

SIEMENS Pneumatic Circuit

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Presentation Out Line

- What is Pneumatic Circuit & Why we need it
- Train Formation & Train Control System
- Air Generation & Pneumatic Circuit
- Braking System
- Pantograph
- COS
- VCB
- Air Suspension System
- Hooter & Wiper System
- Conclusion

Necessity of Air in EMU

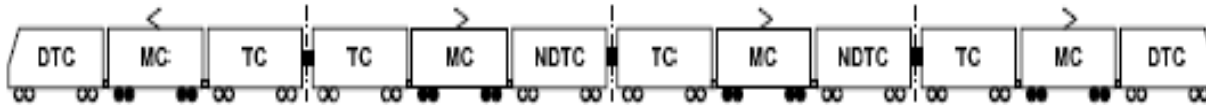
- Braking System
- Pantograph
- VCB & COS
- To release parking brakes
- For air suspension
- For hooter and wiper

Train Formation

Two type of Basic unit : End BU & Middle BU



- 12 car rake comprising of 4 basic units



Each unit is coupled to other unit through:

- Coupler & 08 Inter Vehicle Couplers (A,B,C,D,E,F,G & H)
- Coupling cocks and Flexible hose pipe to connect MR, BP pipes

Train Control System

- Type: 32 bit μ P based Siemens SIBAS 32
- Main Components: CCU, TCU, BECU, SKS, ACU & other accessories
- Connected through MVB lines & Inter Vehicle Jumpers
- Functions: Central control, Traction (Driving) & Break control, Auxiliary control, Monitoring, Protection and Diagnosis
- Operation: Takes I/O & Feed Back \rightarrow Process \rightarrow O/P

Pneumatic System

➤ Consists of

1.Main Air Compressor

2.Auxiliary Compressor

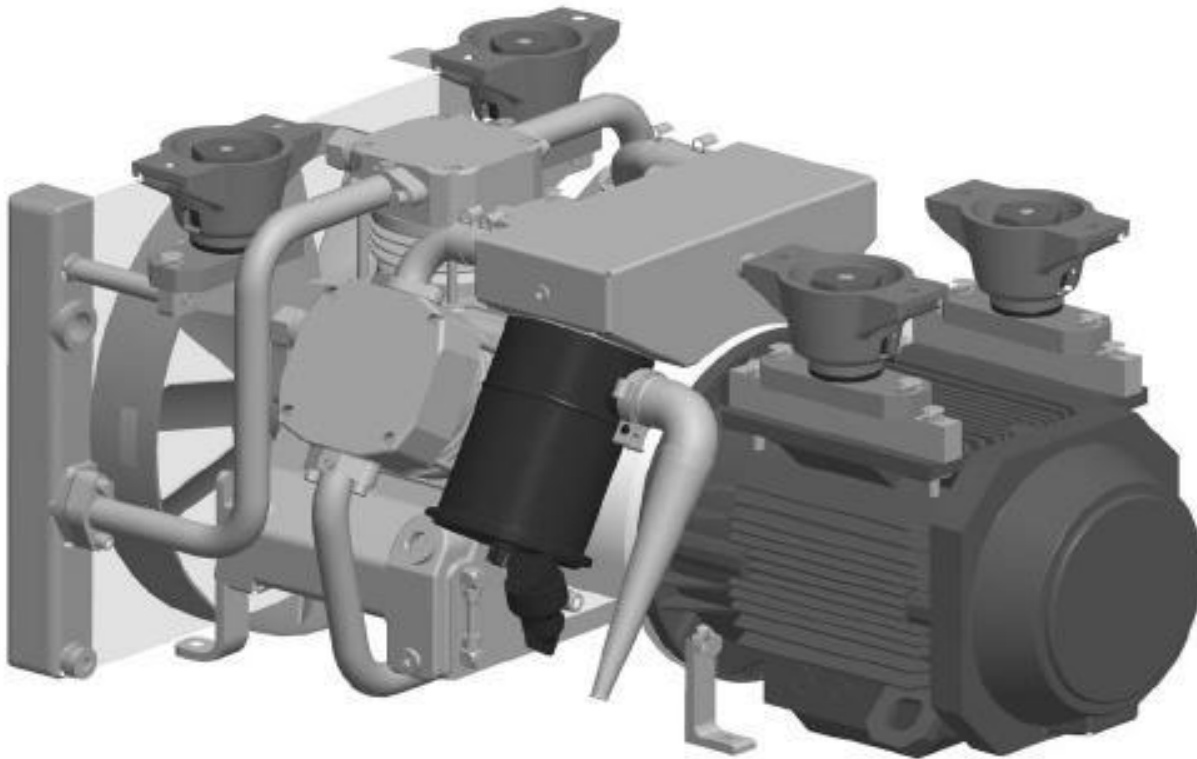
3.Piping arrangement

(Valves, SS pipes, hose pipes, air reservoirs and other fittings)

Pneumatic System

- Air pressure is generated by compressor.
- Air is then stored in two main air reservoirs viz MR & BP.
- Continuity of air pressure is maintained by SS pipes, coupling cocks and flexible hose pipe connections

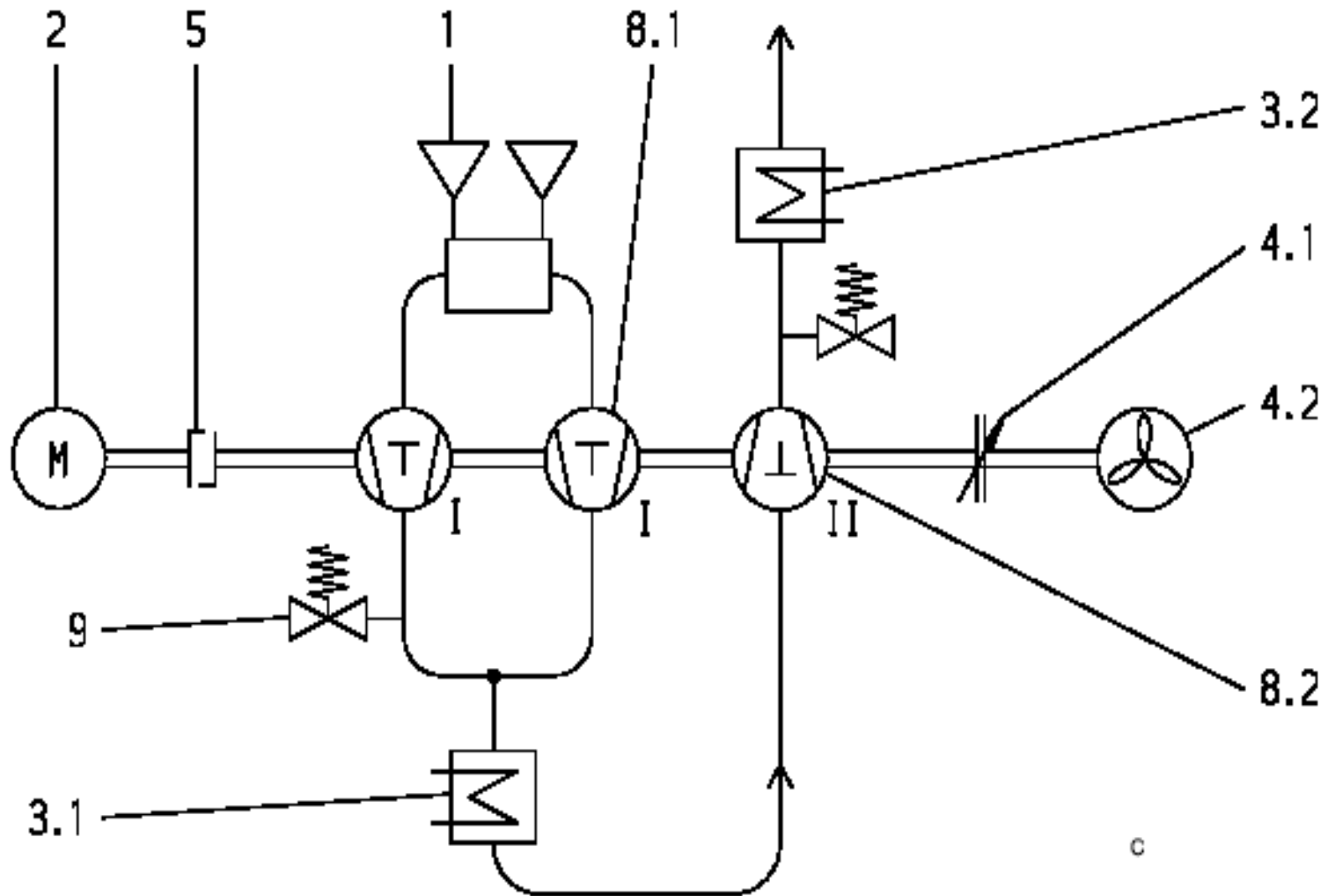
Main Air Compressor



Main Air Compressor

- Located under DTC coach of each basic unit
- Driven by 3 Phase, 415 V Induction Motor
- Controlled by Train Control System using governor cut in and cut out setting 6 ± 0.1 & 7 ± 0.1 kg/cm²

Main Air Compressor



Auxiliary Air Compressor



Auxiliary Air Compressor

- Located inside motor coach in HTC
- Driven by DC motor supplied by 110 V DC
- Controlled by Train Control System using pneumatic governor
- Switched on only when MR pressure is less than 6 kg/ cm²
- Supplies compressed air to own basic unit
 - Raising the pantograph
 - Switching AC circuit breaker
 - Switchover the change over switch

Piping Arrangement & Air Distribution

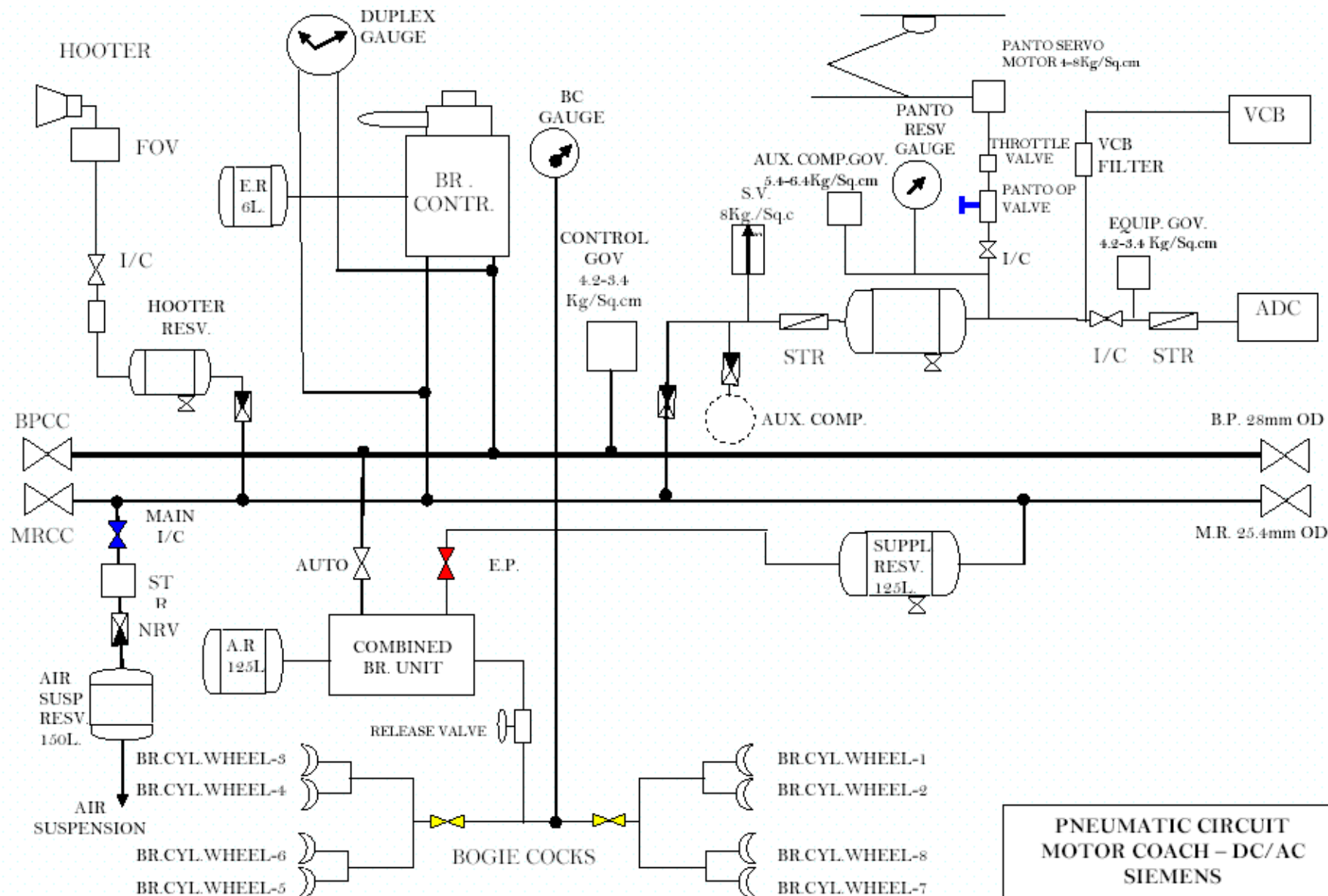
- Two metallic pipelines runs from one end to the other end of EMU to carry & distribute compressed air

1. Main Reservoir Pipeline

- diameter 0.75"
- charged through main compressor at pressure of 6 to 7 bars
- MR pressure to apply EP brake

2. Brake Pressure Pipeline

- diameter 1"
- charged at 4.5 to 5 bars
- BP pressure to apply Auto brake



**PNEUMATIC CIRCUIT
MOTOR COACH – DC/AC
SIEMENS**

Braking System

- Requirement of Brake
 - To reduce the speed
 - To stop train at station or at signal
 - To stop at short duration during any obstruction
 - To reduce speed to observe speed restriction
 - To control speed at down gradient

Braking System

Brake Equipments

- Master Controller
- Brake Controller
- EP Unit
- Brake Rigging

MOTORMAN'S DESK OF AC/DC SIEMENS RAKE

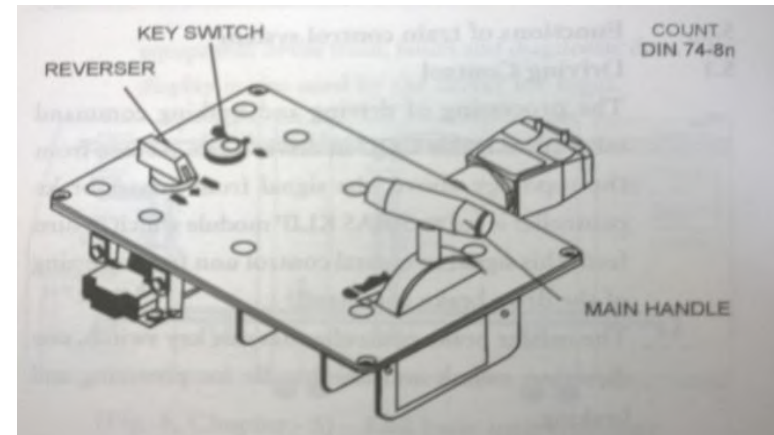


- 1) LEFT HAND SIDE PANEL & SIGNAL LIGHTS**
- 2) MMI WITH EMERGENCY OFF PUSH BUTTON.**
- 3) PRESSURE GAUGE PANEL**
- 4) SPEEDOMETER PANEL**
- 5) PIS PANEL**
- 6) MTRC PANEL**
- 7) PARKING BRAKE GAUGE**
- 8) PNEUMATIC BRAKE CONTROLLER**
- 9) MC SWITCH ON/OFF(VCB/HSCB)**
- 10) NEUTRAL SECTION PUSH BUTTON**
- 11) CRUISE CONTROL**
- 12) PANTO UP/DN SWITCH**
- 13) MASTER CONTROLLER**
- 14) RIGHT HAND SIDE PANEL**

Master Controller

Parts

- Key Switch: On, Zero & RDM
- Direction Switch: Fwd, Zero, Rev
- Dead man Switch:
Dead, Alive, Coasting



Positions

- Traction , Coasting, Brake

Functions:

- acceleration / deceleration

MR PIPE @ 7Kg/cm²

BP PIPE @ 4.7±0.2Kg/cm²

RDK

I/C

I/C

TRIPLE VALVE

A

D

AUXILLARY
RESERVOIR

B

C

@ 1.8 Kg/cm²

ALV

ALV

SV

@ 2 Kg/cm²

HMV

AMV

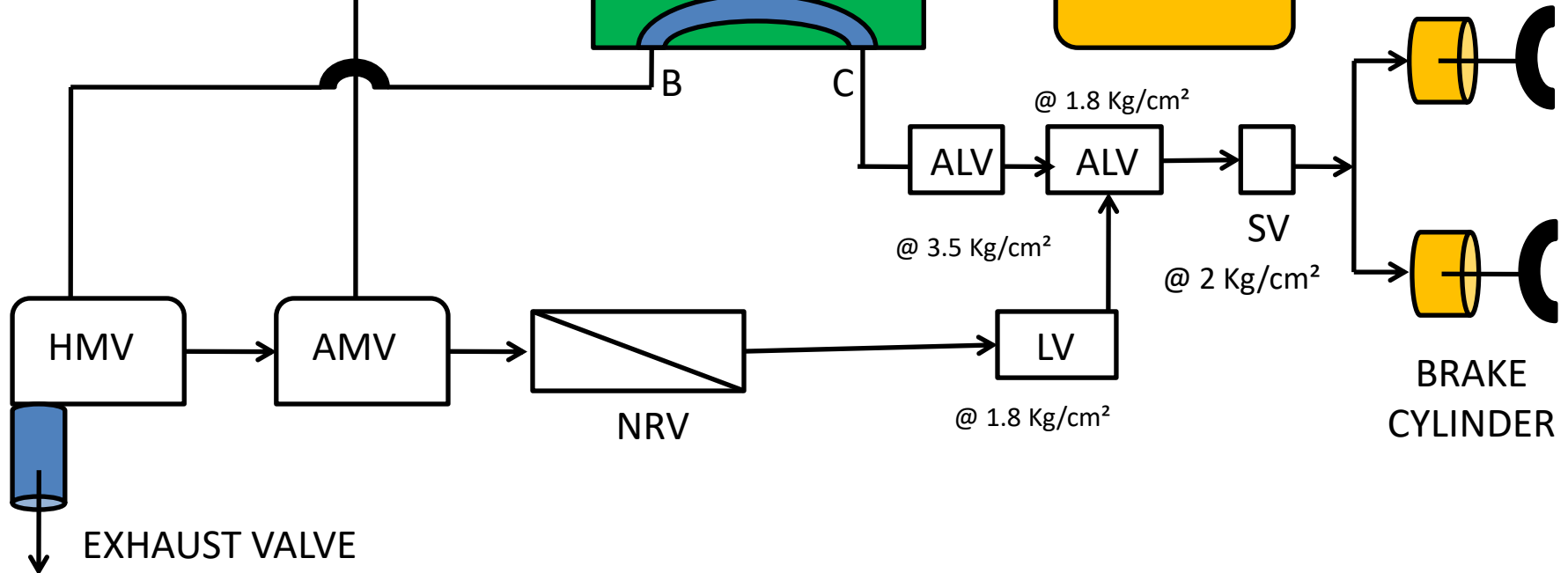
NRV

LV

@ 1.8 Kg/cm²

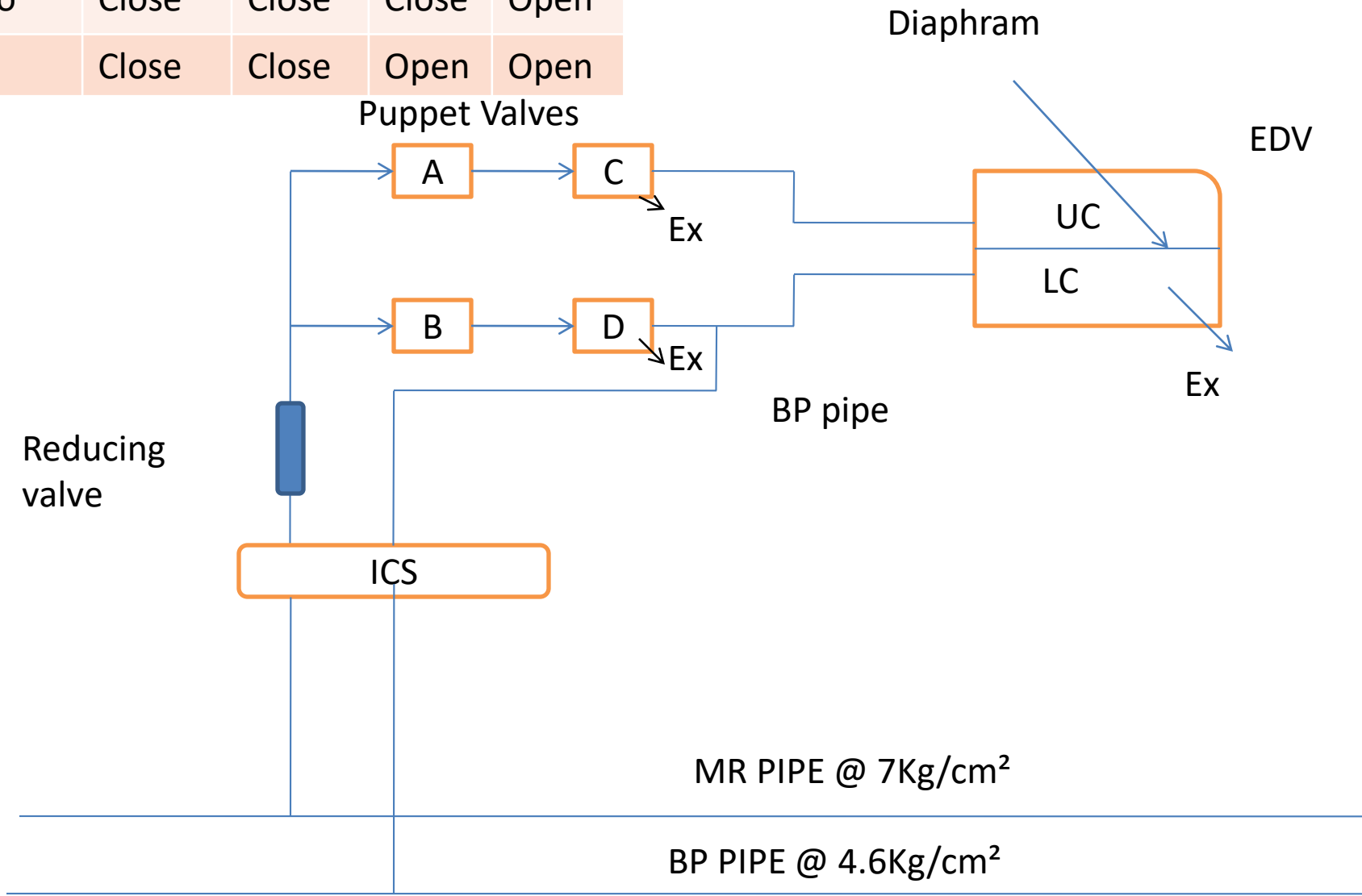
BRAKE
CYLINDER

EXHAUST VALVE



	A	B	C Ex	D Ex
release	Open	Open	Close	Close
auto	Close	Close	Close	Open
EB	Close	Close	Open	Open

Brake controller pappet valve



Brake Controller

Parts

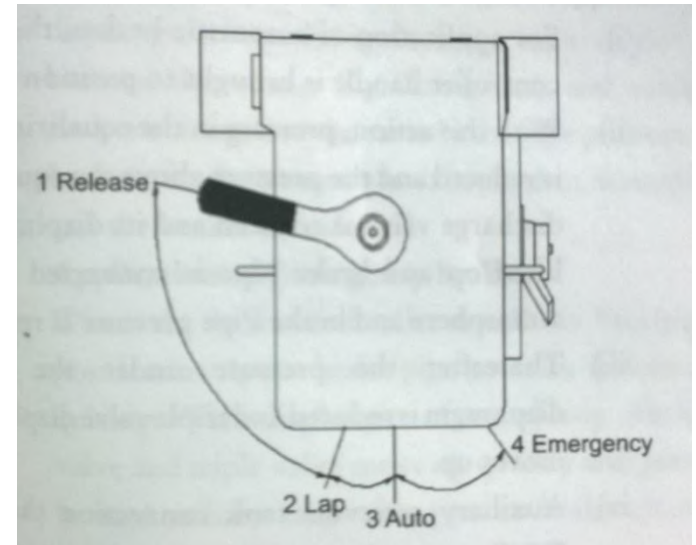
- Reducing valve, pupate valve

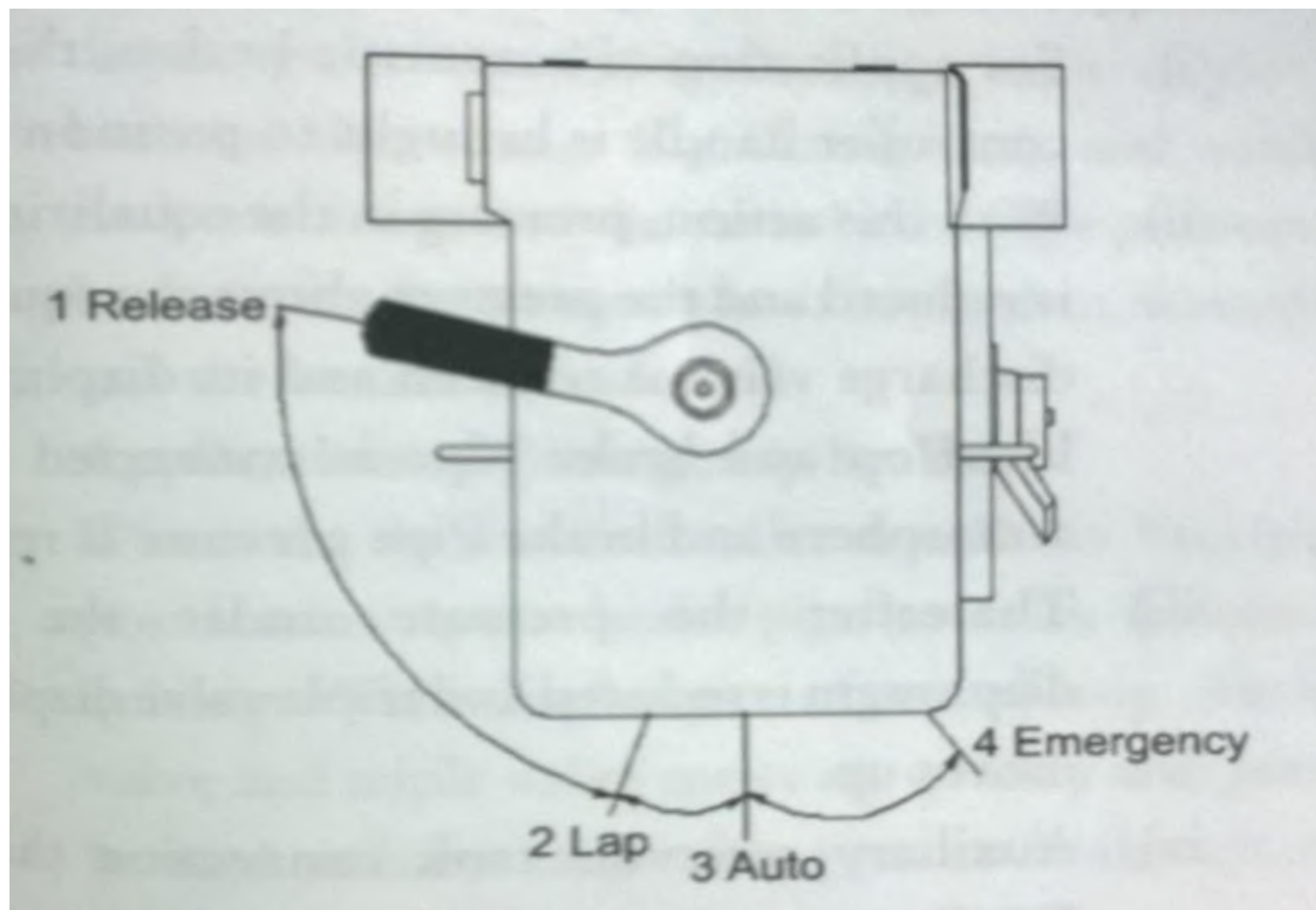
Positions

- Release, EP, LAP, Auto & Emergency

Function

- Braking





Brake Types

- Electro pneumatic Brake
- Auto Brake
- Emergency Brakes (Auto + EP Brake)
- Parking Brakes
- Guard's emergency Brake
- Dead man's handle Brake
- Coasting Brake

Electro Pneumatic Brake

- Activation by Master controller or Brake controller

Electrical Signal Flow

CCU → SKS → BECU / TCU → EP unit (AMV & H MV)

ICS

- Air Flow

MR Pressure → AMV → NRV → Reducing Valve → Additional Reducing Valve → Safety Valve → Brake Cylinder



Auto Brake

- **Activation by Drive brake handle or Brake Controller**

- **Electrical Signal Flow**

Train line MVB → fast exhaust valve (brake pipe) → EP-unit (triple valve) and additional Train line → BECU → EP-unit

- **Air Flow**

Triple Valve Exhaust port open & BP Pressure released & Diaphragm of Triple Valve Raised → Pressure from Auxiliary Reservoir → Triple Valve → Additional Limiting Valve → Safety Valve → Brake Cylinder

Emergency Brake

- **Activation by Master controller / DMH**

Brake pipe (BP) → EP unit (triple valve) and additional

BP pressure switch → Train line → BECU → EP unit (magnetic valves)

- **AIR FLOW →**

Train line → fast exhaust valve (brake pipe) → EP unit (triple

valve) and additional Train line → BECU → EP unit

Guard's Emergency Brake

- **Activation by Guard's emergency brake**
Train line → fast exhaust valve (brake pipe) → EP unit (triple valve) & additional Train line → BECU → EP unit Brake Controller
- **Air Flow**
Triple Valve Exhaust port open & BP Pressure released & Diaphragm of Triple Valve Raised → Pressure from Auxiliary Reservoir → Triple Valve → Additional Limiting Valve → Safety Valve → Brake Cylinder

Parking Brake

- Activation by Push buttons in Driver's /Shunting desk
- Electrical Signal Flow
CCU → SKS → Magnetic valve
- Air Flow
Magnetic Valve → Spring Loaded Cylinder → Brake Cylinder

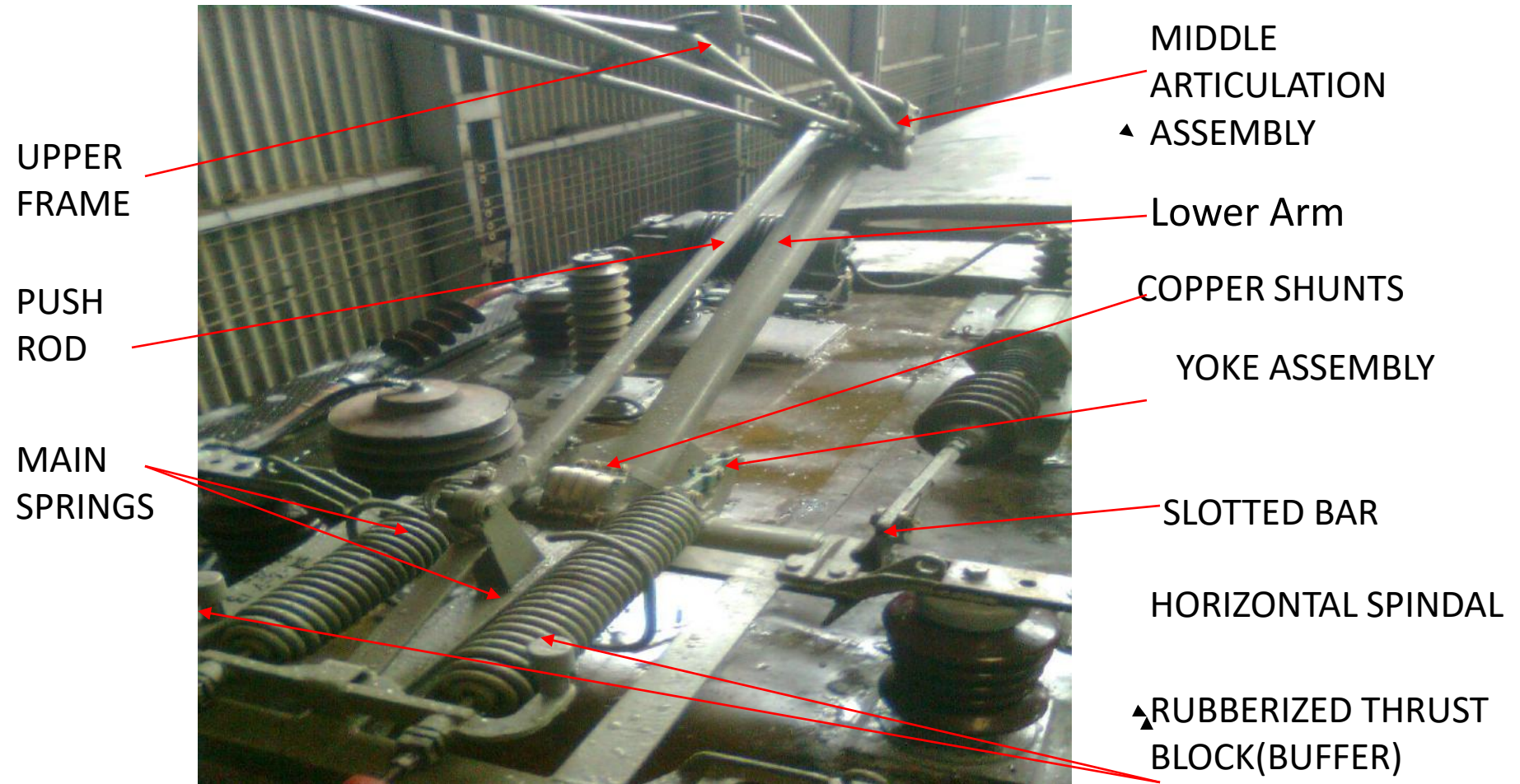
AWS Brake

- Electrical Signal Flow

AWS → Exhaust valve (brake pipe) → EP unit
(Triple valve)

& additional AWS → CCU → BECU → EP unit

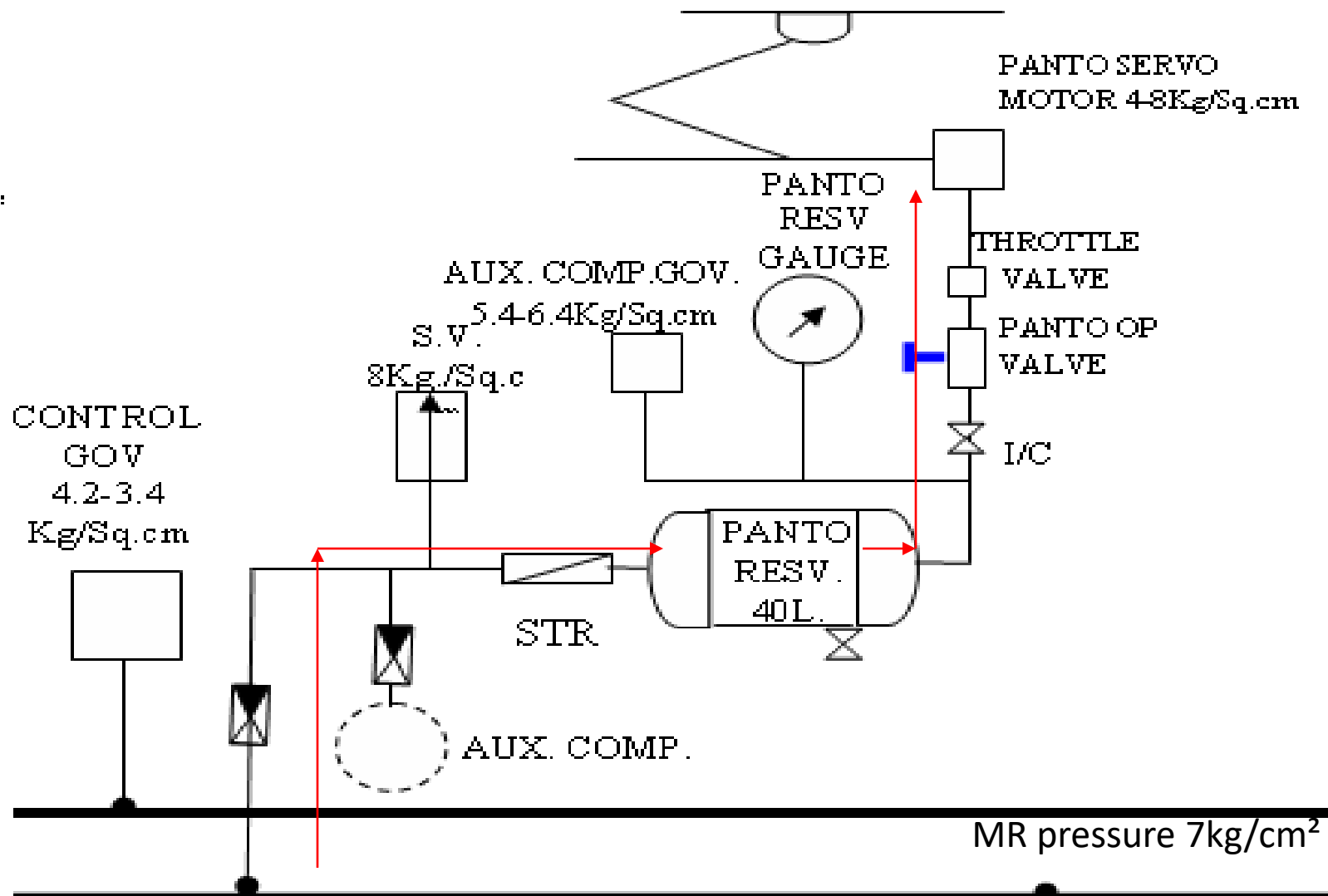
Pantograph



PANTOGRAPH

- Link between the OHE Contact wire and power circuit of EMU.
- The power is collected through collector strip of the pantograph, sliding along a bare contact wire.
- Raising Operation
 1. by Auxiliary Compressor
 2. by MR Pressure

PANTO AIR CIRCUIT





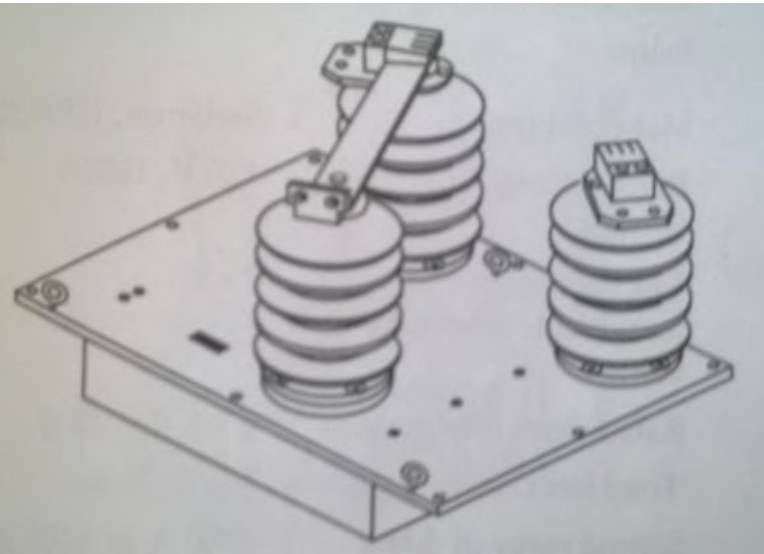
Pantograph

Activation by Panto Up/Down S/W in DTC	Chain of command / actuating elements DTC (Panto up/down switch)→ SKS/TCU/HARD WARE LINE →Contactor 21 K 03 →Panto Up/down coil of Panto Magnet Valve
Air Flow →Press Reqd-5.2 Kg/cm²	MR(more than 5.3Kg/cm ²) →Panto Reservoir →Panto Magnet Valve → Air Servo Motor

COS

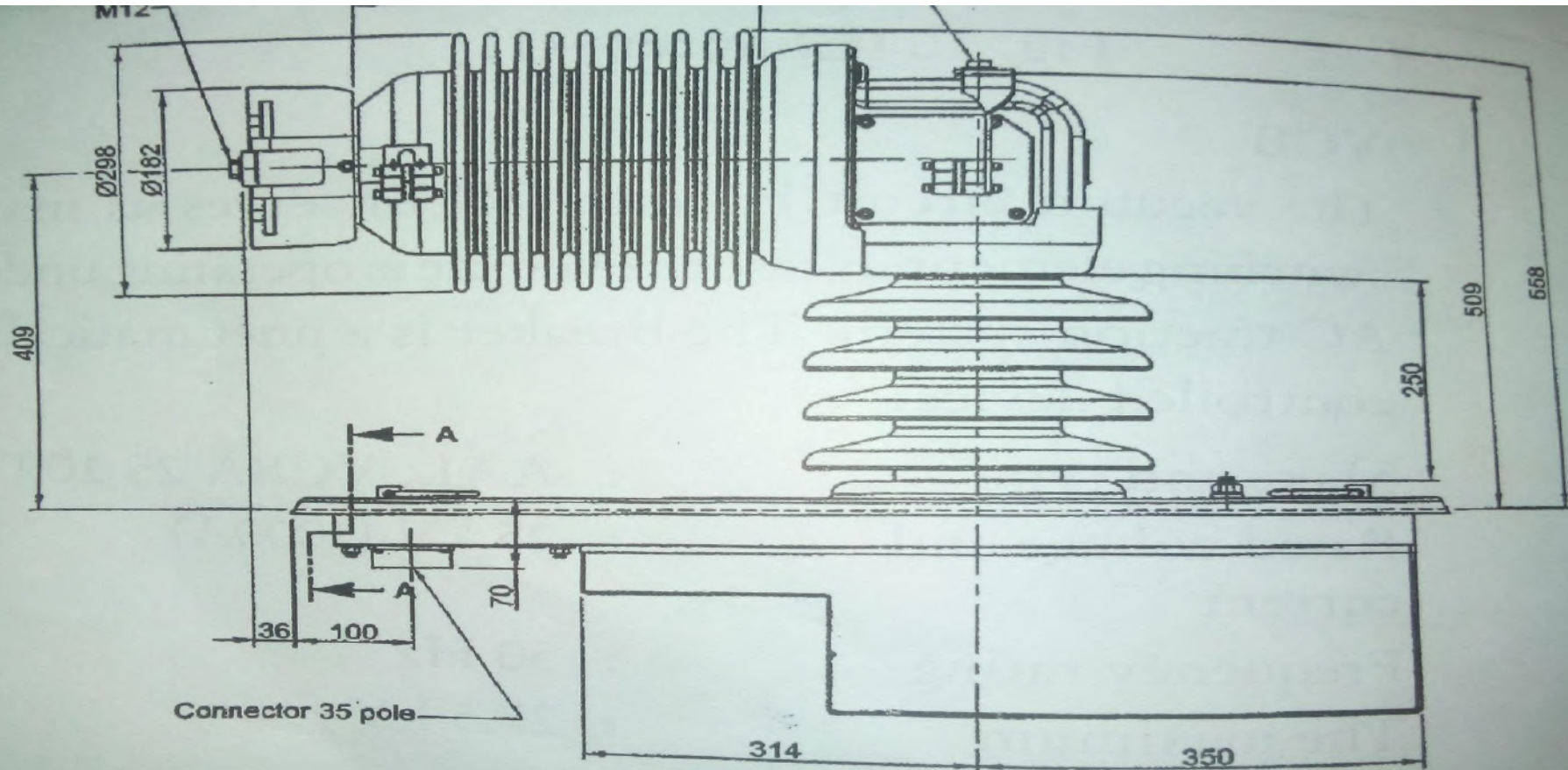
Operates when below conditions are met:

- Pantograph- Up & VSS senses AC/DC
- MCB Close command fm DTC/MC is given
- ACU & TCC are healthy



Activated by VSS OHE Sensing + MCB ON Command	Chain of command / actuating elements TCU →SKS/21Q05→DC/AC Coil→ COS Magnetic valve
Air Flow →	MR →Pento Reservoir → COS Magnetic Valve→ COS Cylinder

VCB



<p>Activated by MC ON/OFF s/w in DTC/MC</p>	<p>Chain of command / actuating elements TCU → SKS 21Q 01/Release or 21Q 02/Closing → VCB Magnetic valve</p>
<p>Air Flow →</p>	<p>MR → Pento Reservoir → COS Magnetic Valve → COS Cylinder</p>

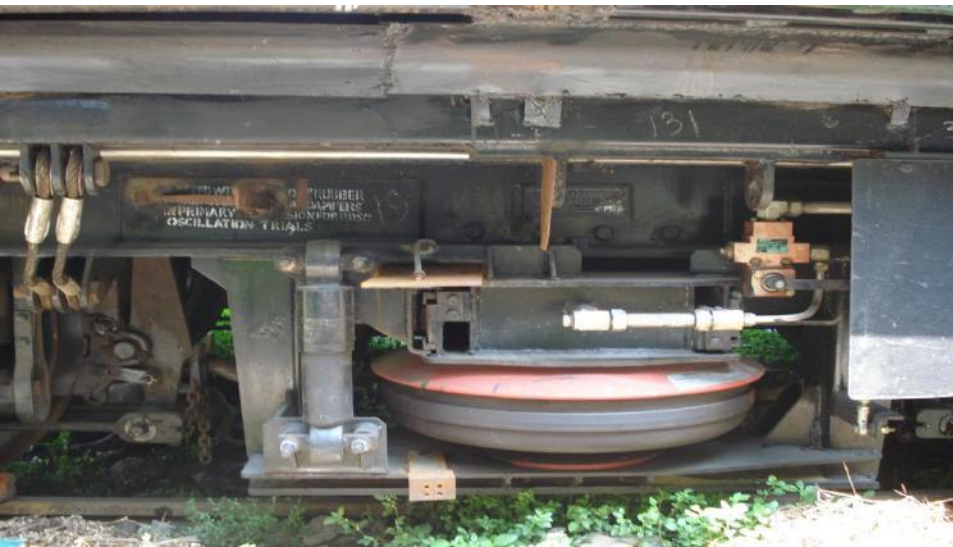
Air Suspension System

Requirement:

- To absorb shock
- Passenger comfort
- To make proper contact of rail & wheel for smooth running

Types: Double Stage Suspension system

(a) Primary Suspension

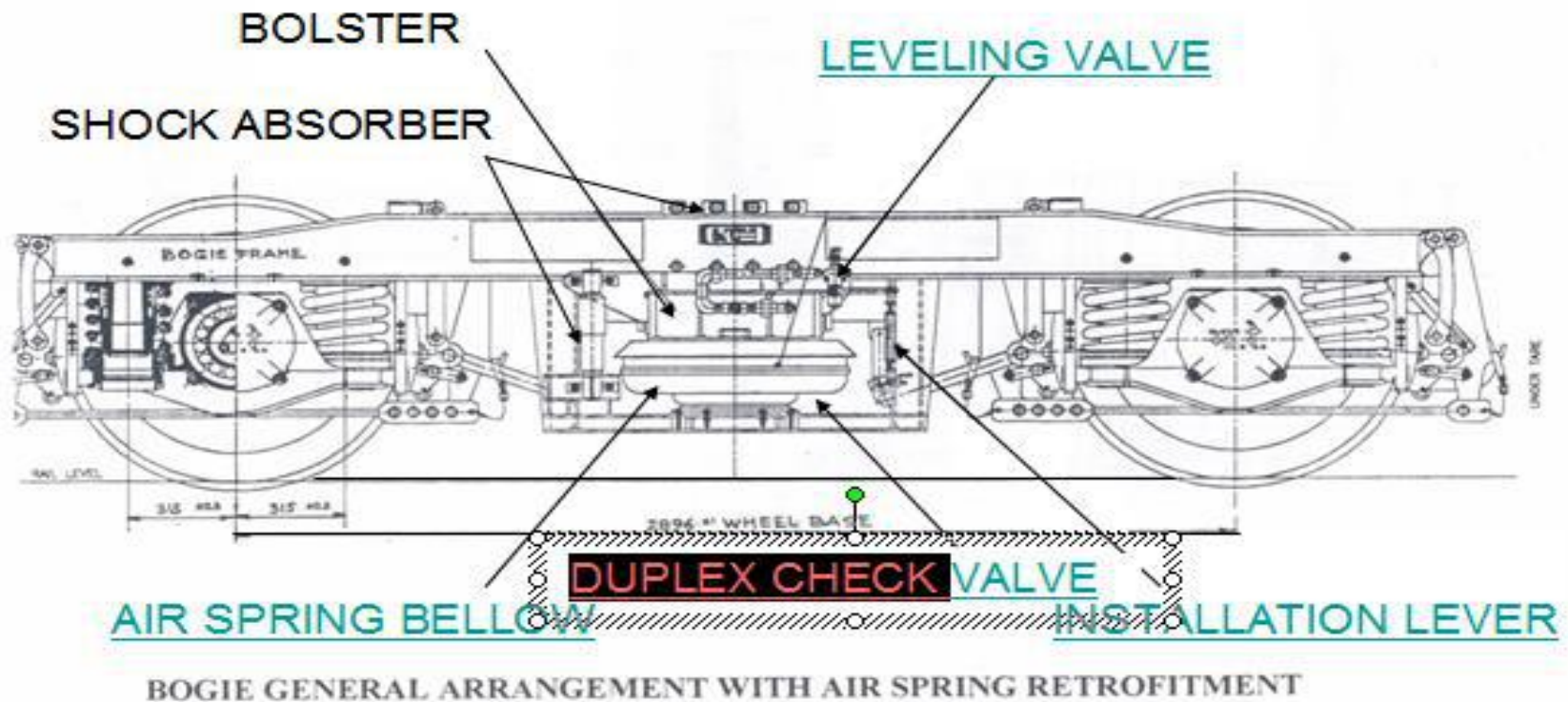


(b) Secondary Suspension

Advantages:

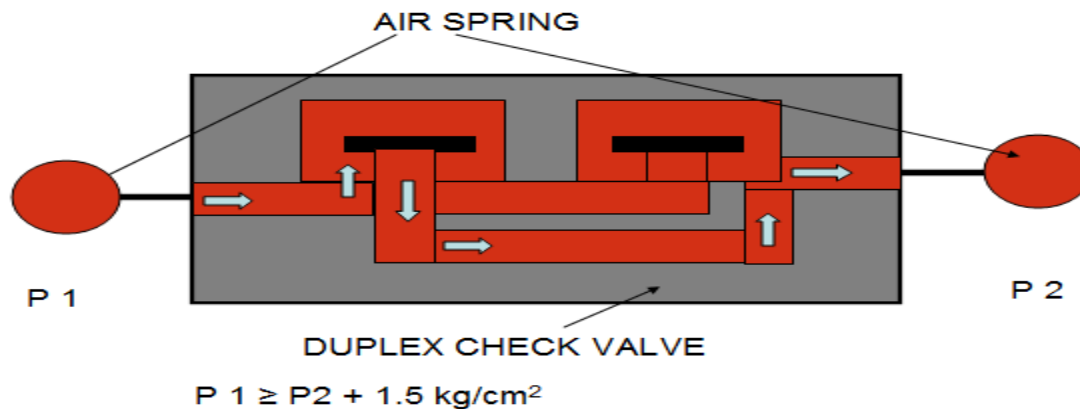
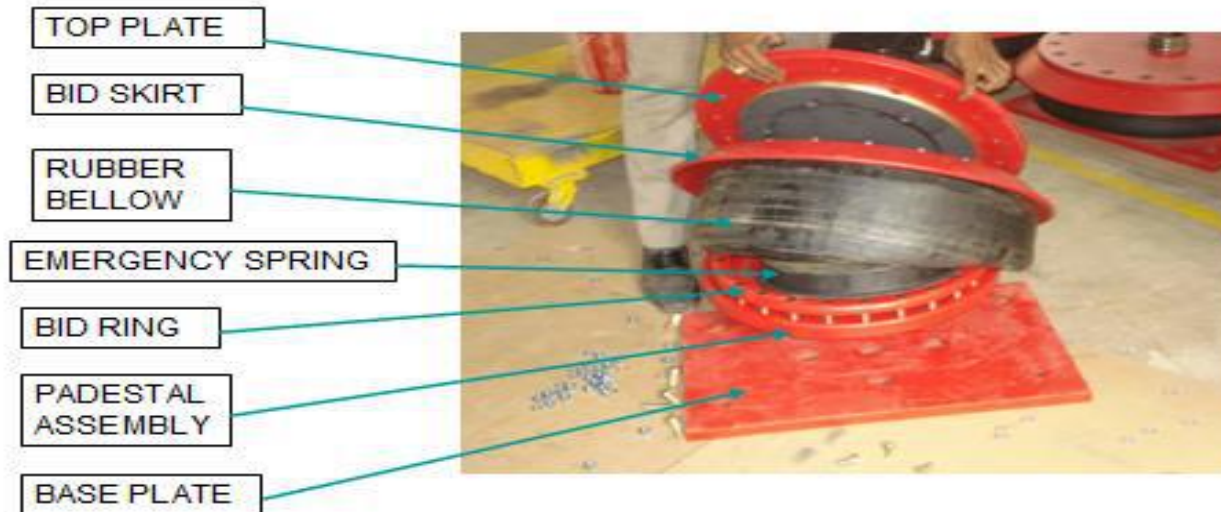
- CONSTANT HEIGHT OF COACH IRRESPECTIVE OF LOAD
- NO CHANCE OF PLATFORM RUBBING
- VERY SMOOTH RIDING
- LESS MECHANICAL FAILURE
- LESS MAINTENANCE

Air Suspension Bogie of EMU:



Components

DETAILS OF FIRESTONE MAKE AIR SPRING BELLOW



Leveling Valve

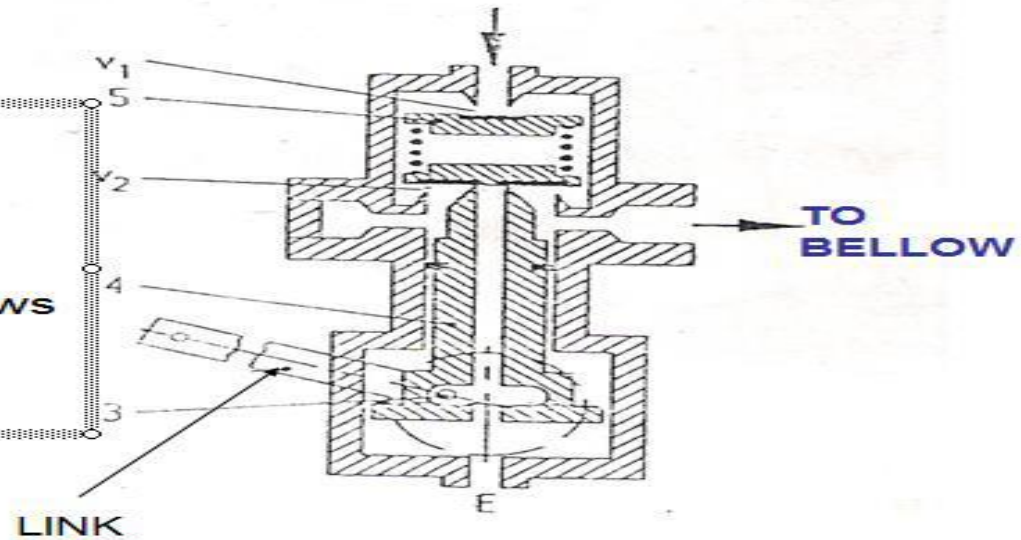
INPUT FROM 150 LTRS. RESERVOIR

It is heart of this system.

Mounted on bolster and its link is fitted with installation lever.

03 positions of this valve:

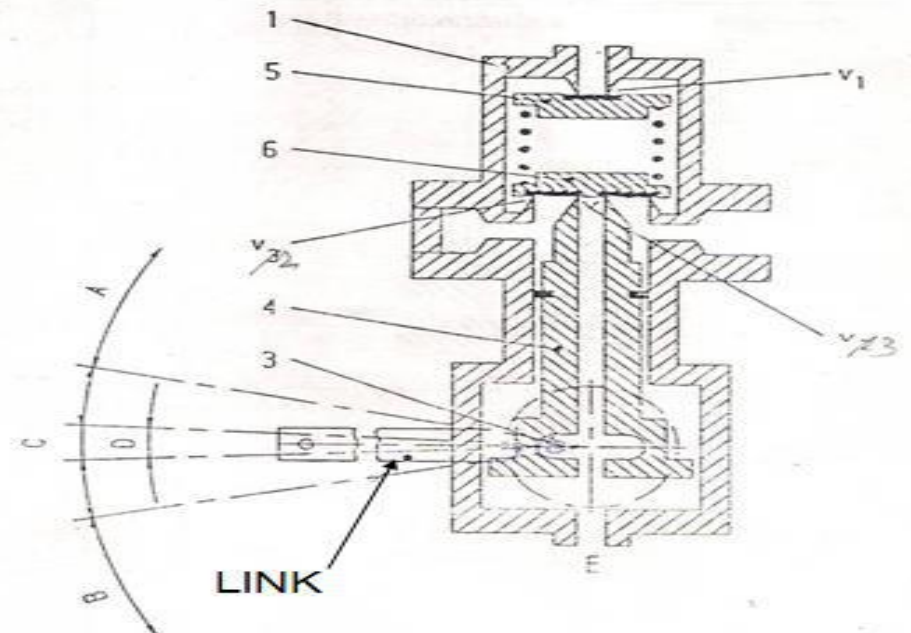
1. Charging Mode-Air from MR flows to Air Bellows



2. Dead Band Zone:

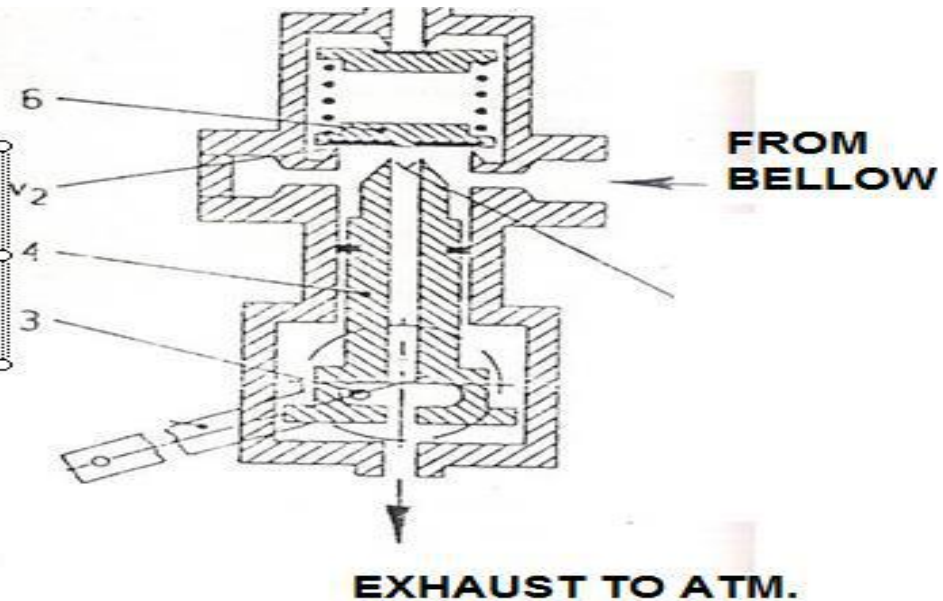
Band width is $\pm 40'$ to $1^\circ 20'$

In this zone all the ports are isolated from each other.



3. Discharging Mode:

Air from air spring bellow destroys to atmosphere through exhaust of this valve.



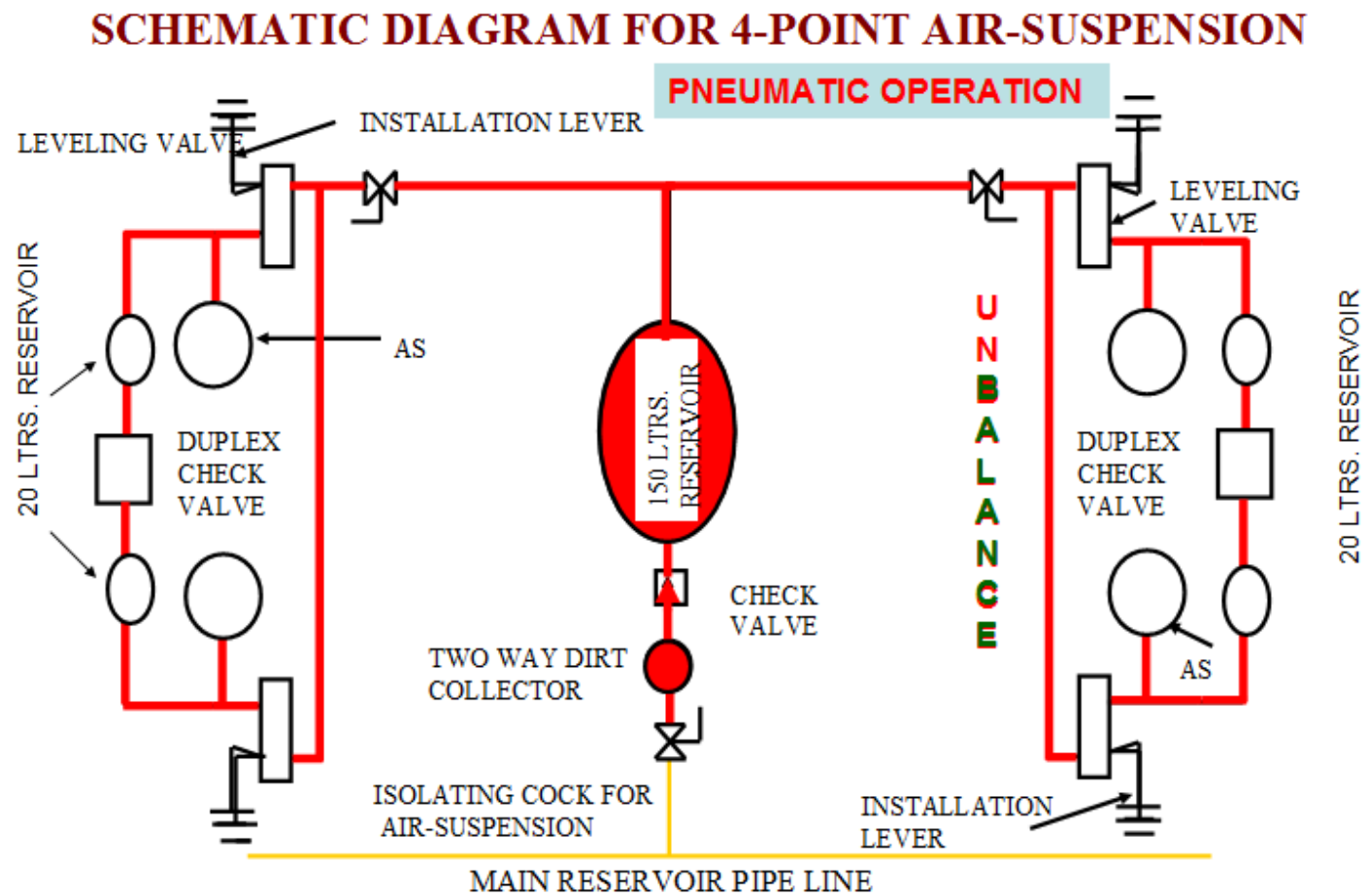
Fitted between link of Leveling valve and bogie frame. The ball and socket joint at both ends are provided to give flexibility. By increasing the length of installation lever, the bellow height increases and reducing its length the bellow height decreases.



INSTALLATION LEVER

Type of Suspension: 3 Point & 4 Point

Adv of 4 Point Suspension: Each bellow of each bogie is controlled by individual leveling valve.

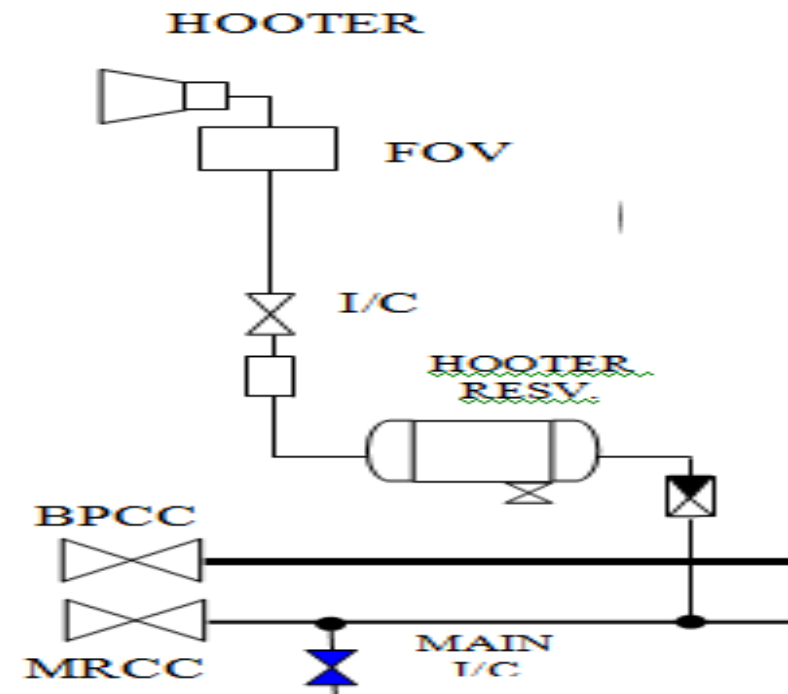
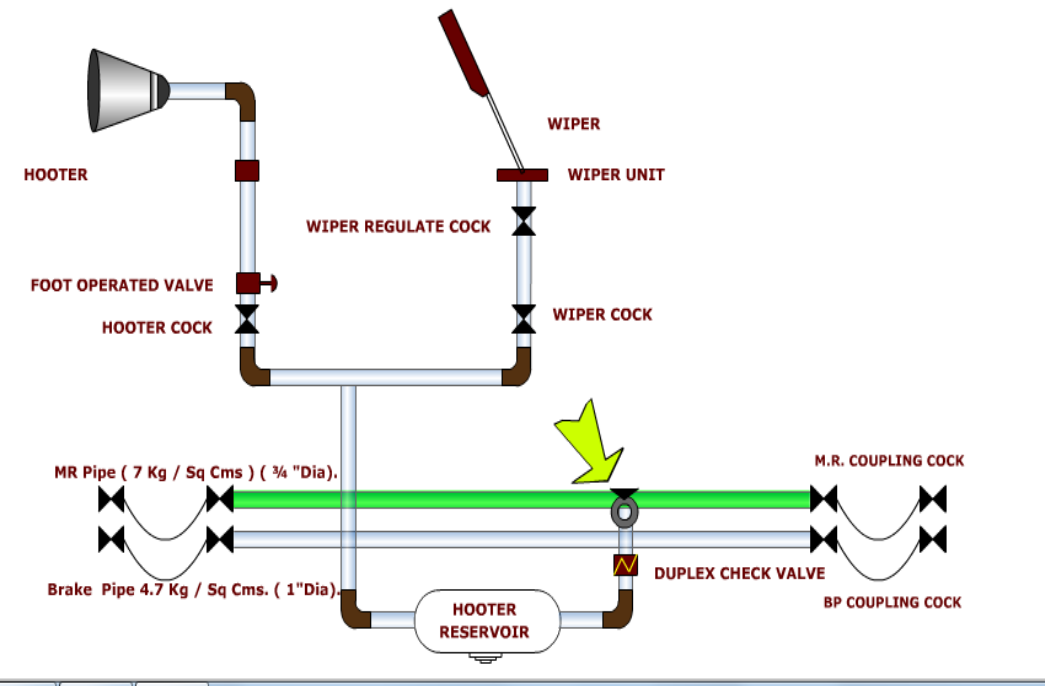


HOOTER & WIPER AIR CIRCUIT

Components: Hooters, Foot Operated Valve & Hand Operated Valve, Hooter Reservoir

Operation: MR → Hooter Reservoir → Foot Operated Valve or Hand Operated Valve/Wiper Regulating Cock → Hooter/Wiper Cylinder

MC Hooter Pneumatic Circuit:



Conclusion: How important Pneumatic Circuit is this ???

THANKS