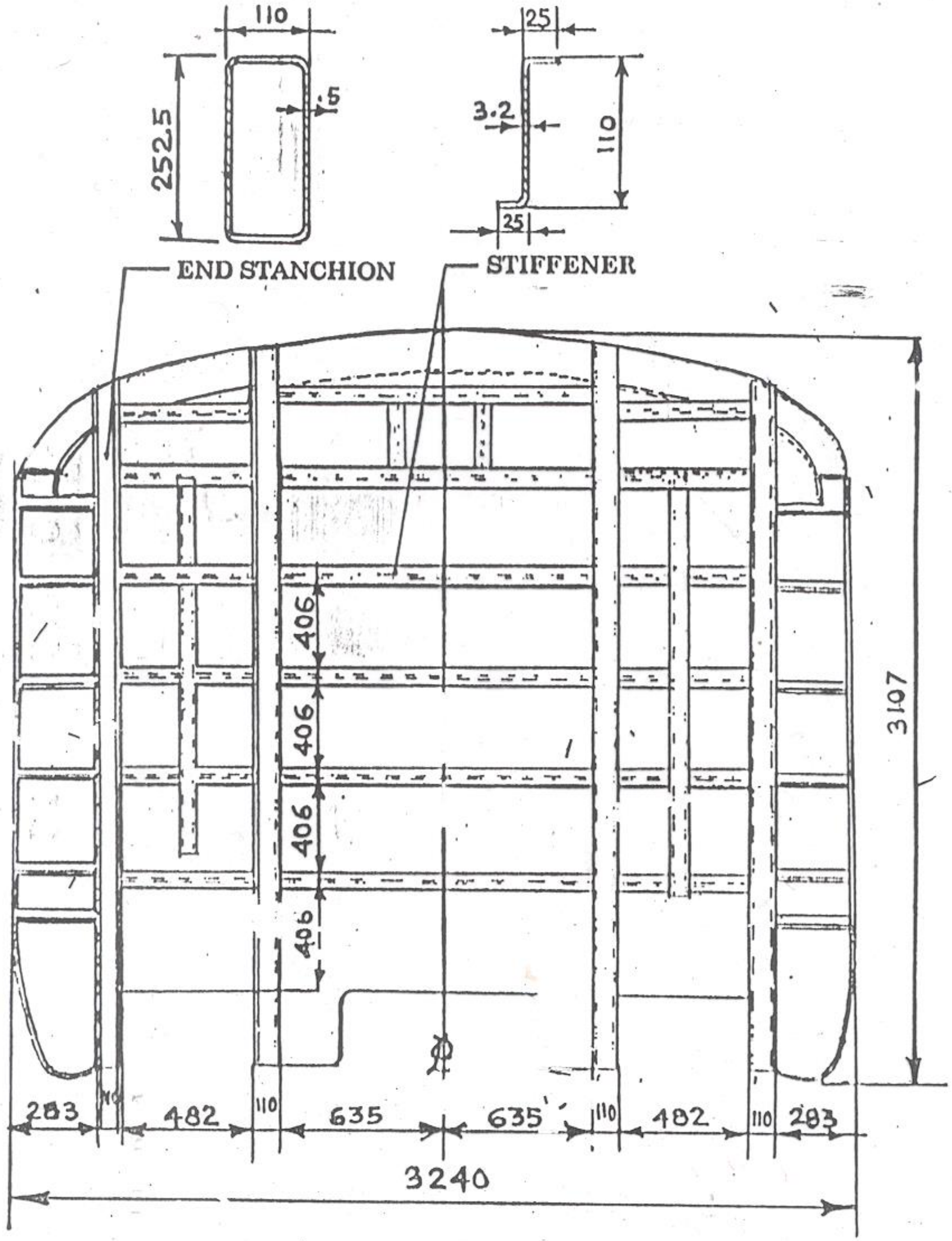
- Static tubes- formed of
- - side wall
- - Under frame
- - Roof - similar to hollow tube
- Bracing to the tube by a series of hoops made of
  - Side Pillars
  - Carlines
  - Floor cross bearers
- Hoop rings are connected together by sole bar, waist rails, cant rail, and stiffeners longitudinally
-



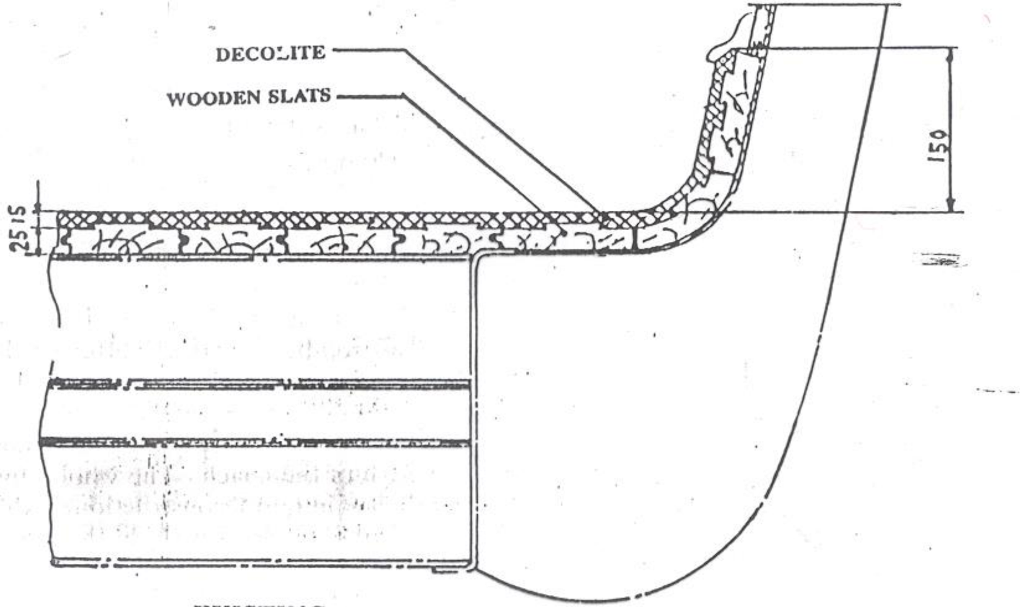
SHELL FOR ICF COACHES
(CROSS SECTIONAL VIEW)

Design & Construction - ICF shell

- Anti telescopic - end wall box structure to absorb major portion of the collision energy
- destructive tubular structure is added between Trough floor and head stock to have a comp. Weaker section.
- Trough floor made of corrugated sheet to absorb a large portion of buffing forces



END CONSTRUCTION OF BROAD GAUGE
ALL METAL LIGHT WEIGHT. COACH ICF.



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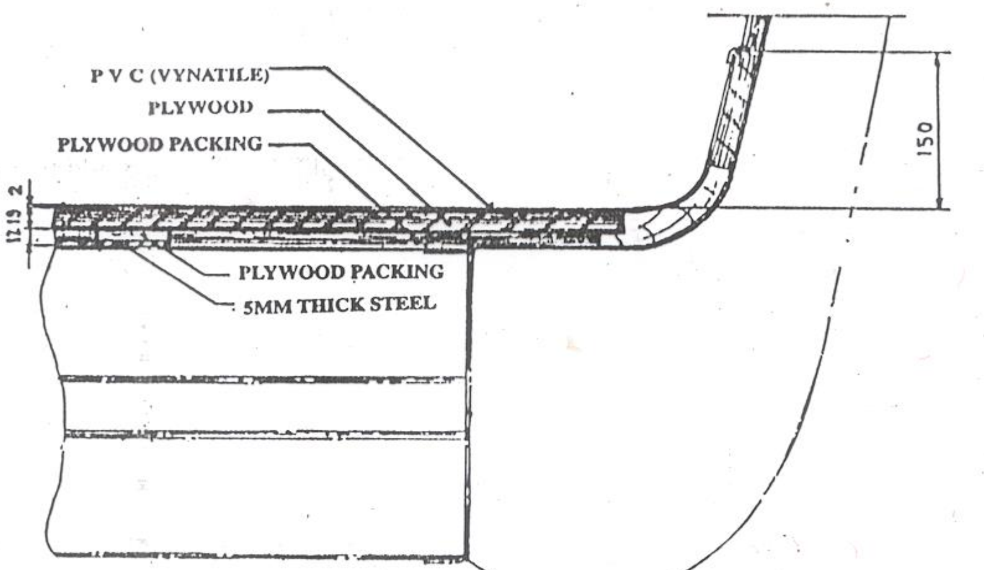


MODIFIED

FLOORING WITH PVC SHEET ON PLYWOOD

BASIC ASSUMPTIONS OF INTEGRAL SHELL

TARE & PAY LOAD ARE EQUQLLY DISTRIBUTED OVER THE BODY SHELL

WEIGHT OF THE SHELL IS DISTRIBUTED OVER THE ENTIRE PHERIPHERY OF THE SHELL

WT OF THE EXTRA FLOORING & PAYLOAD IS CARRIED BY THE FLOOR & LOWER PORTION OF THE SIDE WALL

HORIZONTAL SQUEEZ LOAD AT THE BUFFER CENTRE LINE TAKEN BY THE TROUGH FLOOR & SIDE LONGTUDINAL

SHELL TREATED AS **THIN WALLED HOLLOW GIRDER.**

Advantages of Integral Design

- Ability to withstand higher dynamic force, hence greater safety in an accident
- Weight 20 % less than ordinary steel shell & 25 % less than timber coach, hence less operating cost
- Superior Resistance against torsion & Bending stress
- Extra-ordinary compression rigidity
- less fire hazard
- more amenable to mass production

Design Characteristics- coach Body

- Adequate resistance to Horizontal Shearing forces – Connection between SW & UF
- End Wall to Absorbs to collision energy before any other part of coach body are deformed.
- No resonance Under all loading conditions -

INTERNATIONAL STANDARD FOR LOADS FOR COACHES UIC - 566

- The coach body load should with stand the following test loads without permanent deformation and without exceeding the permitted stress:
- **A - STATIC COMPRESSIVE LOEDS**

At buffer level	200 t
Diagonally at buffer level	50 t
At 350 mm above buffer level	40 t
At centre Rail	30 t
At cant rail	30 t

INTERNATIONAL STANDARD FOR LOADS FOR COACHES

- B. uniformly distributed load

- P =k (P1 + P2)
- where k = 1.3 (a coefficient of Dynamic augment)
- P1 = wt of body in tare condition
- P2 = 2 X no of seats x 80 kg

Crashworthiness

Crashworthiness of rail coach body is its characteristic to absorb the collision energy in controlled and predictable manner such that maximum safety is imparted to traveling passengers

Crashworthiness- ICF SHELL

- Anti-telescopic shell of Schileren design
- Energy absorption capacity of 10 kJ per side buffer
- Squeeze load up to 102t at each side-buffer level
- Vertical load of 2.165t per meter run, uniformly distributed
- Squeeze load of 60t at height of 305 mm above buffer center line
- Horizontal load of 31t uniformly distributed over entire over end wall

Crashworthiness- ICF SHELL

At reaction of 203 t – 10 g acceleration developed

Higher acceleration > more injury to passenger

Design to aim for controlled Deformation keeping force below 2000 kN

Crashworthiness-Improvement & Design Considerations

- CBC coupler with tight lock & anti climbing features
- Energy absorption capacity 30 KJ in LHB, now being increased to 45 KJ
- **45 KJ provide protection for impact speeds up to 9.5 Kmh**
- **Stainless shell shell for better energy absorption capability**.

Crashworthiness-Improvement & Design Considerations

Design Considerations:

- Managing collision energy
- Collapse & occupants zones
- Buckle imitators
- Anticlimbing
- Train Impact Simulationn

DESIGN OF

LHB SHELL

CAR BODY SHELL

DESIGN FEATURES

1. LIGHT WEIGHT
2. SPEED : OPERATIONAL SPEED = 160 KMPH

   TEST SPEED = 180 KMPH
3. DIMENSIONS :

TRACK GAUGE : 1676 mm

OVERALL MOVING DIMENSIONS AS PER

RDSO DRAWING NO. EDO 590

DIMENSIONS RELATED TO S.O.D. – 1939

SHARPEST CURVE – 175 MTRS. RADIUS

SUPER ELEVATION - 165 mm

CLEARANCE ABOVE RAIL LEVEL – 102 mm

BODY SHELL

THE BODY SHELL BE OF INTEGRAL LIGHT WEIGHT
CONSTRUCTION CONSISTING OF SEPARATE ASSEMBLY GROUPS FOR U/F, SW, ROOF & END WALL.

WHOLE CAR BODY SHELL CONSISTS OF THREE TYPES OF STEEL.

THE INDIVIDUAL ASSEMBLIES ARE JOINED TO EACH OTHER BY WELDING

OVERALL DIMENSIONS OF THE COACH

A	LENGTH OVER BODY	23540 mm
B	BUFFER CENTRES	1956 mm
C	MAXIMUM WIDTH OVER BODY	3250 mm
D	HEIGHT OF CENTRES OF COUPLER FROM RAIL LEVEL	1105 mm
E	HEIGHT OF COMPT. FLOOR FROM RAIL LEVEL	1303 mm
F	MAX. DIST. BETWEEN INNER WHEELS	12345 mm
G	MAX. HEIGHT OF CENTRES OF BUFFERS ABOVE RAIL LEVEL	1105 mm

TYPES OF STEELS USED IN LHB SHELL

S. No.	TYPE OF STEEL	APPLICATION
1.	1.4301(Austenitic) 1.25 mm X5 Cr Ni 18 10	Trough floor & roof sheet
2.	1.4003(Ferritic) Carline –2mm. Roof beam -2mm. Side wall -2mm. Window Sill -2.5mm. Body Pillar -2.5mm. Cant Rail - 4mm.	Restructure including carlines, roofbeam, body pillar, end wall structure, side wall sheets, etc.
3.	Corten-A	All Parts of under frame except trough floor including Sole Bar.

SIDEWALL

- TIG WELDING OR LASER WELDING OF SIDEWALL SHEETS
    - LOW HEAT INPUT
    - LESS DISTORTION
    - NEGLIGIBLE SHRINKAGE

SIDE WALL

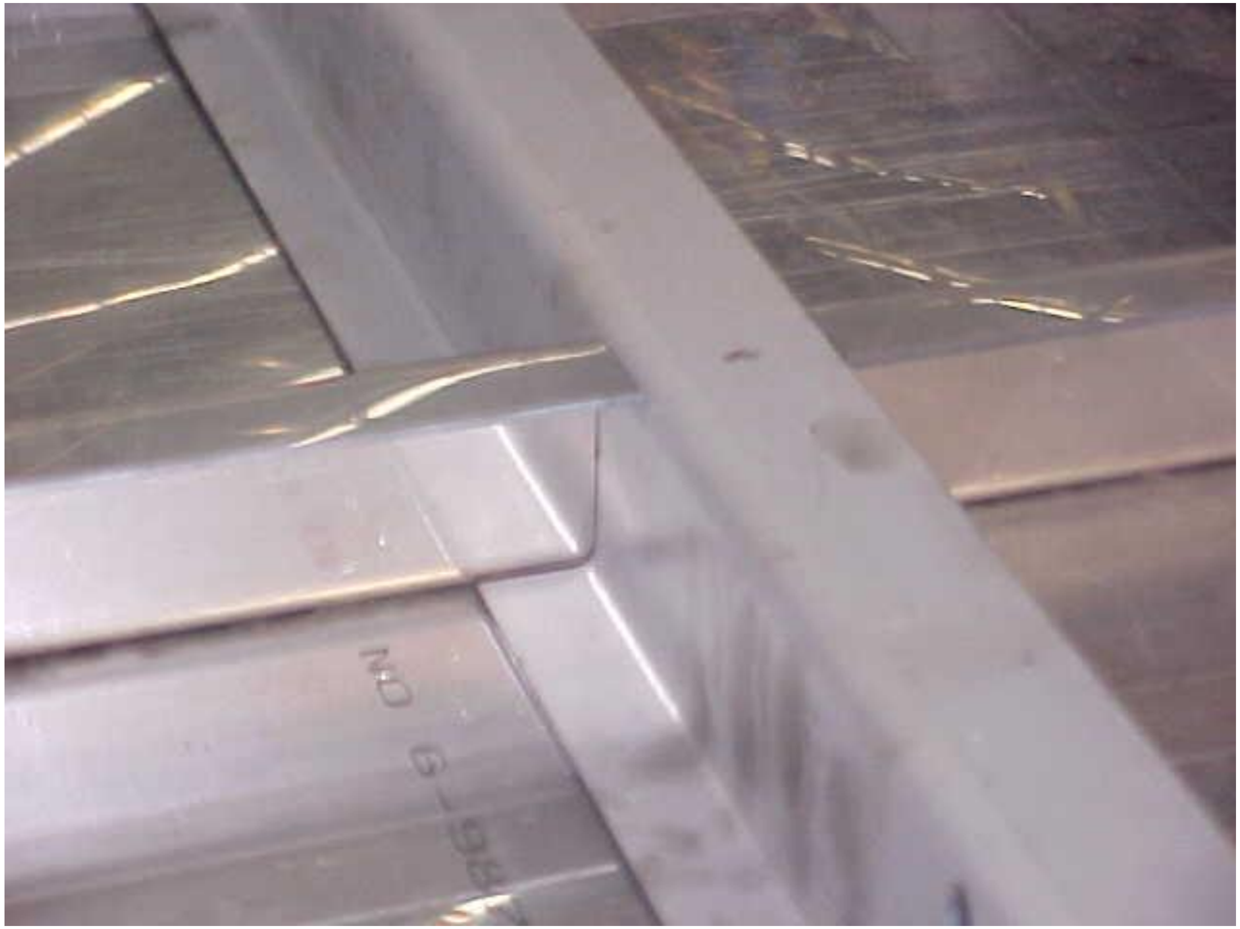
THICKNESS OF SIDE WALL : 2mm

LASER CUT, BUTT JOINT TIG WELDING OR LASER WELDING, SPOT WELDING

DOOR FRAMES IS A PART OF SUB ASSEMBLY OF SIDE WALL, BUT FABRICATED SEPERATELY

THICKNESS OF DOOR FRAME : 4mm

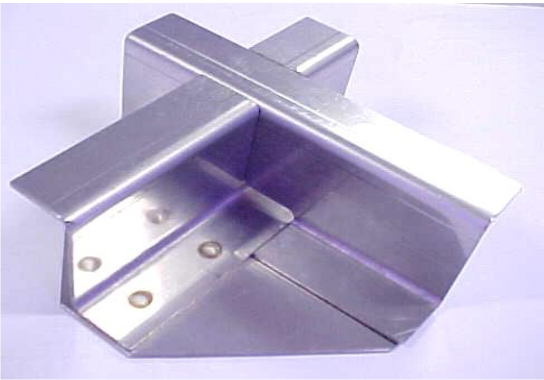
DOOR FRAMES ARE DESIGNED IN A MANNER TO ENABLE THE COMPENSATION OF TOLERANCES IN WHOLE SIDE WALL

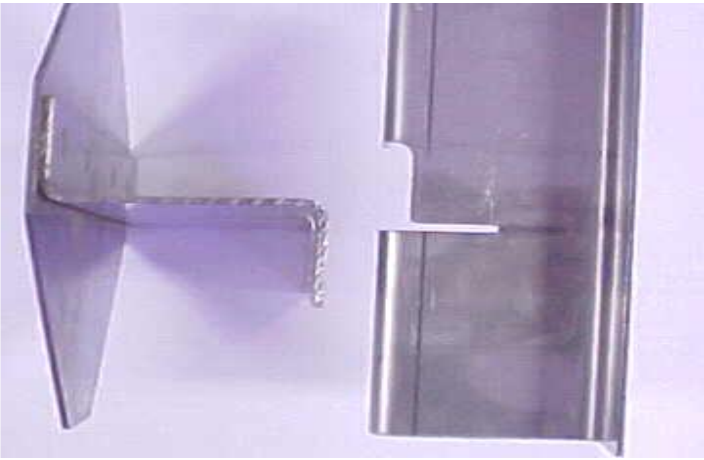


- POSITIVE INTERLOCKING BETWEEN ALL HORIZONTAL AND VERTICAL MEMBERS
    - BETTER STRENGTH,
    - REDUCTION OF SIDE WALL THICKNESS TO 60MM FROM 90 MM,
    - BETTER GEOMETRICAL INTEGRITY

Sidewall-Interlocking

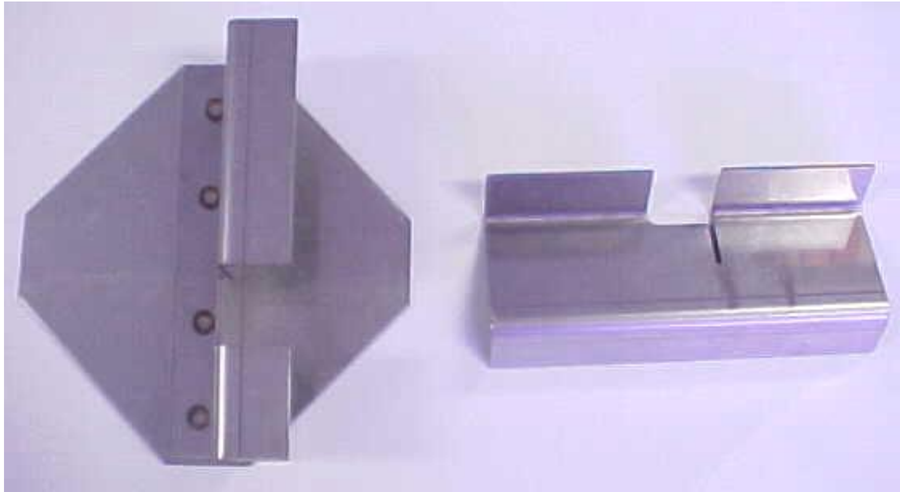
- Interlocking between the horizontal and vertical stiffening members of sub-assemblies like sidewall, endwall, underframe, etc.





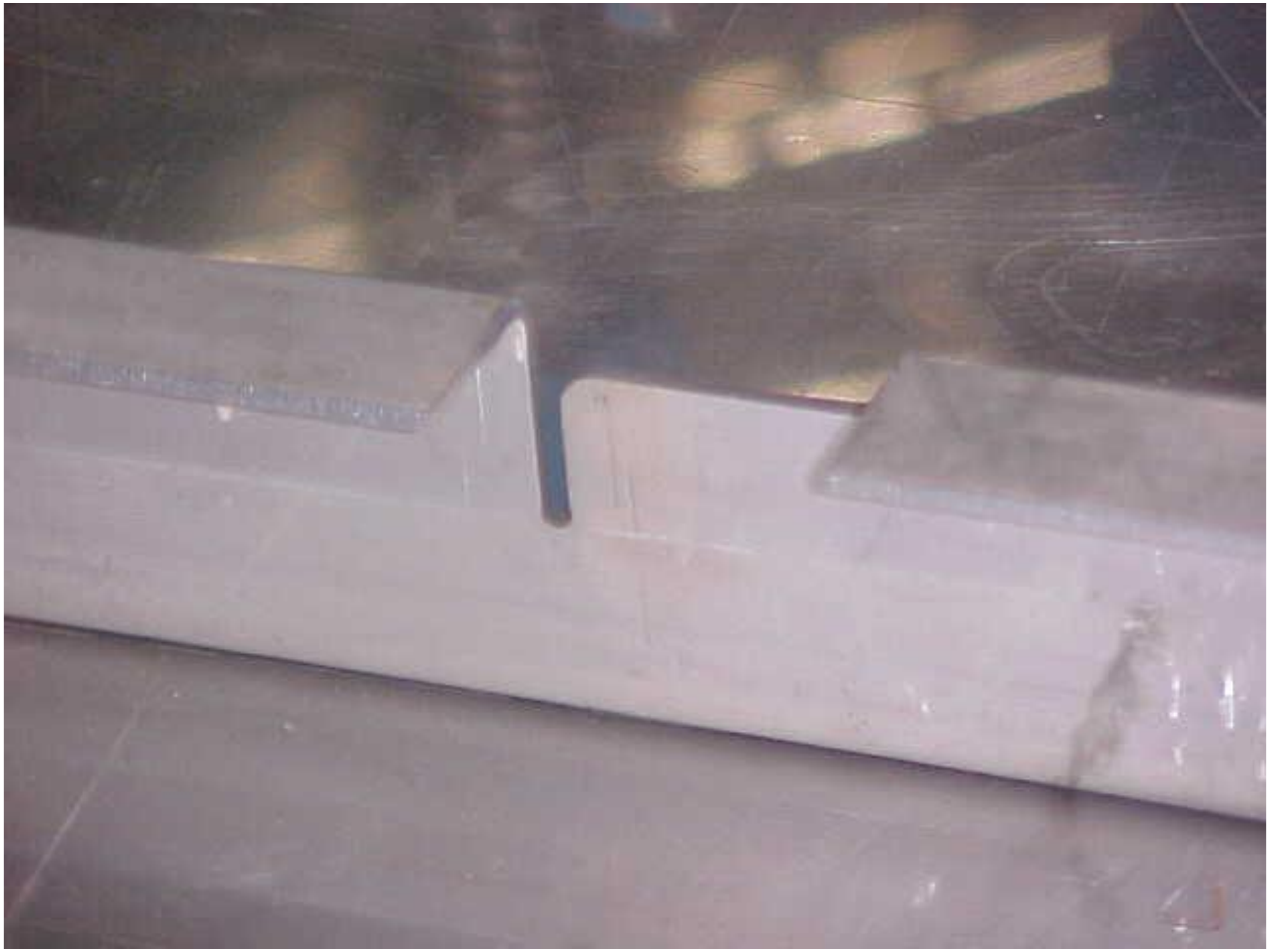
- Aligned stress flow
  - Better strength

- Reduction of side wall width from 90 mm to 60mm



SITUATION BEFORE INTERLOCKING TECHNIQUE

IN THE PAST, A LOT OF ROLLED PROFILES HAVE BEEN USED IN FRAME WORK OF SIDE WALL, END WALL AND UNDER FRAME, WHICH RESULTS A LOT OF WELD JOINTS, STRAIGHTENING AND REWORKING. THIS CAUSED A QUALITY REDUCTION AND INCREASE OF COST.

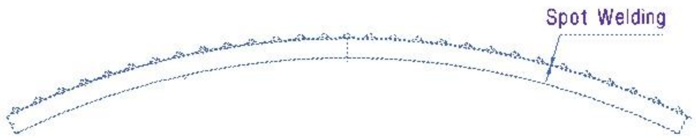


CUT PROVIDED IN S/W MEMBER FOR INTERLOCKING

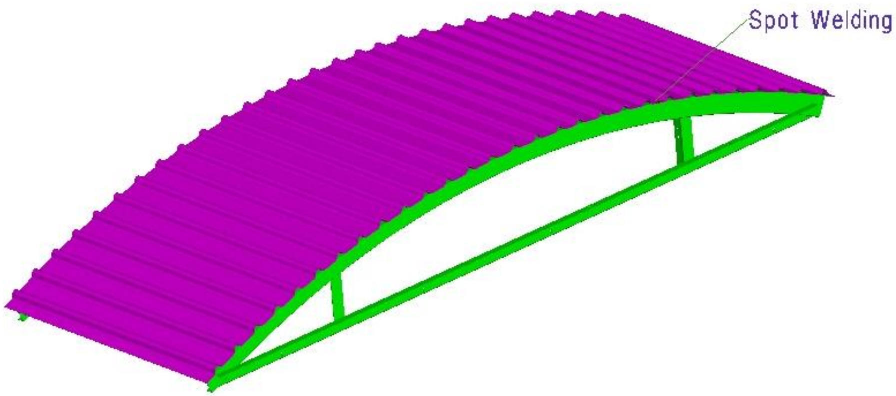
COMPLETE SIDEWALL

- CARLINE (CANT RAIL IN CONV. COACHES) IS PART OF THE SIDE WALL, UNLIKE CONV. COACHES WHERE IT IS A PART OF ROOF
    - BETTER RIGIDITY OF SIDE WALL
    - POSITIVE LOCATION OF ROOF

Roof



- ❑Corrugated roof sheet spot welded to z-section roof arches



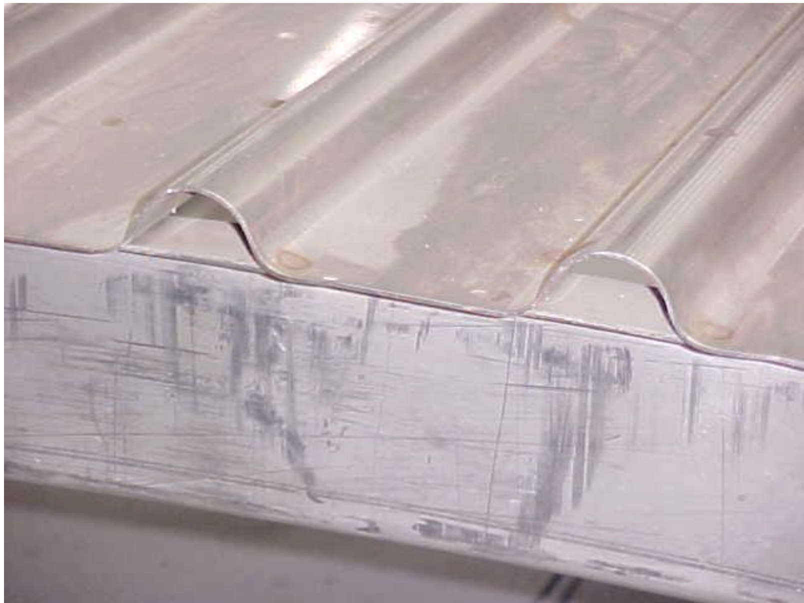
- ❑Uniform height of arches along it’s length
- ❑Roof weighs only about 1000kg
- ❑Spot welded austenitic steel cladding
- ❑Pocket free

END WALL

HOLES PROVIDED IN ALL STIFFENERS OF END WALL TO REDUCE WEIGHT

ROOF

- CORRUGATED ROOF SHEET SPOT WELDED TO Z-SECTION ROOF ARCHES
- UNIFORM HEIGHT OF ARCHES ALONG IT'S LENGTH
- ROOF WEIGHS ONLY ABOUT 1000KG



ROOF

- **MIDDLE PART:**
- CORRUGATED SHEET 1.25 mm THICK AUSTENITIC STAINLESS STEEL
- # ROOF ARCHES : Z SECTION 30x80x30x2
- # HORIZONTAL CROSS BRACES : Z SECTION 30x50x30x2
- **END PARTS :** THESE ARE PREPARED FOR MATCHING THE TAPERING AT ENDS

UNDERFRAME

UNDERFRAME FRONT PART IS MADE BY JOINING TOGETHER HEAD STOCK…

…AND BODY BOLSTER

UNDER FRAME

MAIN COMPONENTS OF UNDER FRAME

TWO SIDE SILS (SOLE BAR) W SECTION 220x65x8

TWO MAIN CROSS MEMBERS - BOX TYPE 6 mm THICK SITUATED IN A REGION OF BOGIES

FRAME WORK – CROSS MEMBERS MADE OF FOLDED CHANNEL SECTIONS 140x50x4 FORM THE MAIN PART OF THE FRAME WORK OF U/F

FRONT PART – IT IS HEAD STOCKS CONSISTS OF SHEETS WITH THICKNESS OF 10mm, 6mm & 4mm

FLOOR – IT CONSISTS OF CORRUGATED SHEETS OF 1.25 mm THICK

- UNDER FRAME CORRUGATED TROUGH FLOOR IS PLUG WELDED FROM TOP WITH THE CROSS MEMBERS
- ALUMINIUM BASED WELDABLE PRIMER USED FOR WELDING CORTEN STEEL TO SS TO PREVENT BI-METALLIC CORROSION

PROVISION FOR CBC AS WELL A SIDE BUFFER MOUNTING IN HEAD STOCK

FLOORING SUPPORT MEMBERS ON UNDERFRAME

WATER TANK MOUNTING BRACKETS WELDED ON THE UNDER FRAME

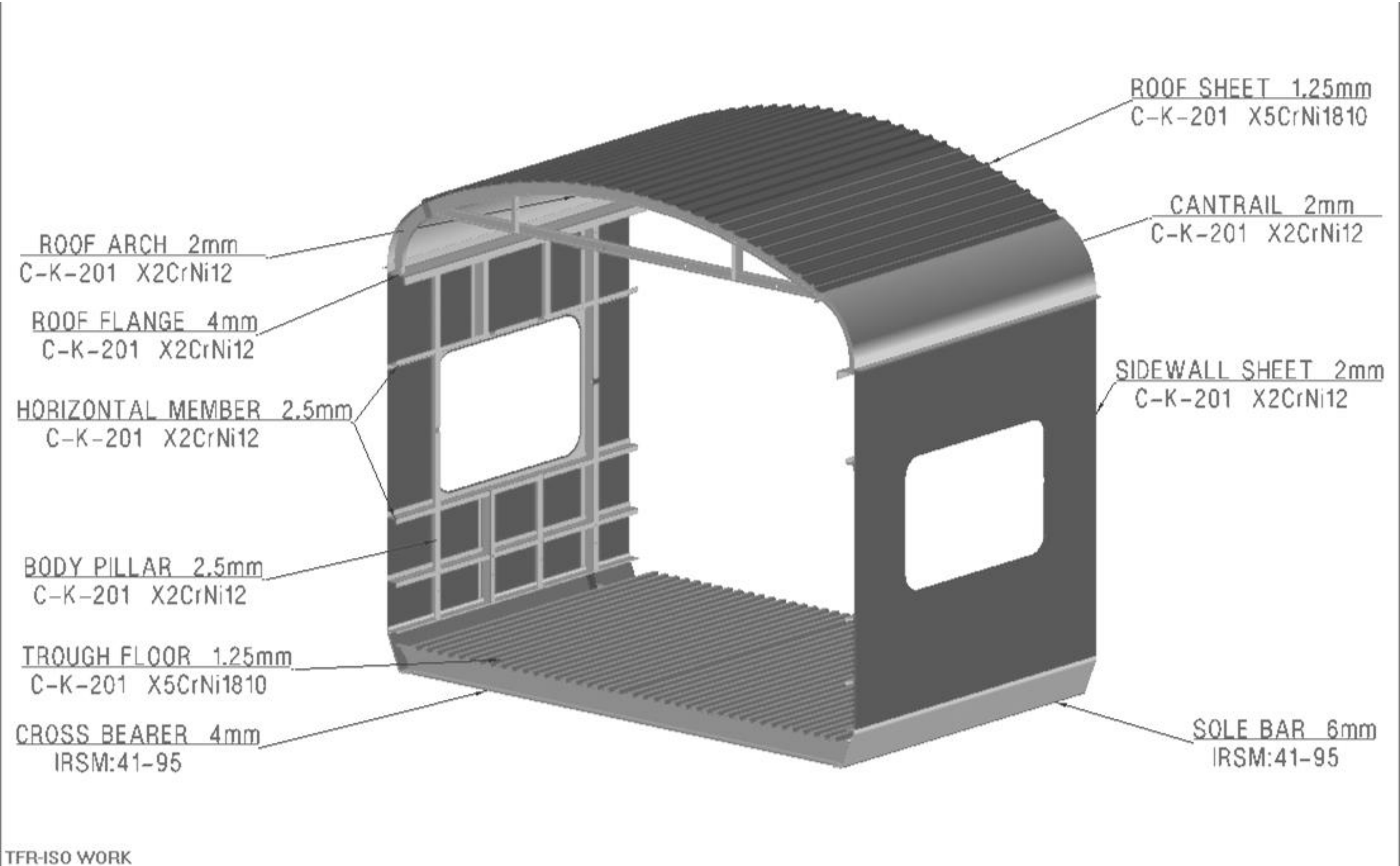
YAW DAMPER (CONNECTED BETWEEN UNDERFRAME AND BOGIE FRAME) BRACKETS WELDED ON THE UNDERFRAME

Steels used in LHB Coach Shell

Shell Assemblies	Steels used and their %age compositions	UTS N/mm^2	Yield Stress N/mm^2
Side wall, End wall and Roof structure	X2 Cr8 Ferritic Steel (SS 409M) (C < .03%, Cr 10-12%, Si 1%, Mn 1.5%)	450-600	320
Roof sheet and Trough floor	X5 CrNi 18 10 Austenitic Steel (SS 304) (C < .07%, Cr 18%, Ni 10 % Si 1%, Mn 2%)	700-850	235
Underframe	IRS M-41 / CortenSteel (C < .01%, Cr .35 -.6%, Ni .2 - .4% Cu .3 - .6% Si .3 - .7%, Mn .25%)	440-480	320

SS 409M is a modified version of SS 409 offering higher strength abrassion resistance and weldability

Shell structure



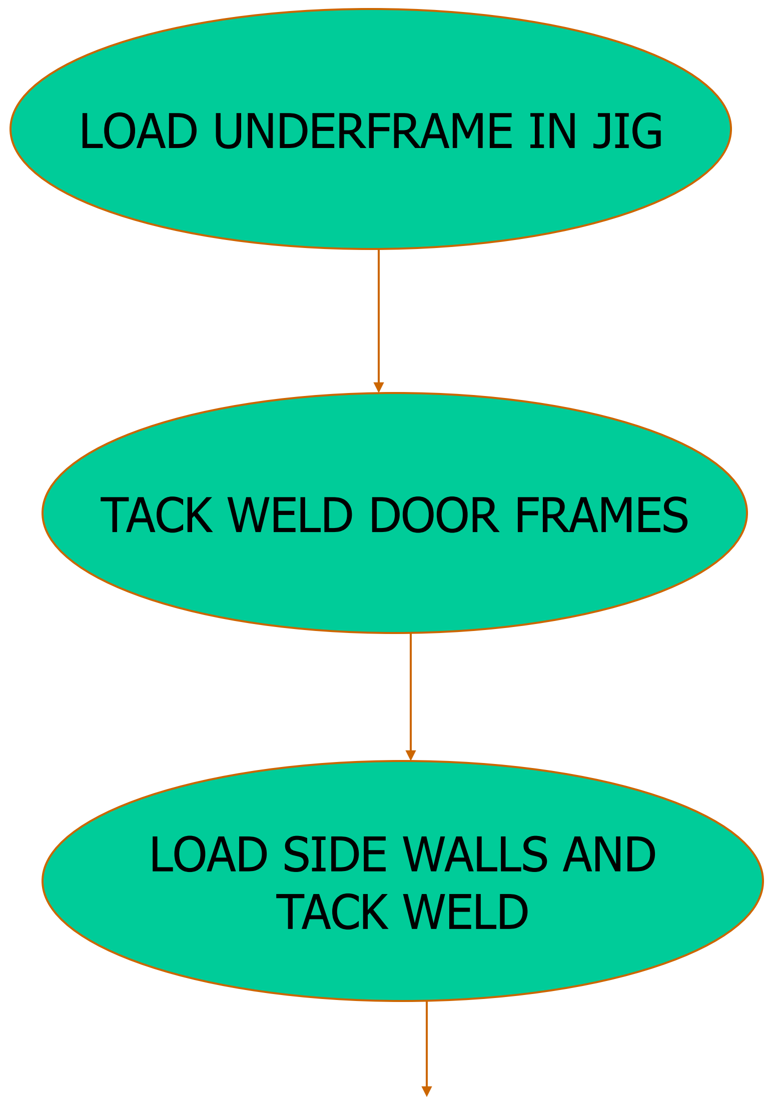
Manufacturing Techniques

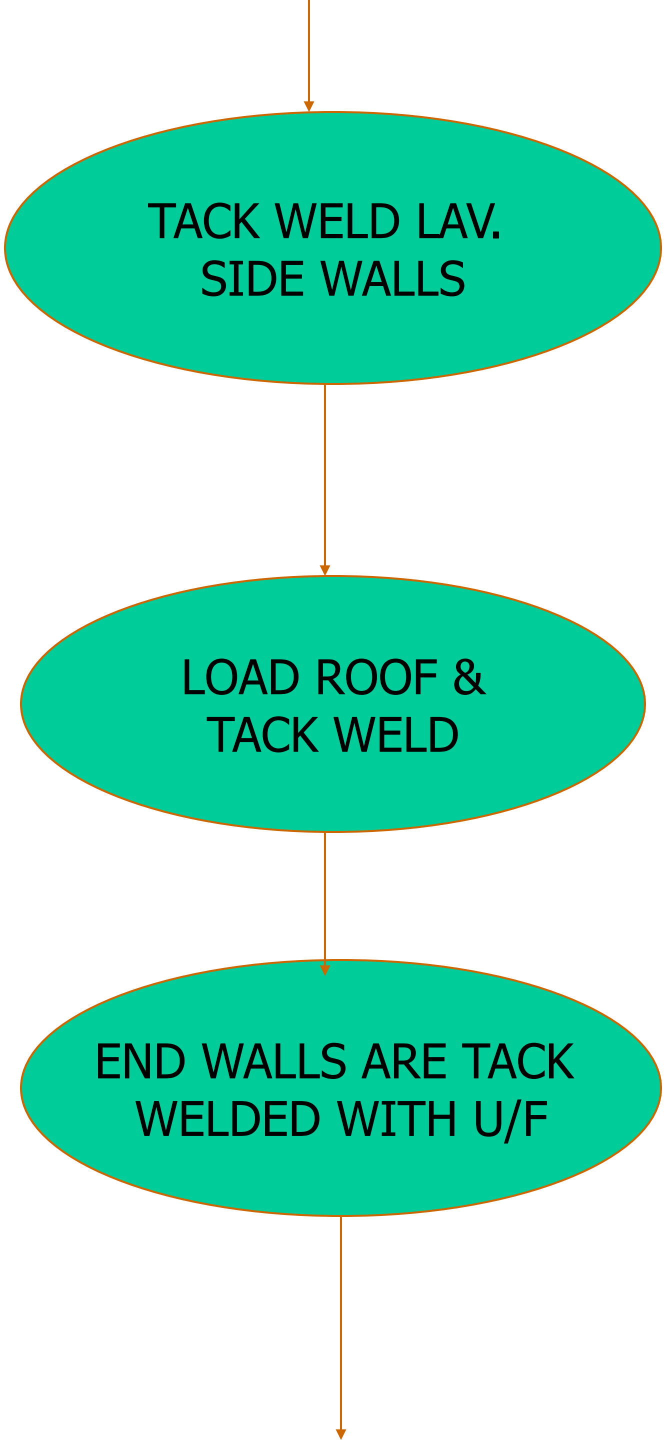
- ❑ Laser Profile Cutting Of Components
- ❑ Sidewall/Roof Spot Welding
- ❑ Magnetic Skin Tensioning Of Shell

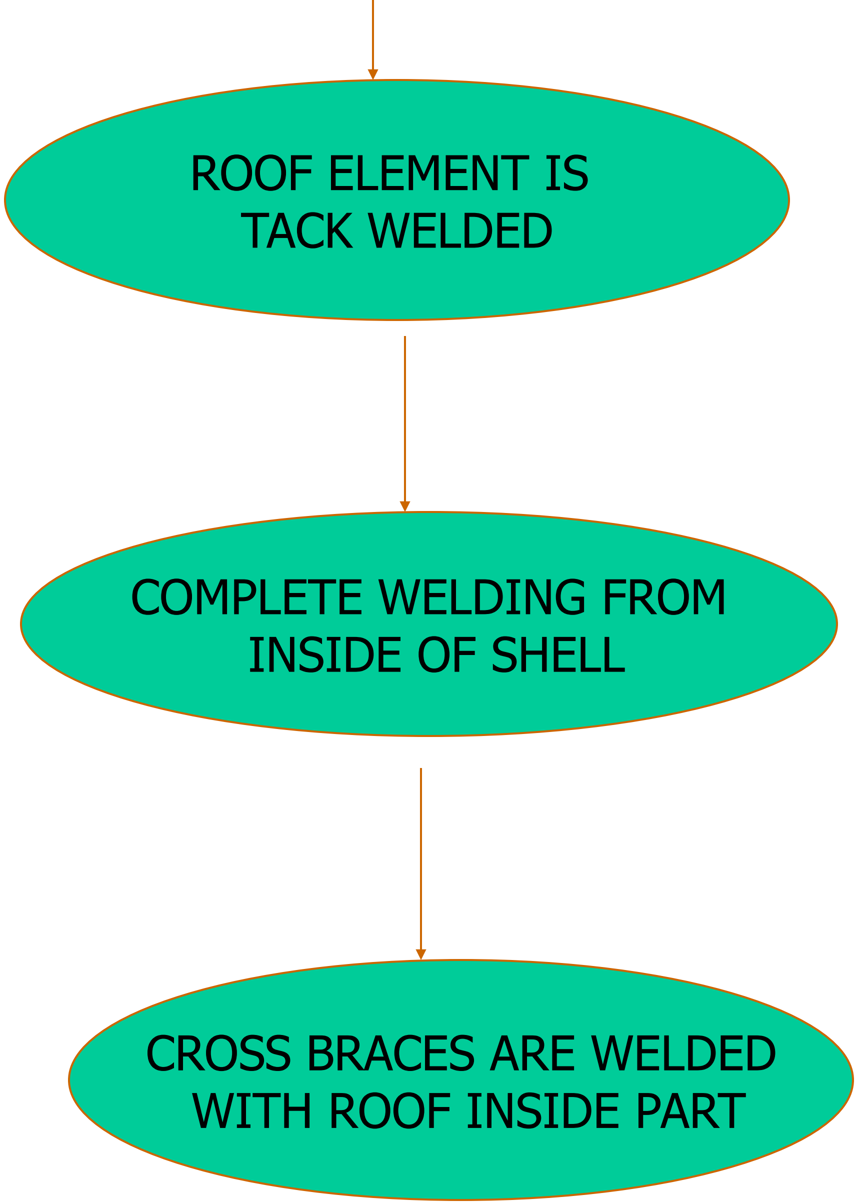
JIGS & FIXTURES

S.NO.	*DESCRIPTION*
1.	*BODY SHELL ASSEMBLY JIG*

PROCESS CHART
STAGE 1




TACK WELD LAV.
SIDE WALLS
LOAD ROOF &
TACK WELD
END WALLS ARE TACK
WELDED WITH U/F

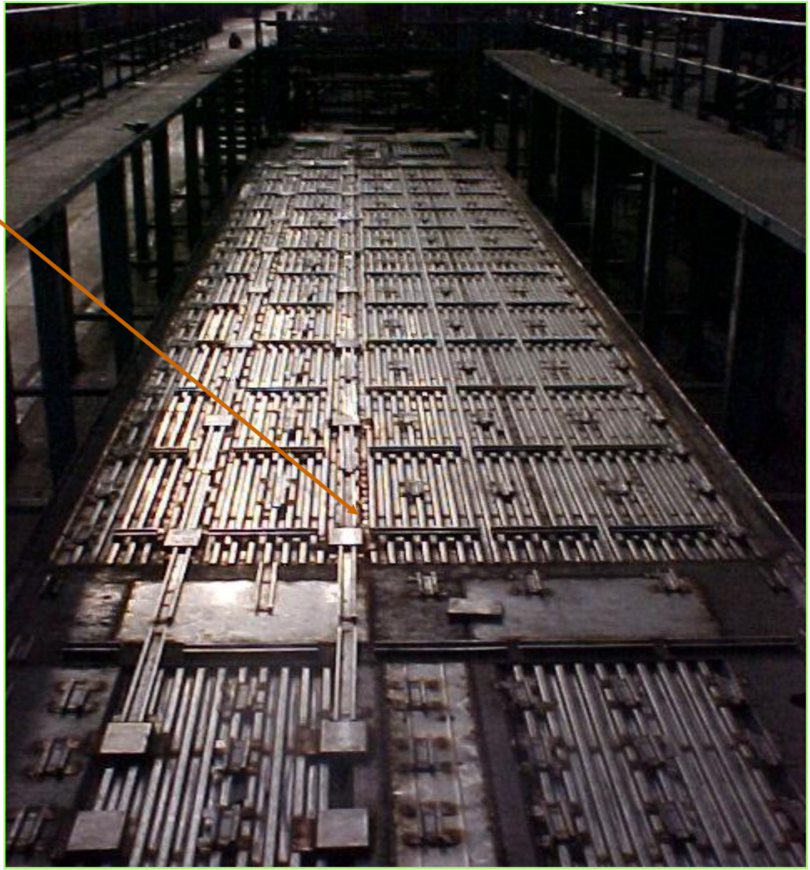

ROOF ELEMENT IS TACK WELDED
COMPLETE WELDING FROM INSIDE OF SHELL
CROSS BRACES ARE WELDED WITH ROOF INSIDE PART

PROCESS

STAGE -1

CONTD…

1. *CLEAN THE JIG FROM SPATTERS AND LOAD UNDER FRAME ON IT. CENTRE THE UNDERFRAME AND CLAMP IT.*



CONTD…

2. DOOR FRAMES ON ONE SIDE ARE LOADED AND TACK WELDED.

TIE RODS

CONTD…

3. *SIDE WALLS ARE LOADED IN THE JIG ON BOTH SIDES AND TACK WELDED. INTERNAL DIMENSIONS ARE MAINTAINED.*

CONTD…

4. *AGAIN DOOR FRAMES ARE LOADED ON THE OTHER END OF UNDERFRAME. TIE RODS ARE USED TO MAINTAIN THE INTERNAL DIMENSIONS.*

CONTD…

5. *LAVATORY SIDE WALLS ARE LOADED AND TACK WELDED WITH UNDERFRAME AND DOOR FRAMES.*

CONTD…

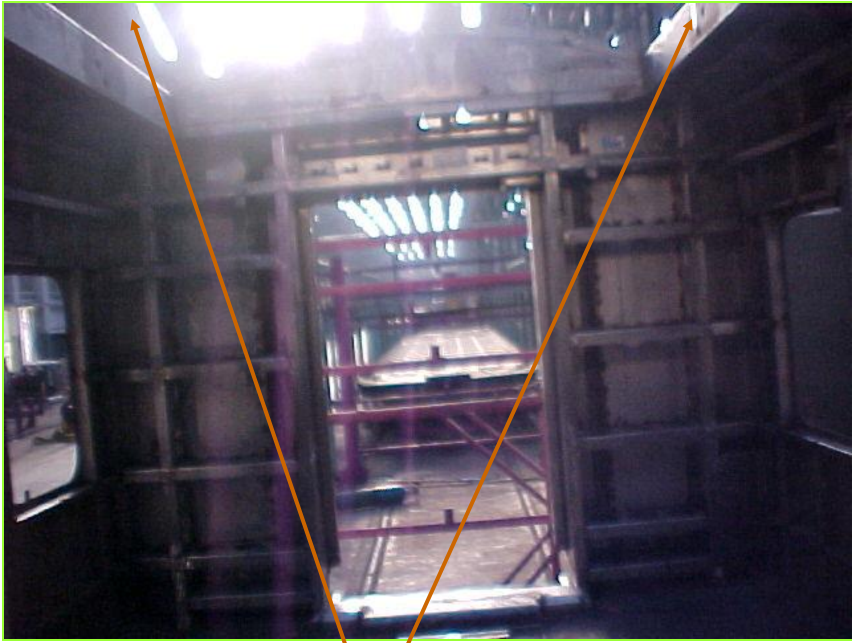
6. *ROOF IS MOUNTED OVER SIDE WALLS AND TACK WELDED.*

CONTD…

7. *END WALL ASSEMBLIES ARE LOADED ON THE HEAD STOCK OF THE UNDER FRAME AND TACK WELDED.*

CONTD…

8. *ROOF ELEMENT IS LOADED OVER LAV. SIDE WALLS ON BOTH SIDES AND TACK WELDED. IT IS USED FOR FITTING OF AIR CONDITIONER ASSEMBLY.*



ROOF ELEMENT

CONTD…

9. COMPLETE WELDING OF FOLLOWING PARTS IS DONE FROM INSIDE.

(i) ROOF WITH SIDE WALL.

(ii) SIDE WALL WITH UNDERFRAME.

(iii) SIDE WALL WITH DOOR FRAME.

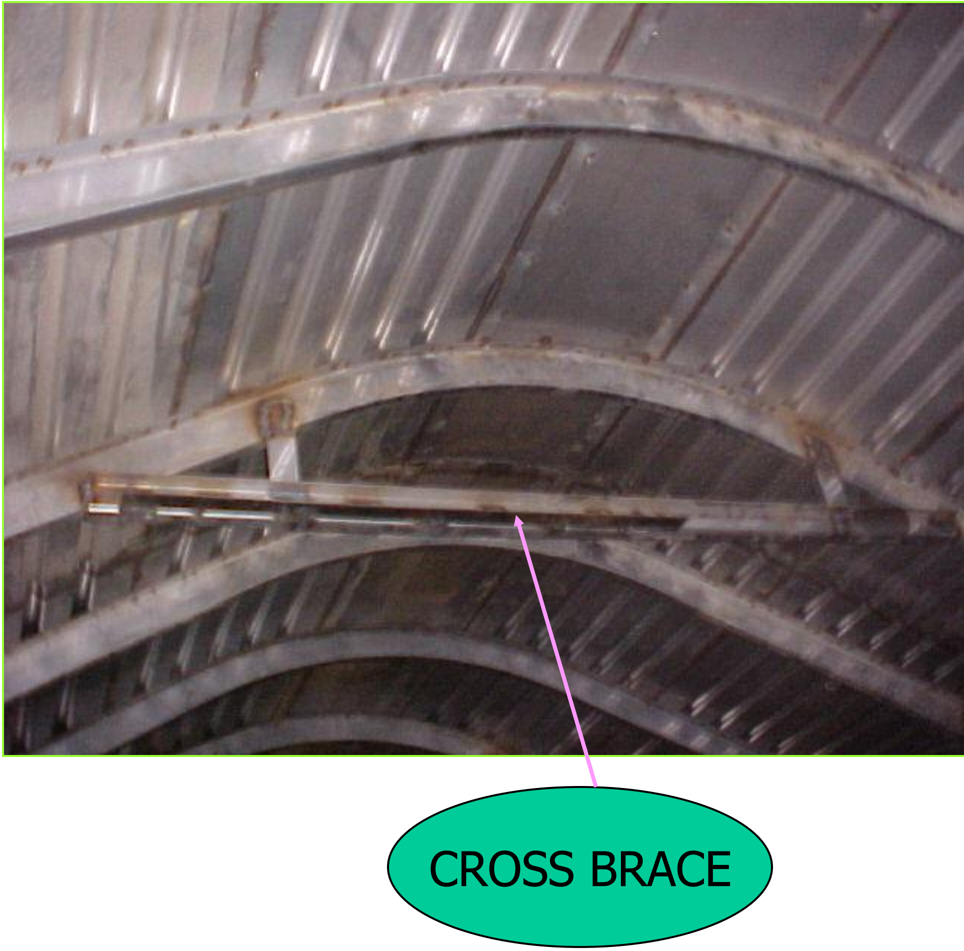
(iv) LAV. SIDE WALL WITH END WALL.

(v) ROOF ELEMENT WITH DOOR FRAME.

(vi) UNDERFRAME WITH END WALL.

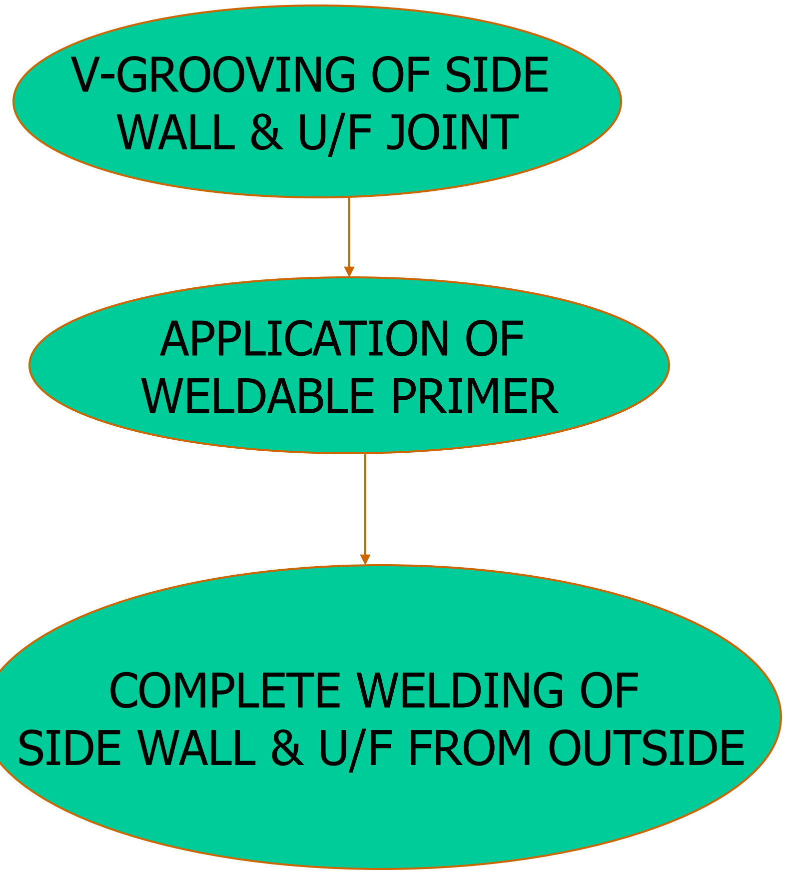
CONTD…

10. CROSS BRACES ARE WELDED WITH ROOF INSIDE SHELL FOR AIR CONDITIONER'S DUCT. THEN THE SHELL IS MOVED TO STAGE 2.



STAGE II

PROCESS CHART STAGE 2



1. *V- GROOVING OF UNDERFRAME SOLE BAR WITH SIDE WALL JOINT IS DONE FROM OUTSIDE THE SHELL BY USING ANGLE GRINDER ON BOTH SIDES OF SHELL.*

2. *'META COT 'SILVER GREY WELDABLE PRIMER IS APPLIED TO AVOID BIMETALLIC CORROSION.*

CONTD….

3. SOLE BAR AND SIDE WALL ARE WELDED FROM EXTERIOR OF SHELL USING MAGNETIC TRACK WELDING MACHINE.

4. GRINDING OF WELDED JOINTS OF SOLE BAR AND SIDE WALL IS DONE.

WELDING JOINT

WELDING PARAMETER FOR MAG CO2 WELDING

MAT. THICKN-ESS	NO. OF LAYERS	WIRE DIA mm	WELDING CURRENT (AMP)	ARC VOLTAGE	WIRE FEED M/MIN	TRAVEL SPEED CM/MIN	THROAT THICKN-ESS (a mm)
1.6*1.6	1	0.8	100-120	22-24	5.0	50	1.2
2.0*2.0	1	0.8	100-120	22-24	5.0	45	1.6
2.0*5.0	1	1.2	100-120	22-24	5.0	45	2.5
5.0*5.0	1	1.2	200-220	26-27	6.5	40	3.2

STAGEWISE ACTIVITIES OF SHELL ASSEMBLY

SAS-I

ACTIVITIES :- CLAMPING OF U/F BY CLAMPS.

ALIGN WITH PIANO WIRE AT THREE LOCATIONS

LOADING OF 5 INTERNAL JIGGING FRAME

DOOR FRAME FITMENT

MIDDLE SIDE WALL FITMENT

TACKING OF SIDE WALL SHEET TO U/F FLANGE

STRAIGHTNESS IS CHECKED WITH PIANO WIRE

PLACEMENT OF ROOF

ROOF CROSS BRACES FITMENT

PLACEMENT OF FINAL ROOF ELEMENT

END WALL FITTING

STAGES OF SHELL ASSEMBLY

SAS-II

WELDING OF SIDE WALL WITH SOLEBAR BOTH SIDES FROM OUTSIDE WITH TRACTOR WELDING. GRINDING OF ALL THE HORIZONTAL & VERTICAL WELDING JOINTS FOR PROPER OUTER FINISH

STAGES OF SHELL ASSEMBLY

- **SAS-III**
- SENDER GRINDING TO REMOVE HIGH SPOTS
- COLD STRAIGHTENING THE SIDE WALL & END WALL
- SKIN TENSIONING BY HEATING OF SIDE WALL FROM INSIDE THROUGH PERFORATED PLATE HOLES WITH MULTI HEAD TORCH BY USING OXY ACETYLENE SET.
- CHECK THE SURFACE FINISH BEFORE & AFTER SKIN TENSIONING.
- PIN WELDING ON ROOF (660 Nos) BY PIN WELDING MACHINE TO HOLD GLASS WOOL.

STAGES OF SHELL ASSEMBLY

SAS-IV

FITTING OF PARTITION FRAME WHERE REQUIRED

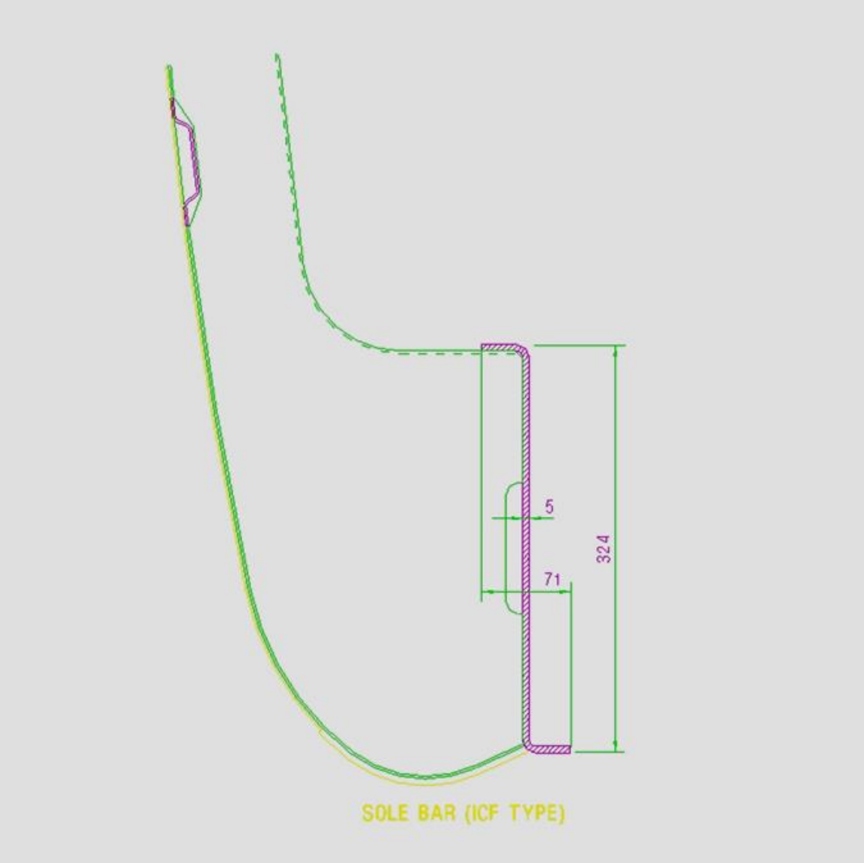
WELDING PARTS CAR BODY SHELL PP END & NPP END

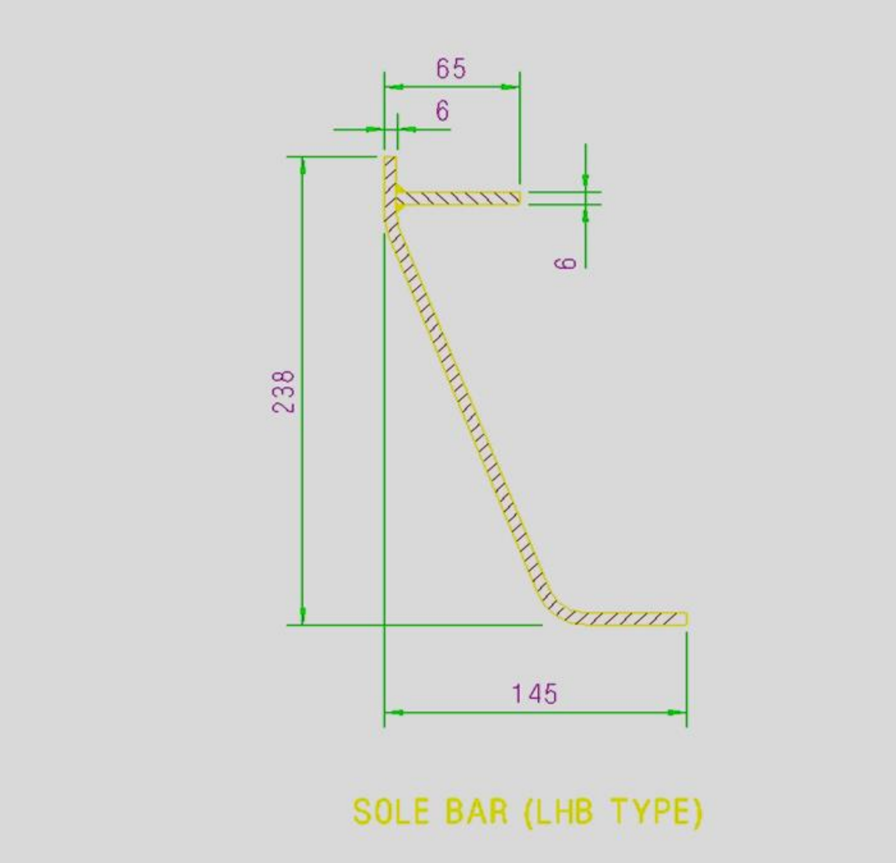
CBC FITMENT

STAGES OF SHELL ASSEMBLY

- CHECKING & INSPECTION
- # ALL DIMENSIONAL INSPECTION OF THE SHELL
- # DPT TEST FOR SIDE WALL JOINTS
- # TWIST CHECK
- # PLACING ON DIPLORY FOR SHIFTING TO NEXT STAGE

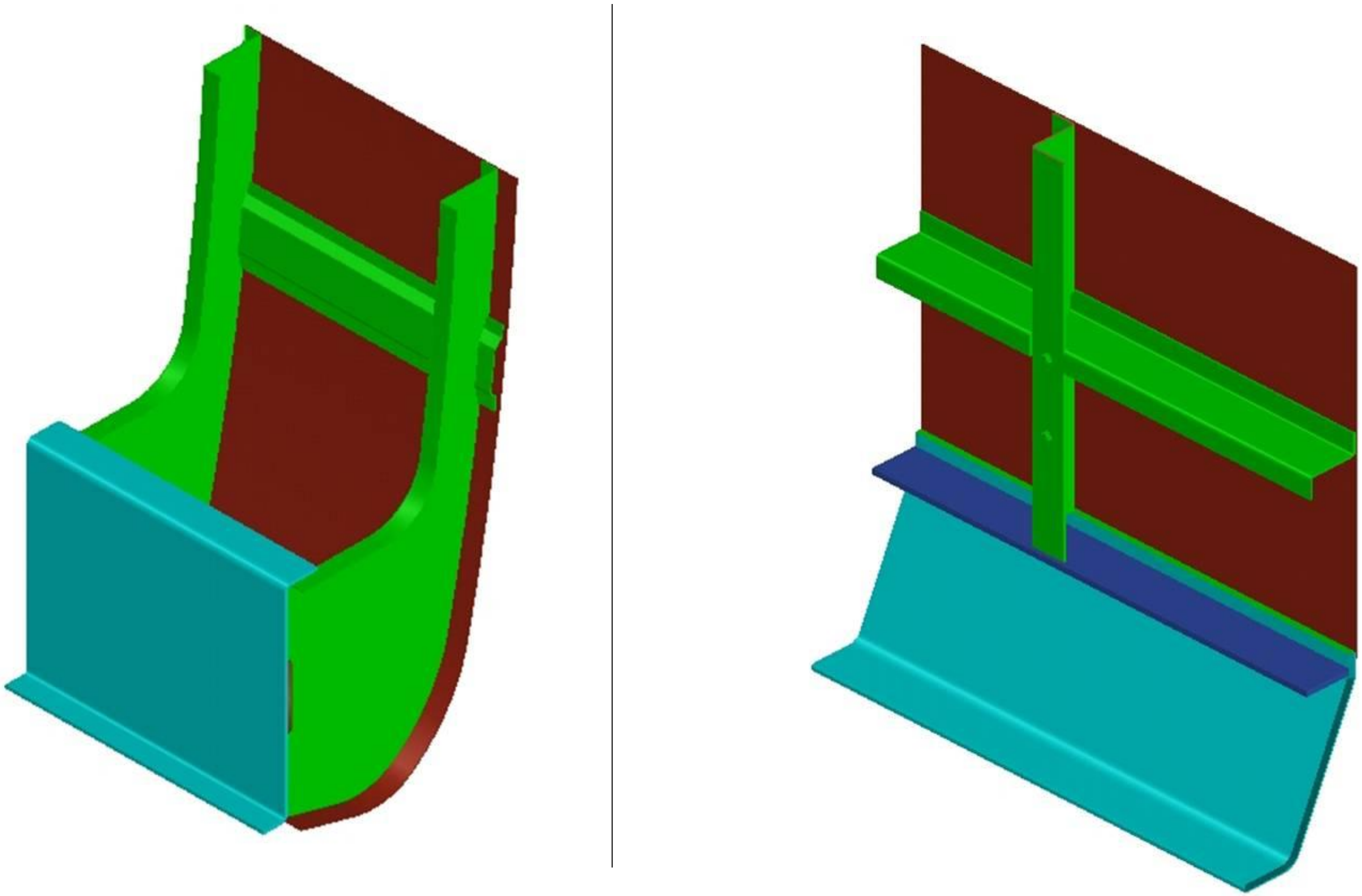
COMPARISION





- TURN UNDER HAS BEEN ELIMINATED
- CLEAR APPROACH FOR SAND BLASTING AND PAINTING
- NO ACCUMULATION OF WATER AND MUCK
- PILLAR RESTS ON SOLEBAR AS COMPARED TO LOAD TRANSFER THROUGH A VERTICAL WELDED JOINT IN CONV. COACHES

SIDEWALL TO UNDERFRAME JOINT, CONV. VS.LHB



END WALL OVERHANGS BEYOND HEAD STOCK

-RELEASING MORE SPACE INSIDE

-REDUCING SPACE AND HENCE WIND RESISTANCE DUE TO TURBULENCE BETWEEN COACHES.

-GAP BETWEEN END WALLS OF TWO COUPLED COACHES IS 300 MM ONLY

SEPARATE DOOR FRAME FITTED BEFORE SIDEWALLS IN LHB, NO PROBLEM OF DOOR SIZE/SQUARENESS ETC.

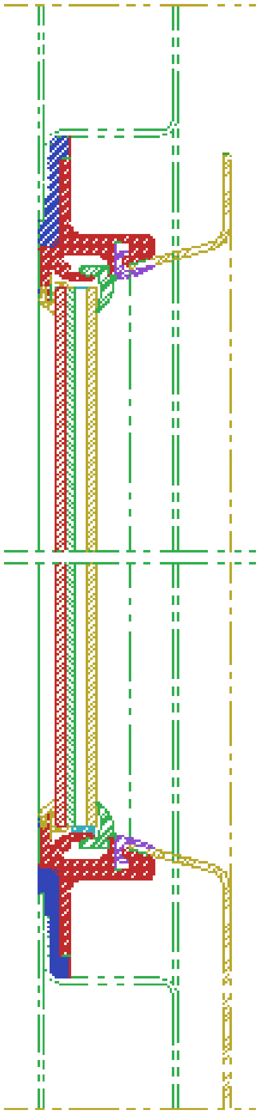
NO DOOR FRAME, DOOR OPENING SQUARENESS MAINTAINED BY FITTING ONE SIDE'S DOOR CORNER SHEET AFTER SIDE WALL

- WEIGHT PER METER LENGTH OF LHB COACHES IS APPROXIMATELY 10% LESS THAN THE CONVENTIONAL COACHES. BETTER PAYLOAD TO TARE WT RATIO.
- NO CHANGE REQUIRED IN SHELL DESIGN FOR SPEEDS OF 200KMPH
- DIMENSIONAL COMPARISON

DIMENSIONAL COMPARISON	ICF	LHB
LENGTH OVER BODY	21770	23540
LENGTH OVER BUFFER	22280	24700
WIDTH OVER BODY	3245	3240
INNER WIDTH	3065	3120
WINDOW OPENING (ac sleeper)	1220x610	1180x760

WINDOWS

Sealed window Glass Units



- The window glass unit characteristics are:
  - K value not lass than 1.6 W/M^{2}K
  - Transparency > 39 %
  - Reflection > 40
  - Total energy absorption < 21%
- The sealed window units consists of 8.4 mm outer laminated and 4 mm tempered inner glass with 6 mm Krypton/Argon gas filling
- Window glass is secured to Al extrusions by rubber profiles
- The Al frame is glued to the car body with the help of PU, elastic gap filling structural adhesive (Sikaflex-264 T & eq.). Capable of withstanding high dynamic stresses

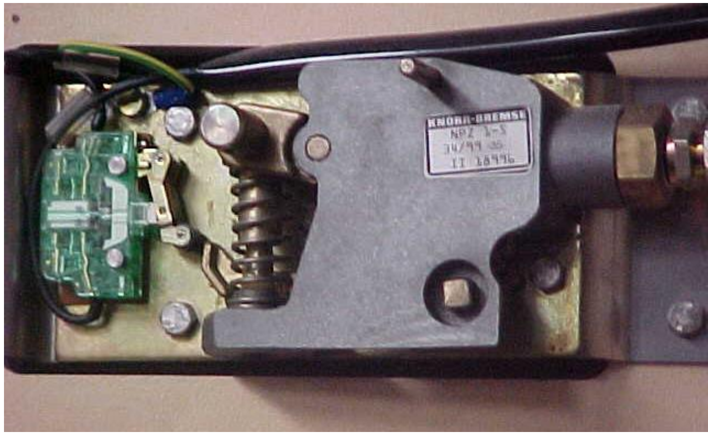
Emergency openable window

- It is similar to the fixed unit
- Four units are provided each coach to allow emergency evacuation of passengers
- A handle connected to the rubber profile opens the glass unit of the emergency window

HOPPER WINDOW FOR LAVATOTRY

Passenger Emergency Alarm

- 5 passenger emergency alarms per coach in chair car have been provided at following locations:
  - 2 in passenger compartment
  - 3 in lavatories
- There is no mechanical linkage like a chain and these handles directly operate a valve venting the brake pipe
- Designed to stop the train not just warn the driver




THANK YOU
FIRST AC CHAIR CAR

Wheel Shelling

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

Guidelines for wheel inspection in open line depots (Ref RDSO CMI-K003)

For this purpose, following shelling limits need to be followed.

1. Depth of shelling marks has reached to 1.5 mm.
2. Length of shelling marks has reached to 40 mm.
3. Depth of hollow tyre reached to 3 mm.
4. This limit of 3 mm is kept to study the effect of wheel shelling and service life of wheels.
5. The rejectable limit of hollow tyre will continue as more than 5 mm as specified in IRCA part IV.

Following major causes have been identified For wheel shelling:

- Non-optimal choke sizes of Dump Valves.
- Obstructions in air-brake piping between dump valves and brake cylinders.
- Wrong / Loose electrical connections of WSP system.
- Jamming of Brake Calipers / Actuators.
- Poor design of Junction Box prone to dust/water ingress.

Item wise consolidated list of instructions issued by RDSO (2018-19):

1.Brake Cylinder Pressure

(Ref: RDSO letter no. MC/LHB/Brake dated 20.04.2018 to PCMEs All Zonal Rlys and PUs)

Zonal Railways / PUs should not resort to alteration in Brake Cylinder pressure of LHB Coaches from the specified value of 3.0+0.1kg/cm2 .

2.Dump Valve Chock Size

(Ref: RDSO letter no. MC/LHB/Brake dated 27.09.2018 to PCMEs All Zonal Rlys and PUs)

Dump valve chock size should be ensured as under.

Brake system Make/model	Exhaust chock size	Charging chock size
KBIL (Model MGS2)	Remove existing 7mm chock	Replace existing 5 mm chock with 9mm chock
FTRIL (Model SWKP AS20R)	Remove existing 9mm chock	Replace existing 6 mm chock with 9mm chock
Above modification should be ensured in all newly manufactured as well as existing LHB coaches		

3.Modification in air brake pipeline & associated fittings in LHB Coaches.

Ref: 1)RDSO letter no.MC/LHB/Brake dated 08.03.2019 to PCMEs/RCF,MCF,ICF

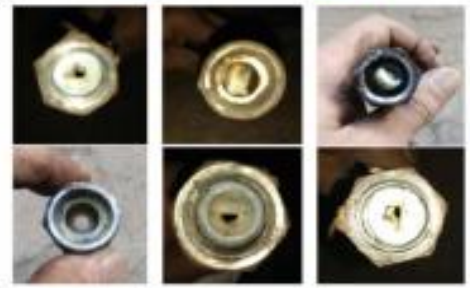
2)Presentation on wheel shelling by Bengaluru Division/SW Railway in 18th CMG

3) RDSO letter no.MC/LHB/Brake dated 12.04.2019 to PCMEs/All Zonal Rlys and Pus

1. Flexible Air Hose (600mm) for Bogie

During the field studies by RDSO at BCT/WR & SBC/SWR;

- Problems are observed with the existing hose results in restriction in smooth air flow in pipe line.
- Ultimately affects the performance of brake system which may leads to Wheel Shelling in case of wheel slip.

S.No.	Observations	Causes	Photographs
i.	***Less inner diameter***	Insufficient air flow passage	
ii.	***Washers***	The Nylon/Teflon washers provided inside the hose gets perished/shrink due to over tightening or during in service of the coach, which results in blockage of the air passage and thus to inoperativeness of brake cylinders.	
iii.	***More nos. of pipe joints/fittings***	Restriction in air flow & more chances of occurring leakages.	

To overcome above issues, RDSO has developed a standardized design of flexible hose

d. Details of standardized flexible hoses:

S.No.	DRAWING/PART NO.		
A.	**M/s Knorr-Bremse**	**M/s Faiveley Transport**	**M/s Escorts**
	Flexible Hose (650mm) – for body to bogie		
	KP0274893	FT0052512-001	1J112000031
B.	Flexible Hose (500mm) – for Brake Actuators		
	KP0313153	FT0052512-002	3EB9942

Note: *The upgraded flexible hose should only be procured from RDSO approved sources for Axle Mounted Disc Brake system to ensure quality of this critical item.*

The upgraded flexible air hose for bogie has following advantages:

Bigger Inner diameter: Sufficient air flow passage -The diameter of hose was increased from 9mm to 12mm.

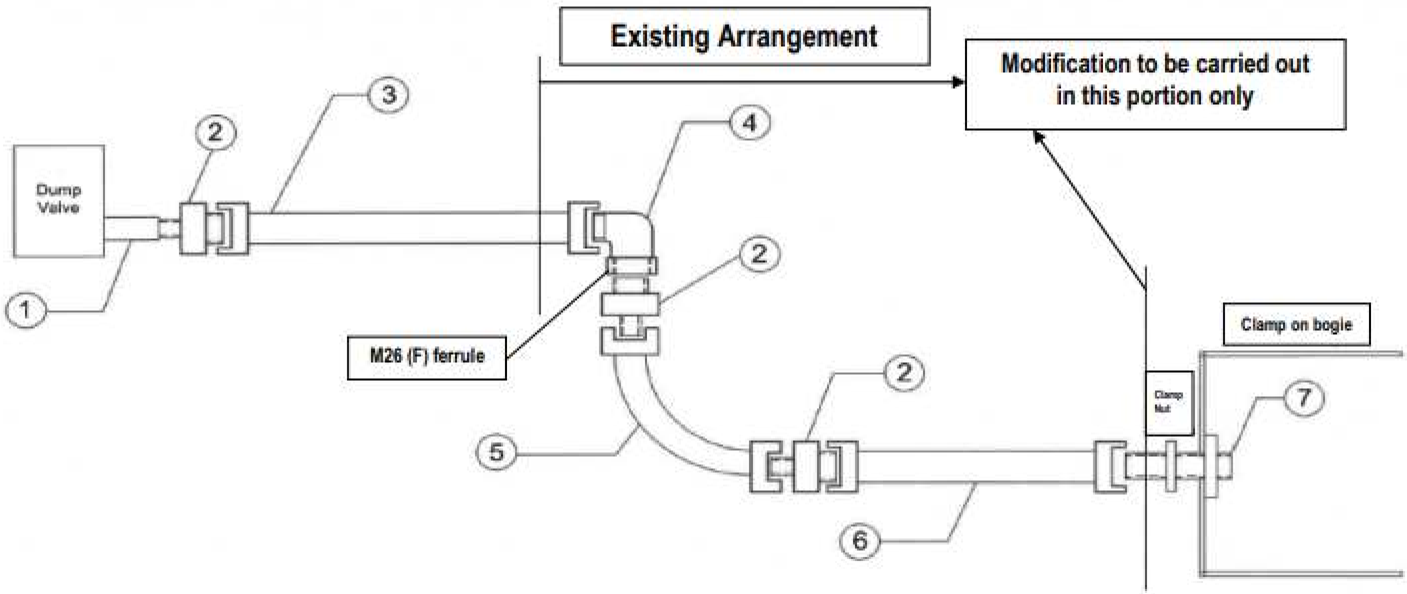
No washers: Avoids blocking of air passage and increase smooth operation of brakes- The new hose eliminates the use of washers and have ferrule arrangement at both ends.

Less pipe joints/fittings: Avoids air flow restriction & leakages- By the use of upgraded hose associated joints/fittings for air connections were reduced from 9 to 6nos.

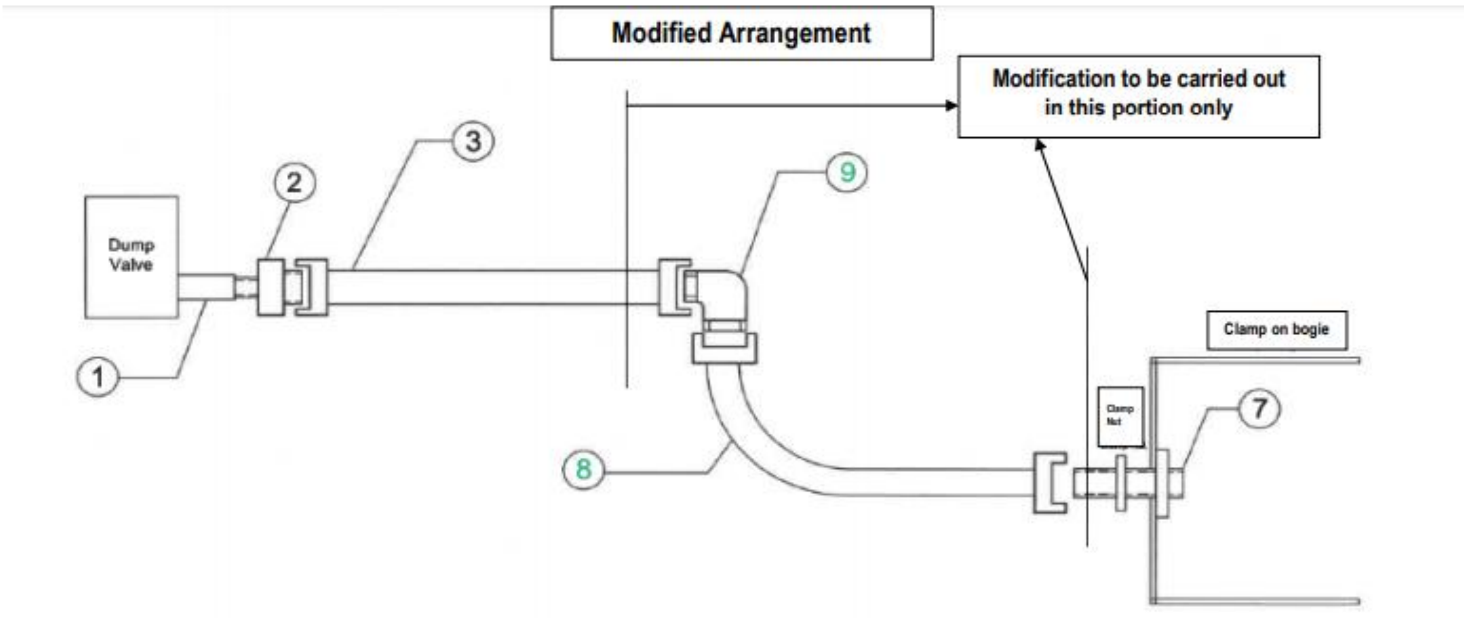
Increase in hose length: Avoids stretching & rupture- The length of upgraded hose was increased from 600 to 650mm, as in original Alstom design and also to avoid stretching & rupture of the hose.

Existing piping arrangement

Modified piping arrangement with reduced joints and modified hose



LEGEND		
S.No.	**Description**	**Quantity**
1.	Adopter	01
2.	Ferrule Stud ½" (M) X M26 (M)	03
3.	18 OD Pipe with M26 ferrule fittings	01
4.	Elbow M26 (M) X M26 (F) ferrule	01
5.	Hose ½" with ½" BSP (F) both sides	01
6.	18 OD Pipe with M26 ferrule fittings	01
7.	Stud M26 both sides	01
	Total Quantity	**09**



LEGEND			
S.No.	**Description**	**Quantity**	**Remarks**
1.	Adopter	01	--
2.	Ferrule Stud ½" (M) X M26 (M)	01	Quantity reduced from 3 nos. to 1 nos.
3.	18 OD Pipe with M26 ferrule fittings	01	--
4.	Elbow M26 (M) X M26 (F) ferrule	00	Replace with S.No.9
5.	Hose ½" with ½" BSP (F) both sides	00	Replace with S.No.8
6.	18 OD Pipe with M26 ferrule fittings	00	Eliminated
7.	Stud M26 both sides	01	--
8.	Hose 5/8" with M26 (F) both sides	01	To replace with S.No.5
9.	Elbow Male Connector M26 (M)	01	To replace with S.No.4
	Total Quantity	**06**	

Note: Items at S.No.4, 5 & 6 (in Red) to be deleted and at S.No.8 & 9 (in Green) to be added.

4.Self Lubricating Bushes for Brake calipers /Actuators

(Ref: RDSO letter no. MC/LHB/Brake dated 06.09.2018

1.Only Self lubricating bus.hes should be fitted in Brake calipers /Actuators.

2. Practice of oiling with self lubricating bushes needs to be stopped .

3. Due to use oil, the grease film of self lubricating bushes gets damaged and these bushes no longer function as designed.

4.Also dust gets accumulated in form of muck which may obstruct freeness of caliper and can affect brake releasing and application timing.

5.Ensuring Integrity of Electrical connections of WSP System and Free movement of Brake calipers

(Ref: RDSO letter no. MC/LHB/Brake dated 27.09.2018 to PCMEs All Zonal Rlys and PUs)

Integrity of Electrical connections of WSP System and Free movement of Brake calipers during Brake application/release is absolutely vital in reducing wheel shelling.

चक्के से सम्बन्धित दोष और परिचालन में यान की स्थिरता पर उसका प्रभाव

डीप फ्लैन्ज

बीजी में 28.5 तथा एमजी में 25.5 से बढ़कर 35 तथा 32 मिमी0 से अधिक हो जाय

(1) यदि रेल हेड का ऊपरी सतह भी घिसा हुआ हो तो चक्के का फ्लैन्ज, फिश प्लेट तथा डिस्टेन्स ब्लाक चेक ब्लाक से टकराने लगता है।

(2) चक्के के ट्रेड के साथ–साथ फ्लैन्ज में भी घिसाव होता रहता है। अतः फ्लैन्ज के डीप होने की अवस्था में उसका थिन हो जाना भी स्वाभाविक है। जिससे फ्लैन्ज बल का मान भी बढ़ जाता है।

शार्प फ्लैन्ज

फ्लैन्ज के टिप का अर्धव्यास 5 मिमी से कम

प्रभाव–

(1) पाजिटिव एंगुलरिटी बढ़ जाती है।

(2) घर्षण बल का मान बढ़ जाता है।

(3) फेसिंग दिशा में चक्का दो रास्तों पर जा सकता है अथवा घिसे या थोड़ा सा टूटे हुए टंग रेल के प्वाइंट पर चढ़कर अवपथित हो सकता है।

हालो टायर/फाल्स फ्लैन्ज

बाहरी सिरा मध्य की अपेक्षा 5 मिमी0 से ज्यादा नीचे आ जाय

प्रभाव—

(1) फाल्स फ्लैन्ज ट्रेलिंग दिशा में चलते समय प्वाइन्ट को चीर कर उसमें (**Gap**) अन्तर बना सकता है जिसके फलस्वरूप फेसिंग दिशा में आ रही किसी दूसरी गाड़ी का चक्का दो रास्तों पर जा सकता है।

(2)क्रासिंग पोर्सन पर चक्का विंग रेल के सम्पर्क में चल कर नोज पर गिर सकता है।

(3) अत्याधिक हंटिंग (**Hunting**) होती है।

थिन फ्लैन्ज

बीजी में 28.5 मिमी. तथा एमजी में 25.5 मिमी. से घटकर 16 मिमी. से कम रह जाय

प्रभाव—

(1) रेल पथ तथा चक्कों के मध्य अन्तर बढ़ जाने के कारण लर्चिंग बढ़ जाती है। जिससे फ्लैन्ज बल का मान भी बढ़ जाती है।

(2) एक्सल की कोणीयता (Angularity) बढ़ जाती है।

रूट रेडियस में घिसाव

बीजी में 16 मिमी. तथा एमजी में 15 मिमी. से घटकर 13 मिमी. रह जाय

प्रभाव–

(1) चक्के तथा रेल हेड के मध्य सम्पर्क क्षेत्र बढ़ जाने के कारण घर्षण बल का मान भी बढ़ जाता है। क्योंकि इस दशा में फ्लैन्ज घिस जाने के कारण उसमें 1:2.5 का प्रारम्भिक ढाल काफी कम हो जाता है।

(2) धूरे की कोणीयता के समान मान के लिए भी पाजिटिव इसेन्ट्रिसिटी बढ़ जाती है।

फ्लैट टायर

एमजी में 51मिमी, बीजी सवारी यानों में 50 तथा माल यानों में 60 मिमी. चपटा हो जाय।

प्रभाव—धीमी गति 20—25 किमी0/घंटा पर हैमरिंग का प्रभाव (Hammering effect) बढ़ जाता है। जिसके कारण रेल में उत्पन्न होने वाले प्रतिबल का मान भी लगभग 2.5 गुना तक हो जाता है।

ह्वील गेज में अन्तर

ह्वील गेज बीजी तथा एमजी के लिए क्रमशः 1600 मिमी. तथा 930 मिमी. होता हैं। माल यानों तथा सवारी यानों के लिए इसमें 02 मिमी. ढोला तथा 01 मिमी. टाइट अनुमेय है। ह्वील गेज अधिक ढोला अथवा टाइट नहीं होना चाहिए।

- **प्रभाव**–चक्के में घुमावदार गति (W0bbling) होने लगती है जो यान की स्थिरता को प्रभावित करती है।

चक्के के व्यास में अन्तर

- चक्के के व्यास में निम्न अन्तर अनुमेय है
- एक ही यान में –एमजी में 10 तथा बीजी में 13 मिमी.
- एक ही ट्राली में – 5 मिमी. तथा
- एक ही एक्सल पर– केवल 0.5 मिमी.

प्रभाव–

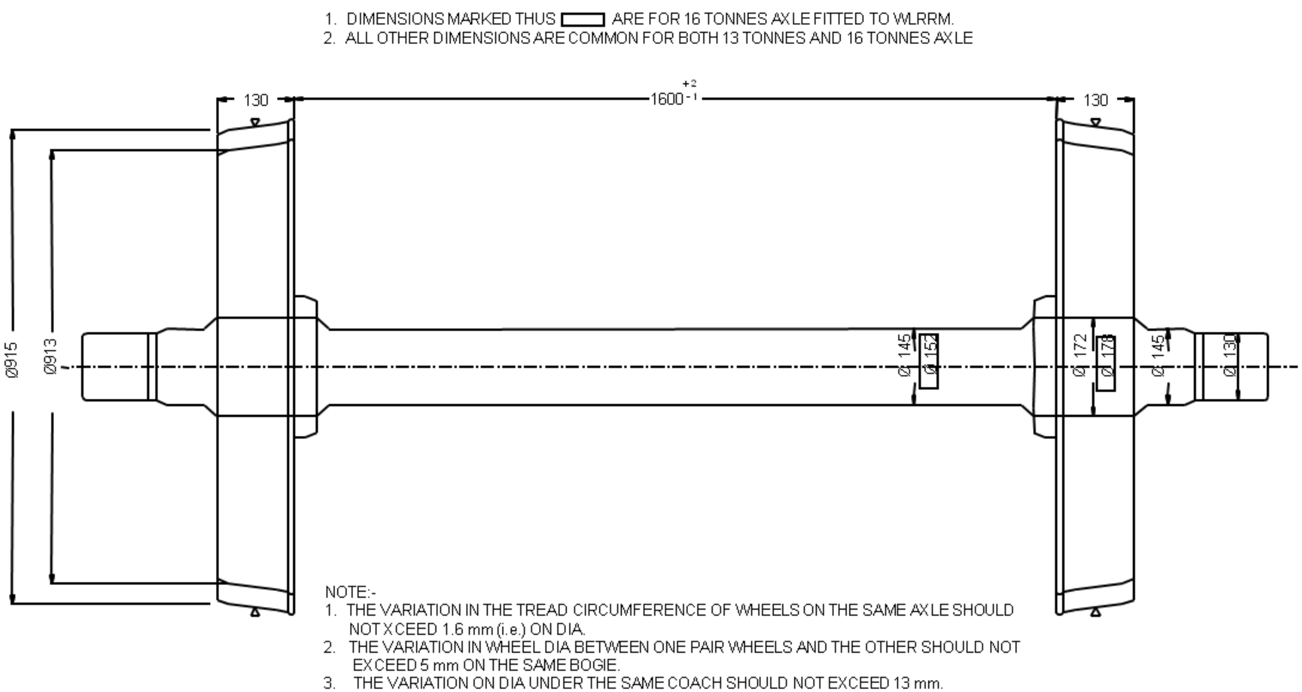
(1) एक ही एक्सल पर चक्के के व्यास में अन्तर के कारण उनके द्वारा समान चक्करों में चली गयी दूरी भी अलग–अलग होती है जिससे पाजिटिव एंगुलरिटी लगातार बनी रहती है।

(2) एक ही यान के चक्कों के व्यास में अत्याधिक अन्तर बफर हाइट को प्रभावित कर सकता है।

(3) यान के अन्य कारकों के साथ मिलकर फर्श के ढाल को भी प्रभावित करता है।

Wheel & Axle

Wheel, Tread and Axle



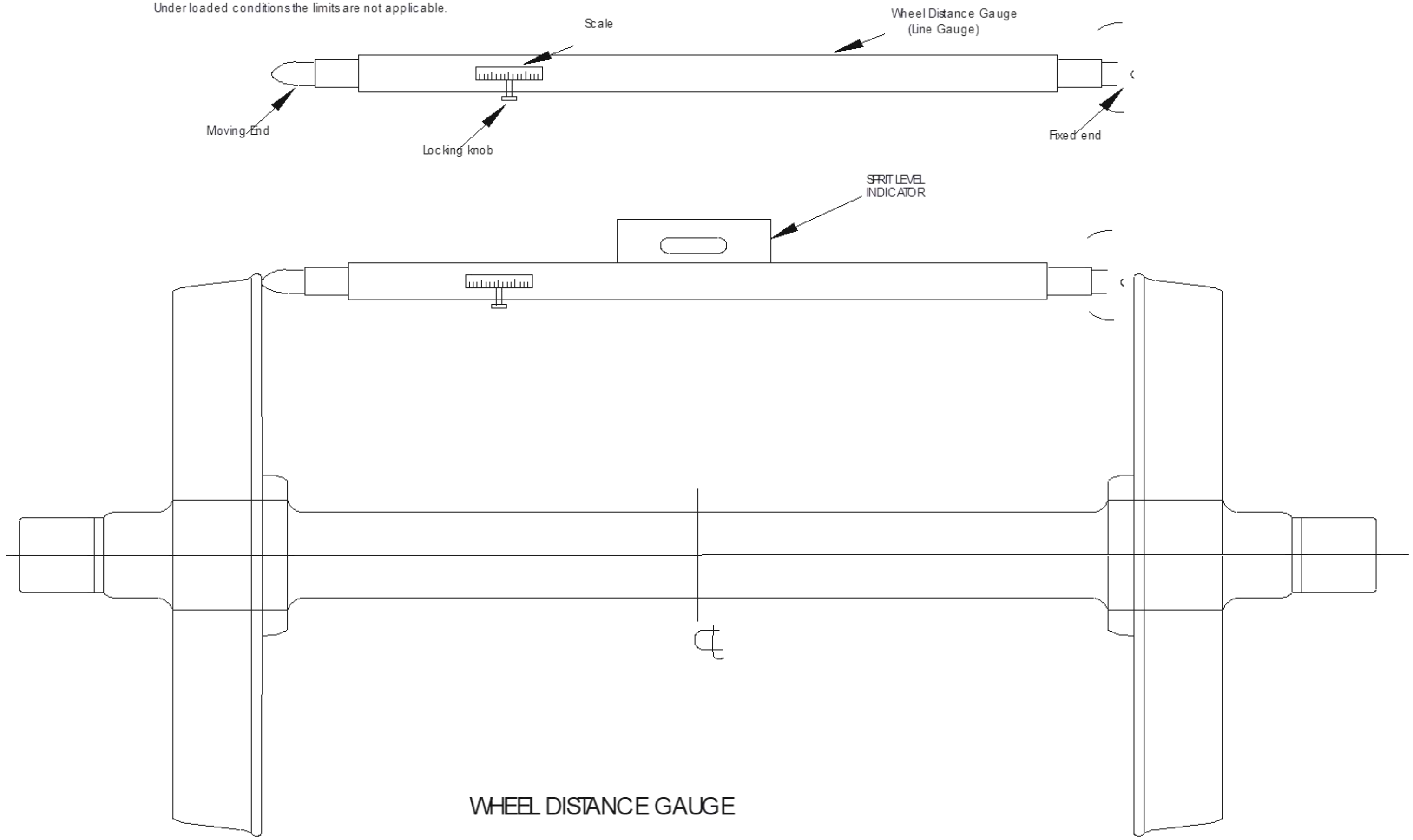
- Nomenclature
  - Axle
    - Journal
    - Collar
    - Wheel seat
  - Disc
    - Tread
    - Hub
    - Tyre profile

Wheel Gauge

Newly assembled wheel set should be checked for the distance between inner face of wheel i.e. 1600 + 2/-1 mm using Wheel Distance Gauge.

The wheels to be gauged on a level track after taking off from coaching vehicle.

Under loaded conditions the limits are not applicable.

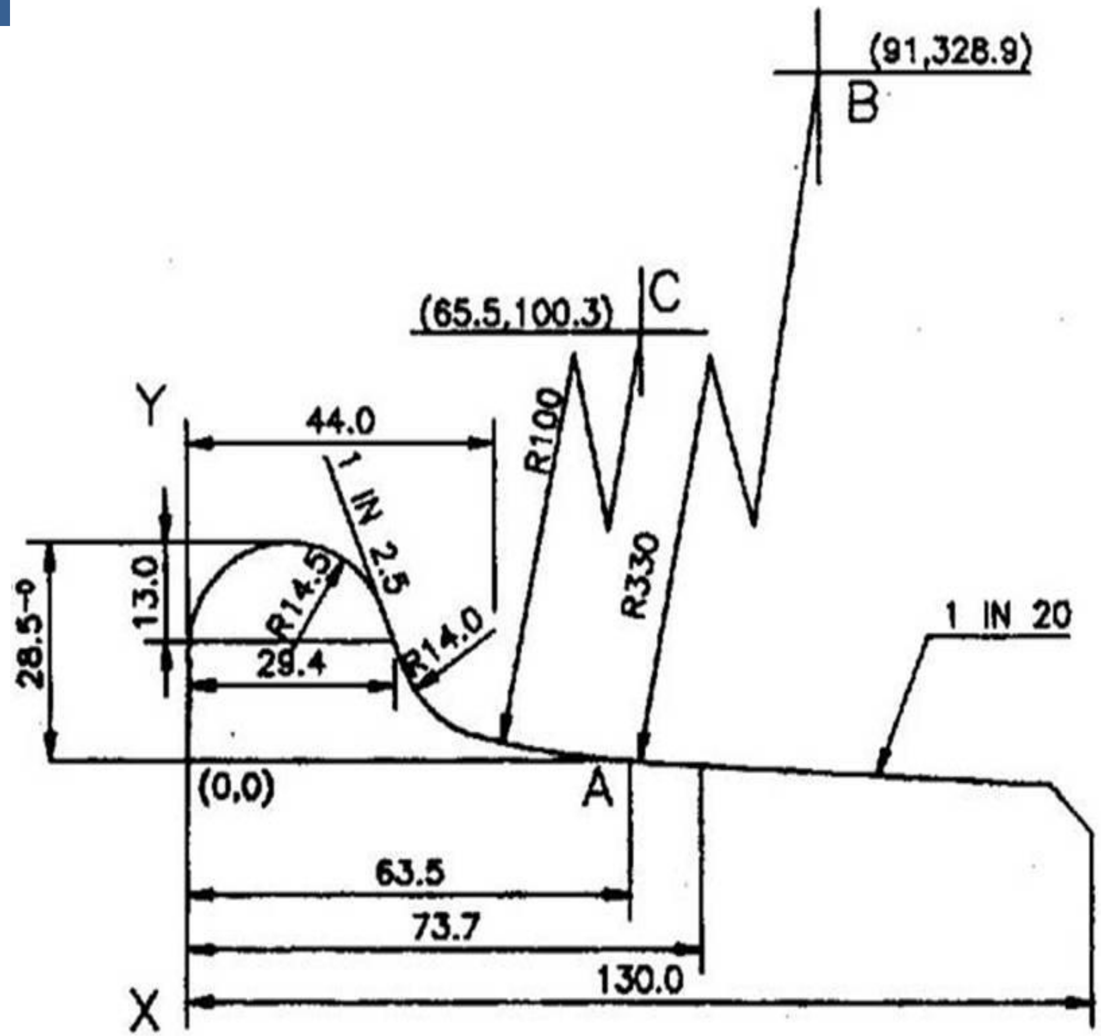


WHEEL DISTANCE GAUGE

FIGURE 10.6

Wheel Tyre Profile

- Standard wheel profile
- Worn wheel profile (Conforming profile)
- No Intermediate profile now.



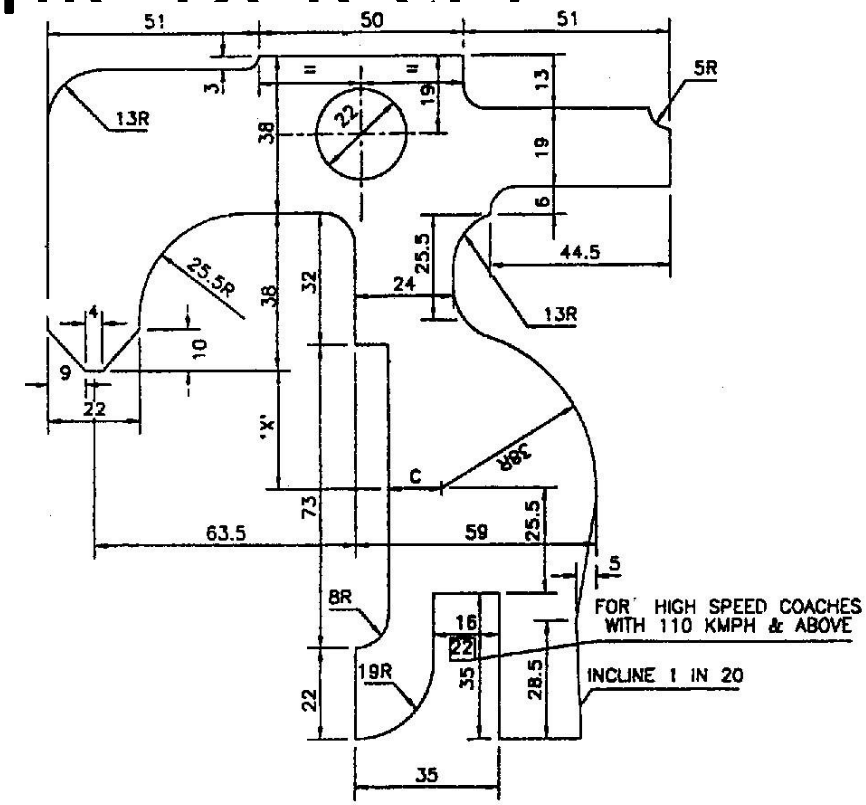
Difference in Wheel Diameter

	On the same axle	On the same trolley	On the same wagon
For Wagon	0.5	13	25
For Coach	0.5	5	13

- Prescribed in
  - Rule No. 2.8.14.2 IRCA Part III and
  - Rule No. 2.9.4 IRCA Part IV
- These limits do not form a part of train examination.
- The rejection of wheels worn beyond service limits will continue to be determined by the normal wear limits specified in IRCA Rules (Rly. Bd. letter No. 86/M(N)960/8 Dated 22.8.86).

Wheel Profile Defects

- Flat tyre
- Hollow tyre
- Sharp flange
- False flange
- Deep flange
- Thin flange
- Root radius



All coaches (Including EMU & DMU) 50 mm

NOTE:-

1. CONDEMNING MARK 'C' TO BE STAMPED ON BOTH SIDE OF GAUGE.
2. CONDEMNING MARKS FOR TYPE OF STOCK ON LINE ONLY NEEDS TO BE STAMPED.
3. DISTANCE 'X' AT WHICH CONDEMNING MARK 'C' FOR VARIOUS TYPE OF WHEELS TO BE STAMPED ARE AS BELOW:-

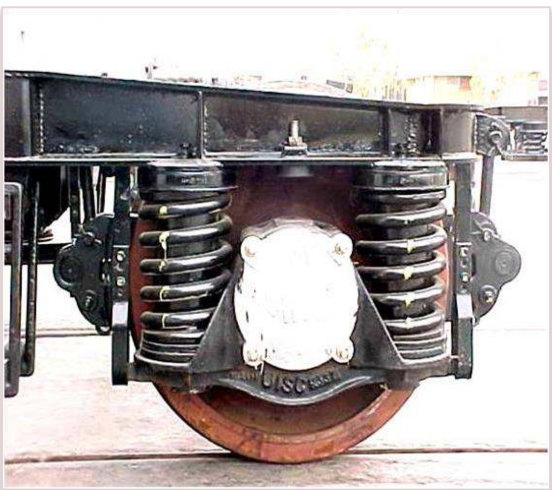
i)	SOLID WHEEL OF ICF & BEML MAIN LINE COACHES	6.5 mm.
ii)	SOLID WHEEL OF IRS MAIN LINE COACHES	5 mm.
iii)	TYRED WHEEL OF IRS, ICF & BEML MAIN LINE COACHES	26 mm.
iv)	TYRED WHEEL OF ac & dc EMU MOTOR COACHES.	38.5 mm.
v)	TYRED WHEEL OF ac & dc EMU TRAILER COACHES.	28.5 mm.

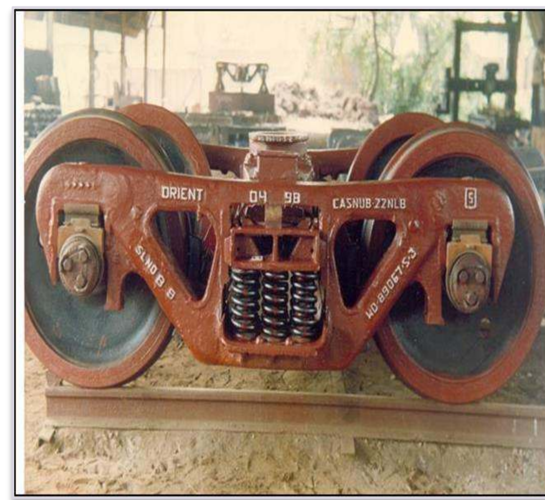
Axle Guide Arrangement

ICF

FIAT

CASNUB





Function of Axle Guides

- Guides the axle w.r.t. bogie frame laterally as well as longitudinally.
- Transmits tractive & braking force between bogie frame & axle box.
- In ICF, acts as a single acting hydraulic vertical shock absorber for primary spring.
- In FIAT bogie, provides control flexibility between frame and axle.

Axle Box Bearing

- CASNUB bogie
  - CTRB
- ICF bogie
  - Spherical type roller bearing with self-align feature.
    - Automatically adjust to the deviation in the centre line of the axle during run.
- FIAT bogie
  - CTRB

Wheels

MSTC/GKP

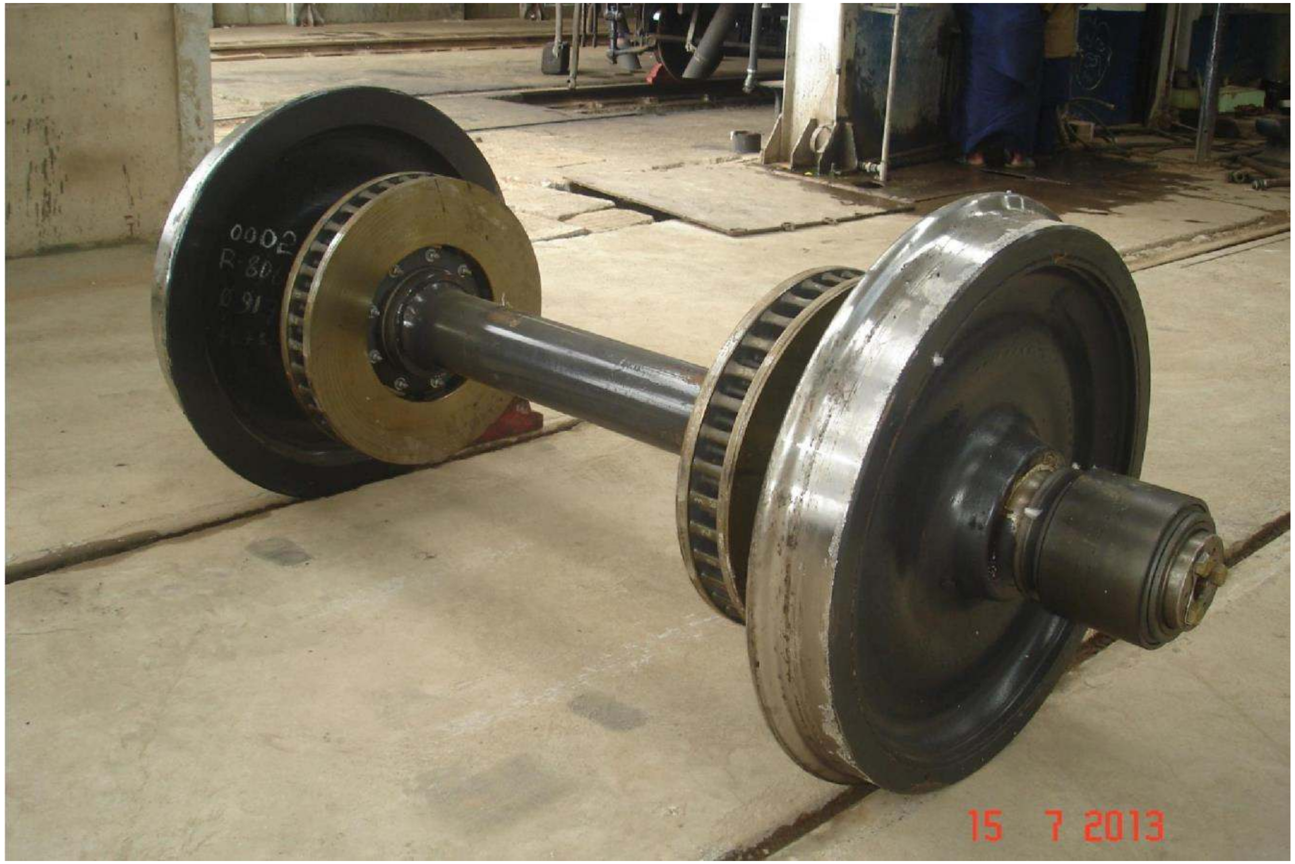
Railway Wheels

- Railway wheel is assembly of two wheels fixed to the axle by interference fit and they rotate along with the axle, without any independent relative movement as in the case of other automobile wheels.
- These wheels are provided with flange towards the inner side, which guide the wheels to travel on the rails and does not allow it to fall down from the rails.

Railway Wheels

ICF Coach Wheel

Railway Wheels



LHB Coach Wheel

Material of Wheel

- Steel made by Electric or Basic Oxygen process
- Steel shall be of killed quality for forged steel
- The max hydrogen content shall not exceed 3 ppm
- The max nitrogen content shall not exceed 0.007%

Railway Whee

BOXN Wheel

Material of Wheel

The chemical composition of the steel for Cast Wheel	
C	0.47% to 0.57% for type A used for carriage stock 0.57% to 0.67% for type B used for wagon stock
Mn	0.60 to 0.80%
P	0.03% max
S	0.03% max
Cr	0.15% max
Ni	0.25% max
Mo	0.06% max
Combined % for Cr, Ni & Mo must be 0.40% max	

The procedure to calculate chemical composition will be in accordance to IS:228

Mechanical Properties of Cast Wheel

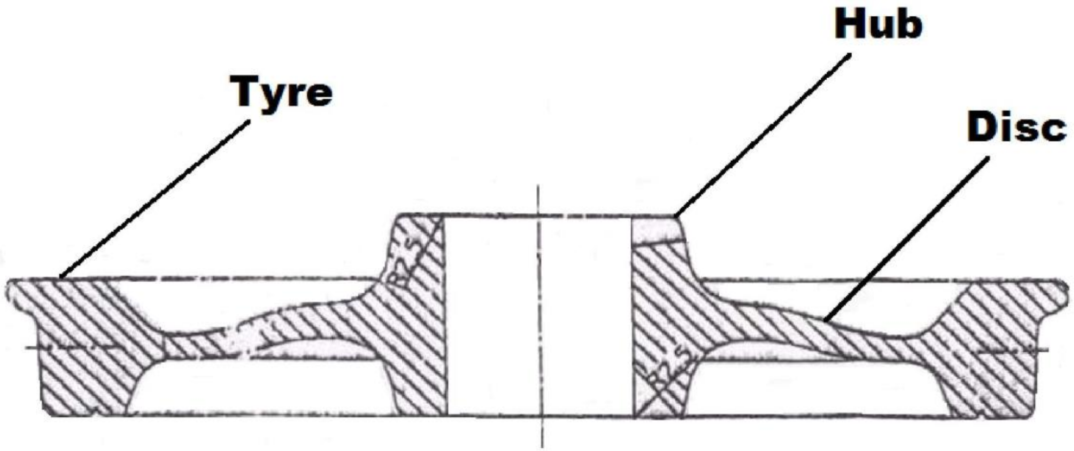
Sl. No.	Particulars	Type A	Type B
1	Tensile Strength at 15 mm below tread face	900 N/m2 min.	930 N/m2 min.
2	Tensile strength at middle of the web	800 N/m2 min.	800 N/m2 min.
3	Minum yield strength at 15 mm below tread face	50% of UTS	50% of UTS
4	Minimum yield strength at middle of the web	50% of UTS	50% of UTS
5	Minimum elongation at 15 mm below tread face	5.0%	4.5%
6	Minimum elongation at middle of the web	7.0%	7.0%
7	Hardness range at 15 mm below tread face	255-320 BHN	271-341 BHN
8	Minimum impact strength at 15 mm below tread face	10 J/cm2 at 20 deg C	--

Railway Wheels

The wheel is better understood by dividing it into the following parts

- Hub
- Disc
- Tyre

Wheel



hub

- Hub is the centre portion of the wheel, where the wheel is fixed to the axle by means of interference fit.
- Thickness of the wheel is maximum at the hub portion.
- UT details is marked on the Hub

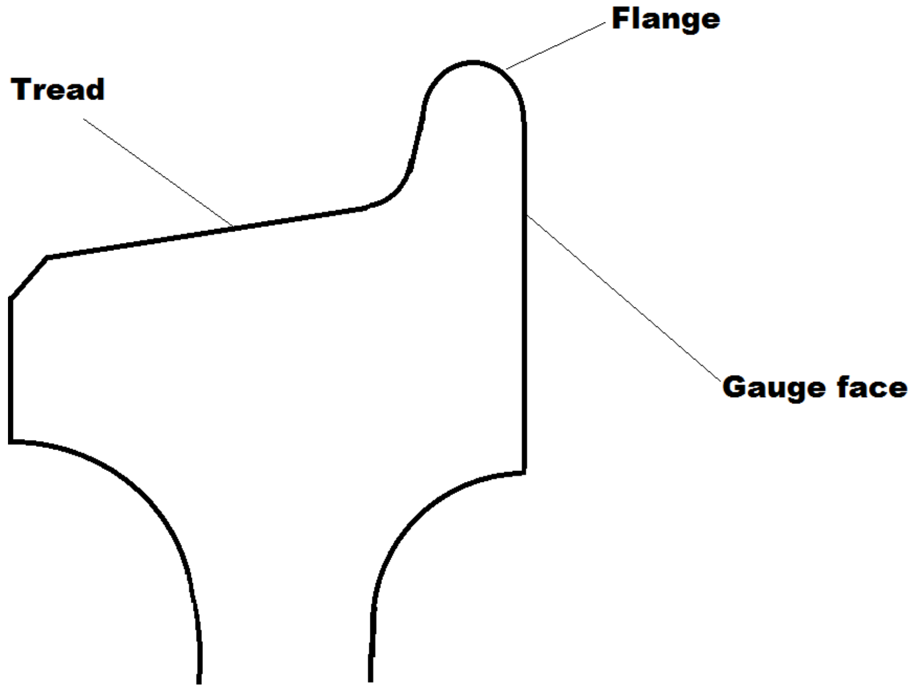
Disc

- Disc is the portion of the wheel between the hub and the tyre.
- This portion is the thinnest portion of the wheel as it does not come in contact with rail nor it is coming in contact with the axle.

Tyre

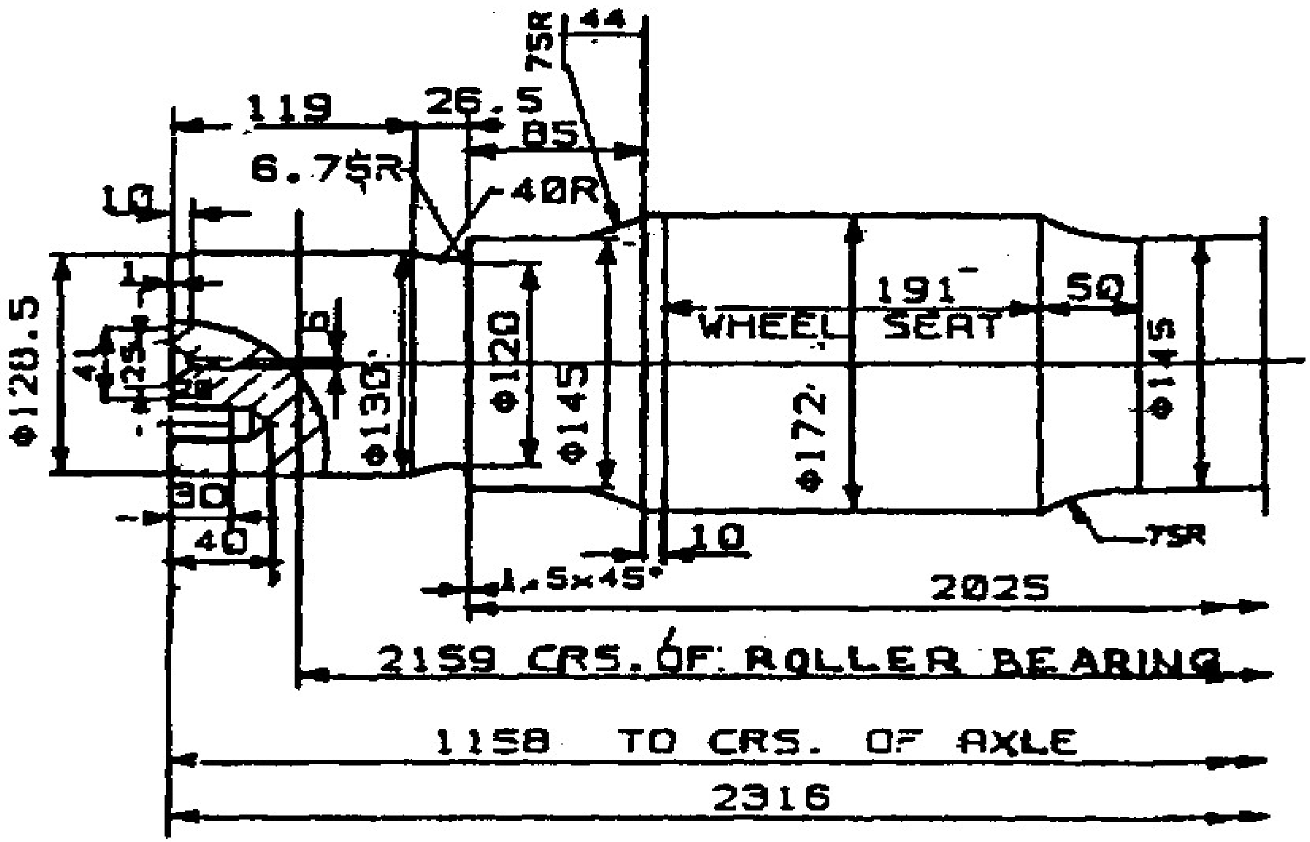
- Tyre is the portion in contact with the rail, which wears out in service.
- The profile of the tyre is significant for safe running of the trains.
- Taper is given on the tread to have higher diameter near the flange and lower diameter at the outer edge, to facilitate curve negotiation.

Tyre



Axles

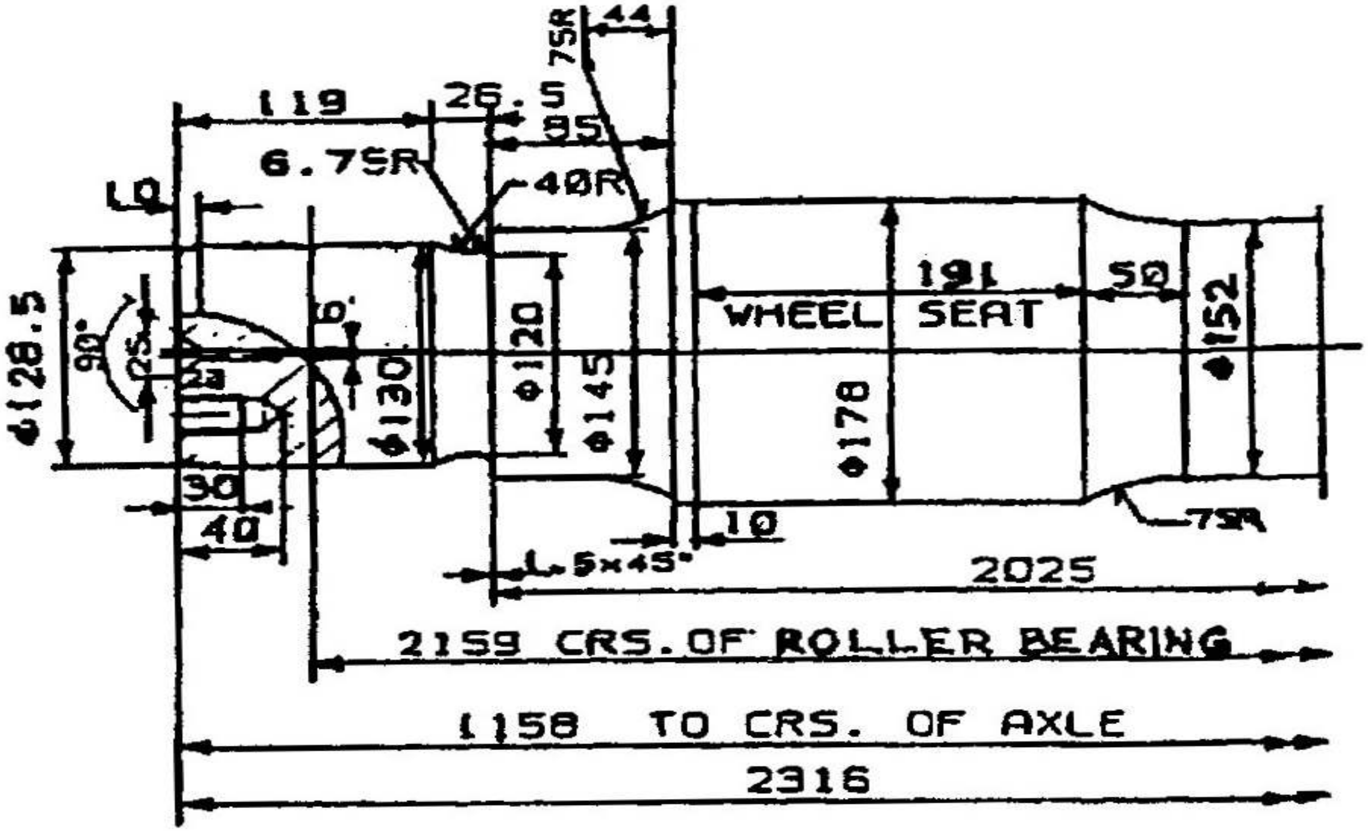
13 t Axle for ICF coach



ICF DRG. NO. T-0-2-622

Axles

16.25 t Axle for ICF coach



ICF DRG. NO. WTAC3-0-2-301

Press fit of wheel on axles

- Wheel disc is pressed to axle with interference fit (the bore of the wheel should be 0.304 mm to 0.355 mm less than the outer dia of the wheel seat on the Axle)
- Wheel Gauge should be in between 1599 and 1602 mm
- Axial off centre should be within 1.0 mm (wagon) & 0.8 mm (coach)
- Radial off centre should be within 0.5 mm (wagon) & 0.25 mm (coach)
- The Journals should be protected with bituminous black to IS:9862
- All Axles fitted by workshop during POH or despatched to depot should be Ultrasonically tested

Press fit of wheel on axles

Hydraulic press is used for assembly of the wheel with a force of 400 to 500 Kgs per mm dia of wheel seat (approximate force used for different wheels are given below)

Description	**Tonnage**
13 tonne axle	68.8 to 103.2 t
16.25 tonne axle	71.2 to 106.8 t
BOXN & BLC	85 to 127 t

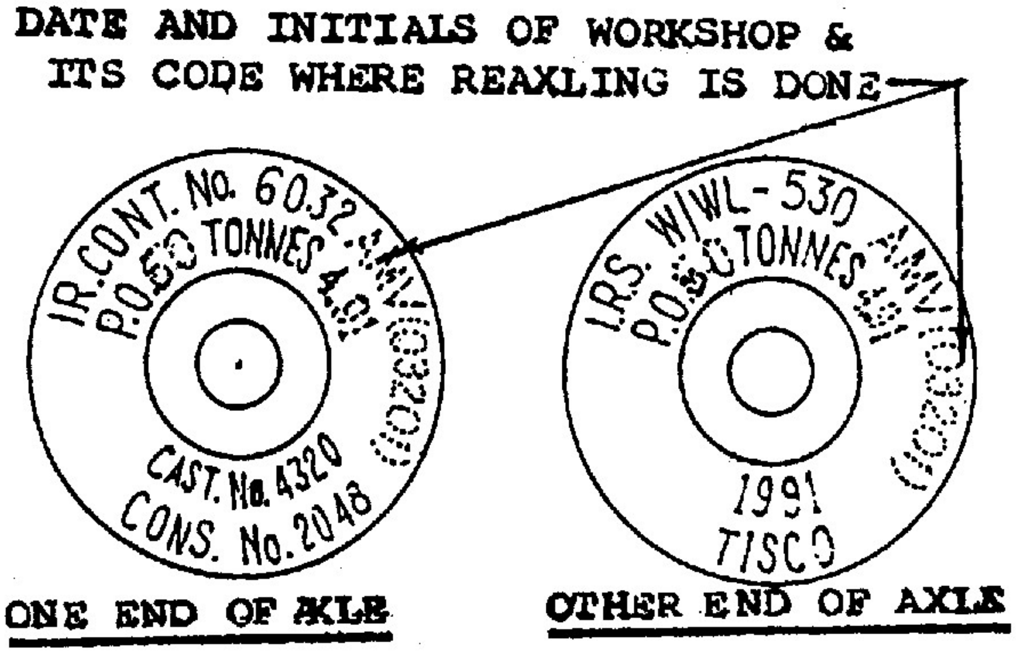
Stamping of particulars

Whenever axles are renewed the workshop shall punch in 5 mm letters the following particulars on the journal face

- Place of pressing
- Date of pressing
- Pressure of pressing

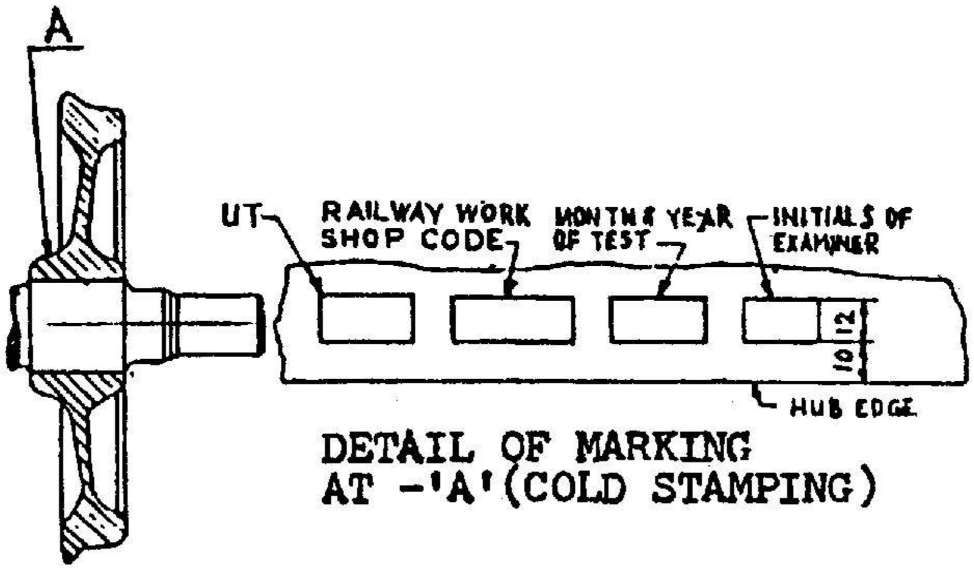
Whenever UT is done the details shall be stamped cold on the inner hub fillet with 6 mm punch not more than 1.5 mm depth

Stamping of particulars



NOTE:
ALL STAMPING TO BE DONE WITHIN 63 DIA.
ON BOTH JOURNAL FACES.

Stamping of particulars

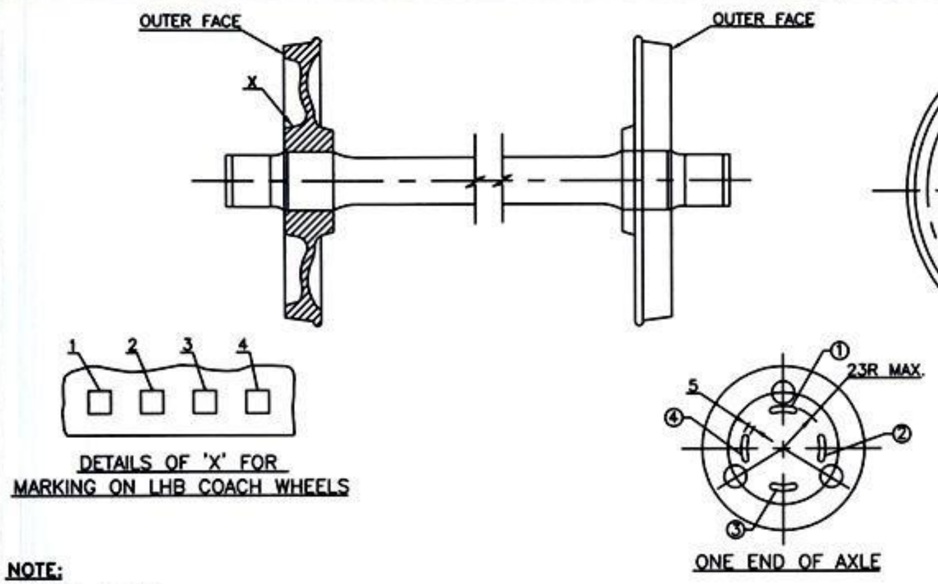


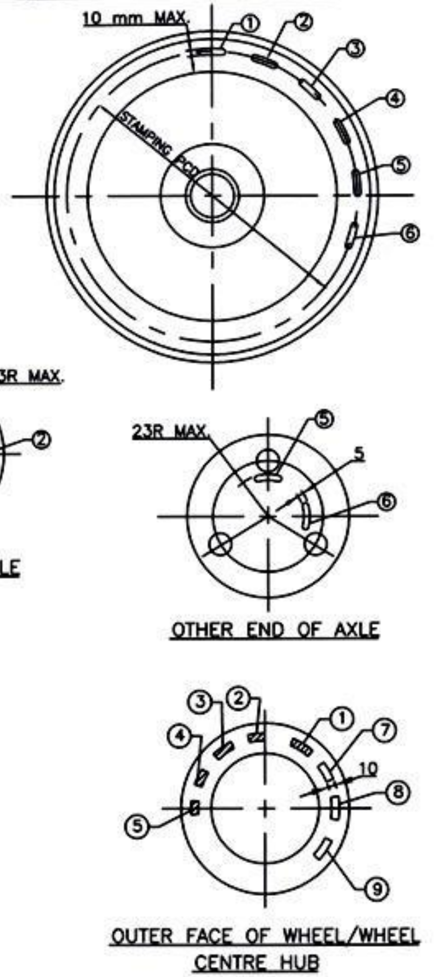
DETAIL OF MARKING
AT -'A'(COLD STAMPING)

NOTE:-

1. 'UT' INDICATES ULTRASONIC TESTING OF AXLES.
2. THE MARKING SHALL BE STAMPED COLD ON THE INNER HUB FILLET AS SHOWN AT 'A' AFTER THE SURFACE IS GROUND PROPERLY.
3. THE EXAMINING WORKSHOPS SHALL MAINTAIN ALL THE PARTICULARS OF AXLES TESTED VIZ. I.R. PART NO., CONTRACT NUMBER, CAST AND CONSECUTIVE NUMBERS, MANUFACTURER'S INITIALS AND YEAR OF MANUFACTURE IN REGISTER PROPERLY MAINTAINED BY THEM.
4. REF. WDO DRG. NO. WD-81089/S-1

Stamping of particulars





STAMPING PARTICULARS

WHEEL/WHEEL CENTRE AND AXLE DETAILS	1	MANUFACTURER'S CODE
	2	YEAR OF MANUFACTURE
	3	CONSECUTIVE No.
	4	BATCH No.
	5	INSPECTOR'S APPROVAL STAMP
	6	'UT' FOR ULTRASONIC TESTING
ASSEMBLY DETAILS	7	MANUFACTURER'S/WORKSHOP'S CODE
	8	MONTH AND YEAR OF ASSEMBLY
	9	PRESSING ON PRESSURE IN TONNES

PCD OF STAMPING OF DIFFERENT WHEELS

TYPE OF WHEEL	PCD OF STAMPING ON RIM
COACHING WTAC3-0-2-301 T-0-2-622 W/WL-1660 MG/T-0-1-004	788 mm 788 mm 788 mm 610 mm
WAGON W/WL-4764 W/WL-4771 WD-89025/S-5 WD-89025/S-9	870 mm 780 mm 830 mm 960 mm
CONTAINER FLAT CONTR.-9404-S/13	755 mm
SOLID WHEEL FOR EMU Sk-K4004	842 mm (FOR MC) 832 mm (FOR TC)

NOTE:

1. WHEEL DETAILS
   .1 TO BE HOT/COLD STAMPED OR MARKED BY ELECTRIC ETCHING IN 10 mm LETTERS ON OUTER FACE OF THE RIM OF ROUGH TURNED OR FINISH TURNED WHEELS.
   .2 FOR LHB COACH WHEELS, STAMPING SHOULD BE DONE ON OUTER FACE OF THE HUB. PARTICULARS OF S.No. 1 TO 4 SHALL ALSO BE STAMPED ON OUTER HUB FILLET AT LOCATION MARKED AS 'X', FOR EASY IDENTIFICATION IN ASSEMBLED CONDITION.
2. WHEEL CENTRE DETAILS
   TO BE COLD STAMPED OR MARKED BY ELECTRIC ETCHING IN 10 mm LETTERS AT THE HATCHED LOCATIONS ON OUTER FACE OF THE HUB.
3. AXLE DETAILS
   .1 TO BE STAMPED COLD OR MARKED BY ELECTRIC ETCHING ON BOTH ENDS IN 5 mm LETTERS LETTERS IN CASE OF ROUGH TURNED OR FINISHED AXLES.
   .2 TO BE STAMPED IN 10 mm LETTERS IN CASE AXLES ARE SUPPLIED IN AS FORGED CONDITION.
4. ASSEMBLY DETAILS
   TO BE STAMPED COLD OR MARKED BY ELECTRIC ETCHING IN 10 mm LETTERS ON THE OUTER FACE OF THE WHEEL/WHEEL CENTRE HUB.
5. IT IS MANDATORY TO STAMP THE RESPECTIVE MARKINGS AT THE LOCATIONS INDICATED ABOVE.

ALT.	ITEM	AUTHY.	DESCRIPTION	DATE
7	--	SS/21/09	DETAILS OF 'X' FOR ADDITIONAL MARKING ON LHB COACH WHEELS ADDED AND NOTE 1.2 MODIFIED.	12/09
6	--	SS/19/09	RADIUS AT END VIEWS OF THE AXLE CHANGED FROM 18R TO 23R.	10/09
5	--	SS/01/06	DRAWING REVISED	1/06
4	--	SS/13/03	DRAWING REVISED	3/03
3	--	SS/3/02	DRAWING REVISED	2/02
2	--	CD/17/99	DRAWING REVISED	8/99
1	--	CD/6/97	DRAWING REVISED	9/97

SUPERSEDED BY:
SUPERSEDES:

SCALE	P	
	C	G.V.RAMAN
	D	PANTA SANJAY
	T	--
	J.S.	--

B.G. R.D.S.O. [c]

BRANDING DETAILS ON WHEEL & AXLE

SKETCH-92114

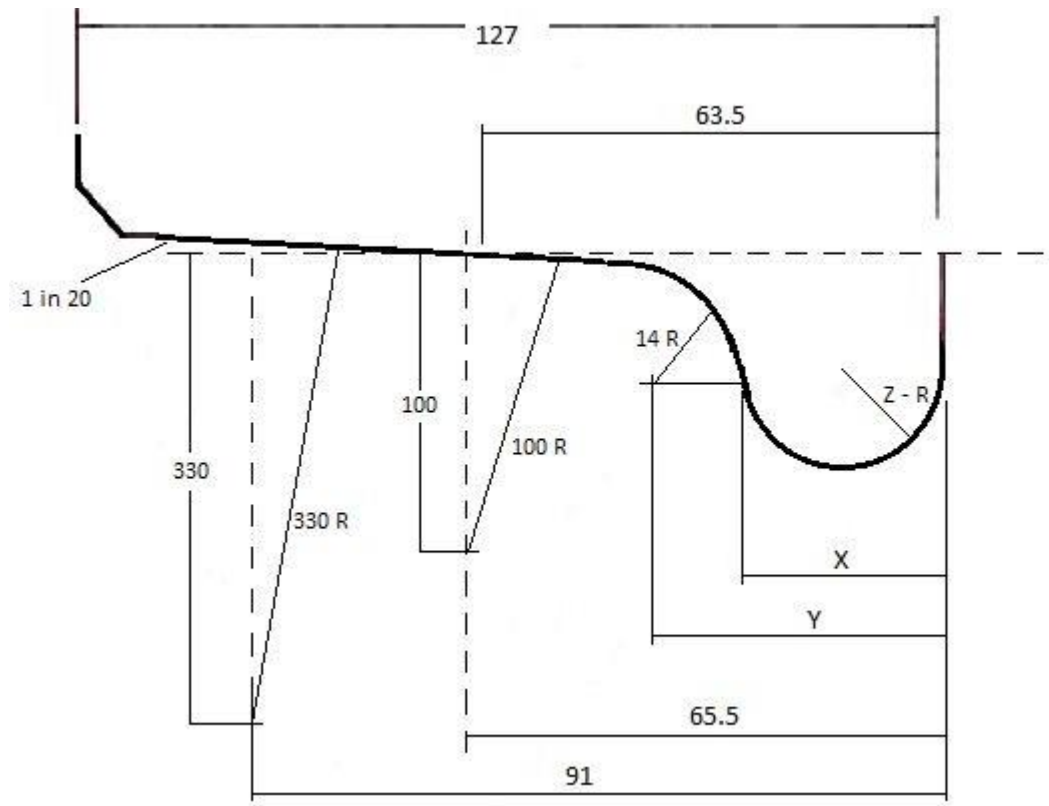
Worn Wheel Profile

80 % of the track in Indian Railways is having rails which are already worn in service. Standard wheel profile running on these tracks tend to wear to a specific profile within short time itself, and further wear from this profile is very slow. Hence if the wheels are turned initially to this worn wheel profile, it will increase the wheel life by avoiding frequent re-profiling.

Worn Wheel Profile

The worn wheel profile is made standard for all the wheels in Indian railways as the standard wheel profile is found uneconomical with lesser kilometres being run by the wheels within condemnation.

Worn Wheel Profile



Step Sizes of Worn Wheel Profile

Further to reduce the metal removal during tyre turning, intermediate worn wheel profile based on the flange thickness is introduced.

Flange Thickness (X)	Y	Z
28 mm	42.23 mm	13.5 mm
27 mm	41.29 mm	13.0 mm
26 mm	40.34 mm	12.5 mm
25 mm	38.41 mm	11.5 mm
24 mm	37.44 mm	11.0 mm
23 mm	36.47 mm	10.5 mm
22 mm	35.49 mm	10.0 mm
21 mm	34.5 mm	9.5 mm
20 mm	33.5 mm	9.0 mm

Wheel Defects

- Manufacturing Defects
- Improper Assembly Practices
- Normal Wear and Tear during service

Manufacturing Defects

- Casting Defects
- Improper Heat treatment
- Machining Imperfections

Improper Assembly Practices

- Stipulated dimensional tolerances for Wheel seat and bore not adhered to resulting in use of higher or lower than the prescribed force during pressing leading to improper wheel set assembly.
- Ovality on Journals - 0.02 mm (max)
- Taper on Journal - 0.01mm (max)
- Difference in dia of wheels on the same axle should not exceed 0.5mm

Wheel defects

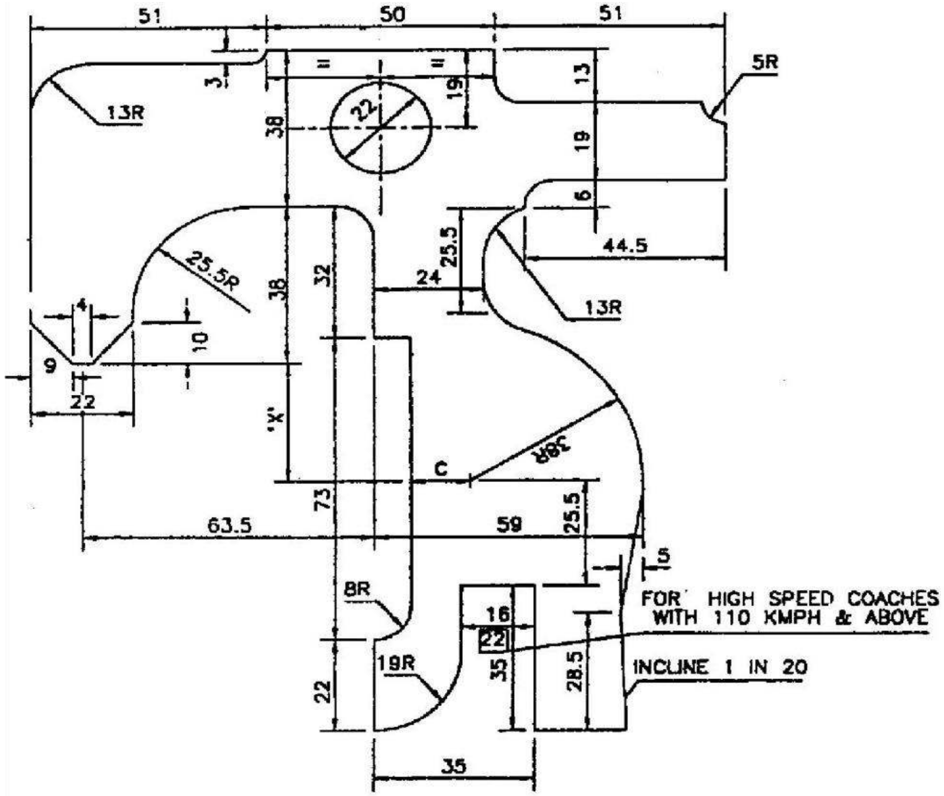
Measurable wheel defects arising due to normal wear & tear during service

- Thin flange
- Deep flange
- Sharp flange
- Less radius at root of flange
- Hollow tyre
- Thin tyre
- Flat tyre

Std & cond limits

Defect	Std	Cond
Thin flange	28.5	22 (Coaches) 16 (Wagons)
Deep flange	28.5	35
Sharp flange (radius)	14.5	5
Less radius at root of flange (radius)	14 (wwp)	13
Hollow tyre		5
Thin tyre		Based on wheeldia
Flat tyre		50 (Coaches) 60 (wagons)

Tyre Defect Gauge



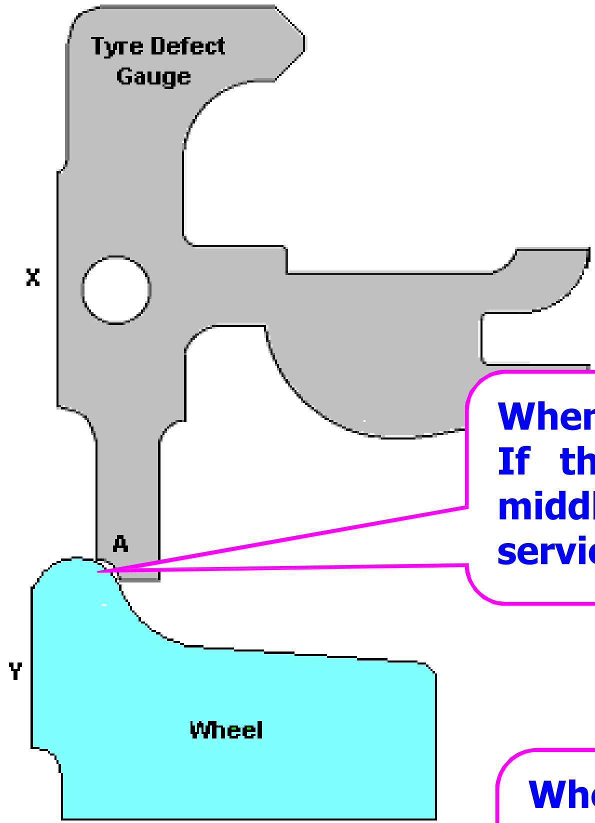
All coaches (Including EMU & DMU) 50 mm

NOTE:-

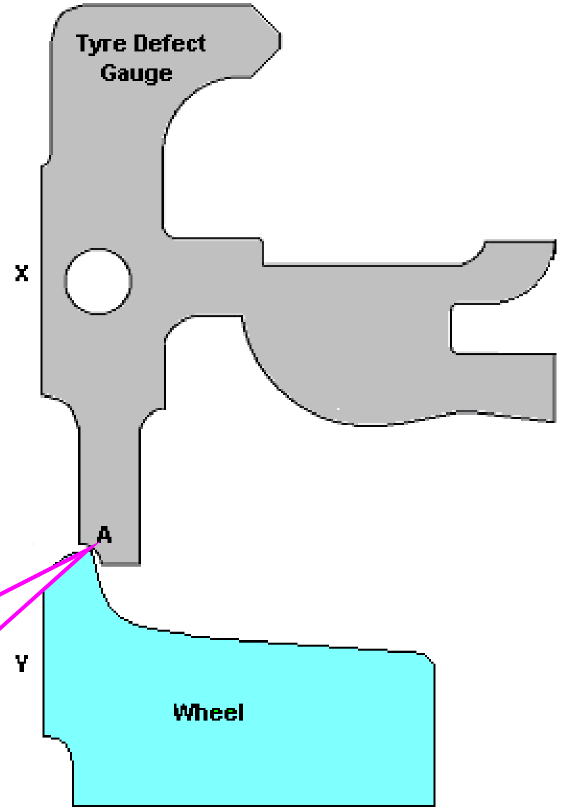
1. CONDEMNING MARK 'C' TO BE STAMPED ON BOTH SIDE OF GAUGE.
2. CONDEMNING MARKS FOR TYPE OF STOCK ON LINE ONLY NEEDS TO BE STAMPED.
3. DISTANCE 'X' AT WHICH CONDEMNING MARK 'C' FOR VARIOUS TYPE OF WHEELS TO BE STAMPED ARE AS BELOW:-

i) SOLID WHEEL OF ICF & BEML MAIN LINE COACHES 6.5 mm.
ii) SOLID WHEEL OF IRS MAIN LINE COACHES 5 mm.
iii) TYRED WHEEL OF IRS, ICF & BEML MAIN LINE COACHES 26 mm.
iv) TYRED WHEEL OF ac & dc EMU MOTOR COACHES. 38.5 mm.
v) TYRED WHEEL OF ac & dc EMU TRAILER COACHES. 28.5 mm.

Checking for sharp flange

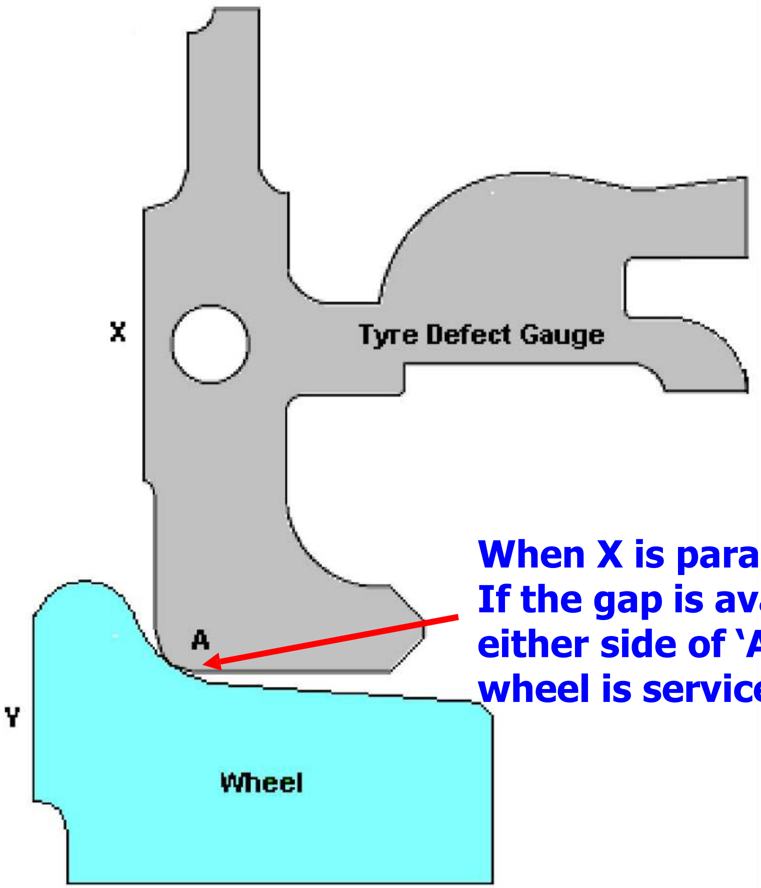


**When X is parallel to Y,
If there is Gap in the middle at A, the Wheel is serviceable**

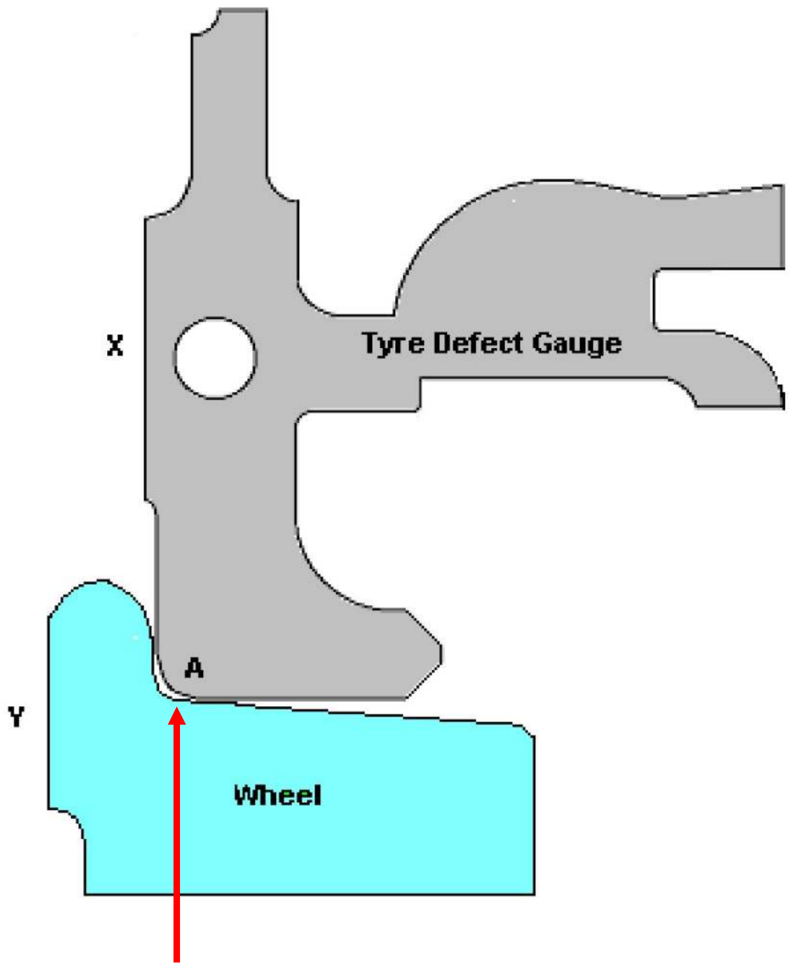


**When X is parallel to Y,
If there is gap on either side of A, the Wheel is rejectable**

Checking the root of flange

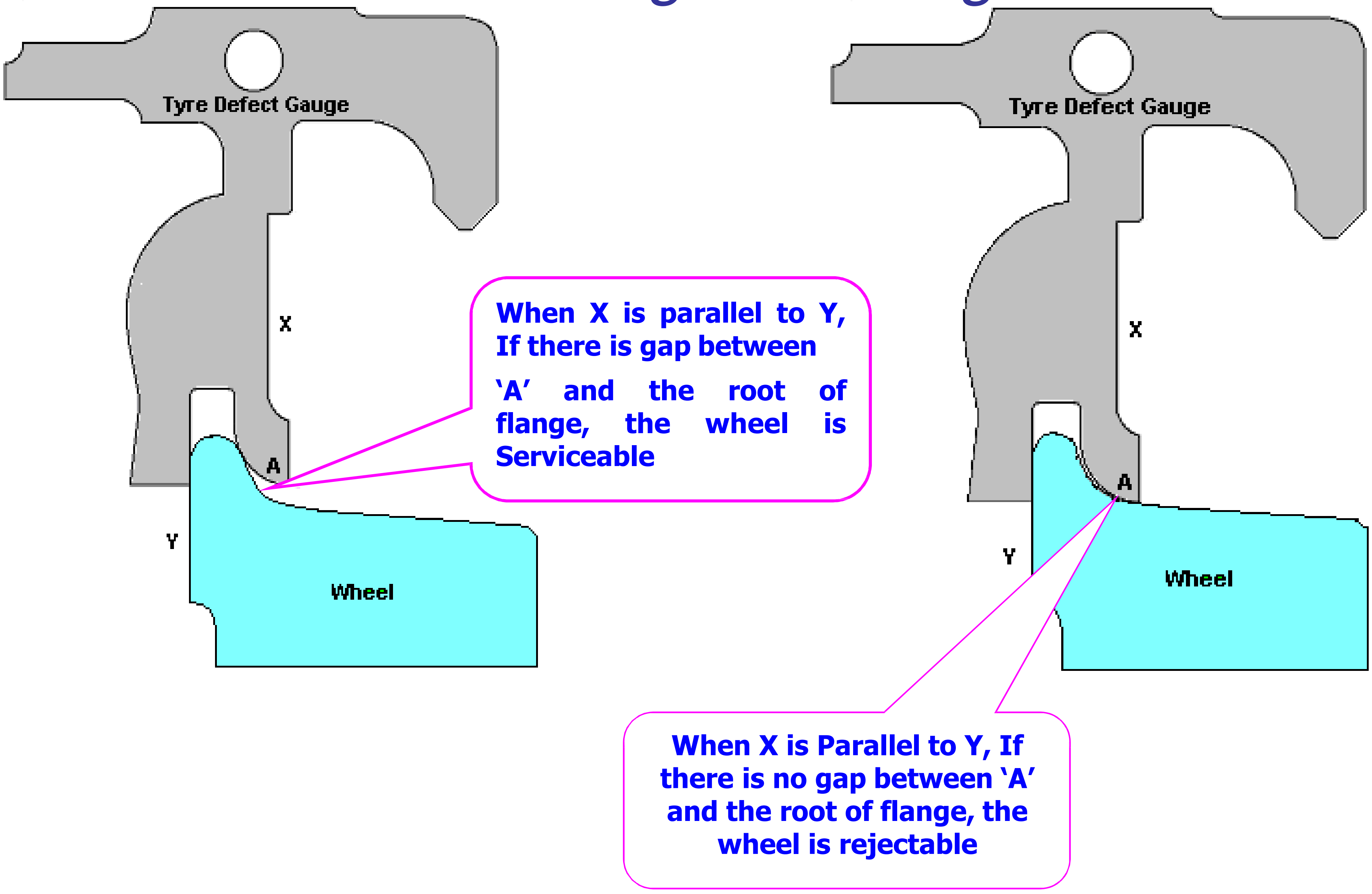


When X is parallel to Y, If the gap is available at either side of 'A', the wheel is serviceable.

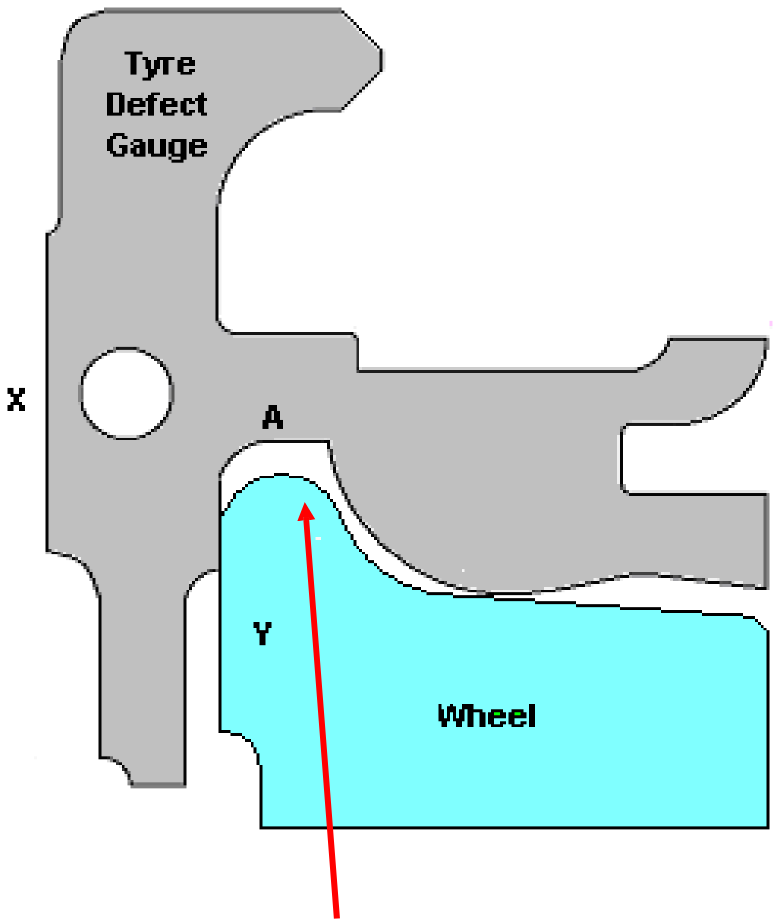


When X is parallel to Y , If there is a gap between gauge and the Root of Flange at A , the Wheel is Rejectable

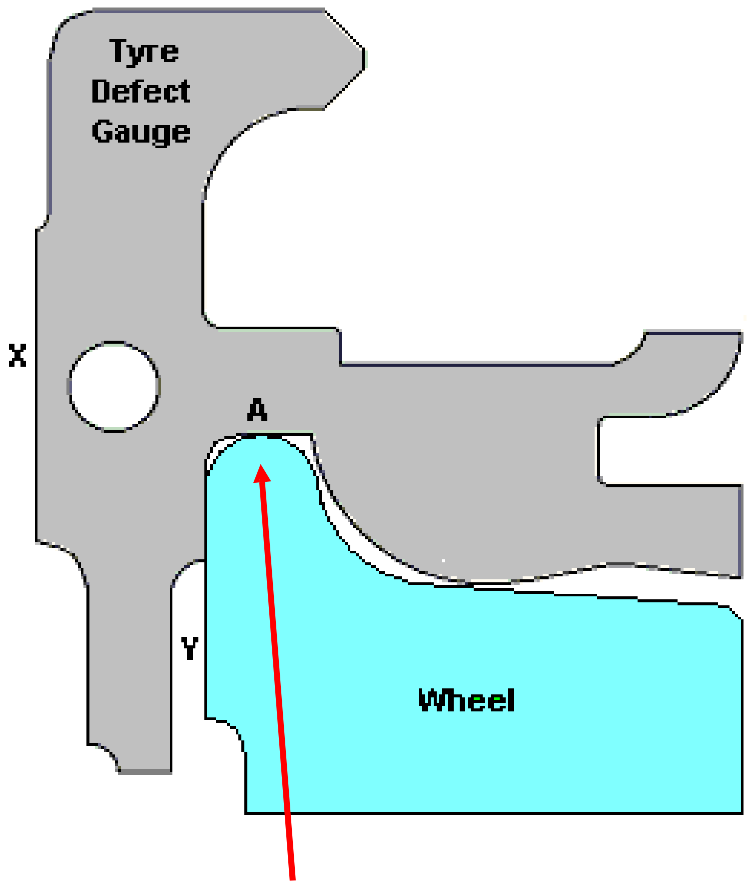
Checking Thin flange



Checking Deep Flange

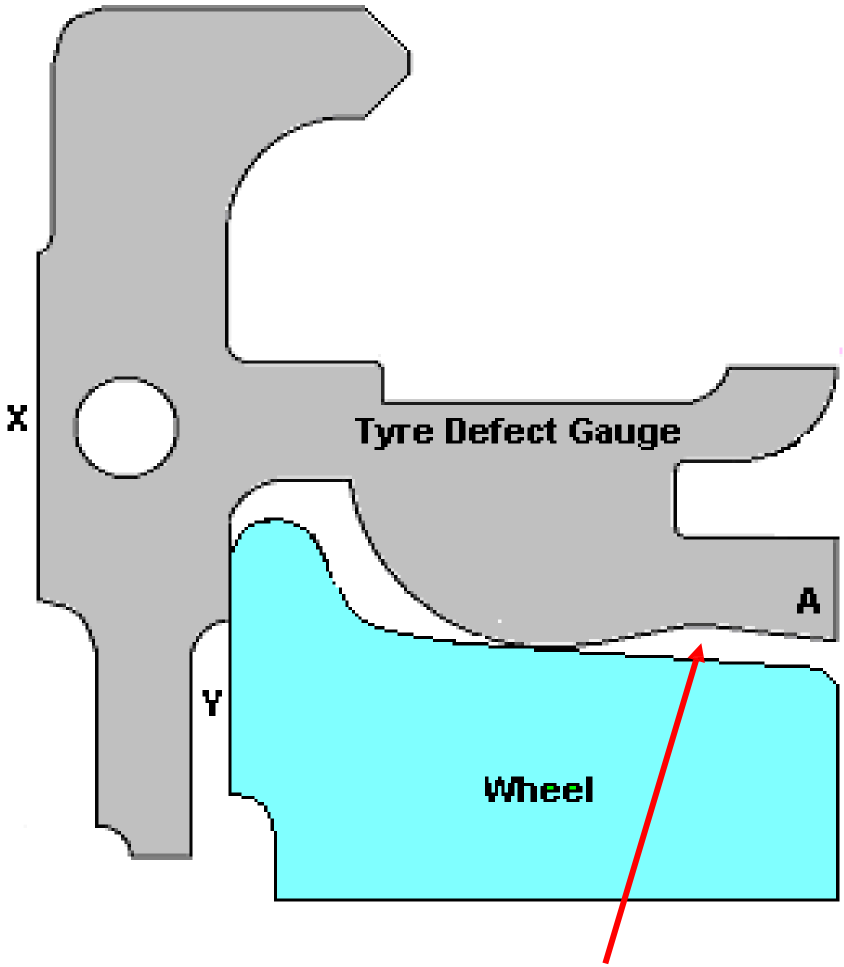


When X is parallel to Y,
If there is a gap between 'A'
and tip of the flange, the wheel is
serviceable.

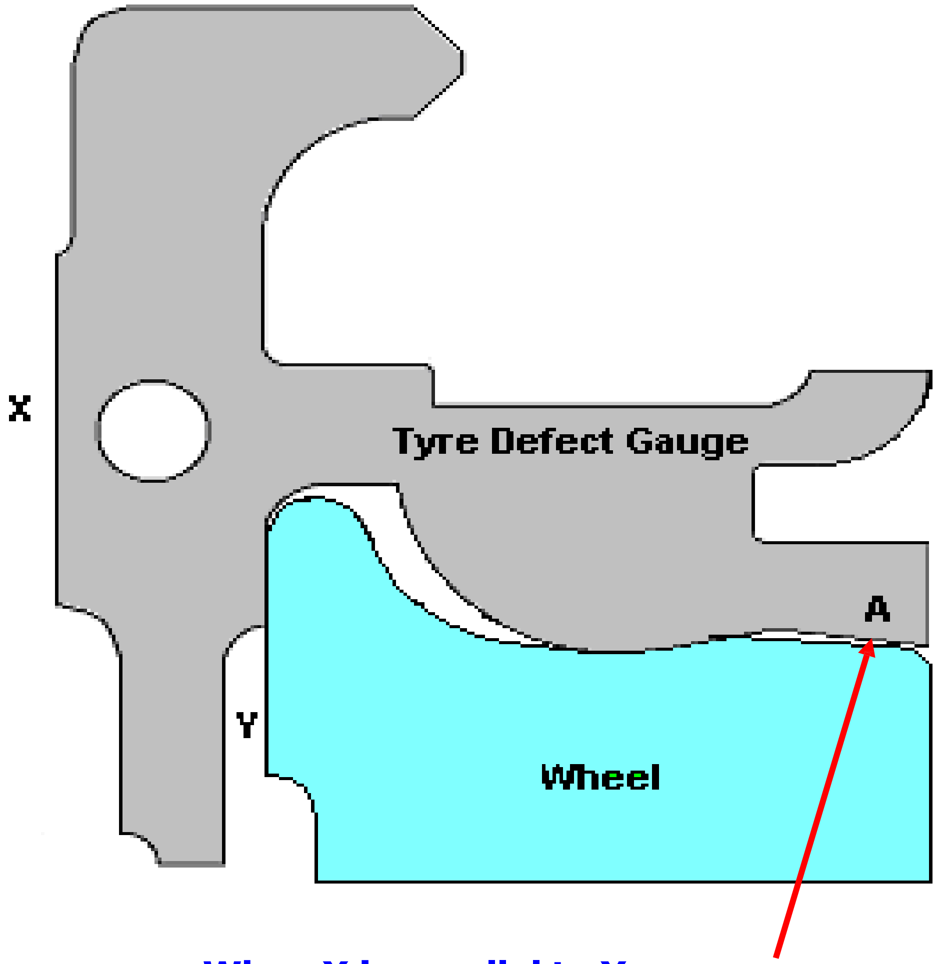


When X is parallel to Y,
If there is no gap between 'A'
and tip of the flange, the wheel is
rejectable

Checking Hollow tyre

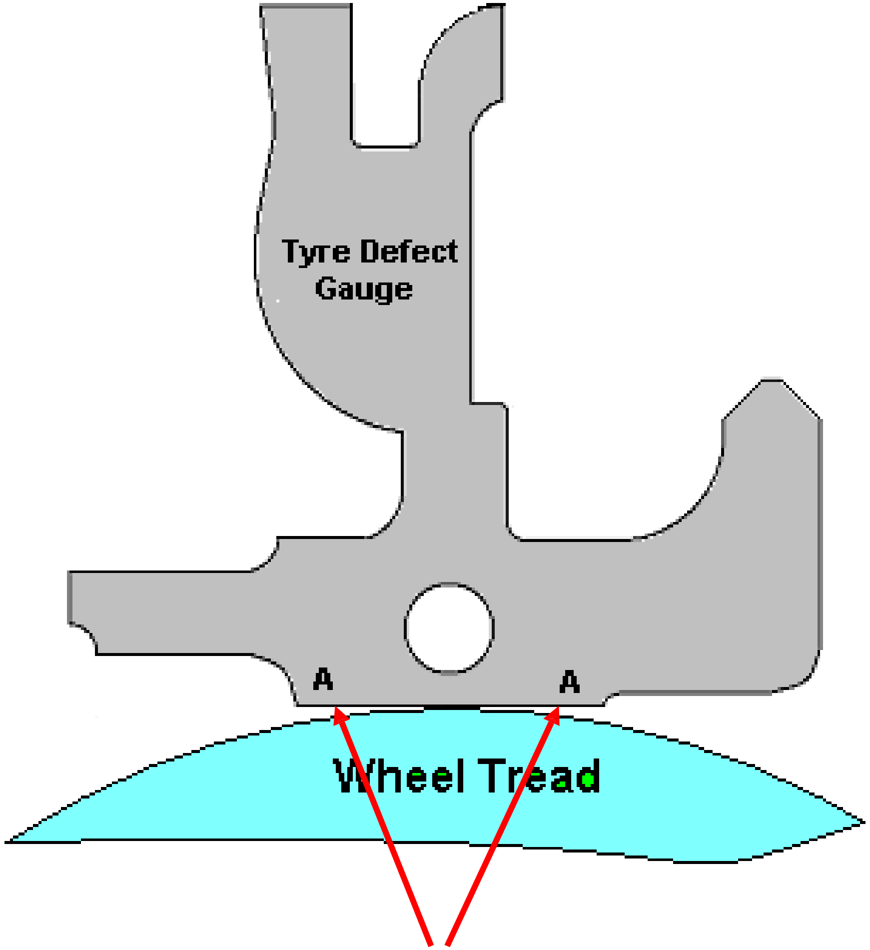


When X is parallel to Y,
If there is gap between the wheel tread and gauge at "A",the wheel is serviceable

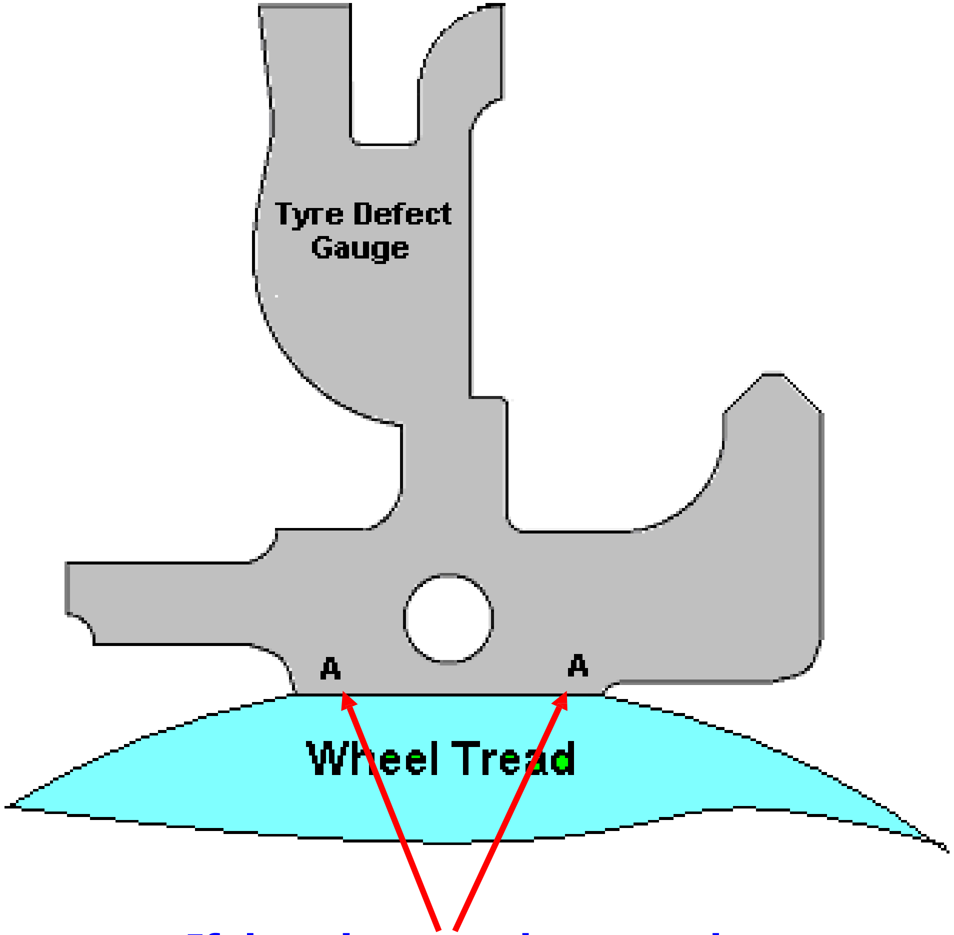


When X is parallel to Y,
If the gauge touches the wheel tread at "A",The wheel is rejectable.

Checking Flat tyre

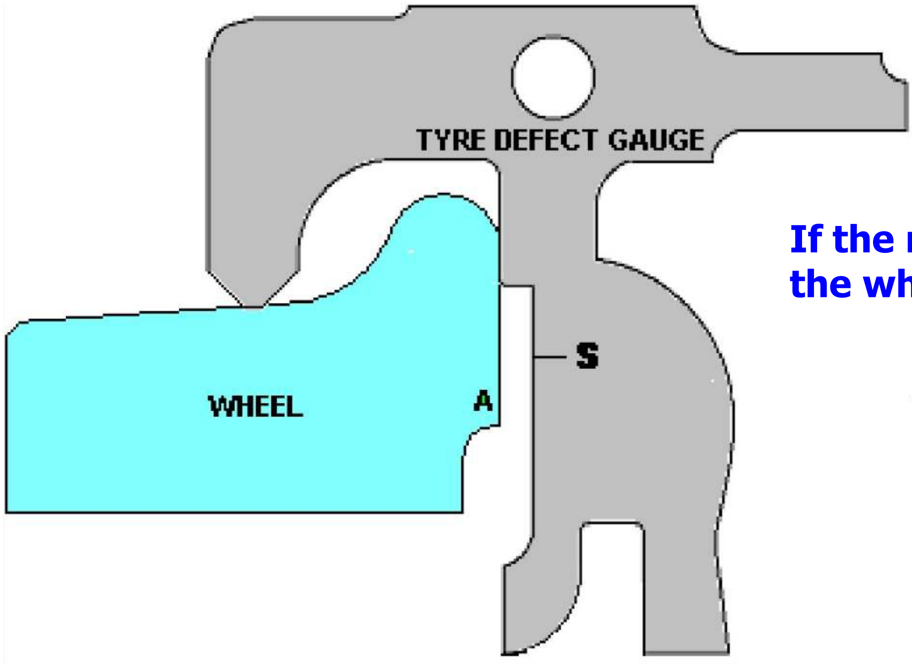


If there is gap between the gauge and the wheel tread at "A", the wheel is serviceable.

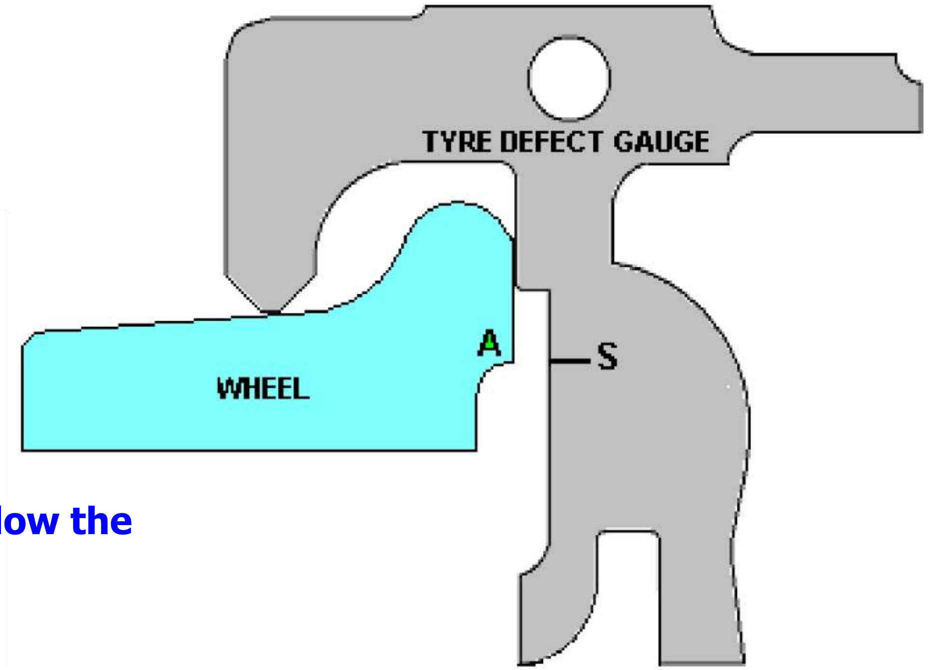


If there is no gap between the gauge and the wheel tread at "A", the wheel is rejectable.

Checking Thin tyre



If the mark S in the gauge is above the location A , the wheel is serviceable.



If the mark S in the gauge is in line or below the location A , the wheel is rejectable.

Wheel defect as per CMI K 003

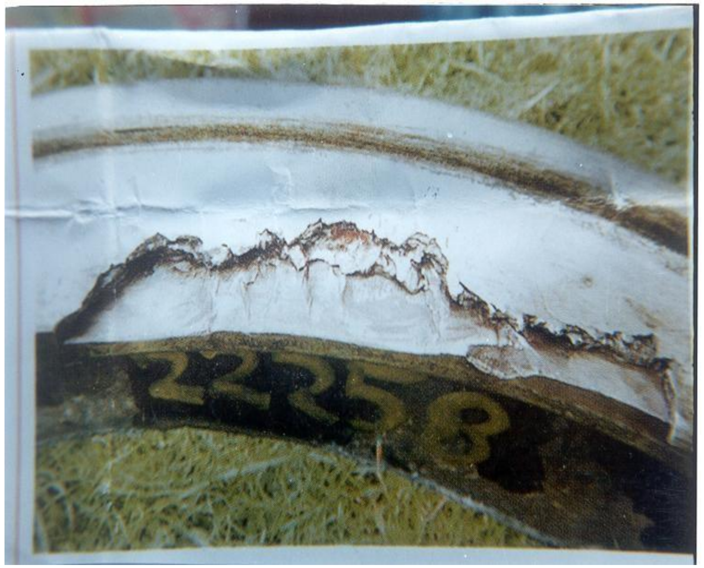
- Shelled tread
- Shattered rim
- Spread rim
- Thermal crack
- Heat checks
- Disc crack
- Loose axle

Shelled Tread

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

Shattered Rim

A wheel with a fracture on the tread or flange must be withdrawn from service. Shattered Rim is a rejectable defect. (This does not include wheels with localized pitting or flaking without presence of any rejectable condition).



Spread Rim

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

Rim Flow

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

Thermal Crack

Thermal cracks appear on a wheel tread due to intense heating of the wheel arising out of severe brake binding. Such cracks occur on the tread and generally progress across the tread in a transverse & radial direction. Whenever such a crack becomes visible on the outer face of the rim or tread crack has reached the outer edge (non-gauge face) of the rim, the wheel should be withdrawn from service. If a crack becomes visible on the outer flange face, the wheel should be withdrawn from service. Such wheels should be sent to workshop for examination and subsequent rejection.

Thermal Crack

Wheels involved in brake binding during service, should be examined carefully during the maintenance to rule out the possibility of rejectable thermal cracks. Such wheels may be identified by presence of flats (even within acceptable limits) and severe discoloration or blue/ black heating marks on the tread.

Heat Checks

Fine superficial cracks visible on the tread on or adjacent to the braking surface are called heat checks, which are usually denser than the thermal cracks. Heat checks are caused on the tread due to heating and cooling cycles undergone by the wheel during normal braking. Such wheels need not be withdrawn but should be carefully distinguished from the rejectable thermal cracks

Disc Crack

A crack on the disc due to material failure is called disc crack. The wheel should be with drawn from service.

Loose Axle

- While assembling wheel with axle proper interference should be maintained between wheel and axle. Due to improper selection of interference the wheel may shift outwards or it may come out completely. Loose axle is a rejectable defect.
- Axles involved in Accidents should be magnaflux tested in addition to Ultrasonic test.
- Axle having notch should be withdrawn from service

- All wheel sets withdrawn from service for any of the conditions mentioned above must be sent to the associated workshops for detailed investigations and further disposal.
- The date and station code of the maintenance depot where the wheels are changed should be stencilled on the end panels. An entry should also be made in the maintenance card of the coach.
- No repairs, except wheel profiling of wheel sets is permitted to be done in the maintenance depot.

Wheel Gauge

Description	Std	Max	Min
Coach MG	930	932	929
ICF coach BG	1600	1602	1599
LHB coach	1600	1601	1599
Wagons	1600	1602	1599

Wheel Diameter

Description	Std	Cond
Coach MG		
ICF coach BG	915	825
LHB coach	915	845
BOXN	1000	906
UIC	1000	860
BLC	840	780

Wheel Changing

Wheels to be paired within the diameters variation as below while changing the wheels

Type	**On the same bogie**	**On the same coach**
Coach MG	5	10
Coach BG	5	13
Wagons	13	25

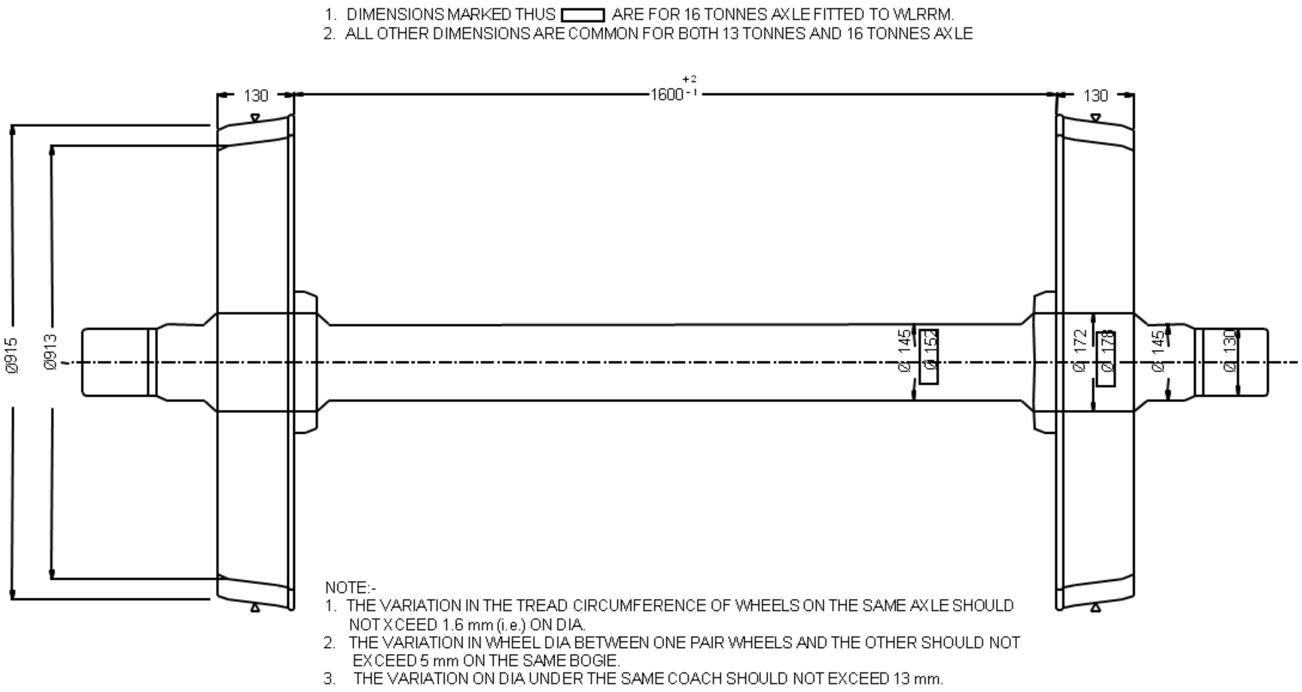
While tyre turning, it should be ensured that variation on the same axle is within 0.5 mm

For in service wheels the variation on the same axle shall be guided by the tyre defect gauge

Thank You

WHEEL & AXLE

Wheel, Tread and Axle



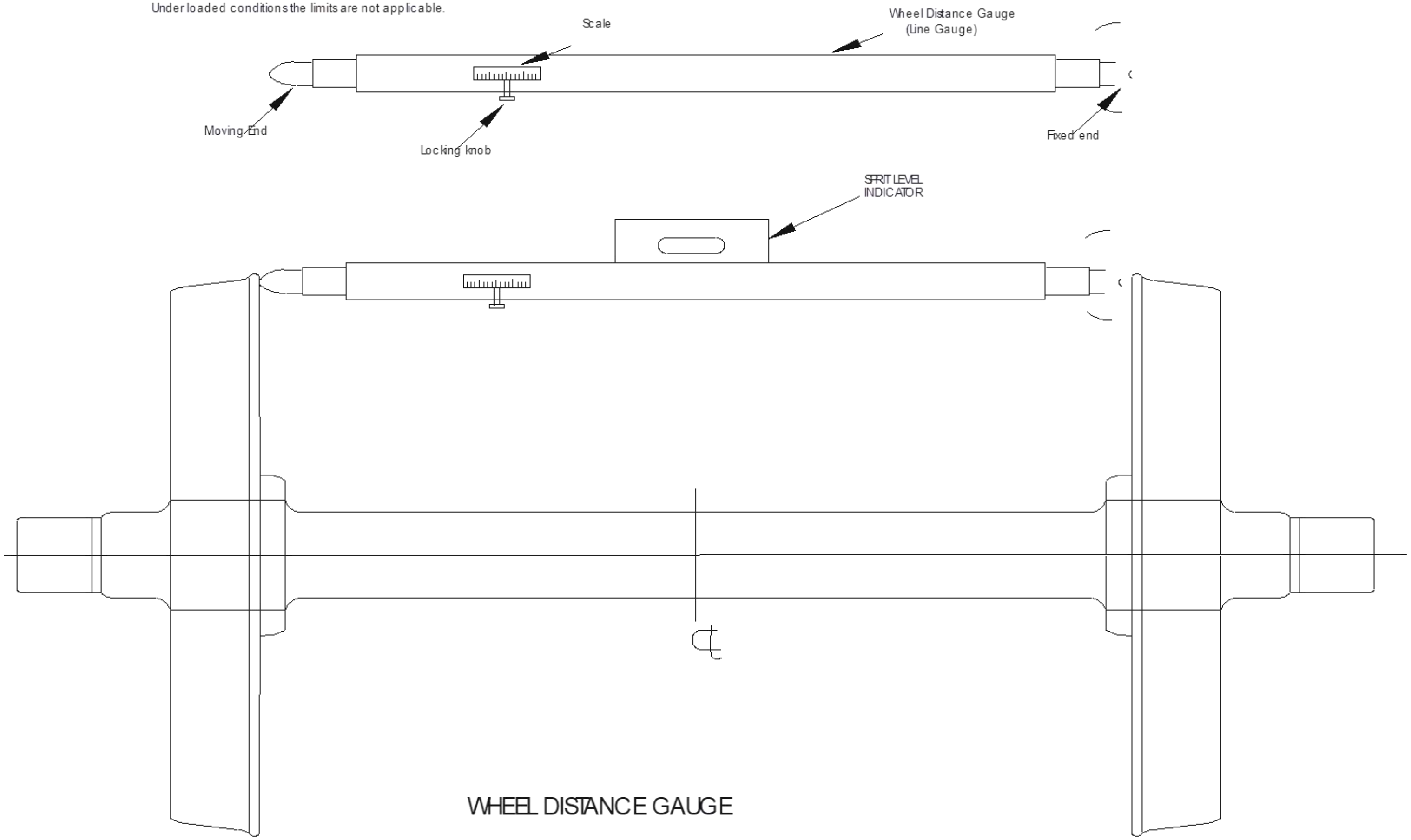
- Nomenclature
  - Axle
    - Journal
    - Collar
    - Wheel seat
  - Disc
    - Tread
    - Hub
    - Tyre profile

Wheel Gauge

Newly assembled wheel set should be checked for the distance between inner face of wheel i.e. 1600 + 2/-1 mm using Wheel Distance Gauge.

The wheels to be gauged on a level track after taking off from coaching vehicle.

Under loaded conditions the limits are not applicable.

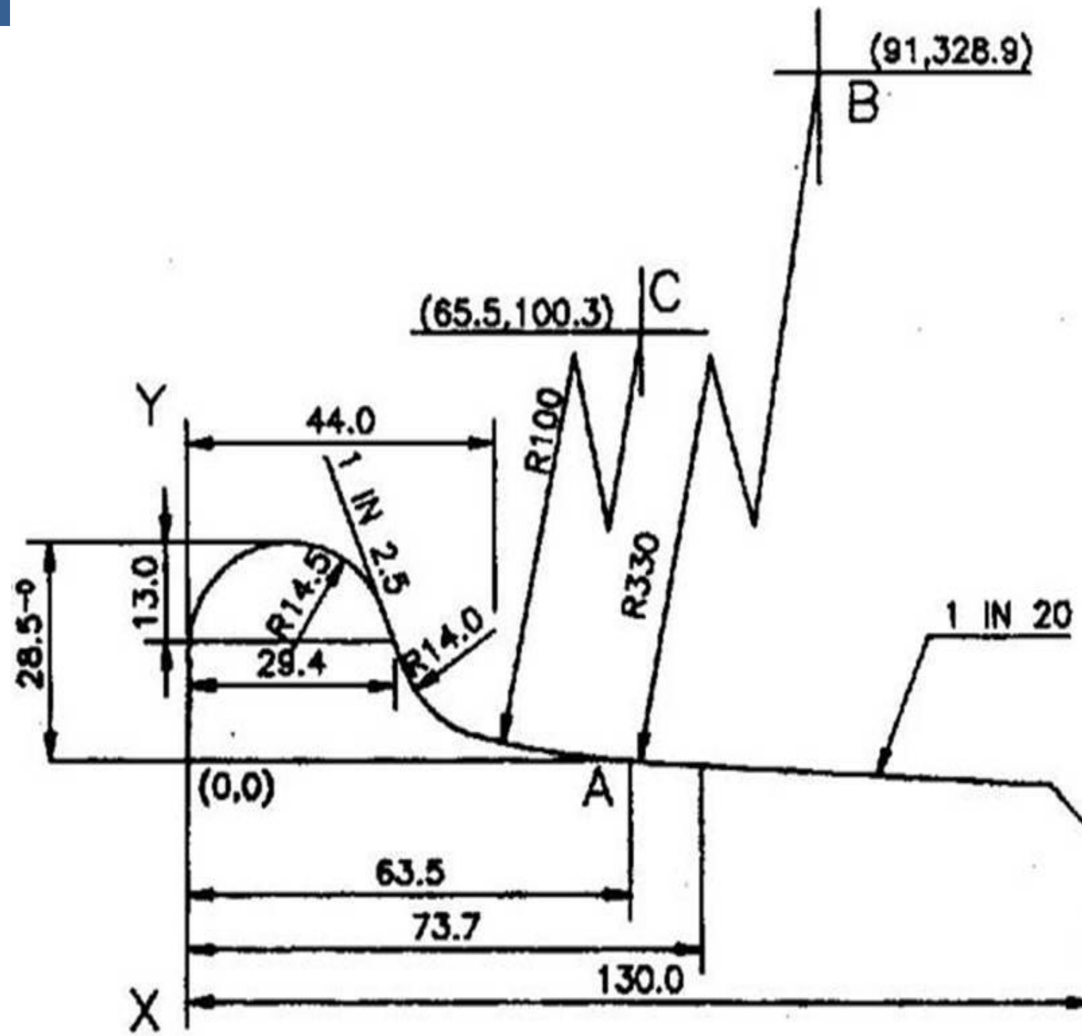


WHEEL DISTANCE GAUGE

FIGURE 10.6

Wheel Tyre Profile

- Standard wheel profile
- Worn wheel profile (Conforming profile)
- No Intermediate profile now.



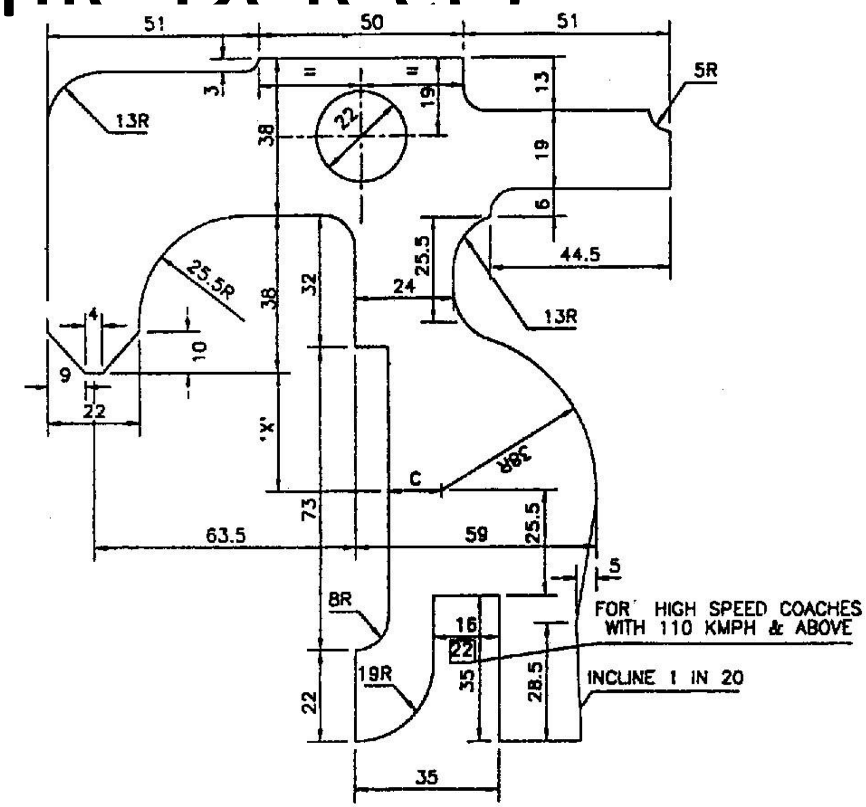
Difference in Wheel Diameter

	On the same axle	On the same trolley	On the same wagon
For Wagon	0.5	13	25
For Coach	0.5	5	13

- Prescribed in
  - Rule No. 2.8.14.2 IRCA Part III and
  - Rule No. 2.9.4 IRCA Part IV
- These limits do not form a part of train examination.
- The rejection of wheels worn beyond service limits will continue to be determined by the normal wear limits specified in IRCA Rules (Rly. Bd. letter No. 86/M(N)960/8 Dated 22.8.86).

Wheel Profile Defects

- Flat tyre
- Hollow tyre
- Sharp flange
- False flange
- Deep flange
- Thin flange
- Root radius



All coaches (Including EMU & DMU) 50 mm

NOTE:–

1. CONDEMNING MARK 'C' TO BE STAMPED ON BOTH SIDE OF GAUGE.
2. CONDEMNING MARKS FOR TYPE OF STOCK ON LINE ONLY NEEDS TO BE STAMPED.
3. DISTANCE 'X' AT WHICH CONDEMNING MARK 'C' FOR VARIOUS TYPE OF WHEELS TO BE STAMPED ARE AS BELOW:–

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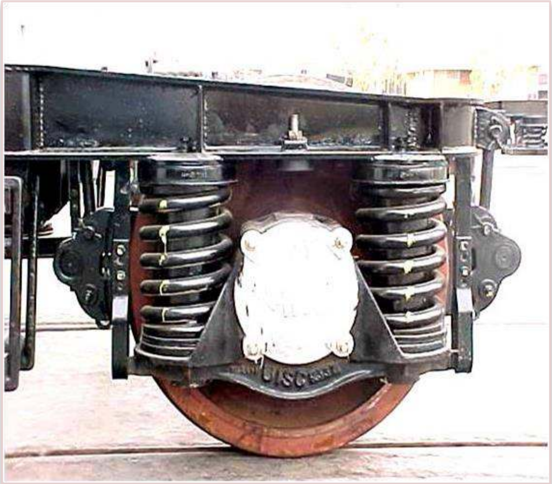
iii) TYRED WHEEL OF IRS, ICF & BEML MAIN LINE COACHES	26 mm.
iv) TYRED WHEEL OF ac & dc EMU MOTOR COACHES.	38.5 mm.
v) TYRED WHEEL OF ac & dc EMU TRAILER COACHES.	28.5 mm.

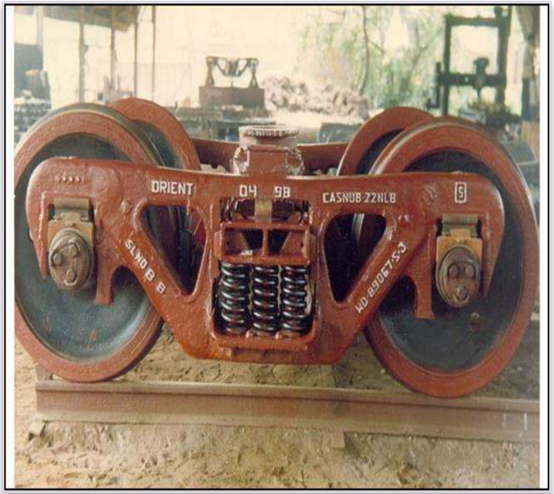
Axle Guide Arrangement

ICF

FIAT

CASNUB





Function of Axle Guides

- Guides the axle w.r.t. bogie frame laterally as well as longitudinally.
- Transmits tractive & braking force between bogie frame & axle box.
- In ICF, acts as a single acting hydraulic vertical shock absorber for primary spring.
- In FIAT bogie, provides control flexibility between frame and axle.

Axle Box Bearing

- CASNUB bogie
  - CTRB
- ICF bogie
  - Spherical type roller bearing with self-align feature.
    - Automatically adjust to the deviation in the centre line of the axle during run.
- FIAT bogie
  - CTRB

चक्के से सम्बन्धित दोष और परिचालन में यान की स्थिरता पर उसका प्रभाव

डीप फ्लैन्ज

बीजी में 28.5 तथा एमजी में 25.5 से बढ़कर 35 तथा 32 मिमी0 से अधिक हो जाय

(1) यदि रेल हेड का ऊपरी सतह भी घिसा हुआ हो तो चक्के का फ्लैन्ज, फिश प्लेट तथा डिस्टेन्स ब्लाक चेक ब्लाक से टकराने लगता है।

(2) चक्के के ट्रेड के साथ–साथ फ्लैन्ज में भी घिसाव होता रहता है। अतः फ्लैन्ज के डीप होने की अवस्था में उसका थिन हो जाना भी स्वाभाविक है। जिससे फ्लैन्ज बल का मान भी बढ़ जाता है।

शार्प फ्लैन्ज

फ्लैन्ज के टिप का अर्धव्यास 5 मिमी से कम

प्रभाव–

(1) पाजिटिव एंगुलरिटी बढ़ जाती है।

(2) घर्षण बल का मान बढ़ जाता है।

(3) फेसिंग दिशा में चक्का दो रास्तों पर जा सकता है अथवा घिसे या थोड़ा सा टूटे हुए टंग रेल के प्वाइंट पर चढ़कर अवपथित हो सकता है।

हालो टायर/फाल्स फ्लैन्ज

बाहरी सिरा मध्य की अपेक्षा 5 मिमी0 से ज्यादा नीचे आ जाय

प्रभाव–

(1) फाल्स फ्लैन्ज ट्रेलिंग दिशा में चलते समय प्वाइन्ट को चीर कर उसमें (Gap) अन्तर बना सकता है जिसके फलस्वरूप फेसिंग दिशा में आ रही किसी दूसरी गाड़ी का चक्का दो रास्तों पर जा सकता है।

(2)क्रासिंग पोर्सन पर चक्का विंग रेल के सम्पर्क में चल कर नोज पर गिर सकता है।

(3) अत्याधिक हंटिंग (Hunting) होती है।

थिन फ्लैन्ज

बीजी में 28.5 मिमी. तथा एमजी में 25.5 मिमी. से घटकर 16 मिमी. से कम रह जाय

प्रभाव–

(1) रेल पथ तथा चक्कों के मध्य अन्तर बढ़ जाने के कारण लर्चिंग बढ़ जाती है। जिससे फ्लैन्ज बल का मान भी बढ़ जाती है।

(2) एक्सल की कोणीयता (Angularity) बढ़ जाती है।

रूट रेडियस में घिसाव

बीजी में 16 मिमी. तथा एमजी में 15 मिमी. से घटकर 13 मिमी. रह जाय

प्रभाव–

(1) चक्के तथा रेल हेड के मध्य सम्पर्क क्षेत्र बढ़ जाने के कारण घर्षण बल का मान भी बढ़ जाता है। क्योंकि इस दशा में फ्लैन्ज घिस जाने के कारण उसमें 1:2.5 का प्रारम्भिक ढाल काफी कम हो जाता है।

(2) धूरे की कोणीयता के समान मान के लिए भी पाजिटिव इसेन्ट्रिसिटी बढ़ जाती है।

फ्लैट टायर

एमजी में 51मिमी, बीजी सवारी यानों में 50 तथा माल यानों में 60 मिमी. चपटा हो जाय।

प्रभाव—धीमी गति 20–25 किमी0/घंटा पर हैमरिंग का प्रभाव (Hammering effect) बढ़ जाता है। जिसके कारण रेल में उत्पन्न होने वाले प्रतिबल का मान भी लगभग 2.5 गुना तक हो जाता है।

ह्वील गेज में अन्तर

ह्वील गेज बीजी तथा एमजी के लिए क्रमशः 1600 मिमी. तथा 930 मिमी. होता हैं। माल यानों तथा सवारी यानों के लिए इसमें 02 मिमी. ढोला तथा 01 मिमी. टाइट अनुमेय है। ह्वील गेज अधिक ढोला अथवा टाइट नहीं होना चाहिए।

- **प्रभाव**—चक्के में घुमावदार गति (W0bbling) होने लगती है जो यान की स्थिरता को प्रभावित करती है।

चक्के के व्यास में अन्तर

- चक्के के व्यास में निम्न अन्तर अनुमेय है
- एक ही यान में –एमजी में 10 तथा बीजी में 13 मिमी.
- एक ही ट्राली में – 5 मिमी. तथा
- एक ही एक्सल पर– केवल 0.5 मिमी.

प्रभाव–

(1) एक ही एक्सल पर चक्के के व्यास में अन्तर के कारण उनके द्वारा समान चक्करों में चली गयी दूरी भी अलग–अलग होती है जिससे पाजिटिव एंगुलरिटी लगातार बनी रहती है।

(2) एक ही यान के चक्कों के व्यास में अत्याधिक अन्तर बफर हाइट को प्रभावित कर सकता है।

(3) यान के अन्य कारकों के साथ मिलकर फर्श के ढाल को भी प्रभावित करता है।

Wheels

MSTC/GKP

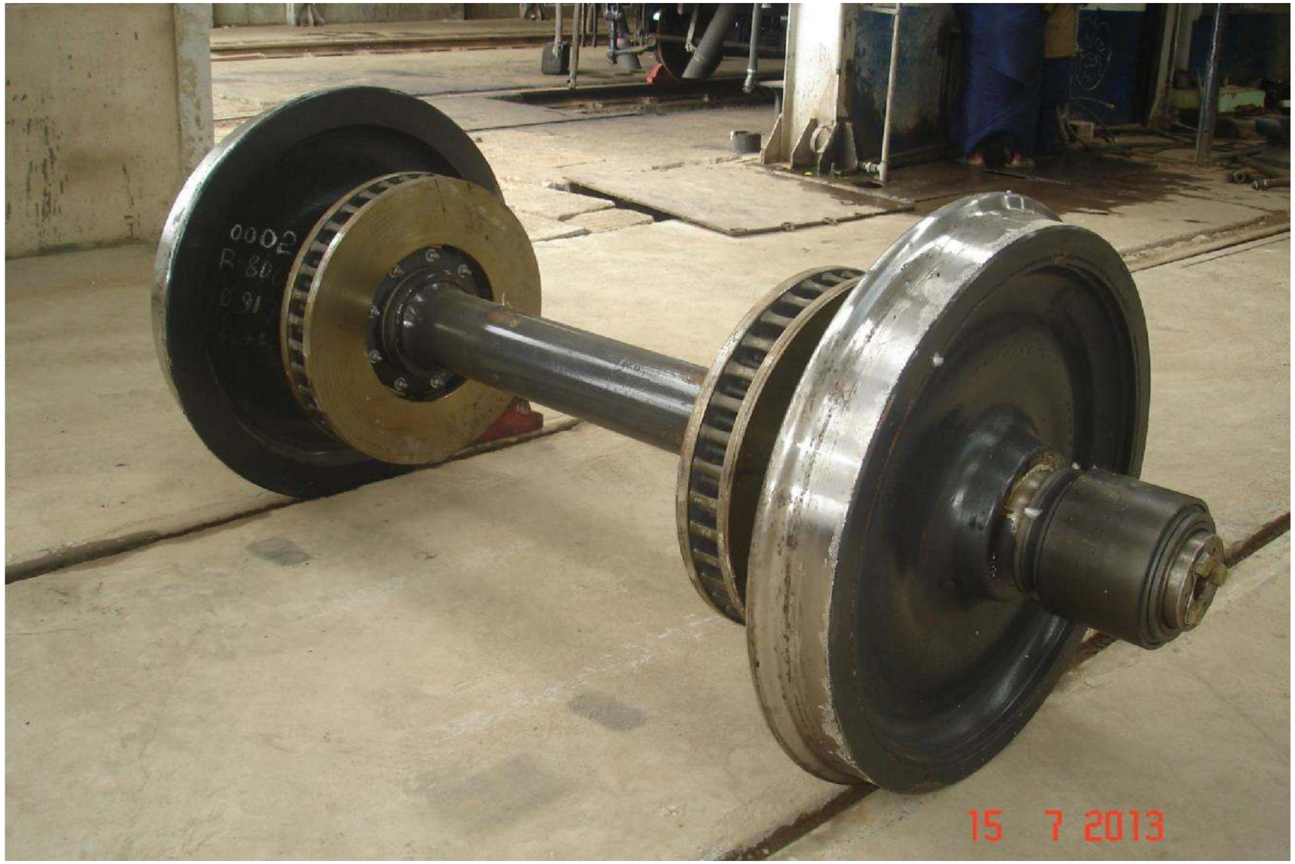
Railway Wheels

- Railway wheel is assembly of two wheels fixed to the axle by interference fit and they rotate along with the axle, without any independent relative movement as in the case of other automobile wheels.
- These wheels are provided with flange towards the inner side, which guide the wheels to travel on the rails and does not allow it to fall down from the rails.

Railway Wheels

ICF Coach Wheel

Railway Wheels



LHB Coach Wheel

Material of Wheel

- Steel made by Electric or Basic Oxygen process
- Steel shall be of killed quality for forged steel
- The max hydrogen content shall not exceed 3 ppm
- The max nitrogen content shall not exceed 0.007%

Railway Whee

BOXN Wheel

Material of Wheel

The chemical composition of the steel for Cast Wheel	
C	0.47% to 0.57% for type A used for carriage stock 0.57% to 0.67% for type B used for wagon stock
Mn	0.60 to 0.80%
P	0.03% max
S	0.03% max
Cr	0.15% max
Ni	0.25% max
Mo	0.06% max
Combined % for Cr, Ni & Mo must be 0.40% max	

The procedure to calculate chemical composition will be in accordance to IS:228

Mechanical Properties of Cast Wheel

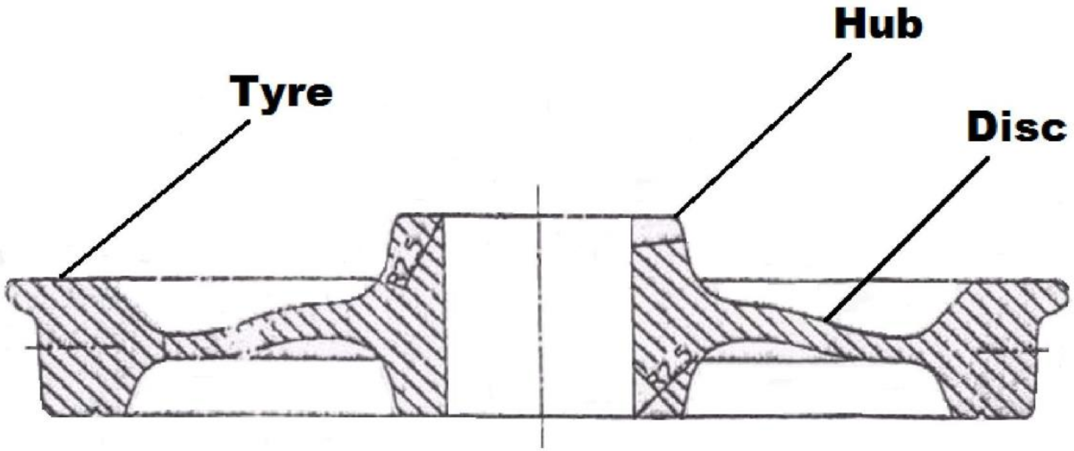
Sl. No.	Particulars	Type A	Type B
1	Tensile Strength at 15 mm below tread face	900 N/m2 min.	930 N/m2 min.
2	Tensile strength at middle of the web	800 N/m2 min.	800 N/m2 min.
3	Minum yield strength at 15 mm below tread face	50% of UTS	50% of UTS
4	Minimum yield strength at middle of the web	50% of UTS	50% of UTS
5	Minimum elongation at 15 mm below tread face	5.0%	4.5%
6	Minimum elongation at middle of the web	7.0%	7.0%
7	Hardness range at 15 mm below tread face	255-320 BHN	271-341 BHN
8	Minimum impact strength at 15 mm below tread face	10 J/cm2 at 20 deg C	--

Railway Wheels

The wheel is better understood by dividing it into the following parts

- Hub
- Disc
- Tyre

Wheel



hub

- Hub is the centre portion of the wheel, where the wheel is fixed to the axle by means of interference fit.
- Thickness of the wheel is maximum at the hub portion.
- UT details is marked on the Hub

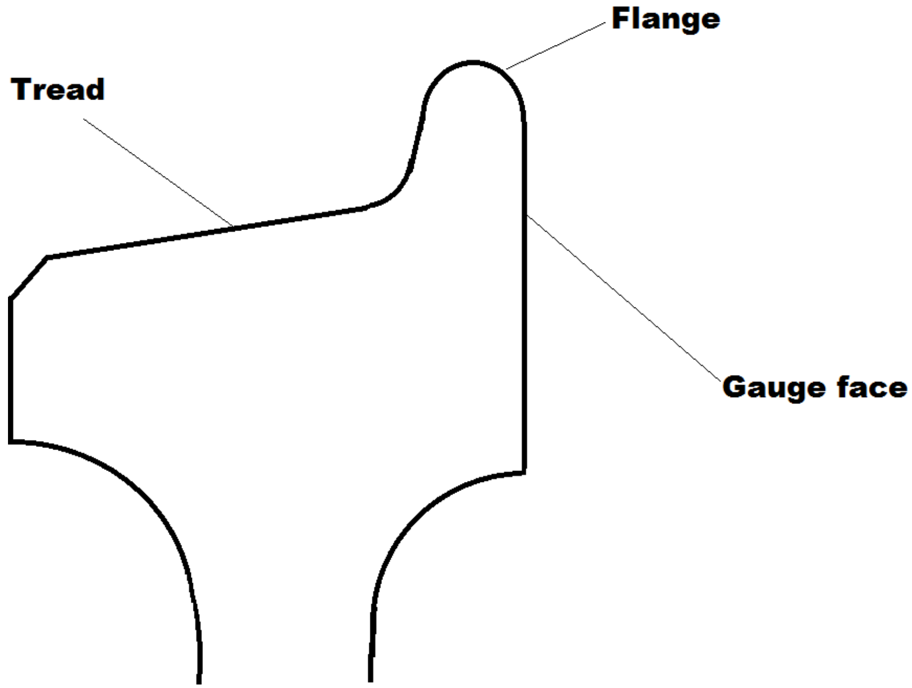
Disc

- Disc is the portion of the wheel between the hub and the tyre.
- This portion is the thinnest portion of the wheel as it does not come in contact with rail nor it is coming in contact with the axle.

Tyre

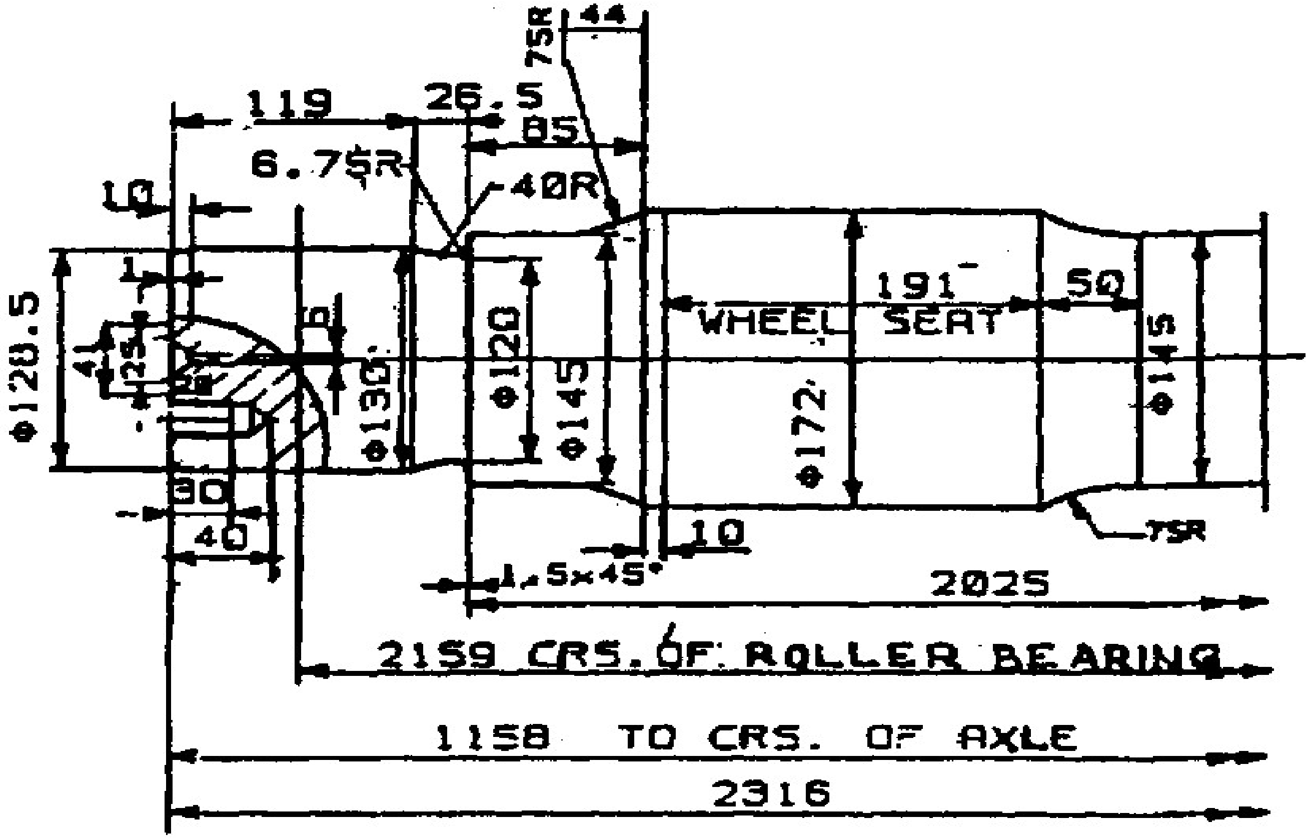
- Tyre is the portion in contact with the rail, which wears out in service.
- The profile of the tyre is significant for safe running of the trains.
- Taper is given on the tread to have higher diameter near the flange and lower diameter at the outer edge, to facilitate curve negotiation.

Tyre



Axles

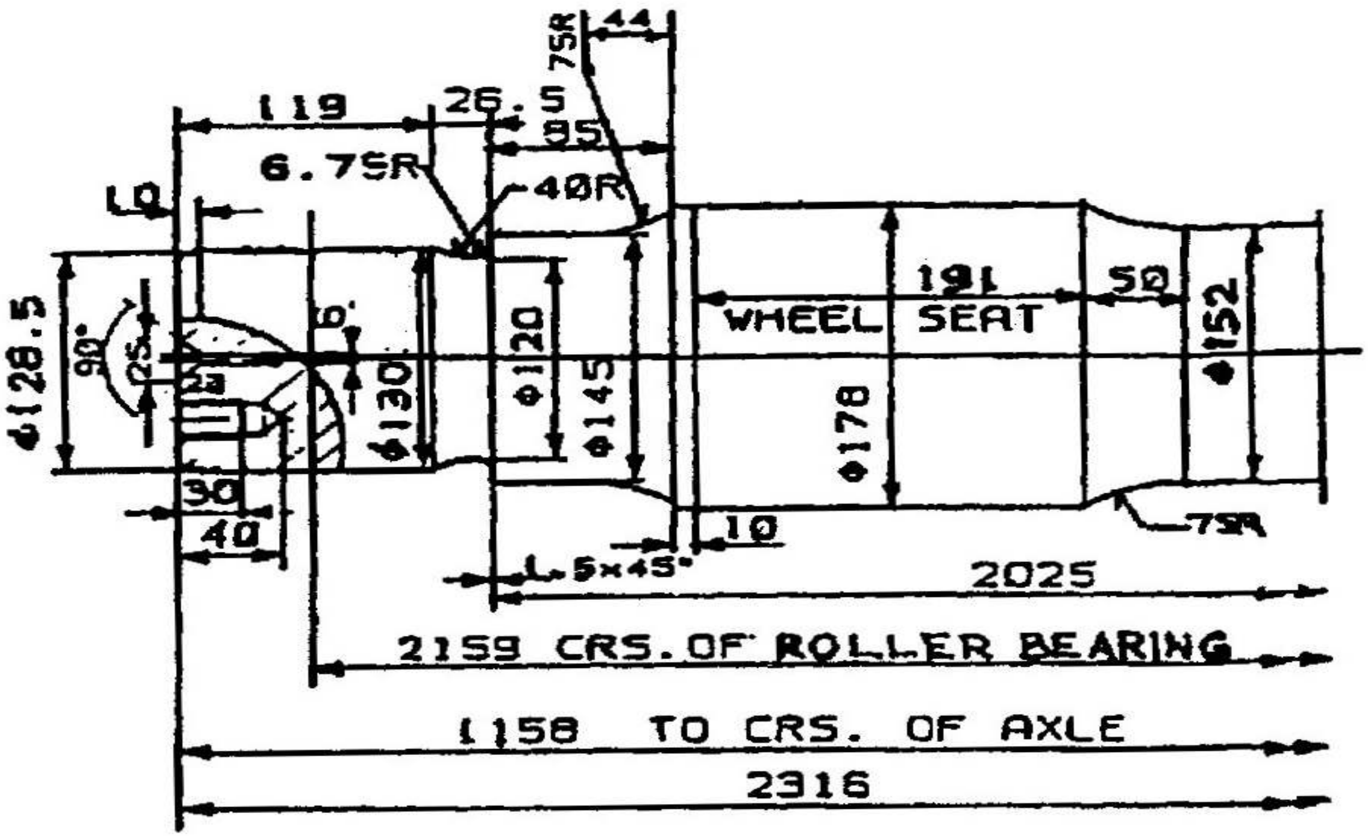
13 t Axle for ICF coach



ICF DRG. NO. T-0-2-622

Axles

16.25 t Axle for ICF coach



ICF DRG. NO. $WTAC_3$-0-2-301

Press fit of wheel on axles

- Wheel disc is pressed to axle with interference fit (the bore of the wheel should be 0.304 mm to 0.355 mm less than the outer dia of the wheel seat on the Axle)
- Wheel Gauge should be in between 1599 and 1602 mm
- Axial off centre should be within 1.0 mm (wagon) & 0.8 mm (coach)
- Radial off centre should be within 0.5 mm (wagon) & 0.25 mm (coach)
- The Journals should be protected with bituminous black to IS:9862
- All Axles fitted by workshop during POH or despatched to depot should be Ultrasonically tested

Press fit of wheel on axles

Hydraulic press is used for assembly of the wheel with a force of 400 to 500 Kgs per mm dia of wheel seat (approximate force used for different wheels are given below)

Description	Tonnage
13 tonne axle	68.8 to 103.2 t
16.25 tonne axle	71.2 to 106.8 t
BOXN & BLC	85 to 127 t

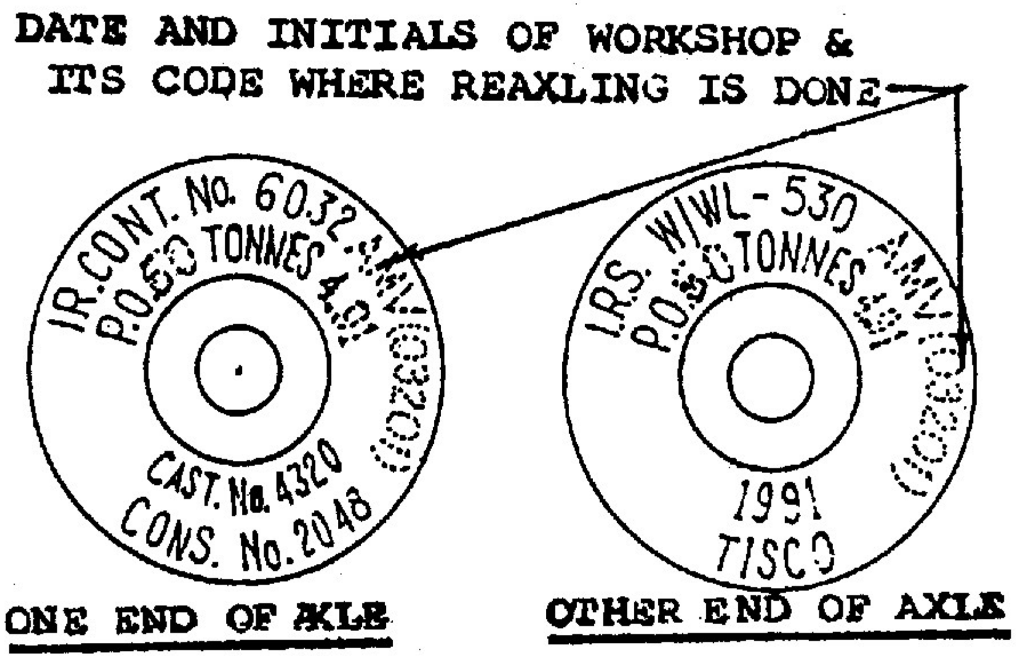
Stamping of particulars

Whenever axles are renewed the workshop shall punch in 5 mm letters the following particulars on the journal face

- Place of pressing
- Date of pressing
- Pressure of pressing

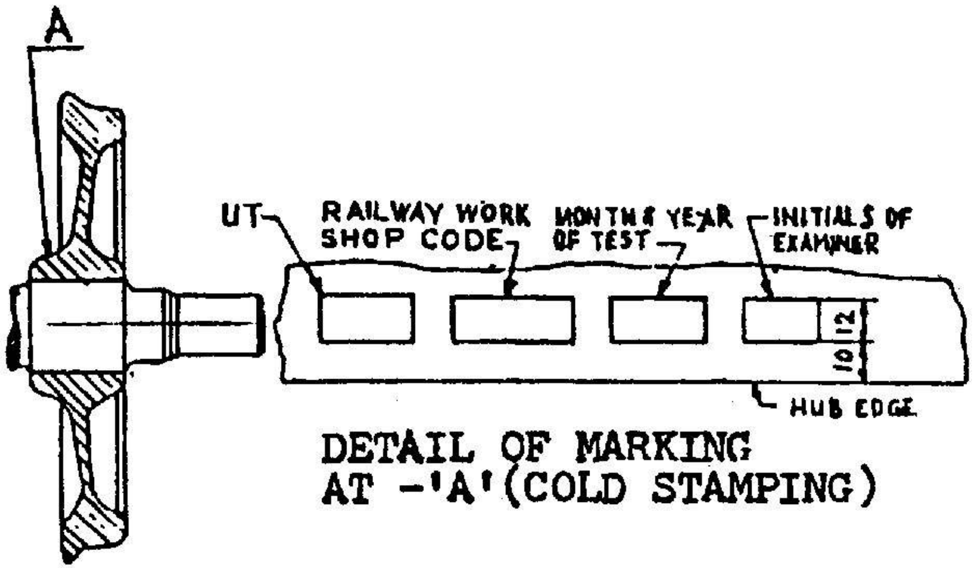
Whenever UT is done the details shall be stamped cold on the inner hub fillet with 6 mm punch not more than 1.5 mm depth

Stamping of particulars



NOTE:
ALL STAMPING TO BE DONE WITHIN 63 DIA.
ON BOTH JOURNAL FACES.

Stamping of particulars

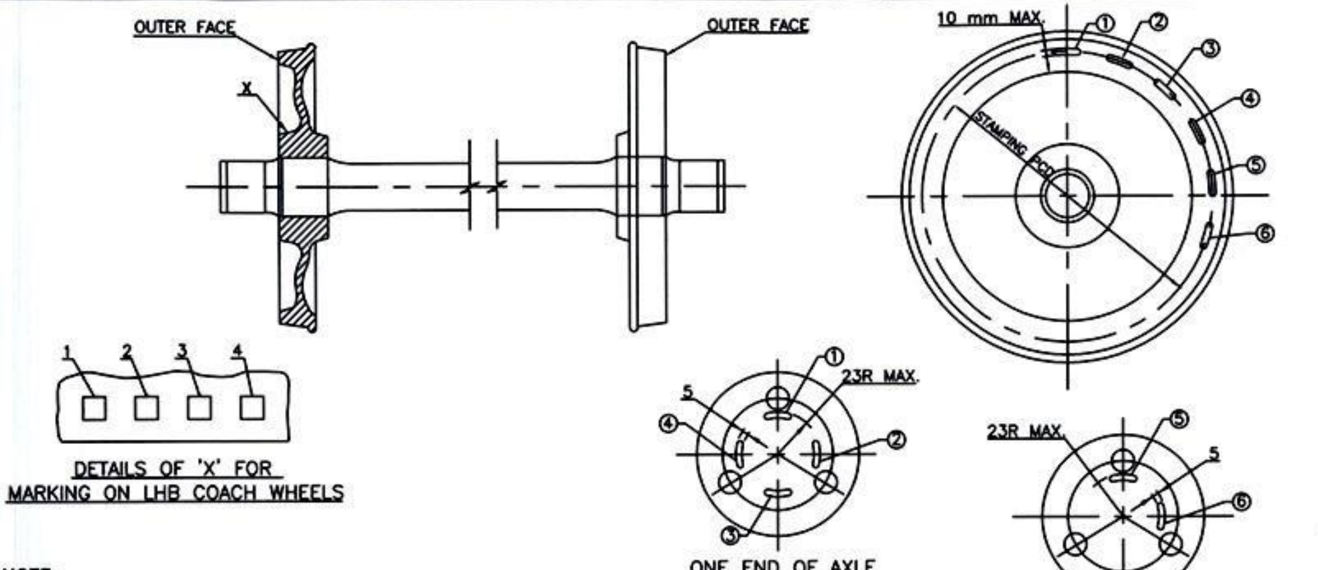


DETAIL OF MARKING
AT -'A'(COLD STAMPING)

NOTE:-

1. 'UT' INDICATES ULTRASONIC TESTING OF AXLES.
2. THE MARKING SHALL BE STAMPED COLD ON THE INNER HUB FILLET AS SHOWN AT 'A' AFTER THE SURFACE IS GROUND PROPERLY.
3. THE EXAMINING WORKSHOPS SHALL MAINTAIN ALL THE PARTICULARS OF AXLES TESTED VIZ. I.R. PART NO., CONTRACT NUMBER, CAST AND CONSECUTIVE NUMBERS, MANUFACTURER'S INITIALS AND YEAR OF MANUFACTURE IN REGISTER PROPERLY MAINTAINED BY THEM.
4. REF. WDO DRG. NO. WD-81089/S-1

Stamping of particulars



STAMPING PARTICULARS

WHEEL/WHEEL CENTRE AND AXLE DETAILS	1	MANUFACTURER'S CODE
	2	YEAR OF MANUFACTURE
	3	CONSECUTIVE No.
	4	BATCH No.
	5	INSPECTOR'S APPROVAL STAMP
	6	'UT' FOR ULTRASONIC TESTING
ASSEMBLY DETAILS	7	MANUFACTURER'S/WORKSHOP'S CODE
	8	MONTH AND YEAR OF ASSEMBLY
	9	PRESSING ON PRESSURE IN TONNES

PCD OF STAMPING OF DIFFERENT WHEELS

TYPE OF WHEEL	PCD OF STAMPING ON RIM
COACHING WTAC3-0-2-301 T-0-2-622 W/WL-1660 MG/T-0-1-004	788 mm 788 mm 788 mm 610 mm
WAGON W/WL-4764 W/WL-4771 WD-89025/S-5 WD-89025/S-9	870 mm 780 mm 830 mm 960 mm
CONTAINER FLAT CONTR.-9404-S/13	755 mm
SOLID WHEEL FOR EMU Sk-K4004	842 mm (FOR MC) 832 mm (FOR TC)

NOTE:

1. WHEEL DETAILS
   .1 TO BE HOT/COLD STAMPED OR MARKED BY ELECTRIC ETCHING IN 10 mm LETTERS ON OUTER FACE OF THE RIM OF ROUGH TURNED OR FINISH TURNED WHEELS.
   .2 FOR LHB COACH WHEELS, STAMPING SHOULD BE DONE ON OUTER FACE OF THE HUB. PARTICULARS OF S.No. 1 TO 4 SHALL ALSO BE STAMPED ON OUTER HUB FILLET AT LOCATION MARKED AS 'X', FOR EASY IDENTIFICATION IN ASSEMBLED CONDITION.
2. WHEEL CENTRE DETAILS
   TO BE COLD STAMPED OR MARKED BY ELECTRIC ETCHING IN 10 mm LETTERS AT THE HATCHED LOCATIONS ON OUTER FACE OF THE HUB.
3. AXLE DETAILS
   .1 TO BE STAMPED COLD OR MARKED BY ELECTRIC ETCHING ON BOTH ENDS IN 5 mm LETTERS LETTERS IN CASE OF ROUGH TURNED OR FINISHED AXLES.
   .2 TO BE STAMPED IN 10 mm LETTERS IN CASE AXLES ARE SUPPLIED IN AS FORGED CONDITION.
4. ASSEMBLY DETAILS
   TO BE STAMPED COLD OR MARKED BY ELECTRIC ETCHING IN 10 mm LETTERS ON THE OUTER FACE OF THE WHEEL/WHEEL CENTRE HUB.
5. IT IS MANDATORY TO STAMP THE RESPECTIVE MARKINGS AT THE LOCATIONS INDICATED ABOVE.

ALT.	ITEM	AUTHY.	DESCRIPTION	DATE
7	--	SS/21/09	DETAILS OF 'X' FOR ADDITIONAL MARKING ON LHB COACH WHEELS ADDED AND NOTE 1.2 MODIFIED.	12/09
6	--	SS/19/09	RADIUS AT END VIEWS OF THE AXLE CHANGED FROM 18R TO 23R.	10/09
5	--	SS/01/06	DRAWING REVISED	1/06
4	--	SS/13/03	DRAWING REVISED	3/03
3	--	SS/3/02	DRAWING REVISED	2/02
2	--	CD/17/99	DRAWING REVISED	8/99
1	--	CD/6/97	DRAWING REVISED	9/97

SUPERSEDED BY:
SUPERSEDES:

SCALE	P	
Z	C	G.V.RAMAN
	D	PANT& SANJAY
	T	--
	J.S.	--
B.G.	R.D.S.O. [c]	

BRANDING DETAILS ON WHEEL & AXLE

SKETCH-92114

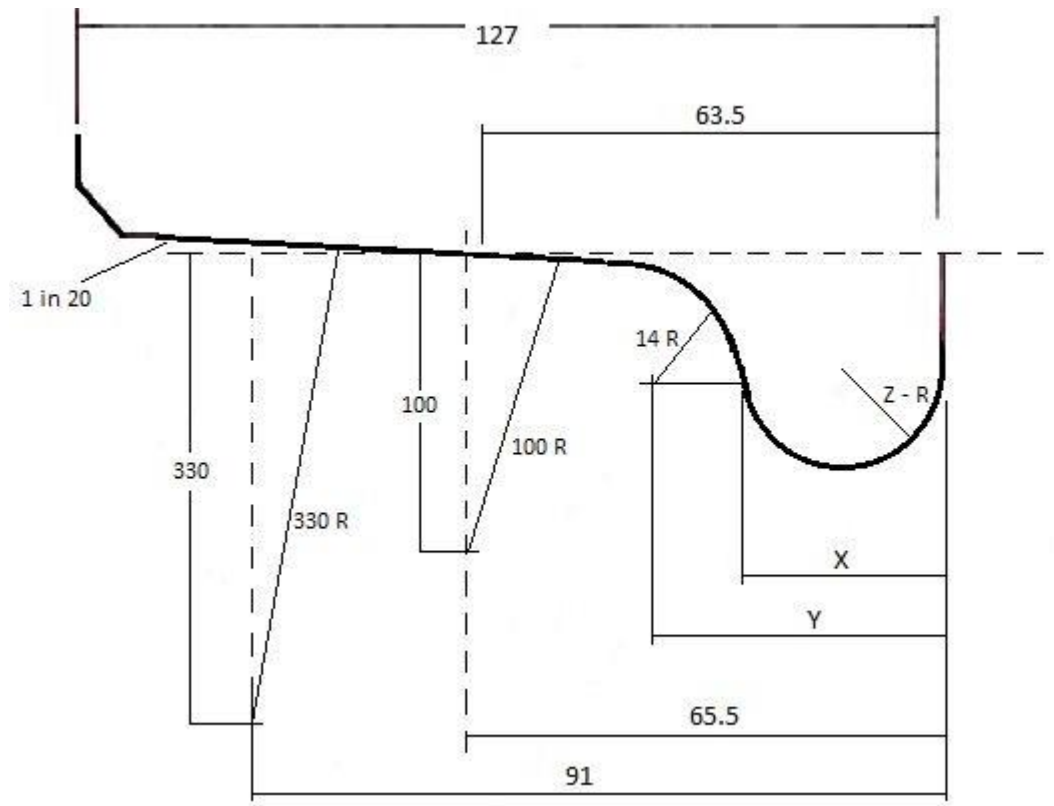
Worn Wheel Profile

80 % of the track in Indian Railways is having rails which are already worn in service. Standard wheel profile running on these tracks tend to wear to a specific profile within short time itself, and further wear from this profile is very slow. Hence if the wheels are turned initially to this worn wheel profile, it will increase the wheel life by avoiding frequent re-profiling.

Worn Wheel Profile

The worn wheel profile is made standard for all the wheels in Indian railways as the standard wheel profile is found uneconomical with lesser kilometres being run by the wheels within condemnation.

Worn Wheel Profile



Step Sizes of Worn Wheel Profile

Further to reduce the metal removal during tyre turning, intermediate worn wheel profile based on the flange thickness is introduced.

Flange Thickness (X)	Y	Z
28 mm	42.23 mm	13.5 mm
27 mm	41.29 mm	13.0 mm
26 mm	40.34 mm	12.5 mm
25 mm	38.41 mm	11.5 mm
24 mm	37.44 mm	11.0 mm
23 mm	36.47 mm	10.5 mm
22 mm	35.49 mm	10.0 mm
21 mm	34.5 mm	9.5 mm
20 mm	33.5 mm	9.0 mm

Wheel Defects

- Manufacturing Defects
- Improper Assembly Practices
- Normal Wear and Tear during service

Manufacturing Defects

- Casting Defects
- Improper Heat treatment
- Machining Imperfections

Improper Assembly Practices

- Stipulated dimensional tolerances for Wheel seat and bore not adhered to resulting in use of higher or lower than the prescribed force during pressing leading to improper wheel set assembly.
- Ovality on Journals - 0.02 mm (max)
- Taper on Journal - 0.01mm (max)
- Difference in dia of wheels on the same axle should not exceed 0.5mm

Wheel defects

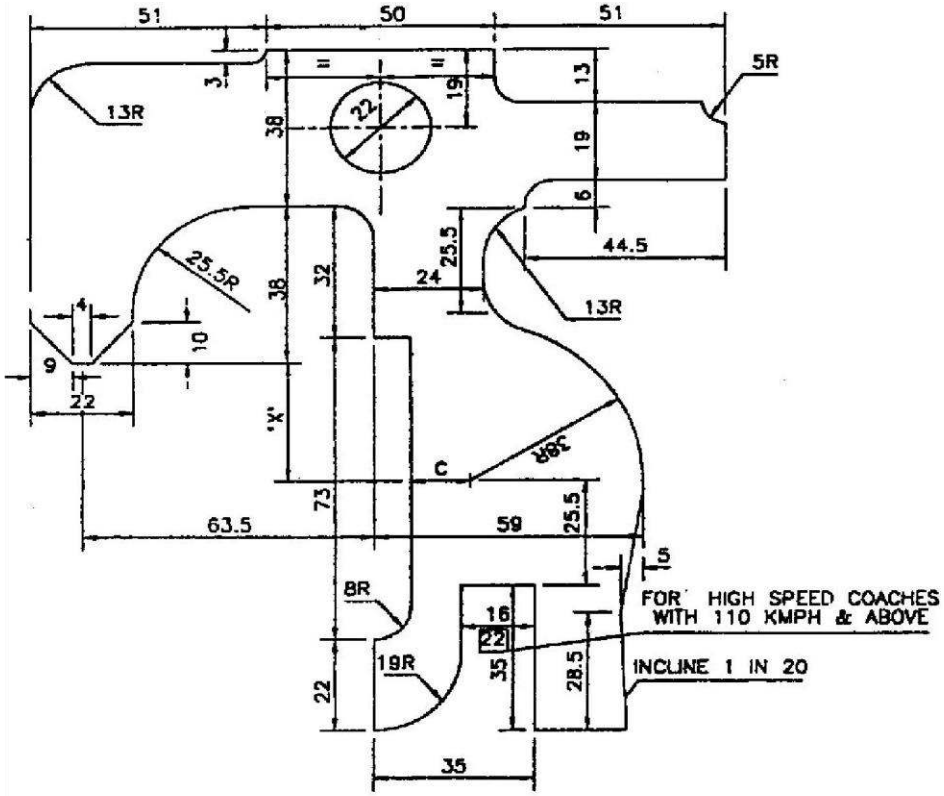
Measurable wheel defects arising due to normal wear & tear during service

- Thin flange
- Deep flange
- Sharp flange
- Less radius at root of flange
- Hollow tyre
- Thin tyre
- Flat tyre

Std & cond limits

Defect	Std	Cond
Thin flange	28.5	22 (Coaches) 16 (Wagons)
Deep flange	28.5	35
Sharp flange (radius)	14.5	5
Less radius at root of flange (radius)	14 (wwp)	13
Hollow tyre		5
Thin tyre		Based on wheeldia
Flat tyre		50 (Coaches) 60 (wagons)

Tyre Defect Gauge



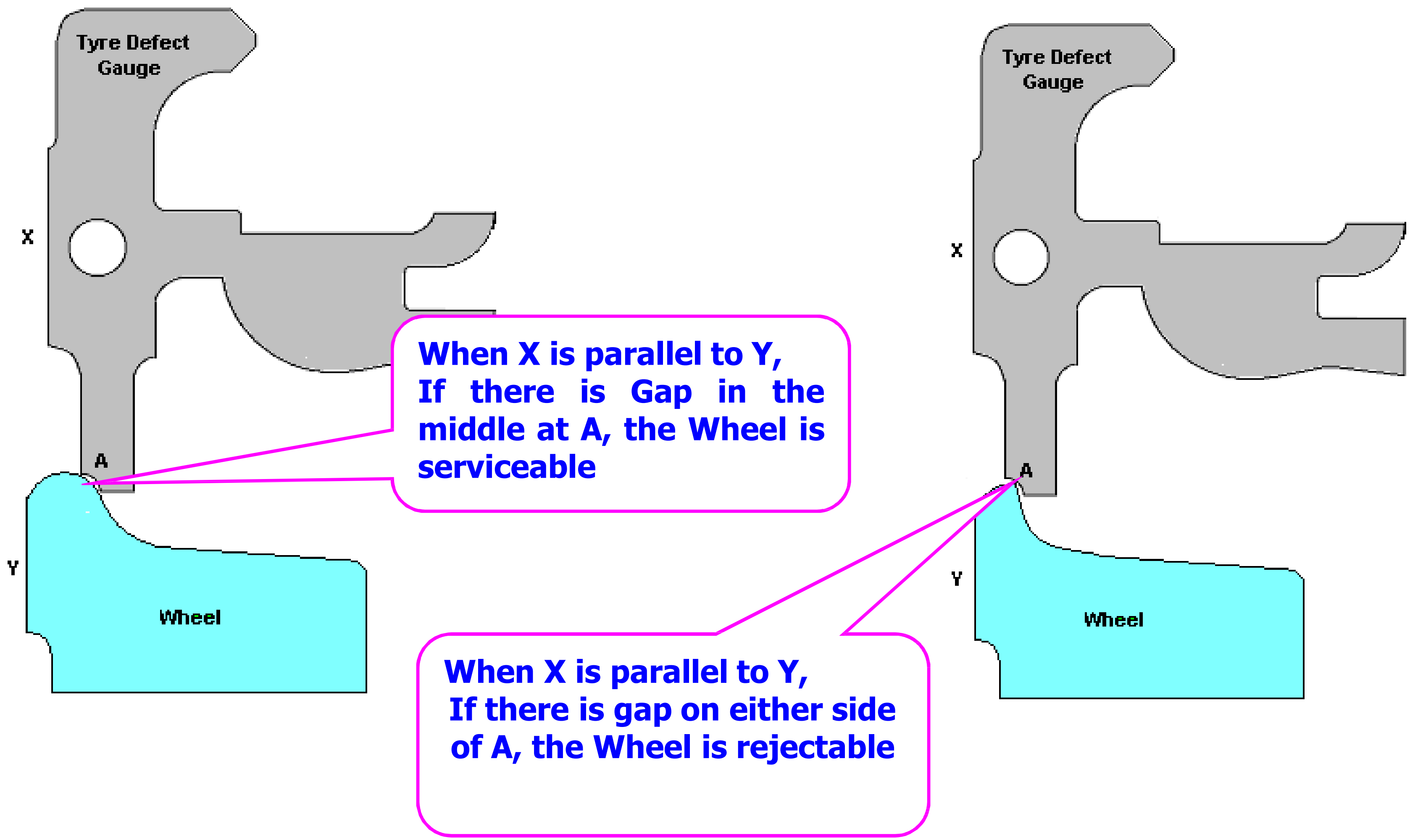
All coaches (Including EMU & DMU) 50 mm

NOTE:–

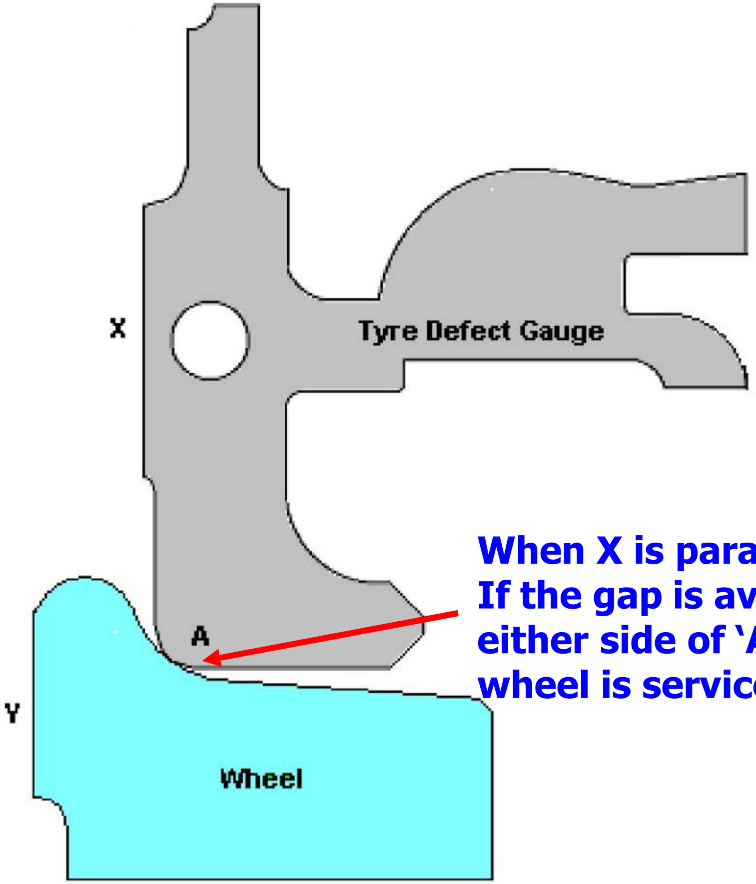
1. CONDEMNING MARK 'C' TO BE STAMPED ON BOTH SIDE OF GAUGE.
2. CONDEMNING MARKS FOR TYPE OF STOCK ON LINE ONLY NEEDS TO BE STAMPED.
3. DISTANCE 'X' AT WHICH CONDEMNING MARK 'C' FOR VARIOUS TYPE OF WHEELS TO BE STAMPED ARE AS BELOW:–

i)	SOLID WHEEL OF ICF & BEML MAIN LINE COACHES	6.5 mm.
ii)	SOLID WHEEL OF IRS MAIN LINE COACHES	5 mm.
iii)	TYRED WHEEL OF IRS, ICF & BEML MAIN LINE COACHES	26 mm.
iv)	TYRED WHEEL OF ac & dc EMU MOTOR COACHES.	38.5 mm.
v)	TYRED WHEEL OF ac & dc EMU TRAILER COACHES.	28.5 mm.

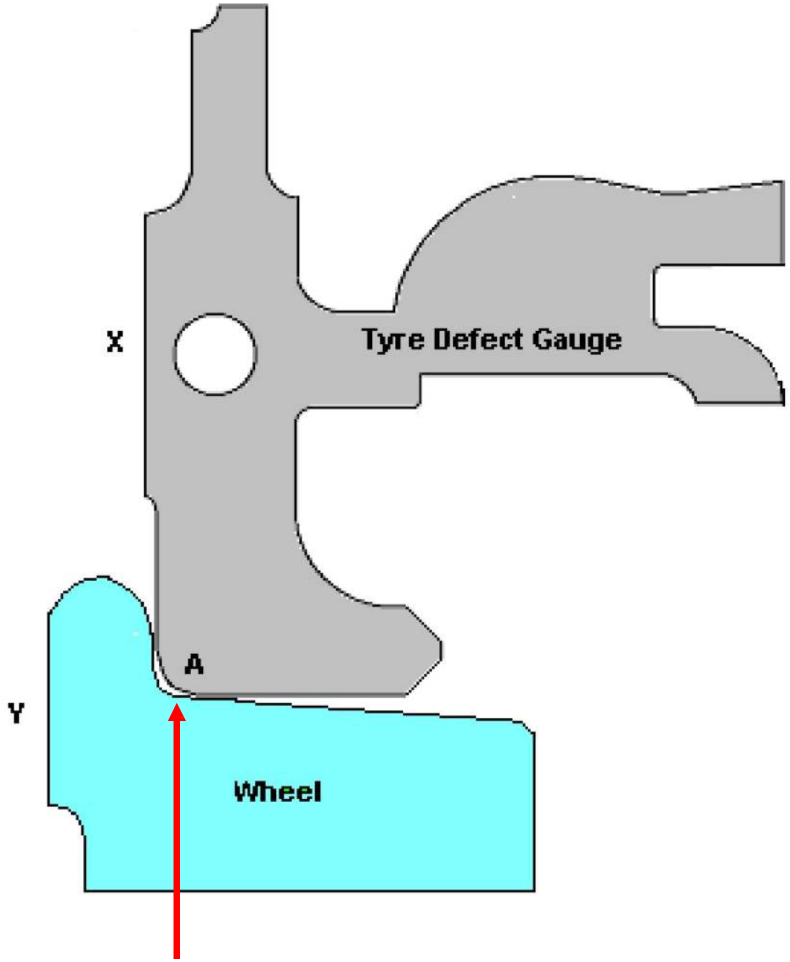
Checking for sharp flange



Checking the root of flange

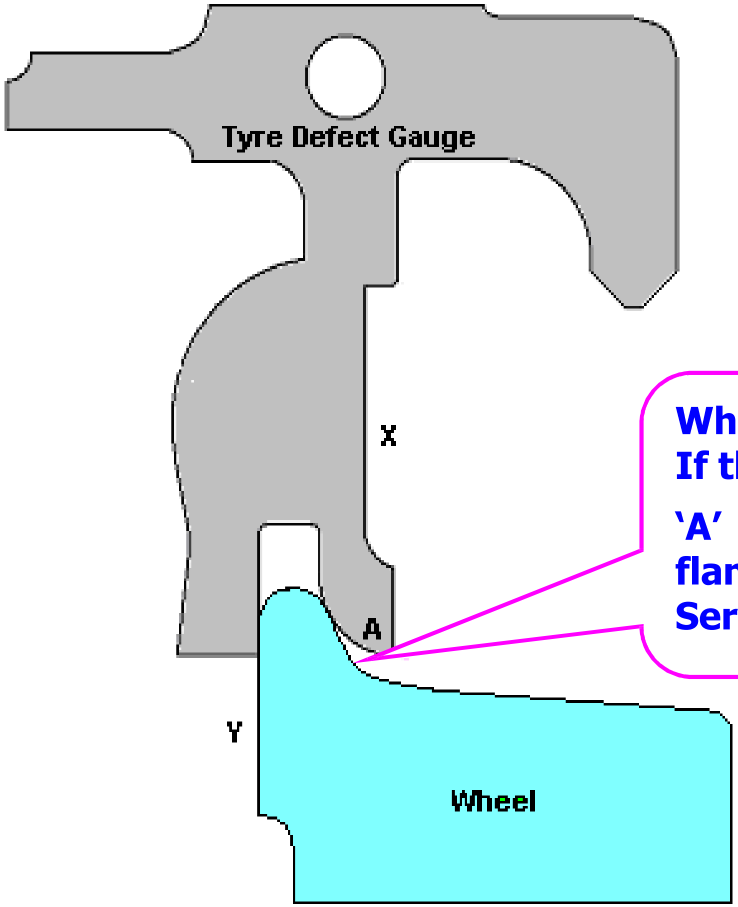


When X is parallel to Y, If the gap is available at either side of 'A', the wheel is serviceable.

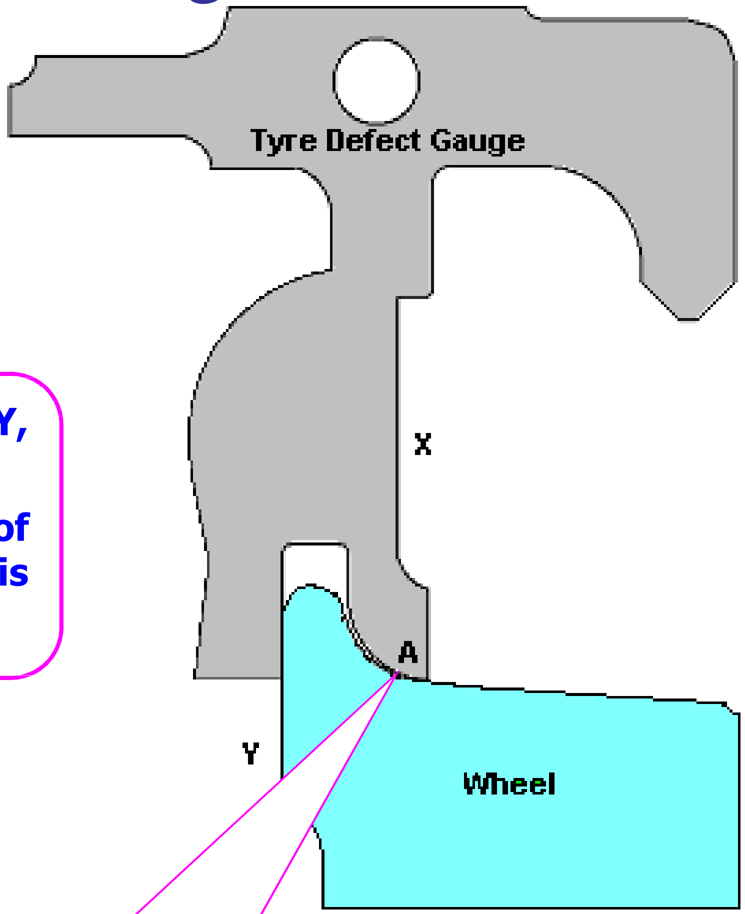


When X is parallel to Y , If there is a gap between gauge and the Root of Flange at A , the Wheel is Rejectable

Checking Thin flange

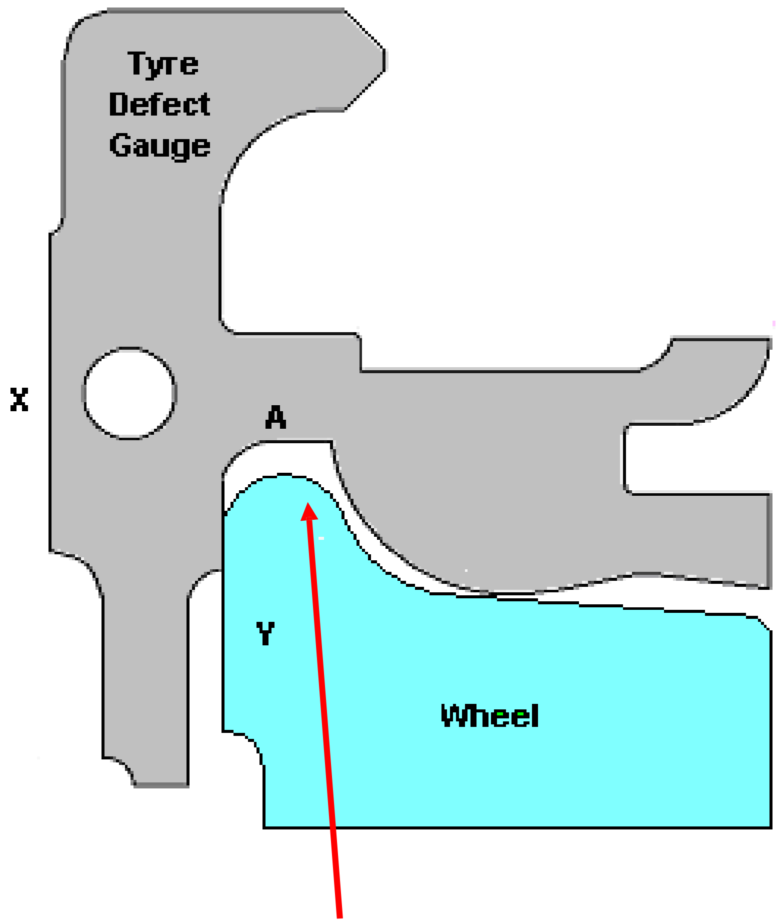


When X is parallel to Y, If there is gap between 'A' and the root of flange, the wheel is Serviceable

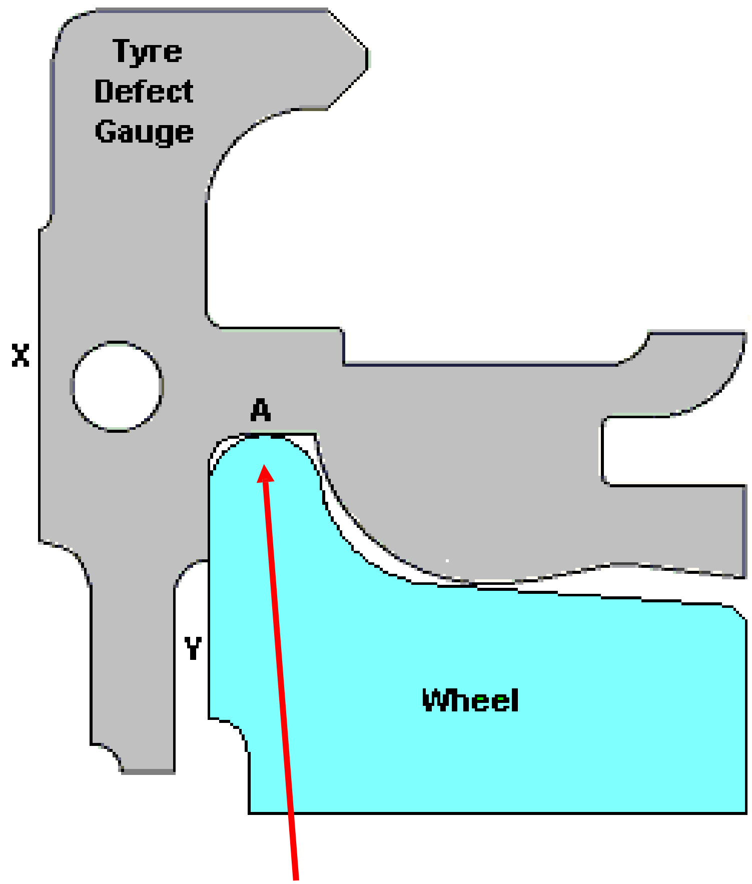


When X is Parallel to Y, If there is no gap between 'A' and the root of flange, the wheel is rejectable

Checking Deep Flange

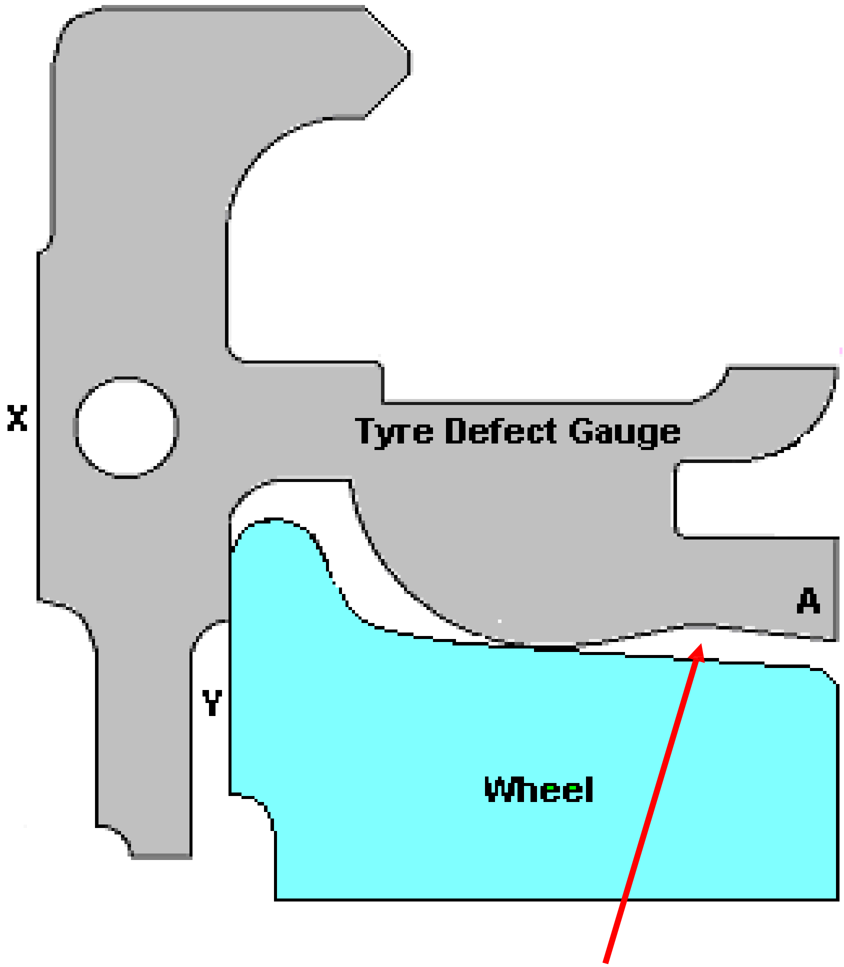


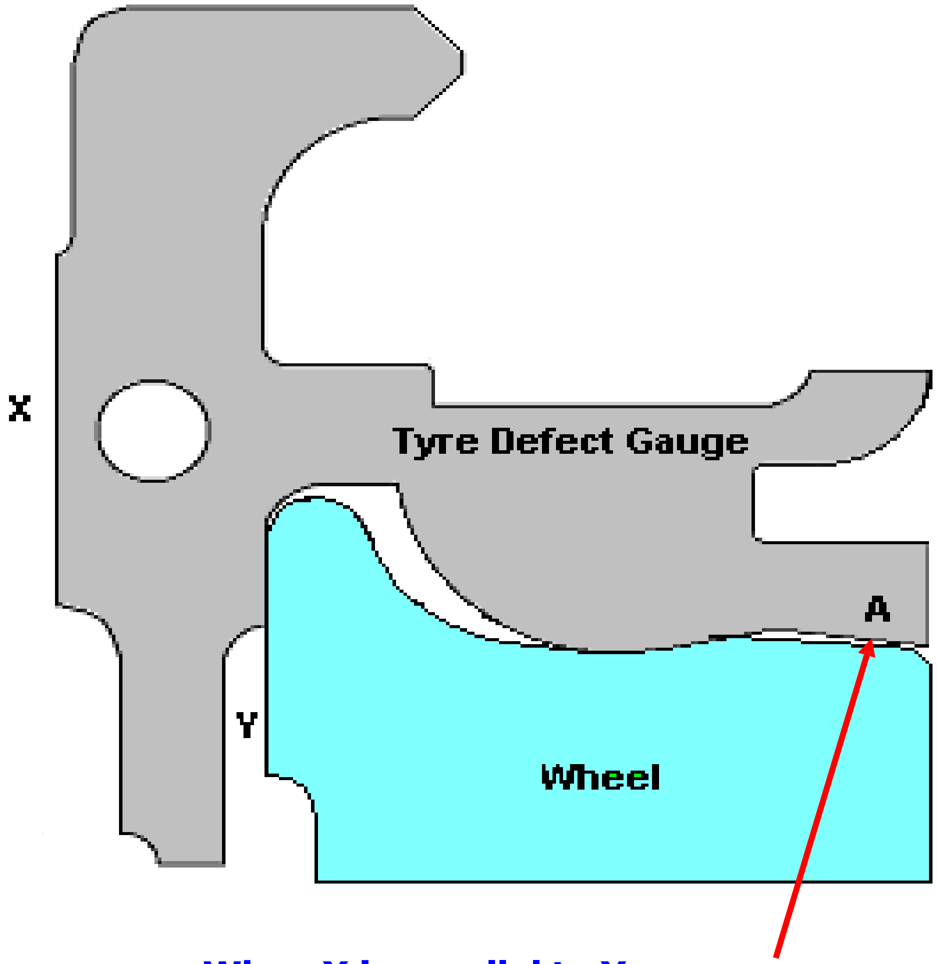
When X is parallel to Y,
If there is a gap between 'A'
and tip of the flange, the wheel is
serviceable.



When X is parallel to Y,
If there is no gap between 'A'
and tip of the flange, the wheel is
rejectable

Checking Hollow tyre

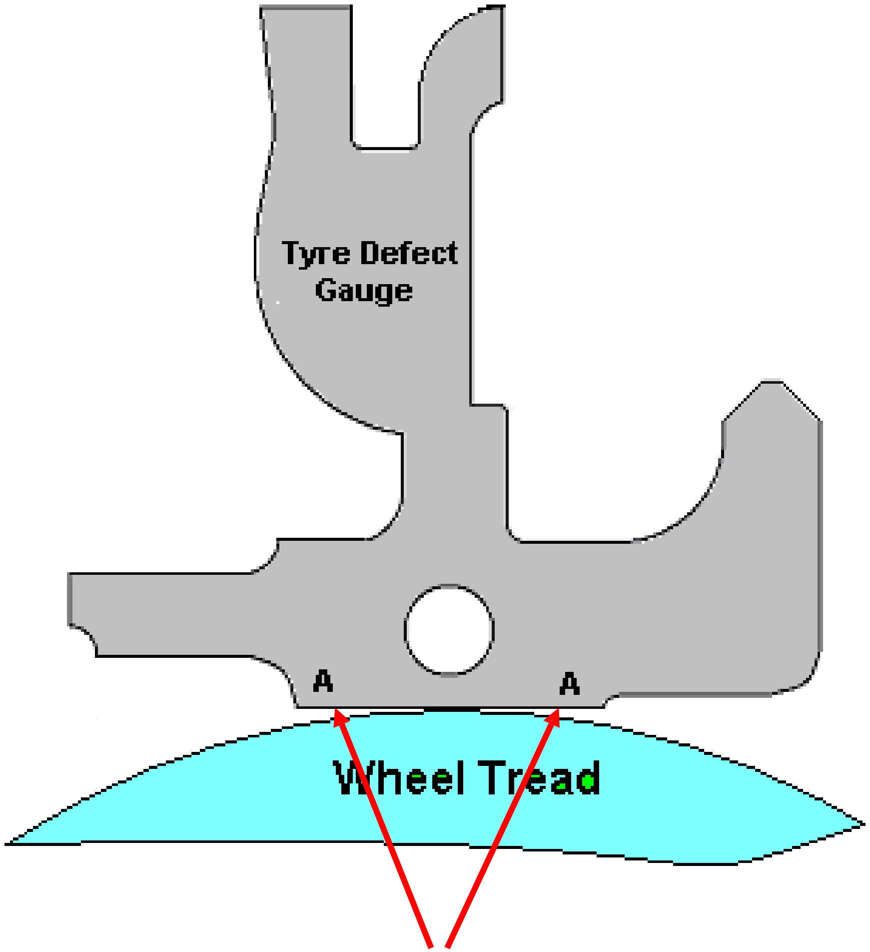




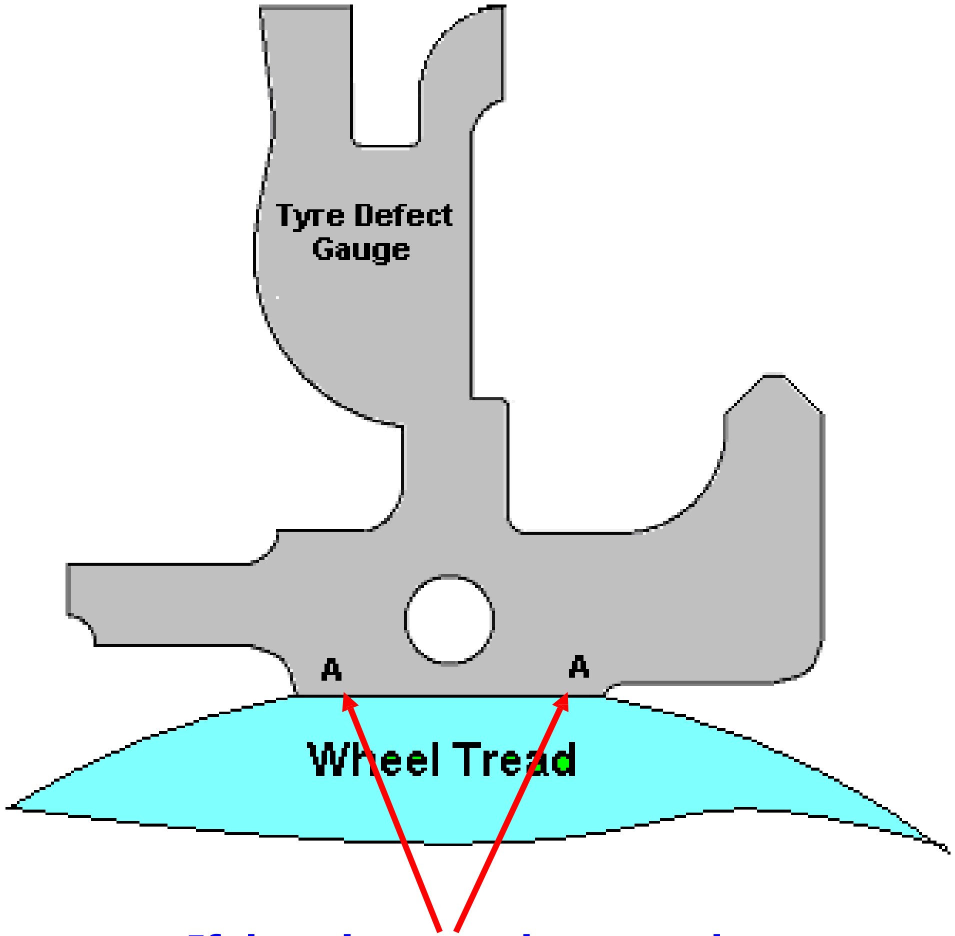
When X is parallel to Y,
If there is gap between the wheel tread and gauge at "A",the wheel is serviceable

When X is parallel to Y,
If the gauge touches the wheel tread at "A",The wheel is rejectable.

Checking Flat tyre

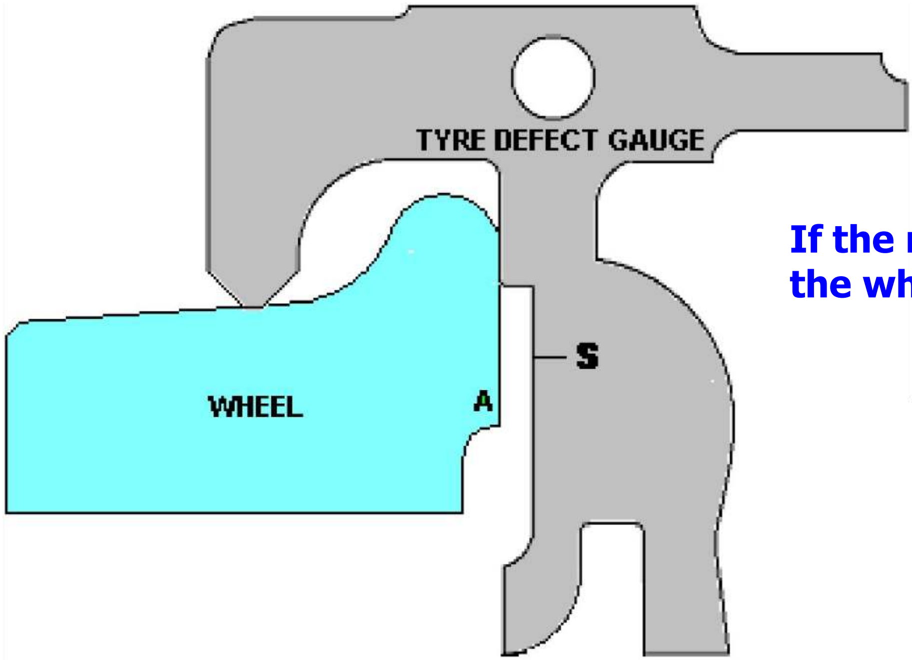


If there is gap between the gauge and the wheel tread at "A", the wheel is serviceable.

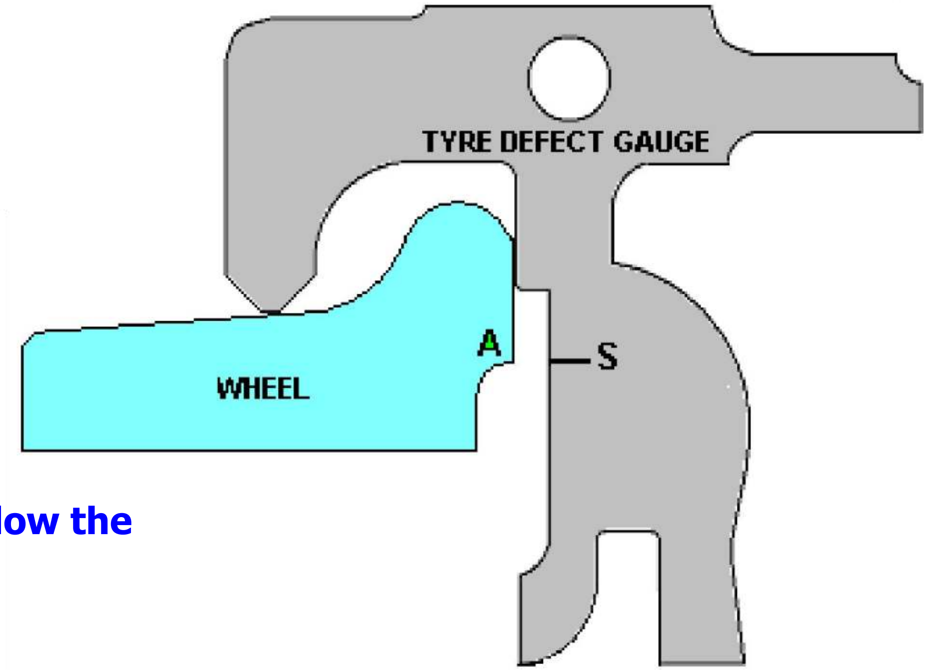


If there is no gap between the gauge and the wheel tread at "A", the wheel is rejectable.

Checking Thin tyre



If the mark S in the gauge is above the location A , the wheel is serviceable.



If the mark S in the gauge is in line or below the location A , the wheel is rejectable.

Wheel defect as per CMI K 003

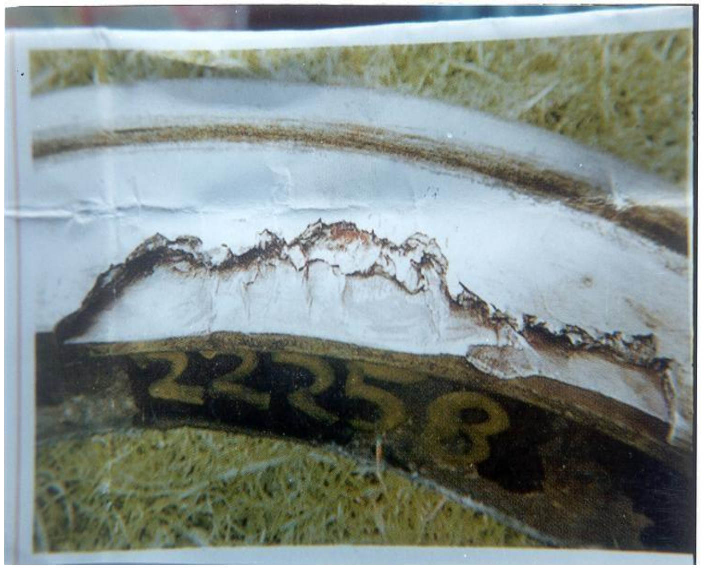
- Shelled tread
- Shattered rim
- Spread rim
- Thermal crack
- Heat checks
- Disc crack
- Loose axle

Shelled Tread

Shelling can be identified by pieces of metal breaking out of the tread surface in several places more or less continuously around the rim. Shelling takes place when small pieces of metal break out between the fine thermal checks. These are generally associated with small skid marks or “chain sliding” Such wheels should be withdrawn from service and sent to workshops for re-profiling.

Shattered Rim

A wheel with a fracture on the tread or flange must be withdrawn from service. Shattered Rim is a rejectable defect. (This does not include wheels with localized pitting or flaking without presence of any rejectable condition).



Spread Rim

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

Rim Flow

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

Thermal Crack

Thermal cracks appear on a wheel tread due to intense heating of the wheel arising out of severe brake binding. Such cracks occur on the tread and generally progress across the tread in a transverse & radial direction. Whenever such a crack becomes visible on the outer face of the rim or tread crack has reached the outer edge (non-gauge face) of the rim, the wheel should be withdrawn from service. If a crack becomes visible on the outer flange face, the wheel should be withdrawn from service. Such wheels should be sent to workshop for examination and subsequent rejection.

Thermal Crack

Wheels involved in brake binding during service, should be examined carefully during the maintenance to rule out the possibility of rejectable thermal cracks. Such wheels may be identified by presence of flats (even within acceptable limits) and severe discoloration or blue/ black heating marks on the tread.

Heat Checks

Fine superficial cracks visible on the tread on or adjacent to the braking surface are called heat checks, which are usually denser than the thermal cracks. Heat checks are caused on the tread due to heating and cooling cycles undergone by the wheel during normal braking. Such wheels need not be withdrawn but should be carefully distinguished from the rejectable thermal cracks

Disc Crack

A crack on the disc due to material failure is called disc crack. The wheel should be with drawn from service.

Loose Axle

- While assembling wheel with axle proper interference should be maintained between wheel and axle. Due to improper selection of interference the wheel may shift outwards or it may come out completely. Loose axle is a rejectable defect.
- Axles involved in Accidents should be magnaflux tested in addition to Ultrasonic test.
- Axle having notch should be withdrawn from service

- All wheel sets withdrawn from service for any of the conditions mentioned above must be sent to the associated workshops for detailed investigations and further disposal.
- The date and station code of the maintenance depot where the wheels are changed should be stencilled on the end panels. An entry should also be made in the maintenance card of the coach.
- No repairs, except wheel profiling of wheel sets is permitted to be done in the maintenance depot.

Wheel Gauge

Description	Std	Max	Min
Coach MG	930	932	929
ICF coach BG	1600	1602	1599
LHB coach	1600	1601	1599
Wagons	1600	1602	1599

Wheel Diameter

Description	Std	Cond
Coach MG		
ICF coach BG	915	825
LHB coach	915	845
BOXN	1000	906
UIC	1000	860
BLC	840	780

Wheel Changing

Wheels to be paired within the diameters variation as below while changing the wheels

Type	On the same bogie	On the same coach
Coach MG	5	10
Coach BG	5	13
Wagons	13	25

While tyre turning, it should be ensured that variation on the same axle is within 0.5 mm

For in service wheels the variation on the same axle shall be guided by the tyre defect gauge

Thank You

ICF BOGIE

Vestibule type AC Pantry car

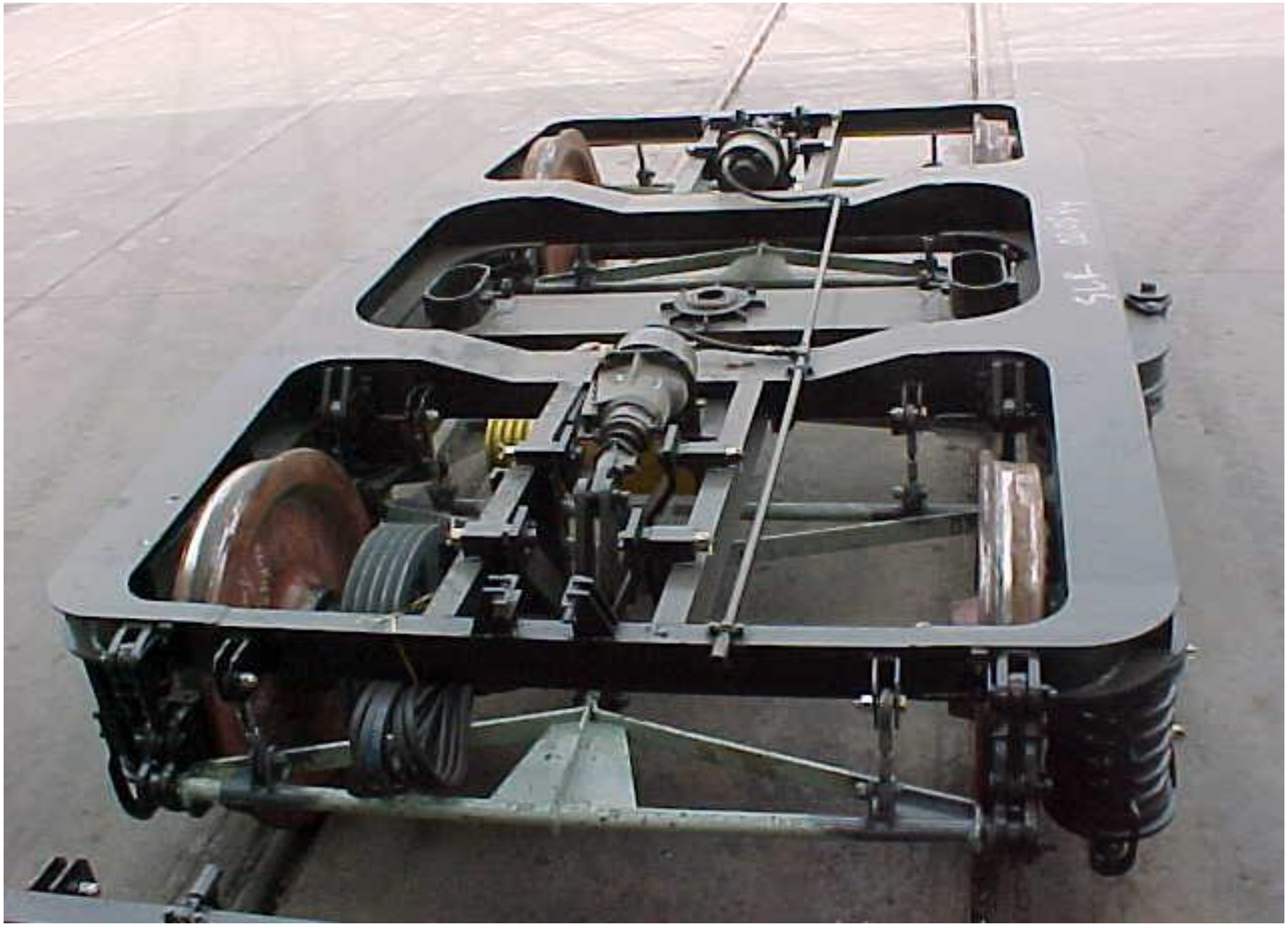
Construction of coaching stock

- Shell or the skeleton part
- Furnishing or the provisions of amenities
- Bogie (Trolley), the running gear

Running of passenger Coaches with safety

Speed and Comfort mainly depends on the bogie on which the coach is placed.

Bogie



BOGIE (TROLLEY)

What ?

Why?

Bogie - What?

- It is an independent unit used under a long vehicle.

- It is usually mounted on two pairs of wheels.

  (In exceptional cases, such as special purpose stocks or high capacity vehicles of well Wagons or crocodile trucks, inspection carriages etc the bogie may be mounted on three or more pairs of Wheels)

Bogie - What?

- Normally two bogies are used under a Vehicle.
- Each bogie carries half the load of the vehicle body and it's loading.
- Each bogie is provided with a pivot on its central transom or bolster for engagement with its male counterpart provided underneath the vehicle under frame.

Bogie - What?

- **The bogie trucks can swivel about these pivots with case and without restraining the vehicle body while negotiating a curved truck.**

Bogie - Why?

- Limitation of maximum rigid wheel base of a vehicle
- Limitation of maximum axle load prescribed for track
- Full utilisation of track loading density

Requirement of Bogie

- Sturdy construction to withstand vertical, longitudinal and lateral shocks
- Satisfactory damping devices
- Suitable suspension gear

Requirement of Bogie

- Sturdy running gears to give trouble free service
- Easy negotiability on curved track without restraining body structure

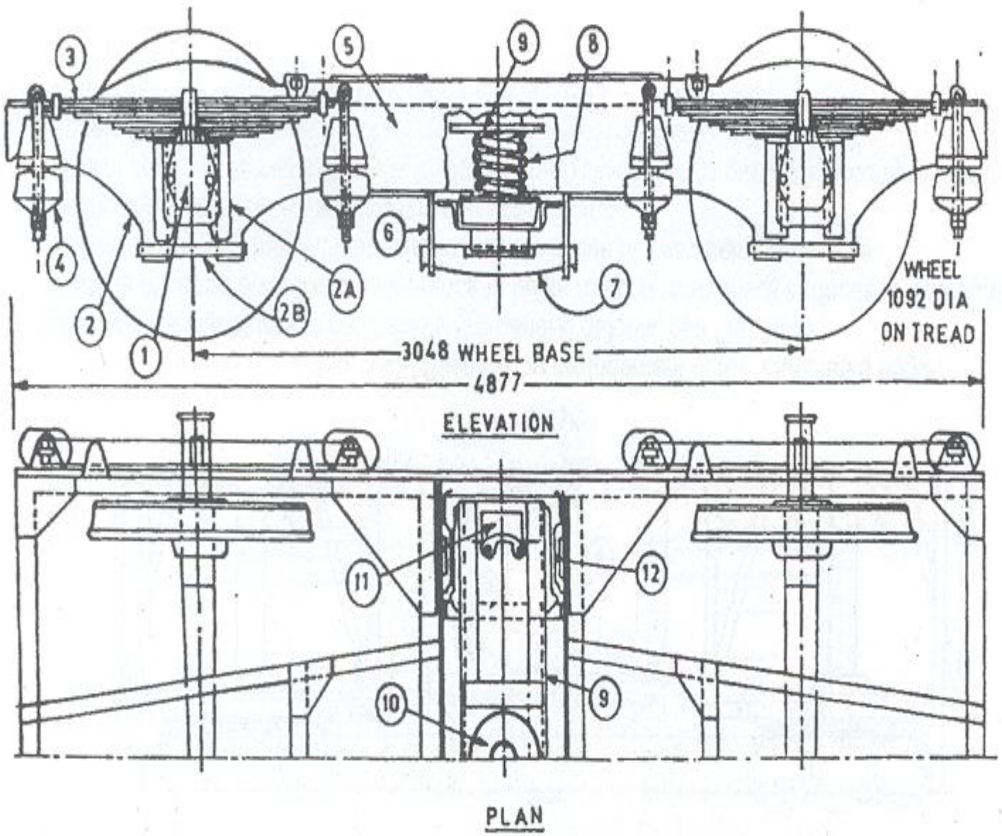
Main Units of a Bogie

1. Bogie Frame
2. Wheel and Axle
3. Bearing Arrangement
4. Bogie Frame – Axle Joint
5. Bolster
6. Primary Suspension
7. Secondary Suspension
8. Bogie – Body Joint
9. Brake System

Version of Coaching Bogie

- IRS Bogie
- SCHLIEREN Bogie (ICF Laminated Bogie)
- MAN-HAL Bogie (BEML Bogie)
- ICF All Coiled Bogie
- IR-20 Bogie
- Fiat Bogie (Similar to IR-20 Bogie)

IRS Bogie



1. Plain bearing axle box.
2. Axle guard.

2A. Horn cheek.

2B. Bridle bar

3. Primary springs (laminated).
4. Auxiliary rubber block (or spring).
5. Bogie frame (rivetted).
6. Swing links.
7. Spring plank.
8. Secondary springs (helical)
9. Bolster.
10. Centre pivot.
11. Side bearers.
12. Check guides (connected to bogie frame).

Suspension arrangement of IRS (B. G.) bogie.

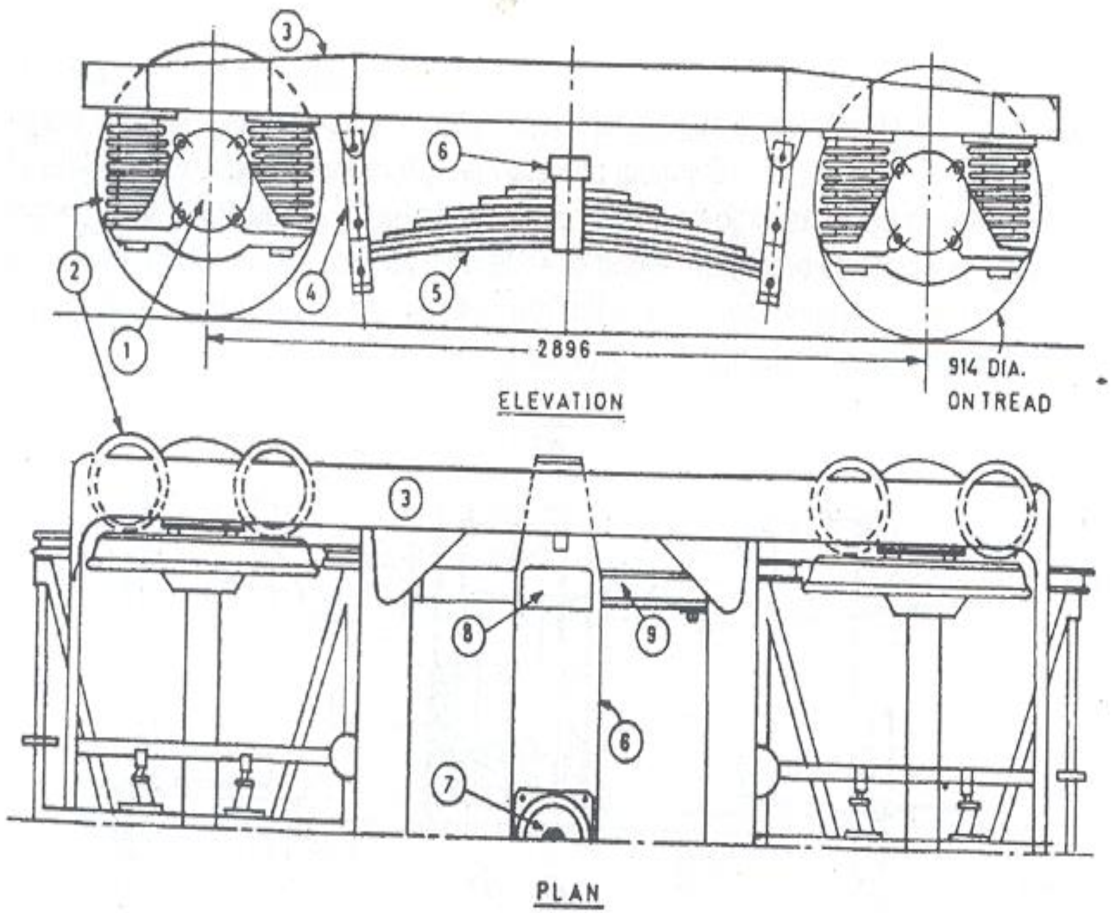
IRS Bogie

Developed / Built by: British Make

Introduction to Railway : Since 1930 – 31

Status: Productions abolished and use discontinued on Mail / express service.

SCHLIEREN Bogie
(ICF Laminated Bogie)



1. Wing type roller bearing axle box.
2. Primary springs (helical), with dash-pot inside.
3. Bogie frame.
4. Swing links.
5. Secondary springs (laminated).
6. Bolster.
7. Centre pivot.
8. Side bearers.
9. Anchor links.

Suspension arrangement of ICF Laminated bogie.

SCHLIEREN Bogie
(ICF Laminated Bogie)

Developed / Built by:

M/S Swiss Car and

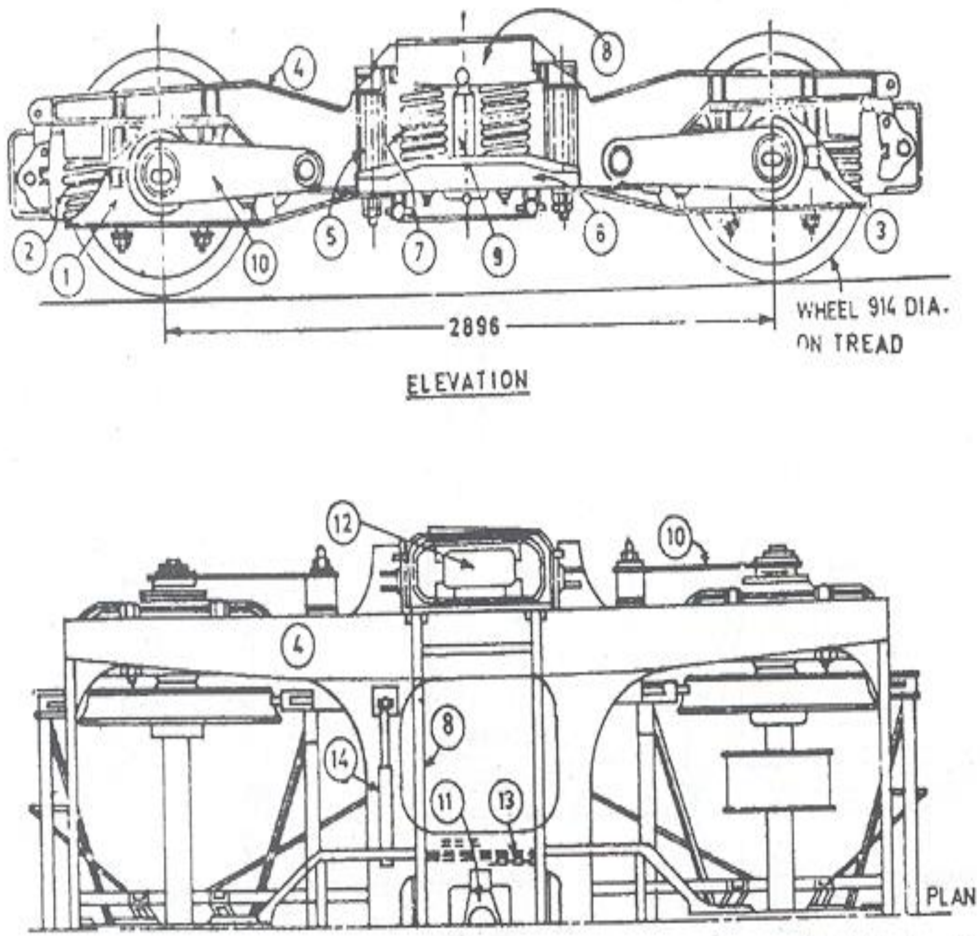
Elevator manufacturing corporation Ltd,

Schlieren, Zurich

Introduction to Railway : Since 1951

Status: **Productions abolished and use discontinued on Mail / express service.**

MAN-HAL Bogie
(BEML Bogie)



Suspension arrangement of BEML bogie :

1. Wing type roller bearing axle box.
2. Primary springs (helical).
3. Axle guide rollers (16 Nos. per bogie i. e. 32 Nos. per coach).
4. Bogie frame.
5. Swing links.
6. Spring plank.
7. Secondary springs (helical).
8. Bolster.
9. Vertical shock absorber (hydraulic).
10. Axle link (or axle holding arm).
11. Centre pivot.
12. Side bearers.
13. Anchor links.
14. Lateral shock absorber (hydraulic).

MAN-HAL Bogie
(BEML Bogie)

Developed / Built by:

M/S HAL Banglore

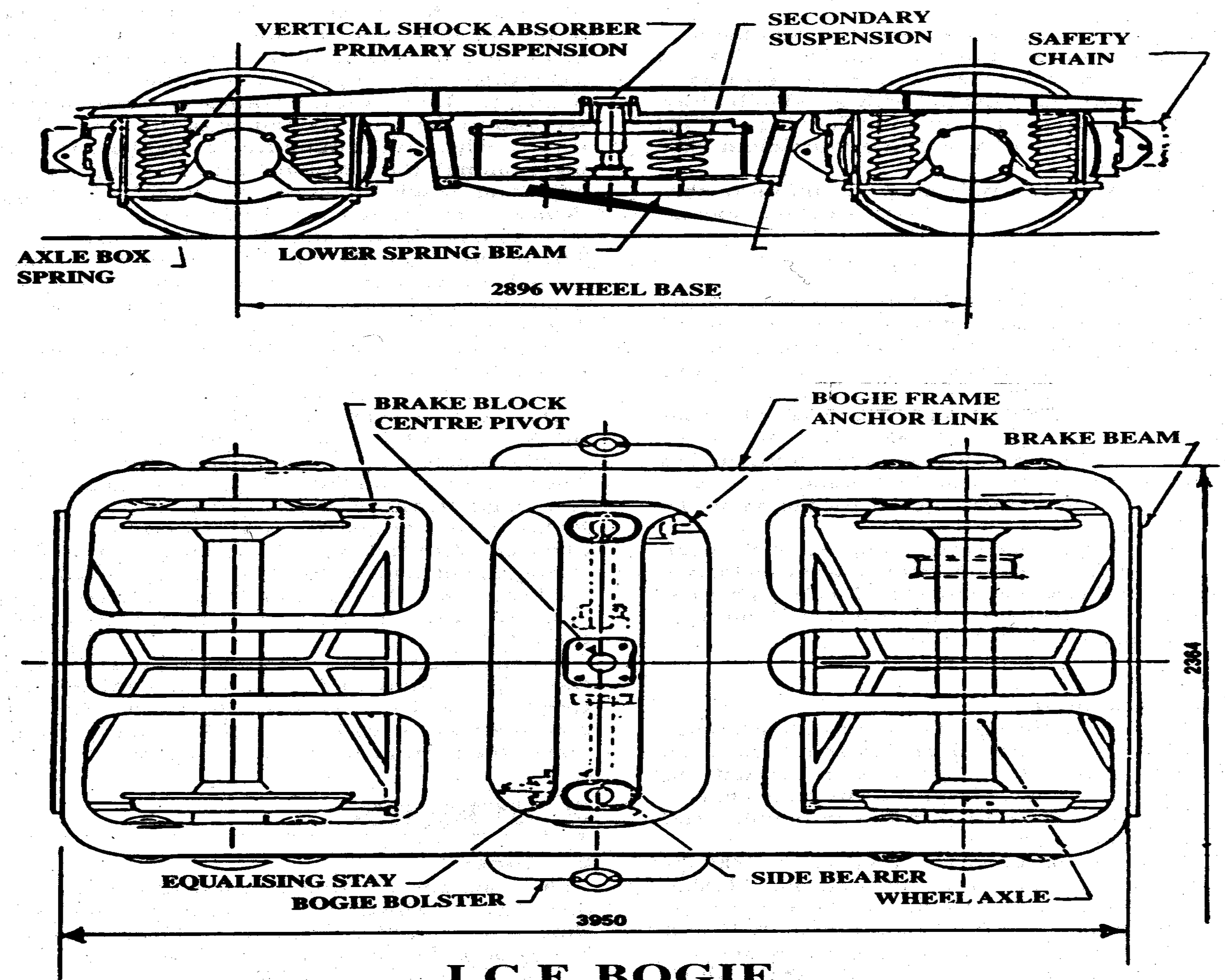
in collaboration with

M/S MAN Nurnberg (West Germany)

Introduction to Railway : Since 1958-59

Status: **Productions abolished and use discontinued on Mail / express service having speed more than 105 KMPH.**

ICF All Coiled Bogie



I.C.F. BOGIE

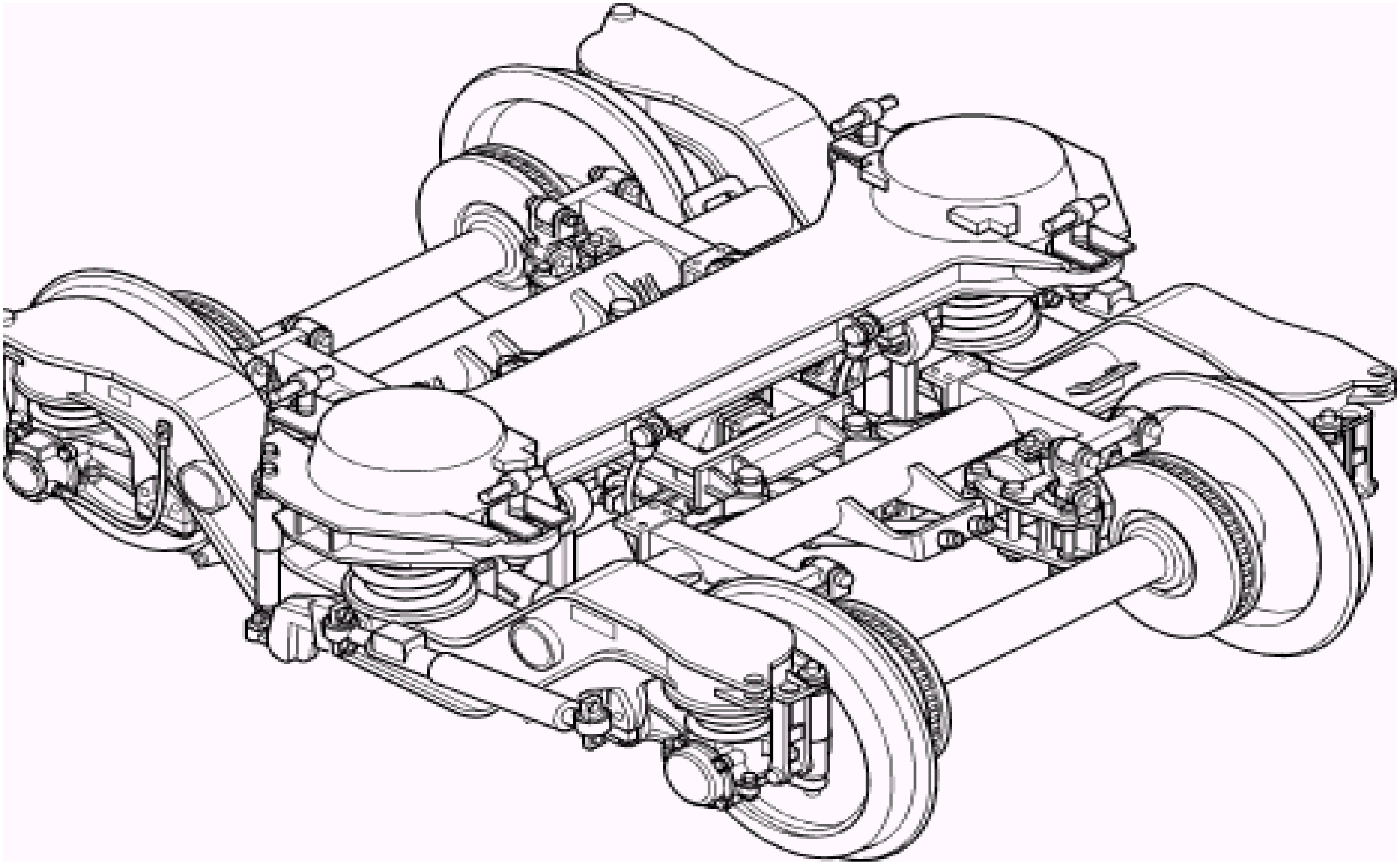
ICF All Coiled Bogie

Developed / Built by: ICF & RCF

Introduction to Railway : Since 1965

Status: Productions continue by ICF & RCF.

Fiat Bogie
(Similar to IR-20 Bogie)



2.B. 20.12.99 ISSUE

IR-20 Bogie

Developed / Built by: RCF

Introduction to Railway : Since 1998

Status: Used in few coaches and production abolished due to introduction of FIAT bogie.

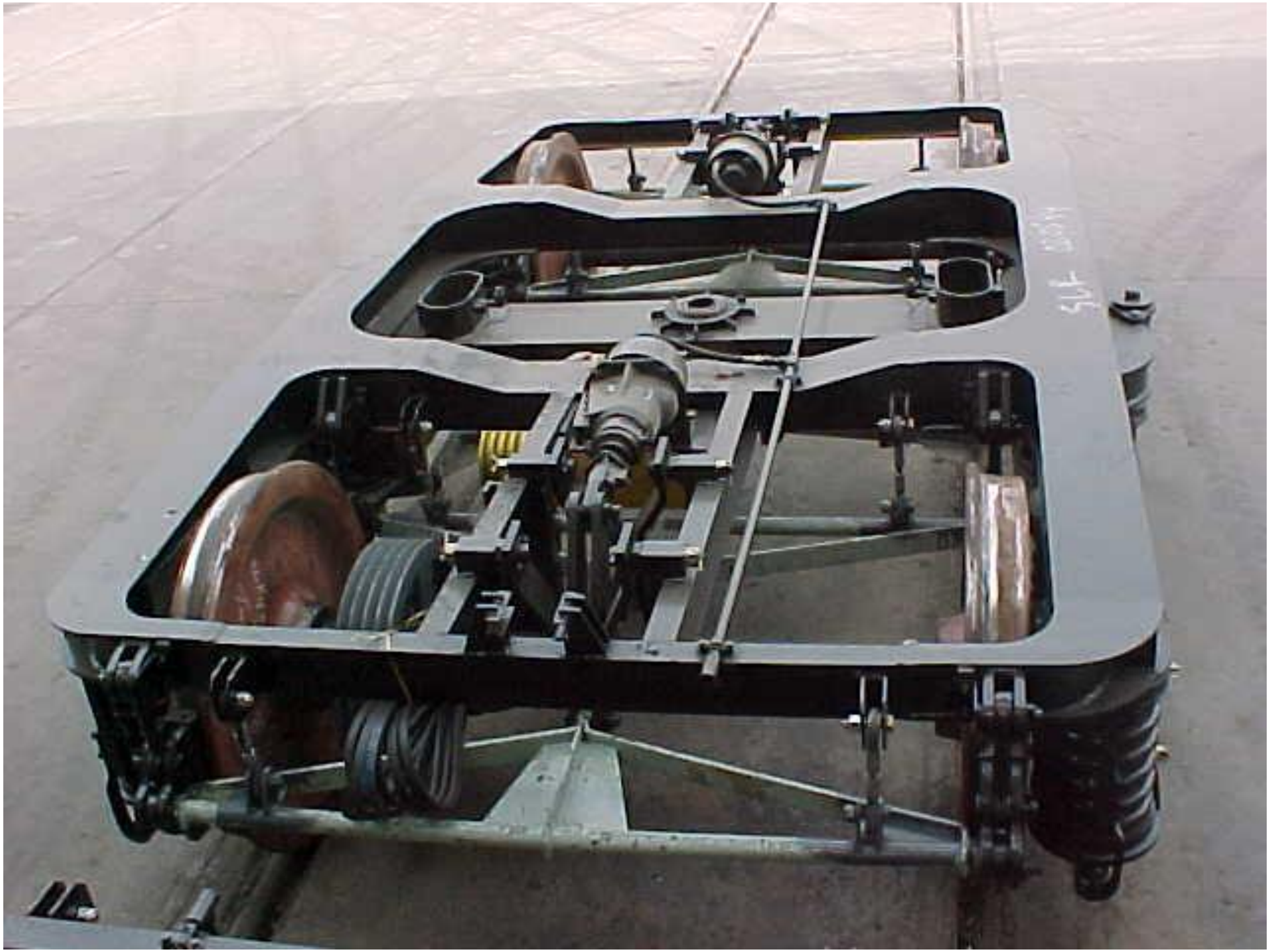
FIAT Bogie

Developed / Built by: 24 Coaches imported from Switzer land in 2000- 01.

Introduction to Railway : Since 2001

Status: Productions started in RCF.

ICF BOGIE (Top View)



ICF BOGIE (Side View)

ICF Bogie

S. No.	Description	Parameters
1.	Maximum Axle load bearing capacity	16.25t, 13t
2.	Wheel base	2896mm
3.	Wheel diameter (New)	915mm
4.	Axle guidance	Telescopic axle guide with oil damping
5.	Primary suspension	Coil spring
6.	Secondary suspension	Coil spring
7.	Shock absorbers	i) Vertical dashpot in primary suspension. ii) Hydraulic double acting vertical shock absorber in secondary suspension.
8.	Transfer of coach body weight	Through bogie side bearer pitched at 1600mm.

ICF Bogie

- Manufactured by ICF/RCF
- Helical coil springs are used in both the primary and the secondary stages.
- The axle guide device provides viscous damping across primary springs while hydraulic dampers are provided across the secondary stage.

ICF Bogie

- Rigid axle box guide arrangement eliminates any longitudinal or transverse relative movement between the axles and the bogie frame.

- These guides are fitted with guide caps having nine holes of diameter 5 mm equidistant through which oil in the lower spring seat passes under pressure during dynamic oscillation of coach and provide necessary damping to primary suspension to enhance better riding quality of coach.

ICF Bogie

- Isolation of vibration is effected by rubber pads in primary and secondary suspension.

- The wheel sets are provided with self-aligning spherical roller bearings mounted in cast steel axle box housings.

ICF Bogie

- 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.

ICF Bogie

- The quantity of oil required to achieve **40 mm** oil level above the guide cap in modified arrangement is approximately **1.6 liters** and in unmodified arrangement is approximately **1.4 liters**. As it is not possible in open line to distinguish between modified and unmodified arrangements, **40 mm** oil level is standardised for both.

ICF Bogie

- Side-bearers consist of lubricated metal slides immersed in oil baths.

- The ends of the bogie bolsters rest on the bolster helical springs placed over the lower spring beam suspended from the bogie frame by the inclined swing links at an angle 7 degree.

ICF Bogie

- **SILENT BLOCK**
  - This is a synthetic rubber bush fitted in anchor link and center pivot of ICF bogies to transmit force without shock and reduce noise.

ICF Bogie

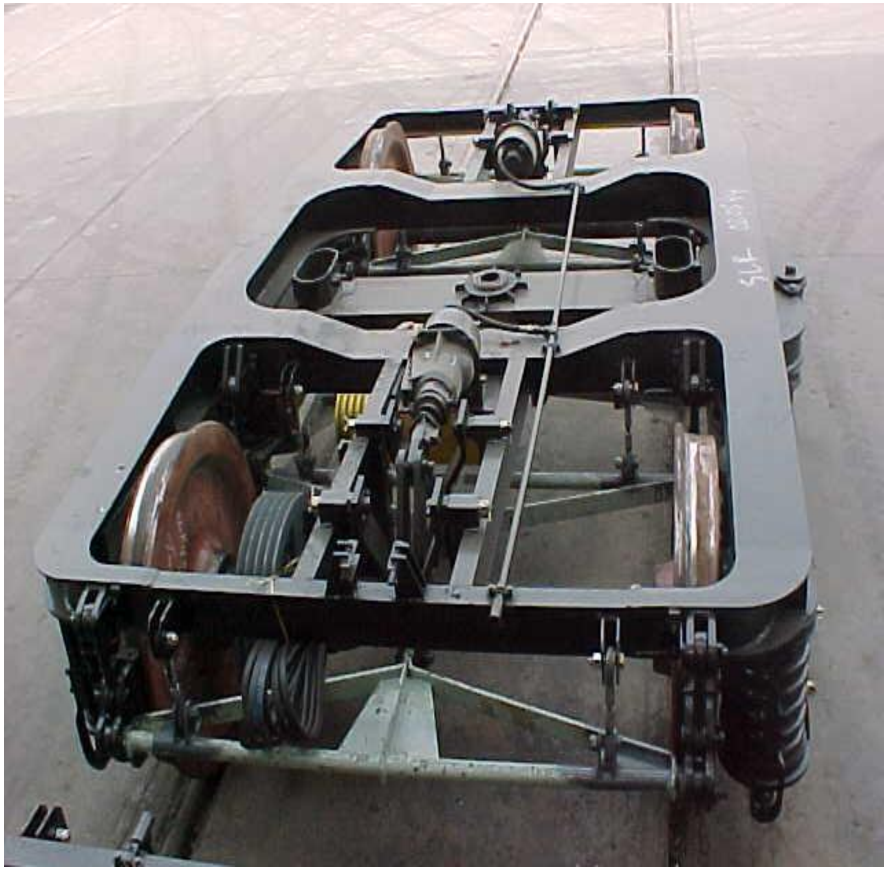
- The two anchor links diagonally positioned are provided with silent block bushes. The links prevent any relative movement between the bogie frame and coach body.

ICF

- **CENTRE PIVOT ARRANGEMENT**

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

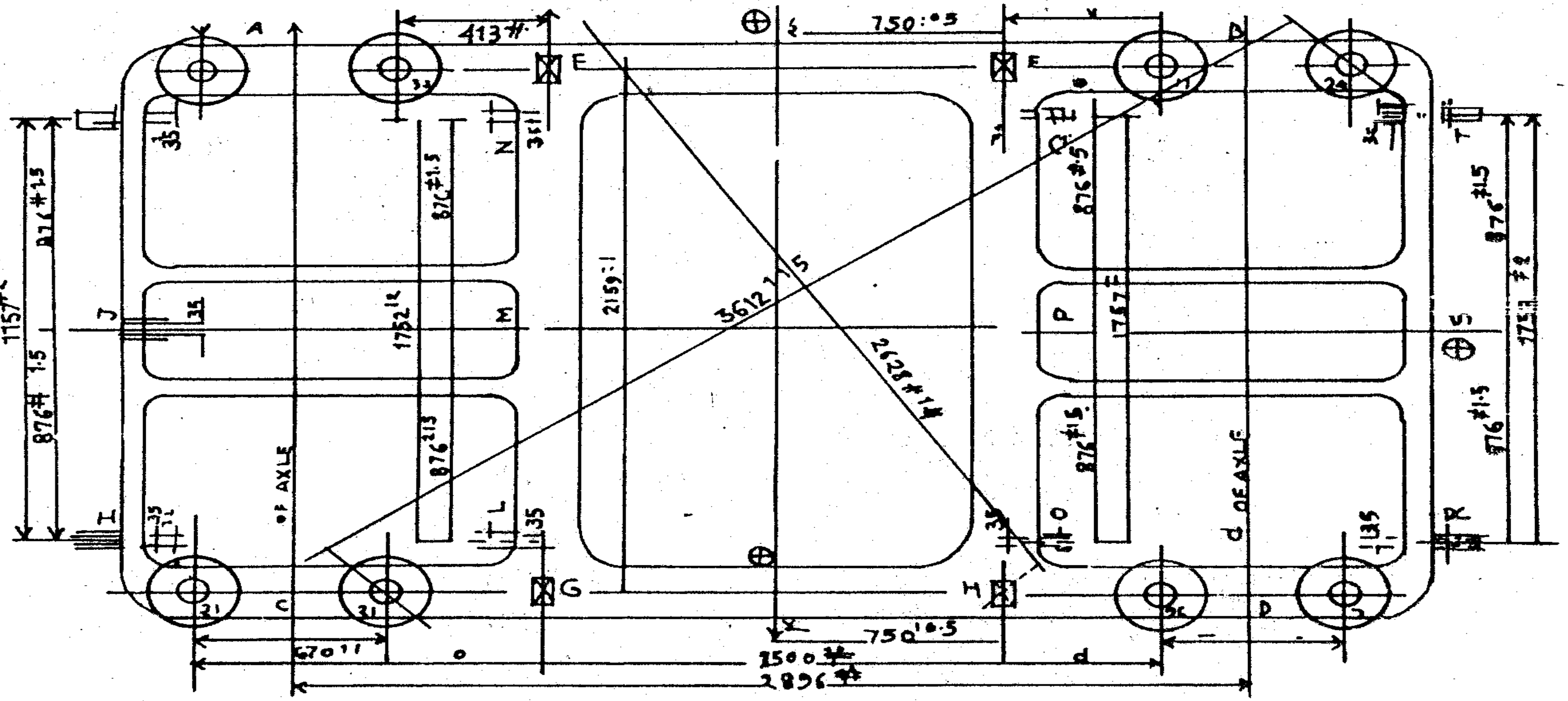
Bogie Frame



Bogie Frame

- All welded light weight construction.

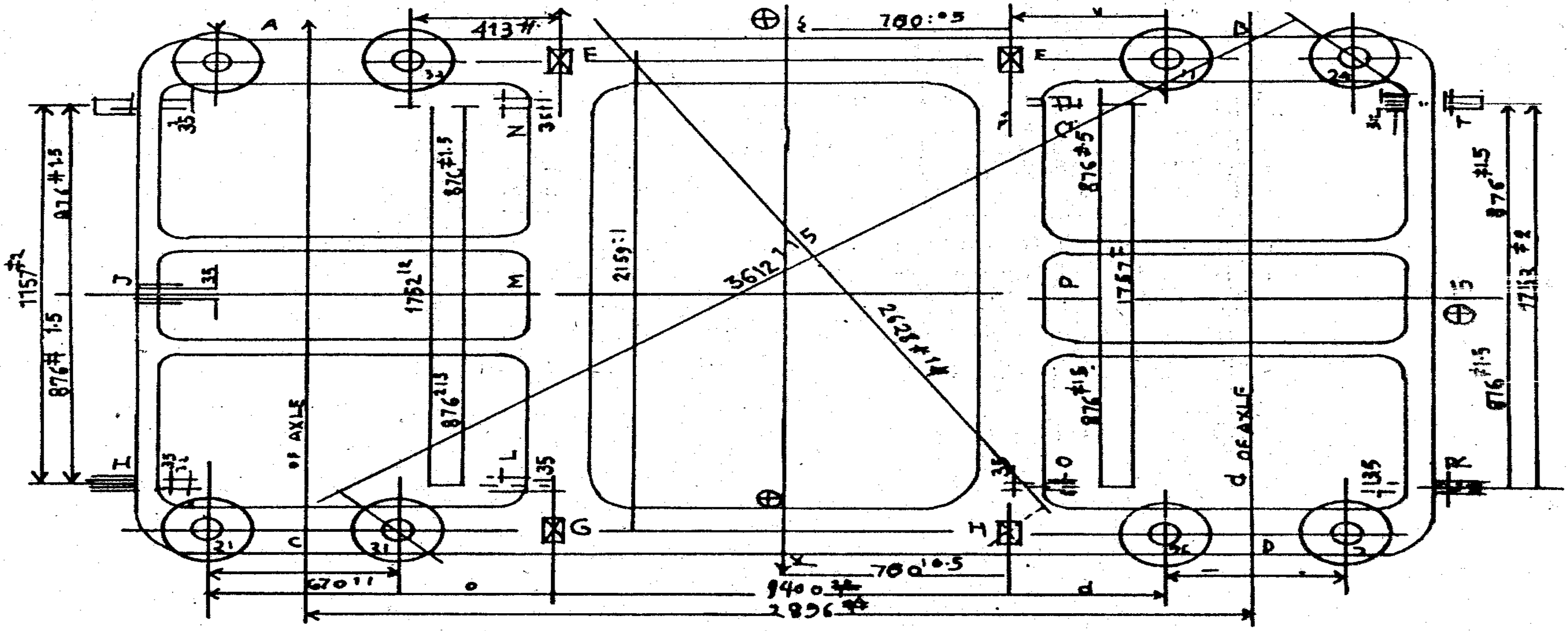
Bogie Frame



DIMENSIONAL CHECK REPORT

FOR AC- AND POWER CAR BOGIE FRAME

1. SOLEBAR & HEAD STOCK CENTRES OF BOGIE FRAME WILL BE PERMANENTLY PUNCH MARKED IN CONSPICUOUS MANNER.
2. REPRESENTS LOCATION OF AXLE GUIDES.
3. RIPRESENTS LOCA TION OF BOLSTER SPRINGS SUSPENSION BRACKET.
4. BOLSTER SPRING SUSPENSION BRACKET PIN HOLES E,F,G,H, SHALL BE LOCATED AT 750 + 0.5 mm FROM THE TRANSVERSE CENTRE LINE PUNCH MARKS ON SOLEBAR & CHECK IF.
5. WELDING JOINT SHALL NOT COME UNDER THE AXLE GUIDE.



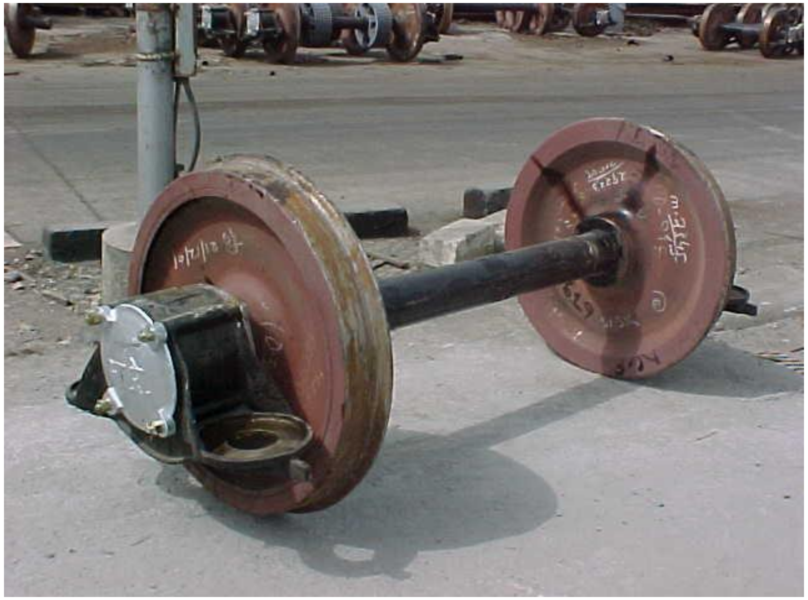
DIMENSINAL CHECK REPORT

FOR NON AC BOGIE FRAME

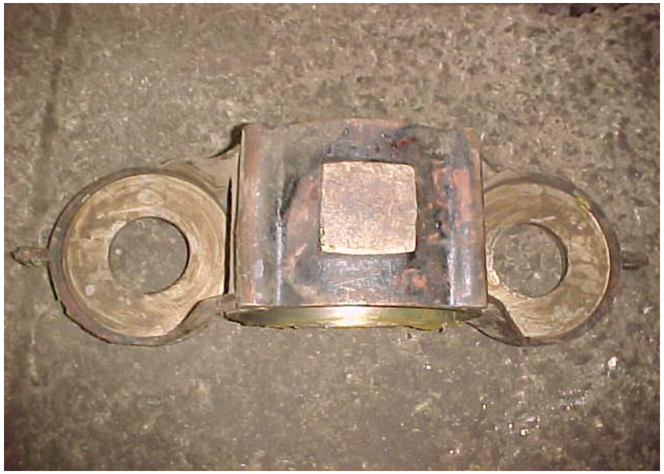
1. SOLEBAR & HEAD STOCK CENTRE OF BOGIE FRAME WILL BE PERMANENTLY PUNCH MARKED IN CONSPICUOUS MANNER.
2. REPRESENTS LOCATION OF AXLE GUIDES.
3. REPRESENTS LOCA TION OF BOLSTER SPRINGS SUSPENSION BRACKET.
4. BOLSTER SPRING SUSPENSION BRACKET PIN HOLES E,F,G,H, SHALL BE LOCATED AT 700 + 0.5 mm FROM THE TRANSVERSE CENTRE LINE PUNCH MARKS ON SOLEBAR & CHECK IF.
5. WELDING JOINT SHALL NOT COME UNDER THE AXLE GUIDE.
6. NO INACCURACY IN ALLIGNMENT OF HOLES IN THE BRACKETS WILL BE PERMITTED.

Suggested BSS bracket and axle guide alignment gauges	**13t bogies**	**16.25t bogies**
Longitudinal gauge for BSS brackets	**1400±1.0 mm** (**700±0.5 mm** from longitudinal center-line)	**1500±1.0 mm (750±0.5 mm** from longitudinal center-line)
Transverse gauge for BSS brackets	**2159 ±1.0 mm**	**2159 ± 1.0 mm**
Diagonal gauge for BSS brackets	**2573 ±1.0 mm**	**2629 ± 1.0 mm**
Longitudinal gauge for axle guide	**570±1.0 mm** (equidistant from center-line of axle)	**570 ± 1.0 mm** (equidistant from center-line of axle)
Transverse gauge for axle guide	**2159±1.0 mm**	**2159±1.0 mm**
Diagonal gauge for axle guide	**3612±1.0 mm**	**3612±1.0 mm**
Distance between BSS bracket and adjacent axle guide	**463±1.0 mm**	**413±1.0 mm**
Longitudinal gauge for suspension strap	**870±1.0 mm** (equidistant **from center-line of axle)**	**870±1.0mm** (equidistant from center-line of the axle)

Wheel & Axle



Axle Box Housing

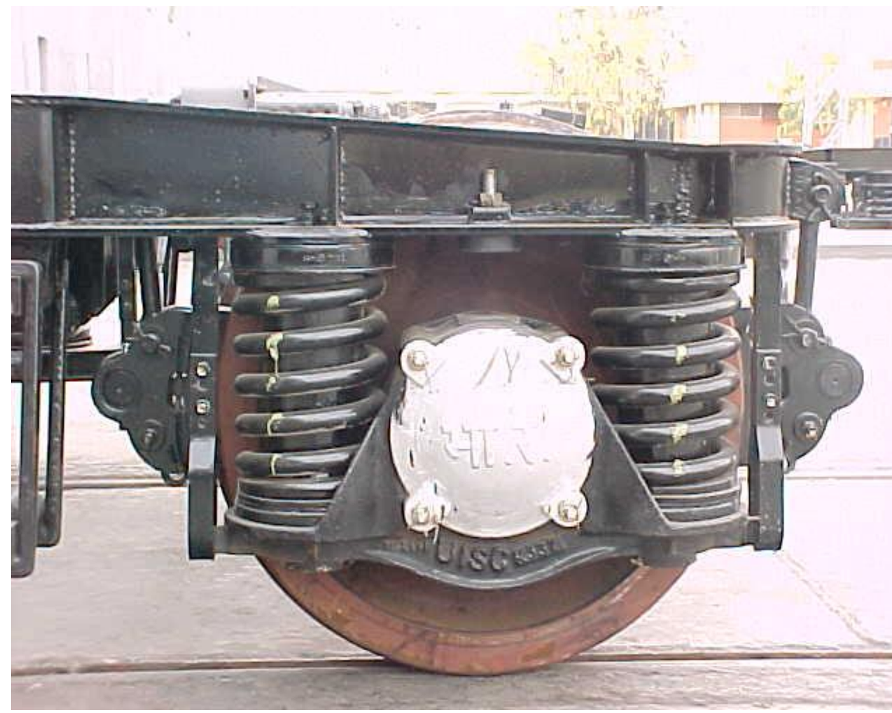


Roller Bearing

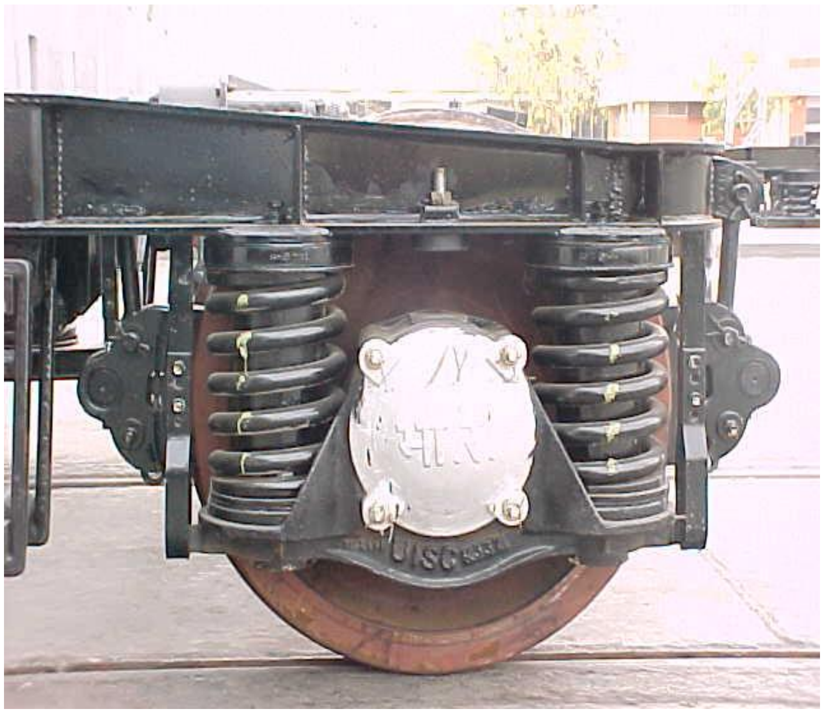
Wheel & Axle

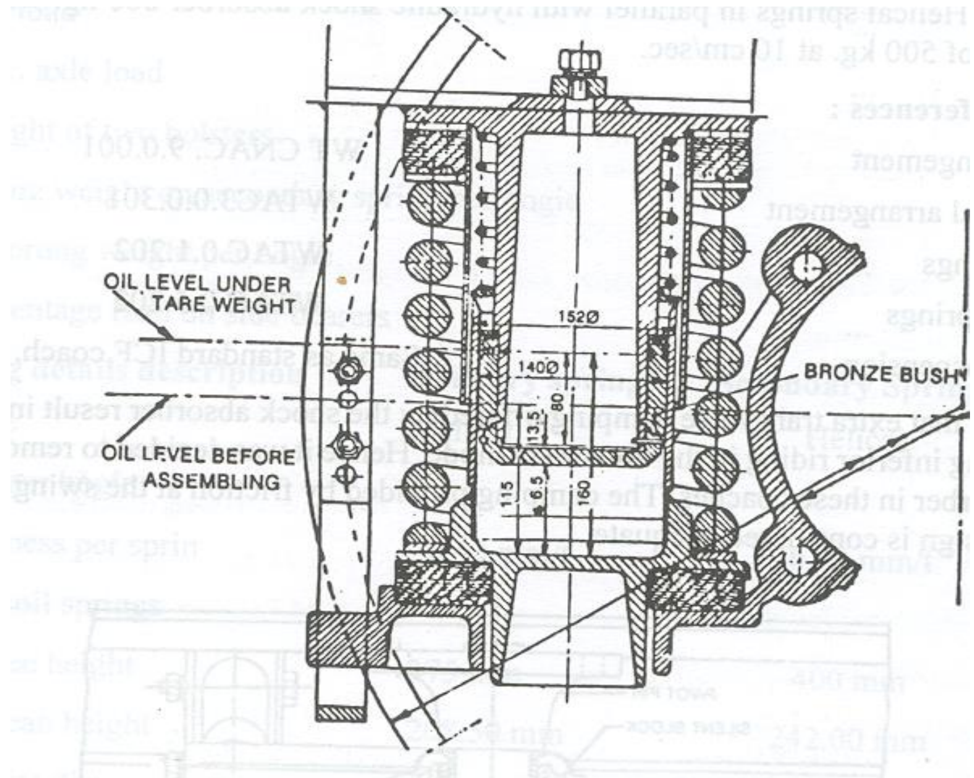
- Axles are located on the bogie by telescopic dash pot and axle guide assemblies.

Axle Box Spring

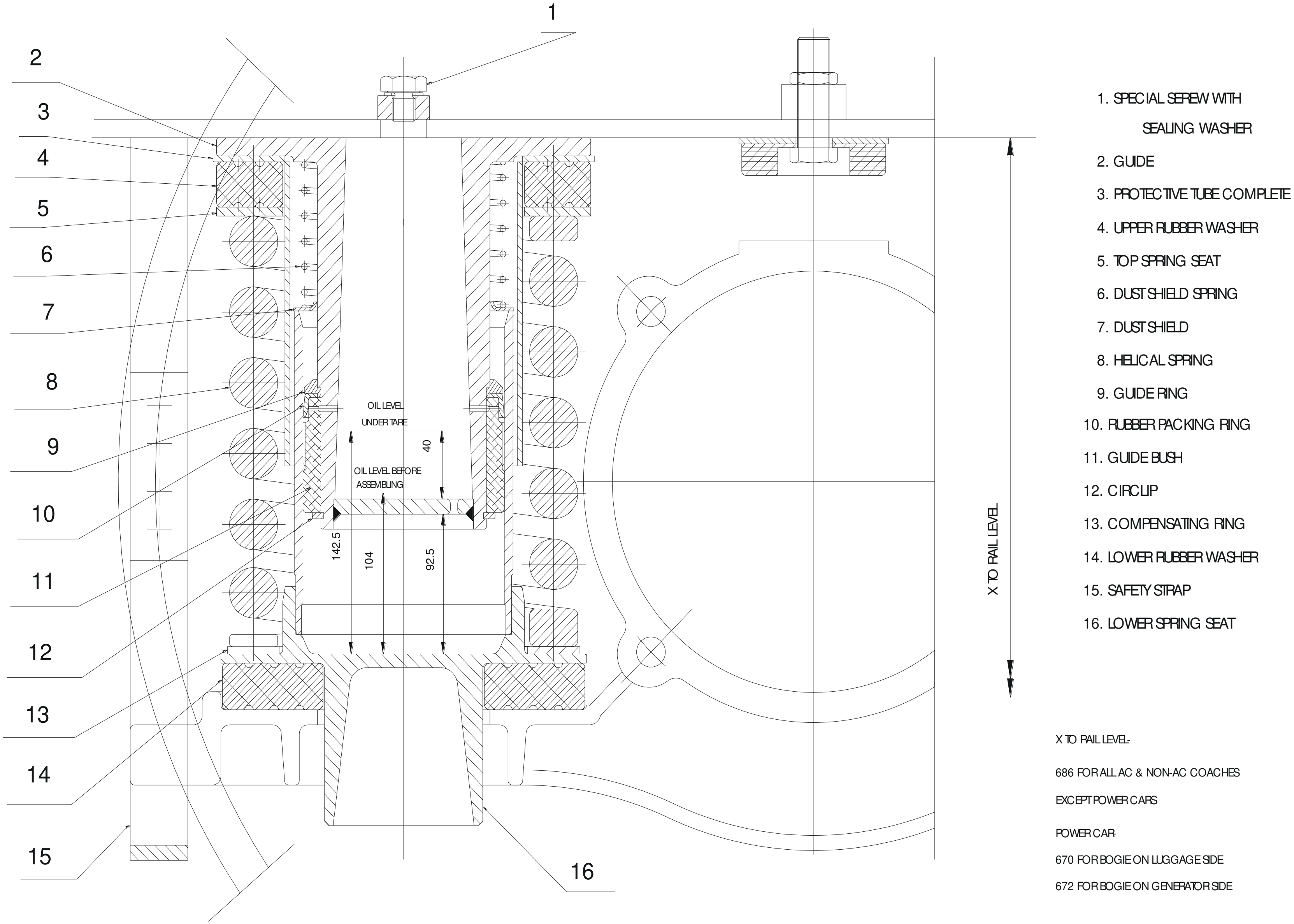


Dashpots and Axle Guide Assembles





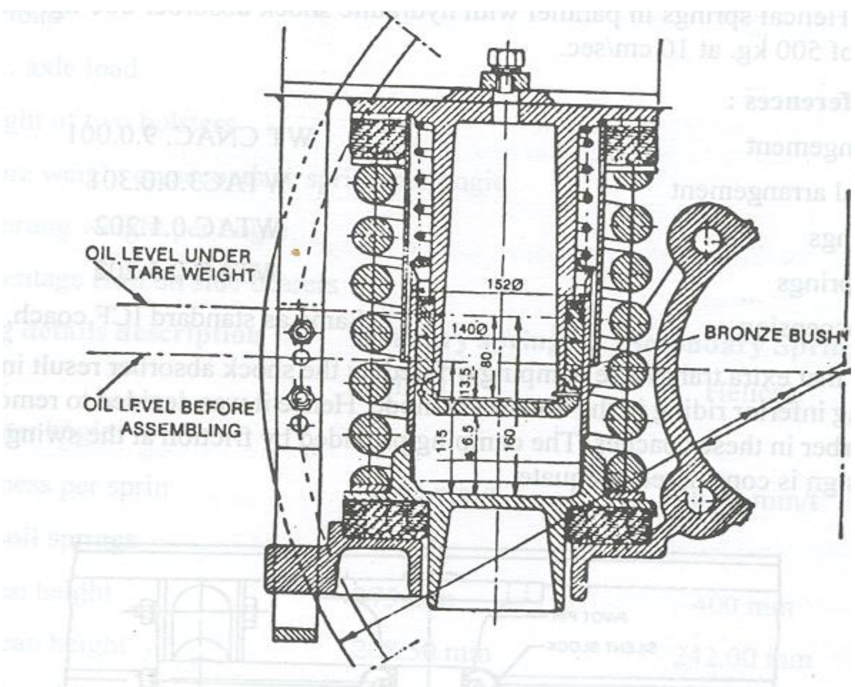
Axle Box Guide Arrangement of ICF All Coil Bogie



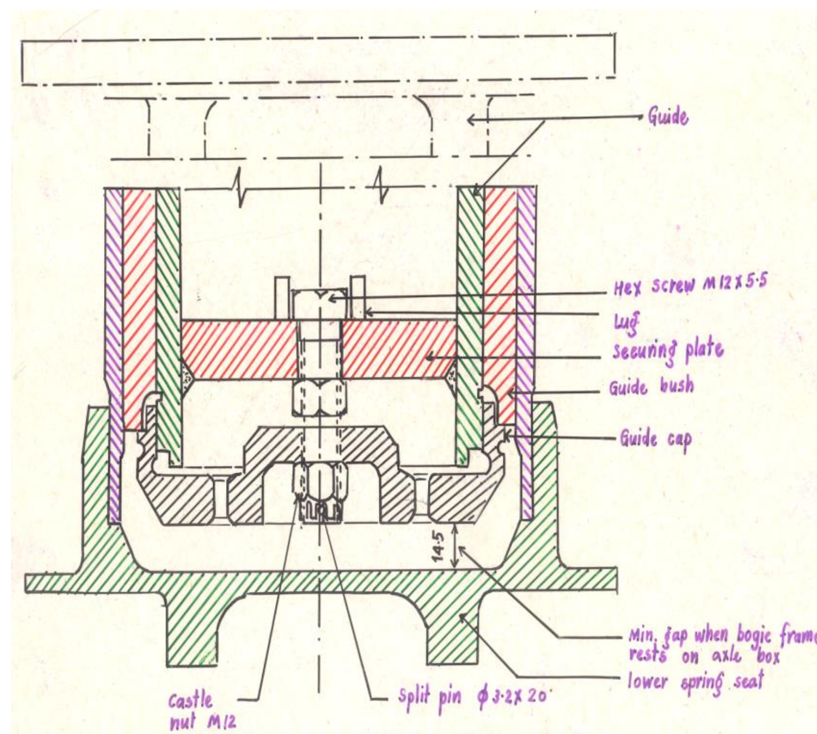
MODIFIED AXLE BOX GUIDE ARRANGEMENT

Figure 3.2a

Dashpots and Axle Guide Assembles

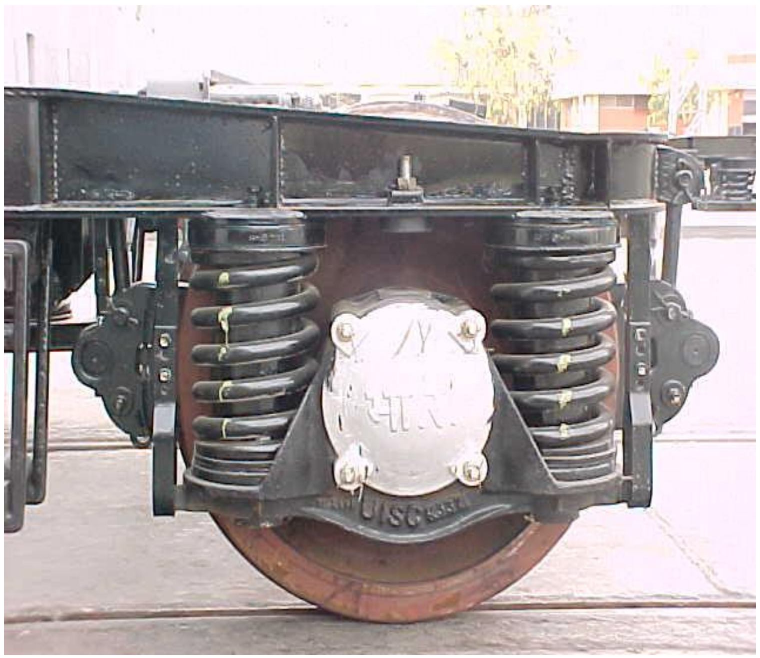


Axle Box Guide Arrangement of ICF All Coil Bogie



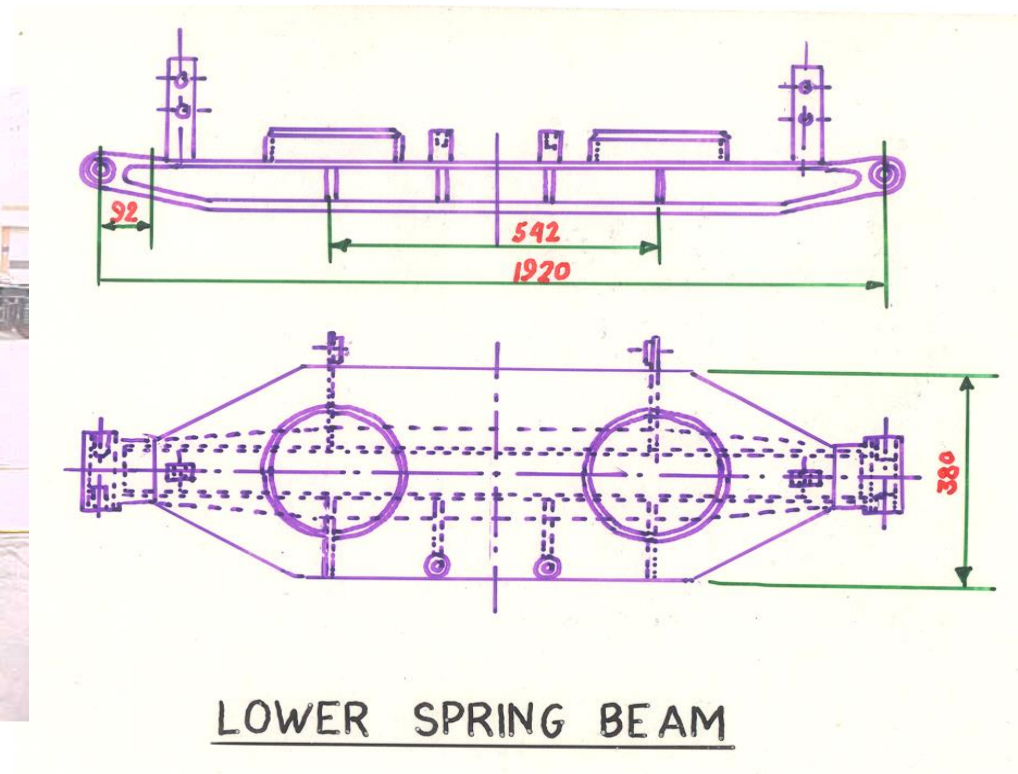
METHOD OF SECURING GUIDE CAP TO THE AXLE GUIDE

Dashpots and Axle Guide Assembles



Bolster Springs

Lower Spring Beam / Seat



Drawing code of springs for ICF BG coaches (Reference RDSO Amendment slip no. 5 of September 2001 to STR WD-01-HLs- 94 (Rev.1 May 95)

Type of spring	Type of bogies	ICF Drg. No	Drg. Code No.
Axle box	All Non AC ICF type	F-0-1-006	A01
	All AC ICF type	WTAC-0-1-202	A03
	Power car	WLRRM2-0-1-202	A04
	Double decker	DD-0-1-001	A06
	High capacity Power Car	WLRRM8-0-1-802	A09
	High capacity parcel van	RDSO /SK-98017	A10
Bolster	All Non AC ICF type	F-0-5-002	B01
	All AC ICF type	WTAC-0-5-202	B03
	Power car	WLRRM2-0-5-202	B04
	Double decker	DD-0-5-003	B06
Bolster	High capacity Power car	WLRRM8-0-5-802	B11
			B13
	High capacity Parcel van	RDSO /SK-98018	B15
			B16

Load deflection testing and grouping of Axle box spring (B.G Main line coaches)

Code	Wire dia	Free height	Test Load	Acceptable height under test load	Groups as per loaded spring height		
					A	B	C
					Yellow	Oxford Blue*	Green
A01	33.5	360	2000	279-295	279-284	285-289	290-295
A03	33.5	375	2800	264-282	264-269	270-275	276-282
A04	35	372	3000	265-282	265-270	271-276	277-282
A06	36	337	2400	269-284	269-273	274-279	280-284
A09	37	360	3000	277-293	277-282	283-288	289-293
A10	39	315	1800	276-289	276-279	280-284	285-289

Load deflection testing and grouping of Bolster spring (B.G Main line coaches)

Code	Wire dia	Free height	Test Load	Acceptable height under test load	Groups as per loaded spring height		
					A	B	C
					Yellow	Oxford Blue #	Green
B01	42	385	3300	301-317	301-305	306-311	312-317
B03	42	400	4800	291-308	291-296	297-303	304-308
B04	47	400	6100	286-304	286-291	292-297	298-304
B06	36	416	4200	280-299	280-286	287-292	293-299
B11	47	386	6700	306-322	306-311	312-317	318-322
B13	34						
B15	40	393	6000	256-272	256-261	262-267	268-272
B16	32.5	286					

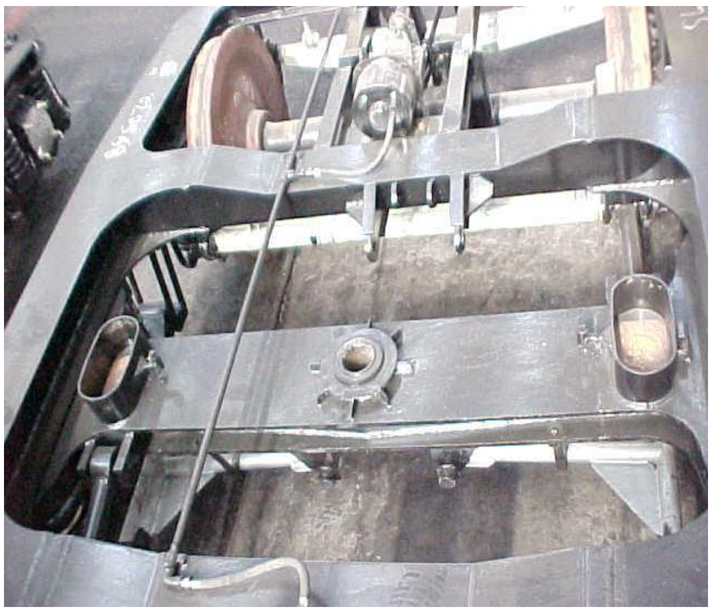
Shock absorbers

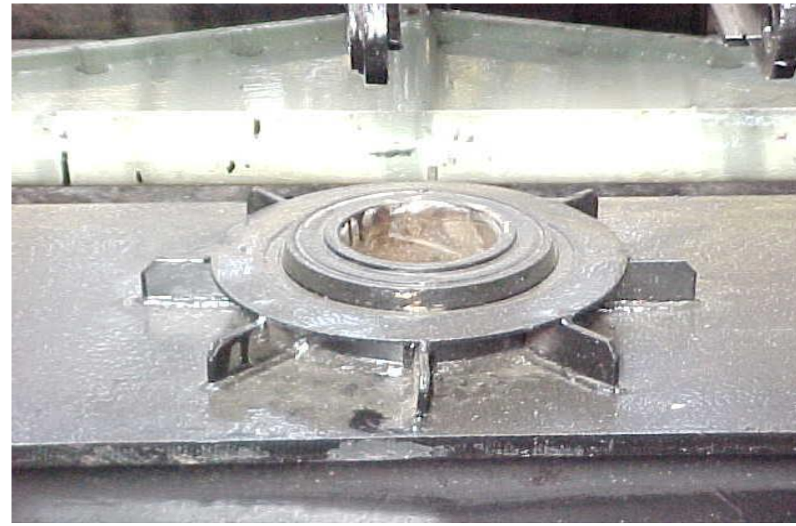
Equalising stays

Equalising stays

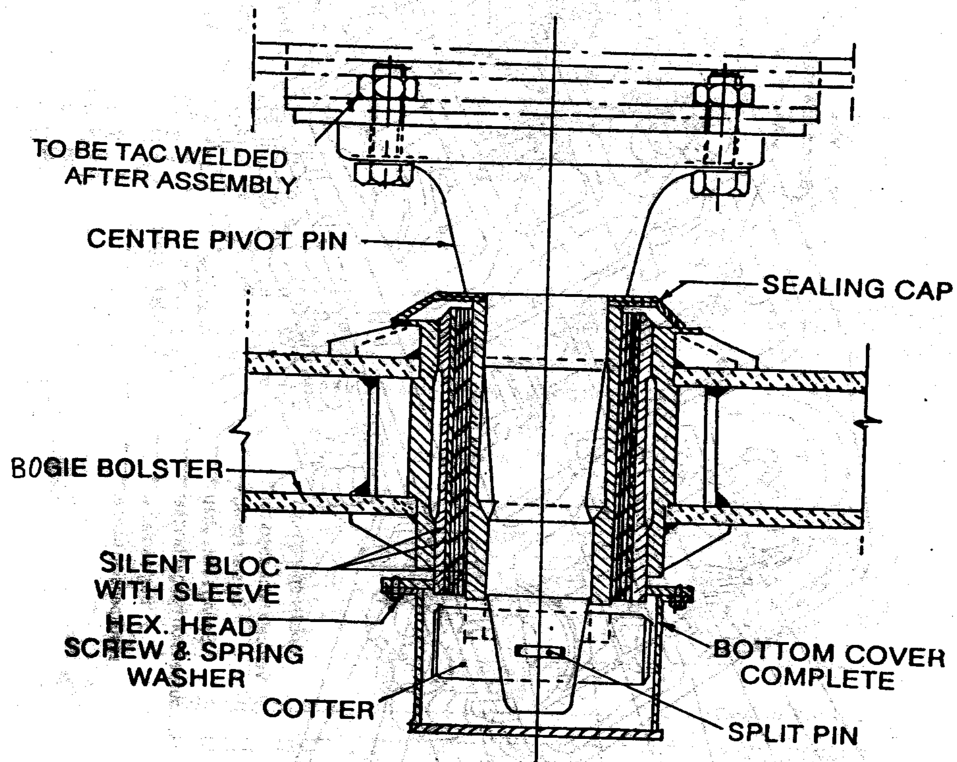
- Provided on bogies between the lower spring plank and the bolster
- To prevent lateral thrust on the bolster springs which have not been designed to take the lateral forces.
- Pin connections at both ends to swivel freely.

Centre Pivot



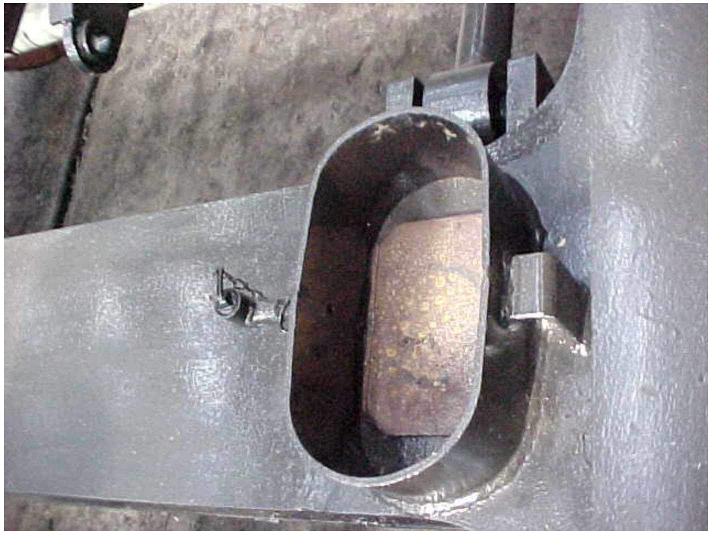


Centre Pivot



Centre Pivot Arrangement (ICF Bogie)

Side Bearers



Side Bearer

- Consists of a machined steel wearing plate immersed in an oil bath
- Floating bronze-wearing piece with a spherical top surface kept in it
- The coach body rests on the top spherical surface of these bronze-wearing pieces through the corresponding attachments on the bottom of the body-bolster.

Side Bearer

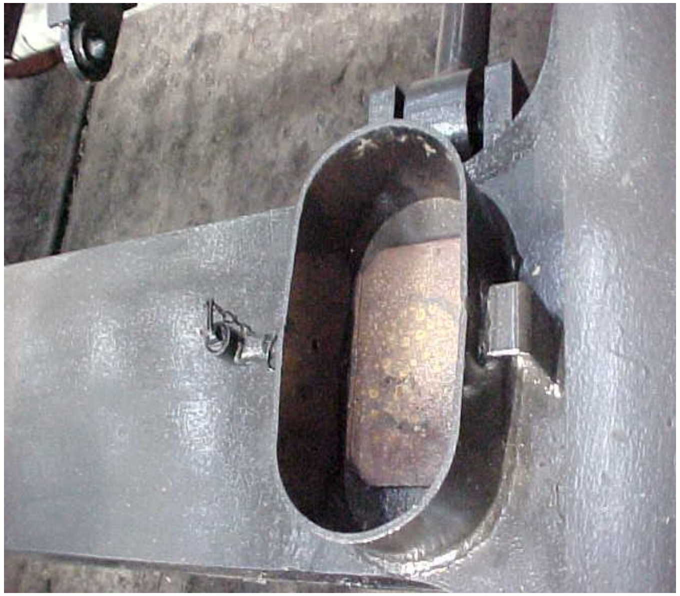
Wear limit for wearing plate

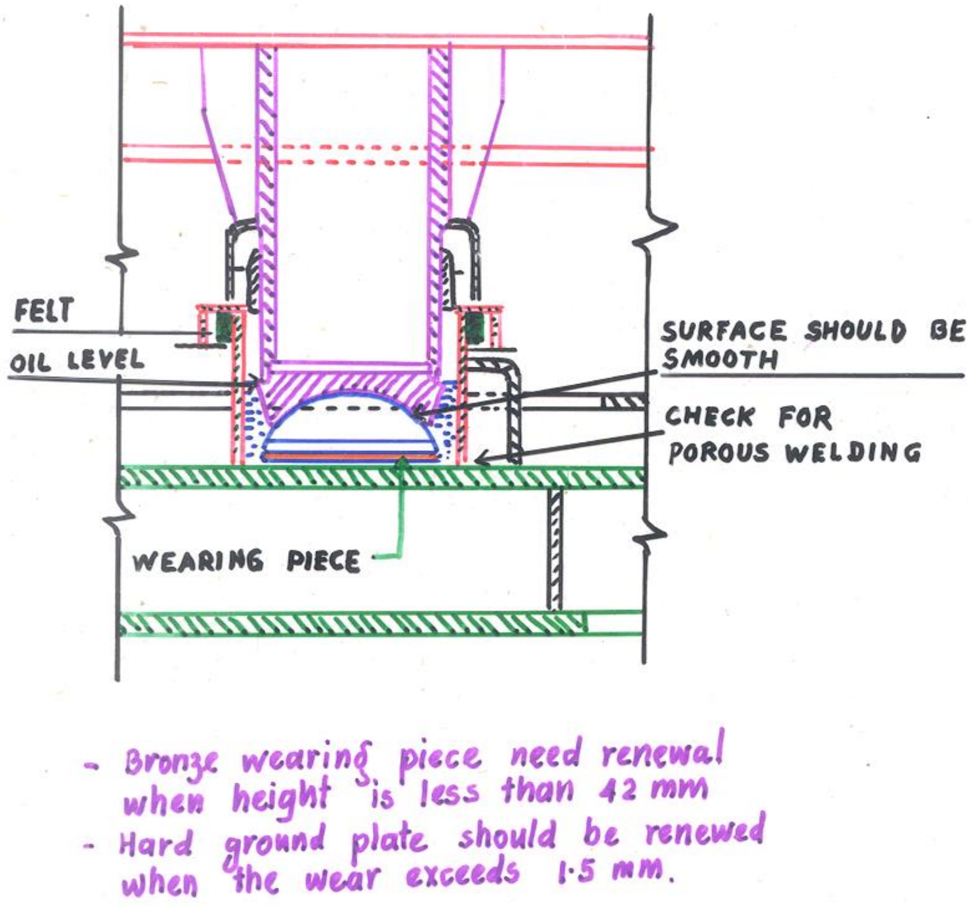
New size	Shop renewal size	Condemning size
10 mm	9 mm	8.5 mm

Wear limit for wearing piece

New size	Shop renewal size	Condemning size
45 mm	43.5 mm	42 mm

Side Bearers





Side Bearer

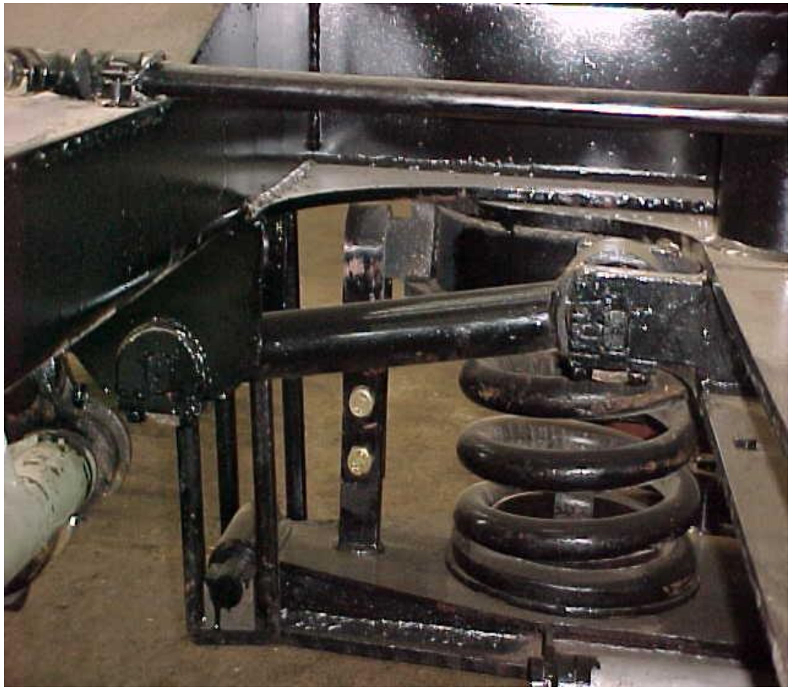
Quantity of oil in Side bearer oil-bath (Each):

2 litres

Approved brands of oils.

- Servoline – 100 of IOC
- Yantrol – 100 of HPC
- Bharat univol – 100 of BPC

Anchor Links



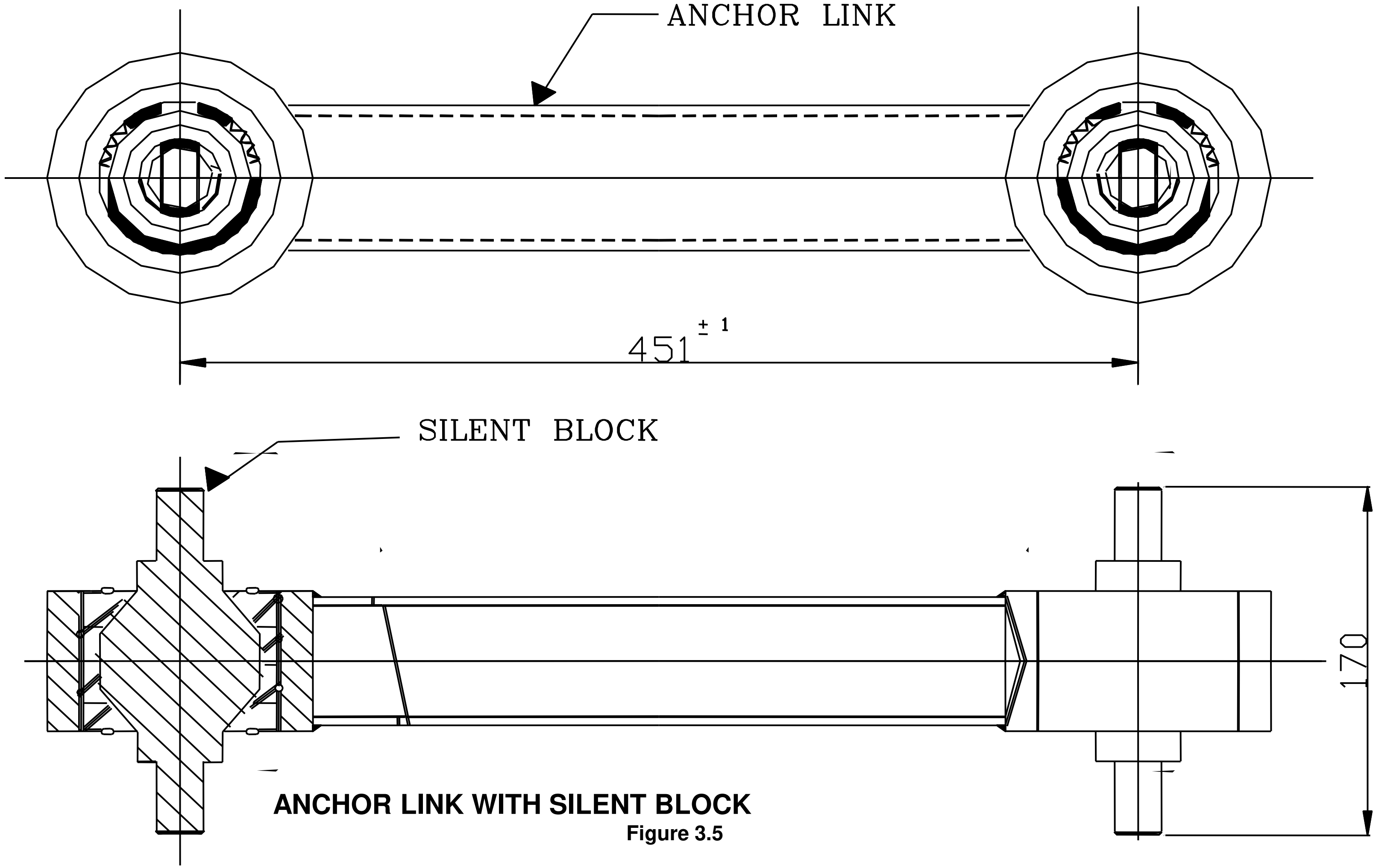
Anchor links

- Pin connection to the Bolster sides and the Bogie Transoms.
- Can swivel universally to permit the bolster to rise and fall and sway side wards.
- One anchor link is provided on each side of the bolster diagonally across.
- Fitted with silent block bushes

Anchor link

- To hold in position longitudinally the floating bogie bolster
- To design to take the tractive and braking forces.

Anchor link

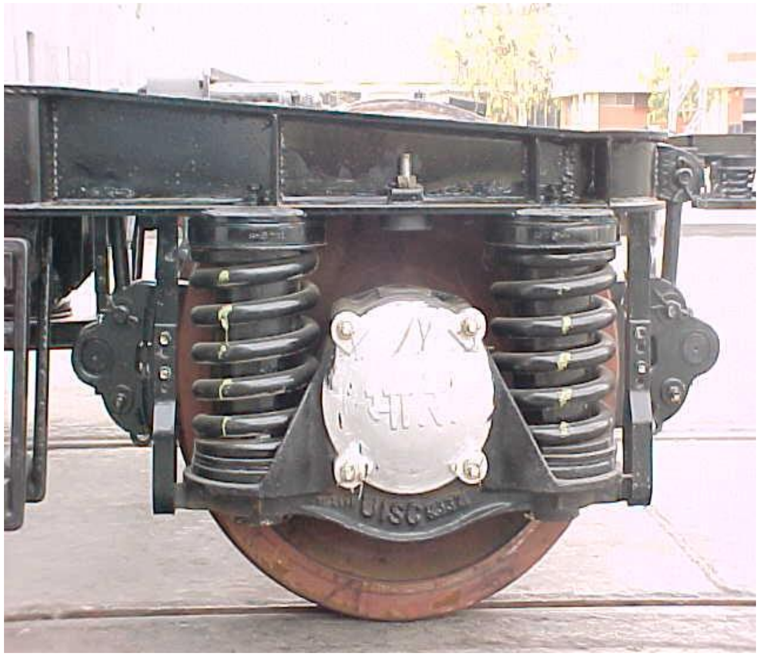


ANCHOR LINK WITH SILENT BLOCK

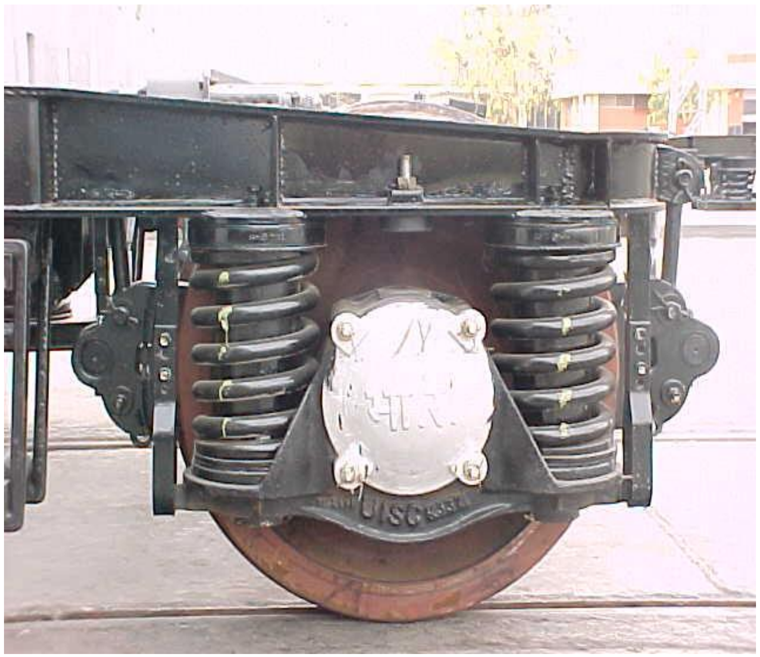
Figure 3.5

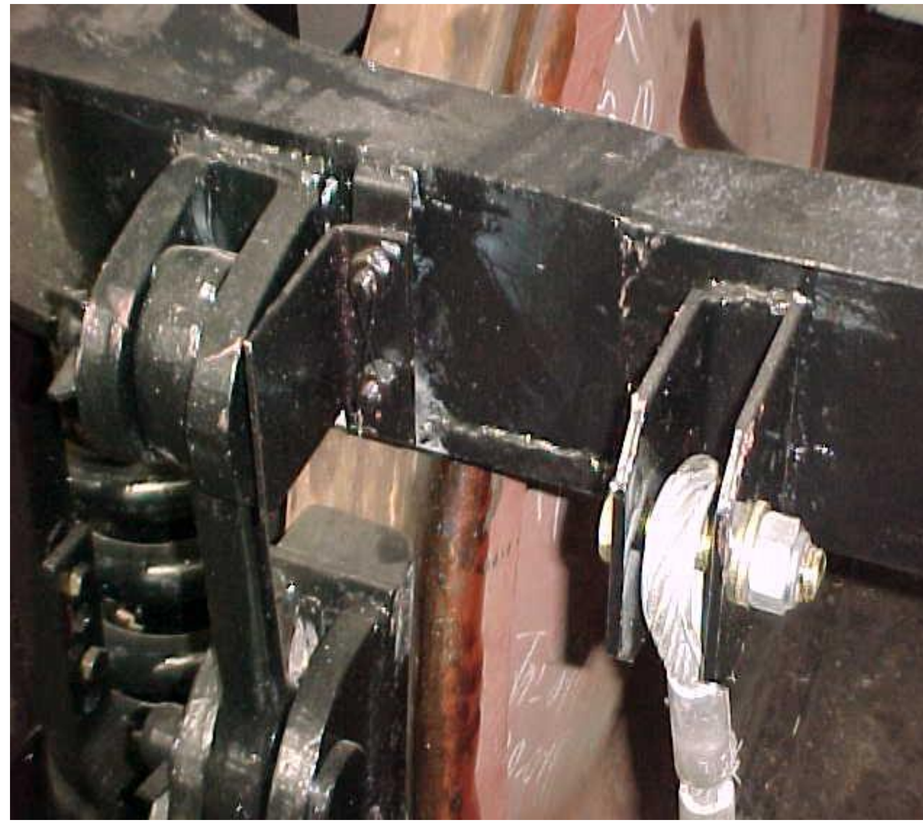
Hanger and Hanger Blocks

Axle Box safety Strap



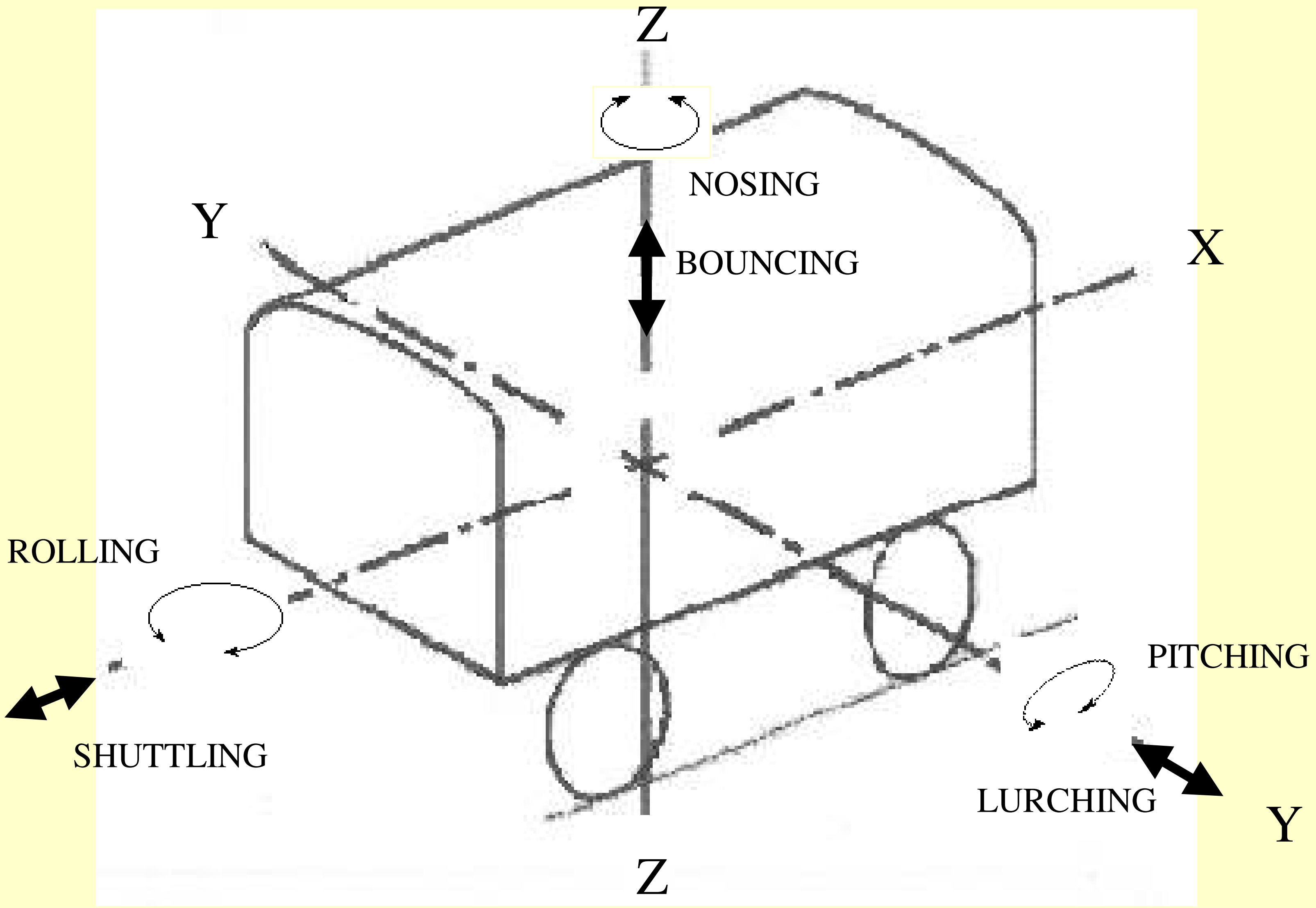
Hanger Pin Safety Stopper





Oscillation modes of vehicles

There are six modes of oscillations:



Limitations of ICF bogie Design

- **Longitudinal and transverse flexibilities of the axle guidance cannot be optimised independently as generally required for high-speed bogies.**

- **There are vertical space constraints to accommodate desirably softer secondary suspension springs and the consequent dynamic movements of the bogie bolster and coach body, as also to increase the length of the swing hangers.**

Limitations of ICF bogie Design

- Friction damping in the transverse suspension is neither amenable to optimisation nor the same can be controlled during service.
- Headstocks increase the yaw inertia of the bogie frame and thereby influence the tendency for hunting.
- A large wheelbase, as that of ICF bogie, affects curvability and there by increases wheel flange wear.

Failure

Any part or assembly is considered to have failed when any of three conditions takes place-

- ⏭ **When it becomes completely inoperable.**
- ⏭ **When it is still operable but no longer able to perform its intended functions satisfactorily.**
- ⏭ **When serious detoriation has been made it unreliable and unsafe for continued use.**

Fundamental source of failure

- Deficiencies in design
- Deficiencies in selection of material
- Imperfection of material
- Deficiencies in processing
- Errors in assembly
- Improper service condition
- Improper maintenance

Brake Shoe head

- In order to fit the brake block snugly in the brake head to avoid any movement between them.

- To avoid excessive wear at the ends of the brake head.

Brake shoe key

- In order to fit the brake block snugly in the brake head to avoid any movement between them.

Safety wire rope

- The old arrangement of safety straps is reported to be falling in service due to ballast hitting.
- To improve the safety of brake beam falling on the track safety wire rope introduced.

Brake block hanger

- To avoid brake block climbing over the wheel in case of fully worn out wheels.

Standardization of equalizing stay

- **The old equalizing stay had a pin dia of 25 mm. The longer pin is found to be bending in service resulting in removal difficulties.**

- **In the standardized equalizing stay the dia of pin has been increased to 31 mm.**

Pin for brake lever hanger

- To avoid slipping of nylon bush in the lever hanger a washer is welded.

- Castle nut with split pin introduced.

Improved brake beam

- The old brake beam does not cater to the load requirement of air braked coaches and it also bends under extra loads.

Single piece brake block hanger

- **Single piece design will avoid misalignment of brake block with respect to wheel tread.**

Revised side buffer casing

- To avoid cracks developing from the bolt holes in the U/frame headstock.
- Horizontal pitch for bolt holes has been increased from 254 mm to 349 mm.
- Vertical pitch for bolt holes has been increased from 127 mm to 170 mm.

Provision of locking arrangement for guide cap

- To avoid falling of guide cap due to breakage of spring clip.

Rubber stopper axle box crown bolt

- To prevent the breakage of axle box crown hexagonal bolt assembly in service.
- The hexagonal head bolt is prevented from hitting directly. Instead the rubber stopper will be hitting the crown.

Weld joint of bogie side frame with head stock

- The side frame head stock joint below guide in the old design was undesirable as the joint leads to misalignment of guides.

- Shifted to headstock beyond brake hanger brackets.

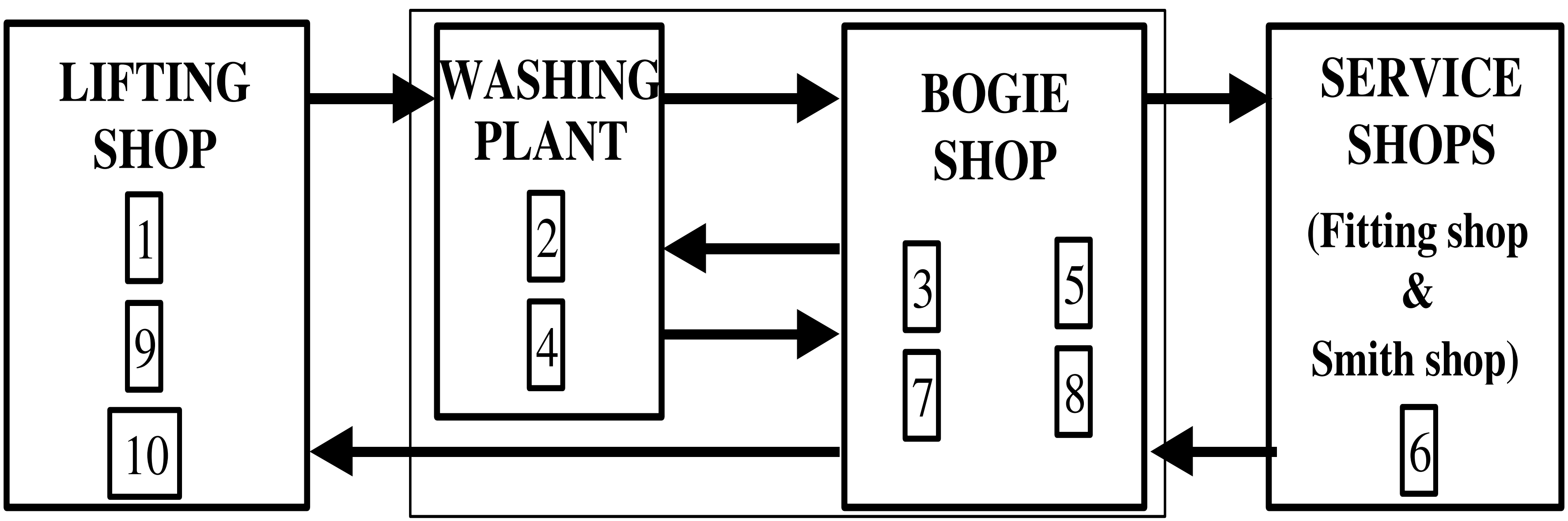
Slack adjuster articulation

- To provide freedom of rotation in horizontal plane an additional pin joint has been provided.
- Freedom of rotation in vertical plane is also ensured at the floating lever end.
- This arrangement is expected to minimize the incidence of slack adjuster spring breakages.

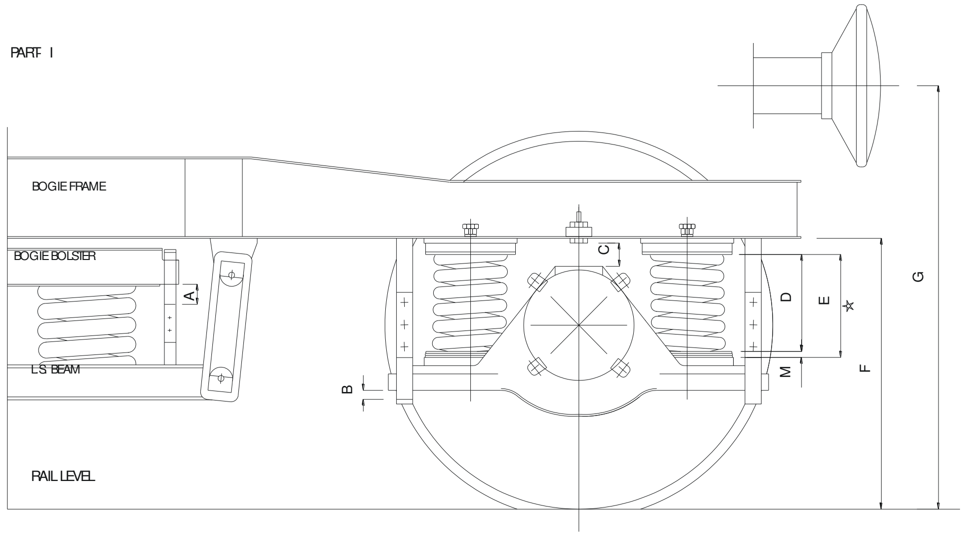
Workshop Activities

1. Coach lifting
2. Bogie cleaning
3. Bogie dismantling
4. Component cleaning
5. Attention to components
6. Repair of components
7. Bogie assembly
8. Load testing and adjustment
9. Lowering of coach
10. Final adjustment

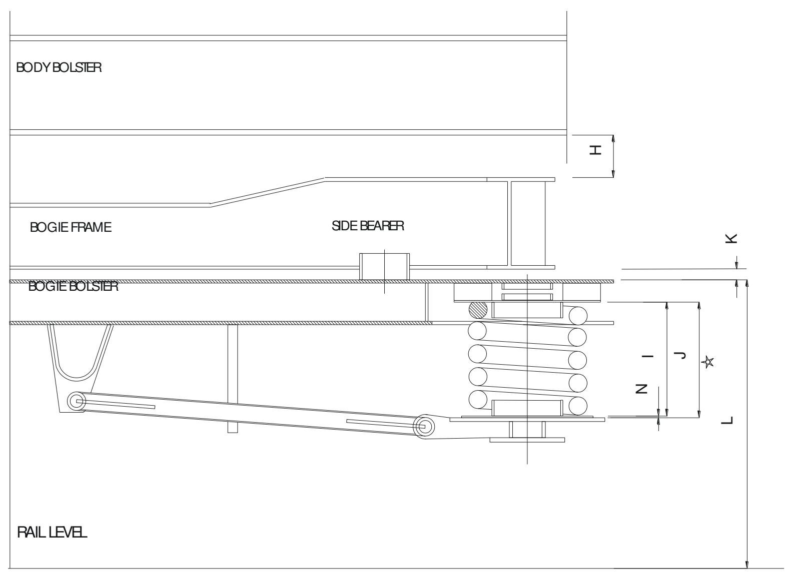
Workshop Maintenance of ICF Bogie- Flow diagram



PART- I



PART- II



NOTE - P1. Dimensions E & J shall be maintained with required number of compensating rings of standard thickness of 4 mm.P2. Axle box springs : WTAC -0-1-202P Bolster springs : WTAC -0-5-202

☆

2

2

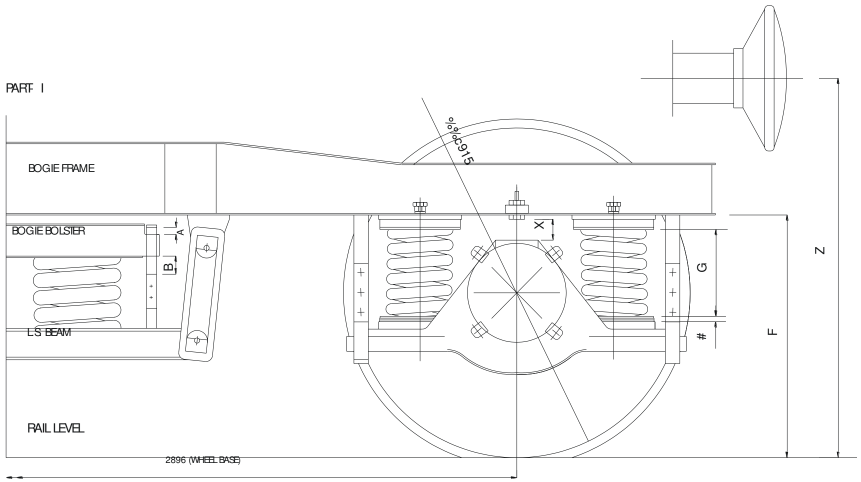
SUSPENSION DIAGRAMMATIC ARRANGEMENT

FOR SELF GENERATING AC COACHES (ICF DRAWING NO. ICF/SK -9-0-126)P

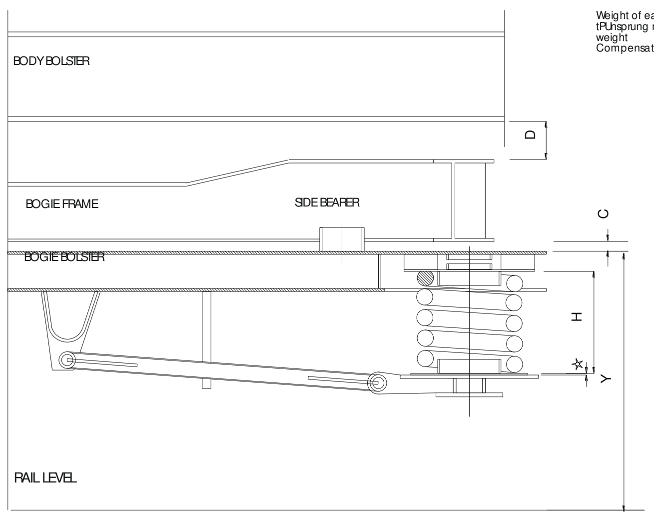
2

FIGURE 1.4a

PART- I



PART- II



Weight of each bogie = 5.9
tPUnsprung mass/bogie = 3.2 tPBolster
weight = 0.4 tPC.R =
Compensating ring

NOTE - P1. Dimensions A & B marked should be ensured less than dimensions C & D marked respectively.P2. # CR to drawing No.-CC01140 to be provided.P3. * CR to drawing No. - CC05251 to be provided.P4. 'F' the variation in all the four bogie corner heights must be less than or equal to 10 mm.P5. Drawing No. SG90002, SZ90004, SE90011, LB90002 are superseded by this drawing.P6. The height of Axle box spring and bolster spring in tare & gross conditions is for reference only.P7. The requirement of CR's as shown in the columns for primary & 30 mm in secondary suspension.P8. Only blue bend springs both in primary and secondary stage are to be used in postal van coach.

SUSPENSION DIAGRAMMATIC ARRANGEMENT

FOR NON AC COACHES (RCF DRAWING NO. CC90019)P

FIGURE 1.4c

Check List

Type of coach	Tare weight of coach	Normal pay load	Total pay load	Bogie frame bolster clearance		Body bogie clearance		Crown clearance	
AC	In tonnes	In tonnes	In tonnes	B dimension		C Dimension		A Dimension	
				Tare	Gross	Tare	Gross	Tare	Gross
ACCW (EOG)	44.8	3.68	3.68	40±5	50±5	70±3	60±3	28±3	20±3
ACCW (SG)	49.1	3.68	3.68	40±5	50±5	70±3	60±3	30±3	22±3
ACCN (EOG)	48.3	5.12	5.12	40±5	54±5	70±3	56±3	34±3	22±3
ACCN (SG)	52.53	5.12	5.12	40±5	53±5	70±3	57±3	35±3	23±3
ACCZ (EOG)	43.1	5.36	5.36	40±5	54±5	70±3	56±3	32±3	20±3

Check List

Type of coach	Tare weight of coach	Normal pay load	Total pay load	Test load per bogie		Bogie frame bolster clearance		Body bogie clearance		Crown clearance	
AC	In tonnes	In tonnes	In tonnes	Under tare	Under Gross	B dimension		C Dimension		A Dimension	
				In tonnes	In tonnes	Tare	Gross	Tare	Gross	Tare	Gross
ACCZ (SG)	46.83	5.84	5.84	17.22	20.14	40±5	56±5	70±3	54±3	35±3	22±3
FACZ (EOG)	42.6	3.68	3.68	15.10	16.94	40±5	50±5	70±3	60±3	27±3	19±3
RA (NON AC)	41.3	1.20	1.20	14.45	14.05	40±5	44±5	70±3	66±3	20±3	17±3
VP (HIGH CAPACITY)	32	23	23	9.8	21.3	40±5	81±5	70±3	29±3	36±3	11±3
IRQ ACCN (SG)	41.3	5.12	5.12	19.45	22.01	40±5	54±5	70±3	56±3	35±3	23±3
RA AC	46.69	1.20	1.20	17.14	17.14	40±5	43±5	70±3	67±3	22±3	19±3

Check List

Type of coach	Tare weight of coach	Normal pay load	Over load	Total pay load	Test load per bogie		Bogie frame bolster clearance		Body bogie clearance		Crown clearance	
AC	In tonnes	In tonnes	In tonnes	In tonnes	Under tare	Under Gross	B dimension		C Dimension		A Dimension	
					In tonnes	In tonnes	Tare	Gross	Tare	Gross	Tare	Gross
GS	36.99	5.85	100%	11.70	12.6	18.45	40±5	74±3	70±3	36±3	47±3	20±3
SOC	37.00	7.02	100%	14.04	12.6	19.62	40±5	81±5	70±3	29±3	50±3	18±3
SCN	38.03	5.76	-	5.76	13.12	16.00	40±5	57±5	70±3	53±3	31±3	17±3

Check List

Type of coach	Tare weight of coach	Normal pay load	Over load	Total pay load	Test load per bogie		Bogie frame bolster clearance		Body bogie clearance		Crown clearance	
AC	In tonnes	In tonnes	In tonnes	In tonnes	Under tare	Under Gross	B dimension		C Dimension		A Dimension	
					In tonnes	In tonnes	Tare	Gross	Tare	Gross	Tare	Gross
SLR	37.10	10.60	2.6	13.20	12.65	19.25	40 ±5	79±5	70±3	31±3	50±3	20±3
VP	32.00	18.00	-	18.00	10.30	19.30	40 ±5	77±5	70±3	33±3	39±3	11±3
IRQ SCN	37.2	5.76	-	5.76	12.7	15.58	40 ±5	57±5	70±3	53±3	30±3	17±3
Postal Van	36.5	3.0	-	3.0	12.35	13.85	40 ±5	49±5	70±3	61±3	22±3	15±3

Cause – Buffer height low

- Wear on wheel tread .
- Wear on wearing piece and wearing plate of the side bearers .
- Wear on hanger , hanger block and pin of the secondary suspension .
- Loss in free heights of primary and secondary coil springs .
- Load deflection characteristics of the primary and secondary springs not being within the prescribed limit .

AXLE

Rajendra

Instructor C&W/MSTC GKP

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 (**See figure 10.3** for Axle)

The axles are forged from the pre-cast steel blooms of desired specification and length, machined to accuracy after checking for both internal and external flaw detection systems. Blooms are checked for chemical composition and micro/macro properties before they are taken up for forging.

Axles are manufactured to various sizes and specification. Blooms to the desired specification are procured from leading integrated steel plants in sizes specified to obtain the desired reduction ratios. The blooms are thoroughly inspected for their chemical composition and micro/macro properties before they are taken up for forging.

Billets are cut to required unit lengths and heated in a rotary hearth furnace to forging temperatures. The heated billets are then transferred to a CNC controlled precision Long Forging Machine procured from M/s. GFM, Austria. The advantage of the precision forging process is minimised machining allowance, leading to reduced wastage. The fish tail ends of the forged axles are gas cut and the axles hot stamped with a unique number. The forged axles are

then normalised in a walking beam furnace, followed by air-cooling and tempering. For axles meant for traction applications, where higher tensile strength and hardness is required, the axles are quenched after normalising using polymer quenchant.

Samples are drawn from each batch and checked for physical and metallurgical properties tested before being taken up for machining.

The machining line is again a completely automated system with integrated engineering for material transfer from one station to another. The various machining stages include end milling, cup turning and cantering; rough, semi-finish and finish turning, burnishing of wheel drilling and tapping of axle end holes, grinding of axle journal and dust guards. During the course of machining cycle, all axles are ultrasonically checked for internal flaws and Magnetic Particle Testing is done to detect any surface flaws. RWF is procuring a radial scanning equipment to undertake radial probing of the axles required as per UIC standards.

Stage Inspection of Axles

- Chemical Composition and visual/ultrasonic tests on blooms before forging
- Macro and micro properties of forged axles
- 100% ultrasonic including radial scanning and magnetic particle testing
- Measurement of pitch circle diameter, journal diameters, tapped holes and ovality
- Measuring the surface finish.

Axles

A) Loco Application:

Gauge	Description
BG	WDM-2C
	WDM-2
	WAG-7
	WDP-2
	TAO-659
	WDP-1 & WDG-2
	WDG2 & WDG3
	WAP-1, WAP-4
	WAG-9
	WAP-5
	WDP-4
	WDG-4
	X Class
MG	VDM-4

B) Freight Application:

Gauge	Description
BG	BOX N - 22.9T
	25T axle suitable for k class CTRB
	25T axle load axle

C) Passenger Applications:

Gauge	Description
BG	BG EMU axle (MC)
	BG EMU axle (MC) MEMU
	BG EMU TC axle
	EMU axle for Milk Tank Wagon
	16T BG Coaching
	LHB axle
	Kolkata Metro axle (TC)
	Kolkata Metro axle (MC)

Wheelsets

A) Freight Application:

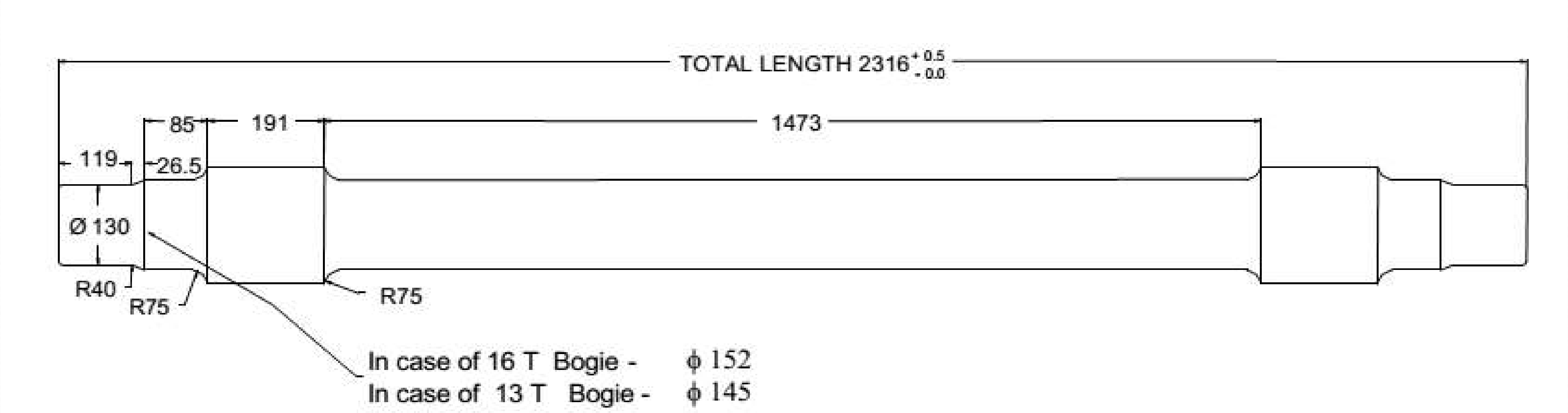
Gauge	Description
BG	Box_N
	840 mm dia container flat wagon wheelset
	840 mm dia for 25T axle load wheelsets

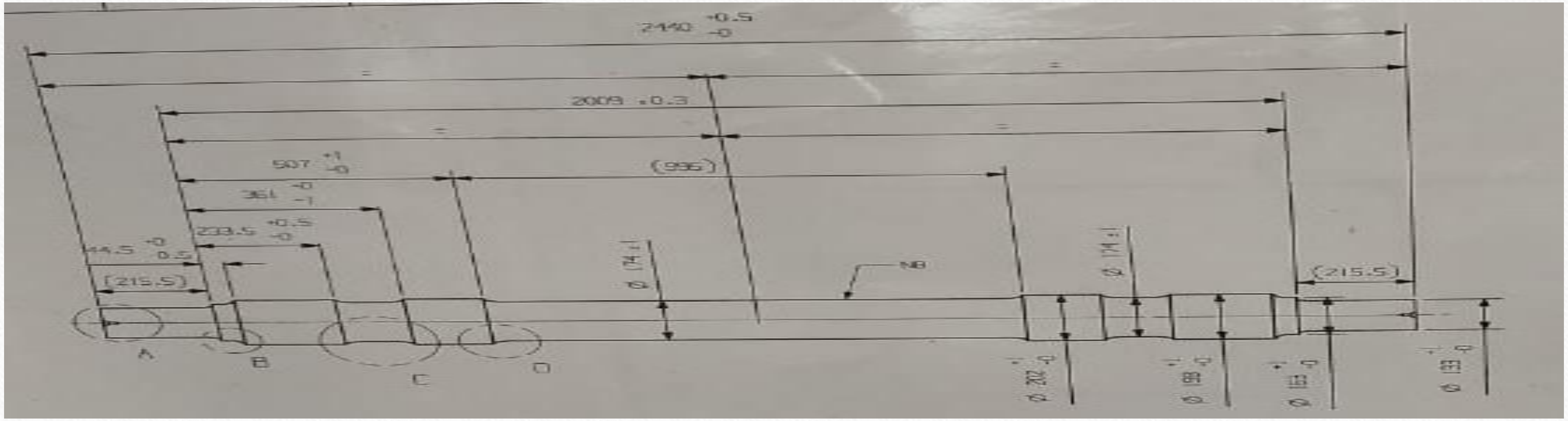
B) Passenger Applications:

Gauge	Description
BG	BG Coaching
	958 mm dia EMU wheelset for Milk Tank Wagon

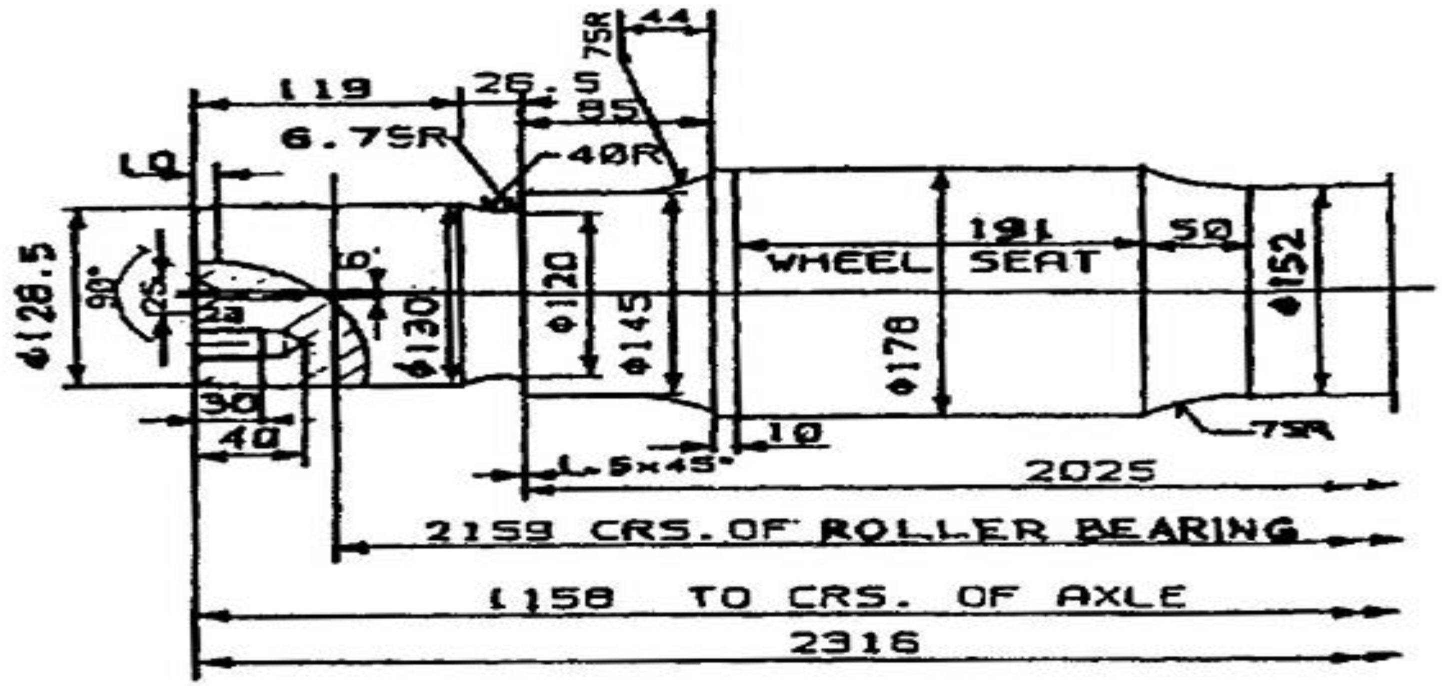
Axle Specifications

Specification	Application	C	Mn	Si	P	S	Hydrogen in Liquid Steel	Ultimate Tensile Strength N/mm2	Yield Strength N/mm2 Min	Elongation Min	Impact U-notch J Min	Grain Size
IRS R-16-95	Passenger & Freight Car Axles	0.37 max	1.12 max	0.15 - 0.46	0.04 max	0.04 max	< 3 ppm	550 - 650	320	22%	25	5 - 8
IRS R-43-92	Traction Axles	0.40 - 0.55	0.60 - 0.90	0.15 min	0.045 max	0.045 max	< 2 ppm	570 - 685	Not less than 50% of UTS	17 - 21%	25	6 - 8


TOTAL LENGTH 2316 +0.5 -0.0
85
191
1473
119
26.5
Ø 130
R40
R75
R75
In case of 16 T Bogie - ϕ 152
In case of 13 T Bogie - ϕ 145


2440 +0.5 -0
(996)
(215.5)
(215.5)
A
B
C
D

16.25 t Axle for ICF coach



ICF DRG. NO. WTAC$_3$-0-2-301

Press fit of wheel on axles

- Wheel disc is pressed to axle with interference fit (the bore of the wheel should be 0.304 mm to 0.355 mm less than the outer dia of the wheel seat on the Axle)
- Wheel Gauge should be in between 1599 and 1602 mm
- Axial off centre should be within 1.0 mm (wagon) & 0.8 mm (coach)
- Radial off centre should be within 0.5 mm (wagon) & 0.25 mm (coach)
- The Journals should be protected with bituminous black to IS:9862
- All Axles fitted by workshop during POH or despatched to depot should be Ultrasonically tested

Press fit of wheel on axles

Hydraulic press is used for assembly of the wheel with a force of 400 to 500 Kgs per mm dia of wheel seat (approximate force used for different wheels are given below)

Description	Tonnage
13 tonne axle	68.8 to 103.2 t
16.25 tonne axle	71.2 to 106.8 t
BOXN & BLC	85 to 127 t

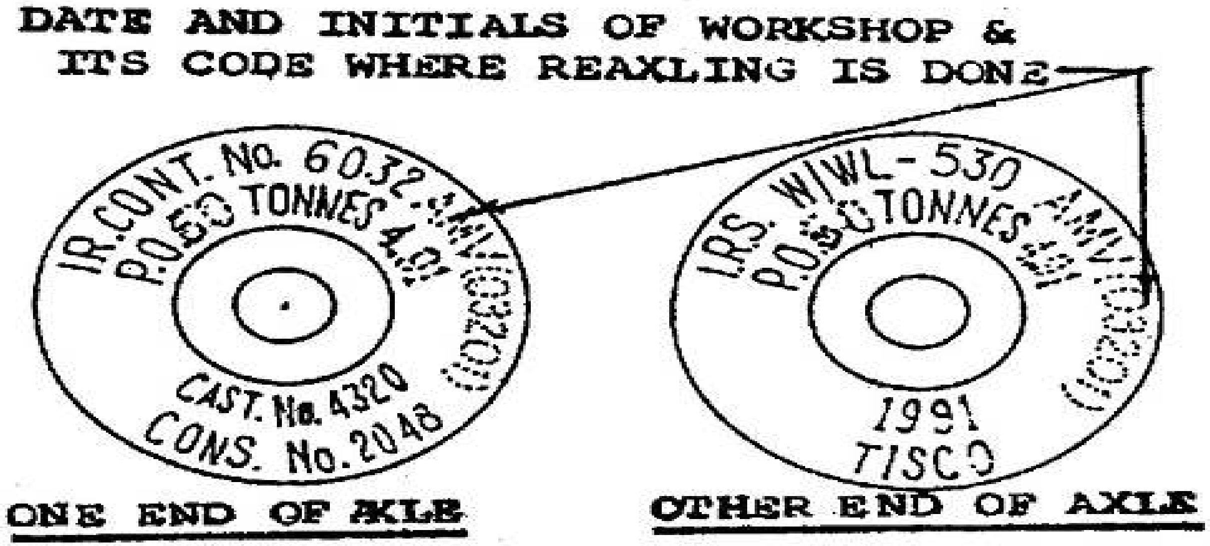
Stamping of particulars

Whenever axles are renewed the workshop shall punch in 5 mm letters the following particulars on the journal face

- **Place of pressing**
- **Date of pressing**
- **Pressure of pressing**

Whenever UT is done the details shall be stamped cold on the inner hub fillet with 6 mm punch not more than 1.5 mm depth

Stamping of particulars



NOTE:
ALL STAMPING TO BE DONE WITHIN 63 DIA.
ON BOTH JOURNAL FACES.

DEFECT OBSERVED ON THE AXLES AND THEIR ORIGIN

The defects arising on the axle are therefore primarily due to short comings during manufacture and also during manufacture and also due to a variety of service conditions to which they are subjected.

The sources of various defects are –

a) steelmaking and shaping operation

b) machining operation

c) heat-treatment operation

d) assembly operation

e) Repair Practice

f) maintenance practice and g) corrosion.

Loose Axle

- While assembling wheel with axle proper interference should be maintained between wheel and axle. Due to improper selection of interference the wheel may shift outwards or it may come out completely. Loose axle is a rejectable defect.
- Axles involved in Accidents should be magnaflux tested in addition to Ultrasonic test.
- Axle having notch should be withdrawn from service

ULTRASONIC TESTING OF AXLES

All incoming wheel sets are tested for flaw detection test of axles in the shop before sending them to service. Following techniques are adopted to test the axles.

i. Far end scanning
ii. Trace delay
iii. Near end low angle scanning
iv. High angle scanning

HOT AXLE-

An axle, which has run hot, should be distinguished by stamping 5-mm size star on the face of the affected journal as shown in Plate 25; wheel sets with such axles must not be used in passenger carrying vehicles. If journal or end of axle has any discolouration due to over heating or if circumferential cracks determined by magnetic crack detection are found in the journal, the axle may be scrapped and mutilated to prevent re-use.

Note: - Wheels with discoloured journals due to overheating should be sent to workshops for checking cracks in the journal.


WHEEL & AXLE COMPLETE
AXLE FINISH MACHINED
SEMI FINISHED AXLE
5S
Modern Coach Factory
FINISHED AXLE
Modern Coach Factory
SEMI FINISHED AXLE
(PL NO-33509037)
(QPC-04)
(DRAWING NO-LW02149 ALT-C)

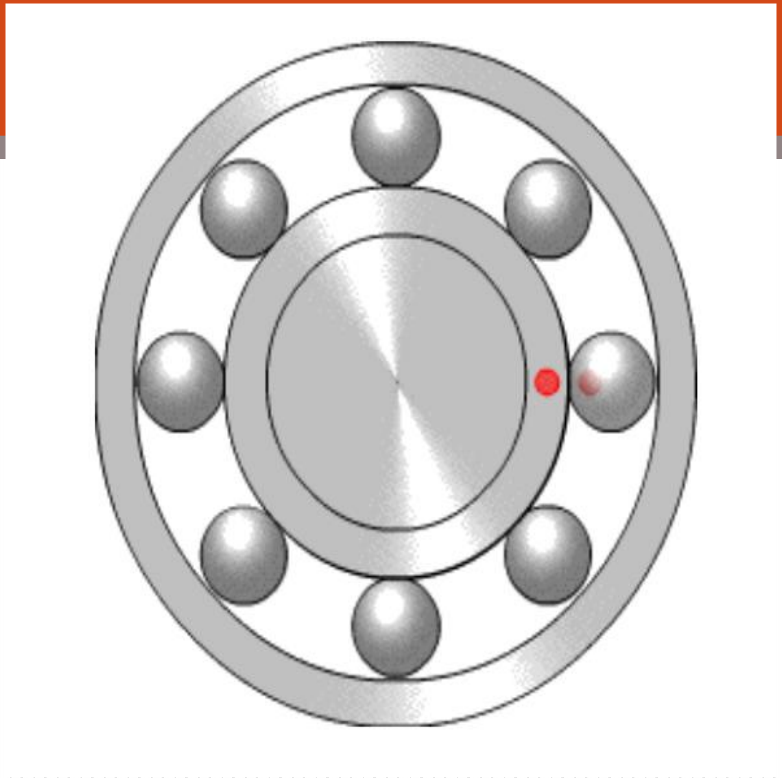
Material of Wheel

The chemical composition of the steel for Cast Wheel	
C	0.47% to 0.57% for type A used for carriage stock 0.57% to 0.67% for type B used for wagon stock
Mn	0.60 to 0.80%
P	0.03% max
S	0.03% max
Cr	0.15% max
Ni	0.25% max
Mo	0.06% max
Combined % for Cr, Ni & Mo must be 0.40% max	

The procedure to calculate chemical composition will be in accordance to IS:228

THANK YOU

Roller Bearing



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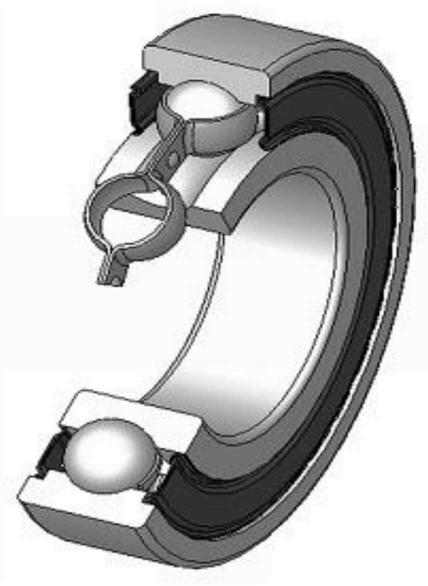
Introduction

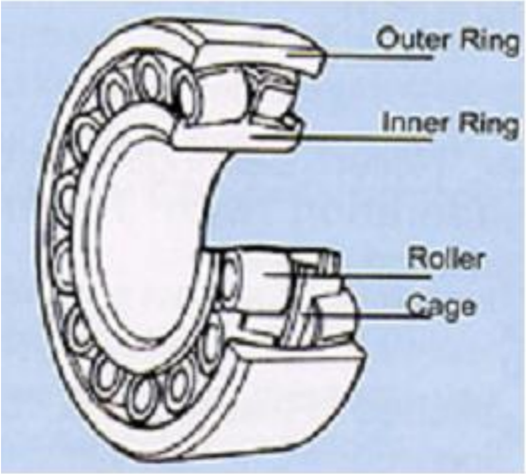
- A bearing is a device to permit constrained relative motion between two parts, typically rotation or linear movement.
- Bearings may be classified broadly according to the motions they allow and according to their principle of operation

CLASSIFICATION OF BEARINGS

- BEARING
  - ANTIFRICTION BEARING
  - FRICTION BEARING

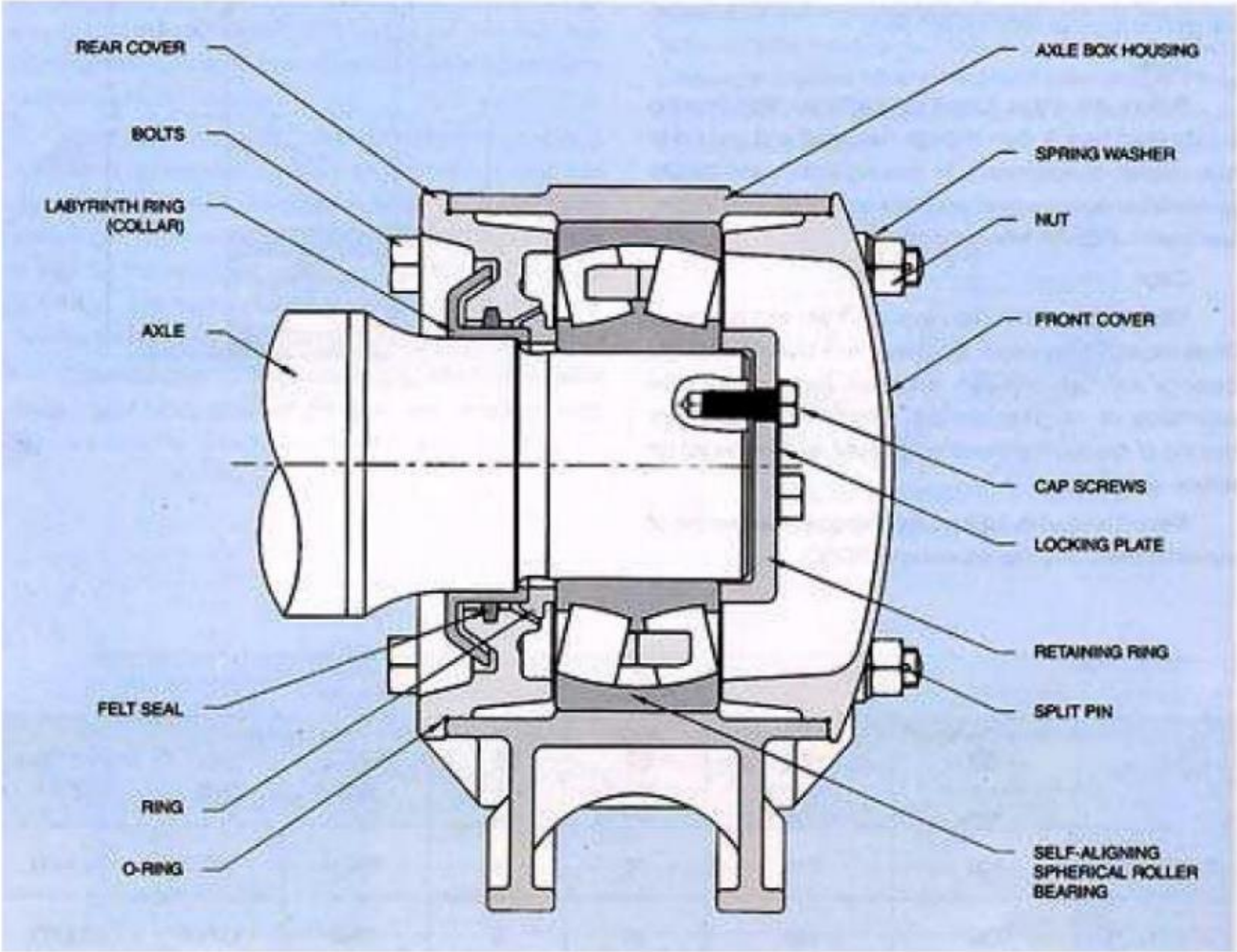


spherical roller bearing

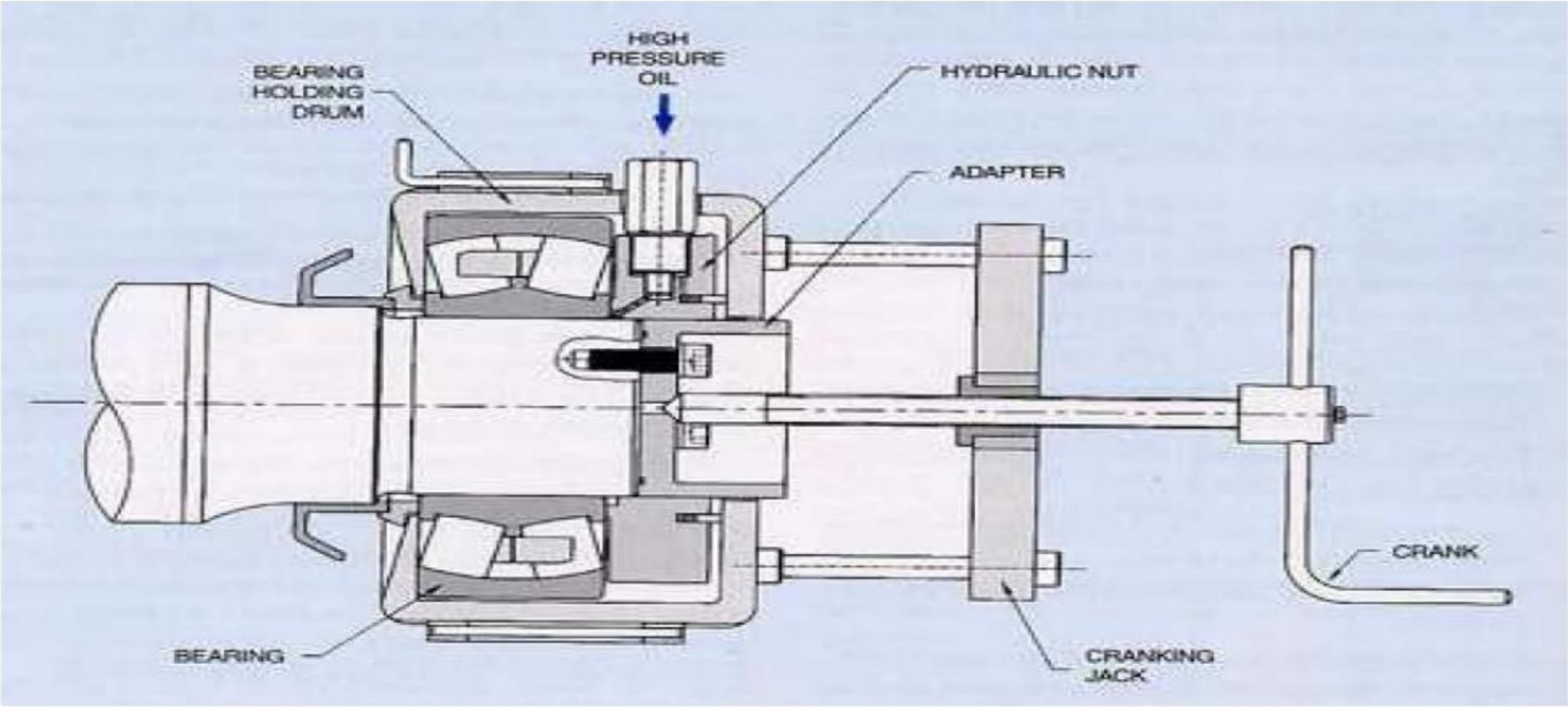


SPHERICAL ROLLER BEARING

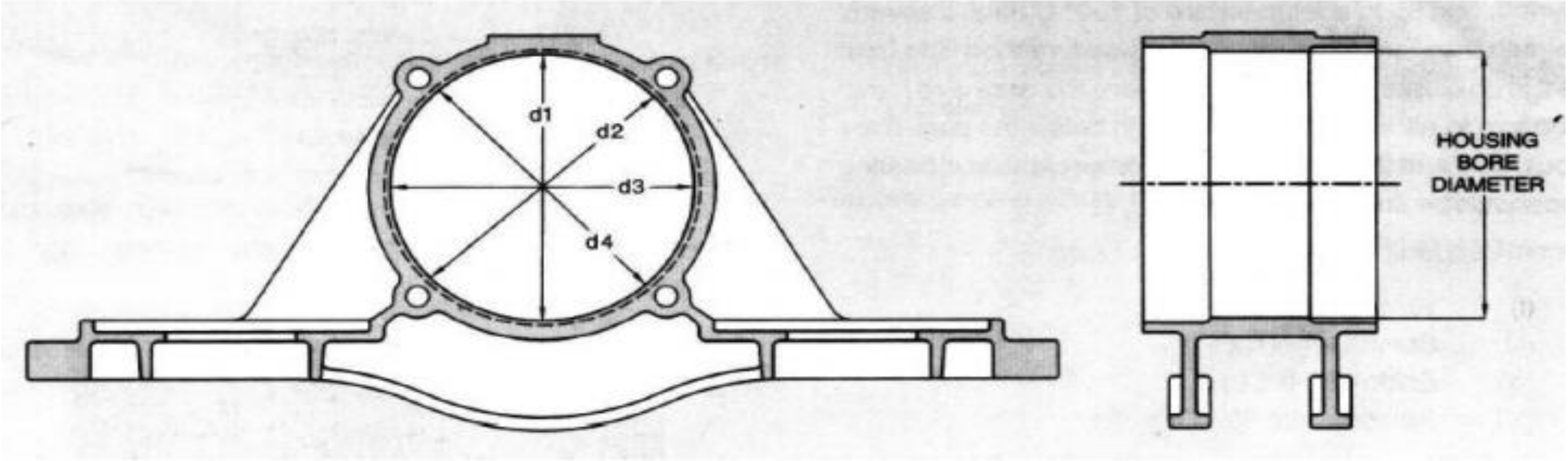
- Spherical roller bearings have a large capacity for radial loads, axle loads in either direction, and complex loads.
- They are suited for the applications such as railway rolling stocks where vibrations and shock loads are encountered.
- Roller Bearings are named according to the shape of rollers. Roller Bearings with spherical rollers are called as Spherical Roller Bearings
- Spherical Roller bearing no. **22326/C3 with 130 mm** parallel bore on the inner ring is being used on ICF type coaches.
- They are directly **shrunk fit on the axle journals**.


REAR COVER
BOLTS
LABYRINTH RING (COLLAR)
AXLE
FELT SEAL
RING
O-RING
AXLE BOX HOUSING
SPRING WASHER
NUT
FRONT COVER
CAP SCREWS
LOCKING PLATE
RETAINING RING
SPLIT PIN
SELF-ALIGNING SPHERICAL ROLLER BEARING

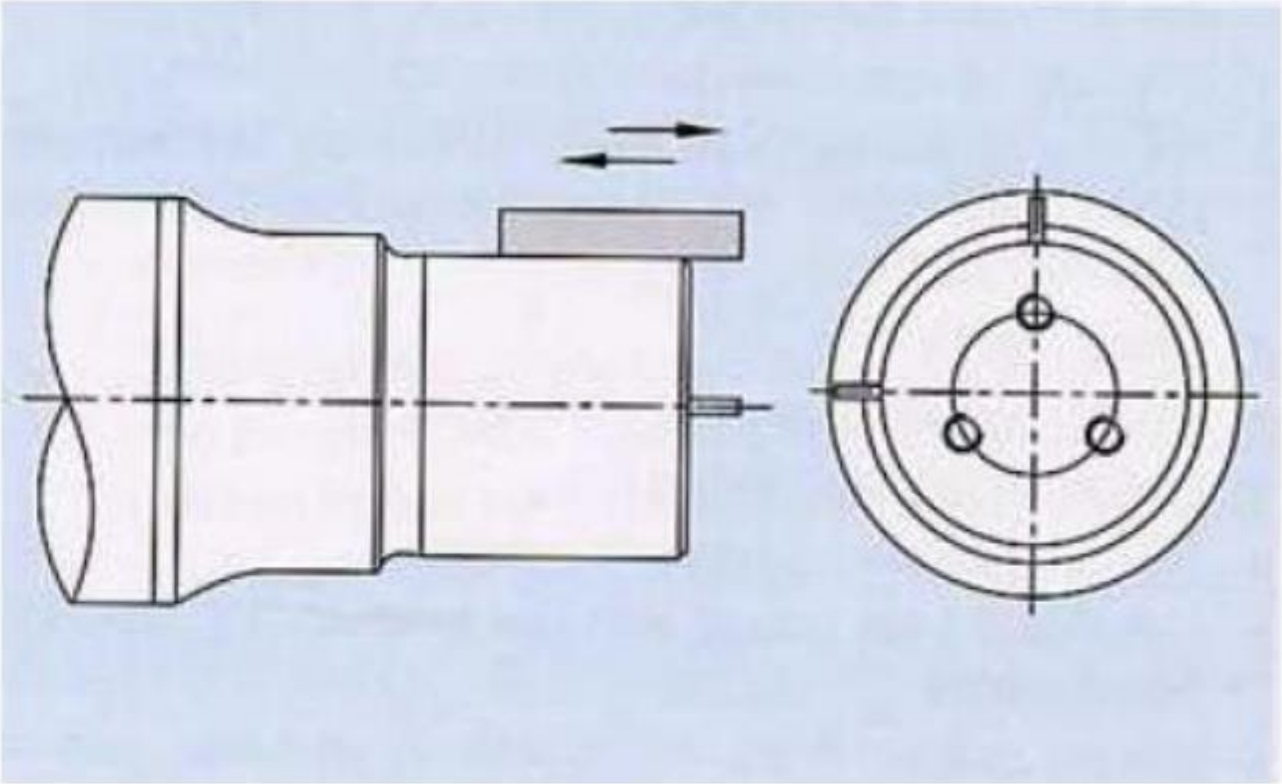
ICF self aligning Spherical Roller Bearings : Dismounting -



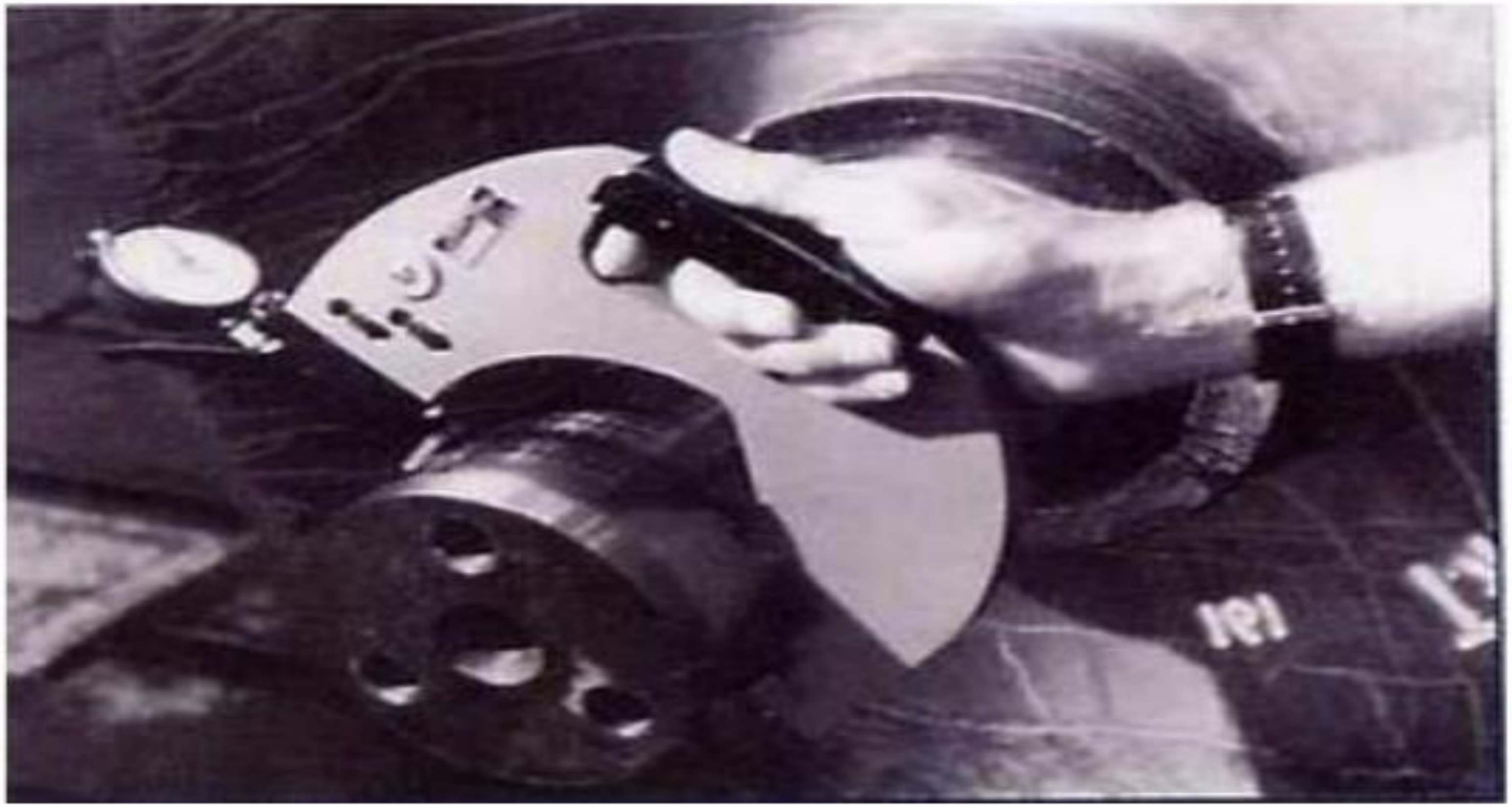
ICF self aligning Spherical Roller Bearings : Mounting housing image -



ICF self aligning Spherical Roller Bearings: Straight edge Journal checks-



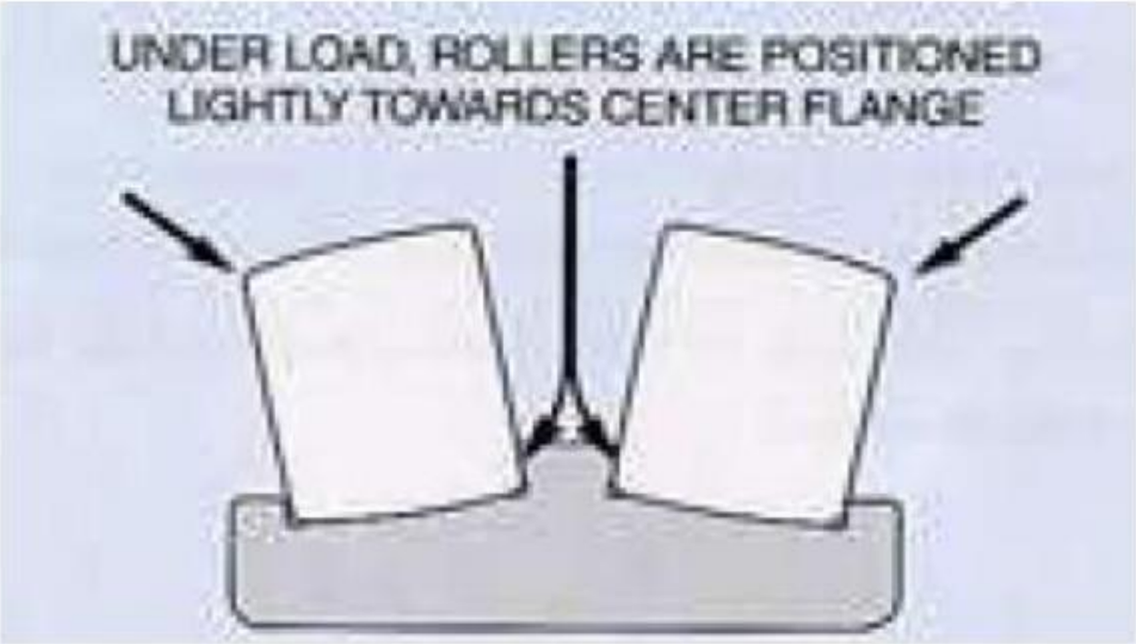
ICF self aligning Spherical Roller Bearings: Dial Snap Gauge Journal Diameter checks-



Journsl = Journal.

Journsl Diameter ØA(Max/Min)	Maximum permissible out of roundness (mm)	Maximum permissible taper (mm)
130.068 /130.043	0.015	0.015

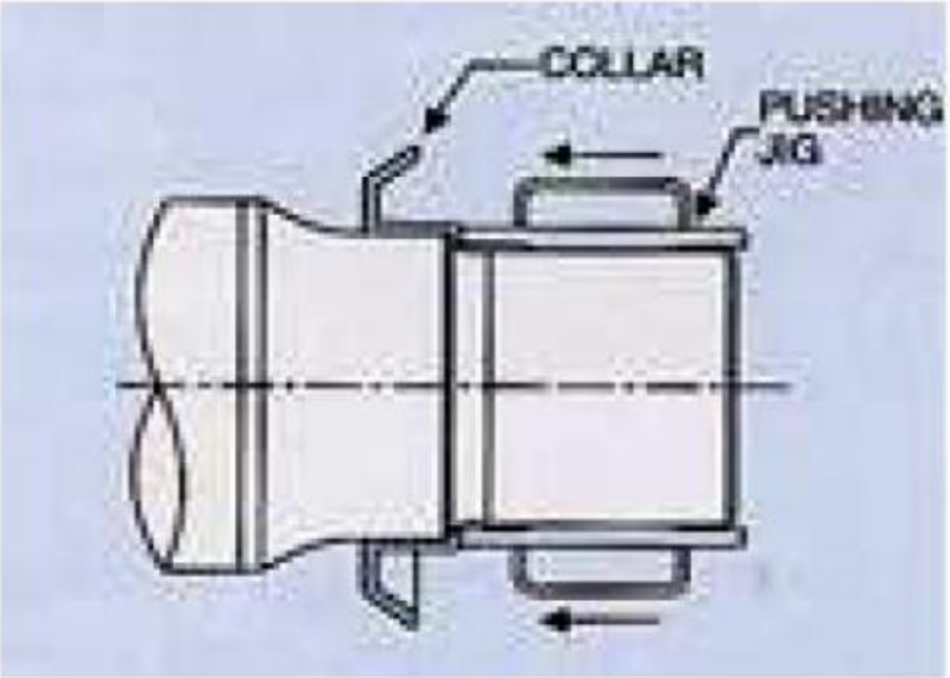
ICF Spherical Roller Bearings : Functions -



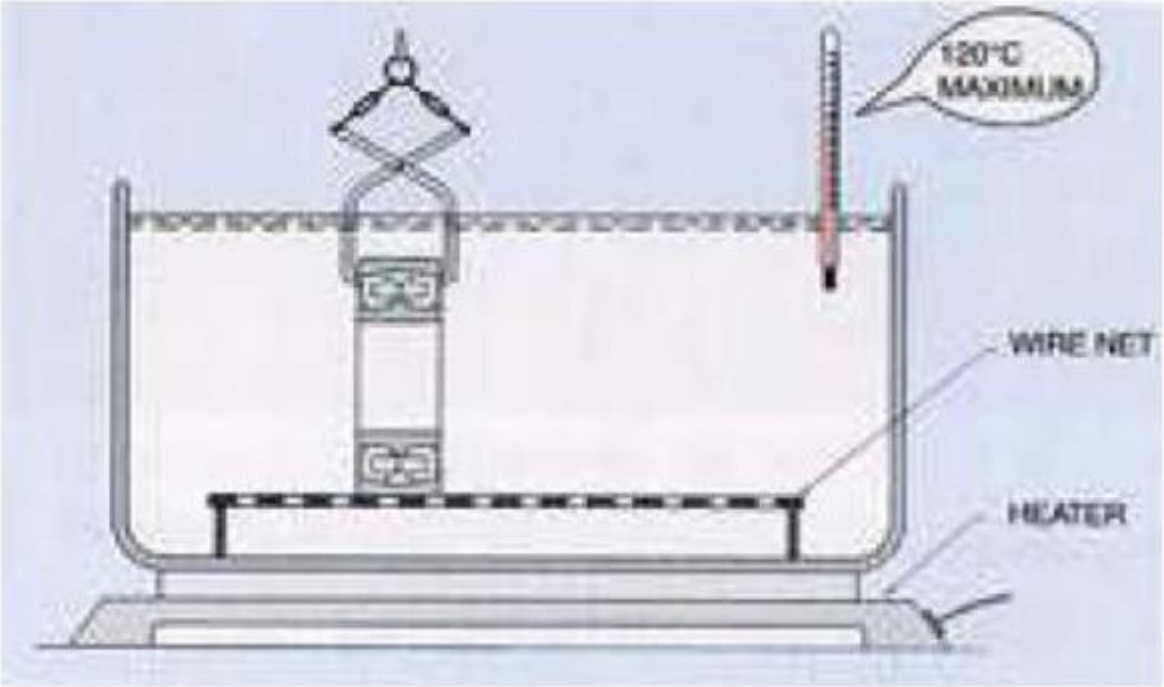
ICF Spherical Roller Bearings : Inspections -

ICF Spherical Roller Bearings : Clearances -

ICF Spherical Roller Bearings : Mounting -



ICF Spherical Roller Bearing : Oil bath Heating during mounting -



ICF Spherical Roller Bearing : Induction heating during bearing mounting -

ICF Spherical Roller Bearing : Radial clearance checks on mounting -

ICF Spherical Roller Bearings : Radial Clearances in mounted bearings -

Bearing make	Radial clearance in mounted condition (in mm)	
	New Bearings	In service bearings
FAG/NORMA	0.080-0.160	0.220 max.
NEI/NBC	0.080-0.160	0.245 max.

ICF Spherical Roller Bearing : Incorrect mounting failures – Effects & Reasons.

Damage during mounting	Possible Cause
Score marks on rings	Bearing inner ring not properly aligned with axle during mounting. Forcible entry on axle box during mounting.
Surface cracks	Rapid or excessive heating of bearing (temperature more than 120 ^{O}C)
Discolorated surface	Excessive heating temperature (more than 120^{O}C)
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	Oversize housing bore
Grease oozing from rear cover	Used or poor quality of felt seal

ICF Spherical Roller Bearings : Peak Operating temperature – 80 deg. Cel. {Li based grease filled/Axlebox = 1.75 Kg}

HOT AXLES

IN CORRECT FIT

IMPROPER MOUNTING

IMPROPER HANDLING

POOR LUBRICATION

CONTAMINATION

EXCESSIVE HEATING

EXCESSIVE LOAD

Hot Axles : Reasons & Effects -

Defect	Effect on Bearing
Felt ring perished	1. Grease may ooze out from rear cover 2. Dust and water may enter the axle box
Rubber 'O' rings of cover perished	Dust and water may enter the axle box

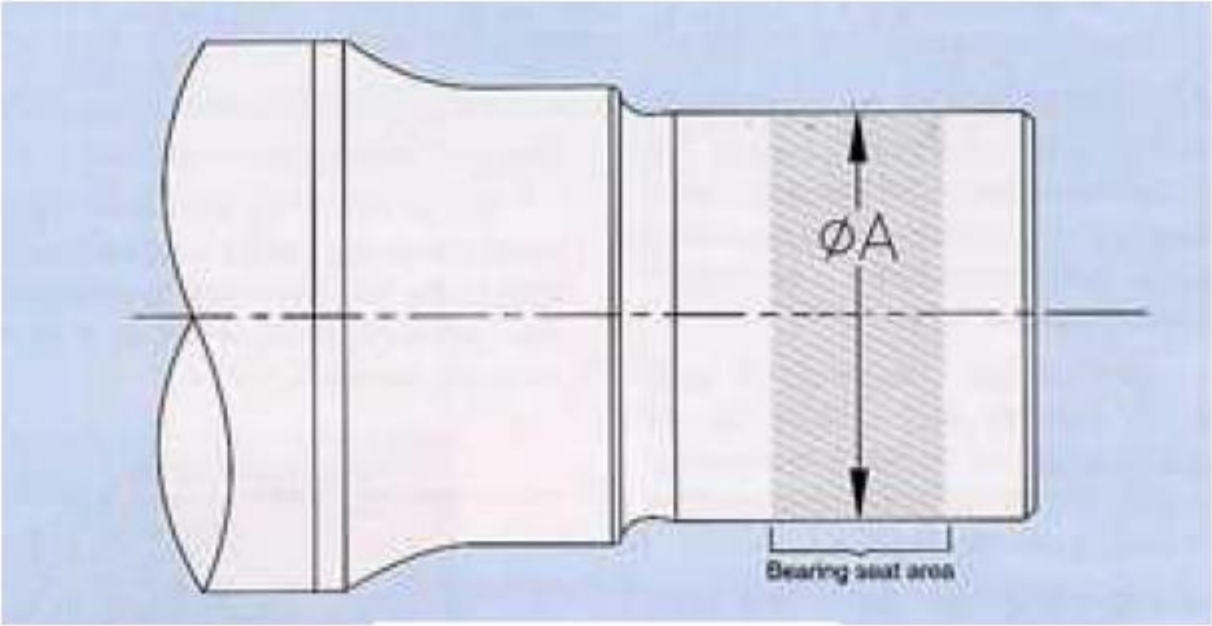
ICF Spherical Roller Bearings : Hot Axles Continued -

'V' grooves on rear cover, front cover and axle box faces not filled with grease.	Dust and water may enter the axle box.
Improper and/or excessive / inadequate grease.	Excessive temperature, seizing or complete failure of Roller Bearing.
Bearing clearance not within prescribed limits.	Excessive wear of rollers and races leading to bearing failure.

ICF Spherical Roller Bearings : Hot Axles Continued -

End locking screws not tightened properly.	End locking arrangement may fail.
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.
Excessive or inadequate lateral clearance between axle box covers and bearings.	1. Excessive clearance may damage roller bearings or covers. 2. Inadequate clearance may result in gap between axle box housing and bearings.

ICF self aligning Spherical Roller Bearings: Journal Diameter-



ICF Spherical Roller Bearings : Hot Axles Concluded -

Fitment of substandard/ improper size end locking bolts/ screws.	Bolt may fail in service cause damage to front cover and bearings
Improper locking of end locking screws.	Screw may get loose in service and cause damage to front cover and bearings
End locking screws not tightened properly.	End locking arrangement may fail.

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 rings 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.

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.

GENERAL INSTRUCTIONS AND PRECAUTIONS

1. **Do no drop the bearing.**
2. **Bearing should not be unpacked until it is ready for mounting.**
3. **All plastic wedges inserted between rollers to protect from any damage during transportation, must be removed prior to fitment on axle journal.**
4. **Spherical Roller bearings are designed, manufactured and assembled to provide a specific amount of radial clearance. Therefore, components of any spherical roller bearings should never be interchanged with other bearing. This can lead to poor performance or failure of the bearing.**
5. **Mounting, dismounting, inspection and maintenance work of bearings must be done by trained/ qualified persons as per laid down procedures/ specifications.**
6. **Use only recommended tools for mounting / dismounting and maintenance work.**

Contd…

7. Use only those parts, which are new or otherwise satisfactory to reach the next

reconditioning interval after service.

8. Bearing parts of different roller bearing units or different manufacturers must

never be mixed or interchanged.This can disturb the radial and axial clearances,

which can lead to poor performance of the bearing during service.

9. Never mix two different brands of grease or used grease with fresh grease.

10. Lubricate both new and used cap screws prior to installation.

Periodicity of Inspection of Roller Bearing

All roller bearings should be cleaned, inspected and re-lubricated with fresh grease during each attention to the wheel set /bearings in the workshop.

The roller bearings should be dismounted from the wheel set during every alternate attention in the workshops for thorough inspection of the components,

rear cover and renewal of the felt sealing ring. The wheel bearing should however necessarily be dismounted and overhauled in case of any warranted out of course of attention in the workshop.

Radial Clearance In Bearings

Bearing make	Radial clearance in un-mounted condition. (mm)		Radial clearance in mounted condition. (mm)	
	New Bearings	In service bearings	New Bearings	In service bearings
FAG/NORMA	0.145–0.190	0.270 max.	0.080-0.160	0.220 max.
NEI/NBC	0.145–0.190	0.295 max.	0.080-0.160	0.245 max.

Fig: 3.0 Checking Bearing radial clearance in mounted condition

Life of Spherical Roller Bearing

The codal life of spherical roller bearings type 22326 (16.25 t) used on BG main line coaches is fixed as 20 years.

Lubrication

- **The quantity of grease filled per axle box**

  FAG/NBC/other make bearings **1.75 kg**

- Only lithium base grease of approved brands should be used

Brand Name Of Grease	**Supplier**
Servogem RR3	Indian Oil Corporations
LL3 (Balmerol multigrease)	M/s Bamer Lawre & Co. Ltd. Corporation Limited
Bharat RR Grease-3	M/s Bharat Petroleum Corp. Ltd.

Bearing should be rejected for the following defects

- Pitted or flaked roller tracks and rollers.
- Cracked or deformed or badly worn out cage.
- Cracked inner or outer ring.
- Scored or damaged outer surface of the outer ring.
- Indentation on rings or rollers.
- Scoring of roller tracks or rollers.
- Rust/corrosion, damage or excessive fretting corrosion.
- Brinelling or false brinelling.
- Rings exhibiting deep straw or blue or purple colour indicating heat effect.
- Excessive or less radial clearance.

Rust and corrosion

Surface becomes partially or fully rusted. Sometimes rusted at spacing equal to distances between rolling element

Fretting

Fretting Surfaces wear producing red coloured particles that form hollows.

Flaking/ Spalling

Flakes form on the surfaces of the raceway and roller elements. When the flakes fall off, the surface becomes rough and uneven.

Seizure

Bearing heats up, becomes discolored and eventually seizes up.

Cracking

Splits and cracks in bearing rings and rollers

Cage damage

Breaking or wear of cage.

Smearing and scuffing

Surface becomes rough with small deposits. "Scuffing" generally refers to roughness of the bearing ring ribs and roller end faces.

Rolling Path Skewing

Roller contact path in raceway surface strays or skews.

Indentations

Hollows in raceway surface produced by solid foreign objects trapped or impacts (False brinelling)

Electric Current Damages

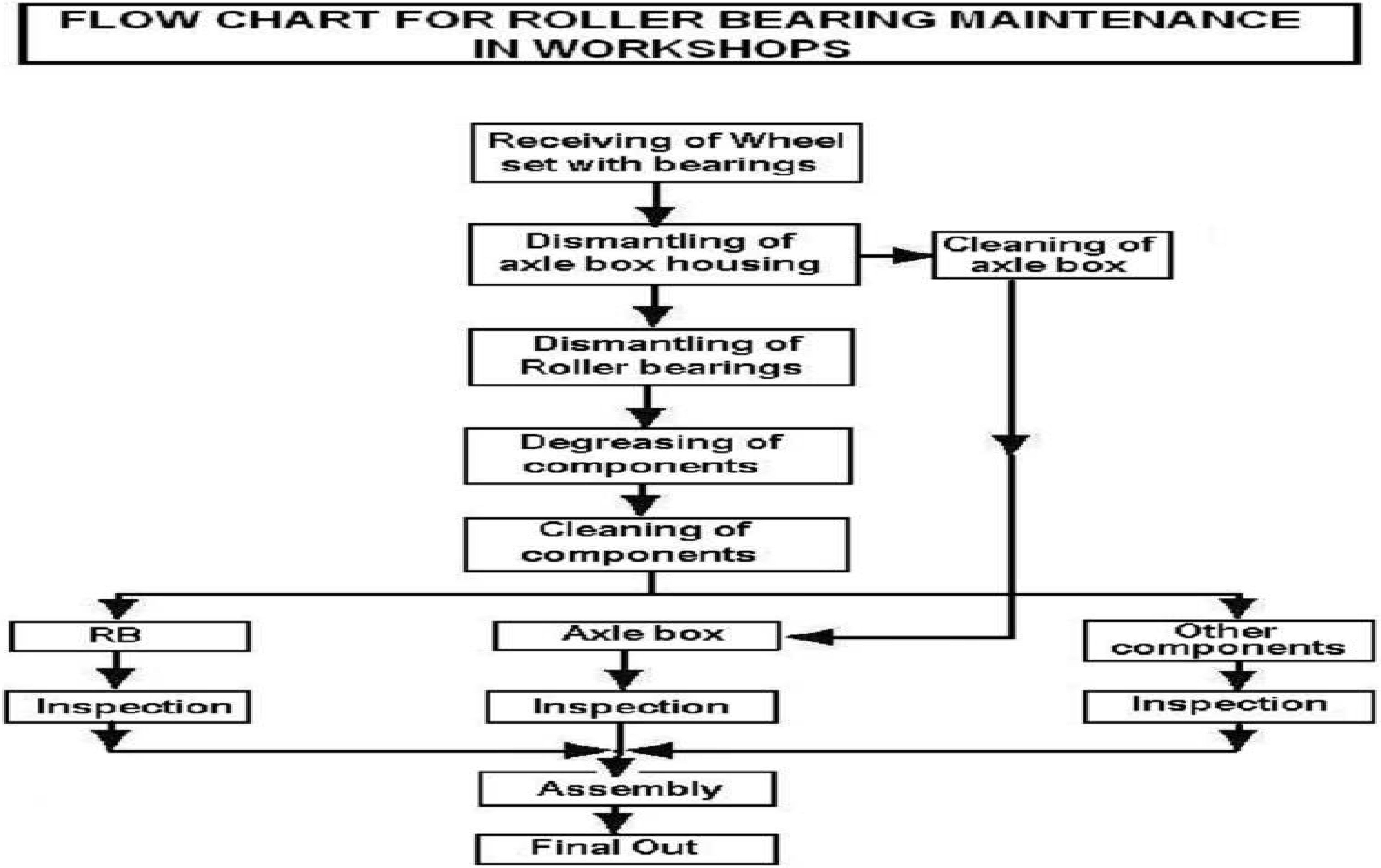
Pits form on raceway and develop into ripples.
Further development leads to corrugated surface. Some times spot or localized burns are also noticed.

Discoloration

Change of raceways / roller colour

Peeling

Peeling is a cluster of very small spalls. Peeling can also include very small cracks which develop in to spalls.


FLOW CHART FOR ROLLER BEARING MAINTENANCE IN WORKSHOPS
Receiving of Wheel set with bearings
Dismantling of axle box housing
Cleaning of axle box
Dismantling of Roller bearings
Degreasing of components
Cleaning of components
RB
Axle box
Other components
Inspection
Inspection
Inspection
Assembly
Final Out

MAINTENANCE IN OPEN LINE & PRECAUTIONS TO AVOID HOT AXLE CASES

Visual Examination

During Rolling-in & Rolling out examination, inspect axle box for any indication of hot box. Any wheel set with axle box running hot in the coach, must immediately be removed from service and sent for replacement. Visually inspect the axle box housing, front cover, rear cover and other parts for any damage. Check for any missing or loose fasteners. Watch for any other reason that could be detrimental to the performance of roller bearing and could lead to unsafe condition in service.

Roller bearings and axle boxes damaged due to fire, over heating, water submersion or welding, must be removed from service and sent for detailed internal examination.

Running Temperature

Check operating temperature of axle box by non-contact type thermometers at top of the cast steel axle box (crown) housing. The limit of temperature of the axle box top crown will be 80^0 C. If the temperature of axle box is found above 80^0 C, the affected coach should be detached en-route from the train service.
(RDSO Letter No. MC/AB Dated 21/24.08.2009).

Abnormal sound

In Rolling-in and Rolling-out examination, try to listen for any unusual / abnormal noise or grinding. Detach the coach & remove the wheel set / roller bearing axle box in case it produces abnormal sound and should be sent for internal part examination.

Grease oozing

During service, a small amount of grease leakage could be normal and comes from initial purging of grease and relieving of internal pressures. However, if fresh grease continues to leak, wheel set must be removed from service.

Axle boxes involved in Derailment / Accidents / Flood

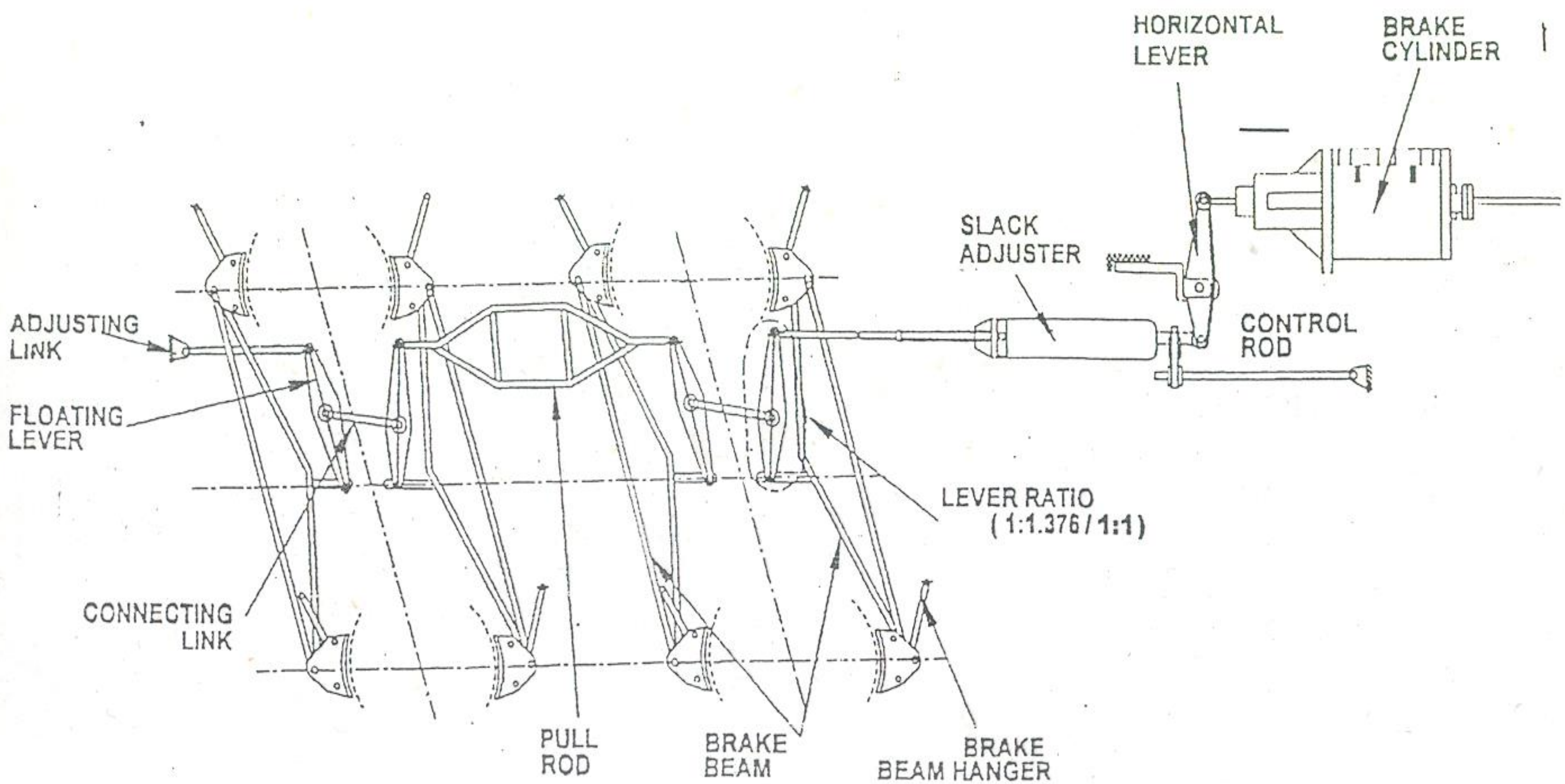
All wheel sets of the coaches, involved in accident, fire, flood or submerged in water, must be removed from service.
Bearing and parts must be identified separately by marking "ACCIDENT INVOLVED" and should not be reused. It is recommended that inspection of roller bearing is made together with parts including wheel sets, bogie etc.

AIR BRAKE SYSTEM

Types of Air Brake System

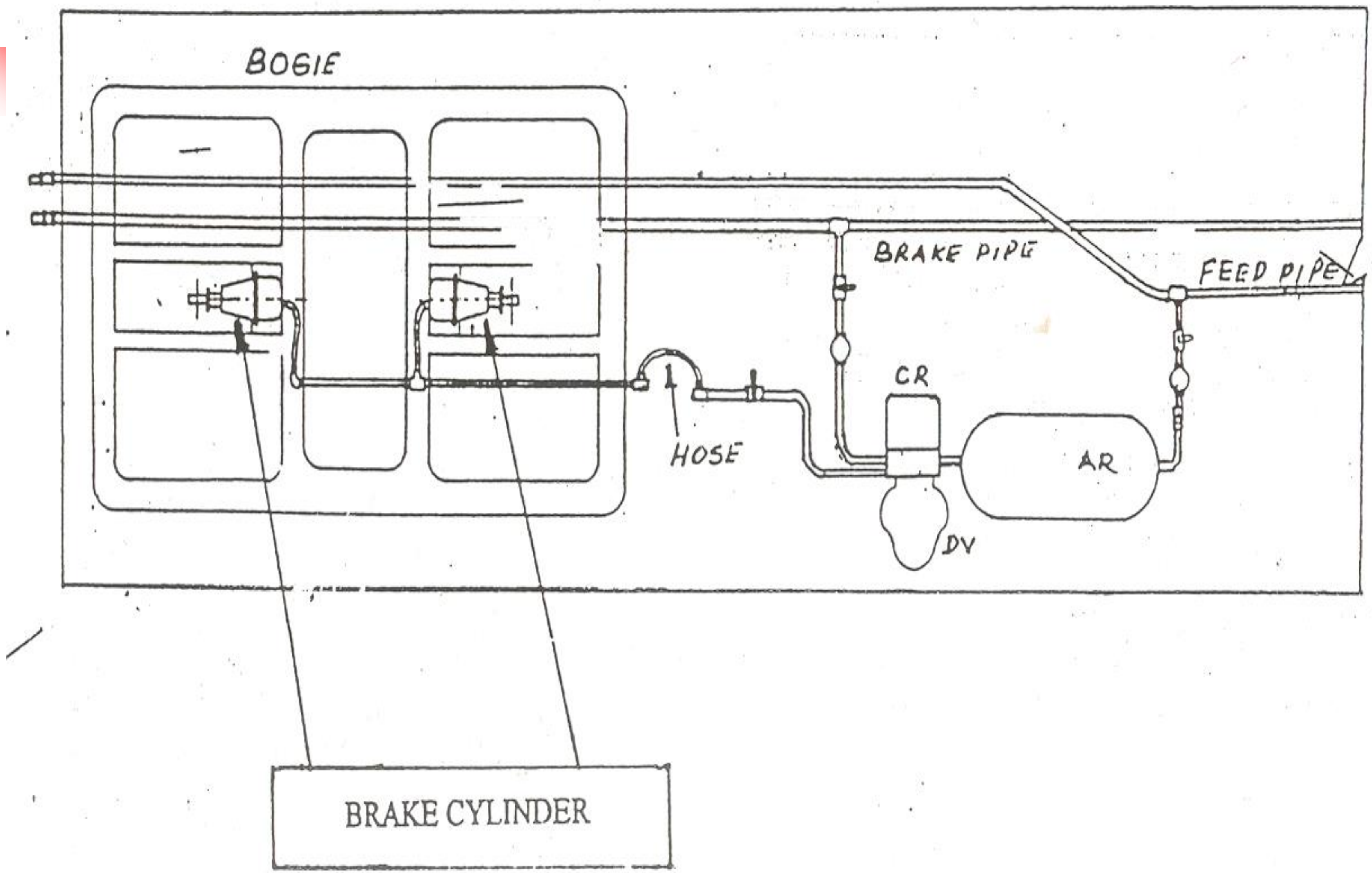
- **Coach Under frame Air Brake System**
- **Bogie Mounted Air Brake System (All new coaches- Since January 1999)**

Coach Under frame Air Brake System



COACH UNDERFRAME BRAKE RIGGING

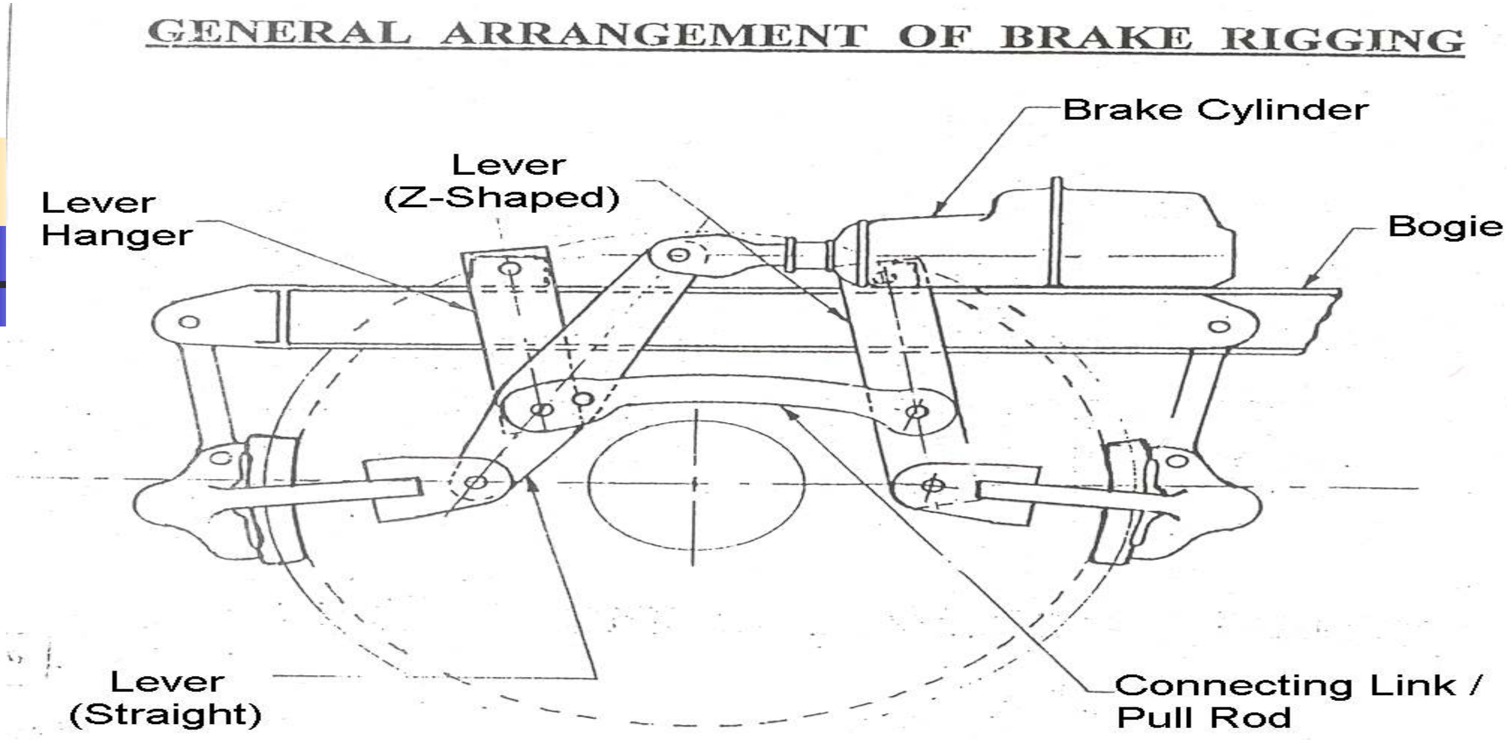
Bogie mounted air Brake System



Comparative chart of Conventional & BMBC Air Brake System

Comparative chart of Conventional & BMBC Air Brake System

Items	Conventional	BMBC
Weight reduction (as compared to conventional)	---------------	492 Kg
Braking distance at 110 kmph with 18 coaches	905 m	800 m
No of pins and bushes	102	84
Brake block wear rate	3 cc/kwh	1.325 cc/kwh
Conversion cost from Vacuum brakes	Rs 102064/-	Rs 118001/-



Brake rigging of BMBC

Difference between SAB & Inbuilt Slack Adjuster of BMBC

Difference between SAB & Inbuilt Slack Adjuster of BMBC

SAB

- Take up and pay out the clearance between the wheel & brake block.
- The effective length of pull rod is decreased during take up the clearance.

Inbuilt Slack adjuster of BMBC

- Only take up the clearance between the wheel & brake block.
- The effective length of piston rod is increased during take up the clearance.

Difference between SAB & Inbuilt Slack Adjuster of BMBC

SAB

- It maintains a uniform piston stroke through out the formation.
- It does not require adjustment of piston stroke every trip.

Inbuilt Slack adjuster of BMBC

- The piston stroke of the cylinder is not uniform through out the formation and varies up to 60mm.
- Every trip the piston stroke require to be adjusted.

Difference between SAB & Inbuilt Slack Adjuster of BMBC

SAB	**Inbuilt Slack adjuster of BMBC**
Spindle is made up of triple start thread.	Adjusting screw (spindle) is made up of double start thread.
To adjust the slack, the length of the pull rod is increased or decreased during forward stroke.	To adjust the slack the length of the piston rod is increased during return stroke.

Difference between SAB & Inbuilt Slack Adjuster of BMBC

SAB	Inbuilt Slack adjuster of BMBC
When length of the pull rod increased manually the clearance between the wheel & brake block increases.	When the effective length of piston rod is increased manually, the clearance between the wheel & brake block decreases.

Necessity of Bogie Mounted Brake System (?)

Necessity (?)

- The SAB slack adjuster used in the underframe mounted brake system has limited vendors.

- The total brake force is in the order of 100% of the tare weight and therefore the brake linkages are heavily loaded resulting in frequent maintenance demands on brake beam, brake head, brake gear pins and bushes.

Necessity (?)

- **The brake pull rod is supported by spring loaded nylon rollers which wears out very fast. Thus it becomes inefficient unless the nylon rollers are changed regularly.**

- **Breakage of pull rod (of SAB) also occurs due to bending while negotiating the curves.**

Necessity (?)

- The components like support brackets, pins and bushes, pull rod and support for pull rod provided on the under frame increases additional weight of the coach.

- Vibration of the pull rod during running cause rattling noise.

Design Features of Bogie Mounted Brake Cylinder

Design Features of Bogie Mounted Brake Cylinder

- External slack adjusters have been eliminated.Total four nos. of 8” (203.2 mm) size brake cylinders (two per bogie) are used in place of two 14” (355 mm) size under frame mounted brake cylinders in standard air brake.

Design Features of Bogie Mounted Brake Cylinder

- Each cylinder is provided with built-in single acting slack adjuster to take up the clearance automatically between wheel and brake block whenever the clearance increases due to wear on the brake block and the wheel and the maximum slack take-up is 305 mm.

Design Features of Bogie Mounted Brake Cylinder

- These cylinders are mounted between central longitudinal members connecting the bogie transom and the headstock on either side.
- Each cylinder controls the braking of wheels of each axle. Piston stroke is 32 mm.
- Provided with less number of brake fittings, therefore, easy to maintain.

Design Features of Bogie Mounted Brake Cylinder

- High friction ‘K’ type composite brake blocks are used, whose life is 5-6 times more than that of cast iron brake blocks.
- Unusual noise on run is completely eliminated.
- Use of curved pull rod with additional hole for manual adjustment of brake gear.

Design Features of Bogie Mounted Brake Cylinder

- **The overall weight saving per coach is about 492 kg.**
- **Number of pins and bushes reduced from 102 to 84.**
- **Braking distance has come down from 905 mm to 800 mm.**

Working Principle of BMBC

Working Principle of BMBC

There is no change in the pneumatic system of the brake for bogie-mounted arrangement compared to underframe mounted brake. The system will respond to action of A-9 valve in similar fashion as in the case of standard air brake system during brake application and release.

or

There is no change in the overall brake system in bogie mounted arrangement up to the action of DV.

Brake Application

Compressed air is admitted to brake cylinder between piston and cylinder body forces the piston trunk assembly to move outward against the force of release spring. The brake force is transmitted through the trunion body, adjusting screw, adjusting tube, cross head, brake rigging and finally to the brake blocks.

Brake Release

When the compressed air from brake cylinder is vented the release spring moves the piston trunk sub-assembly to release piston. As soon as the piston stroke exceeds (32 mm) during return stroke the adjustment (in built-in one way slack adjuster) takes place.

Manual Adjustment of BMBC

Manual Adjustment

A red paint mark on the adjusting tube sub-assembly indicates that the piston unit has extended over its full range and requires re-setting. The design of the brake-rigging unit is done in such a way that range of slack adjuster covers the life of brake blocks so that re-setting and replacing brake blocks will be done at the same time.

Procedure of Manual Adjustment

- Disengage the cross head from the adjusting tube, by pulling the latch.
- Turn the adjusting tube clockwise to decrease the length of the adjusting tube (Effective length of piston rod).
- After replacing the brake blocks, apply to brake and check the piston strokes.

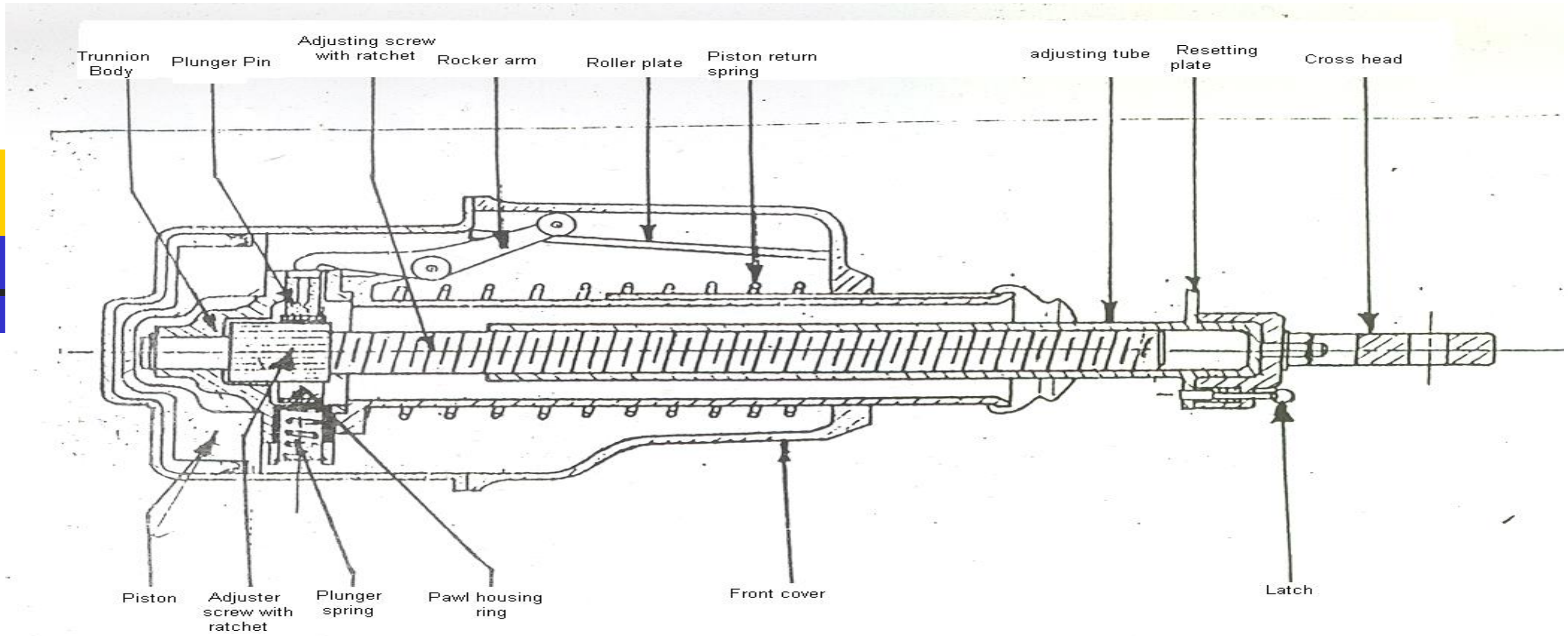
Procedure of Manual Adjustment

- If piston stroke is correct, engage the cross head with the resetting plate by releasing the latch.

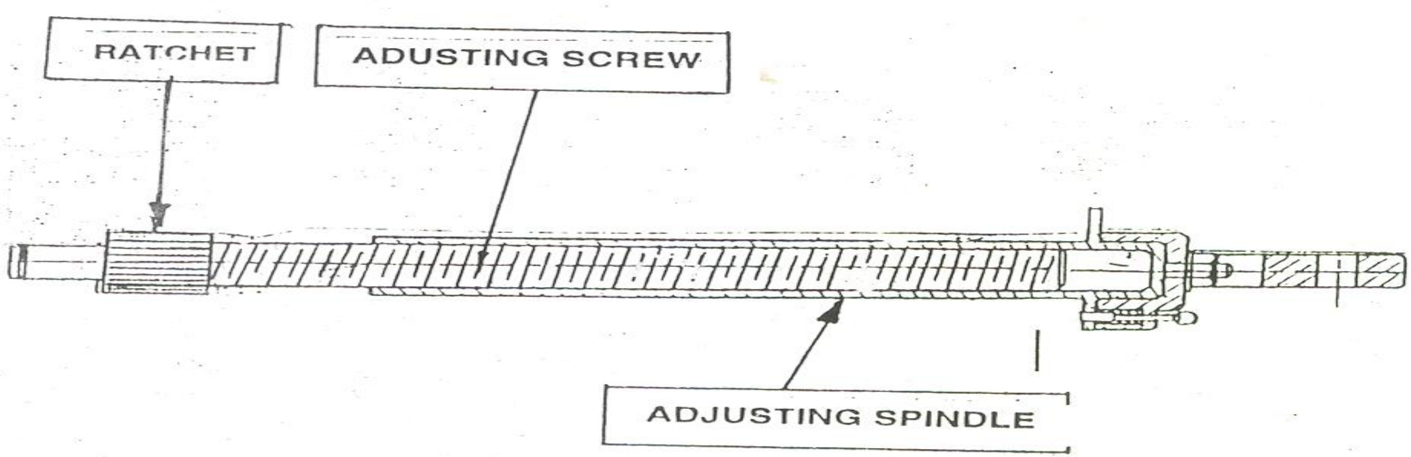
- If the piston stroke is less, decrease the length of adjusting tube to increase to clearance between wheel and brake block.

Procedure of Manual Adjustment

- If the piston stroke is more, increase the length of adjusting tube to decrease the clearance between wheel and brake block.
- After adjusting the piston stroke, ensure the cross head is locked with adjusting tube with the latch.



Components of Bogie Mounted Brake Cylinder



Functions of Main Parts

Functions of Main Parts
Adjusting Screw

- **The function of adjusting screw is to move the adjusting tube forward to increase the effective length of the piston rod automatically or to decrease the effective length of the piston rod manually.**

- **The adjusting screw is connected with a ratchet and forms a single unit. The adjusting screw is provided with a pitch of 1/8" (3.15 mm). The ratchet is provided with 18 teeth.**

Functions of Main Parts
Adjusting Screw

- When the adjusting screw completes one full rotation it makes adjusting tube to move forward or backward by 2X3.15 mm = 6.30 mm.

- If the ratchet is moved/rotated by one tooth, the adjusting screw is rotated by 360 degree/18 =20 degree, which in turn moves the adjusting tube outward/inward by 6.30/18 mm = 0.33 mm (1/72 “).

- From the above, it is clear that to move the adjusting tube forward automatically by 1”, it requires 72 return strokes.

Functions of Main Parts
Rocker Arm

- The rocker arm is fitted with piston head by means of shackles and it moves along with the piston head.

- The roller end of the rocker arm slides over the roller plate and the other end of the rocker arm rests on the pawl housing through plunger pin.

Functions of Main Parts
Rocker Plate

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

Functions of Main Parts
Pawl-Housing Ring

- The pawl-housing ring is pivoted with the pivot pin of turnion body at one end and the other end of the pawl housing ring moves/turns freely. A spring-loaded pawl is housed at the free end of the pawl housing. At the bottom of the pawl housing a spring loaded plunger / sleeve is kept between the turnion body and the pawl housing to move the pawl housing upward during forward stroke. At the top, a plunger is kept between the rocker arm and the pawl-housing ring to move the pawl housing downward during return stroke.

Functions of Main Parts
Pawl-Housing Ring

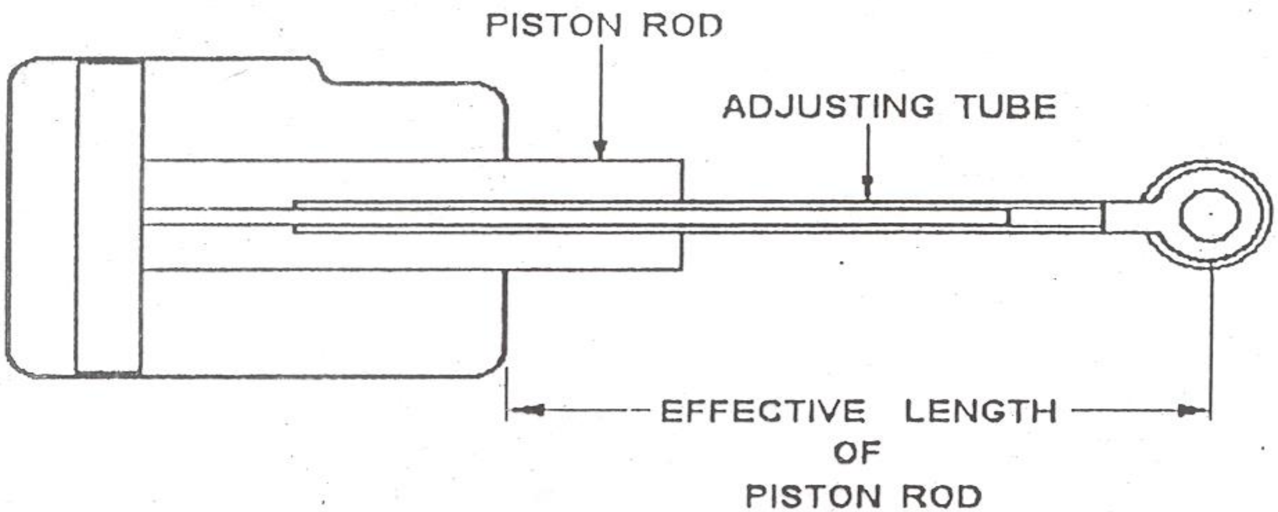
- **The function of the pawl housing and the pawl is to move /turn the ratchet by one tooth whenever the piston stroke exceeds 60 mm to increase the effective length of the piston during return stroke.**

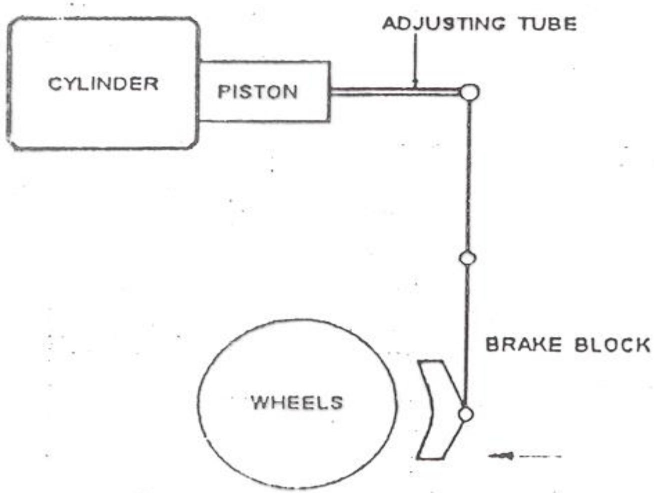
Slack Take – up Action

Slack Take – up Action

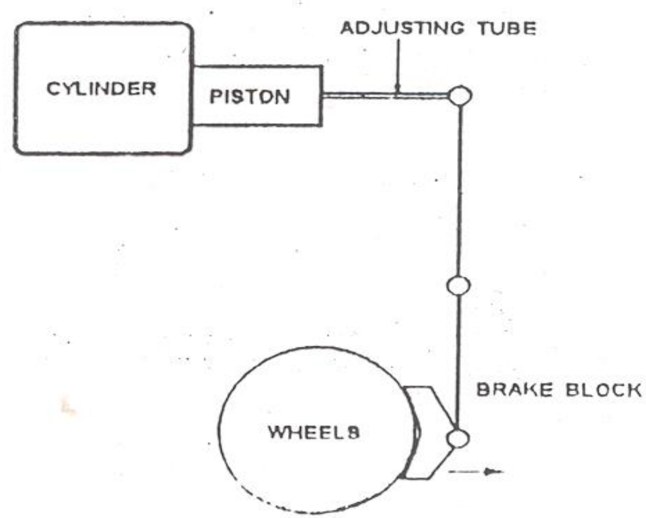
Piston stroke exceeds a predetermined value (on account of wear of either brake block or wheel or both), a ratchet with adjusting screw fitted insides the cylinder turns thereby <u>increasing the effective length of the piton rod AUTOMATICALLY.</u>

How does the Effective length of Piston Rod increase automatically ?

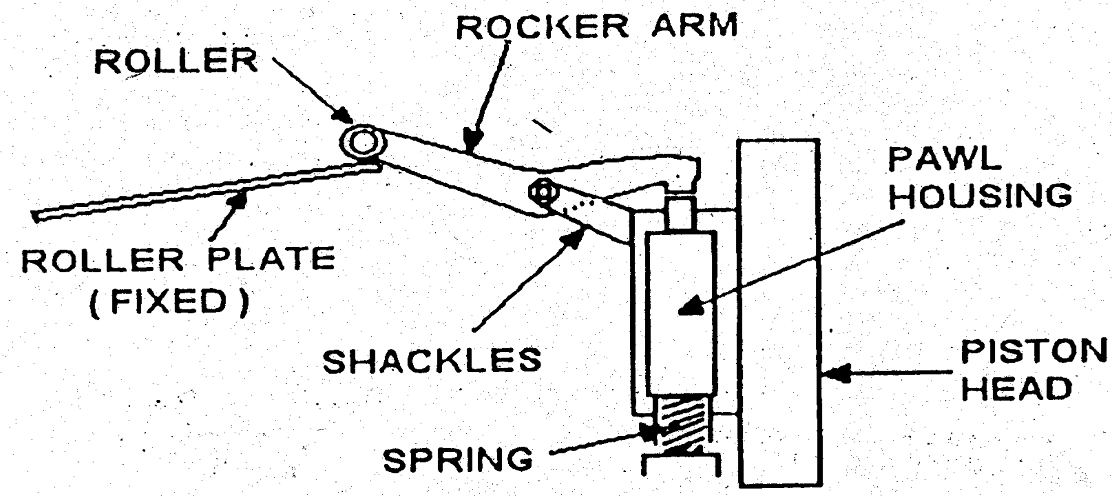


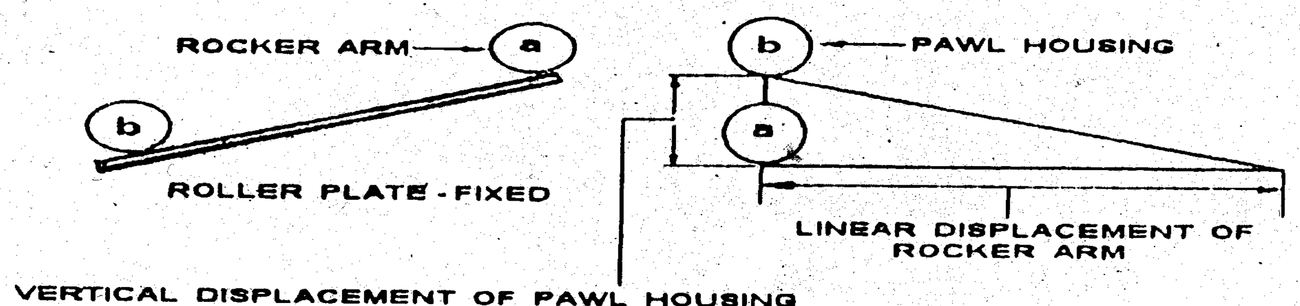


POSSIBLE TO DECREASE THE CLEARANCE,
IF EXCESS



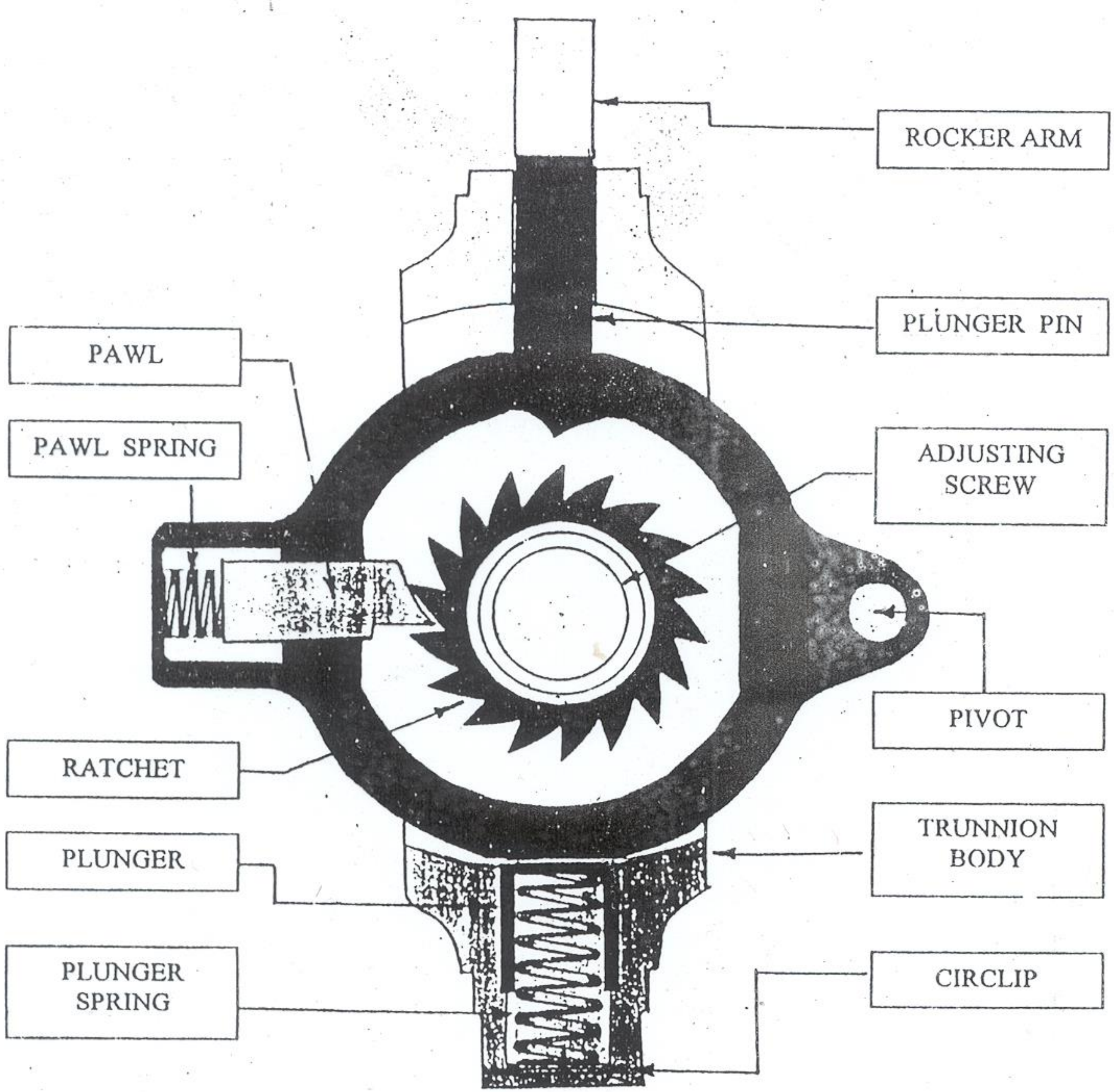
NOT POSSIBLE TO INCREASE THE CLEARANCE,
IF LESS



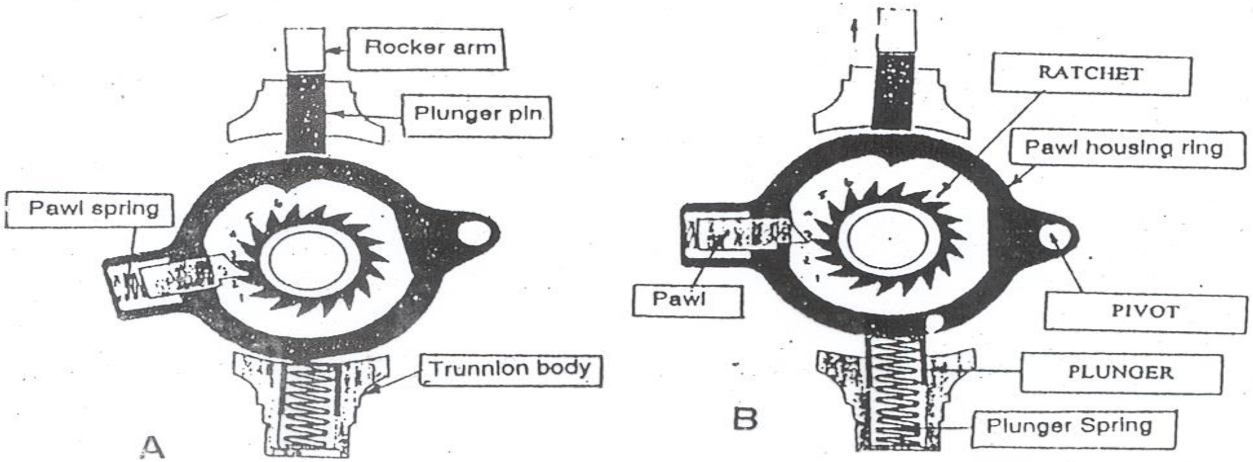


a. POSITION OF ROCKER ARM & PAWL HOUSING IN RELEASED POSITION.

b. POSITION OF ROCKER ARM & PAWL HOUSING IN APPLIED POSITION.

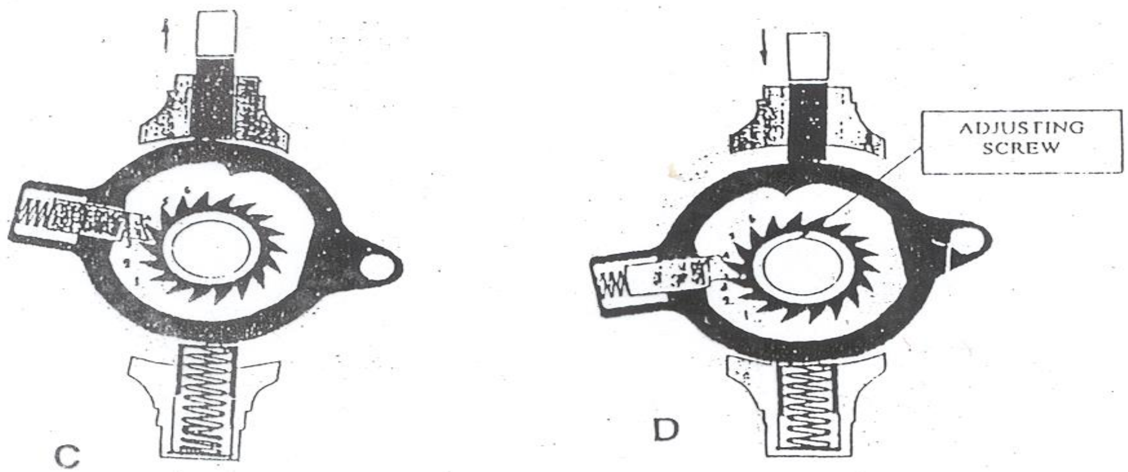

ROCKER ARM
PLUNGER PIN
PAWL
PAWL SPRING
ADJUSTING SCREW
PIVOT
RATCHET
TRUNNION BODY
PLUNGER
PLUNGER SPRING
CIRCLIP

WORKING OF INBUILT / SLACK ADJUSTER:



A. POSITION OF PAWL & RATCHET, WHEN THE BRAKE IS IN RELEASED POSITION

B. POSITION OF PAWL & RATCHET, WHEN THE PISTON STROKE IS WITH IN 60mm



C. POSITION OF PAWL & RATCHET, WHEN THE PISTON STROKE EXCEEDS 60mm. DURING FORWARD STROKE.

D. POSITION OF PAWL & RATCHET, AT THE END OF RETURN STROKE.

Maintenance Instructions of BMBC

Maintenance Instructions of BMBC

- Ensure high friction composition brake block (K-type) be used.
- Do not mix up the levers used in the brake gear for AC & Non-AC coaches in storing.
- Do not mix up the curved profile pull rods used in the brake gear for AC & Non-AC coaches in storing.

Maintenance Instructions of BMBC

- Use extreme holes of the curved profile pull rods for the assembly of brake gear for the wheel diameter up to 839 mm.

- Use inside adjacent hole of the curved profile pull rods for the assembly of brake gear for the wheel diameter below 839 mm. In addition, provide 38 mm packing plate at the axle box to maintain buffer height.

Maintenance Instructions of BMBC

- **Replace all brake blocks those fitted with the part of the wheel set when RED MARK provided on the adjusting tube of the corresponding brake cylinder is visible.**

- **Replace the brake blocks as wear in each block reaches the IDENTFICATION MARK of condemnation.**

Thank You

PASSENGER AMENITY & SAFETY FITTINGS

Presented by-

Rajendra Kushwaha

Instructor/C&W

MSTC/GKP

Passenger Amenity & Safety fittings

- Some basic facilities required to undertake long distance travel to make it more comfortable.
- For this purpose each coach is equipped with many fittings for the utility of the passenger.
- All these fittings are called as Amenity fittings.

Sr.No.	Name of Amenity Fittings	Sr.No.	Name of Amenity Fittings
1.	Main Door	2.	Door handle
3.	Hand rails	4.	Latches to close the door
5.	Seat	6.	Berth
7.	Berth Chain	8.	Window
9.	Window bars	10.	Roof ventilator
11.	Coat hook	12.	Light and fan
13.	Alarm chain	14.	Armrest, tea/snack table
15.	Foot steps to climb to upper berth	16.	Back rest with locking provision for the side berths
17.	Glass and Venetian shutters with lock provision	18.	Provision of securing arrangement below the seat for the luggage
19.	Luggage rack in case of general compartments	20.	Washbasin on either ends of the coach with mirror and mirror stand
21.	Provision of night lamp for sleeper and upper class coaches	22.	Vestibule with door and fall plate arrangement secured with pin

Sr.No.	Name of Amenity Fittings.
23.	Provision of reading lamp in AC and First class coaches
24.	Curtains for having privacy in AC class
25.	Provision of Coupe system in First class coaches with door
26.	Door with turn over latch and locking arrangement
27.	Flushing cock with FO handle, FO pipe and fish tail
28.	Windows with Frosted glass for light and ventilation
29.	Mugs in the upper class coaches
30.	Fan and Alarm chain arrangement in Upper class coaches
31.	Squatting pan/Commode with commode lid and cover
32.	Provision of mirror, mirror stand and wash basin
33.	Provision of push cock/ Jason cocks 2 nos
34.	Shower arrangement in first class coaches
35.	Air freshener in upper class coaches
36.	Provision of 3 Indian style and 1 western style toilet with the following fittings

Safety Fittings-Among these amenity fittings, a few are classified as safety fittings as their function forms a critical element.	
Sr.No.	Name of Safety Fittings.
1.	Berth chain to secure the berths
2.	Alarm Chain system
3.	Window shutters
4.	Foot steps
5.	Main door turn over latch for securing the door
6.	Locking arrangement for the window shutters
7.	Latches in window shutters
8.	Hand rails at the entrance
9.	Fall plate pin in the vestibule
10.	Fire Extinguishers
11.	Locking arrangement for locking Vestibule door and rolling shutter
12.	Safety bars on window openings

Maintenance practice for amenity fitting during train examination-

- All coaches during maintenance are checked for the availability of all the amenity and safety fittings.
- If any fittings are found to be missing, the same has to be provided once again.
- All the repairs so carried out will be recorded in the repaire register.
- Any Fittings not able to be provided will also be recorded and the reason for not providing the same has to be mentioned.
- If it is due to non-availability of fittings in the Stores, an out of stock statement has to be obtained from the stores.
- A few trains are identified as Zero defect trains – which means that the coaches are supposed to have all its fittings fully intact and no missing fittings are allowed.
- Many trains have got ISO certification; those coaches, which are running in these trains, are given full attention with respect to the availability and correct working of these fittings.
- To improve the aesthetics of the coach, provision has been given so that these fittings can be procured locally and used.

THANK YOU

AMENITY ITEMS FOR MAINLINE COACHES

- **Lavatory Amenity Items**
- Porcelain Commode
- Wall protector
- Wash Hand Sink ‘D’ Type
- Flushing valve
- Fish Tail Flushing Head
- Hand Rail/Towel Rail
- Coat Hook

AMENITY ITEMS FOR MAINLINE COACHES

- Sunk in shelf below mirror
- Toilet shelf
- Gravity cock
- Toilet Paper Holder
- Mug with Chain
- Air Refreshner
- Soap Dish

AMENITY ITEMS FOR MAINLINE COACHES

- Door stop
- Litter bin below outside wash basin
- Lavatory door design
- Lavatory Flooring

AMENITY ITEMS FOR MAINLINE COACHES

Passenger Area Amenity Items :

- Foldable Bottle holder
- Snack table
- Ladder
- Magazine bag
- Shelf below mirror
- Ring below berth securing
- Sealed Window Cowl

AMENITY ITEMS FOR MAINLINE COACHES

Passenger Area Amenity Items :

- Sealed Window
- Curtains/Blinds
- Alarm Chain pulling Arrangement
- LED based Coach lights
- Rexine/Upholstery
- PVC Flooring
- Fans
- Light luggage racks
- Laptop and mobile Chargers

AMENITY ITEMS FOR RAJDHANI COACHES

- **Lavatory Amenity Items**
- Porcelain Commode
- Wash Hand Sink ‘D’ Type
- Flushing valve
- Hand Rail/Towel Rail
- Coat Hook
- Sunk in shelf below mirror
- Toilet shelf
- Toilet Paper Holder
- Mug with Chain

AMENITY ITEMS FOR RAJDHANI COACHES

Lavatory Amenity Items

- Air Refreshner
- Soap Dish
- Liquid soap container
- Door stop
- Litter bin below outside wash basin
- Lavatory door design
- Lavatory Flooring

AMENITY ITEMS FOR RAJDHANI COACHES

Passenger Area Amenity Items :

- Foldable Bottle holder
- Snack table
- Ladder
- Magazine bag
- Ring below berth securing
- Sealed Window Cowl
- Sealed Window

AMENITY ITEMS FOR RAJDHANI COACHES

Passenger Area Amenity Items :

- Curtains/Blinds
- Alarm Chain pulling Arrangement
- LED based Coach lights
- Fans
- Light luggage racks
- Laptop and mobile Chargers

HOUSE KEEPING FOR COACHES

- Cleaning/Watering
  - Cleaning of floor with phenyl
  - Checking and repairing of Curtains
  - Spray Room freshener
  - Washing of coaches
  - Cleaning of windows
- Cleaning of Toilet Area
  - Cleaning of commode
  - Cleaning of washbasin
  - Filling of liquid soap
  - Loading of Napkin paper Roll
  - Cleaning of Dustbin

TRAIN MAINTENANCE

- **Washing line :-**

  After every 3500 km(ICF) &4000Km(LHB)

  Schedule "A" maintenance- 1 month

  Schedule "B" maintenance- 3 months

- **Sick line :-**

  IOH- 9 months for ICF Type and 18 months for LHB coaches

  POH- 18 months for ICF Type and 36 months for LHB coaches

- **Platform Train Duty:-**

  On starting & ending stations

WORKS CARRIED IN WASHING LINE

- Inspection
- Cleaning& washing
- Brake testing
- Primary Maintenance
- Secondary Maintenance
- Pantry car provisions
- Watering
- Loading of linen
- Maintenance of AC & electrical circuits of coaches

SECONDARY MAINTENANCE

- The trains for the secondary maintenance are given at least 4 hrs on the washing line
- Linen and pantry car provisions
- Washing & cleaning of coaches
- Maintenance of AC system of coaches
- Examination of lightening arrangement
- Under gear & braking system examination

PRIMARY MAINTENANCE

- The trains for the primary maintenance are given at least 6 hrs at the washing line
- Washing & Cleaning of complete rake
- Oil on Side Buffer
- Wheel profiles are visually examined and gauged
- Pest control treatment
- Axle box is examined for grease oozing out from rear cover
- Check of Brake power & Brake blocks
- All under gear equipments check

Coach Maintenance

In coach maintenance generally these work being done

- Testing/maintenance of air conditioner.
- Maintenance of other electrical circuits like fan light etc.
- Buffer maintenance.
- Brake testing by S.C.T.R. (Single car testing rig)

SICK LINE:

Sick line is the workshop for the major and periodical maintenance of the coaches it consists of modern facilities like pit for working under frame And crane for separation of coach & bogie for repair of all type of defects

THANK YOU

Suspension System in Rolling Stock

Objectives

- Concept of suspension
- Concept of tractive effort and braking
- Requirements from suspensions + braking system
- Working of suspension systems
- Name and function of bogie components
- Understand the working of brake system.
- Name & function of Braking System Components
- The latest development in bogie+braking system

Spring Design

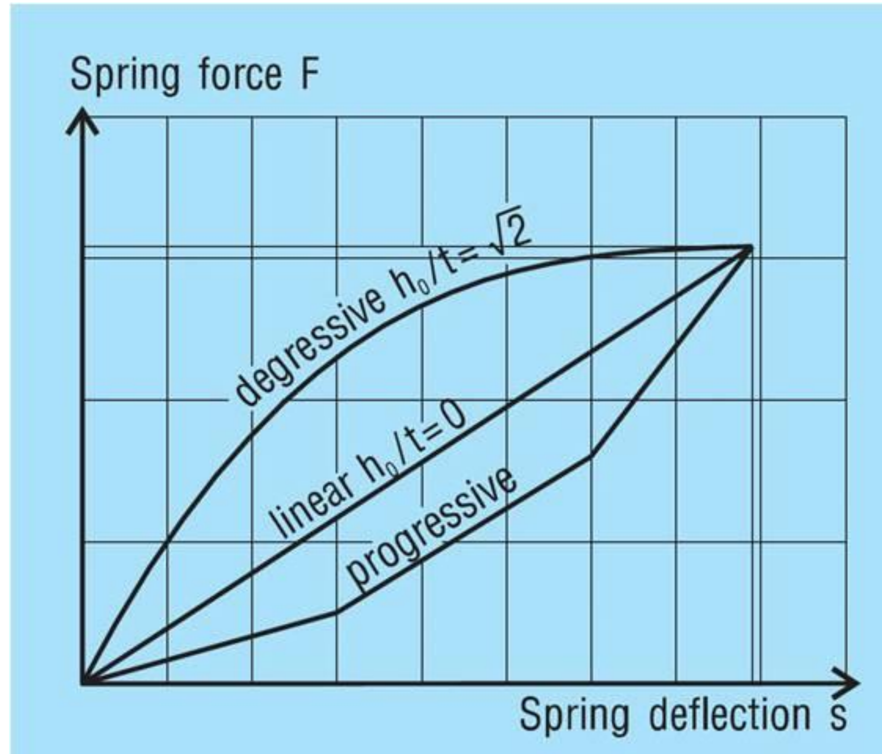
- Essential requirement of spring
  - To absorb jerk encountered by the wheel due to wheel/track irregularities.
  - To filter out the vertical irregularity between wheel and track.
- Softer springs preferred for better comfort.

Criteria for Selection of Stiffness

- Space
  - Floor height
  - Accommodation at bolster level
- Tare and gross weight
  - Deflection in two stages
    - Free to tare: Maximum buffer height is 1105 mm.
    - Tare to gross: Permissible maximum buffer drop is 75 mm.
- Residual Deflection
  - Must not go ‘home’ under the adverse condition
  - Kept at least 15 % of the total deflection
- Natural frequency to avoid resonance

Concept of Suspension

- Spring Mechanism
  - Linear
  - Step/ non-linear
  - Bumps (Limiters)
  - Progressive spring characteristics



Spring Types

- Coil Springs
- Flexi-coil springs
  - A larger height to mean coil diameter (H/D) ratio.
  - Required more space to accommodate.
  - Used in secondary suspension of LHB Coach.
- Air springs
  - Offer optimum stiffness at all loads.
  - Must needed in case of DEMU.
- Solid Springs
  - Rubber pads.
  - PU pads.

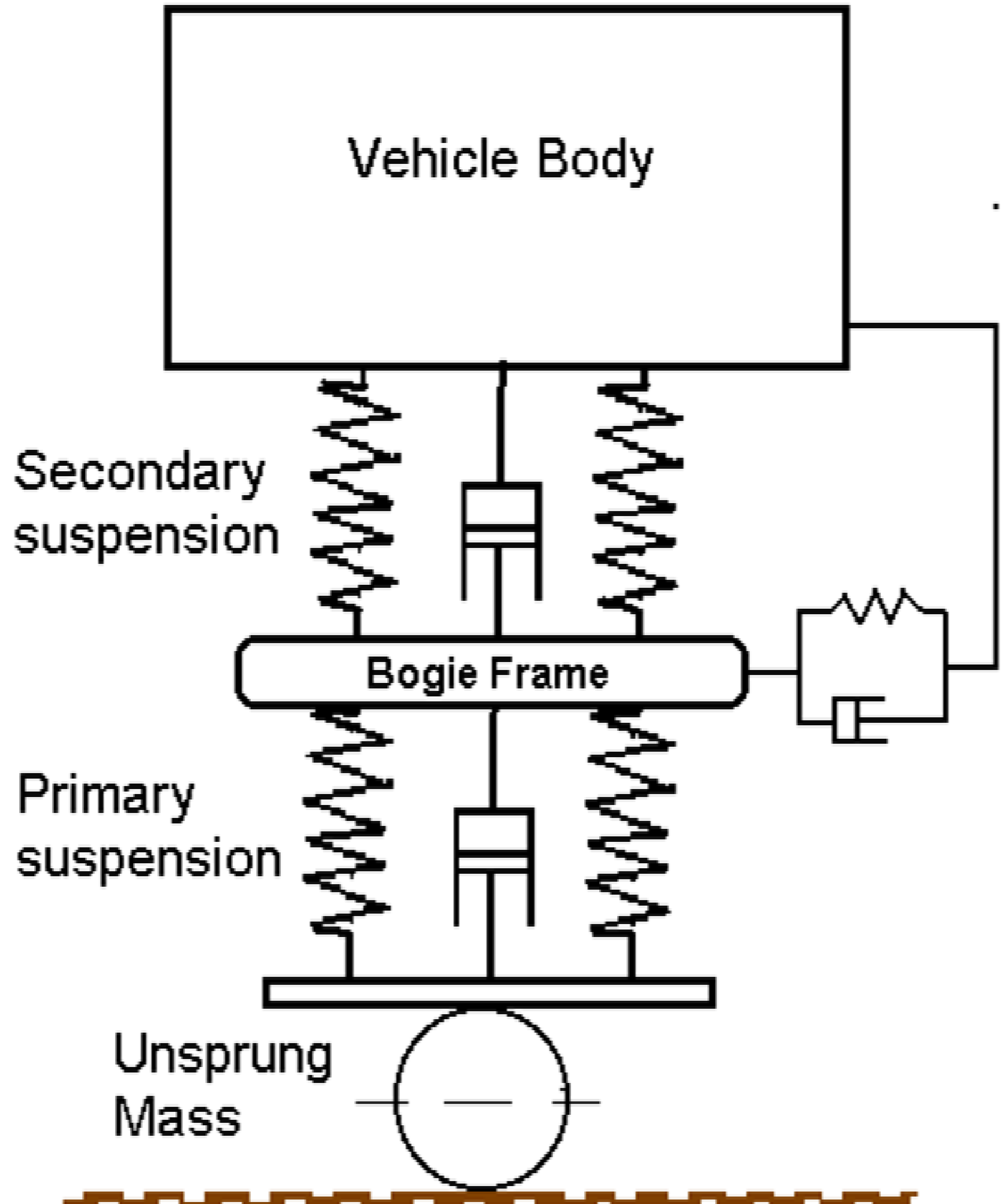
Suspension Systems in Railways

- Single stage system
  - Primary suspension only
    - UIC bogie (not in use now)
    - Primary suspension bypassed during braking
  - Secondary suspension only
    - CASNUB bogie
- Two stage suspension system
  - Both primary and secondary
    - ICF and FIAT bogie

Dampers/ Shock Absorbers

- Hydraulic dampers
  - Conventional dampers
- Friction dampers
  - Friction wedge block arrangement in CASNUB bogie
  - BSS hanger and block arrangement in ICF bogie
- Pneumatic dampers
    - Use of 40 litres capacity Aux. Reservoir in coaches fitted with Air Suspension System
- Rubber/ composite
  - Silent blocks

Diagram: Two Stage Suspension

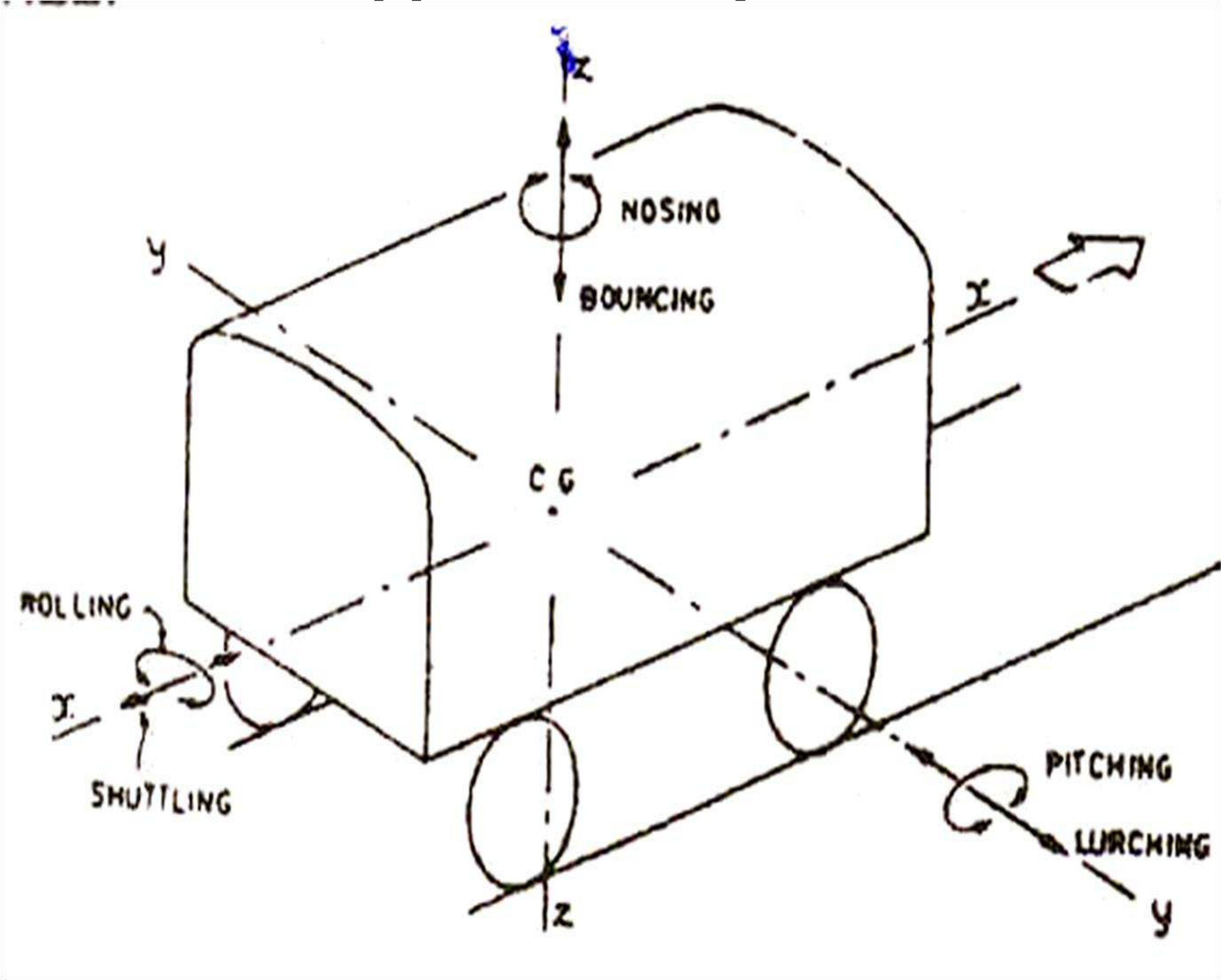


Kinematic Elements in Suspension

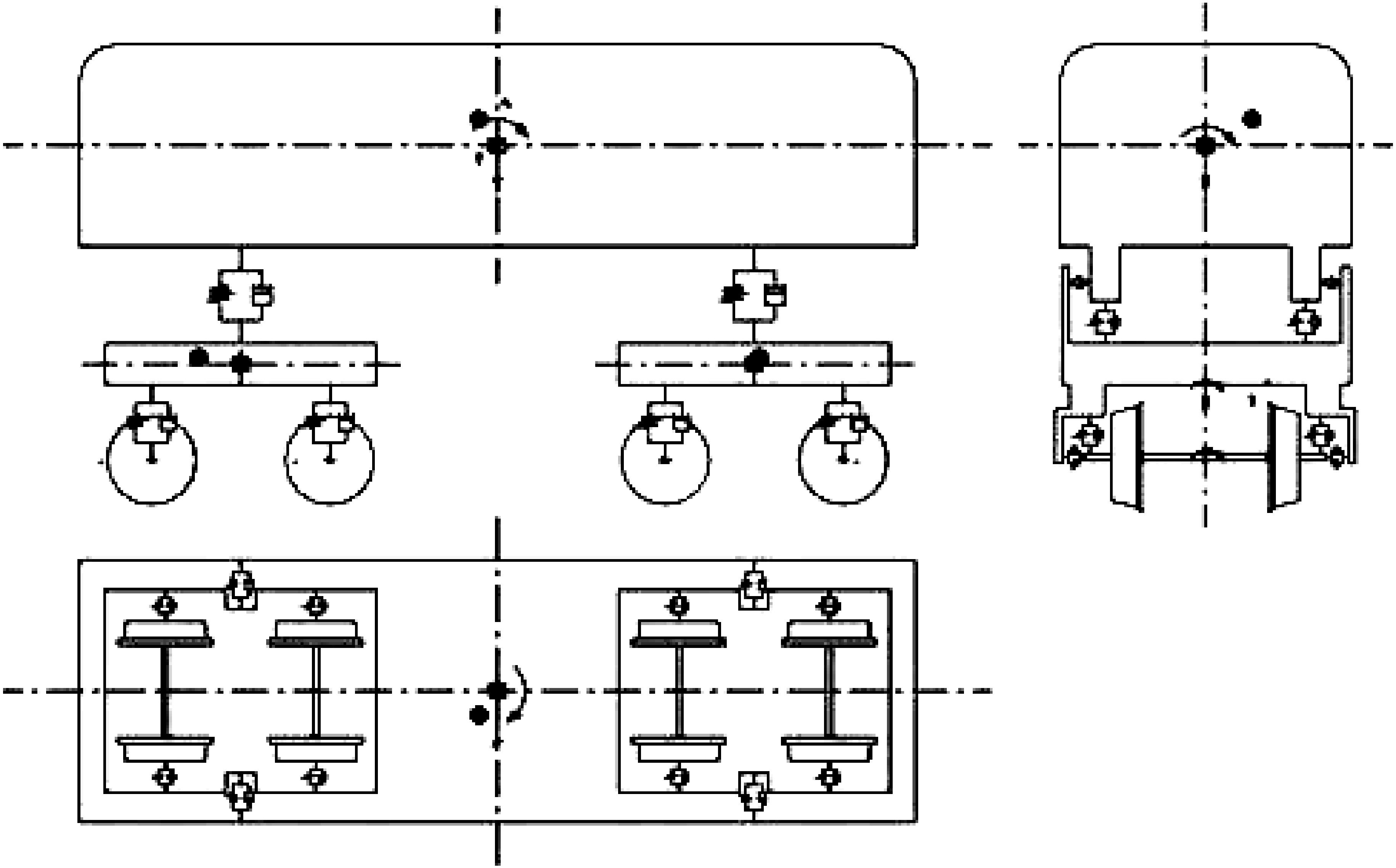
- Track
- Wheel-set
- Primary suspension
- Bogie frame
- Secondary suspension
- Lateral suspension
- Tractive & braking effort transfer components.

Simple DOF of a Single Body

- 3 linear
  - Shuttling
  - Lurching
  - Bouncing
- 3 rotational
  - Rolling
  - Pitching
  - Nosing or Yaw



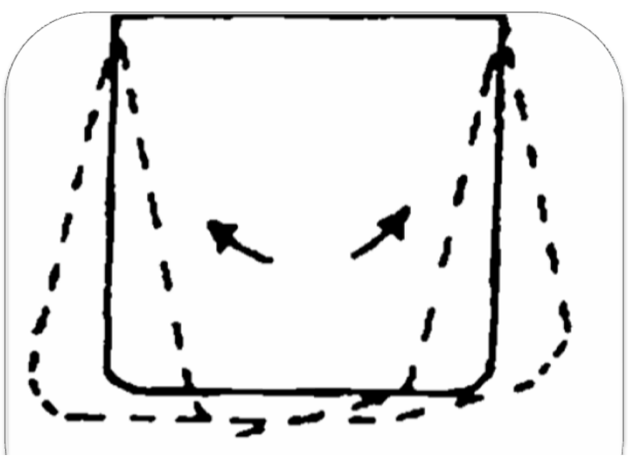
Complex Support of a Single Body



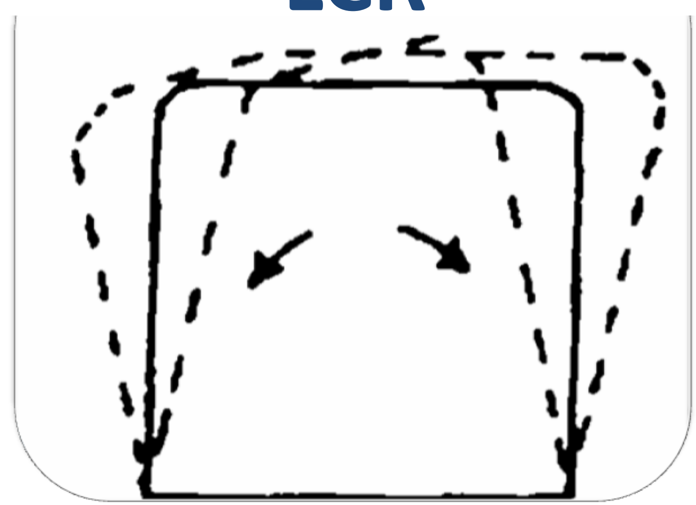
Roll and it's Prevention

- Effect of roll on human body
  - Type of roll: UCR and LCR
- Prevention not available in ICF bogie.
- Anti-Roll bar mechanism in LHB bogie.
- Air suspension system case.
  - Use of duplex check valve.

UCR



LCR



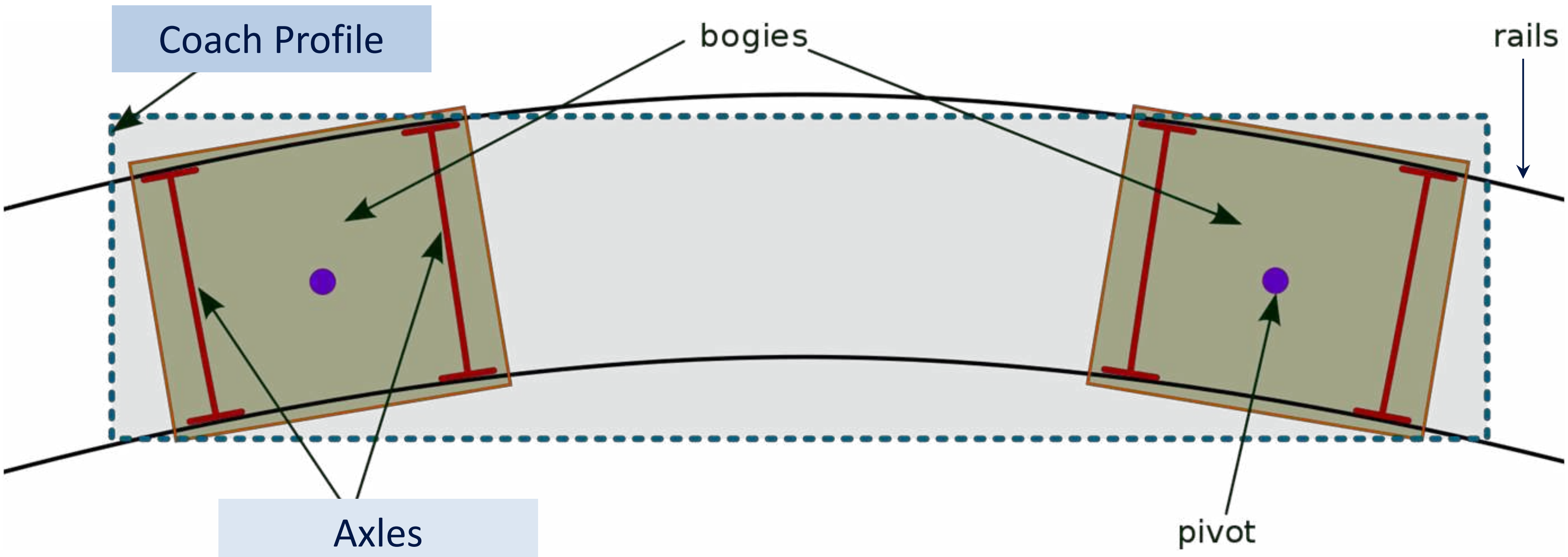
REQUIREMENTS FROM BOGIE

Requirements from a Bogie

- Linear/Curving requirement.
- Energy transmission and control:
  - Linear: vertical, lateral, longitudinal.
  - Rotational.
- Roll prevention requirement.
- Ability to filter out the irregularity between track and bogie.
  - Concept of offloading.
- Ability to bear the static load.

Linear/Curving requirements & Control

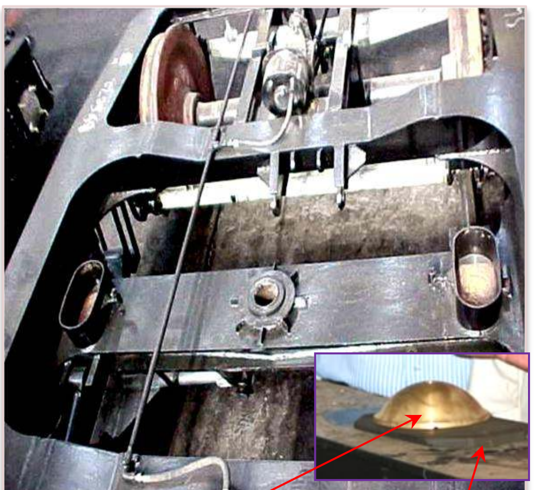
- ***Controlled clearance required***



Static Load Transmission

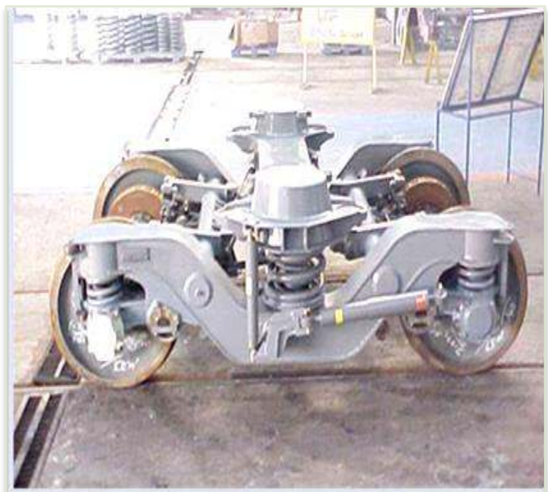
- Side Bearers and Centre Pivot

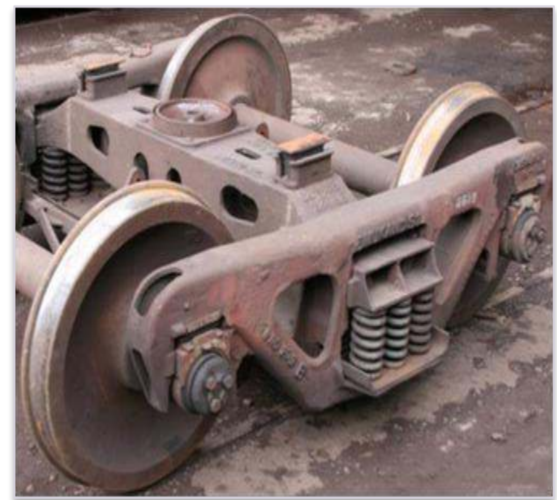
ICF Side Loaded	FIAT Side Loaded	CASNUB Centrally Loaded



Wearing piece: hemispherical for self-aligning characteristic

wearing plate

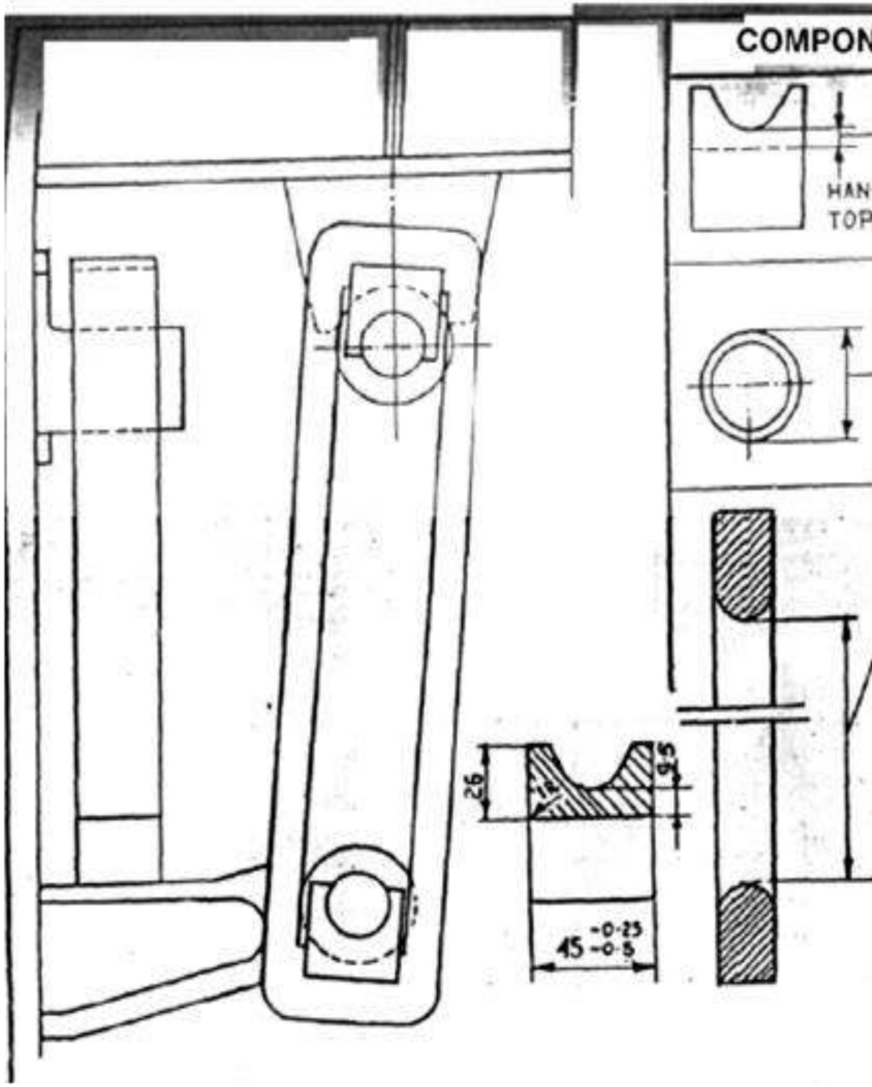




Lateral Energy Control Mechanism

- ICF
  - Spring-tilt mechanism
    - BSS Hanger & equalising stay arrangement at secondary suspension.
  - Much limited at primary suspension.
- LHB
  - Flexi coil springs at secondary suspension.
  - Control arm arrangement at primary suspension.
- Casnub
  - Much limited (spring nest & friction wedge block).

Wear Limits for Hanger, Block & Pin



COMPONENTS	SIZE-NEW	CONDEMNING	WEAR IN mm	SHOP ISSUE SIZ
HANGER BLOCK TOP AND BOTTOM	9.5	8	1.5	8.50
PIN	37	35.5	1.5	36.00
HANGER	384	387	3.0	386

CKS

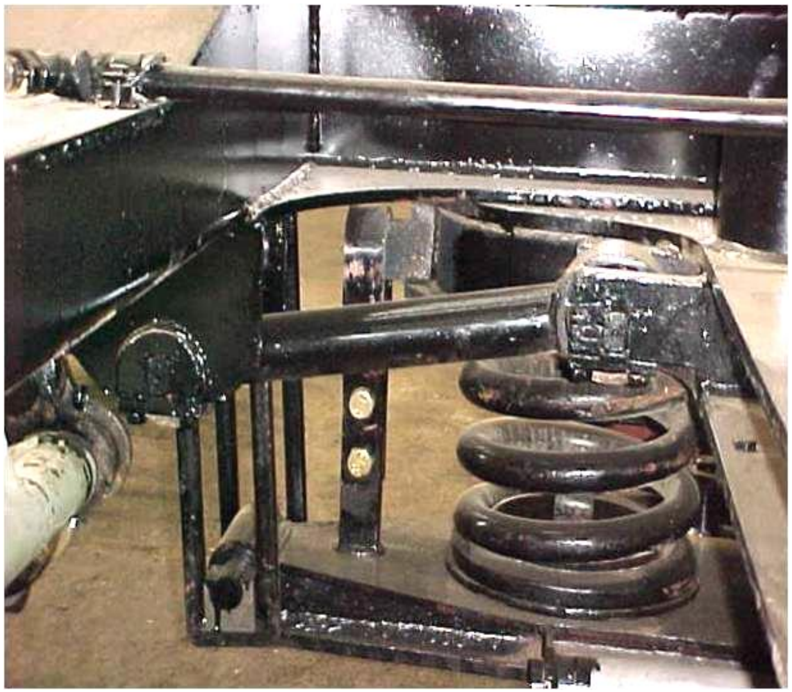
Longitudinal Load Transfer Mechanism

- Tractive/ Braking force transfer mechanism.
- Effect of inclined components
  - Concept of traction centre.
  - Effect of buffer height on traction centre.

Components for Longitudinal Load Transfer

- ICF
  - Centre pivot arrangement
  - Anchor links.
    - Anchor link silent block.
  - Rigid type axle guides.
- LHB
  - Body-bogie connections.
  - Traction assembly.
  - Control arm arrangement.

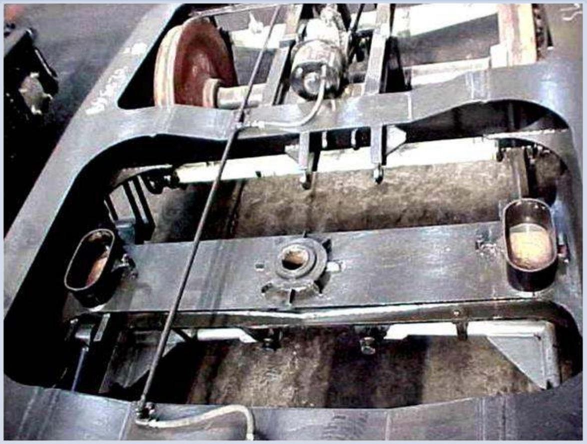
Anchor Link (ICF Coach)



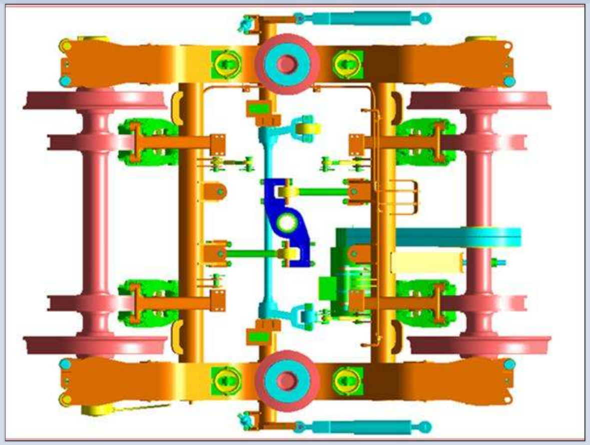
- Fitted with silent block.
- Transmits the tractive and braking forces.
- Can swivel universally
  - To permit the bolster to rise & fall and to sway sidewards.

Centre Pivot Arrangement

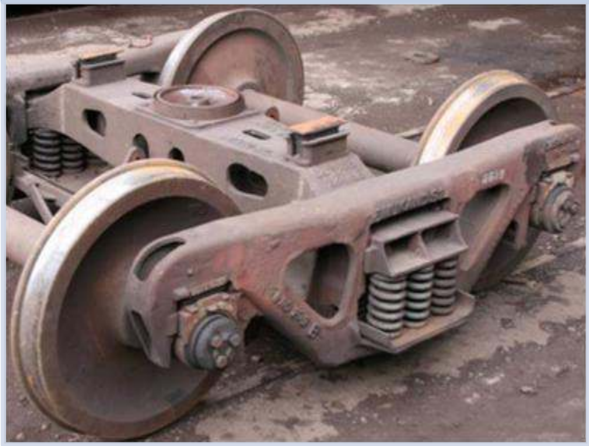
ICF



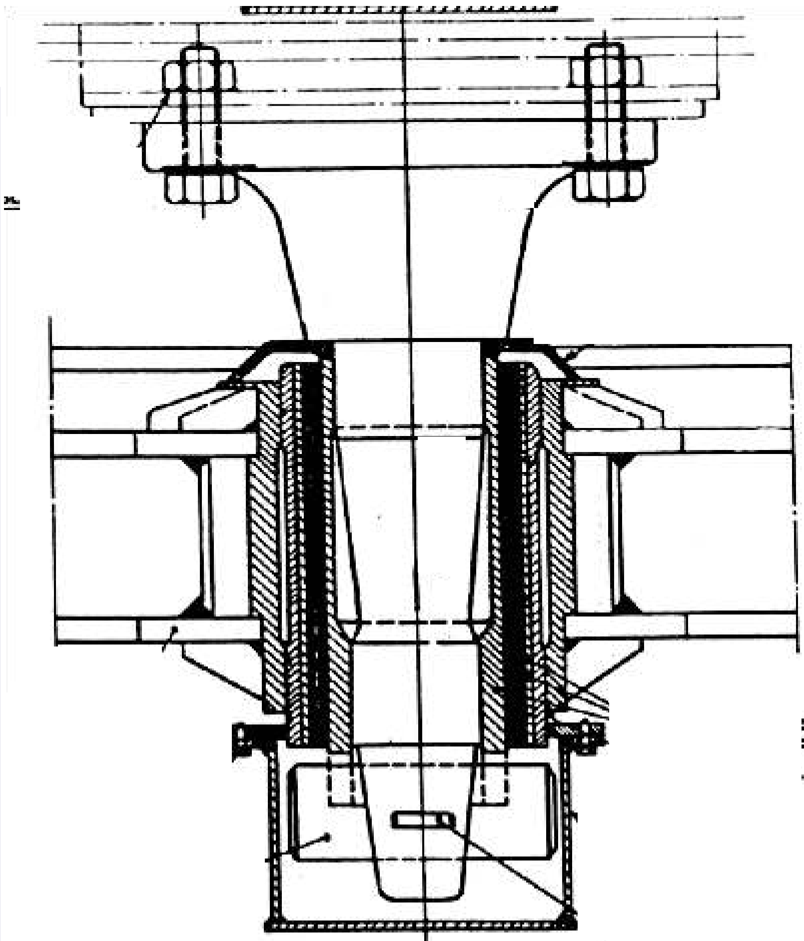
FIAT



CASNUB



Centre Pivot Arrangement (ICF Bogie)

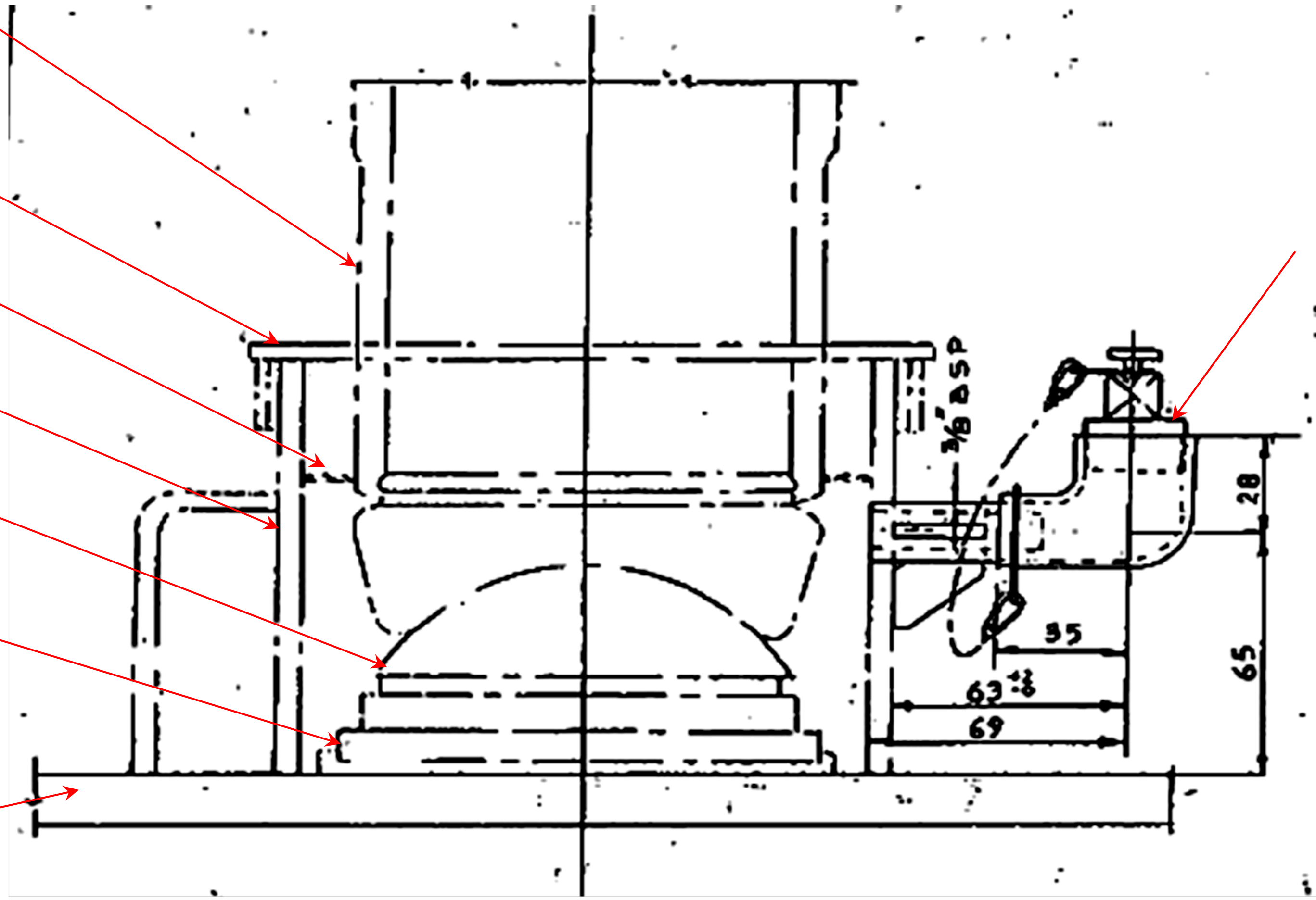


- Facilitates body-bogie joint .
- Transmits the tractive & braking forces.
- Rubber silent block
  - Injection moulded type
  - Tends to centralise the bogie w.r.t. the body
  - To some extent, control and damp the angular oscillations of the bogies.

Springs and Off-loading

- Frame twist flexibility
  - 25 mm offload.
  - 50 mm offload.
- Softer secondary
  - Not possible due to space constraint in ICF.
  - Used in FIAT bogie.
- Variation in buffer height.

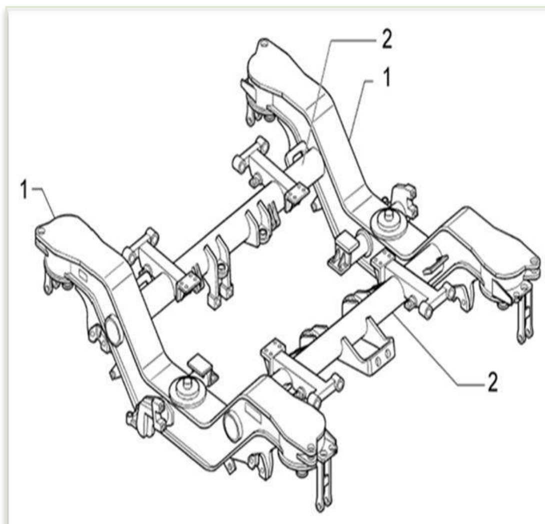
Side Bearer Arrangement (ICF Coach)



Bogie Frame

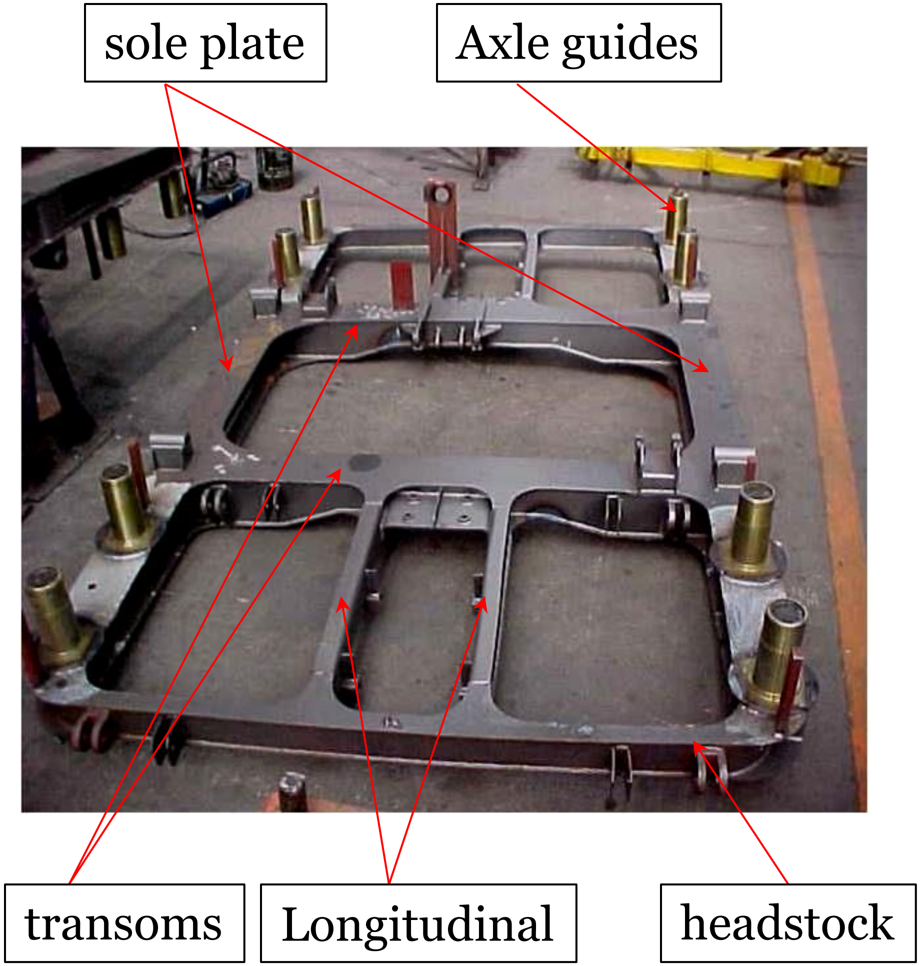
ICF

FIAT



CASNUB

Bogie Frame with Axle Guides (ICF)



- Rigid type Consists of
  - 2 sole plates (side frames).
  - 2 headstocks.
  - 2 transoms at centre.
  - 4 longitudinals.
- 8 axle guides welded to the side frame with close dimensional accuracy.

THANK YOU

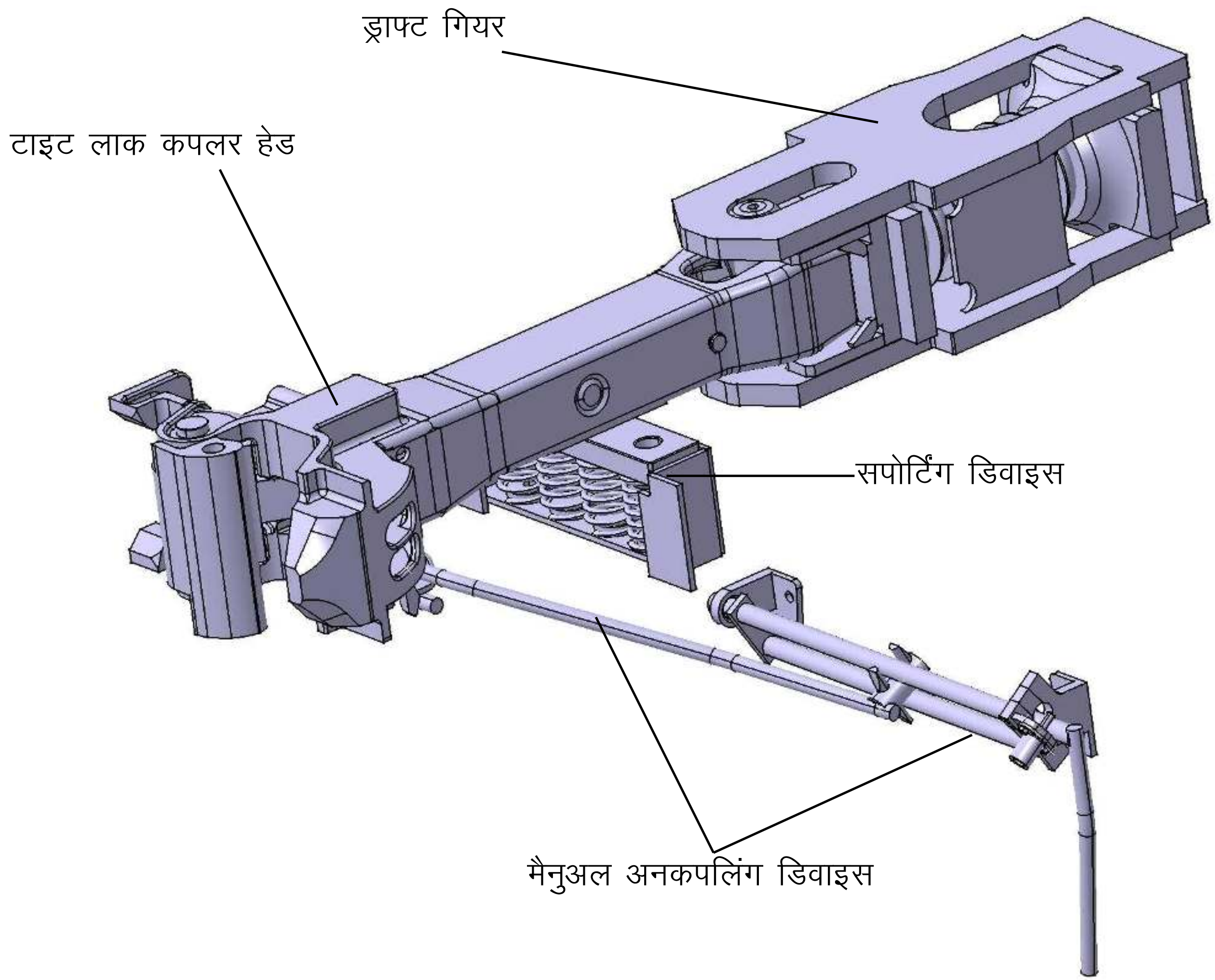
सेन्टर बफर कपलर को लॉक करने व खोलने की सही विधि

राजेन्द्र कुशवाहा
अनुदेशक/समाडि

कपलर के प्रकार

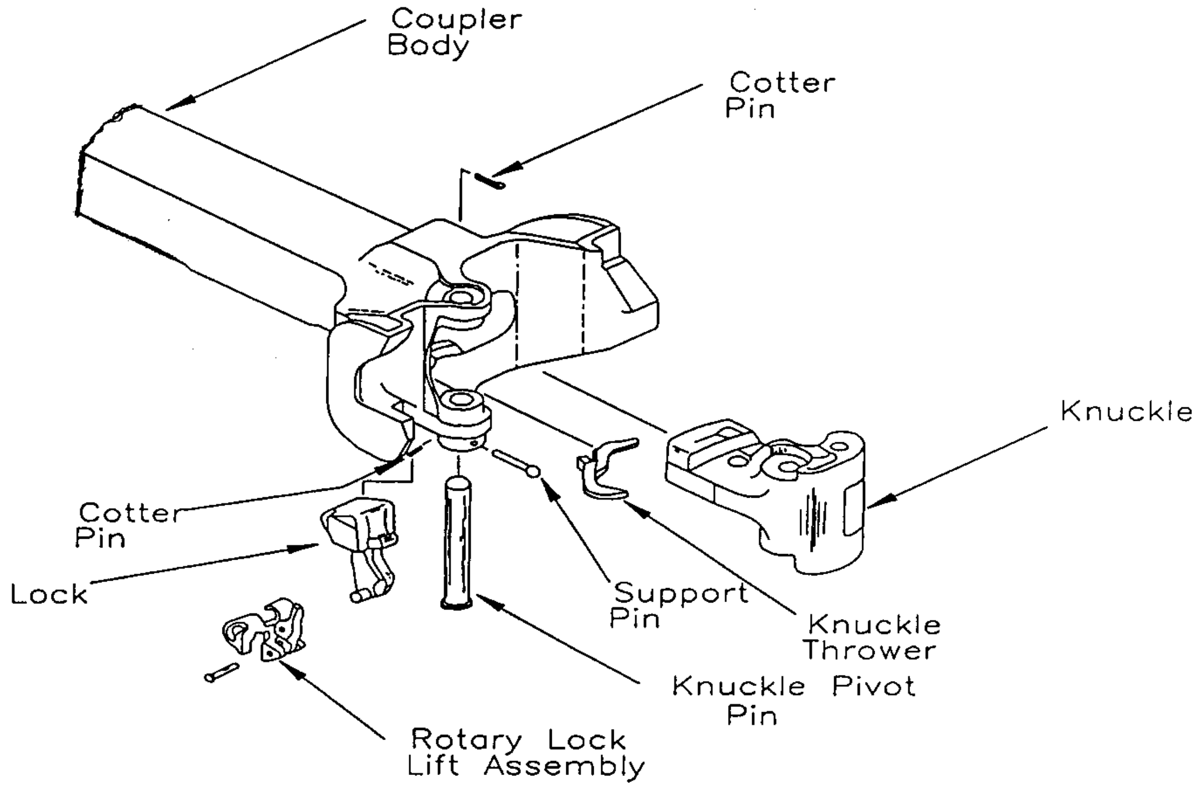
- आटोमेटिक बफर कपलर (मीटर गेज)
- स्क्रू कपलिंग
- ट्रान्जिशन सीबीसी कपलिंग
- सीबीसी कपलिंग
- एएआर एच टाइप कपलिंग

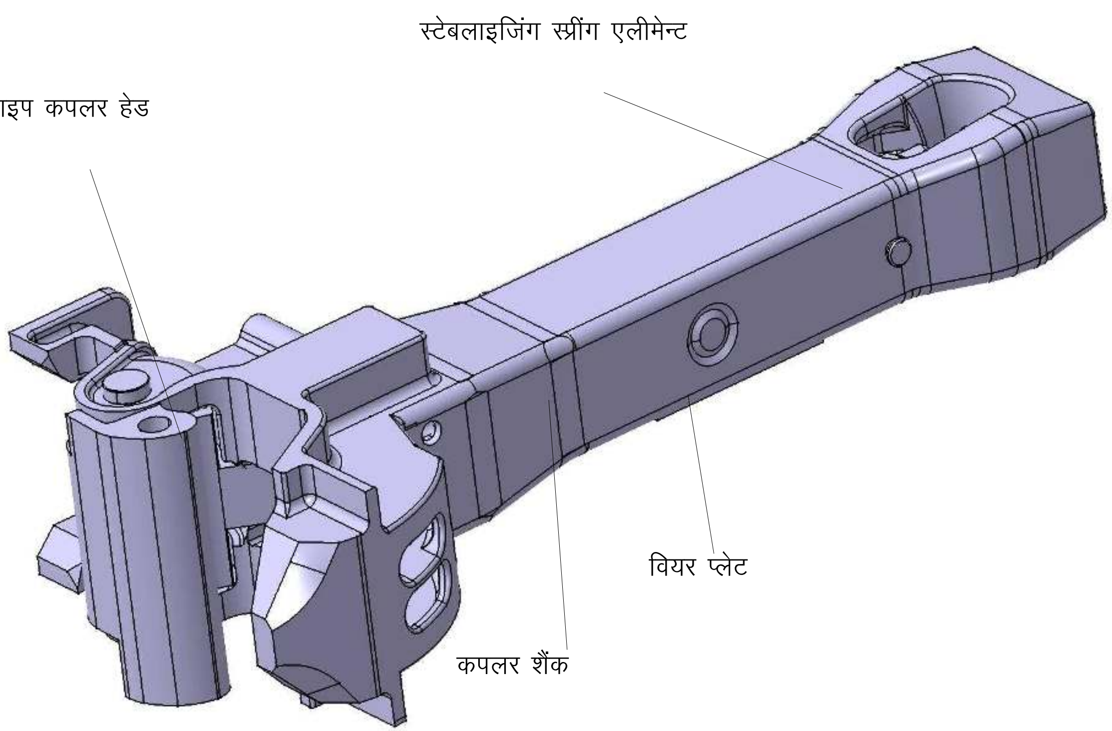
टाइट लाक सेन्टर बफर कपलर कम्पलीट (एएआरएच)

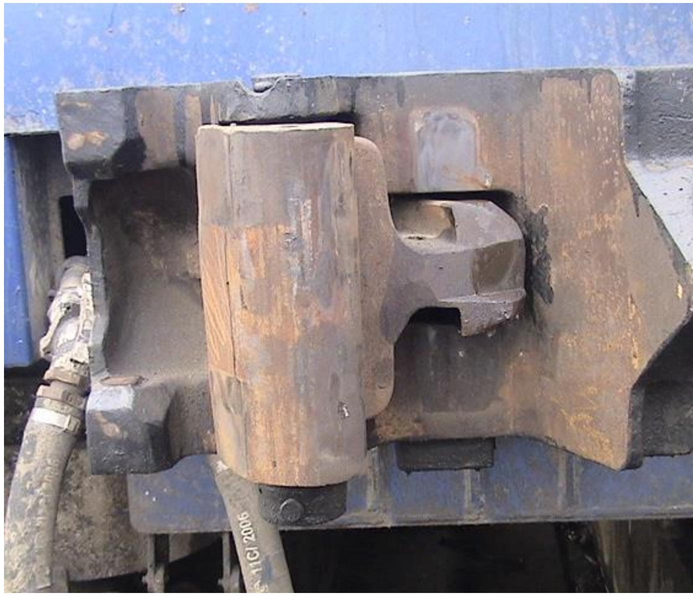


मुख्य पार्टस

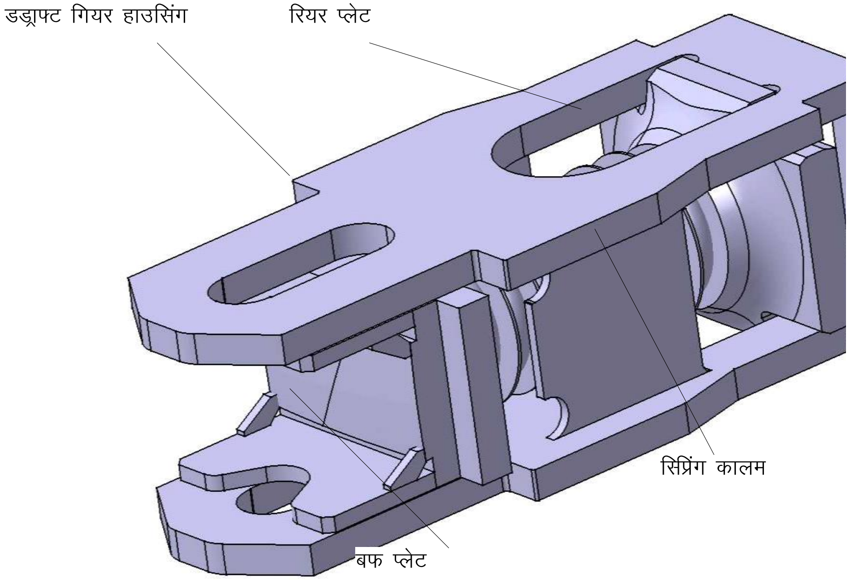
1. टाइट लाक कपलर हेड
2. ड्राफ्ट गियर
3. सपोर्टिंग डिवाइस
4. मनुअल अनकपलिंग डिवाइस




स्टेबलाइजिंग स्प्रींग एलीमेन्ट
एच टाइप कपलर हेड
वियर प्लेट
कपलर शैंक



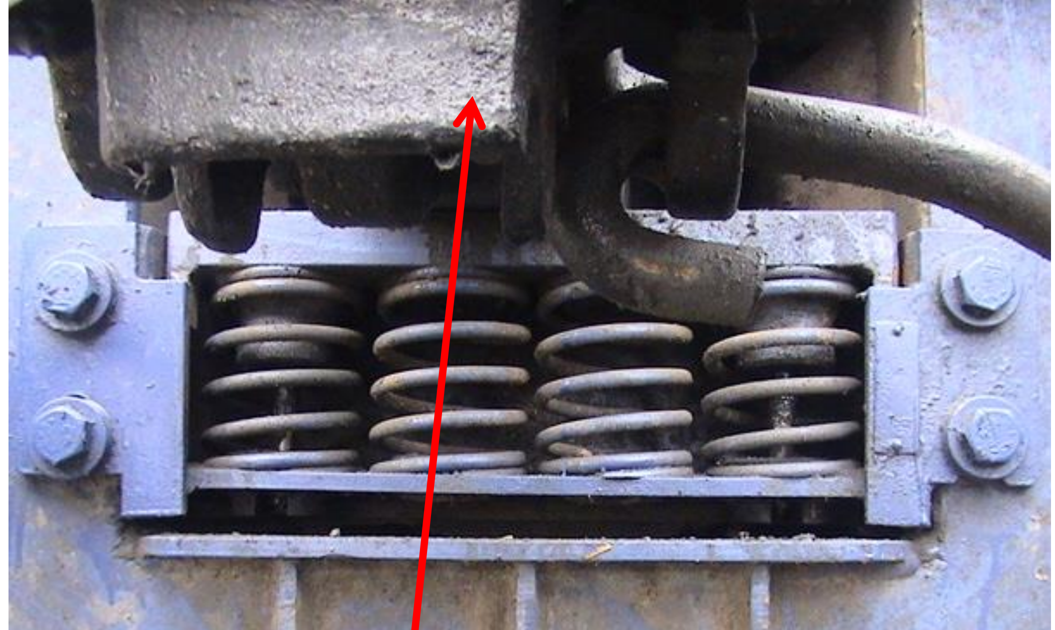
ड्राफ्ट गियर



एनर्जी एब्जार्पशन हेतु डबल एंक्टिंग डिवाइस

स्ट्रोक टेन्साइल. – 58 मि.मी

बफर – 80 मि.मी



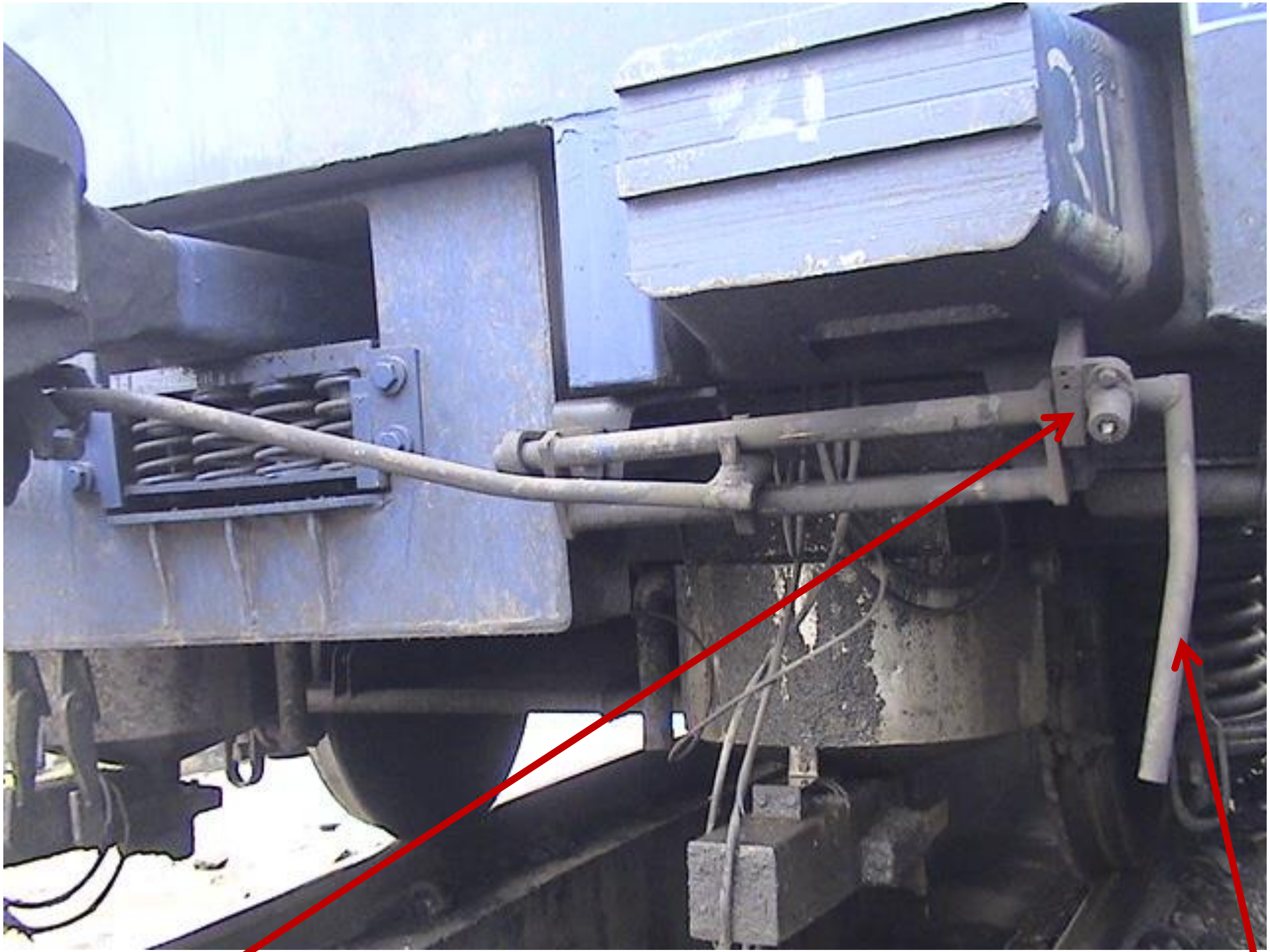
सपोर्टिंग डिवाइस

- प्रीलोडेड कम्प्रेशन स्प्रिंग
- कप्लर हेड सपोर्टिंग डिवाइस पर रेस्ट करता है

गैदरिंग रेंज

क्षैतिज : +/- 110 m.m.

ऊर्ध्वाधर : +/- 90 m.m.



कपलिंग आटोमेटिक है। अनकपल करने के लिये हैन्डिल को अनलाक करें, उठायें और क्लाकवाइज घुमायें।

कपलिंग डिवाइस की मैनुअल लाकिंग एवं अनलाकिंग

टाइट लाक कपलिंग फिटेड कोच की पहचान

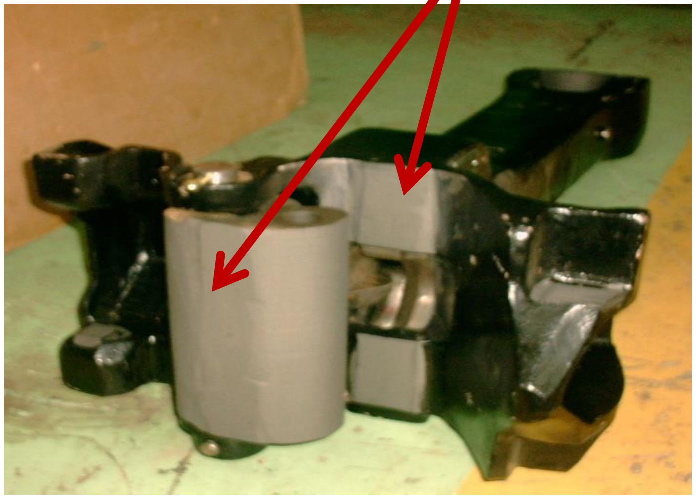
- साइड पैनल के अन्त में पीली पट्‌टी
- कोच नं0 के अन्त में लेटर 'C' का प्रयोग


10214/C
प्रवेश
ENTRY
1 - 80
TO SEAT / SLEEP
1-8
9-16
LIFT HERE

कपलिंग से पहले की चेक

चेक प्वाइंट नं–1 कपलर के सतह पर ग्रीस अथवा तेल का प्रयोग न करें अन्यथा अनकपल होने की संभावना बढ़ जाती है।

चेक प्वाइंट नं–2 जब नकल क्लोज हो तो नकल और कपलर हेड का मशीन्ड फेस समानान्तर होना चाहिये।



कपलिंग का तरीका (कोच से कोच)

- कोच को 2–3 किमी0/घं0 की स्पीड से एक दूसरे के नजदीक लाकर 1–2 मी0 की दूरी पर रोक देते हैं।
- एलाइन्मेन्ट देखें। इसे गैदरिंग रेन्ज में रहना चाहिए।
- आवश्यकतानुसार कपलर को खींचकर गैदरिंग रेन्ज में लायें।
- मैनुअल अनकपलिंग आपरेटिंग राड हैन्डिल खुले रहने चाहिये। कोच तथा लोको दोनों का नकल खुला होना चाहिये। धीरे–धीरे धक्का दें।
- आगे का 5 कोच में ब्रेक लगा हो।
- टेल–टेल की पोजीशन चेक करें। टेल–टेल स्लाट क्लियर रखें।
- कपलिंग के बाद मैनुअल अनकपलिंग डिवाइस के हैंडिल को लाक करना सुनिश्चित करें।
- कपलिंग के बाद यान को अलग खींचें।
- यह सही कपलिंग को सुनिश्चित करने का एक टिपिकल पुल टेस्ट है।

कपलिंग का तरीका (कोच से लोको)

- लोको साइड से पाँच कोच में ब्रेक लगा हो।
- लोको को पहले कोच से 20 मी0 पहले रोक दें और धीरे–धीरे आगे बढ़ें। जब 3 मी0 तक की दूरी रह जाय तो लोको को रोक दें।
- एलाइन्मेन्ट देखें। इसे गैदरिंग रेन्ज में रहना चाहिए। आवश्यकतानुसार कपलर को खींचकर गैदरिंग रेन्ज में लायं।
- एसएलआर सीबीसी को नार्मली क्लोज पोजीशन में और लाको सीबीसी नकल को ओपन केडीशन में रहना चाहिये।लेकिन आवश्यक्तानुसार कोच तथा लोको दोनों का नकल खुला होना चाहिये।
- धीरे–धीरे धक्का दें।
- लोको पायलट को धीरे–धीरे आगे बढ़ना चाहिये जिससे कि कपलिंग के समय गति 2–3 किमी0/घं0 हो।

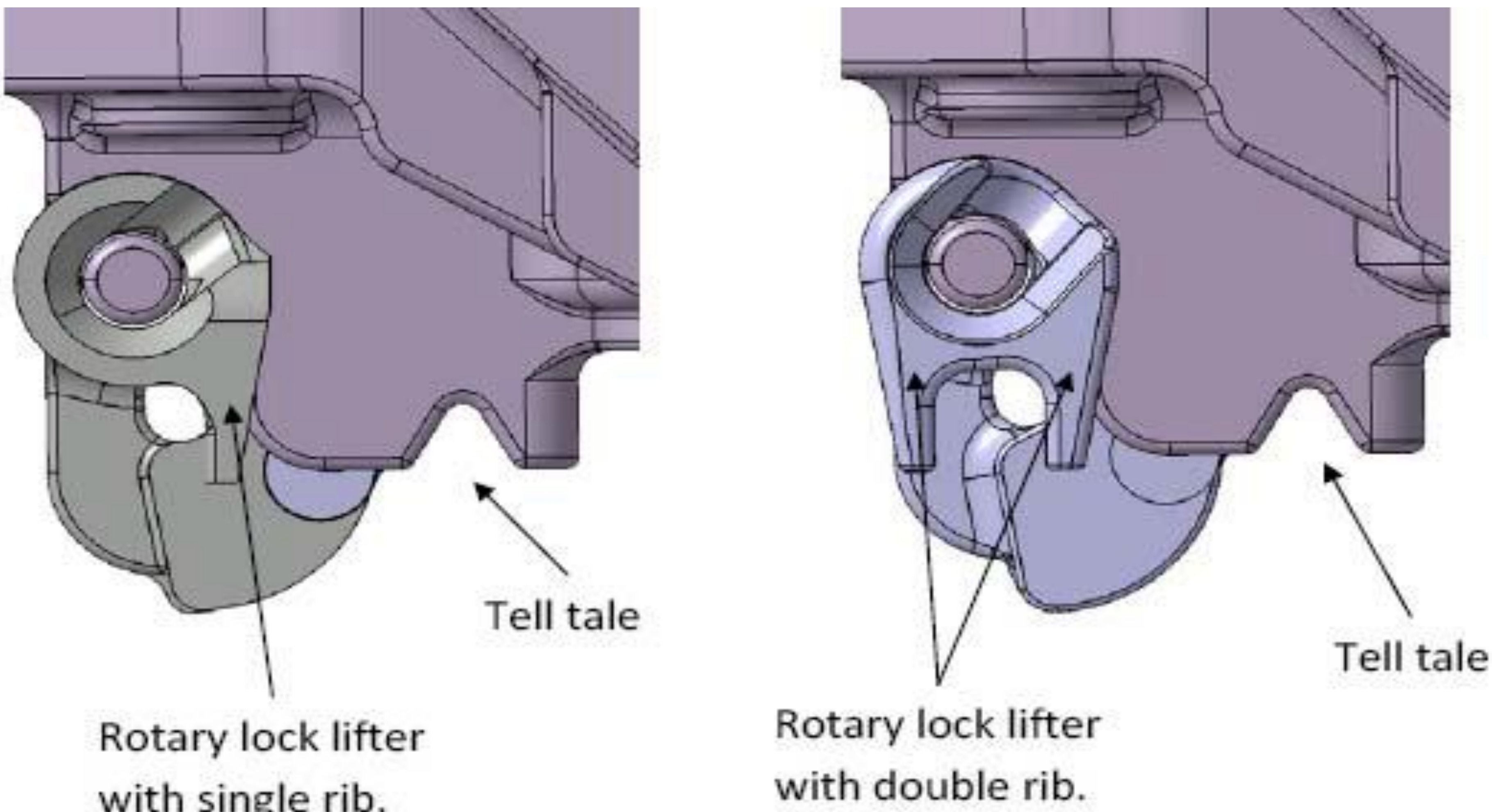
कपलिंग का तरीका (कोच से लोको)

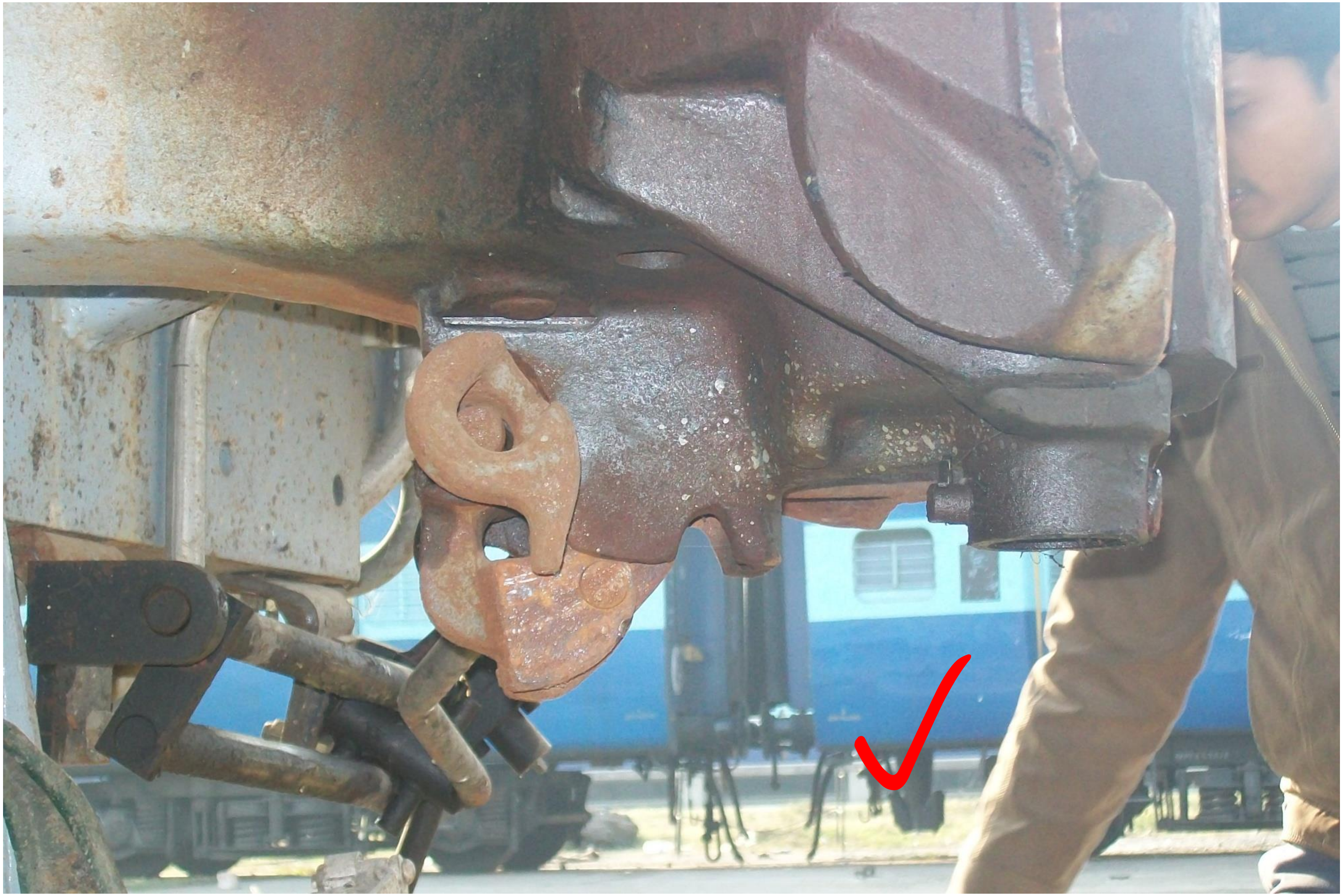
- लोको पायलट को 2 नॉच पर रेक को आगे खींचना चाहिय।
- जब लोको खींचे हुए कंडीशन में हो तो दोनों सीबीसी के बीच गैप को पर्याप्त मोटाई के सिम (रिस्ट्रिक्टर) द्वारा कै0 एण्ड वै0 स्टाफ द्वारा भर दिया जाना चाहिए।
- लोको पायलट और गार्ड द्वारा बी.पी और एफ.पी पाइप का प्रेशर सुनिश्चित किया जाना चाहिए।
- प्रथम पाँच कोच के ब्रेक को रीलीज कर देना चाहिए।
- टेल–टेल की पोजीशन चेक करें। टेल–टेल स्लाट क्लियर रहना चाहिये।
- मैनुअल अनकपलिंग आपरेटिंग राड हैन्डिल को लाकिंग स्क्रू से बन्द कर देना चाहिए।

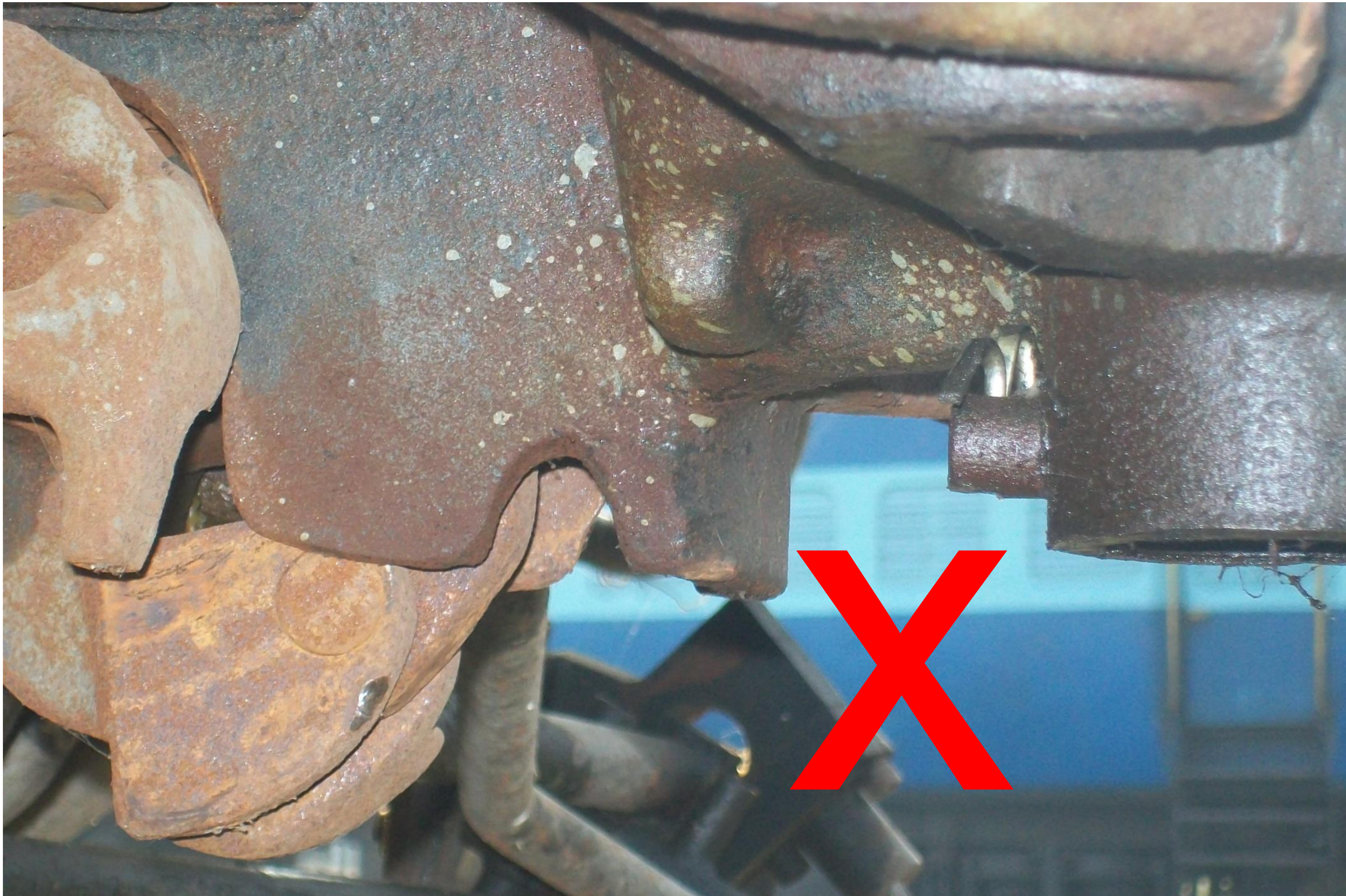
सही कपलिंग हेतु चेक प्वाइन्ट्स

चेक प्वाइन्ट

1. टेल–टेल स्लाट बिल्कुल क्लियर हो।
2. रोटरी लाक लिफ्टर रिब वर्टिकल हो।
3. मैनुअल लॉकिंग डिवाइस पूर्ण रूप से लाक पोजीशन में हो।


Tell tale
Rotary lock lifter
with single rib.
Tell tale
Rotary lock lifter
with double rib.

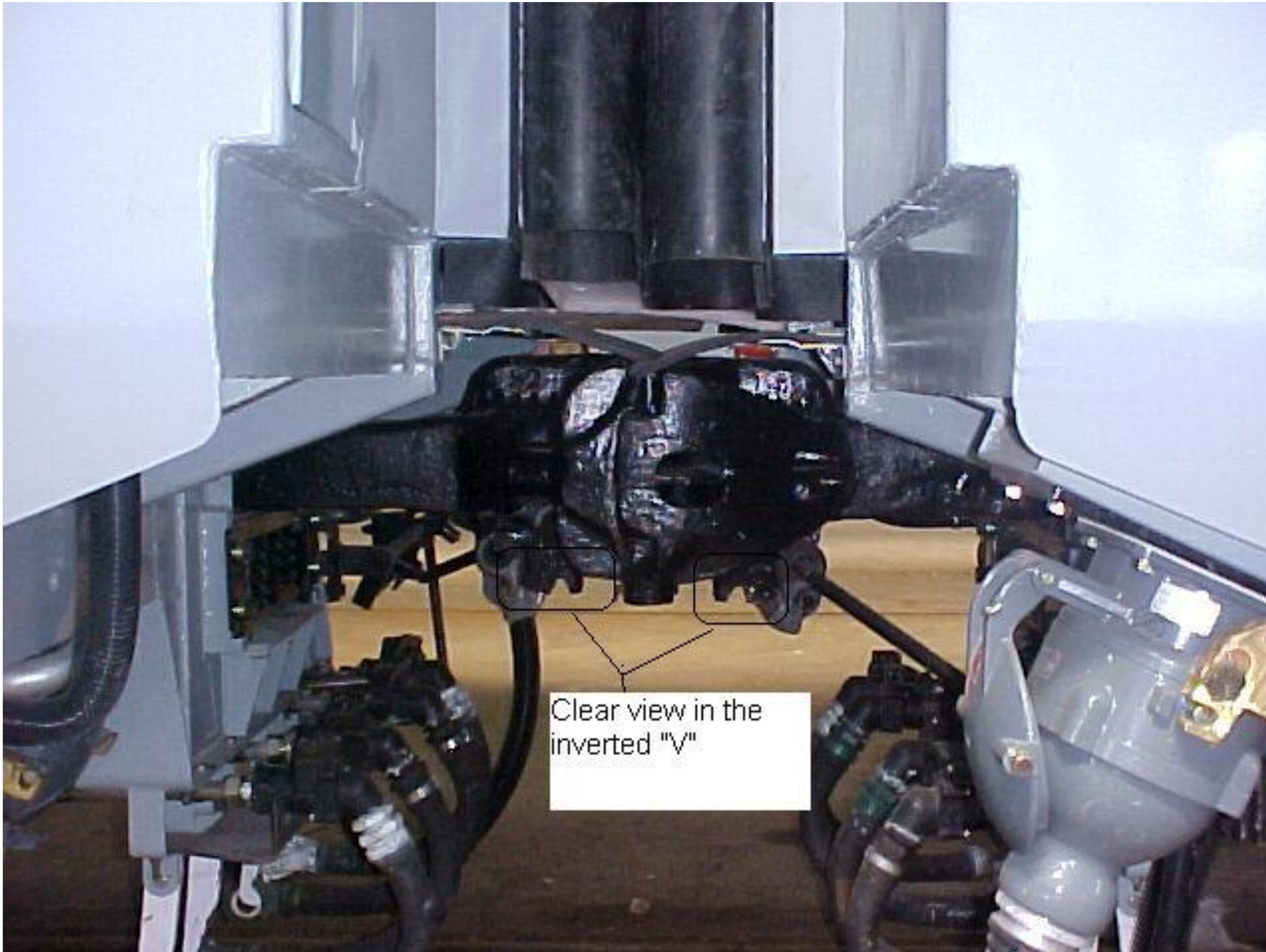




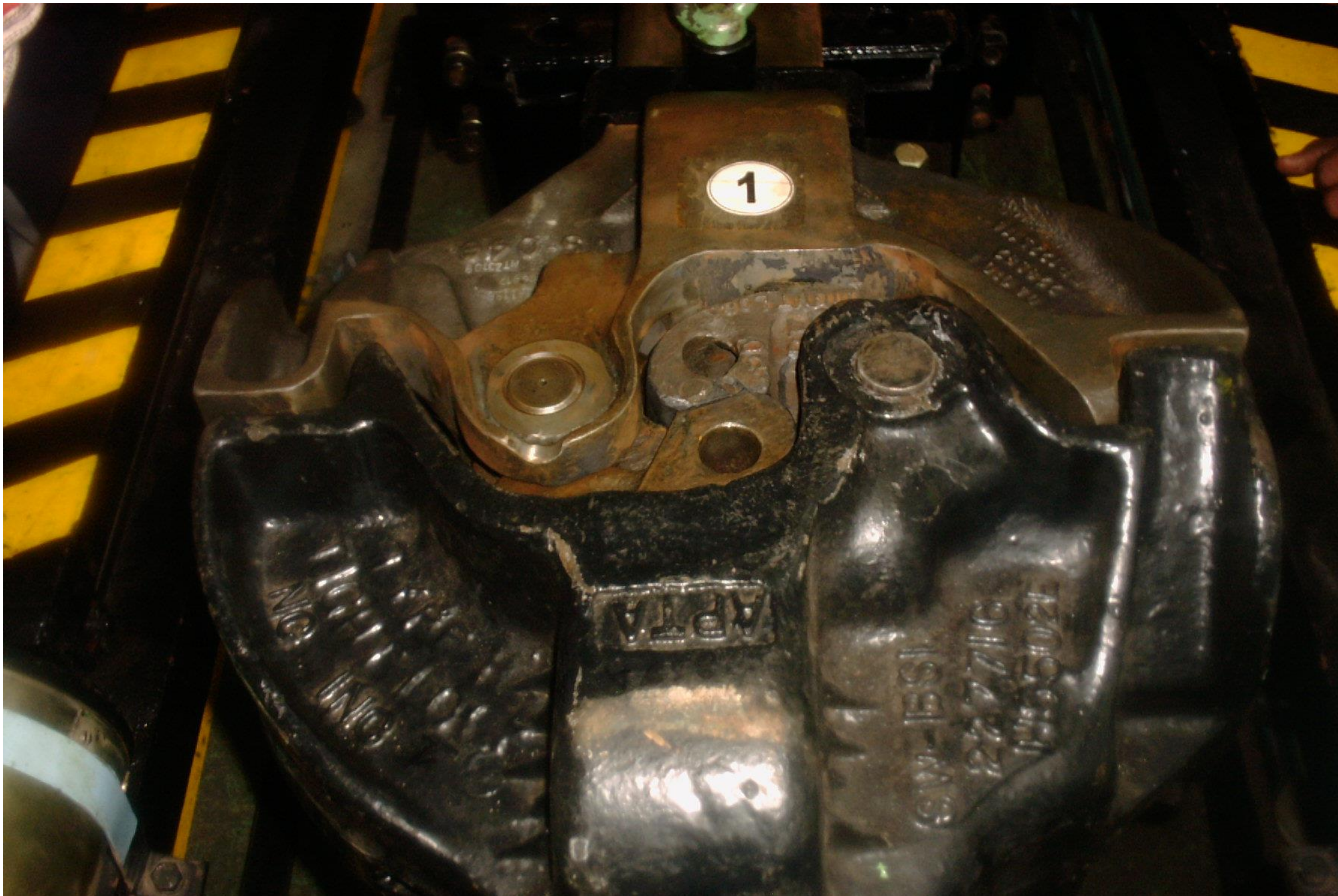
कपलिंग को खोलने का तरीका

- अनकपलिंग से पहले सुनिश्चित करें कि कपलर पर कोई टेन्साइल लोड नहीं है तथा लीवर फ्री है।
- टेल–टेल की पोजीशन चेक करें।
- अनकपलिंग के लिये मैनुअल अनकपलिंग डिवाइस को खोलें।

- रोटेटिंग लाकिंग स्क्रू को स्पेशल की के द्वारा खोलें। हैंडिल को उठायें और हॉरिजेन्टल पोजीशन तक क्लाक वाइज घुमायें तथा बाहर खींचें।


Clear view in the
inverted "V"

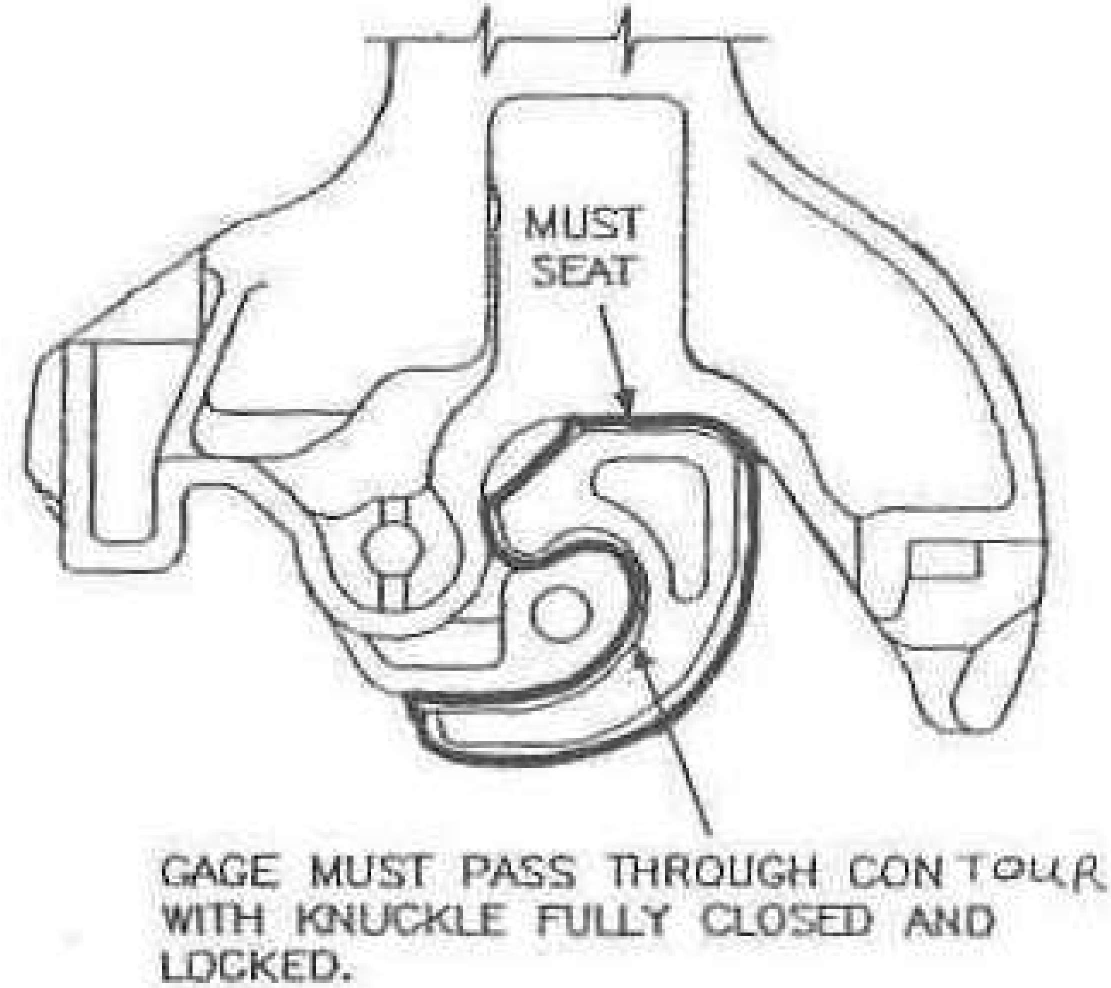
ए0आर0आर0 टाइप एच कपलर कपुल्ड कंडीषन में



रिस्ट्रिक्टर लोको एवं कोच के बीच फिट होता है जो वर्ट्रिकल मूवमेन्ट को रोकता है

स्क्रू कपलिंग की तुलना में सीबीसी कपलिंग के लाभ

- आटोमेटिक कपलिंग।
- डिरेलमेन्ट या एक्सीडेन्ट के समय एन्टीक्लाइम्बिंग फीचर।
- अधिक भार क्षमता वाली लम्बी गाड़ियों का कम्पोजीषन संभव।
- ड्राफ्ट एवं बफिंग दोनों फोर्सेज का ट्रान्समिषन संभव।
- अराजक तत्वों द्वारा अनकपल करना संभव नहीं।
- ब्रेकिंग के समय कम जर्क।
- अनुरक्षण की आवष्यकता कम।
- बफर के इन्टरलॉकिंग की संभावनाये समाप्त।


MUST
SEAT
GAGE MUST PASS THROUGH CONTOUR
WITH KNUCKLE FULLY CLOSED AND
LOCKED.

प्रोफाइल गेज

धन्यवाद

Centre Buffer Coupler

Introduction

- Coupling facilitates inter connection of rolling stock to form a train.
- Earlier design
  - Draft load through screw coupling arrangement
  - Buffing load through side buffers.

Screw Coupling.

- Limitations
  - Haulage of longer train is not possible in freight
  - Climbing of coaches in collisions and derailment.
  - Shunting Staff at Risk.
  - Higher maintenance staff requirement

Centre Buffer Coupler

- Transmits both draft & buffing load between vehicles and to/ from under-frame
- Absorb high frequency forces during impact
- Dissipates low frequency forces to protect the vehicle from damage.
- Multi functional units
  - Draft+Buffing
  - Automatic FP+BP connections

Advantages of CBC

- Safe for shunting staff & reduces time required.
  - Automatic coupling type
  - Quick detachment possible.
- Less staff for uncoupling
- Coach only - Anti-climbing feature is to prevent damage to life & property during accident.
- Prevention of un- coupling in the event of derailment / accident

Types of CBC adopted in IR

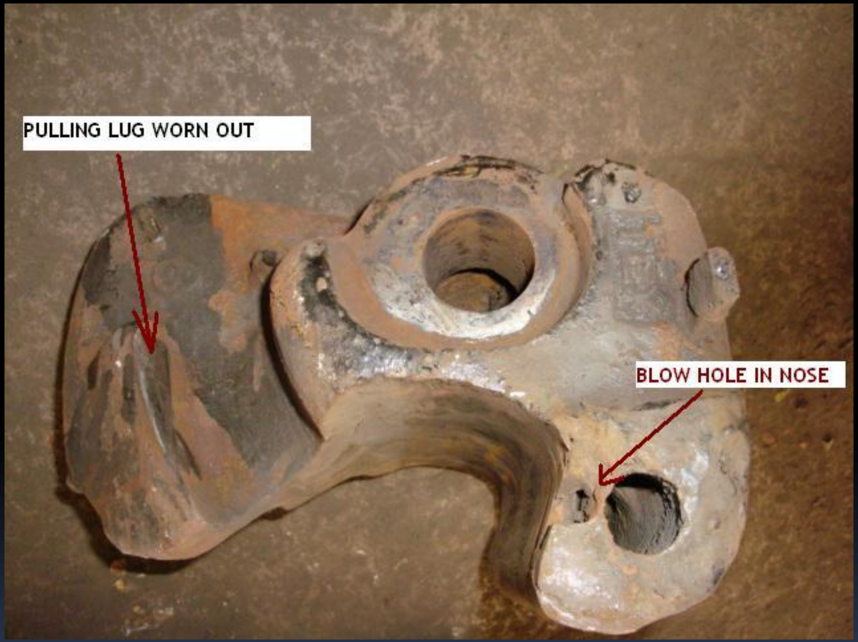
- AAR E/F type used in wagon.
- AAR(H) type Tight lock used in LHB coach.
  - Supplied by M/S Faiveley & M/S Escorts
- Dellner Coupler used in LHB coaches
- Rigid Type- Shacku coupler used in EMU.
- Slackless drawbar – BLC wagons
- Transition coupling
- Hook type – MG/ NG stock

Main Components of CBC

- Coupler body,Knuckle,Lock
- Knuckle thrower
- Lock lifter assly
- Yoke,Yoke pin,Yoke pin support
- Striker casting
- Draft Gear
- Uncoupling device
- Back stop.

Coupler for Wagon

Knuckle



Knuckle

- Fitted with coupler head.
- Used to couple two coupler heads of two coaches/wagons
- NO repair work.
- Always replace by NEW one.

Lock

- Fitted with coupler head.
- After assly of two coaches, it locks the both coupler heads

Lock Lifter Assly

- Fitted with coupler head.
- Used to lift the lock during uncoupling.
- Toggle,Lock lift lever connector,Lock lift lever hook.

Striker Casting

Knuckle Thrower

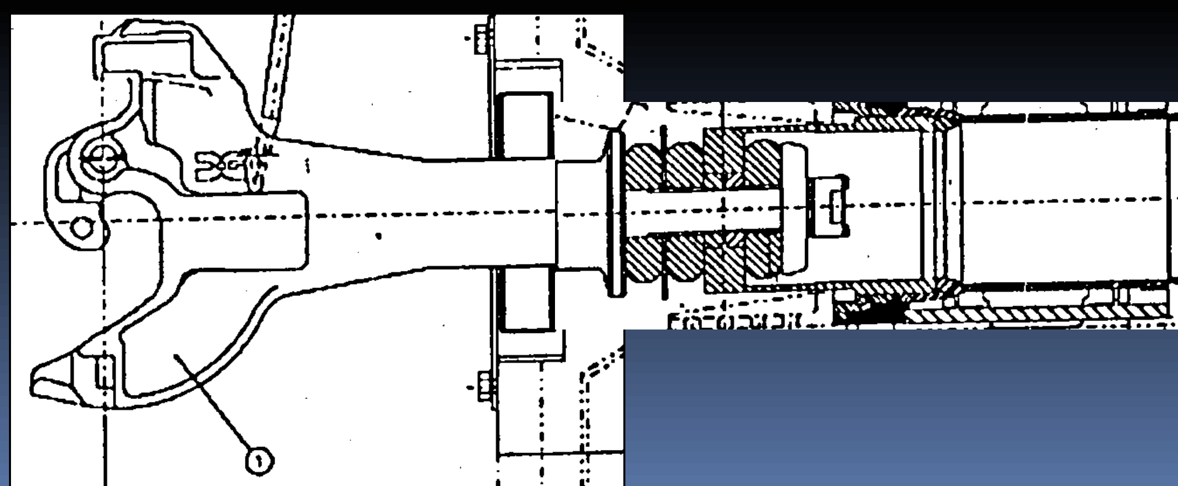
CBC used in LHB Coach

- AAR(H) type tight lock coupler
  - Couple-ability with E type coupler.
  - Anti-climbing feature in built.
- ASF-Key Stone made Draft Gear which was earlier fitted in coach is obsolete now.
- At present,supplied by M/S Faiveley & M/S Escorts
- Dellner Coupler from M/S Dellner, Sweden

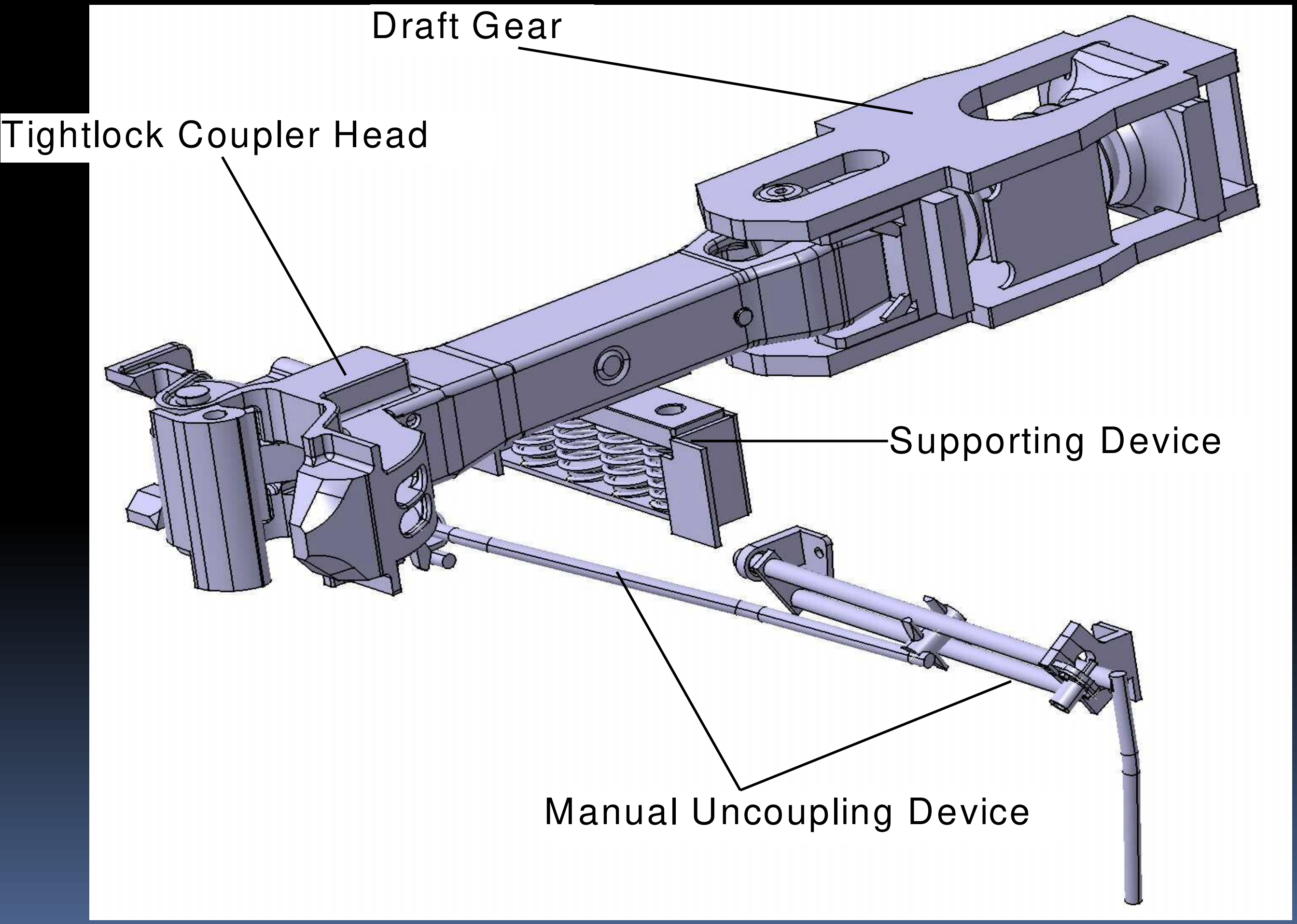
Dellner Coupler Photo

Dellner Coupler

- Single piece coupler
  - No connection between draft gear & coupler shank.
  - No any horizontal pivoting movement.
  - No slack generation due to draft gear action.
  - Tight tolerances-minimum slack 2 mm between heads.

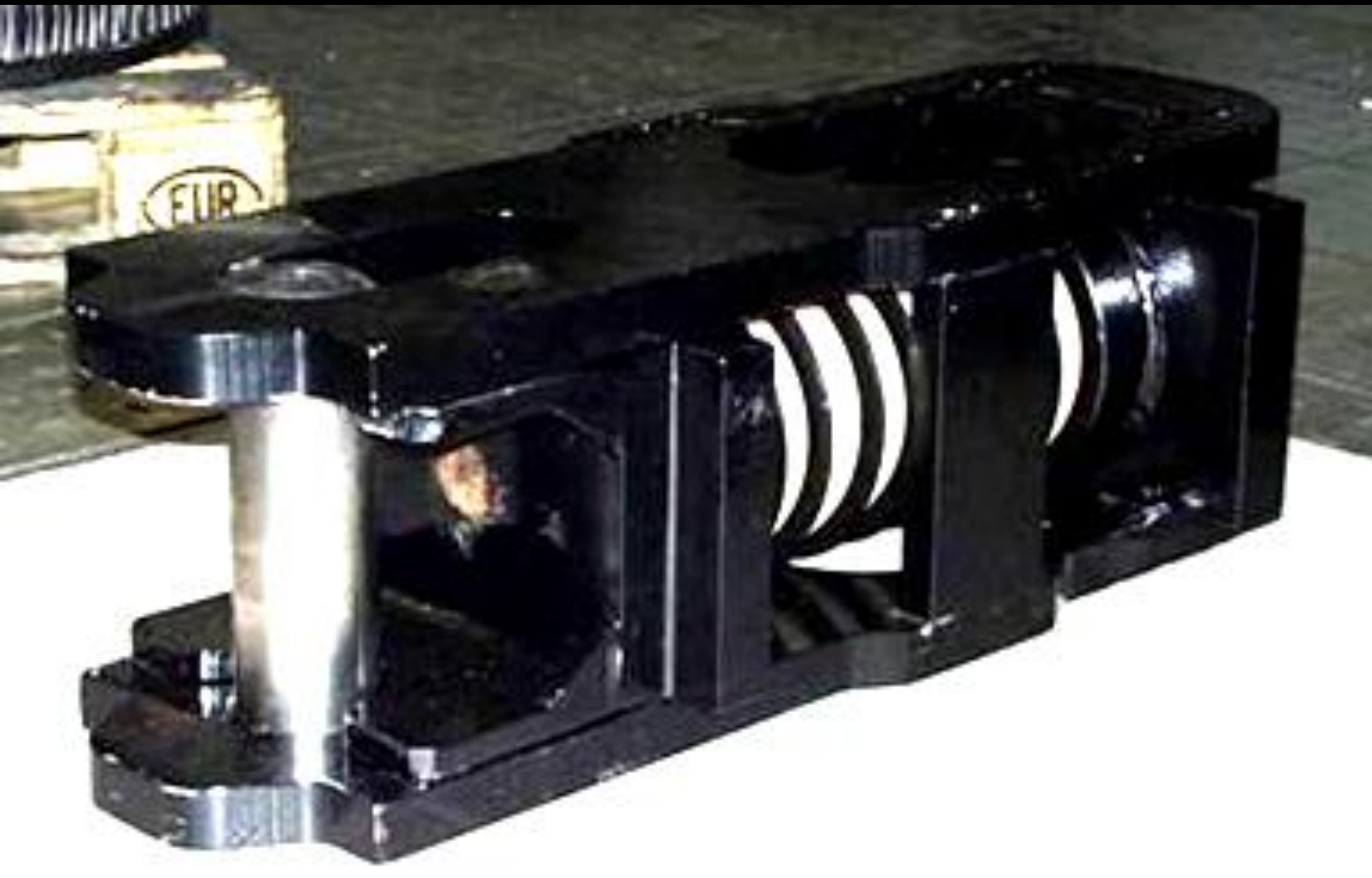


AAR(H) Type Tight Lock CBC



Aikon Draft Gear

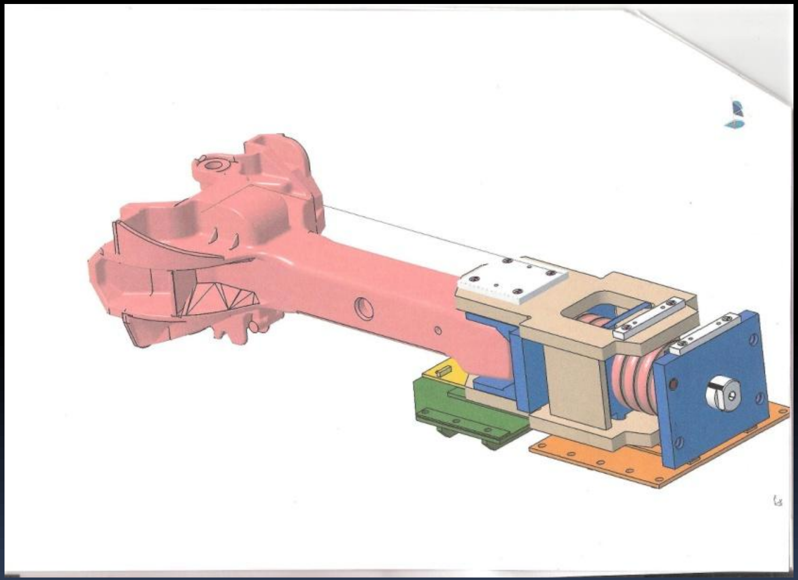
Faiveley Draft Gear



Faiveley Double acting Draft Gear

H-Type tight lock coupler head

Duoble Acting Draft Gear



Maintenance of Draft Gear

Monthly	Check for loose bolts, external damage.
Quarterly	Repeat above checks. Check draft gear seating in the pocket. Examine condition of buff plate. Apply grease if necessary.
Annually	Repeat above checks.
6 – 8 years	Repeat above checks. Check pre-load value. Replace spring column if necessary.

Problems noticed during POH & Solution

- POH of CBC/ Month in LLH-34 Nos.
- DG Rubber Pads damaged,36%
  - Replace
- Longitudinal jerk due to excess pre-load
  - Reduced pre load from 50 KN to 30 KN
- Yoke hole oblonged,18%
  - Replace
- Housing cracked,9%
  - Replace

Coupler Heads

Faivley made

Escourt made

Problems Noticed & Solution

- Coupler body cracked,9%
  - Replace.
- Knuckle worn out,65%
  - Replace
- Yoke Hole worn out,40%
  - Replace

Maintenance of Coupler Head

Monthly	Check tell tale of couplers. Visual check for external damage, condition of wear plate on shank. Replace wear plate if necessary.
Quarterly	Repeat above checks. Coat bare steel areas of coupler head body and knuckle with Molykote D321R (or equivalent) dry spray. **CAUTION: Do not spray on the knuckle locking surface and internal parts like lock etc.**
Annually	Repeat above checks. Check gap between coupler head and knuckle with Jaw gap gauge (NO-GO). If wear out is not acceptable replace knuckle etc., as advised in the maintenance manual. Check by profile gauge (GO). Conduct anti-creep check.
6 – 8 years	Repeat above checks. Overhaul coupler head. Check parts for wear out. Replace if necessary.

Supporting Device

Supporting Device

Problems Noticed & Solution

- Function: To absorb vertical vibration.
- Spring box worn out causes spring height increased,55%
  - Replace
- 100% Nut Bolts worn out causes vertical jerking,hence replaced all nuts & bolts.
- Springs damaged& free hight short,70%
  - Replace

Maintenance of Supporting Device

Monthly	Visual check for external damage. Check height 187.5 mm both sides near the bolts. Tighten the M16 nut to set specified height. Apply grease on wear plate. Check condition of wear plate. Replace wear plate if necessary.
Quarterly	Repeat above checks.
Annually	Repeat above checks.
6 – 8 years	Repeat above checks. Check compression spring for loss of pre-load. Replace if necessary.

Operating Handle

Operating Handle

Problems Noticed & Solution

- Operated from both sides in coach & wagon.
- Bolts worn out/corroded,100%
  - Replace
- Bracket corroded,100%
  - If excess, then replace
- Bolts to be tightened with specific torque value.
- Check groove in bore of the bracket

Maintenance of Operating Handle

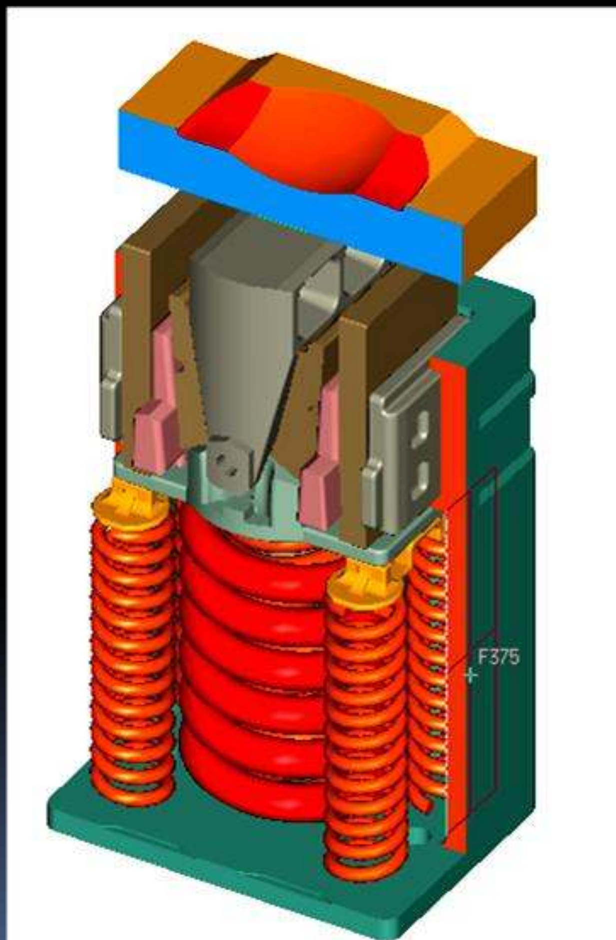
Monthly	Visual check for external damage, loose bolts etc. Apply grease on the slide and slide rods.
Quarterly	Repeat above checks.
Annually	Repeat above checks. Check wear on slide, slide rods and bearings. Replace if wear is excessive.
6 – 8 years	Repeat above checks.

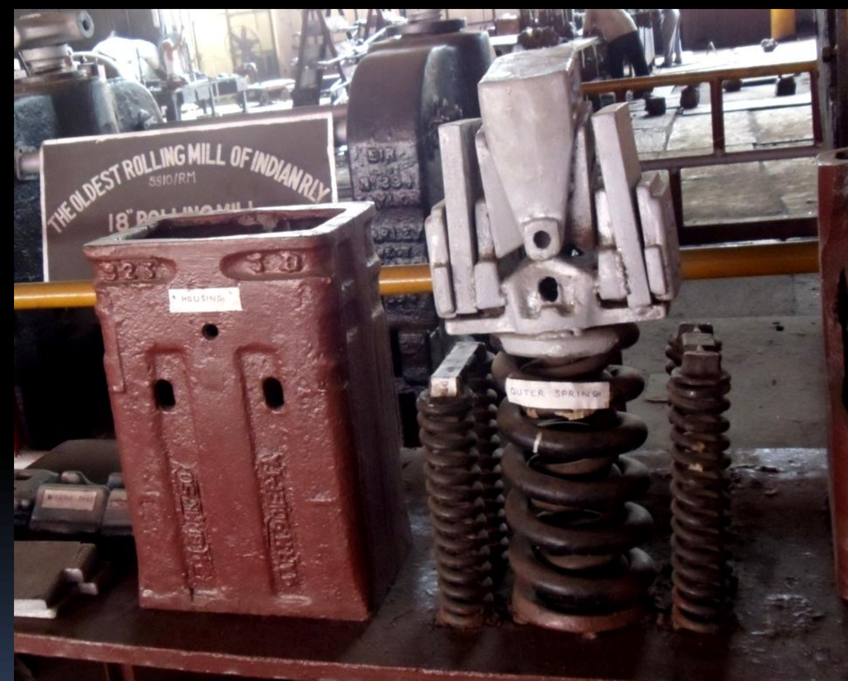
CBC used in Freight Stock

- AAR E/F Type coupler is used in wagons.
- HT Draft Gears are used-MK-50 & RF-361
- Supplied by M/S Jupiter & Alloy Steel India Ltd(JASIL)
- M/S Tex Meco
- M/S FAS
- Draft Gear to be fitted with yoke

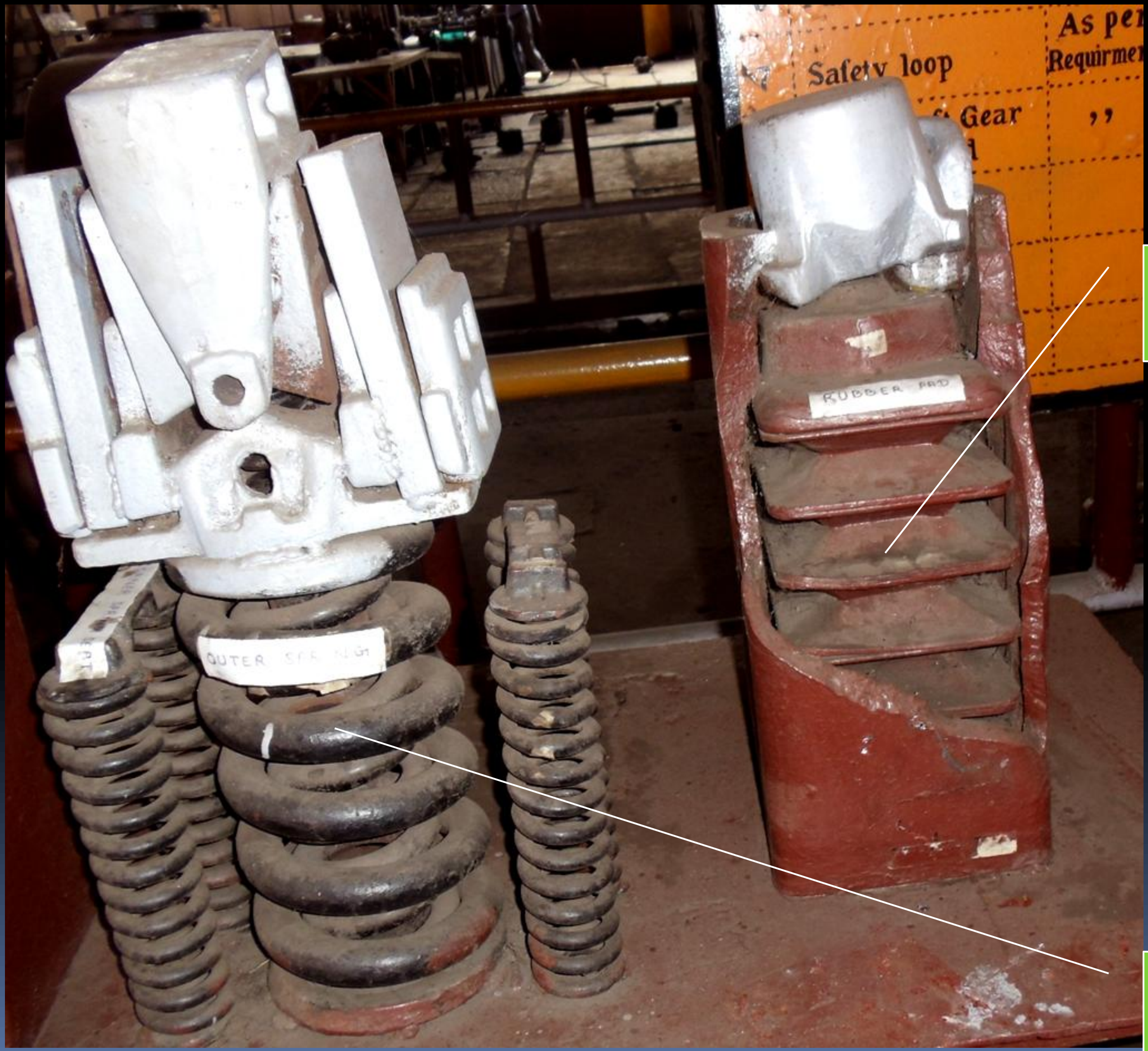
High Capacity Draft Gears

MK-50 Draft Gear





MK-50 & RF-361 Draft Gear



RF-361

MK-50

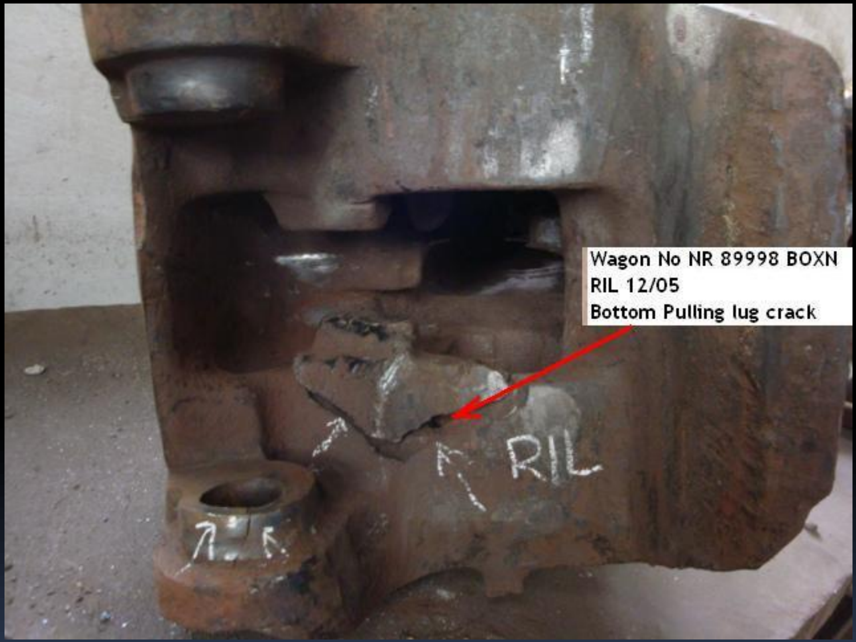
Design Features of Draft Gears

Particulars	MK-50	RF-361
Weight	170 Kg	138 Kg
Capacity	5385 Kgm	5725 Kgm
Travel	81.5 mm	67.8 mm
Reaction force	269 T	232 T
Performance efficiency	23.7 %	36.6 %
Energy absorption	86 %	79.6 %

Draft Gears of BoxN HL

Couplers of BoxN HL


Location of Crack in Coupler



MK-50 Draft Gear Failure & Solution

- Housing cracked,9%
  - Replace
- Spring damage/ broken/bent,100%
  - Replace
- Yoke hole worn out,55%
  - Replace
- Yoke body cracked,15%
  - Replace

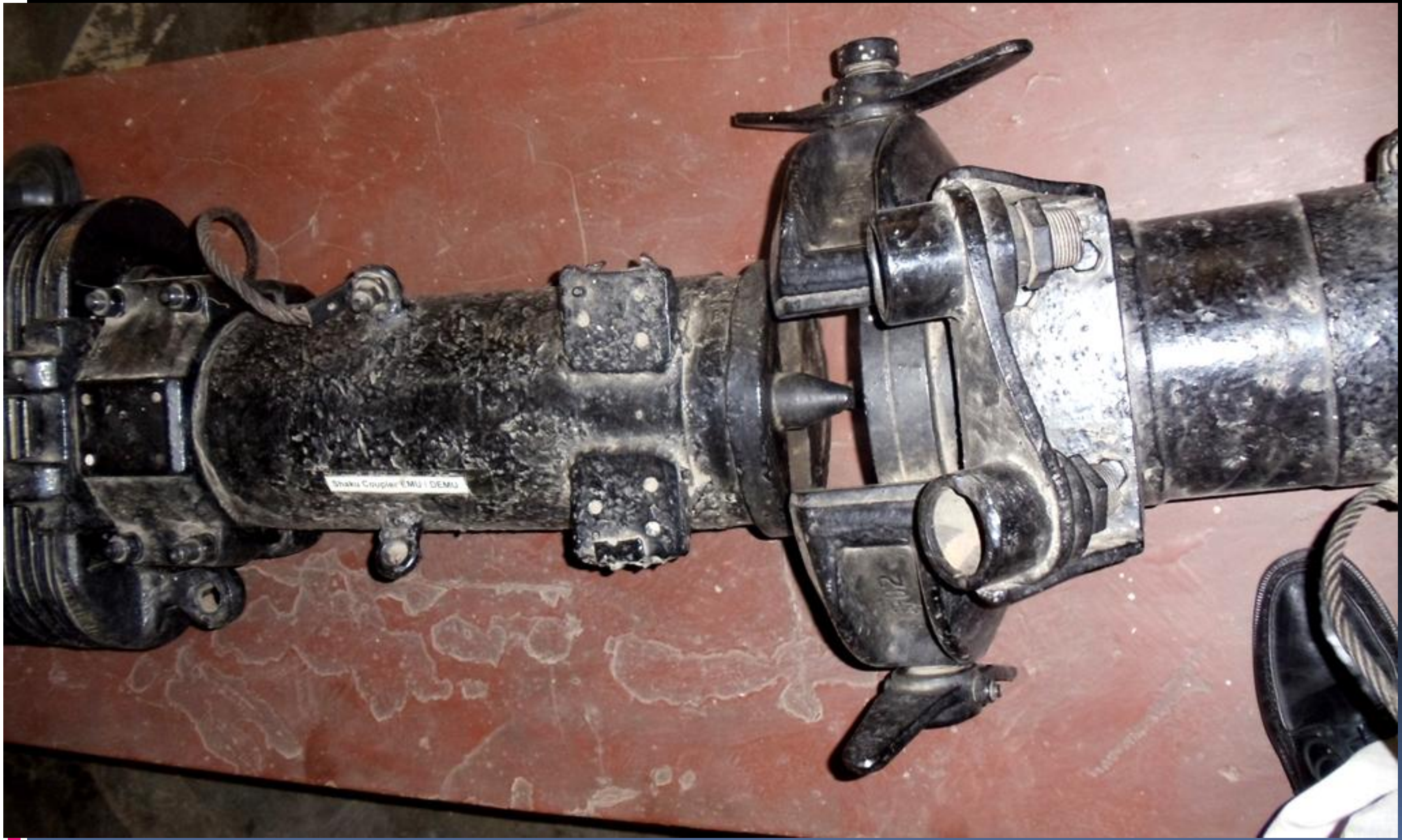
RF-361 Draft Gear Failure & Solution

- Housing cracked,10%
  - Replace
- Rubber pad damage,65%
  - Replace
- Rubber pad thickness less than 54 mm,20%
  - Replace
- 30° shoe broken/ worn out,15%
  - Replace

CBC used in EMU

- Shacku wedge lock coupler is used in EMU
- Rubber pad damaged,65%
  - Replace
- Yoke hole bush worn out/elongated,100%
  - Replace
- Coupler body damaged,36%
  - Replace
- Housing cracked,15%
  - Replace

Shacku Coupler

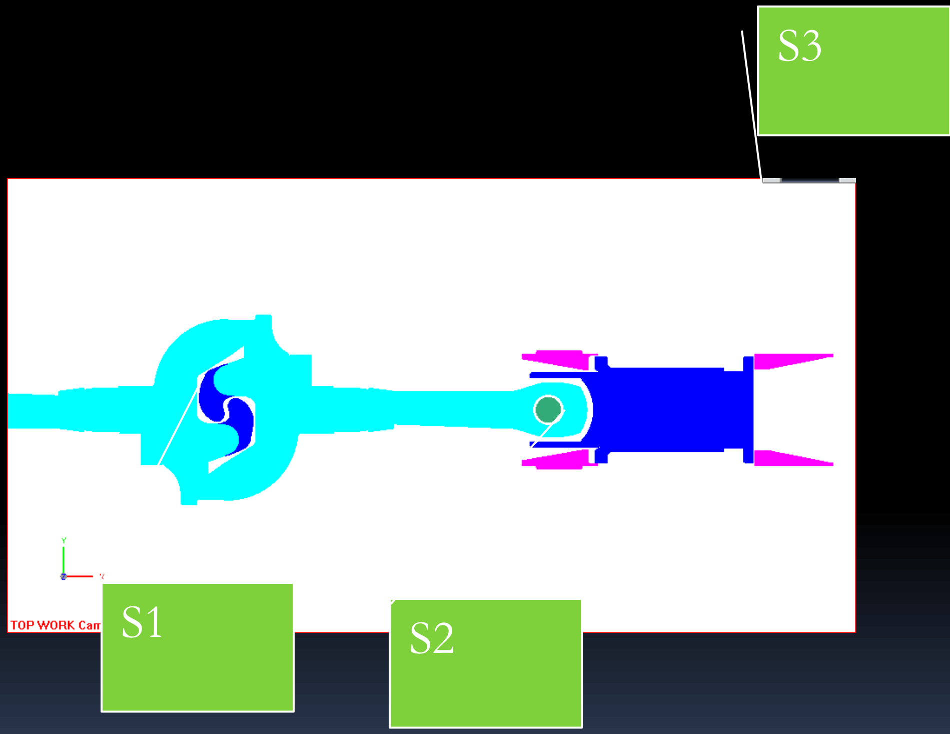


Reasons for the Jerks

- Slack between coupler heads
- Slack in the coupler & draft gear connection due to wear
- Successive movement will produce jerk
- High response time of the draft gear
- Loss of preload due to wear of friction springs

Total Possible Slack

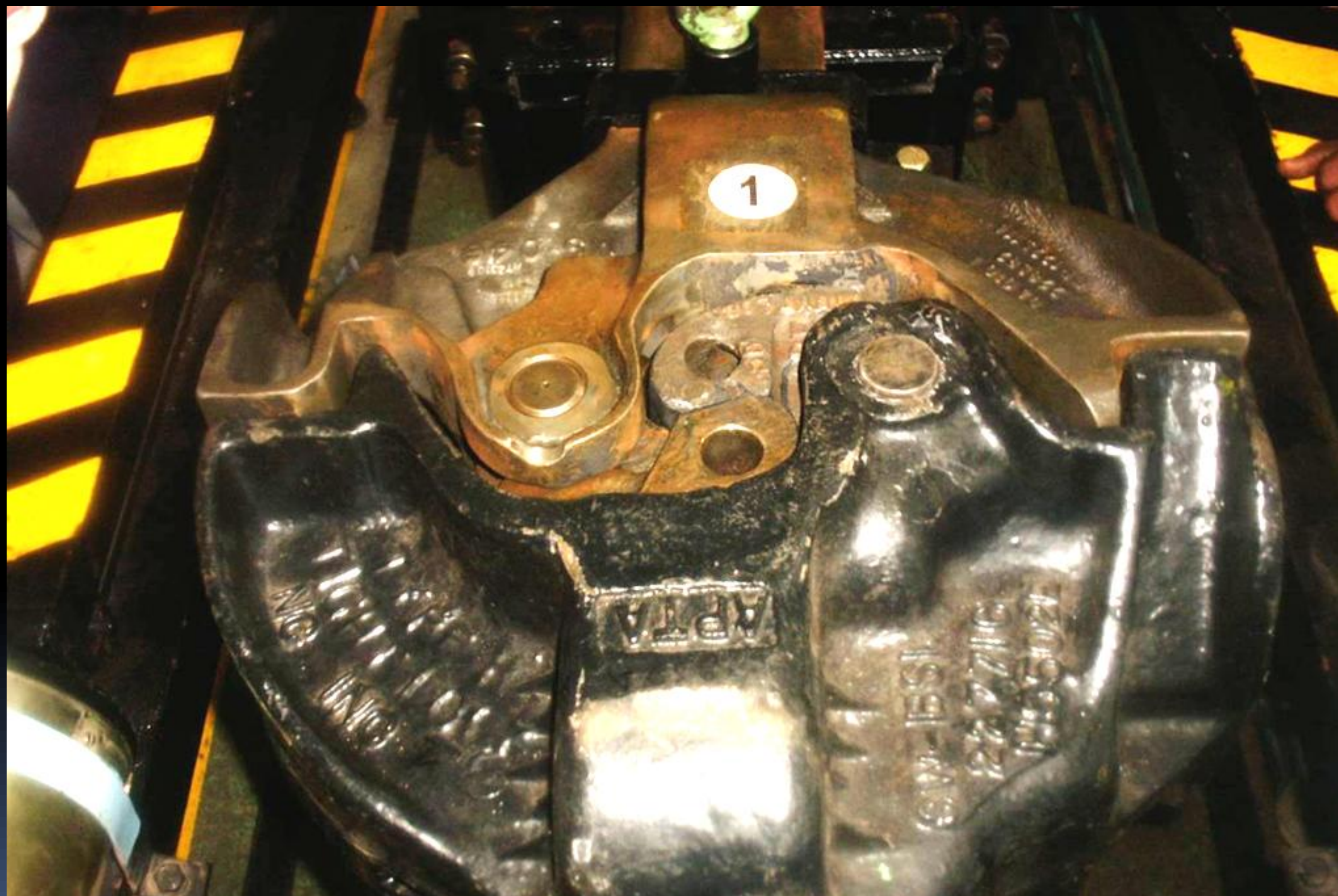
- S1-Between coupler knuckles
- S2-In the coupler and draft gear connection
- S3-Due to draft gear action



Measures Adopted

- AAR(H) type tight lock coupler is used in LHB to minimise slack
- Reduced Pre-Load up to 30 KN.
- Use Dellner Coupler
- Check yoke hole, if oblong found replace it
- Check rubber pad of draft gear
- During POH, preload setting to be done

AAR(H) type coupler in coupled condition



Factors affecting the performance of CBC

- **Stroke: longer stroke will generate lower pressure .**
- **Low end-pressure results in low vaule of deceleration during impact.**
- **Initial pre compression**
  - **A smooth operation is achieved by giving an initial compression which minimise low intensity buffing & draft load**

Continued

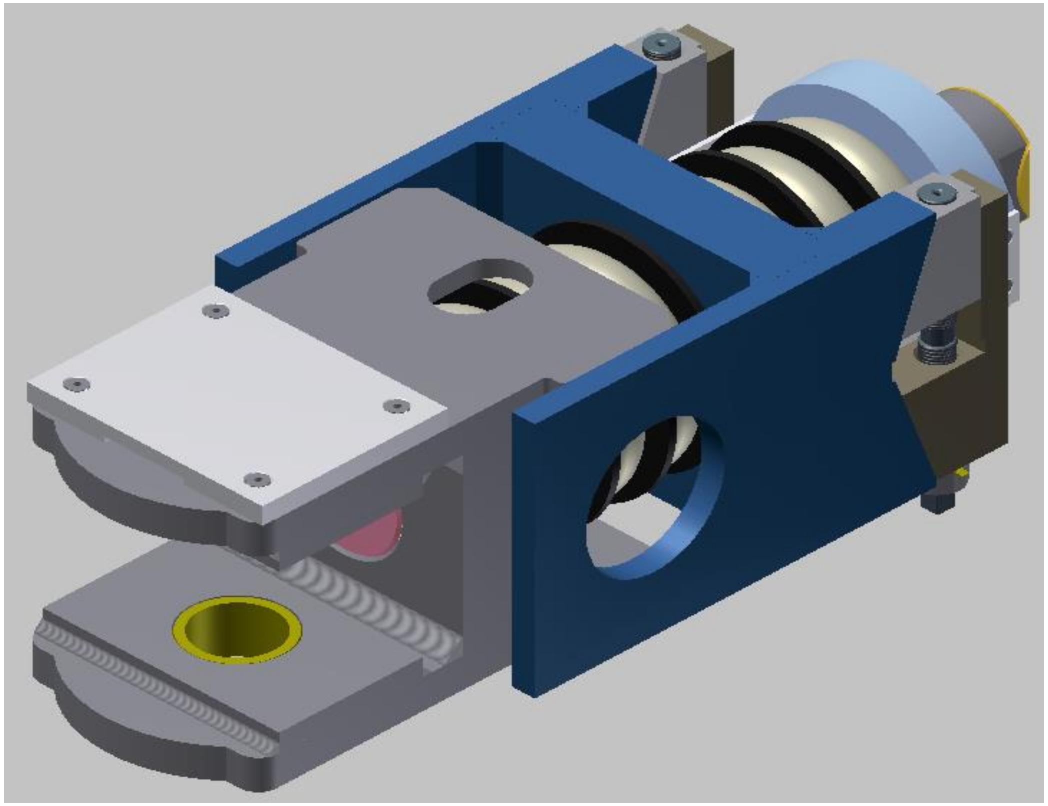
- Amount of recoil: The value of recoil should be as low as possible in order to avoid high reaction force
- . The % of recoil varies widely with different materials.
  - Very high in helical spring
  - Very low with friction & hyd gears

Restrictor

- **To prevent un coupling of loco & power car**

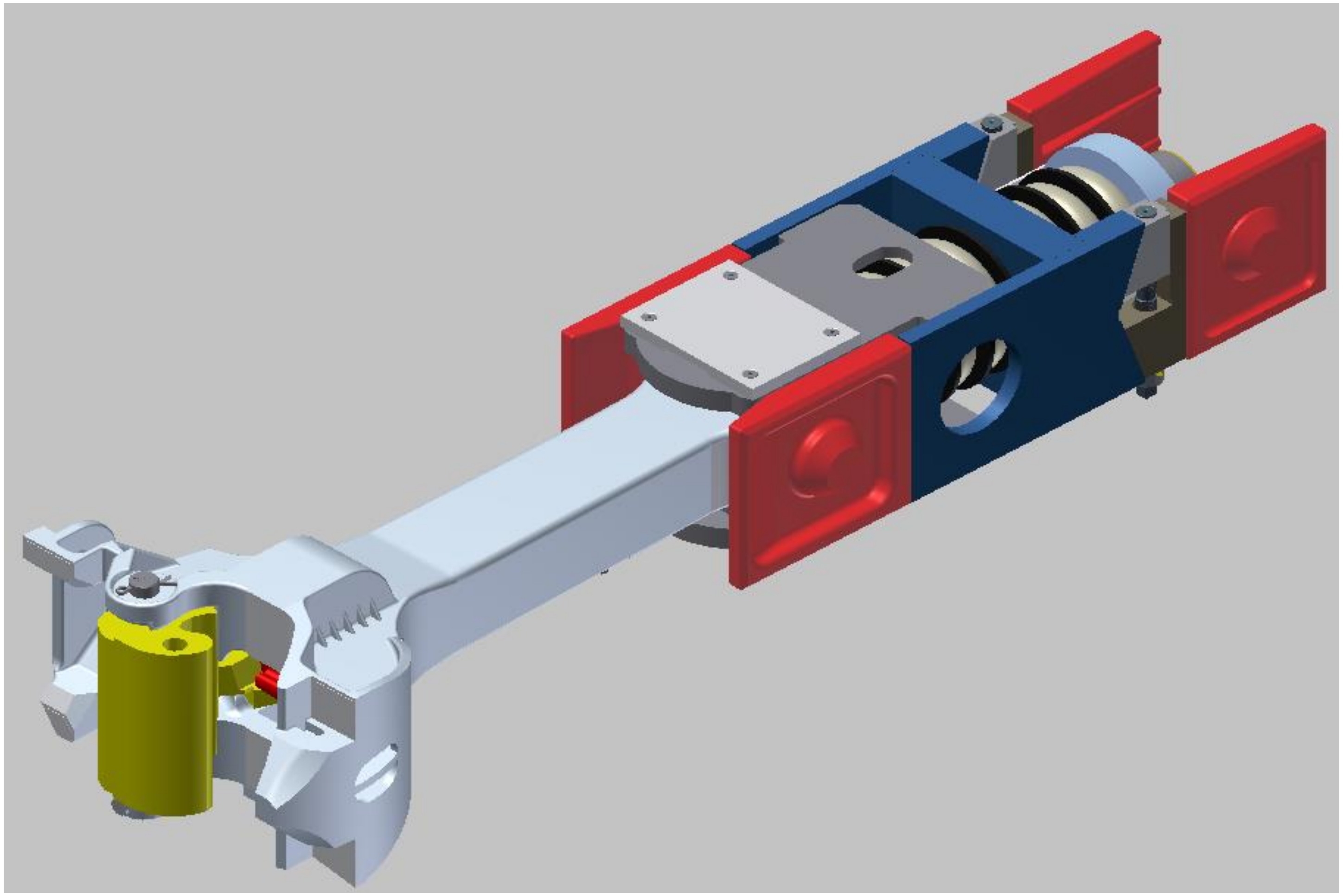
THANK YOU

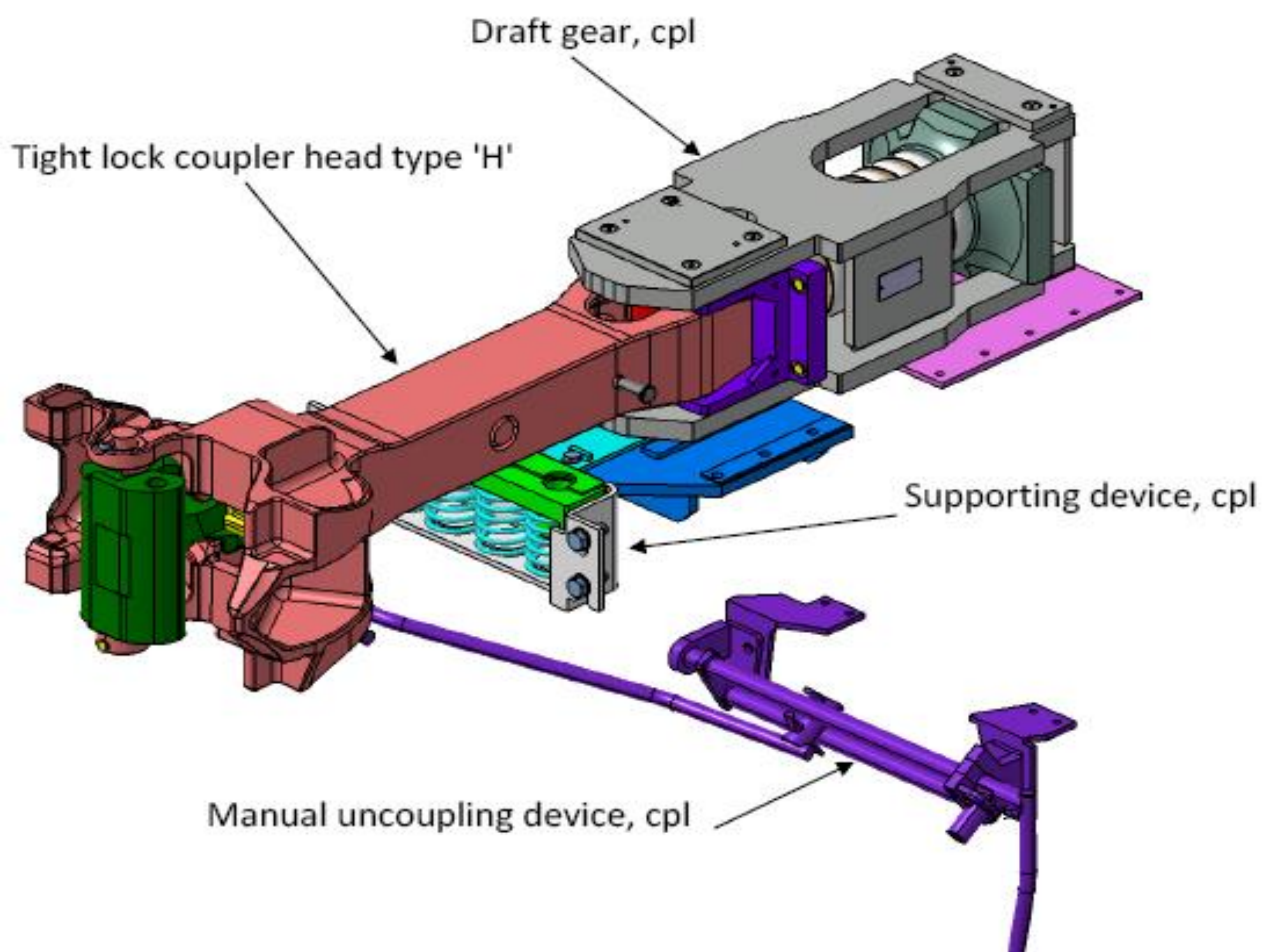
BALANCED DRAFT GEAR

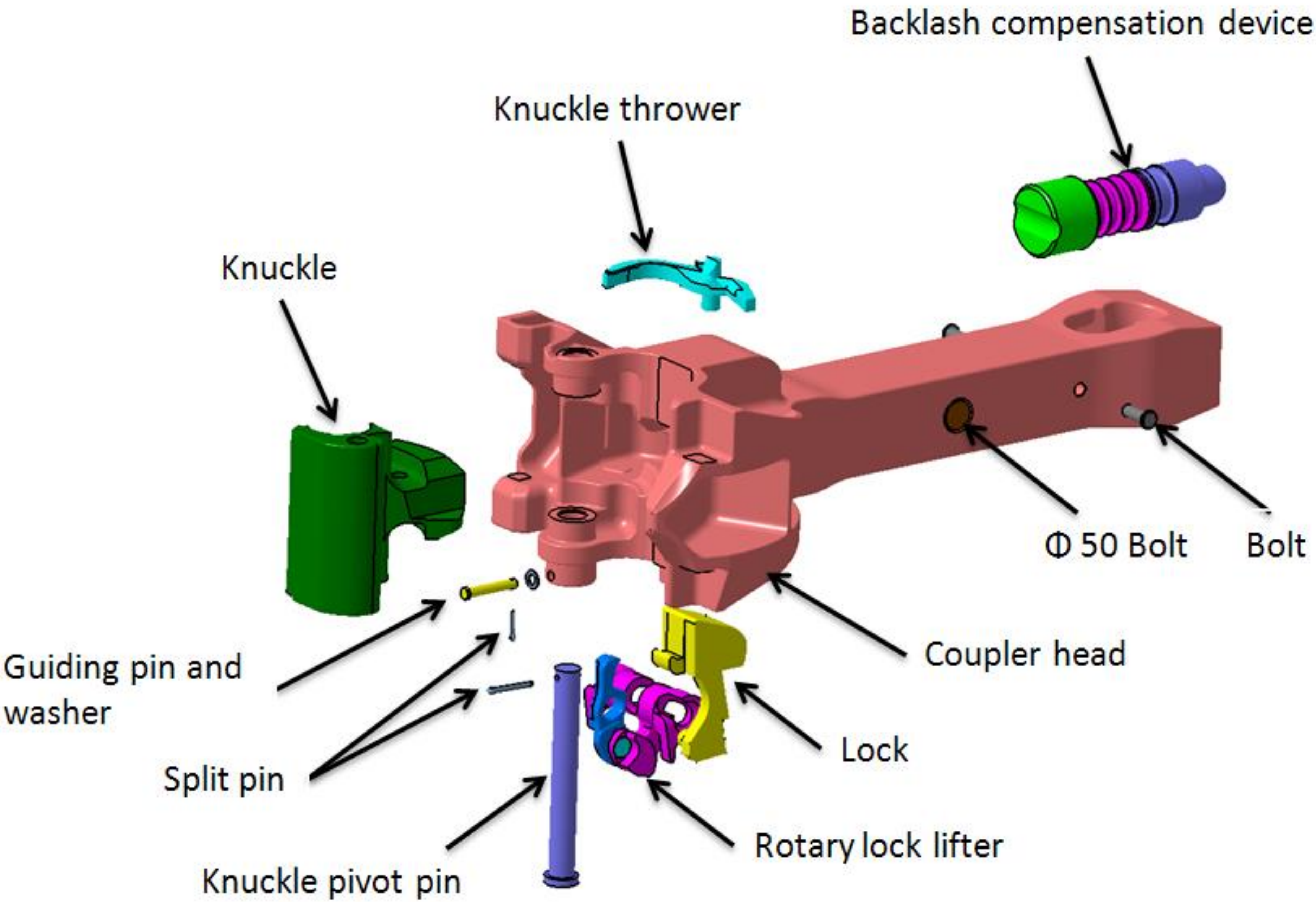


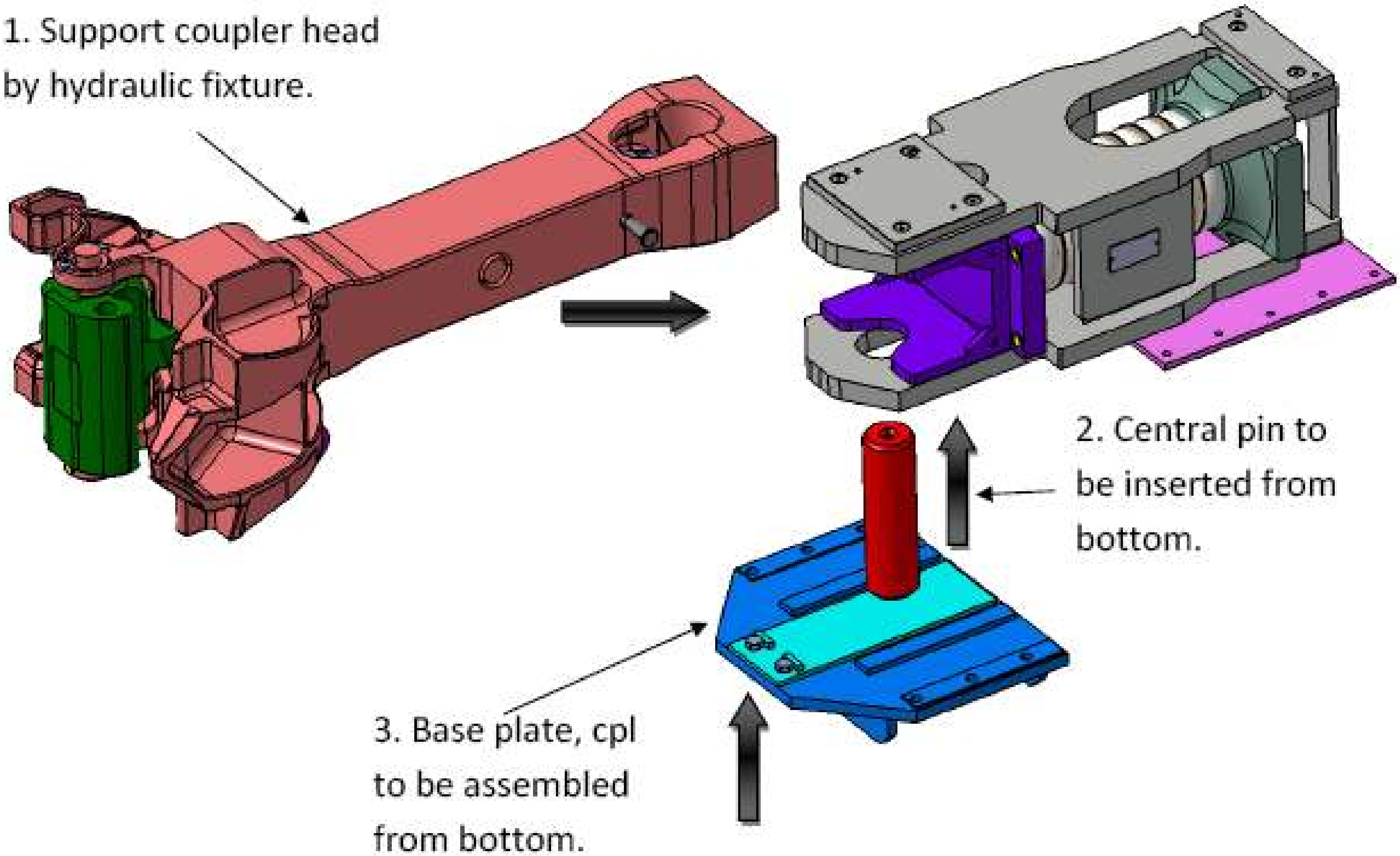
Rajendra Kushwaha
Inst./C&W

AAR H coupler with BDG




Draft gear, cpl
Tight lock coupler head type 'H'
Supporting device, cpl
Manual uncoupling device, cpl


Backlash compensation device
Knuckle thrower
Knuckle
Φ 50 Bolt
Bolt
Guiding pin and washer
Coupler head
Lock
Split pin
Rotary lock lifter
Knuckle pivot pin



Mounting of the Coupler head

- **IR introduced High Tensile AAR 'H' type Tight Lock Centre Buffer Coupler on passenger coaches with the view to have longer train rakes, higher speed and safety features.**
- **AAR 'H' type Centre Buffer Coupler (CBC) was first time used in 24 imported Alstom /LHB coaches.**
- **The trains fitted with these couplers, when put in service, "Jerks" were observed.**

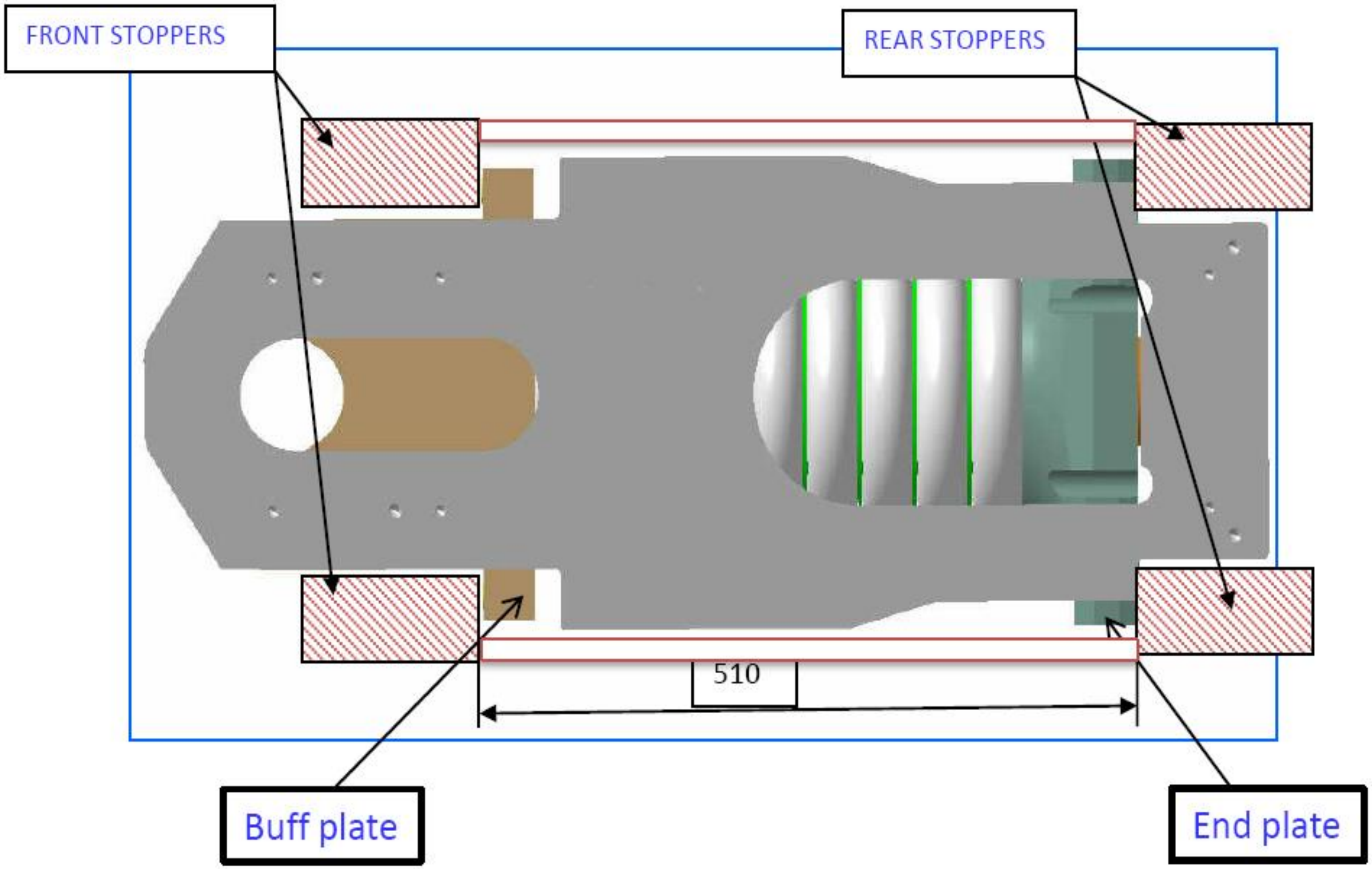
- **The AAR H coupler has been supplied by FTIL and Escorts which are fitted std Draft Gear, all were observed to have Jerks.**

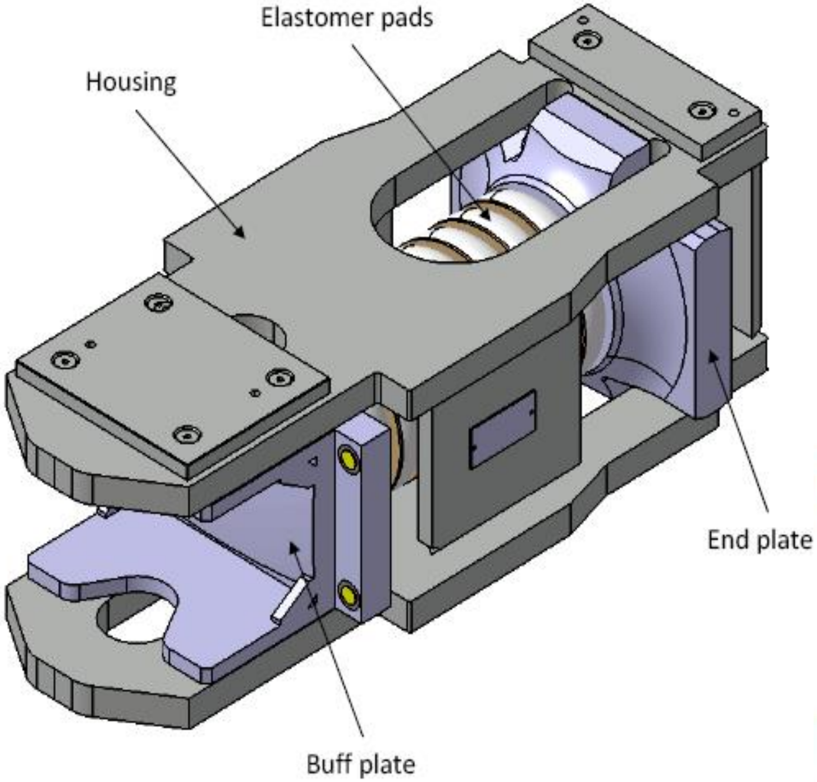
- Longitudinal jerks in mainline coaches equipped with CBC have been a major concern since introduction of CBC.
- Several measures were taken in the past to reduce the longitudinal jerks but they resulted in minor improvements only.

- The specification of CBC CK-009 (Rev.2) does not specify the type of draft gear. Suppliers are free to supply any type of draft gear such as single pack, twin pack, floating plate or any other design-
- On the basis of a systematic study of design of CBC, a new specification of CBC has been made. In the new specification, balanced type draft gear has been specified.

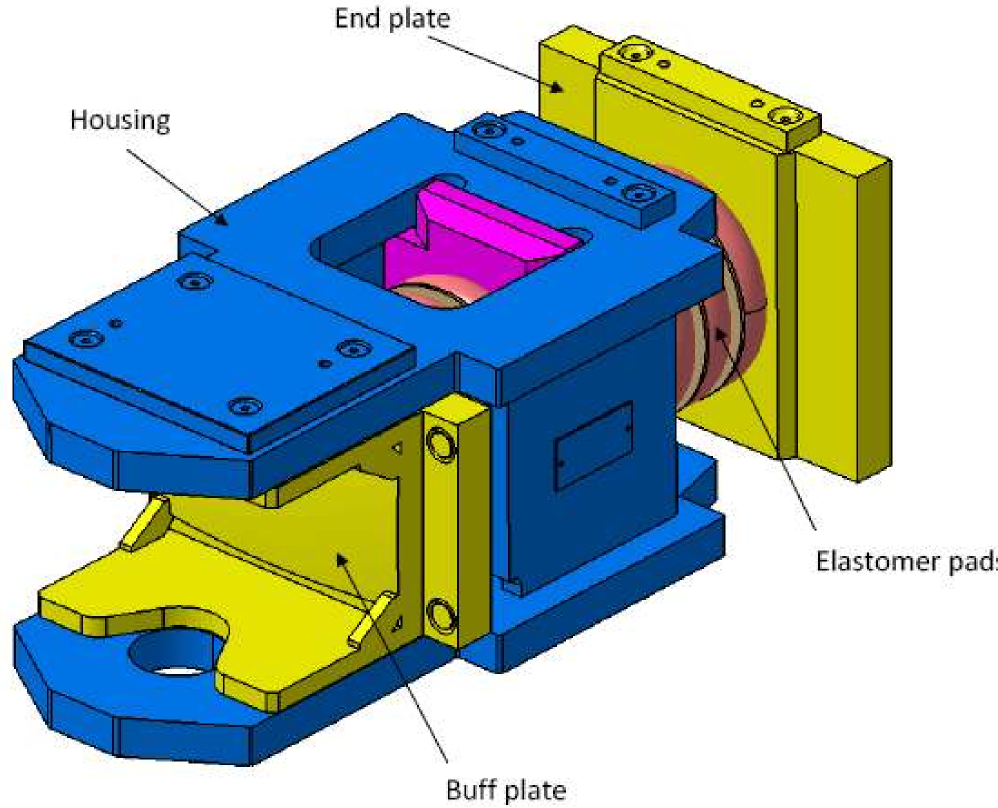
The couplers to this new specification have been mostly supplied to IR by M/s Faiveley, M/s ASF-Keystone and M/s Escorts.

Type of draft gear	Population (Coach sets)	Service Since
Single pack	2560	Year 2001
Twin pack	325	Year 2004
Floating Plate	30	February 2010
Balanced type	22	February 2011


FRONT STOPPERS
REAR STOPPERS
510
Buff plate
End plate



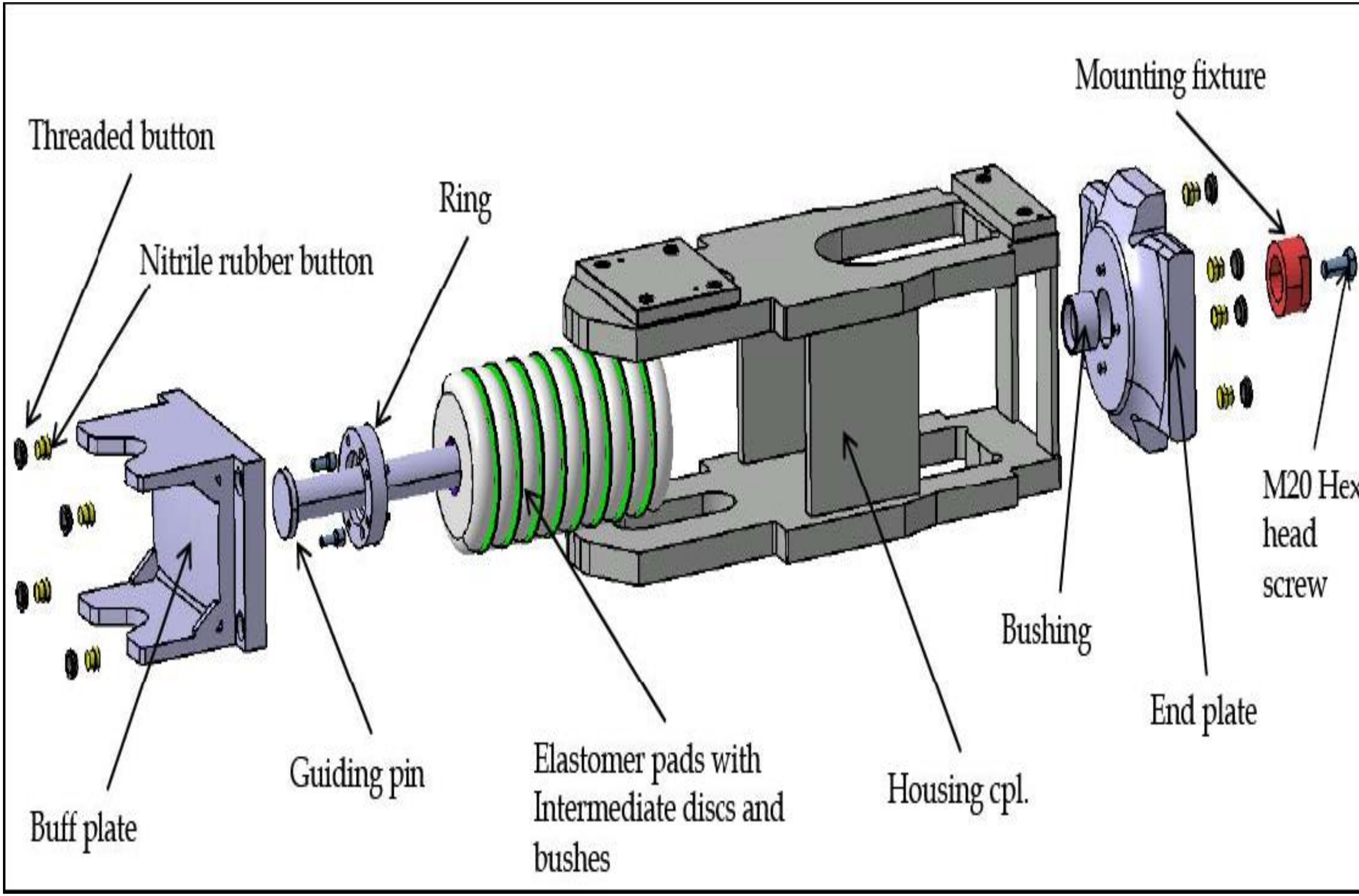
Draft gear, cpl



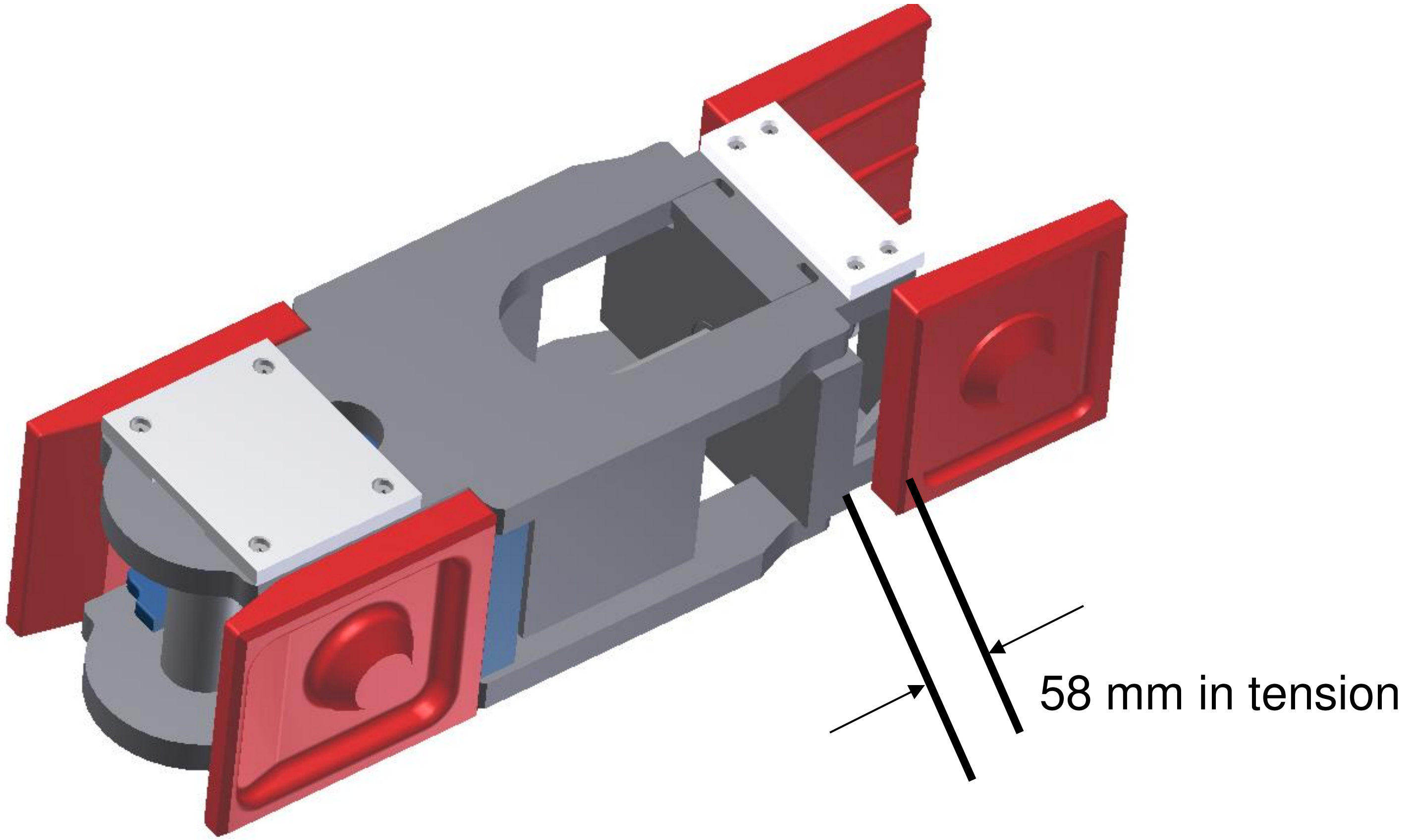
Draft Gear, cpl. with Floating plate, Type BC 80/45F

- **Single Pack Draft Gear**
- In this type of draft gear, same set of draft pads is used in buff as well as in draw mode.

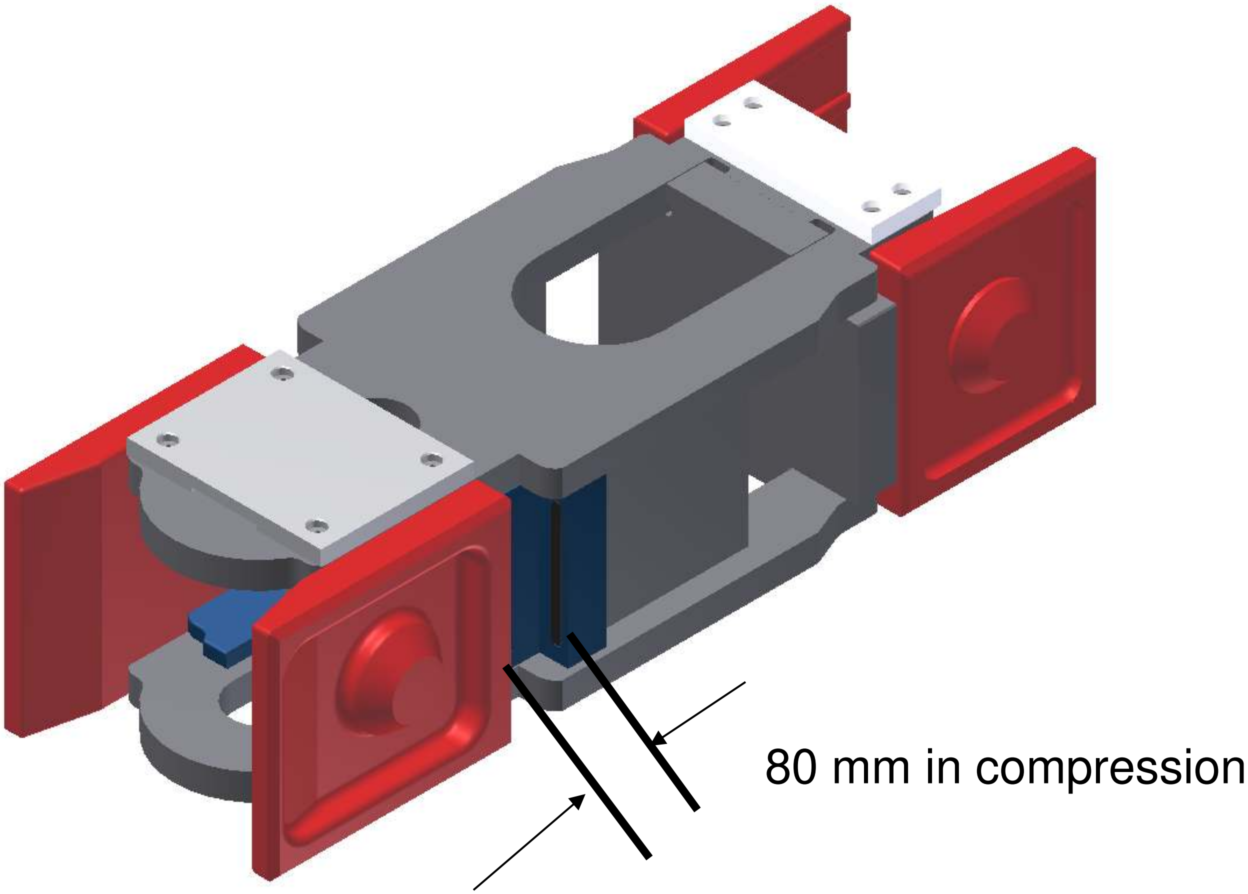
- In dynamic condition, the front follower leaves the front stopper during buff and the rear followers leaves the rear stopper during draw modes and hits them on load reversal.

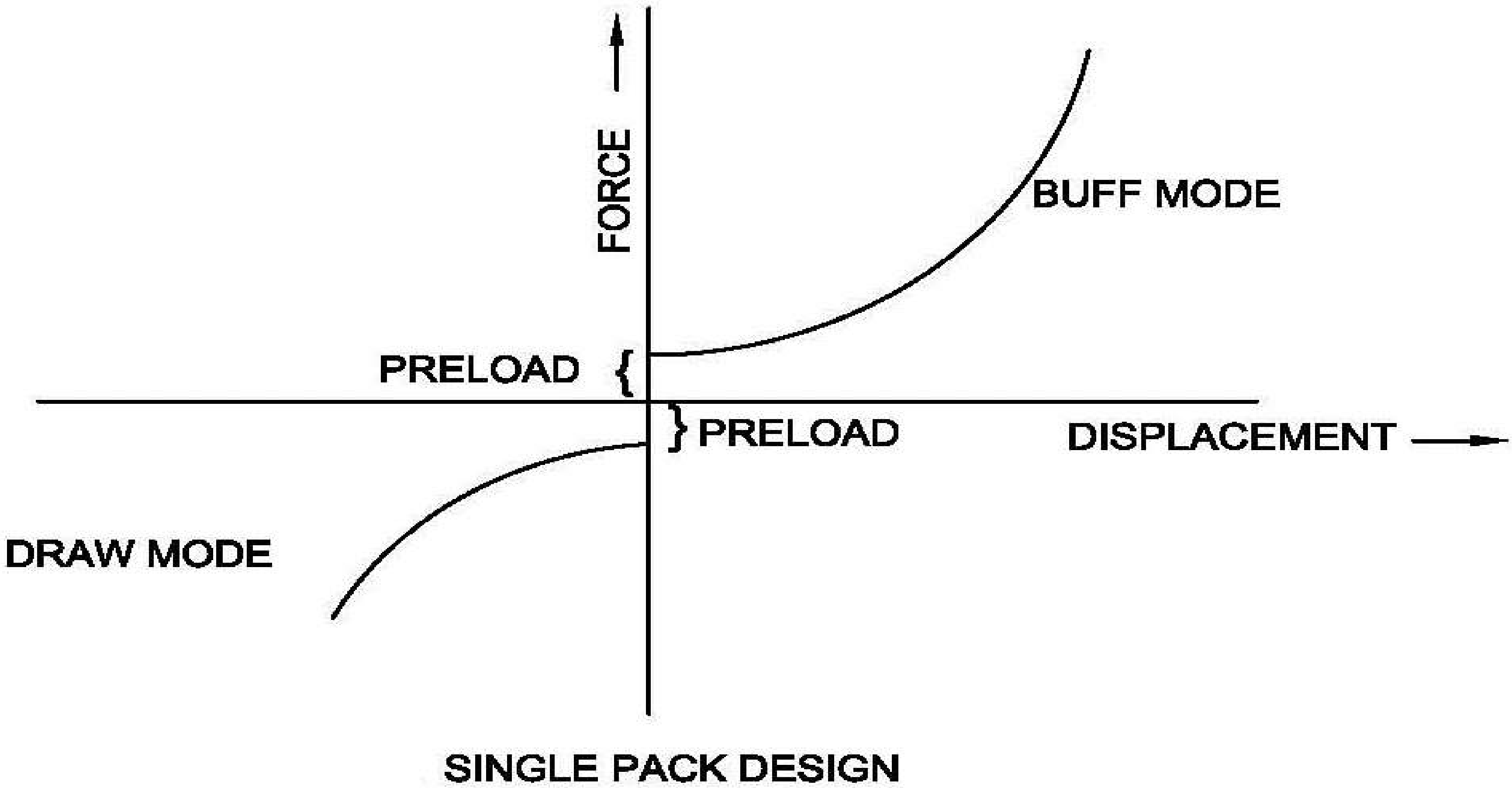

Mounting fixture
Threaded button
Ring
Nitrile rubber button
M20 Hex head screw
Bushing
End plate
Guiding pin
Elastomer pads with Intermediate discs and bushes
Housing cpl.
Buff plate

STANDARD DRAFT GEAR IN TENSILE MODE



STANDARD DRAFT GEAR IN COMPRESSION MODE





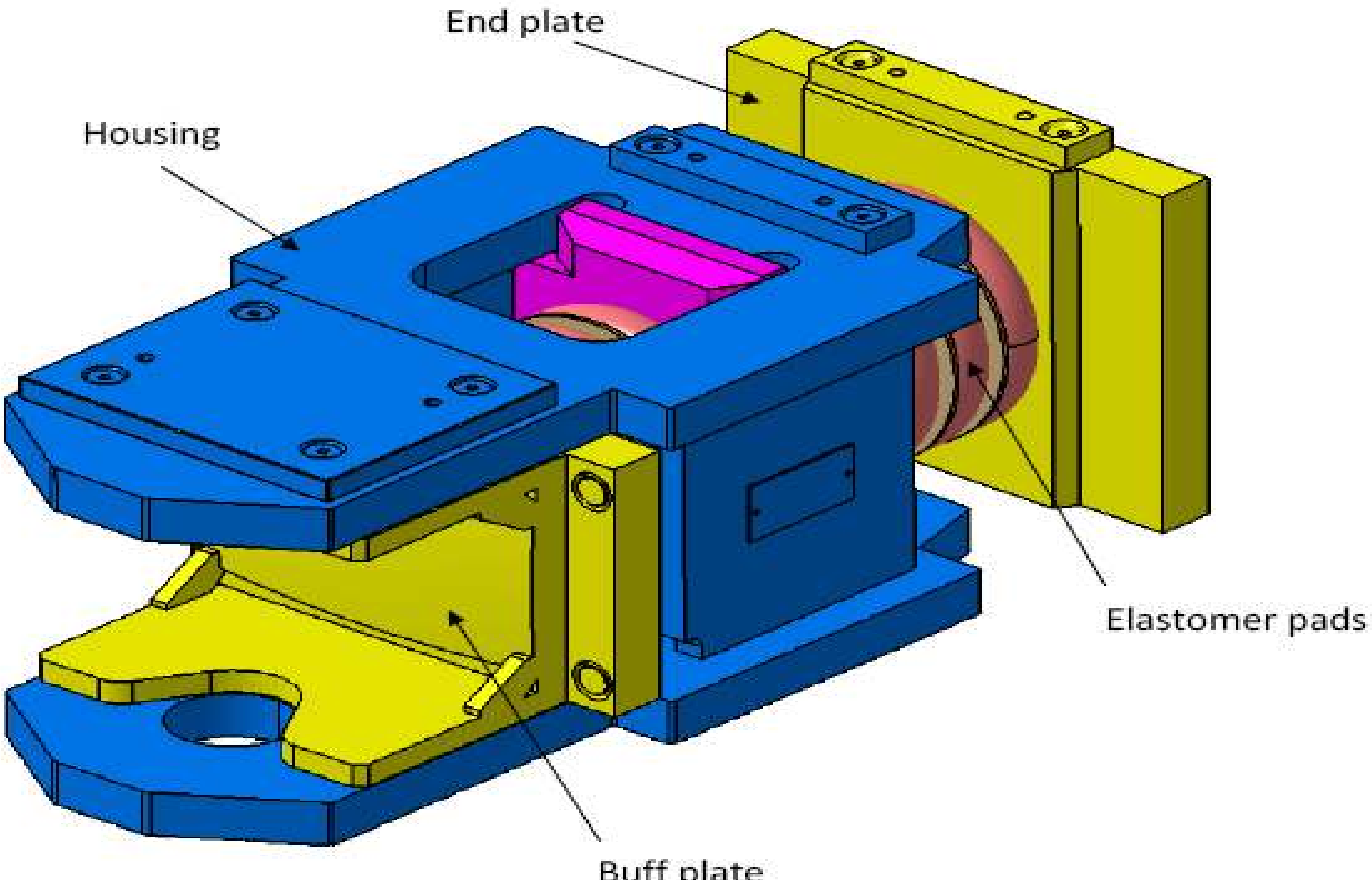
Travel Characteristics of Single Pack Draft Gear

Floating Plate or Twin Pack Draft Gear

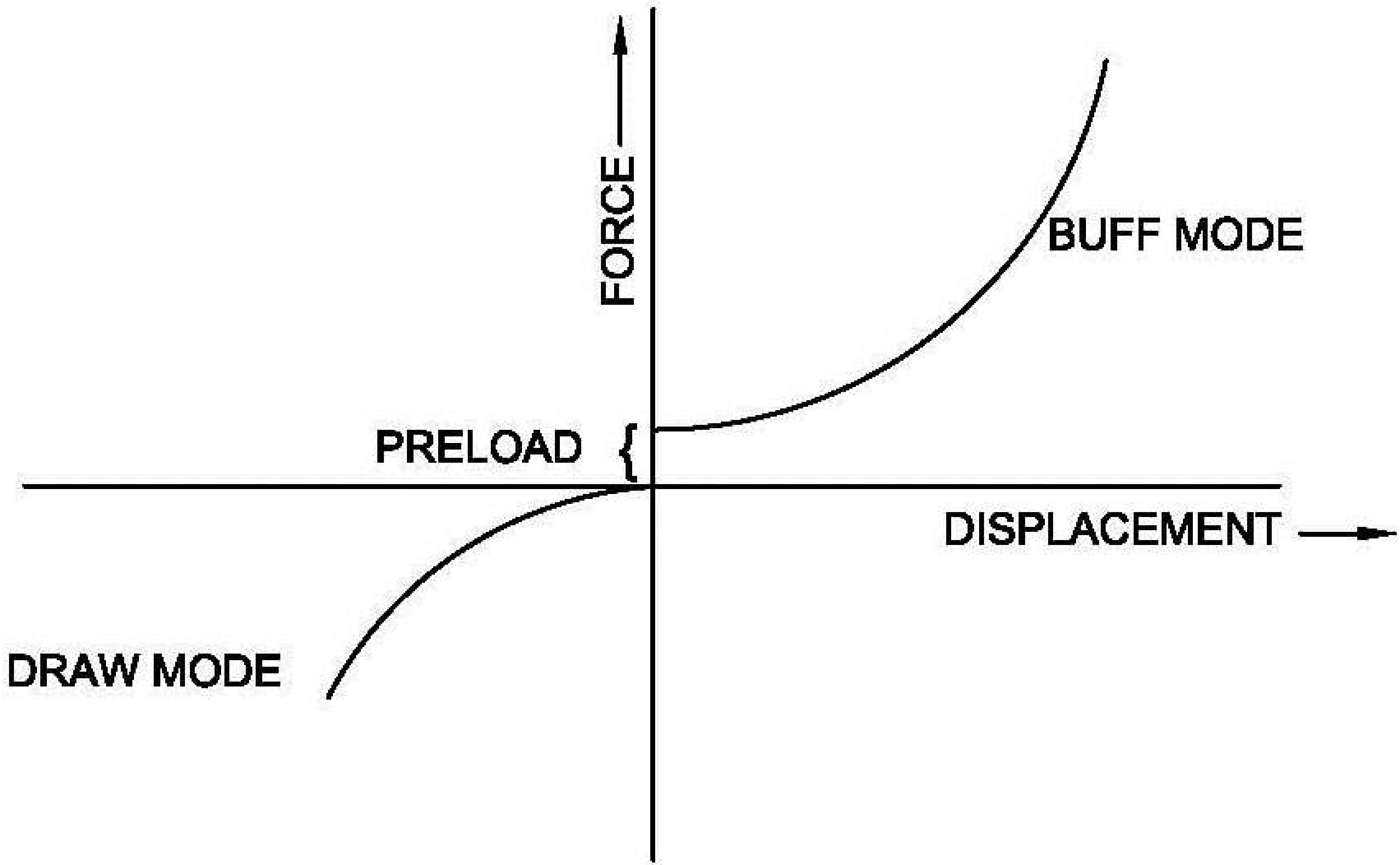
Floating plate or twin pack draft gear has similar cushioning arrangement.

In floating plate or twin pack draft gear, the problem of rear follower plate striking the rear stopper has been addressed by dividing the draft pads into two parts by a floating plate and using this floating plate for the purpose of transmitting force in draw mode. In draw mode, only draft pads between floating plates and front follower is compressed whereas in buff mode, all the draft pads are used to take buff load. It has zero preload in draw mode.

However, in buff mode, this type of draft gear behaves in a way similar to single pack draft gear.
In dynamic condition, the front follower leaves the front stopper and hits it on load reversal. Also, preload in the buff mode adversely affects the longitudinal dynamics of a train.



Draft Gear, cpl. with Floating plate, Type BC 80/45F



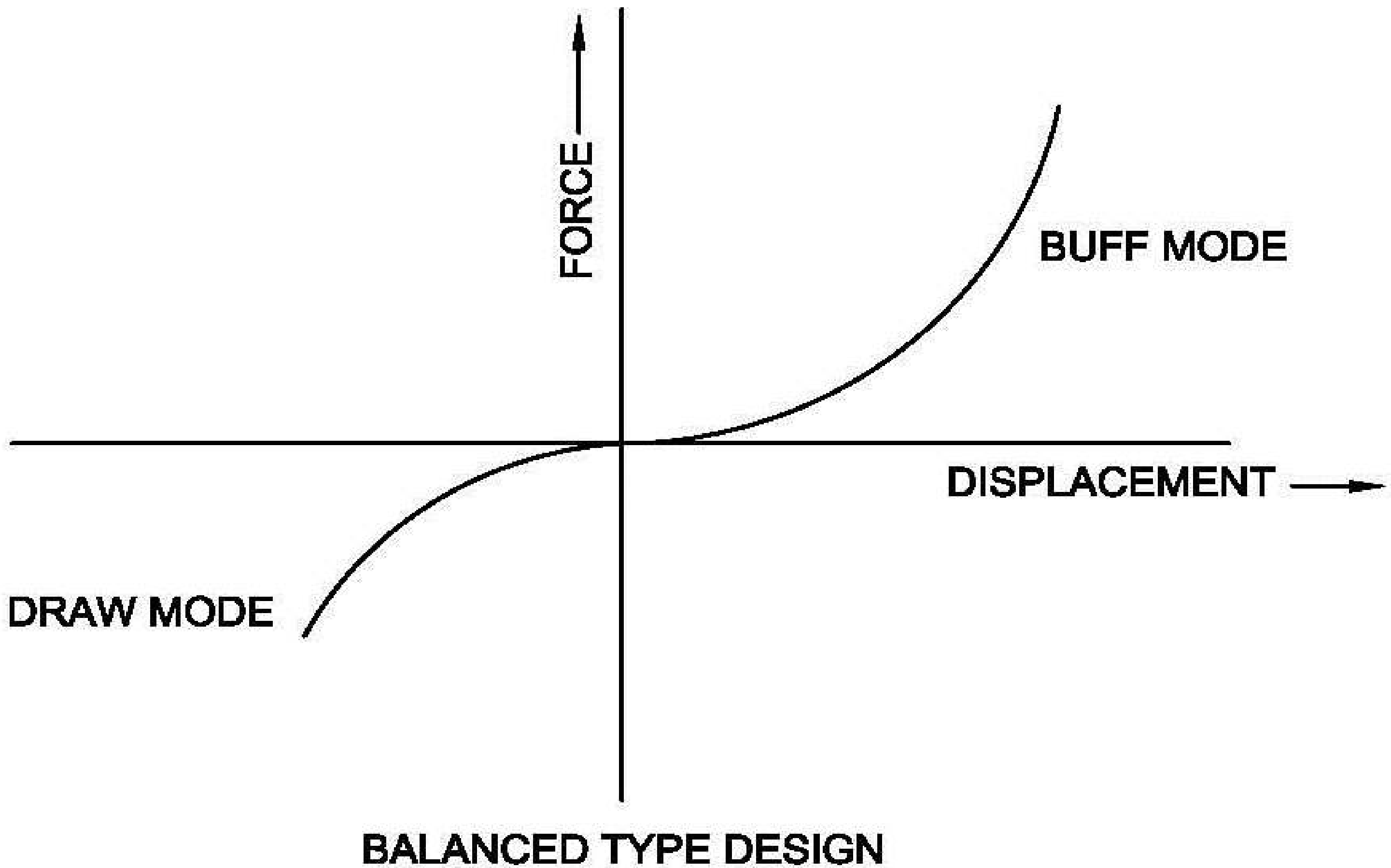
TWIN PACK AND FLOATING PLATE TYPE DESIGN

Balanced Type Draft Gear

Balanced type draft gear overcomes all the problems mentioned in the above sections. The draft gear is fixed between the front and rear stopper and no relative movement between the draft gear frames and these stoppers is possible.

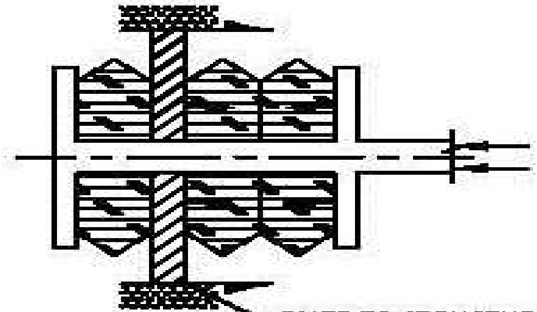
There is no situation of front follower leaving the front stopper and rear follower leaving the rear stopper and hitting them on load reversal.

- Apart from this, the following diagram of conceptual draft gear characteristics shows that there is no abrupt change in force on load reversal.
- Force travel curves are regular and they are not vertically separated at neutral position.
- It facilitates smooth load reversal.

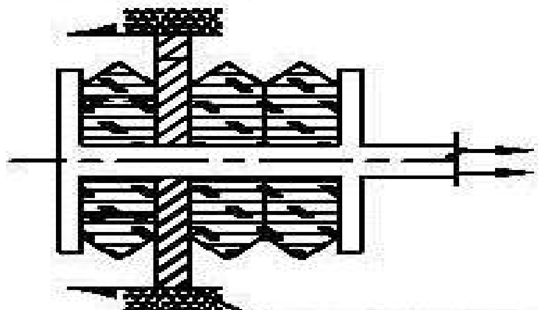


Travel Characteristics of Balanced Type Draft Gear

FORCE FLOW DIAGRAM OF DOUBLE ACTING BALANCED DRAFT GEAR



BUFF MODE



DRAFT MODE

NOTE

1. NO.OF PAD SHOWN IN THE SKETCH IS SYMBOLIC ONLY.
2. DRAFT GEAR ARRANGEMENT SHALL HAVE EFFECTIVE ZERO PRELOAD IN BUFF AS WELL AS DRAFT MODE. IT MEANS THAT FORCE Vs DISPLACEMENT CURVE OF DRAFT GEAR CHARACTERISTICS DRAWN FOR QUASISTATIC CONDITION SHALL PASS THROUGH ZERO FORCE AND SHALL HAVE REGULAR CURVE (NOT SEPARATED BY VERTICAL LINE) IN LOAD REVERSAL IN BOTH THE DIRECTIONS i.e.
   (a) BUFF TO NEUTRAL TO DRAW AND
   (b) DRAW TO NEUTRAL TO BUFF.

ALT.	AUTHY	DESCRIPTION	DATE
1	CC/48/11	NOTE ADDED.	08/11

SUPERSEDED BY

SUPERSEDES ALT. NIL

REFERENCE:-

SCALE		
NTS	P	
	C	
	D	SPAwasthi
	T	
	JS	CC/10/08

FORCE FLOW DIAGRAM OF DOUBLE ACTING BALANCED DRAFT GEAR

FILE No.:-

BG

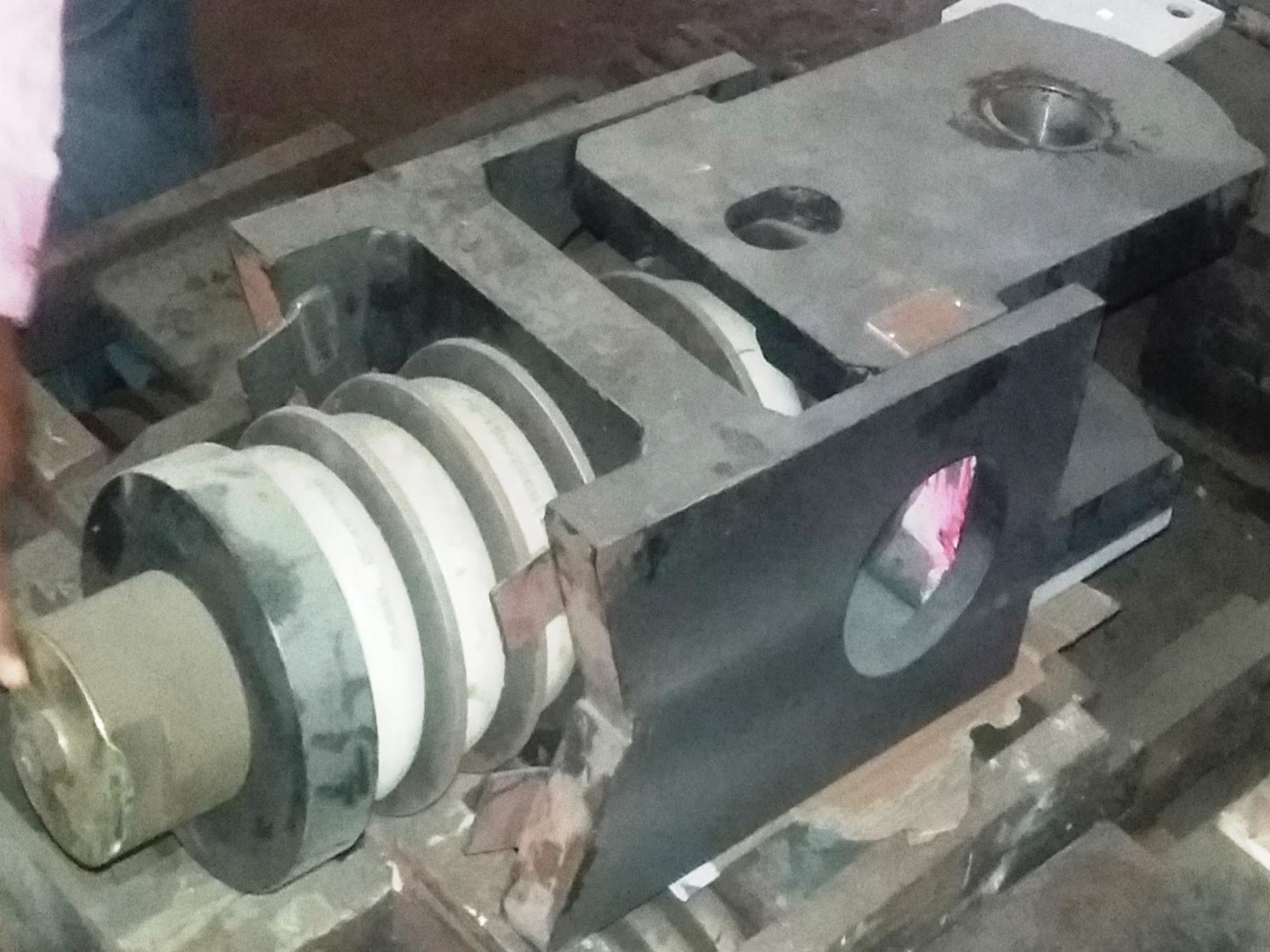
RDSO (CARRIAGE)

CG- K8207

- NO. OF PAD SHOWN IN THE SKETCH IS SYMBOLIC ONLY.
- DRAFT GEAR ARRANGEMENT SHALL HAVE EFFECTIVE ZERO PRELOAD IN BUFF AS WELL AS DRAFT MODE. IT MEANS THAT FORCE Vs DISPLACEMENT CURVE OF DRAFT GEAR CHARECTORISTICS DROWN FOR QUASISTATIC CONDITION SHALL PASS THROUGH ZERO FORCE AND SHALL HAVE REGUULAR CURVE (NOT SEPARATED BY VERTICAL LINE) IN LOAD REVERSAL IN BOTH THE DIRECTION i.s

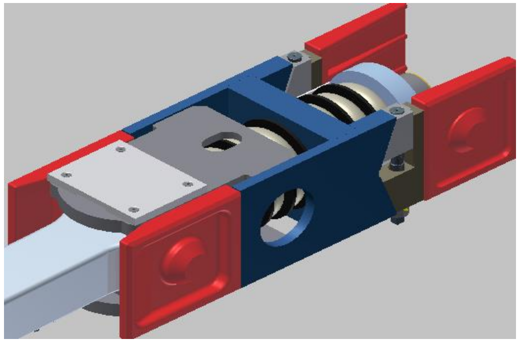
  (a) BUFF TO NEUTRAL TO DRAW &

  (b) DRAW TO NEUTRAL TO BUFF.



BDG MAJOR COMPONENTS

- **Stack of Heavy Duty Elastomeric Pads (Imported) - 04 in compression & 03 in tensile mode.**
- **PA-6 bushes for smooth sliding of intermediate plates & pads over Main bolt.**
- **Fabricated Front Fork & H - Housing.**
- **Main bolt - High toughness, forged.**

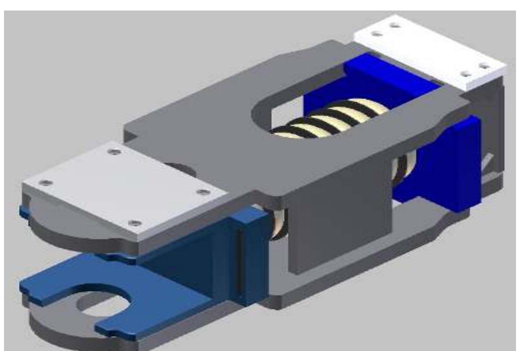


- **Adjustable wedges to tighten the BDG assembly with coach under frame.**
- **The fixed plate, a part of H Housing (blue color,) which is tight fitted with coach under frame (red color) between front & rear stoppers with the help of special design wedge key.**

COMPARISION

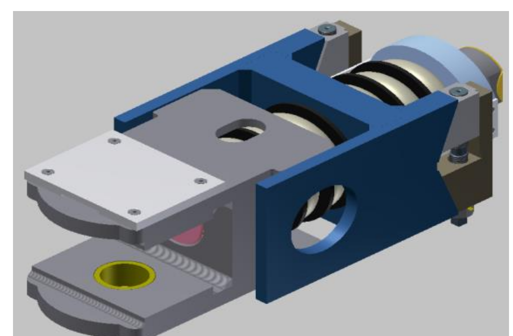
CONVENTIONAL DRAFT GEAR

- Energy absorption 45 KJ in dynamic testing as per RDSO specification CK 009(Rev.02)
- Single pack of 10 Nos. Elastomeric pads used in buff & tensile loading.
- Life is average due to single pack takes load in both buff & tensile mode.
- Jerks experienced in longitudinal train dynamics.
- Escorts drawing No. DG-01-15(Rev.5) for Draft Gear.
- Draft Gear size (length 510+0/-5 * width 345 * height 275 mm) is suitable to fit in coach under frame pocket



BALANCED DRAFT GEAR

- Energy absorption 45 KJ in dynamic testing as per RDSO specification CK 009(Rev.02).
- Two separate packs of Elastomeric pads (4 pads in Buff & 3 pads in tension) have been used.
- Enhanced fatigue life due to separate packs used for buff & tensile loading.
- Jerks totally eliminated in longitudinal train dynamics by enhancing design.
- Escorts Drawing No. SK 1550(Rev.8) for Balanced Draft Gear.
- Draft Gear size (length 510+0/-5 * width 345 * height 275 mm) is suitable to fit in coach under frame pocket



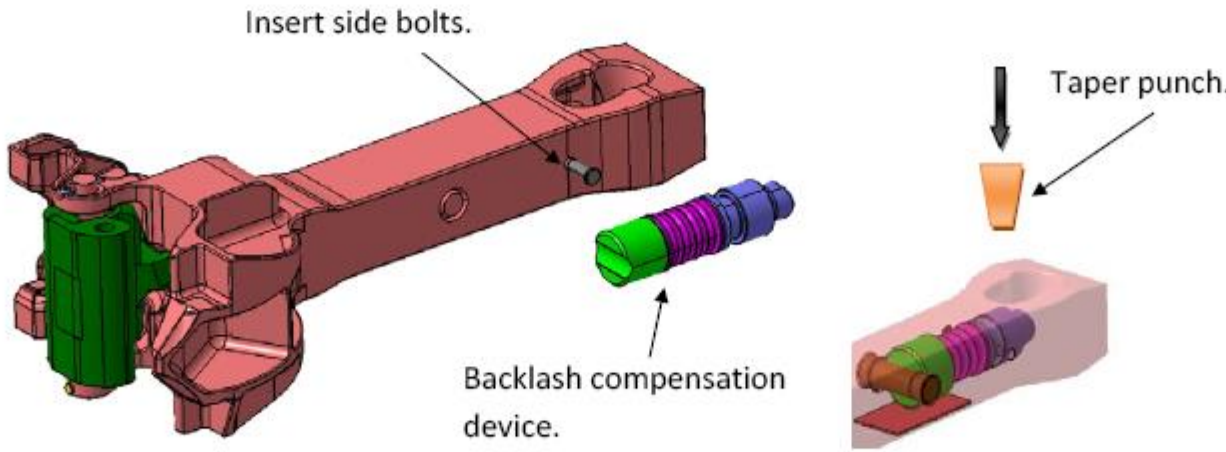
Following are the subjective assessment of relative performance of various types of draft gear

Performance Criteria#	Single Pack Draft Gear	Twin Pack Draft Gear	Balanced Draft Gear
Energy storage Capacity in Draw mode	*****	***	***
Energy storage Capacity in Buff Mode	*****	*****	***
Longitudinal Train Dynamics (Jerk Free)	*	**	*****

- Higher number of * means better attributes.

- Stabilizing link in case used with the balanced type of draft gear creates a reverse situation in which draft gear has effectively zero preload but stabilizing link has preload of 25 kN.

- The new specification specifies linking arrangement between coupler and draft gear to overcome this problem. Spherolastic bearing prescribed in the specification meets the functional requirement of articulation. Apart from its role of providing articulation to coupler head, it helps in blocking transmission of vibration and noise to coach body.



Insert side bolts.
Taper punch.
Backlash compensation device.


3

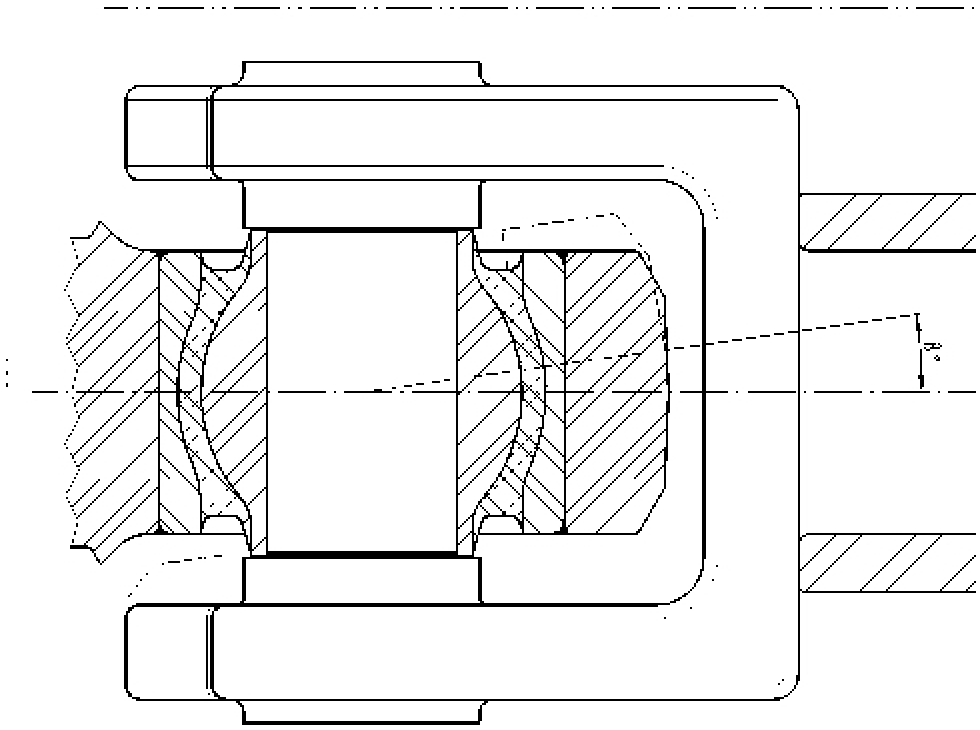
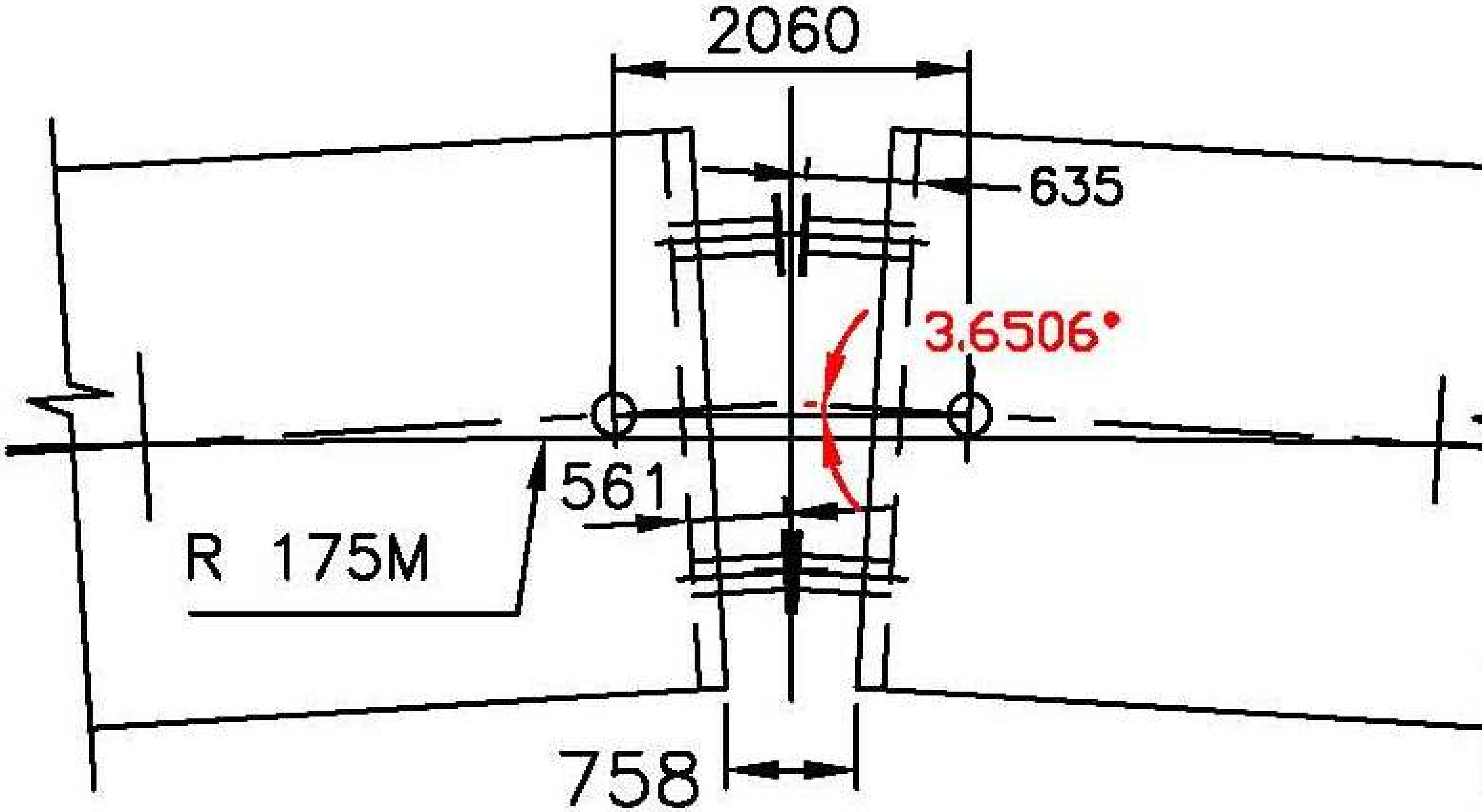


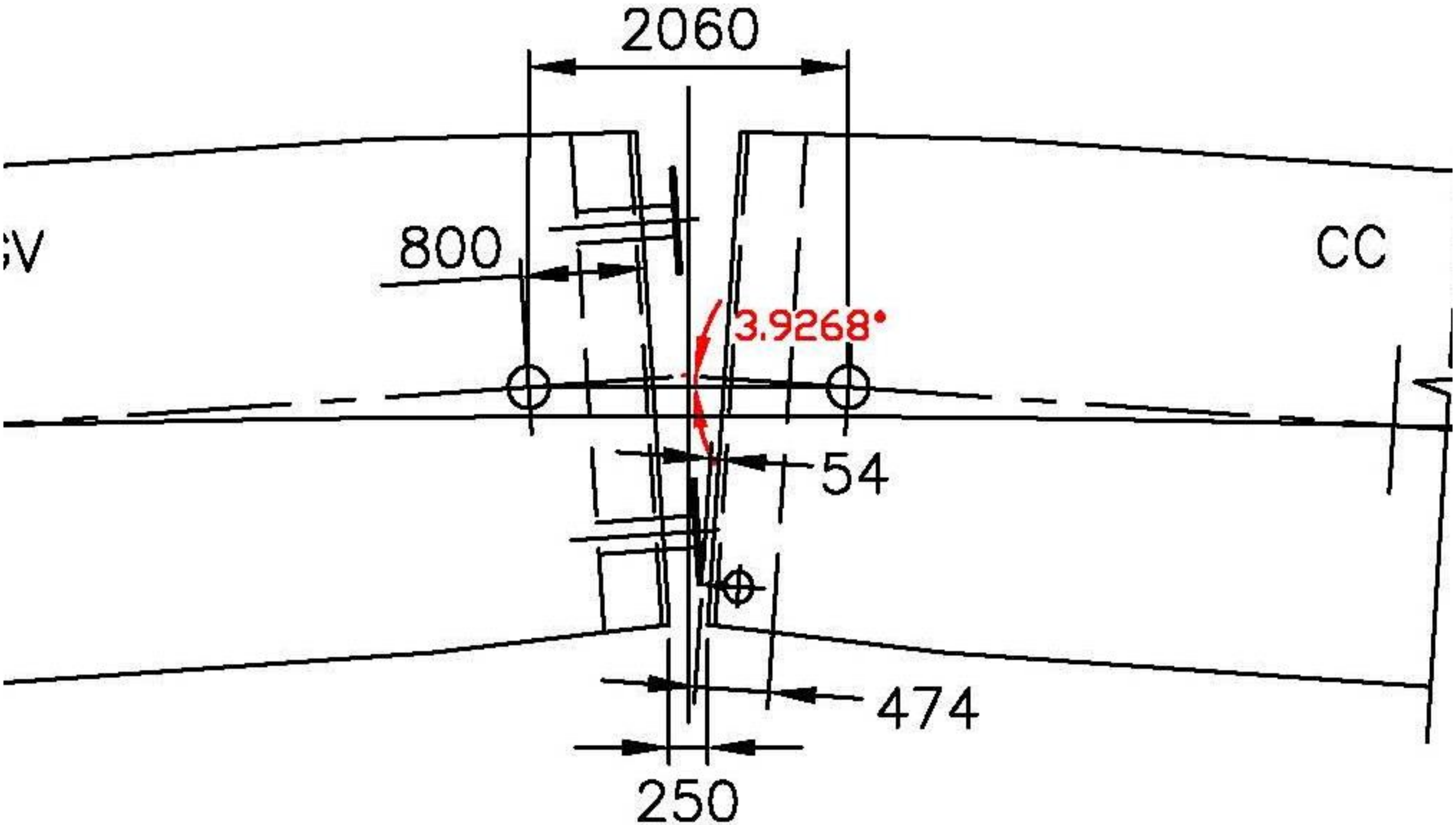
Figure-5: Spherolastic Bearing

Various doubts have been raised on using articulation inside draft gear.
Analysis of LHB coach on 10 degree curve indicates that geometrical requirement of coupler head movement because of curvature of track is 3.9 degree horizontal swing.
The estimated bending force because of this horizontal swing is insignificant as compared to bending strength of the shank prescribed in the specification.



CONDITION:- NO COMPRESSION IN BOTH THE DRAFT GEA

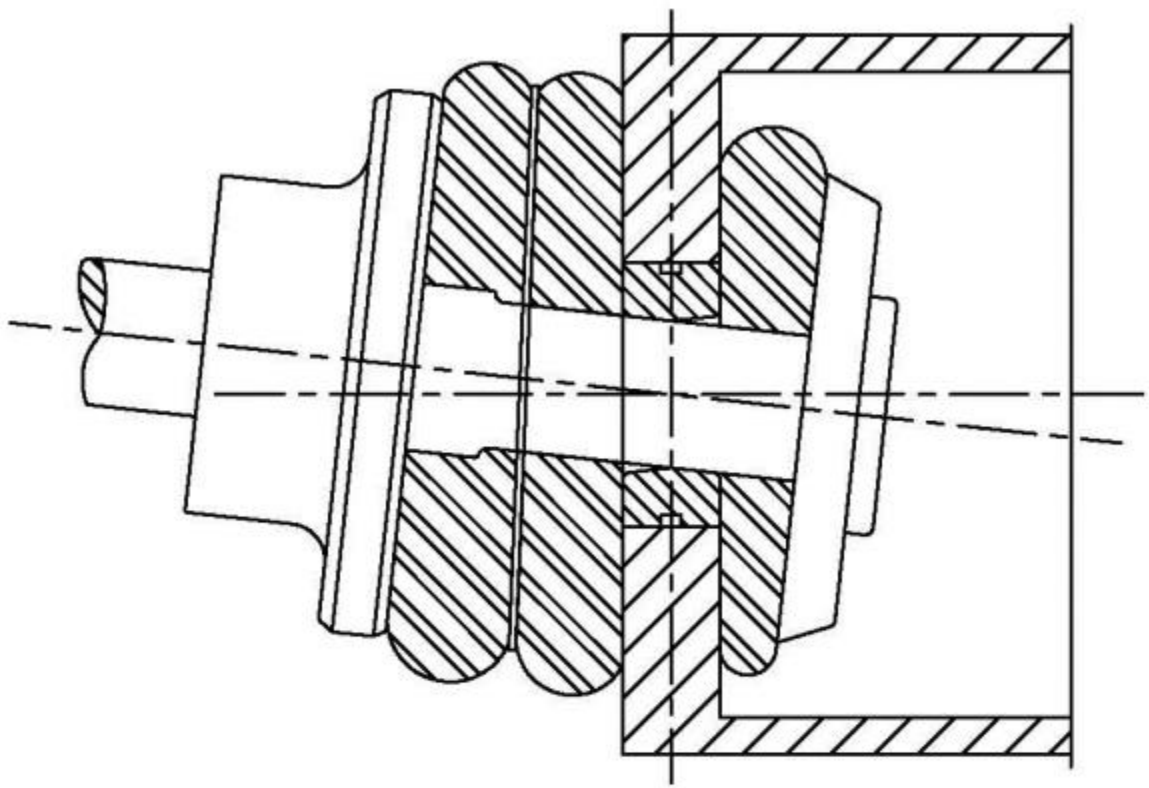
ICF COACH COUPLED WITH ANOTHER ICF COAC



CONDITION:– NO COMPRESSION IN BOTH THE DRAFT GEARS

LHB COACH COUPLED WITH ANOTHER LHB COACH

In many coupling system design, some stiffness and damping in horizontal swing is desirable to prevent yaw of a coach during the taking of curve, transitions and switch points.



BALANCED TYPE DRAFT GEAR WHILE NEGOTIATING CURVE

ADVANTAGES

- Design aims at eliminating Jerk.
- In new design Draft Gear (BDG), Jerk & hammer noise problem has been eliminated completely by modifying the design.
- On the other hand End force has been balanced in tensile as well as in compressive mode.
- Enhanced life of equipment by using Durel GmbH heavy duty Elastomaric pads.
- Balanced Draft Gear flexible connection with coupler shank is a proven one and eases the horizontal & vertical movement of coupler head.
- Poly Acetel bushes used to avoid wear of Main bolt from metallic separator plates.
- In BDG separate packs of heavy duty Elastomaric pads have been used for tension and compression which will enhance the life of equipment up to double of conventional Draft Gear.
  BDG 04 pads stack is equal to 10 pads stack of conventional Draft Gear in Energy absorption and damping. BDG have bigger size imported (Durel Germany) pads than conventional Draft Gear pads.

VkbV ykd difyax fQVsM dksp dh igpku

- lkbM iSuy ds vUr esa ihyh iV~Vh
- dksp ua0 ds vUr esa ysVj ’C’ dk Á;ksx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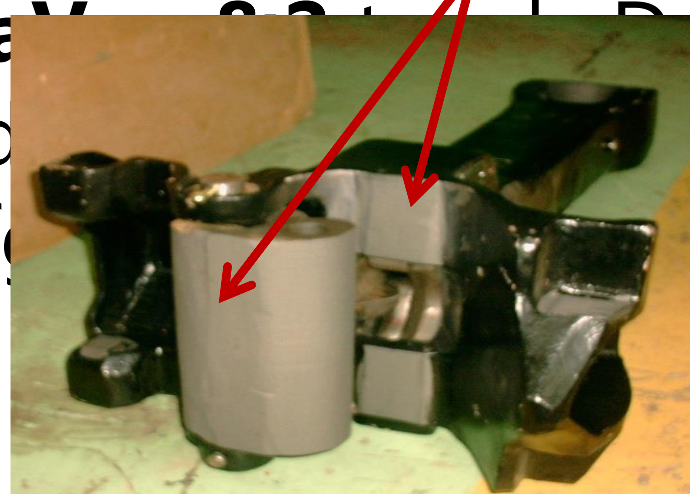
प्रवेश
ENTRY
1 - 80
TO SEAT / SLEEP
1 - 8
9 - 16
LIFT HERE
भा.रे.

difyax ls igys dh psd

psd IokbaV ua&1 diyj ds lrg ij xzhl vFkok rsy dk iz;ksx u djsa vU;Fkk vudiy gksus dh laHkkouk c<+ tkrh gSA

psd Iokba ... kst gks rks udy vkSj o ... M Qsl lekukUrj gksuk pkf ...



difyax dk rjhdk ¼dksp ls dksp½

- dksp dks 2&3 fdeh0@?ka0 dh LihM ls ,d nwljs ds utnhd ykdj 1&2 eh0 dh nwjh ij jksd nsrs gSaA
- ,ykbUesUV ns[ksaA bls xSnfjax jsUt esa jguk pkfg,A
- vko';drkuqlkj diyj dks [khapdj xSnfjax jsUt esa yk;saA
- eSuqvy vudifyax vkijsfVax jkM gSfUMy [kqys jgus pkfg;sA nksuksa dksp dk udy [kqyk gksuk pkfg;sA /khjs&/khjs /kDdk nsaA
- vkxs dk 5 dksp esa czsd yxk gksA
- Vsy&Vsy dh iksth'ku psd djsaA Vsy&Vsy LykV

difyax dk rjhdk ¼dksp ls yksdks½

- yksdks lkbM ls ik¡p dksp esa czsd yxk gksA
- yksdks dks igys dksp ls 20 eh0 igys jksd nsa vkSj /khjs&/khjs vkxs c<+saA tc 3 eh0 rd dh nwjh jg tk; rks yksdks dks jksd nsaA
- ,ykbUesUV ns[ksaA bls xSnfjax jsUt esa jguk pkfg,A vko';drkuqlkj diyj dks [khapdj xSnfjax jsUt esa yk;saA
- ,l,yvkj lhchlh dks ukeZyh Dykst iksth'ku esa vkSj vkdks lhchlh udy dks vksju

difyax dk rjhdk ¼dksp ls yksdks½

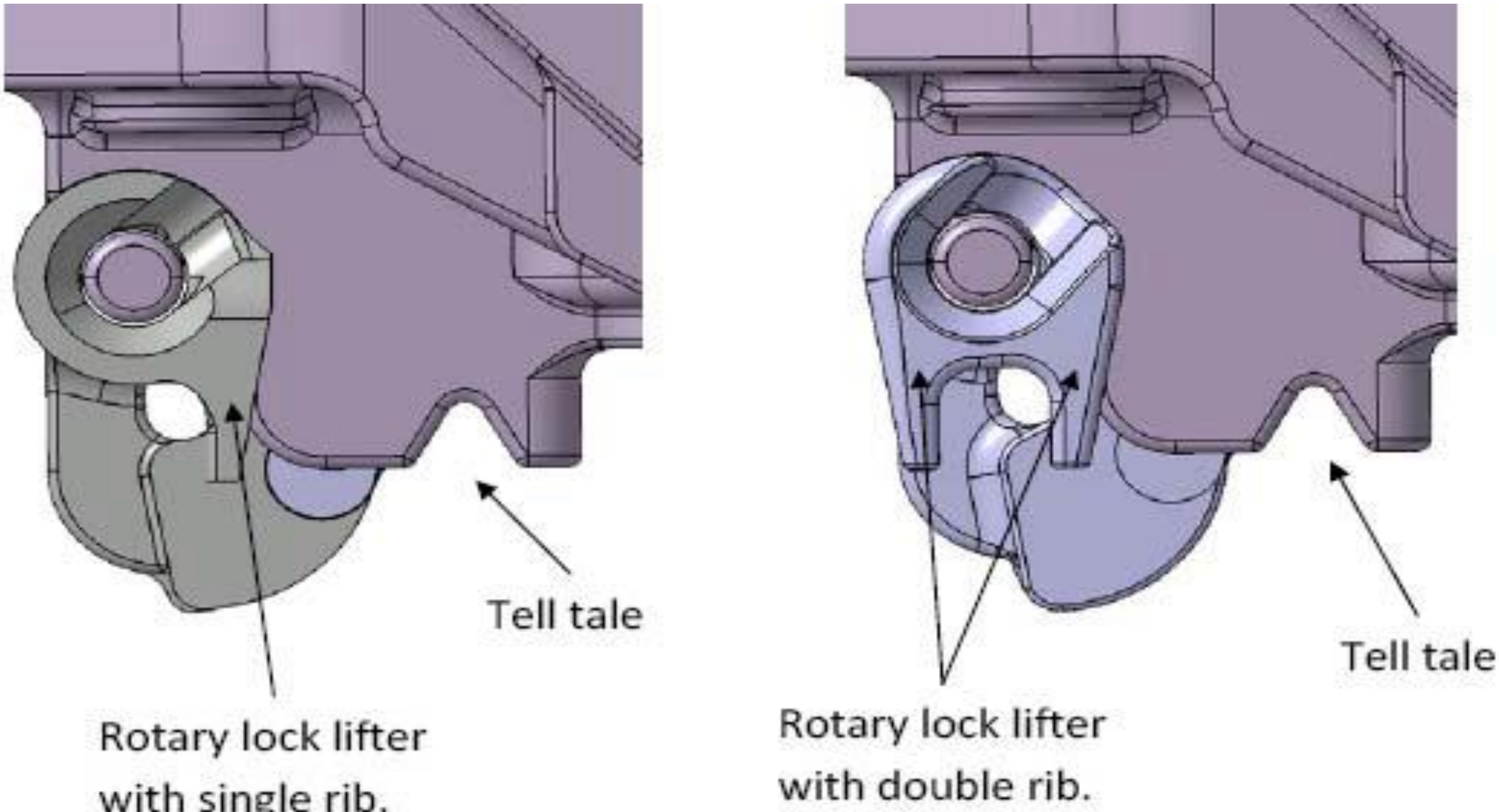
- yksdks ik;yV dks 2 ukWp ij jsd dks vkxs [khapuk pkfg;sA
- tc yksdks [khaps gq, daMh'ku esa gks rks nksuksa lhchlh ds chp xSi dks i;kZIr eksVkbZ ds fle ¼fjfLVªDVj½ }kjk dS0,.MoS0 LVkQ }kjk Hkj fn;k tkuk pkfg,A
- yksdks ik;yV vkSj xkMZ }kjk chih vkSj ,Qih ikbi dk Ás'kj lqfuf'pr fd;k tkuk pkfg,A
- ÁFke ik;p dksp ds czsd dks ihyht dj nsuk

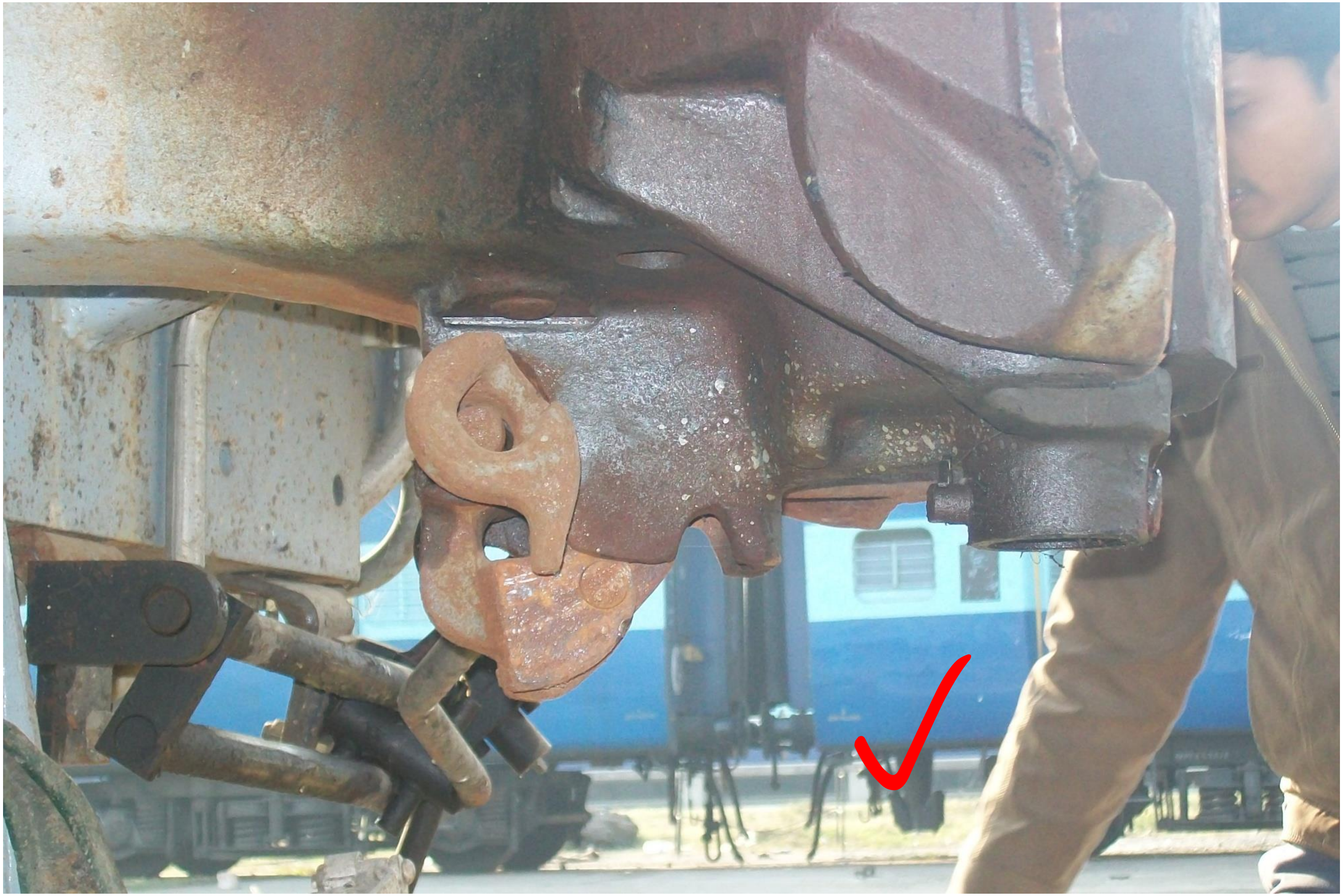
lgh difyax gsrq psd IokbUV~l

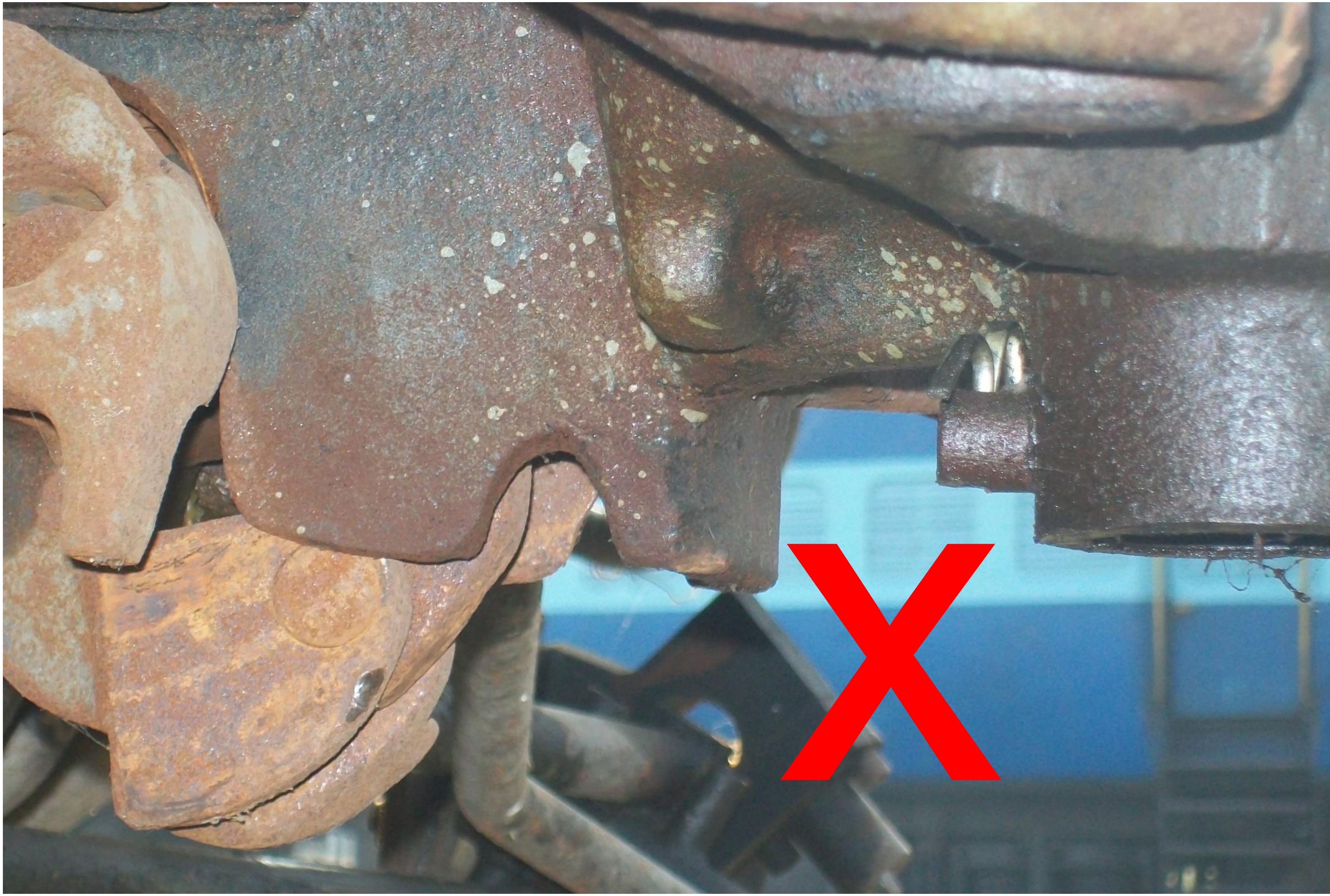
psd IokbUV 1- Vsy&Vsy LykV fcYdqy fDy;j gksA

2- jksVjh ykd fy¶Vj fjc ofVZdy gksA

3- eSuqvy ykfdax fMokbl iw.kZ :i ls ykd iksth'ku

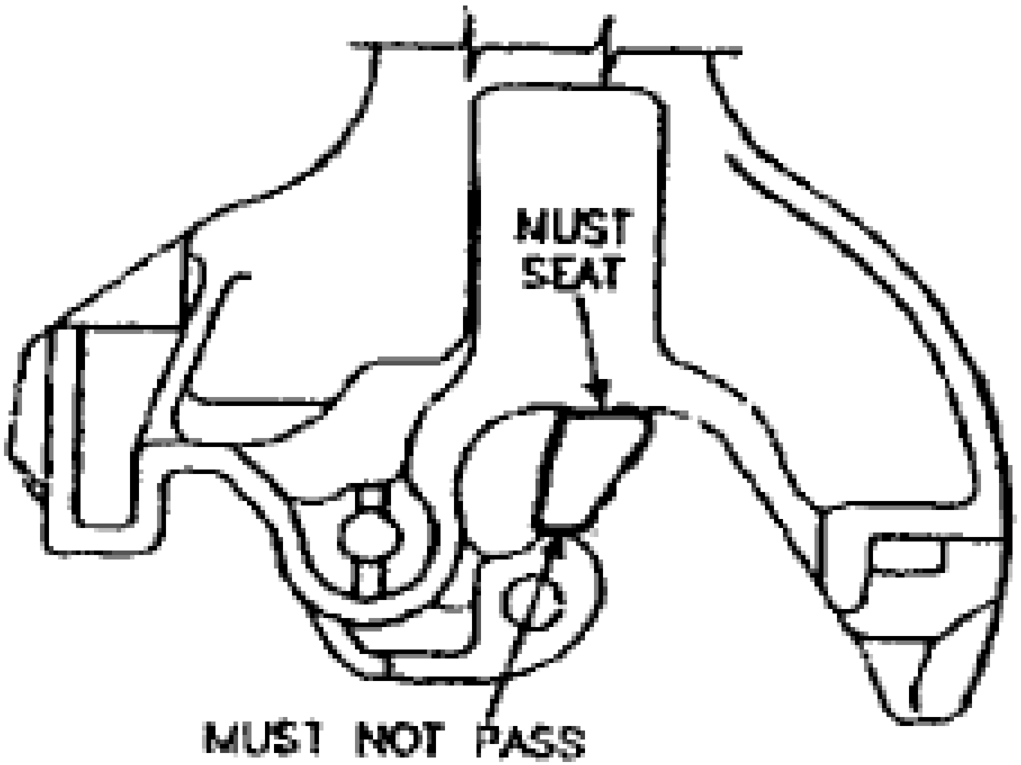

Tell tale
Rotary lock lifter with single rib.
Tell tale
Rotary lock lifter with double rib.





Jaw gap test :

We check the contour of the coupler head assembly using “Condemning limit gauge



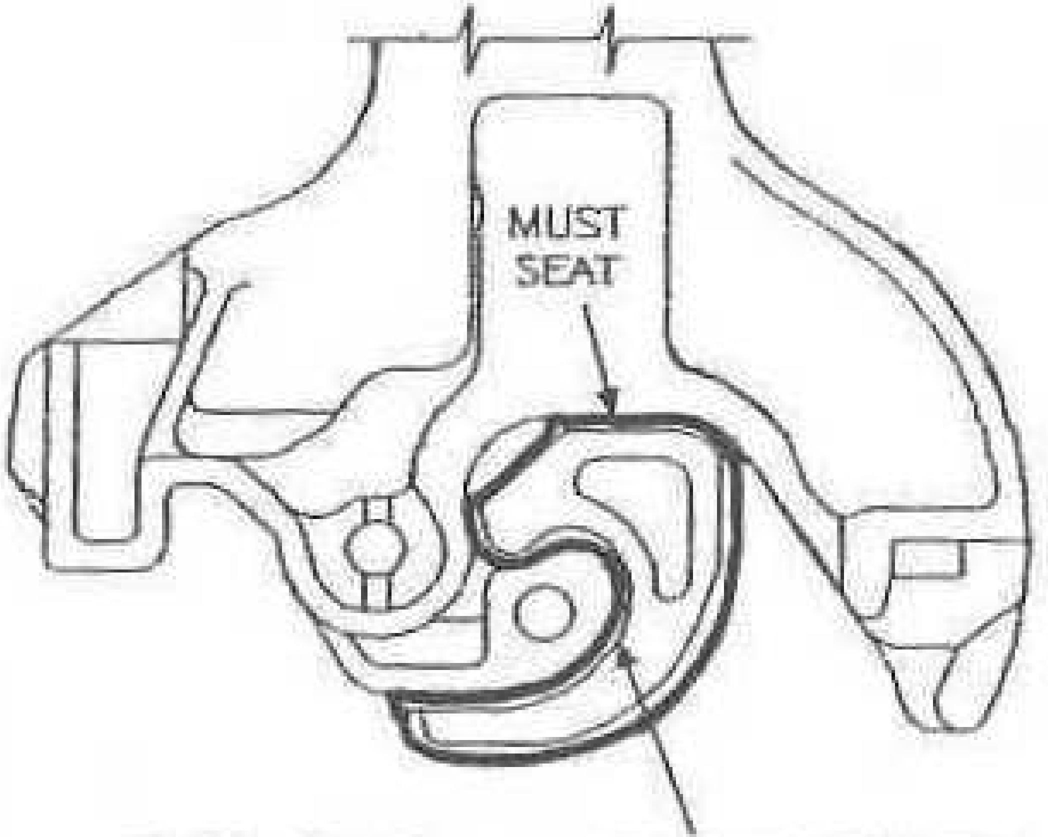
Knuckle contour (profile) check :

Check the contour of the knuckle using the “ Contour maintenance Gauge .

Shake the knuckle while passing the gauge.

This is to ensure that slack in the assembly is included in the profile.

If gauge does not pass, Knuckle and coupler head must be checked and replace it or lock to be modified per APTA standards.(American Public Transportation Association)

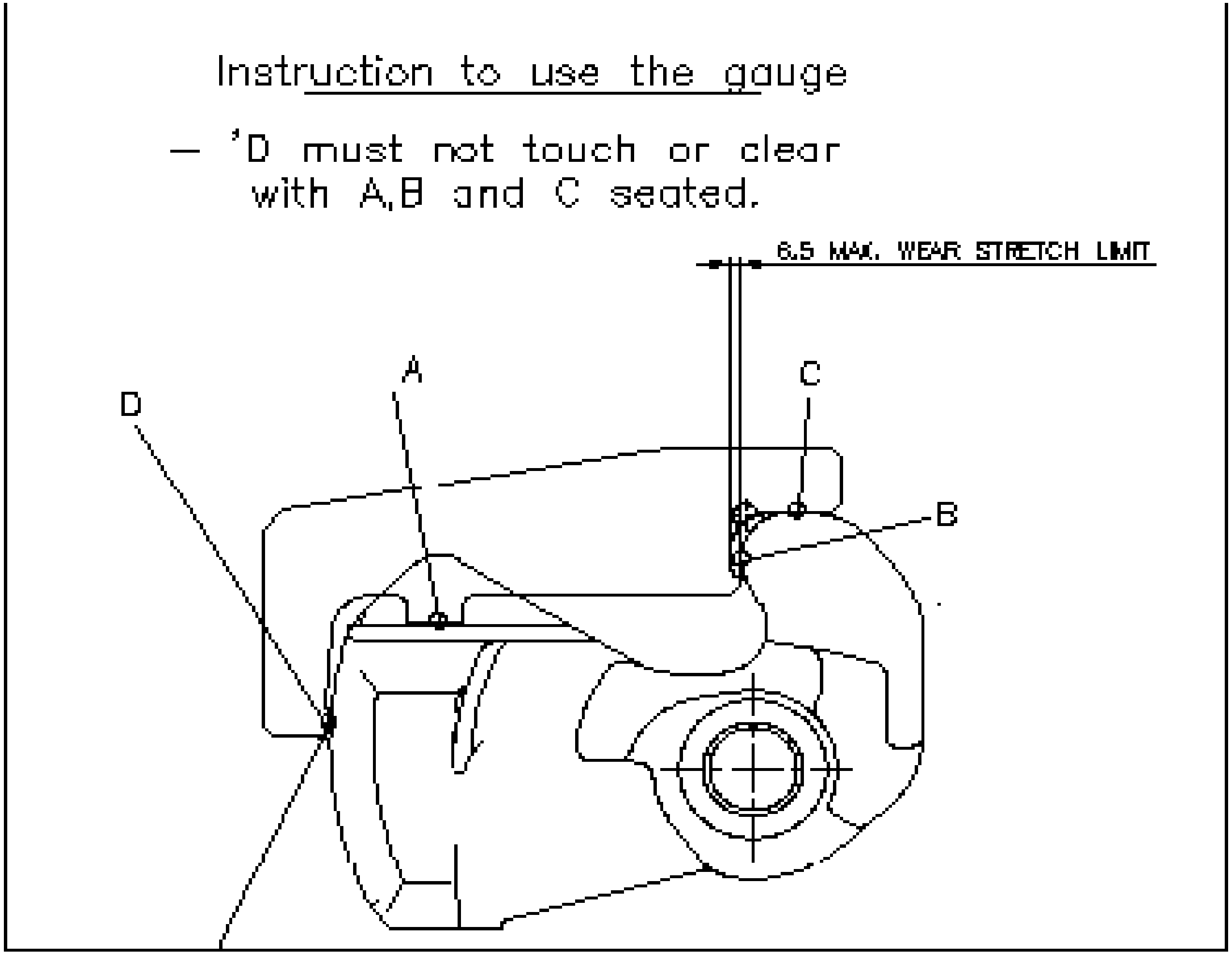


GAGE MUST PASS THROUGH CONTOUR WITH KNUCKLE FULLY CLOSED AND LOCKED.

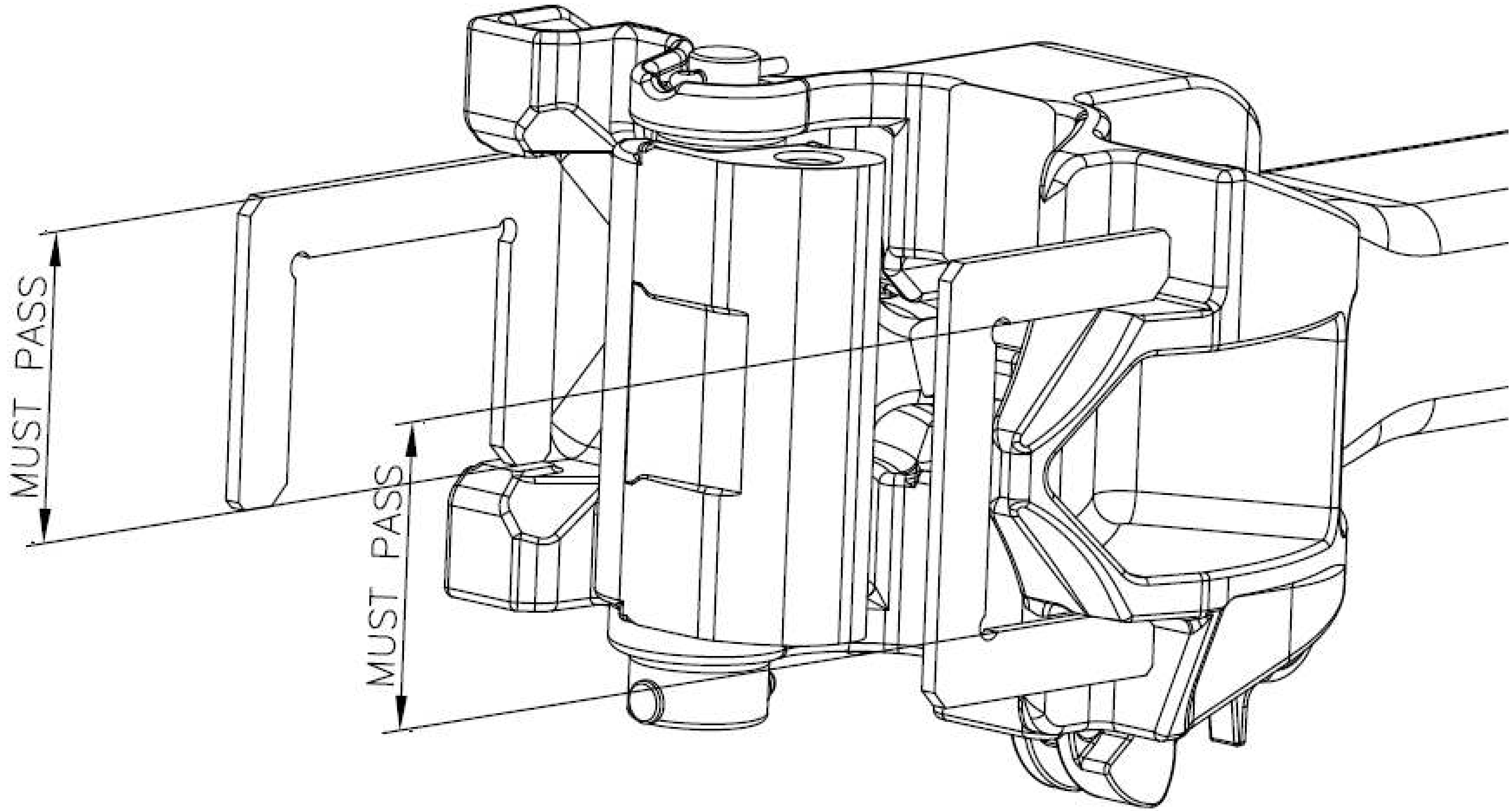
ÁksQkby xst

Knuckle nose wear and stretch limit gauge

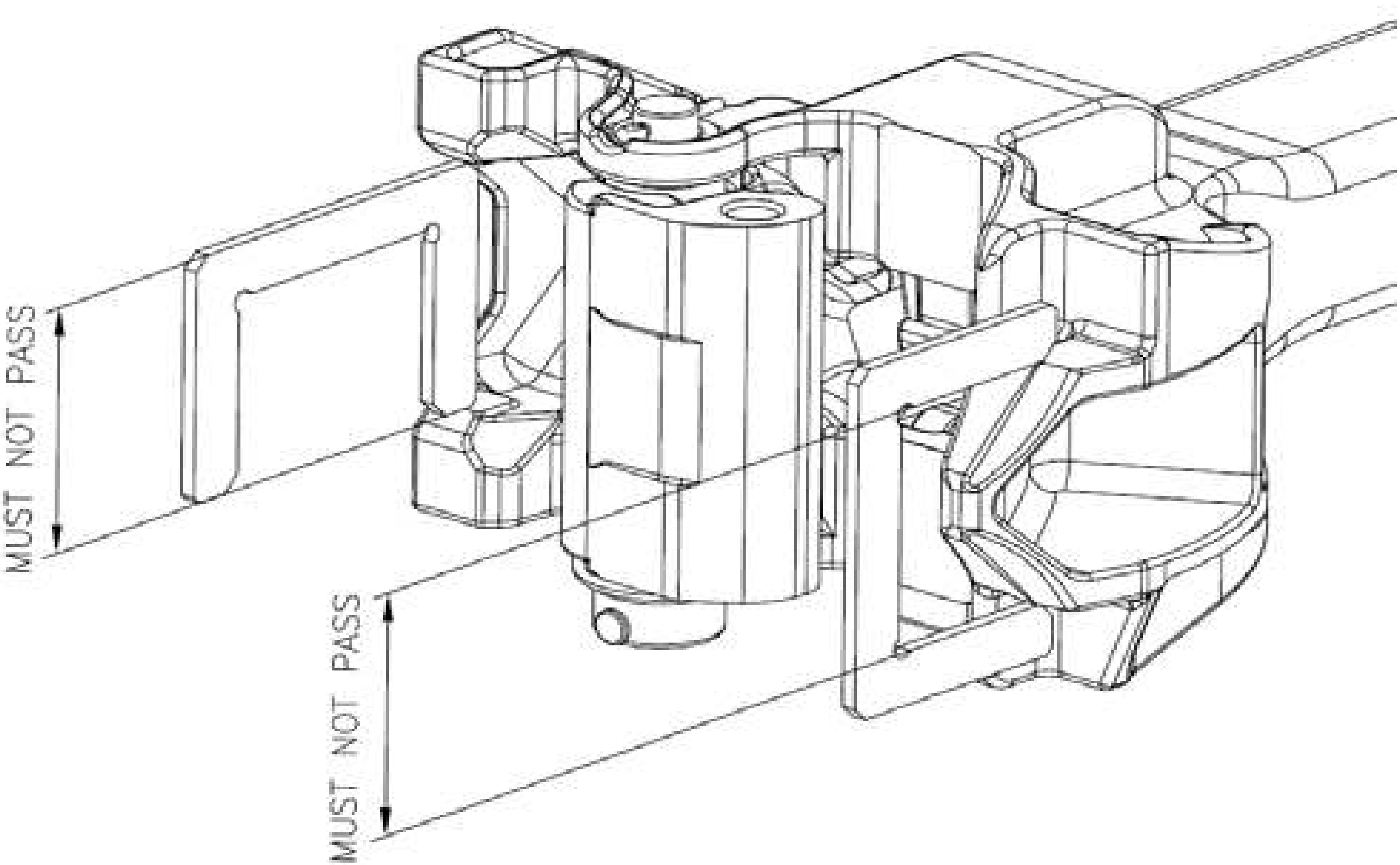
The permitted wear at the nose side is 6.5 mm.



Vertical height aligning wing pocket and guard arm gauge (GO)



Vertical height condemining limit aligning wing pocket and guard arm gauge (NO GO)



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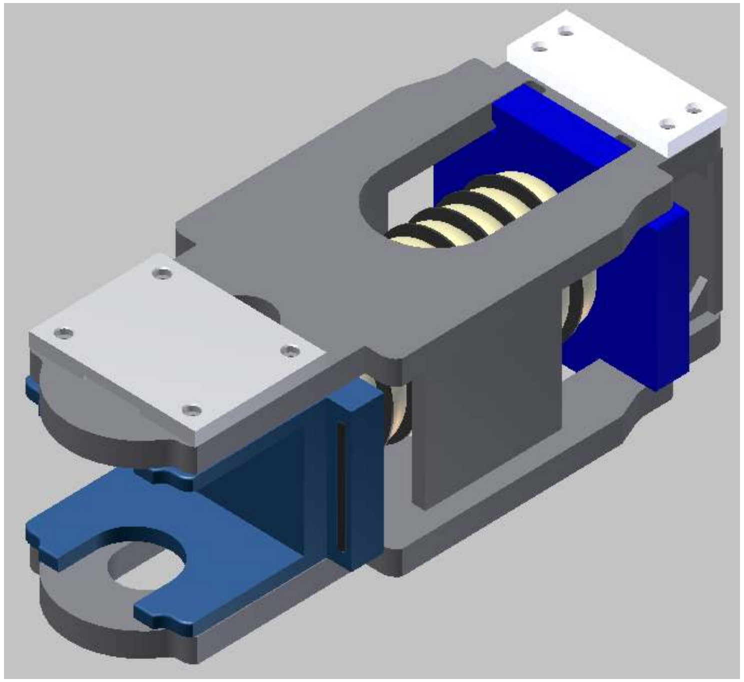
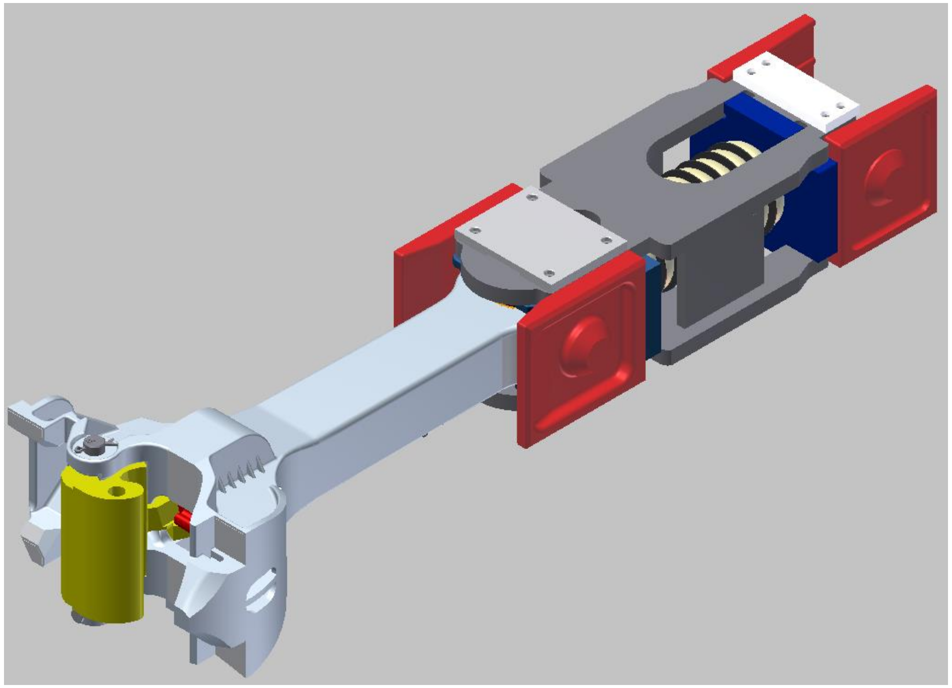
CONVENTIONAL DRAFT GEAR



- **Standard Draft Gear consists of a single pack of 10 nos. Elastomeric pads which work in compression as well as in tensile loading.**
- **On the other hand BDG consists of separate packs for compression (4 pads) and for tension (3 pads).**
- **Elastomeric pads used for compression in BDG (pack of 4 pads) have equal energy absorbing capacity as compared to 10 pad pack used in conventional draft gear.**

CONVENTIONAL DRAFT GEAR

- **Standard Draft Gear has Front Fork plate and Rear Stopper plate (in blue color).**
- **These two plates hit the coach under frame Stoppers (in red color) during force reversal after buffing (compression) and in tension mode respectively in deceleration and acceleration.**



Draw and Buffing Gear System

for

LHB Coaches

Rajendra

Instructor C&W

Two Types Of System

- **Screw Coupling with side buffer**
  - Separate elements for draft and buff action
- **Centre buffer coupler**
  - Same element to take the draw and buff load

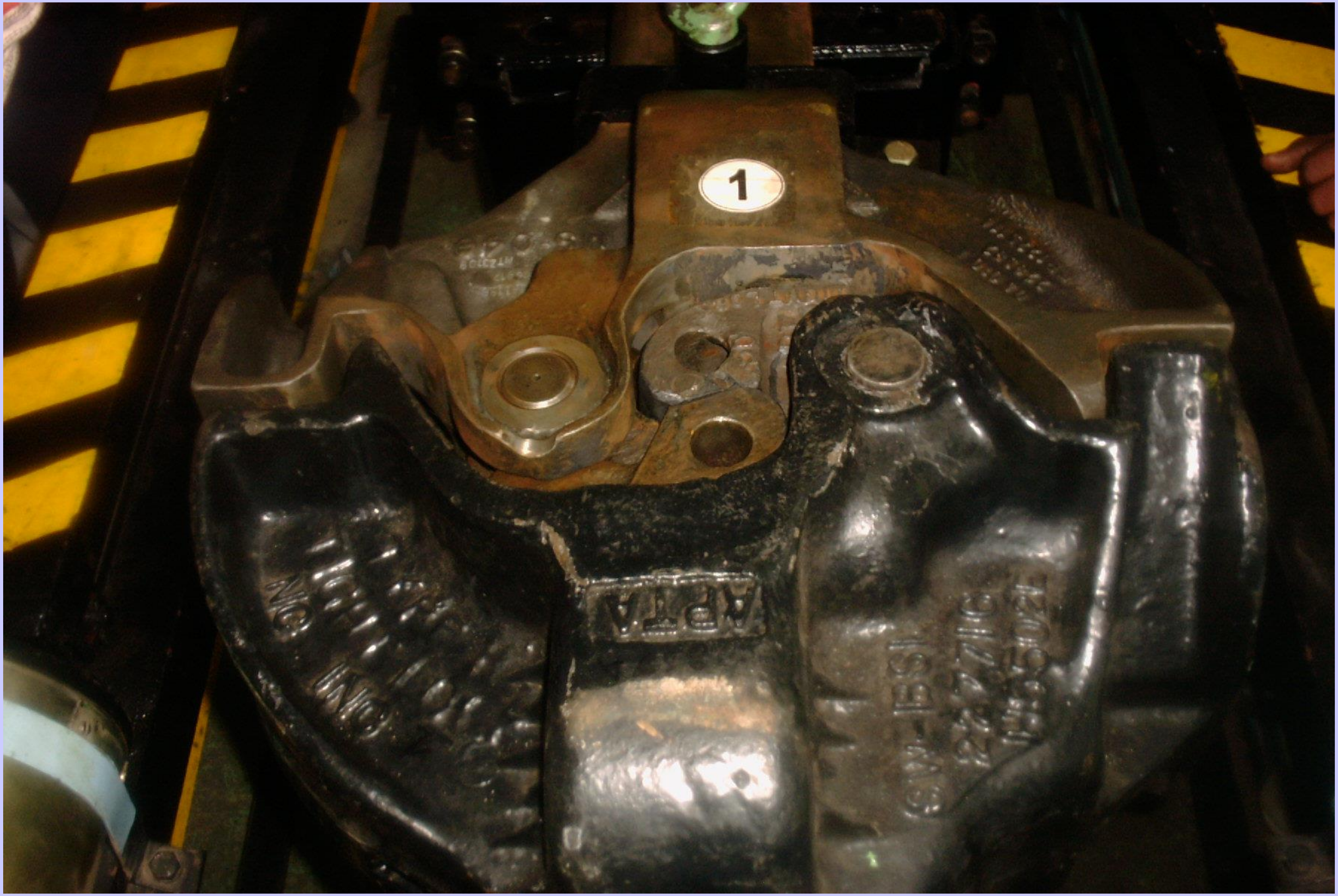
Benefits of CBC

- Higher strength-Haulage of longer trains possible.
- Anti-climbing Feature.
- Lesser Intercoach Distance Possible.
- Lesser Maintenance.
- Less No. of Components ,Reduced inventories.
- Shunting Time Reduced.

  Shunting at Higher Speeds Possible.

  Automatic Coupling.
- Quick detachment possible in the event of fire.

AAR TYPE H Coupler in Coupled Condition



PERFORMANCE TEST - INTERCHANGEABILITY OF PARTS – COUPLING OF SAB WABCO COUPLER WITH MERIDIAN RAIL COUPLER (…..CONTD)

Types of Centre Buffer Coupler

- **Open Claw Type**

  Janney-AAR D Type,AAR E type,Atlas,Alliance;Willision

- **Claw Type(Knuckle Type Tight lock)**

  AAR F Type,AAR H Type,AP -Tightlock,Controlled Slack, JNR

- Rigid Type

  Shacku,Compact,Wedgelock,Westinghouse, George Fischer

Limitations of Screw Coupling

- Limited Strength due to weight restriction.
  - Haulage of longer trains not possible.
  - Train can not stop automatically on ACP.
- Over-riding of coaches in collisions and derailment
- Anti-climbing Arrangement Not Possible.
- Shunting Staff at Risk.
- Longer Inter-coach Distance.
- More Number of Components and Assemblies.
- Higher maintenance requirement.
- Less energy absorption.

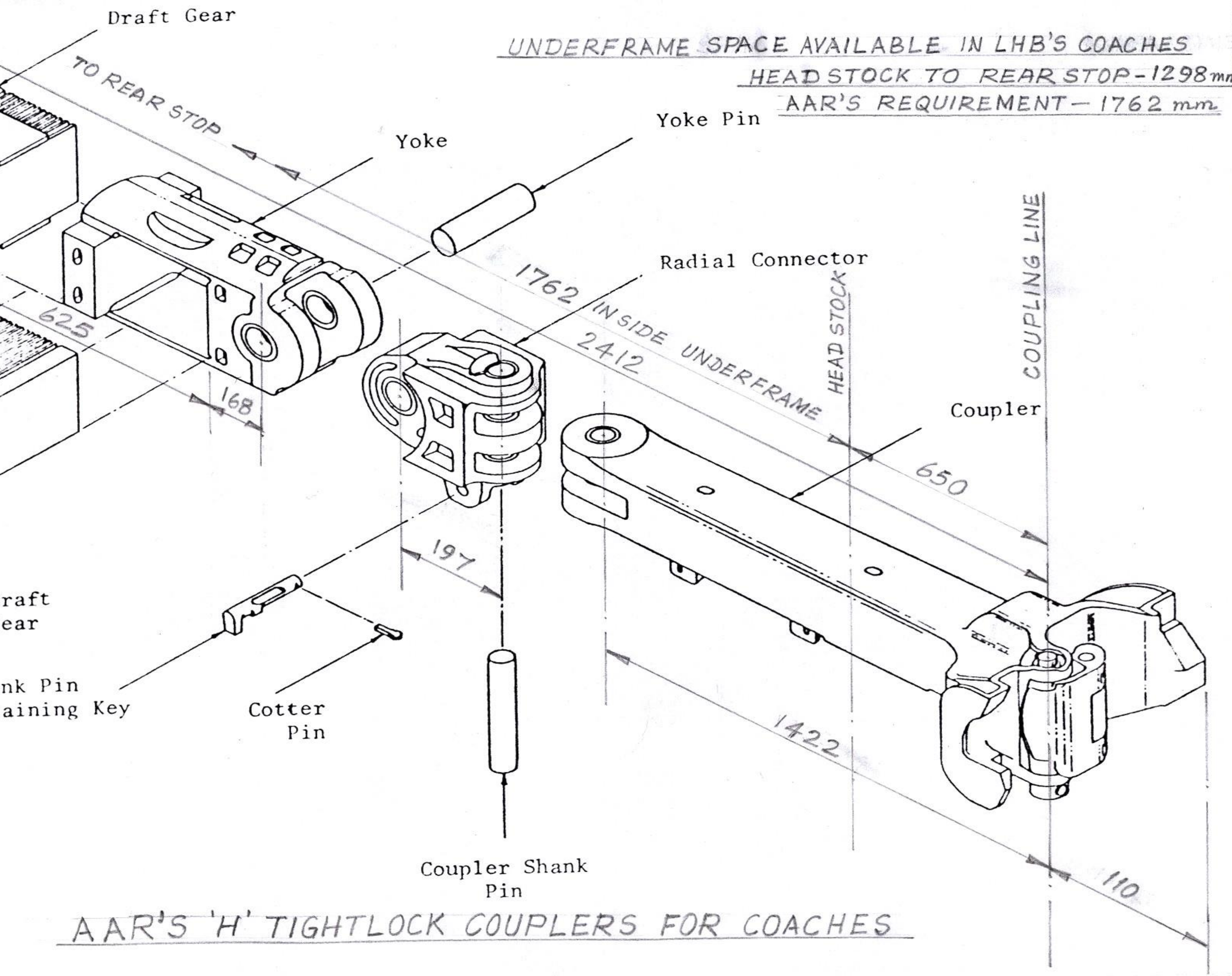
IR Adopted AAR Type `H' Coupler

Main Reasons:-

- Couplability with Type-E Coupler fitted on IR Locomotives.
- **Anti-climbing Feature in-built.**
- Strength Suitable for Operation of 26-coach Train.
- **Low Cost.**

IR Efforts on adoption of AAR H type Coupler

- Effort started in late Seventies.
- Specification was issued in 1985.
- ICF issued Global Tender.
- Purchase did not materialise due to very high price.



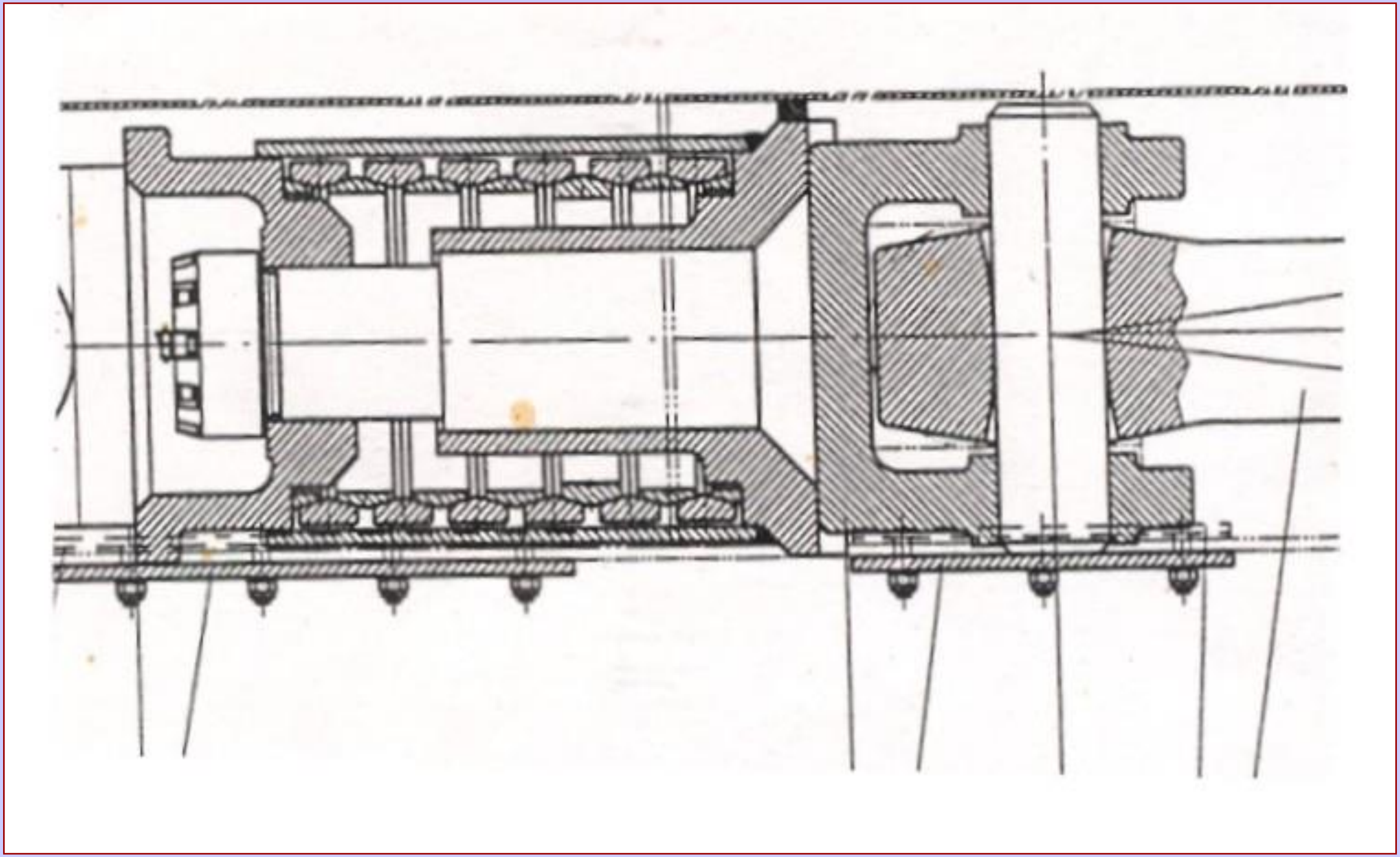
AAR'S 'H' TIGHTLOCK COUPLERS FOR COACHES

LHB Coach Specification

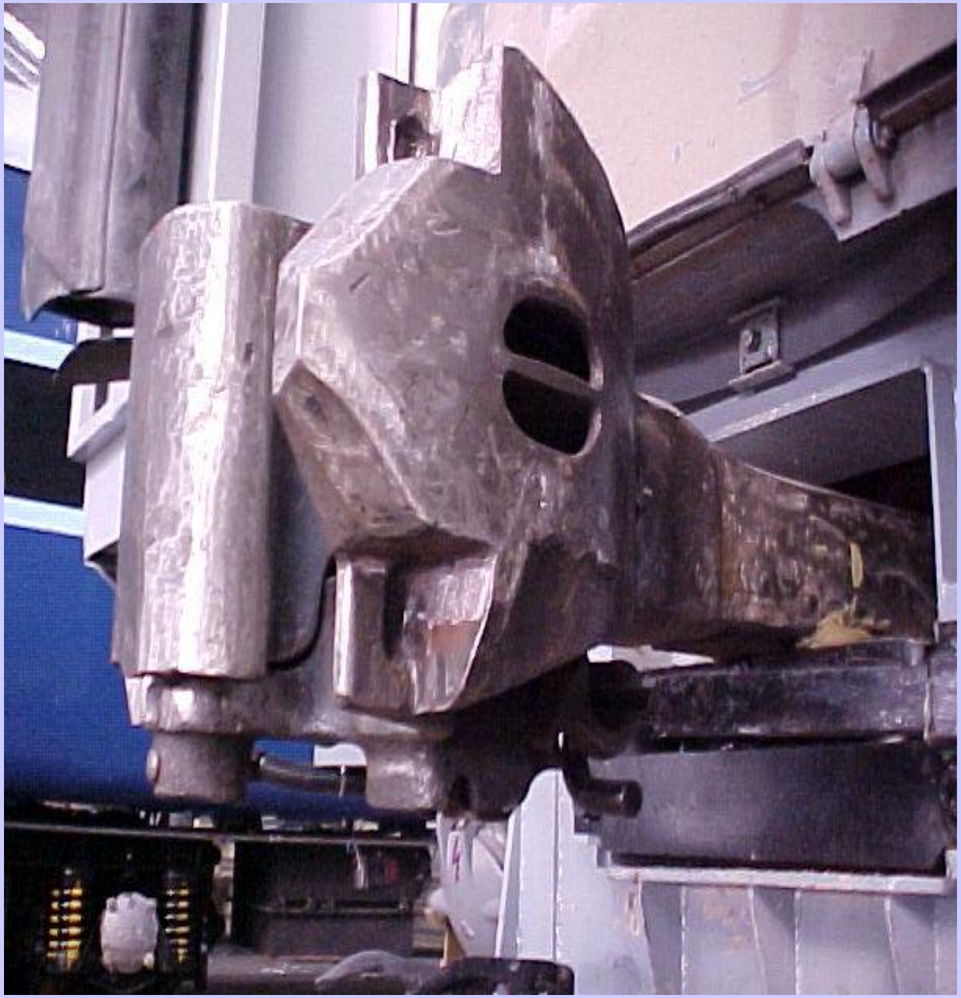
- Tight lock centre buffer coupler
- The draft gear will adequate capacity for operation of 16 coach at 160 kmph and 26 coaches at 110 kmph.
- Train has to stop on ACP

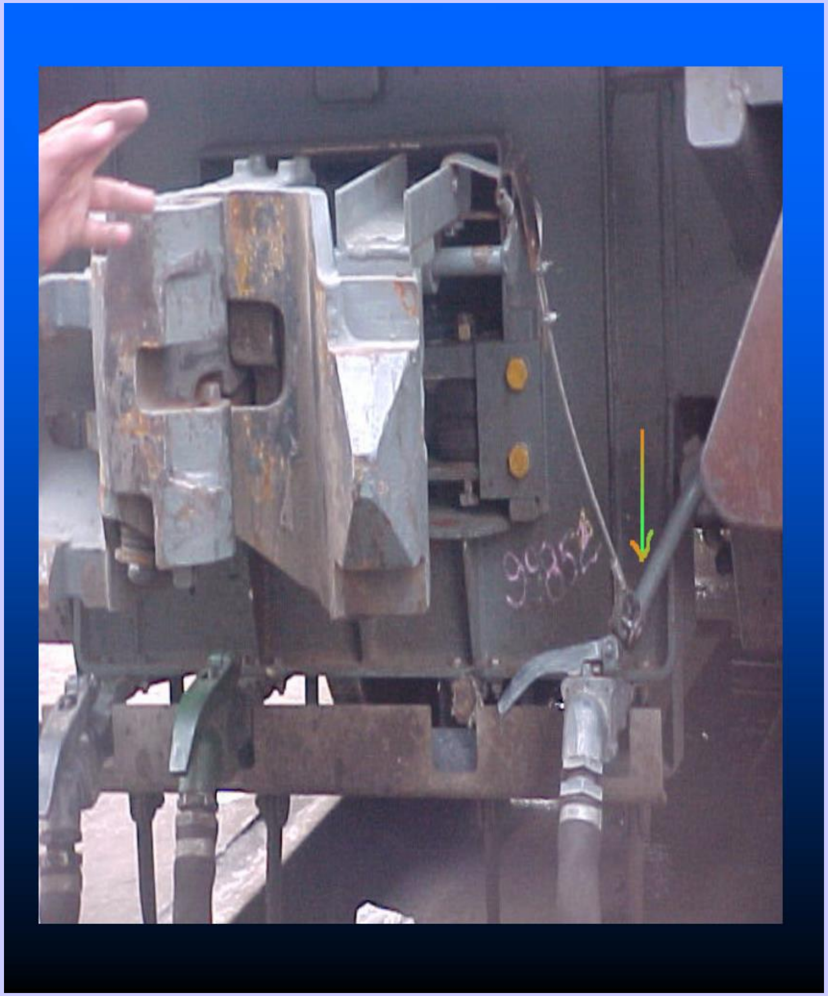
CENTER BUFFER COUPLER OF IMPORTED LHB COACHES

Ring-feder Draft Gear



Comparison of two coupler heads





ANTI-CREEP TESTING

Problems Encountered

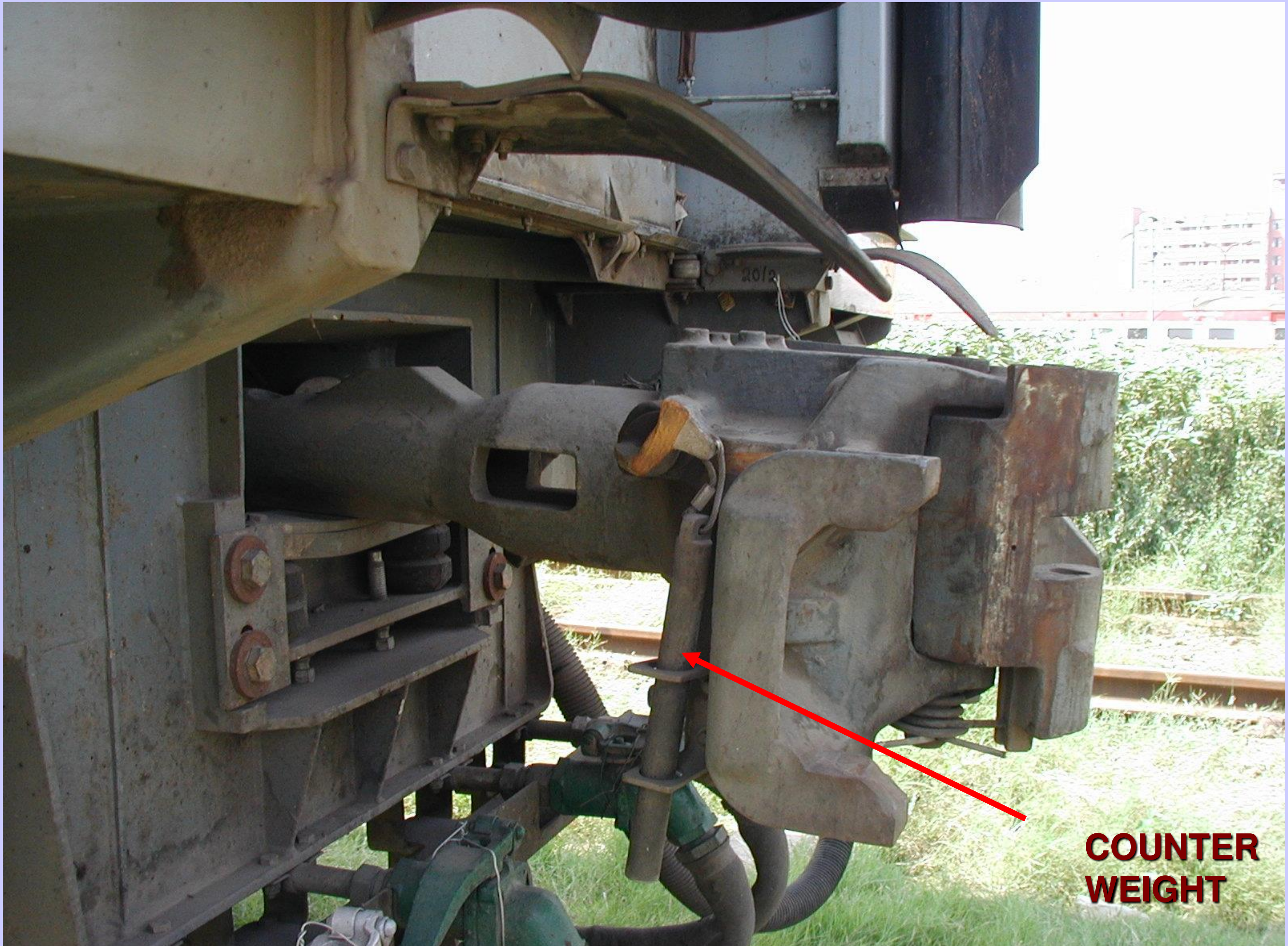
- Train Partings
    - 3 Partings in Train service
    - 3 Parings during trials
- Longitudinal Jerks in Train Operation
    - Increased with service
- Rapid Wear at Coupler and Draft Gear Connection
- Coupler damaged in shunting.
    - Strength of Shank not suitable for Indian Condition

Reasons for Uncoupling

- **Coach To Coach**
  - Weak return spring.
  - Ambiguous tell-tale.
  - Anti-creep Design not fool proof.
- **Between Loco and Gen. Van**
  - Low height of couplers.
  - Vertical interlocking between loco coupler and coach coupler not available.

Measures Adopted

- Return spring replaced with dead weight
- Locking of the rotor lever through a pin
- Painting of new tell-tale marks on the coupler body and the rotor
- Buffer height adjustment of the coaches
- Provision of a restrictor between loco and coach knuckle


COUNTER
WEIGHT

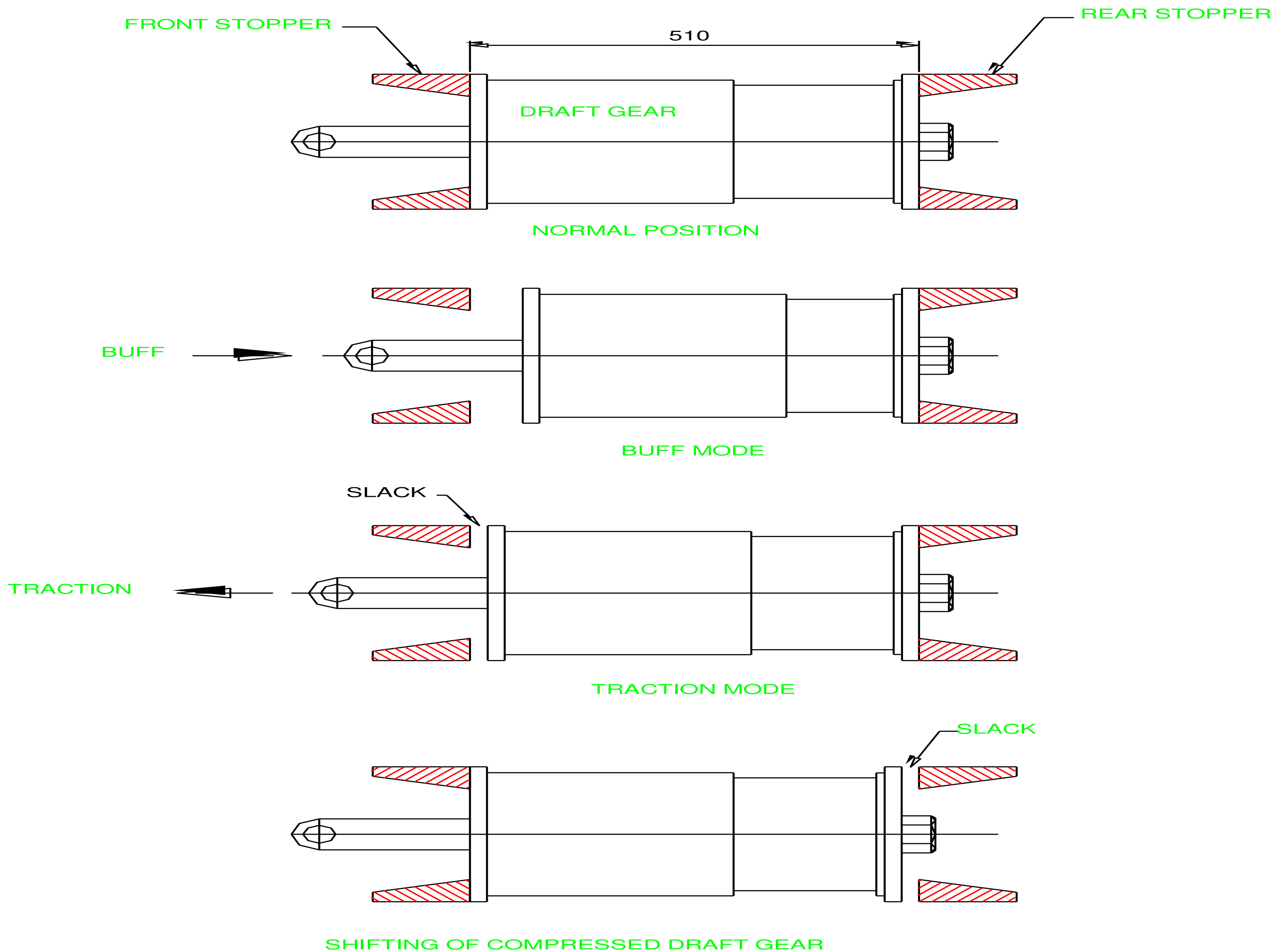
Restrictor was provided on Power Car CBC knuckle to prevent the vertical separation of knuckles between Power Car & Engine

Reasons for the jerks in train service

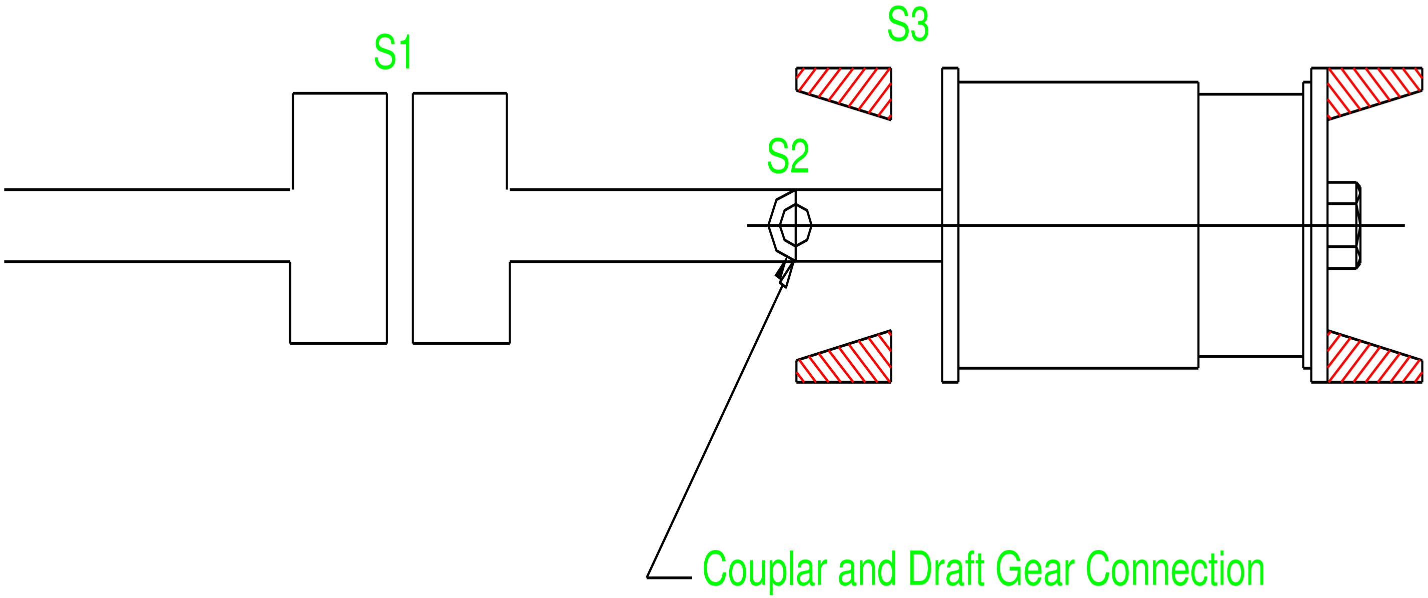
- Slack in coupler heads
- Slack in the coupler and draft gear connection due to wear
- High response time of the draft gear due to slip-stick-slip phenomenon
- Slack generation due to draft gear action
- Loss of preload due to wear of friction springs

SHANK EYE HOLE DIA INCREASED

SLACK DUE TO DRAFT GEAR ACTION



SLACK DUE TO DRAFT GEAR ACTION



New designs of coupler

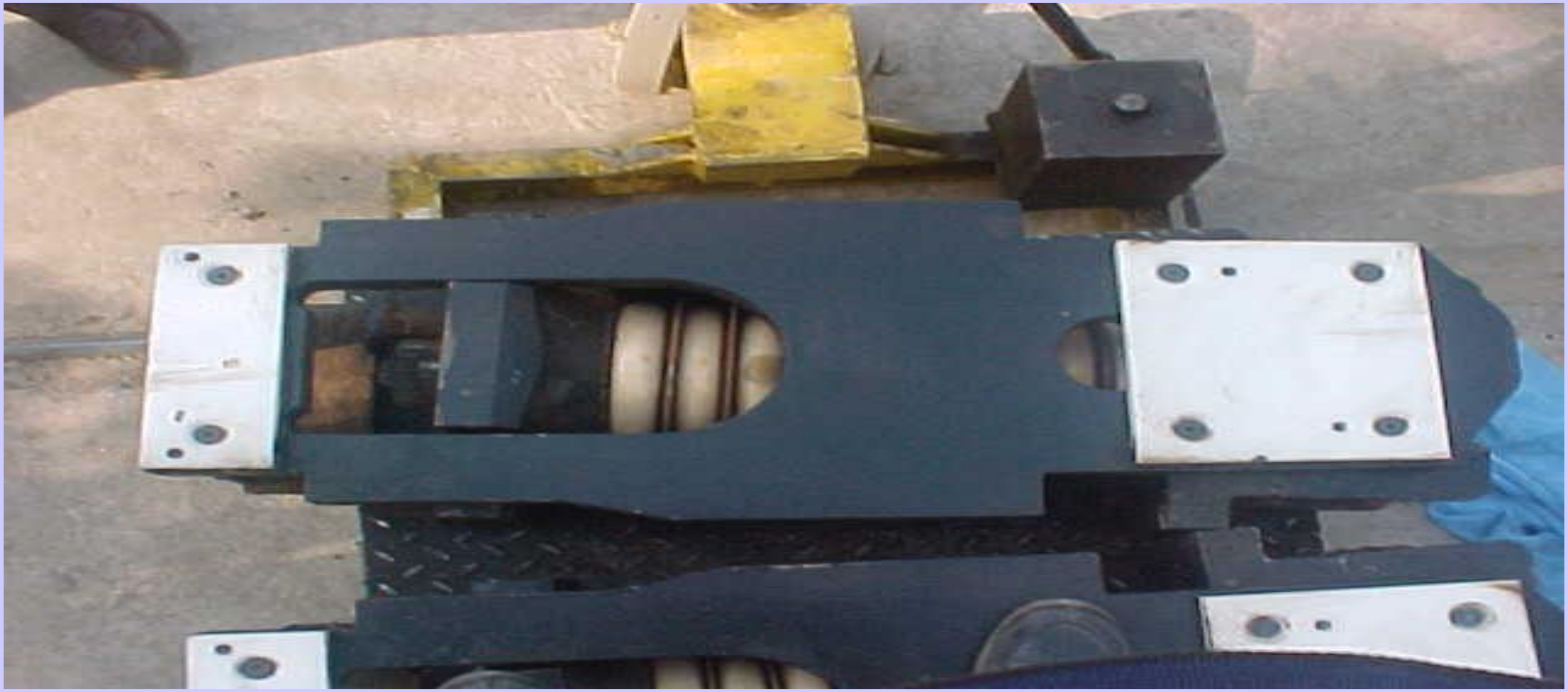
- RDSO developed specification CK-009
- Board issued a Global Developmental Tender
- Two Designs were selected
    - M/s SAB WABCO India Ltd
    - M/s ASF-Keystone USA

INTERCHANGEABILITY OF PARTS

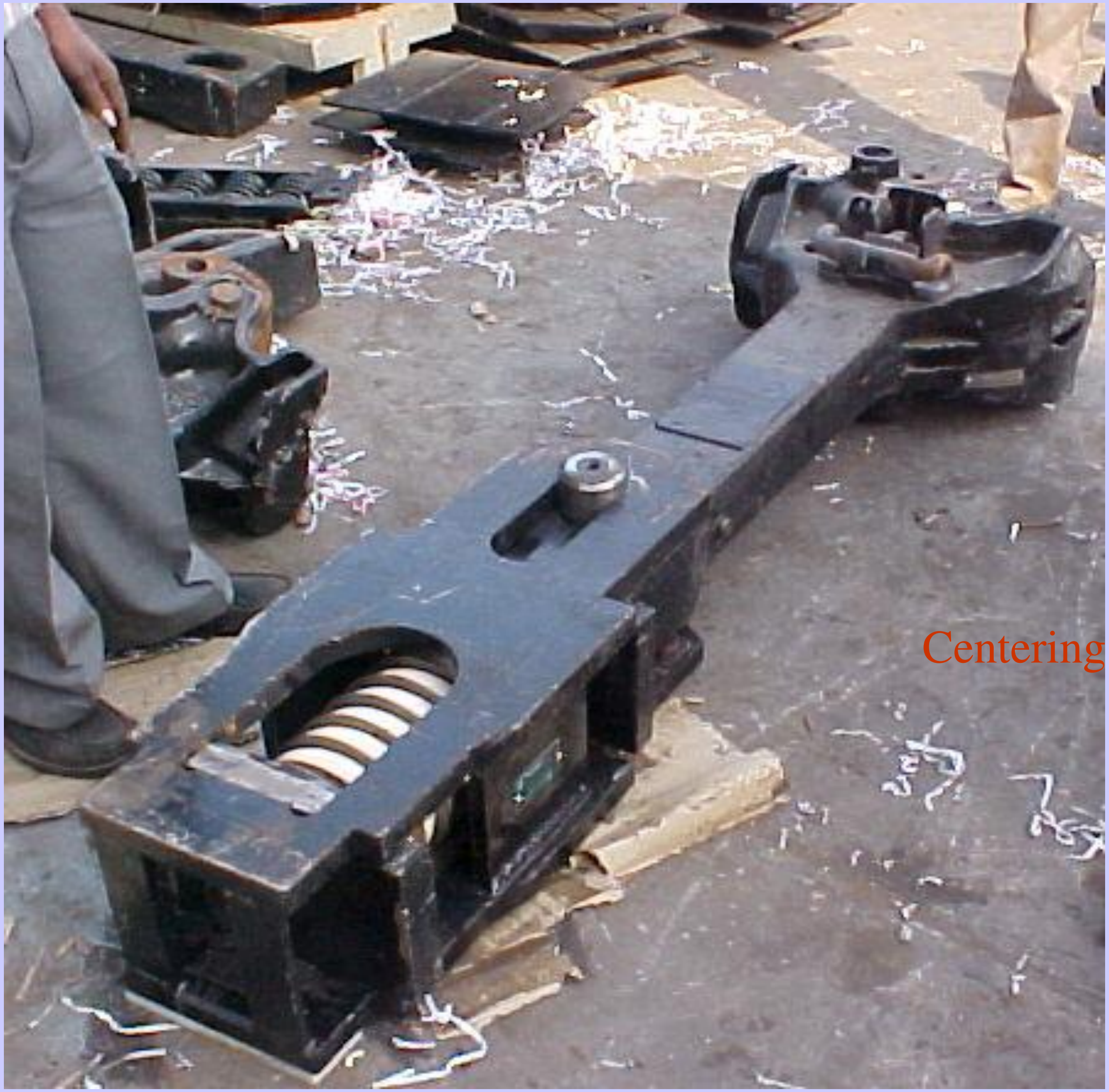
SAB WABCO COUPLER HEAD WITH MERIDIAN RAIL KNUCKLE

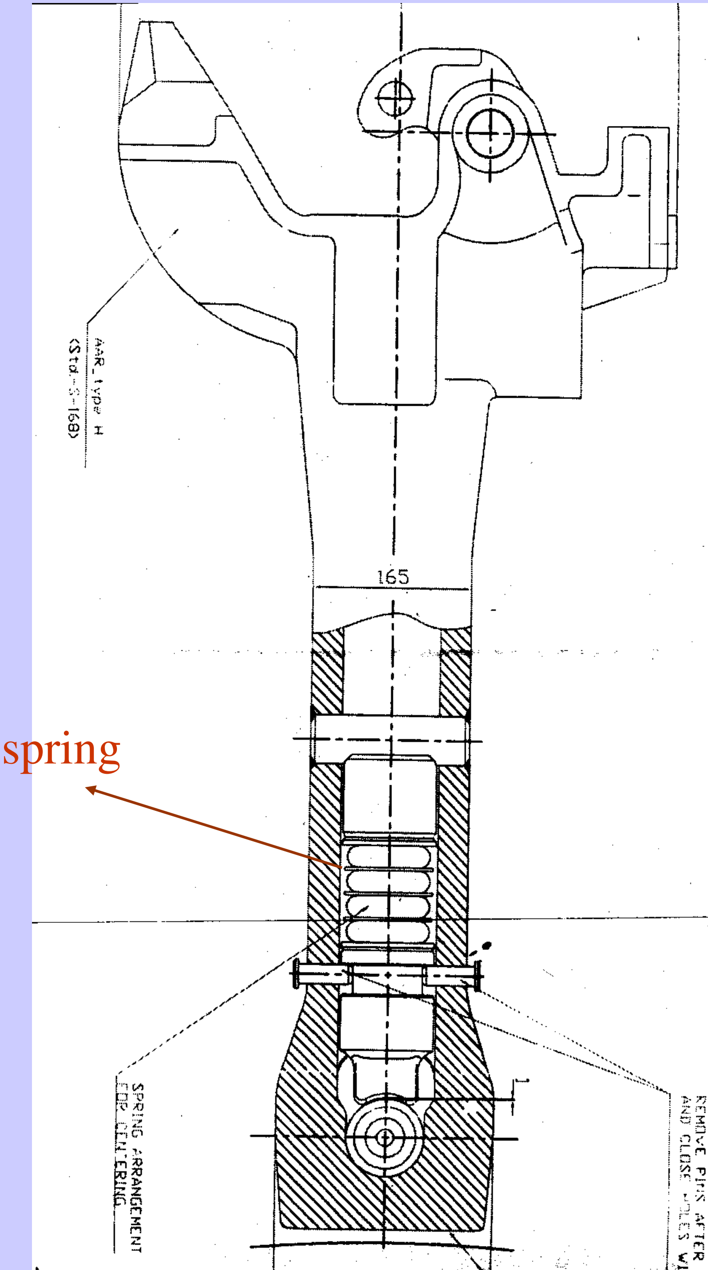
FEATURES OF SAB-WABCO COUPLERS

- AAR ‘H’ TYPE COUPLERS WITH SQUARE SHANK
- DRAFT GEAR HAVING MTPACK SPRINGS



SAB-WABCO





Centering spring

Coupler on the LHB Coach

Salient Features

- Slack in new condition specified 3.5 mm.
- End Force –1600KN Max.
- Damping factor specified 0.6.
- Travel of draft gear increased to 90 mm.
- Pre-load specified as 50+/- 10 KN.
- Emphasis on indigenization for more sources.
- Test procedure regarding Mech. Proper-ties defined.

Thank

You

PRESENTATION
ON
IMPROVED HIGH TENSILE TIGHT LOCK C B C WITH AAR 'H' TYPE HEAD AND BALANCED DRAFT GEAR

Rajendra

Instructor/MSTC /GKP

Since the introduction of Centre Buffer Coupler, Indian Railways are facing problem of longitudinal jerks. Though various measures were taken in the past to deal with the problem of jerks, no significant improvement was observed.

RDSO has done a comprehensive analytical study on causes for longitudinal jerks and based on the finding, it has been concluded to use balanced type draft gear for coaching stock.

A new specification of CBC with balanced type draft gear has been prepared.

The specification has been made to meet IR's specific requirement and on the basis of experience of using CBC in passenger stock for approx. one decade.

At present, the supporting arrangement inside the under frame of the coach has provision of front stopper and rear stopper which is suitable for single pack draft gear.

This is not optimal for balanced type draft gear. However, as of now , no change in supporting arrangement has been made in the specification.

PARTICULAR REQUIREMENTS

The Coupler shall be of non-transition type and also couplable with the existing AAR E type couplers, RDSO specification No.56-BD-07 drawing No. SKDL-3430 being used on locomotives

Coupler head should be of AAR‘H’ type. The connection between coupler and draft gear should have sound design concept suitable for main line passenger trains.

All components and sub-assemblies of the coupler (including draft gear) shall be interchangeable with corresponding parts of another coupler of the same make and design.

Length from coupling line to pivot point as 1030mm shall be mandatory . The head contour shall be as per S-168 of APTA SS-M-002-98.

The guard arm of coupler head shall be up to 3.5 mm only in new condition.

Double rotary lock lifter should be provided with an additional anticreep mechanism

by providing rib in addition to existing rib to prevent unintended lifting of lock lift lever

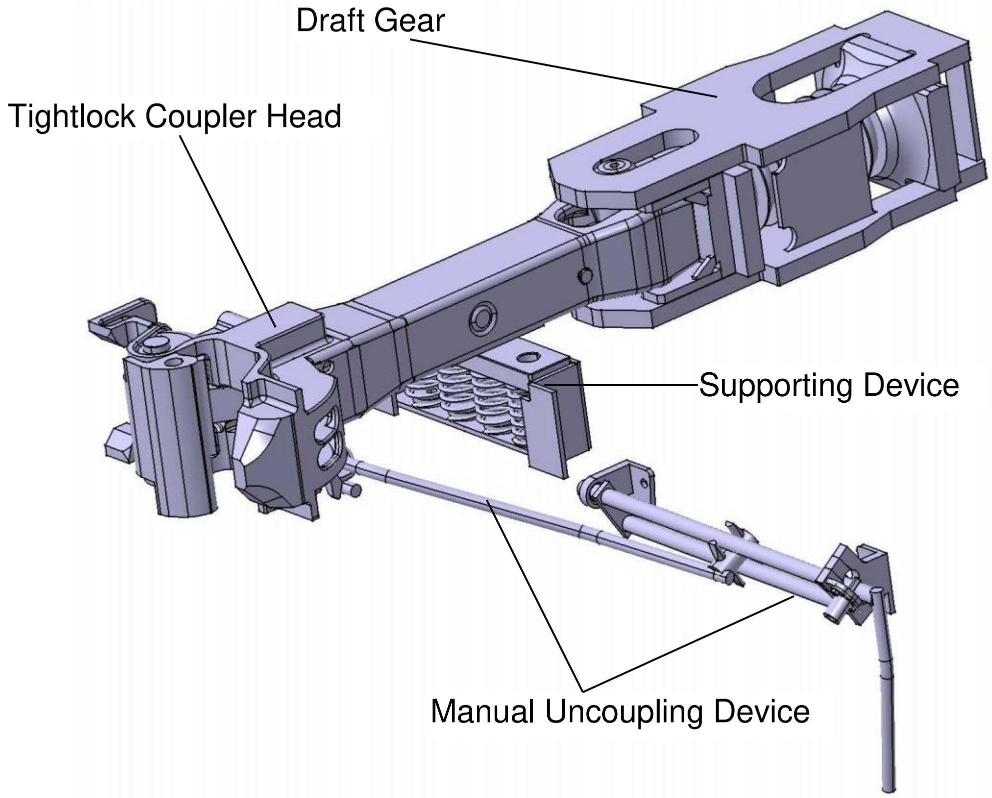
(the hook of the uncoupling rod should be in between ribs.)

The coupler operating mechanism shall comprise of rigid steel members for articulation. Use of wire or any other limp/flexible material in the articulation shall not be accepted. The coupler operating mechanism should have proper locking arrangement for anti-vandalism.

Locking screw arrangement with protective cover to prevent lifting of uncoupling rod by unauthorized persons shall be provided. It should be possible to operate the locking mechanism with the help of a key

The design of coupler head shall enable coupling of two couplers with a maximum vertical displacement of their centre lines of by 90mm without manual assistance

The horizontal gathering range of the coupler heads shall be 110mm on either side of
the longitudinal centre lines of the coaches without manual assistance on straight track.

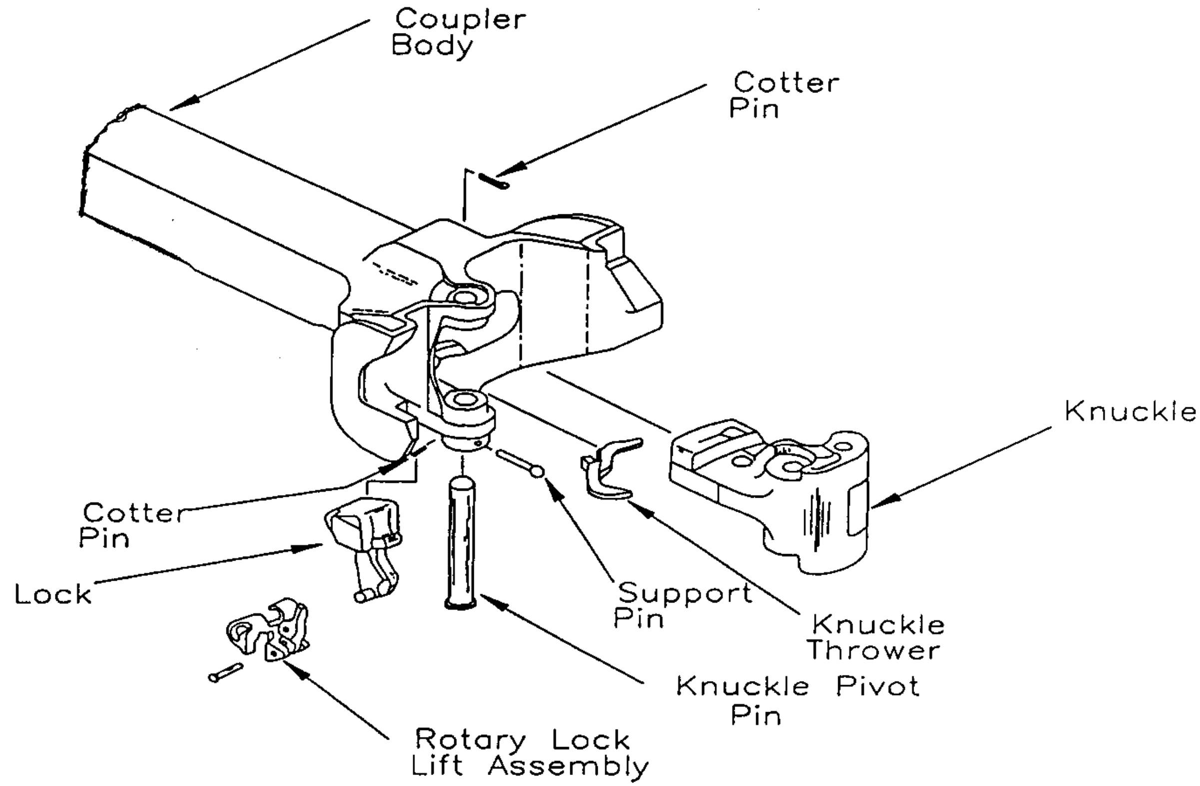

Draft Gear
Tightlock Coupler Head
Supporting Device
Manual Uncoupling Device

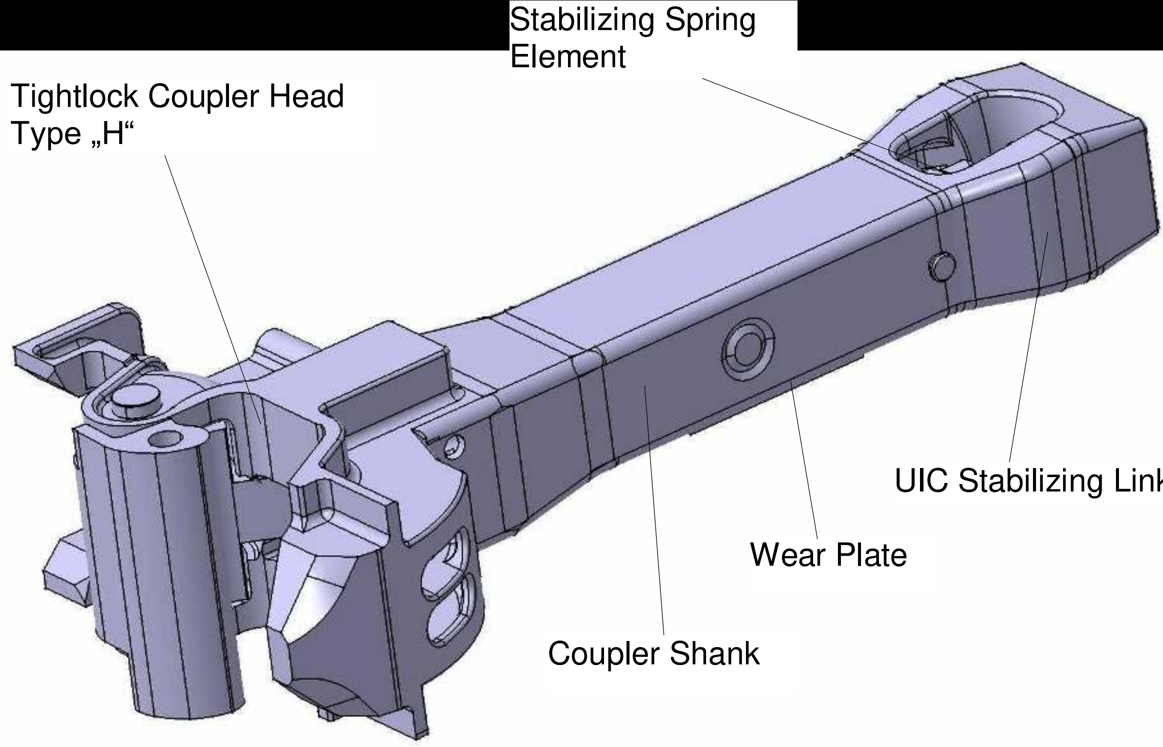
Advantage

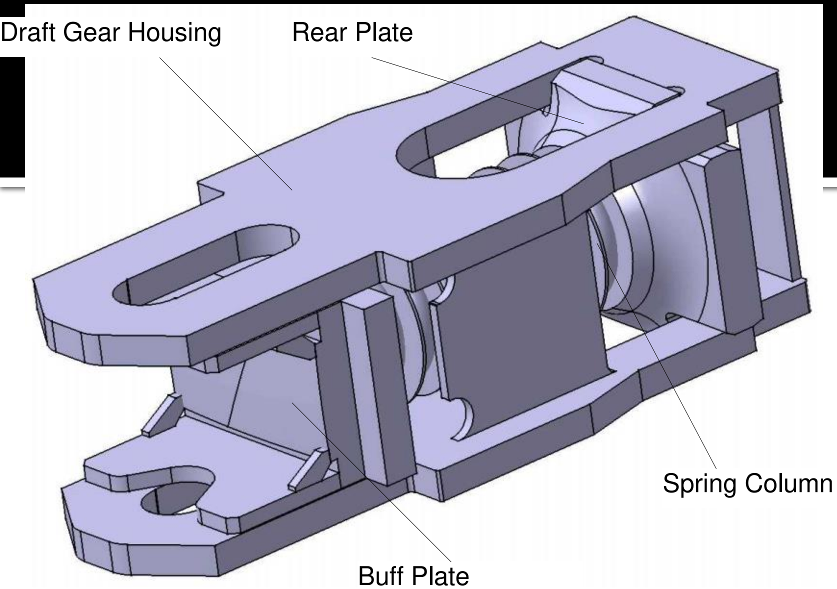
1. Automatic Coupling
2. Anti climbing feature in the event of derailment / accidents.
3. Higher strength-haulage of Longer trains possible
4. Transmit both draft and buffing forces
5. Chances of unauthorized uncoupling eliminated
6. Less jerk in coaches during braking
7. Lesser maintenance
8. Chances of interlocking of buffers has been eliminated during impact

Main parts

1. Tight lock Coupler Head
2. Draft Gear
3. Supporting Device
4. Manual Uncoupling Device




Stabilizing Spring Element
Tightlock Coupler Head Type „H“
UIC Stabilizing Link
Wear Plate
Coupler Shank



Double acting device for energy absorption

Stroke Tensile-58m.m.

Buff -80m.m.

SUPPORTING DEVICE

- Four preloaded compression spring
- Coupler head rest on the supporting device

Gathering Range

Horizontal : +/- 110 m.m.

Vertical : +/- 90 m.m.

Coupling is automatic , for uncoupling –unlock the handle, lift and rotate clockwise

Locking and unlocking of manual uncoupling device

- Yellow strip on the end of side panel
- Use of letter ‘C’ as suffix to the coach number.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प्रवेश
ENTRY
1-8
9-16
LIFT HERE

Fitted between Loco& Coach

Restricts vertical movements

OPERATING CONDITIONS

- Axle Load 16.25 t max
- Gross Load (Coach)) 65.00 t max
- Gross Load (Train) 1300 t (max without loco)
- Grade 1 in 37 (steepest)
- Speed (max) 110 kmph (with 26 coaches)

160kmph (with 18 coaches)

Shunting Speed (max) 9.5 kmph

Wheel Dia

- New 915 mm.
- Condemning 813 mm.
- LHB varients 840 mm.

Coupler Height

- For Coaches 1105mm.
- For Locos 1090mm.

Braking Distance

- 1200 m from a speed of 160 kmph
- Maximum deceleration 1.3m/sec^2 per square sec

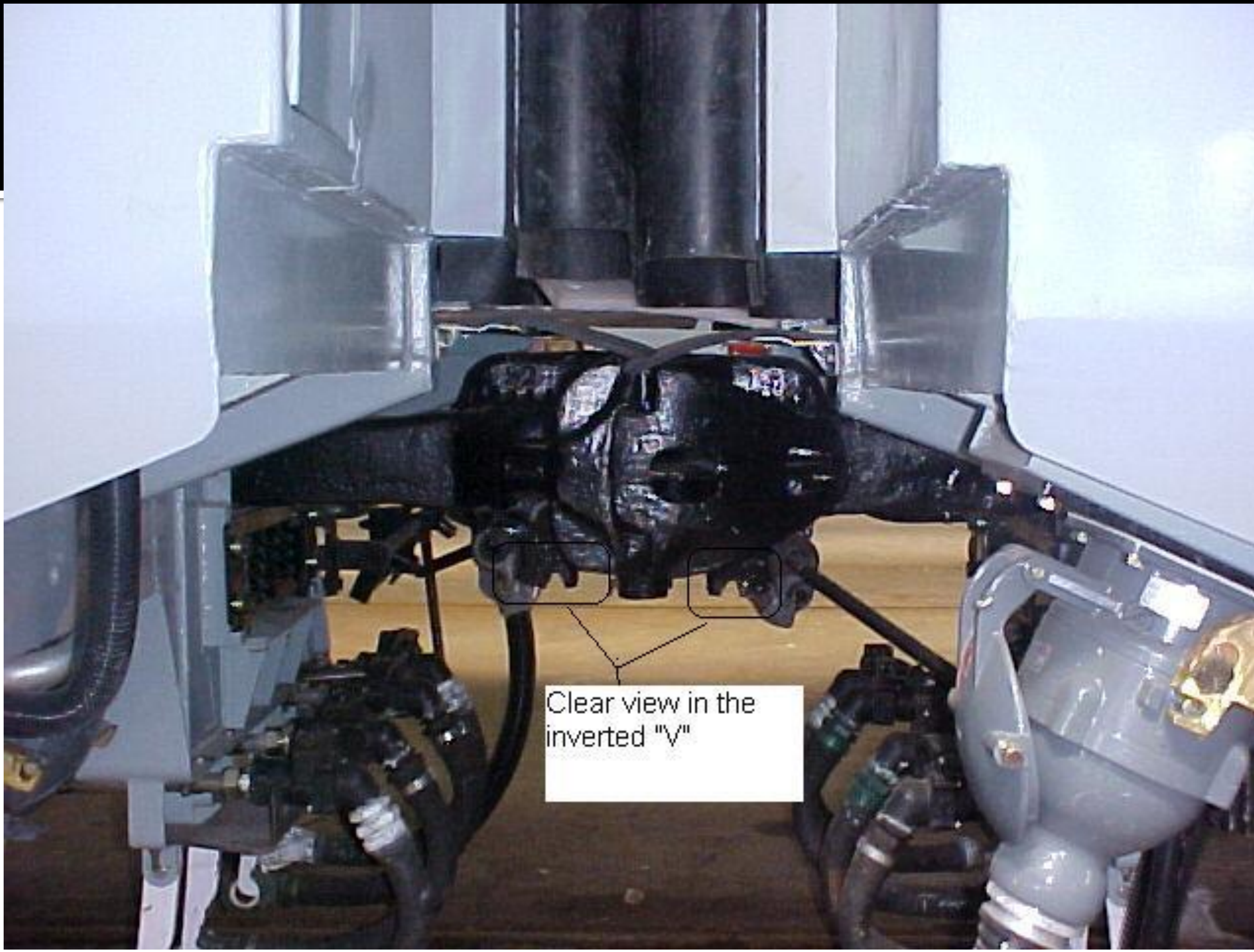
Following points shoud be checked before coupling

Check points 1:- No oil or grease should be applied on the coupler internal parts such as Knuckle, Lock Lifter etc. Oil and grease on the coupler internal parts can cause the lock to slide and lead to uncoupling automatically.

Check points 2:- Knuckle and coupler Head machiined faces should be parallel when Knuckle is in closed condition. This can be examined visually.

Bring the vehicles near to each other at a slow speed (aprox.2-3 kmph) and stop the vehicle approximately 1 -2 meter distance of each other.

- Check the alignment and position of coupler centers. Coupler must stand within the gathering range.
- If the required, pull the coupler manually towards each other and make sure that they are in gathering range of the coupler geometry.
- Now push vehicles together slowly (approx. 3kmph)for coupling the two coaches.
- Check the position of tell tale device for proper coupling. Locked the handle of manual uncoupling device.


Clear view in the
inverted "V"

- [redacted] after coupling.

- After coupling reverse the power to pull (snatch) the vehicles apart.
- This is a typical pull test to reconfirm a positive coupling.

Uncoupling procedure

- Location of the tell tale

- For uncoupling, use the manual uncoupling device provided. Uncoupling lever of this device is accessible from the trackside.

- Unlock the handle by rotating locking screw with the special key. Lift and turn the handle in clockwise direction to a horizontal position (minimum 90°) and pull the coaches apart.

- Before uncoupling make sure that the couplers are not subjected to any tensile load and the uncoupling lever is fairly free to turn.

A common practice for this uncoupling operation is also to push the vehicles together (with one vehicle applied with parking brake) to avoid excessive binding in the system.

Check points to ensure proper coupling

The following points must be checked to insure proper coupling:-

Coupled condition:

Check points 1: telltale slot should be clear of rotary lock lift Lever

Check points 2: Rotary lock Lifter rib should be vertical

- Check points 3:

  Locking screw of manual Un Coupling Device shoud be in locked condition.

Following points shoud be checked before coupling

Check points 1:- No oil or grease should be applied on the coupler internal parts such as Knuckle, Lock Lifter etc. Oil and grease on the coupler internal parts can cause the lock to slide and lead to uncoupling automatically.

Check points 2:- Knuckle and coupler Head machiined faces should be parallel when Knuckle is in closed condition. This can be examined visually.

- Uncoupled Condition

Check points 1: Securing bolt should be in unlocked condition. Uncoupling device operating rod handle can be operated to uncouple.

- Uncoupled Condition

Check points 1: Securing bolt should be in unlocked condition. Uncoupling device operating rod handle can be operated to uncouple.

Check points 2 :-Rotary lock Lift Lever should be visible in tell tale slot.

Check point 3:- Rotary lock Lifter rib should not be vertical.

oo

- Check point 4:-The knuckle and coupler Head machined faces should not be paralles.

a When both knuckles are in open condition

b when one knuckle is open & the other is in closed condition.

C couplers are coupled.

However, for coupling first coach with locomotive,SLR CBC knuckle shall be in the closed position as advised in para -4 of section A. For coach to coach coupling, coupler head of one of the coach shall be preferably in closed condition.

- Condition that will not permit coupling .
- I. If both knuckles are in closed condition coupling will not take place.

Maintenance of Coupler Head

Monthly	Check tell tale of couplers. Visual check for external damage, condition of wear plate on shank. Replace wear plate if necessary.
Quarterly	Repeat above checks. Coat bare steel areas of coupler head body and knuckle with Molykote D321R (or equivalent) dry spray. **CAUTION: Do not spray on the knuckle locking surface and internal parts like lock etc.**
Annually	Repeat above checks. Check gap between coupler head and knuckle with Jaw gap gauge (NO-GO). If wear out is not acceptable replace knuckle etc., as advised in the maintenance manual. Check by profile gauge (GO). Conduct anti-creep check.
6 – 8 years	Repeat above checks. Overhaul coupler head. Check parts for wear out. Replace if necessary.

Maintenance of Draft gear

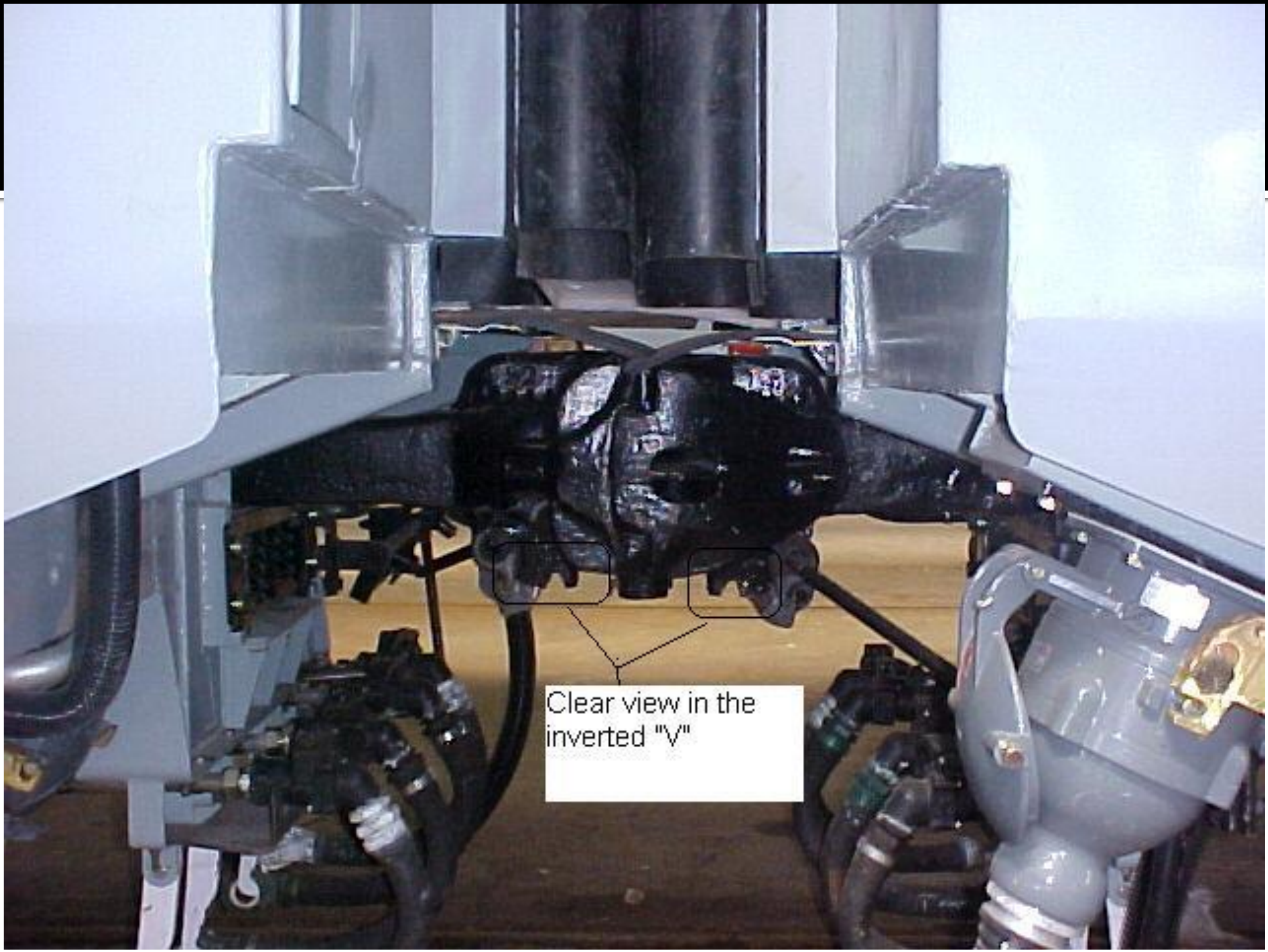
Monthly	Check for loose bolts, external damage.
Quarterly	Repeat above checks. Check draft gear seating in the pocket. Examine condition of buff plate. Apply grease if necessary.
Annually	Repeat above checks.
6 – 8 years	Repeat above checks. Check pre-load value. Replace spring column if necessary.

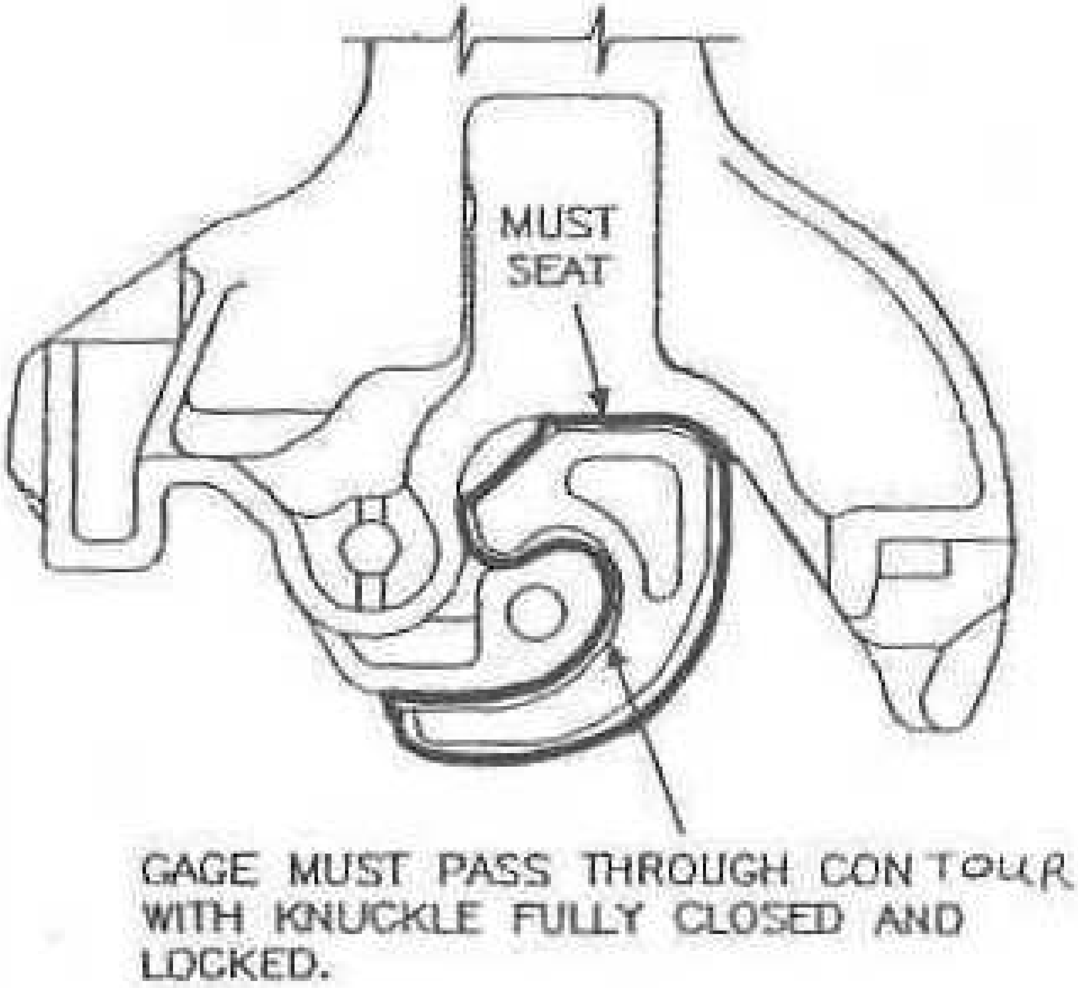
Maintenance of Supporting device

Monthly	Visual check for external damage. Check height 187.5 mm both sides near the bolts. Tighten the M16 nut to set specified height. Apply grease on wear plate. Check condition of wear plate. Replace wear plate if necessary.
Quarterly	Repeat above checks.
Annually	Repeat above checks.
6 – 8 years	Repeat above checks. Check compression spring for loss of pre-load. Replace if necessary.

Maintenance of Manual uncoupling device

Monthly	Visual check for external damage, loose bolts etc. Apply grease on the slide and slide rods.
Quarterly	Repeat above checks.
Annually	Repeat above checks. Check wear on slide, slide rods and bearings. Replace if wear is excessive.
6 – 8 years	Repeat above checks.


Clear view in the
inverted "V"



PROFILE GAUGE

- DESIGN FEATURES OF HIGH CAPACITY DRAFT GEARS

Type of Draft Gear	wt (kg)	Capacity (kg.m.)	Travel (mm)	Reaction force (tonnes)	Performance efficiency (%)	Energy absorption
MK-50	170.3	5385	81.5	269.0	23.7	86
RF-361	138.0	5725	67.8	232.3	36.6	79.6

- DEVELOPMENT OF HIGH TENSILE COUPLER & HIGH CAPACTY DRAFT GEAR.

Coupler body	Gr.B	Gr.E	290	330	169	205
Knuckle.	Gr.c	Gr.E	251	295	132	180

THANKS

TRAIN PARTING

WHAT IS TRAIN PARTING?

Train parting is unforeseen division of a train into two or more portions while the train is on run or just about to move. This is termed as “J” Class Accident

Types of Train Parting

Train parting is classified under two main heads.

1.Vertical parting -takes place due to

- Excessive CBC height variation. The main reasons for variation in CBC height are;
- Loose/ low rail joints
- Mud pumping under the rail joints.
- CBC drooping– excessive wear and tear of coupler shanks and striker casting/ bearing piece.
- Excessive over loading in the wagons.

2.**Horizontal Parting :-**

Horizontal train parting takes place due to following reasons:

- Uncoupling of CBC.
- Breakage/ wear of CBC components due to inherent defects. Failure of draft gear.
- Bad engineman ship.

THE REASON OF TRAIN PARTING

I. Operational reason
II. Due to defective signal
III. Poor Maintenance of P. Way Track
IV. Improper maintenance of rolling stock
V. Failure on A/C of Commercial Department
VI. Miscellaneous

Operational reason

- Bad engineman ship by driver
- Brake binding due to emergency application of the brakes.
- Bad driving technique such as fast notching up of locomotive.
- Sudden application of brakes, bad driving on gradient, improper road knowledge etc. Can also contribute to train parting.

Due to defective signal

- Train parting mostly occurs on up gradient followed with down gradient.
- The most important location where the cases are more is near the home signal where drivers while starting from home signal after stopping are not ensuring releasing of brake resulted shock load on knuckles

Poor Maintenance of P Way Track

Analysis of section wise occurrence of train parting on railway indicates that bad section can be identified such as poor rail joints, mud accumulated track create uneven height with CBC coupler resulted train parting due to vertical slipping of knuckle and driver should be counselled for pre drive techniques.

Main Cause of Train parting

(i) Lock not properly engaged –

- In most of the cases, the lock does not drop down to the full locked position inside the coupler head.
- This may result in slipping up of the lock during run causing uncoupling.

(ii) Ineffective anti-creep device –

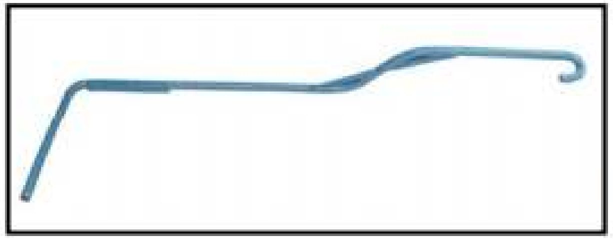
- Lock may slip up due to jerking and jolting during run if the anti creep feature is not effective.

(iii) OPERATING HANDLE DROPPING ON RUN –

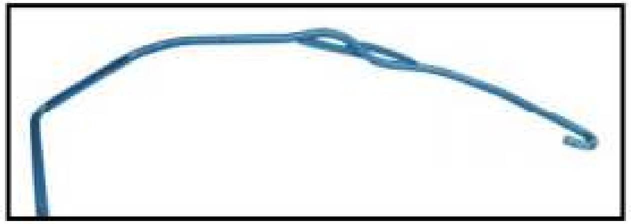
- This is caused by breakage of supporting bracket resulting in operating handle falling down on run and hitting the ballast.
- This tends to turn the handle leading to lifting of the lock piece and uncoupling.

(IV) EXCESSIVE PLAY BETWEEN ANTI–ROTATION LUG AND BEARING PIECE SLOT :

- Due to excessive play between anti-rotation lug and bearing piece slot, operating handle can operate on run due to jerks and can cause uncoupling.
- Anti rotation lug is made out of square cross section MS bar with standard dimensions of 16 mm x 16 mm and slot width in bearing piece of 17.5 mm.



Standard operating handle



Bent operating handle

Standard slot width

Worn out slot width

(iv). Variation between the CBC heights of adjacent wagons should be within the permissible limit **of 75 mm.**

(v) Unauthorized tempering with operating handle –

(vi) Uncoupling due to vertical slipping out of knuckle –

Measures to avoid Train Parting-

The Loco Pilots have an important role to pay in preventing the train parting cases. Good driving skill is very important. Some of the guidelines useful for drivers are given as under : -

- **It is observed that additional shock load comes on the coupler when drivers apply traction before full release of brakes.**
- **Starting of goods train after stopping-wait for minimum 3 minutes in case of air brake train to release the brakes.**

- Avoid jerky movement during starting and stopping train.
- While starting a train, the notching up shall be gradual as to have smooth run out and thereby avoid the shock loading of CBCs.

- While negotiating gradients, camel humps, maintain uniform speed, till the train passes the section.
- Before negotiating and ascending or descending gradients, attain the critical speed necessary to negotiate the section, so that uniform speed can be maintained while passing over the graded section

- After application of brake, sufficient time shall be given for the release of brakes on the entire formation, before accelerating.
- When continuous wheel slip is experienced, reduce the speed of the train, to avoid shock loading of CBCs.
- There shall be proper co-ordination between the leading driver and banker driver while negotiating the up-gradient in ghat section.

Failure on A/C of Commercial Department

Over-Loading (Beyond carrying capacity) :

If any particular wagon is over-loaded beyond its carrying capacity will lead to difference in buffer height between two wagons (more than 75 mm), it may cause disengagement of knuckle in locked condition i.e. vertical slipping of knuckles.

Un-Even Loading: Due to un-even loading of any particular wagon it may lead to uneven CBC height on either end of the wagon & may cause in train parting.

Miscellaneous

- Due to handling of operating handle by miscreant.
- Grazing of operating handle with platform while running.

THANK YOU

ए.ए.आर.(एच) टाइप टाइट लॉक सेन्टर बफर कपलर

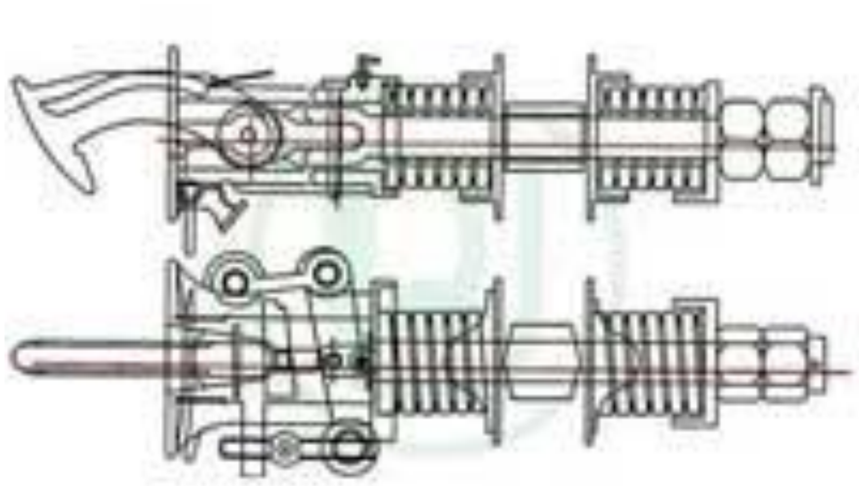
राजेन्द्र कुशवाहा
अनुदेशक(समाडि)

The different types of couplers and their usage are-

S.No	Type of coupling	Usage
1.	**Screw coupling**	
	IRS Type	4-Wheeler wagons
	Enhanced coupling	All Coaching stock
2.	**Centre Buffer Coupler**	
	AAR type NHT	8 Wheeler goods stock Vacuum braked stock
	AAR type HT	Wheeler goods stock Air braked stock
	Alliance II type	4 Wheeler goods stock
3.	**Automatic buffer Coupler**	MG stock
4.	**Schaku Coupler**	DEMU / EMU
5.	**AAR Modified**	LHB coaches
6.	**Slack free Coupler**	BLC Wagons

कपलर के प्रकार

- ABC Coupling



- Screw Coupling

Types of CBC adopted in IR

1. AAR E/F type used in wagon.
2. AAR(H) type Tight lock used in LHB coach. (Supplied by M/S Faiveley & M/S Escorts)
3. Dellner Coupler used in LHB coaches
4. Rigid Type- Shacku coupler used in EMU.
5. Slackless drawbar – BLC wagons
6. Transition coupling
7. Hook type – MG/ NG stock

Introduction

- Coupling facilitates inter connection of rolling stock to form a train.

❖ Earlier design-

(i)Draft load through screw coupling arrangement.

(ii)Buffing load through side buffers.

Screw Coupling.

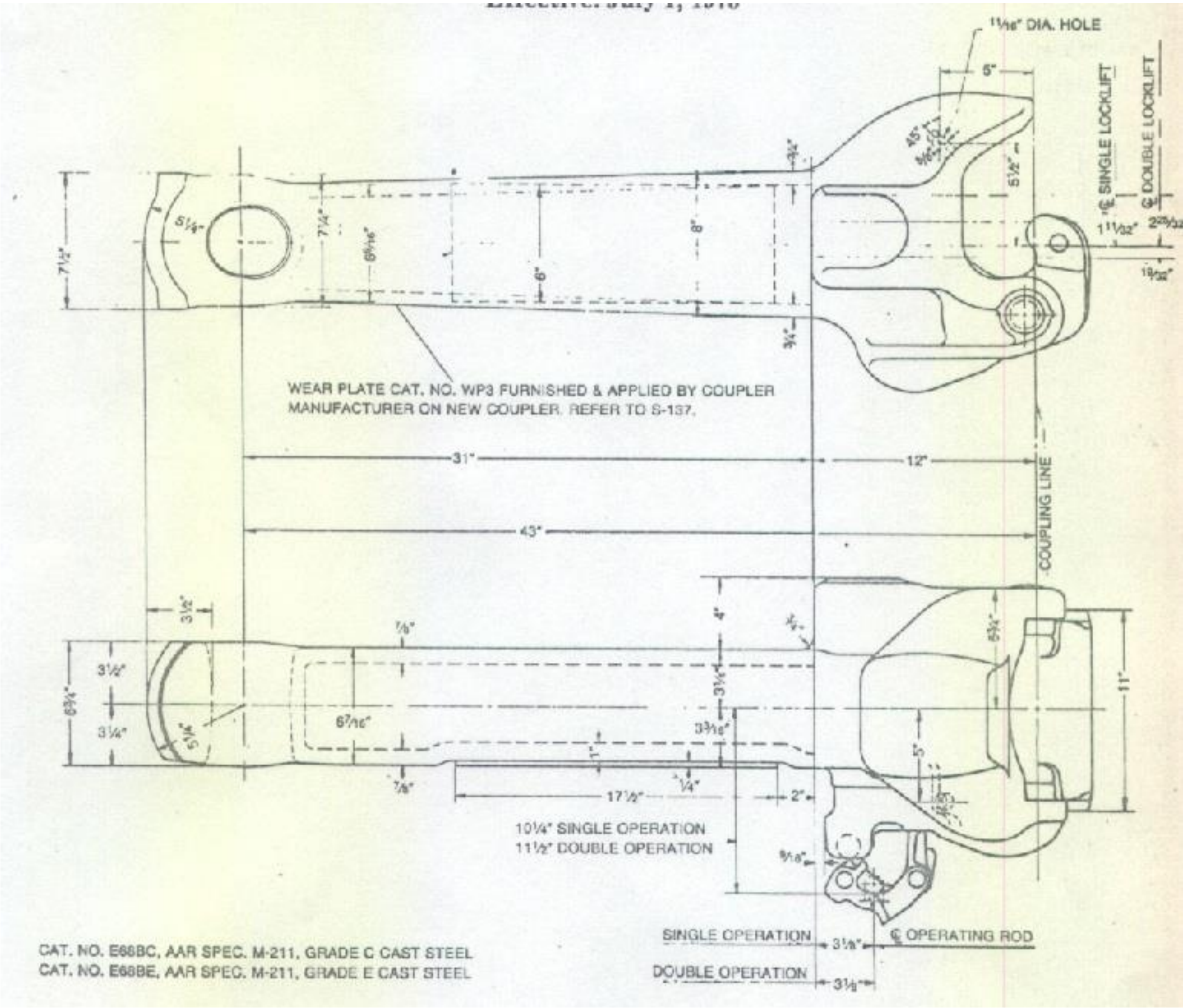
- Limitations
  - Haulage of longer train is not possible in freight
  - Climbing of coaches in collisions and derailment.
  - Shunting Staff at Risk.
  - Higher maintenance staff requirement

Advantages of CBC

- Safe for shunting staff & reduces time required.
  - Automatic coupling type.
  - Quick detachment possible.
- Less staff for uncoupling
- Coach only - Anti-climbing feature is to prevent damage to life & property during accident.
- Prevention of un- coupling in the event of derailment / accident

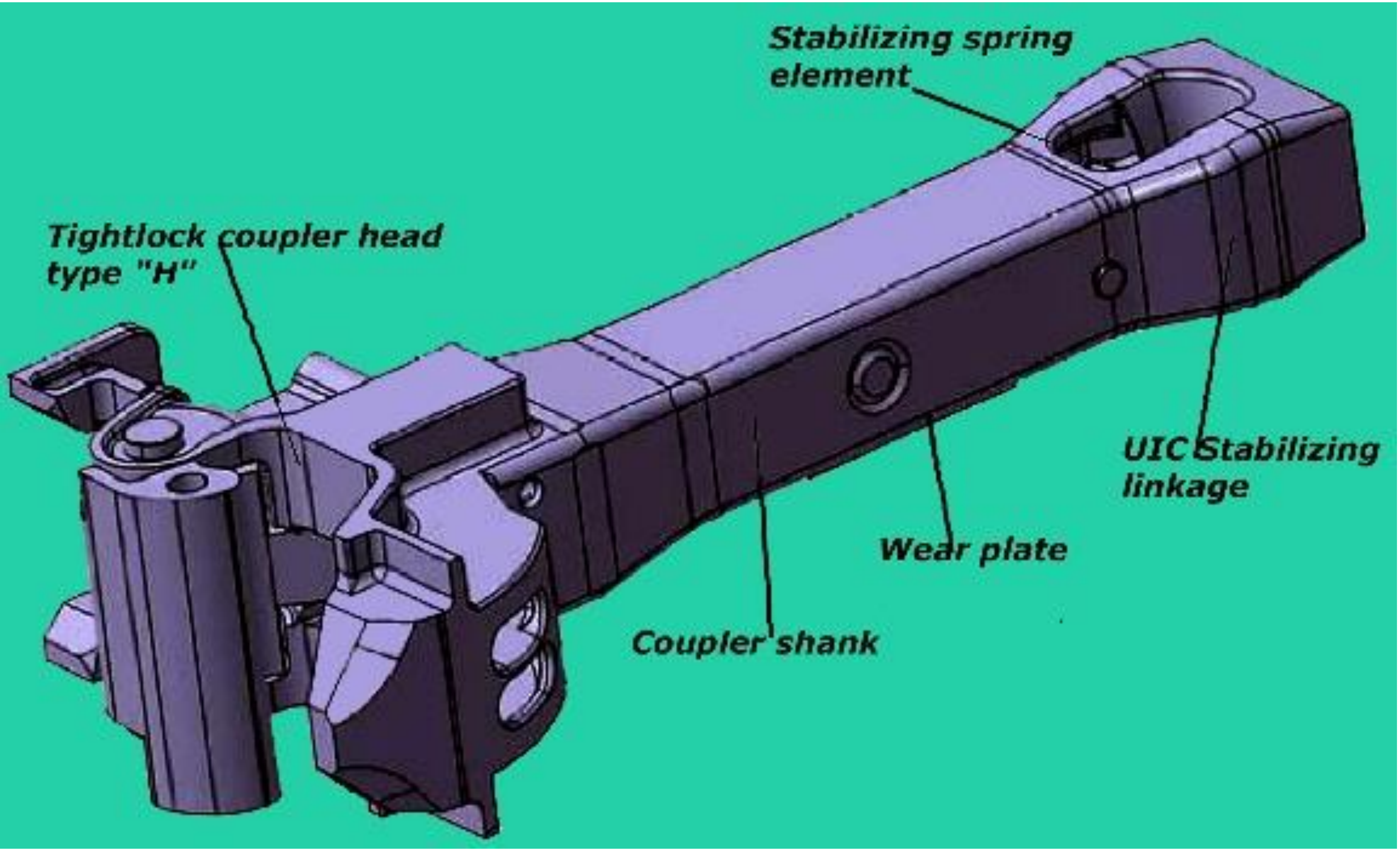
- ट्रान्जिशन सीबीसी कपलिंग

• सीबीसी कपलिंग

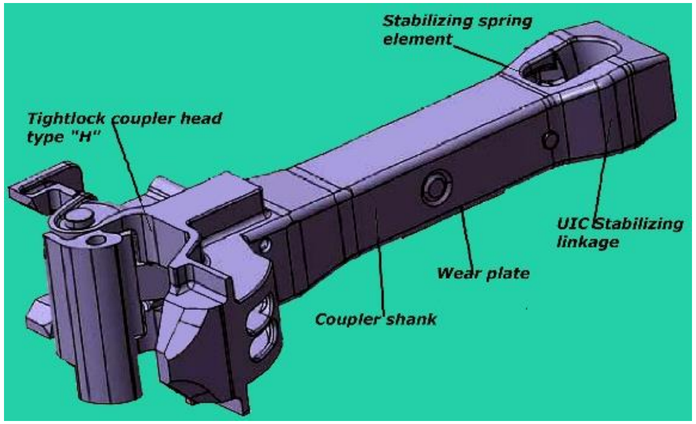


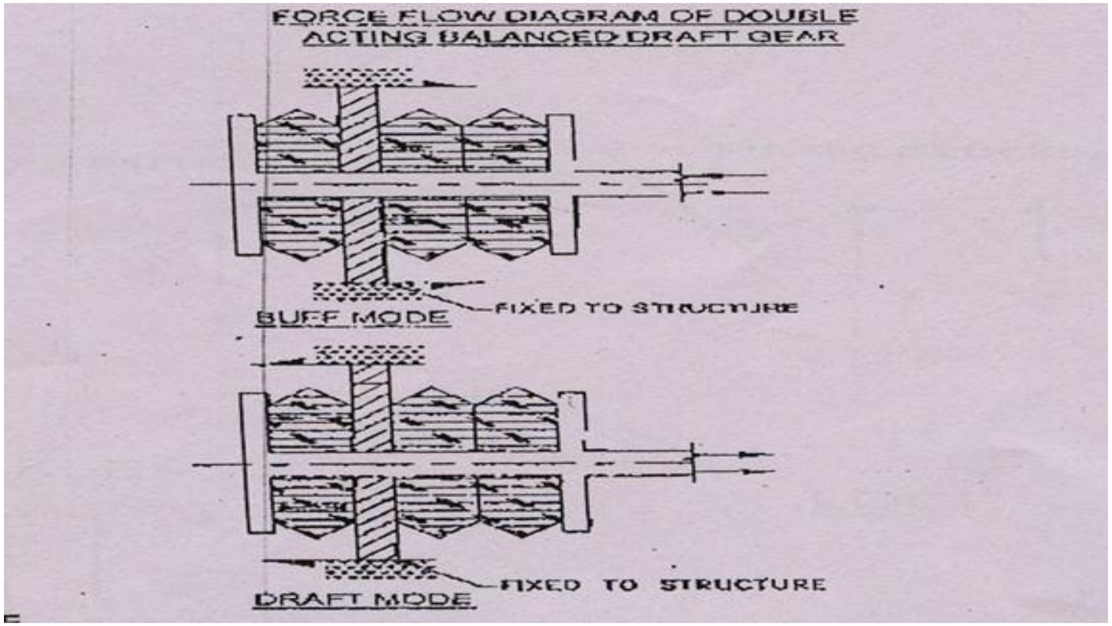
11/16" DIA. HOLE
℄ SINGLE LOCKLIFT
℄ DOUBLE LOCKLIFT
WEAR PLATE CAT. NO. WP3 FURNISHED & APPLIED BY COUPLER MANUFACTURER ON NEW COUPLER. REFER TO S-137.
31"
12"
43"
COUPLING LINE
17½"
2"
10¼" SINGLE OPERATION
11½" DOUBLE OPERATION
SINGLE OPERATION
DOUBLE OPERATION
℄ OPERATING ROD
CAT. NO. E68BC, AAR SPEC. M-211, GRADE C CAST STEEL
CAT. NO. E68BE, AAR SPEC. M-211, GRADE E CAST STEEL

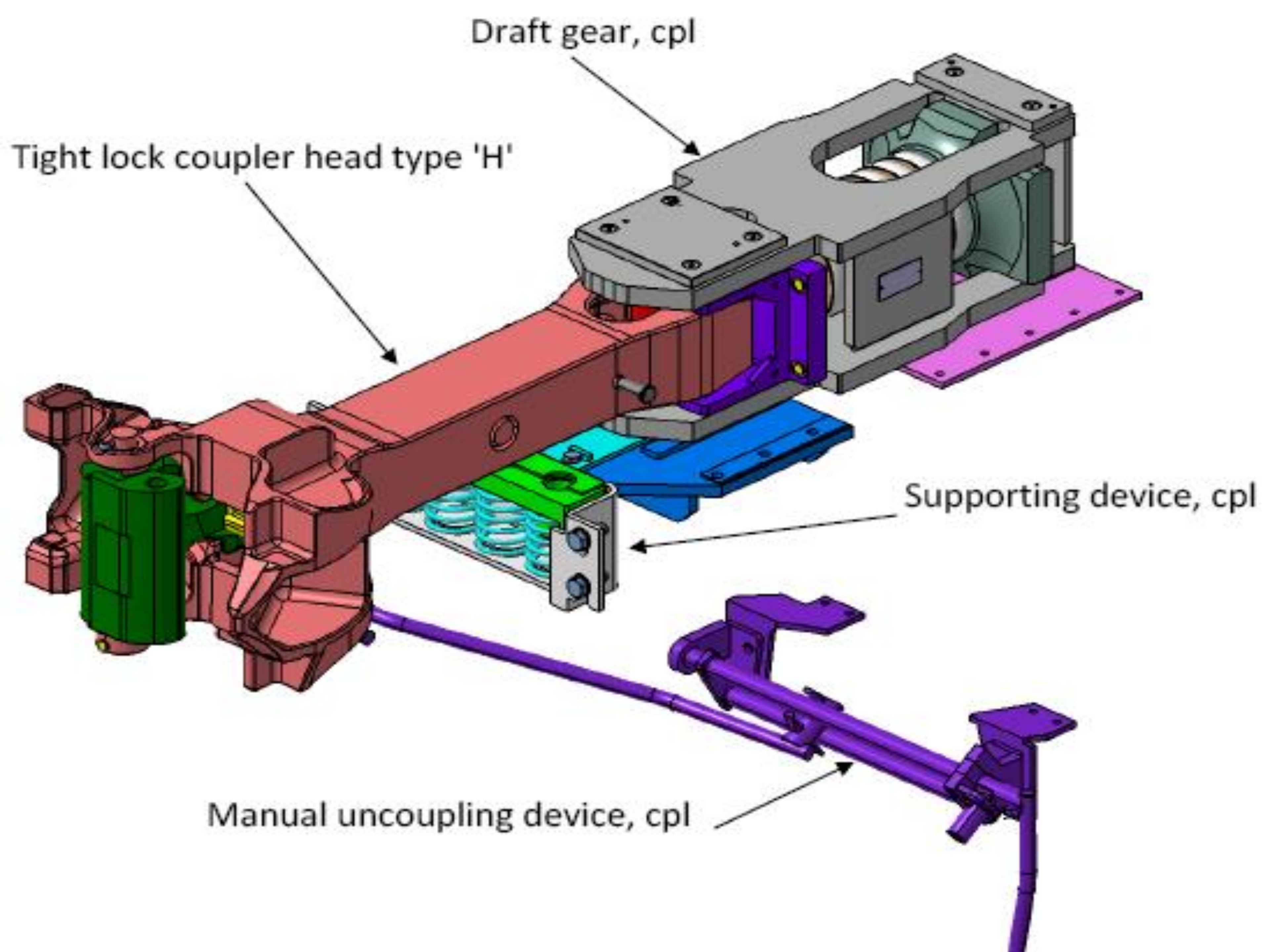
- एएआर एच टाइप कपलिंग



• इम्प्रूव्ड टाइट लॉक कपलिंग

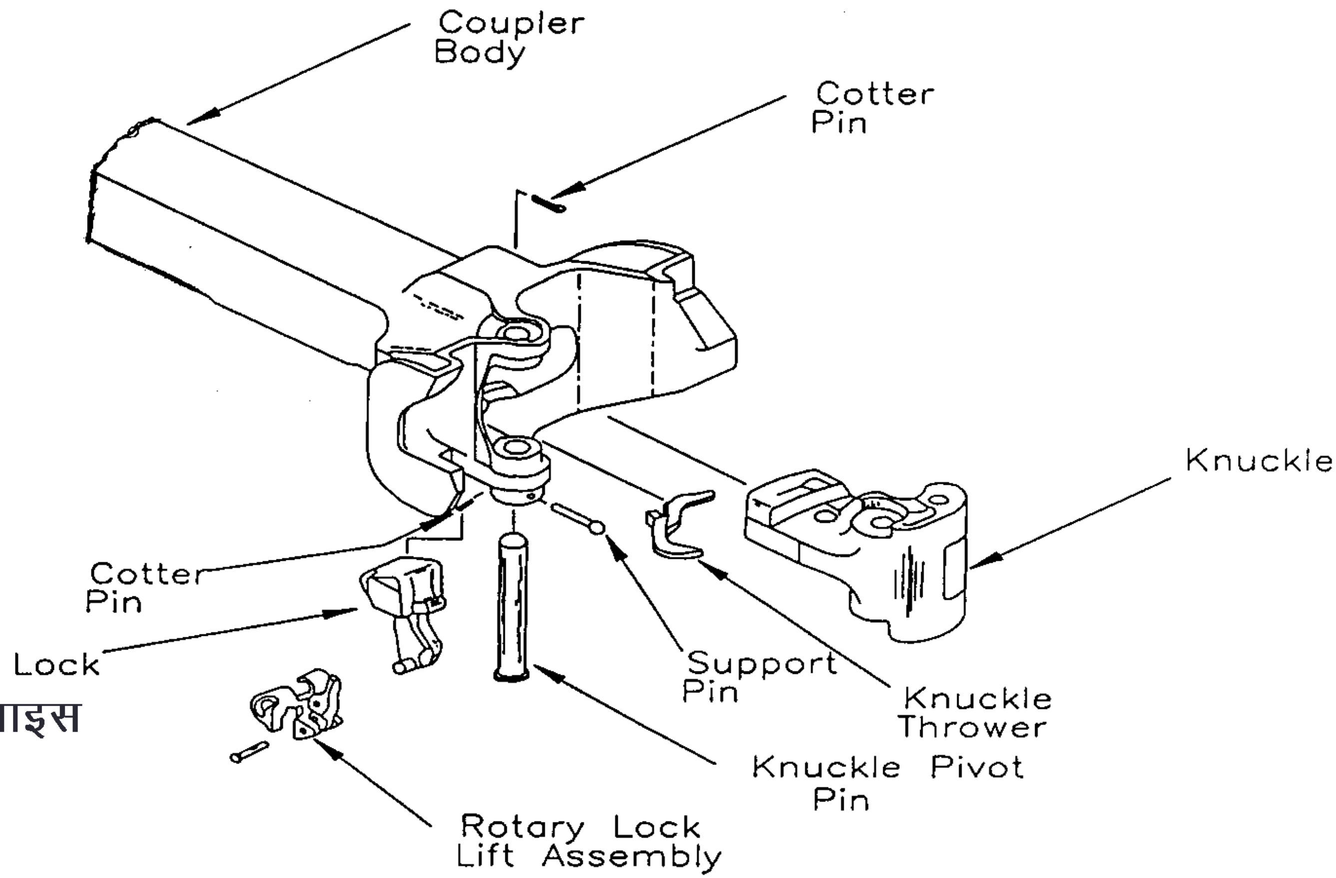


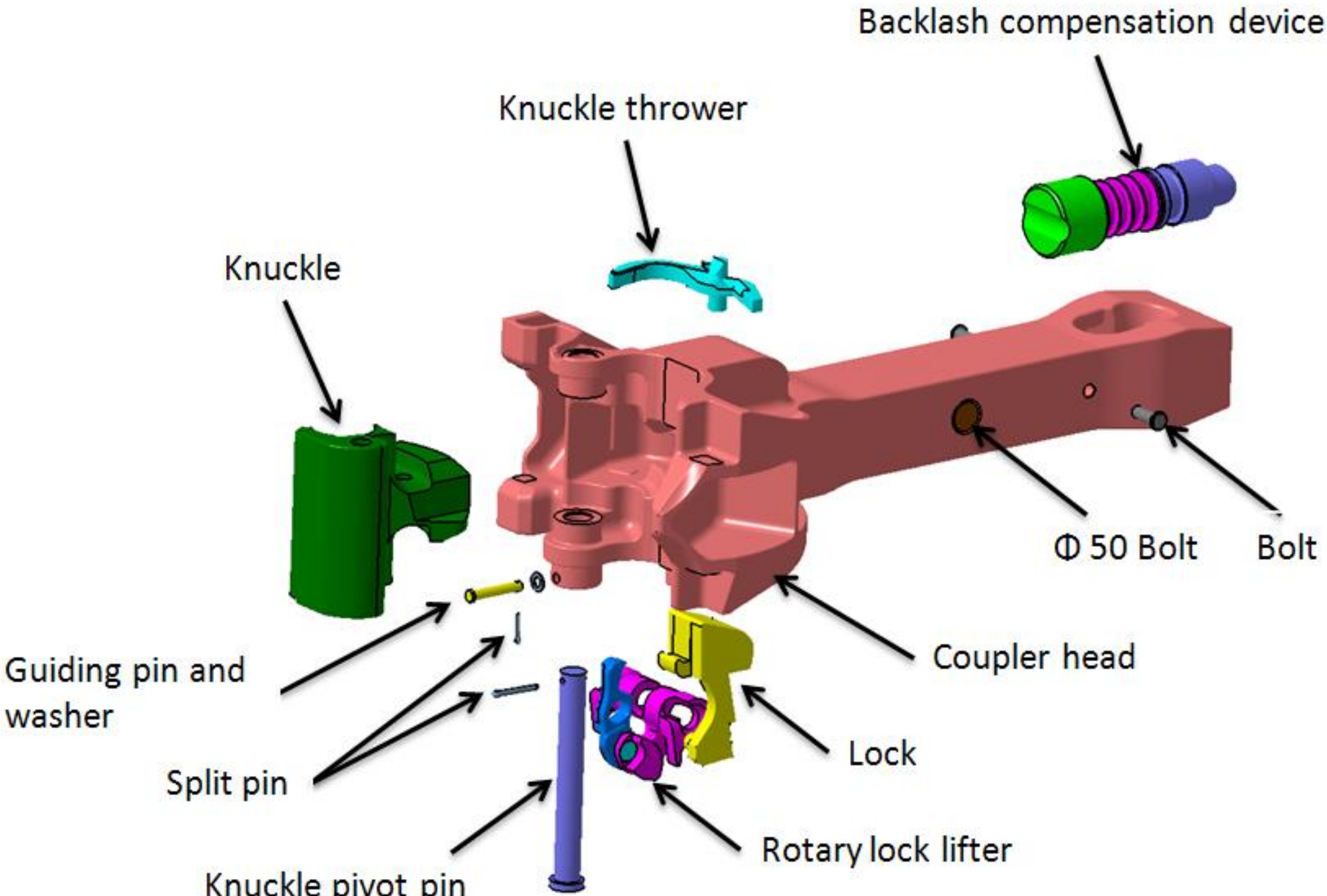



Draft gear, cpl
Tight lock coupler head type 'H'
Supporting device, cpl
Manual uncoupling device, cpl

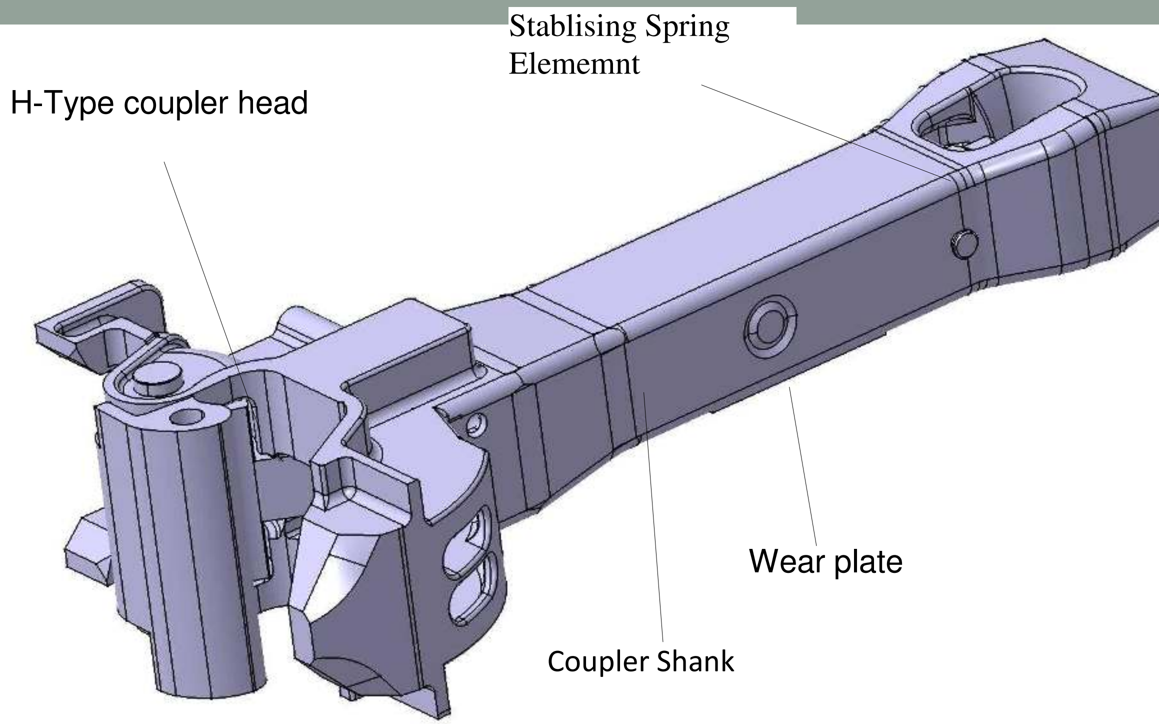
मुख्य पार्टस

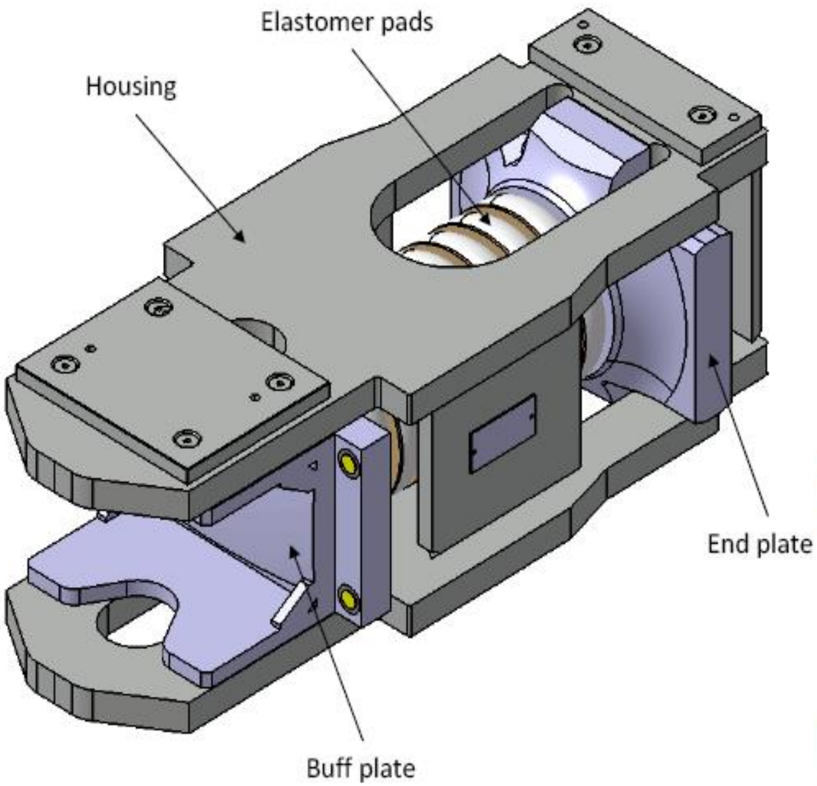
1. टाइट लाक कपलर हेड
2. ड्रफ्ट गियर
3. सपोर्टिंग डिवाइस
4. मनुअल अनकपलिंग डिवाइस



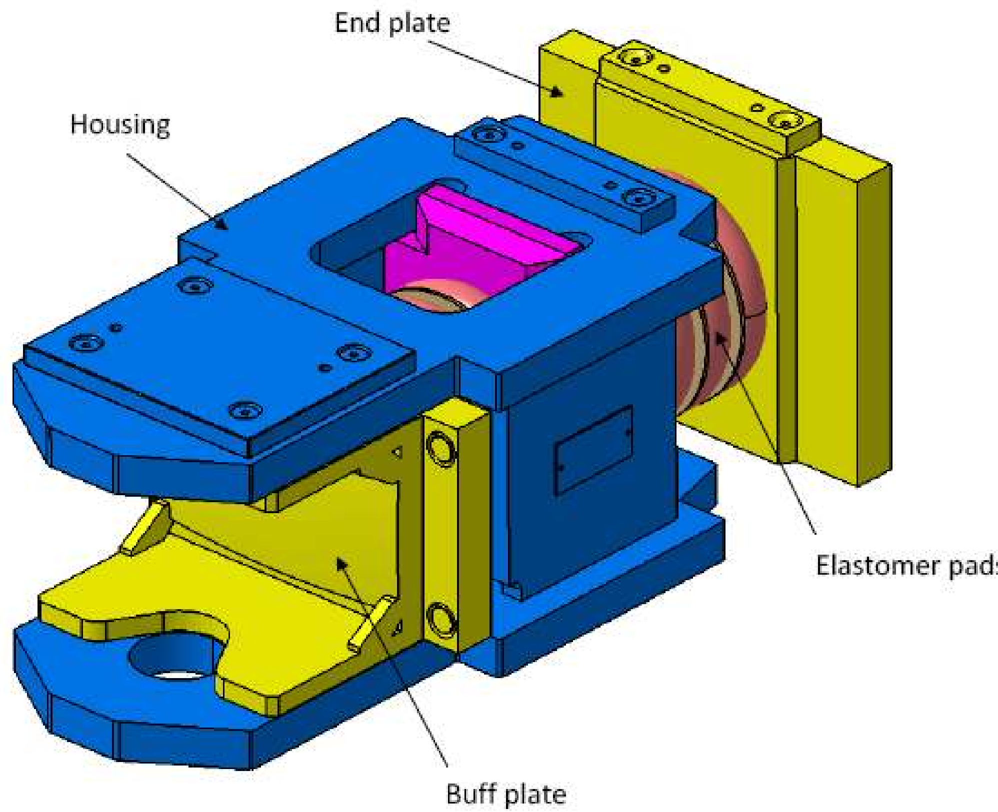


Backlash compensation device
Knuckle thrower
Knuckle
Φ 50 Bolt
Bolt
Coupler head
Guiding pin and washer
Lock
Split pin
Rotary lock lifter
Knuckle pivot pin


Stablising Spring
Elememnt
H-Type coupler head
Wear plate
Coupler Shank

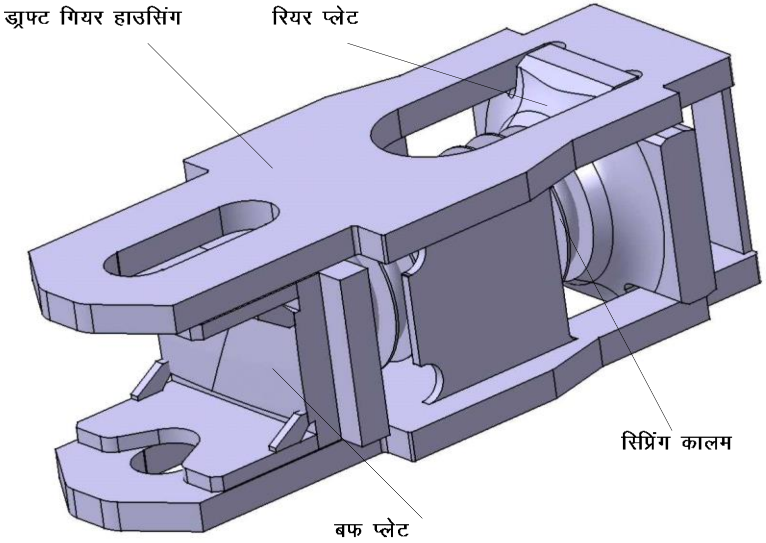


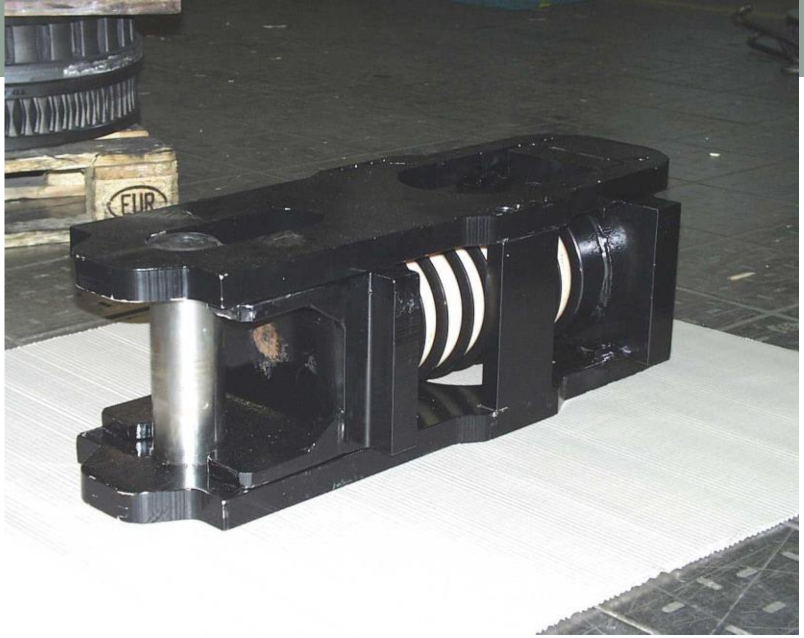
Draft gear, cpl



Draft Gear, cpl. with Floating plate, Type BC 80/45F

Draft Gear

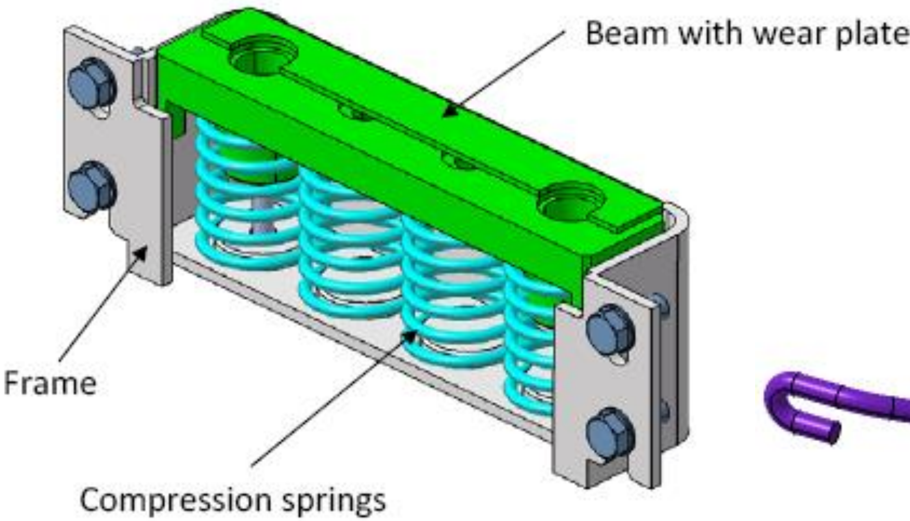




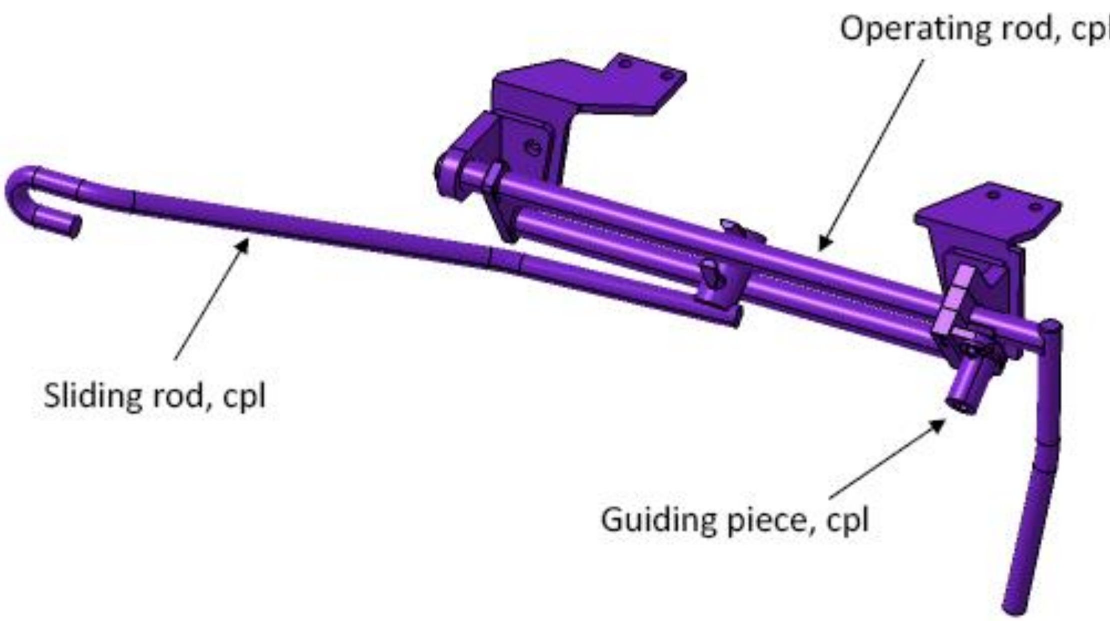
एनर्जी एब्जार्पशन हेतु डबल एक्टिंग डिवाइस

स्ट्रोक टेन्साइल. – 58 मि.मी

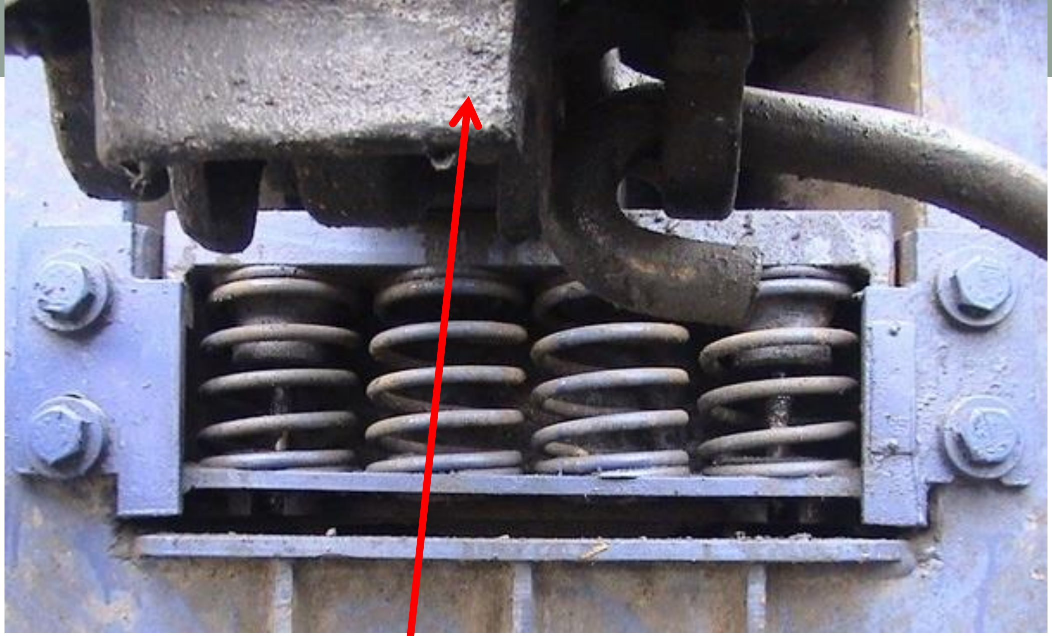
बफर – 80 मि.मी



Beam with wear plate
Frame
Compression springs

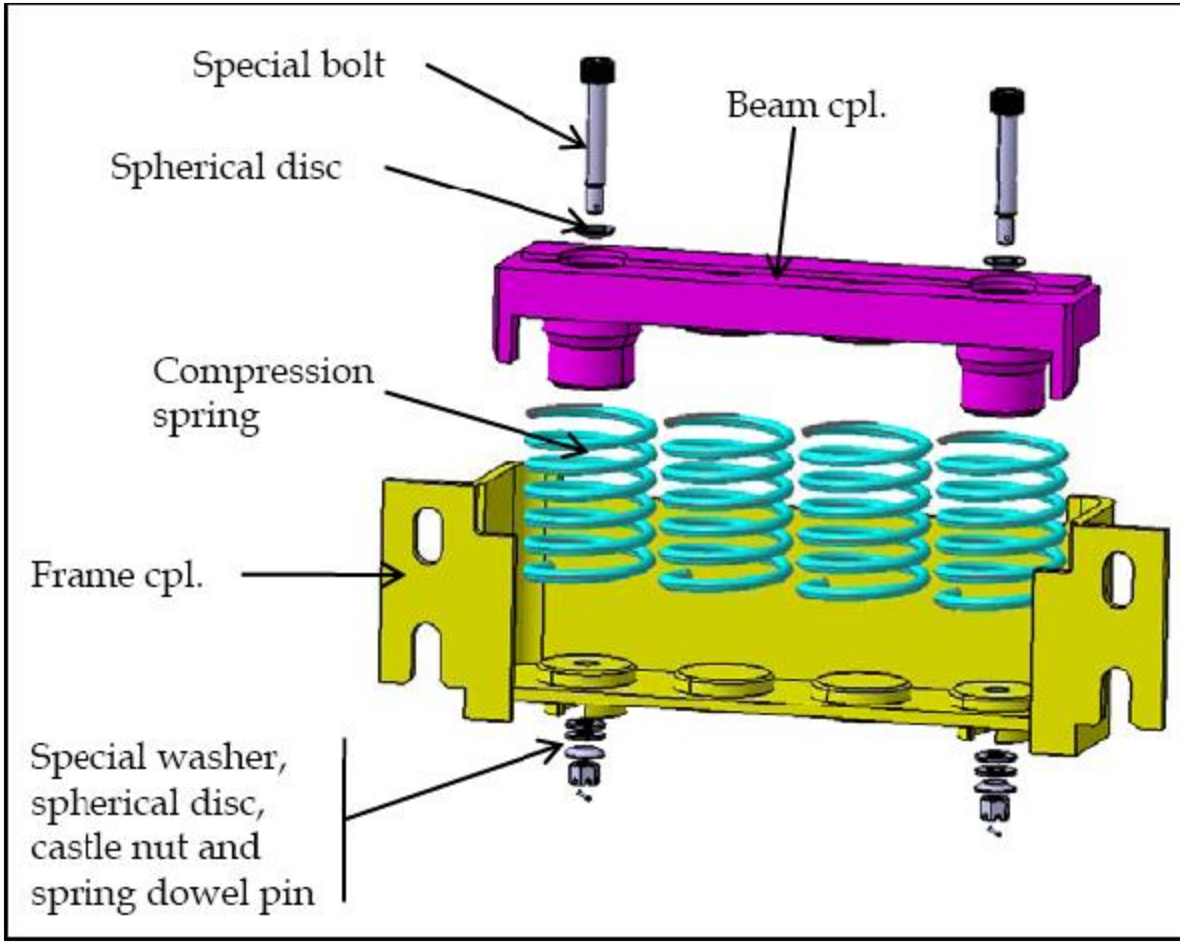


Operating rod, cpl
Sliding rod, cpl
Guiding piece, cpl



सपोर्टिंग डिवाइस

- प्रीलोडेड कम्प्रेशन स्प्रिंग
- कप्लर हेड सपोर्टिंग डिवाइस पर रेस्ट करता है


Special bolt
Beam cpl.
Spherical disc
Compression
spring
Frame cpl.
Special washer,
spherical disc,
castle nut and
spring dowel pin

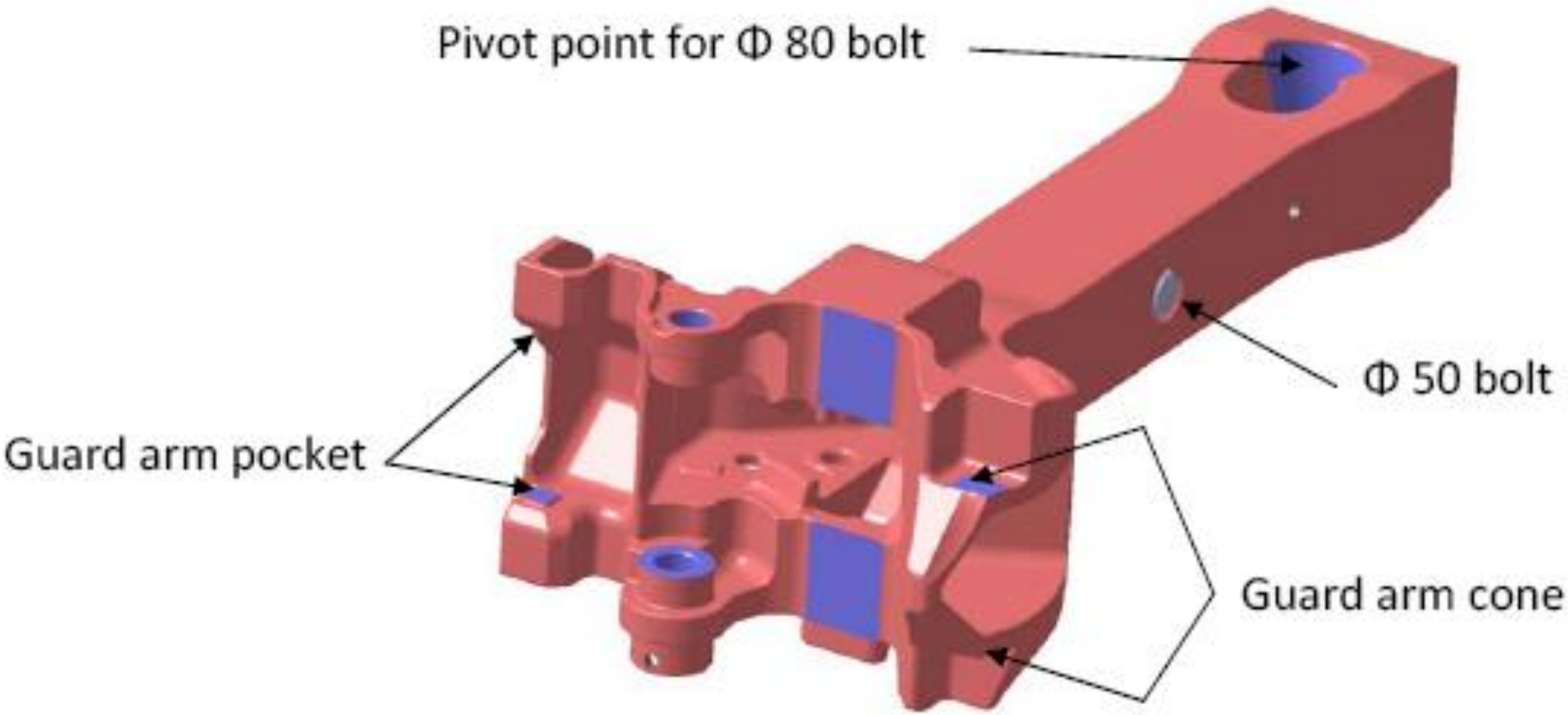
Pocket

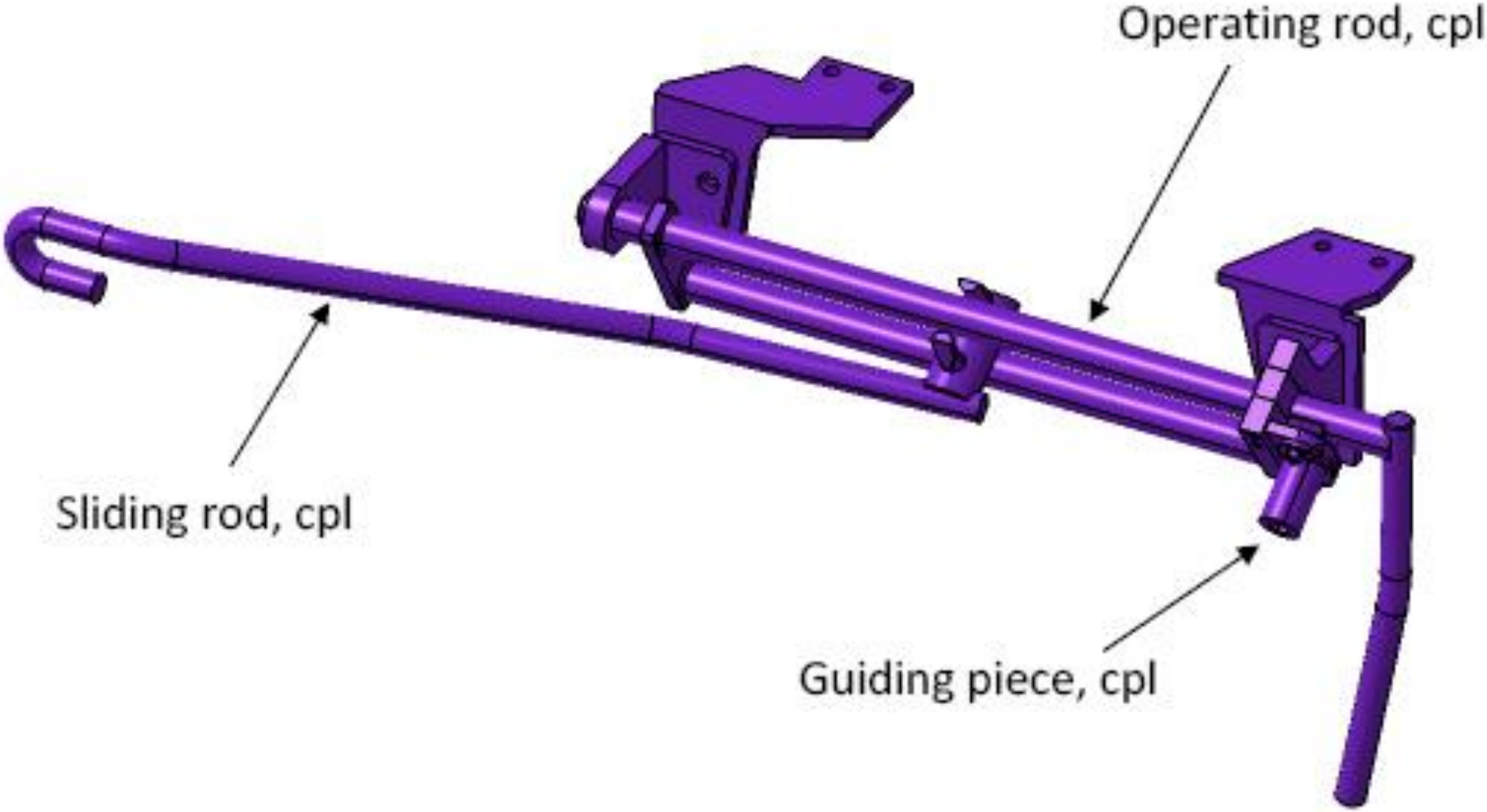
AR
M

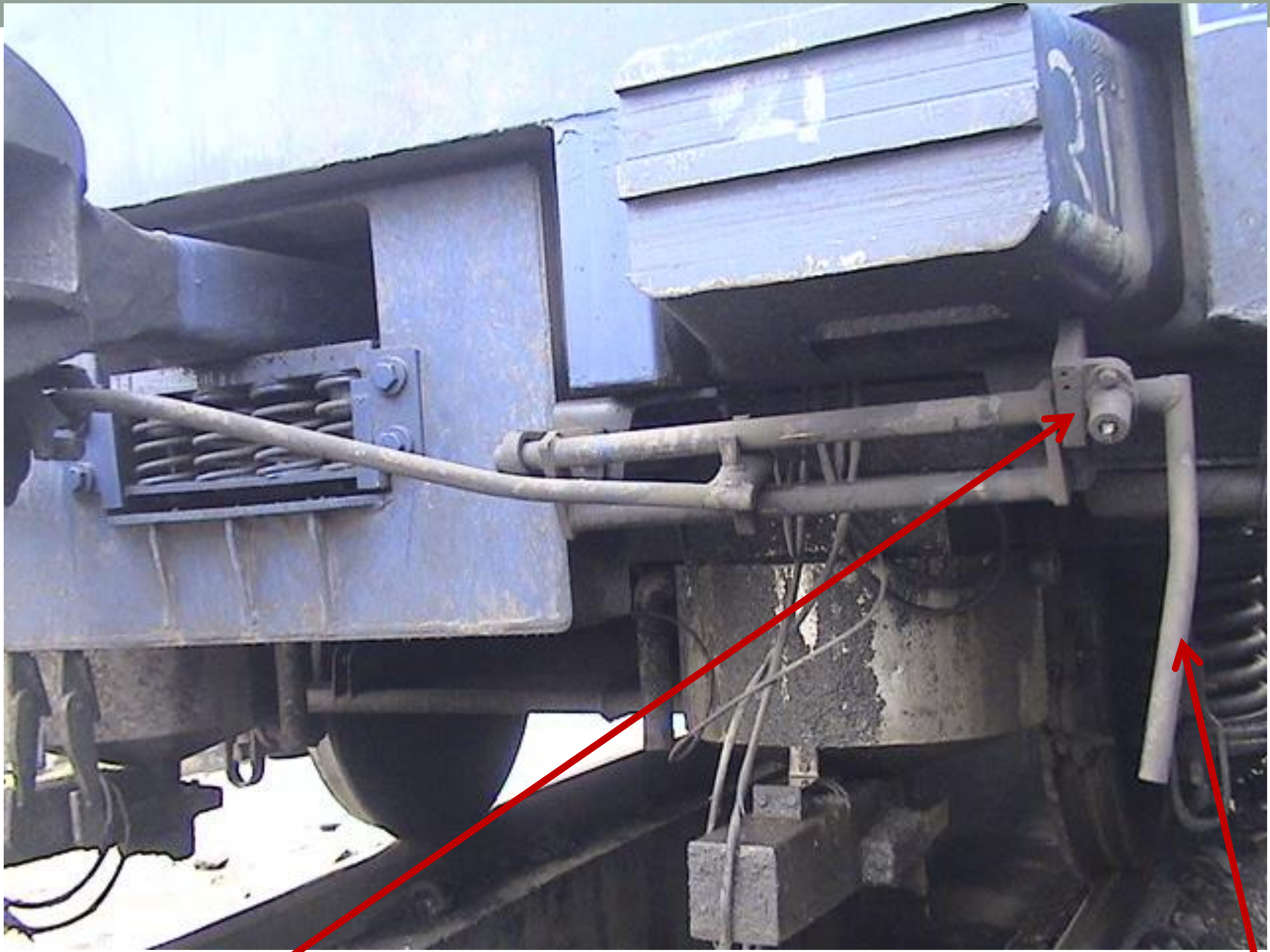
Gathering Range

Horizontal : +/- 110 m.m.

Vertical : +/- 90 m.m.


Pivot point for Φ 80 bolt
Φ 50 bolt
Guard arm pocket
Guard arm cone

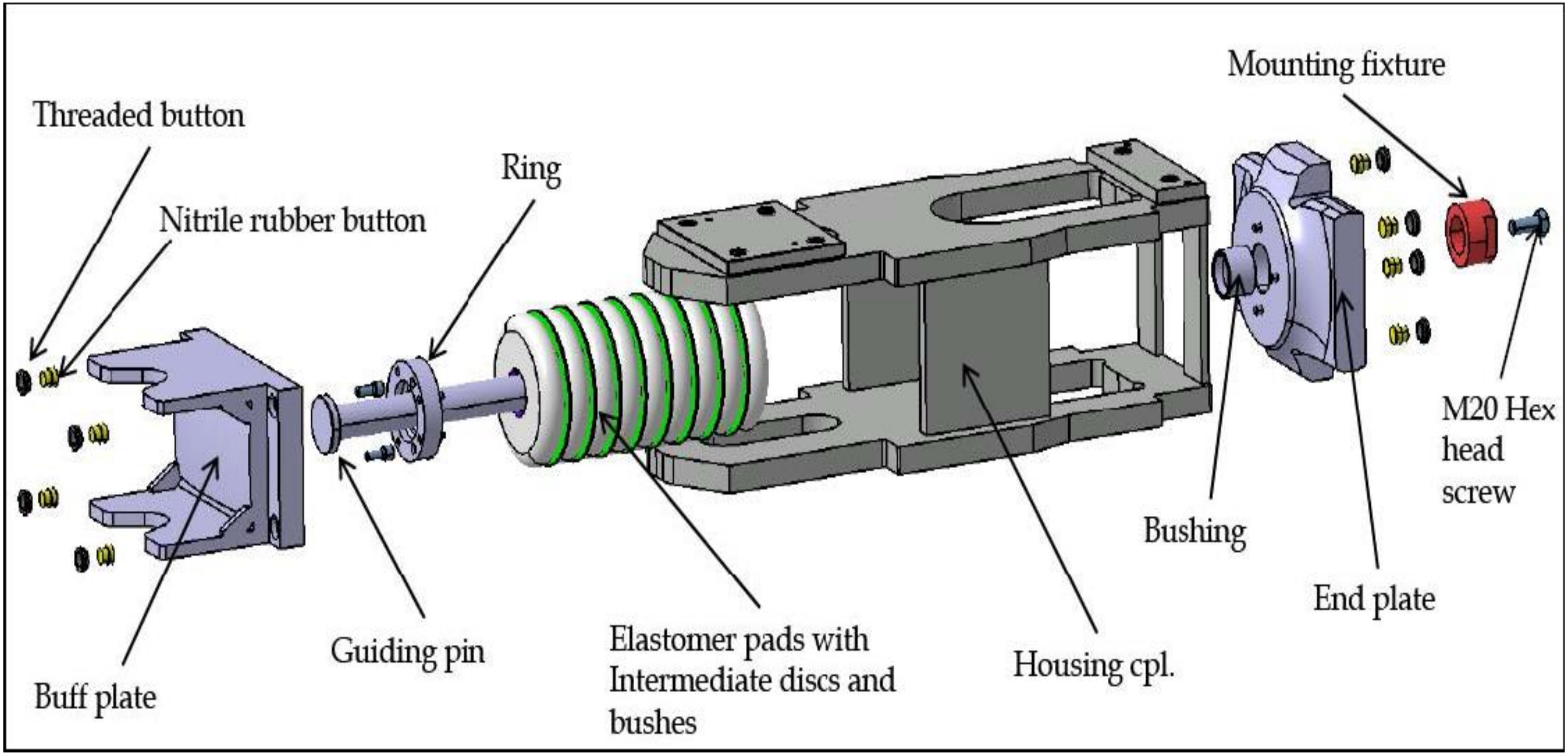

Operating rod, cpl
Sliding rod, cpl
Guiding piece, cpl

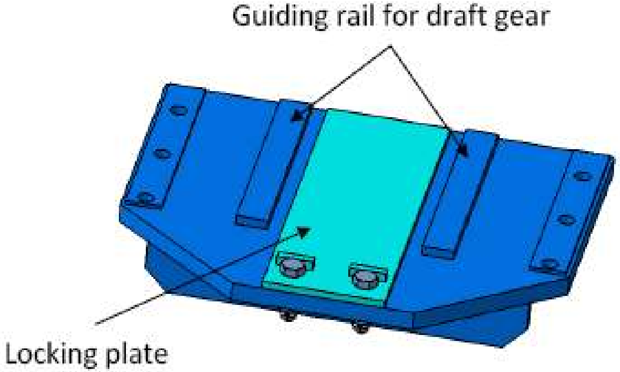


कपलिंग आटोमेटिक है। अनकपल करने के लिय हैन्डिल को अनलाक करें, उठायं और क्लाकवाइज घुमायं।

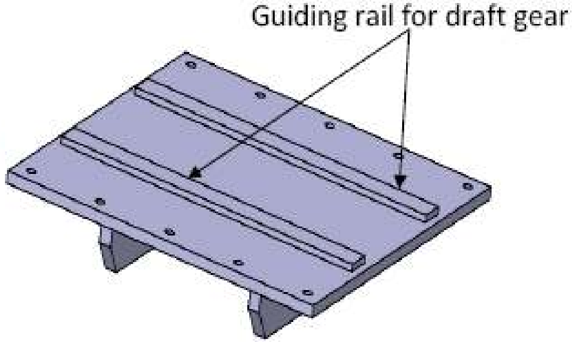
कपलिंग डिवाइस की मैनुअल लाकिंग एवं अनलाकिंग

Mounting of the draft gear :

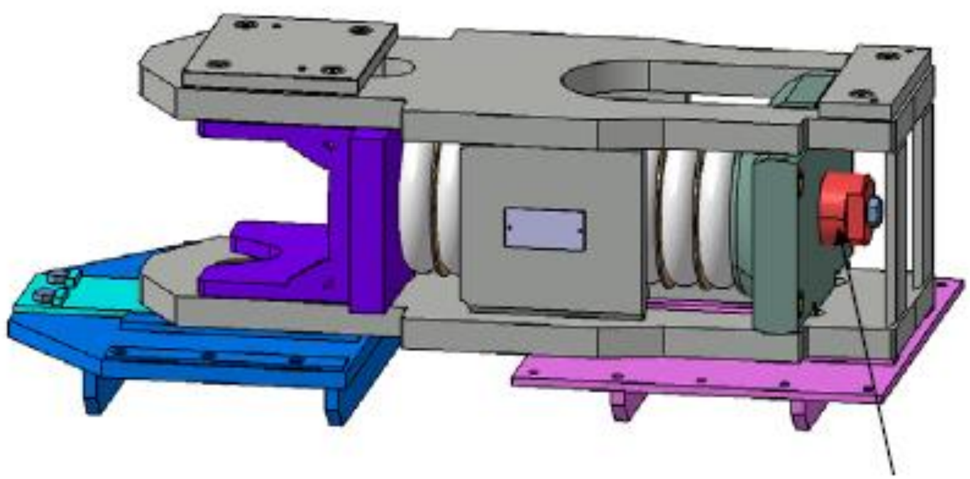


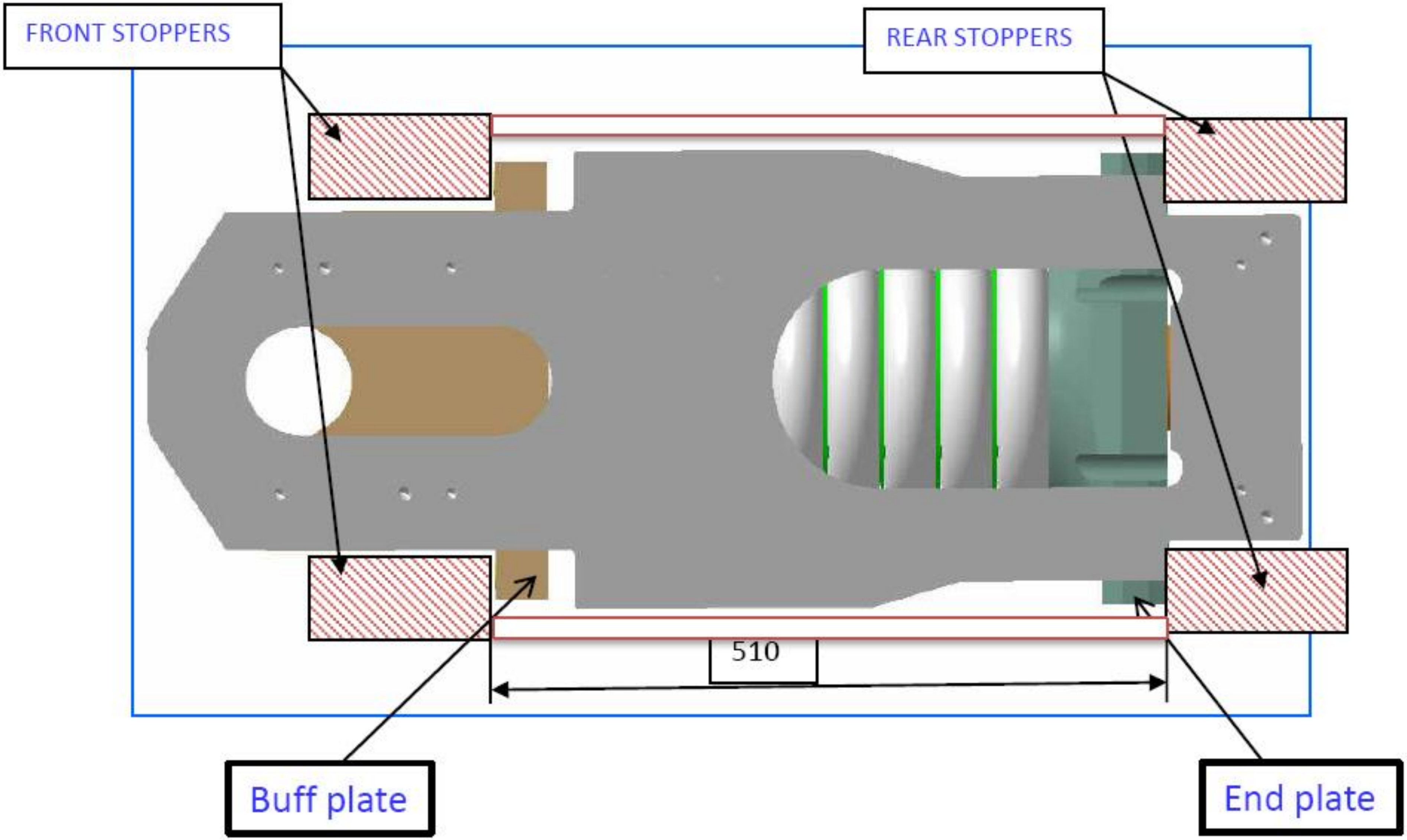


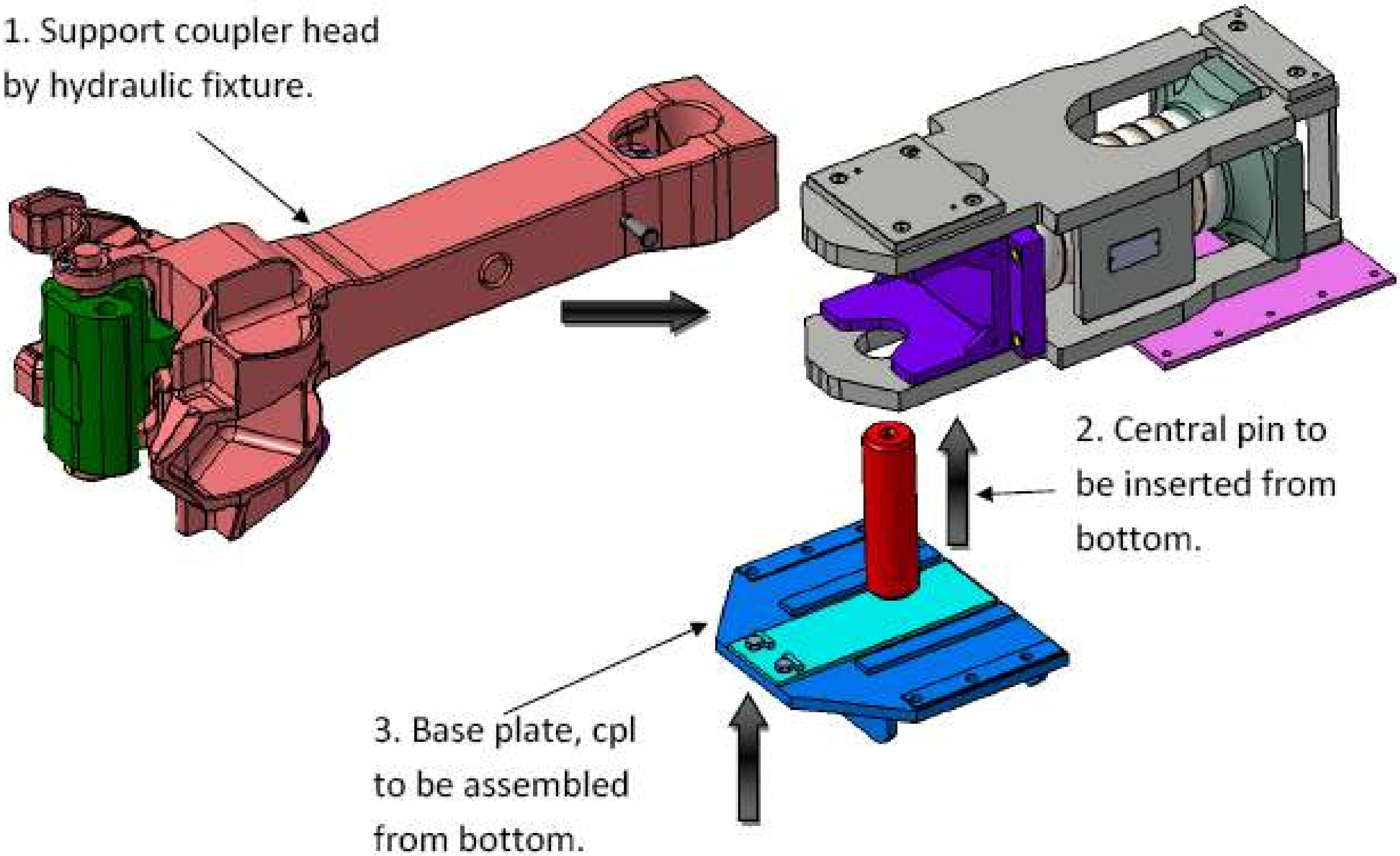
Base plate, cpl



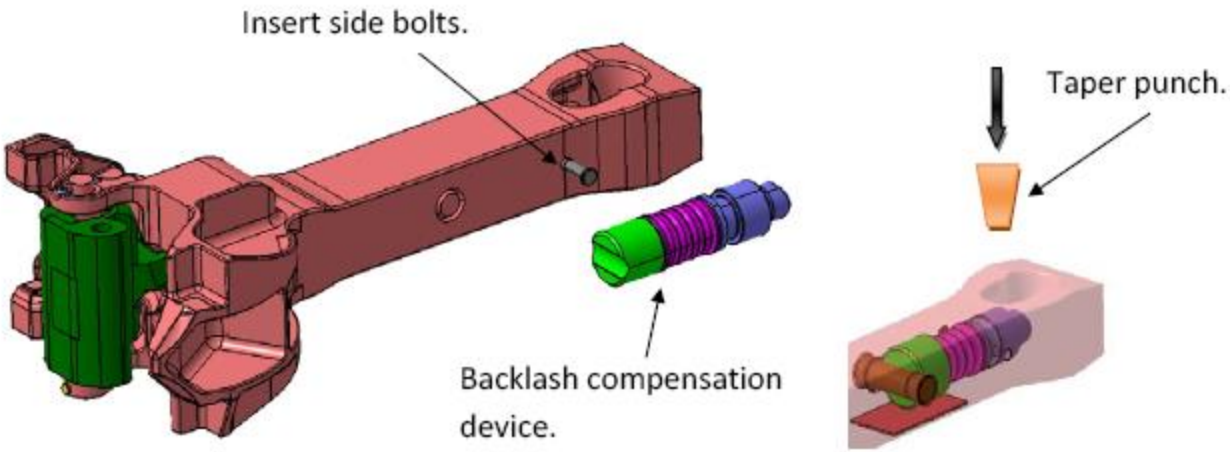
Support plate, cpl

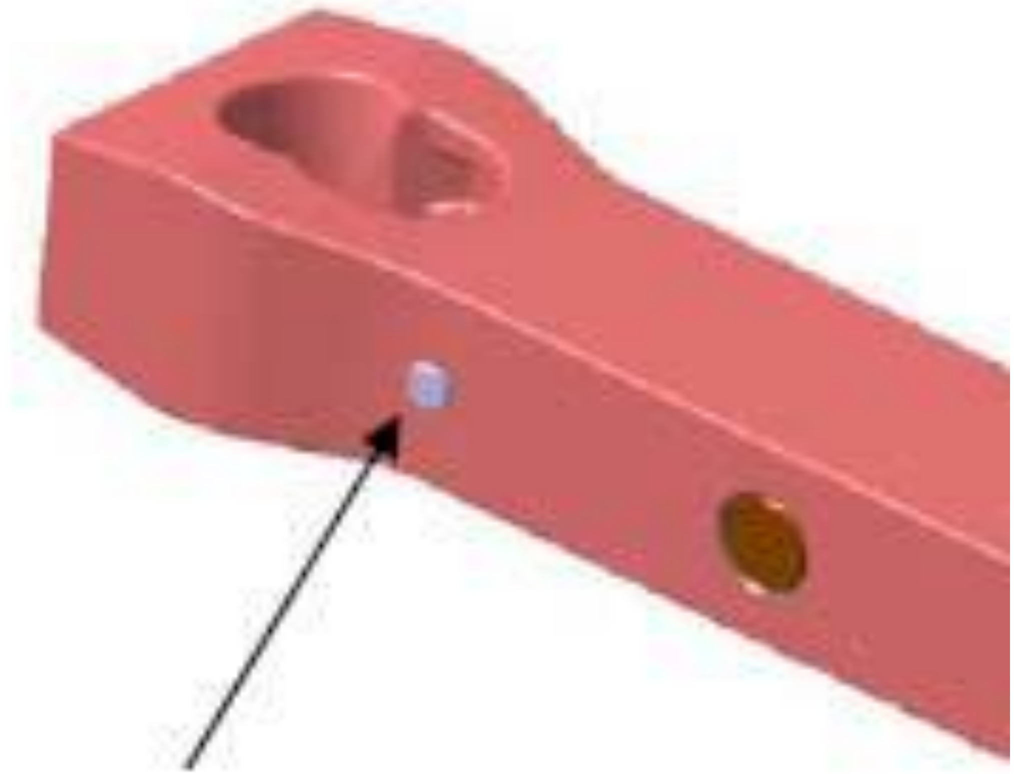



FRONT STOPPERS
REAR STOPPERS
510
Buff plate
End plate

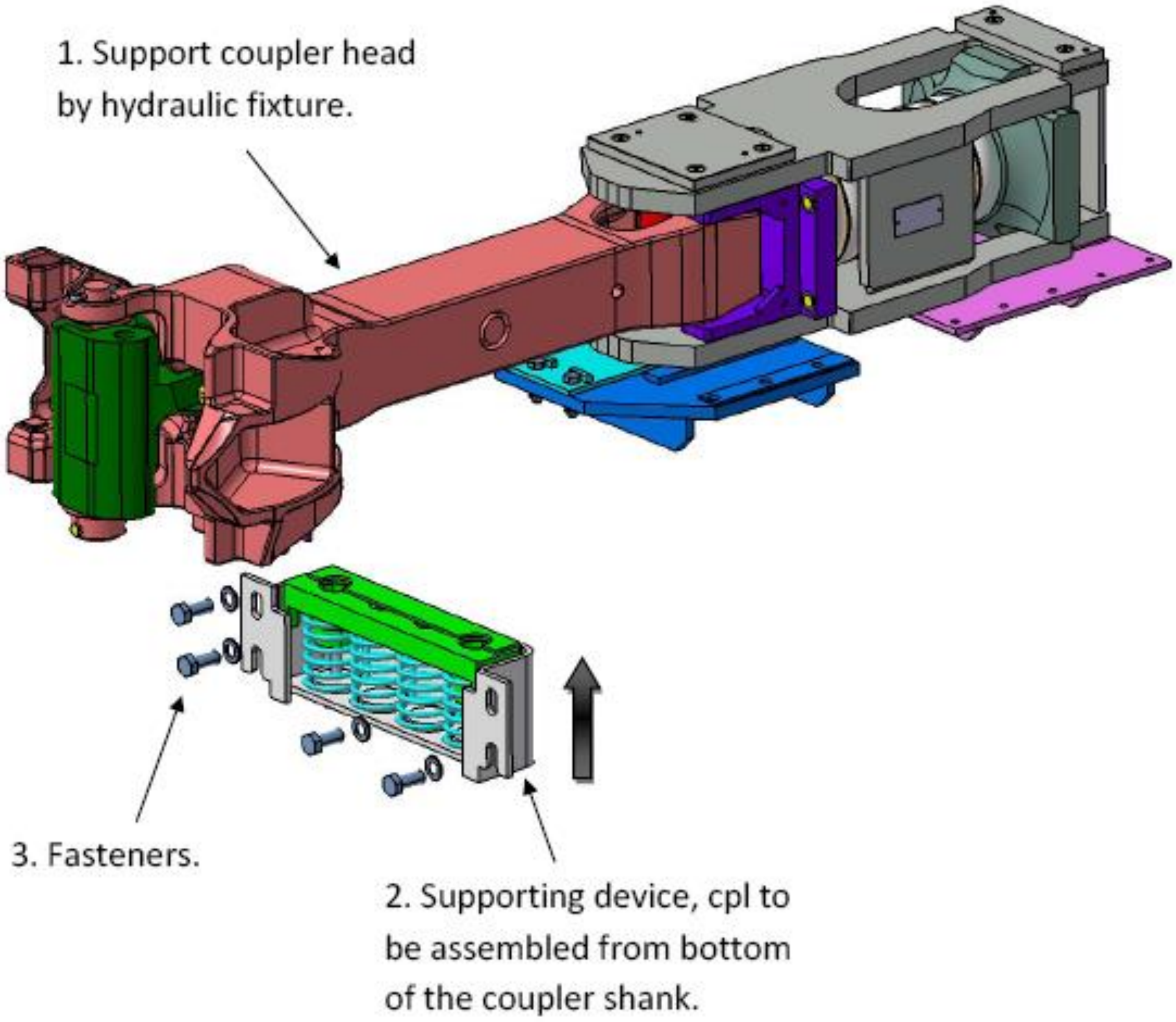


Mounting of the Coupler head


Insert side bolts.
Taper punch.
Backlash compensation
device.

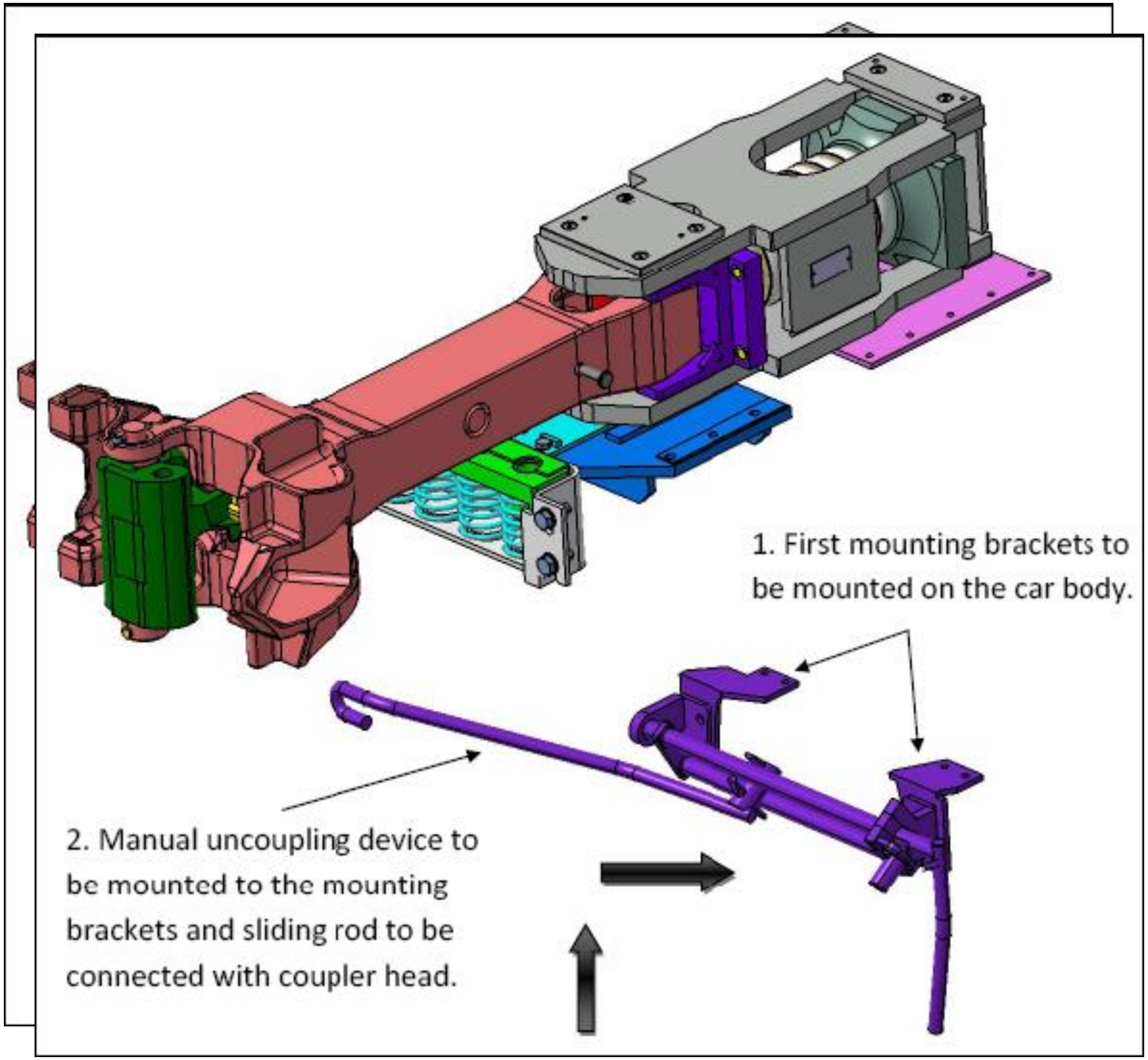


Remove the bolt on both sides of coupler and apply grease to both the holes.

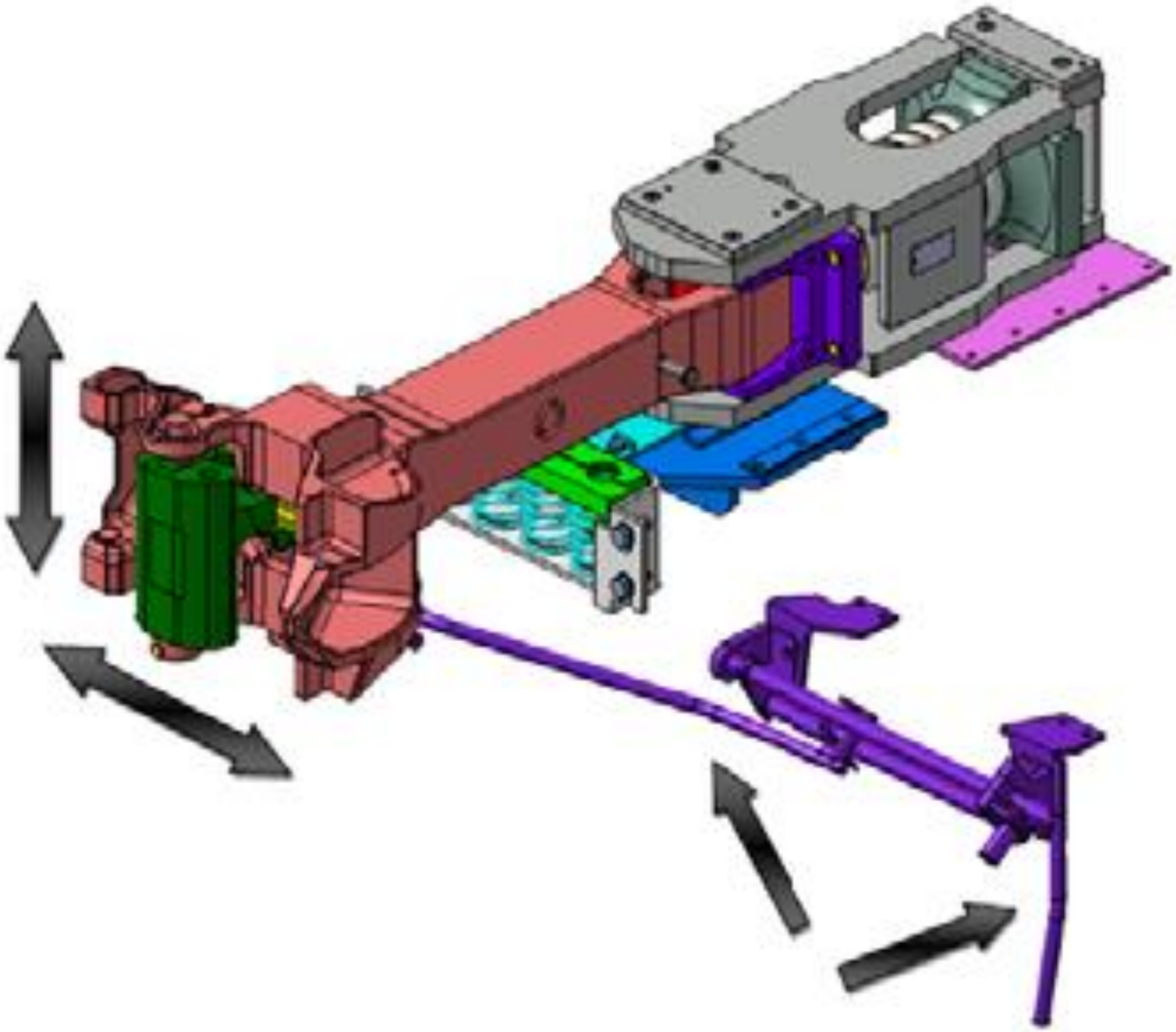


Mounting of the supporting device

Mounting of the manual uncoupling device :

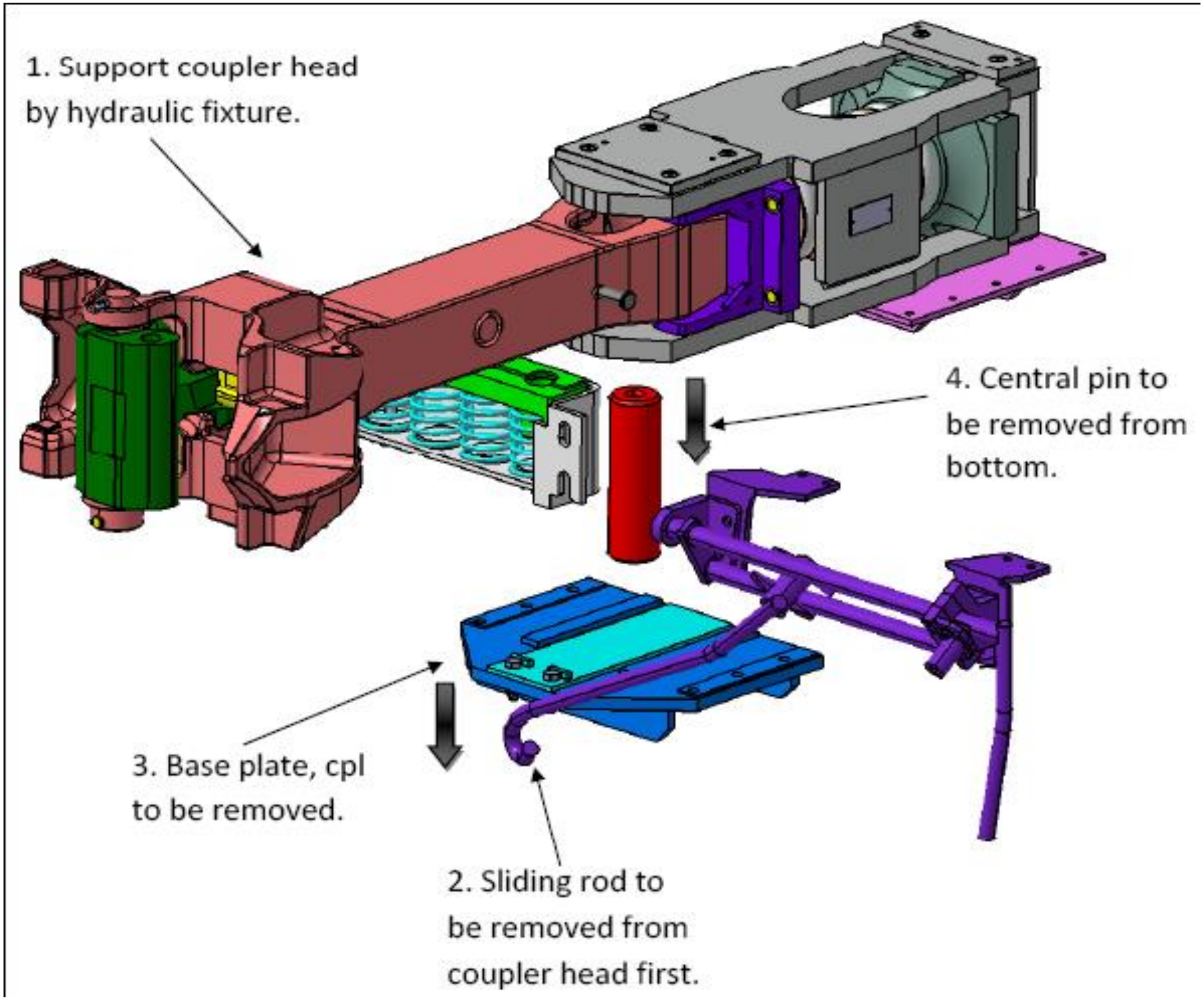


Final check of coupler installation



Dismounting of coupler from coach :

Dismounting coupler head



टाइट लाक कपलिंग फिटेड कोच की पहचान

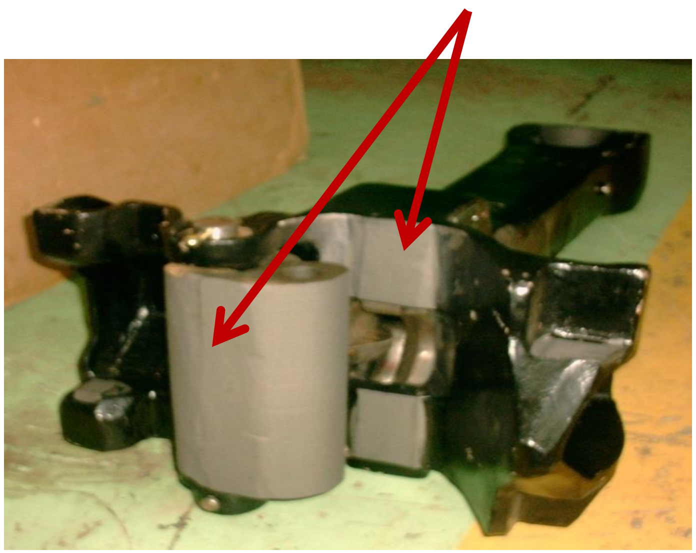
- साइड पैनल के अन्त में पीली पट्टी
- कोच नं. के अन्त में लेटर **'C'** का प्रयोग


प्रवेश
ENTRY
10214/C
1-8
9-16
LIFT HERE

कपलिंग से पहले की चेक

चेक प्वाइंट नं–1 कपलर के सतह पर ग्रीस अथवा तेल का प्रयोग न करें अन्यथा अनकपल होने की संभावना बढ़ जाती है।

चेक प्वाइंट नं–2 जब नकल क्लोज हो तो नकल और कपलर हेड का मशीन्ड फेस समानान्तर होना चाहिये।



कपलिंग का तरीका (कोच से कोच)

- कोच को 2–3 किमी0/घं0 की स्पीड से एक दूसरे के नजदीक लाकर 1–2 मी0 की दूरी पर रोक देते हैं।
- एलाइन्मेन्ट देखें। इसे गैदरिंग रेन्ज में रहना चाहिए।
- आवश्यकतानुसार कपलर को खींचकर गैदरिंग रेन्ज में लायें।
- मैनुअल अनकपलिंग आपरेटिंग राड हैन्डिल खुले रहने चाहिये। दोनों कोच का नकल खुला होना चाहिये। धीरे–धीरे धक्का दें।
- आगे का 5 कोच में ब्रेक लगा हो।
- टेल–टेल की पोजीशन चेक करें। टेल–टेल स्लाट क्लियर रखें।
- कपलिंग के बाद मैनुअल अनकपलिंग डिवाइस के हैंडिल को लाक करना सुनिश्चित करें।
- कपलिंग के बाद यान को अलग खींचें।
- यह सही कपलिंग को सुनिश्चित करने का एक टिपिकल पुल टेस्ट है।

कपलिंग का तरीका (कोच से लोको)

- लोको साइड से पाँच कोच में ब्रेक लगा हो।
- लोको को पहले कोच से 20 मी0 पहले रोक दें और धीरे–धीरे आगे बढ़ें। जब 3 मी0 तक की दूरी रह जाय तो लोको को रोक दें।
- एलाइन्मेन्ट देखें। इसे गैदरिंग रेन्ज में रहना चाहिए। आवश्यकतानुसार कपलर को खींचकर गैदरिंग रेन्ज में लायं।
- एसएलआर सीबीसी को नार्मली क्लोज पोजीशन में और लाको सीबीसी नकल को ओपन कंडीशन में रहना चाहिये ,लेकिन आवश्यक्तानुसार कोच तथा लोको दोनों का नकल खुला होना चाहिये। धीरे–धीरे धक्का दें।
- लोको पायलट को आगे बढ़ना चाहिये जिससे कि कपलिंग के समय गति 2–3 किमी0/घं0 हो।

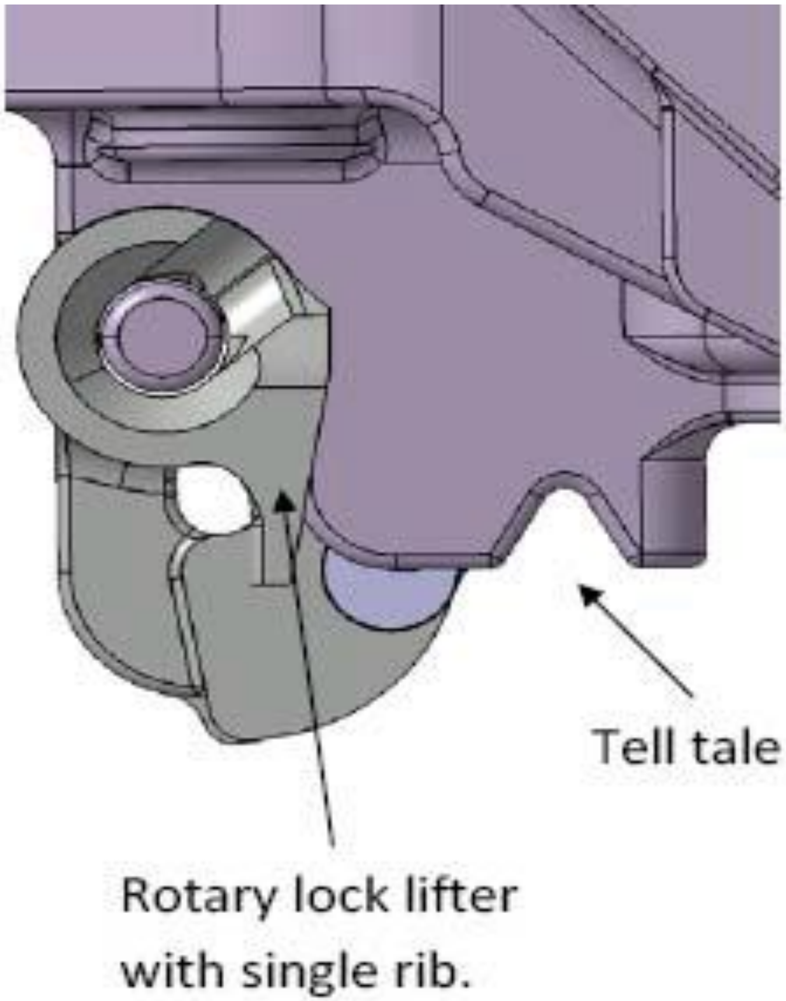
कपलिंग का तरीका (कोच से लोको)

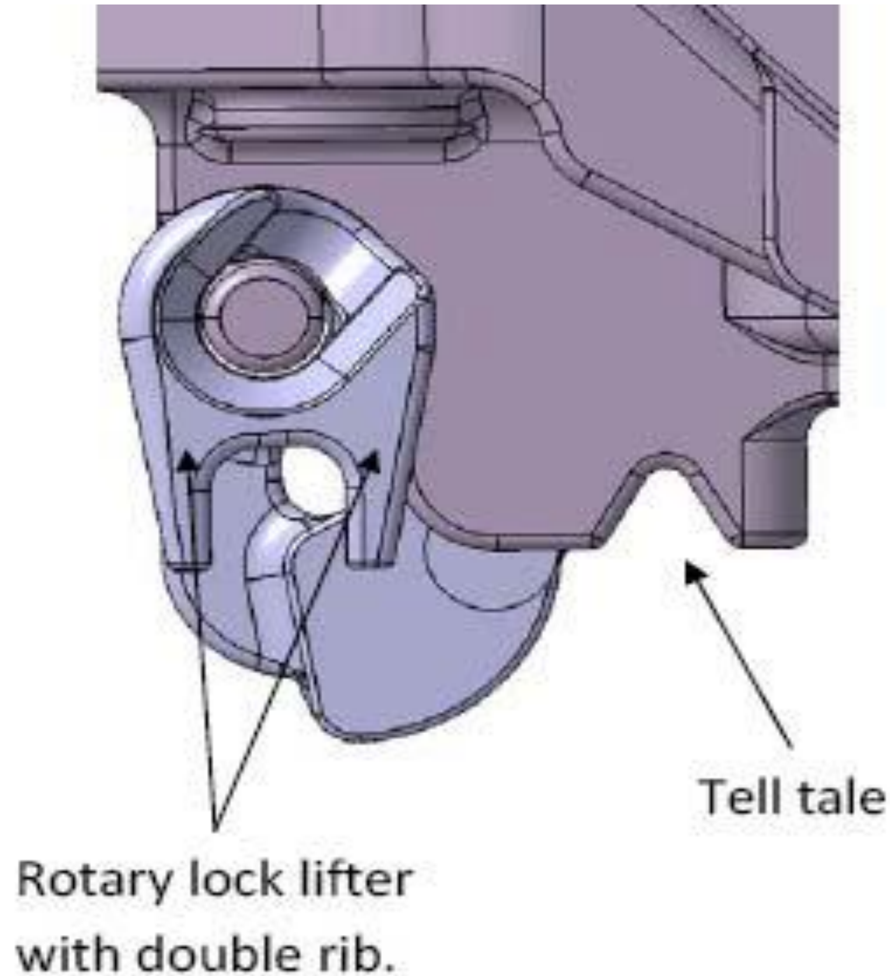
- लोको पायलट को 2 नॉच पर रेक को आगे खींचना चाहिय।
- जब लोको खींचे हुए कंडीशन में हो तो दोनों सीबीसी के बीच गैप को पर्याप्त मोटाई के सिम (रिस्ट्रिक्टर) द्वारा कै0एण्डवै0 स्टाफ द्वारा भर दिया जाना चाहिए।
- लोको पायलट और गार्ड द्वारा बीपी और एफपी पाइप का प्रेशर सुनिश्चित किया जाना चाहिए।
- प्रथम पाँच कोच के ब्रेक को रीलीज कर देना चाहिए।
- टेल–टेल की पोजीशन चेक करें। टेल–टेल स्लाट क्लियर रखें।
- मैनुअल अनकपलिंग आपरेटिंग राड हैन्डिल को लाकिंग स्क्रू से बन्द रहना चाहिये।

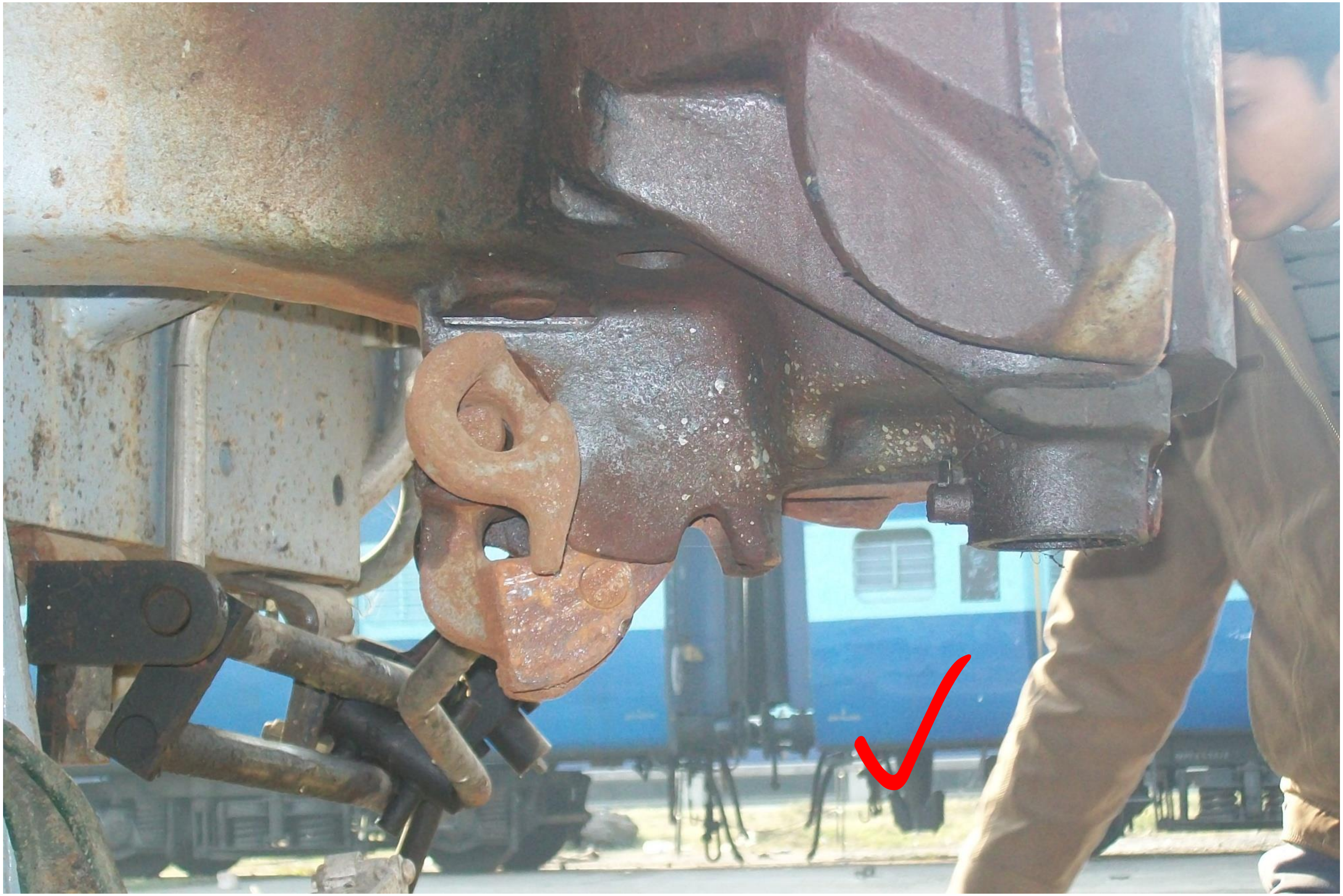
सही कपलिंग हेतु चेक प्वाइन्ट्स

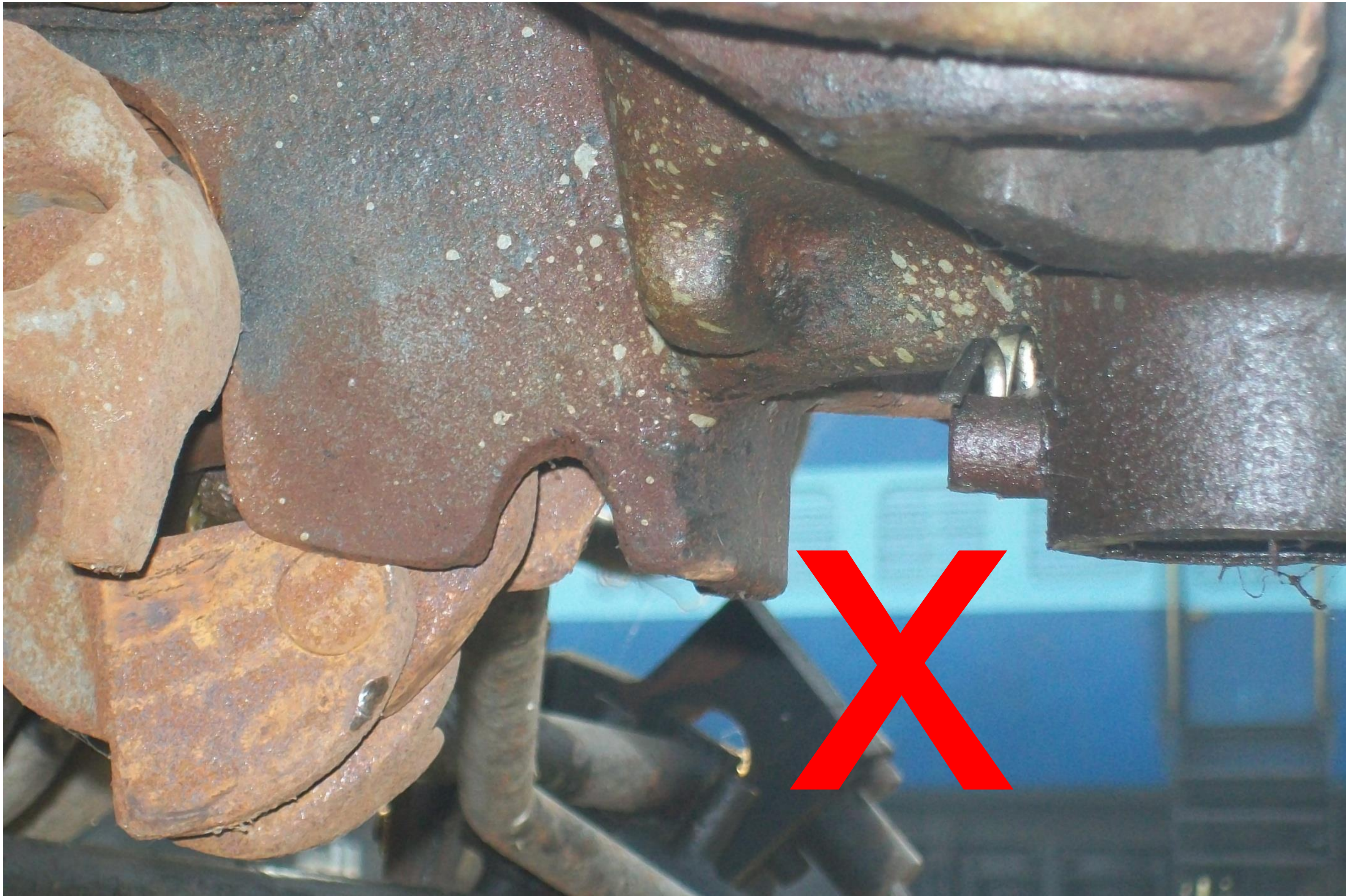
चेक प्वाइन्ट

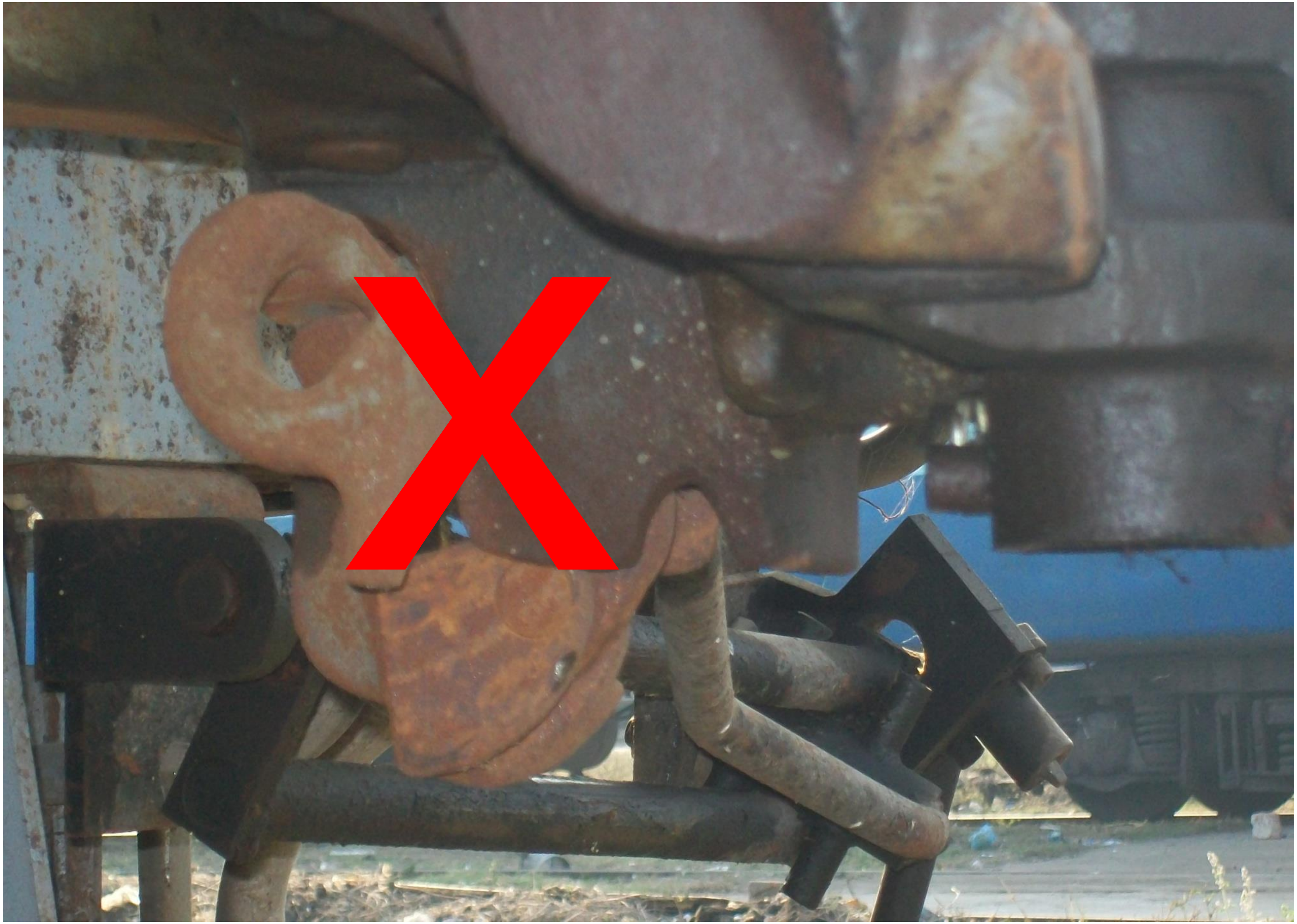
1. टेल–टेल स्लाट बिल्कुल क्लियर हो।
2. रोटरी लाक लिफ्टर रिब वर्टिकल हो।
3. मैनुअल लाकिंग डिवाइस पूर्ण रूप से लाक पोजीशन में हो।


Tell tale
Rotary lock lifter
with single rib.


Tell tale
Rotary lock lifter
with double rib.

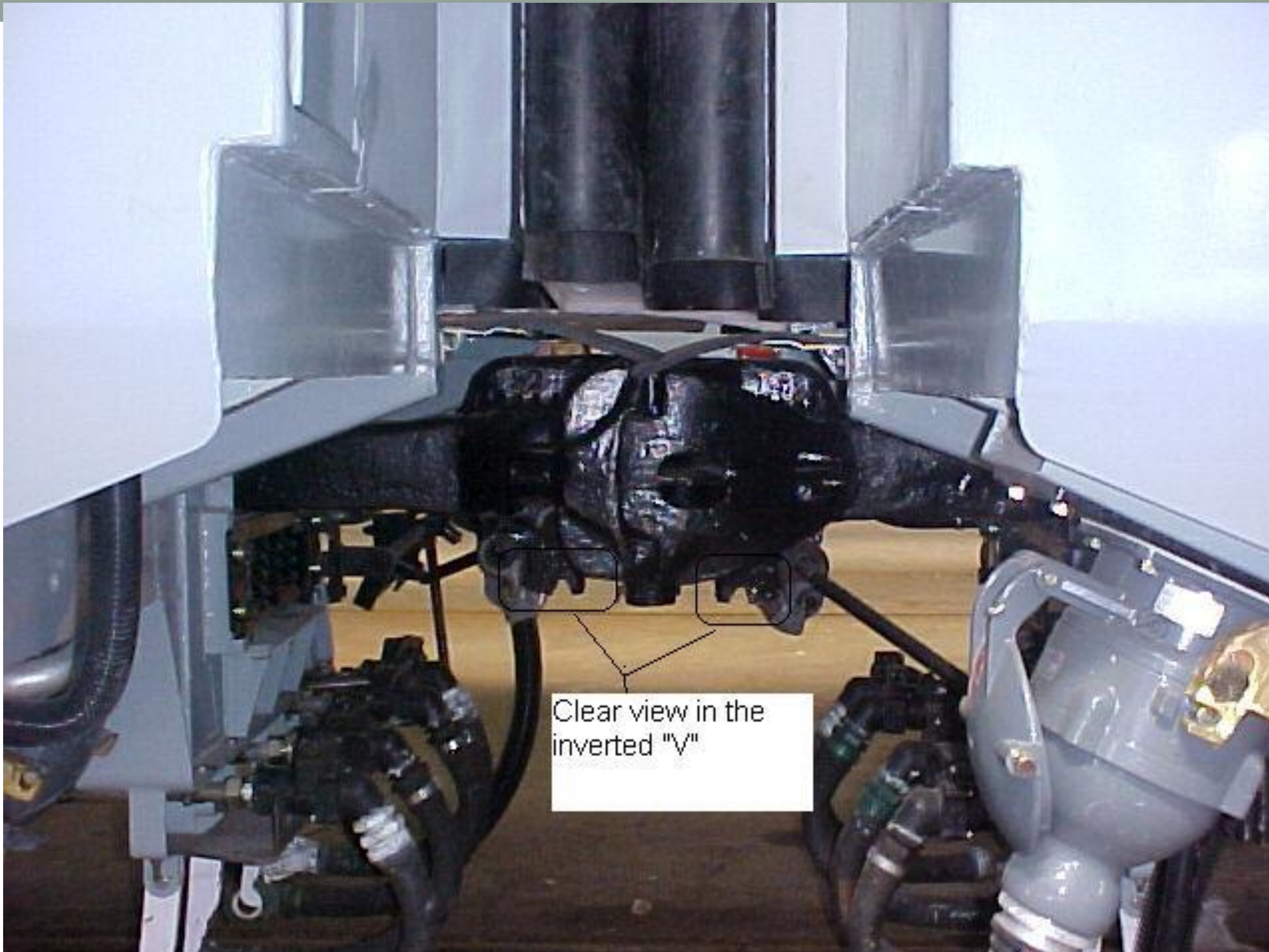




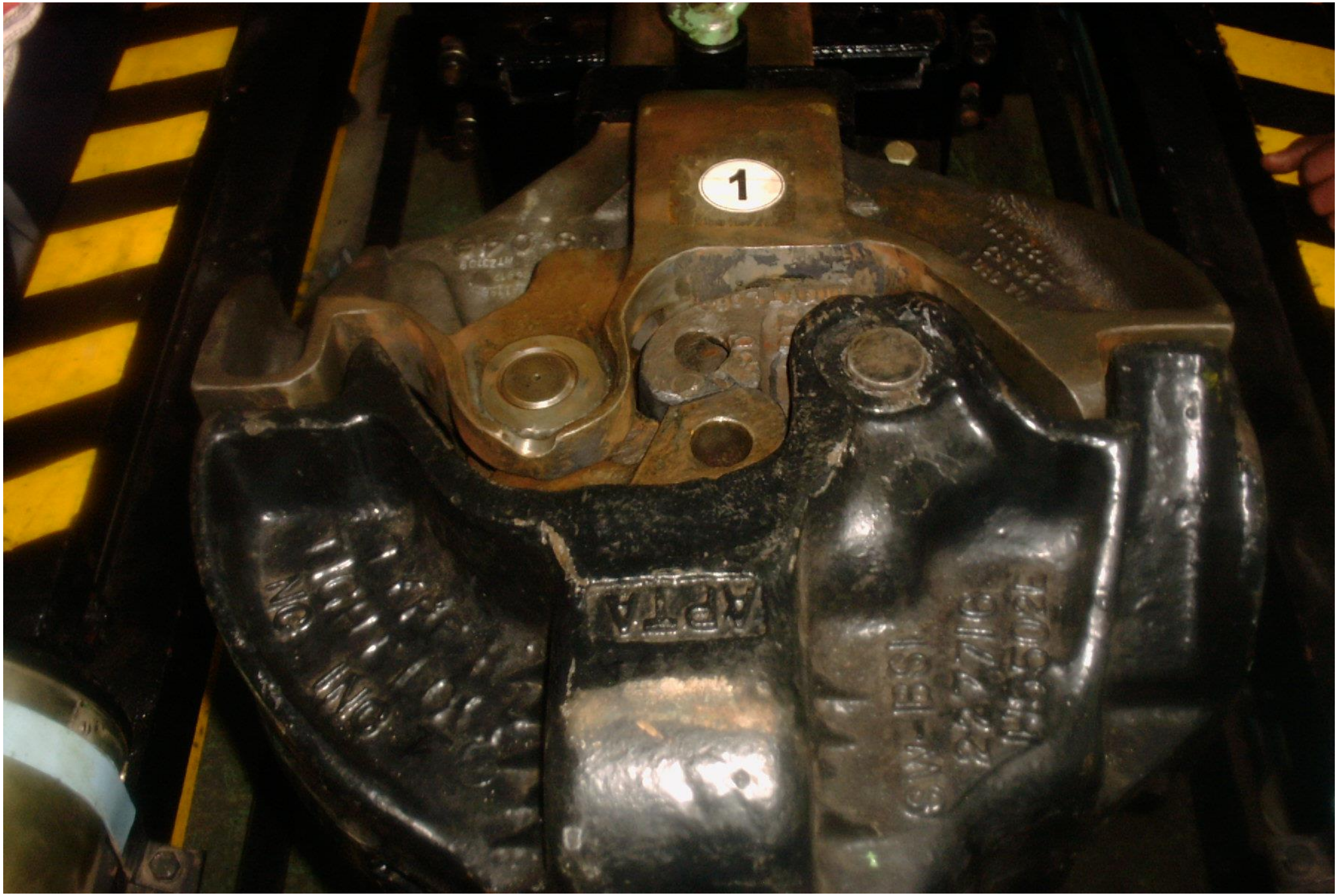


कपलिंग को खोलने का तरीका

- अनकपलिंग से पहले सुनिश्चित करें कि कपलर पर कोई टेन्साइल लोड नहीं है तथा लीवर फ्री है।
- टेल–टेल की पोजीशन चेक करें।
- अनकपलिंग के लिये मैनुअल अनकपलिंग डिवाइस को खोलें।
- रोटेटिंग लाकिंग स्क्रू को स्पेशल की के द्वारा खोलें। हैंडिल को उठायें और हॉरिजेन्टल पोजीशन तक क्लाक वाइज घुमायें तथा बाहर खींचें।


Clear view in the
inverted "V"

ए0आर0आर0 टाइप एच कपलर कपुल्ड कंडीशन में



रिस्ट्रिक्टर लोको एवं कोच के बीच फिट होता है, जो वर्टिकल मूवमेन्ट को रोकता है

IMPROVED HIGH TENSILE TIGHT LOCK C B C WITH AAR 'H' TYPE HEAD AND BALANCED DRAFT GEAR

A new specification of CBC with balanced type draft gear has been prepared.

The specification has been made to meet IR's specific requirement and on the basis of experience of using CBC in passenger stock for approx. one decade.

At present, the supporting arrangement inside the under frame of the coach has provision of front stopper and rear stopper which is suitable for single pack draft gear.

This is not optimal for balanced type draft gear.

supporting arrangement has been made in the specification.

PARTICULAR REQUIREMENTS

The Coupler shall be of non-transition type and also couplable with the existing AAR E type couplers,

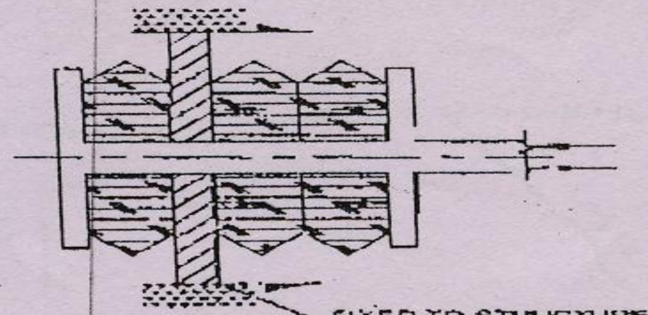
Coupler head should be of AAR‘H’ type.
The connection between coupler and draft gear should have sound design concept suitable for main line passenger trains.

All components and sub-assemblies of the coupler (including draft gear) shall be interchangeable with corresponding parts of another coupler of the same make and design.

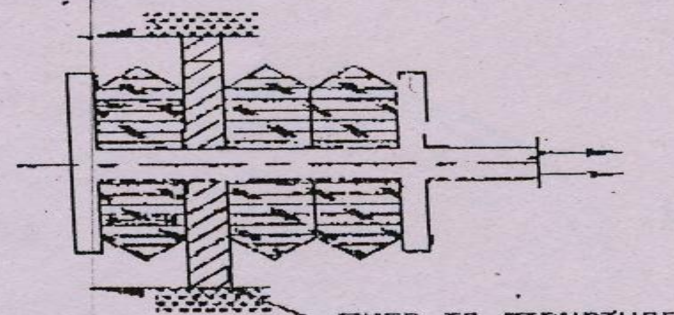
Double rotary lock lifter should be provided with an additional anticreep mechanism by providing rib in addition to existing rib to prevent unintended lifting of lock lift lever (the hook of the uncoupling rod should be in between ribs.)

Locking screw arrangement with protective cover to prevent lifting of uncoupling rod by unauthorized persons shall be provided. It should be possible to operate the locking mechanism with the help of a key

FORCE FLOW DIAGRAM OF DOUBLE ACTING BALANCED DRAFT GEAR



BUFF MODE



DRAFT MODE

NOTE

1. NO.OF PAD SHOWN IN THE SKETCH IS SYMBOLIC ONLY.
2. DRAFT GEAR ARRANGEMENT SHALL HAVE EFFECTIVE ZERO PRELOAD IN BUFF AS WELL AS DRAFT MODE. IT MEANS THAT FORCE Vs DISPLACEMENT CURVE OF DRAFT GEAR CHARACTERISTICS DRAWN FOR QUASISTATIC CONDITION SHALL PASS THROUGH ZERO FORCE AND SHALL HAVE REGULAR CURVE (NOT SEPARATED BY VERTICAL LINE) IN LOAD REVERSAL IN BOTH THE DIRECTIONS i.e.
   (a). BUFF TO NEUTRAL TO DRAW AND
   (b). DRAW TO NEUTRAL TO BUFF.

ALT.	AUTHY	DESCRIPTION	DATE
1	CD/48/11	NOTE ADDED.	08/11

SUPERSEDED BY

SUPERSEDES . ALT. NIL

REFERENCE:-

SCALE		
NTS	P	
	C	
	D	SPAWAN
	T	
	JS	CD/10/08

FORCE FLOW DIAGRAM OF DOUBLE ACTING BALANCED DRAFT GEAR

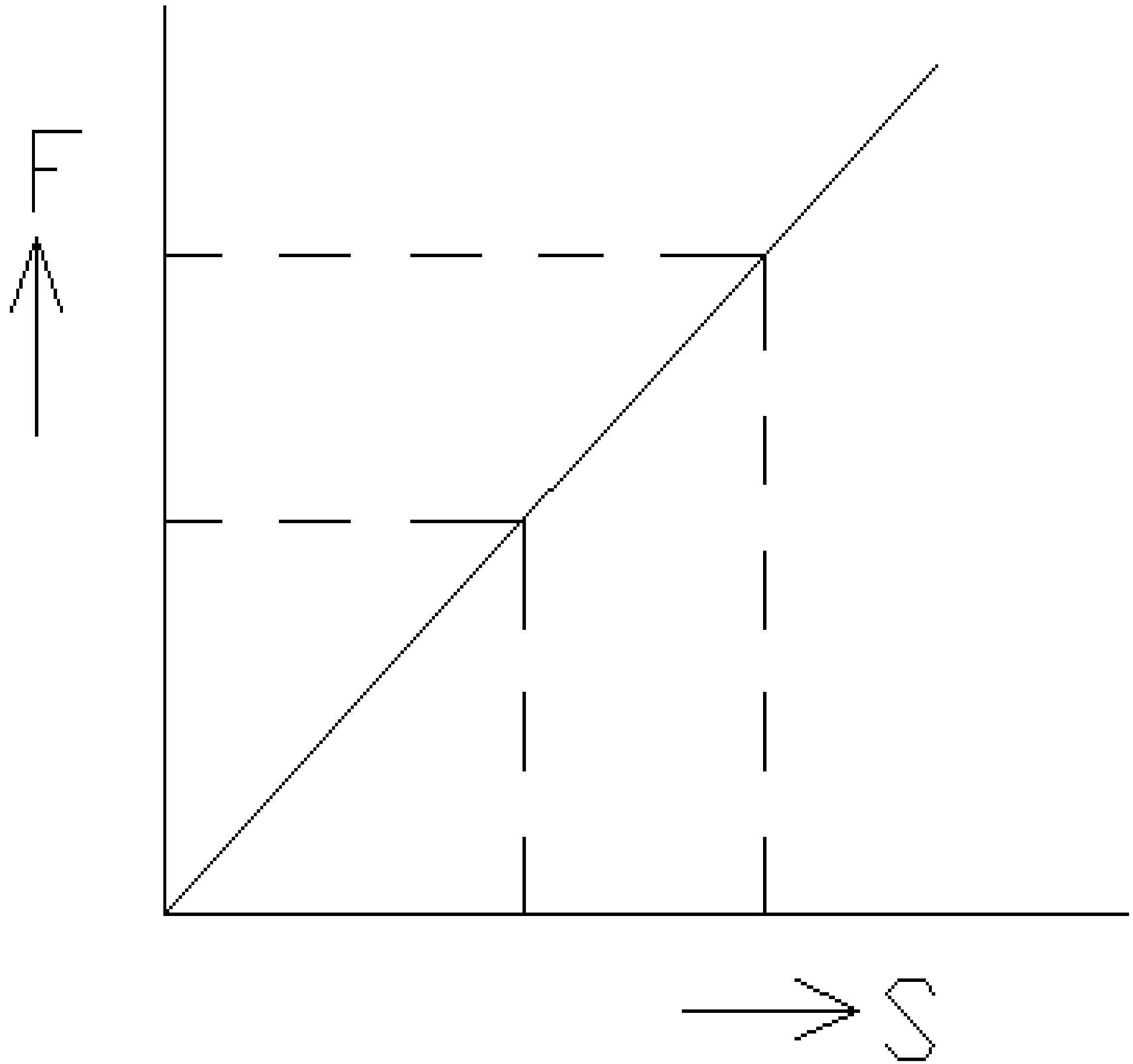
FILE No.:-

BG	RDSO (CARRIAGE)		CG- K8207

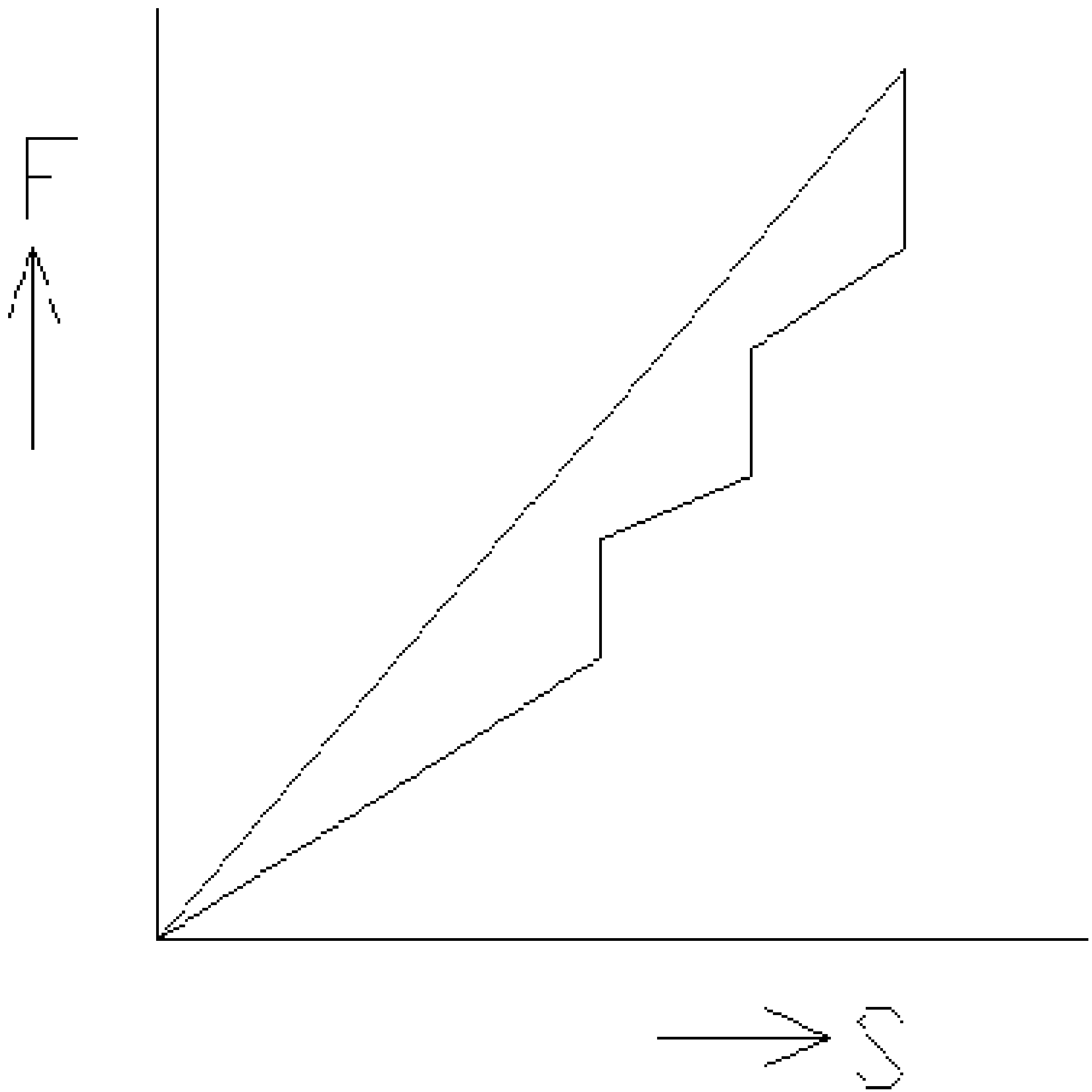
- NO. OF PAD SHOWN IN THE SKETCH IS SYMBOLIC ONLY.
- DRAFT GEAR ARRANGEMENT SHALL HAVE EFFECTIVE ZERO PRELOAD IN BUFF AS WELL AS DRAFT MODE. IT MEANS THAT FORCE Vs DISPLACEMENT CURVE OF DRAFT GEAR CHARECTORISTICS DROWN FOR QUASISTATIC CONDITION SHALL PASS THROUGH ZERO FORCE AND SHALL HAVE REGUULAR CURVE (NOT SEPARATED BY VERTICAL LINE) IN LOAD REVERSAL IN BOTH THE DIRECTION i.s

  (a) BUFF TO NEUTRAL TO DRAW AND

  (b) DRAW TO NEUTRAL TO BUFF.



Regular Curve


F
S

OPERATING CONDITIONS

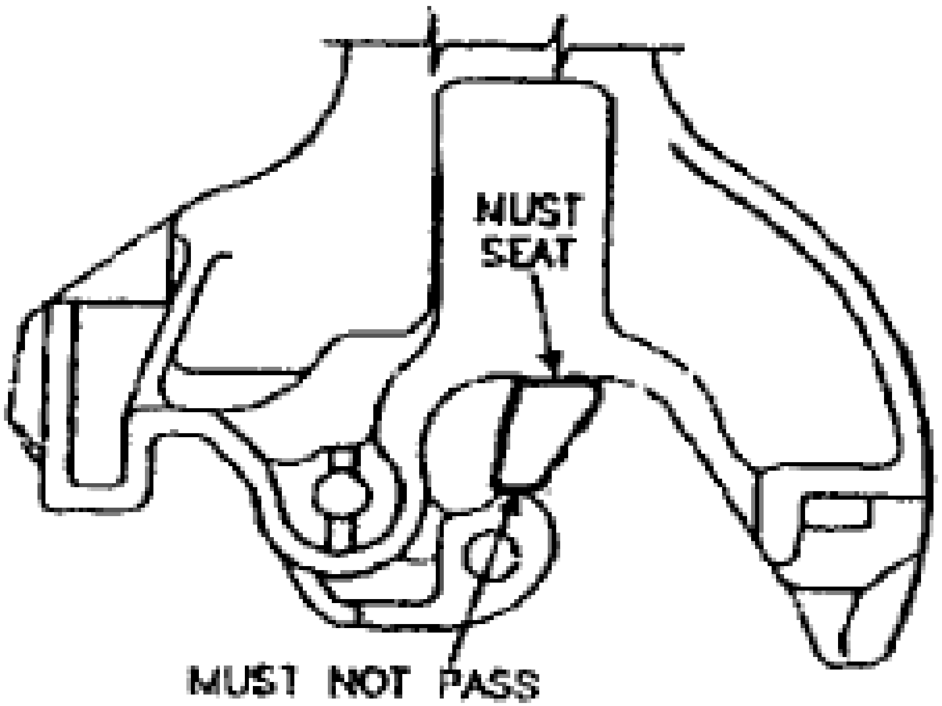
- **Axle Load 16.25 t max**
- **Gross Load (Coach)) 65.00 t max**
- **Gross Load (Train) 1300 t (max without loco)**
- **Grade 1 in 37 (steepest)**
- **Speed (max) 110 kmph (with 26 coaches)**

  160 kmph (with 18 coaches)

  Shunting Speed (max) 9.5 kmph

Jaw gap test :

We check the contour of the coupler head assembly using "Condemning limit gauge



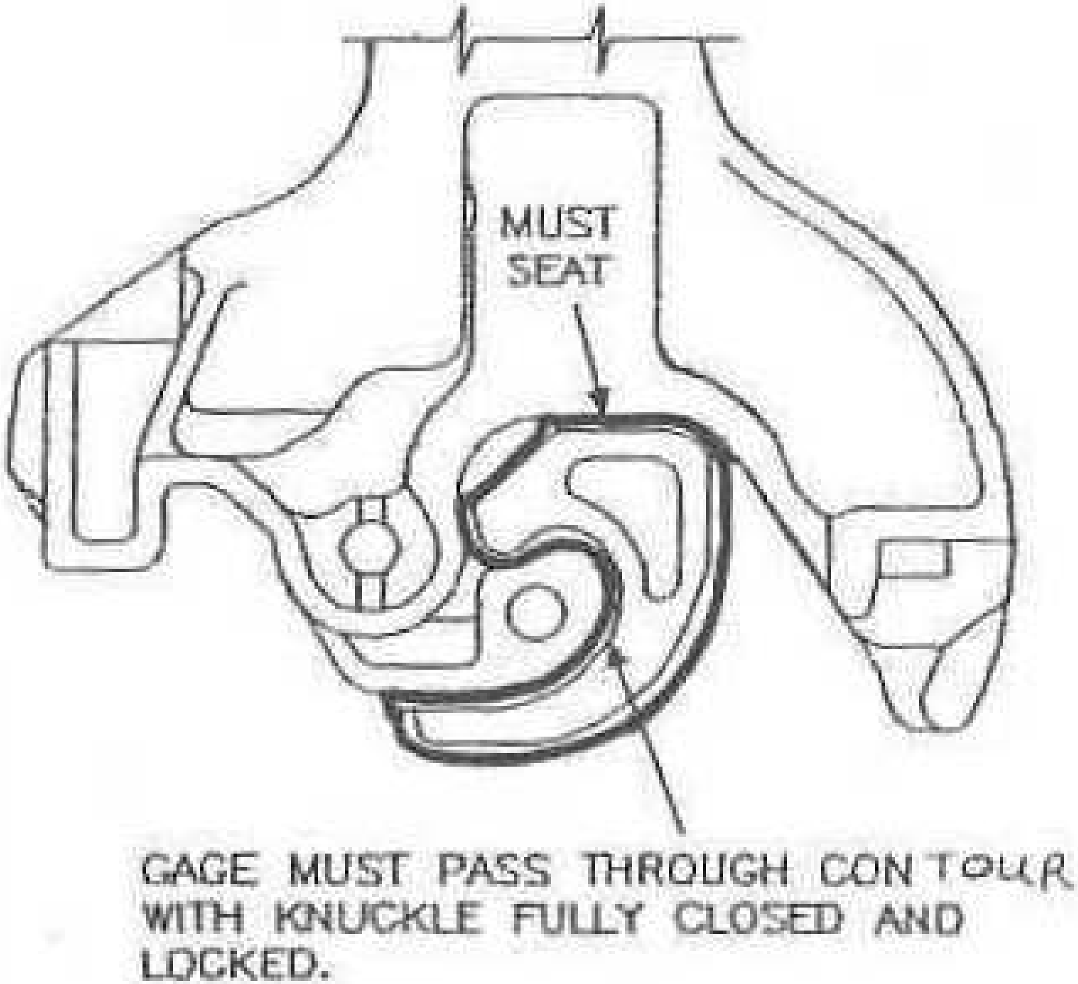
Knuckle contour (profile) check :

Check the contour of the knuckle using the " Contour maintenance Gauge .

Shake the knuckle while passing the gauge.

This is to ensure that slack in the assembly is included in the profile.

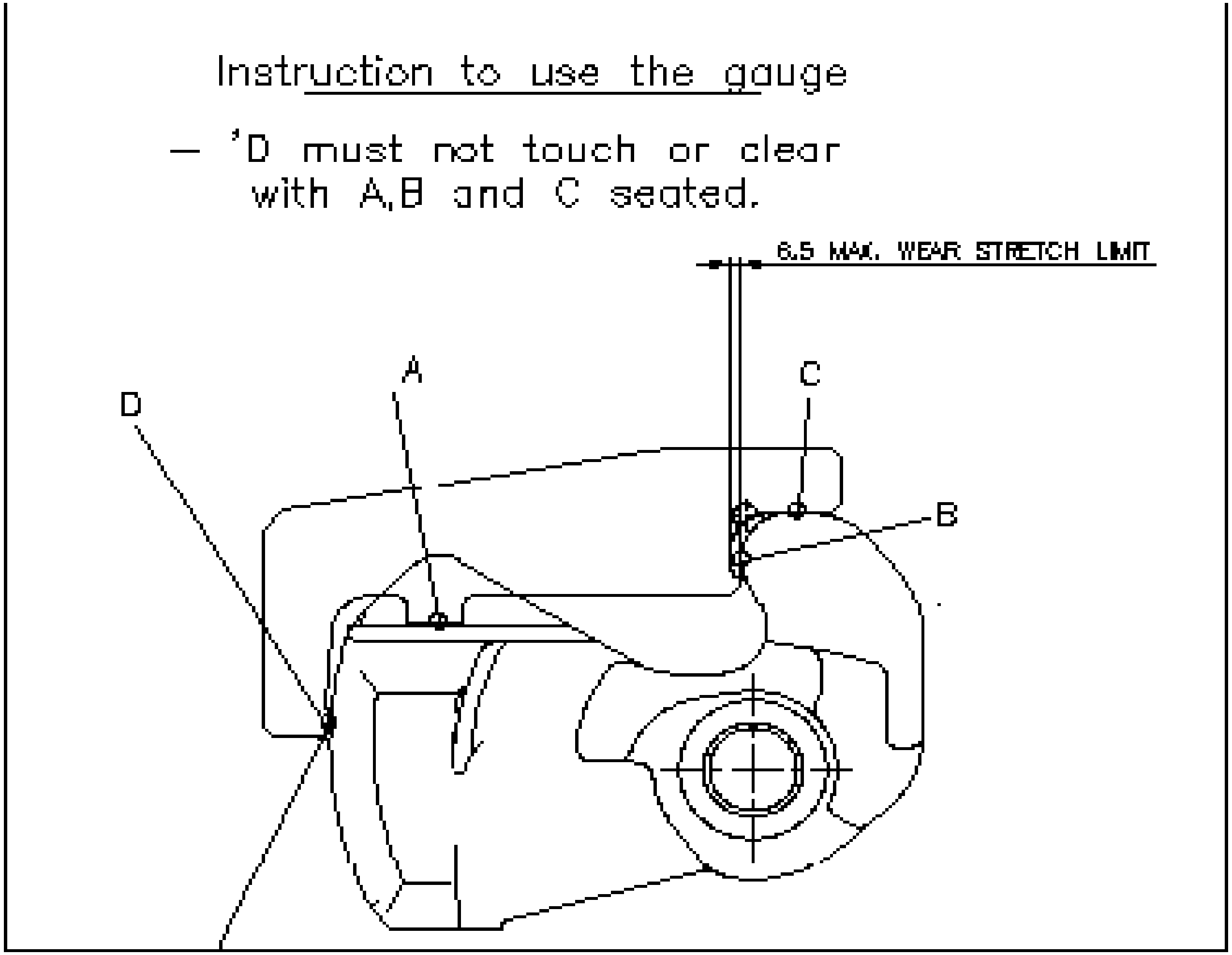
If gauge does not pass, Knuckle and coupler head must be checked and replace it or lock to be modified per APTA standards.(American Public Transportation Association)


MUST SEAT
GAGE MUST PASS THROUGH CONTOUR WITH KNUCKLE FULLY CLOSED AND LOCKED.

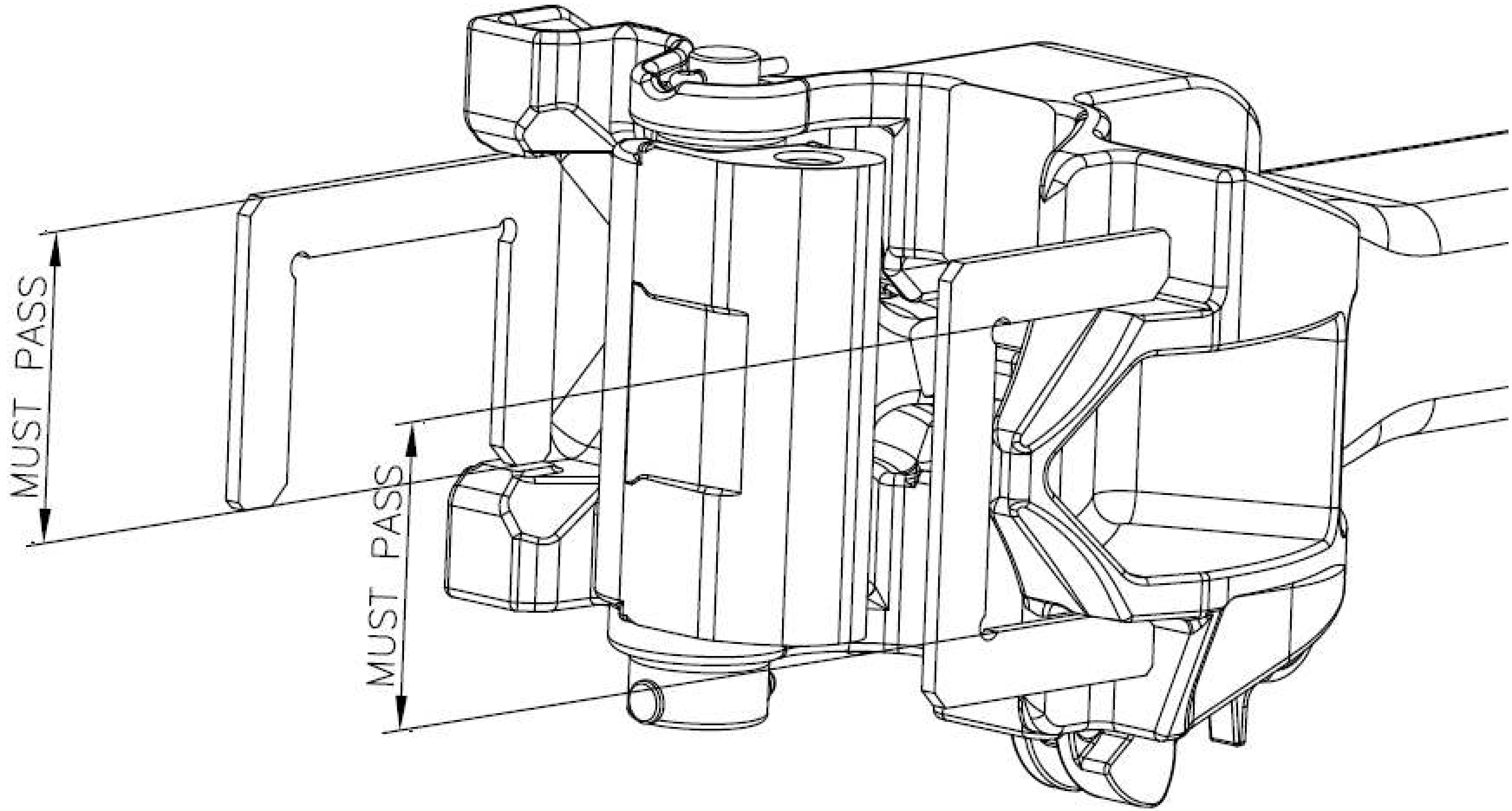
ÁksQkby xst

Knuckle nose wear and stretch limit gauge

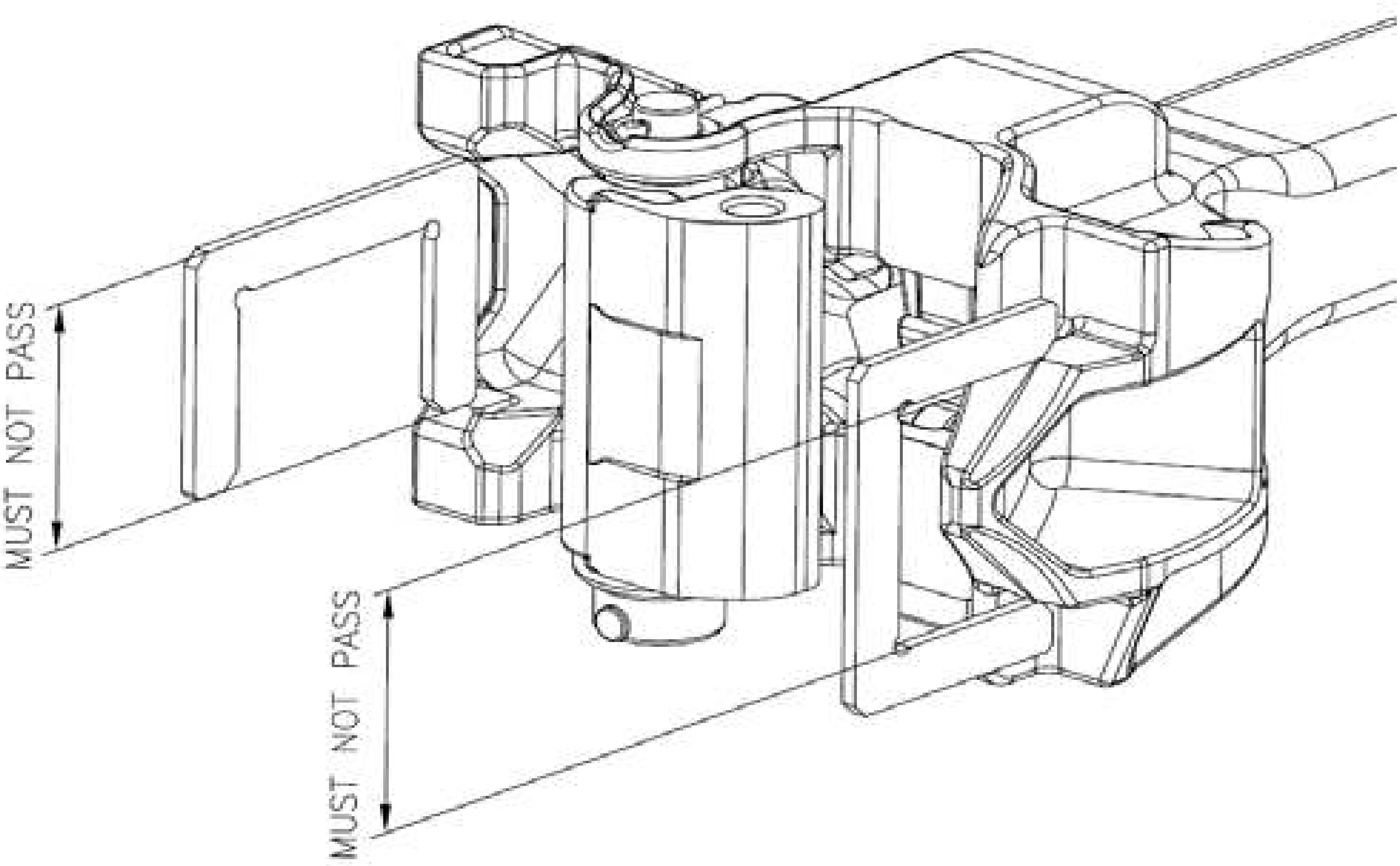
The permitted wear at the nose side is 6.5 mm.

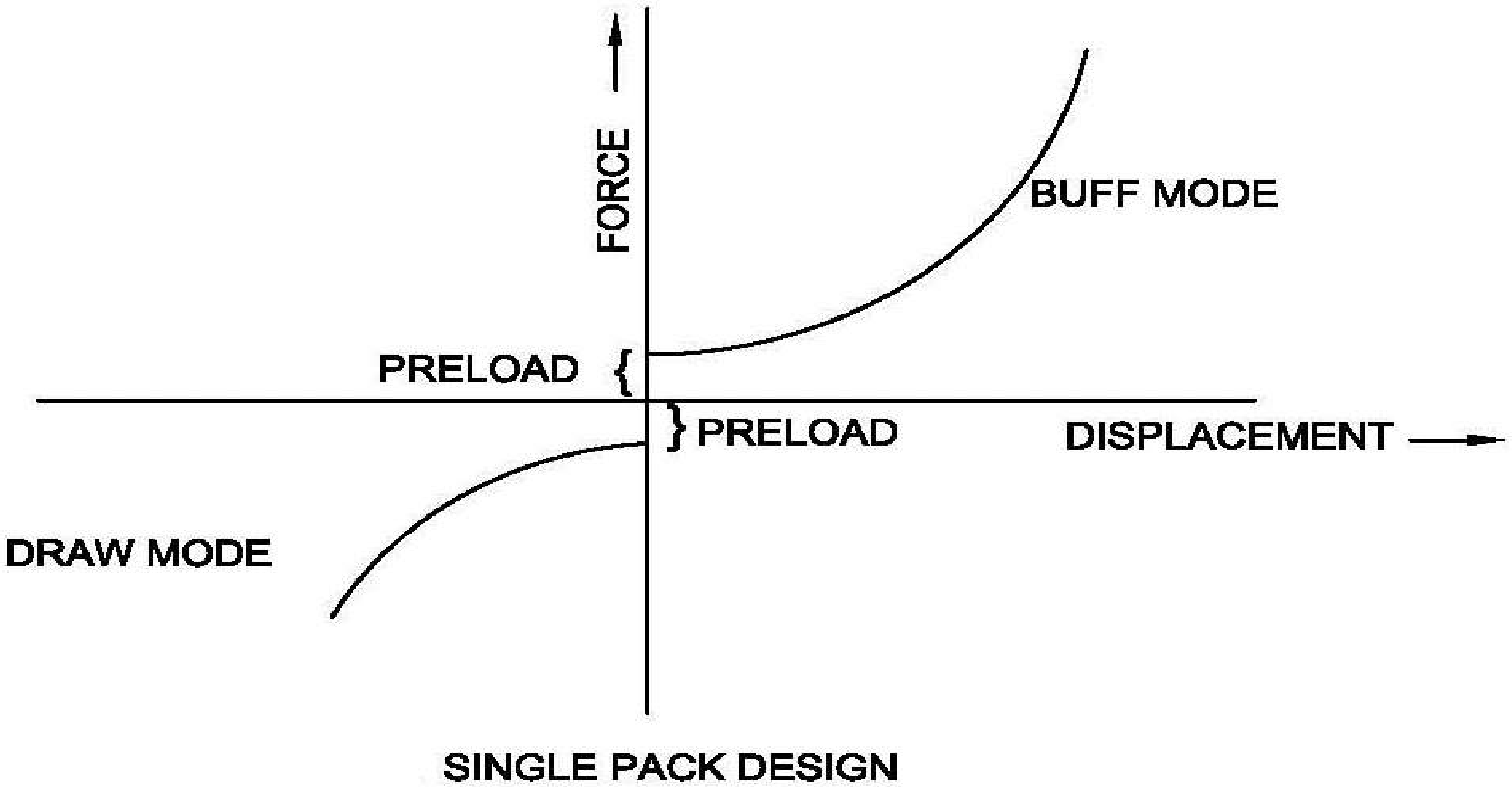


Vertical height aligning wing pocket and guard arm gauge (GO)

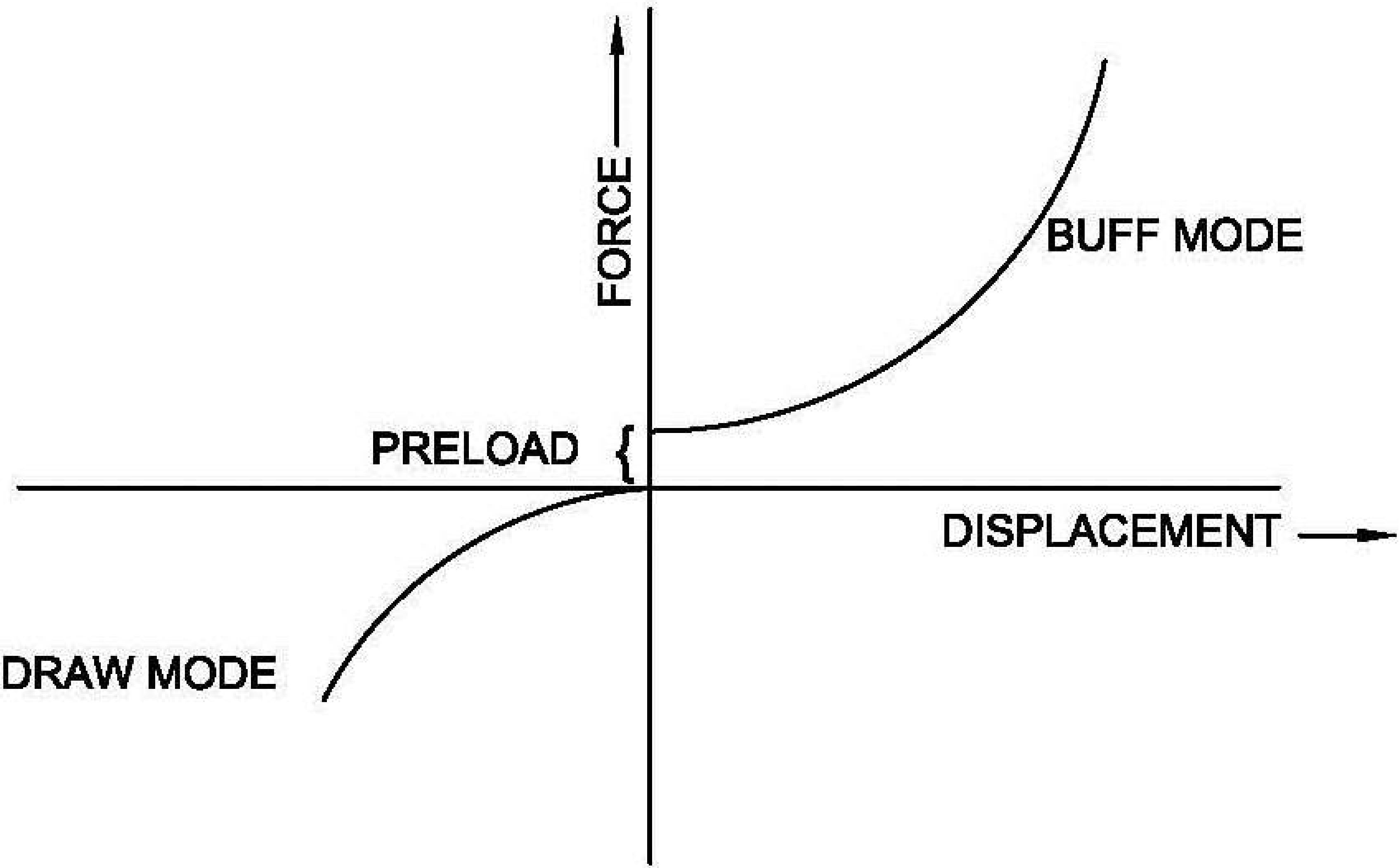


Vertical height condemining limit aligning wing pocket and guard arm gauge (NO GO)

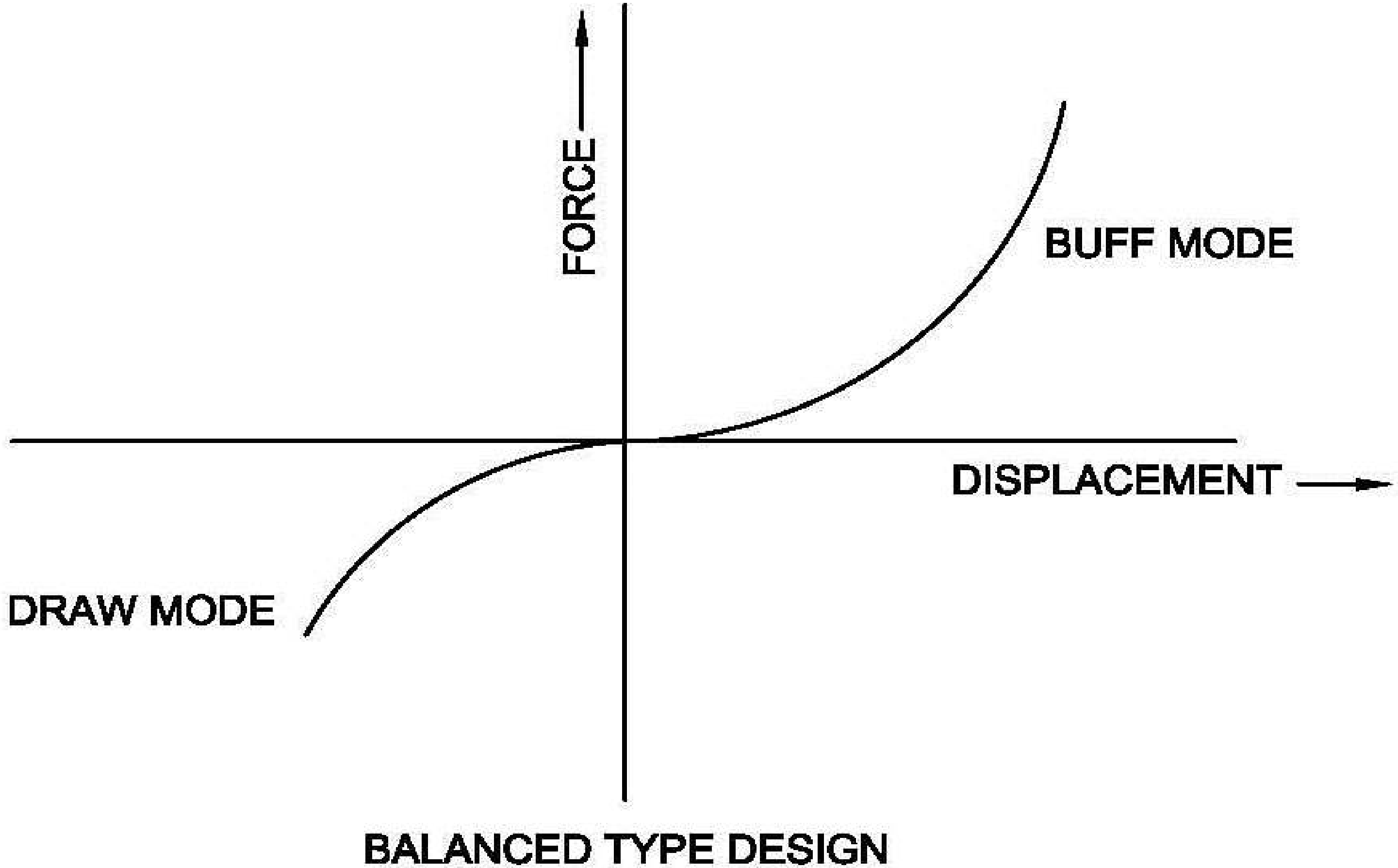




Travel Characteristics of Single Pack Draft Gear



TWIN PACK AND FLOATING PLATE TYPE DESIGN



Travel Characteristics of Balanced Type Draft Gear

Advantage

1. Automatic Coupling
2. Anti climbing feature in the event of derailment / accidents.
3. Higher strength-haulage of Longer trains possible
4. Transmit both draft and buffing forces
5. Chances of unauthorized uncoupling eliminated
6. Less jerk in coaches during braking
7. Lesser maintenance
8. Chances of interlocking of buffers has been eliminated during impact

धन्यवाद

TYPES OF COACHES

IRS-

BEML-

ICF (Schelerine Bogie)-

ICF (All Coil Bogie)-

IRY-

LHB-

Hybrid-

PCV- Passenger coaching vehicle

OCV- Other coaching vehicle

Codal life of Coaches:-

IRS- 30 years

ICF/BEML- 25 years

ICF- (light utilisation)-40 years

ICF- (light utilisation After rebuilt)-35years

LHB- Not decided

Maintenance Sch. Of ICF &LHB

ICF:-

Schedule	Periodicity
(1) Trip schedule	Every trip
(2) Schedule A	one month±3 days
(3) Schedule B	Three months±7 days
(4) IOH	(1) 9 Month +/-30 days/00 (After 1st POH)
	(2) 12 Months+/-30 days/00 (After MLR & Newly built.)
(5) ART/ARNV	24 Months

LHB:-

Schedule	Periodicity
(1) Trip schedule D1	Every trip
(2) Monthly Schedule/D2	one month±3 days
(3) Six monthly Schedule/D3	six months ±15 days
(4) SS-I	18 months ±30 days/6 Lakh KMs which ever is earlier
(5) SS-II	36 months /12Lakh KMs which ever is earlier
(6) SS-III	72 months /24Lakh KMs which ever is earlier

TRAIN EXAMINATION COACHES

Presented by-

Rajendra Kushwaha

Instructor/C&W

MSTC/GKP

Maintenance:-

The methods of inspection, replacement or repair of components / assemblies, usage of the quality of material / specifications of materials and keeping the tolerances / dimensions is called maintenance.

Why maintenance is required:-

Maintenance is required on any equipment to keep it in good working condition with safety, security and reliability so that it shall not fail during the course of work.

Types of Maintenance:-

(I) Preventive maintenance:

- It is a method of carrying out inspection, repairs/replacements of omponents/assemblies before the failure of equipment.
- In Indian Railways the following preventive maintenance methods are followed:
- Trip Schedule, “A” Schedule, “B” Schedule, “IOH/ROH” and “POH”

(II) Breakdown maintenance:-

- It is a method of carrying out inspection, repairs/replacements of components /assemblies after the failure of equipment.
- In Indian Railways the following breakdown maintenance methods are followed:
  - Sick line attention,
  - Attention of derailments and other accidents.
- Both preventive and breakdown maintenances are followed on Indian Railways.

various maintenance practices on coaching stock-

- Primary maintenance
- Secondary maintenance
- Terminal maintenance
- R&D

Primary maintenance:-

At primary maintenance depot all the primary maintenance schedule like trip schedule examination that is examination after every trip, schedule "A" or monthly examination, schedule "B" or quarterly examination and IOH (Intermediate over Hauling) will be done on the coaches in which they are running.

Secondary maintenance:-

- Secondary maintenance will be done on rakes which are terminated after a run more than 3500 KM at the other ends which are nominated for this purpose.
- At secondary maintenance depots on termination the rake is to brought to pit line attend all the items of trip schedule, mandatory, like external washing, internal cleaning, watering,provision of missing amenity fitting etc.
- Fresh BPC is to be issued up to primary maintenance depot.

- **Trip Schedule-**

➢ This is a schedule, which is to be carried out every round trip.

➢ The rakes/coaches of all trains should be given a trip schedule as prescribed by the CME of the railway.

➢ This examination may be given at the primary maintenance depot or the secondary maintenance depot.

Terminal maintenance:-

- With in the validity of BPC whenever a train is terminated, like change in train number etc.,the train has to bee given certain attention as per RPC IV rules.
- This attention is called Terminal maintenance. All the terminating trains shall be examined at stations for safe to run examination,internal cleaning and watering to be attended.
- If the train is moved to yard and stabled for more than 2 Hrs BPC is to be endorsed with brake power check otherwise with air continuity.

R & D:-

- R&D means receiving and dispatch. All the primary maintained rakes and passenger through trains shall be conducted rolling in examination, examination on terminating /and pass through.
- The R&D staff shall take up position on both sides of the line short of the platform on which the terminating train/pass through train is to be received and watch the condition of running gear, flat places on tyres , axle box, broken springs, defective brake gear etc.
- The R&D staff should also check, the rakes after coming to halt, gear wise and ensure that no rejectable defects are there.
- The R&D staff should also be dispatch the originating trains on platform by issuing BPC after the levels of air pressures are ensured on the engine and brake.

LHB COACH

Presented by

Rajendra Kushwaha

Instructor/C&W/STC/GKP

ADVANTAGES OF LHB COACHES

HOW IT BENEFITS RAILWAY

A LONGER COACH

LHB coaches are approximately 2-meters longer than the conventional ICF type coaches.

This means “more travel space” “increased seating capacity”, “wider bays and doorways” etc.

A LIGHTER COACH

Per meter length, weight 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 160 kmph.**
- **For speeds of 200 kmph, minor changes are required.**

LESSER MAINTENANCE

- Use of superior materials with longer life.
- Superior braking with WSP.
- Bogie with less moving parts.
- Items of wear & tear shall not require replacement/renewal before 10lakh kms.

LESSER MAINTENANCE

- Use of stainless steel and less bogie moving parts shall reduce maintenance requirements.
- Entrance doors flush with side wall allowing automatic car washing.

HOW IT BENEFITS THE PASSENGER

BETTER RIDE QUALITY

- Improved ride comfort - ride index reduced from over 3. 0 to 2. 5 at a speed of 160 kmph.
- Plush interiors of international standards.
- Improved air-conditioning through better duct designing & humidity control.
- Bigger size sealed windows filled with "argon" gas for a panoramic view & heat insulation.

BETTER RIDE QUALITY

- Modular “oriental” & “western” style toilets with “cdts”& “ Bio Toilets” to avoid soiling of station premises.
- Well equipped pantry with hot cases, deep freezer, bottle coolers etc.
- Flush type swiveling berth reading light.
- Polycarbonate transparent centre tables.

MORE SAFE

- Safety of passengers is of paramount importance, so a number of precautionary measures have been adopted in LHB design coaches , like :-
- Four emergency exit windows for faster passenger evacuation during emergencies.
- Wider vestibule design for smooth inter coach movement.

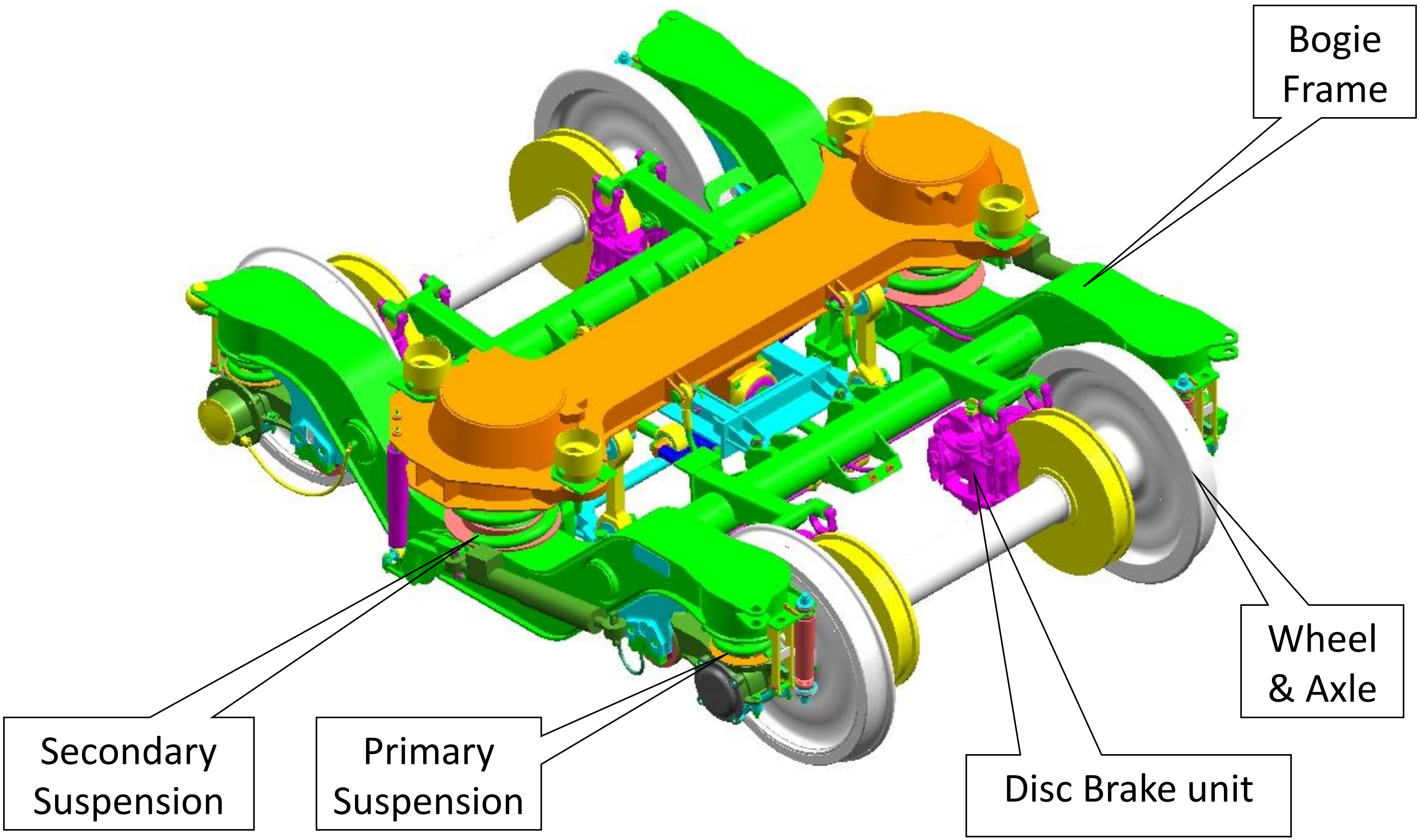
MORE SAFE

- Convenient to operate emergency alarm pull operation and fire- retardant furnishing.
- Tight lock center buffer coupler makes coaches anti-climbing.
- Crashworthiness.


गाड़ी खड़ी करने के लिए
खींचें
उचित एवं पर्याप्त कारण के बिना
1000 रुपये तक जुर्माना और / या
TO STOP TRAIN PULL HANDLE
PENALTY FOR USE WITHOUT REASONABLE AND SUFFICIENT
CAUSE FINE UPTO Rs. 1000 AND / OR IMPRISONMENT UPTO ONE YEAR


आपात निकास
EMERGENCY EXIT

(Complete Assembly)



BOGIE FRAME

- **Solid welded frame -steel sheets and forged, steel cast parts .**

- **Two side frames connected by two cross beams –support brake units. Various brackets on frame.**

BOGIE FRAME

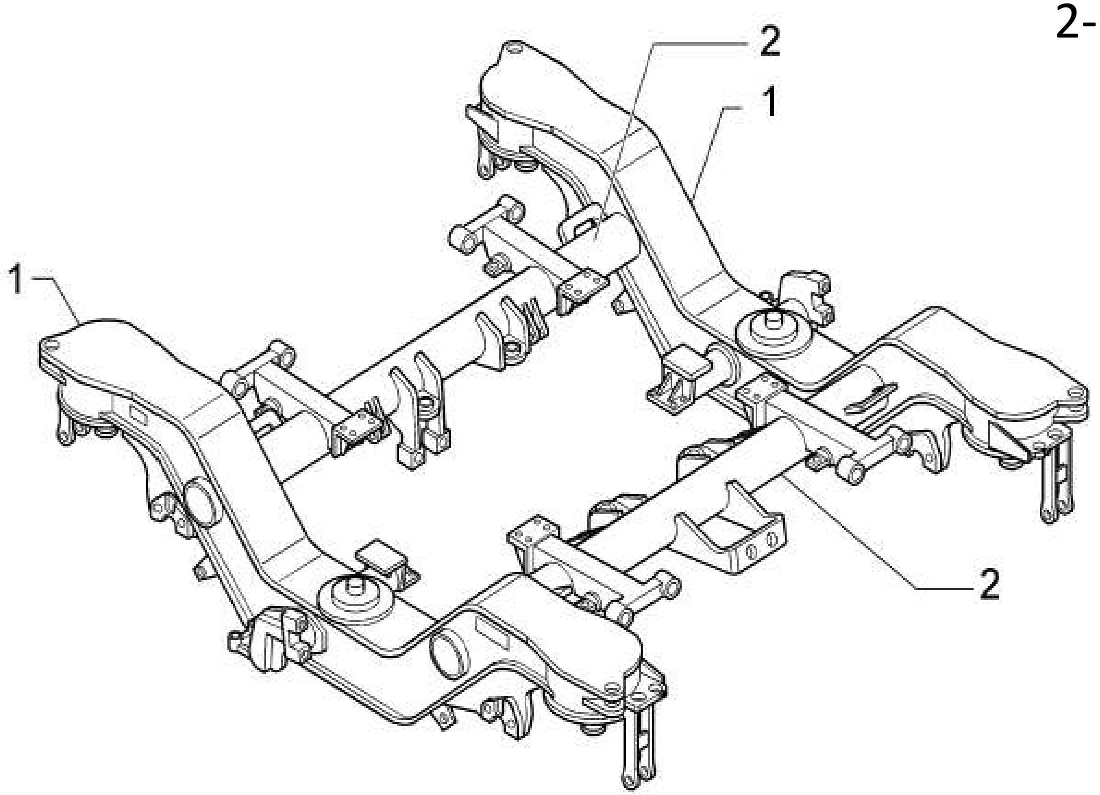
- The bogie frame rests on the primary suspension spring units and supports the vehicle body by means of a bolster beam.

- The bolster beam is connected to the bogie frame by secondary suspension.

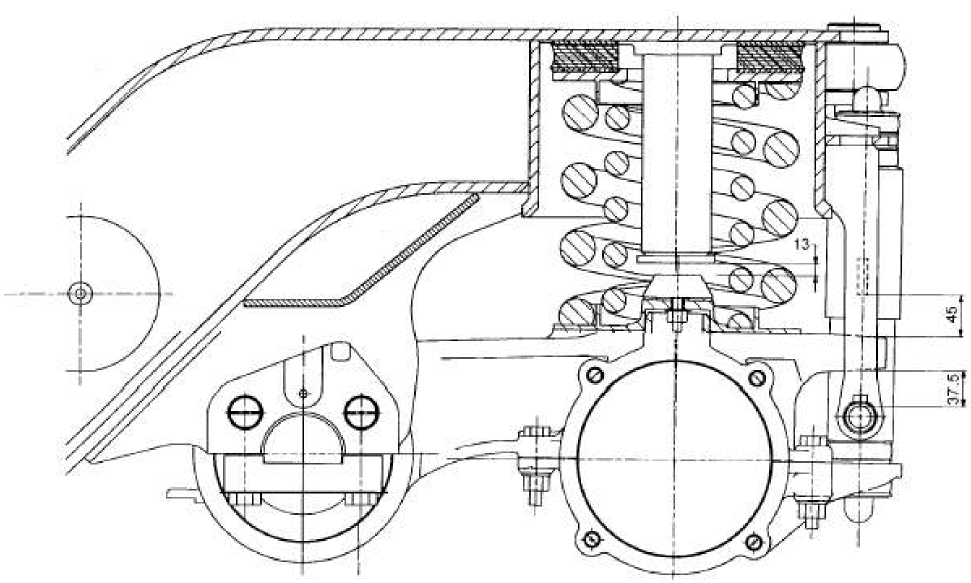
BOGIE FRAME

1.-SIDE FRAME

2-.CROSS BEAM



- **Primary suspension**
- Two coil springs, one vertical damper, articulated control arm, elastic joints connecting the axle bearing to the bogie frame
- Better curve negotiation



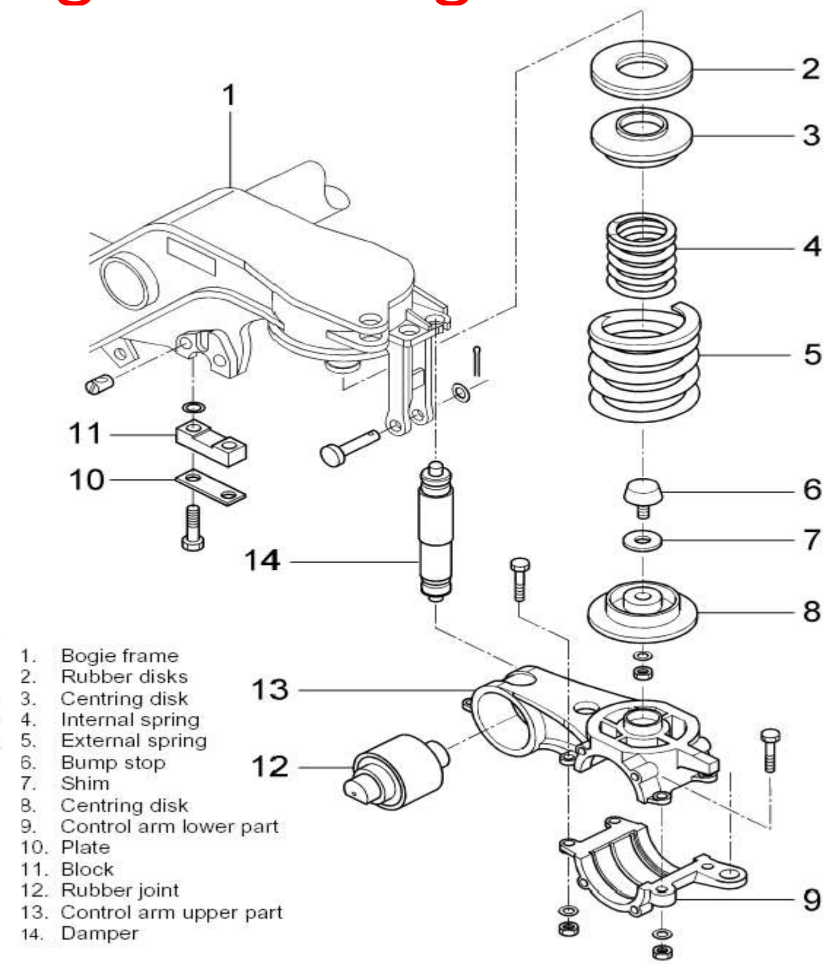
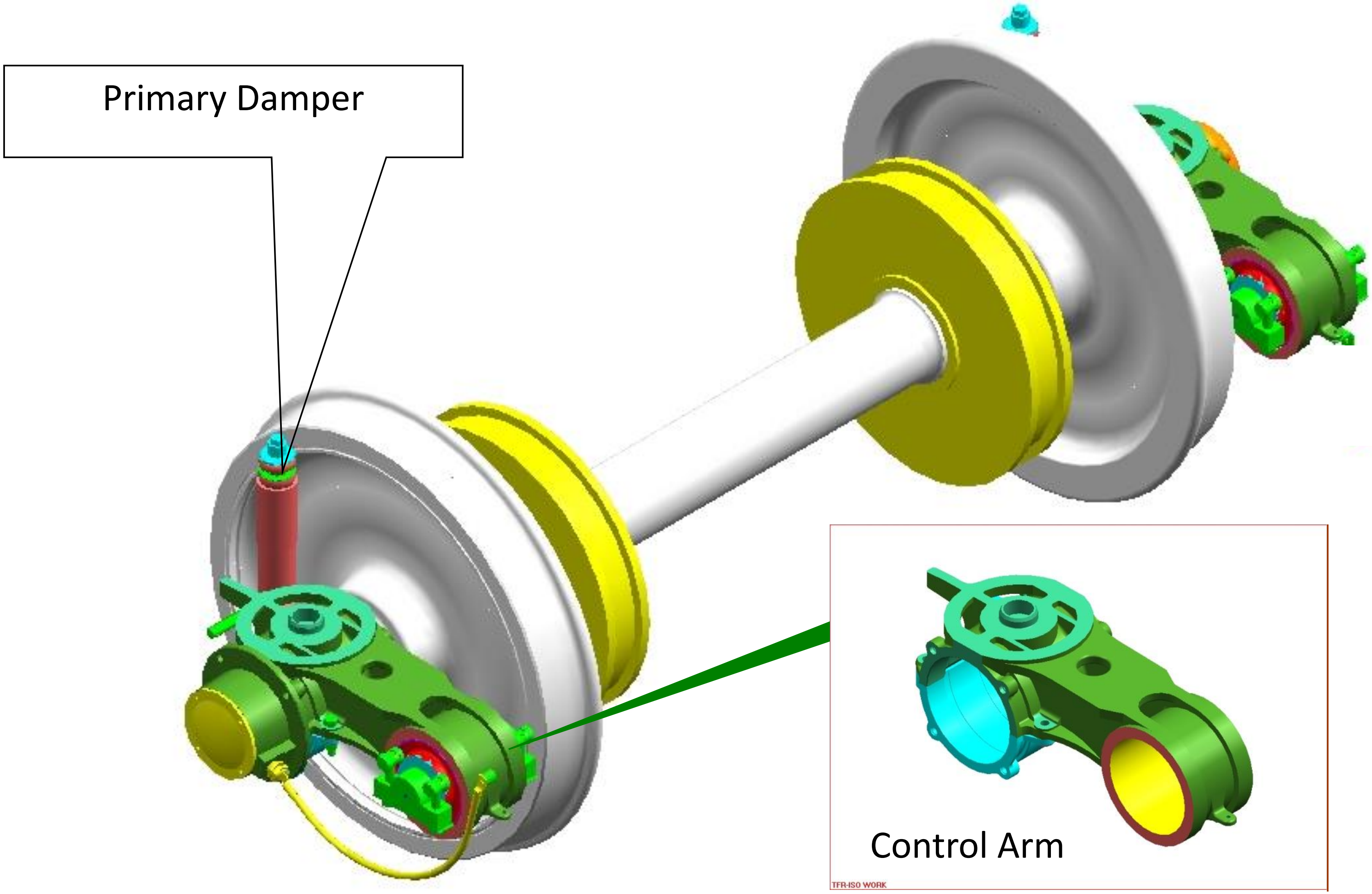
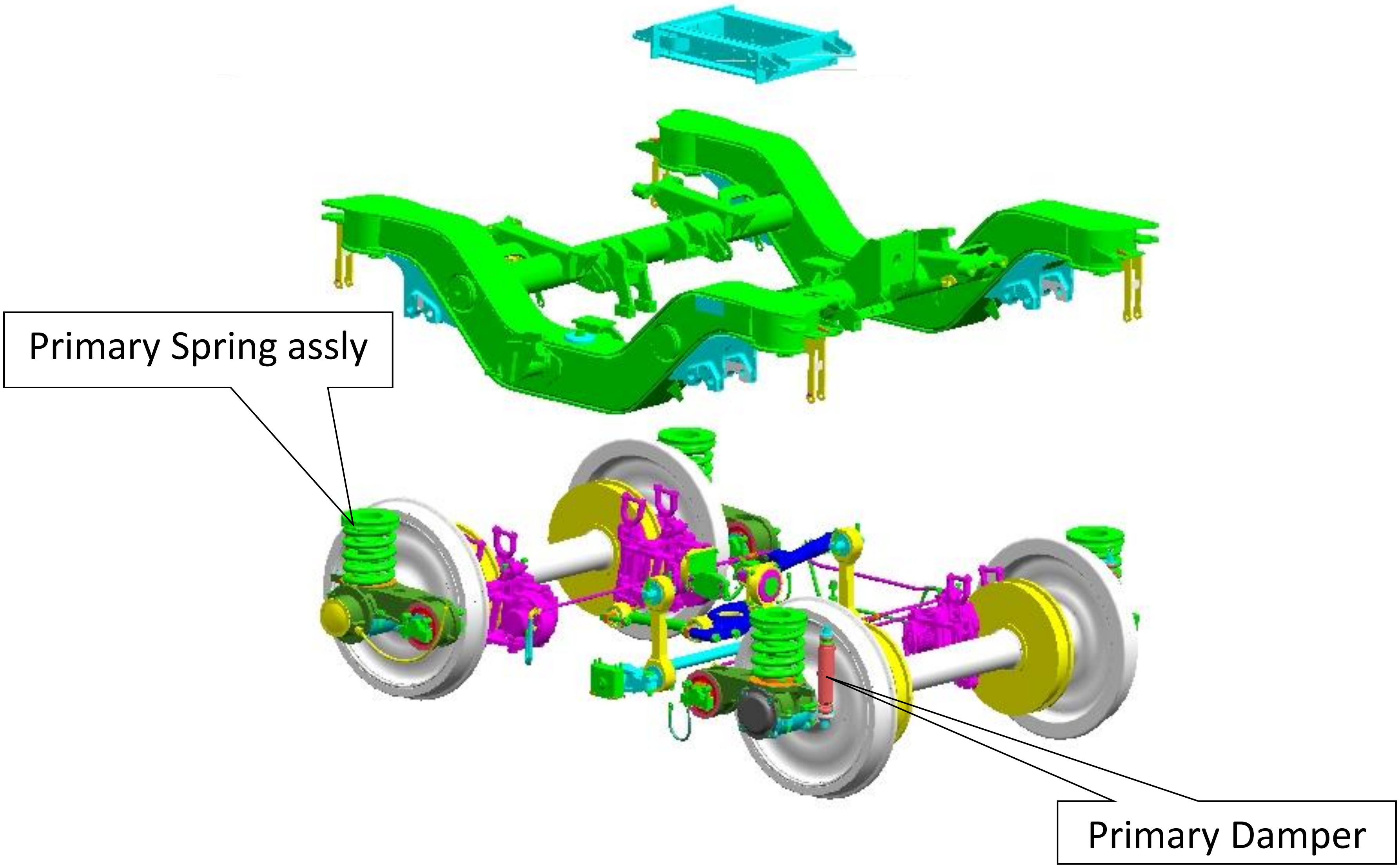


FIG. 1-8 PRIMARY SUSPENSION

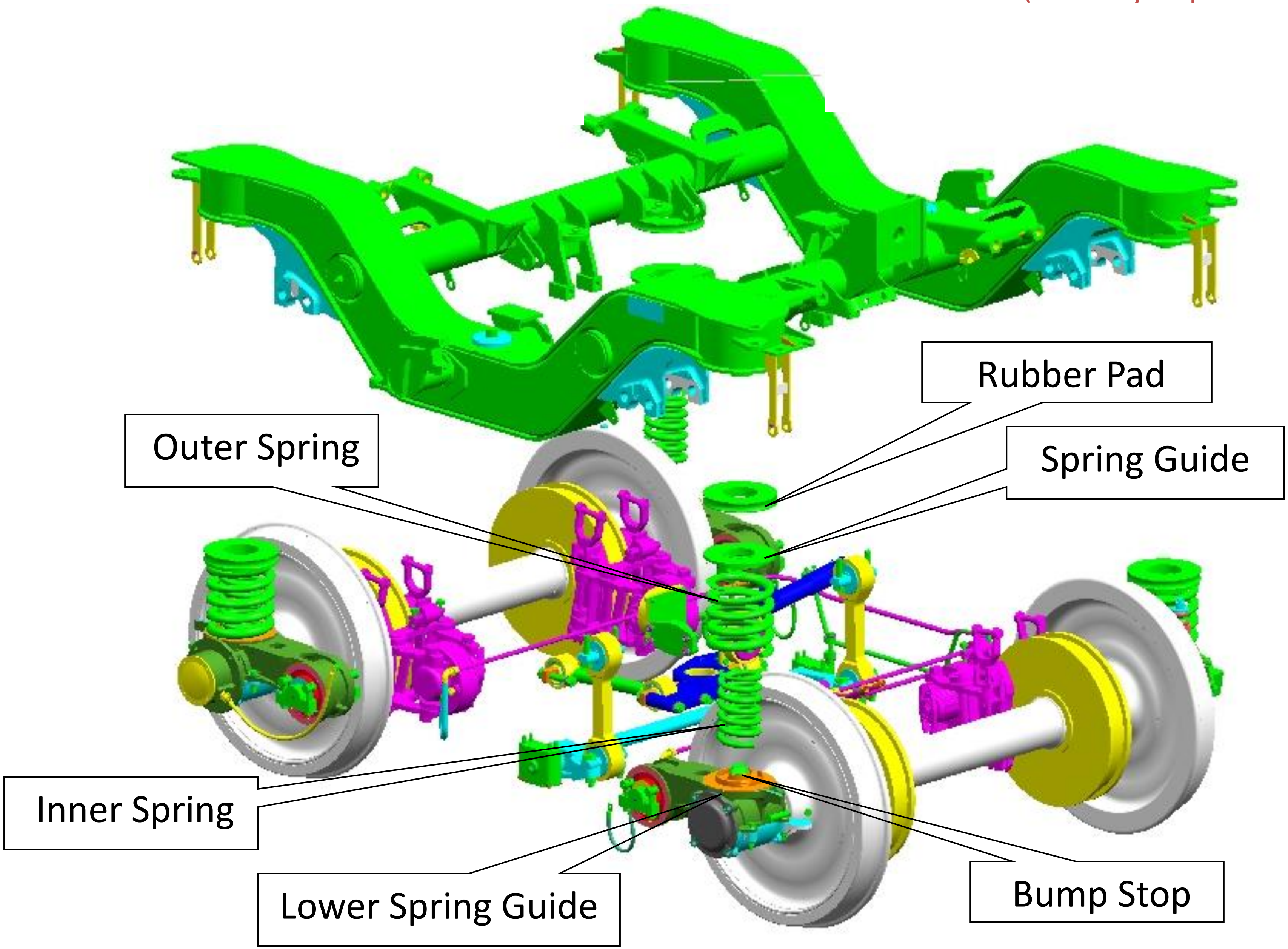
(Wheel set with Primary springs removed)



(Bogie frame lifted)

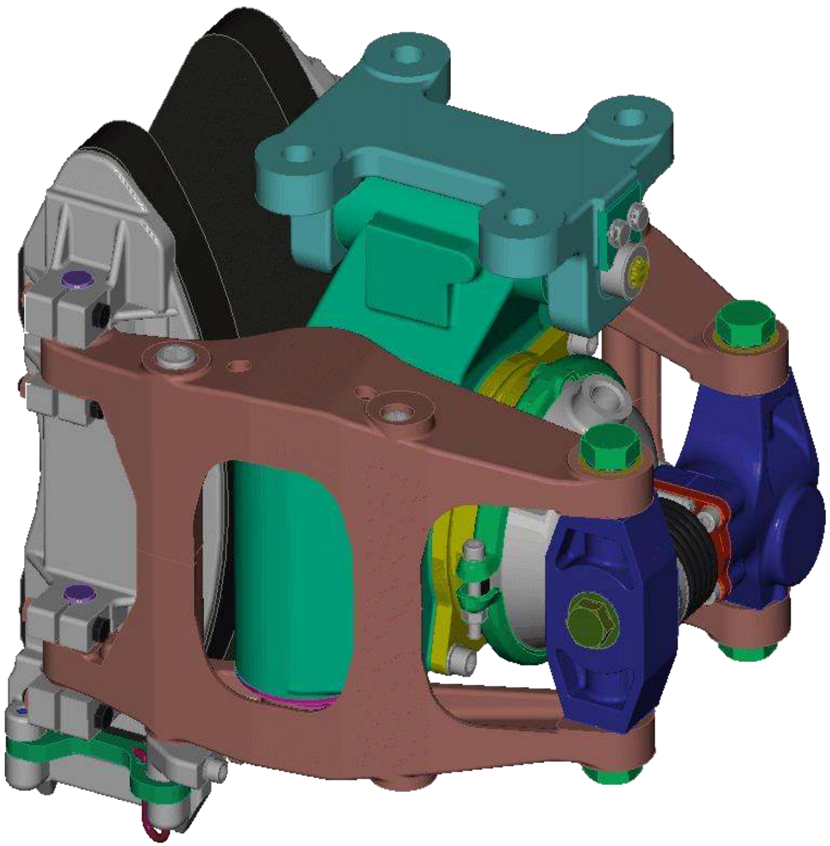


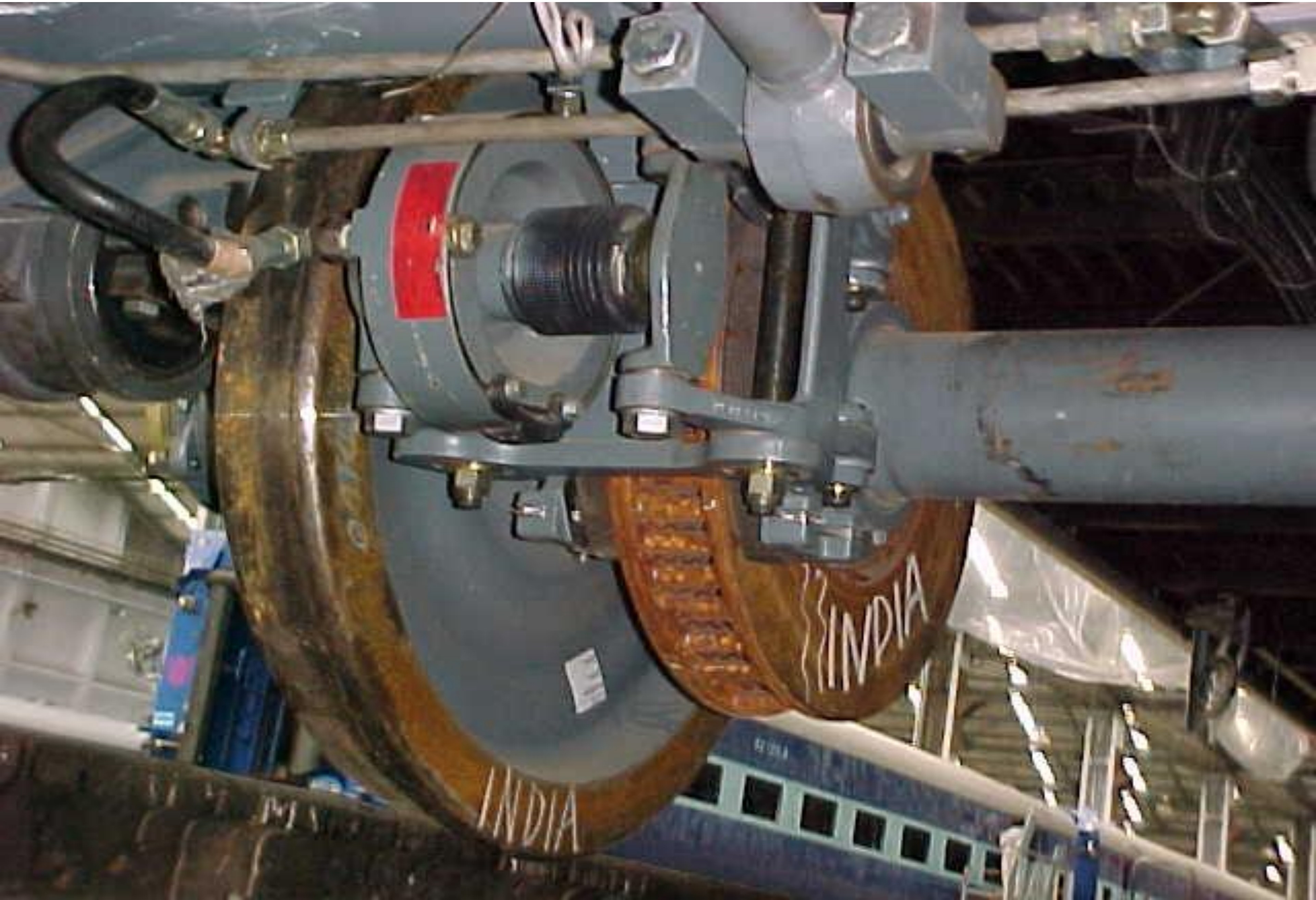
(Primary exploded)



DISC BRAKE SYSTEM

- Axle mounted disc brake.
- Two discs per axle of dia. 640 mm.
- Inbuilt slack adjuster in brake cylinders.
- 35 mm Brake pads.

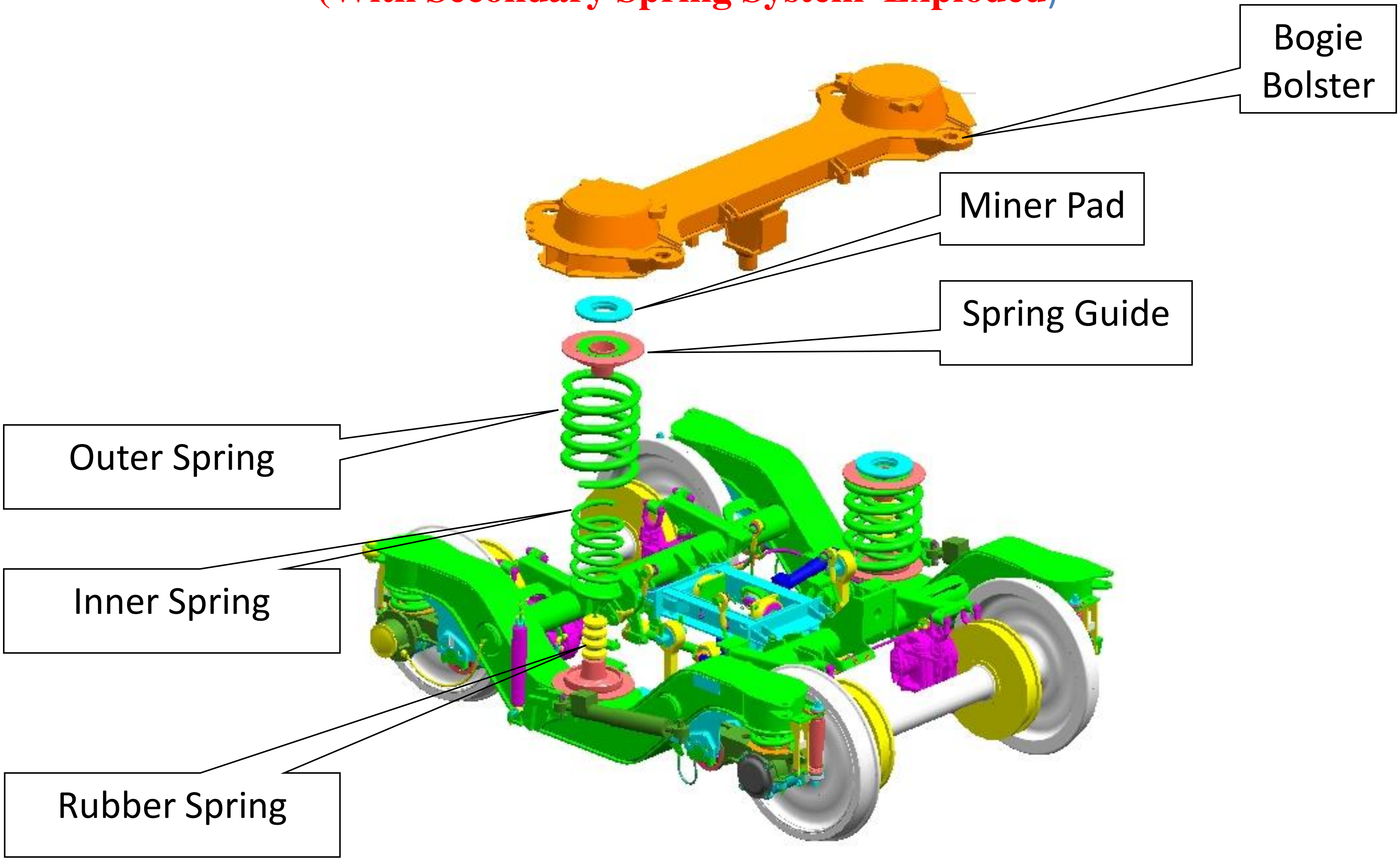



INDIA
INDIA

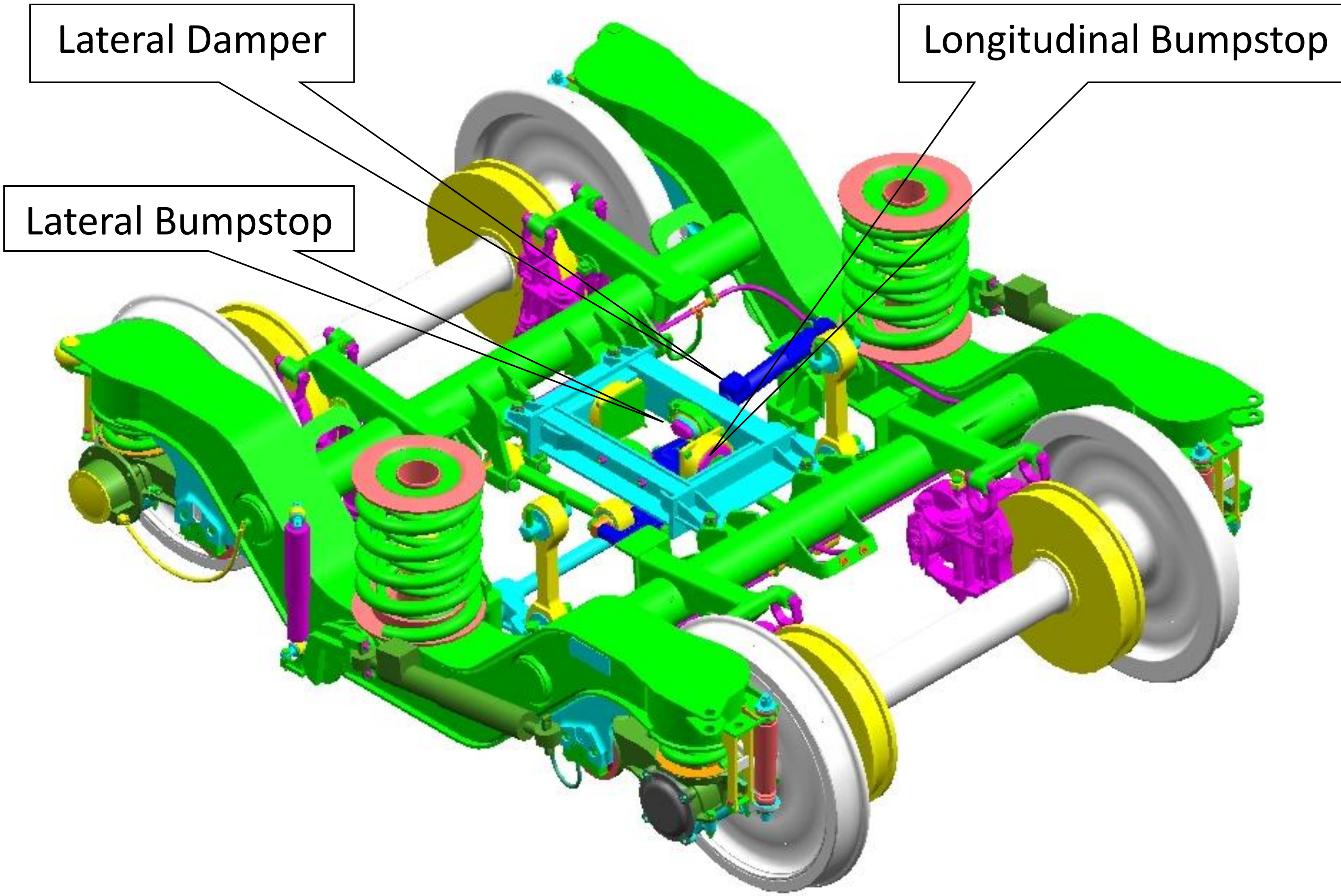
SECONDARY SUSPENSION

- Nest of flexi-coil springs inner and outer, rubber spring and secondary pad
- Vertical dampers
- Lateral dampers
- Yaw dampers
- Anti-roll bar
- Anchor links

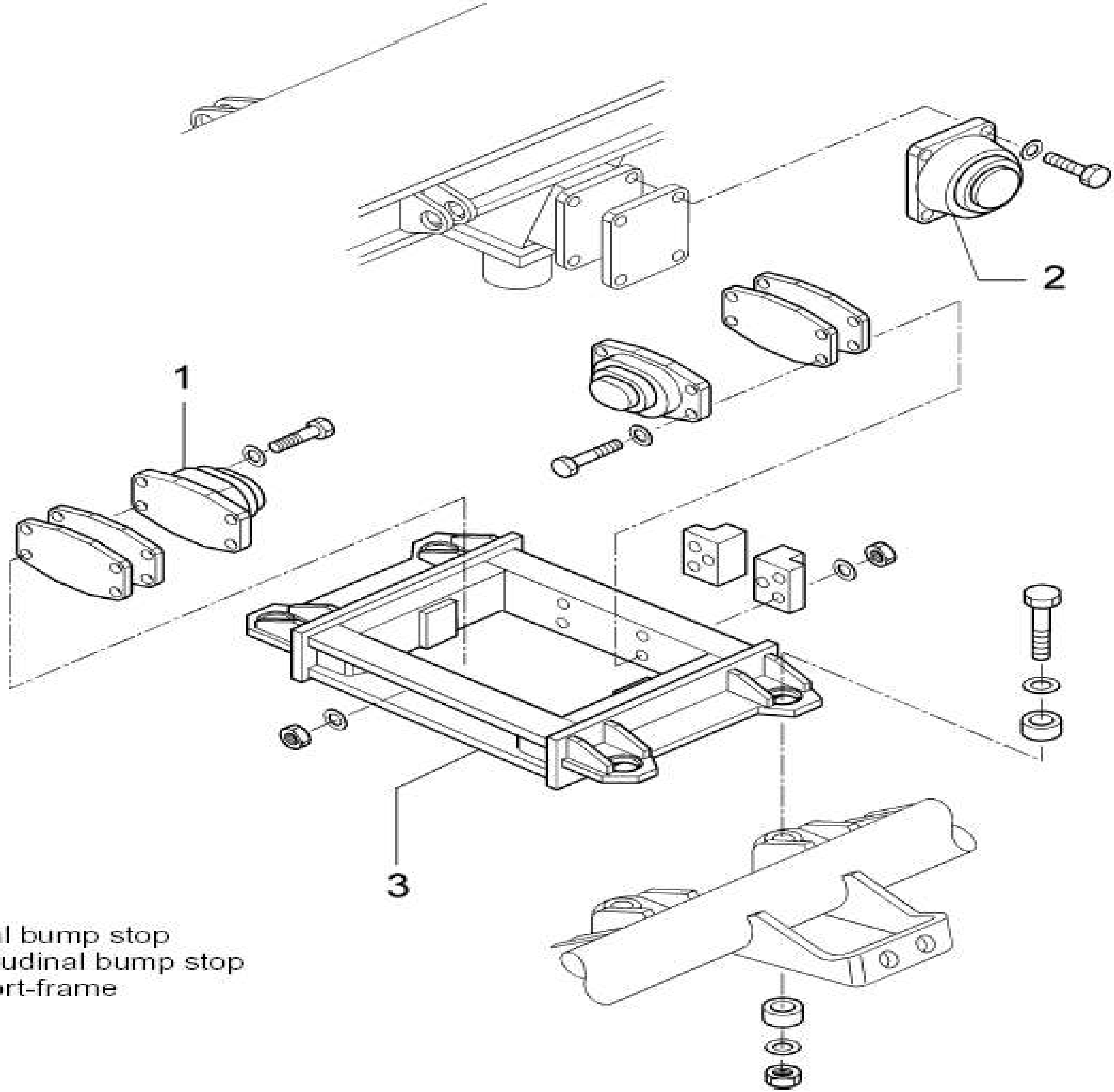
(With Secondary Spring System Exploded)



(Bolster removed)



THANK YOU



1. Lateral bump stop
2. Longitudinal bump stop
3. Support-frame

LHB COACH MAINTENANCE SCHEDULES

- **Coaching Depot Schedule**
- Schedule D1 : Every Trip/Weekly
- Schedule D2 : Monthly ± 3 days
- Schedule D3 : Half Yearly ± 15 days
- **Shop Schedule**
- Shop Schedule I : 18 months/ 6 lakh Kms whichever is earlier
- Shop Schedule II : 36 months/ 12 lakh Kms whichever is earlier
- Shop Schedule III : 72 months/ 24 lakh Kms whichever is earlier

- The details of activities to be carried out during these schedules are given below .

SCHEDULE D1 : TRIP/WEEKLY
(on rake at nominated primary depot)

- **1. Coach**
- Coach should be washed both from outside & inside.
- Disinfect and spray at corner and crevices of coaches after washing all coaches.

- **2 .Shell**
- Visually check body panels/end walls for damages
- Visually inspect destination boards brackets.
- Visually inspect window bars for damage/missing
- Examine body side doors for working/ damages
- Inspect door handles for damages/missing
- Inspect vestibule and its Rubber fittings for damages/missing, repair if necessary
- Visually check vestibule fall plate, mounting brackets, pins and lock lever for ease of operation, damages/ deficiency

- **3. Bogie Frame and Bolster Assembly**
- Perform a visual check on longitudinal beams, cross beams & bolster for cracks, damages and corrosion.
- Perform a visual check on brake supports, damper supports, traction center supports and anti roll bar.
- supports for cracks, damages and corrosion.
- Check bogie bolster sub assembly and brackets for cracks, damages and corrosion.

- **4. Brake Equipment**
- Check functionality of brake equipment and Hand brake equipment.
- Perform a visual check on Brake cylinders/ brake levers and Hand brake equipment for damage, cracks and corrosion.
- Perform a functional test on pneumatic brake system. Make sure that no leaks are present.
- Perform a visual check on hoses.
- Visually inspect steel piping for cracks/ damages/ ballast hitting. Repair/ replace as necessary.

- **5. Axle Bearing Instruments**
- Perform a visual check on all grounding cables & WSP equipment cables for breaks/ damages.
- Visually check equipment for absence of damages, cracks, and corrosion marks.
- Check functioning of WSP equipment.

- **6. Primary & Secondary Suspension**
- Visually check springs for broken & damages,
- Visually check safety cables for damages, cracks and corrosion.

- **7. Primary/Secondary/Yaw dampers**
- Perform a visual check on dampers for damage, cracks and oil leaks.
- Perform a visual check on all fixings for loosening and/or missing components.
- Perform a visual check on rubber elements for cracks and ageing.

- **8. Bearings**
- Carry out bearing feeling for detection of hot bearing.
- Check Axle box for grease leakage.
- **9. Wheel & Axle**
- Check axle for cracks and signs of corrosion .

- **10. Control Arm**
- Perform a visual check on all fixings for loosening and / or missing components.
- Visually check control arm parts for damages, cracks or corrosion marks.
- Inspect the rubber joint until it is visible for, damages and ageing.

- **11. Anti Roll bar assembly**
- Perform a visual check on Anti roll bar, links and Brackets for cracks, damages and corrosion.
- Visually inspect for grease oozing out of anti-roll bar bearings, which may result in bearing failure.
- Perform visual check on all fixing for loosening/missing fittings.

- **12. Traction Centre**
- Perform a visual check on the traction center lever and on the rods for cracks, damages and corrosion.
- The assembly should be free to move, and not blocked by any foreign objects.
- Perform a visual check on all fixings for loosening.
- Perform a visual check on rubber joints for cracks/damages.

- **13. Rotation Limiter**
- Perform a visual check of rotation limiter, components.

- **14. Draw & Buffing Gear -**
- **(Ref: CMI No: RDSO/2006/CG/CMI/01 Re v No: Nil)**
- Visual Inspection of coupler head for damage.
- Checking of coupler operating mechanism for damage, loose, bolts etc.
- Greasing of glide rod of coupler operating mechanism.
- Checking tell tale recess for ensuring proper coupling.
- Inspection of coupler carriers/supporting device & its spring for cracks & breakage.
- Inspection of loose/broken/missing nuts & bolts (M-16) of coupler pin support plate & draft gear support plate.

- **15. Corridor Connections -**
- Check corridor connections for external damage & foreign bodies.
- Check vestibule connection for external damage & foreign bodies.

- **16. Pressure Air Equipment**
- Safety valve check for correct function.

- **17. Interior fitting passenger accommodation**
- General visual check for damage .
- Check for regulation provision of rubbish bins & operational fire extinguishers.
- Check hand rails, sliding door, shutters, toilet doors, vestibule doors, functioning.
- Check bath room fitting (visual) .
- Clean top & bottom guide rails of luggage doors of power cars & greasing of guide bearing.
- 1-leaf sliding door - general function check (ease of movement, how it shuts).
- 2-leaf connection door - general function check (ease of movement, how it shuts) .

- **18. Passenger Doors**
- General function checks (ease of movement)

- **19. Water supply system**
- Check tanks pipes for leakage.
- Check tank mountings.

- **20. Pantry**
- Check for damages & deficiencies in the pantry construction & fittings.
- Check water supply & drainage of the pantry area.

- **21. Sanitary Equipment**
- Check functioning of toilet system.

SCHEDULE D2 : MONTHLY 30 ± 3 DAYS (On rake at nominated primary depot)

- **1. All items of Schedule D1**

- **2. Coach**
- Disinfect and spray insecticide at corner and crevices of coaches after washing all coaches.
  (AC & Pantry Car – 15 Days)
- Intensive cleaning of coach.

- **3. Bogie Frame and Bolster Assembly**
- Wash the bogie frame thoroughly with water jet.

- **4. Brake Equipment**
- Perform a visual check on brake discs.
- Check wear of brake pads/ brake discs.
- Lubricate the brake levers, fixings and all moving parts.

- **5. Axle Bearing Instruments**
- Monthly / Quarterly inspection of WSP equipment to be carried out as per schedule given by OEM.

- **6. Wheel & Axle**
- Perform a visual check on wheels for cracks.
- Check by wheel profile gauge .
- Check tread diameter and wear of wheel profile. If necessary, perform re-profiling.

- **7. Rubber and Rubber/Metal Bonded parts**
- Perform a visual check on Rubber and Rubber - Metal bonded parts for cracks, damages and ageing.

- **8. Pins and bushes**
- Lubricate all pins and Bushes.

- **9. Body works -**
- General inspection of Vehicle body work (paint work, glazing).

- **10. Pressure Air Equipment**
- Dry out air - filter
- Clean air - filter
- Clean airline - filter

- **11. Interior fitting passenger accommodation**
- Inspect seats & check for completeness.
- Inspect luggage racks & check for completeness.
- Check handrails manually for fitment of fixing.
- Inspect floors.
- Checks stick-on notices and directions for condition & completeness.

- **12. Passenger Doors**
- Clean & lubricate door mechanisms.

- **13. Water supply system**
- Rinsing the pipes & water tanks.

SCHEDULE D3 : HALF YEARLY 6 MONTHS ± 15 DAYS

(On rake at nominated primary depot)

- **1. All items of Schedule D2**
- **2. Shell**
- Thoroughly clean and remove dust, rust accumulated at pillars with coir brush and compressed air.
- Examine for corrosion of sole bar and other under frame members with torch light or inspection lamp.
- Touch up damaged paint both inside & outside.
- Check roof ventilator for damages.

- **3. Bogie Frame and Bolster Assembly**
- Examine the bogie frame for corrosion / damages, especially at critical locations.
- Carry out paint touch up with high built epoxy primer and paint as per RCF specifications MDTS – 166.

- **4. Brake Equipment**
- Verify that the clearance between each pad and disc surface is 1-1.5 mm.

- **5. Axle Bearing Instruments**
- Inspect the Earthing equipment for wear of slip assembly / carbon bars.
- **6. Primary & Secondary Suspension**
- Check miner pads for cracks, damages and ageing.
- **7. Wheel & Axle**
- Check wheels offset on axle (1600 ±1 mm)

- **8. Anti Roll bar assembly**
- Perform a visual check on rubber joints for cracks, damage and ageing.
- **9. Body works -**
- Replenish supplies.
-
- **10. Passenger Doors**
- Lubricate door seals with silicone paste.

THANK YOU

Comparison of FIAT with ICF Bogie

Features	FIAT	ICF
Speed Potential (kmph)	160	140
Ride Index (max.)	2.75 at 180kmph	3.5 at 140kmph
Weight (t)	6.5	5.72 (13t) 6.5(16.25t)
Wheel base(mm)	2560	2896
Inner axle distance (m)	12.34	11.89
Wheel dia new (mm)	915	915
Wheel dia worn (mm)	845	814
Axle box guidance	Articulated	Rigid
Dampers – Primary	Hydraulic damper	Dashpot

Indian Railway Conference Association – IRCA

Presented by-

Rajendra Kushwaha

Instructor/C&W

MSTC/GKP

Indian Railway Conference Association – IRCA

Indian Railway Conference Association – IRCA

- Indian Railway Conference Association situated in New Delhi.
- Gives out the rules for the standard and condemning sizes of various components used on a rolling stock.
- They also give the guidelines for the maintenance of rolling stock in workshops and in open lines.
- The rulebooks issued for the Carriage & Wagon department are:-

- **Part III - For Wagon Stock**
- **Part IV - For Coaching Stock**

IRCA Part III and IV contains 4 chapters

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

Codification of Railway Zones:-

Sl No	Name of the Railway	Code	Head Quarters
1	Central Railway	01	Mumbai (CSTM)
2.	Eastern Railway	02	Kolkota
3.	Northern Railway	03	New Delhi
4.	North Eastern Railway	04	Ghorakpur
5.	North Frontier Railway	05	Maligon
6.	Southern Railway	06	Chennai
7.	South Eastern Railway	07	Kolkata
8.	Western Railway	08	CharchGate
9.	South Central Railway	09	Secundrabad
10.	East Central Railway	10	Hajipur
11.	North Western Railway	11	Jaipur
12.	East Coast Railway	12	Bhubaneshwar
13.	North Central Railway	13	Allahabad
14.	South East Central Railway	14	Bilaspur
15.	South Western Railway	15	Hubli
16.	West Central Railway	16	Jabalpur

Different types of Workshops and their code

Type of Workshop	Code
Loco Workshops	1
Carriage & wagon Workshops	2
Loco, Carriage & Wagon Workshops	3

Every workshop is given with a 5 digit code - **XXYZZ**

XX - the first two digits indicates the Zonal Railway

Y - The third digit indicates the type of Workshop

ZZ - The last two digits indicates the individual number of the workshops

The different Workshops in the Indian Railways are-

Railway	S.N	Name of the workshop	Code
Central 01	1	Parel	01101
	2	Matunga	01201
	3	Kurduwadi	01301
Eastern 02	4	Jamalpur	02101
	5	Kancharapara(Loco)	02102
	6	Kancharapara(C&W)	02201
	7	Lilluah	02202
Northern 03	8	Charbagh	03101
	9	Amritsar	03102
	10	Alambagh	03201
	11	Jagadhri	03202
	12	Kalka	03203
North Eastern 04	13	Gorakhpur	04301
	14	Izat Nagar	04302
North East Frontier 05	15	New Bongaigaon	05201
	16	Dibrugargh	05301
	17	Tinddharia	05302
Southern 06	18	Perambur (Loco)	06101
	19	Perambur (C&W)	06202
	20	Golden Rock	06303
South Eastern 07	21	Kharagpur	07301

Railway	*S.N*	*Name of the workshop*	*Code*
Western 08	22	Dahod	08301
	23	Parel & Mahalaxmi	08201
	24	Junagarh	08202
	25	Pratapnagar	08302
	26	Bhavnagar	08203
South Central 09	27	Guntapalli	09201
	28	Tirupati	09202
	29	Lallaguda	09203
East Central 10	30	Samastipur	10201
North Western 11	31	Ajmer (Loco)	11301
	32	Ajmer (C & W)	11201
	33	Jodhpur	11202
	34	Bikaner	11203
East Coast 12	35	Mancheshwar	12201
North Central 13	36	Jhansi	13201
S.E. Central 14	37	Raipur	14201
	38	Nagpur	14301
S. Western 15	39	Mysore	15201
	40	Hubli	15202
West Central 16	41	Bhopal	16201
	42	Kota	16202

CHAPTER -1

Definitions used in IRCA:-

1.0 For the purposes of these rules, the following terms will have the meaning herein assigned to them.

1.1 Air brake system on a passenger coach consists of the following main components:-

a) Brake cylinder: -

(i) Under frame mounted

(ii) Bogie mounted

b) Brake pipe: -

c) Feed pipe: -

d) Distributor valve: -

e) Angle cock: -

f) Air hose couplings: -

g) Auxiliary reservoir: -

h) Guard's van valve and pressure gauge: -

i) Isolating cock: -

j) Choke: -

k) Passenger emergency alarm signal device (pilot valve):-

l) Passenger emergency alarm valve: -

m) Dirt collector: -

1.1 Air-conditioned coach: -

1.2 Anti-telescopic coach: -

1.3 Bogie: -

1.4 Anchor-link/Drag-link: -

1.5.1 ICF Schlieren Bogie: -

1.5.2 ICF all coil bogie: -

1.5.3 BEML (HAL/MAN) Bogie: -

1.5.4 IRS Bogie:-

1.6 Coaching stock :-

1.6.1 Passenger Coaching Vehicles (PCV): -

1.6.2 Other Coaching Vehicles (OCV): -

1.6.3 Passenger train

1.6.4 'Train'

1.7 Direct Admission Valve: -

1.8 Dashpots: -

1.9 DRS Cards: -

1.10 Diesel Rail Cars: -

1.11 Electrical Equipments.

1.11.1 Dynamo/Alternator: -

1.11.2 Emergency Coupler: -

1.11.3 Switch Gear:

1.11.4 DC generator/Alternator: -

1.11.5 Condenser motor:-

1.11.6 Delta panel:-

1.11.7 Thermostat:-

1.11.8 Expansion Valve:-

1.12 Electric Multiple Unit (EMU):-

1.12.1 Mainline Electric Multiple Unit (MEMU):-

1.12.2 Diesel Multiple Unit (DMU)/(DHMU):-

1.13 Gross load at rail:-

1.14 Goods stock:-

1.15 Owning Railway:-

1.15 Hot Box:-

1.16 Prescribed schedules/procedures (methods) /materials/ dimensions/tolerances/ special instructions :- As laid down by Railway Board, RDSO and Camtech.

1.17 Rolling stock- includes both coaching and goods stock.

1.18 Shock Absorber:-

1.19 Silent Block: -

1.20 Slack Adjuster/Brake regulator:-

1.21 Unit:- This term applies to one four wheeled vehicle.

1.22 Using Railway:- It means a railway using a junction worked by another railway.

1.23 Working Railway:- It means a railway working a junction.

1.24 **Owning Railway:-** It is the railway to which the vehicle belongs.

Chapter 2-

- **Deals with the Workshop Repair practices.**
- **For further details refer to IRCA Part IV.**

Chapter 3-

- **Deals with Maintenance practices in open line.**
- **For further details refer to IRCA part IV.**

CHAPTER-IV

- **REJECTIONS-**

Rejections Broad Gauge and Meter Gauge Stock.

THANK YOU