AIR SPRING

- **Suspension System in Railway:**

  The system that connect a coach to its Wheels and allows relative motion between them.

- **Function of suspension system:**

  i. Maximizing the contact between the wheel & rail.

  ii. Providing steering stability & supporting the weight of the vehicle.

  iii. Ensuring the comport of passenger by absorbing and damping.

Types of suspension system use in IR.-

There are two types of suspension system use in Railway:-

1. Single Stage suspension system.

2. Two stage suspension system

- **Single stage-**

  i) Comport is not the primary criteria

  ii) High carrying capacity compared to tare weight.

  III) Moderate speed are required.

- Twin Stage:

  i) Comport level is an important consideration.

  ii) Pay load is low as compared to tare weight.

  iii) Moderate high speed is required

OBJECTIVE OF AIR SPRING

a) Air spring is a rubber bellow containing pressurized compressed air with an emergency rubber spring

b) It provide various suspension characteristics to maintain a constant Buffer height irrespective of the loaded condition**.**

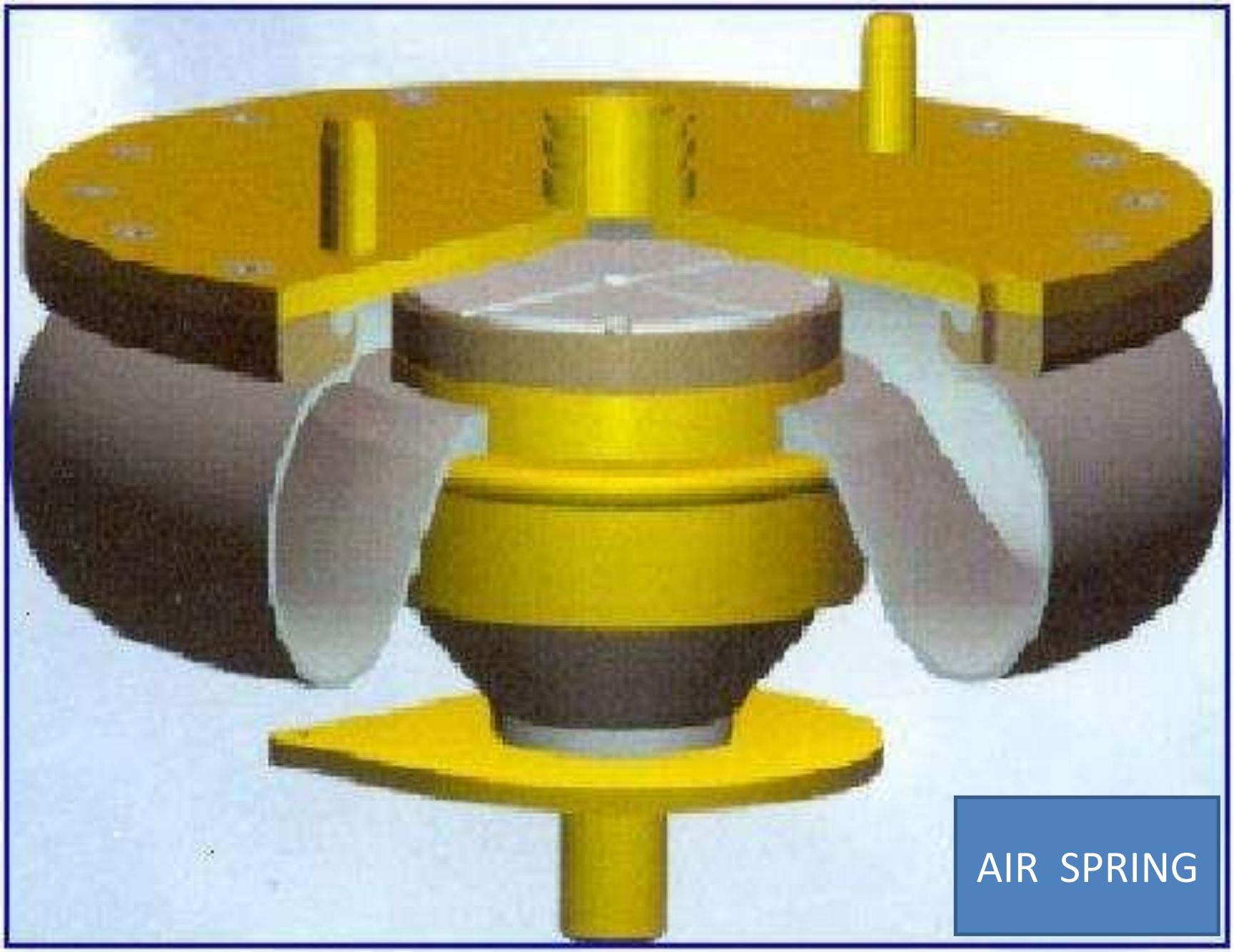
c) In suburban trains like DEMU,EMU the number of passengers entraining (Super Dense Crush Load) in to the coach cannot be controlled and hence the payload of the coach increases from 18 tons to 34 tons.

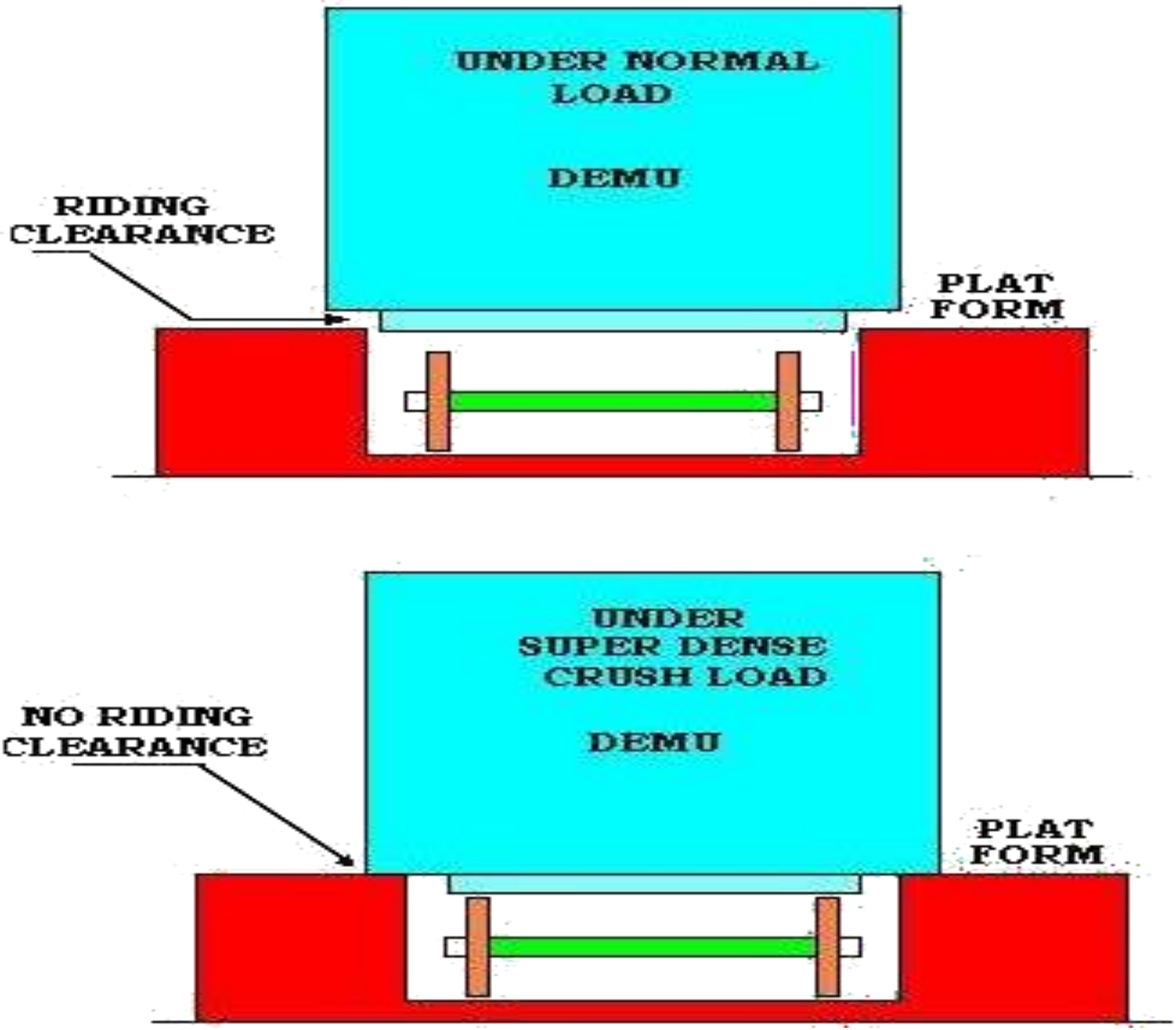
Objective of Air Spring

d) This abnormal increase of payload reduces the Riding Clearances between the Coaches and Wayside platforms and also reduces buffer height resulting in hitting of coach on the platforms.

e) Due to the Super Dense Crush Load the bolster springs become solid, which in turn damages / breaks the Coil springs resulting in discomfort to the passengers.

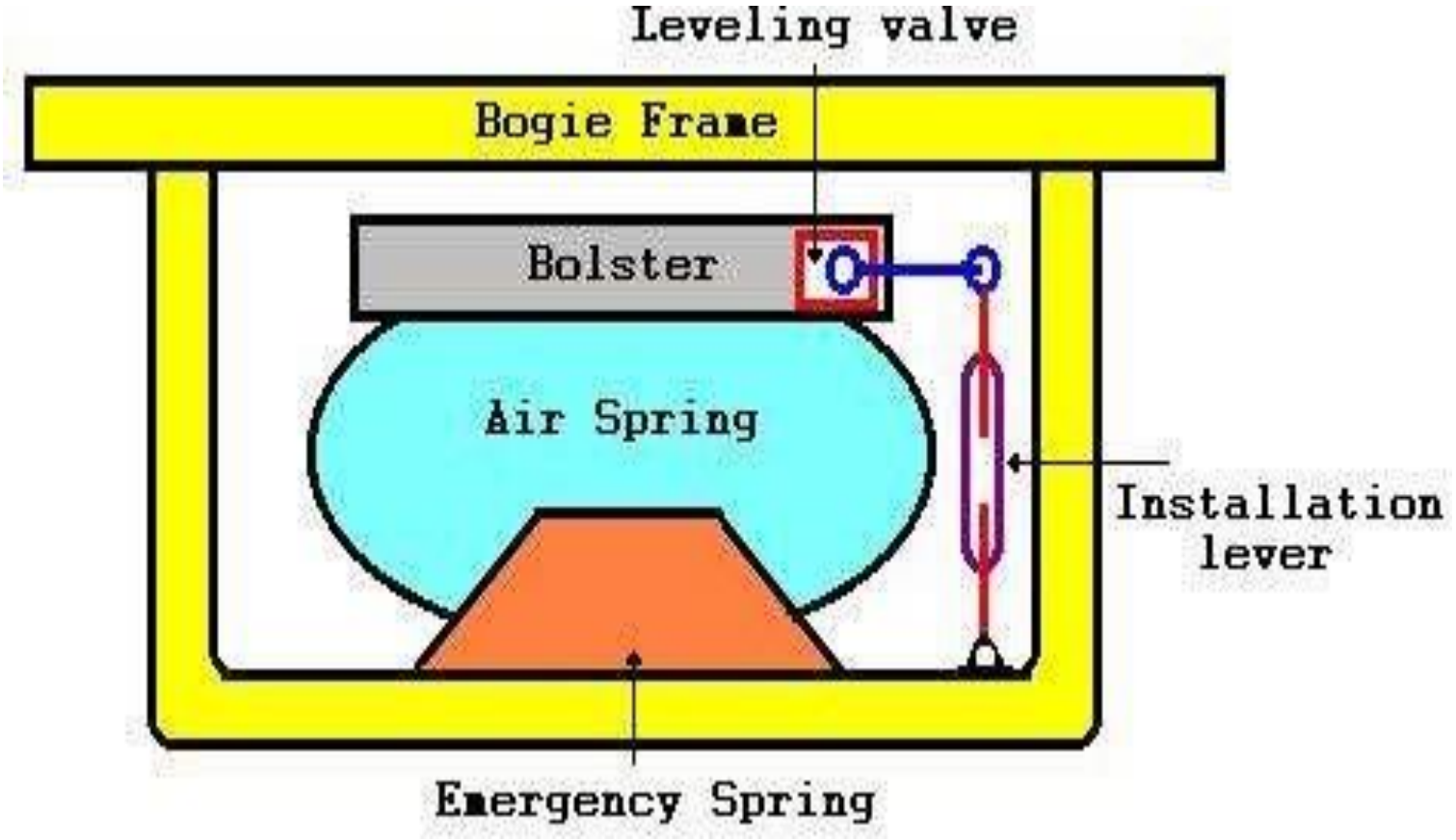
f) To overcome the above problems an Air Suspension (Air spring) is introduced in the secondary suspension to maintain a constant buffer height irrespective of loaded conditions by varying the pressure of air inside the air spring.


AIR SPRING


UNDER NORMAL
LOAD
DEMU
RIDING
CLEARANCE
PLAT
FORM
UNDER
SUPER DENSE
CRUSH LOAD
DEMU
NO RIDING
CLEARANCE
PLAT
FORM

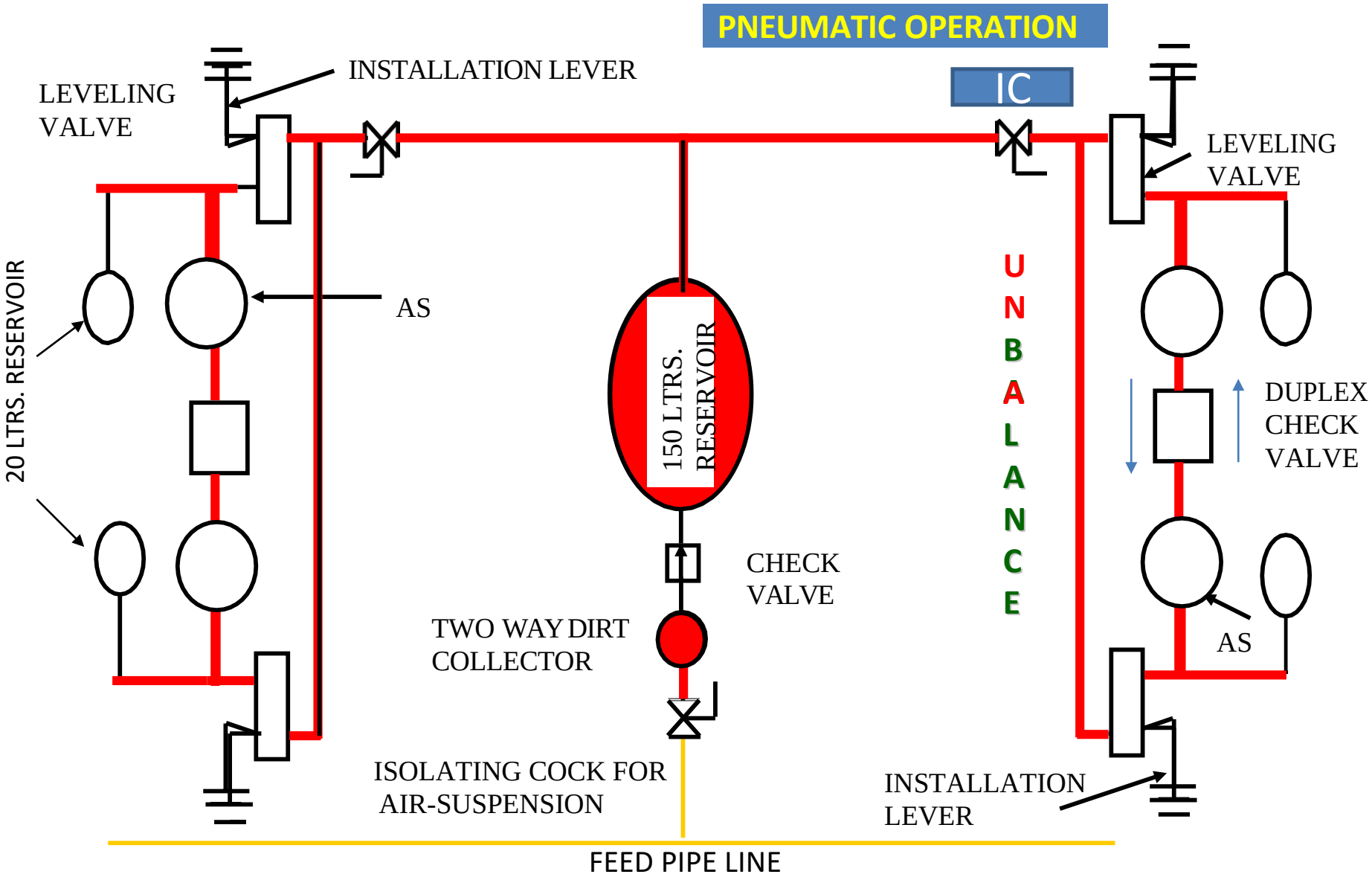
Components of Air Suspension:

a) Air spring
b) Emergency spring
c) Leveling valve
d) Installation lever with adjusting Screw rod
e) Duplex check valve
f) Main Air Reservoir
g) Auxiliary Reservoir
h) Isolating cock

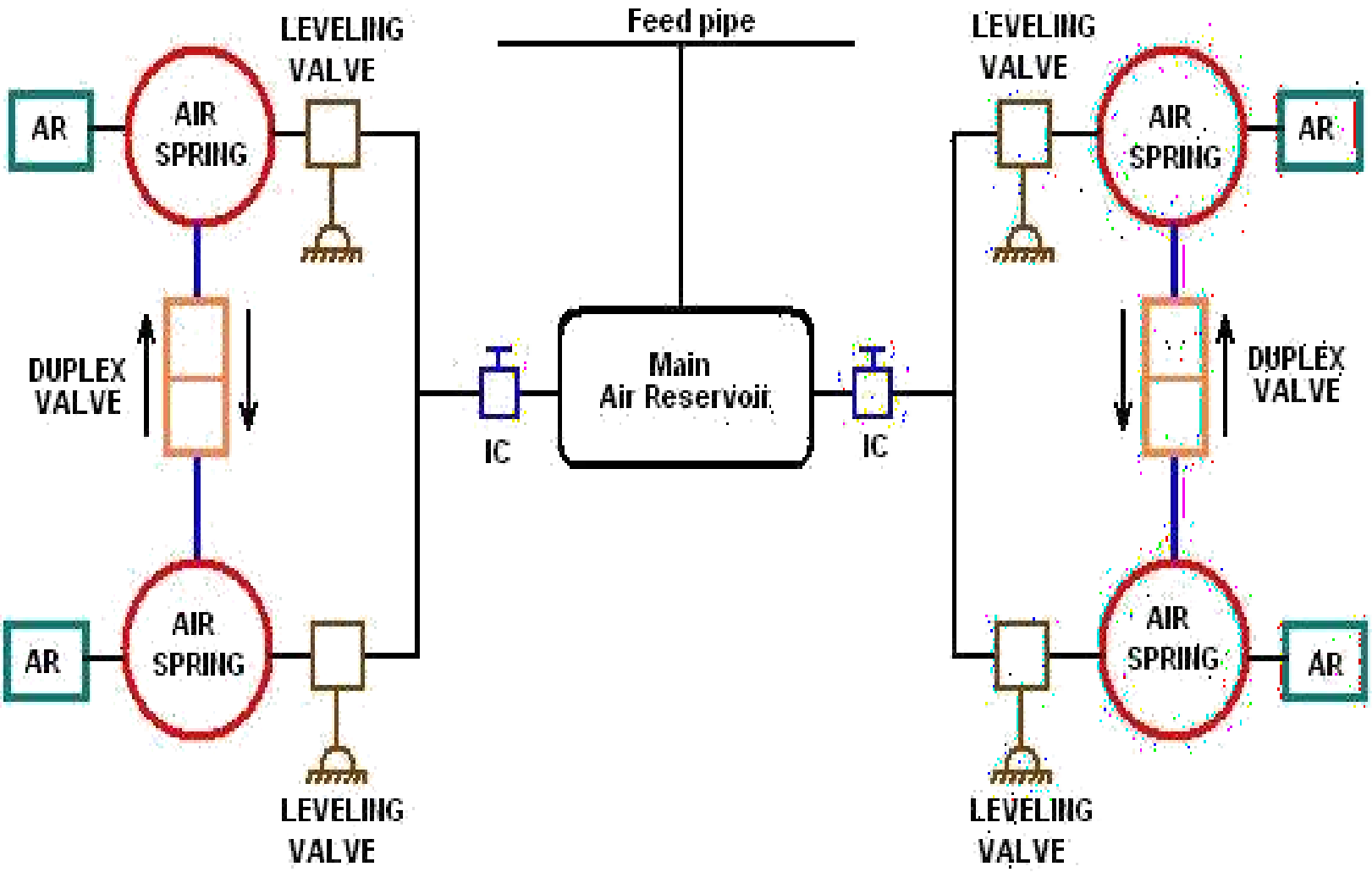


SCHEMATIC DIAGRAM FOR 4-POINT AIR-SUSPENSION

In this system the each bellow is controlled by individual leveling valve. So, there are four leveling valve & Installation lever, four bellow and two duplex check valves in each coach.



LINE DIAGRAM OF AIR-SUSPENSION



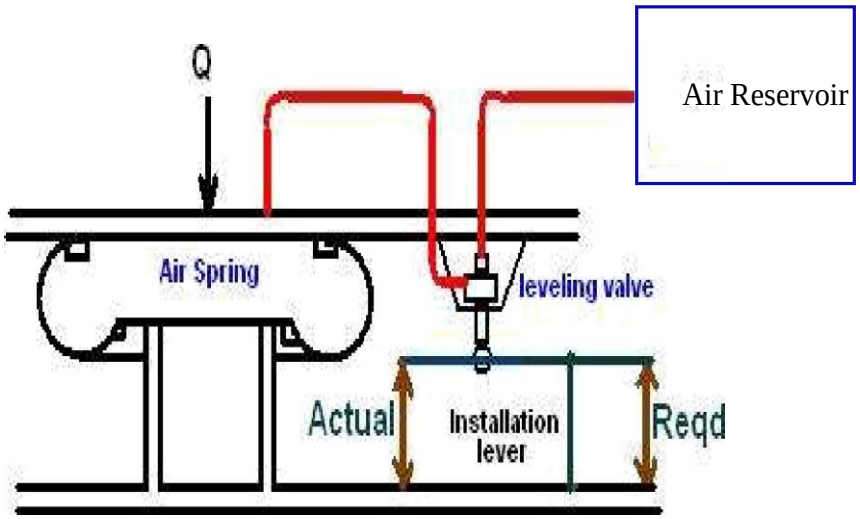
LEVELLING VALVE:

a) The levelling valve is fitted in Top of bogie bolster and is designed to move up and down along with bolster.

b) Under normal condition, it is designed to take **LAP** position when the actual buffer height is equal to the required buffer height.

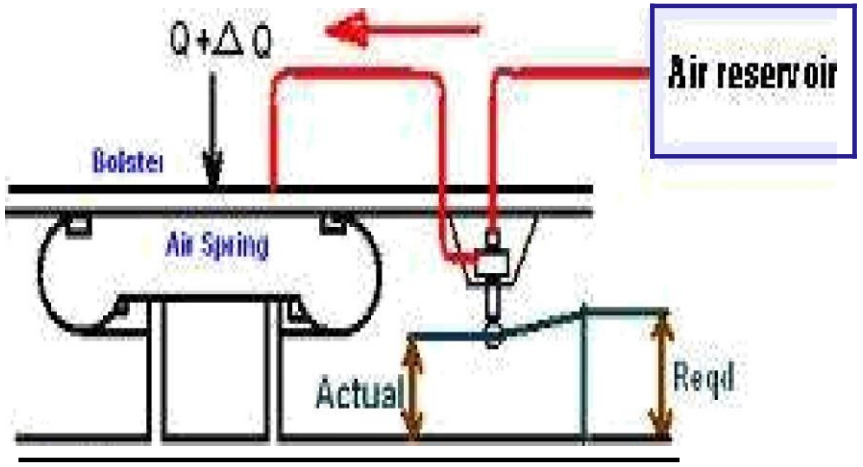
c) Levelling valve is to connect the main reservoir with the air spring to admit more air in to the Air spring, due to abnormal increase in the Pay load (Super Dense Crush load).

d) It also connects the air springs with exhaust to release the excess air from air spring, due to reduction in the Pay load after detraining of passengers from the coach.

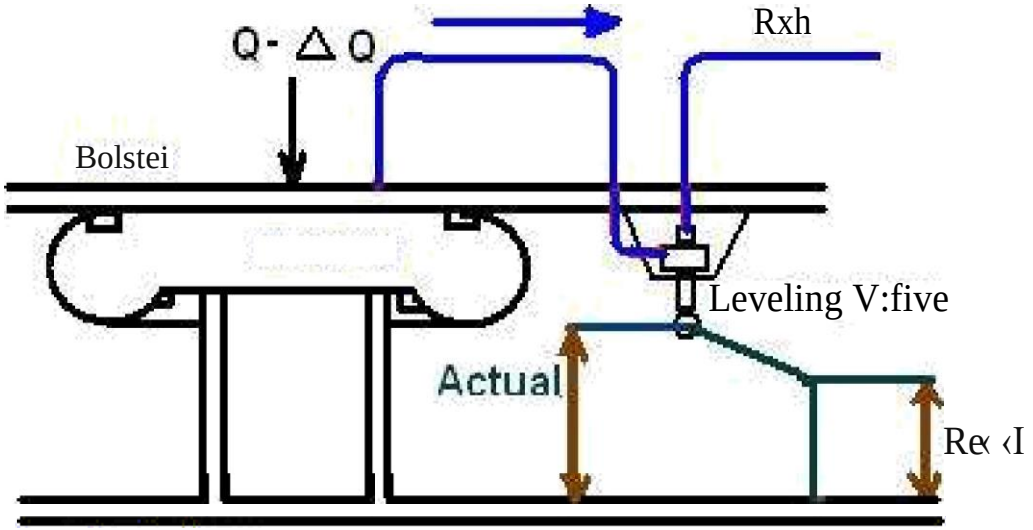


EQUALISATl0N

b- normalL‹



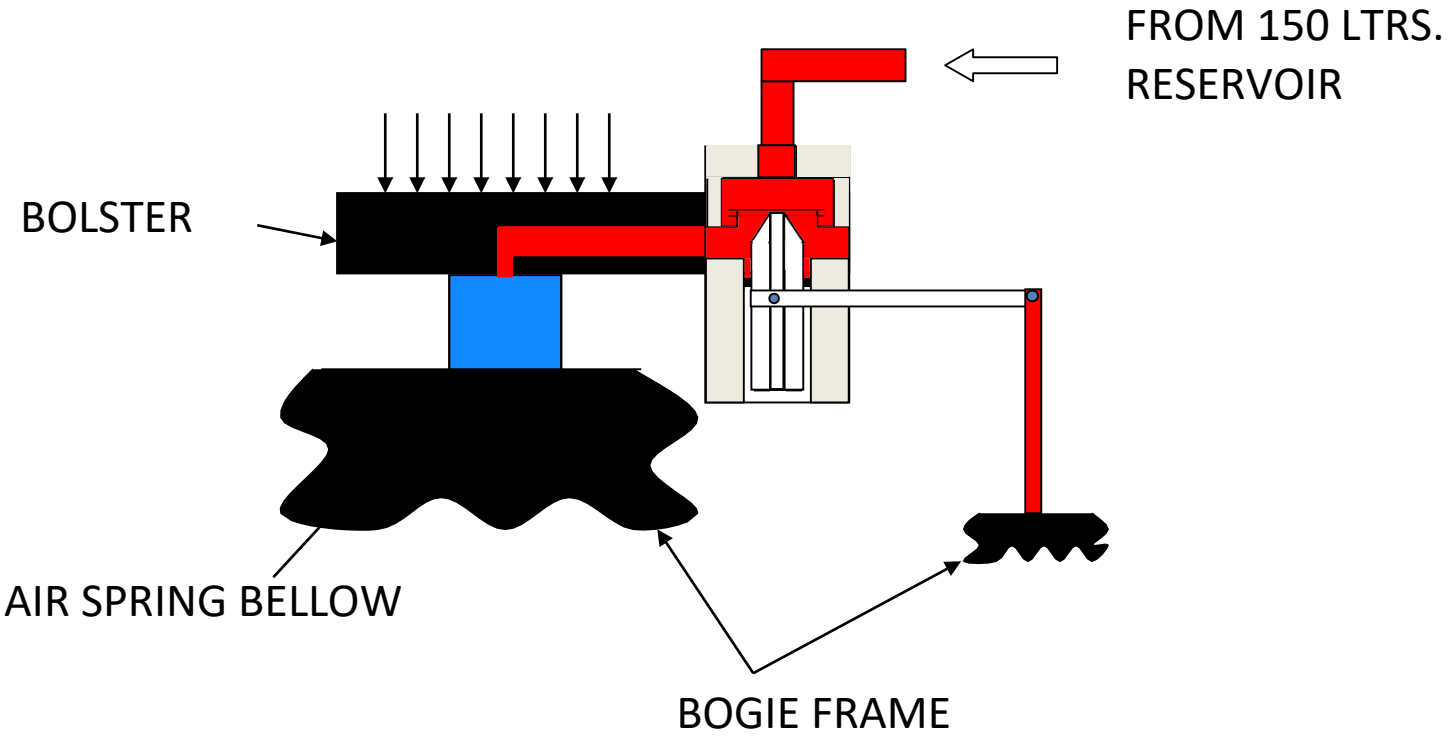
**** LOADING 19-s90,



UN-LOADING gO-SDCL

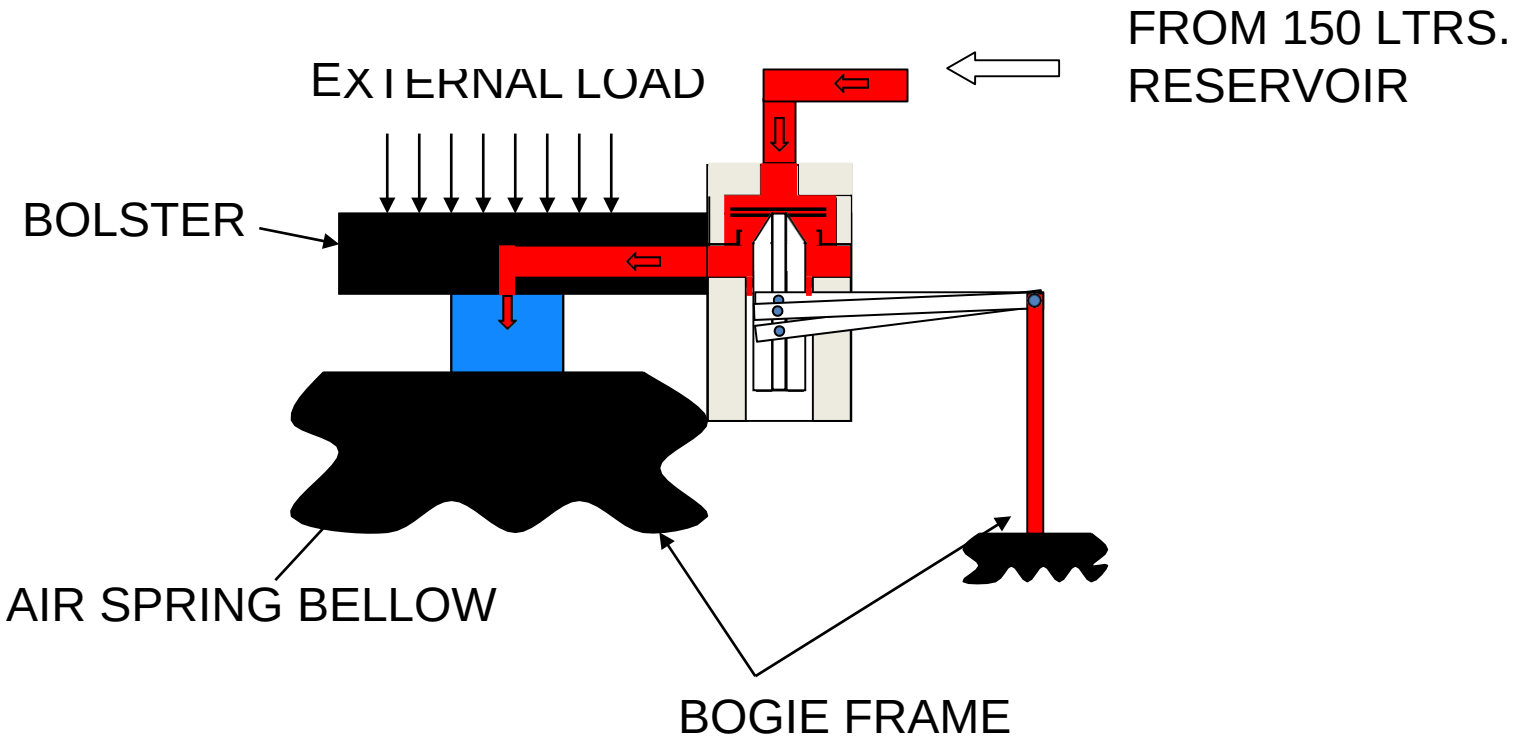
DETAILS WORKING OF LEVELING VALVE

NORMAL CONDITION



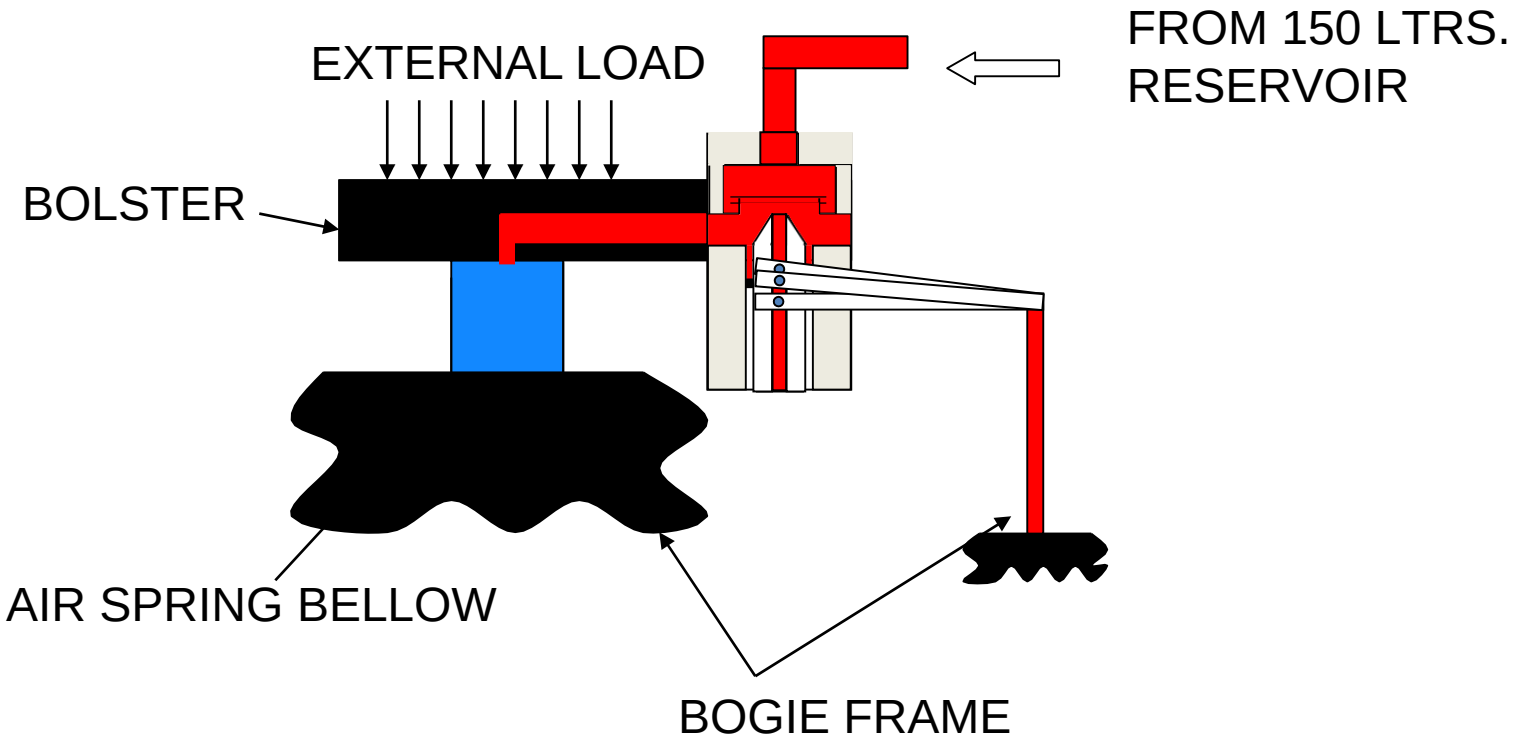
DETAILS WORKING OF LEVELING VALVE

CHARGING CONDITION



DETAILS WORKING OF LEVELING VALVE

DISCHARGING CONDITION



INSTALLATION LEVER:

It is fitted in between the leveling valve and bottom of the bogie frame.

The function of installation lever is to operate the leveling valve automatically by moving the handle of the leveling valve up and down according to the condition of the load.

This up and down movement of IL, leveling valve allows the compressed air in to the Air spring or releases the air from the air spring through leveling valve in proportion to the pay load of the coach.

DUPLEX VALVE:

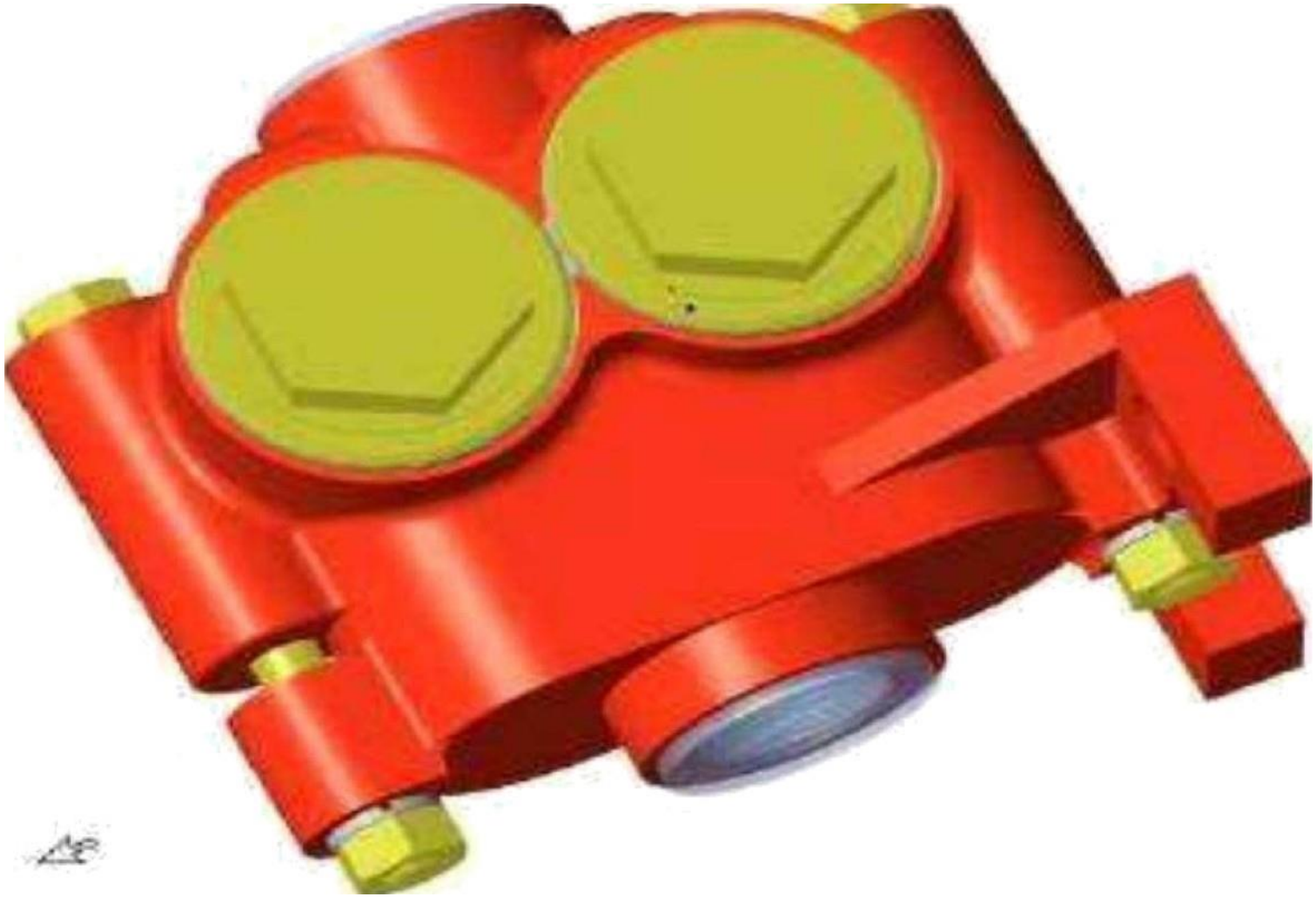
- It is a double check valve provided between the two Air springs of the same bogie.
- It operates with a Pressure differential of 1.5 bar.

- It comprises of two check valves side by side, arranged so that air can flow in either direction whenever the air pressure differential exceeds the pre-set value of 1.5 bar.
- Whenever a burst of air spring occurs on one side, this valve will ensure that no severe tilt or twist occurs during movement of the coach.

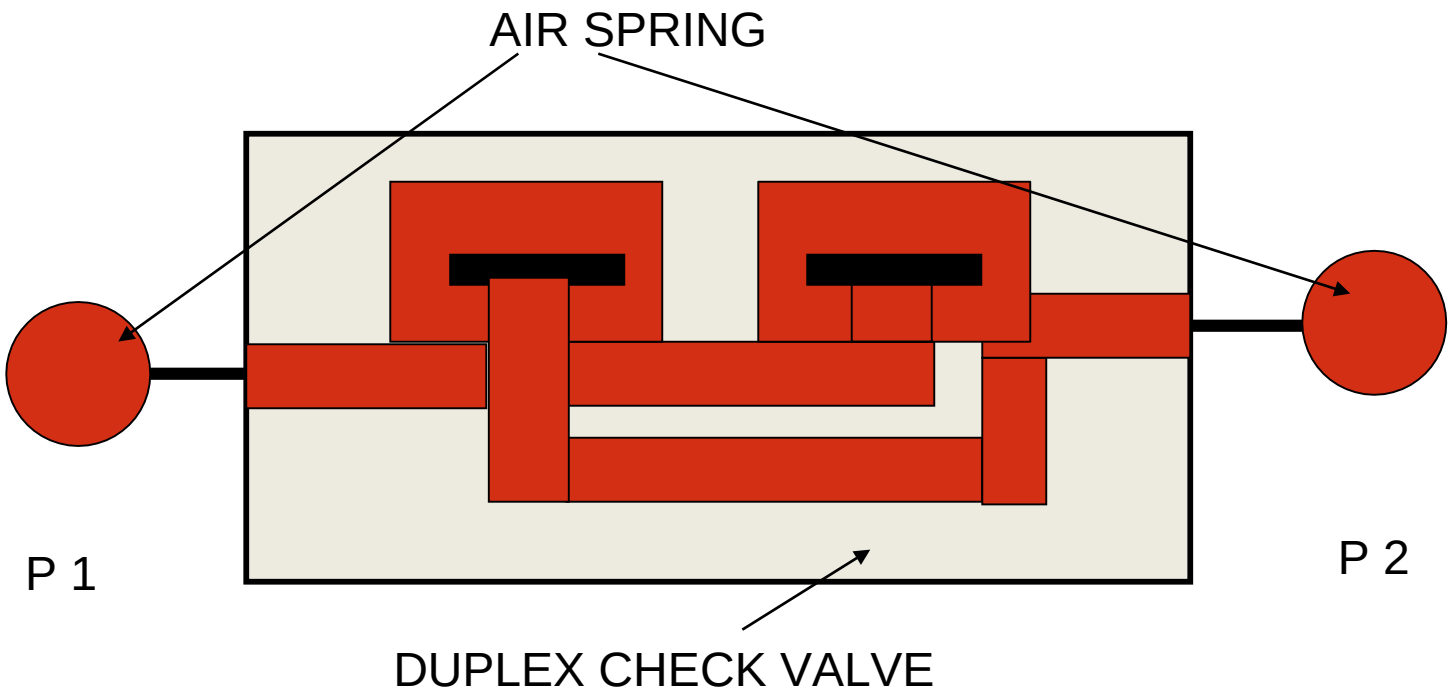
- Both the check valves of Duplex valve remains closed, if the pressure between the two springs is within 1.5 bars.

- In case of burst of Air Spring, the air leaks to atmosphere. Due to high-pressure differential, the Duplex check valve releases the air from the intact air spring through burst air spring. Thus complete coach will gradually come down and rest on the emergency rubber springs.

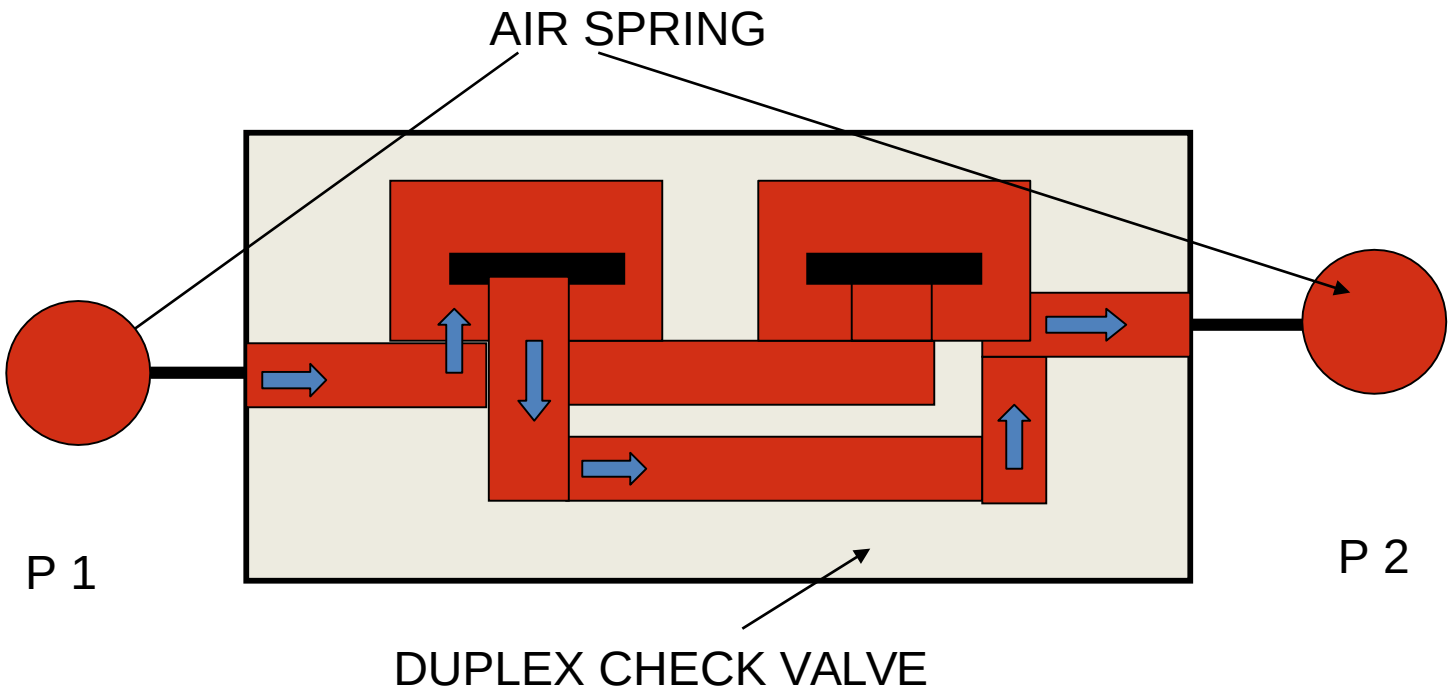
Dupiex Check Vaive



DETAILS OPERATION OF DUPLEX CHECK VALVE

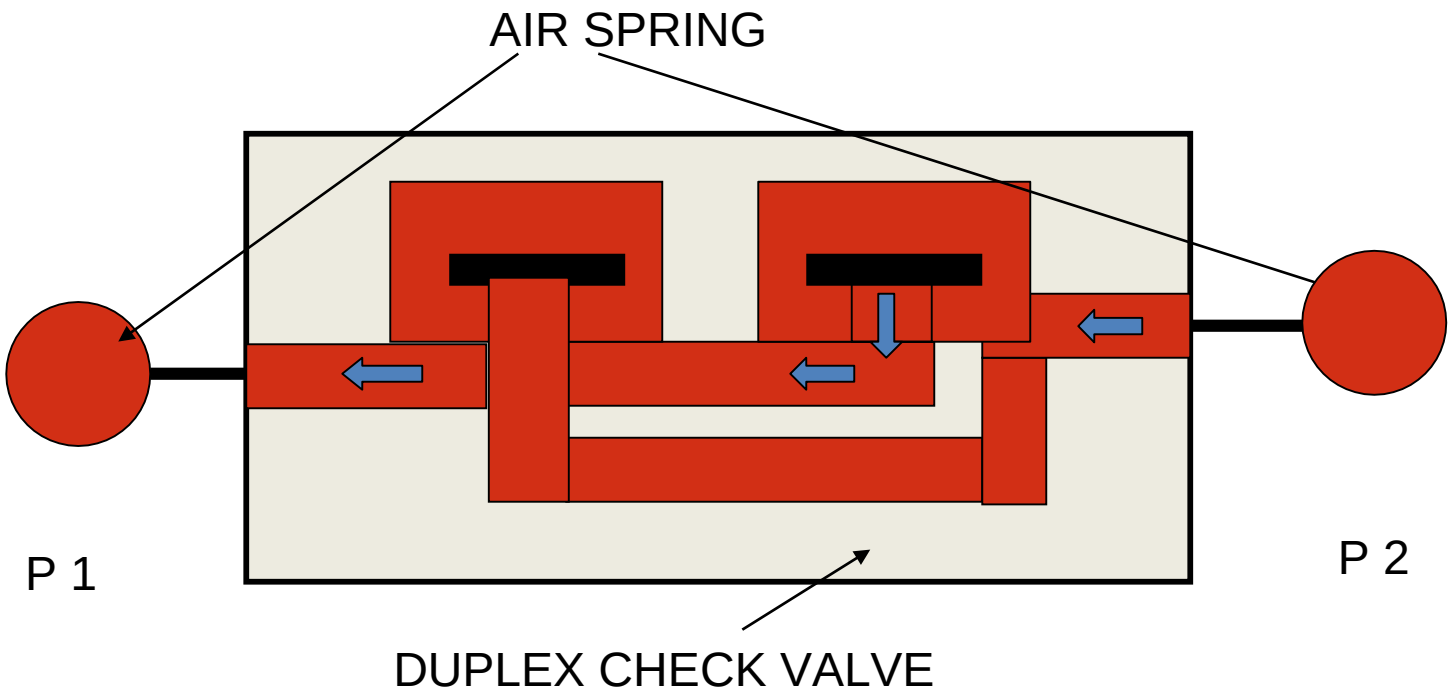


DETAILS OPERATION OF DUPLEX CHECK VALVE



(P 1 – P2) ≥ (1.53) kg/cm^2

DETAILS OPERATION OF DUPLEX CHECK VALVE



(P 2 – P1) ≥ (1.53) kg/cm^2

AUXILIARY RESERVOIR OF AIR SPRING:

- It is fitted with the Air spring. The capacity of this reservoir is 20 /40 Litres.
- There is an orifice kept between air spring and additional reservoir.
- It acts as an Air damper to overcome vertical and lateral oscillations so as to increase the riding comfort

➢ MAIN AIR RESERVOIR:

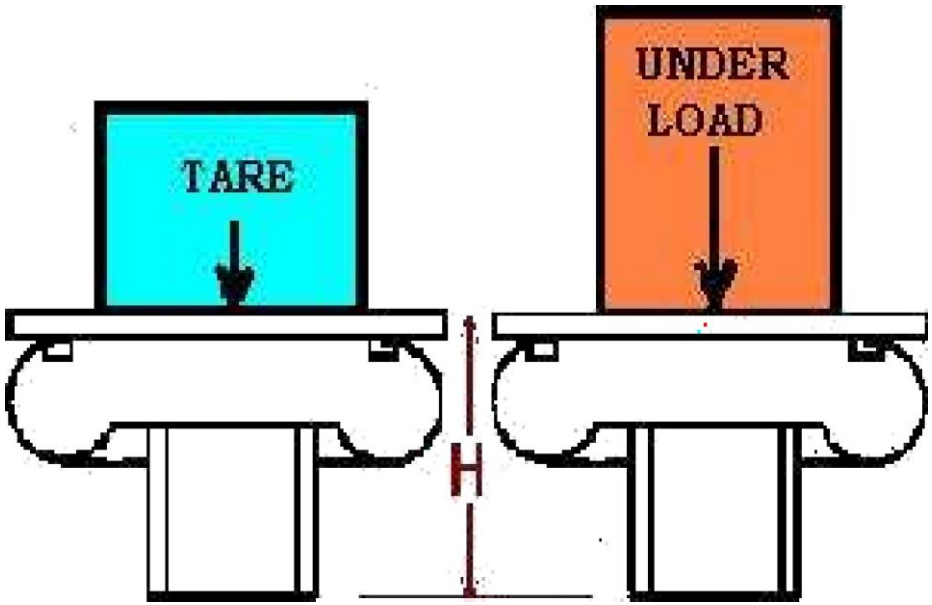
The capacity of the main reservoir is 150 litres and it is exclusively used for feeding the compressed air in to the Air Spring.

➢ EMERGENCY SPRINGS:

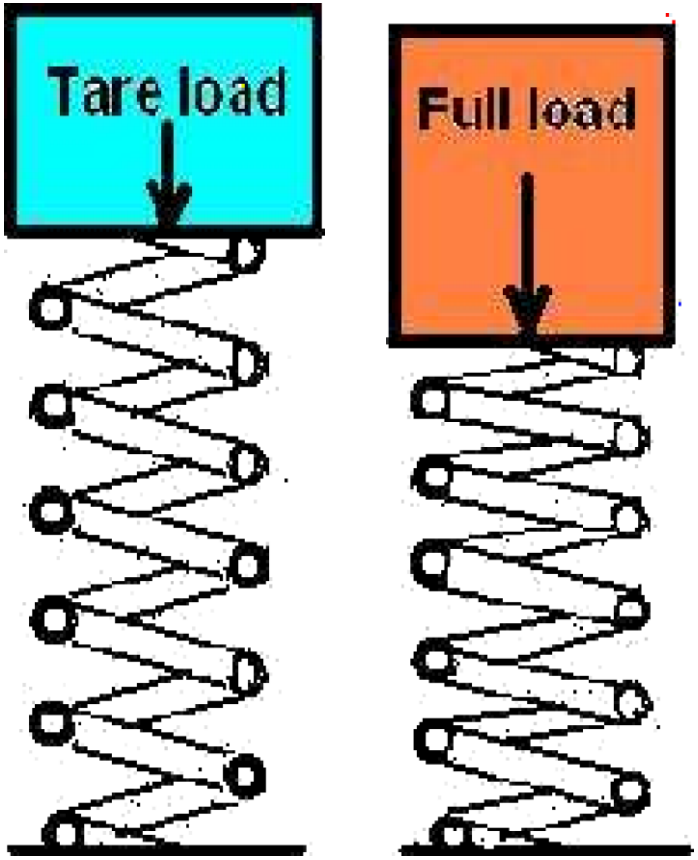
The function of emergency spring is to support the top bolster to prevent tilt of coaches whenever the Air spring burst.

Comparison of Helical coil springs with Air Springs:

- Unlike steel springs, air springs retain their height under changing loads.
- Soft natural characteristics under vertical direction achived by compression of spring.
- In case of coil spring, deflection is proportionate to the load so under high payload using of spring, riding behavior is un satisfactory & reduced speed potential
- Air springs through its control mechanism offer a load proportionate stiffness, constant floor height and better ride behavior with higher speed.



AIR SPRING



HELICAL SPRING

Advantages of Air Suspensions:

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

THANK YOU