

Air Brake System

Introduction

In 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 reservoir and the brake pipe is connected to the brake cylinder through the distributor valve. Brake application takes place by dropping the pressure in the brake pipe.

Principle of operation of twin pipe graduated release air brake system.

(a) Charging the brake system

- Brake pipe throughout the length of train is charged with compressed air at 5 Kg/cm².
- Feed pipe throughout the length of train is charged with compressed air at 6 Kg/cm².
- Control reservoir is charged to 5 Kg/cm².
- Auxiliary reservoir is charged to 6 Kg/cm².

(b) Brake application stage

- For brake application the brake pipe pressure is dropped by venting air from the driver's brake valve.
- Subsequently the following actions take place
- The control reservoir is disconnected from the brake pipe.
- The distributor valve connects the auxiliary reservoir to the brake cylinder and the brake cylinder piston is pushed outwards for application of brakes.
- The auxiliary reservoir is however continuously charged from feed pipe at 6 Kg/cm².

Brake release stage:

- Brakes are released by recharging brake pipe to 5 Kg/cm² pressure through the driver's brake valve.
- The distributor valve isolates the brake cylinder from the auxiliary reservoirs.
- The brake cylinder pressure is vented to atmosphere through DV and the Brake cylinder piston moves inwards.

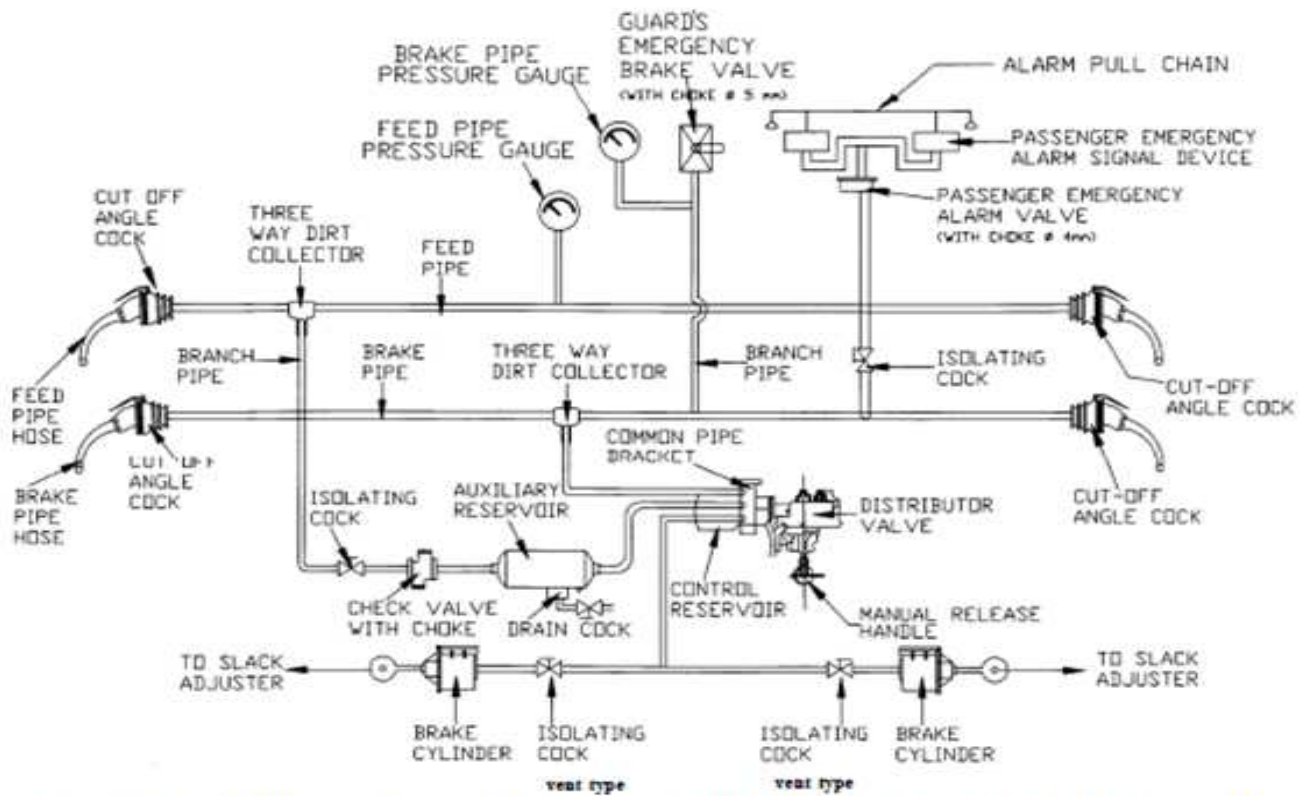


Figure- SCHEMATIC LAYOUT OF TWIN PIPE GRADUATED RELEASE AIR BRAKE SYSTEM

Description	Reduction in B. P. Pressure
Minimum Brake Application	0.5 to 0.8Kg/cm ²
Service Brake Application	0.8 to 1.0Kg/cm ²
Full Service Brake Application	1.0 to 1.5Kg/cm ²
Emergency Brake Application	Brake pipe is fully exhausted and its pressure reduces to almost zero.

Emergency application and working of Distributor valve (C3W)

During emergency application the brake pipe pressure is reduced rapidly to 0 kg/cm² by the driver's brake valve.

Because of this drop the position of the various valves will be as described below.

Main valve: With drop in BP pressure to 0 kg/cm² differential pressure acts across the large diaphragm. As a result the hollow stem is moved in upward direction and pushes the check valve there by opening the passage for entry of auxiliary reservoir pressure at top portion of main valve. This pressure then gets a way to brake cylinder through limiting device. The brake cylinder thus gets charged with the compressed air. This pressure is known as BC-pressure.

Limiting Device: The auxiliary reservoir pressure which entered into the top position of main valve now enters the limiting device through the valve which is held open. From limiting device air pressure now enter the brake cylinder. When the BC pressure rises to 3.8 kg/cm² the upwards force on the diaphragm lifts the guide and the valve at the bottom of the limiting device gets closed. Thus further entry of air into the brake cylinder stops.

When the brake cylinder pressure reaches 3.8 kg/cm² this pressure i.e. BC pressure act on

- Top face of small diaphragm of main valve
- Bottom face of upper diaphragm of cut off valve
- Top (small chamber) of quick service valve

Now because of this BC pressure acting at main valve small diaphragm, the hollow stem is pulled down. As a result the check valve at top comes down to close stage and assume lap position with the hollow stem closing further entry of AR pressure.

Cut off valve : In cut off valve the bottom face of the upper diaphragm is subjected to BC pressure because of which the guide is lifted. Also the upper portion of lower diaphragm is subjected to CR pressure, which pushes the total assembly downwards. This action closes the valve of cut off valve, thereby isolating it from control reservoir pressure.

Quick Service Valve : In quick service valve BC pressure acts at the top of valve and control reservoir pressure act at top face of upper diaphragm. As a result the stem is pushed down. The valve at the bottom gets opened. Now as the BP pressure inside the DV is at "O" kg/cm² the residue BP

pressure from the bulb of quick service valve will flow back and vent to atmosphere with the BP line.

Graduated application

During graduated brake application the brake pipe pressure is dropped in steps by driver's brake valve. The movement of various valve assemblies is almost in the same direction as during emergency application, but their movement is comparatively less. In the main valve however after each application the hollow stem assumes the lap position with the check valve. In addition to this during graduated application the bottom valve of limiting device is held open to allow compressed air to enter into brake cylinder. When BC pressure reaches 3.8 kg/cm^2 the bottom valve in the limiting device gets closed. Similarly at the time of full service application as the BC pressure reaches $3.8 + 0.1 \text{ kg/cm}^2$ within specified time.

Manual release: Double release valve provides for accelerated manual brake release, which is particularly useful during shunting operation. A short pull on the lever of double release valve is all that is needed. This action opens the

control reservoir release check valve, which is then held open by the locking rod. Venting of control reservoir through the open control reservoir release check valve brings the main valve to release position and exhausts the brake cylinder pressure through the hollow stem.

10

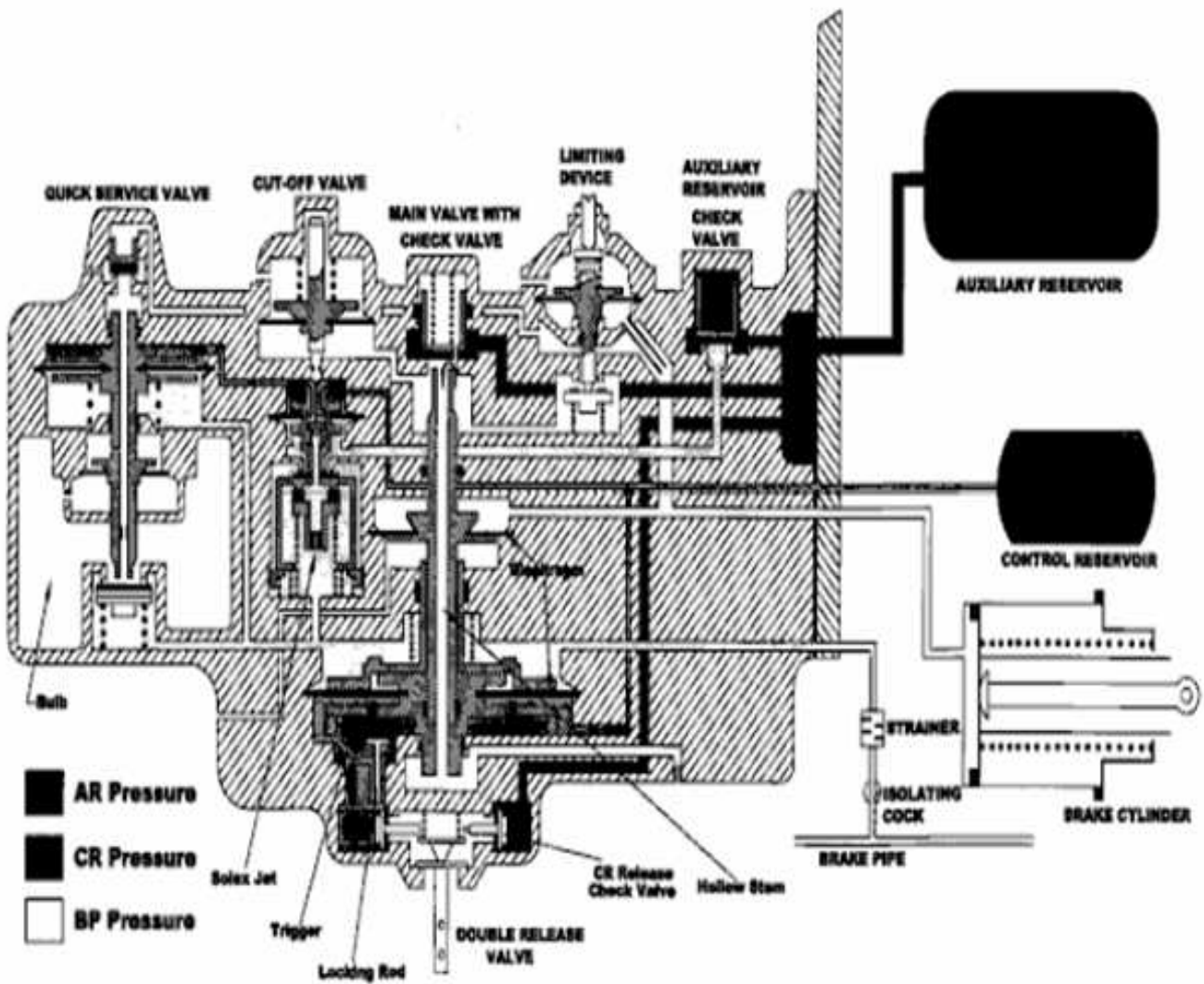


Figure-C3W DISTRIBUTOR VALVE

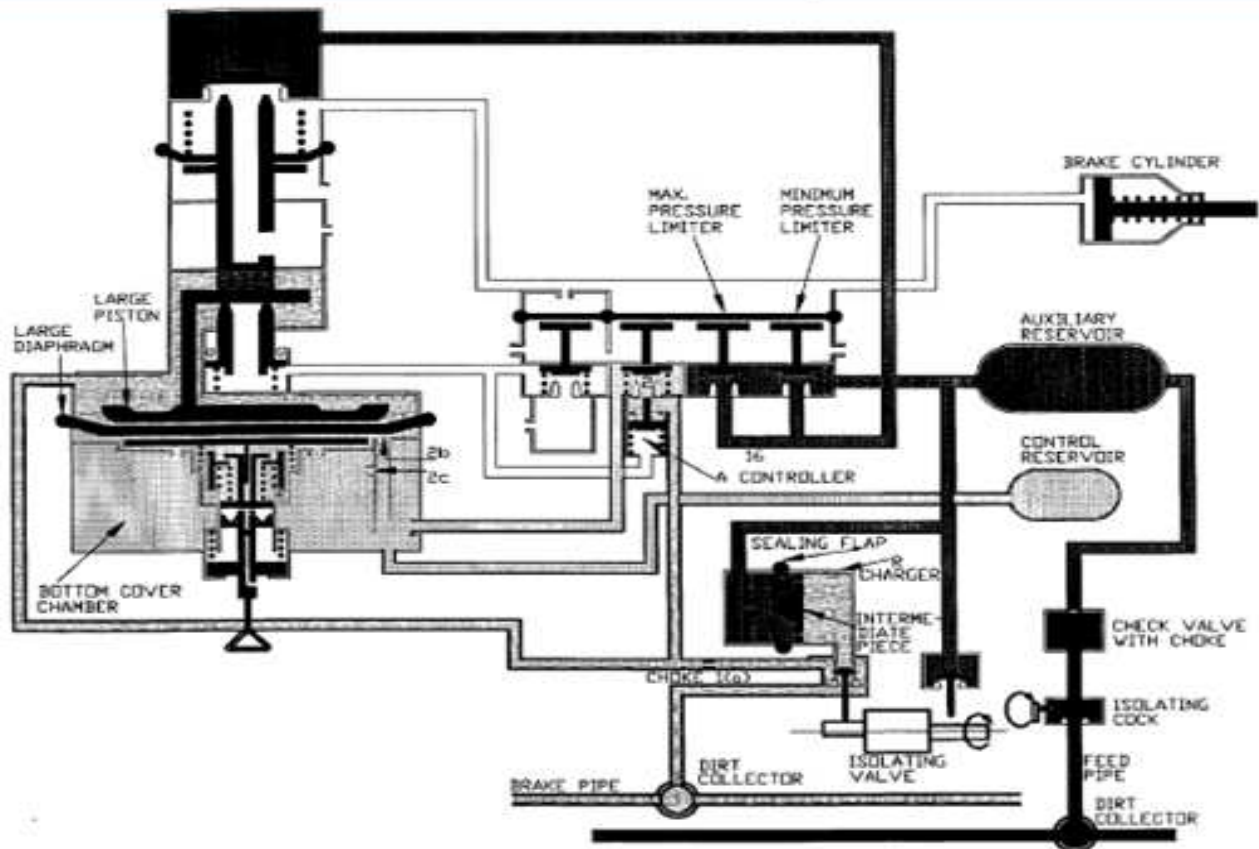


Figure- KE DISTRIBUTOR VALVE (CHARGING STAGE)

Passenger emergency alarm system

Passenger emergency alarm system consists of two components:

- Passenger Emergency Alarm Signal Device (PEASD).
- Passenger Emergency Alarm Valve (PEAV).

These two components in combination give an indication to the driver that some passenger is in need to stop the train. The

indication is transmitted from the coach when the passenger pulls the chain

Passenger emergency alarm signal device

Passenger Emergency Alarm Signal Device (PEASD) is a manually operated pilot vent valve. It is operated through mechanical force exerted by pulling the alarm chain provided inside the coaches for emergency use.

The passenger emergency alarm signal device does not need any maintenance during normal service except when it is found damaged or is due for periodic overhauling.

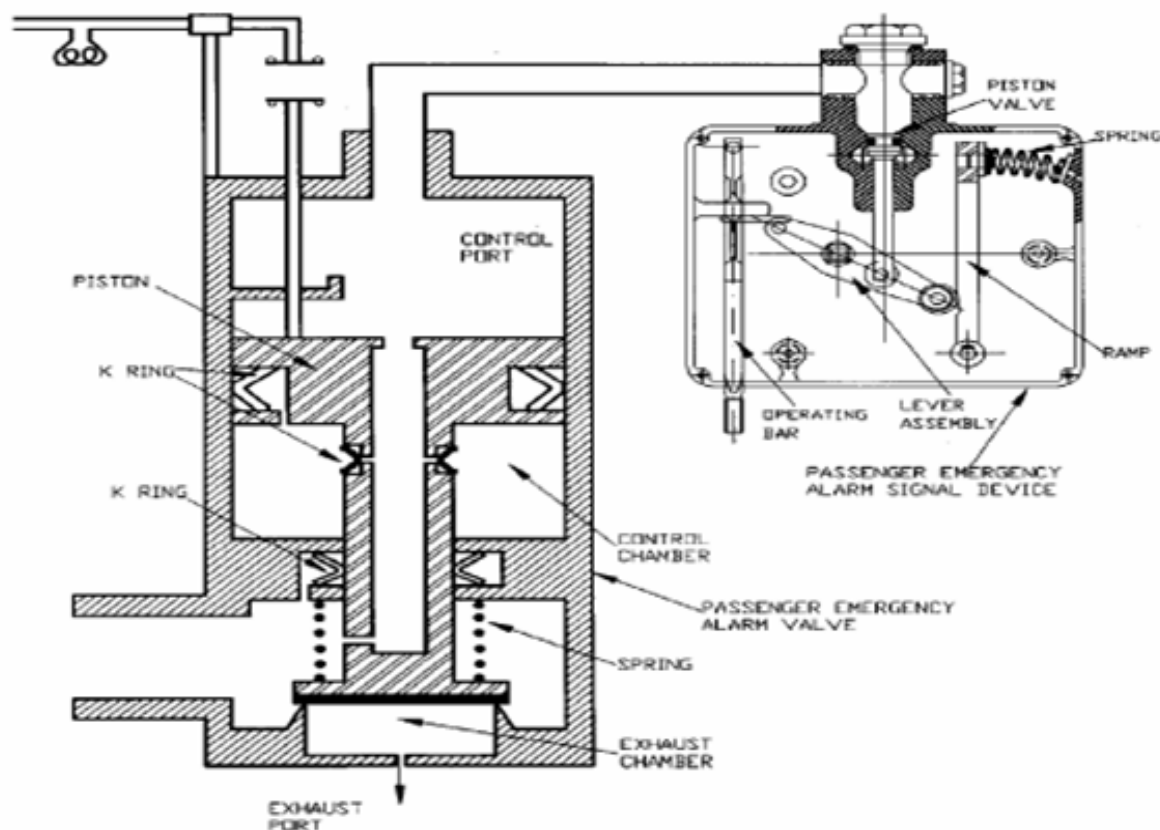


Figure- PEAV and PEASD

Air brake testing parameters

Description of Test	Results Required	Observation	
AR Charging Time from 0 to 4.8 Kg/cm ² (Main Reservoir pressure > 7.5 Kg/cm ²)	270+/- 30 sec for C3W (170+/- 10 sec for KE)		
CR Charging Time from 0 to 4.8 Kg/cm ² (Main Reservoir pressure >7.5 Kg/cm ²)	260+/- 20 sec for C3W (160+/- 10 sec for KE)		
Leakage Test (Brake Release) Check DV Leakage by Soap water only at joints.	No Leakage		
FULL SERVICE APPLICATION & RELEASE			
Brake Cylinder filling time from 0 to 3.6 Kg/cm ²	3 to 5 seconds		
Maximum Brake Cylinder Pressure	3.8 +/- 0.1 Kg/cm ²		
Leakage Test (Application) Check Leakage in DV by Soap water only at joints	No Leakage		
Brake Cylinder Release Time from Max. B.C. Pressure i.e. from 3.8 +/-0.1 Kg/cm ² to 0.4 Kg/cm ²	15 to 20 Seconds		
OVERCHARGE PROTECTION (BP pressure 6 Kg/cm ²)	CR pressure should not increase by more than 0.1 Kg/cm ² in 25 sec.		
CR overcharge reduction test Overcharge CR to 5.7 Kg/cm ² and pull double release lever for 3 seconds.	Overcharged CR should come to regime pressure of 5 Kg/cm ² .		
EMERGENCY APPLICATION		Single pipe	Twin Pipe
Brake Cylinder filling Time from 0 to 3.6 Kg/cm ²	3 to 5 Seconds		
Maximum Brake Cylinder Pressure	3.8 ± 0.1 Kg/cm ²		
Leakage Test (Emergency) Check Leakage in DV by Soap water only at joints	No Leakage		
Brake Cylinder Release Time from Max. B. C. Pressure i.e. from 3.8 ± 0.1 Kg/cm ² to 0.4 Kg/cm ²	15 to 20 Seconds		
SENSITIVITY & INSENSITIVITY			
BP pressure drop at the rate of 0.6 Kg/cm ² in 6 Seconds	Brake should start applying within 1 Sec.		
With a pressure drop stopped immediately after the operation of Quick Service Valve	Brakes must remain applied.		
BP pressures drop of 0.3 Kg/cm ² maximum in 60 seconds.	Brakes must not apply.		