



INDIAN RAILWAYS
GOVERNMENT OF INDIA

**POCKET BOOK
ON AIR BRAKE SYSTEM
FOR DRIVERS & GUARDS
(FRIEGHT STOCK)**

(For official use)

CAMTECH/2000/M/PBAB/1.0

APRIL'2000

Centre
for
Advanced
Maintenance
TECHnology



Maharajpur, Gwalior - 474020

CONTENTS

<i>FOREWORD</i>	<i>i</i>
<i>PREFACE</i>	<i>ii</i>
<i>CONTENT</i>	<i>iii</i>
<i>CORRECTION SLIP</i>	<i>v</i>
1. INTRODUCTION	1
2. PRINCIPLE OF OPERATION	1
2.1 Charging stage	3
2.2 Application Stage	3
2.3 Release stage	4
3. AIR BRAKE SUB ASSEMBLIES	5
3.1 Distributor valve	5
3.2. Brake cylinder	6
3.3 Auxiliary reservoir	7
3.4 Cut off angle cock	7
3.5 Hose coupling	8
3.6 Dirt collector	8
3.7 Guard's emergency brake valve	9
3.8 Pressure gauge	9
3.9 Quick Coupling	9
3.10 Slack Adjuster	9

4.	DUTIES OF DRIVERS & GUARDS OF AIR BRAKED GOODS TRAINS	10
4.1	During Originating Examination	10
4.2	Stopping of the train	12
4.3	Starting of train after stopping	14
4.4	Action to be taken in case of hose pipe Disconnection/ Train parting.	14
4.5	Action to be taken in case of Cattle Run Over	17
5.0	BRAKE CONTINUITY TEST	19
5.1	Objective	19
5.2	Principle	19
5.3	When required	20
5.4	Who shall carry out	20
5.5	Test procedure	20
6.0	LEAKAGE TEST	23
7.0	EN-ROUTE TROUBLE SHOOTING ON AIR BRAKE TRAINS	26
	<i>DISTRIBUITION LIST</i>	32

1. INTRODUCTION

Air brake system is most efficient and reliable braking system used to run heavy and long trains at high speeds. It has following advantages:-

- Short braking distance.
- Higher braking force.
- Reduced brake power deterioration.
- Uniform brake power over train length.
- Compact and light equipment.

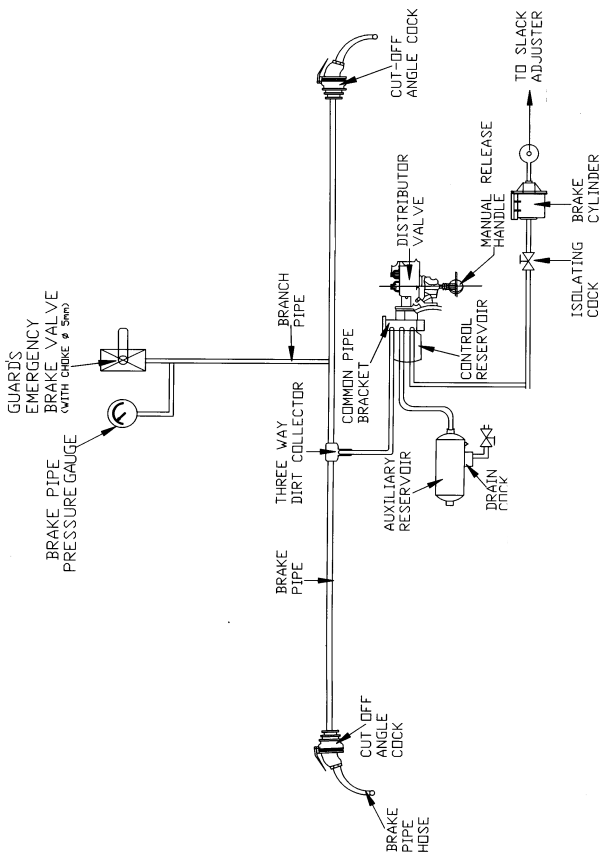
Air brake system is classified as:

- Single pipe air brake system
- Twin pipe air brake system

Air brake system used in freight stock is single pipe graduated release air brake system. The diagram shown on page 2, illustrates the schematic layout of air brake equipment on the under frame of freight stock.

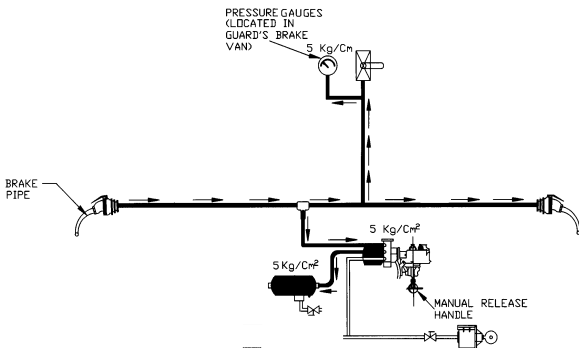
2. PRINCIPLE OF OPERATION

Air Brake Freight stock is fitted with single pipe graduated release air brake system. In single pipe, brake pipes (BP) of all wagons are connected. Also all the cut off angle cocks are kept open except the front cut off angle cocks of BP of leading loco and rear end cut off angle cock of BP of last vehicle. Isolating cock on all wagons are also kept in open condition. Auxiliary reservoir is charged through distributor valve at 5kg/cm^2 .



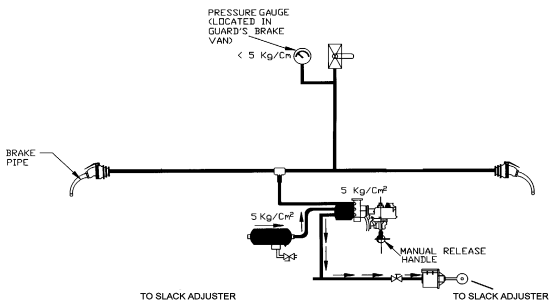
2.1 Charging Stage

During this stage, brake pipe is charged to 5 kg/cm^2 pressure which in turn charges control reservoir and auxiliary reservoir to 5 kg/cm^2 pressure via distributor valve. At this stage, brake cylinder gets vented to atmosphere through passage in Distributor valve.



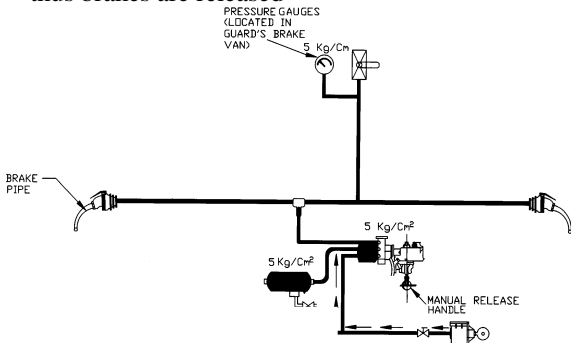
2.2 Application Stage

For application of brakes, the pressure in brake pipe has to be dropped. This is done by venting air from driver's brake valve. Reduction in brake pipe pressure positions the distributor valve in such a way that the control reservoir gets disconnected from brake pipe and auxiliary reservoir gets connected to brake cylinder. This results in increase in air pressure in brake cylinder resulting in application of brakes. The magnitude of braking force is proportional to reduction in brake pipe pressure.



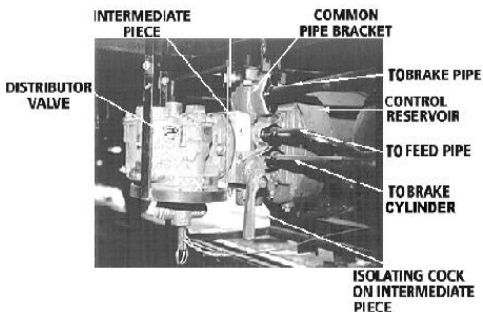
2.3 Release Stage

For releasing brakes, the brake pipe is again charged to 5 kg/cm^2 pressure by compressor through driver's brake valve. This action positions distributor valve in such a way that auxiliary reservoir gets isolated from brake cylinder and brake cylinder is vented to atmosphere through distributor valve and thus brakes are released



3. AIR BRAKE SUB ASSEMBLIES

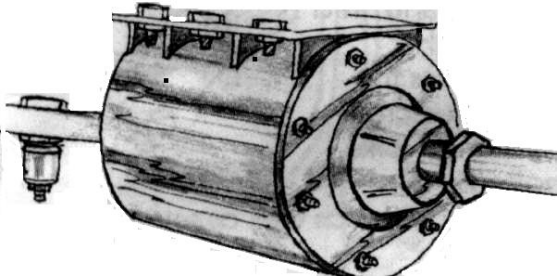
3.1 Distributor Valve



Distributor valve is the most important functional component of the air brake system and is also sometimes referred to as the heart of the air brake system. The function of the distributor valve is to distribute compressed air received from brake pipe to auxiliary reservoir and control reservoir. In addition to this it also senses drop and rise in brake pipe pressure for brake application and release respectively.

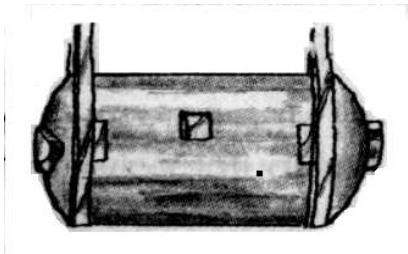
It is connected to brake pipe through branch pipe. Various other components connected to the distributor valve are auxiliary reservoir, brake cylinders and control reservoir.

3.2 Brake Cylinder



At the time of brake application, compressed air from Auxiliary Reservoir, via Distributor Valve, enters Brake Cylinder and moves its piston out-wards. The force on the piston in the Brake Cylinder is multiplied and transmitted to Brake via the brake rigging.

3.3 Auxiliary Reservoir

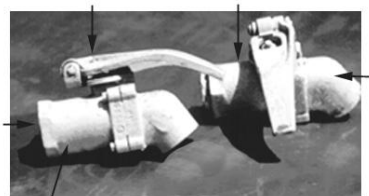


The auxiliary reservoir stores air required to fill the Brake Cylinder for brake application. In Single Pipe System it receives the supply of compressed air from Brake Pipe through Distributor valve at 5.0 kh/cm^2 .

3.4 Cut Off Angle Cock

Opened

Closed



Angle Cock is provided on the brake pipe at either end of each wagon which is used for opening or closing the Brake Pipe.

When Angle Cocks are closed, the connected Hoses get vented and, then, they can be uncoupled without any danger.

When the handle of Cut Off angle Cock is parallel to the pipe, it is open and when at right angle to the pipe, it is closed.

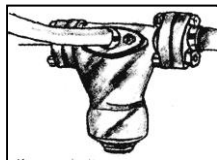
3.5 Hose Coupling



Hose Coupling is provided to connect Brake pipe hoses of consecutive wagons. The brake pipe is there by made continuous through out the train. It enables the supply of compressed air to all wagons for activating their brake equipments.

3.6 Dirt Collector

The Dirt Collector is provided at the junction of Brake pipe and Branch pipe. It removes dust from the compressed air coming through the brake pipe so that only dust free air enters the Distributor valve and Auxiliary Reservoir.



3.7 Guard's Emergency Brake Valve

The Valve is provided in the rake Van for use by the Guard for application of brakes from the Brake Van during emergency.



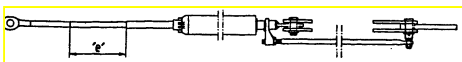
3.8 Pressure Gauge

The gauge is provided in Brake Van to enable the Guard to check the pressure in the Brake Pipe.

3.9 Quick Coupling

The function of Quick Coupling is to fix the pressure gauge in BP pipe provided in Brake Van. Guard has to fix the BP pressure gauge by press fit into quick coupling.

3.10 Slack Adjuster



Slack adjuster (also known as brake regulator) is a device provided in the brake rigging for automatic adjustment of clearance/slack between brake blocks and wheel. It is fitted into the brake rigging as a part of mechanical pull rod. The slack adjuster is double acting and rapid working i.e. it quickly adjusts too large or too small clearance to a predetermined value known as 'A' dimension.

4. DUTIES OF DRIVERS AND GUARDS OF AIR BRAKED GOODS TRAINS

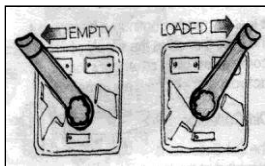
4.1 During Originating Examination ensure that:

- Hand brakes of all wagons are fully released.



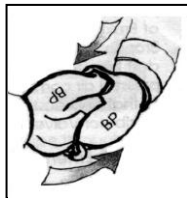
- Operating handle of empty load box is in

correct position i.e. in empty position when wagon is empty or lightly loaded and in loaded position

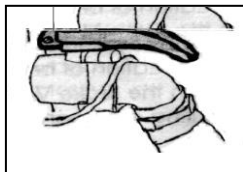


when wagon is loaded beyond the specified value.

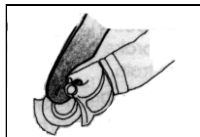
- Hose coupling of brake pipe on consecutive wagons are coupled to one another to form a continuous air passage from the locomotive to the rear end of the train.



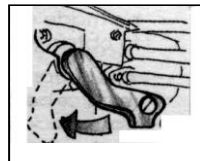
- All the angle cocks, except that at the rear end of the train, are kept OPEN.



- Hose coupling at the rear end of the train is placed on its hose coupling support.



- Isolating cocks of distributor valves of all wagons are in OPEN position.



- Isolating cocks of feed pipes (wherever existing) of all wagons are in CLOSE position.
- After full charging of the system, brake pipe pressure should be as below:

No. of wagons	Engine	Brake van
Upto 56 wagons	5.0 kg/cm ²	4.8 kg/cm ²
More than 56 wagons	5.0 kg/cm ²	4.7 kg/cm ²

- Apply service brake & ensure that:
 - Piston strokes in empty & loaded condition are within the limits. The specified limits are:
 - Empty wagons* - 85 ± 10 mm
 - Loaded wagons* - 130 ± 10 mm
 - Brake blocks of wagons are mating the wheels.

- Release the brake & ensure that:
 - Piston rod of brake cylinder is fully inside.
 - Brake blocks are away from the wheel treads.
- Before starting the train carryout BRAKE CONTINUITY TEST as given at section 5.0 to ensure continuity of the brake pipe pressure through out the train.
- Set the red needle in Air flow meter to the position of white needle which is equivalent to leakage/charging rate of brake system.

4.2 Stopping of the Train

4.2.1 On level track

When the train is to be brought to a stop on level, first apply brakes with a small reduction of brake pipe pressure in the train pipe by auto brake valve (A-9). This will allow the rear portion to run smoothly. A heavier reduction of brake pipe pressure may then be made. In order to make the final stop very smooth, the brake application should be gradually reduced by increasing the brake pipe pressure as the train is about to come to stop. The loco independent brakes should only be applied gradually when the speed has come down to about 5 kmph. This would help in bunching of the train and would help in easier start.

4.2.2 On Down Grade:

Destroy brake pipe pressure partially on trains by automatic brake valve except in case of emergency stop. The application of air brakes being increased as the speed comes down. When speed comes down, if proportionate brakes are in operation, the train shall be brought to stop with train and loco air brakes on. Heavy application should never be made or the rear portion is liable to run in violently and damage to rolling stock may occur. Similarly quick release will cause front portion to run out resulting in service jolts.

4.2.3 On Up Grade

When a train is brought to stop on an up gradient, the brakes should be kept applied by the automatic brake valve, till the train actually stops. This will prevent the rear portion from rolling back.

Note: After stopping of train keep brakes on locomotive and train applied by A-9 brake valve . It will prevent rolling back of train on gradients. Do not leave the train with only SA-9 in applied condition.

4.3 Starting of train after stopping

Do

- Move the brake valve handle (A-9) to release position.
- Wait for 3 minutes to release the brakes for single pipe brake system. Earlier starting, if train brakes have not been released fully, may result in excessive force on coupler and brake binding.
- Ensure that air flow indicator white needle coincide with fixed red needle and light & buzzer is not giving any indication.

Do not

- Do not move the train unless air pressure is achieved 5Kg/cm² in the loco BP gauge.

4.4 Actions to be taken in case of hosepipe disconnection / train parting.

If sudden rise of air flow indication much higher than the reading given by fixed red needle, drop in brake pipe and main reservoir pressure is noticed on air braked train, it indicates either hose pipe disconnection or train parting has happened. The actions to be taken during hose pipe disconnection and train parting are given on next page:

Do

- Apply brakes by moving automatic brake valve handle to stop the train. In case of train parting, ensure that before stopping of front portion of the train, parted rear portion has stopped first then apply emergency brake.
- Bring throttle handle to idle.
- Ensure that guard has protected the rear portion of the train.
- Ensure that brakes are in applied condition to avoid roll back of the train.
- Check the train to identify defective wagon.
- Heavy sound of air leakage will indicate the affected hose pipe.
- Close the angle cocks of adjacent ends of two wagons where hose pipe disconnection has taken place.
- Inspect the hose pipe which has got disconnected.
- In case these pipes are damaged replaced them, In case there is no damage, reconnect the existing ones.
- In case train parting has taken place, reconnect the parted portion of the train as per prescribed procedure.

- Now open the closed angle cocks, no leakage should take place from the reconnected hose pipe.
- Ensure the continuity of the brake system and train.
- In case the brake hose pipe is damaged or cannot be replaced the pipe of the last wagon of the front portion should be put on dummy and the angle cock closed. The brakes of the portion in rear should be manually released and the train brought to the next station at reduced speed.
- Ensure that screw coupling of effected coaches are not loose.
- Observe the position of movable needle of air flow indication gauge, it should coincide with the fixed red needle.

Do not

- Do not operate D-1 emergency brake valve.
- Do not move train until the air flow indicator light is glowing and its white needle has not coincide with red needle or buzzer is giving sound.
- Do not start train after stopping the train at least for 3 minutes in case of single pipe air brake system fitted on trailing stock to release the brake.

- Do not move train unless the brakes on entire train are released fully.
- Do not move train unless specified pressure are achieved.

4.5 Actions to be taken in case of Cattle Run Over

Due to cattle run over sudden impact in front of the locomotive is observed. Action to be taken during such condition is given below:

Do

- Apply brake through A-9 brake valve to stop the train.
- Check leading angle cocks of brake pipe to ensure that they are in proper condition.
- In case leading brake pipe angle cock is damaged then
 - a) If an additional cock is provided on the loco then close the additional angle cock on leading side of the loco.
 - b) If additional cock has not been provided then fail the locomotive and ask for assistance.

- Ensure that trailing end hose pipe coupling and angle cocks of the locomotive and trailing stock are in perfect working condition.
- Ensure that cattle guard is O.K. and there is no infringement with the track or with any part of the locomotive.
- In case the run over cattle has also passed below the train, check the under gear of the effected wagon. Any hanging parts shall be secured or removed. There should not be any infringement of track.
- Wait for 3 minutes to release the brakes in case of single pipe air brake working.

Do not

- Do not move the train if any part of locomotive and trailing stock concerning to brake is damaged.
- Do not leave the train with only loco brake (SA-9) . After stopping both loco and train brake should be applied by automatic brake valve (A-9).
- Do not move the train without continuity test.

5. BRAKE CONTINUITY TEST

5.1 Objective

Brake continuity test is one of the most important test of air brake system. This test is done to check the continuity of the brake pipe through-out the train. It ensures that the brake pipe pressure gets released/ created, during the brake application/released, simultaneously in brake pipes of all wagons through out the length of the train.

5.2 Principle

The underline principle of the test is that first the brake pressure is created from the locomotive. The pressure so created in brake pipe is then destroyed from the brake van/last vehicle and in doing so, the brake pipe pressure in locomotive should also become zero.

The brake pipe pressure is once again created from the locomotive and the build-up of brake pipe pressure is checked from the brake van/last vehicle.

In case of any discontinuity and/or blockage in the brake pipe the rise/fall of brake pipe pressure in loco shall not cause rise/fall of brake pipe pressure in brake van and vice versa.

5.3 When required

The brake continuity test must be carried out on train in the following circumstances without exception as prescribed by RDSO.

- a) Fresh locomotive or additional locomotive is attached to the front of the train.
- b) Fresh locomotive or additional locomotive is attached to the rear of a fully fitted train.
- c) Vehicle is attached at any position in the fitted portion of the train.
- d) Vehicles in the fitted portion of the train are detached from other than extreme rear end.
- e) After any brake defect or irregularity which has affected the continuity of the brake system has been rectified.

5.4 Who shall carry out

The drivers and guards together must carry out this test as soon as possible after the locomotive is coupled or re coupled strictly following the detailed procedure laid down by RDSO as given herein:

5.5 Test procedure

Step-1: The driver must move the automatic brake valve handle to RUNNING in the leading driving compartment and check that approx. 5.0 kg/cm^2 is registered on the brake pipe pressure gauge.

Step-2: The driver must move the automatic brake valve handle to HANDLE OFF/NEUTRAL without a pause and retain initially at least 4.0 kg/cm^2 on the brake pipe pressure gauge.

In the case of A9 automatic brake valve which does not have HANDLE OFF/NEUTRAL position the following procedure shall be followed:

- After the brake pipe pressure has stabilised close the brake pipe isolating cock provided between additional C2 relay valve and brake pipe of locomotive.

STEP-3: The guard must then with out delay carry out the following:

- If a brake van is the rear vehicle, open the guards's emergency Brake Valve until all air is exhausted reducing the pressure to zero. The valve must then be closed.
- If a brake van is not the rear vehicle, open the Brake Pipe cut off angle cock on the rear end of the last vehicle un till all air is exhausted. The Cock must then be closed.
- In the case of partly fitted train, the Cock must be opened on the rear end of the rear vehicle in the fitted portion all the air is exhausted. Before carrying out this part of the test, the guard must have a clear understanding with the driver as to what is to be done to ensure that the train is not moved during the test.

- If locomotive in the rear of the last wagon in addition to the driving locomotive in the front of the train, is used and this locomotive is the last vehicle on the train, then the guard must instruct the driver of the rear most locomotive to perform the duties of the guard in carrying out the brake continuity test. Then the driver must move the Automatic Brake Valve to emergency until the Brake Pipe Pressure falls to zero. He must then move the Automatic Brake Valve Handle to OFF/NEUTRAL and observe that the brake Pipe pressure does not immediately rise. In case of A9 Automatic Brake Valve which does not have HANDLE OFF/NEUTRAL position, the isolating Cock provided between additional C2 relay Valve and Brake Pipe of locomotive must be closed and must observe that the Brake Pipe pressure does not immediately rise. The Guard must obtain an assurance from the driver of the rear most locomotive that this has been done.

STEP-4: The driver of the driving locomotive must observe that the brake pipe pressure has dropped to zero in the leading driving compartment and does not commence to rise again. If the Brake Pipe pressure does not fall, this can be due to Brake Pipe Cut Off angle Cock being closed. If the brake Pipe pressure does not fall to zero, check if a locomotive Automatic Brake Valve or brake controller in another cab/control stand is not in the HANDLE

OFF/NEUTRAL position. In the case of A-9 Automatic Brake Valve which does not have HANDLE OFF/NEUTRAL position, check whether the isolating C2 relay Valve and brake pipe of locomotive is not in closed position.

STEP-5: After correction of any fault a further brake continuity test commencing at STEP 3 must be carried out.

STEP-6: The driver must move the Automatic Brake Valve to RUNNING position and check that 5.0 kg/cm² is registered in the locomotive cab and maximum level in the last vehicle as stipulated in the operating rules. In case of A9 brake valve which does not have HANDLE OFF/ NEUTRAL position, after the Cut-out cock between C2 Relay valve and Brake pipe is opened the brake pipe pressure should again build upto 5 Kg/cm² in the locomotive and to a maximum pressure in the last vehicle as stipulated in the operating rules.

6. LEAKAGE TEST

When ever the problem of low brake pipe pressure is experienced, conduct leakage test as per procedure detailed below to check whether the leakages in train air brake system are within permissible limits and to take corrective actions, if required.

STEP –1: Ensure that brake pipe of all wagons are coupled and brake pipe angle cocks on all the wagons are in open position.

STEP – 2: Place the Driver’s Automatic Brake valve handle in Release position. Ensure that the brake pipe pressure has stabilised in the locomotive and rear most vehicle to the level indicated below:-

Length of the train	Loco	Last wagon
Up to 56 BOXN wagons	5.0 Kg/cm ²	4.8 Kg/cm ²
More than 56 BOXN wagons	5.0 Kg/cm ²	4.7 Kg/cm ²

STEP –3 : Move the Driver’s Automatic Brake valve towards the APPLICATION position to reduce the brake pipe pressure from 5 Kg/cm² to 4 kg/cm².


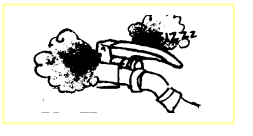
STEP–4: After the brake pipe pressure has stabilized , close the brake pipe isolating cock provided between additional C2 relay valve and brake pipe on the locomotive.

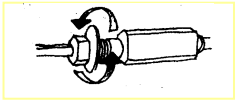
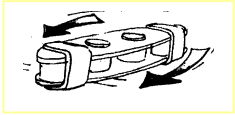
STEP-5: Wait for 60 seconds for temperature and gauge settlement and then note the drop in pressure in the brake pipe pressure gauge in the locomotive for five minutes.


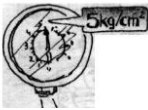
STEP –6: The drop in brake pipe pressure gauge shall not be more than 1.25kg/cm² in 5 minutes (i.e rate of drop should be less than 0.25 kg/cm²/min.).

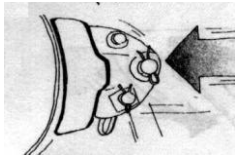
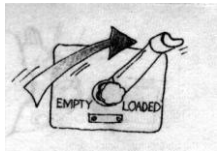
STEP –7: If the leakage rate is more than the value indicated in step 6,check for leakage's on individual wagons.

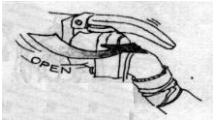

7. EN-ROUTE TROUBLE SHOOTING ON AIR BRAKE TRAINS

Sr No	Trouble	Defects	Remedial Action	
1.	Brake Binding	Leakage from Coupling head due to displaced work out MU washer.	Reset/Replace MU washer	
		Leakage from angle cock brake pipe joints drains plugs of auxiliary & control reservoir.	Control Leakage by Tightening loose joints.	
		Hand brake may be partially 'ON'	Release hand brakes fully.	

Sr No	Trouble	Defects	Remedial Action	
		Setting of empty load device handle may be disturbed.	Reset it properly.	
		Sleeve nut of empty tie rod may be in tampered condition.	Adjust and lock properly.	
		Horizontal live lever jamming against its guide brackets.	Ensure smooth operation & lubricate.	

Sr No	Trouble	Defects	Remedial Action	
2	Poor Brake power	Lack of through brake pipe connection from loco to brake van.	Ensure full open position of all Angle cocks –i.e., all angle cock handles in parallel Position.	
		Inadequate air pressure level in engine and brake van.	Ensure specified BP pressures are maintained in loco (5 kg/cm ²) and in brake van (4.8 kg/cm ² for 56 wagons).	
		In operative Pistons	Check & Ensure that isolating cock of DV are in “ON” position of wagons with in operative piston.	

Sr No	Trouble	Defects	Remedial Action	
		Brake Blocks not gripping wheels during application although Brake cylinder piston is working	Check whether brake rigging is linked up properly or brake blocks are excessively worn.	
		Empty load box change over handle of loaded wagon is kept in empty position.	Keep the handle in correct position.	

Sr No	Trouble	Defects	Remedial Action	
3.	Brake pipe is not charging	Cut off angle is being closed position.	Move the handle to open position i.e. move it to parallel with the pipe line.	
4.	Un-coupling of Air hose on run.	Air hose too short and not forming cradle shape.	Replace air hose with proper length (i.e. 660 ± 6 mm)	
		Working out of air hose from nipple or palm end.	Replace MU washer & Ensure proper fitment of MU washer and re-coupled properly.	
		Air hose not coupled properly.	Re-couple loco and first wagon BP hoses correctly.	

Sr No	Trouble	Defects	Remedial Action	
5.	BP Pressure in last vehicle more than 5 kg/cm ² .	Loco feed pipe coupled to brake pipe.	Re-couple Loco and first wagon BP hoses correctly.	

DISTRIBUTION LIST

Railway Board, Rail Bhavan New Delhi

1. Addl. Member (M)
2. Executive Director Mech.Engg. (Freight)
3. Executive Director (Freight)

RDSO, Manak Nagar, Lucknow.

4. Secretary to DG for kind information of DG/RDSO.
5. Executive Director (Wagon)
6. Library, RDSO, Lucknow

Zonal HQ

7. Chief Mechanical Engineer
Central Railway, Mumbai, C.S.T.
8. Chief Mechanical Engineer
Western Railway, Church gate Bombay.
9. Chief Mechanical Engineer
Eastern Railway, Fairlie Place, Calcutta
10. Chief Mechanical Engineer
Southern Railway, Chennai.[T.N.]

11. Chief Mechanical Engineer
North-Eastern Railway, Gorakhpur (U.P)
12. Chief Mechanical Engineer
South-Eastern Railway
Garden Reach, Calcutta.(W.B.)
13. Chief Mechanical Engineer
South-Central Railway, Secundrabad.(A.P.)
14. Chief Mechanical Engineer
Northeast-Frontier Railway
Maligaon.[Assam]
15. Chief Mechanical Engineer
Northern Railway, Baroda House
New Delhi.
16. Chief Mechanical Engineer
OSD'S Office,
East Coast Railway Zone, Bhubhneswar.
(Orissa)
17. Chief Mechanical Engineer
OSD'S Office,
North Central Railway Zone,
Allahabad. (UP)
18. Chief Mechanical Engineer
OSD'S Office,
North Western Railway Zone, Jaipur. (Raj.)

19. Chief Mechanical Engineer
OSD'S Office,
South Western Railway Zone,
Banglore, Karnataka.
20. Chief Mechanical Engineer
OSD'S Office,
West Central Railway Zone, Jabalpur (MP)
21. Chief Mechanical Engineer
OSD'S Office,
East Central Railway Zone, Hazipur, Bihar.

Institutions

22. Principal,
Railway Staff College, Vadodara
23. Director
IRIMEE, Jamalpur.
24. Principal,
Supervisors Training Centre
All Zonal Railways
25. Documentation Centre
CAMTECH, Gwalior.
26. Library
CAMTECH, Gwalior.

OUR OBJECTIVE

To upgrade Maintenance Technologies and Methodologies and achieve improvement in Productivity and Performance of all Railway Assets & Manpower which interalia would cover Reliability, Availability, Utilisation and Efficiency

If you have any specific comments and suggestion please write to us:

Contact Person : **Director(M)**

Contact Address : **Indian Railways
Centre for Advanced
Maintenance Technology
Maharajpur, Gwalior-20**

Telephone : **0751-470803, 470890**

Fax : **0751-470841**

E-mail : **dirmech@sancharnet.in**