BRAKE SYSTEM

BY:

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AP/DSL/IRIMEE
<table>
<thead>
<tr>
<th>TYPE</th>
<th>LOCO BRAKE</th>
<th>TRAIN BRAKE</th>
<th>DESIGNED BY</th>
<th>FITTED IN</th>
</tr>
</thead>
<tbody>
<tr>
<td>28 LV1</td>
<td>AIR</td>
<td>VACUUM</td>
<td>WABCO</td>
<td>WDM2, YDM4, WDS5, WDS6</td>
</tr>
<tr>
<td>28 LAV1</td>
<td>AIR</td>
<td>AIR &amp; VACUUM</td>
<td>WABCO</td>
<td>WDM2A, WDM2C, WDP2, WDG2, WDP1</td>
</tr>
<tr>
<td>KNORR</td>
<td>AIR</td>
<td>VACUUM</td>
<td>M/s KNORR BREMSE, GERMANY</td>
<td>WDM3, WDS4, ZDM3, WDS3</td>
</tr>
<tr>
<td>IRAB</td>
<td>AIR</td>
<td>AIR</td>
<td>RDSO</td>
<td>WDM2C, WDP2, WDG2, WDM3C</td>
</tr>
<tr>
<td>CCB</td>
<td>AIR</td>
<td>AIR</td>
<td>KNOR BREMSE</td>
<td>WDG4, WDP4</td>
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</table>
ADVANTAGES OF AIR BR. OVER VAC BR.

- Easy to maintain
- Lesser weight
- Maint cost low (about 1/5th of vac br. Stock)
- Pre departure delays less (about 50 to 60 secs vs 4 mins for vac. Br.)
- Possibility of longer train formation (about 2000 mtrs without pr. Drop in br.van) vs (max. 600 mtrs long for vac train due to vac drop > 30% at br van)
- Brake power drop is negligible in every 400 kms for air brake train (significant in case of vac br. Stock)
- No brake fade in down grades due to inherent inexhaustibility (in vac br stock it is significant and require additional loco in down grades)
- Braking distance is quite low (about 550 to 870 m at 75 kmph) vs in vacuum br. stock it is quite long (about 1150 to 1780 mtrs at 75 kmph)
- Percentage ineffectiveness is 10 times lesser than vacuum brake stock
SUB SYSTEM

- Independent Brake System
- Vacuum Brake System
- Proportionate Brake System
- Brake Pipe System
- Feed Pipe System
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>A9. Automatic Valve</td>
<td>Brake application for Loco as well as formations.</td>
</tr>
<tr>
<td>2.</td>
<td>SA 9 Independent Brake Valve</td>
<td>Brake Application for Loco alone</td>
</tr>
<tr>
<td>3.</td>
<td>MU – 2B</td>
<td>M.U. Operation, used as gate valve</td>
</tr>
<tr>
<td>4.</td>
<td>F 1 – Selector</td>
<td>M.U. Operation, used as gate valve</td>
</tr>
<tr>
<td>5.</td>
<td>C2. W. or Additional C2. Valve</td>
<td>Feeding B. P. Pressure to the formation</td>
</tr>
<tr>
<td>6.</td>
<td>24 A. Double Check Valve</td>
<td>This will allow only one operation at a time.</td>
</tr>
<tr>
<td>9.</td>
<td>Pressure Switch</td>
<td>Loco will be brought to idle during A9 emergency application.</td>
</tr>
<tr>
<td>10.</td>
<td>D1. Emergency Valve</td>
<td>For Emergency brake application.</td>
</tr>
<tr>
<td>11.</td>
<td>D1. Pilot air valve</td>
<td>During Dynamic brake Loco brake will be released.</td>
</tr>
<tr>
<td>12.</td>
<td>Pressure Limiting Valve</td>
<td>Pilot air to C2 Relay valve for synchronized brake application is Limited to 2.5 kg / Cm²</td>
</tr>
<tr>
<td>13.</td>
<td>M. R. Safety Valve</td>
<td>When M. R. Pressure goes beyond 10.5 kg / Cm² This valve will operate and release excess pressure from MR.</td>
</tr>
<tr>
<td>14.</td>
<td>Duplex Check Valve (6 kg / Cm²)</td>
<td>This valve will connect MR1 with feed valve when MR pressure exceeds 6 kg / Cm²</td>
</tr>
<tr>
<td>15.</td>
<td>D 24 – Feed Valve</td>
<td>For Feed pipe Pr: 6 kg / Cm².</td>
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</table>
INDEPENDENT BRAKE SYSTEM

INDEPENDENT BRAKE APPLICATION
INDEPENDENT BRAKE SYSTEM

Independent Brake/loco Brake handle (SA9) has 3 position—Application, Release, Quick release.
 When (SA9) handle is brought in application position, SA9 port 30 connects port 20 and starts supplying pilot air to C2-Relay air valve.
 The pilot air passes through MU2B Valve port no. 2 & 20 and inter to C2-Relay at port no.2.
 The pilot air pressure depends upon the handle position; in full application it is 3.5kg/cm2. The C2-relay air valve actuates after getting pilot air and connects MR pressure to brake cylinders of locomotive through port no.1 & 3.
 The brake cylinder pressure depends upon pilot air pressure, supplied into C2-Relay chamber through port no.2.
 The locomotive brake can be graduated on and off with either the automatic (A9) or the independent brake valves (SA9). It is always possible to release the locomotive brakes with the SA9 valve. Gauge line connection is taken from BC pipe near front truck of locomotive to the driver’s control stand for indicating brake cylinder pressure.
INDEPENDENT BRAKE SYSTEM

SA 9 → MU2B → DOUBLE CHECK VALVE → C2 RELAY VALVE → Brake Cylinder

MR LINE

INDEPENDENT BRAKE RELEASE

Brake application through A9
SA 9 INDEPENDENT BRAKE VALVE

The SA9 Independent Brake Valve maintains 3.5kg/cm²-air pressure in the independent brake system against normal leakage through C2-Relay valve. It is suppose to maintain graduated application and release according to its handle position.

The SA9 Independent Brake Valve consists of a self-lapping regulating portion, which supplies or exhausts air pressure for piloting the graduated application or release of brake cylinder pressure on the locomotive. This brake valve also includes a quick release valve.
C2 RELAY VALVE

The C-2 Relay Valve is a diaphragm operated, self-lapping valve which functions to supply and exhaust brake cylinder air pressure during brake applications and release.

The C2-Relay valve maintains 3.5kg/cm²-air pressure in locomotive brake system against normal leakage.
VACUUM BRAKE RELEASE POSITION

A 9 AUTOMATIC BRAKE VALVE

VA1B CONTROL VALVE

TO EXHAUSER

PROTECTION VALVE

CONTROL AIR AT 24 PSI

MR PIPE

BRAKE PIPE

VAC TRAIN PIPE
VACUUM BRAKE APPLICATION POSITION

A 9 AUTOMATIC BRAKE VALVE

TO ATMOSPHERE

TO EXHAUSER

PROTECTION VALVE

CONTROL AIR AT 24 PSI

MR PIPE

BRAKE PIPE

VAC TRAIN PIPE
Test of VAC Brake Train

1. **BLOCKAGE TEST:** Remove one end of the vacuum hose pipe and raise it upwards. If more than 8 cm vacuum is created, there is a blockage in the system.

2. **EFFICIENCY TEST:** Against an 8 mm leak disc, the loco should create 53 cm vacuum.

3. **LEAKAGE TEST:** Vacuum on dummy and on leak disc should not vary more than 3 cm.

- The Board has therefore standardized the vacuum level in engine and brake van for all Railways in both the traction.

<table>
<thead>
<tr>
<th>Type of service</th>
<th>Engine</th>
<th>Brake van</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>M/E</td>
<td>53</td>
<td>47</td>
<td>50</td>
</tr>
<tr>
<td>Passenger</td>
<td>50</td>
<td>44</td>
<td>47</td>
</tr>
<tr>
<td>Goods</td>
<td>46</td>
<td>38</td>
<td>42</td>
</tr>
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</table>
(A9) AUTOMATIC BRAKE VALVE

- The A-9 Automatic Brake Valve is a compact, self-lapping, pressure maintaining brake valve, which is capable of graduating the application or release of locomotive and train brakes.
- The A9 maintains 5kg/cm2-air pressure in B.P System against normal leakage at its release position.
- It also maintains air pressure drop in the system according to its handle position.
VA1B CONTROL VALVE

- VA1B control valve is deployed in vacuum brake system to apply and release the train brake.
- The VA1B Control valve is a very sensitive valve, which works on two different pressure 5kg/cm2 & 1.7 kg/cm2 and controls the vacuum of train pipe.
- It connects the train pipe to atmosphere or exhauster as per variation in BP pressure.
- It helps to operate the train vacuum brakes.
- This valve also acts as a pilot to operate the locomotive air brake through proportionate brake valve.
- It has six pipe connections
  3 – Brake Pipe pressure
  6 – Vacuum train pipe
  2 – Vacuum train pipe
  1 – Vacuum Control pipe
  7 – Vacuum Reservoir Pipe to exhauster
  8 – Atmosphere through GD-80 filter
HS 4 VALVE

The HS4 control air valve delivers a constant, uniform, predetermined air pressure. It serves to regulate the operation of another device in the system. In addition, the air delivered through the valve may be used to operate auxiliary devices.

HS4 valve is provided to supply constant air pressure to bottom chamber of VA1B control valve. It is adjusted at 1.7kg/cm².
PROPORTIONATE BRAKE APPLICATION

- A 9 AUTOMATIC BRAKE VALVE
- TO ATMOSPHERE
- TO EXHAUSTER
- VA1B CONTROL VALVE
- PROTECTION VALVE
- 28 VB VALVE
- C2 RELAY
- BR. CYL
- MR PIPE
- BRAKE PIPE
- VAC TRAIN PIPE
PROPORTIONATE BRAKE RELEASE

- **A 9 AUTOMATIC BRAKE VALVE**
- **28 VB VALVE**
- **C2 RELAY**
- **BR. CYL**
- **VA1B CONTROL VALVE**
- **TO EXHAUSTER**
- **PROTECTION VALVE**
- **CONTROL AIR AT 24 PSI**
- **BRAKE PIPE**
- **VAC TRAIN PIPE**
VAC./AIR PROPORTIONAL VALVE

VBP 1

B.C. 16

30 M.R.

EY 10

VC. 7

20 VENT
AIR FLOW INDICATOR VALVE

The air flow measuring valve is suitable for use on locomotives that are equipped to operate trains fitted with 28LAV1 brake system and is designed for fitting in the main air supply pipe.

This valve indicates the leakage of BP pipe through an indicator in term of wagon.

Indicator is provided on driving control stand so that Driver can watch easily.
R6 VALVE

R-6 Relay valve is a simple relay valve which provides air pressure in 1:1 ratio and is mounted just near the AFM valve. It is required because of long piping from the AFM valve to the indicator.

This is a simple relay valve, which provides air pressure in 1:1 ratio and mounted in between the indicator and the AFM valve. It is required because of long
AIR FLOW INDICATOR

It is a device through which BP (Air brake train) leakage can be seen in the Driver’s cabin. This gauge has two pointers Red & White. Red pointer is called reference pointer, which is attached to a knurled knob and protrudes through the dial glass, so that it can be set manually in any desired position, where as the other pointer moves on the scale depending up on the air flow. The indicator is connected to the measuring valve through R-6 relay valve. The scale on the gauge is calibrated not in the units of airflow but in numbers which normally indicates the number of wagons. The 60 marks correspond to the maximum rate of airflow that can be accepted to overcome leakage on a 60 wagon train.
The D24B Feed valve supplies and regulates air pressure to feed pipe system. It is connected from MR-1.
In single pipe operation D24B Feed valve is isolated through a cut out cock.
Testing of Brake system

System Pressure:

• MR Pressure: $10 \pm 1 \text{ kg/kg/cm}^2$
• Aux Pressure: $6 \pm .1 \text{ kg/cm}^2$
• Limiting valve pressure (BC): $2.5 \text{ kg/cm}^2$
• BP pressure: $5 \text{ kg/cm}^2$
• FP pressure: $6 \text{ kg/cm}^2$
System Efficiency

- Initial charging from 0-10 kg/cm² at idle: 6 min (6 CD 4 UC)/3 min with 6 CD 3 UC
- Charging from 8 to 10 kg/cm² at idle: 60 secs (6 CD 4 UC)/35 secs (6 CD 3 UC)
- BP leakage: 0.7 kg/cm² /5 min
- MR leakage (with A9 in emergency): 0.5 kg/cm² /3 min
- MR leakage (with Ind Br on): 0.6 kg/cm² /3 min
Auto Br valve (A9) Test

Full service application/ release:

• BP Pressure on FS application: 3.5±0.1 kg/cm²
  • Time for BP to drop: 3 to 5 secs

  • Time for BC to attain 2.5 kg/cm²: G/25 - 30 secs, P/ 7- 10 secs
  • Time for BP to charge (Loco): 2 to 4 secs
  • Time for BP to charge (train with 59 wagons): 3 min

  • Time for BC to drop from max to 0.4 kg/ cm²: G/40 -50 secs, P/ 15-20 secs

Emergency application / Release:

• Time for BP to drop to 0: 1 to 2 secs

• BP charging time on release: 4 to 7 secs