FRONZ / ONTRACK

APPROVED CODE OF PRACTISE
FOR
HERITAGE NETWORK OPERATORS

Mechanical Manual
B3.2.7.02

Air Brake Maintenance Manual

Issue	Prepared (P), Reviewed (R), Amended (A)	Approved by	Effective Date
1	P McCallum (P)	Heritage Technical Committee	12 Dec 2006

Reference Material

Source	Description	Date
NZR	Lubrication Schedule	?
NZR	Air Brake Equipment - Car, Vans & Wagons	25 Feb 1959
Tranz Rail	Loco-hauled Passenger Car and Van Brake Manual,	5 June 1996
NZR	Air Brake Equipment on Locomotives Etc.	21 April 1959

The holder of printed or duplicated copies of this document is responsible for ensuring they are using the latest version.

Amendment History

Version	Section	Amendments
1	1 & 2	Removed references to modern lubricants

Index

Section 1
Introduction

This manual is a collection of various NZR instructions for the maintenance of air brake equipment.

These documents date from 1959 to 1996. Over that time some maintenance practices have been amended and recommended lubricants have changed. Maintenance staff should select those techniques most appropriate for the equipment being serviced.

Overhauls

This manual does not include overhaul instructions. Operators wishing to do their own overhauls will need:-

- Documented overhaul and test procedures.
- Staff with demonstrated competence in overhaul of air brake equipment.
- Certified test rig.

It is recommended that operators use a recognised overhaul provider for this work. Eg:-

- Hutt Workshops, United Group
- Knorr-Bremse, Australia
- Queensland Rail
- Pacific National Rail (Air Fluid Otago of Dunedin are agents.)

Other Information

B3.2.7.03 - Wagon Brake Manual
B3.2.8.01 - NZR Air Brake Handbook
Westinghouse Brake and Signal Company component catalogues and handbooks.

Amendments and Deletions

Instructions that have been deleted as no longer relevant are shown as ~~deleted~~ or /

Additions and amendments to instructions are shown in [ ] brackets.

Section 2
Lubricants and Materials

Source – NZR
Date - Unknown

Notes
- Additions and amendments to the original document are shown in [ ] brackets.

Lubricants

1. W.H.B. Contract Grease
2. Approved multi-purpose grease
3. Pale machine oil
4. Powdered graphite
5. Morgans Graphite [Graphite grease]
6. Steam cylinder oil
7. Locomotive bearing oil

Item	**Lubricant to be used**						
	1	2	3	4	5	6	7
Brake Cylinders :							
Cylinder walls, piston trunk. Packing cups and felt swabs	X						
Brake Valves :							
Rotary valves and seats		X					
Equalising piston and bush			X				
W2E, W and WS types –							
Exhaust cups	X						
Balance lever pins, rollers etc			X				
Cocks (where dismantled) :							
Brake pipe isolating and coupling cocks.		X					
Brake valve isolating		X					
Compressors (Steam) :							
Air strainers (steel wool)							X
Piston rod swab						X	
Distributing Valves :							
As for triple valves, packing cups and gaskets	X						
Emergency valves :							
As for triple valves							
Feed and reducing valves :							
Slide valves and seats		X					
Pistons and bush			X				
Gaskets :							
Dressing leather and “Wabco” cups	X						
Copper gaskets exposed to steam					X		
Governors :							
Valve guides, linkage – where			X				

Item	Lubricant to be used						
	1	2	3	4	5	6	7
required							
Relay Air Valves :							
Piston guide and bush		X					
Packings	X						
Brake Rigging :							
Adjuster threads – pins and bushes when renewed							
Slack adjusters :							
Screw thread; Crosshead and guide				X			
Ratchet nut bearing				X			
Cylinder, piston and packing	X						
Triple Valves :							
Piston and bush			X				
Slide valves and seats		X					

General Materials To Be Used

Muslin or stockinette cloth must be used for cleaning the internal parts of brake valves, distributors, triple valves, relay valves, etc. Cotton waste may only be used on exterior parts or where loose threads cannot get into the brake system and cause defective operation.

Kerosene or similar cleaning agents may be used for removing dirt, grease and gummy deposits but must not be used on leather or Wabco packing cups or gaskets.

Non-caustic soft soap in solution with water is to be used for testing of air leaks in piping and brake parts. [The foam produced by a small amount of dishwashing detergent diluted in water and shaken works well.]

Fine and medium commercial water-soluble grinding compounds to be used for renewing seats, valve faces, etc.

“Brasso” and “Shino” or similar proprietary polishes may be used for final lapping of valves, surfaces, etc.

On new pipe work hemp must not be used to obtain a tight joint. Full threads and approved jointing compound are to be used. Where joints are remade, the addition of hemp to the compound is permitted where considered necessary but must be reduced to a minimum (See Instruction regarding “Piping”).

Backnuts and string for making joints are not permitted except where expressly approved.

Section 3
Air Brake Equipment
Car, Vans & Wagons
Maintenance Procedures

Source – NZR
Date - 25 February 1959; with amendments to 28 October 1977

Index

1. Triple Valves

(a) Triple valves may be removed from vehicle if it is impracticable to give them the necessary attention in place.

(b) Remove cover, piston assembly, bulb and the regulating valve of improved triples (see Item (h)).

(c) Thoroughly clean piston and slide valve assembly and rotate piston ring in the groove freeing it with kerosene if necessary. Clean piston bush and slide valve bush. Clean feed groove using a piece of pointed wood or brass wire. Dry all parts thoroughly and see that the interior of the triple is free of any foreign matter.

(d) Inspect slide valve face and seat for defects, check spring, graduating valve and pin.

(e) Clean regulating valve of improved triples and depress valve to check spring. Replace securely in position. Clean bulb checking that syphon tube is clear. Replace bulb. Check that reservoir tube of combined brake sets is clear.

(f) Place a light smear of “Rocol 1000’ or recommended lubricant on the slide valve face. Replace piston assembly and work the slide valve on its seat for several strokes. Remove piston assembly and wipe excess from the slide valve face with the palm of the hand, also removing any excess on the slide valve seat. Lubricate the bush with a light smear of “Rocol 1000” also the piston ring, rotate the ring in the groove to distribute the Rocol into the ring groove. Wipe off surplus Rocol. Replace piston and slide valve assembly seeing that the gap in the piston ring is placed opposite the right hand bottom bolt.

(g) Clean triple valve cover and face. Renew gasket, if necessary, smearing both sides with a little W.H.B. grease and secure cover in place. Clean exhaust nipple

(h) Do not remove the regulating valve cover of A.F. type triple valves as no attention to the components of this assembly is necessary at “Brake Cleans”. On single vehicle testing of vehicles fitted with A.F. triples, however, soap suds are to be applied to the regulating valve vent hole and if leakage occurs or grease is found working out, the triple valve must be changed.

(i) See that the brake cylinder exhaust nipple is thoroughly cleaned. (Wheel flats have resulted from blocked nipples). Clear cavity and replace nipple.

(j) All defective triple valves are to be sent to Workshops for overhaul and no repairs other than those authorised by the Chief Mechanical Engineer are to be undertaken at brake cleaning.

(k) Before dispatching triple valves they must be cleaned of all dirt and scale. A suitable wood cover must be placed over the bolting up flange and a piece of defective hose over the screwed thread of the nipple to protect them from damage in transit.

2. Brake Cylinders

(a) Other than A.F. Type.

Remove dome cover or head and withdraw piston. Clean cylinder of dirty and dry lubricant. Clean leakage groove. Kerosene may be used to assist cleaning but

must be completely removed to prevent damage to piston packing leather. Rust on cylinder walls may be removed with emery cloth. Where cylinder walls are ridged, scored or worn, and prevent proper sealing of the piston packing leather they may be re-bored up to a limit of 0.030" above nominal size. Where cylinders are worn excessively they must be replaced.

Clean piston, packing leather (DO NOT USE KEROSENE) and expander ring. Examine leather packing cup. If the leather is spongy, perished, thin at any point or has split, it is to be renewed.**

If the packing leather is satisfactory, check that the expander ring has a correct bearing and cannot escape from groove. Expander rings should stand open at least 3/4" when free. If correct, remove gap to a new position in packing leather. Check follower plate for cracks and studs for tightness. Make sure that the piston rod is secure to the head. Check piston rod bearing in non—pressure head (dome cover) for wear; if the hole is out of round 1/8" or 1/16" for trunk type, the head must be renewed or bushed. The release spring is to be cleaned of all dirt and rust.

Lubricate the packing leather with approved grease, working the lubricant well into the leather. Grease inside cylinder wall evenly and thinly over its whole surface. Replace piston in brake cylinder, taking care to keep the expander ring in place. Special care to be taken that the leather is not damaged. No sharp instrument should be used to assist in replacing leathers. When piston has entered the cylinder, revolve a quarter of a turn in either direction to ensure that no binding takes place. Replace dome head and bolt up.

**(Leathers should be fitted with flesh (rough) side to cylinder wall.)

(b) A.F. Brake Cylinders.

A.F. Brake Cylinders are to receive attention where applicable, as for other brake cylinders. The piston swab is to be removed, cleaned by brushing and lubricated. The protector housing, swab and rings to be cleaned and examined. If the seal rings are not tight on the piston truck, they are to be removed. Remove strainer and clean horsehair pad to ensure that it is free from oil and grease. Lubricate cylinder wall and leather packing, working lubricant well into the leather. Fill the groove between the piston packing leather and felt swab with brake cylinder grease; at the same time the protector housing is to be lubricated with grease by filling the inside space. Insert piston in brake cylinder using special compressing band. Take care to ensure piston swab is not damaged. Replace cover and after coating threads with grease, bolt up securely.

(c) Lubricating A.F. Brake Cylinders. [See also page 4.18]

Lubrication of these brake cylinders is carried out by grease gun and the amount of lubricant is set out in the table below.

The greasing of the brake cylinder is to be done with the piston IN THE FULL RELEASE POSITION. Remove the special plug from the pressure end of the cylinder, connect the grease gun, and inject the grease. The plug should then be replaced and the piston rotated one quarter of a revolution by turning the end of the piston trunk projecting from the non-pressure dome cover.

(d) Amount of Grease to be used.

The number of strokes of the grease gun lever which is required is as follows and. it is important that this quantity be not exceeded :-

Diameter of Brake Cylinder.	Strokes of Lever.	[Gland End]
6 inches	9.	[2]
8 "	12.	[2]
10 "	15.	[2]
12 "	18.	[3]

NOTE : The quantity of lubricant is based on that given by means of a "Tecalemit" grease gun, junior hand compressor type 1.

(e) Stencilling of Vehicles after completion of greasing "AF" Cylinders.

On completion of complete air brake overhaul the stencil symbols denoting this are shown thus :-

WB/Z. 5.58.

The letters to be used when "AF" brake cylinders are not dismantled at an overhaul period but are lubricated by grease gun are :-

WB/Z. 5.58
1

When the "AF" brake cylinders are lubricated a second time by grease gun at a brake cleaning period the stencil denoting this shall be :-

WB/Z. 5.58
2

The depot symbol, month and year, follow the brake overhaul (WB) stencil as per example.

(f) A strainer must be fitted in the branch pipe union nipples of triple valves on vehicles not fitted with centrifugal dirt collectors.

3. Auxiliary Reservoirs

Remove auxiliary reservoir plug and drain reservoir. Grease threads of plug and replace this in clean condition.

4. Release Valves.

(a) These must be examined and tested and replaced if defective. The handle must have a minimum 1/2" lost travel at its lower end. Check release wires and connections to ensure that these are properly secured replacing where necessary.

(b) Defective valves must be sent to Otahahu or Addington Shops for repair.

5. Brake Piping.

All air pipes must be examined for corrosion, chafing, worn threads and cracks. Any defects are to be made good or new pipe fitted.

During "lift periods" and while dirt collectors are off pipes should be blown out with air to rid the pipes of loose scale and dirt.

With new pipes, after bending and screwing operations are completed, remove all burrs from the ends of pipes and thoroughly clean the pipe by blowing out with steam or air. Steel pipe should also be hammered at the same time to loosen dirt and pipe scale.

Except where otherwise specified, all pipes and fittings must be of steel and the best steam quality. Elbows must not be used in air pipes as they reduce the efficiency of the complete air system. Bends in piping are to be made at a red heat and the radius of the bend must not be less than 2 ½ times the diameter of the bore.

When installing pipes all joints and connections must be made accessible, and no force shall be used to bring the ends together or into alignment. All threads shall be full size, running joints and back nuts being eliminated where possible in favour of approved pipe unions. All unions must be jointed by means of leather gaskets, not soft jointing. On no account must rags or waste be used for plugging pipes or openings. Wooden plugs only to be used for this purpose.

All piping must be adequately clipped and tightly secured, particular attention being paid to the method of clipping the pipe at the headstock.

6. Centrifugal Dirt Collector.

The centrifugal dirt collector must be dismantled and thoroughly cleaned and examined.

7. Brake Pipe Cocks (Not A.4.R. type).

(a) Examine cocks at each end of the vehicle and check that cock body, handle and cap are intact and secure. See that stop lugs on body and handle are in good condition and effective and that the pin in the handle is secure. If the cock is in any way defective it should be replaced.

(b) Lubricate the cocks by removing the coupling hoses and inject a small quantity of approved oil down the brake pipe by means of a syringe, after which the cock handle should be operated several times to ensure the plug valve is adequately lubricated. Emergency cocks in cars and vans must be lubricated in a similar manner.

(c) With isolating cocks remove handle and cap to withdraw plug. The interior of the cock and plug should be inspected for signs of scoring and distortion and if damaged in any way it must be replaced. After cleaning smear lightly with approved lubricant, re-insert plug through angle of 90 to distribute the lubricant and reassemble the cock. Particular care is to be taken to see that the plug is not allowed to drop or receive any abrasion.

8. A.4.R. Angle Cocks.

These cocks are designed to provide a blow of air from an. exhaust port in the body or the cock when the handle is moved from either the fully “closed” to fully “open” position, or vice versa. Failure to fully place the handle in either of these positions will result in a continual blow of air from the exhaust port to atmosphere. This feature assists in detecting partly closed cocks during train examination.

Periodical maintenance should be confined to operation and visual inspection of

cock body, stop lugs, handle and holding bolts. The handles of these cocks are secured with split pins and should be replaced if defective.

During the air testing of vehicles fitted with the Type A.4.R. cocks it will be necessary to affix a dummy coupling to the air hose not in use on the vehicle and fully open both cocks.

When the air brake system is fully charged an inspection should be made of both cocks. If a blow of air is obtained from the cock body, check that the handle is in the fully "open" position. Should the blow still exist, it would indicate a faulty rubber valve seat. Under these circumstances it will be necessary to dismantle the faulty cock and brake pipe air should be drained for this purpose. The removal of the two nuts from the holding bolts will permit the coupling hose, pipe bend and cover to be taken off, followed by the cock body. Both these parts should be handled with care and placed in a safe and clean location.

Two rubber seats, together with support rings can now be dismantled by the use of a piece of hard wood. UNDER NO CIRCUMSTANCES MUST METAL TOOLS BE USED IN EXTRACTING THESE ITEMS.

Examine :—

(a) The spherical plug (Piece C. 4826).
(b) Both rubber valve seats (Piece C. 4829).
(c) Both support rings (Piece C. 4830).

It should be noted that the two rubber valve seats and the air cock handle, (Piece C. 8430) are the only items to be replaced at Depots.

Both rubber valve seats are reversible and should inspection show bearing faces to be worn excessively which would prevent an air tight seal, valve seats should be reversed. Before replacing however, powdered graphite should be rubbed well into the surface of the spherical plug and the valve seatings.

Should inspection show the bearing surface of the plug to be worn or defaced a new or reconditioned cock must be fitted and the defective cock forwarded to Otahuhu or Addington Workshops for overhaul and testing.

9. Hose Pipes.

(a) Examine all hoses for cuts and for surface or other defects. See that rubber gaskets are in good condition. Check coupling head and stop pin, if defective the hose must be changed.

(b) Hoses found defective are to be sent to Otahuhu or Addington Shops for re-conditioning.

(c) Replace defective dummy couplings.

(d) When coupling heads and nipples are fitted, they must be free of all rust and passage clear. All of the portion inserted within the hose must be perfectly clean and unpainted. Rubber solution or non-caustic soapy water are the only lubricants to be used when fitting these parts.

(e) Protection wires must be applied strictly in accordance with drawing W 15042, the wires being coiled tightly and extending from clamp to clamp. Before old wires are

re-used they must be rewound to ensure that each coil is formed to a true circle.

(f) After assembly, reconditioned and new hoses are to be subjected to an air pressure of 125 pounds per square inch while totally submerged in a tank of clear water. Leakage from not more than three points and at a rate not exceeding one bubble per second from each point may be allowed. The rubber packing ring in the coupling head must be carefully inspected and renewed only if the water test proved it to be defective. Oil or grease must not be used in the fitting of new packing rings.

(g) Cars and. brake vans regularly used on express services are to have new coupling hoses fitted each time the vehicle is shopped for brake overhaul, the replaced hoses being water tested as outlined above before being returned to service for general use.

(h) In repair depots and outstations, spare coupling hoses must be stored under cover in a dust and oil free position, and, whenever possible, blown through before being fitted to the vehicle. The threads of the nipple must not be oiled or greased.

10. Brake Rigging

(a) The brake rigging is to be examined to ascertain that all rods, levers and hangers are intact and secure, pins and split cotters in place. Any split pins missing should be replaced. Brake pins worn 1/32" less than the standard diameter shall be renewed and holes in rods, levers etc., elongated in excess of 1/16" of the nominal size of the hole shall be reconditioned either by forging or electric welding to provide 1/32” clearance with new pins. The maximum lift permitted on brake blocks is not to exceed 3/8" At overhaul periods (every 2nd “lift”) all brake levers, pull rod ends and hangers shall be removed and normalised (referred to as heat annealing in schedule) by heating thoroughly to a bright red (about 1200OF and slowly cooling in air. All brake rigging is to be painted when reassembled before vehicles are returned to service.

(b) The brake rigging should be so adjusted that, with brake applied, the piston travel is within permissible limits. All rigging and working parts must be free to move, also that adjustment can be made in service as the brake blocks wear. All brake shoes worn to the condemning limit should be replaced. (See instructions covering the operation of single vehicle tester.)

11 Load Compensating Air Brake Equipment.

Vehicles fitted with manual operated load compensating air brake equipment and grade control valves are to have attention as follows:-

(a) Inspect pipe fittings from brake cylinder to change over mechanism and from this arrangement to the variable volume device. Check condition of operating gear and rod and ensure that all nuts, securing brackets and bolts are tight. Examine toggle pins, springs and cotters and liberally oil the various pins associated with the working of the operating mechanism.

(b) Grease the variable volume device at the nipple provided on the pressure head with the grease gun as described for lubricating A.F. brake cylinders (Item 2 (c)). The number of strokes of the grease gun will be the same as that prescribed for the pressure head of the size of brake cylinder to which the variable volume device is connected.

(c) Grade control valve.

Inspect grade control valve and see that the cock cap is secure. Operate handle between “H.P.” and position and observe that it operates freely and see that no binding of the operating rod takes place. Oil the universal joint of the operating rod.

Remove the exhaust nipple from the valve and clean making sure all ports in the nipple are thoroughly clear.

Should the valve or its parts prove defective on test it must be changed and. the faulty valve sent to Otahuhu Shops for repair.

12. Automatic Slack Adjuster.

(a) The automatic slack adjuster is to have the operating mechanism examined and overhauled. Remove pipe connection between brake cylinder and slack adjuster cylinder and ascertain that this pipe is clean and clear. Examine nipple in brake cylinder and ensure that the 1/8" port is clear. Dismantle slack adjuster and the operating mechanism. Remove ratchet nut and thoroughly clean adjuster screw threads but DO NOT oil or grease. Examine ratchet nut and pawl to ascertain that teeth are not broken and worn. Closely inspect the springs and locking mechanism to ensure they are in good condition. Remove piston, examine leather, clean and grease as laid down for brake cylinders.

(b) On re-assembly the cylinder piston and ratchet nut is to be thoroughly, yet sparingly, lubricated with approved brake grease. See that the grease does not come into contact with adjuster screw thread within the ratchet nut. The adjusting screw thread the ratchet nut bearing within the casing and the crosshead and guides must have fine dry graphite rubbed into their bearing surfaces. Partially fill the hollow adjuster nut with dry graphite.

(c) After overhaul, the slack adjuster is to be tested by coupling the cylinder to an air pressure of not more than 140 kPa and by means of a 3-way cock inserted in the air supply line, operated until the ratchet nut has traversed the full length of the adjuster screw. At the completion of this test, the piston assembly and cylinder must be tested for leakage by the application of soap suds while an air pressure of 140 kPa is maintained in the cylinder. No leakage is allowed.

13. Pressure Gauges.

Brake pipe air pressure gauges in brake vans and water raising air pressure gauges on passenger cars must be removed, and tested strictly in accordance with Locomotive Code Instruction No. 33.

14. Pneumatic Water Raising Equipment.

The overhaul and testing of the air pressure reducing valve non-return valve and air pressure governor valve, shall be undertaken by the Air Brake Groups at Workshops only.

15. Vehicles Fitted with Brake Pipe Only

Vehicles which are fitted with a brake pipe only shall have the coupling cocks lubricated each time they are shopped, the brake pipe inspected for wear and

corrosion and tested for leakage. Upon the completion of this work, the vehicle shall be stencilled “PIPED ONLY” in the position shown on Drawing W30607.

16. Testing Passenger Emergency Valves.

(a) Have main air supply at least 700 kPa.

Open cocks A and B on single car tester, then open passenger emergency valve.

Pressure should maintain at 364 kPa ± 24 kPa and brakes stay applied for at least twenty minutes.

This test could be carried out on more than one vehicle.

Section 4
Tranz Rail
Loco-hauled Passenger Car and Van Brake Manual, 5 June 1996

This manual covers the equipment in use on passenger cars and vans in service with Tranz Rail in the 1990's.

Scope: The maintenance of loco-hauled passenger car brakes including periodic service and vehicle overhaul. It does not cover the overhaul of brake system components.

Omissions: Part I, which covers brake service schedules and testing using the Tranz Rail standard single car brake tester, is omitted. See B3.2.3.01 - Brake Service Schedule for recommended service schedules for heritage vehicle brake equipment.

Index

PART II

PROCEDURES

CHANGING BRAKE BLOCKS

1. *Pneumatic slack adjuster:* wind the cross-head in towards the brake cylinder to create as much slack as possible.

   SAB slack adjuster: Wind the barrel clockwise (looking from the tail to the head end) to create sufficient slack.

2. Pull the rigging up to the brake beam where the blocks are to be changed to create as much slack as possible.

3. Remove the retaining skewer (retaining pin on 25330 bogies). Skewers may need tapping out.

4. Slide the old block out (off the wheel towards the centre of the car).

5. Slide the new block in.

6. Replace the retaining skewer (or pin and split pin).

7. Repeat steps 3 - 6 for the block on the other side of the brake beam.

8. Repeat steps 2 - 7 for another pair of brake blocks, if necessary.

9. *Pneumatic slack adjuster:* If necessary, wind the cross-head back until there is an average of 6 mm slack at each brake block. (This is the same as having 24 mm at one pair with all others hard against wheels.)

   If all blocks have been changed, the cross head should not need to be wound back. Too much slack with the cross head wound up to the brake cylinder indicates an incorrect hockey stick adjustment.

   If only some blocks have been changed, the slack adjuster will need winding back away from the brake cylinder to achieve the correct slack at the brake blocks.

   NOTE: Pneumatic slack adjusters must be set accurately to achieve the correct slack at the brake blocks. This is because

   (a) Pneumatic slack adjusters take up slack automatically, but DO NOT create slack if there is too little. If the cross-head is wound too far away from the brake cylinder, too little slack is left and brakes will not release properly.

   (b) Pneumatic slack adjusters take up only a small amount of slack with each brake application. If too much slack is left, the braking effect will be poor for a large number of brake applications until the slack adjuster has taken up the slack.

   SAB slack adjuster: Wind the barrel back towards the original position. The slack adjuster will adjust itself to the correct position, in either direction, when the brakes are applied.

BOGIE RIGGING POSITIONS

Cars and vans run on either 28020 or 25330 bogies (see Figs 2-1 and 2-2). Adjustment to take account of different wheel sizes is by means of nuts on the pullrods (hockey sticks) under the axles. Normally, this adjustment should need altering only when wheels are turned or new wheel sets fitted. Lever and hanger positions should match those shown in Figs 2-1 and 2-2.

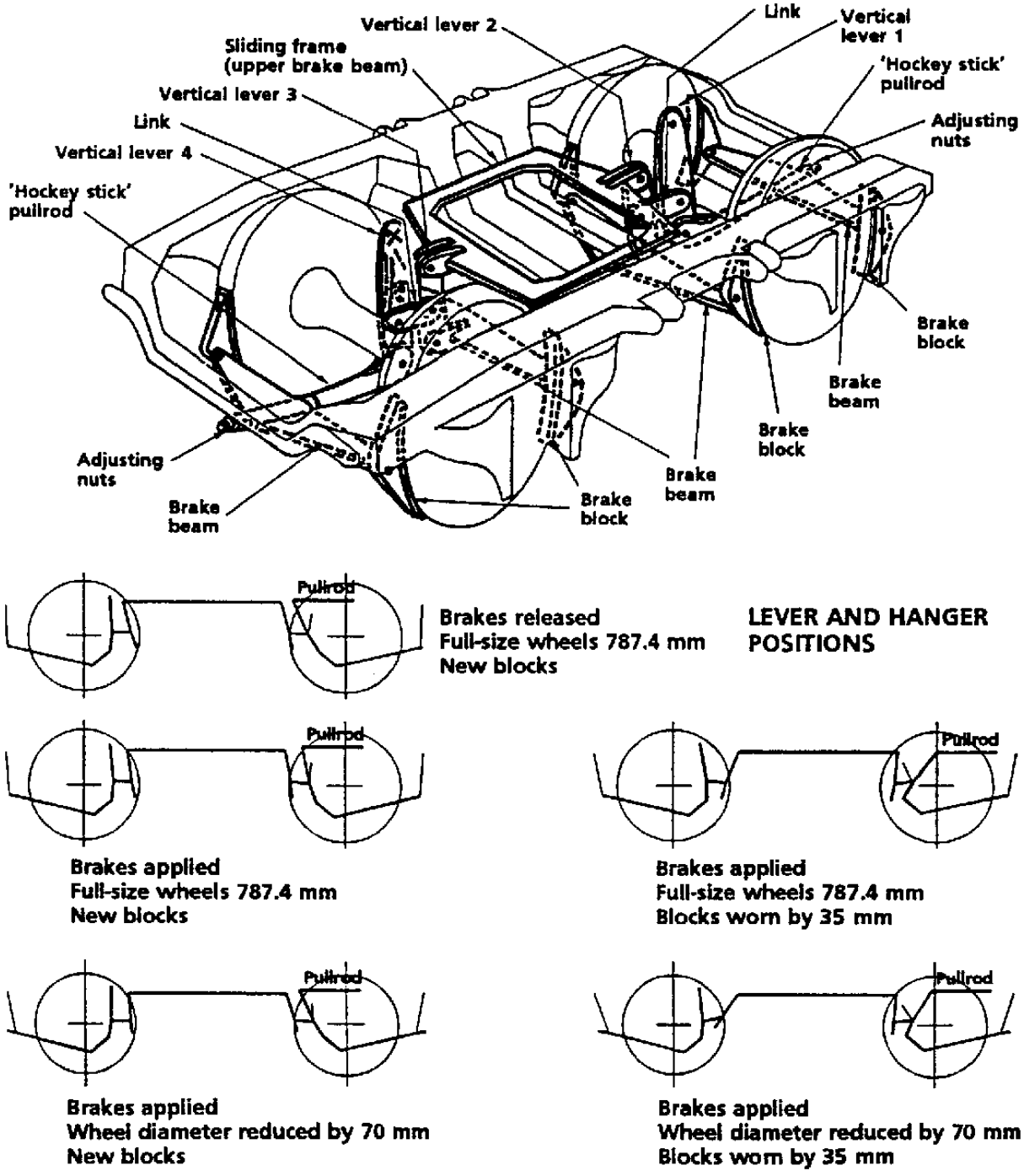


Figure 2-1. 28020 bogie rigging

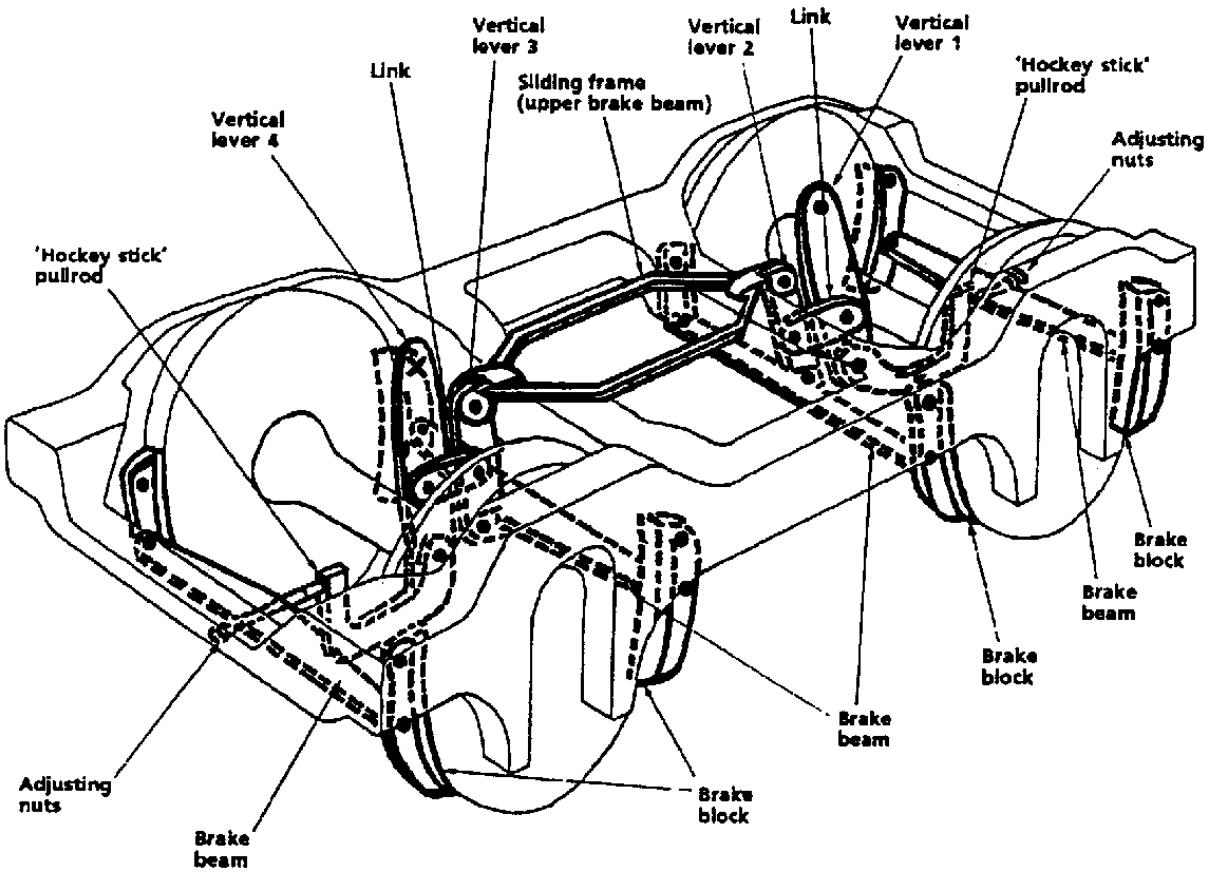


Figure 2-2. 25330 bogie rigging

BRAKE SET-UP: CARS

Introduction

All cars run on 28020 or 25330 bogies and their brake systems are fitted with the following (Fig. 2-3):

Triple valve:	type WP 12 with exhaust choke P12
Brake cylinder:	300 mm, 165 mm stroke, type AF with trunk, or older type without trunk
Slack adjuster:	pneumatic type J

Brake maintenance

Brake maintenance requirements are specified in Part I of this manual.

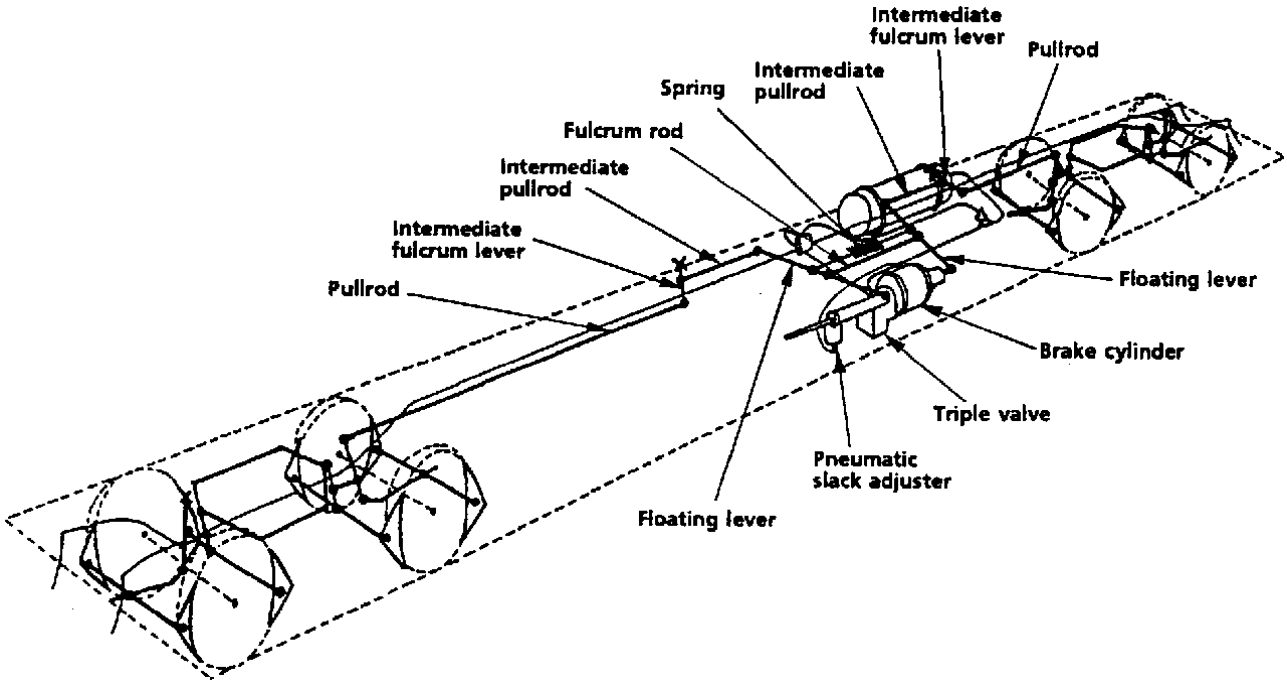


Figure 2-3. Brake rigging on 56 foot passenger cars

Procedure

1. Make sure all rigging pins, slides and rollers move freely.

2. Wind the cross head of the pneumatic slack adjuster fully in towards the brake cylinder to create maximum slack.

3. Replace brake blocks (see procedure above).

4. Pull up the rigging towards one end of the car.

> **IMPORTANT**
> Follow Steps 5, 6 and 7 strictly in order, to position the sliding frame correctly over the bolster.

5. Wind the nuts of the inside hockey stick out as far as the split pin.

6. Adjust the nuts of the outer hockey stick to give 25 mm of slack at one pair of brake blocks with all the other blocks applied.

7. Check that sliding frame is within 25 mm of its stop towards the end of the car.

8. Adjust the nuts of the inner hockey stick to give 25 mm of slack at one pair of brake blocks with all the other blocks applied. Tighten the nuts together and lock as described above.

9. Repeat Steps 4 - 8 at the other end of the car.

10. Connect a single vehicle tester to the car and charge the system fully to 550 kPa.

11. Apply the brakes several times, using a 150 kPa reduction, checking that piston travel is correct (165 mm). Adjust the hockey stick nuts evenly to achieve correct piston travel.

    If wheels are at minimum size and hockey stick nuts have run out of travel, wind the slack adjuster away from brake cylinder to achieve correct piston travel.

    If the piston travel is too short, check that the slack adjuster is connected to the centre port on the brake cylinder.

12. Tighten hockey stick nuts together and lock them either with tab washers or with wire (Fig. 2-4).

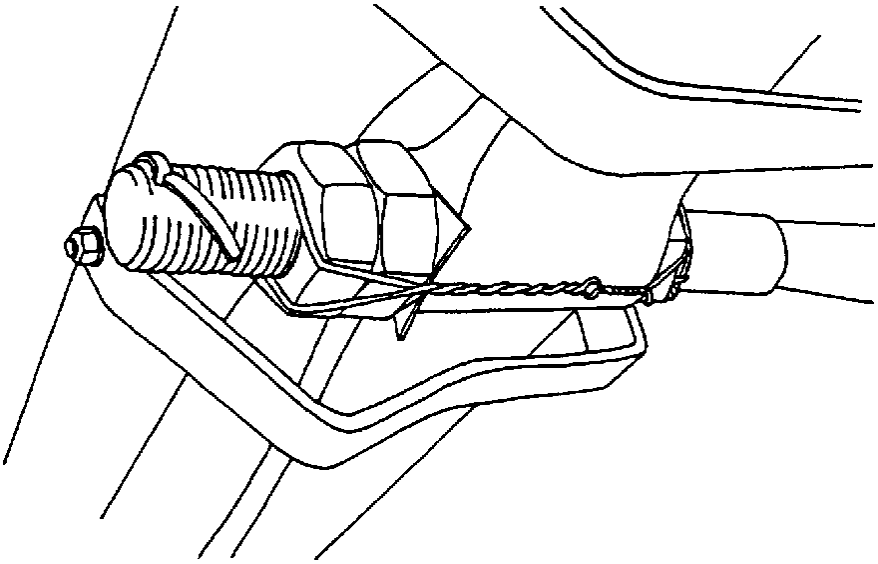


Figure 2-4. Hockey stick nuts locked with wire

13. With the brakes applied, match the positions of the levers and hangers with those shown in Fig. 2-1 and Fig. 2-2.

    If the levers are at the wrong angle, but piston travel is correct and the slack adjuster is operating in the correct position, check that rigging components are the correct size and shape.

14. Adjust the handbrake, if necessary, to give the correct number of turns to apply the brakes. On cars it should be 6 - 8 turns.

BRAKE SET-UP: VANS

Introduction

Vans type AG run on 28020 (Fig. 2-5): bogies. The brake system is fitted with the following

Triple valve:	type WPL, exhaust choke P10
Slack adjuster:	SAB type 600H
Brake cylinder:	250 mm, stroke 125 - 130 mm, with trunk

Brake maintenance

Brake maintenance requirements are specified in Part I of this manual.

[Figure not yet available]

Figure 2-5. Brake rigging on AG van.

Procedure

1. Make sure all rigging pins, slides and rollers move freely.

2. Wind the SAB slack adjuster clockwise (looking from the tail to the head of the slack adjuster).

3. Replace brake blocks.

4. Pull up the rigging towards one end of the van.

> **IMPORTANT**
> Follow Steps 5, 6 and 7 strictly in order, to position the sliding frame correctly over the bolster.

5. Wind the nuts of the inside hockey stick out as far as the split pin.

6. Adjust the nuts of the outer hockey stick to give 25 mm of slack at one pair of brake blocks with all the other blocks applied. Tighten the nuts together. Lock the nuts in place with either a tab washer (preferably placed between the nuts) or with wire as shown in Fig. 2-4.

7. Check that sliding frame is within 25 mm of its stop towards the end of the car.

8. Adjust the nuts of the inner hockey stick to give 25 mm of slack at one pair of brake blocks with all the other blocks applied. Tighten the nuts together and lock as described above.

9. Repeat Steps 4 - 8 at the other end of the car.

10. Unwind the slack adjuster back to its original position.

11. With the blocks on the wheels, check that the positions of the levers and hangers match those shown in Fig. 2-1.

12. Connect a single vehicle tester to the car and charge the system filly to 550 kPa.

13. Apply the brakes several times using a 150 kPa reduction, until the slack adjuster stops moving, and check that piston travel is 125 - 130 mm.

    Adjust the piston travel, if necessary, by altering the slack adjuster control rod (the threaded rod at the head end of the slack adjuster) (see Fig. 2-6). It may be necessary to heat the threaded end to free it. Apply grease when it has cooled.

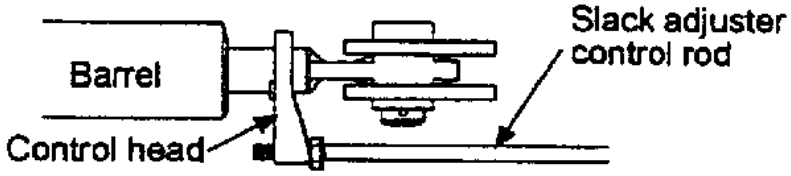


Figure 2-6. SAB slack adjuster control rod

    If piston travel is too long, reduce the distance between the regulator barrel and the control head. One turn of the control rod alters piston travel by about 3 mm. If piston

travel is too short, increase the distance.

Make at least three 150 kPa applications after each alteration.

14. Check the distance on the slack adjuster rod, from the groove to the tail end of the housing. The correct distance is 380 - 560 mm, preferably nearer the maximum. This allows full range of take-up on the slack adjuster (see Fig. 2-7).

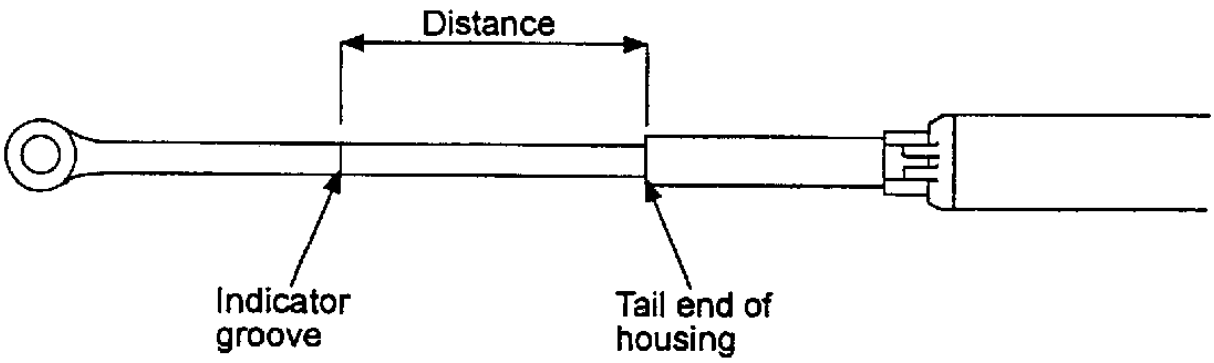


Figure 2-7. SAB slack adjuster indicator groove.

15. Adjust the handbrake, if necessary, to give 1 - 6 turns to apply the brakes.

PART III

COMPONENTS

BRAKE COMPONENTS

This part describes the major components of the passenger car and van brake system, also stating their purpose, occurrence and principle of operation. Inspection, testing and maintenance (though not overhaul) is also described.

SAB SLACK ADJUSTER

Purpose

The SAB slack adjuster is designed to take up all the slack created by brake-block wear. With rigging and piston travel set correctly, the slack adjuster will automatically take up sufficient slack so that brake shoes will apply against the wheels even if the blocks are removed.

Occurrence

An SAB slack adjuster, type 600H, is fitted to the long pull rod of the rigging of each van.

Description (See Fig. 3-1).

The SAB slack adjuster consists of a long barrel, which contains springs, clutches and nuts around a spindle and adjustment tube. The barrel forms a narrow housing at the 'tail' end of the device. A control head and adjustment rod are located at the 'head' end.

Principle of operation

Correct slack: As the brake is applied, the adjuster tube and barrel are pulled towards the control head. The barrel touches the control head at the same time as the blocks touch the wheels. With correct slack, the slack adjuster neither takes up nor pays out any slack when the brake is applied.

Too much slack: As the brake is applied, the control head pushes on the barrel before the blocks apply. Clutch A is released, allowing the leader nut to rotate in relation to the barrel. Both nut and barrel move to the left down the spindle. The adjuster nut does not move, so the payout spring is extended and the adjuster spring is compressed.

As the brake is released, clutch A is engaged, and the adjuster spring causes the adjuster nut to screw down the spindle towards the leader nut, until both springs return to their original length.

The spindle has thus been screwed into the barrel and the pull rod has been shortened.

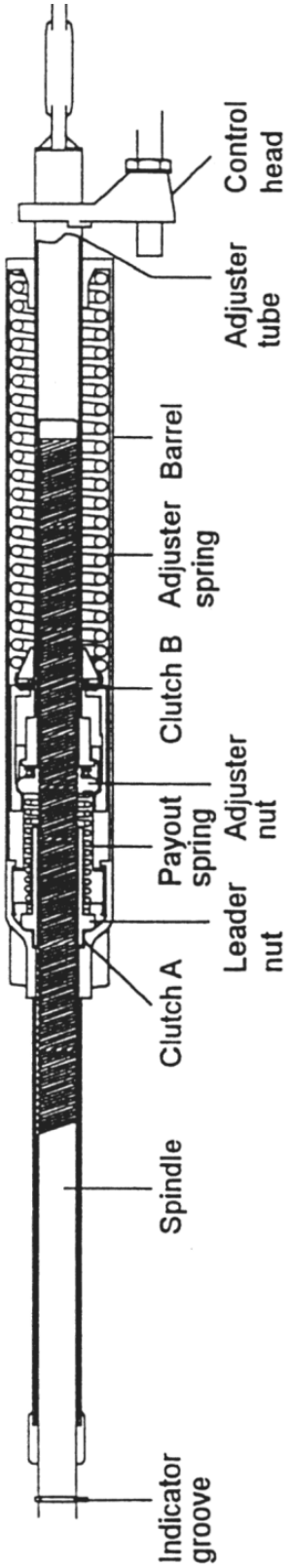


Fig 3-1. SAB slack adjuster

Too little slack: As the brake is applied the first time, clutch B releases, and the leader nut and the barrel rotate on the spindle until the barrel touches the control head. The payout spring is compressed, and the adjuster spring is extended.

As the brake is applied the second time, the payout spring pushes on the adjuster nut, which rotates up the spindle to the right to return both springs to their original length.

The spindle has thus been screwed out of the barrel, and the pull rod has been lengthened.

Rotation of the barrel is a normal part of the operation of the slack adjuster when it is paying out slack.

Inspection, testing and maintenance

The barrel of the slack adjuster is wound up clockwise (looking from the 'tail' to the 'head' end) to provide maximum slack when changing brake blocks. With new blocks fitted, it is wound back to approximately the correct position, then the air brake applied three times to allow it to adjust itself

With new blocks, and after the three brake applications, the distance between the 'tail' end of the housing and the groove on the spindle should be

380 - 560 mm for type 600H,

preferably near the maximum. Brake block wear of 40 mm represents 320 mm of slack at the slack adjuster, so it is important that the minimum distance be observed. Otherwise the slack adjuster will run out of travel before the brake blocks are worn. An incorrect distance can be caused by incorrectly set bogie rigging or piston travel, or by a malfunctioning slack adjuster.

The operation of the slack adjuster is tested by winding up the barrel several turns to pay out slack, applying the air brake several times, and then checking that the excess slack is taken up again. The barrel is then unwound several times and the process repeated. If the distance from the housing to the groove does not return to what it was, then the slack adjuster is not operating properly.

Slack adjusters should not need any maintenance in service except for greasing the rod at the 'tail' end. If a slack adjuster is not operating correctly it should be replaced with a reconditioned unit. A reconditioned unit should be fitted at B/10 as required by brake service schedules.

PNEUMATIC SLACK ADJUSTER

Purpose

The purpose of a pneumatic slack adjuster is to take up slack caused by brake block wear automatically, without the need for any manual adjustment. It is also used to create sufficient slack to change brake blocks.

Occurrence

A pneumatic slack adjuster, WB Type J, is fitted to each passenger car, and is mounted behind the brake cylinder.

Description (See Fig. 3-2).

The pneumatic slack adjuster contains an adjuster cylinder and piston, pawl, ratchet nut, screw and cross-head. An air pipe connects the adjuster cylinder to the brake cylinder. The cross-head acts on the pivot point of the fixed brake lever.

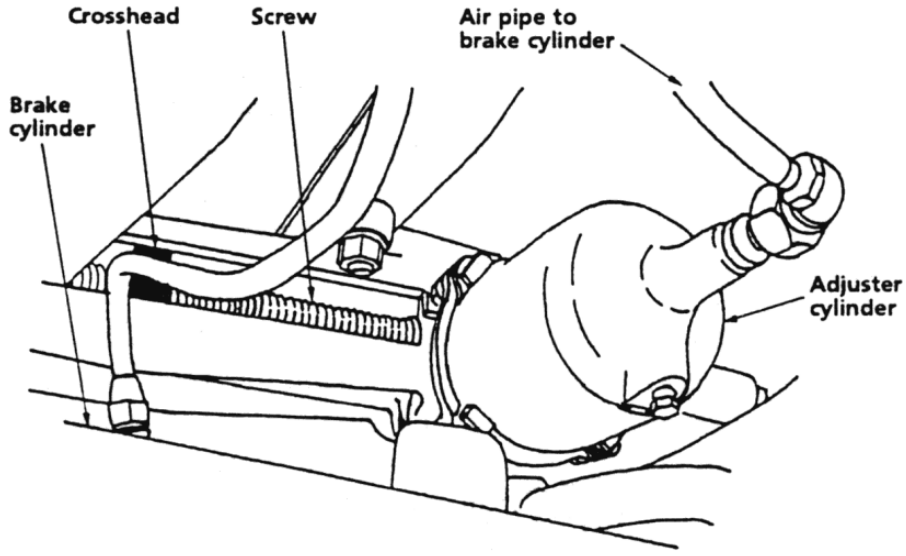


Figure 3-2. Pneumatic slack adjuster

Principle of operation

When the brake cylinder piston travels past the port leading to the slack adjuster, air flows to the slack adjuster cylinder. The adjuster cylinder piston travels to the end of its stroke against a spring, so operating the pawl which engages the ratchet nut.

When the brakes are released, the adjuster piston returns to its original position, pulling the pawl with it and turning the ratchet nut one-eighth of a turn. This acts on the screw, which moves the cross-head away from the brake cylinder. This alters the pivot point of the fixed brake lever and so shortens the brake cylinder piston travel.

To create sufficient slack to fit new brake blocks, the cross head of the slack adjuster is wound back as far as possible towards the brake cylinder. If only some new blocks are fitted, it is then wound away from the brake cylinder to take up the excess slack

Inspection, maintenance and testing

The operation of the slack adjuster can be tested, with partly worn blocks, by screwing the cross-head up towards the brake cylinder and applying the brakes several times. The cross-head should return towards its original position, with the adjusting thread rotating one eighth of a turn with each brake application. If it does not, then the unit should be replaced.

Pneumatic slack adjusters are replaced with overhauled units after 10 years service (at B/10) as required by brake service schedules. Any found to be faulty before this period should also be replaced.

BRAKE CYLINDERS

Purpose

To convert air pressure from the auxiliary reservoir into mechanical force, applied through the rigging to the brake blocks.

Occurrence

All passenger cars and vans have a single brake cylinder.

Description (See Fig. 3-3.)

Cars are fitted with 300 mm diameter cylinders, with a stroke of 165 mm. These may be of the older type (sometimes called ITV) without a trunk and with a slotted pushrod. Or they may be of the newer AF type, with a trunk, and with a hole at the end of the pushrod instead of the slot.

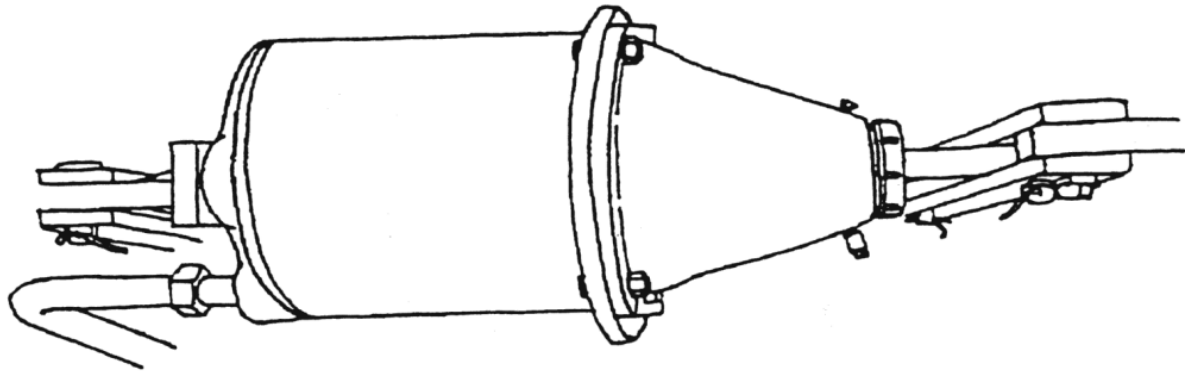
Vans are fitted with 250 mm diameter cylinders, with a trunk, and with a stroke of 120 - 130 mm.

Principle of operation

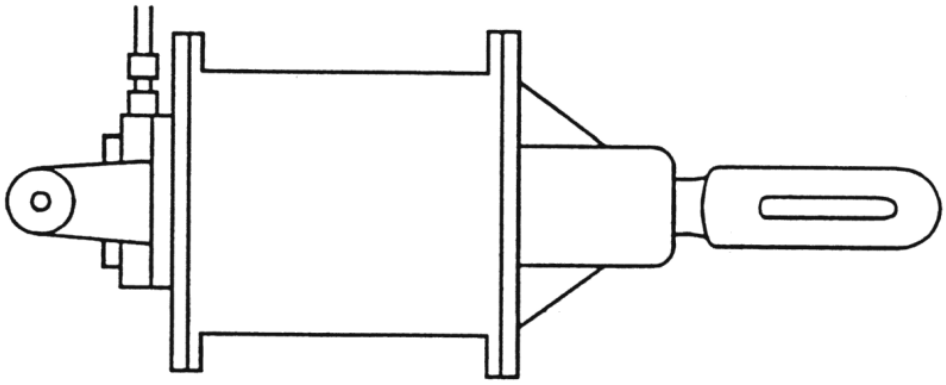
When brake pipe pressure drops, the triple valve releases compressed air from the auxiliary reservoir into the brake cylinder, driving the piston down the cylinder, forcing the piston trunk and pushrod out of the cylinder, acting through the brake rigging to push the blocks onto the wheels.

When brake pipe pressure is regained, the triple valve cuts off the supply from the reservoir and opens an exhaust port to allow air to flow from the brake cylinder to atmosphere and to allow the release spring to return the piston to its original position.

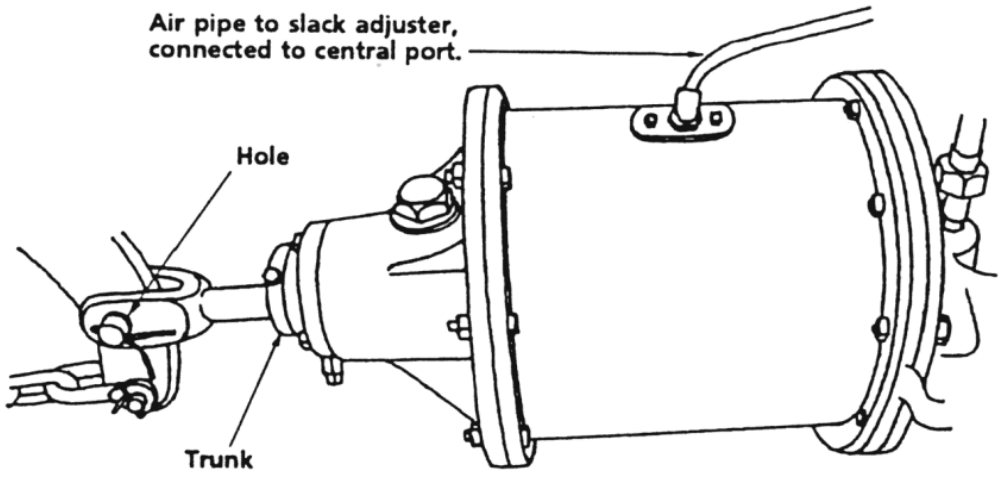
On cars with pneumatic slack adjusters, once the piston has travelled to a point that represents 165 mm piston travel, air from the reservoir is allowed through a port in the cylinder to the slack adjuster, activating the adjuster to take up slack and maintain piston travel at the correct distance.



(a) Brake cylinder fitted to AG vans.



(b) Older type car cylinder: piston has no trunk and pushrod is slotted at the brake lever end.



(c) Newer AF type with trunk piston: pushrod has a hole at the brake lever end.

Figure 3-3. Brake Cylinders fitted to cars and vans.

Inspection, maintenance and testing

Check for leaks at the cylinder whenever a vehicle is in a depot.

Cylinders are lubricated annually. If the cylinder has a greasing nipple or port, at B/1 - 4 and 6 - 9 grease through the nipple, and rotate the piston one and a half turns. At B/5 remove the piston, clean, examine, lubricate and reassemble. At B/10, remove the piston, clean it and fit new seals ('leather'), examine and lubricate the piston and pushrod (and trunk) before reassembly.

If the cylinder has no greasing nipple, remove the piston, clean, examine and lubricate the piston and pushrod before reassembly.

It is important that correct piston travel is maintained. Insufficient travel can result in brakes not releasing fully. Excessive travel results in reduced pressure in the brake cylinders, and can cause piston push rod jamming, and damage to piston return springs.

Correct piston travels are as follows:

Cars:	300 mm cylinders:	165 mm
Vans:	250 mm cylinders:	125 - 130 mm.

Incorrect piston travel may be caused by SAB slack adjuster faulty or incorrectly set, pneumatic slack adjuster faulty or at the end of its travel (especially on a car with small wheels), pneumatic slack adjuster connected to the wrong port on the brake cylinder (it should be connected to the centre port).

TRIPLE VALVES

Purpose

The triple valve is a device that controls the operation of the brakes. It responds to changes in the brake pipe pressure to apply and release the brakes, as well as controlling air flow to and from reservoirs and to exhaust brake cylinders to atmosphere.

Occurrence

All cars are fitted with type WP12 triple valves, with P12 exhaust chokes.

All vans are fitted with WPL triple valves, with P10 exhaust chokes.

Description

See Fig. 3-4.

Triple valves are an arrangement of diaphragms, valves, chokes and ports mounted on a pipe bracket. All type 'W' triple valves consist of a central unit to which are bolted different side units depending on which type 'W' triple valves they are. Choke plates are located between the central and side units to control the flow of air. Type WP triple valves are fitted to passenger vehicles, while type WF triple valves are fitted to freight vehicles. Type WP have a faster application and release rate than type WF.

The tag attached to every triple valve states the type it is as well as the arrangement of chokes.

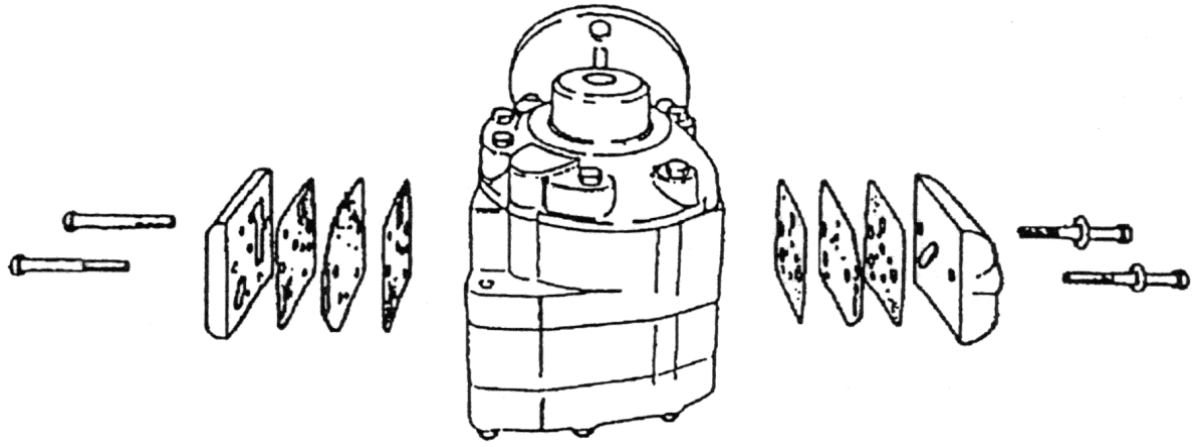


Figure 3-4. Type WP triple valve

Principle of operation

The main diaphragm responds to a difference in pressure between the brake pipe and the auxiliary reservoir.

A reduction in brake pipe pressure closes off the supply of air from the brake pipe to the auxiliary reservoir, and causes air to flow from the auxiliary reservoir to the brake cylinder, until the pressures are about equal. This applies the brakes.

Air also flows from the brake pipe into the quick service bulb to cause a localised drop in pressure and therefore speed up the operation of the triple valve on the next vehicle.

An increase in brake pipe pressure closes the supply of air from the auxiliary reservoir to the cylinder, opens an exhaust port and allows air in the brake cylinder to exhaust to atmosphere and release the brakes. It also reconnects the brake pipe to the auxiliary reservoir to recharge it.

Air from the quick service bulb is used to ‘snap’ the main diaphragm assembly into the release position.

Inspection, maintenance and testing

The operation of a triple valve is tested with the testing procedure specified in brake service schedules. Replace triple valves that fail to pass the test, and those that have been in service for more than 12 years.

COUPLING HOSES

Purpose

To connect the brake pipe from vehicle to vehicle to form one continuous pipe the length of the train.

Occurrence

Two at each end of some cars. One at each end of every van and of some cars.

Description (See Fig. 3-5).

The coupling hose consists of a length of reinforced rubber hose, with a tapered-threaded nipple clamped to one end and a coupling head clamped to the other. A gasket in the head provides an air-tight seal when hoses are coupled. The nipple screws into the brake pipe.

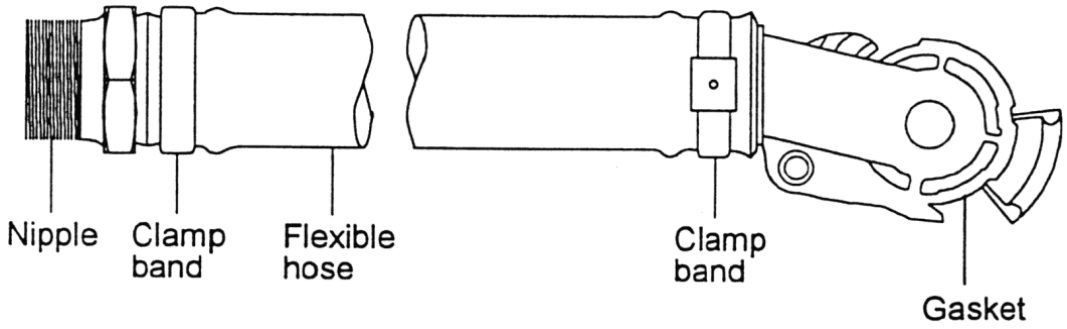


Figure 3-5. Coupling hose

Principle of operation

Coupling hoses provide the necessary flexibility between vehicles when the train is in motion.

Inspection, maintenance and testing

Inspect hoses for cracks and any other defects, and check for leaks at three monthly and annual brake service. If necessary, replace the gasket in the head. Replace any defective hoses, and replace all hoses every 10 years (at B/10).

COUPLING COCKS

Purpose

To open or close the air supply through the brake pipe between two vehicles, usually to enable coupling or uncoupling a vehicle.

Occurrence

Between the coupling hose and the brake pipe.

Description

Types A4R, A4L, B2R B2L, B2RA and B2LA (Fig. 3-6) have a handle that rotates a round plug with a hole through it between two rubber sealing rings. The older type D, fitted to many cars, has a brass plunger.

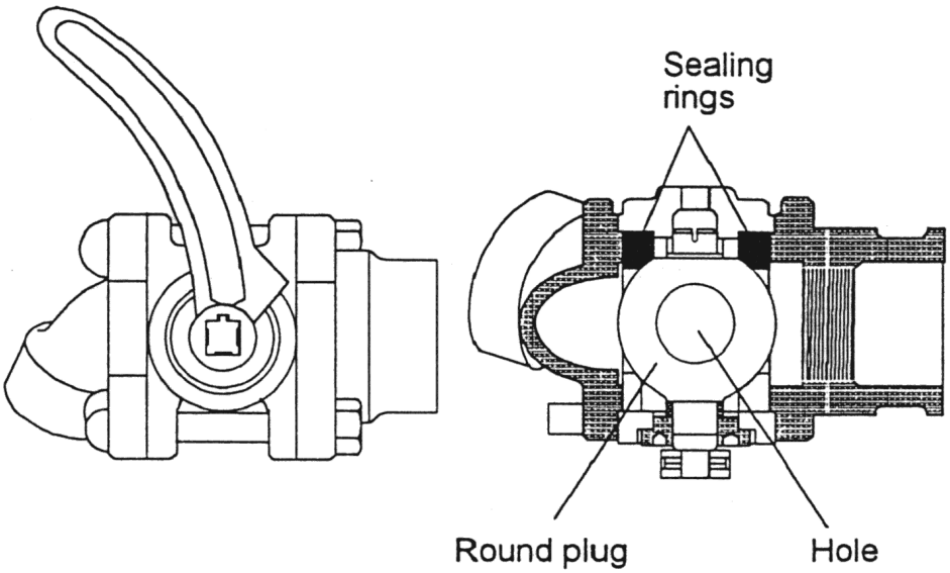


Figure 3-6. Coupling cock

Principle of operation

When the round plug is rotated to line up the hole in it with the brake pipe, air will flow. When it is rotated 90 degrees from this, air will not flow, and a vent allows pressure in the coupling hose to escape.

Inspection, maintenance and testing

Inspect cocks whenever a vehicle is in a depot. Check for damaged pipe where the cock is screwed onto the brake pipe. Lubricate if the ball has become tight. Dismantle and replace the rubber sealing rings if they leak.

ISOLATING COCKS

Purpose

To allow the brakes to be cut out on a vehicle. This may be done in service when wheels have bad flats, or when brakes are faulty; or to allow work to be carried out on brakes. (Note that it is the release valve that is used to release trapped air from the system.)
On cars, a second isolating cock is fitted to enable the water-raising system to be cut out.

Occurrence and description

Cars have ½ inch D type cocks fitted to the crossover pipe that connects the brake pipe to the triple valve.

The water-raising isolating cock is fitted to the brake pipe to the water-raising reservoir.

Vans have type 'W' rotary isolating cocks (Fig. 3-7).

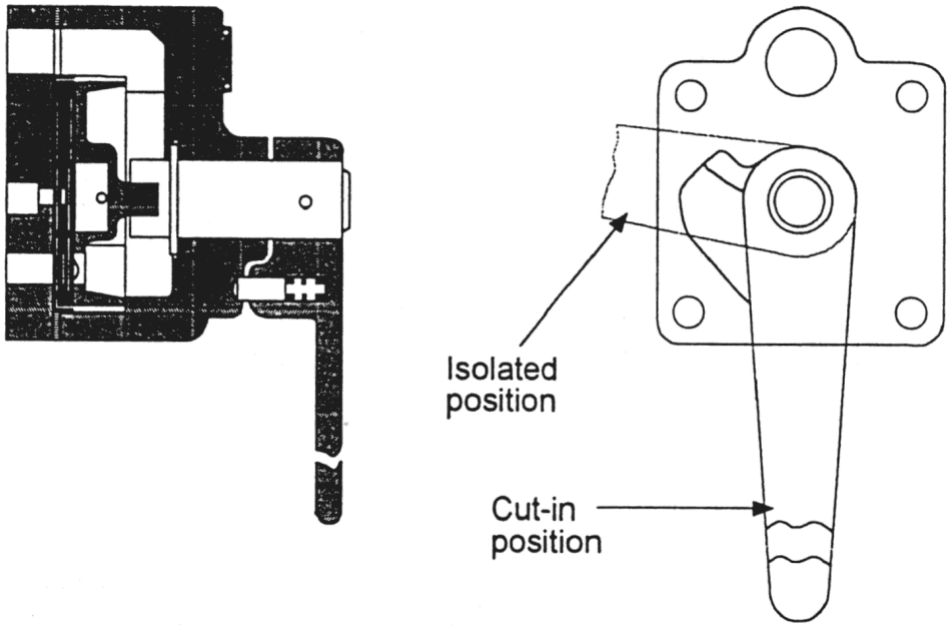


Figure 3-7. Type W isolating cock.

Principle of operation

Turning the handle from horizontal to vertical opens the cock.

Inspection, maintenance and testing

Check isolating cocks for leakage, any other defects and correct operation at three monthly and annual brake service. Replace cocks if they are faulty. Lubricate them if they are stiff. Use only approved silicone grease for type 'W' isolating cocks.

AUTOMATIC RELEASE VALVES

Purpose

To allow air to be drained from the system.

Occurrence

Type 'A.W.' valves are located under the isolating cock on the triple mounting bracket.

Description (See Fig. 3-8).

Automatic release valves are diaphragm valves with a handle pointing downwards, and wires attached to the handle to make them operable from either side of the vehicle.

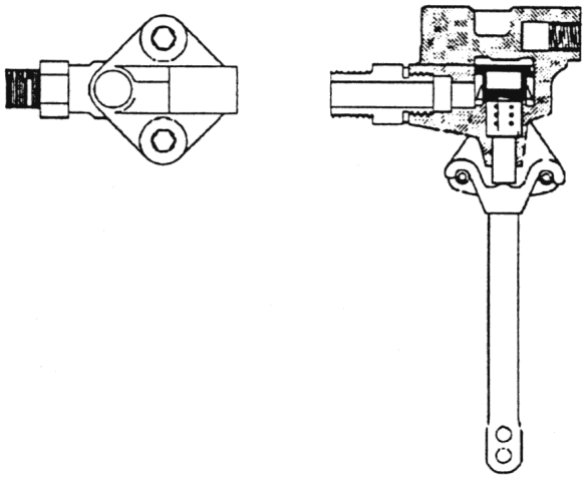


Figure 3-8. Automatic release valve

Principle of operation

Movement of the handle pushes the plunger up, allowing air from the auxiliary reservoir and brake cylinder to release to atmosphere. It also allows the same air into the middle chamber, below the upper diaphragm. As long as there is no greater pressure from the brake pipe above the upper diaphragm, the valve will be held open, by the spring, until all air is exhausted. The valve will close again when pressure from the brake pipe acts through the upper diaphragm to hold the plunger down. Pressure from the auxiliary reservoir will then keep the valve closed until the handle is moved again.

Inspection, maintenance, and testing

At three-monthly and annual brake service, check that the valve operates with the brake pipe both charged and empty. When the brake pipe is charged, the valve will close when the handle is released. When the brake pipe is empty, the valve will continue releasing air after the handle is released.

Problems with the brakes not applying or releasing correctly may be caused by a leaking release valve diaphragm.

FILTERS, STRAINERS AND DIRT COLLECTORS

Purpose

To remove dirt from air entering the triple valve or other parts of the system.

Occurrence

A filter or dirt collector is fitted to the crossover pipe from the brake pipe to the triple valve (Fig. 3-9). Another filter is fitted on the intake to the water-raising reservoir (Fig. 3-10).

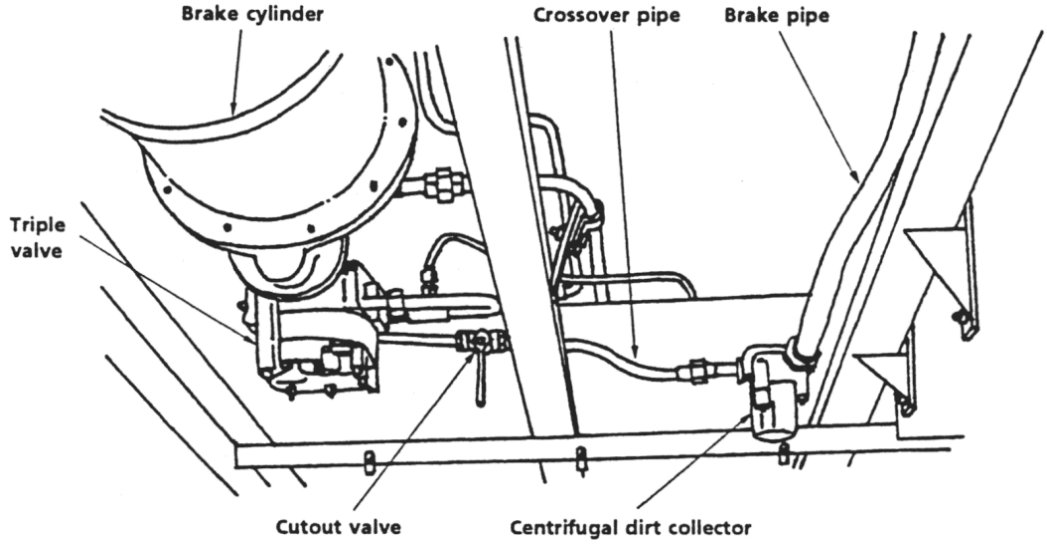


Figure 3-9. Centrifugal dirt collector fitted to crossover pipe.

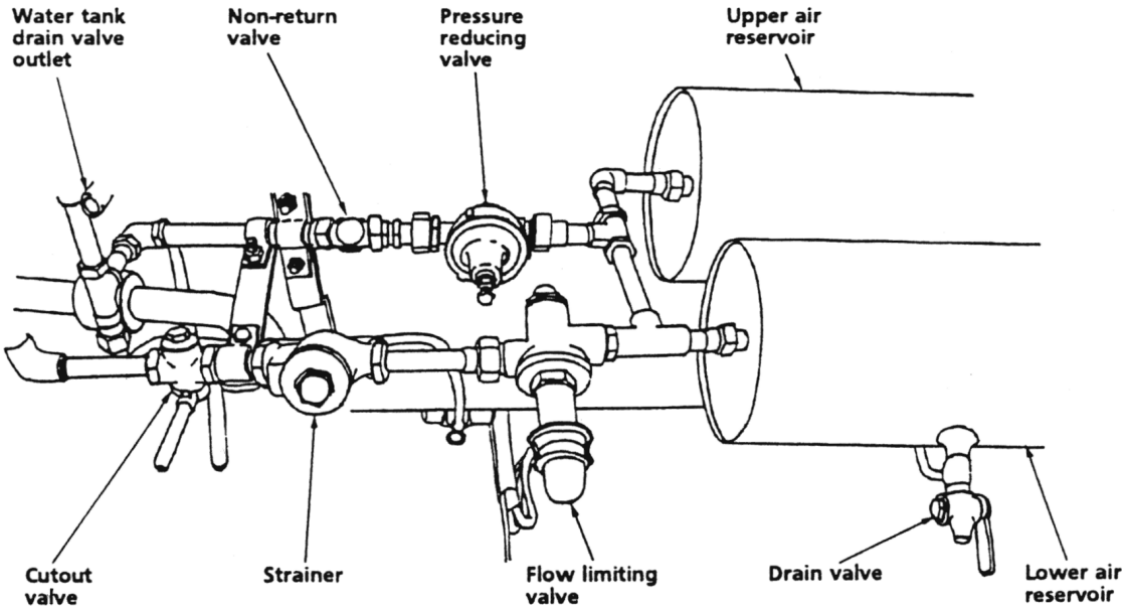


Figure 3-10. Strainer fitted to inlet of the water-raising system.

Description

Dirt collectors: The dirt collector body houses a valve and a dirt chamber.

Filters: The filter body houses a strainer and replaceable filter element.

Principle of operation

The inlet and outlet ports are connected either via a strainer and filter element or via a shaped chamber where dirt is deposited as a result of the air movement. Dirt in the air is thus removed before entering the triple valve.

Inspection, maintenance and testing

Dismantle, clean and replace any filter element each 10 years (at B/1 0).

EMERGENCY DUMP VALVES

Purpose

To enable emergency application of the brakes by the train crew or by passengers.

Occurrence

One on each passenger vehicle, fitted to the brake pipe.

Description

See Fig. 3-11. The body houses a diaphragm valve. Two small-bore pipes are connected, one leading to each end of the car interior.

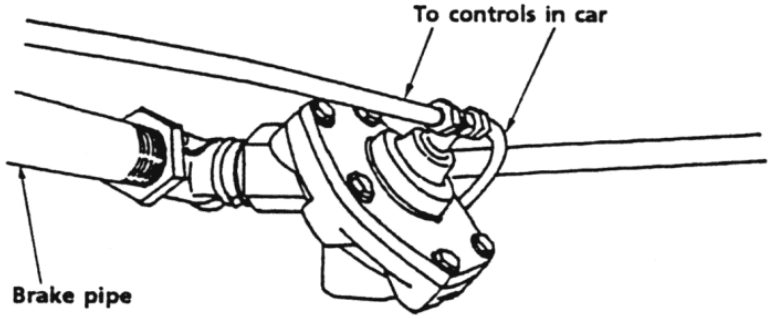


Figure 3-11. Emergency dump valve.

Principle of operation

When the controls are operated, the pressure in the small pipe is released. This moves the diaphragm to the exhaust position, and air from the brake pipe is exhausted to atmosphere. Brake pipe pressure drops and the brakes are applied.

Inspection, maintenance and testing

This valve is inspected and tested for correct operation at the B check and C check. It is replaced with an overhauled unit after 10 years (at B/10).

AIR PIPING

Purpose

To carry compressed air from the locomotive to all parts of the vehicle brake system.

Occurrence: All vehicles

Description

All vehicles have a brake pipe running the length of the vehicle with a branch to the triple valve. Smaller diameter pipes connect reservoirs, cylinders and empty/load brake into the system.

Small bore piping was originally of steel, then of copper, and is now being progressively replaced with nylon, because of the fractures developing in the copper.

Inspection, maintenance and testing

Inspect piping for damage and wear, especially at headstocks and at points where pipes can come in contact with the vehicle frame.

Section 5
Air Brake Equipment on Locomotives Etc.
Maintenance Instructions

Source - NZR
Date – 21 April 1959

Index

1 Automatic Brake Valves

(a) The rotary main valve and the equalizing piston and ring must be withdrawn and cleaned in a bath of kerosene then thoroughly dried with air and wiped with a clean cloth. Thoroughly examine to ensure that all parts are suitable for a return to service. Before the cleaned piston is replaced in the piston bushing, which has been cleaned and wiped dry, three drops of approved oil should be placed in the groove, and the ring moved about to distribute the oil. The rotary main valve and seat, before being replaced, must be lubricated with a little graphite grease. The handle stop pins and springs as well as the handle stops must be examined to ensure correct functioning and that no excessive wear exist.

(b) The independent brake valve must be dismantled, cleaned, examined and lubricated. The handle, handle stops, springs and spindle must be examined for wear or stiffness in operation.

(c) Self-Lapping Brake Valves

Dismantle the valve and thoroughly clean. Inspect valves, balance levers, yokes, rollers, and pins. Check springs for corrosion or other defects. See that all ports and passages are clear. Valves and seats should be ground in if necessary. The exhaust piston leather cup should be replaced if brittle or worn. Renew gaskets where required. See that all working parts are lightly lubricated on reassembly and that all bolts and nuts are tightened evenly. After reassembly is complete the valve must be tested for leakage and operation.

2. Feed Valves

Feed valves must be removed from the brake valve, dismantled and all parts cleaned in kerosene and then dried by means of a jet of compressed air. If inspection reveals the valves are in a suitable condition for further service all parts are to be sparingly lubricated with approved oil before re-assembly. In the slide valve type of feed valve, parts are to be lubricated in the manner detailed for triple valves. After being replaced on the brake valve, all capnuts and the gasket joint must be securely tightened.

3. Distributing Valve

The triple valve, relay or application portions of distributors are to be withdrawn. The relay and equalizing piston bushes must be thoroughly cleaned and wiped dry with a clean cloth. Lubricate the surfaces with oil and wipe out with a clean cloth. The piston, with rings, is to be immersed in clean kerosene then dried off with an air jet and wiped thoroughly dry with a clean cloth. Slide valves and graduating valves should be thoroughly cleaned and lubricated with fine powdered graphite rubbed well into the faces by means of a chamois-faced paddle. The relay piston packing cup should be sparingly lubricated with brake cylinder grease. The application valve must be dismantled and cleaned to ensure proper seating. Check that it closes and opens freely. The graduating spring stem must move freely against its spring within the equalizing cylinder cover. Examine all seals and gaskets before reassembly. Drain the auxiliary and relay chambers of any water.

4. Independent Release Valve

The independent release valve must be removed from the distributing valve and thoroughly cleaned with kerosene, care being taken to protect all seals and gaskets from the kerosene. After being dried, all parts must be examined to ensure that they are in a suitable condition for further service. The piston packing ring must not be removed from the piston and when the valve is being re-assembled this ring and the piston bush must be lubricated sparingly (one drop each) with an approved oil.

5. Dead Engine Device

The dead engine device must also be removed from the distributing valve and cleaned in a similar manner to the independent release valve. The cock plug is the only portion requiring lubrication, and this must be carried out with an approved graphite grease.

6. Triple Valves

Triple valves may receive attention without being removed from the vehicle. The valve cover is to be removed and the slide valve and piston assembly withdrawn and thoroughly cleaned in kerosene. Using a piece of cloth soaked in kerosene clean the slide valve chamber and piston bush. Thoroughly clean feed grooves with a pointed piece or wood (USE NO METAL IMPLEMENTS). Dry all parts. Inspect the slide valve and seat for proper bearing and note that slide valve spring and rivet are in good order. The slide valve and seat are to be lubricated with fine powdered graphite rubbed well into the faces with a chamois-faced paddle. The piston ring and groove is to be lubricated with two drops of pale oil and the ring rotated to distribute the oil. The bulb of the improved triple valve is to be removed and the syphon tube and regulating valve examined to ensure proper functioning. Before assembly see that the cover gasket is in good condition and free of all verdigris.

7. Brake Cylinders

Brake cylinder pistons must be withdrawn and the piston assembly and springs thoroughly cleaned. Clean the cylinder and leakage groove of all old lubricant. Kerosene may be used to assist provided that care is taken to remove all traces of kerosene before re-assembly, or serious damage to gasket and packing cup may result. If rusty patches are present they maybe rubbed down with emery paper. Each piston assembly must be dismantled for inspection and any parts found defective or worn are to be replaced. The leather packing cup should be replaced if brittle, thin, cut or cracked. Examine the piston head studs for looseness and the head and follower for cracks. New packing cups must be well dressed with approved grease and, if leather, the flesh, or rough side, must come into contact with the cylinder wall. Before reinserting the piston assembly apply a thin coating only of approved brake grease to the cylinder wall. Too much grease is detrimental to other devices (such as distributor or triple valve) into which grease may find its way during the release cycle. The joint at the dome head is to be cleaned and in all positions of piston travel, the piston rod, or the push rod, must not bind on the dome head or the piston trunk, as the case maybe. Piston rod crossheads must be tight and should the guide hole through the dome head show excessive wear the dome head must be replaced.

All supporting bolts of brake cylinders must be checked.

8. Reducing Valves

This valve must be cleaned and examined in accordance with instructions for feed valves.

9. Double Check Valves

The double check valve must be dismantled, all parts cleaned and finally wiped dry with a clean cloth. The ring must not be removed from the piston but the ring, as well as the valve and valve faces, must be in good condition for further service. The piston ring bush only need be lubricated with one drop of oil properly distributed in the bush. On re-assembly, see that the cap is securely tightened.

10. Release Valves

Release valves, where fitted, must be examined and replaced if found defective. The handles must have a minimum of 1/2” lost travel at their lower end.

11. Retaining Valve

Retaining valves, where fitted, must be examined and replaced if found defective.

12. Safety Valves

Safety valves must be dismantled and cleaned to ensure correct seating and opening. The valve must be reset correctly after re-assembly.

13. Cut-Out Cocks

Cut-out cocks, must operate freely and be free from leakage.

14. Coupling Cocks

Lubricate the coupling cocks by removing the hose and injecting a small quantity of oil down the brake pipe by means of a syringe after which the cock should be operated several times to ensure that the plug is adequately lubricated. Defective cocks must be replaced. Very slight leakage of air from the plug valve is permissible.

15. Isolating Cocks

All isolating cocks to be checked to ensure that they operate freely.

16. Coupling Hoses And Air Hoses Between Engine And Tender

Hoses must be examined and replaced if found defective. Dummy couplings also must be replaced if damaged.

17. Pressure Gauges

Air pressure gauges must be tested in accordance with Locomotive Code Instruction No.33. See that the face of the gauge is clean and legible.

18. Brake Rigging

The brake rigging is to be inspected to ascertain that all rods, levers and hangers are intact, pins and cotters in place, and properly secured, Any defect or parts showing excessive wear should be rectified before the locomotive is returned to service. Brake blocks must be replaced when damaged or too thin for further service. In the case of locomotives fitted with brake shoes, the shoes must be set at an angle to ensure that the brake blocks are worn evenly. Check that the rigging does not bind when the piston is at its maximum possible travel.

19. Brake Piping

All air piping is to be examined for wear and corrosion and related brackets and clips for security. Drip cups must be drained and the bowls of the centrifugal dirt collectors, where fitted, must be removed and cleaned. Steam piping to compressors must be in good condition, secure, and free from leakage.

20. Reservoirs

Reservoirs must be drained and between examinations, maintained in accordance with clause 24 of Locomotive Code Instruction No. 28. All supports and bolts are to be checked for security.

21. Air Compressor (Steam Locomotives)

The reversing valve plate and its screws must be examined for wear and slackness by first withdrawing the reversing valve rod and then removing the top head from the compressor. The main valve assembly and the reversing valve and rod must also be examined for wear.

The jointing faces of the steam cylinder and top head, as well as the copper gasket, must be examined and should steam cutting be taking place across any portion of either face, the compressor or top head, as the case may be, must be replaced. An inspection must be made to ensure that the automatic drain valve and the steam cylinder drain are functioning correctly. The top-head lubricator, the air cy1inder automatic oil cup and the oil cup supplying the piston-rod swab must be cleaned and examined. The straining medium of the air strainers must be cleaned; those of horse-hair being freed of all dust and grit and those of steel wool being washed in a bath of kerosene, dried by means of a jet of compressed air and re-lubricated with approved oil. All strainers must be adequately filled with the correct straining medium. When re-fitting the top head, the securing bolts must be tightened evenly and in correct sequence.

Air valve cases and air valves are to be cleaned and examined for wear, the valves being ground in if necessary. The valve lift must not exceed 5/32” otherwise damage to both the valve and its seat may result. If the valve lift gauge should indicate lift in excess of 5/32” the valve stop must be built up with electric welding and carefully dressed so that the lift is reduced to 3/32”. Should any of the air passages show excessive formation of carbon the compressor must be replaced if the deposit cannot be cleared. The piston rod packing must be checked for steam and air leaks and the packing renewed if it is unsuitable for further service. The exterior of each compressor must be cleaned with the high pressure locomotive washer each time the running gear

of the locomotive is washed down.

22. Air Compressor Exhaust Silencer (Steam Locomotives)

Where exhaust silencers are fitted, the perforated tube must be withdrawn and inspected to ensure that the holes are clear of deposit and the drain pipe tested to ensure that it is unobstructed. On locomotives fitted with an exhaust drainage tank, the drain pipe of this device must also be tested to ensure that it is clear.

23. Automatic Drain Valves (Steam Locomotives)

Automatic drain valves and their drain pipes must be inspected to ensure that they are functioning correctly.

24. Air Compressor Steam Stop Valve (Steam Locomotives)

The stop valve must completely cut off the steam supply when closed and there must be no leakage past the spindle packing. The operating rod must be in good condition and rotate freely within its supports. Should the valve and its seat be worn beyond refacing the stop valve must be replaced.

25. Air Compressor Governor (Steam Locomotives)

The diaphragm and piston body must be detached from the steam valve, dismantled, and thoroughly examined to ensure that they are free from dirt, grit and corrosion, and in a suitable condition or further service. The steam valve must move freely within its spindle guide and both the upper and lower seats as well as the seat within the steam valve body must be reground, if necessary. The piston packing ring, which must not be removed from the piston, should move freely in its groove and the piston must be able to move freely within the piston body for the full length of its stroke. The vent choke plug must be clear and the diaphragms and their operating parts in a serviceable condition. Before re-assembly, only the piston packing ring and the cylinder is to be lubricated; two drops each of approved oil to be applied to the packing ring and cylinder.

26. Air Compressor (Electric Locomotives)

The inlet and discharge valves must be cleaned, examined for wear and ground in if necessary. Should the valve lift be too great, excessive wear of both the valve and its seat will result. Air strainers must be cleaned and maintained in the manner described for those fitted to steam driven air compressors. The crankcase is to be drained, flushed out with an approved flushing oil and then refilled with approved oil. The air valves must not be lubricated.

27. Electric Air Compressor And Control Governors

Electric compressor governors must be replaced with newly overhauled governors after they have been in service for one year. Replaced governors must be dismantled, cleaned, all passages cleared and the switch contacts re-dressed. Lubricate the switch piston. The air strainer is to be cleaned and maintained in the manner described for those fitted to steam-driven air compressors.

28. Magnet Valves

Magnet valves to be checked for operation and leakage. If there is doubt as to the condition of the valve, it is to be removed for testing (where facilities are provided or replaced with a new or reconditioned spare).

To test the magnet valve it must be connected to an air supply and the terminals to the test voltage supply. The valves must operate within the pick-up and drop-out voltages as specified for the particular type of magnet valves. The valve must also be checked for leakage. Magnet valves failing to pass the tests must be replaced with spare tested equipment and the defective valve sent to shops for overhaul.

29. Isolating Cock Switch (E.P. Brake)

The isolating cock switch must be examined and the contact fingers and segments renewed where necessary. The cock should be tested for ease of operation and to ensure that it is air tight.

30. Automatic Slack Adjuster

(a) The automatic slack adjuster is to have the air motor removed. Dismantle and thoroughly clean. See that kerosene does not come into contact with the piston leather which is to be examined for suitability for further service. The adjuster operating mechanism must be examined for worn and broken teeth and cleaned. Thoroughly clean the adjuster screw threads and wipe dry.

(b) On re-assembly, the cylinder piston and ratchet nut is to be thoroughly, yet sparingly lubricated with approved brake grease. See that the grease does not come into contact with the adjuster screw thread within the ratchet nut. The adjuster screw thread, the ratchet nut bearing within the casing and the crosshead and guides must have fine dry graphite rubbed into their bearing surfaces. Partially fill the hollow adjuster nut with dry graphite.

(c) Ascertain that the pipe and connections between brake cylinder and slack adjuster cylinder are clear. Examine the port in the brake cylinder to ensure that it is also clear.

31. Piston Travel And Brake Adjustment

The brakes on all locomotives undergoing brake examination should be adjusted so that the piston travel is at the minimum limit after a 15 lb. reduction of brake pipe pressure has been made. The hand brake must be in the release position when this adjustment is carried out. To avoid disturbing the alignment of rigging, excessive brake adjustment must not be carried out at one point only.

Hand brakes must be adjusted so that movements to effect a brake application shall not be excessive.