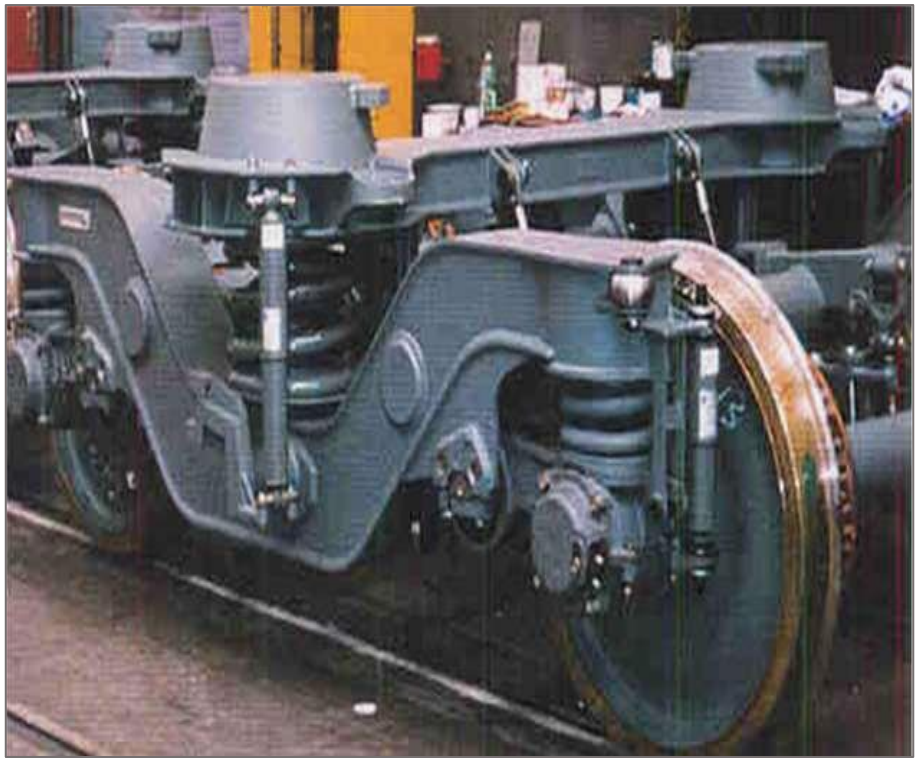
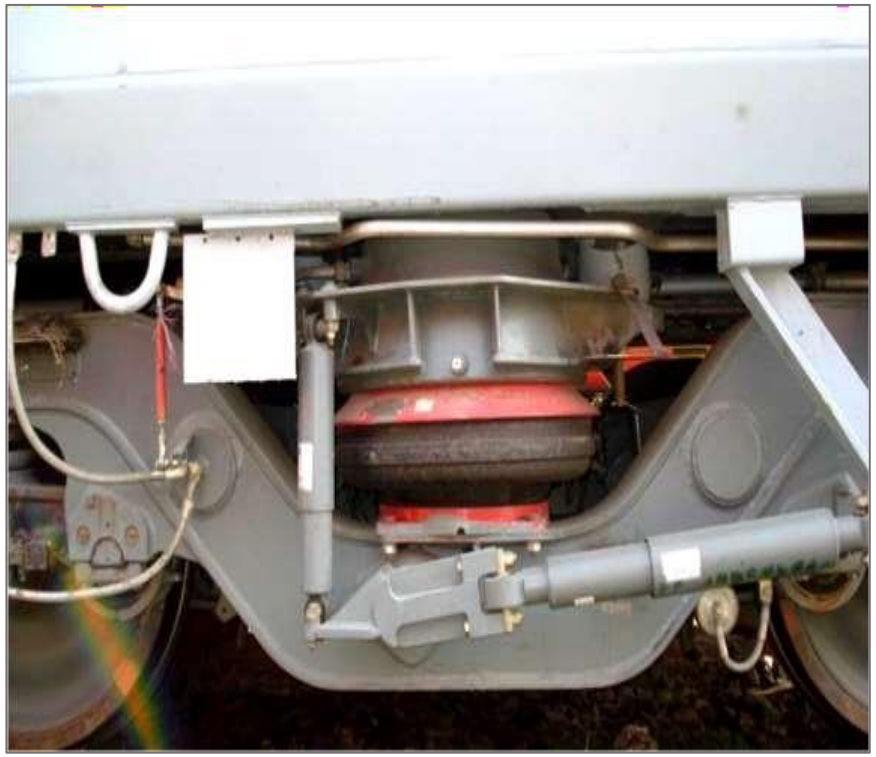
# Air Suspension in FIAT Bogie

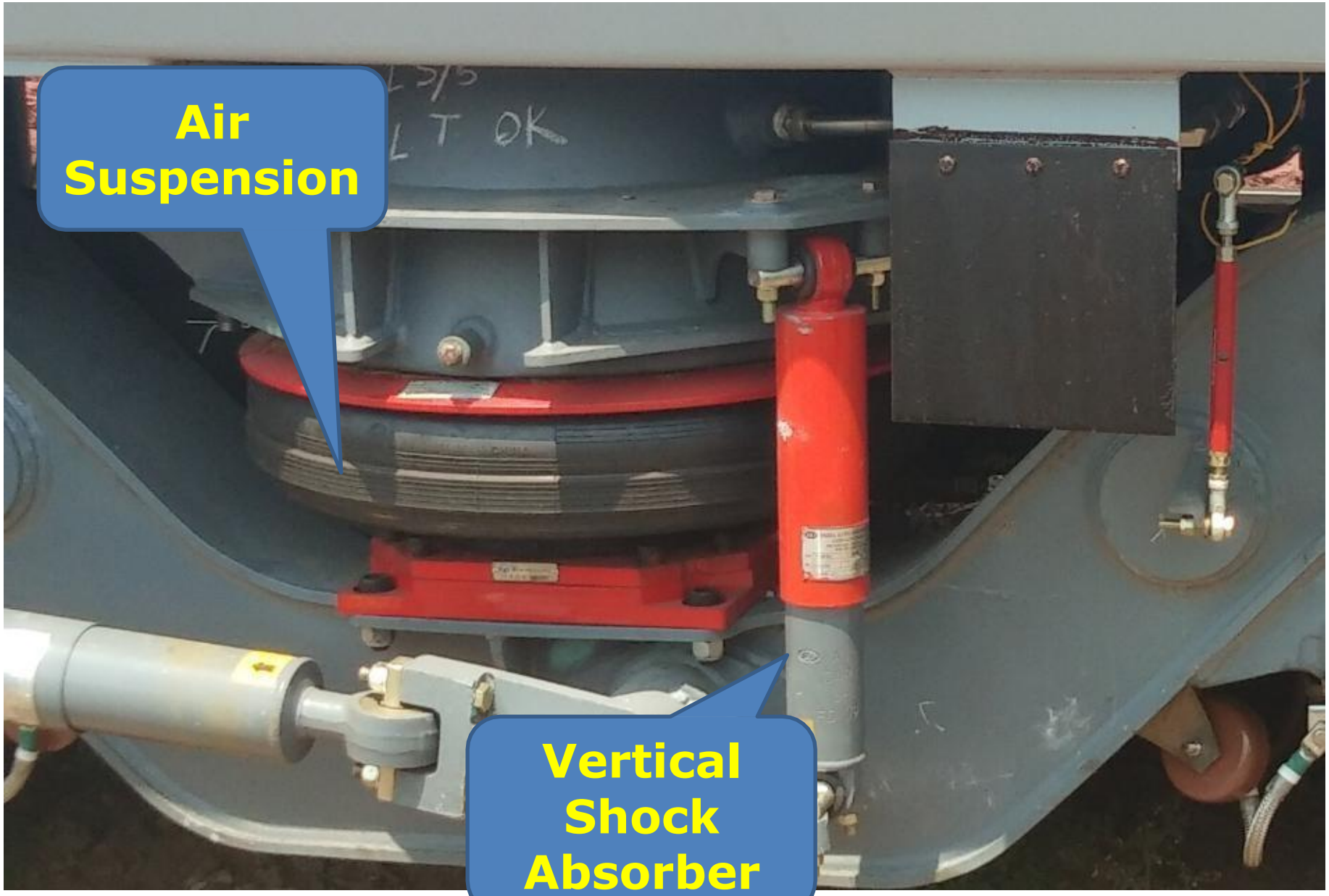
**With steel spring**

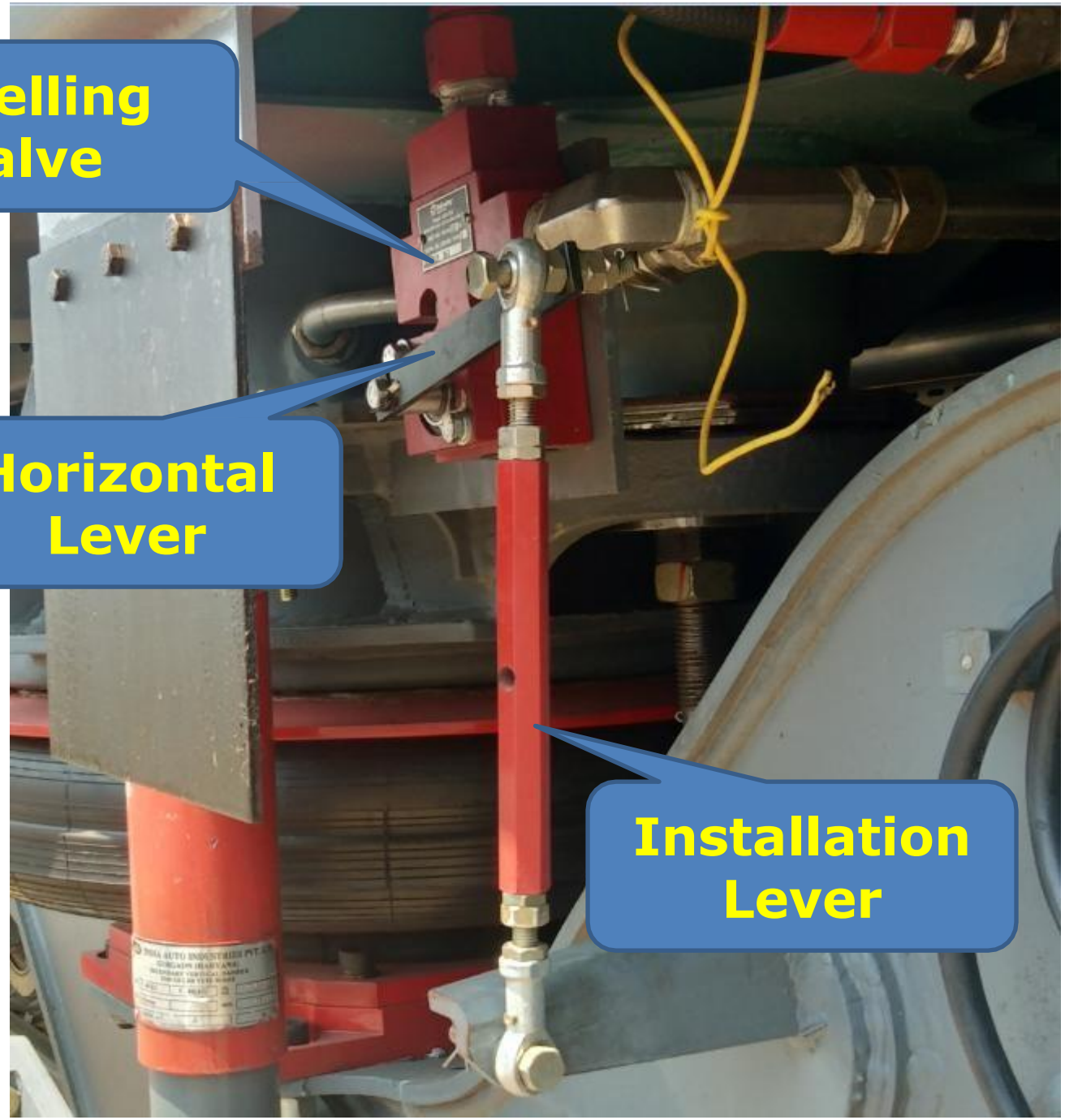


**With air spring**

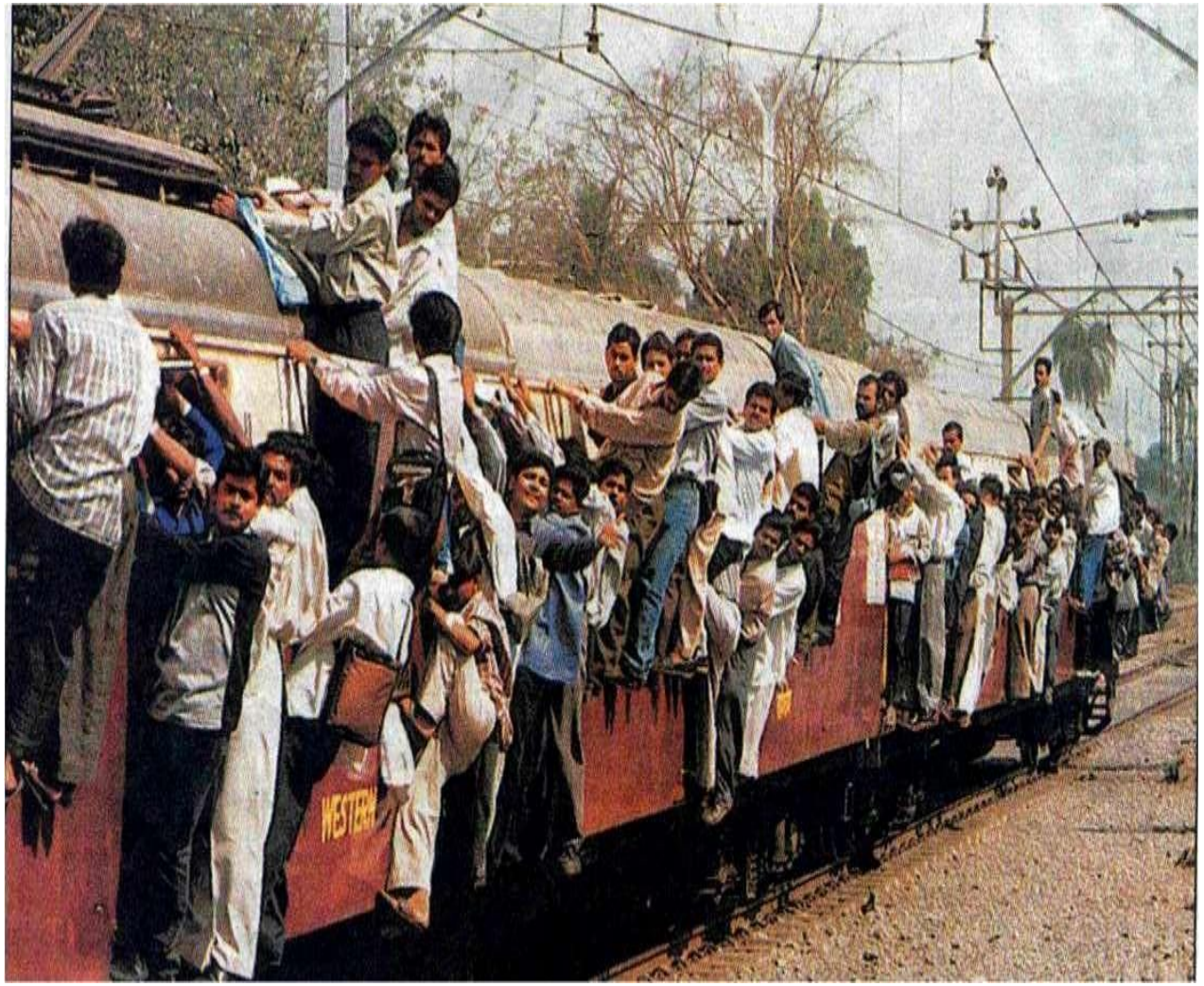


# LHB Coach with Air Suspension


Air Suspension
Vertical Shock Absorber


Levelling Valve
Horizontal Lever
Levelling valve allows air to enter or exhausts air from Air bellows to maintain uniform level
Installation Lever

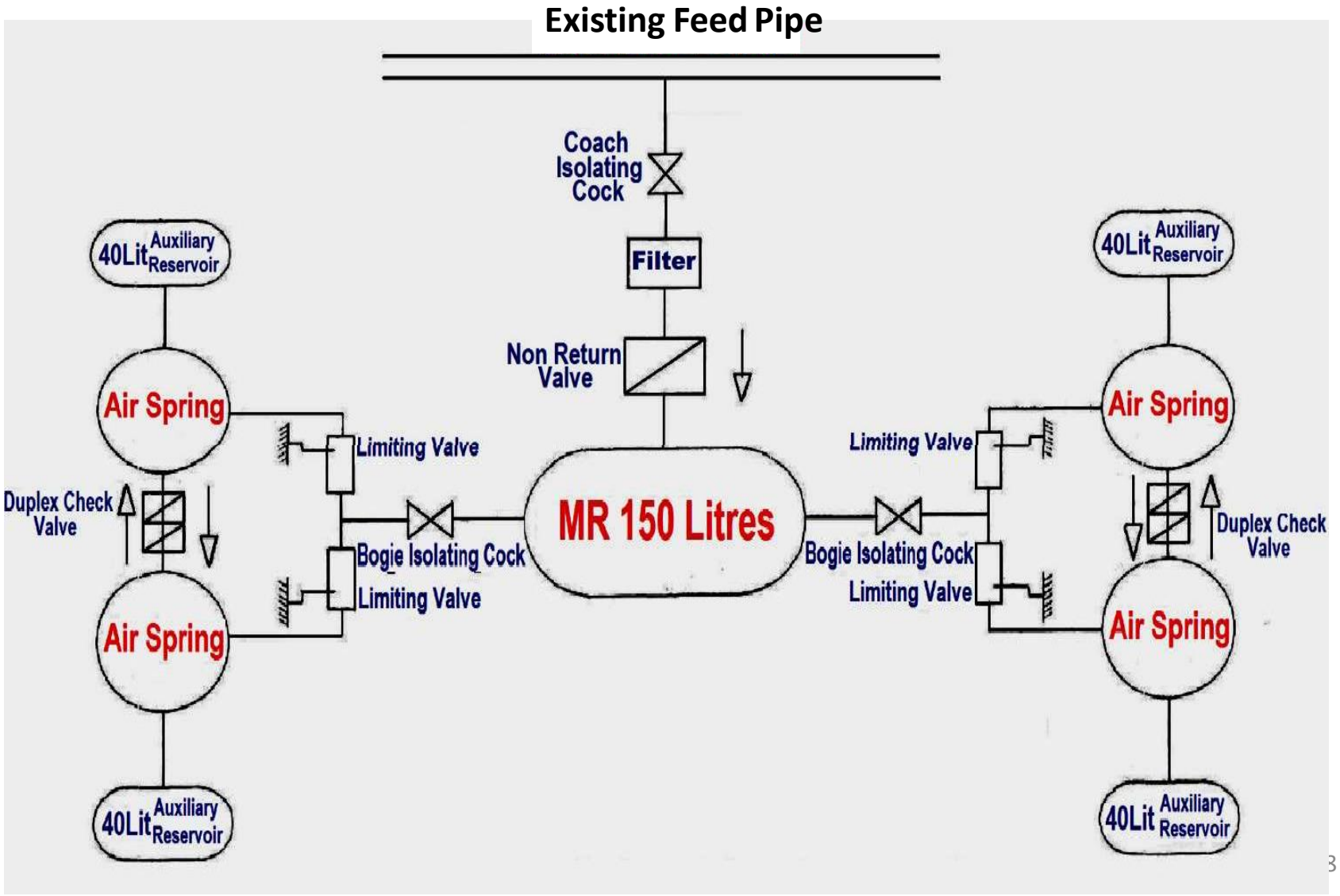
# Need for adoption of Air suspension



# Need for adoption of Air suspension

- Abnormal increase in pay load condition e.g. Trailer coach of EMU (tare wt. 32.5T) pay load increased from 18T to 34T.
  - Poor riding behavior of coach .
- Need to maintain “Ride Height” to have parity with the way side “Platforms” and “Coupling Height” for train formation.

# Schematic Diagram of Air Suspension System

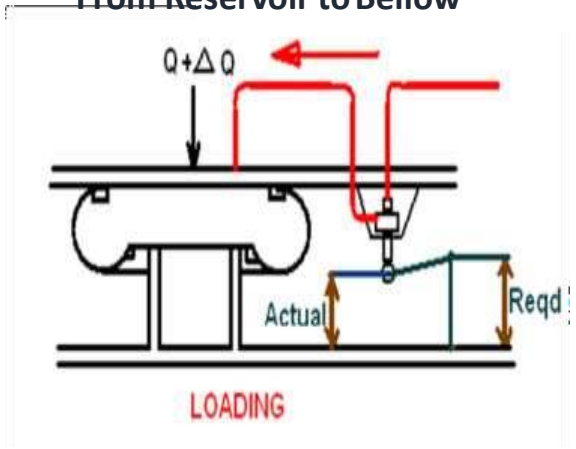


# Working Principles

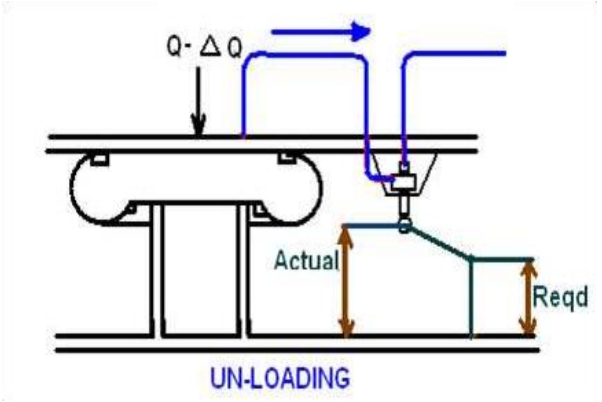
- A height monitoring valve (called levelling valve) actuates as per changing loads on vehicle,
  - either getting the air pressure into the rubber bellow from reservoir, or
  - releasing air pressure from bellow to atmosphere.
- The process continues until the original height is restored.

# Working Principles

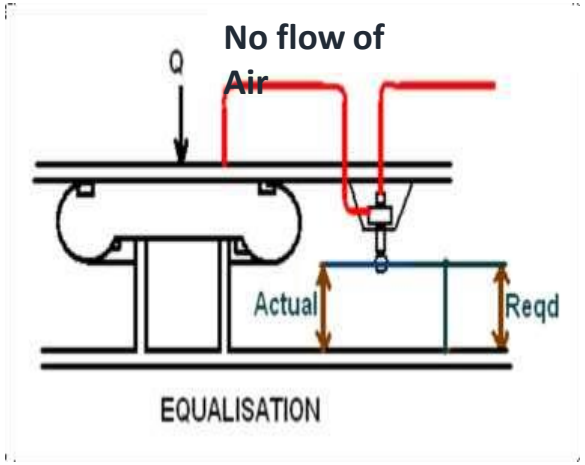
From Reservoir to Bellow




From Bellow to atmosphere



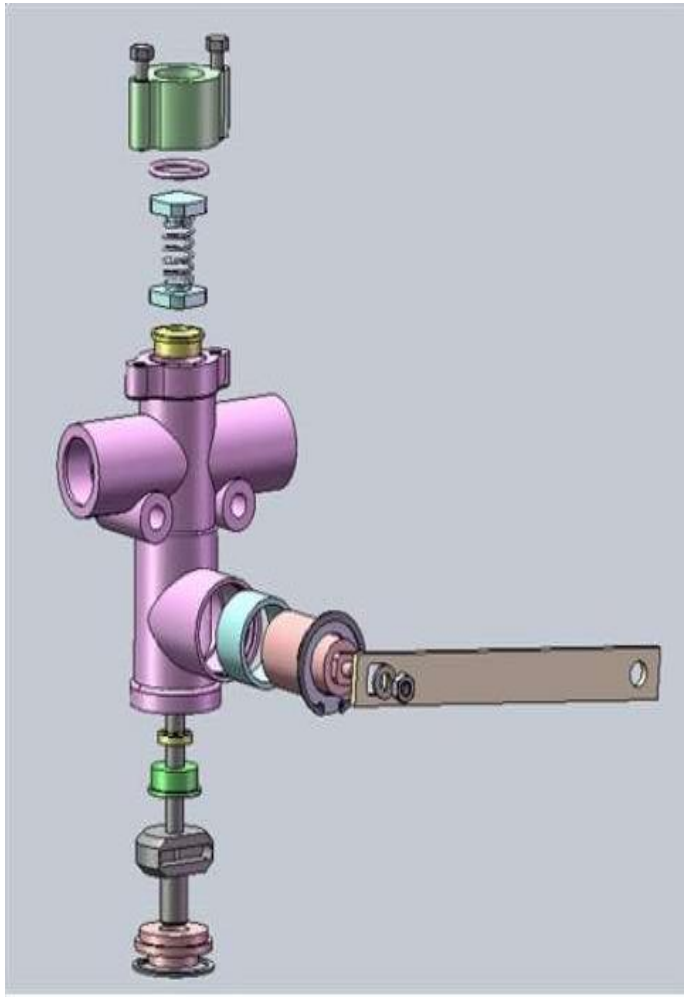

No flow of Air



# Main Equipments of the System

- Air Spring (Bellow)
- Leveling Valve
- Installation Lever
- Duplex Check Valve

# Levelling Valve



# Levelling Valve

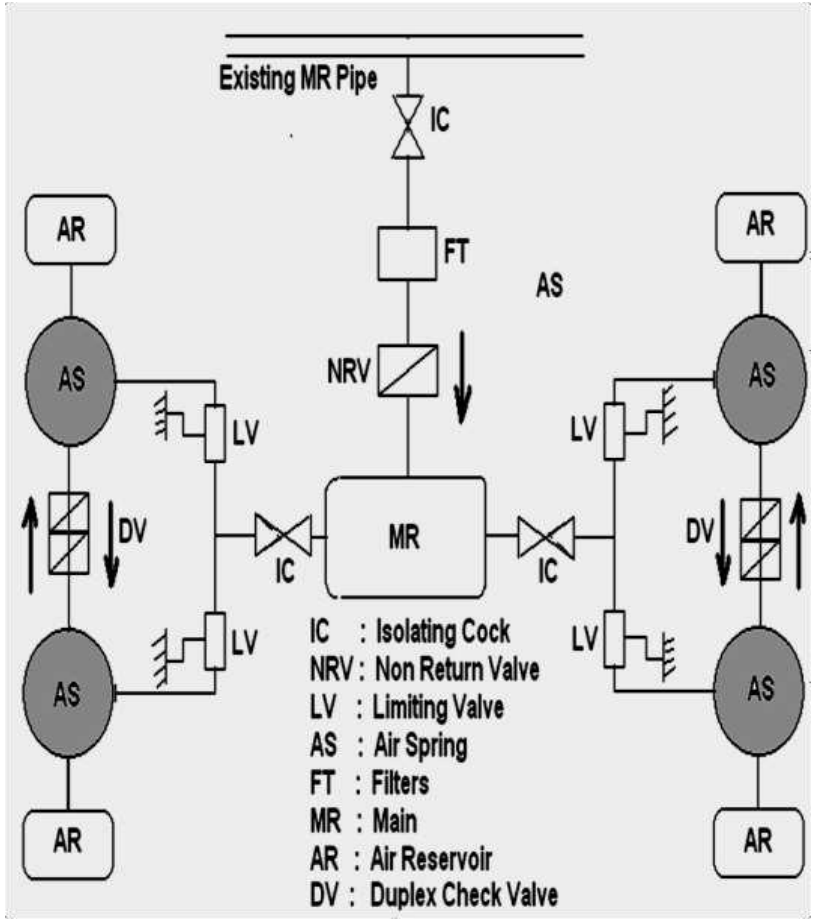
- Heart of the system.
- Mounted on bolster.
- It’s link is connected with installation lever.
- It has three positions:
  - Dead Band Zone
  - Charging Mode
  - Discharging Mode

# Installation Lever

- Fitted between link of Leveling valve and bogie frame.
- The ball and socket joint at both ends are provided to give flexibility.
- Left and Right hand threads are there at it’s either ends to increase or decrease it’s length so that the bellow as well as coach height increases and decreases respectively.

# Duplex Check Valve

- Fitted between two air bellows.
- Comprises of two check valves side by side
- Air can flow in either direction when the air pressure differential exceeds the pre-set value at 1.5 bar.



# FIBA

**Failure Indication and Brake Application Device**

# FIBA: Failure Indication & Brake Application

- Initiates brake application by sensing the pressure drop in any bellow beyond a limit.
- Objectives of FIBA:
  - To initiate the application of brakes to stop the train in case of bursting of Air Spring Bellow.
  - To indicate the driver and the crew by whistling sound and indicators on that particular coach.

# Working Principle

- Drops BP pressure when the pressure of any bellow falls below 1 kg/ cm2.
- Gives a red indication through indicators with brake application.
- Provided with isolating cocks to stop the discharge of BP pressure to enable the train to run at restricted speed up to the destination.

# Necessity for FIBA

Supply for air spring is taken from FP

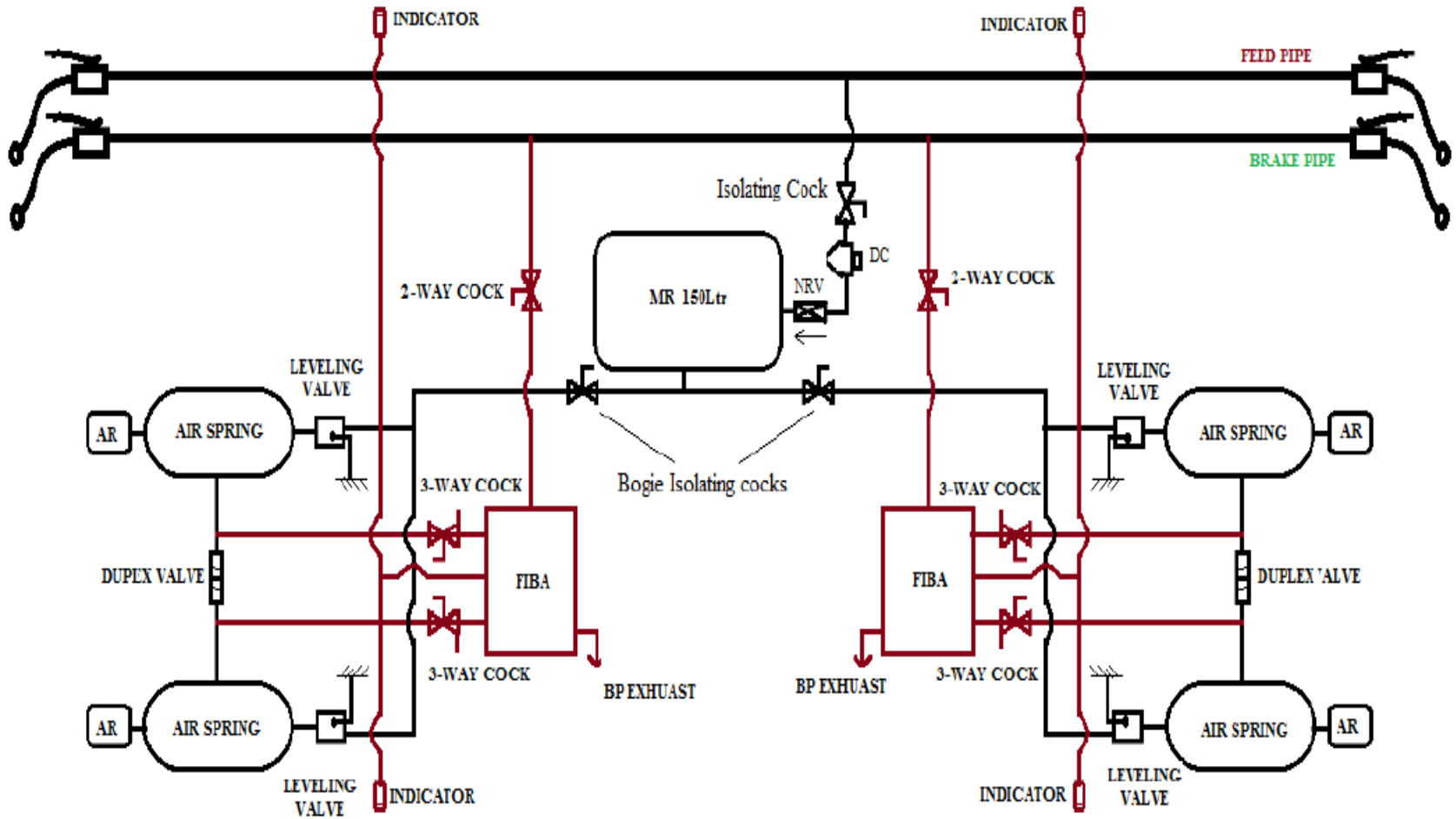
- loss of compressed air from the system not immediately noticed
- Unsafe train operation due to exhaust of compressed air
- Delay in identifying the cause

FIBA is provided in the coach to apply service brake automatically in the event of failure of air spring

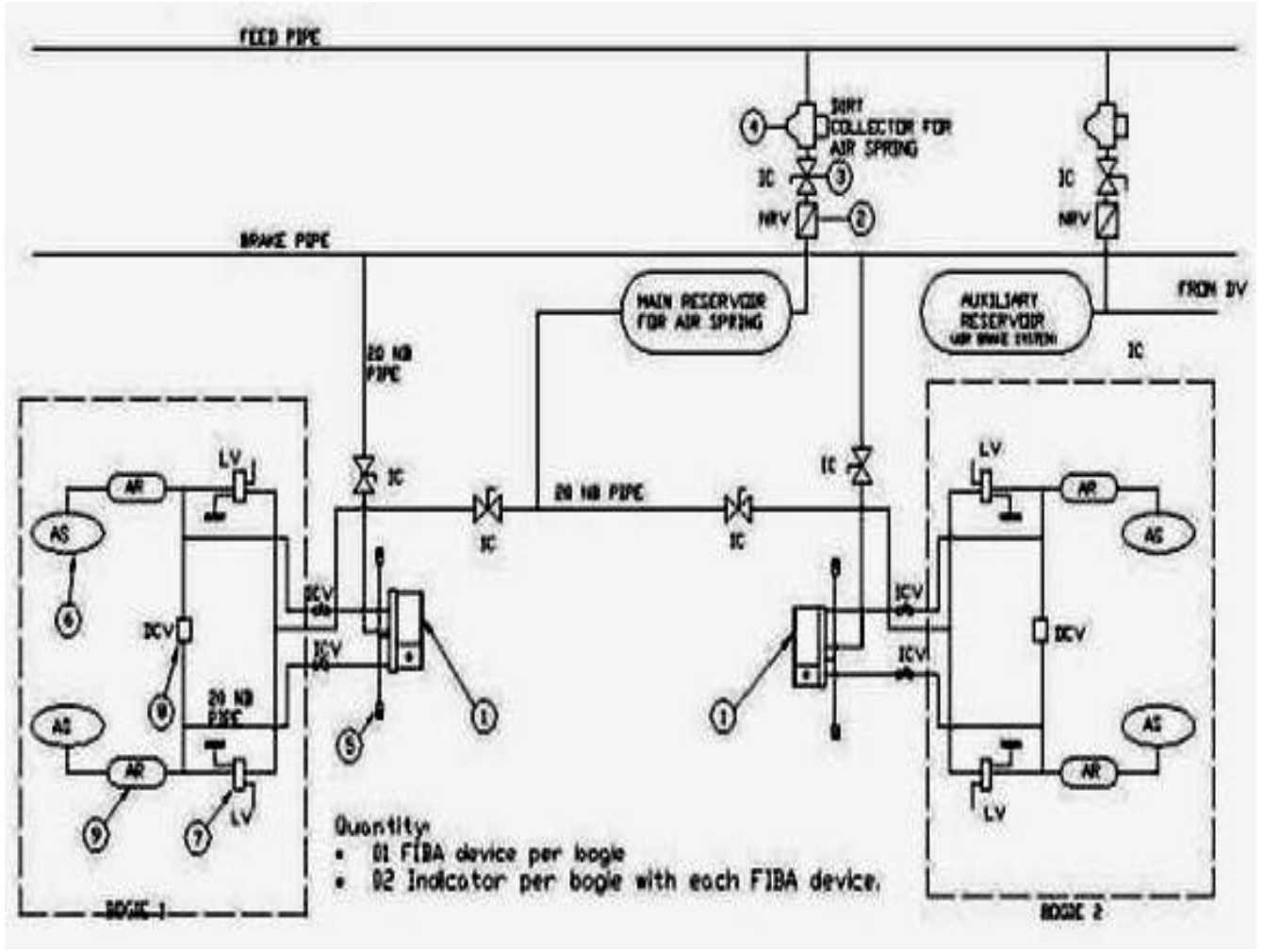
# Indication of failure by FIBA

- Automatic BP dropping through FIBA unit 8 mm choke exhaust & brake application on the train
- FIBA brake indicator on either side of coach for each bogie
- Audio sound from the FIBA device

# Line diagram for FIBA in coach



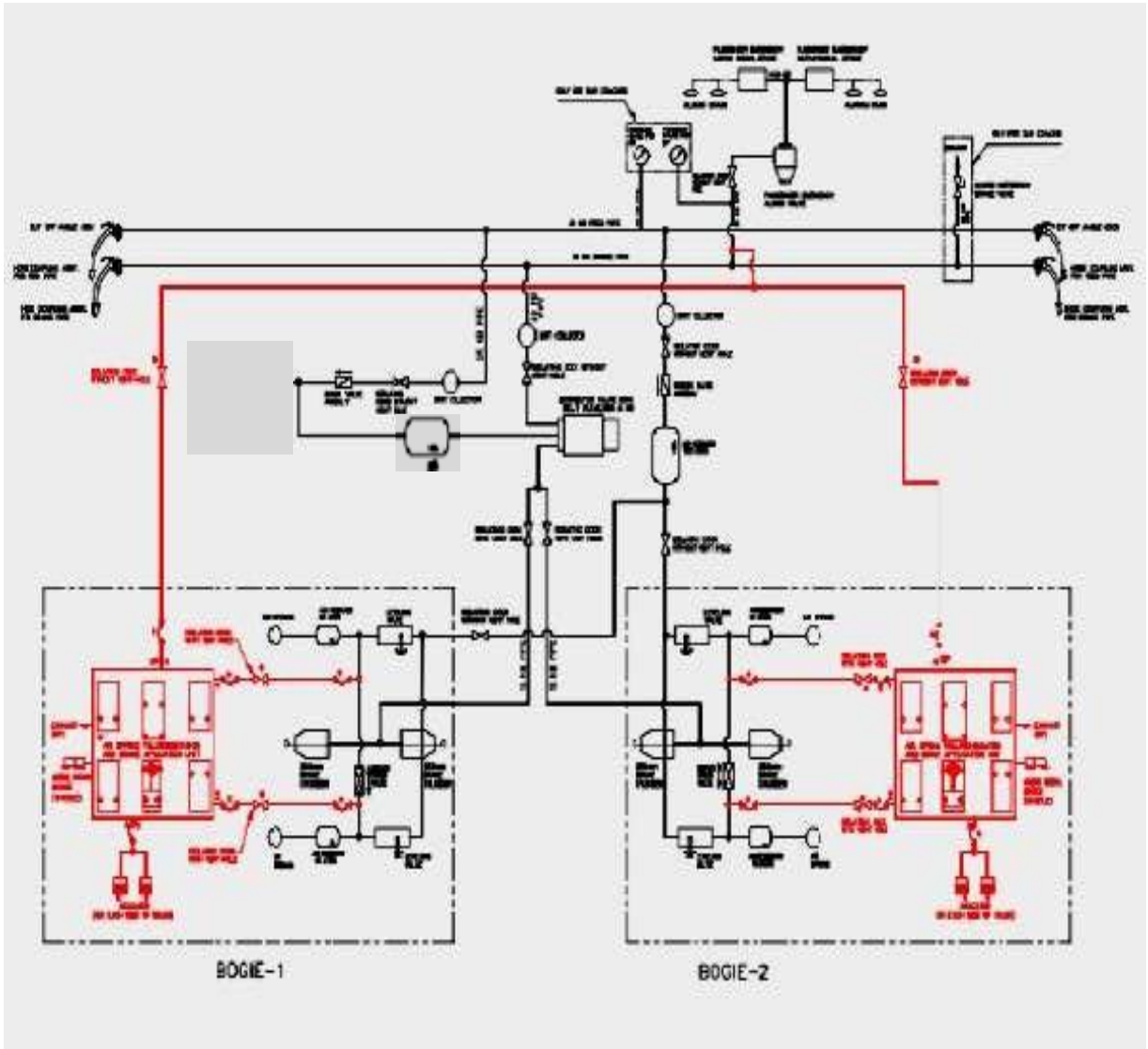
# Schematic



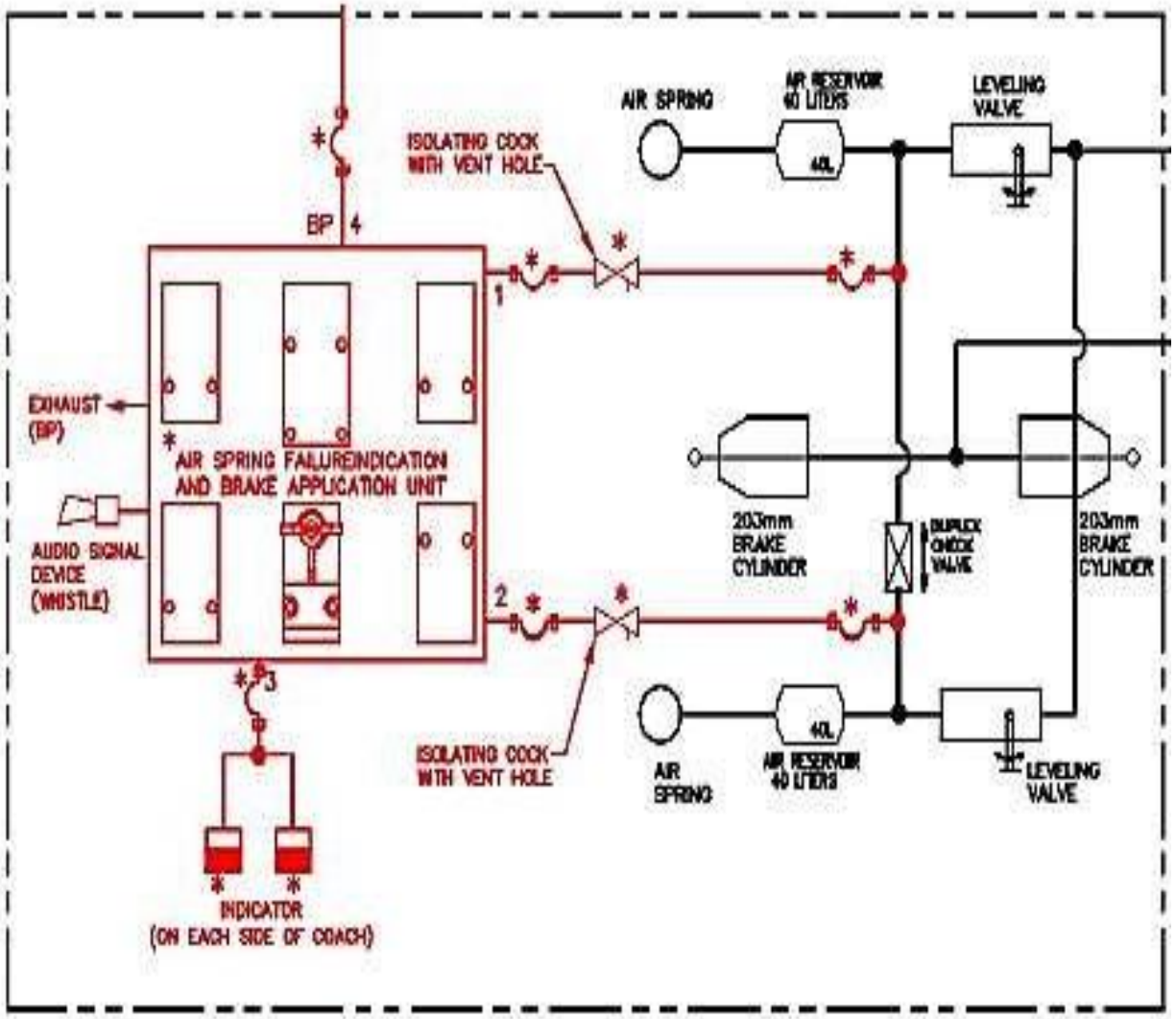

| | | |
|---|---|---|
| 1 | FIBA | FAILURE INDICATION CUM BRAKE APPLICATION DEVICE |
| 2 | NRV | NON RETURN VALVE |
| 3 | IC | ISOLATING COCK |
| 4 | DC | DIRT COLECTOR |
| 5 | IND | INDICATOR FOR FIBA DEVICE |

| | | |
|---|---|---|
| 6 | AS | AIR SPRING |
| 7 | LV | LEVELING VALVE |
| 8 | DCV | DUPLEX CHECK VALVE |
| 9 | AR | AUXILARY RESERVOIR |

# Schematic Layout (Full



# Schematic Layout (FIBA

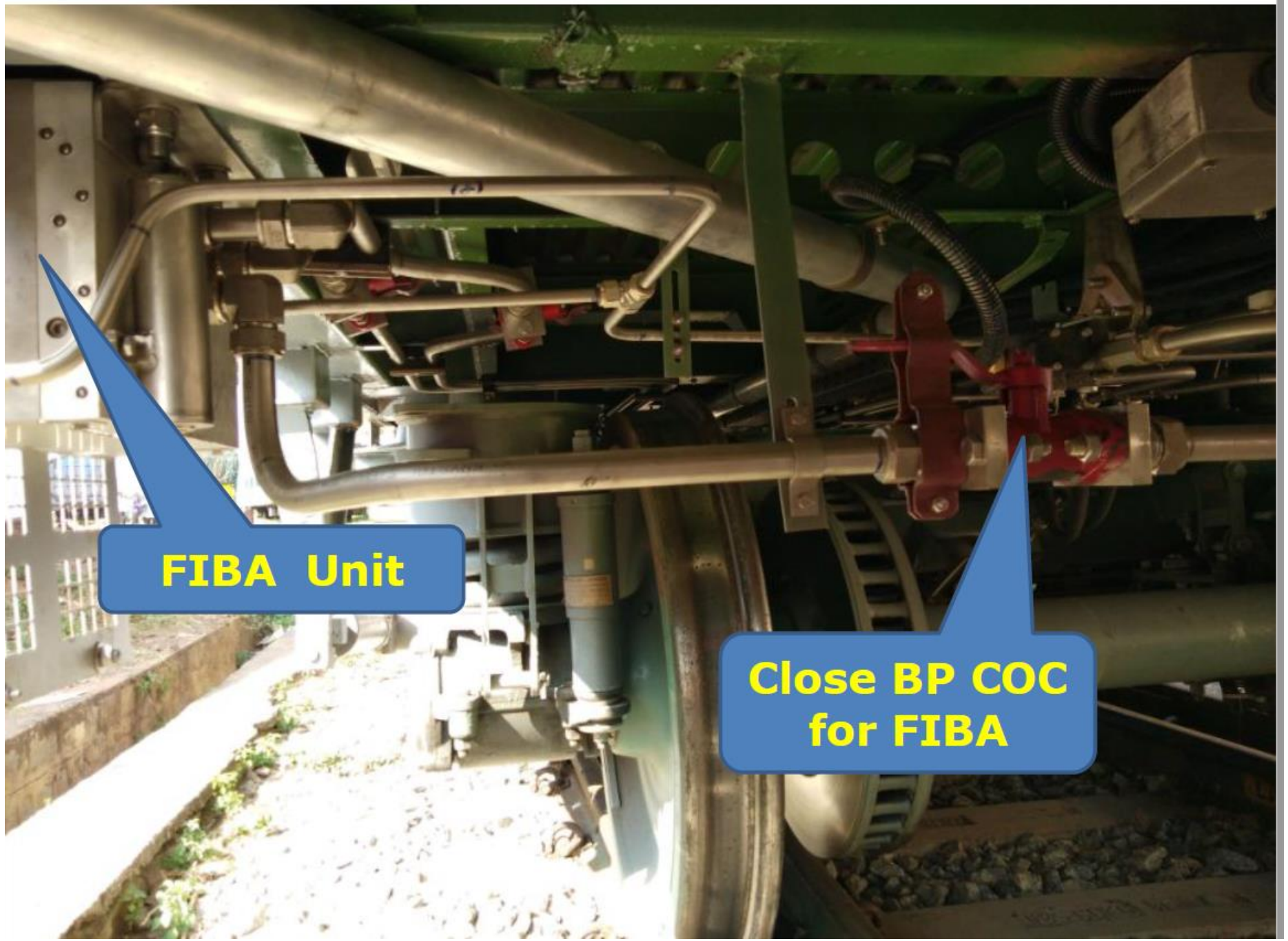


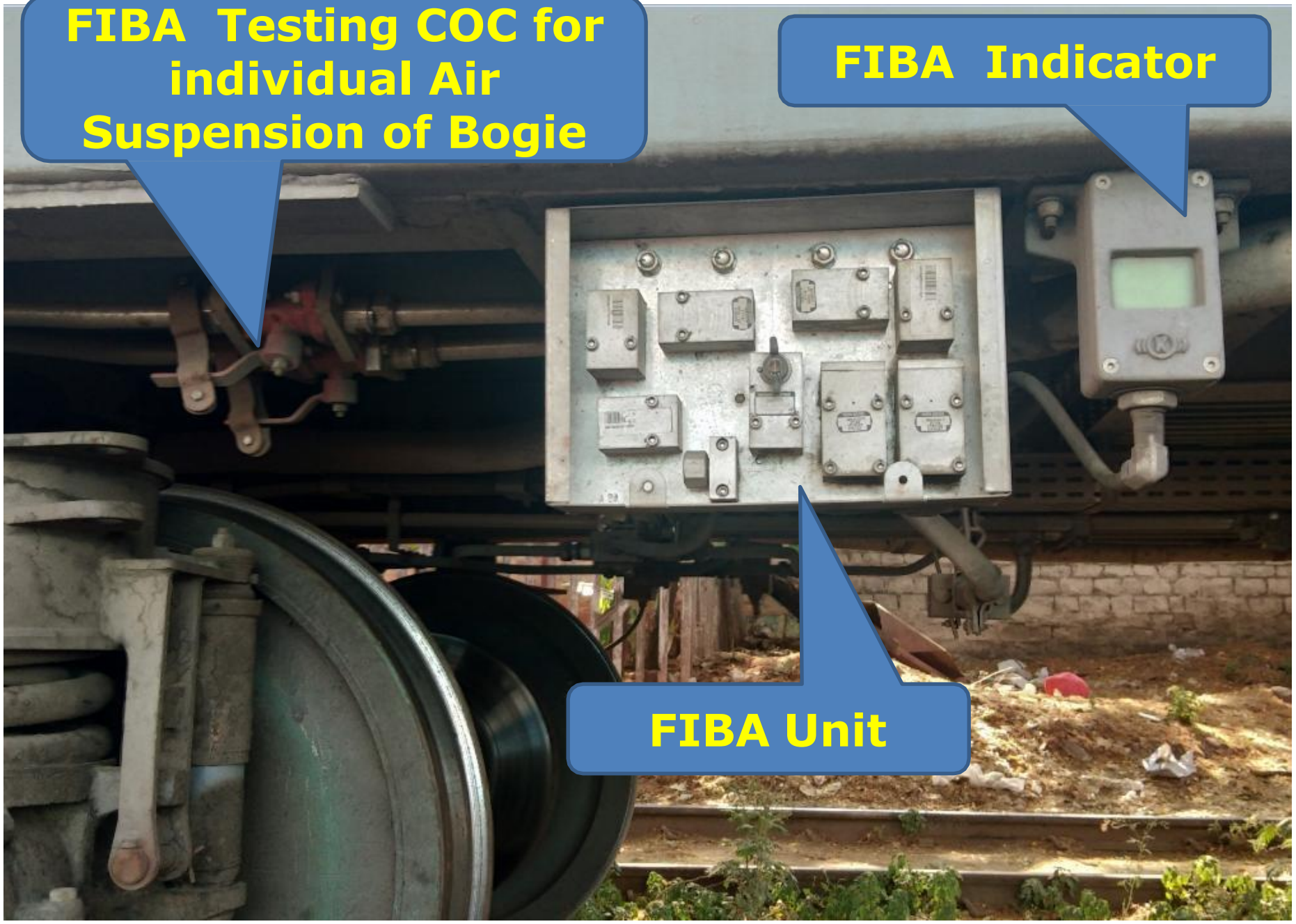
# Procedure for attending

- When the train brake application is identified, Loco pilot should make service application.
- Locate the coach with ruptured bellow through FIBA Indicator and hissing sound.
- Close BP COC on branch pipeline connected to FIBA unit

# Procedure for attending

- Isolate the Bogie isolating cock of the Air spring which is provided between the MR and the Bogie.
- Ensure both springs air is vented and coach is sitting on the emergency springs without any tilt.
- Continue the journey with speed limit of 60 Kmph.
- Inform PRC / Section Control


FIBA Unit
Close BP COC for FIBA

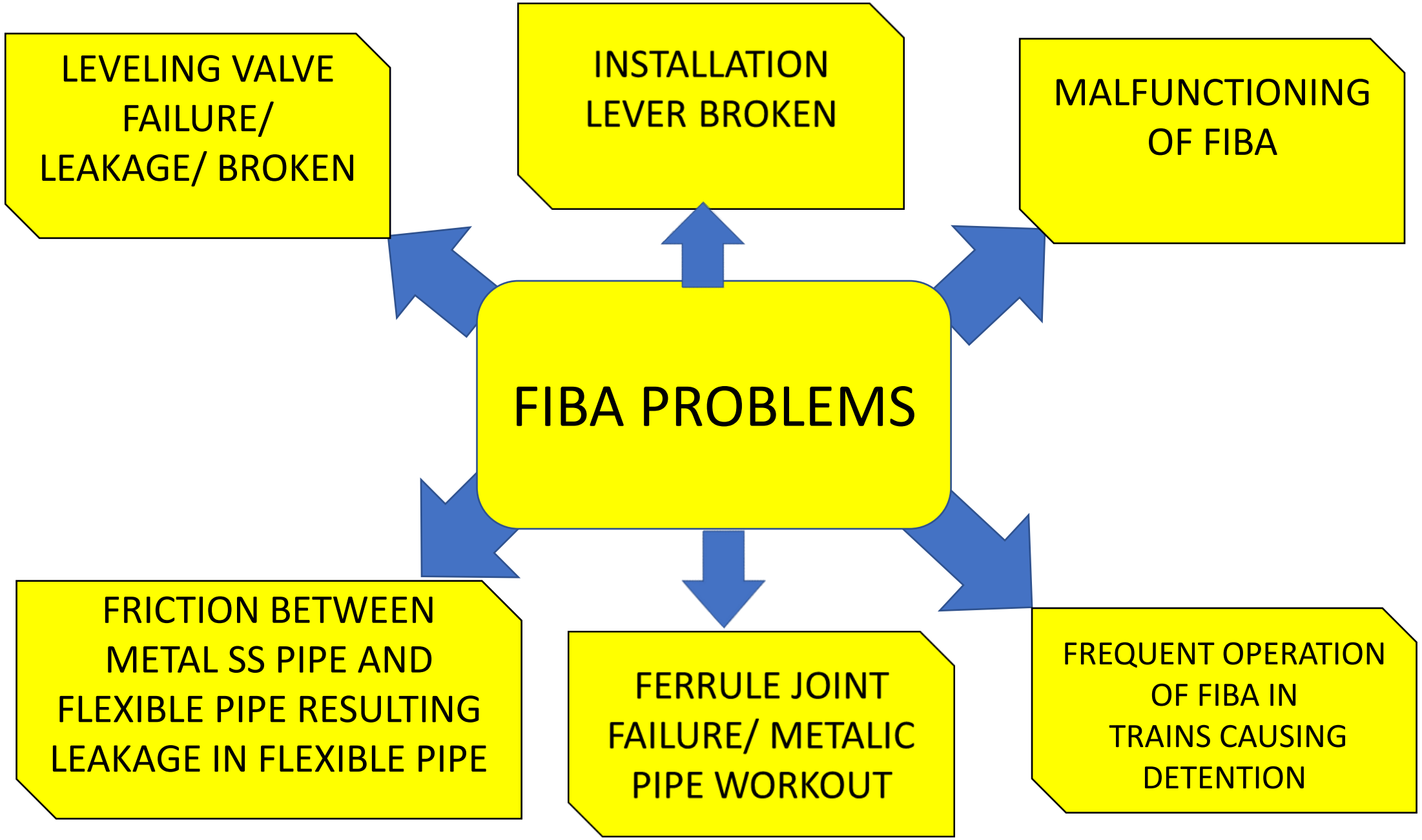

FIBA Testing COC for individual Air Suspension of Bogie
FIBA Indicator
FIBA Unit

# KBI- FIBA


FIBA Testing COC for individual Air Suspension of Bogie
FIBA Indicator
FIBA Unit

# FTIL-FIBA

# ESCORTS-FIBA


LEVELING VALVE FAILURE/ LEAKAGE/ BROKEN
INSTALLATION LEVER BROKEN
MALFUNCTIONING OF FIBA
FIBA PROBLEMS
FRICTION BETWEEN METAL SS PIPE AND FLEXIBLE PIPE RESULTING LEAKAGE IN FLEXIBLE PIPE
FERRULE JOINT FAILURE/ METALIC PIPE WORKOUT
FREQUENT OPERATION OF FIBA IN TRAINS CAUSING DETENTION

# Failure on account of FIBA Device and Associated Components till Sep.-2022

- Total 204 cases reported
- Investigation report of 155 cases obtained

# Cause Wise Analysis of Punctuality Loss Cases

| st. No. | Reason of FIBA actuation Enroute | No. of failures | Remarks & action taken |
|---|---|---|---|
| 1 | Leakage in Flexible pipe due to rubbing with metallic pipe /clamping bracket. | 67 | 88 cases related to piping layout/ clamping bracket. (56.77 % of total investigated cases)<br>• CAIs (issued by RCF & ICF) for modification of piping layout/ clamping bracket have been issued to PUs & Zonal Railways on 17.03.2021, 04.O2.2022 & 16.08.022.<br>• Audit of PUs, workshop & depots have been done by RDSO official & instructions have been issued vide this office letter no. SV.AS.FIBA dated 16.08.2022 for full implementation of RCF CAI (CAI/RCF/MECH/LHB/024 Rev.01 & CAI/RCF/MECH/LHB/O34 Rev.00) & ICF CAI (lCF CAI Na B-2021/02 Rev-01) at PUs & Zonal Railways. |
| 2 | Ferrule joint failure/ metallic pipe workout | 21 | |

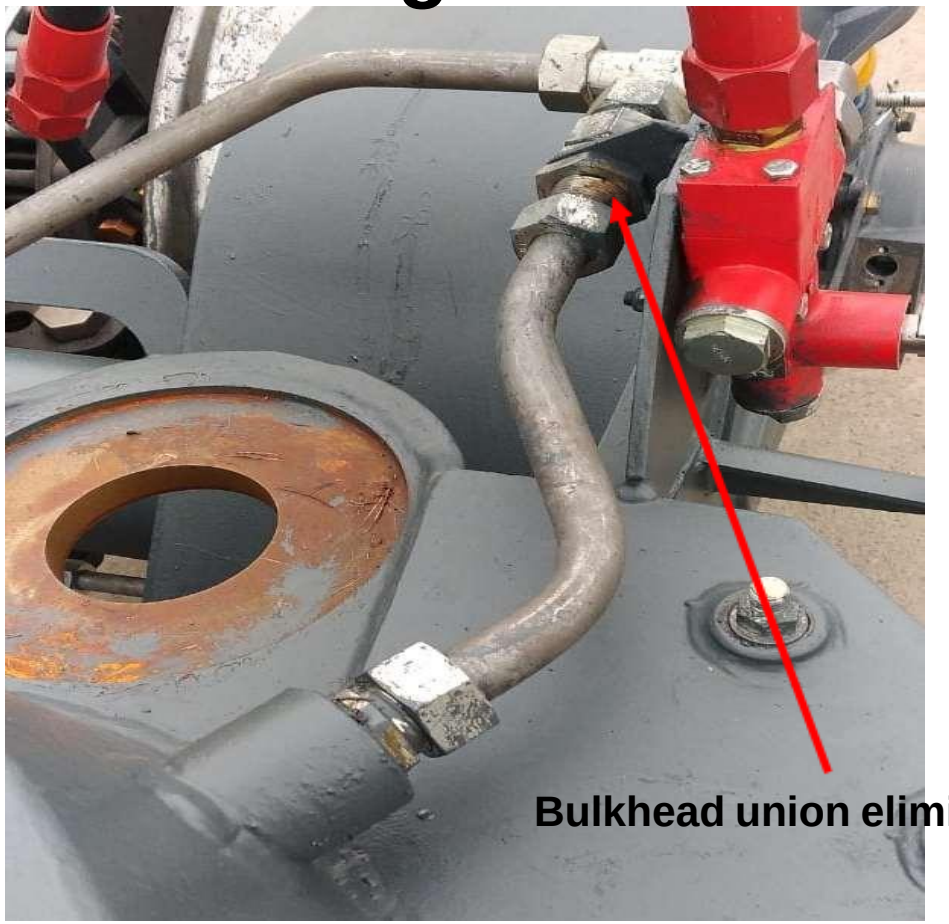
# Flexible hose pipe between Auxiliary Reservoir & leveling valve touches with the coach body and has sharp bend



Steel pipe provided on under frame for connecting flexible hose to leveling valve has been redesigned and shifted towards end of coach. Elbow has been provided on leveling valve to ensure smooth loop which is not touching with car body and ensures that bend radius limits for the SAE100 hoses is not compromised

Piping layout between leveling valve and Dome cum air reservoir of FIAT bogie's bolster

## Old Design




## New Design

Piping layout of this area has been revised resulted into reduction of bulkhead unions

# Failure of ferrule joint of flexible hoses for FIBA

- This failure was attributable to the following root causes: -

  1. Relative movement between the bolster and the bogie frame which is constantly moving the hoses.

  2. Grazing of flexible hose with steel pipe for connection of leveling valve.

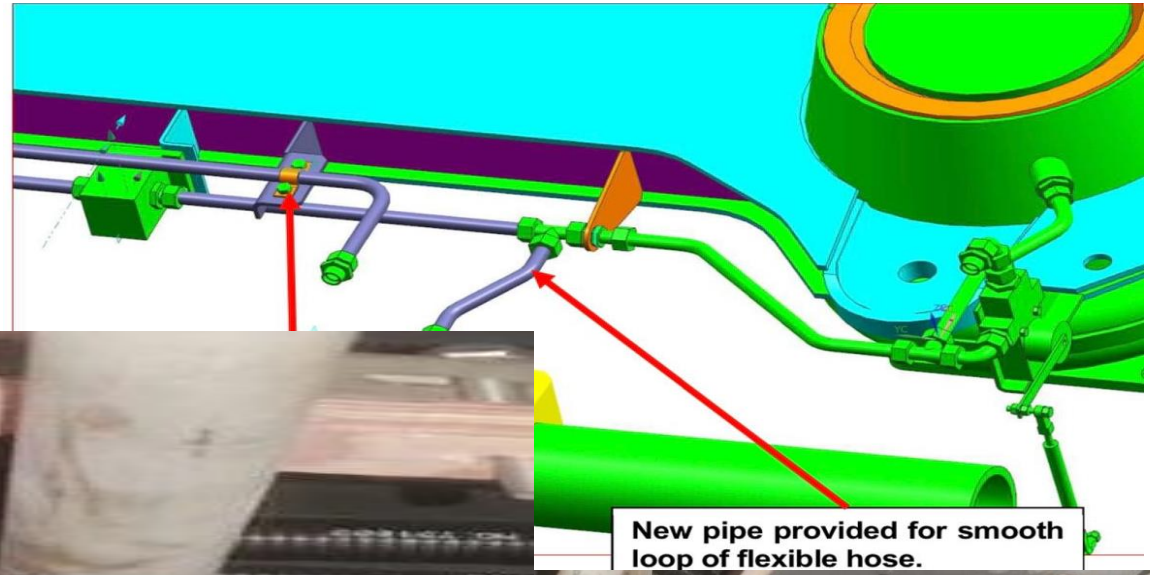
- The piping arrangement provided on cross beam of FIAT bogie frame has been shifted to bogie bolster. Hub flange of underframe and pin bracket of FIAT bogie bolster will work as a single unit after carrying out body bogie connection
- Steel Pipe connected with leveling valve through flexible hose has also been redesigned and shifted towards coach end. This shifting resulted into clearance between flexible hoses and steel pipes. Moreover, loop of flexible hose is become smoothened by providing additional modified pipe with tee of duplex valve piping which is not touching to car body pipe.

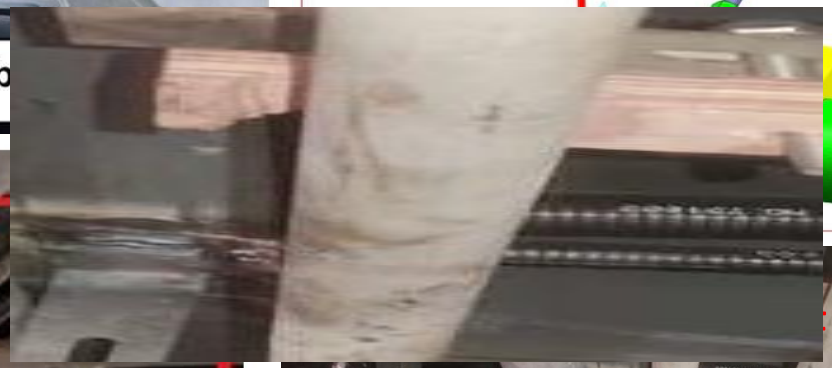
# Remedy for avoiding Flexible pipe rubbing & ferrule joint failure

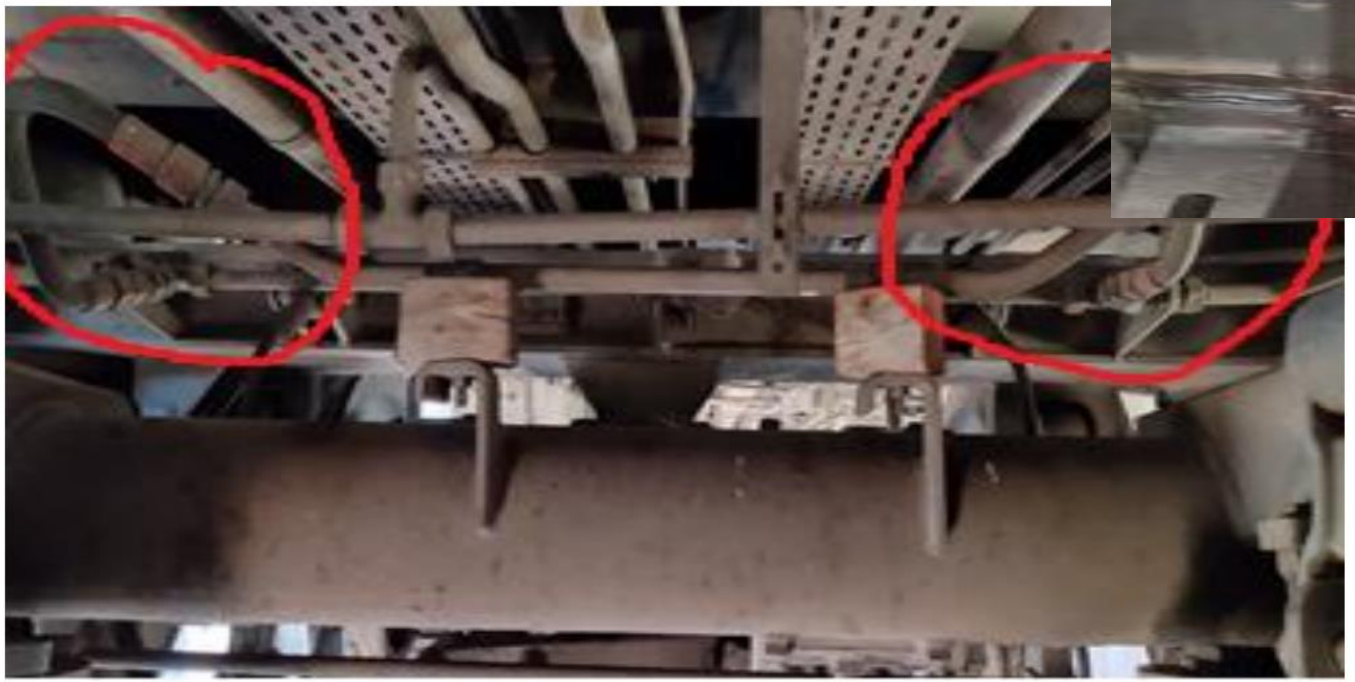
The piping arrangement provided on Cross beam of FIAT bogie frame has been shifted to bogie bolster. Hub flange of underframe and pin bracket of FIAT bogie bolster will work as a single unit after carrying out body bogie connection. Thus, this modification will result into no movement between joints of flexible hoses whose one end is connected to FIBA piping provided on underframe and other end connected with piping of bogie bolster.

# Remedy for avoiding Flexible pipe rubbing & ferrule joint failure

**Old Design**

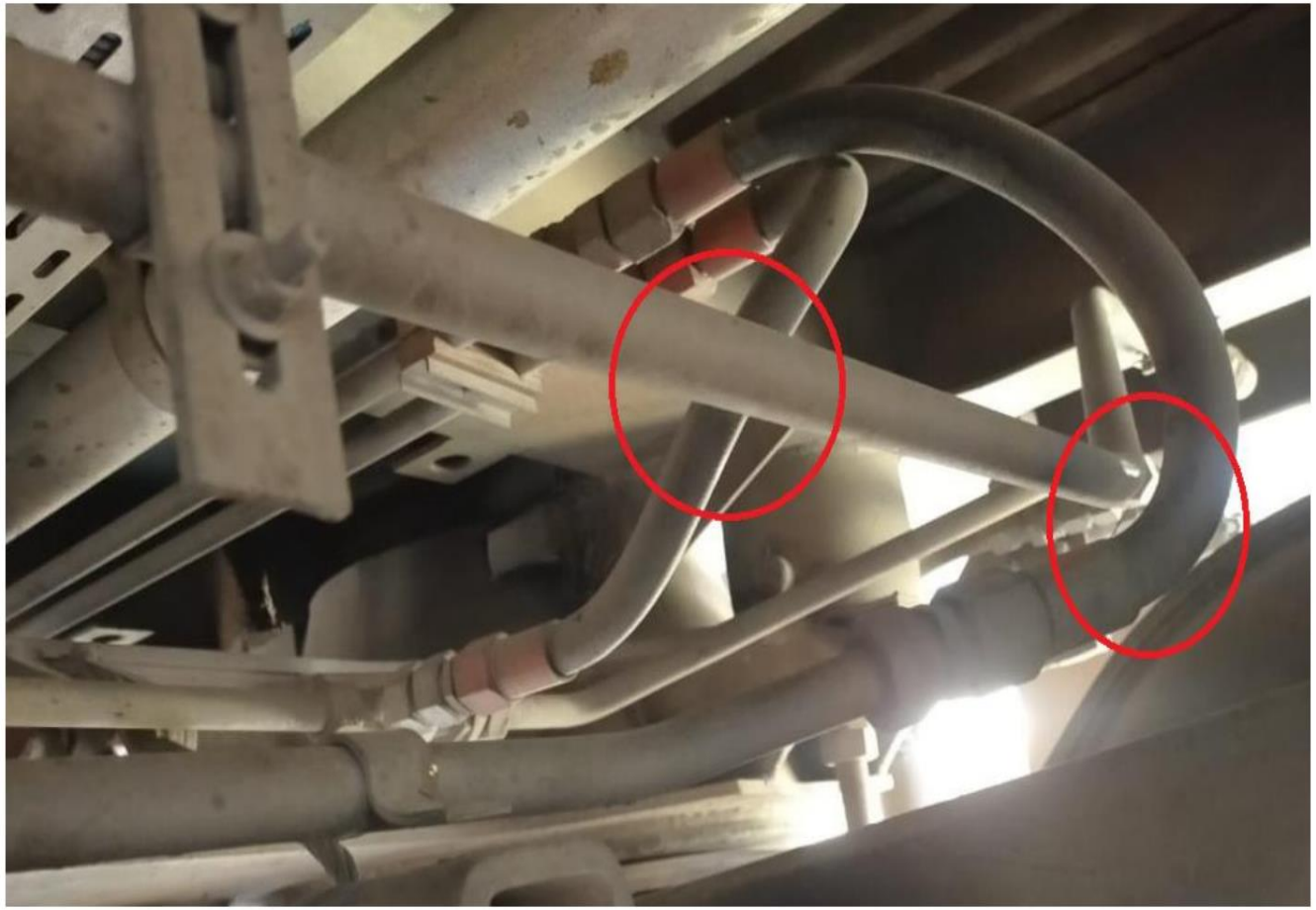





lexible Hoses for FIBA

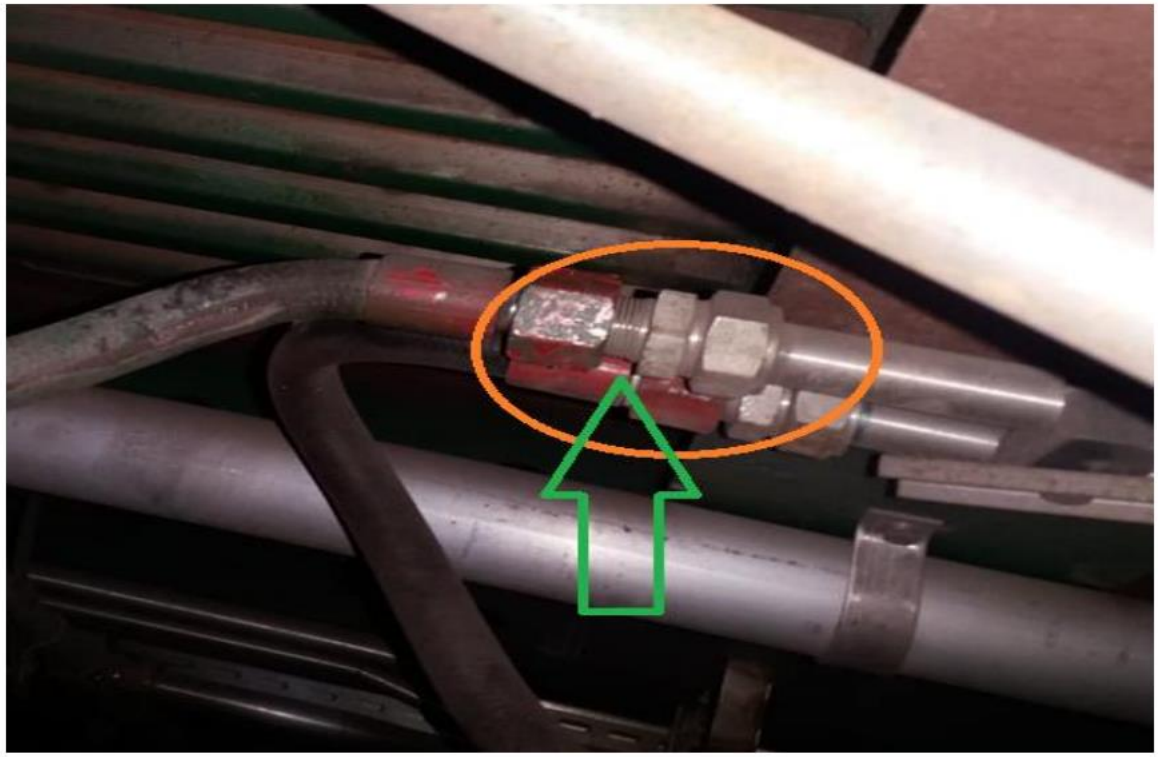
# Remedy for avoiding Flexible pipe rubbing & ferrule joint failure

# Leakage in Flexible pipe due to rubbing

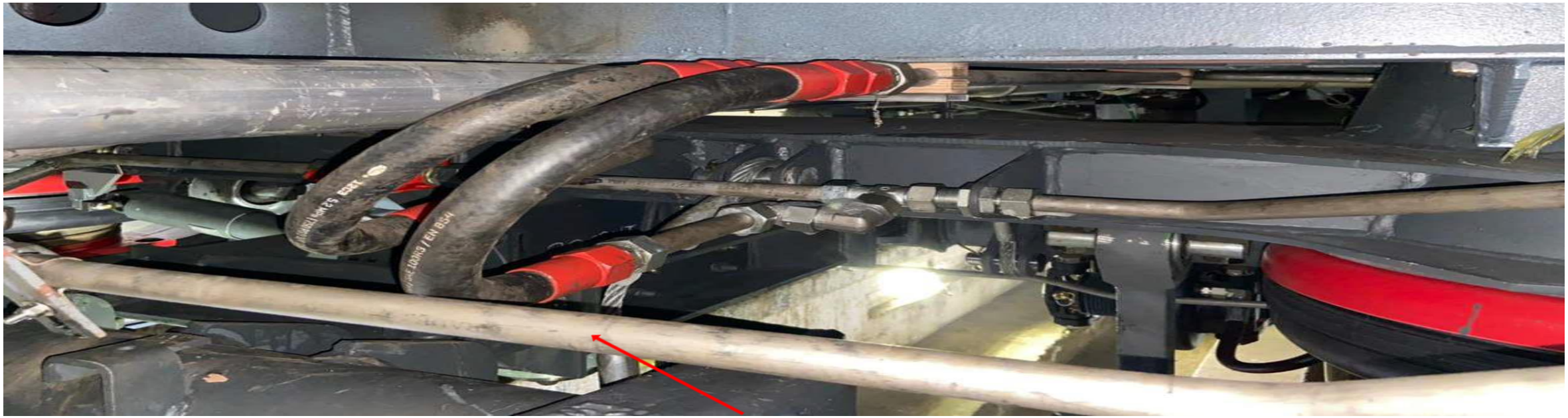


Rubber hoses covered with rexin

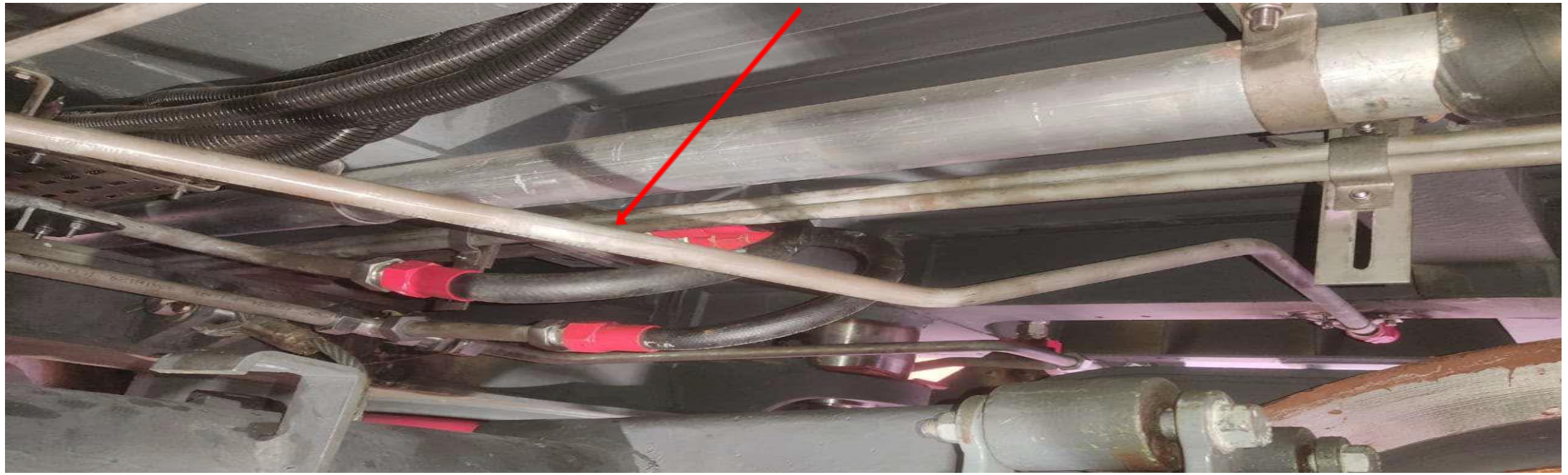
# Ferrule joint failure/metallic pipe workout



- CAI circulated by RDSO (issued by RCF & ICF) vide this office letter No SV.AS. FIBA, dated.17.03.2021 & 04.02.2022 regarding piping layout of ASCE & FIBA yet not been implemented completely. Coaches are being turned out with old piping layout. As a result, failure/leakage in ferrule joint & flexible hose pipe etc. are continuously being reported by Zonal Railways



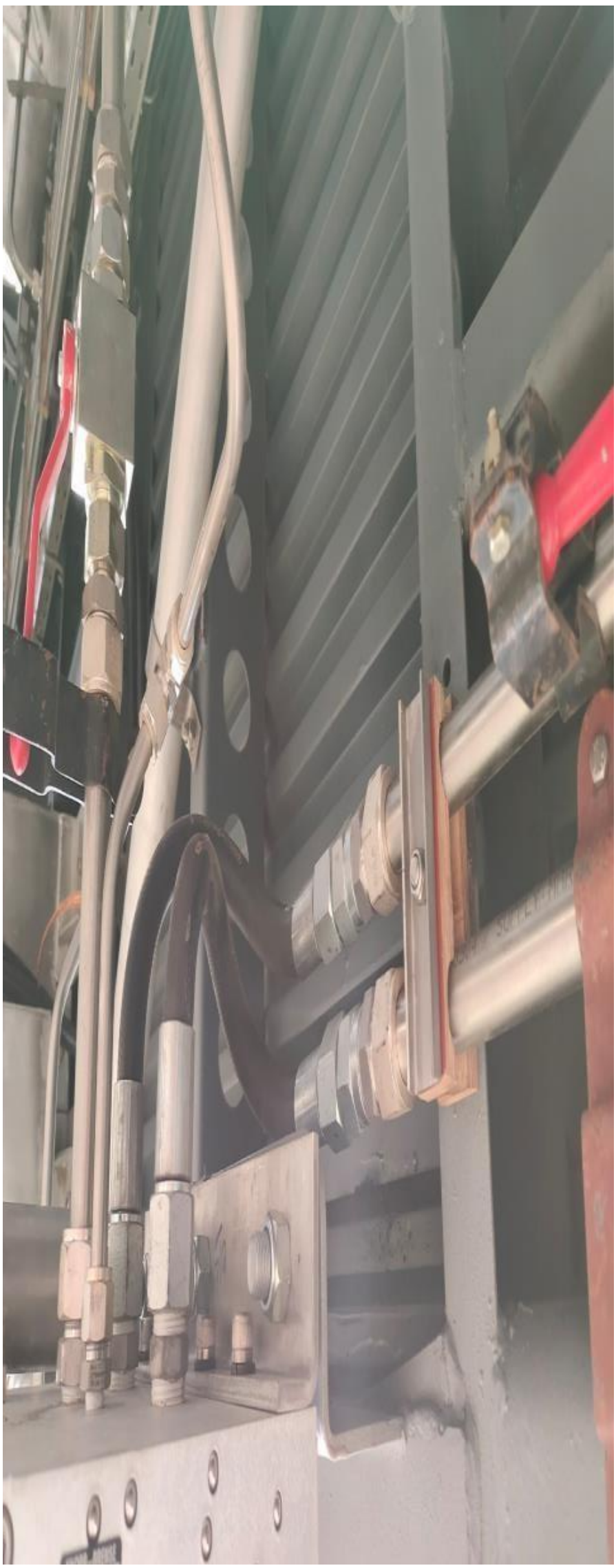
**STEEL PIPE FOR CONNECTING FLEXIBLE HOSE PIPE TO LEVELLING VALVE**



**CLOSER VIEW OF SHIFTED STEEL PIPE TOWARDS COACH END**

## CLOSER VIEW OF FLEXIBLE PIPES CONNECTED WITH FIBA PIPING OF UNDERFRAME

## CLEARANCE FROM STEEL PIPE TO BE CONNECTED TO LEVELING VALVE



# Cause Wise Analysis of Punctuality Loss Cases

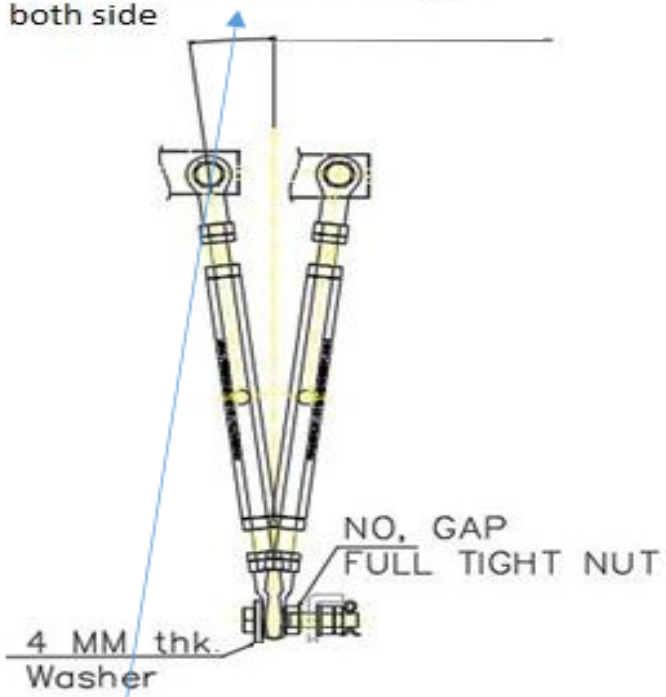
| St. No. | Reason of FIBA actuation Enroute | No. of failures | Remarks & action taken |
|---|---|---|---|
| 3 | installation lever broken/bent/not working | 27 | (17.41 % of total investigated cases) Root cause analysis has been carried out for broken/bent cases of the installation lever. identified reasons for breakage/bent along with detailed instructions for proper fitment of installation lever (fig.1.1 & fig.1.2) are attached as Annexure C for PUs & Zonal Railways . |
| 4 | Pressure drop in coach /Air spring | 9 | 5.80 % of total investigated cases) Movement of LHB coaches/rakes in yard/ platform without FP pressure (One of the reason for pressure drop in coaches). instruction regarding movement of LHB rakes/coaches with Air spring in secondary suspension in yard/platform has already been issued vide this office letter no. SV.AS. FIBA, dated 19.11 .202A & 16.08.2022. |

# MOVEMENT OF INSTALLATION LEVER & BALL SOCKET IN ASSEMBLY

**Annexure C**

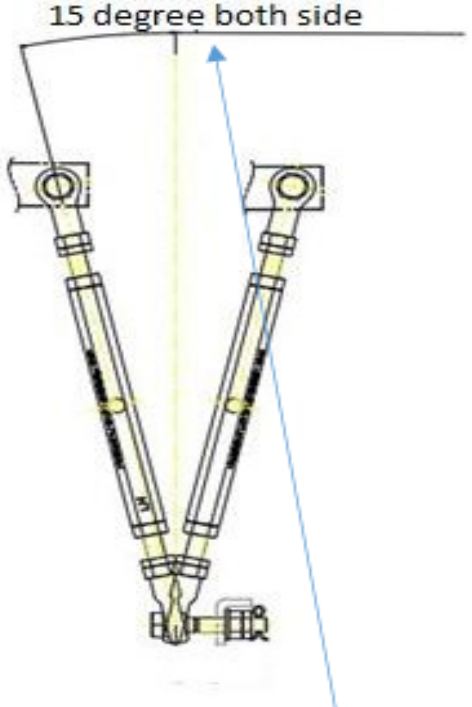
**Wrong fitment**

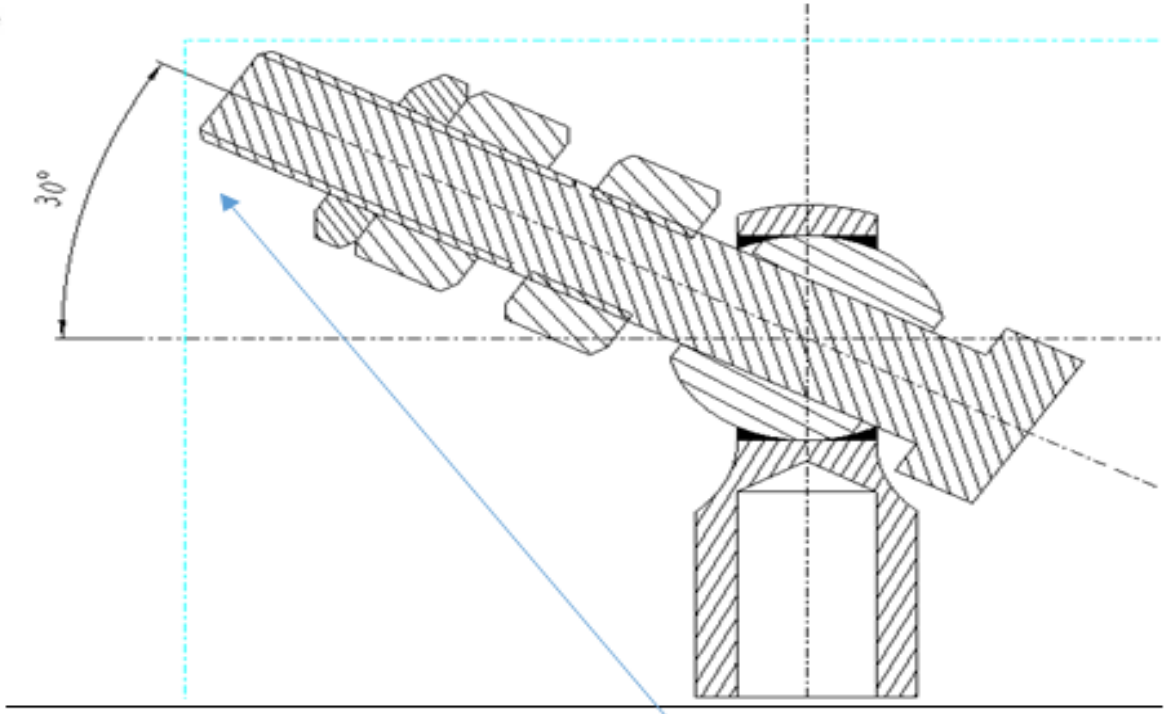
Free movement up to 7 degree both side




**Right fitment**

Free movement up to 15 degree both side






No proper gap & wrong fitment of washer etc.

(less permissible movement & higher forces on installation lever & leveling valve horizontal lever)

With proper gap & correct fitment of washer etc.

(more free movement and normal forces on installation lever & leveling valve horizontal lever)

Bolt rotated 30º approx. in 360 angle w.r.t centre axis (when proper gap maintained as given in above figure)

## INCORRECT METHOD OF FITMENT

(No proper gap at top & bottom rod bearing to allow the free movement of installation lever)

## CORRECT METHOD OF FITMENT

(Proper gap for installation lever movements)

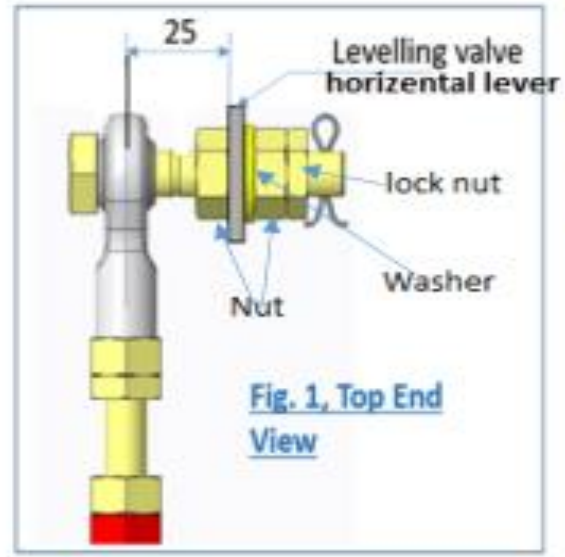



Fig. 1, Top End View

Note : There should be proper gap from center to first nut to be fitted with levelling valve lever at top & mounting bracket at bottom to allow required free movement

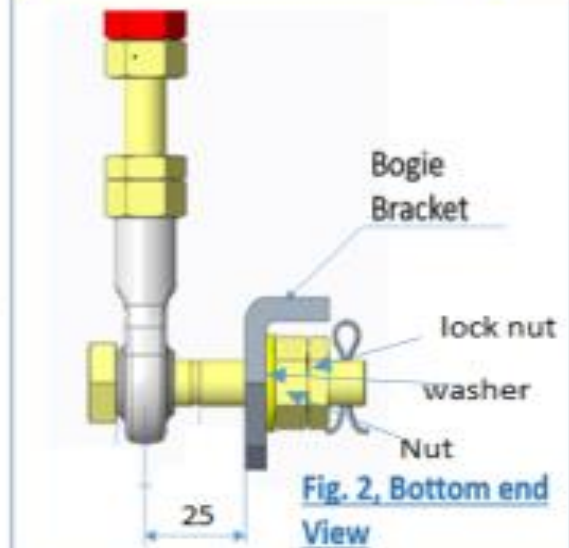



Fig. 2, Bottom end View

It is suggested to follow the correct method of fitment as shown (Fig. 1 & 2) to minimize the breakage issue of installation lever.

**Fig. 1.1**

**Issues** :-**(1)** No gap (**2**) wrong fitment of washer (**3**) All the nuts etc. not provided (**4**) Installation lever are of non-approved source (not approved by RDSO)

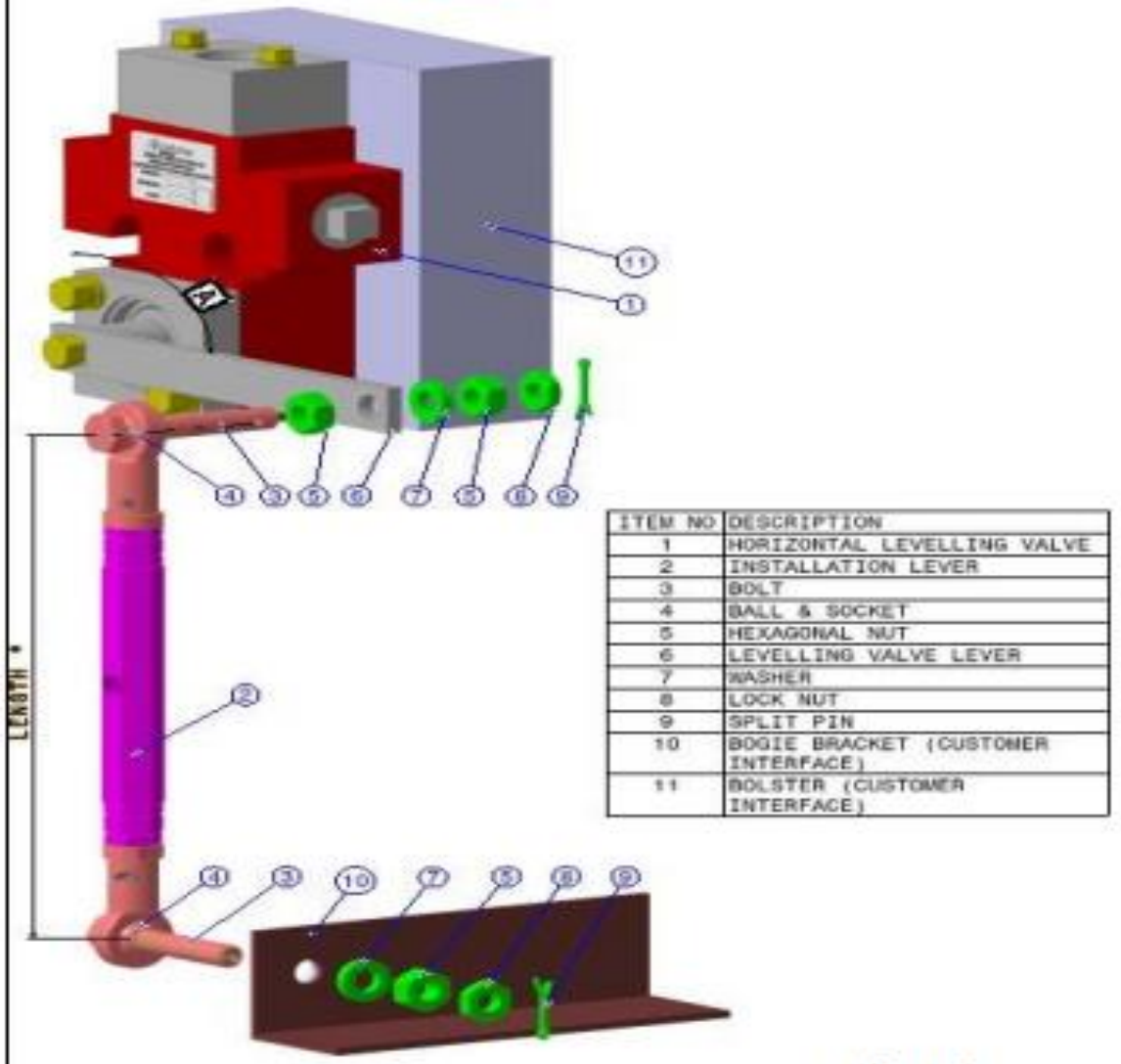
## INCORRECT SEQUENCING OF NUTS, LOCK NUTS, WASHER & LEVELLING VALVE HORIZONTAL LEVER

(All the nuts & lock nuts are not placed in correct sequence during assembly for proper fitment/movement of installation lever & levelling valve handle.)

## CORRECT SEQUENCING OF NUTS, LOCK NUTS, WASHER & LEVELLING VALVE HORIZONTAL LEVER

(All the nuts, lock nuts & washer should be as placed correct sequence as given below)

TOP SIDE




| ITEM NO | DESCRIPTION |
|---|---|
| 1 | HORIZONTAL LEVELLING VALVE |
| 2 | INSTALLATION LEVER |
| 3 | BOLT |
| 4 | BALL & SOCKET |
| 5 | HEXAGONAL NUT |
| 6 | LEVELLING VALVE LEVER |
| 7 | WASHER |
| 8 | LOCK NUT |
| 9 | SPLIT PIN |
| 10 | BOGIE BRACKET (CUSTOMER INTERFACE) |
| 11 | BOLSTER (CUSTOMER INTERFACE) |

**Fig 1.2**

BOTTOM SIDE

## INCORRECT FITMENT OF INSTALLATION LEVER, NUTS, LOCK NUTS, WASHER & LEVELLING VALVE HORIZONTAL LEVER

**Cause no.01**-Totally tightened. No space for ball movement

**Cause no.02**-Incorrect Fitment of washer, bolt & levelling valve horizontal lever etc.

**Resulting in**-Leveling valve Handle in bent condition

**Resulting in**-Installation Lever Broken

**Resulting in** -Installation Lever Broken

**Resulting in**-Leveling valve Handle in bent condition.

**Result:** -Undesirable forces are developing during train operation on installation lever & Levelling valve horizontal lever. As a result, levelling valve handle are getting bent and installation levers get broken.

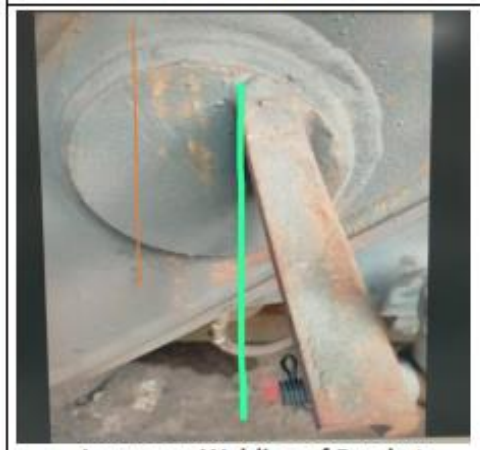
# Cause Wise Analysis of Punctuality Loss Cases

| St. No. | Reason of FIBA actuation Enroute | No. of failures | Remarks & action taken |
|---|---|---|---|
| 5 | Levelling valve failure/leakage/broken | 9 | (5.80 % of total investigated cases)<br>• During the investigation, some of the cases of premature failure of levelling valve were identified due to wrong fitment of installation lever with horizontal lever of levelling valve (leakage observed during train operation).<br>• Horizontal lever bent cases due to excessive loading (reason is wrong fitment of installation lever).<br>• In this regard, fitments instruction are attached for proper fitment (fig. 1.1 & fig.1 .2) of installation lever to avoid premature failure during train operation as Annexure-C. |

# Levelling valve failure/leakage/broken


Improper Welding of Brackets

Improper Welding of Brackets

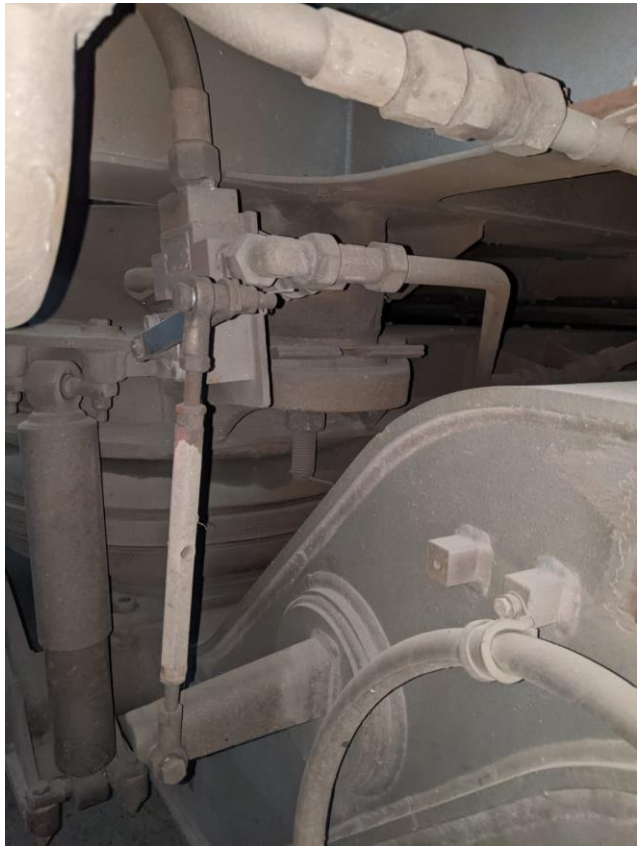


Improper Welding of Brackets

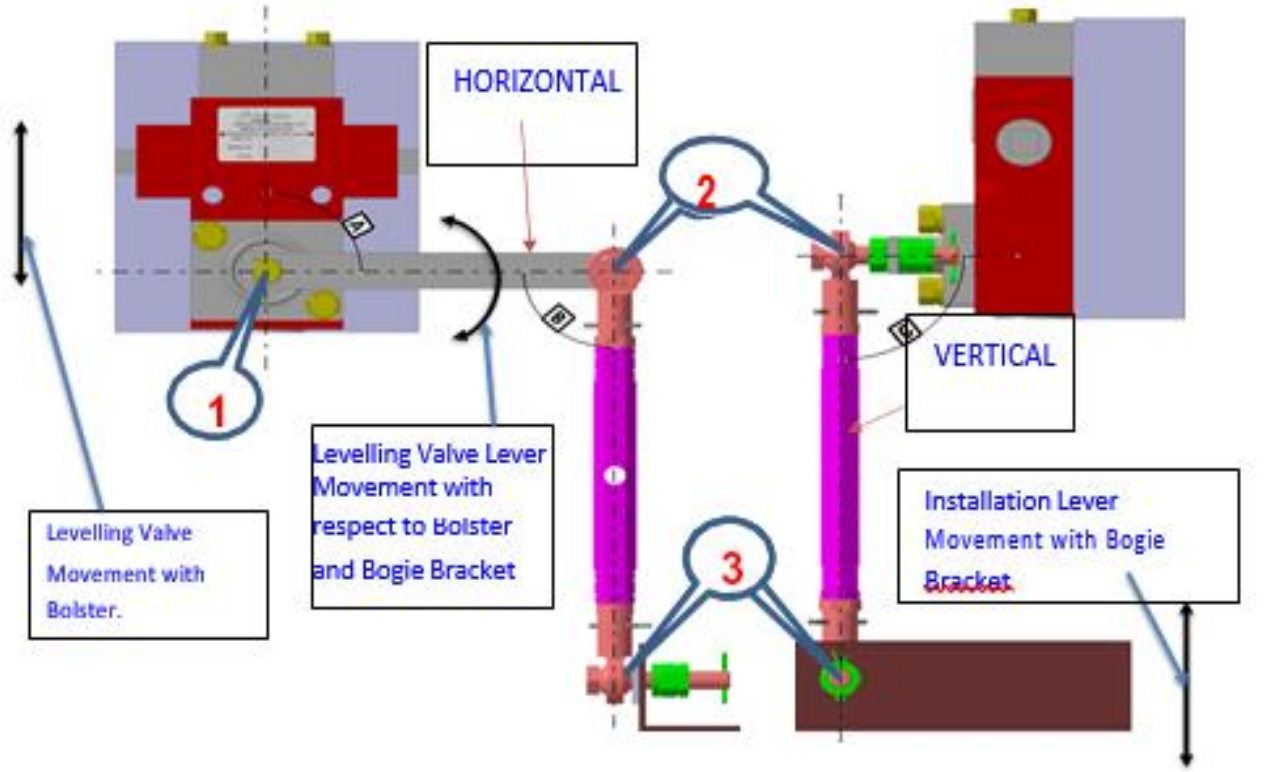
Misalignment of mounting Holes

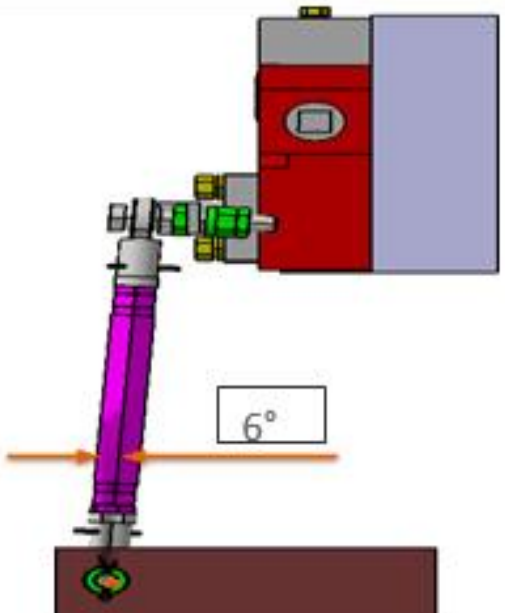
Misalignment of mounting Holes

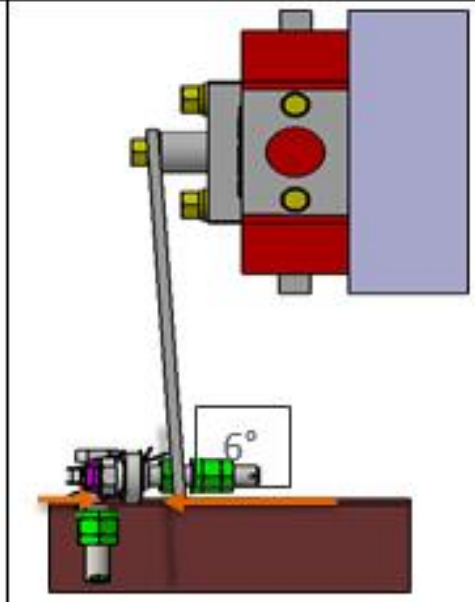
Leveling valve handle in bent position

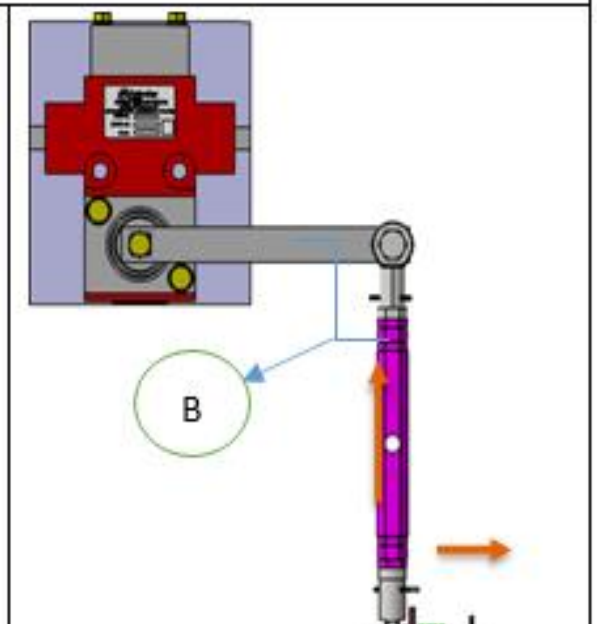


**Improper orientation causes excessive forces on levelling valve & installation lever**


HORIZONTAL
VERTICAL
1
2
3
Levelling Valve Movement with Bolster.
Levelling Valve Lever Movement with respect to Bolster and Bogie Bracket
Installation Lever Movement with Bogie Bracket


6°


6°


B

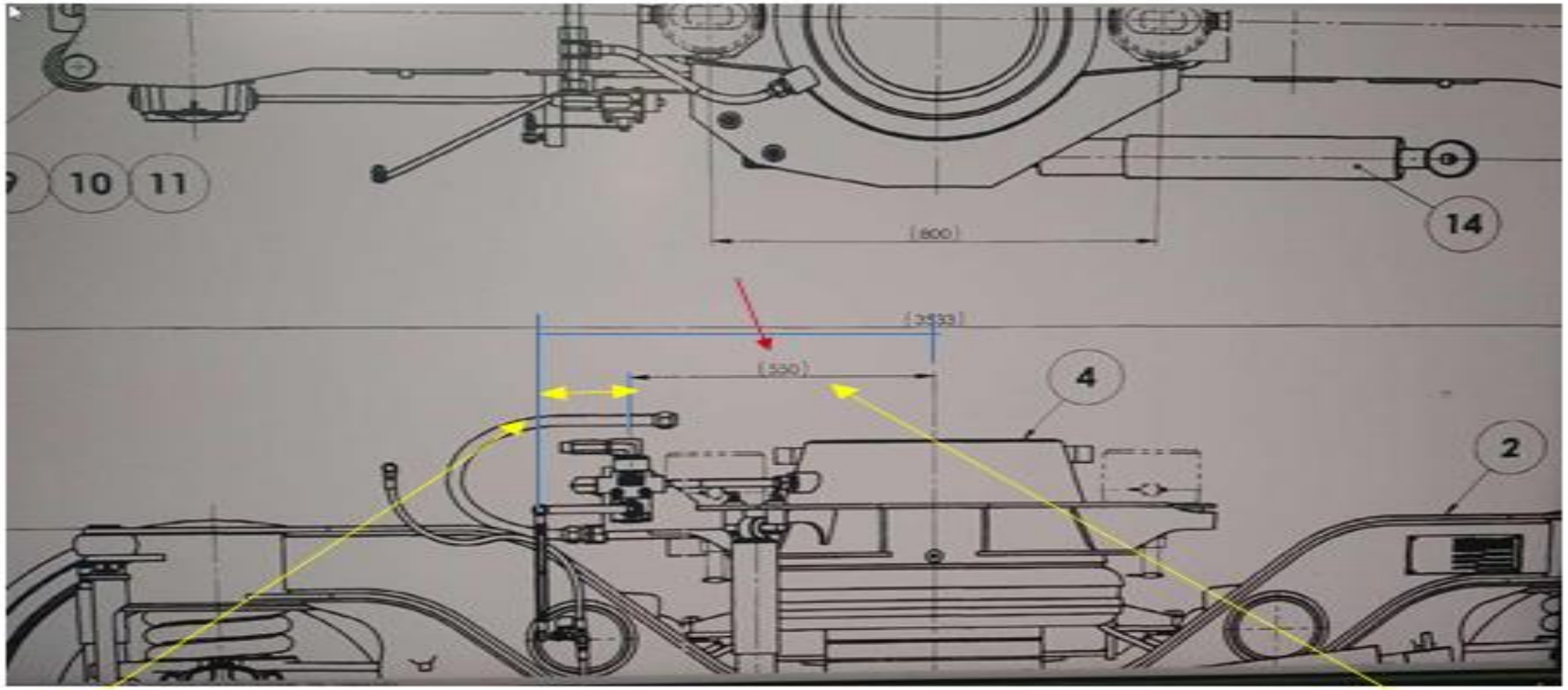
## CAUSES IDENTIFIED FOR TILTED/INCORRECT POSITION OF INSTALLATION LEVER

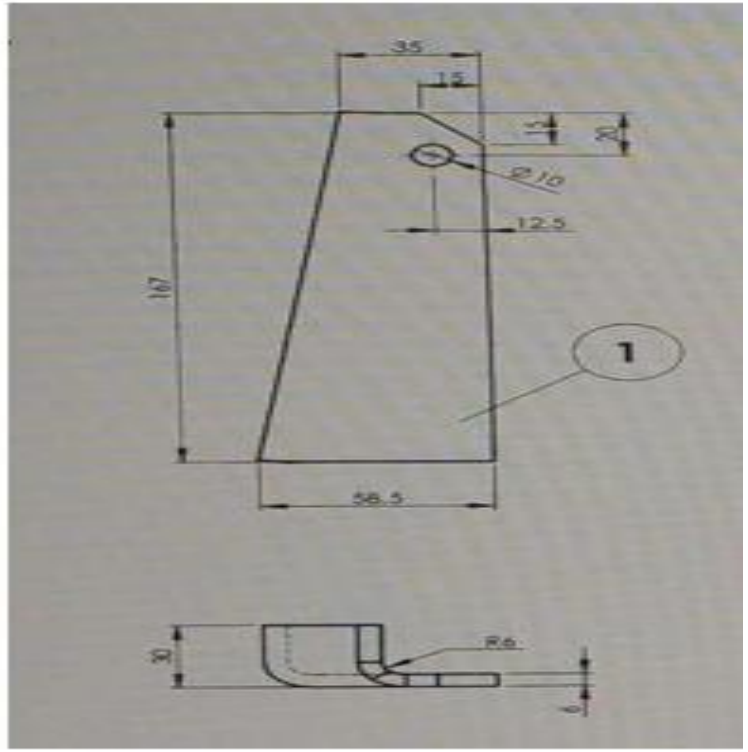
- Incorrect/Improper welding of upper & lower brackets for leveling valve and installation lever, which resulting in misaligned/inclined position of installation lever (Not at right angle). Lower bracket should be perpendicular to bogie frame side face after welding & machining.

- Upper bracket for levelling valve on bogie bolster must be perfectly aligned in longitudinal direction with its axis parallel to level track.

- Misalignment of mounting holes for leveling valve.

- Center to center distance between ball socket joint of installation lever and leveling valve lever hole is varying in different coaches (It should be fixed to 160 mm approx.).
- Horizontal lever of levelling valve is getting bent due to transfer of undesirable forces during service



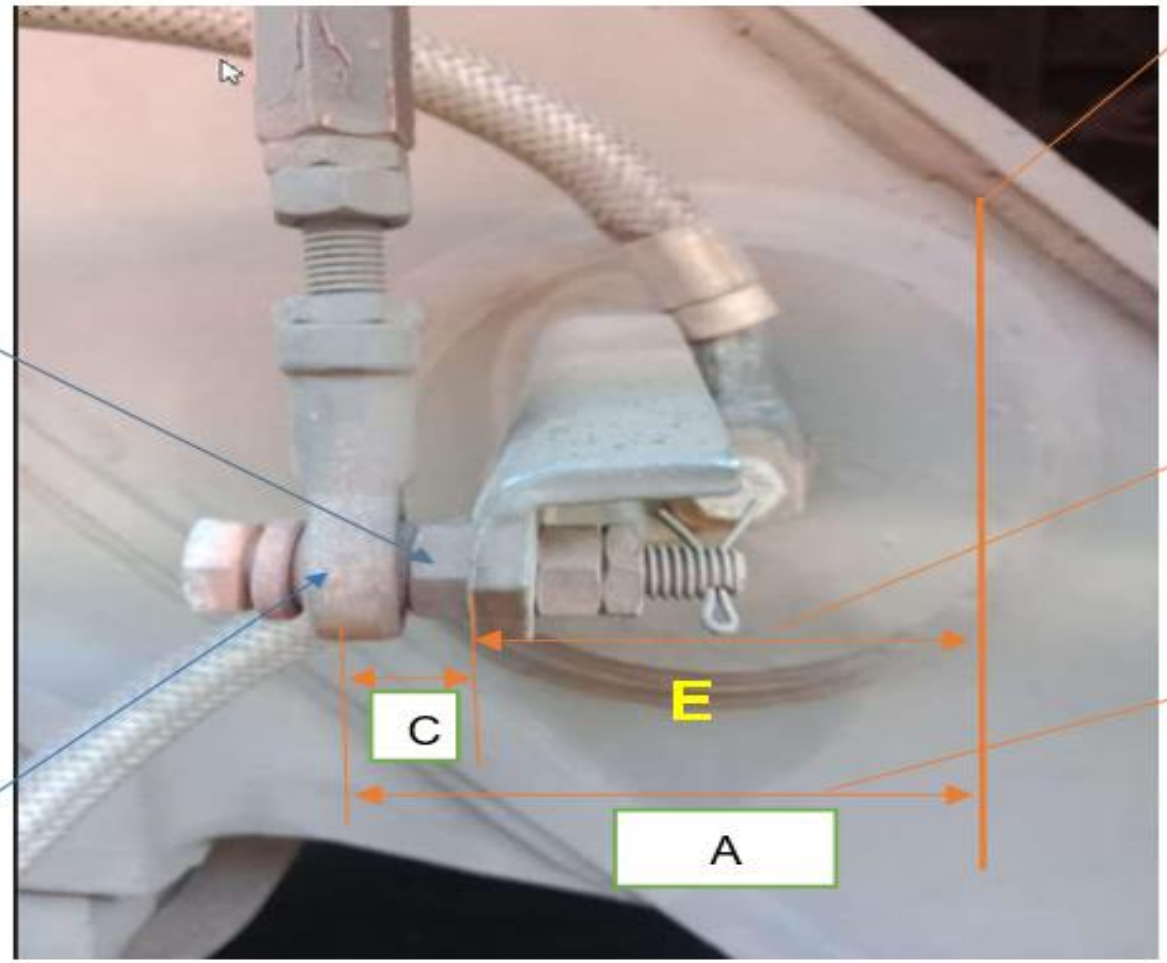




This dimension should be controlled & should be standardized as 160 mm (Approx.) for proper fitments of installation lever & levelling valve.

This dimension should also be controlled & should be standardized as 550 mm (Approx.) for proper fitments of installation lever & levelling valve.

**Distance B=** should be approx. 160 mm for proper fitments of installation lever & levelling valve (**Mounting of levelling valve & installation lever on LHB coach** shown in below figure)

**To keep Installation Lever straight in vertical position, Dimension 'C' (half of Turn buckle thickness & thickness of Nut) + dimension 'E' should be equal to dim. 'A' i.e. 160 mm (As shown in below figure)**




Mid-point of levelling valve lever hole

Distance A= Should be approx. 160 mm. (**Distance between two holes of Horizontal Lever)**

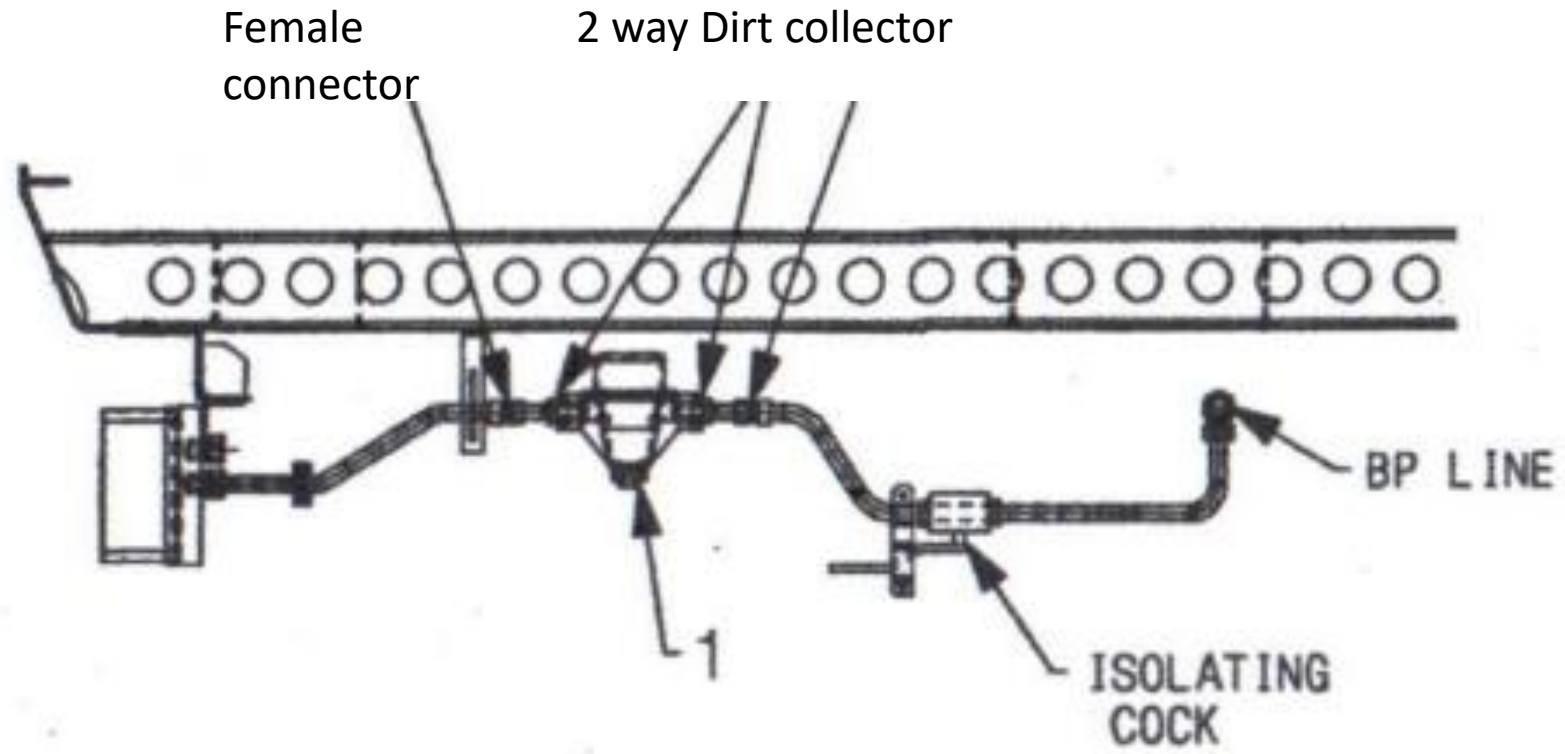
Dimension E= From outside of angle (bracket at lower) to center of levelling valve should be controlled.

Dimension A= Dimension C+ Dimension E (Should be maintained to keep installation lever straight).

# Cause Wise Analysis of Punctuality Loss Cases

| st. No. | Reason of FIBA actuation Enroute | No. of failures | Remarks & action taken |
|---|---|---|---|
| 6 | Malfunctioning of FIBA | 9 | 17.74 % of total investigated cases) Root cause analysis of failure FIBA has been done at firm's premises. FIBA malfunctions due to ingress of dust, dirt & foreign particles in FIBA valve/panel. In this regard, provision of dirt collector in BP line has been introduced & RCF has issued CAI for provision of dirt collector in BP line (ref. vii). . |

# Malfunction of FIBA




Provision of additional dirt collector in BP Line

# Important points for Air spring maintenance

**Schedule- D1**

- Draining of 150L air reservoir
- Air spring installation height : 289-294 mm
- General condition & Leakage check of air springs,ASCE,isolating cocks,hoses,DCV
- Any isolated component
- Ensuring same make Air spring in same bogie and same capacity in same coach
- Functional check of FIBA in any 01 coach as per Annexure-A

# Annexure-A

**ANNEXURE-A**

**ON VEHICLE TEST FORMAT FOR FIBA DEVICE:**

Depot/Div/Rly/PU.....Date of testing.....Coach no.....POH/mfg. Details (Coach) ..... Return date.....Year Built.....

| S. No. | Test and testing procedure | Standard | Results obtained | | | |
|---|---|---|---|---|---|---|
| | | | Bogie no..... S. No. of FIBA device: Make: Mfg. date : | | Bogie no..... S. No. of FIBA device: Make: Mfg. date: | |
| | | | Air spring -1 | Air spring -3 | Air spring -2 | Air spring -4 |
| 1. | **Initial Charging:** **i)** Ensure that all isolating cocks and cut of angle cocks for charging of air springs, BP and FP should be in open condition. Other end cut of angle cock and drain cocks provided in AR, MR and coach should be closed position. **ii)** Charge the FP at 6.0 Kg/Cm$^2$ and BP at 5.0 Kg/Cm$^2$ . iii)Ensure the charging of air springs with the help of levelling valve lever position. | FP= 6 $\pm$ 0.1 Kg/Cm$^2$ BP= 5 $\pm$ 0.1 Kg/Cm$^2$ Levelling valve lever should be in horizontal position. | | | | |
| 2. | **Leak detection:** Check for any leakage in entire system. Any leakage found in FIBA device or pipe lines should be attended. | No leakage | | | | |
| 3. | **Functional Test :** Charge the air springs on tare condition of the coach and BP at 5.0 Kg/Cm$^2$. Open the ½" drain cock of 40L auxiliary reservoir of one side air spring in ICF coaches. In LHB coaches, air to be vented by detaching installation lever from levling valve by opening nut. | i) FIBA device of relevant bogie should actuate. ii) Brakes should apply in entire coach. iii) Both indicators of same bogie should be red. Indicators of other bogie should show green. iv) Whistling/ Hissing sound should blow. | | | | |
| 4. | **Brake Pipe Isolation** Close the isolating cock of BP line of actuated FIBA device. | Brake should release in entire coach **Note-Indicators of some make FIBA device may turn to green.** | | | | |
| 5. | **Suppression of Indicator:** Close the both isolating cocks with vent feature and pull the resetting keys if provided on FIBA device. | Both indicators of same bogie should turn to green from red. Indicators of other bogie should remain green. | | | | |
| 6. | After functional testing, all air springs & FIBA device of coach shall be set for their desired function & not in isolated condition. | To be ensured | | | | |

*** Air will be drained from different air spring of a coach during each functionality test so that in 4 functionality testof FIBA device of a coach, all the 4 air springs of the coach are covered.**

# Important points for Air spring maintenance

**Schedule- D2**

- All activities of D-1
- Clean Dirt collector filter with kerosene & refit
- Detailed investigation for variation in Air spring installation height : 289-294 mm to be done.
- Check for the proper gap and sequence of fitment of fasteners

# Important points for Air spring maintenance

**Schedule- D3**

- All activities of D-1 & D-2
- Removing mud/oil deposit on air spring,FIBA
- Bottom exhaust air filter of levelling valve to be cleaned with kerosene
- Any wrong fitment, backlash error or malfunctioning of levelling valve to be rectified.
- Leakage  using soap solution.
- Functional check of FIBA as per Annexure-A

# Important points for Air spring maintenance

**Schedule- SS1**

- All activities of D-3
- Draining of 60L reservoir
- Inspect for any water collection in rubber bellow
- Air spring fixing holes to be inspected for any elongation
- All valves /cocks/nrv/dirt collector to be cleaned & tested for functioning in bogie & coach
- After dismounting leak test of air spring to be done on test bench or similar leak test on bogie with 6kg/cm2 to be done
- Schedule maintenance of FIBA device & indicators
- Leakage  using soap solution.
- Functional check of FIBA as per Annexure-B
- Provision of additional dirt collector

# Annexure-B

**ANNEXURE-B**

**ON VEHICLE TEST FORMAT FOR FIBA DEVICE:**

Depot/Div/Rly/PU.....Date of testing.....Coach no.....POH/mfg. Details (Coach) ..... Return date.....Year Built.....

| S. No. | Test and testing procedure | Standard | Results obtained | | | |
|---|---|---|---|---|---|---|
| | | | Bogie no..... S. No. of FIBA device:Make: Mfg. date : | | Bogie no..... S. No. of FIBA device:Make: Mfg. date: | |
| | | | Air spring -1 | Air spring -3 | Air spring -2 | Air spring -4 |
| 1. | **Initial Charging:**<br>i) Charge the FP at 6.0 Kg/Cm$^2$ and BP at 5.0 Kg/Cm$^2$.<br>ii) Ensure the charging of air springs with the help of levelling valve lever position. | FP= 6 ± 0.1 Kg/Cm$^2$<br>BP= 5 ± 0.1 Kg/Cm$^2$<br>Levelling valve lever should be in horizontal position. | | | | |
| 2. | **Leak detection:**<br>Close the air supply & check for any leakage in entire system for 15 minutes. Any leakage found in FIBA device or pipe lines should be attended. | Leakage should not be more than 1% | | | | |
| 3. | **Functional Test :**<br>Charge the air springs on tare condition of the coach and BP at 5.0 Kg/Cm$^2$. Open the ½" drain cock of 40L auxiliary reservoir of one side air spring in ICF coaches. In LHB coaches, air to be vented by detaching installation lever from levlling valve by opening nut. | i) FIBA device of relevant bogie should actuate.<br>ii) Brakes should apply in entire coach.<br>iii) Both indicators of same bogie should be red. Indicators of other bogie should show green.<br>iv) Whistling/ Hissing sound should blow. | | | | |
| 4. | **Brake Pipe Isolation**<br>Close the isolating cock of BP line of actuated FIBA device. | Brake should release in entire coach | | | | |
| 5. | **Suppression of Indicator:**<br>Close the both isolating cocks with vent feature and pull the resetting keys if provided on FIBA device. | Both indicators of same bogie should turn to green from red. Indicators of other bogie should remain green. | | | | |
| 6. | **Brake Pipe Variation Test:**<br>Drop Brake Pipe pressure from 5.0 Kg/Cm$^2$ to zero. | i) FIBA device should not actuate.<br>ii) Brakes should apply.<br>iii) No FIBA indicator should turn to red.<br>iv) No whistling/Hissing sound. | | | | |
| 7. | Repetition of test for testing of FIBA devices for remaining 03 Air springs of the coach. | Repeat the above procedures for testing of remaining 03 Air springs accordingly and note down the reading in relevant column. | | | | |
| 8. | After functional testing, all air springs & FIBA device of coach shall be set for their desired function & not in isolated condition. | To be ensured | | | | |

# Important points for Air spring maintenance

**Schedule- SS2**

- All activities of SS1
- Remove IC Cocks,NRV,DC,reservoir,drain cocks,Levelling valve,DCV & FIBA for carrying out external cleaning,overhauling & function test
- IC with ferrule type fittings to be tested