

SUMMER TRAINING REPORT

SIX WEEKS INDUSTRIAL TRAINING

AT



NORTHERN RAILWAY CARRIAGE WAGON JAGADHRI WORKSHOP

(A Unit of INDIAN RAILWAY)

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD
OF DEGREE OF

BACHELOR OF TECHNOLOGY

IN

MECH ENGINEERING

SUBMITTED BY:

SUBMITTED TO:

ACKNOWLEDGEMENT

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I also thanks to the workers of their respective stations, who were always ready to clarify my doubts and helped me to increase my knowledge by illustrating me to the finer points.

I wish to express my deep gratitude to all the concerned persons, whose enthusiasing support and co-ordination have given me the success to complete my training in the organization.

I hope that my report will reflect my technical knowledge and innovativeness, which I gained at *Northern Railway Carriage Wagon Workshop Jagadhri*.

DECLARATION

This report is based on the summer training i have undergone in the premises of Northern Railway Carriage Wagon Workshop Jagadhri (NRCWW) A unit of INDIAN RAILWAY from 23rd June 2014 to 19th August 2014. I obtained the knowledge of Carriage Wagon through the selfless efforts of the Employee arranged to me by the Railway administration. The experience of the training was good and i learned lots of things. I was successfully able to complete the training.

PLACE:- Jagadhri

DATE:-

PREFACE

Industrial Training is meant to expose the students of engineering of the actual Industrial Processes about which they have been studying in detail from their semesters. They have spent the last two years in gaining theoretical knowledge of various manufacturing and assembly processes.

The six week training has exposed us to the actual application of the various studied. The training period has been very interesting wherein we got to know how the final product comes to the market. Each product undergoes a number of quality control tests to bring in uniformity and quality.

Each field requires skilfully handling and training at given at each step which will help us in the long run.

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SOME TECH

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ORGANIZATION INTRODUCTION

Till recently, **Indian Railways** have been transporting passenger traffic mainly through coaches of ICF design. These coaches are being manufactured at ICF and RCF. A limited number of these coaches are being manufactured at BEML/Bangalore also. These type of coaches are having limitations in terms of

- i) Speed potential;
- ii) Heavy corrosion;
- iii) Poor riding comfort;
- iv) Wearing of parts in the under gear;

To overcome these limitations, Indian Railways entered into supply and technology transfer contracts with **M/s. ALSTOM LHB**/Germany to initially supply 24 coaches consisting of 19 AC chair cars, 2 AC Executive Class Chair cars and 3 Generator cum Brake vans. The bogies for these coaches are manufactured by M/s. FIAT/SIG Switzerland. These coaches arrived in India and got commissioned in the year 2001 and put in service on route. These type of coaches are far superior w.r.t. passenger comfort, safety, speed, corrosion, maintenance and aesthetics in appearance. These coaches are also longer as compared to ICF design resulting into more carrying capacity.

The expected benefits from these type of coaches are as under:-

- I. **Higher carrying capacity** - These coaches are about 2 meters longer than ICF coaches. With this extra length two additional rows of chairs in chair cars or one additional bay in sleeper coaches can be accommodated.
- II. **The weight of LHB coach is lesser as compared to ICF design coaches.** LHB coach can accommodate 72 passengers as compared to 64 in conventional AC III Tier Coach. Thus giving better pay to tier ratio.
- III. **Low corrosion** – There will be low corrosion of LHB coaches due to extensive usage of Stainless Steel and better design and manufacturing techniques.
- IV. **Low Maintenance** – Replacement and removal of sub-systems will be required only after one million kilometers. There are no doors handles projecting outside the coach thus mechanized car washing is facilitated.

- V. LHB Coaches have **aesthetically superior interiors** with FRP panels for side wall and roof. They can be removed easily for maintenance, **resist water seepage and are wear resistant.**
- VI. There are no visible screws inside the passenger compartment.
- VII. **Better passenger comfort:** Ride Index of 2.5 (Not exceeding 2.75) has been specified as compared to in conventional ICF coaches.
- VIII. LHB coach offers **better passenger safety** due.
- Use of fire retardant materials for furnishing.
 - Provision of emergency open able windows.
 - Vertically interlocked. Centre Buffer couplers.
- IX. LHB coach offers **better passenger amenities** due to
- More space for pantry;
 - Individual reading light in chair car;
 - Ergonomically designed chairs with reclining back rest.

Important Parameters of LHB Coaches

Overall dimensions of coach

| | |
|--|-------------|
| Gauge | 1676 mm |
| Length over buffer | 23540 mm |
| Length over buffer | 24000 mm |
| Height over roof | 4039 mm |
| Maximum width over body | 3240mm |
| Maximum distance between inner wheels | 12345 mm |
| Window opening | 1180x760 mm |
| Distance between centre pivots | 14900 mm |
| Height of compartment floor from rail level Under tare condition | 1303 mm |
| Maximum buffer drop under gross load and worn conditions | 75 mm |
| Maximum height of centre line of side Buffers above rail level for empty vehicle | 1105 mm |

| | |
|---|---|
| Maximum height of centre line of side Buffers above rail level for loaded vehicle | 1030 mm |
| Maximum tare weight | |
| Chair Car | 39.4t |
| First AC | 40.5t |
| Second AC | 48.4t |
| Third Ac | 50.6t |
| LSLR | 37.9t |
| Wheels mono block | 915 mm |
| Maximum axle load permissible | 16 tones |
| Number of toilets | 3 |
| No.of seats | 78 (2 nd AC Chair car) 56 (Exe. AC Chair car) 24 (First class sleeper FAC) 52(Two tier AC sleeper) 72 (Three tier AC sleeper) |
| Higher speed potential | 180 Kmph up gradable to 200 |
| Ride index of coach | 2.5 at 160 Kmph but not >2.75 |

VARIOUS PARTS OF THE LHB RAKE

WHEEL AND AXLE ASSEMBLY

This is the part of a rake which is just adjacent to the tracks. It basically consists of four main parts:

- a) Wheel
- b) Axle
- c) Bearing and Housing

Wheel

Wheel of a rake is a specifically made cylindrical portion having an outer edge shape to fit in the railway track. The material is **stainless steel**.

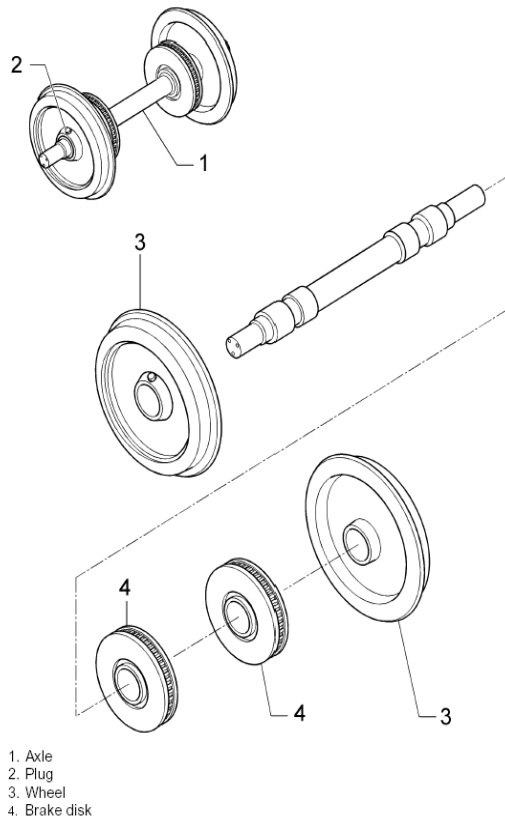


Axle

Axle is the main long cylindrical bar on which wheels are fixed with the help of bearings. This is also made of stainless steel as above. Each axle contains 2 wheels, the brake cylinders are also attached to it and in case of LHB coaches, the braking discs are fixed on to the axle.



COMPONENTS OF WHEEL AND AXLE ASSEMBLY



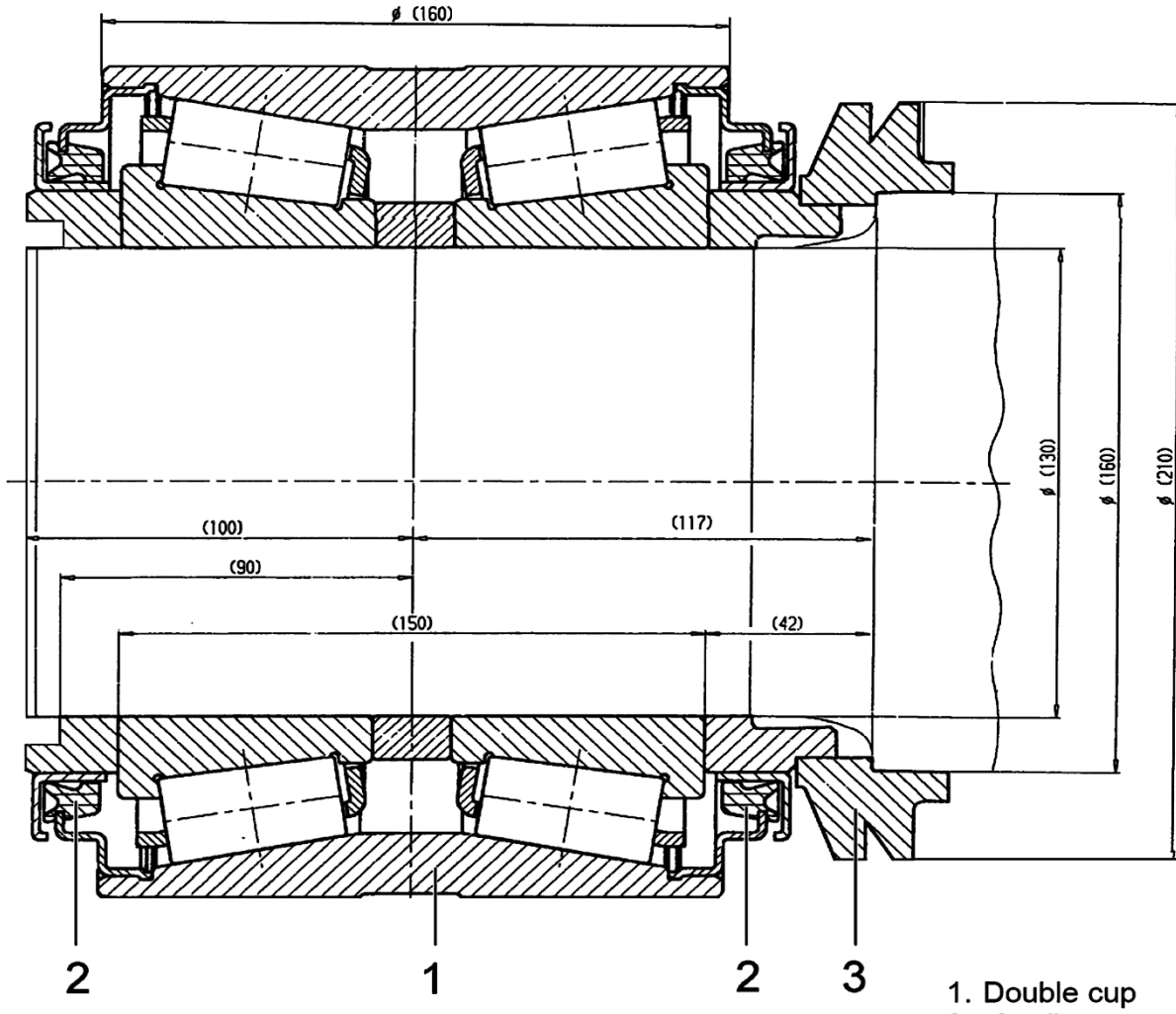
- Two brake disks (4), diameter 640 mm and
○ width 110 mm.
- In built slack adjusting brake cylinder fitted
- Two wheel disc of tread dia 915 (New), 845 (worn).

Axle Bearings

A taper roller cartridge type bearing is used and it makes up a preassembled unit. The axle bearings on the bogie are fitted with sensors for detecting speed (whose signal is elaborated by the ant slipping system) and a current return device.

The ends of the control arms are fitted with centering devices for the primary suspension spring assembly. The bearing lubricating plug is fitted in the lower part.

1. Double cup
2. Sealing system
3. Backing ring



AXLE BEARING LONGITUDINAL SECTION

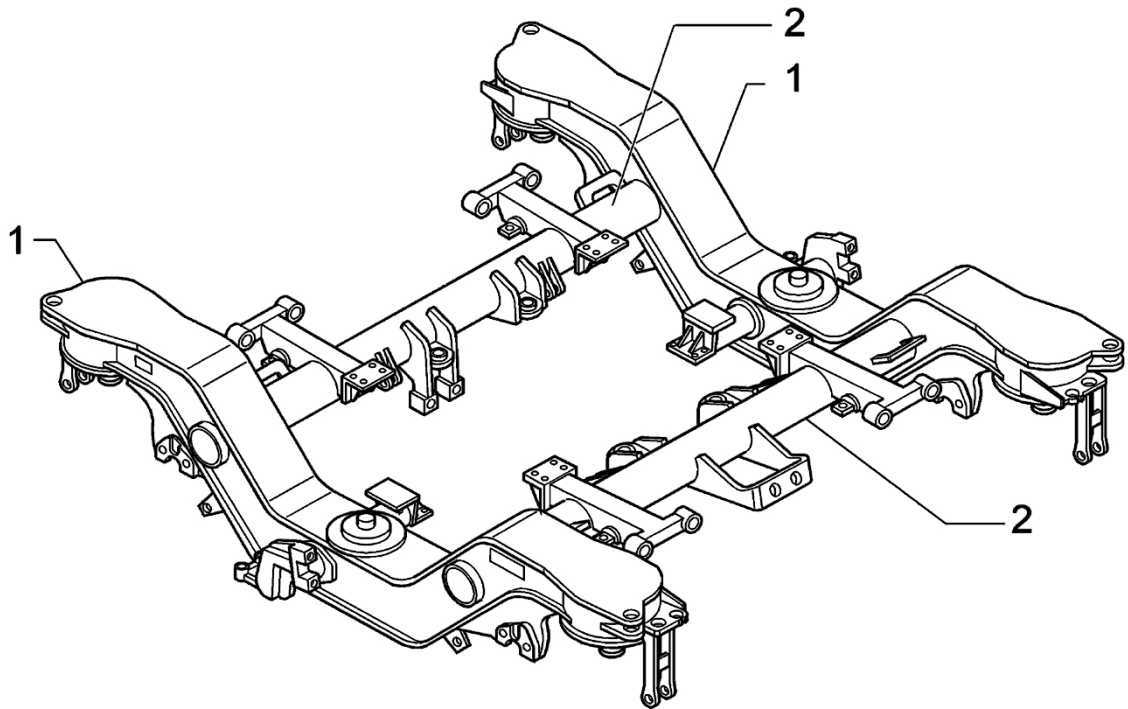
BOGIE

The FIAT Bogie is two-axle type, with a primary and a secondary suspension. The bogie assembly is shown in fig. 1-1. The Salient features of FIAT Bogie are:

- **Solid welded Bogie Frame** made up of two longitudinal components connected by two cross beams. The bogie frame rests on the primary suspension spring units and supports the vehicle body by means of Bolster beam. The Bolster beam is connected to the bogie frame by secondary suspension.
- **Primary suspension** consist of two steel coil springs (internal/external) laid out on the Control Arm upper part.
- **Secondary suspension** consists of two spring packs which sustain the bolster beam over the bogie frame. Each spring pack is made up by an internal and external spring. An Anti roll bar fitted on the bogie frame realizes a constant, reduced inclination coefficient during running. The bogie frame is linked to the bolster beam through two vertical dampers, a lateral damper, four safety cables and the traction rods. The bogie frame is linked to the coach body through two yaw dampers.
- **Traction Centre** - The traction Centre transmits traction and braking forces between bogie frame and body by a traction lever on the bolster beam pin and two rods.
- **Disk Brakes** – The FIAT bogie is fitted with pneumatic disk brakes. The pneumatically operated brake cylinders are fitted with automatic device for taking up the clearances.
- **Taper Roller Cartridge Bearing** – Fiat Bogie is fitted with 130 mm Cartridge type roller bearings.

Bogie frame

The bogie frame is a solid welded frame made by steel sheets and forged or cast parts. The frame is made up of two longitudinal components (1) connected by two cross-beams (2) which also support the brake units. The various supports which connect the different bogie components are welded to the 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 the secondary suspension.



1. Bogie frame longitudinal component
2. Cross-beam

Primary suspension:

Primary suspension is implemented by two units (see FIG. 4-3) of two steel coil springs (internal (4) and external (5)) laid out on the control arm upper part (13) by a centering disk (8) and adjustment shims, (if required).

The suspension is also completed by the following components:

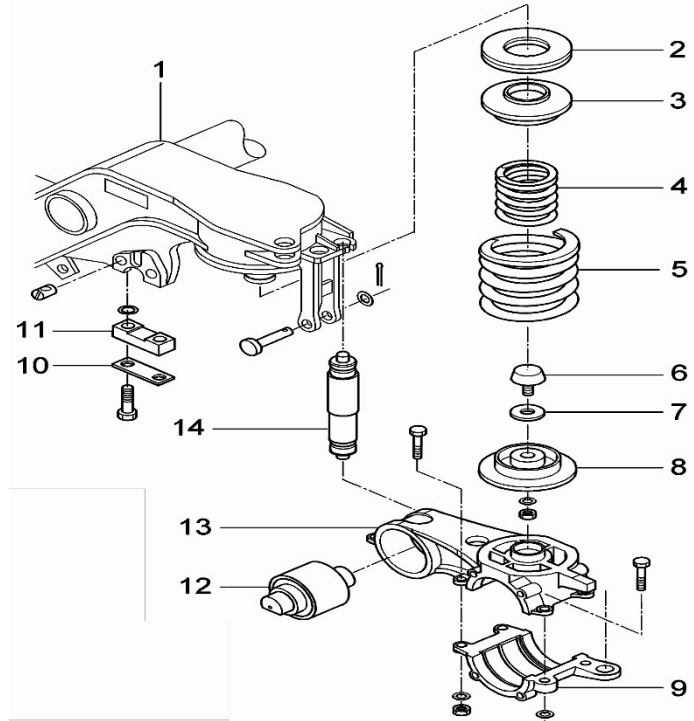
- A control arm (13), fitted with twin-layer elastic joints (12), connecting the axle bearing to the bogie frame and transmitting, not stiffly, lateral, longitudinal and part of the vertical forces;
- A vertical damper (14).

Rubber elements (2) separate the primary suspension from the bogie to realize noise reduction.

Stops and protections are mounted on the bogie frame for the lifting.

1. Bogie frame
2. Rubber disks
3. Centering disk

4. Internal spring
5. External spring
6. Bump stop
7. Shim
8. Centering disk
9. Control Arm Lower Part
10. Plate
11. Block
12. Rubber joint
13. Control Arm Upper Part
14. Damper



Secondary suspension

The secondary suspension enables lateral and vertical displacements and bogie rotation with respect to body when running through curves.

It is implemented by two spring packs (A, FIG. 4-4) which sustain the bolster beam (1) over the bogie frame (6). Each spring pack is made up by an internal (3) and an external spring (4), mounted and positioned through the centering discs (5).

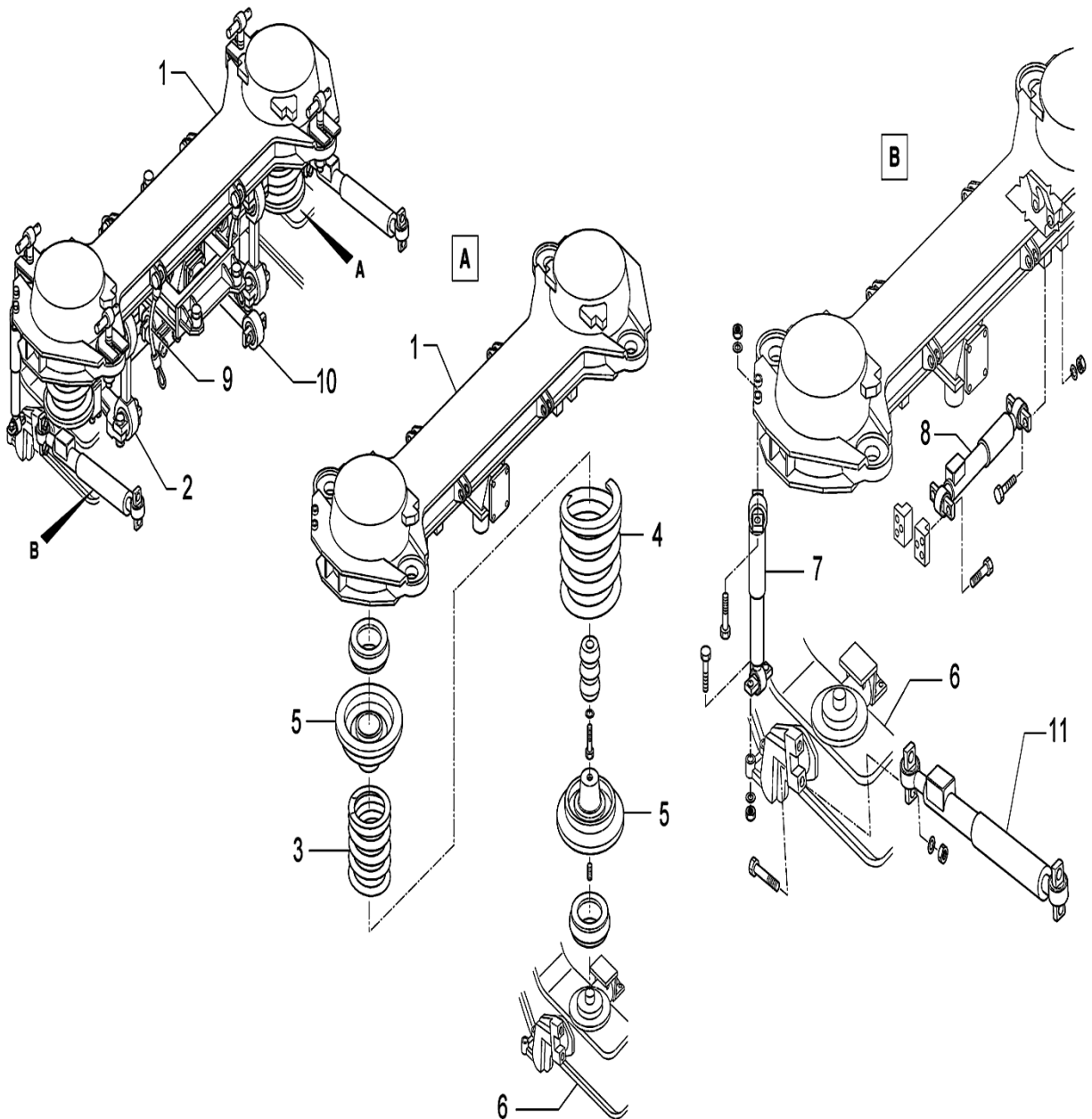
An anti-roll bar (2), fitted on the bogie frame (6), realizes a constant, reduced inclination coefficient during running.

The bogie frame is linked to the bolster beam through two vertical dampers (7), a lateral damper (8), four safety cables (9) and the traction rods (10).

The bogie frame is also linked to the coach body through two yaw dampers (11).

1. Bolster beam
2. Anti- roll bar
3. Internal spring
4. External spring

5. Centring disk
6. Bogie frame
7. Vertical damper
8. Lateral damper
9. Safety cables
10. Traction rod
11. Yaw damper



Cross Bar :- Cross bar is the connection between the two ends of the trolley which also maintains the uniform distribution of the hauling force to all wheels to ensure equal velocity.

Bolster Assembly:- Bolster assembly is the host of the secondary suspension system. In other words it is like two interconnected housing for springs. It also connects trolley and the body of the rake. The main function of bolster assembly is to transform the hauling force and the raking force from body to wheel and from wheel to body respectively.

Draw and Buffing Gear Assembly :- Draw and buffing gears are attached to the end of one coach and this two gear mechanisms are made to suit two adjacent coaches into an uniform continuous movement. They also transform the hauling force from main engine to the following rake, draw gear is specialized for these purpose, where as the buffing gears are essential for maintaining a vibration less motion of a coach with respect to its former one.

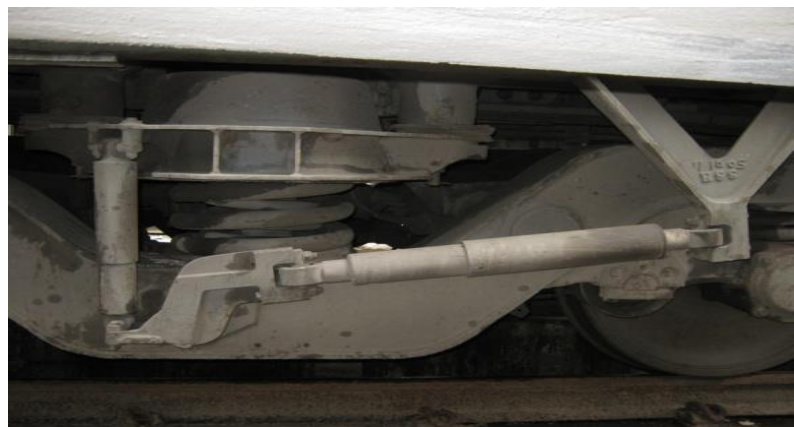
Screw coupling and the side buffers serves the aforesaid purpose in case of the draw and buffing gears respectively in case of ICF coaches. Screw coupling not only gives the boost but also let two coaches to connect in the formation of a continuous rake. The two jaws of the screw on both sides are guarded with spring and rubber to minimize the vibration the hauling force produces. They are called the DRAFT GEARS.

Side buffers are uniquely shaped buffers. They have a flat plate made of stainless steel and duly lubricated in contact to each other facing each other in motion. They are also guarded with the iron plated and spring and rubber to minimize the vibration as much as possible.



SIDE BUFFERS

SOME - Tech



PRIMARY SUSPENSION UNIT

SHELL

The body shell is of integral light weight construction consisting of separate assembly group for under frame, side wall, roof and end wall. The individual assemblies are joint to each other by welding. Three types of steel are used for manufacture of body 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 |
| Under frame | IRS M-41 / Corten Steel (C < .01%, Cr .35 -.6%, Ni .2 - .4% Cu .3 - .6% Si .3 - .7%, Mn .25%) | 440-480 | 320 |

BODY

Body is basically the coach itself without the braking mechanisms and suspensions. It Has the following constituents. They are discussed below:

- a) The **Carriage** is the main structure of the coach. This contains a floor which is called **Turf**. There are **Arch Levers** which maintain the weight distribution throughout the whole coach. And then there is the roof which is of a typical aero dynamical shape.
- b) At the bottom of the carriage there are two kind of bars made of stainless steel which transfers the weight from the carriage to the wheels.

The **Sole Bar** is throughout the whole body of the coach vertically. These are at the bottommost position of the body. The Cross Bar is the horizontally arranged bars across the body. They get their support from the sole bar.

CENTER PIVOT ASSEMBLY

Center Pivot is welded to the upper bolster plank and passes through the supporting frame which is rectangular in shape. This is a pivoting system used in transportation of force through a mechanically advantageous system of pivot. At the bottom of the center pivot there is a traction lever. A traction rod is also connected at the end of traction lever having its other end connected with the cross bar.

Body- Bogie connection : - Specially in case of the LHB Coaches, there are a special kind of bolts called swing bolts, which are four numbered in each trolley. These connect the body to the bogie to the body. Each bolt is fastened with a pin which can swing in the direction of the motion

THE TRANSMISSION OF HAULING FORCE

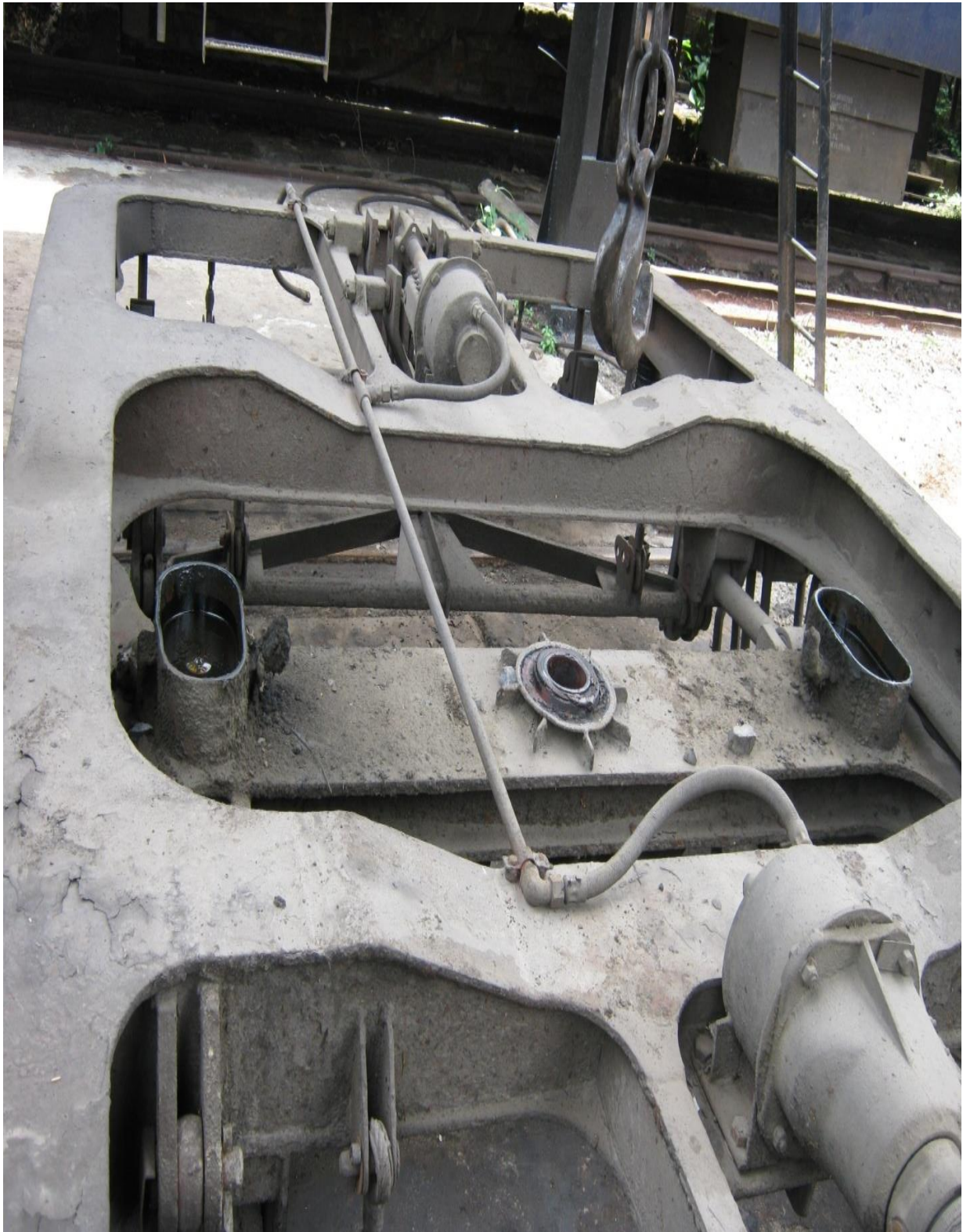
The transmission of hauling force is an important observation phenomenon of the running of rakes with engines. It is done through a number of ways and each way consists of a number of steps.

1. **CENTER PIVOT** :- Hauling force is first transmitted to the Screw Couplings which are connected at the front of a coach. From there the force is transmitted to the draft gear then to the crossbar, to the sole bar, all the way to the bolster assembly through swing bolts. Then due to this the swing bolt moves forward and so does the traction lever and the traction rod. So the crossbar moves forward and the wheels start rolling.
2. **LONGITUDINAL BUMP STOP**:- There is another way of transmission of hauling force from the center pivot which is through the longitudinal bumstop. This is partly cubical in shape attached at the front of pivot assembly. When pivot moves forward it also moves covering up the little gap between the frame and the bumstop. Through the supporting frame it goes to the crossbar.
3. **ARTICULATED CONTROL ARM**:- The articulated control arm is a direct connection between the body and the bogie. Through this the force is directly given to the bearings.

TROLLEY

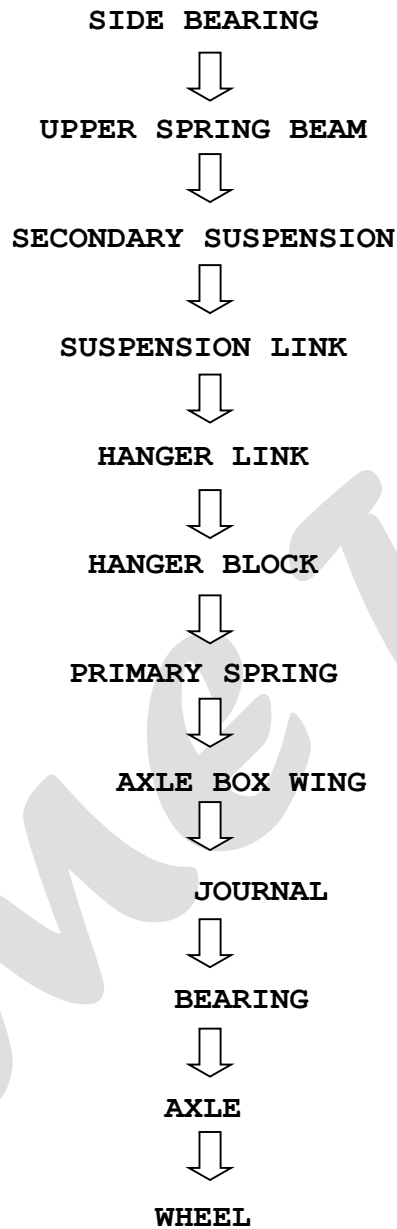
Trolley is basically the separated part containing the wheel and other similar components which are essential to run a coach. When they are attached with the body they are called the bogie. Here we are going to discuss about the trolley parts of the ICF coaches.

1. **TROLLEY FRAME** :- trolley frame is the main construction of the trolley on which the other components rest. This is a metallic construction just like a cage having different gaps in between to fit the components.
2. **CENTER PIVOT**:- this is the centrally situated hole which will indicate the correct position of the trolley when fitted with the body. There is a counter part of the hole attached at the body itself to indicate the perfect position of the trolley. When assembled they should match perfectly.
3. **SIDE BEARING**:- Side bearing is the bearing space engulfed by lubes and a bearing made of bronze which plays a good role in distributing the weight throughout the trolley.
4. **BRAKE CYLINDER**:- If we see the trolley in the direction of the motion we will see two brake cylinders one after one which have the air supply through one outlet. These brake cylinders operate in a critical air pressure and contains a piston which we call the slug adjuster. At that particular pressure the piston inside those cylinders moves and the brakes hold firm onto the wheels.
5. **BRAKE BLOCKS** :- In ICF coaches we generally use the K & L types of brake blocks. These are used as components of shoe brakes attaches at wheels. These special type of blocks are used because of their increased coefficient of friction and also the heat absorbing capability.
6. **EQUILATERAL STEROD**:- This is attached to the trolley symmetrically along the trolley frame horizontally to minimize the lateral force when in motion.
7. **ANCHOR ROD** :- These are rods attached vertically to minimize the longitudinal load. Both of them are made of stainless steel.
8. **SUSPENSION SYSTEMS** :- These are anti-vibrational attachments which are attached to the main frame and the wheel bearing.



TROLLEY

THE LOAD DISTRIBUTION



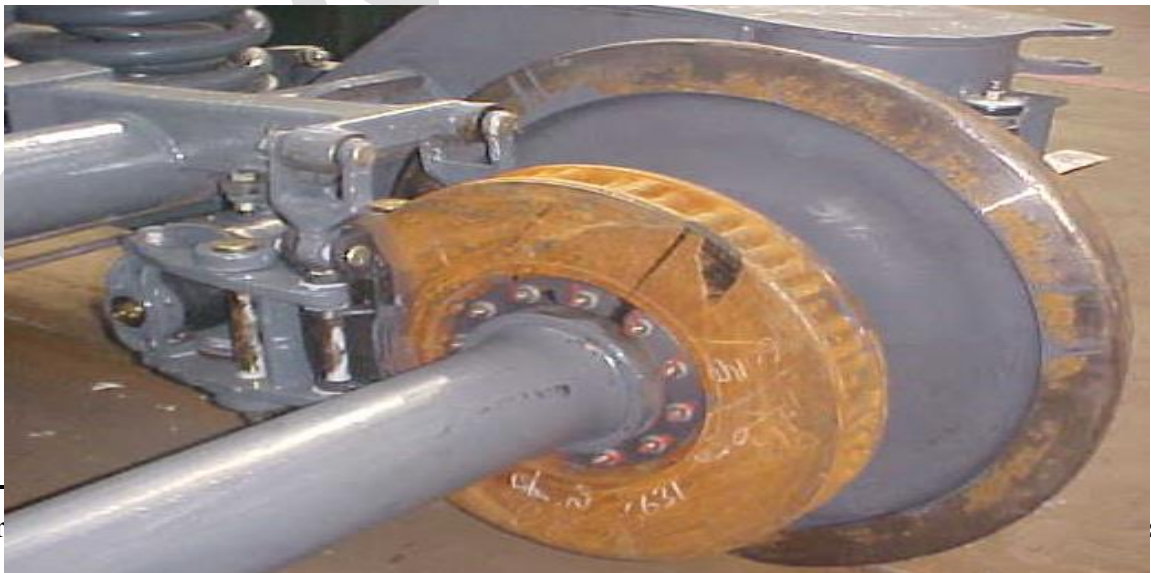
AIR BRAKE SYSTEM

Air Brake system compressed air is used for operating the brake system. The locomotive compressor charges the feed pipe and the brake pipes throughout the length of the train. The feed

pipe is connected to the auxiliary reservoirs and the brake pipe is connected to the brake cylinders through the distributor valve. Brake application takes place by dropping the pressure in the brake pipe. The schematic arrangement of the brake equipment is shown as Fig.1 (For passenger coaches), Fig.2 (For Generator coaches)

Components of Air Brake System

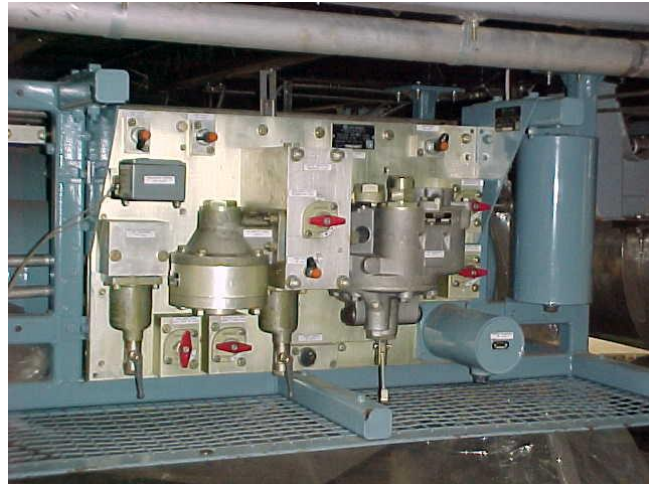
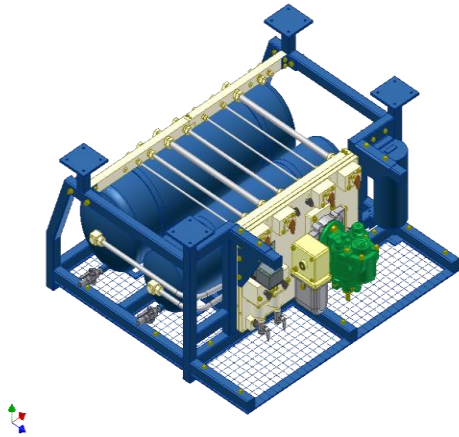
1. Brake Container (Brake Equipment Panel)
2. Distributor valve
3. Pressure Tanks (125 litres, 75 litres, 6 litres)
4. Indicators
5. B.P./F.P. Couplings and Hoses
6. Emergency Brake Pull Box
7. Emergency Brake valve
8. Bogie Brake Equipment, consisting of-
 - Brake Discs
 - Brake Caliper Units (consisting of Brake Cylinder, Brake Calipers, Brake Pads)
9. Wheel Slide Control System, consisting of-
 - Microprocessor Control Unit
 - Speed Sensor/Pulse Generator



Brake

The Br like the Distributor valve, Cocks, Test fittings etc. are mounted. It also consists of the reservoirs

required for the Brake system. The container is mounted under the car body and different lines (Feed pipe, Brake pipe, etc.) are connected to it.



Connections to the container

There are 4 connections to the container for Passenger Coach,

- Feed pipe(FP)
- Brake pipe(BP)
- Brake cylinder pressure -- bogie
- Auxiliary support pipe (for toilet)

There is an additional connection for the containers of the generator coaches, Support for Indicating device of handbrake

These connections from the container to car body are provided at the back plate fitted with Ermeto type fittings.

Brake Application

- The driver lowers the BP pressure by engaging the A-9 valve in the engine.
- This loss in pressure is transmitted from one bogey to the next.

- Since CR pressure remains same, the main diaphragm (above the CR) moves up in response to the pressure drop in DV.
- As a result the 'three pressure valve' opens the AR-BC port .
- Thus the AR pressure of 6 kg/cm² flows into the BC through pressure limiters which reduces BC pressure to 3.8.

Brake Release

- BP pressure is again increased to 5 kg/cm².
- Consequently, main diaphragm move down and the 'three pressure valve' closes the AR-BC port and opens the BC-atm port.
- BC pressure is released and the brake caliper is disengaged.

BOGIE BRAKE EQUIPMENT

The Bogie Brake equipment consists of:

- **Brake Caliper Units**
- **Brake Cylinder**
- **Brake Discs**
- **Brake Shoes**

Each axle is equipped with two grey cast iron brake discs. The brake energy is dissipated only at the axle mounted brake discs, so the wheel set is only stressed by the weight of the coach. The advantage of this arrangement is that the superposition of the thermal stresses and mechanical stresses is avoided.

The braking force is generated for each disc by a brake caliper unit, which consists of a brake cylinder and the brake caliper, amplifying braking cylinder force depending on the lever ratio.

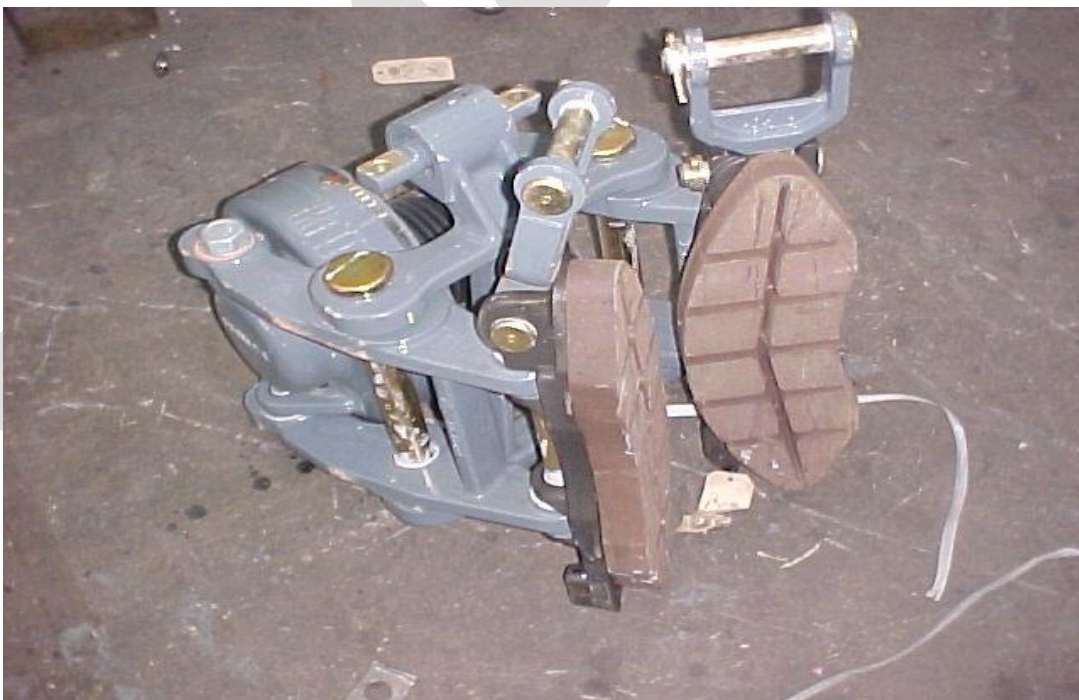
BRAKE CALIPER UNITS The brake caliper units are ready-to-use combinations of a brake caliper and brake-cylinder, providing automatic slack adjustment for wear (abrasion) on brake pads and brake discs. Consequently, the clearance required between the disc and pads for smooth running remains practically constant while the brakes are released.

Brake Caliper units consist essentially of the brake cylinder, the brake caliper, and the brake shoes d1 and d2 with snap lock gates. The brake caliper units are held in the vehicle bogies by a three – point-mounting arrangement.

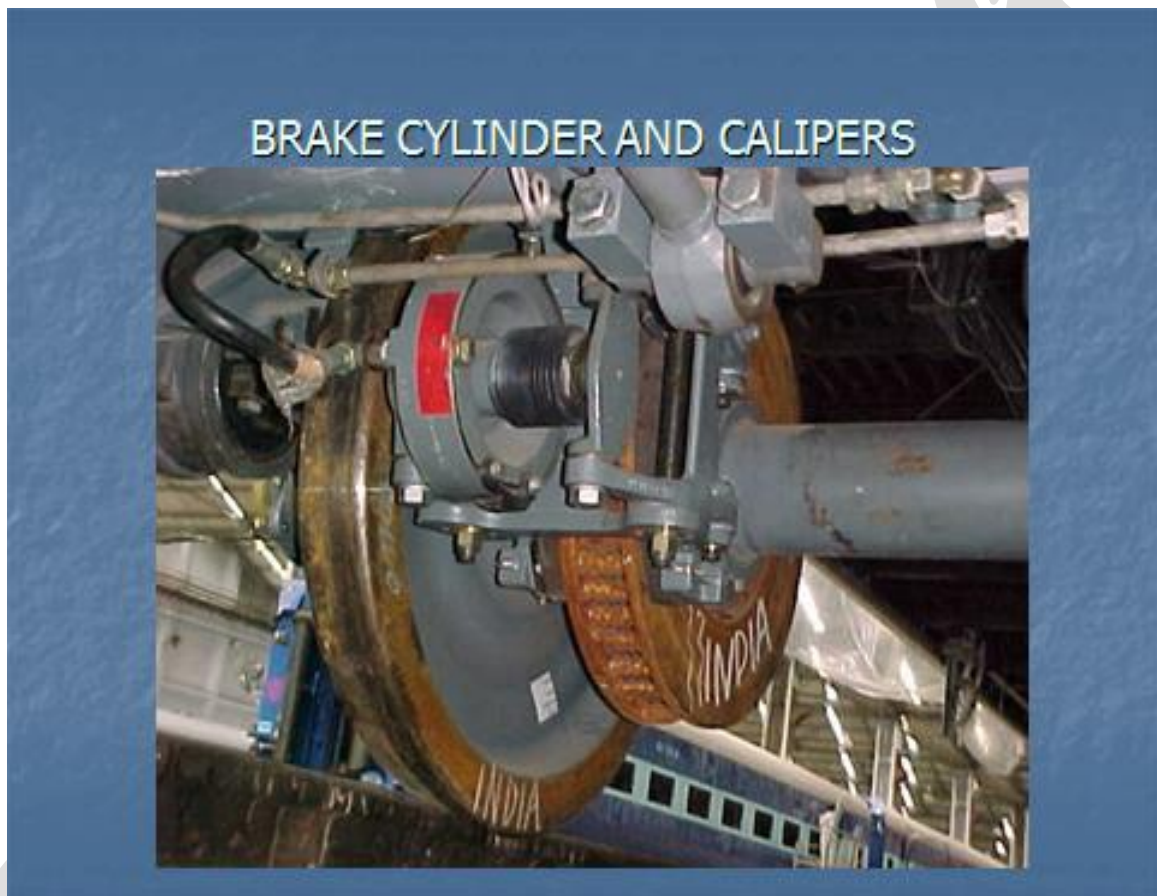
Working principle

Applying the service brake charges the brake cylinder and presses the brake pads against the brake disc. Brake force is built up when the pads are applied. Venting the brake cylinder releases the service brake. The return spring in the brake cylinder moves the caliper levers to the release position.

The handbrake lever is moved mechanically. The piston is pushed forward, and the brake pads are applied to the disc. When the parking brake is released, the caliper levers are drawn to the release position by the return spring in the brake cylinder.

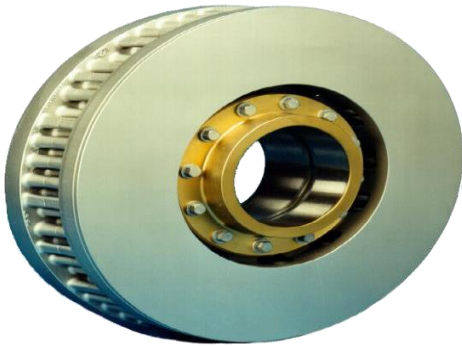


BRAKE CYLINDERS U-series brake cylinders with automatic slack adjustment are used to operate the friction brakes in rail vehicles. U-series brake cylinders are essentially distinguished by their integral, force controlled slack adjustment mechanism which is designed as a single acting clearance adjuster. The working of this mechanism is not influenced in any way by the elastic brake rigging deflection, which varies according to the brake force. In the course of braking, the slack adjuster quickly and automatically corrects the increasing brake pad or brake block clearance due to wear.



BRAKE DISCS The axle-mounted brake disc consists of a gray cast iron friction ring and a cast steel hub, connected by means of radially arranged elastic resilient sleeves which are secured in the hub by means of hexagon screws. The friction ring is manufactured as a solid component or in a split version. In the latter case, the two halves are held together by two tight-fit screws.

Axle Mounted Brake Discs



Wheel Mounted Brake Discs



BRAKE SHOE The brake shoe is provided with a brake pad holder carrying replaceable pads. The brake shoe consists of the brake pad holder, the vertical pins and the brake pad. The brake pad holder is provided with a dovetail guide into which the pad is slipped. The pad is held in place by a captive gate, which is pivoted at the pad holder. To lock the gate a locking spring of spring steel has been provided which is pre-tensioned such that in one position it secures the gate in the pad holder and in the other (released) position it holds the gate open. For each brake disc a right and a left hand brake shoe are required.

Brake Rigging System

- Due to BC pressure, the **piston** moves forward and strikes against the **brake caliper**.
- The lever arm of the brake caliper presses onto the **disc brake** through the **brake shoe**.
- The disc brakes are mounted on the **wheel axle** and so rotate along with the wheels.
- Due to application of brake shoes, the discs begin to lose their angular speed.
- As a result the axle also begins to slow down since the two are connected.
- Ultimately, the **wheels** stop rotating as they are mounted on the same axle.



WHEEL SLIDE PROTECTION EQUIPMENT

- Operates as a pressure regulation device of the air pressure inside the brake cylinder and adjusted the braking force to the wheel to rail friction conditions so as to prevent the wheels from locking and reduce the braking distance
- In the case of the adhesion coefficient provided by a dry rail, the device does not interact with the pneumatic system. The device enters into action when a loss of adhesion of the axles is detected and, moment by moment, it adjusts the braking force to the present adhesion conditions.
- The operation is controlled so that the skidding wheel is allowed to find the most favorable area for the adhesion-skidding characteristics.
- The action of the device is controlled in order to keep the skidding wheel in the most favorable area of the adhesion-skid characteristic.
- Speed signal derived for CDTS.

Wheel Slide Protection Equipment

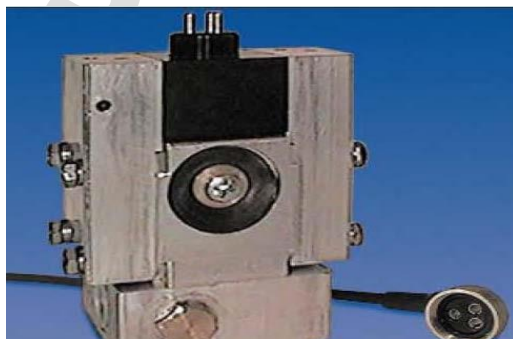
- **Speed sensor**



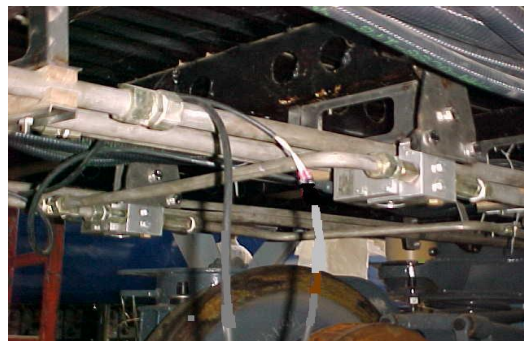
- **Phonic wheel**



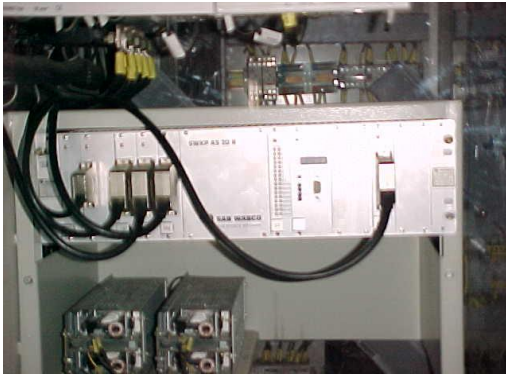
- **Dump Valve**



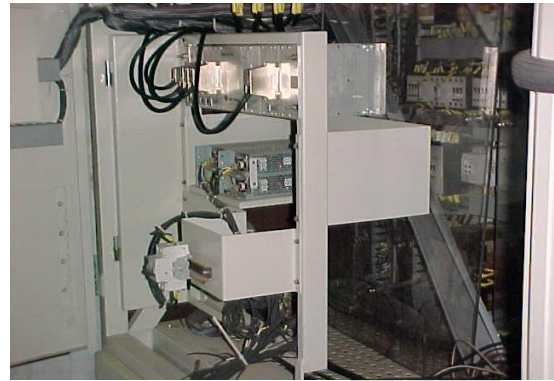
- **Connector**



- **Electronic Connectors**



- **Electronic unit**

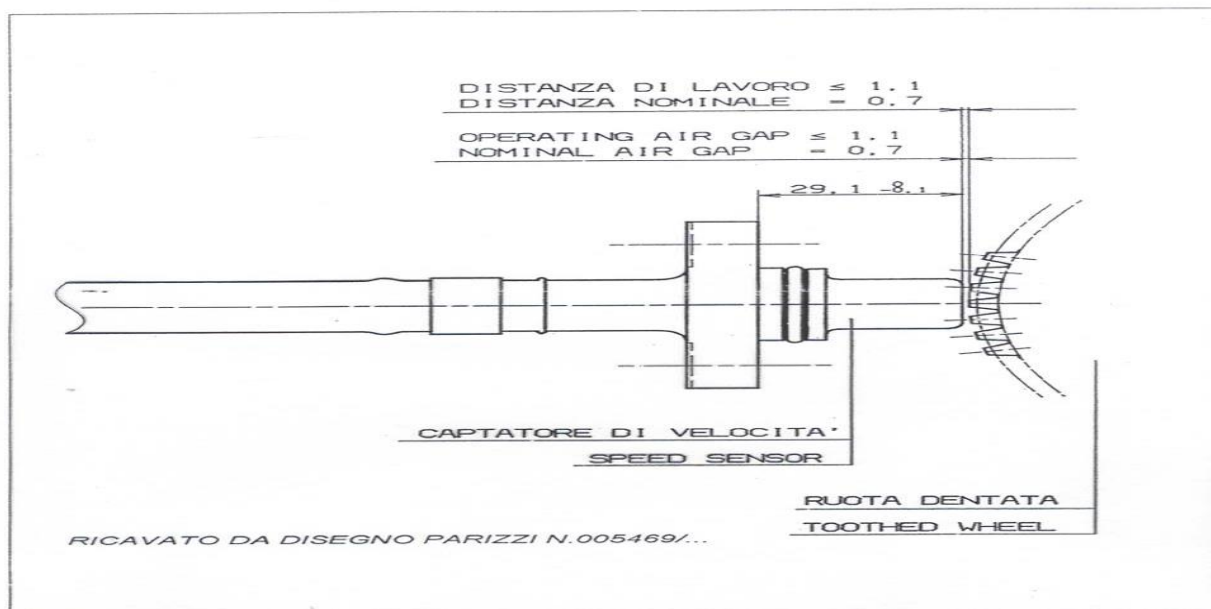


Speed Sensor Generates pulse frequency proportional to the number of revolutions and teeth of the phonic wheel.

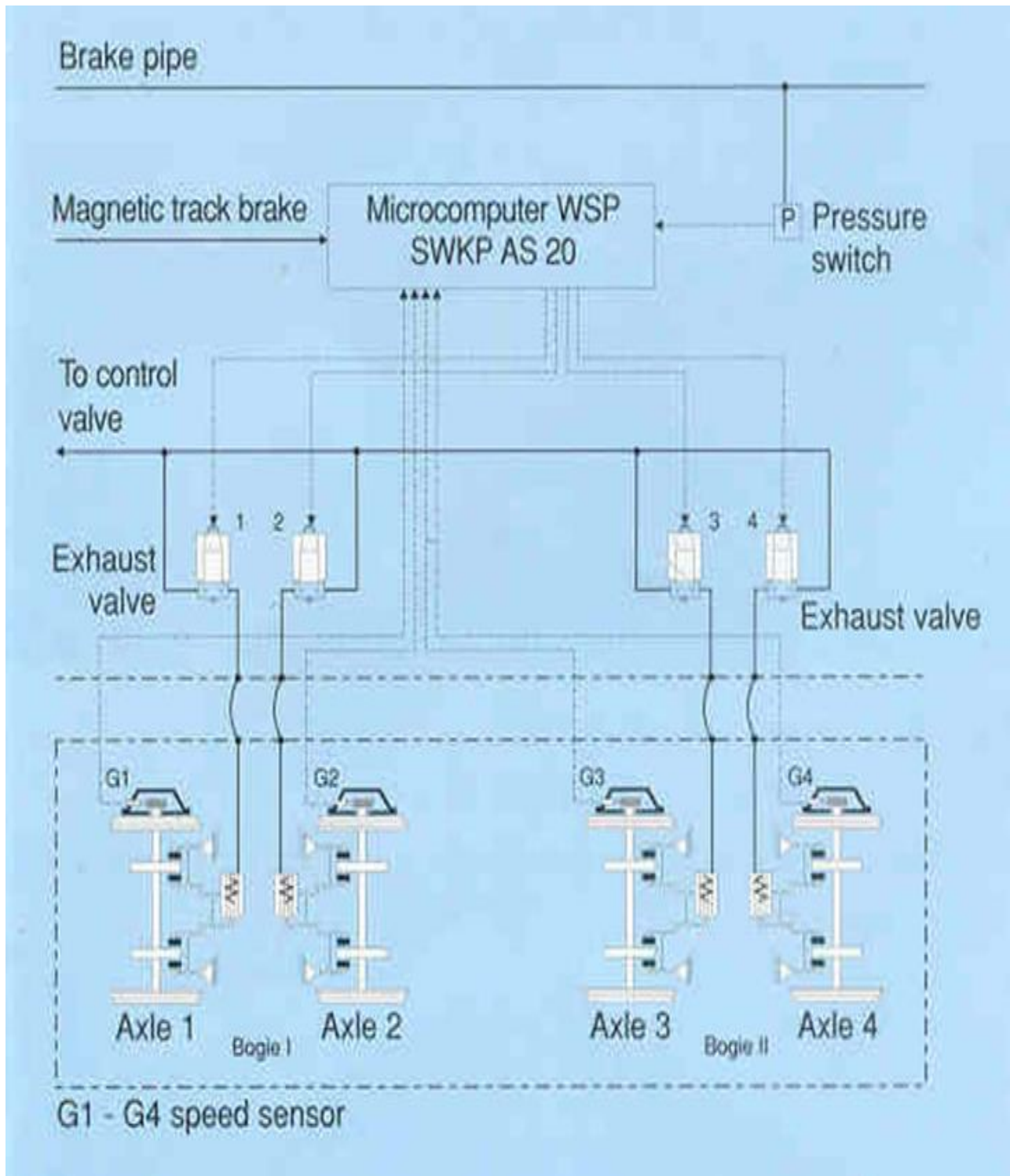
It comprises a magnetic sensor which exploits the principle of magneto-resistance, by which the value of the resistance across the sensor terminals is modulated by variation of the air gap in the magnetic circuit made up of the phonic wheel and the sensor itself.

The pluses coming from the frequency generators are proportional to the number of axles revolutions and are amplified and converted into digital data as a function of the peripheral wheel speed and the effective wheel diameter.

Each bogie microprocessor device controls and manages the signals originating from the two axles of the relevant bogie.



Principle of Antiskid or Wheel Skid Protection System



Center Buffer Coupler

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

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

LHB coaches have been provided with tight lock centre buffer couplers instead of screw coupling.

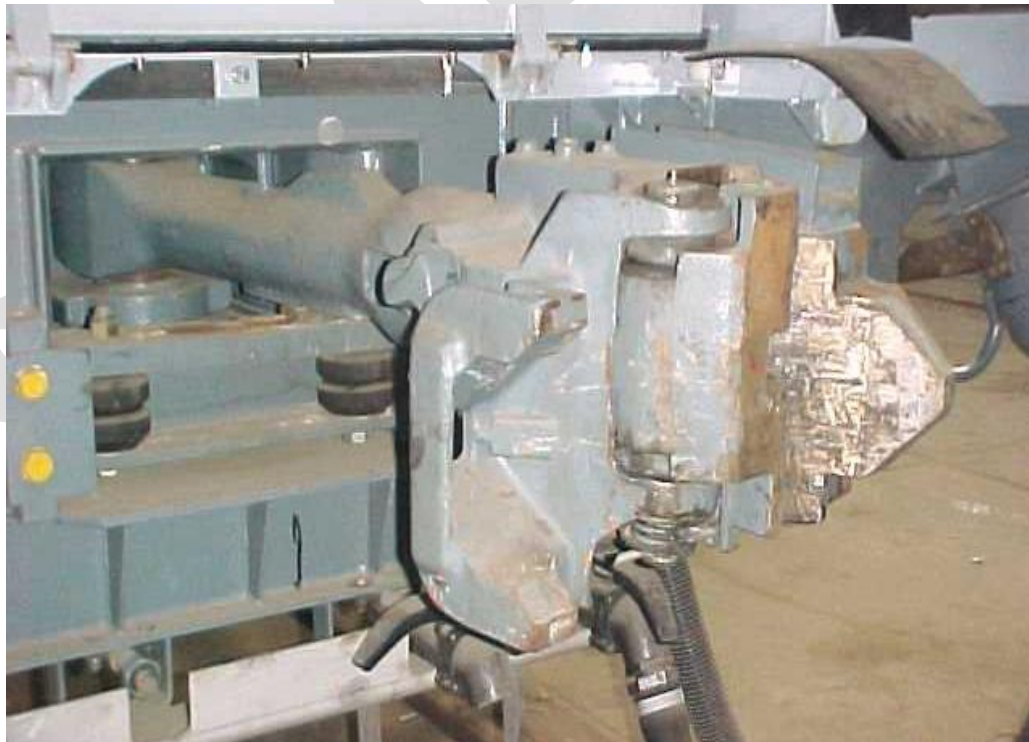
Couplers are AAR-H type and have anti climbing features because of vertical interlocking.

Couplers have adequate strength for:

- Satisfactory hauling of a train of 26 coaches at 110 kmph
- Satisfactory hauling of a train of 18 coaches at 160 kmph

Coupling is possible under angular misalignment both horizontally and vertically. The coupler permits coupled trains to negotiate vertical and horizontal curves and allows rotational movements.

The draw gear ensures cushioning effective in both buff and draft.



Controlled Discharge Toilet System (CDTS)

LHB coaches are fitted with controlled discharge toilet units to avoid soiling of track in station and inhabited areas.

The toilet system is designed to operate with a pressurized water bowl wash that covers 100% of the toilet bowl area. The waste is removed from the toilet bowl and transferred to a retention tank with a minimal amount of water. Water consumption is only 2.5 liters per flush cycle for the Indian style toilet bowl and 1.5 liters for the European style toilet bowl.

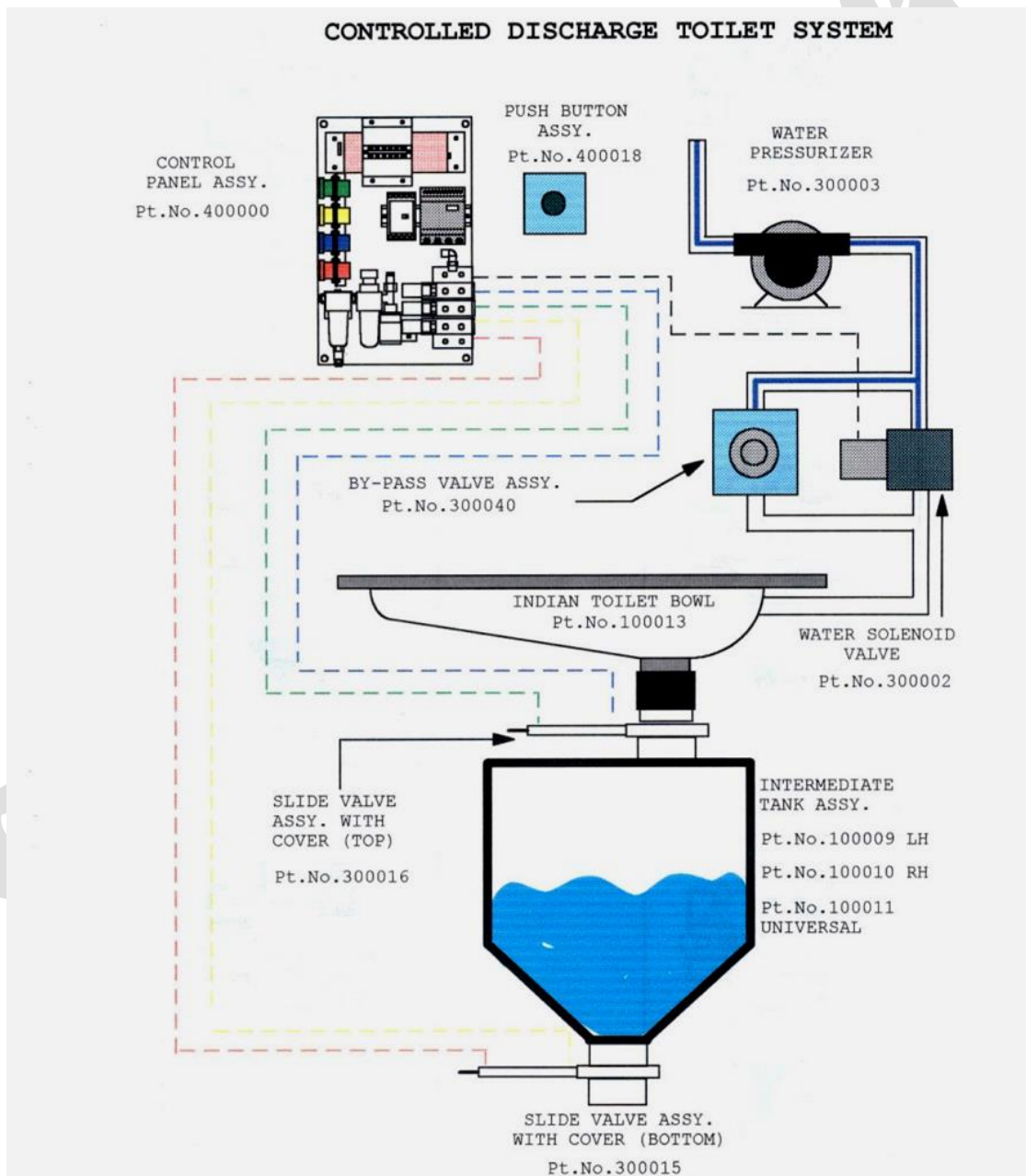
Salient Features

- Programmable.
- Requirement of less Air and Water.
- P.L.C Controlled.
- Easy to clean.
- Hygienic.

Operating Principle of CDTS

- This system works on electrical & pneumatic pressure arrangement. The retention tank stores effluent has two openings. These two openings activates by double acting pneumatic cylinders fed by Feed pipe of air brake system with the help of electromagnetic solenoid valves.
- The system starts working on a single push of flush switch. As the flush switch is pressed, water flows into the toilet bowl & the upper slide valve opens which is connected between the toilet bowl & retention tank. All the toilet waste is transferred into the retention tank. At the end of each flush cycle the supply of water is stopped & the upper slide valve is closed. Thus, the toilet is sealed from the retention tank, preventing odour entering from the toilet room.
- The waste accumulated in the retention tank remains in the retention tank until two parameters are satisfied.
- A predetermined no. of flush counts, &
- The train is reached a predetermined speed.

- As soon as these above two parameters are met, the lower slide valve of retention tank opens & the toilet waste accumulated in the tank is discharged out of the tank to the rail side, away from the station & city.
- The lower slide valve of the retention tank remains open for only small period of time to empty the retention tank. The lower slide valve then remains closed until the above discharge parameter conditions is again satisfied.



Toilet system has following components:-

1. Indian & European toilet basin with flush nozzles:

These are two types of toilet basin used in CDTS system.

2. Control panel:

Control panel of CDTS consists of following equipments:

I. **Programmable logic controller (PLC):** The Programmable logic controller works on 24 V DC having 8 inputs & 4 outputs. It records the no. of flush cycles for opening/closing of lower slide to drain out the effluent from retention tank. PLC also controls the opening/closing of lower slide when signals received from WSP regarding speed of vehicle through WSP System to control the flushing & signal received from Empty WC switch.

II. **Solenoid valve:** The solenoid valve control the entry & exit of pneumatic air in the pneumatic cylinders fitted on the upper & lower slide valves after receipt of signal from PLC.

III. **Control relay:** Control relay is fitted aside of PLC on the control panel. A supply of 110 V DC is present in the control relay. This control relay operates at 24 V DC & connect 110 V DC supply. When 24 V DC supply is received from PLC, control relay operates & the 110 VDC supply present in control relay is passed on to the water pressurizer.

3. Retention tank:

The effluent drained from the toilet basin bowl after flushing is stored in the retention tank. In case of extra flush (beyond the capacity of tank), overflow pipe is provided to drain out the effluent.

4. Lower Slide valve:

Lower slide valve is designed to operate on two parameters (predetermined no. of flush counts, & predetermined speed of vehicle). As soon as these above two parameters are met, the retention tanks lower slide valve open. The toilet wastes accumulated in the tank are discharged out of the tank..

5. **Upper Slide valve:**

Upper slide valve is opened with the operation of flush switch. It closes after effluent enters the retention tank. The slide valves open & closes by the movement of piston of pneumatic cylinders controlled by PLC & solenoid valves.

In the latest version, the flapper arrangement has been introduced instead of upper slide valves, to overcome slide jamming problems. This flapper arrangement consists of a flap, which is connected by means of connecting links to one pneumatic cylinder. This flapper operates in vertical direction (open & closes). The difference between slides & flapper arrangement is the axis of movement of opening arrangement.

6. **Flush button:**

This is an electrical switch. On pressing this switch the electric circuit is completed with the PLC & flush cycle starts.

7. **Water Pressurizer:**

Water pressurizer is fitted in the inlet of water pipe line connection to the CDTS system. As the flush button is operated this water pressurizer is started & pressurized water is supplied to the toilet basin.

8. **Fail Safe Mode:**

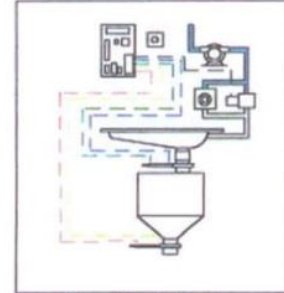
A “FAIL SAFE MODE” of operation is been provided in both Indian and European Style Toilet System.

In the event of a loss of air, a loss of electricity or both, to enable use of the toilet, the “FAIL SAFE MODE” is provided. It is also termed as manual flush.

Operational Description

The status of various components/devices is listed below:

- Water Pressurizer – Off
- Water check Valve – Closed
- Upper Slide Valve – Closed
- Lower Slide Valve – Closed



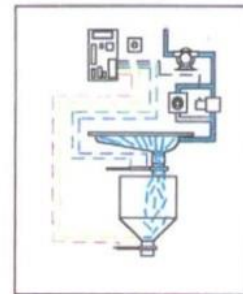
TOILET AT REST
TOILET BOWL DISCHARGE VALVE CLOSED

Flush Cycle

Depress momentarily Flush Button and the status of various components / devices is listed below:

Step - 1

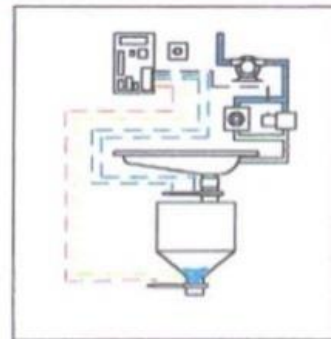
Water Pressurizer & Water check valve – On (for a predetermined time)
Upper Slide Valve – Open (for a predetermined time)



FLUSH CYCLE INITIATED
WATER PRESSURIZER ACTIVATED
TOILET DISCHARGE VALVE OPENS
TOILET BOWL WASTE TRANSFERRED TO WASTE TANK

Step - 2

- Water Pressurizer & Water check valve – Off
- Upper Slide Valve – Closed

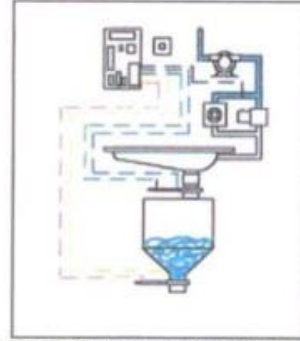


FLUSH CYCLE COMPLETED
WATER PRESSURIZER DEACTIVATED
TOILET DISCHARGE VALVE CLOSES
TOILET WASTE RETAINED IN WASTE TANK

Retention Tank Discharge Cycle

Condition – I

If train speed is - below 30 kmph then the retention tank lower slide valve – closed



WASTE TANK RETAINS WASTE WHEN:
 1. TRAIN SPEED BELOW 30 Kph
 2. FLUSH COUNT BELOW PROGRAMMED FLUSH CYCLES

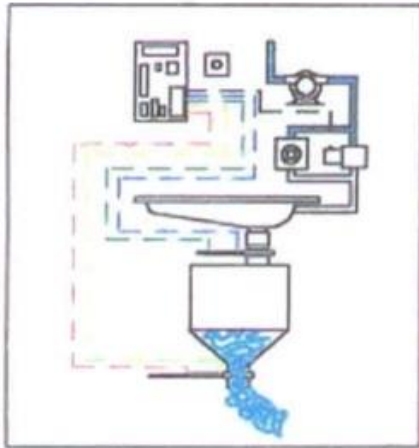
Condition – II

If train speed is above 30 kmph and Flush Count is below Predetermined value, then the Retention Tank Lower Slide Valve remain closed.

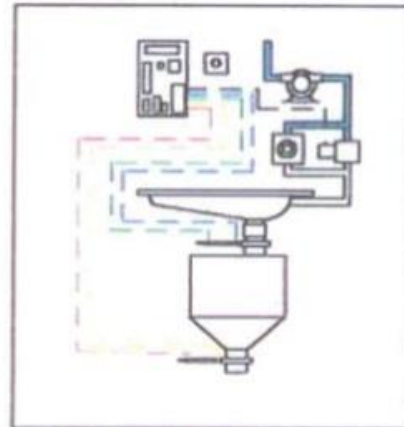
If the train is above 30 kmph and Flush Count is equal or above Predetermined value, the Retention Tank Lower Slide Valve Opens (for a predetermined time).

End of Retention Tank Discharge Cycle

Flush Count restarts at ZERO (0)



WASTE TANK DISCHARGES WASTE WHEN:
 1. TRAIN SPEED IS ABOVE 30 Kph
 2. MORE THAN PROGRAMMED FLUSH CYCLES HAVE BEEN RECORDED

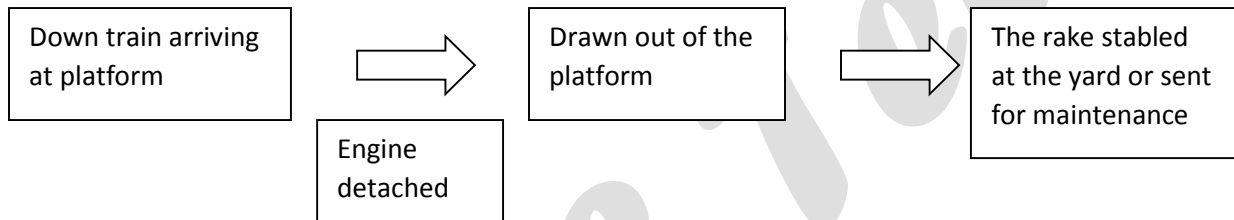


WASTE TANK DISCHARGE VALVE CLOSES
 WASTE TANK EMPTY
 TRAIN SPEED MONITORING RESET
 FLUSH COUNT MONITORING RESET

MAINTENANCE OF TRAINS

THE PRIMARY STRUCTURE Train is the combination of various types of coach and the train engine. There are many kind of rakes which play an important role in serving the main purpose of driving a train. Like public transportation and carrying goods etc.

There are also varieties of train engines depending on the medium they are driven by, like electrical and fuel based, especially diesel. Here we are going to concentrate on the trains which are used mainly for travelling and are equipped with such facilities.



So rake can be defined as the combination of coaches attached together after detachment of the engine from the train.

THE MAINTENANCE OF THE TRAINS

The maintenance of the trains is an important criteria for every coaching facility and workshop. This is very important to make the system run smoothly and to look after the passenger safety. So knowledge about the proper maintenance is essential.

Seen from the point of view of the train itself there are three kinds of maintenance available in Eastern railways.

1. **Primary Maintenance**- According to the rules of railways, every division of railways possesses the responsibility of running some specific trains. For those trains under the consecutive divisions primary maintenance is done before that train leaves that section of railways. In other words the primary maintenance is done at the mother or the terminal station. Here every aspect of pressure related systems, and aspects of public safety are checked. The continuity, the bonding between coaches etc is also taken care of.. This takes

at about 5 – 6 and half an hour duration until it is given the fit to run certificate. Each primary maintenance comprises a form which is known as the v-5 form. This form has information spaces about those aspects that are secured during this maintenance. If a train is given fit instead of any fault not so fatal, that is written in the certificate.

2. **Round trip/Turn Around Maintenance** This maintenance takes place after the train reaches its final destination from the starting one. This is a short duration maintenance preparing the train to send it back to the terminal station. Just the necessary maintenance is carried out. This takes about one hour forty minutes to about two hours to complete.
3. **Secondary Maintenance** Secondary maintenance is a specific type of the primary maintenance. When the train runs for about 3500 kilometers or about 3 days, either way, then at the destination station the train undergoes the secondary maintenance. Here the measures taken are just similar to the primary one. The duration is about six to seven hours.

THE MAINTENANCE SCHEDULES AND THE OVERHAULING PERIODS

There are normally seven kinds of maintenance schedules depending on the condition of coaches and wagons. They are respectively -

1. **A- Schedule** after 30 days of manufacturing or of periodic overhauling, repetitive
2. **B-Schedule** after 90 days of manufacturing or of periodic overhauling, repetitive
3. **C-Schedule** after 180 days of manufacturing or of periodic overhauling, repetitive
4. **Intermediate Overhauling** after 9 months of manufacturing or of periodic overhauling.
5. **Periodic Overhauling** after the returning date given by the workshop after periodic overhauling.
6. **Non-Periodic Overhauling** This is done after 12 months or 18 months after the manufacturing date or the periodic overhauling date depending on the condition of the corresponding coach.
7. **Inter lifting schedule** This is a special kind of maintenance done within the maintenance facility with lifted coach and parts.

PERIODIC OVERHAULING:-Periodic overhauling is the best available process of maintenance of coaches in India. This generally operated after 12 or 18 months after the manufacturing or the previous periodic overhauling done in any workshop. This undergoes a huge process of lifting the coach, isolating the all parts, and changing or replacing the necessary or damaged parts. In other words this is the process of renewing the coaches. Here are some varieties-

1. 12 month basis -
2. 18 months basis -
 - a. Mail and express trains -
 - b. Passenger trains -
3. For MLR coaches - 18 months -
4. For new built coaches - 24 months -

POH DATE AND RETURN DATE:- POH date is that date on which its POH has been done previously in an workshop. This is written on the coach. And the return date is the date on which it is to be dropped off from the track and to be taken for another periodic overhauling. Generally they have a 12 month or 18 month gap between them in accordance with the definition of the POH. Both of the dates should be given by the corresponding workshop where its POH has been done.

SIGNIFICANCE OF COACH NUMBER :- Every coach has its own unique number attached to it which obviously carries some significant information to us. Generally in India that is of five numbered. The first two digits represents the year of manufacturing of the coach. And the rest three digits represents the list of types of coaches. It represents of which type the coach is.|-|

EXAMPLE. 06023 , we can write it up as 06 and 023

06 represents the year of manufacturing which is year 2006

And 023 represents the type which is an FAC type coach.

CONCLUSION

This training focussed upon increasing our knowledge and interest in toward the Production of Railway Carriage & Wagons. Because It is most efficient and necessary needs to peoples in these days so its production at most efficient method with minimum cost and in proper sequence with less wastage. I learnt how to produce it by turbine, generators, cooling towers, water and maintain it. It was a great experience. It increase my practical skills that's the main thing which i learnt in the training session. Thus, I believe that my training session will be beneficial for various purposes & hence our efforts will be fruitful.

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SOME TECH