Introduction

The purpose of this booklet is to explain the function and operation of air brake equipment as applied to locomotive hauled coaching stock and associated vehicles.

As well as explaining the operation of the system, appendices are given which show the actual location of the items of equipment on the vehicles concerned.
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PASSenger CarrYING veHICLES AND CARFLATS (DUAL BRAKED)

Layout of Equipment

The system used is known as the two pipe automatic air brake and all the equipment conforms with the U.I.C. Specification on this subject. The diagramatic layout of the equipment used in the system is shown on PAGE 3 and the reference numbers in the following paragraph correspond to those on the diagram.

Pipework and Arrangement of Equipment

There are two through pipes on each fitted vehicle, namely the brake pipe and the main reservoir pipe. These pipes are fitted at each end with coupling cocks (7). The main reservoir pipe coupling cocks are fitted with $\frac{1}{4}$" hoses (8) which are equipped with check valves in the coupling head, and the brake pipe coupling cocks are fitted with 1" diameter hoses (9) and plain coupling ends. The brake pipe is connected to the distributor (1) which governs the supply of compressed air to the brake cylinders (3). The passenger emergency valve (6) is also connected to the brake pipe to enable a passenger to apply the brakes in an emergency. A feed is taken from the main reservoir pipe through the isolating cock (5) and strainer, check valve and choke unit (4) to the auxiliary reservoir (2) and then to the distributor. A duplex gauge is situated in the guards compartment of brake vehicles showing the air pressure in both the main reservoir pipe and brake pipe. All air pipes are copper with soldered joints, the connections to the equipment being by screw type unions or connectors.

Operation and Details of Equipment

The following section gives the operation of the equipment and states the function of each item in the system and its relation to the other items where applicable.

When the system is fully charged with a brake pipe pressure of 70 p.s.i. and a main reservoir pipe pressure in excess of 70 p.s.i. the brakes are in the release position. Any reduction in brake pipe pressure will cause the brake to be applied in proportion to the reduction. A full brake application is made by the driver reducing the brake pipe pressure with the locomotive brake valve to approximately 46 p.s.i., a greater reduction having no further effect on brake cylinder pressure, this already being at its maximum value due to the brake pipe pressure being reduced to 46 p.s.i. Only on a train division or emergency application would the brake pipe pressure be below this value.

The brakes are fully released by restoring the brake pipe pressure to 70 p.s.i. Graduated release of the brakes is possible, the decrease in brake cylinder pressure being in proportion to the increase of the brake pipe pressure.
Diagram of Air Brake Equipment fitted to Passenger Carrying Vehicles and Carflats

1. Distributor
2. Auxiliary Reservoir
3. Brake Cylinder
4. Strainer, Check Valve and Choke Unit
5. Isolating Cock
6. Passenger Emergency Valve
7. 1" Coupling Cock
8. 2" Main Reservoir Pipe Hose
9. 1" Brake Pipe Hose
10. Brake Pipe and Main Reservoir
11. Emergency Brake Application Valve

* Not fitted on Carflats
♂ Brake Vehicles only
1. **Distributor.**

The distributor is sensitive to brake pipe pressure and passes air from the auxiliary reservoir to the brake cylinders in direct ratio to the reduction in brake pipe pressure. It similarly releases brake cylinder pressure according to increase in brake pipe pressure.

**Features of the Distributor.**

(a) A "quick service" feature is incorporated which allows limited local release of brake pipe pressure and, therefore, propagates a high rate of brake application down the train.

(b) Initially a rapid flow of air is admitted to the brake cylinders allowing a limited pressure to build up, which moves the brake blocks/pads on to the wheels/discs in readiness for a further degree of brake application. This feature is known as "inshot".

(c) An automatic release valve is incorporated at the base of the distributor which allows the brakes, controlled by that particular distributor, to be released, by pulling the cord shown in the photograph on this page.

(d) A 'Passenger', 'Goods' changeover valve can be incorporated which allows the brakes to be applied and released to 'Passenger' or 'Goods' timings as required.
WESTINGHOUSE P4 DISTRIBUTOR

SHOWING BRAKE PIPE, AUXILIARY RESERVOIR AND BRAKE CYLINDER CONNECTIONS.

ISOLATING HANDLE AND RELEASE VALVE STEM.
2. Auxiliary Reservoir.

This item stores air at main reservoir pipe pressure which is then admitted to the brake cylinders via the distributor when a brake application is made. Reservoir pressure is restored automatically through the check valve (4) after a brake application has been made.

Note: The release cord shown on the above illustration is for the vacuum brake cylinder.
3. **Brake Cylinder.**

Two brake cylinders are used on an air braked coaching vehicle each operating on one brake cross shaft which is also actuated by its respective vacuum cylinder. The brake cylinders are single acting with removable push rods and are operated by compressed air admitted to them by the distributor. Air pressure is released from the cylinders through the distributor and the pistons are returned to the release position by a return spring within the cylinder. Separate release springs are fitted to the brake rigging.
STRAINER CHECK VALVE AND CHOKE UNIT WITH
ISOLATING COCK ON THE LEFT SHOWN IN THE OPEN POSITION.

4. Strainer check valve and choke unit.

The auxiliary reservoir is supplied with compressed air from the main reservoir pipe through this unit. Air first passes through the horse hair strainer, then through the check valve which will not permit the return of air from the auxiliary reservoir back into the main reservoir pipe, and finally through a choke, to the auxiliary reservoir.

5. Isolating Cock

This cock is usually situated close to the strainer check valve and choke unit on the main reservoir pipe side and provides a means of isolating the auxiliary reservoir from the main reservoir pipe.
LOCATION OF AIR BRAKE PASSENGER EMERGENCY VALVE.

6. Passenger Emergency Valve (Passenger Carrying Stock only).

The passenger emergency valve is situated on the passenger communication disc rod at the end of the vehicle, usually adjacent to the vacuum emergency application valve, using the same passenger communication disc indicator at each end of the rod. The valve is actuated in the same manner as the vacuum valve as far as passenger operation is concerned. When the cord is pulled the disc rod is rotated and a cam in the box lifts the valve and vents the brake pipe to atmosphere, causing an automatic brake application to be made.

The valve has a locking bias in both open and closed positions by spring loaded plunger, which also gives a positive fly-over action when the valve is operated.
7. **1" Coupling Cocks.**

Each end of both brake and main reservoir pipes are fitted with 1" spherical plug cocks, which are open when the handles are placed in line with the pipes and closed when the handles are at right angles with the pipes. When in the closed position any compressed air in the hose is vented to atmosphere through holes in the valve body. This ensures that air pressure can be released from the hoses before they are uncoupled.
Main Reservoir Pipe and Brake Pipe Hoses and Coupling cocks.

3. ½" Main Reservoir Pipe Hoses.

These hoses are fitted to the coupling cocks at the end of the main reservoir pipe for connection to other air braked vehicles. The coupling head of the hoses is fitted with a check valve which enables main reservoir pipe pressure to be retained in the pipe when the coupling is free and the cock is in the open position. This prevents the escape of air at high pressure if the hoses are disconnected without first closing the main reservoir coupling cocks. When main reservoir pipe hoses are connected together both the check valves in the heads of each hose are held off their seat and allow free passage of air.

These hoses are marked with a white indication band.

9. 1" Brake Pipe Hoses.

The brake pipes are connected from the coupling cocks by 1" hoses with
11. Guards Air Pressure Gauge.

Indication of both brake pipe and main reservoir pipe pressure are shown on the duplex gauge which is situated in the Guards compartment of brake vehicles.

The above illustration shows this gauge in position and as can be seen brake pressure is indicated on the left (this is a red scale and numerals) and the main reservoir pipe pressure is shown on the right (the scale and numerals in this case being black).


In the case of an emergency the guard, by moving the handle of this valve downwards until it is in line with the pipe, vents the brake pipe to atmosphere and thus makes an emergency brake application.
The fitting of air braking on passenger carrying vehicles, carflats and Cartic '4's' has necessitated indication markings and lettering on the vehicles and the following notes give their location.

The location of the distributor release cord is marked on the solebar by a white star as distinct from the vacuum release cord star which is yellow.

The position of the Isolating cock on the feed pipe from the Main Reservoir Pipe is marked in yellow letters on the vehicle solebar adjacent to the cock as follows: - MAIN RESERVOIR PIPE ISOLATING COCK.*

The isolating cock on the distributor is indicated in yellow letters as follows, adjacent to the distributor itself:

BRAKE ISOLATING COCK.*

On vehicles converted to air brake, indication is given on the solebar of air brake overhaul on the date the air brake equipment was fitted. This indication is above the normal brake overhaul details and shown thus:

ABO ..........(Date)..........*

Note. When dual braked vehicles are shopped for classified repair, only one indication of brake overhaul will be given from that date onwards.

BRAKE PIPE cocks and hose fittings are painted RED.
MAIN RESERVOIR PIPE cocks and hose fittings are painted YELLOW.
THE VACUUM PIPE extension beyond the vehicle solebar is painted RED, as is the standard practice on dual braked stock.
ALL other compressed air pipes are painted white.

*Dual Braked Stock Only.
BRAKE ISOLATING COCK

DISTRIBUTOR ISOLATION HANDLE
IN ISOLATED POSITION

DISTRIBUTOR ISOLATION HANDLE
IN WORKING POSITION
1. Air Connections Uncoupled
   Vehicles coupled. Air brake hose connections secured on brackets provided.

2. Coupling heads engaged prior to locking.
3. Coupling Complete

Coupling heads engaged and locked in position.

DESCRIPTION OF COUPLING PROCEDURE.

After coupling the drawgear between two air braked vehicles ensure that all four air brake coupling cocks are in a closed position. (i.e. handles at right angles to pipe).

Remove the main reservoir pipe connection from its bracket on each vehicle. Lift the two coupling heads and hold together with the pipes at 90° as shown in Fig. 2. Enter the mating locating lugs and turn coupling heads until the pipes are in line. The connection is now made and the coupling heads are locked in position.

Repeat the above procedure with the brake pipe hoses. Open all four cocks (handles in line with pipes) and then examine all vehicles to ensure that cocks are open except the two cocks on the end of the last air braked vehicle which must be closed.

When uncoupling two air braked vehicles the coupling cocks must first be closed. The coupling heads can then be disconnected by reversing the procedure above. When disconnected the coupling heads must be secured on the brackets provided.
APPENDIX
LOCATION OF AIR BRAKE EQUIPMENT

This appendix has been prepared to simplify location of the air brake equipment on the stock previously described. The illustrative plans on the following pages are purely diagrammatic and for simplicity do not show the compressed air pipework.

It will be noted that the grouping of the equipment on the dual braked coaches and carflats is such that the valves and cocks required for vehicle isolation are in the same area and easily accessible.
LOCATION OF AIR BRAKE EQUIPMENT AND HOSES
ON RESTAURANT CAR, RU., RB., AND SO VEHICLES

1. Distributor
2. Auxiliary Reservoir
3. Brake Cylinder
4. Strainer, Check Valve and Choke Unit
5. Isolating Cock
6. Passenger Emergency Valve
7. Coupling Cocks
8. ¾" Main Reservoir Pipe Hose
9. 1" Brake Pipe Hose
LOCATION OF AIR BRAKE EQUIPMENT
AND HOSES ON S.L.S. AND B.S.O. VEHICLES

1. Distributor
2. Auxiliary Reservoir
3. Brake Cylinder
4. Strainer, Check Valve and Choke Unit
5. Isolating Cock
6. Passenger Emergency Valve
7. Coupling Cocks
8. ¾" Main Reservoir Pipe Hose
9. 1" Brake Pipe Hose