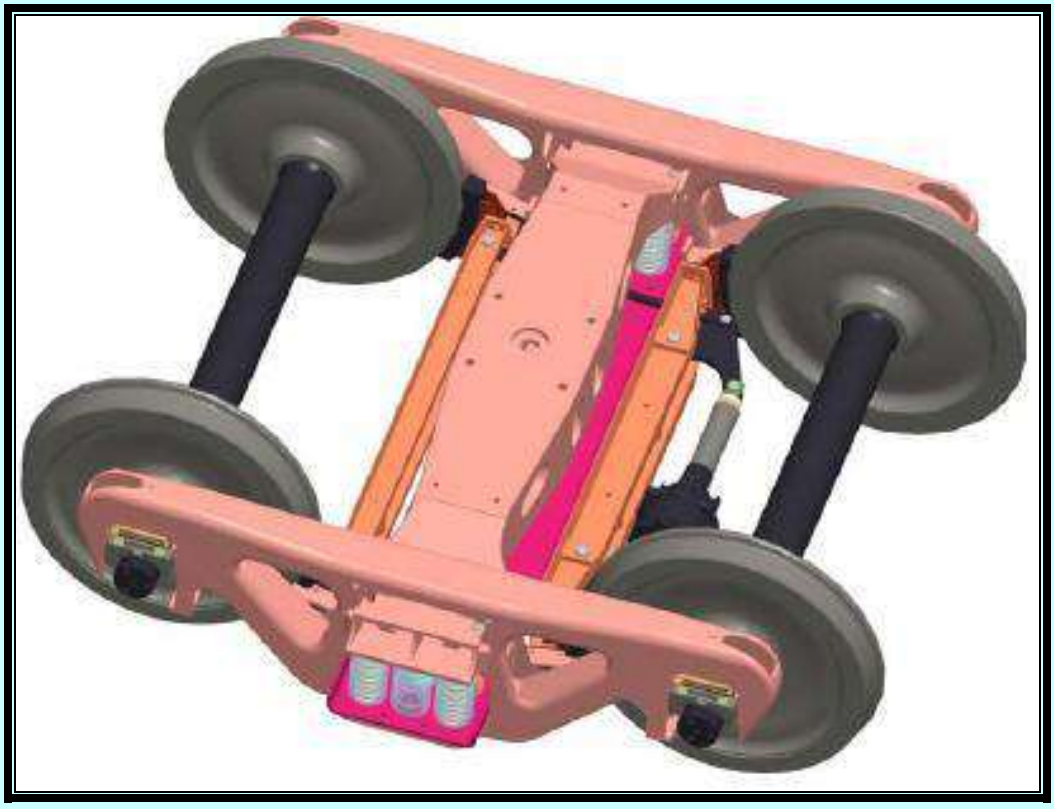
(MAINTENANCE MANUAL FOR WAGONS- 2015)

CHAPTER – 7



AIR BRAKE SYSTEM

CHAPTER 7
AIR BRAKE SYSTEM

701. CLASSIFICATION OF AIR BRAKE SYSTEM

On the basis of type of release, air brake system is classified as:

- Direct release air brake system
- Graduated release air brake system

Both Direct and Graduated release are further available in two forms viz.

- Single pipe and
- Twin pipe

The diagram shown in fig. 7.1 illustrates the schematic layout of air brake equipment on the under frame of freight stock. As shown in figure, the single pipe graduated release air brake system consists of following components:-

i) Distributor valve

ii) Common pipe bracket with control reservoir.

iii) Auxiliary reservoir.100 Litres & 75 Liters

iv) Three way centrifugal dirt collector.

v) Isolating cock.

vi) Brake cylinder 355mm diameter & 300 mm diameter.

vii) Cut off angle cock (32mm size on either ends of brake pipe & feed pipe).

viii) Air brake hose coupling (32mm for brake pipe / 32 mm from feed pipe).

ix) Brake pipe/feed pipe (32mm dia).

x) Branch pipes from BP to brake equipment (20mm bore).

xi) Guard emergency brake valve.

xii) Pressure gauges for BP

xiii) Quick Coupling.

Recently, Bogie mounted Brake System (BMBS) has also been introduced for freight stock. The details of BMBS for freight stocks are given in Para 729 of this chapter

702. PRINCIPLE OF OPERATION OF SINGLE PIPE GRADUATED RELEASE AIR BRAKE SYSTEM

Some of the Air Brake goods stock on IR is fitted with single pipe graduated release air brake system. In single pipe, brake pipes 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 cocks on all wagons are also kept in open condition. Auxiliary reservoir is charged through distributor valve at 5.0 kg/cm^2.

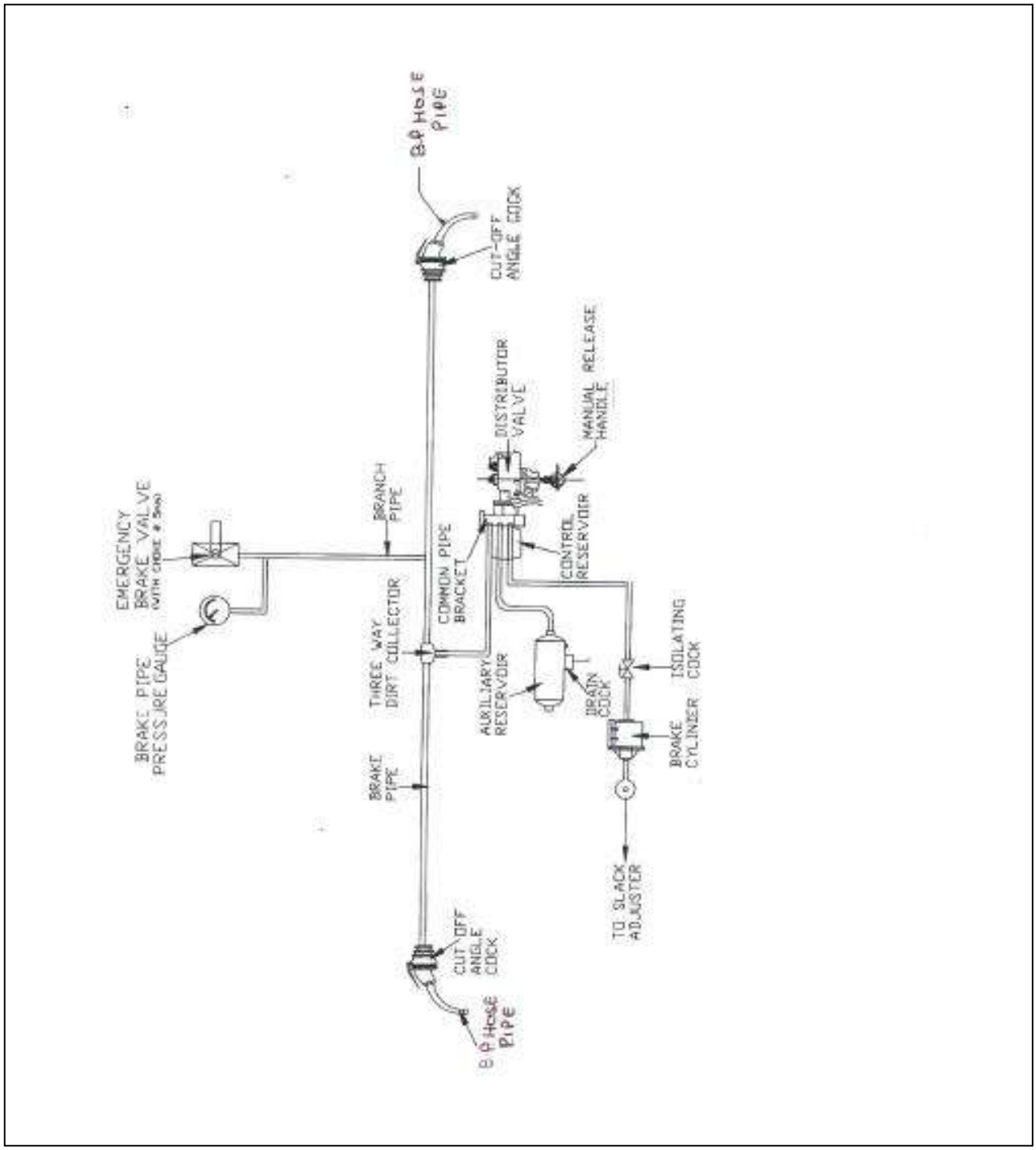


Fig. 7.1

GRADUATED RELEASE SINGLE PIPE AIR BRAKE SYSTEM

A. **Charging stage**

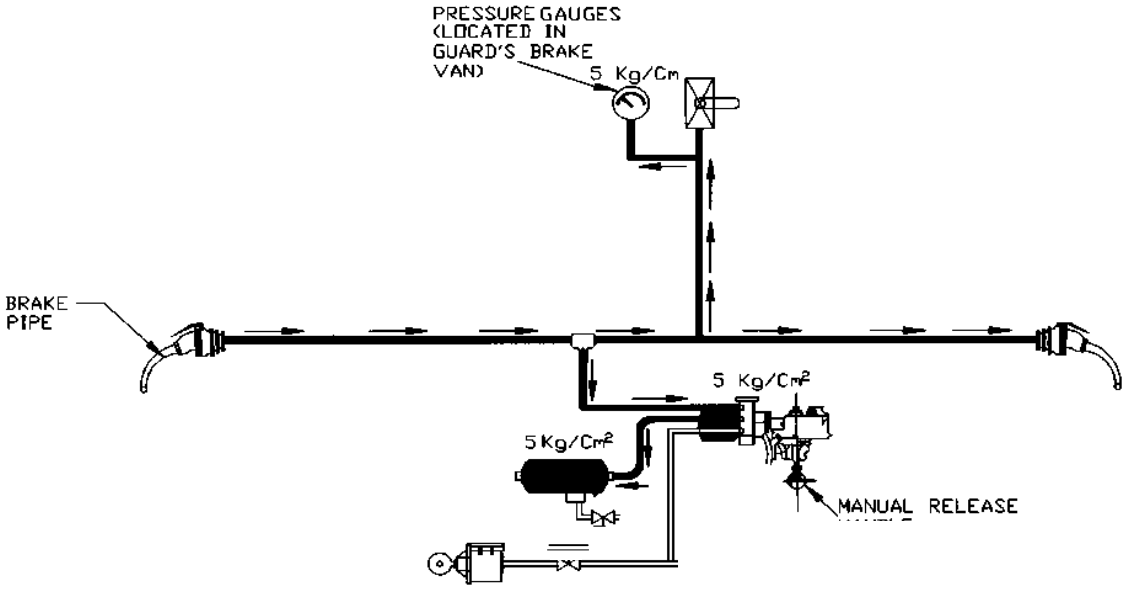


Fig. 7.2 CHARGING

During this stage, brake pipe is charged to 5kg/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.

B. Application Stage

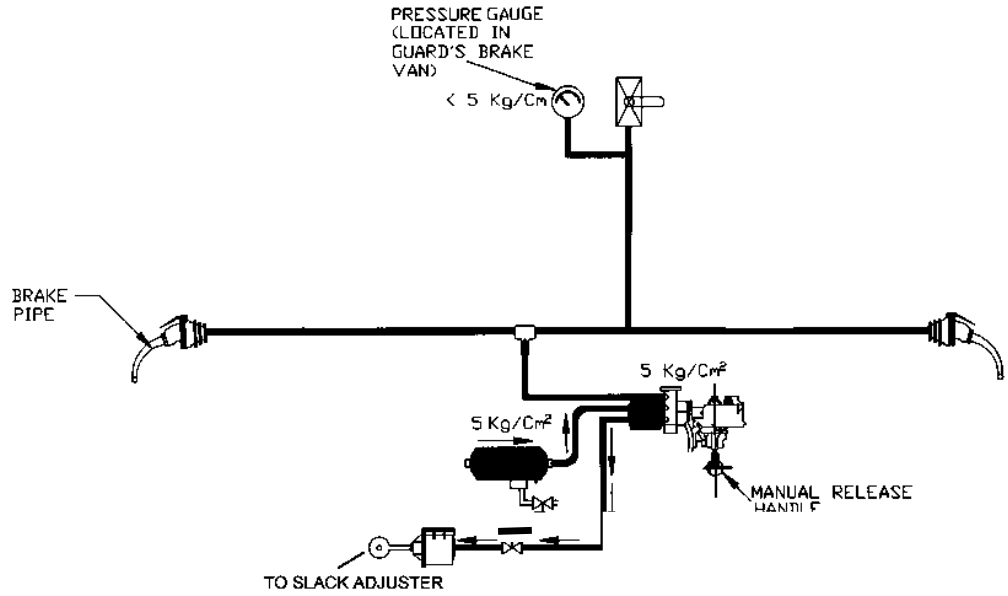


Fig. 7.3 APPLICATION

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

Note: 1. Brake Application takes places when Brake pipe pressure is dropped.

2. The drop of pressure may be a) Intentional and b) Accidental.

C) Release stage

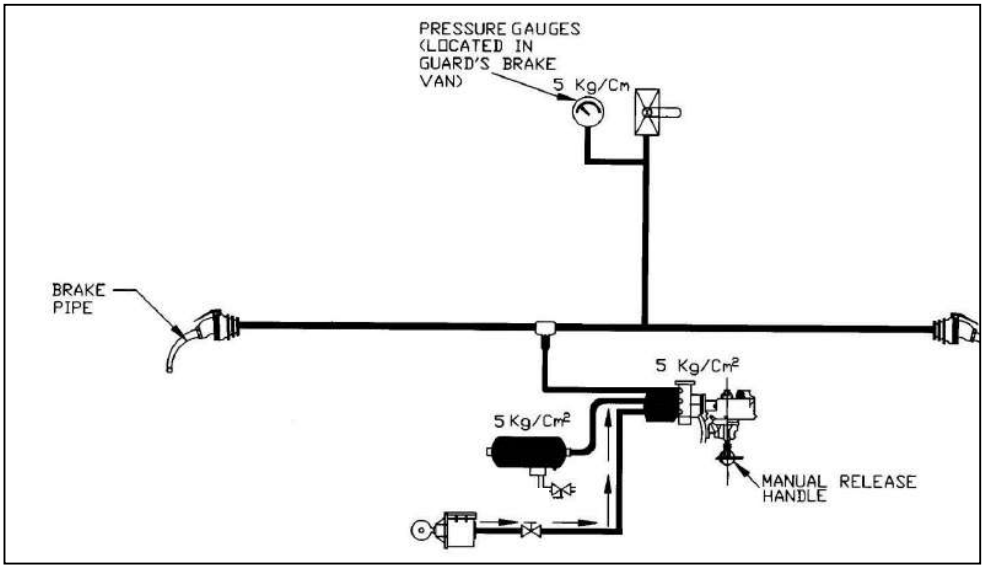


Fig. 7.4 RELEASE

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 away that auxiliary reservoir gets isolated from brake cylinder and brake cylinder is vented to atmosphere through distributor valve and thus brakes are released

702A. PRINCIPLE OF OPERATION OF TWIN PIPE GRADUATED RELEASE AIR BRAKE SYSTEM

Some of the Air Brake goods stock on IR is fitted with Twin pipe graduated release air brake system. In Twin pipe, brake pipes and feed pipes of all wagons are connected. Also all the cut off angle cocks are kept open except the front cut off angle cocks of BP/ FP of leading loco and rear end cut off angle cock of BP and FP of last vehicle. Isolating cocks on all wagons are also kept in open condition. Auxiliary reservoir is charged to 6.0 Kg/cm^2 through the feed pipe.

A. Charging stage

During this stage, brake pipe is charged to 5 kg/cm^2 pressure and feed pipe is charged to 6 kg/cm^2 pressure which in turn charges control reservoir and auxiliary reservoir to 6 kg/cm^2 pressure. At this stage, brake cylinder gets vented to atmosphere through passage in Distributor valve.

B. 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

Note: 1. Brake Application takes places when Brake pipe pressure is dropped.

2. The drop of pressure may be a) Intentional and b) Accidental.

C. 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.

Do's and Don'ts for Twin Pipe working of Freight Trains

Do's:

1. Do ensure that the all twin pipe Wagons are operated in CC rakes only.
2. Do ensure that loco provided for twin pipe rake is having its twin pipe in working condition.
3. Do ensure availability of spare pool of twin pipe wagon & brake van, for replacement, if required.
4. Do ensure availability of spare feed pipe in loco.
5. Do ensure that brake van provided for twin pipe working is having twin pipe system.
6. Do ensure BP coupling heads are marked with 'BP' and painted in green.
7. Do ensure FP coupling heads are marked with 'FP' and painted in white.
8. Do ensure that BP & FP hose couplings at the rear end of the train are placed on their respective hose coupling supports.
9. Do ensure that pressure gauges for BP and FP are provided in the brake van.
10. Do ensure that brake pipe/feed pipe angle cocks are not closed under any circumstance, either for isolation of wagons or for any purpose whatsoever, except for carrying out shunting operation, after which the angel cocks should again be opened to ensure continuity of brake pipe and feed pipe.
11. Do ensure that the isolating cock of feed pipe of all the wagons in the open position. The handle of cock shall be vertically down when open and at horizontal when closed.
12. Do ensure that gauge in guards compartment show pressure not less than 5.8 kg/cm2 in feed pipe after the system is fully charged.
13. Do ensure that feed pipe hose coupling are connected to form a continuous passage from locomotive to last vehicle.
14. Do ensure that feed pipe Cut off angle cocks, except at the rear of train, are kept open.
15. Do ensure availability of the quick coupling for attaching and detaching the pressure gauges for BP/FP in brake van.

16. Do ensure that the leakage in brake system is less than 0.25kg/cm^2 per minute.
17. Do close BP/FP angle cocks of adjacent wagons to uncouple hose couplings.

DON'Ts

1. Do not allow single pipe coupling.
2. Do not allow a feed pipe to be connected to the brake pipe anywhere in the train or vice versa.
3. Do not allow a feed pipe hose coupling at rear end to dangle.
4. Do not allow train to leave with leakage higher than specified.
5. Do not allow train to leave with feed pipe pressure in loco and brake van less than specified.

UNCOMMON ITEMS FOR TWIN PIPE AIR BRAKE SYSTEM

Items	Description & dimensions	Nos./ Wagon	Ref. Drg.
1.	AIR BRAKE HOSE COUPLING (F.P.)	2	WD-81027-S-01
2.	ISOLATING COCK	1	WD-83062-S-04
3.	CHECK VALVE	1	WD-83062-S-03
4.	PIPE 20 N.B.	1	Respected different drawings of different wagons.
5.	PIPE 20 N.B.	1	
6.	PIPE 20 N.B.	1	
7.	PIPE 32 N.B. (F.P.)	1	
8.	PIPE 32 N.B. (F.P.)	1	

MARKING OF TWIN PIPE AIR BRAKE FITTED WAGONS

For easy identification of these wagons, 'Twin Pipe' written in black letters on yellow background and encircled in white band shall be marked on side panel, one side in English and other side in Hindi as specified in RDSO drawings.

NOTE: For further details please refer Annexure XIX of G-97 ammandment No. 3 of Jan. 2010 for "General guidelines for operation and examination of Twin Pipe Air Brake system of complete train" and RDSO repot No. MP. Guide No. 11 (Rev. -01) "Procedure for checking of Diesel/Electric locomotive Hauled Air Braked Trains (Fitted with twin pipe air brake system)"

AIR BRAKE SUB ASSEMBLIES

703. COMMON PIPE BRACKET

Common pipe bracket is permanently mounted on the under frame of a vehicle. The distributor valve along with the intermediate piece (sandwich) which houses the isolating cock is mounted on one face of the common pipe bracket. The control reservoir is mounted on the other face of the Common pipe bracket.

The Common pipe bracket has been evolved with the purpose of making it suitable for use with any make of distributor valve adopted on Indian Railways.

Common pipe bracket is a sturdy casting with internal air passages, matching the intermediate piece mounting face with accurately profiled air cavities and flanged ports leading to the appropriate ports of the distributor valve.

Branch pipes to the brake pipe and brake cylinders are fitted on the appropriate ports on the common pipe bracket. The advantage of fitting a common pipe bracket is to remove the distributor valve for repair or replacement without disturbing the pipe connections.

704. INTERMEDIATE PIECE (SANDWICH PIECE)

Intermediate piece serves the purpose of blanking all the other ports on the common pipe bracket front face other than required for a particular make of distributor valve. Each type of distributor valve is mounted on the common pipe bracket with its own intermediate piece (sandwich).

Intermediate piece is mounted on the common pipe bracket face with a common gasket and the distributor valve is fastened to the intermediate piece. Isolating cock for distributor valve, which is housed in the intermediate piece is for isolating the distributor valve in case of malfunctioning or for disconnecting the brake pipe pressure. Isolating cock on intermediate piece has a built in venting arrangement.

705. BRAKE PIPE HOSES

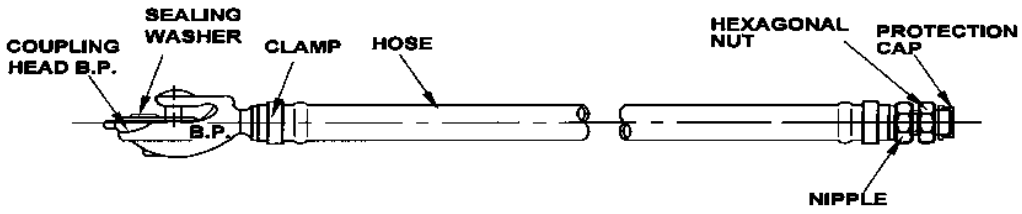


Fig. 8.5

In order to connect two successive wagons, the brake pipes (BP) & Feed Pipe (FP) installed on the underframe are fitted with flexible hoses. The hoses are named as BP/FP hose.

706. BRAKE PIPE COUPLING

To connect subsequent wagons, the hoses of BP are screwed to coupling and hose nipple by means of stainless steel `Bend it' type clips. The coupling is specially designed in the form of palm end and hence also known as palm end coupling. For easy identification the couplings are engraved with letter BP and coupling heads are painted green

Note: Design, controlling dimensions, material and specification of components shall conform to the latest revision of RDSO drg. No. SK-73547 for BP, WD-81027-S-01 for FP and appendix F of 02 ABR 02 of RDSO specification.

The air brake hose couplings are provided in the brake pipe line throughout the train for connecting the brake pipe of adjacent wagons to form the complete rake. Each Air Brake Hose coupling consists of a specially manufactured rubber hose clamped over a

nipple on one end and a coupling head on the other end. Rubber sealing washers are provided on the outlet port of the coupling head.

Since a joint is formed at the coupling head, leakage may take place, through it. Therefore it is necessary to subject the hose coupling of brake pipe to leakage test.

A. TOOLS AND EQUIPMENTS

a) Test stand (Fig. 7.6)

Test stand for testing of the hose coupling consists of the following main equipment

1) Supply of compressed air at – 10 Kg/cm^2
2) Isolating cock – 1a and 1b
3) Exhaust cock – 1c
4) Main reservoir
5) Pressure gauge
   - 6a for main reservoir
   - 6b for flexible hose
6) Flexible hose - for connecting hose coupling for immersing in to water.
7) Water tub with safety cage – for checking leakage from hose coupling.
8) Dummy coupling head.

b) TEST PROCEDURE

For testing the hose coupling the steps given below should be followed:

i. Use a dummy coupling head to block the outlet port of the hose coupling.
ii. Connect to hose coupling under test to the end of flexible hose.
iii. Open isolating cock 1(a)
iv. Adjust pressure regulator (2) so that pressure gauge (6a) shows 10Kg./cm^2 air pressure.
v. Immerse the hose coupling assembly completely in the tub of water.
vi. Open isolating cock (1b) and see that (6b) shows 10 Kg/cm^2 pressure.
vii. Observe leakage, if any from all parts of the hose coupling.
viii. Close the isolating cock 1(b).
ix. Disconnect the hose coupling from test bed.
x. If the leakage is observed through the coupling head, replace the gasket and test again.
xi. If leakage persists even after change of gasket the coupling head is unserviceable and complete assembly shall be rejected. However if leakage occurs at the hose nipple or coupling end hose joint the clamp should be attended/replaced to make the assembly leak proof.

c) SAFETY PRECAUTIONS

- Specified tools and fixtures should be used for connecting and disconnecting the hose coupling with the air supply.
- While testing the hose coupling before charging it to 10kg/cm^2 pressure, the tube should be covered and locked with a protective cage.

- Exhaust the pressure from the hose coupling under test, before lifting the safety cage and uncoupling it.
- After testing, the hose assembly shall be stored in a dry and clean space. The inlet and outlet port must be plugged with protective cap to prevent entry of dust and foreign particles inside the hose coupling.

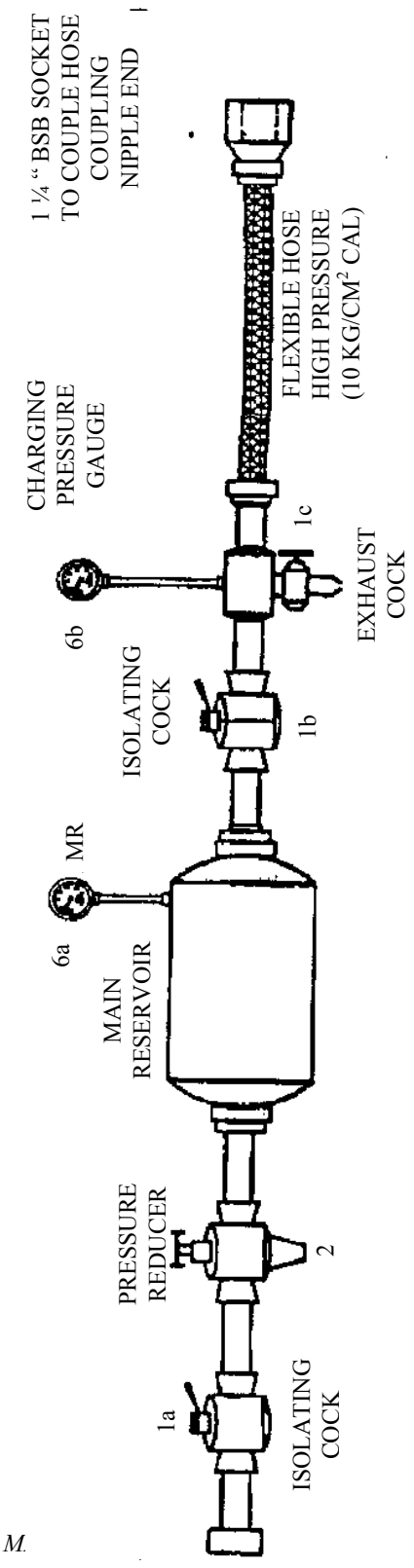


Fig.7.6 TESTING OF HOSE COUPLING

707. CUT OFF ANGLE COCK

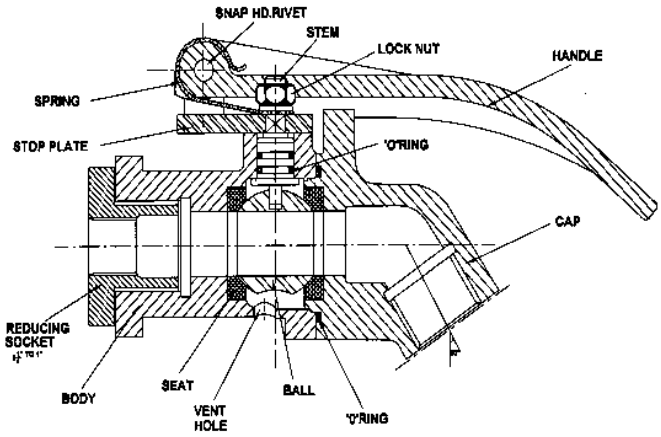


Fig. 7.7

Cut off angle cocks are provided on the air brake system to facilitate coupling and uncoupling of air hoses (i.e. brake pipe). When the handle of the cut off angle cock is placed in closed position it cuts off the passage of compressed air, there by facilitating coupling and uncoupling action.

If coupling action has to be performed on a given rake, ensure that the cut off angle cock provided at the end of the brake pipes are closed. By doing this the compressed air gets cut off and does not enter into the brake pipe air hose . The air hoses without compressed air can thus easily be coupled without any jerk. Similarly during uncoupling the cut off angle cocks of subsequent wagons should be closed. By doing so the air present in the brake pipe air hose gets leaked through the vent provided in the body of the cut off angle cock. Finally the air hoses get emptied and thus can be easily uncoupled without any jerk.

The cut off angle cock consists of two parts viz. cap and body which are secured together by bolts. The cap and the body together hold firmly the steel ball inside it, which is seated on rubber seat. The ball has a special profile with the provision of a groove at the bottom portion for venting the air to the atmosphere.

On the top surface of the body a bore is provided for placing the stem, to which a self locking type handle is fixed. When the handle is placed parallel to the cut off angle cock the inlet port of the cut off angle cock body is connected to the outlet port, through the hole provided in steel ball. Thus air can easily pass through the cock. This position of the handle is known as open position. When the handle is placed perpendicular to the cock body the steel ball gets rotated and the spherical and groove portion of the ball presses against the sealing ring at inlet and outlet port, there by closing the passage of inlet air and venting the outlet air through the vent hole. This position of the handle is known as closed position.

With the stem one leaf spring is provided which presses the operating handle downwards. By virtue of this, handle gets seated in deep grooves at ON/OFF position resulting in a mechanical lock.

Under normal working conditions, the handle of all cut off angle cock of BP are kept open except the rear end angle cock (BP). This facilitates in charging the complete air brake system with compressed air supplied by the compressor housed in the locomotive. Cut off angle cock fitted on the brake pipe is painted green.

Note: The dimension and tolerances of cut off angle cock shall be as indicated in latest revision of RDSO drawing nos. WD-88123-S-01 and WD-88123-S-02.

Since a number of manufacturers exist for air brake equipment and component, refer to concerned original manufacturer's maintenance manual for part no. and description of spares.

A. OVERHAULING OF CUT OFF ANGLE COCK

These angle cocks are of ball-type ensuring better sealing against leakage and facilitate ease of operation. During overhauling, it is dismantled for cleaning, replacement of parts and checking for effective functioning.

The cut-off angle cock is to be completely dismantled and overhauled during POH or when there is some specific trouble.

a) TOOLS & EQUIPMENT

The following tools and fixtures are required for overhauling

(I) Single end spanner.

1) A/F 17 for M10 nut pivot screw.

2) A/F 10 for M6 nut.

(II) Screw driver 12"/300 mm long.

(III) Vice.

(IV) Light hammer.

b) PROCEDURE

Dismantling

- Hold the cut – off angle cock in vice.
- Unscrew the lock nut from the stem.
- Take out the handle assembly (The handle assembly need not be dismantled further unless it is necessary to change the plate spring i.e. if it is found, heavily rusted, pitting crack or the spring is permanent set).
- Unscrew the four hexagonal bolts and spring washers.
- Detach cap from the body.
- Remove 'O' ring and ball seat from the cap.
- Turn the stem in such a way that the ball can be pulled from the stem.
- Slightly hammer the stem at its top and take out the stem through the bore of the body.
- Remove the ball seat from the body.

c) Cleaning of Parts

- Clean out side portion of the body and cap with wire brush.

- Direct a jet of air to remove the dust.
- Clean all metallic parts with kerosene oil and wipe dry.

d) Replacement of Parts

- Replace all rubber parts.
- Replace spring-washer, nut & bolts in case they are excessively corroded or defective.
- Replace handle spring if it is found heavily rusted, is having pitting crack or is permanently set (Dismantle the handle assembly, and fit a new spring along with a snap head rivet).
- Replace stainless steel ball if found with scratch marks on the outer surface or dented.

e) Assembly

- Insert the two 'O' rings in their respective grooves on the stem.
- Keeping the threaded end of the stem first, insert the stem into the body through the bore of the body.
- Place one ball seat in its groove inside the body.
- Position the ball after correctly aligning its venting slot in the bore of the body.
- Place the second ball seat and 'O' ring in their respective positions on the cap.
- Secure the body and cap by Hex. Hd. Bolt (M6) and spring washer (for M6).
- Place the handle assembly on the stem and secure it with Hex. Hd. Nut (M10).
- During assembly apply a light coat of shell MP2 or equivalent grease on the external surface of the threads and the ball.

B. TESTING OF CUT–OFF ANGLE COCK

a) TOOLS AND EQUIPMENT

i. Test Bench

ii. Compressor to build pressure more than 10 kg/cm^2.

iii. Single ended spanner as per IS 2027

a) Across face 17 (for M10 lock nut) - 1 No.

b) Across Face 13 (for M8 studs) 2 No.

iv. Screw Driver –300mm, 1 No.

v. 1 ¼ " BSP dummy Plug with seal.

vi. Dummy plug for angle cock.

b) TEST PROCEDURE

Following test procedure should be adopted step by step for performing the leakage test.

i. Mount the angle cock on the base of the test bench (Part No. 7 of the figure of the test bench).

ii. Move the handle to the closed position.

iii. See that cock (1e) and (1c) are in closed position.

iv. Now open cock 1(a) and 1(b) till MR indicates a pressure of 10 Kg/Cm^2.

v. If necessary, adjust pressure regulator (2) to maintain the pressure at 10 kg/Cm^2.

vi. Open cock (1c) and check the leakage with soap solution. There should not be any leakage.

vii. Check pressure drop in gauge (6b) there should not be any leakage from flange joints, vent and outlet port of the angle cock.

viii. Close cock (1c) and tighten the dummy plug and seal the outlet of the angle cock.

ix. Move the handle to the open position. Open cock 1c.

x. Check for leakage from body and cap joint, vent and all over the stem periphery using soap water. No leakage is permissible.

xi. Move the handle to closed position and notice a short blast of air through the vent.

xii. Close cock 1c then Open cock (1d) and exhaust the pressure to zero.

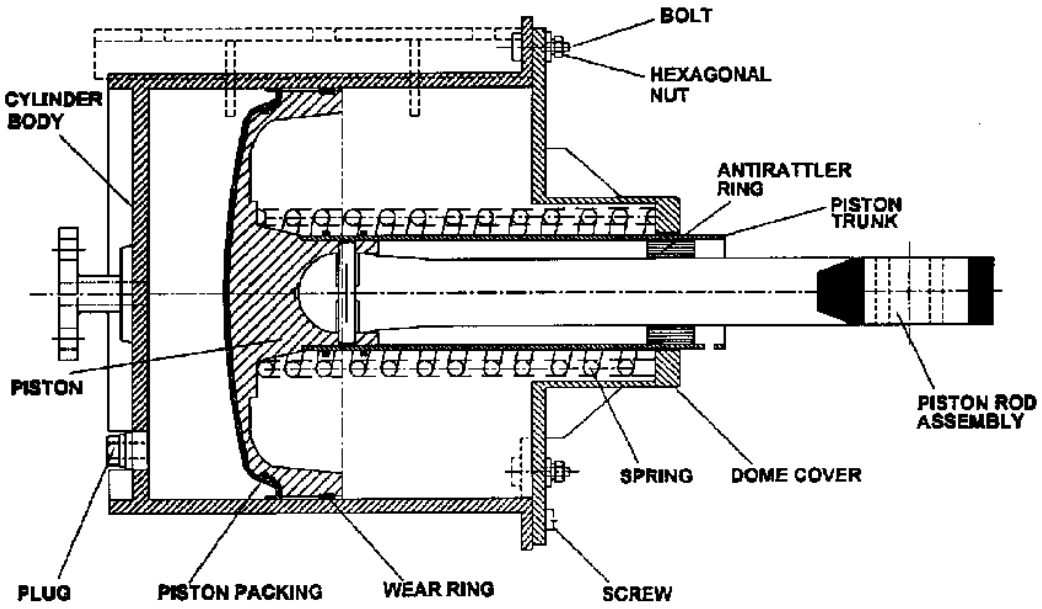
xiii. Remove the angle cock.

xiv. Report results of the test.

c) SAFETY PRECAUTIONS

- Specified tools and fixtures should be used for assembly and disassembly operations.
- The small metal parts like leaf spring, nut, bolts, washers, screws etc should be kept in a safe place and replaced in case found defective.
- Inlet and outlet port of the tested angle cock should be plugged with protection cap to prevent entry of dust and moisture inside the cut off angle cock.
- Ball should be handled carefully to avoid any damage on its surface.
- Threaded portion of body and cap should not be damaged at the time of dismantling.

708. BRAKE CYLINDER



(Note: Anti-rattler ring shall be provided on brake cylinder for passenger stock)

Fig. 7.8 BRAKE CYLINDER

On every wagon fitted with air brake system one brake cylinder is provided for actuating the brake rigging for the application and release of brakes.

During application stage the brake cylinder receives pneumatic pressure from the auxiliary reservoir after being regulated by the distributor valve. There after the brake cylinder develops mechanical brake power by outward movement of its piston assembly. To transmit this power to the brake shoe, the push rod of piston assembly is connected to the brake shoe through a system of levers to amplify and transmit the brake power. During release action of brakes the compression spring provided in the brake cylinder brings back the rigging to its original position.

The cylinder body is made out of sheet metal or cast iron and carries the mounting bracket, air inlet connection, ribs and flange. To the cylinder body, a dome cover is fitted with the help of bolts and nuts. The dome cover encloses the spring and the passage for the piston trunk, which is connected to the piston by screws. The piston is of cast iron having a groove in which piston packing is seated. Piston packing of rubber material which is of oil and abrasion resistant and unaffected by climatic changes. It is snap fit to the piston head and has self lubricating characteristic which ensures adequate lubrication over a long service period and extends seal life considerably

The piston packing also seals the air- flow from the pressure side to the other side and is guided by the wear ring. The wear ring prevents the friction between cylinder body and the piston head. The piston sub assembly incorporates a push rod, which can articulate and take minor variations in alignment during fitment/operation.

Note: The dimension and tolerances of brake cylinder shall conform to the latest revision of RDSO drawing number WD-92051–S 06, WD-92051-S-07, WD-92051-S-08, WD-92057-S-09, WD 92051 –S-09, WD 94048-s-01, WD 92051 –S-11, WD 92051 –S-12, WD 92051 –S-13, WD 92051 –S-14 and WD 92051 –S-15.

A. OVERHAULING OF BRAKE CYLINDER

Brake cylinder has to be thoroughly overhauled for efficient and reliable trouble free performance during its prolonged service life. The complete overhauling of the brake cylinder is to be carried out during POH or when there is some specific trouble.

a) TOOLS & EQUIPMENT

Sr. No.	Description
1.	Torque Wrench 0-3 Kg range
2.	Double End Spanner 24x27 mm across face (For M16)
3.	Double End Spanner across face 13x14 (For M12)
4.	Socket Wrench 19 mm (For M12)
5.	Screw Driver 12" (300 mm)
6.	Special fixture (Screw press/ Pneumatic)
7.	Gauge for examining bore of the cylinder

b) Dismantling of Brake Cylinder

Before dismantling the dome cover insert a rounded head pin of 12x25 long and secure one of the hole in the piston trunk for the purpose of safety to prevent dome cover working out of the piston rod due to the cylinder return spring force while opening the dome cover with the help of a special fixture clamp the dome cover.

- Unscrew the Hex. Hd. nut and take out the spring washer on the dome cover.
- Turn the handle of the fixture to release the clamp and withdraw the holding clamp of the fixture till the return spring inside the cylinder is fully expanded and free.
- Remove the dome cover and take out the return spring.
- Remove the bush on the rod and brake cylinder.
- Remove the piston rod sub-assembly, piston ring packing, wear ring and slide out the anti rattler ring from the piston rod.
- Unscrew the CSK, head screw and separate the piston, pin, piston trunk & piston rod assembly.
- Unscrew the brake cylinder plug at the rear end.

c) Cleaning of Parts

- Blow a jet of air to clean the dust on the external surface.
- Clean the metallic parts using wire brush and kerosene oil.
- Clean the internal parts with nylon bristle brush.
- Clean piston packing, wear ring and rubber parts with soap water solution.

d) Replacement of Parts

- Replace return spring in case of crack, kinks or permanent set.
- Replace the brake cylinder body if found with deep marks, heavily corroded, or the bore is worn uneven or having ovality.
- Replace all rubber parts.
- If piston trunk is worn excessively it should be replaced.
- Replace piston and piston rod for damages, bent etc.
- Replace dome cover for damage, damaged hole etc.

e) Inspection and Repairs of the Parts

Examine visually that the internal surface is free from scratches, rust.

- Brake cylinder bore to be checked for ovalness with proper gauge.
- Check the characteristics of the return spring.
- Piston trunk to be checked for wear and tear.
- Pin, piston rod should be checked for wear.
- Dome cover shall be checked for excessive wear and if worn build up with welding and thereafter re-bore to the required size.
- Gauge bush bore of the piston rod, replace it if worn.

f) Testing Of Brake Cylinder Body for Leakage

Before assembly, put dummy plate on the dome side and subject the brake cylinder for hydraulic pressure of 10 kg/cm^2 for 5 minutes. No leakage is permitted.

g) Assembly of Brake Cylinder

Assemble piston rod, pin, and piston trunk on piston, tighten CSK screws to piston trunk and piston.

- Slide anti-rattler ring from the piston front side.
- Assemble piston return spring on the piston head and insert the dome cover over the piston trunk.
- Insert ϕ 12 x 25 mm long head pin into the hole provided in the extended portion of the trunk.
- Smear the piston head & inside the cylinder body with MP 2 grease or equivalent.
- Ease the packing into the cylinder with a wooden spatula with a round nose and round edge to avoid damage to the piston packing.
- Push the piston assembly approximately to the central position of the cylinder.
- With the help of special fixture, bring down the dome cover on to the cylinder body and fasten the 8 Hex. HD bolt, nut and spring washer with required torque.
- Take out the ϕ 12x25 long pin from the piston trunk hole.
- Fit back the plug at the rear of the cylinder.
- Fit the new piston packing and wear ring.

B. TESTING OF BRAKE CYLINDER

a) BRAKE CYLINDER TEST BENCH (Fig. 7.9)

Test bench consists of the following main parts

i. 3 nos. of isolating cocks

ii. Isolating cock with 1mm choke

iii. Pressure reducing valve

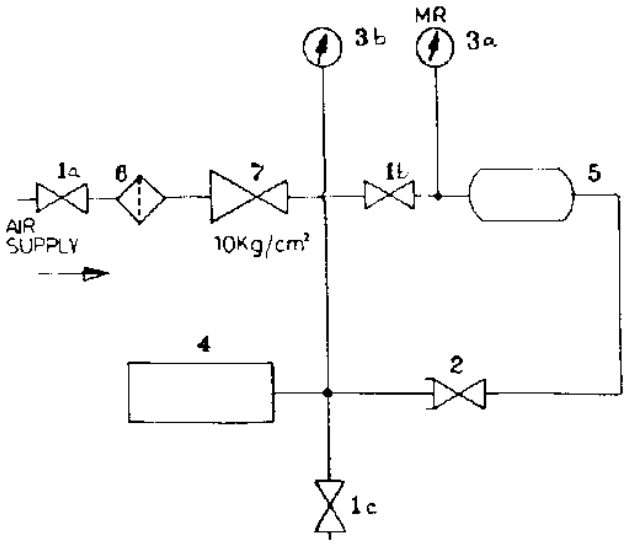


Fig. 7.9 TEST BENCH FOR BRAKE CYLINDER

iv. 2 Nos. Pressure gauges

v. Pipe line filter

vi. Brake cylinder pressure mounting base with safety guard

vii. Air reservoir

viii.

b) TOOLS REQUIRED DURING TESTING

i. Torque wrench range (2-3 kgM capacity) – One number.

ii. Double ended spanner (M16) across face 24x27 – One number.

iii. Socket wrench (M12) across face 19 – One Number.

iv. Double ended spanner (M8) across face 13x14 – One number.

v. Screw Driver – 300mm – One number.

After the overhauling of the brake cylinder, it is mounted on the test bench and tested. It should be operated a few times on the test bench to ease the piston. Each brake cylinder after its maintenance and overhaul shall be subjected to the following tests on the test bench.

Arrangement as shown in Fig. 7.9 is used for testing.

c) STRENGTH TEST

Follow the procedure as given below.

i. Place the brake cylinder on base (4) and connect the line to brake cylinder. Brake cylinder stroke should be free.

ii. Close the safety guard, close the cock (Ic).

iii. Open cock (1b) and let reservoir pressure reach 10 Kg/cm2. Check the pressure in MR gauge (3a).

iv. Open cock (2) till the pressure reaches 6 Kg/cm2 in pressure gauge (3b).

v. Close the cock (2) and wait for 2 minutes.

vi. Open cock (1c).

The above test should be done with the safety guard.

d) PRESSURE TIGHTNESS TEST

Follow the following procedure.

Mount the cylinder on the test stand and tighten the mounting bolts & nuts.

i. Set the brake cylinder stroke at 85 $\pm$ 10 mm.

ii. Open cock (2) and let the pressure gauge (3b) reaches 0.8 Kg/cm^2.

iii. Close the cock (2) and wait for 1 minute till the pressure stablise in gauge (3b).

iv. Check for the pressure drop which should not be more than 0.1 Kg/cm^2 in 10 minutes.

v. Open cock (1 c)

vi. Repeat the test at 130 + 10 mm piston stroke and 3.8 Kg/cm^{2}pressure. Close cock (2) open cock (1c). Remove the brake cylinder.

If pressure is not correct or leakage rate is higher, dismantle the brake cylinder and examine piston packing wear ring for proper fitment. Examine plug for leakage. Reassemble the components and retest.

e) PAINTING

The exterior of the brake cylinder shall be painted with black enamel paint.

f) STORING

Assembled or dismantled brake cylinder should be stored in such a way to prevent the following.

- Flange surface should be prevented from damages.
- Inlet and outlet port should be plugged with protective cap to prevent the entry of dust and moisture inside the brake cylinder.

g) PRECAUTIONS DURING TESTING

- Safety Guard should be used during the strength test.
- Assembled or dismantled brake cylinder should be stored in such a way to prevent the following:

  i. Flange surface should be prevented from damage.

ii. Inlet port should be plugged with a protective cap to prevent the entry of dust and moisture inside the brake cylinder.

- Avoid damage to piston packing by dull or sharp edged thin bladed tool.
- Fit 12 dia, 25 mm long round headed pin on the hole provided in the extended portion of trunk surface before loosening the cover bolts.
- Excessive lubrication of the cylinder must be avoided.
- Specified tools and fixtures should be used for handling, mounting and removing the brake cylinder from the test bench.
- The small metal parts like springs, washer, screws, nuts, bolts, washers should be kept in a safe place and replaced in case found defective.

709. DIRT COLLECTOR

A. FUNCTION OF DIRT COLLECTOR

Dirt Collector is placed in the brake pipe line at a point from where a branch is taken off to the distributor valve. As the name indicates the purpose of the dirt collector is to protect the distributor valve and the auxiliary reservoir by trapping dust and other foreign matters from the compressed air before it enters into the distributor valve and the auxiliary reservoir. This action is achieved by centrifugal action. Hence it is also known as centrifugal dirt collector. The dirt collector ensures inter vehicular full flow of dirt free compressed air to the auxiliary reservoir and the distributor valve through the branch pipes. When the air enters into the body of the dirt collector tangentially through port `A' it passes down through inverted case in a spiral path. Due to the velocity of air flow, dirt particles get flung outwards. There after they slide down & collect at the bottom.

B. SALIENT FEATURES OF DIRT COLLECTOR

The air entering into the dirt collector from the brakepipe is guided through suitably shaped passage in dirt collector body to produce centrifugal flow. The air is then filtered through additional filter assembly before it is passed to outlet on branch pipe side to provide dust proof air to the distributor valve /auxiliary reservoir after arresting fine dust particles. The dirt contained in the air descends down and gets deposited in the dirt chamber. However, fine particles are also arrested in the filter assembly. The dust particles accumulated in the dirt chamber are removed by opening the drain plug. Rubber gasket is provided between the cover and housing to prevent leakage. Similarly leather washer is provided between the housing and the drain plug to prevent leakage.

Note: The dimensions and tolerance of dirt collector shall be as indicated in latest revision of RDSO drawing number WD-92051-S-03, WD-92051-S-04 and WD-92051-S-05.

The dirt collector is to be completely dismantled and overhauled once in 5 years or after 8 lakhs kilometers whichever is earlier or when there is some specific trouble.

C. TOOLS AND FIXTURES

The following tools and fixtures are required for overhauling:

a) Spanner 19 x 22mm

b) Vice.

c) Screw Driver

D. PROCEDURE FOR MAINTENANCE

I. Disassembly

Hold the dirt collector in vice.

- Loosen drain plug and remove it completely from housing.
- Remove top cover and seal by loosening four hexagonal nuts and removing hexagonal bolts.
- Remove filter from body.

II. Cleaning of Parts

- Clean all metallic parts using brush and kerosene oil.
- Clean filter with soap water.
- Check all parts for any damage.

III. Replacement of Parts

- Replace sealing ring and gasket.
- Replace filter.
- Check spring washer and replace in case defective or excessively corroded.

IV. Assembly

- Assemble body after smearing grease.
- Locate filter in position and assemble top cover with new gasket.
- Fix hexagonal bolts/nuts along with the spring washer.
- Fix new sealing ring to the bottom and assemble drain plug.

E. TESTING OF DIRT COLLECTOR

Centrifugal Dirt Collector is provided at the junction of the main pipe and branch pipe in brake pipes. There are three purposes for providing the dirt collector.

i. To ensure inter-vehicular full flow of brake pipe lines.

ii. For branching and feeding to the distributor valve.

iii. To remove dust and scale particles from the air prior to entering the distributor valve and the air reservoir.

As Dirt collector is subjected to high air pressure it has to be tested for the leakage and strength. Testing of dirt collector is needed after its overhauling. There may be various causes due to which overhauling and subsequent testing of the dirt collector is required.

F. TOOLS AND EQUIPMENT

- Test Bench (Fig. 7.10)
- Compressor, capable of building air pressure up to 10 kg/sq. cm.
- Double ended spanner (Across Face 19x22) – One No.
- Dummy flange for dirt collector – 2 nos.

G. TEST PROCEDURE

Each dirt collector after overhauling and maintenance should be subjected to pressure test as below:

i. Mount the dirt collector on base of the test bench.

ii. Keep cocks (1f), (1c) and 1(e) closed.

iii. Open cock (1a) and (1b).

iv. Charge the reservoir (5) to 10 kg/cm^2.

v. Close two openings on the dirt collector using dummy flanges.

vi. Open cock (1e), check the pressure at (6c). It should be equal to 10 kg/sq. cm.

vii. If not develop pressure up to 10 kg/cm^2 by adjusting pressure regulator(2).

viii. Close cock (1e)

ix. Check for leak over the body and joints with the help of soap solution, no leak is permitted.

x. Also check for pressure drop in gauge 6(c)- for 3 minutes

xi. Pressure in the gauge 6c should be maintained.

xii. Reduce the pressure in the main reservoir (5) to 5 kg/cm^2 by opening cock (1f) and adjusting the pressure regulator (2).

xiii. Close cock (1f) as soon as pressure reaches upto 5 kg/cm^2.

xiv. Remove the dummy flange from the outlet port (which feeds to the distributor valve).

xv. Check for free flow of air from the outlet port. (If air is not flowing freely it means that the filter is choked).

xvi. The pressure will soon exhaust through the outlet port.

xvii. Remove the dirt collector from the test stand.

xviii. Report Results.

H. SAFETY PRECAUTIONS

a) The assembled dirt collector should be stored in such a way to prevent the following:

b) Flange surface should be prevented from damage.

c) Inlet and outlet port should be plugged with protective caps to prevent the entry of moisture and dirt inside the dirt collector.

d) Specified tools and fixtures should be used for handling, mounting and removing the dirt collector from the test bench.

e) The small metal parts like screws, nuts, bolts, washers etc. should be kept in a safe place and replaced in case found defective,

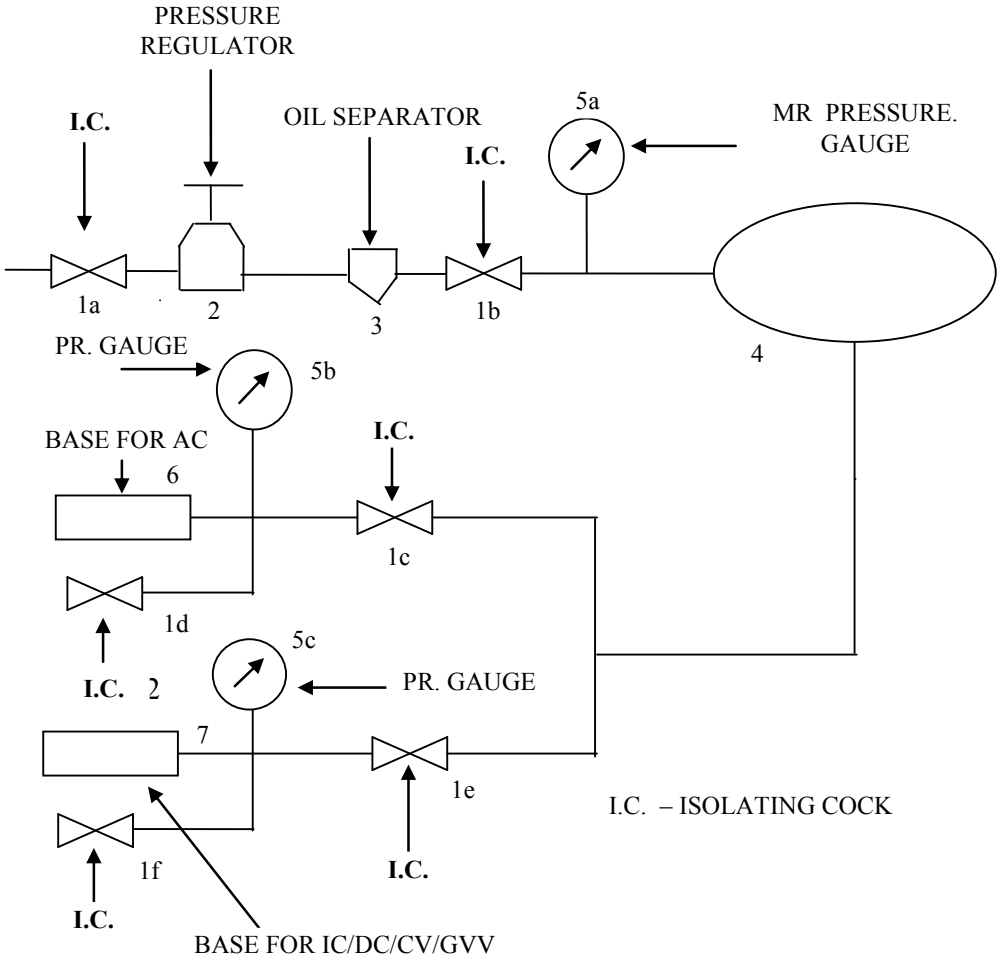


Fig. 7.10 TEST BENCH FOR ANGLE COCK & DIRT COLLECTOR

710. AUXILIARY RESERVOIR

A. FUNCTION

Auxiliary reservoir is actually a pressure vessel and its function is to feed dry compressed air to the brake cylinder for application of brakes.

B. SALIENT FEATURES

The auxiliary reservoir is a cylindrical vessel made of sheet metal. On both the ends of the reservoir, flanges are provided for pipe connection. One end of the auxiliary reservoir is connected to the brake pipe through the distributor valve. Auxiliary reservoir is charged through the brake pipe. The auxiliary reservoir is charged to 5kg/cm^2 pressure, charging from the brake pipe through Distributor valve.

At the bottom of the auxiliary reservoir, drain plug (or drain cock) is provided for draining out the condensate/moisture.

Note: The dimension & tolerances of the auxiliary reservoir shall be as indicated in latest revision of RDSO drawing WD-92051-S-01 for 100 lit. Capacity and RDSO drawing number WD-92051-S-02 for 75 lit. capacity.

The auxiliary reservoir is to be completely dismantled and overhauled during POH or if there is some specific trouble.

C. TOOLS AND EQUIPMENT

a) Spanner A/F 19x22.

b) Light hammer

D. PROCEDURE FOR MAINTENANCE

DISMANTLING

- Unscrew the drain plug or drain cock.
- Drain the water accumulated in the tank.

CLEANING OF PARTS

- Examine the outer surface for any pitting scales or rusting.
- Clean the exterior of the auxiliary reservoir with a wire brush.
- Pour kerosene oil in to the auxiliary reservoir and roll few times and drain the oil.
- Dry the interior of the reservoir with a jet of air.
- Rinse the reservoir with RUSTO-LINE and then with ESSO-RUST 392 or equivalent.
- Clean the drain plug with a wire brush.
- Auxiliary reservoir shall be painted on the exterior with two coats of zinc chromium primer and two coats of black enamel.

REPLACEMENT OF PARTS

- Replace the plug washer.
- Replace the plug if threads are rusted or damaged.
- Replace the reservoir having deep cuts on surface.

ASSEMBLY

Assemble the drain plug with washer by screwing it back into its position.

E. TESTING OF AUXILIARY RESERVOIR

Air Pressure Test

- Block one side passage of the auxiliary reservoir with dummy flange.
- Admit air pressure from the other side passage at 10 Kg/cm^2.
- Check the leakage at the weld seams, with soap water solution.
- No leakage is permitted.

Hydraulic Test

- With a hydraulic pump, apply a pressure of 16 Kg./cm^2 from one flange end after blocking the opposite end.
- Hold the pressure for 5 minutes.
- Check for the leakage on the external surface of the reservoir by gently tapping on the weld seams with a light hammer.
- No leakage is permitted.
- Drain out the water completely and allow the reservoir to dry, by directing a jet of air.

F. SAFETY PRECAUTIONS

- Specified tools and fixtures should be used for assembly and dismantling operations.
- Rubber / leather components should be stored in a safe place away from heat, alcohol & acids. All metal parts like washers should be kept in a safe place.

711. GUARD'S EMERGENCY BRAKE VALVE

Guard's emergency brake valve is provided in the guard‘s compartment. This valve provides a facility to the guard to initiate brake application in case of any emergency.

Guard’s emergency brake valve is connected to the brake pipe. This valve is actually placed in the guard’s compartment so that in case of an emergency, the guard of the train can communicate to the driver of the train by operating the valve provided in the brake van. When the handle of the guard’s emergency brake valve is placed parallel to the pipe, the air from the brake pipe is exhausted to the atmosphere. However, to restrict the excessive drop of air pressure in the brake pipe, a choke of 5mm is provided in this valve. This drop in pressure in the brake pipe can also be observed in the air flow meter provided in the locomotive cabin and finally the driver applies the brakes for stopping the train. The handle of the guard’s emergency brake valve has to be reset manually to normal position before the brake pipe pressure is to be recharged.

A. SALIENT FEATURES

The guard’s emergency brake valve consists of a housing in which a ball is housed. The ball has a through hole similar to the isolating cock. To the ball a handle is fixed at the top. By operating the handle the ball can be rotated along the vertical axis. When the hole in the ball gets aligned with the inlet and the exhaust port the compressed air can pass through the valve. However, for restricting the flow of air a

choke of 5 mm is fitted in the exhaust port for controlling the rate of BP exhaust. In order to have leak proof assembly two rubber seats are also provided in the guard's emergency brake valve

Note: The general design and controlling dimension of guard's emergency valve shall conform to the latest revision of RDSO drawing no SK-73549.

The guard's emergency brake valve should be completely dismantled and overhauled during POH or when there is some specific trouble.

B. TOOLS AND FIXTURES FOR MAINTENANCE

The following tools and fixtures are required for overhauling

- Spanner A/F 19/22.
- Special spanner for removing thread plug.
- Spanner for removing gland.
- Light hammer
- Vice.

C. PROCEDURE FOR MAINTENANC

a) **DISMANTLING**

- Hold the valve in the vice.
- Unscrew the nut on the stem and remove the nut and the spring washer.
- Remove the handle.
- Unscrew the gland and pull out the stem from the body.
- Remove the two gland packing on the stems.
- Unscrew the threaded plug from the body using a special spanner.
- Remove the 'O' ring and the ball seat from the body.
- Remove the ball and the second ball seat from the body.

b) CLEANING OF PARTS

- Direct a jet of air on the valve body to remove the dust & dirt.
- Clean the external parts of the valve with wire brush.
- All metal parts shall be washed with kerosene oil and wiped dry.
- Rubber parts shall be washed with soap water solution.
- Steel ball shall be handled carefully to avoid scratch marks or dent.

c) REPLACEMENT OF PARTS

- Replace all the rubber parts such as gland packing and 'O' ring.
- If spindle thread is corroded or damaged, the spindle shall be replaced with a new one.
- If threads on the threaded plug are damaged or corroded badly, the plug shall be replaced with a new one.
- If ball of the valve has dent or scratch marks it should be replaced with a new one.

d) ASSEMBLY

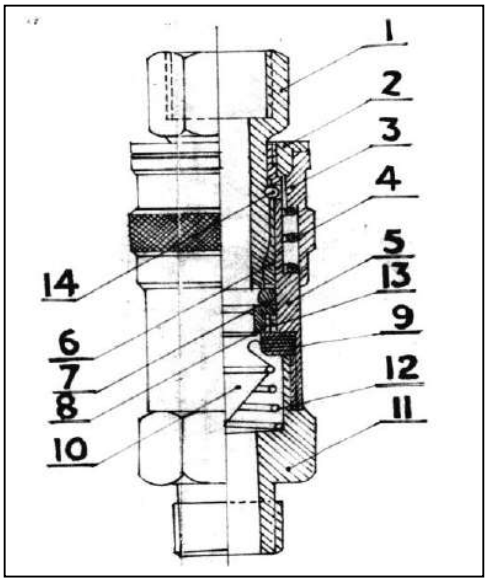
- Place seat ring in its position in the bore of the body on one side.
- Apply grease lightly on the ball.
- Fit 'O' rings on the spindle.
- Insert the ball in the bore of the body in such a way that the ball sits on the seat ring and the groove seat for spindle is in top position.
- Insert the spindle with 'O' rings such that the spindle enters in to the groove.
- Screw the gland in to the body.
- Insert the second seat ring through the bore of the housing.
- Fit 'O' ring on the threaded plug. With a special tool screw the threaded plug.
- Screw the threaded plug along with the 'O' ring into the housing till the ball seat touches the ball.
- The handle shall be put on the spindle and tightened with spring washer and nut.

D. TESTING OF GUARD'S EMERGENCY BRAKE VALVE

- After overhauling, fix the valve to the test bench.
- Put the handle of the valve in off position (close position).
- Charge the inlet port with a pressure of 10Kg./cm^2.
- Check for leakage on the spindle portion and on the exhaust port with soap water solution.
- No leakage is permitted.
- Operate guard's emergency brake valve, by putting the handle in open position. Air should escape through the vent of the valve.

E. QUICK COUPLING ARRANGEMENT

For fitment of gauge an arrangement for quick coupling is provided. The figure shows the arrangement. The quick coupling when assembled with and without plug shall be leak-proof when tested upto 10 kg/cm^2 air pressure.



Details of part nos are as under;

1. Plug	8. Valve
2. Locking nut	9. Valve Seat
3. Locking Ring	10. Valve
4. Spring	11. Lower Body
5. Body Top	12. Spring
6. Locking Bush	13. Spring
7. Seal	14. Ball 3.5 Φ

712. SLACK ADJUSTER

A. SALIENT FEATURES

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. The slack adjuster maintains this `A' dimension throughout its operation. The slack adjuster, type IRSA-600 & IRSA - 750 used on wagons is composed of the following parts

- Adjuster spindle with screw thread of quick pitch (non self locking)
- Traction unit containing adjuster nut, adjuster tube and adjuster ear etc.
- Leader nut unit containing leader nut and barrel etc.
- Control rod with head.

The out standing features of slack adjuster IRSA-600 & IRSA - 750 are:

(I) Fully Automatic

Once initially set, no manual adjustment is further necessary at any time during its operation.

(II) Double-Acting

The brake shoe clearance is adjusted to its correct value both ways, either when it has become too large (owing to wear of the brake shoes and wheels) or when it has become too small (e.g. owing to renewal of `worn out brake blocks').

(III) Rapid Working

Correct brake shoe clearance is automatically restored after one or two applications of the brake.

Verification

If resistance occurs early in the brake application, caused by heavy brake rigging, e.g. an ice coating on the brake shoes, etc., in such cases the IRSA does not pay out slack immediately, but indexes the amount of slack to be paid out. If the slack really is too small, the IRSA will pay out this indexed slack at the next brake application. Thus false pay-out will not occur.

True Slack Adjuster

The slack adjuster adjusts incorrect slack only, thus giving the brake its best possible pre-adjusted limit of piston strokes, ensuring a smooth and efficient braking force at all times.

Shock Resistant

Train shocks will not cause false take-up or pay-out of slack. When brakes are released, the moving parts of the slack adjuster are securely locked.

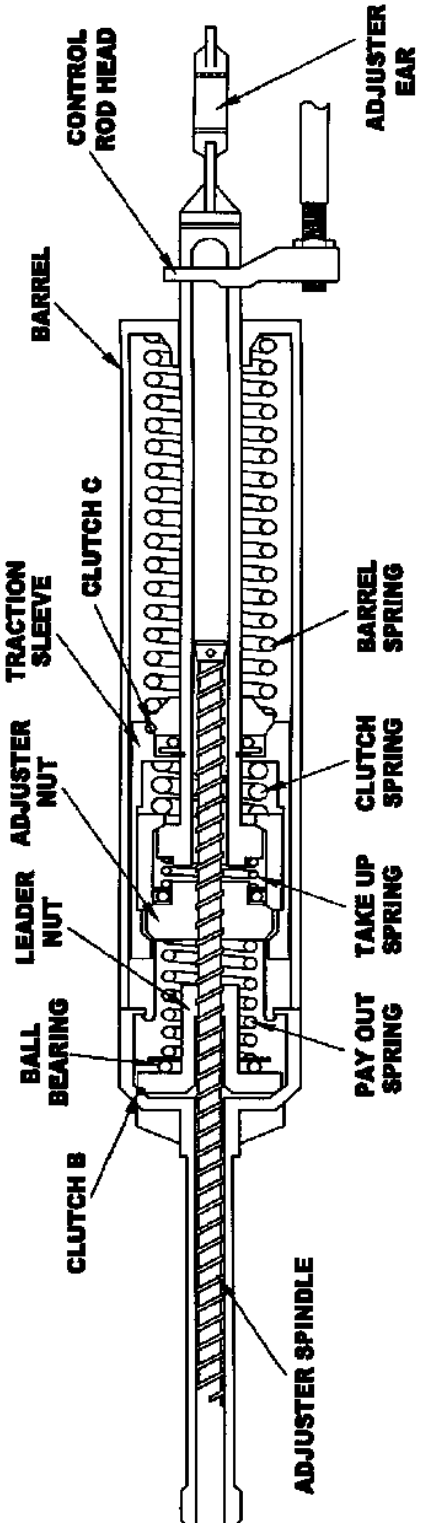


Fig. 7.11 SLACK ADJUSTER

B. WORKING PRINCIPLE OF SLACK ADJUSTER

In slack adjuster the ’A’ dimension is the controlling feature. `A` dimension is the distance measured between the control rod head and the barrel when the brakes are fully released. In other words ‘A’ dimension corresponds to the correct slack when brakes are fully released. For wagons it defers wagon to wagon and ‘e’ dimension which is the limit of length that adjuster will adjust is 555 – 575 mm other then higher axle load wagons (‘A’ and ‘e’ dimension should be maintained under all working conditions). For effective operation, slack adjuster has to operate under three different conditions, i.e. with:-

- Correct slack
- Too large slack
- Too small slack.

a) CORRECT SLACK

If slack is correct then under normal released position, control rod head is at a distance ‘A ‘ from barrel end which corresponds to the correct slack (Refer fig. 1).

For light brake application: During the first part of brake application, adjuster ear traverses distance `A’. With correct slack, the brake shoes start applying against the wheel at the same time when control rod head touches the end of the barrel. (Refer fig. 2). Because of the braking action the left sleeve in traction sleeve is drawn against adjuster nut, against the force of barrel spring. This action compresses the clutch spring and clutch C is disengaged.

For full brake application the brake is more heavily applied. During this action all parts of the brake rigging will be submitted to proportionate stress and will develop elasticity. As a result the ear end will travel an additional distance `e’ corresponding to elasticity/full brake force (Refer Fig. 3). However the barrel is held back against the control rod head. Thus traction unit is drawn longitudinally through the barrel thereby compressing the barrel spring. Also it tries to take leader nut unit along in the movement. This action releases clutch B. The movement of adjuster spindle through leader nut causes leader nut to rotate on the spindle.

For releasing the brakes (Refer Fig. 4)- When pressure in the brake cylinder decreases, the brake cylinder piston and the brake rigging moves back. The traction unit then moves to the left through barrel. As still the clutch spring is compressed the clutch C will remain in open position. The leader nut now gets locked by clutch B and will again begin to rotate on the thread. This time the rotation is in opposite direction, as spindle moves to left. However clutch B is not able to stop this rotation because entire barrel and barrel spring is free to rotate as long as clutch C is held open. Thus barrel and barrel spring rotate with leader nut and during this rotation, barrel spring extends and keeps the end of barrel in contact with control rod head.

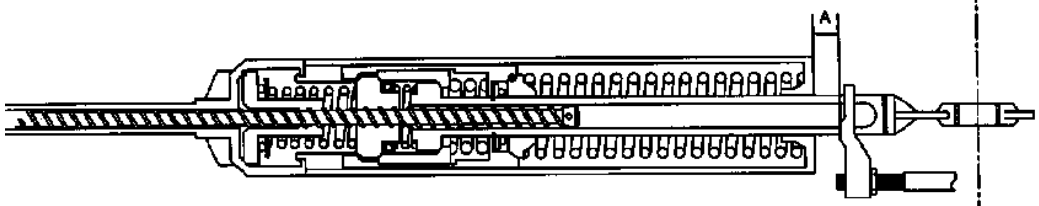


Fig.1

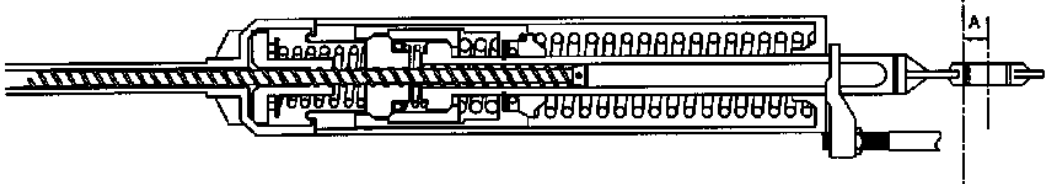


Fig. 2

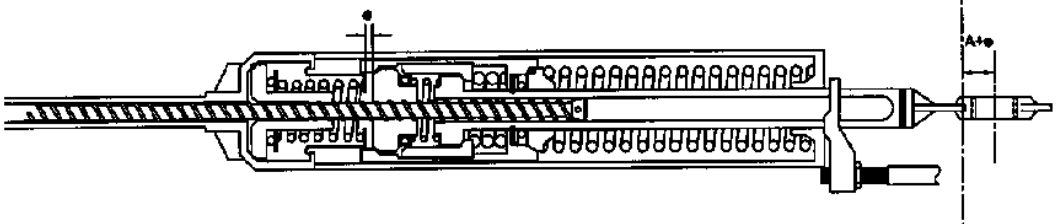


Fig. 3

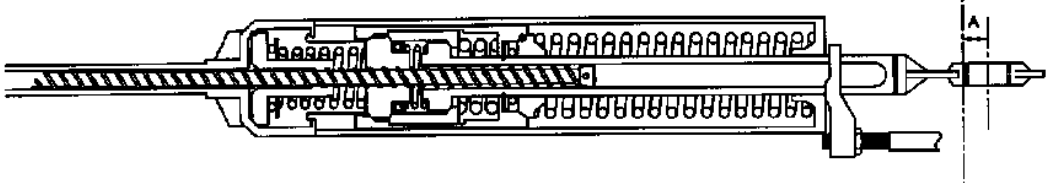


Fig. 4

As long as clutch C is open adjuster nut is kept firmly locked in place on adjuster spindle. Any cycles of brake will cause a correspondingly idle rotation of leader nut unit back and forth on spindle thread. The idling of leader nut prevents all movements from influencing the adjustment. Thus adjustment is governed only by the amount of slack present in the brake rigging.

For full brake release, the effective pressure in brake cylinder gets totally released. Also as braking stress disappears, clutch spring locks clutch C. As a result further rotation of barrel and leader nut gets stopped. If the slack is correct, the locking of clutch C takes place at the same moment as distance `e' is consumed. Adjuster nut is

then momentarily arrested and adjuster ear, adjuster tube and traction sleeve continues to move to left so that sleeve pushes against adjuster nut and locks it. Thereupon whole assembly moves to left until brake is fully released and distance A is restored. (Refer Fig. 1)

Even in emergency application no adjustment takes place. The only difference is that the idle movement of leader nut back and forth will be somewhat longer. This is due to greater deflection of brake rigging under heavier stresses and longer piston travel.

b) TOO LARGE SLACK

In released position there is no difference from release position with correct slack (Refer Fig. 5).

Now during first stage of brake application as the brake cylinder piston is pushed out the force is transmitted through the horizontal lever to pull the adjuster ear to the right until a distance 'A' is traversed. At this point the end of the barrel touches control rod head. When this happens, barrel is arrested and also momentarily adjuster spindle with adjuster nut and leader nut is arrested. The left-hand seat in traction sleeve is then immediately drawn against adjuster nut thereby locking it in place on adjuster spindle (Refer fig. 6).

For full brake application as slack is too large, brake shoes not yet contacted the wheel. Thus adjuster ear is drawn further to right to a distance `l' (Refer Fig. 7) pulling adjuster tube, traction sleeve, adjuster nut and adjuster spindle under compression of barrel spring against control rod head. Leader nut is being retained by spring and ball bearing in leader nut unit now starts rotating as adjuster spindle is drawn through it. When brake shoes starts contacting the wheels braking stress starts developing as a result clutch spring is compressed and clutch C is disengaged.

For releasing the brake (Refer Fig. 8) take up action. When brake release starts there is an idle rotation of leader nut unit together with barrel and barrel spring in opposite direction as brake rigging moves back and braking stress decreases. As braking stress disappears and clutch C locks stopping further rotation of barrel and leader nut. The movement of adjuster spindle to the left stops. Adjuster ear, adjuster tube and traction sleeve continue to the left, adjuster nut is also being pushed along to the left by take up spring acting on ball bearing. This movement of adjuster nut to left over the spindle (under rotation on the spindle threads) continues until adjuster nut abuts the sleeve of spring in leader nut unit, which is held stationary by barrel. This permits the right hand seat of traction sleeve to engage adjuster nut and lock it in place on adjuster spindle. After this whole assembly moves as a unit to left. Barrel then moves away from control rod head until brake is fully released and distance A restored.

Thus adjustment `l' that has taken place by adjuster nut is displaced on adjuster spindle, corresponds exactly to excess of slack that was present in brake rigging.

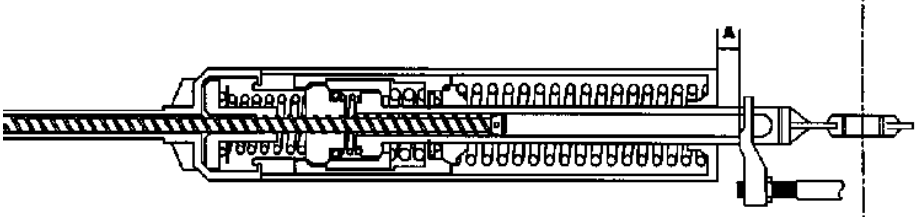


Fig. 5

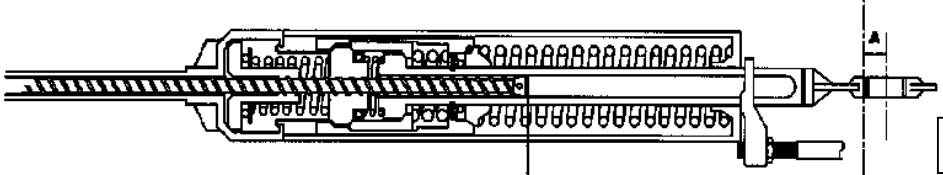


Fig. 6

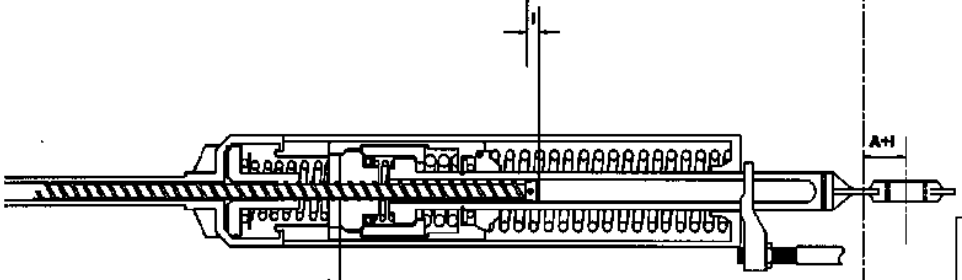


Fig. 7

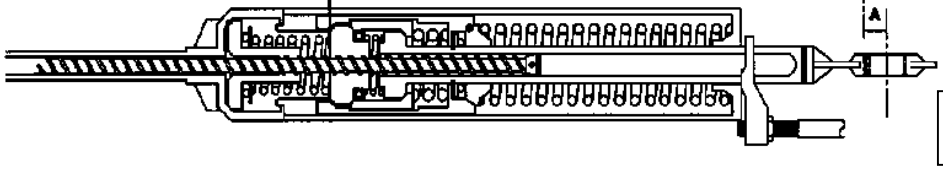


Fig. 8

c) TOO SMALL SLACK

For released position_there is no difference from released position with correct slack.

During **first stage of brake application** (all parts move together to right until) shoes touches the wheels. When this happens, end of barrel has not yet touched the control rod head. There is a distance 'm' between end of barrel and control rod head corresponding to deficiency in slack. The left hand side of traction sleeve is drawn against adjuster nut locking it in place on adjuster spindle. (Refer fig. 9).

During full brake application, braking stress builds up and clutch spring is compressed there by clutch C is disengaged. The force of barrel spring now moves barrel, leader nut, barrel spring to the right to contact the control rod head. Due to this displacement the spring in leader nut unit is compressed and the distance `m' at the end of barrel is transferred to interior of leader nut unit (Refer Fig. 10).

For releasing the brake after usual idle movement of leader nut back and forth, braking stress disappear and clutch spring lock the clutch C. The rotation of barrel and leader nut stops and adjuster spindle is held back momentarily, and right hand seat in traction sleeve engages adjuster nut. There upon the whole assembly moves to the left to a distance corresponding to still deficient slack, thus the end of barrel moves away only the distance A-m. The distance `m' is still indexed in leader nut unit (Refer Fig. 11).

During next brake application (Refer Fig. 12) at first stage all parts move together to the right, until further movement of adjuster spindle is stopped by brake shoes contacting the wheel. The end of barrel then very nearly touches control rod head. Barrel is held back on adjuster spindle by the still locked clutch C.

Now **during second stage** of brake application i.e. payout (Refer fig. 13) adjuster ear, adjuster tube and traction sleeve continue their movement to the right. Now the compressed pay out spring expands and pushes adjuster nut on adjuster spindle under rotation on ball bearing so as to follow receding movement of traction sleeve. When distance 'm' is traversed, sleeve of spring in leader nut unit, stop in barrel, and pushing on adjuster nut is ceased. The left hand seat in traction sleeve engages and locks the nut and the brake action is continued. Thus the effective length of slack adjuster is increased exactly by distance `m' corresponding to the deficiency of slack.

C. OVERHAULING OF SLACK ADJUSTER

a) TOOLS & EQUIPMENT

The following tools and fixture are required for overhauling of slack adjuster;

(i) Jacking tool – for mass repair / overhauling of Slack Adjuster pneumatically operated fixture is used.

(ii) Special Spanner

(iii) Straight Nose plier (external) (spring type)18 mm to 25 mm-external

(iv) Bend nose plier (internal) 25-30mm –internal

(v) Screw driver

(vi) Pipe vice & simple 6" vice

(vii) Open end spanner 11-13 mm.

(viii) Hand punches

(ix) Kerosene oil bath

(x) Air jet gun

(xi) Slack Adjuster test bench

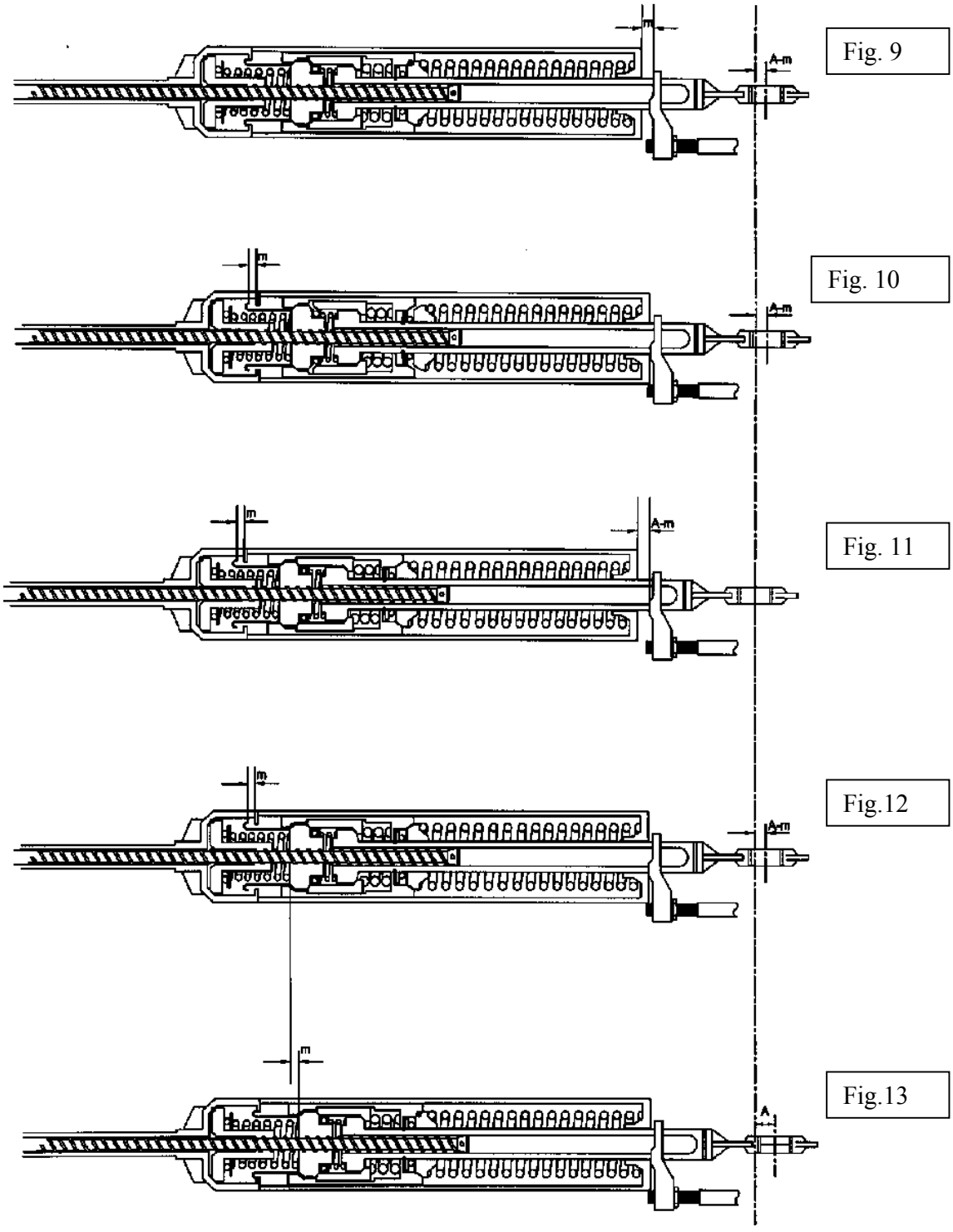


Fig. 9

Fig. 10

Fig. 11

Fig.12

Fig.13

b) PROCEDURE FOR MAINTENANCE

The slack adjuster shall be overhauled at the time of POH of rolling stock.While dismantling or assembling it is essential to use special tools. Each component of slack adjuster shall be examined. Worn out part shall be checked according to the limits. ***For details, refer RDSO Technical pamphlet no. G-92 (September-98).***

I. The minimum desired characteristic of each spring should be taken as under [Ref: RDSO Technical pamphlet No. G-92 (***September*** - 98)]:

Sr. No.	**Desc. Of spring**	**Part No.**	**Spring length compressed**	**Corrosp. Min. permissible force**
1.	Barrel spring	21	475 mm	143 Kg.
2.	Pay out spring	11	100 mm	58 Kg.
3.	Take out spring	37	21.5 mm	22 Kg.
4.	Clutch spring	39	38 mm	300 Kg.

Any spring, which does not conform to the above characteristic, should not be used. In addition any of the springs is badly rusted or having compressed coil turns should not be used.

II. The following parts must be replaced during POH of the slack adjuster [Ref: RDSO Technical pamphlet No. G-92 (***September*** - 98)];

- Spring dowel sleeve part No. (18)
- Lock washer part No. (27)
- Seal ring part No. (2)
- Seal ring part No. (43)
- Rubber gasket part No. (4)
- Spring dowel sleeve part No. (25)
- Dog pin part No. (6)
- Tab washer part No. (34)

D. LUBRICATION

After cleaning and inspection all parts of slack adjuster should be coated with semi-fluid grease SERVOGEM-RR3 or BALMEROL multi grease LL3 before undertaking re-assembly.

E. SAFETY PRECAUTIONS

The following safety precautions should be observed during overhauling of slack adjuster.

i. The place of overhauling must be clean and free from dust.

ii. Ensure that no foreign matter/particle remain inside the sub-assemblies during re-assembly.

iii. All rubber gasket, seal ring, washers must be replaced during overhaul.

iv. Specified tools and fixtures to be used for disassembly and assembly operations.

F. TESTING OF SLACK ADJUSTER

After overhauling, the testing of slack adjuster is carried out in a test rack (Fig. 7.11) for :- i) Take up test & ii) Pay out test

a) Attach the adjuster ear to the free end of the cylinder lever of the test rack

b) Screw the test rack spindle into the Slack Adjuster until the entire length of thread is covered by spindle sleeve and attach the free end of the spindle to the test rack.

I. Take up or Pay-in test

- Let down the control rod, so that the fork of the rod clasps the adjuster tube of the Slack Adjuster
- Apply and release the brake a few times letting the slack adjuster take up until the correct piston stroke is obtained (until the indicator is within $\pm$ 5 mm tolerance field of the scale).

Note: The Slack Adjuster takes up 100 mm per braking.

Dimension A1 will be 98 {+1} mm.

{- 4} 2

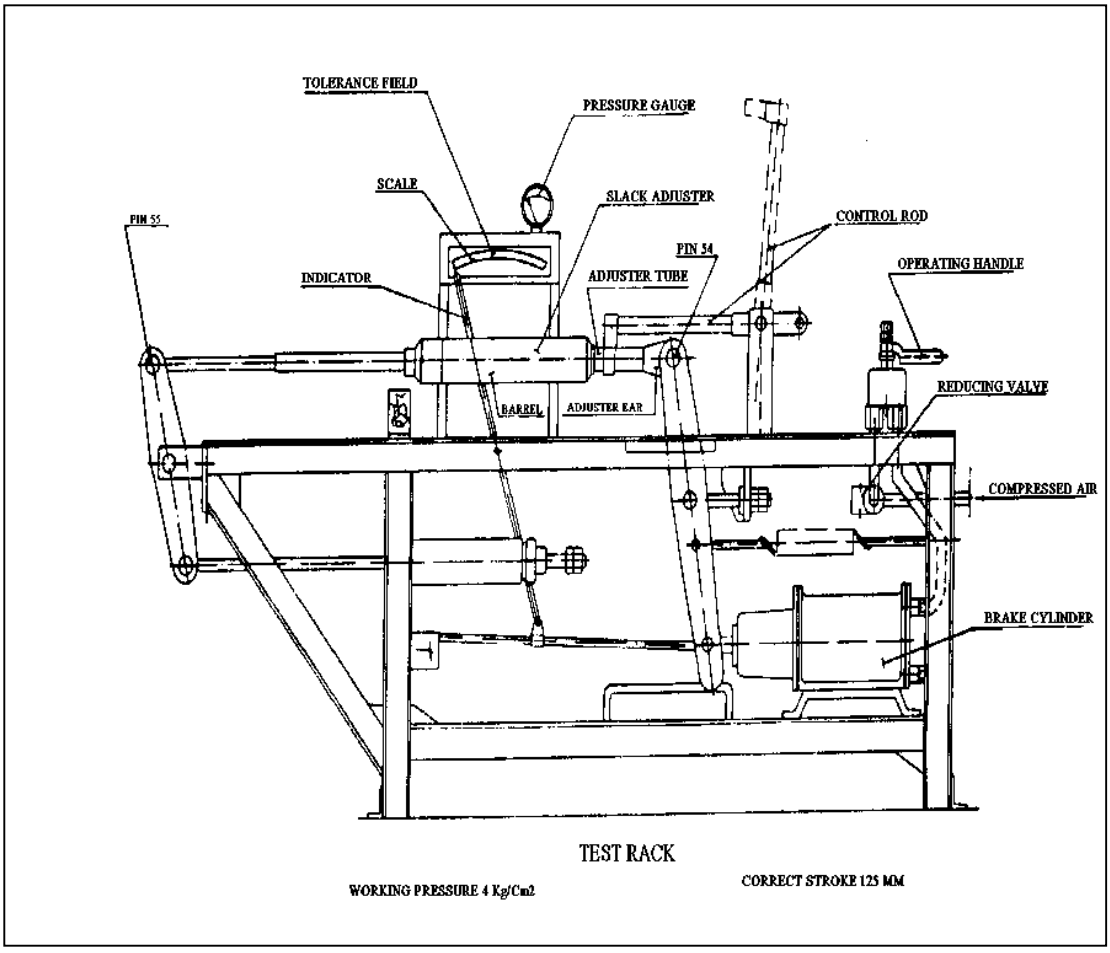


Fig. 7.12

II. Pay-out test

- Turn up control rod and make two brake applications letting the slack adjuster pay out.

Note : The slack adjuster pays out max. 30 mm per braking

- Repeat the above pay in and pay-out tests a couple of times.
- In case the slack adjuster does not accomplish the above mentioned tests satisfactorily, dismantle it and check that the parts are placed correctly.
- The slack adjuster must then be tested once more in the test rack in accordance with the above instruction.
- After the test is finished, remove the spindle from the slack adjuster.
- Remove the slack adjuster from the test rack and unscrew adjuster ear 28.

Give adjuster spindle 23 a final thorough inspection making sure that the threads are liberally greased, and screw it into the Slack Adjuster until its end protrudes from Adjuster tube 41. Put the safety collar 24 and secure it with the spring dowel sleeve. Make sure that the spring dowel sleeve pin fits tightly and that its ends do not protrude above the surface of the collar. Should there be any burrs on the collar, smooth off with a fine file and wipe clean. Then screw the adjuster spindle 23 back into the Slack Adjuster enough to make room for the adjuster ear 28.

Slide control rod head 26 with control rod 44 on to adjuster tube 41. Place lock washer 27 on threaded portion of adjuster ear 28 and screw ear into threaded end of adjuster tube 41.

Note : Hold adjuster tube firmly with a pipe wrench. Secure lock washer.27. Install the Slack Adjuster in the brake rigging.

III. Testing of slack adjuster in brake rigging with hand brake

In case a test rack is not available in the work shop, a test of function of the slack adjuster ought to be carried out after the slack adjuster is installed in the brake rigging and the correct piston stroke is obtained as follows:-

- Place an iron object e.g. a hammer between the brake block and the wheel tread. Make two brake applications after the second application the correct piston stroke should be obtained.
- Remove the iron object. Make two brake applications. After the first application the piston stroke is too long, but after the second application the correct piston stroke is recorded by the slack adjuster.

G. PAINTING

The slack adjuster is given a coat of anticorrosive paint, excluding the adjuster tube 41.

Note : The unthreaded portion of the adjuster spindle 23 should not have a thick coating.

H. PROCEDURE FOR BRAKE RIGGING SETTING AND MEASUREMENT OF "A" AND "e" DIMENSIONS

The procedure to be adopted for operating brake rigging setting and measuring 'A' and 'e' dimension is listed below:-

(I) For 'A' dimension

(i) Ensure the air brake is in fully released condition and all the brake rigging gears are in proper condition.

(ii) Apply brake three to four times to ease the rigging, by dropping and re-charging the air pressure in the brake pipe

(iii) Ensure once again that brake rigging is in fully released condition.

If 'A' dimension is not correct

(iv) Remove pin securing the control rod in U bracket.

(v) Detach control rod and rotate it to adjust the gap between barrel end face & control rod head as specified in note above. Secure the control rod in U bracket.

(vi) Apply brakes two to three times.

(vii) Check the 'A' dimension using the gauge.

(viii) Recheck dimension 'A' with brakes fully released after every brake release.

(ix) Lock the control rod head firmly with check nut and tooth lock washer.

(x) Secure pin with split pin.

(II) For 'e' dimension

(i) If slack is in excess beyond the capacity of slack adjuster (`e' dimension 555 – 575 mm other then higher axle load wagon) there won't be any slack take up provision in the slack adjuster and slack adjuster will only act as strut/pull rod. This is because of brake shoes and wheel wear reaching their condemning limit/near condemning limit. In such cases the `e' dimension can be restored by adjusting link provided on the bogie frame head stock.

(ii) Measure 'e' dimension i.e. distance between protection tube end and mark on adjuster spindle using measuring stick after two or three brake application. It should be set to nearly to its maximum limit i.e. 555 – 575 mm other then higher axle load wagon.

I. SAFETY PRECAUTIONS

i. Always use wedge between wheel and rail before application and release operations for setting and measuring A and e dimension to prevent rolling of wagon

ii. Ensure no part of the worker's body is in touch with moving brake rigging gears during application and releasing of brakes.

iii. Do not touch or hold slack adjuster barrel while it is in motion.

iv. Before setting any dimension ensure wear of brake shoe does not exceed to its minimum permissible worn limit (i.e. thickness of the shoe should not be less then 20mm).

v. There won't be any slack take up provision in the slack adjuster and slack adjuster will only act as strut/pull rod. This is because of brake shoes and wheel wear reaching their condemning limit/near condemning limit. In such cases the `e' dimension can be restored by adjusting link provided on the bogie frame head stock.

vi. Measure 'e' dimension i.e. distance between protection tube end and mark on

adjuster spindle using measuring stick after two or three brake application. It should be set to nearly to its maximum limit i.e. 555 – 575 mm other then higher axle load wagon.

713. 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.

MANUFACTURERS OF DISTRIBUTOR VALVE

Two designs of distributor valves are in use on wagons. These are:

i) C3W Type distributor valve
ii) KE type distributor valve.

Various companies presently manufacturing distributor valves are listed below:

Type	Manufacturers
C3W Type Distributor Valve.	1. Greysham and Co. Delhi
	2. Faiveley Transport India. Hosur
	3. Stone India Ltd. Calcutta.
	4. Greysham international Pvt. Ltd. Noida, U.P.
KE Type Distributor Valve	Escorts Ltd. Faridabad
	Knorr- Bremse Faridabad

A decision has already been taken that new wagons manufactured henceforth will only be fitted either with C3W or KE type distributor valve. Hence the chapter covers description and maintenance of these two types of distributor valves only.

714. C3W DISTRIBUTOR VALVE

The C3W Distributor Valve (Fig. 7.14) consists of the following main subassemblies:

i. Main body
ii. Quick Service valve
iii. Main valve
iv. Limiting device
v. Double release valve
vi. Auxiliary reservoir check valve
vii. Cut off valve
viii. Application choke
ix. Release choke.

A. FUNCTION OF DISTRIBUTOR VALVE

For application and release of brakes the brake pipe pressure has to be reduced and increased respectively with the help of driver's brake valve. During these operations the distributor valve mainly performs the following function.

(i) Charges the air brake system to regime pressure during normal running condition.

(ii) Helps in graduated brake application, when pressure in brake pipe is reduced in steps.

(iii) Helps in graduated brake release, when pressure in brake pipe is increased in steps.

(iv) Quickly propagates reduction of pressure in brake pipe throughout the length of the train by arranging additional air pressure reduction locally inside the distributor valve.

(v) Limits maximum brake cylinder pressure for full service application/ emergency application.

(vi) Controls the time for brake application and brake release depending on service conditions

(vii) Facilitates complete discharge of air from the air brake system manually with the help of operating lever.

(viii) Protects overcharging of control reservoir when the brake pipe pressure is quickly increased for releasing the brakes.

B. WORKING OF C3W DISTRIBUTOR VALVE

The distributor valve distributes the compressed air received from brake pipe to charge control reservoir through cut off valve and auxiliary reservoir through auxiliary reservoir check valve. After charging control reservoir and auxiliary reservoir, when brake pipe pressure is reduced by driver's brake valve, pressure differential acts across the large diaphragm of hollow stem assembly. As a result, the hollow stem gets lifted, opening the check valve of main valve. This action allows auxiliary reservoir pressure to enter into brake cylinder via limiting device for brake application. Main valve together with the limiting device limits brake cylinder pressure to rise to a maximum pressure of 3.8 ± 0.1 Kg/cm^2. As the brake cylinder pressure increases it starts acting on top of upper diaphragm of main valve. This results in downward movement of the main valve along with check valve till it reaches lap position. At this stage the check valve of main valve gets closed, stopping further rise of brake cylinder pressure.

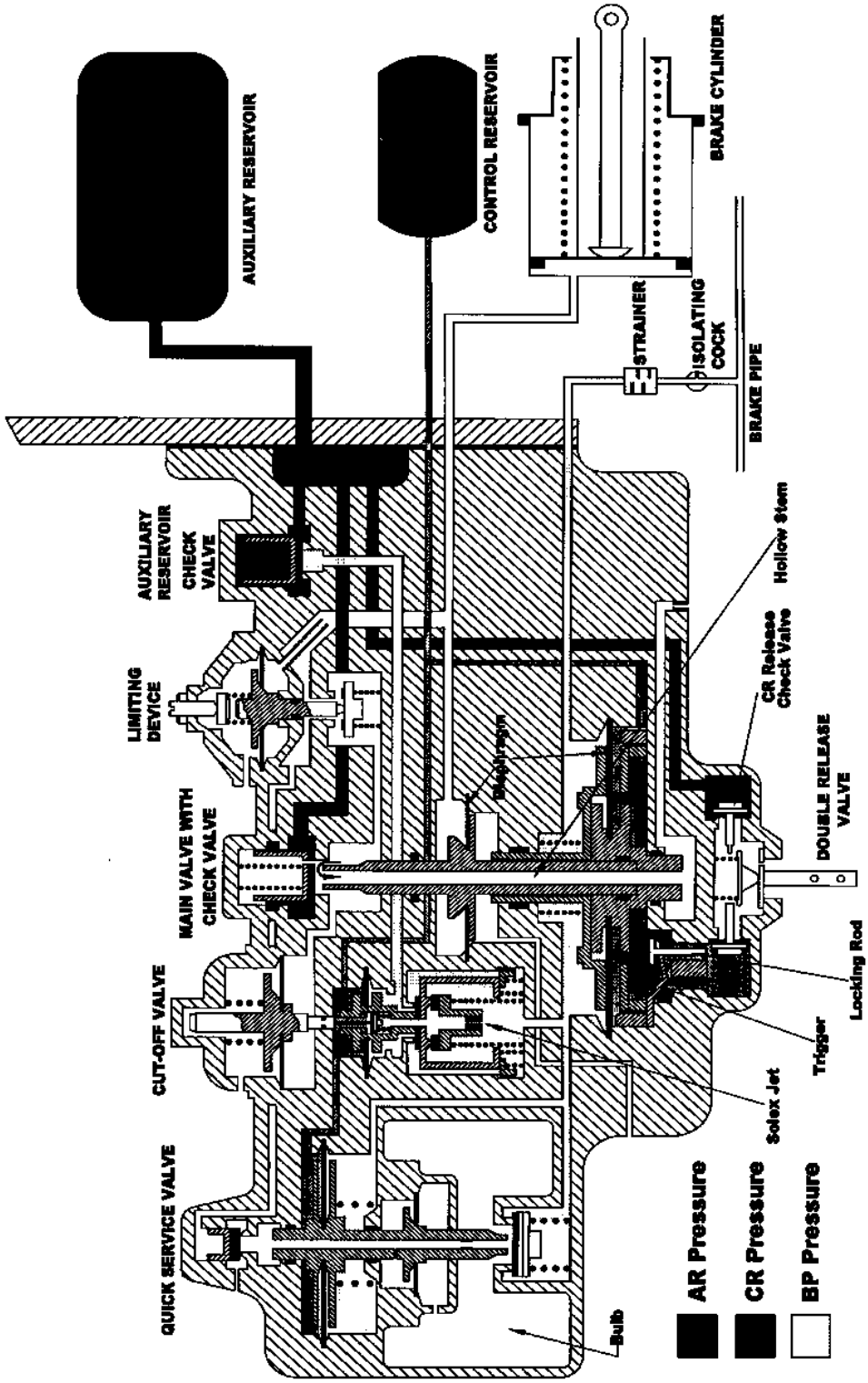


Fig. 7.13 C3W DISTRIBUTOR VALVE

In this position, no further pressure can enter or exit from the brake cylinder. Every time brake pipe pressure is reduced gradually in steps, this phenomenon gets repeated thereby increasing the brake cylinder pressure finally to 3.8 $\pm$ 0.1 Kg/cm^2.

For releasing the brakes, brake pipe pressure is increased by drivers brake valve and the hollow stem assembly of main valve is brought to normal position by neutralizing the pressure differential across main valve large diaphragm. At this stage hollow stem gives way at its top to exhaust the brake cylinder pressure to atmosphere.

However, if brake pipe pressure cannot be increased then for releasing the brakes the pressure of control reservoir acting on large diaphragm of main valve has to be reduced. This can be achieved by tilting the release lever of double release valve. Tilting action opens the control reservoir release check valve thereby allowing control reservoir pressure to vent out & simultaneously hollow stem is pulled down which gives passage to brake cylinder pressure to exhaust to atmosphere resulting in brake release.

C. DESCRIPTION OF VARIOUS COMPONENTS AND SUB-ASSEMBLIES

(a) MAIN VALVE

The main valve is housed in the main body. The various parts alongwith part numbers (as per manufacturer's catalogue) are shown in Fig. 7.14.

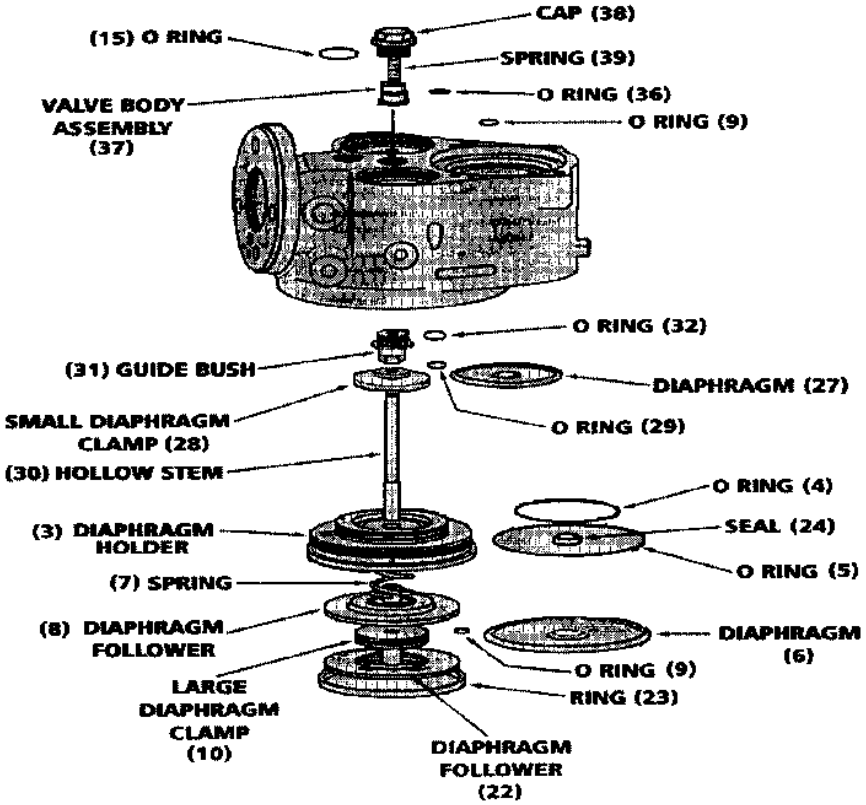


Fig. 7.14 MAIN VALVE

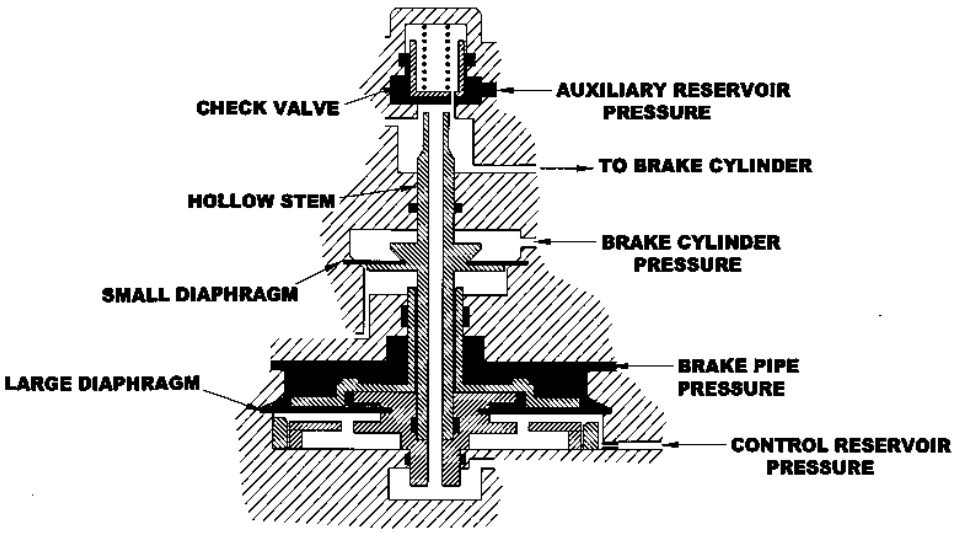


Fig. 7.15 SECTIONAL VIEW OF MAIN VALVE

The main valve consists of two diaphragms i.e. large and small. The top face of the large diaphragm, which is situated at the lower position of the stem assembly, is subjected to brake pipe pressure where as the bottom face is subjected to control reservoir pressure. The small diaphragm is situated at the upper position of the stem. The top face of small diaphragm is subjected to brake cylinder pressure and bottom face to atmosphere. At the top of hollow stem the check valve is situated which controls connection of auxiliary reservoir and brake cylinder. The main valve is also some times referred to as three pressure valve. Fig. 7.14 shows various parts of the main valve. The function of main valve is to supply requisite amount of pressure into the brake cylinder when BP pressure is reduced. Also it provides passage for brake cylinder pressure to exhaust to atmosphere, when brake pipe pressure is raised.

(b) CUT OFF VALVE

The cut off valve is housed in the main body and it consists of the following items:

- Solex jet
- Valve retainer.
- Diaphragm.
- Diaphragm follower.
- Internal circlips.
- Springs.
- Pusher pin.
- Jet valve assembly
- Valve assembly
- Diaphragm clamp
- 'O' rings.
- Body
- Guides etc.

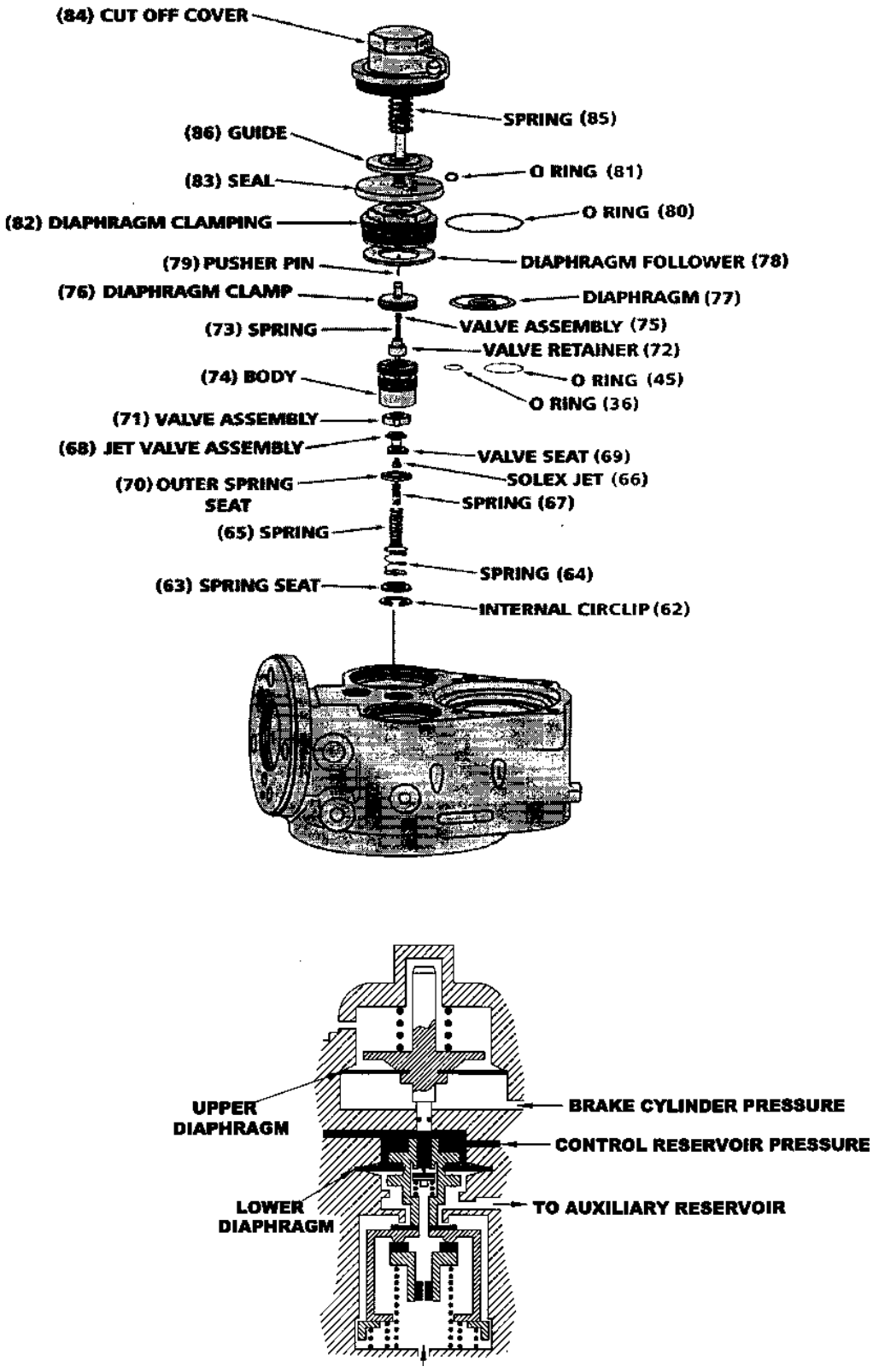


Fig. 7.16 CUT OFF VALVE

The cut off valve has two diaphragms, upper and lower. The top face of lower diaphragm is subjected to control reservoir pressure and the bottom face to the brake pipe pressure. The bottom face of upper diaphragm is subjected to brake cylinder pressure, and the top face is subjected to atmosphere and compressed spring pressure.

The cut off valve connects the brake pipe to control reservoir during charging and cuts off the connection with control reservoir when brake pipe pressure is dropped for application of brakes. This valve also provides a way to BP pressure from its chamber to auxiliary reservoir check valve.

(c) AUXILIARY RESERVOIR CHECK VALVE

The auxiliary reservoir check valve is housed in the main body. It consists of the following items.

- Cap
- Valve assembly
- Spring
- 'O' ring

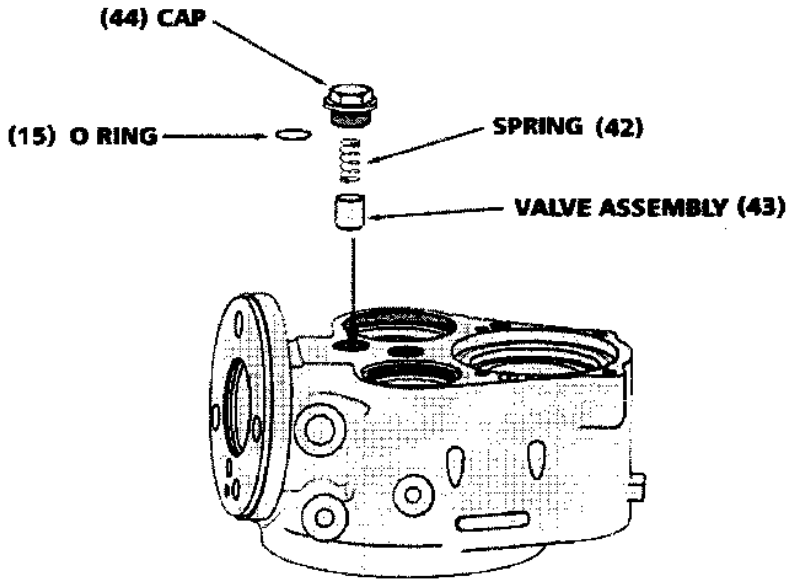


Fig. 7.17 CHECK VALVE

Auxiliary Reservoir Check Valve helps in charging the auxiliary reservoir. In addition to charging it also checks back flow of auxiliary reservoir pressure when brake pipe pressure is dropped for application of brakes.

(d) QUICK SERVICE VALVE

The quick service valve is housed in the main body and consists of the following items :

- Diaphragm
- Diaphragm clamp

- Retainer
- Seal Washer
- 'O' rings
- Springs
- Seal
- Cup
- Valve assembly
- Internal circlip
- Socket etc.

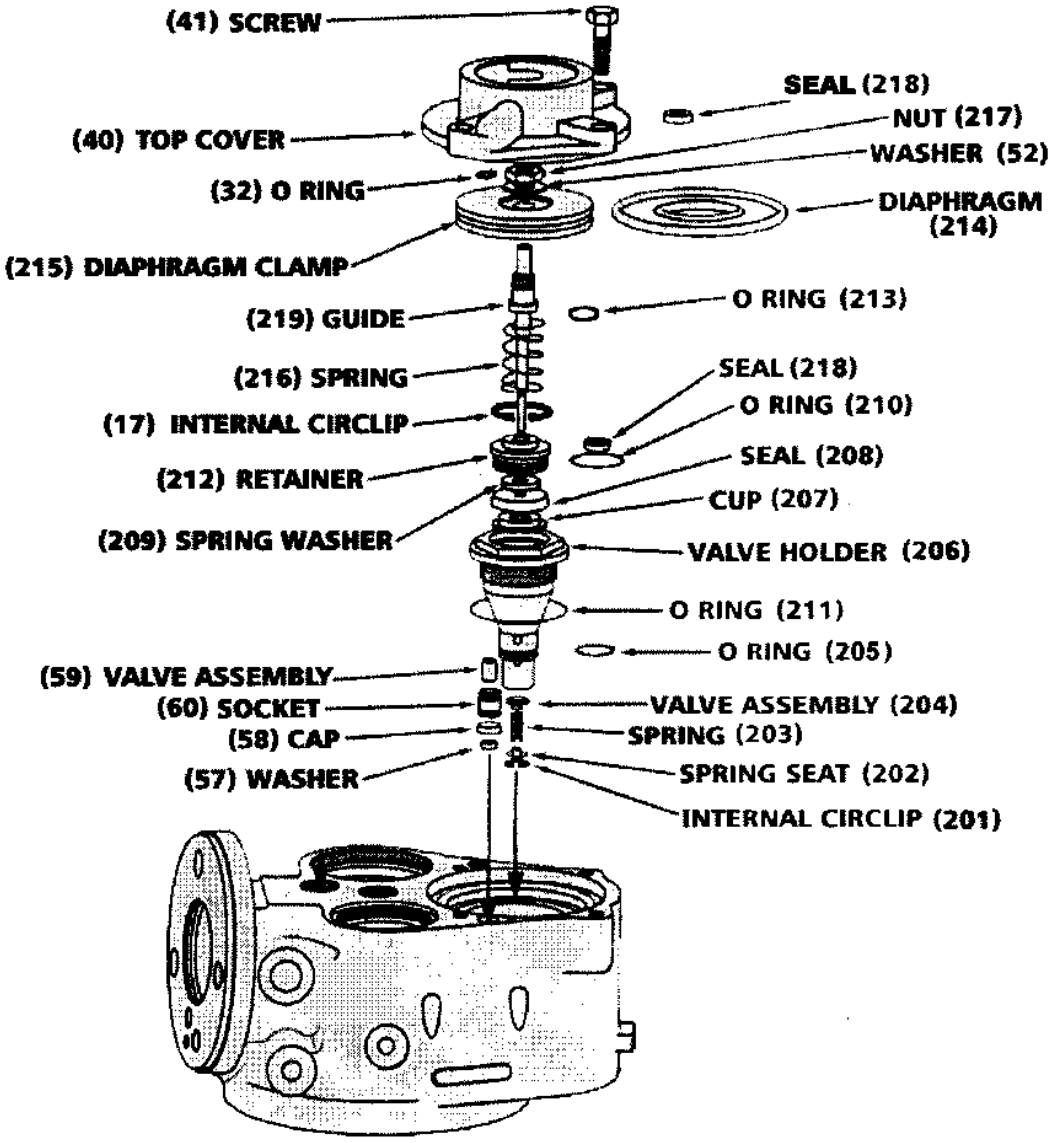


Fig. 7.18 QUICK SERVICE VALVE

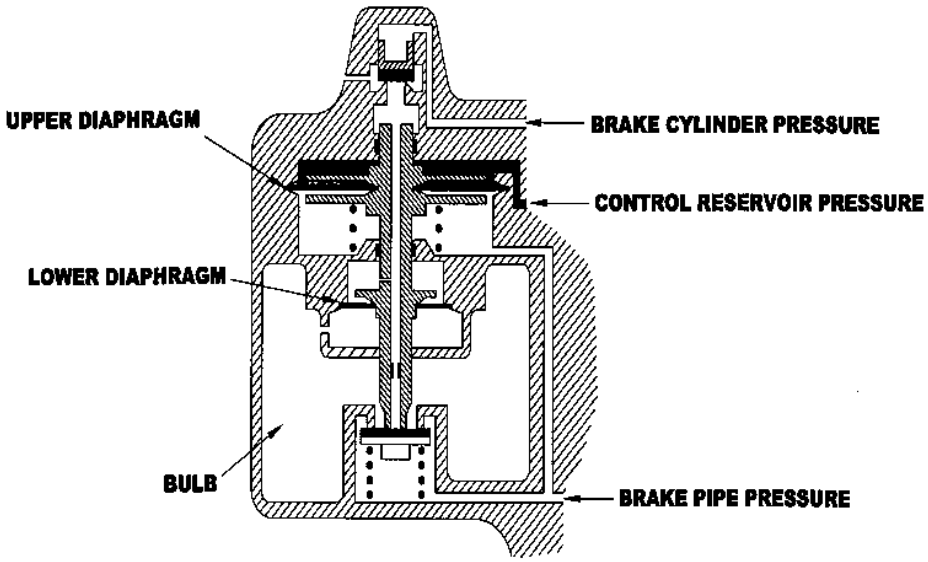


Fig. 7.19 SECTIONAL VIEW OF QUICK SERVICE VALVE

The quick service valve has two diaphragms i.e. upper and lower. The top face of upper diaphragm is subjected to control reservoir pressure and bottom face to brake pipe pressure. Where as at lower diaphragm, the bottom face is subjected to brake pipe pressure when brakes are applied.

The function of quick service valve is to create an initial pressure drop in brake pipe pressure by allowing a sudden entry of brake pipe pressure into the large volume bulb at the start of brake application. This ensures rapid propagation of pressure reduction in brake pipe through out the length of train.

(e) LIMITING DEVICE

The limiting device is housed in the main body and consists of the following items.

- Diaphragm.
- Diaphragm clamp.
- Diaphragm follower.
- Cap.
- Valve retainer.
- Inshot valve assembly.
- Adjusting nut.
- Check Nut.
- Bush with cover.
- ‘O’ rings.

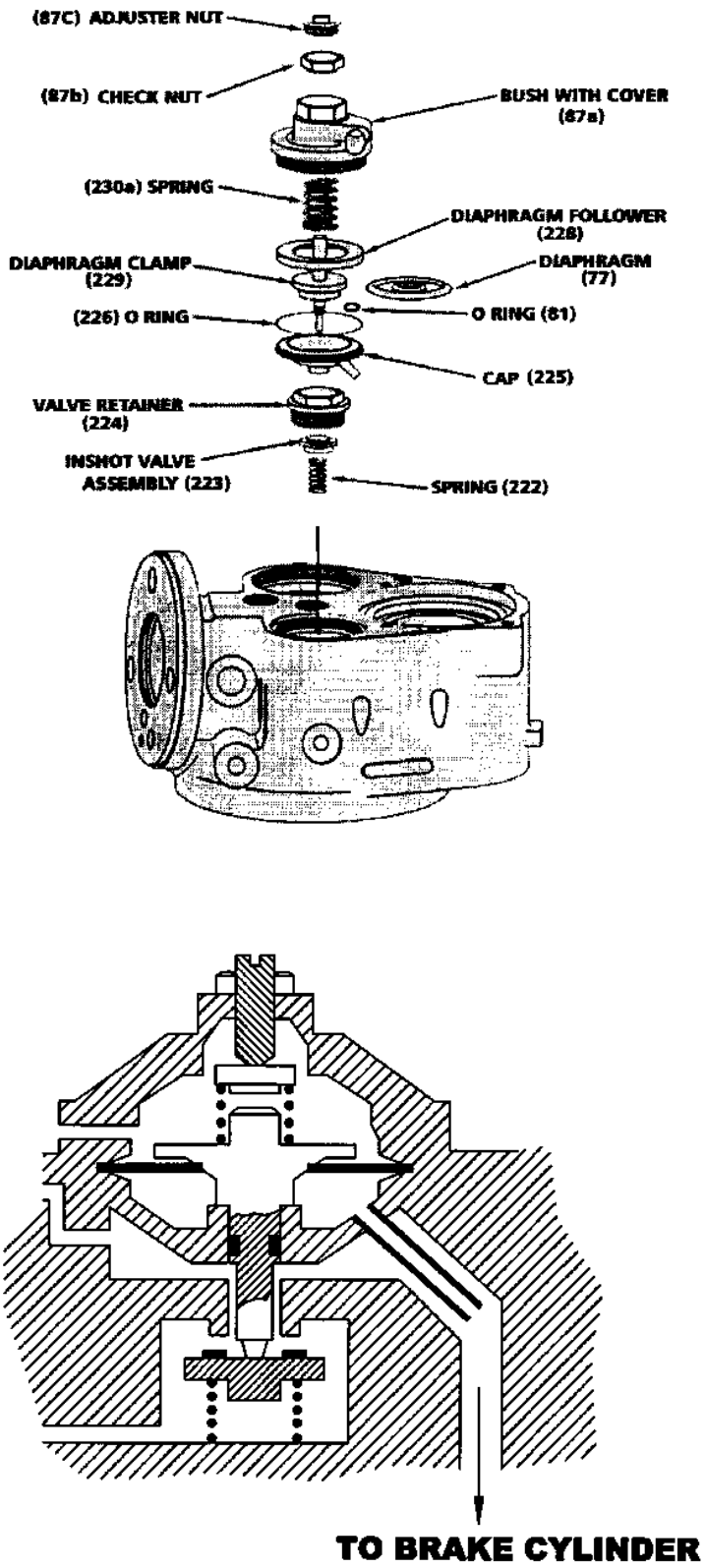


Fig. 7.20 LIMITING DEVICE

The limiting device has one diaphragm. The bottom face of the diaphragm is subjected to brake cylinder pressure during applied brake condition and top face is under pressure of compressed spring and atmosphere.

The function of limiting device is to restrict the maximum brake cylinder pressure to 3.8 $\pm$ 0.1 Kg/cm^2 irrespective of the drop in brake pipe pressure or auxiliary reservoir pressure.

(f) DOUBLE RELEASE VALVE

The double release valve is housed in the bottom cover and it consists of the following items.

- Tilt
- Pin
- Spring
- Swivel Rod
- Spring valve seat
- Washer
- Circlip
- Cap
- Split pin
- Choke
- Control reservoir release check valve
- Auxiliary reservoir release check valve

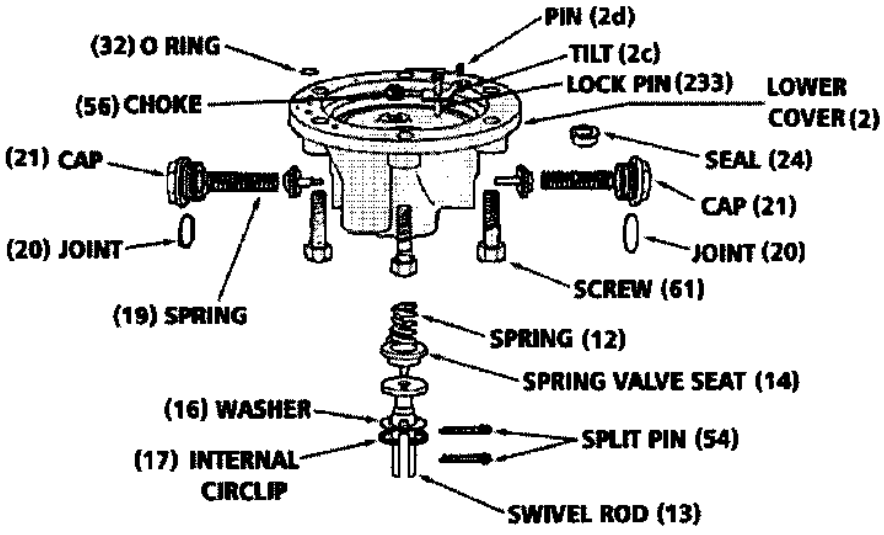


Fig. 7.21 DOUBLE RELEASE VALVE

The function of double release valve is to release the brakes manually when a single brief pull is given to the lever. However with a continuous pull to the release lever it also vents auxiliary reservoir pressure.

D. DIFFERENT STAGES IN OPERATION OF C3W DISTRIBUTOR VALVE

For effective functioning of the air brake system, the distributor valve has to operate effectively during :

a) Charging stage
b) Application stage and
c) Release stage

(a) CHARGING STAGE

During charging stage the compressed air flows from the brake pipe and enters into the brake pipe chamber of the main valve, cut off valve and quick service valve. Due to this pressure the various valves get activated and perform as under.

Main Valve: Due to brake pipe pressure acting on top face of the large diaphragm, differential pressure acts on the main valve. As a result the hollow stem moves downwards there by connecting brake cylinder to atmosphere. In addition, because of BP pressure at the top, large diaphragm presses the ring and trigger. This action unlocks the CR release valve by raising the locking rod upwards.

Cut Off Valve: As brake pipe pressure enters into the cut off valve, it flows through the solexjet and valve (which is held open due to action of BP pressure on bottom side of the lower diaphragm) to the control reservoir. As the CR & BP pressure equalises, diaphragm assembly comes down and valve reaches the lap position. The control reservoir pressure now also reaches the upper portion of top diaphragm of quick service valve and the bottom portion of large diaphragm of main valve.

Simultaneously, the auxiliary reservoir is charged with BP pressure reaching from cut off valve chamber via auxiliary reservoir check valve.

b) APPLICATION STAGE

During emergency application, the brake pipe pressure is reduced rapidly to 0 kg/cm^2 by the driver's brake valve. Because of this drop, the position of the various valves will be as described below.

(i) Main valve: With drop in BP pressure to zero, the differential pressure acts across the large diaphragm. As a result, the hollow stem is moved in upward direction and pushes the check valve thereby opening the passage for entry of auxiliary reservoir pressure at the top portion of main valve. This pressure then gets a way to brake cylinder through limiting device. The brake cylinder thus gets charged with the compressed air. This pressure is known as “BC pressure”.

(ii) Limiting Device: The auxiliary reservoir pressure which entered into the top position of main valve now enters the limiting device through the valve which is held open. From limiting device air pressure now enters the brake cylinder. When the BC pressure rises to 3.8 kg/cm^2, the upward force on the diaphragm lifts the guide and the valve at the bottom of the limiting device gets closed. Thus further entry of air into the brake cylinder stops.

When the brake cylinder pressure reaches 3.8 kg/cm^2, this pressure i.e. BC pressure acts on :

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

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

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

(iv) Quick Service Valve: In quick service valve, BC pressure acts at the top of valve and control reservoir pressure acts at the top face of upper diaphragm. As a result, the stem is pushed down and the valve at the bottom gets opened. Now as the BP pressure inside DV is at zero, the residual BP pressure from the bulb of quick service valve will flow back and vent to the atmosphere.

(v) GRADUATED APPLICATION

During graduated brake application the brake pipe pressure is dropped in steps by driver's brake valve. The movement of various valve assemblies is almost in the same direction as during emergency application, but their movement is comparatively less. In the main valve however after each application the hollow stem assumes the lap position with the check valve.

In addition to this during graduated application the bottom valve of limiting device is held open to allow compressed air to enter into brake cylinder.

When BC pressure reaches 3.8 kg/cm^2 the bottom valve in limiting device gets closed. Similarly at the time of full service application as the BC pressure reaches 3.8 $\pm$ 0.1 kg/cm^2 within specified time, the position of various valve assemblies will be the same as described above.

(c) RELEASE STAGE

When the brake pipe pressure is increased in steps for graduated release of brakes, the position of the different valves is as described below.

(i) Main valve: At the top face of large diaphragm, as the BP pressure increases, the hollow stem moves downwards leaving its lap position with the check valve. The BC pressure thus finds a passage from top of hollow stem to exhaust to the atmosphere. This action reduces pressure on the top of upper diaphragm and the hollow stem again lifts up to lap position. It closes the hollow stem top portion. The same cycle is repeated when BP is increased during next stages. In this way graduated release effect is obtained.

(ii) Cut off valve: As the BP pressure increases the position of cut off valve remains similar as in graduated application i.e. the cut off valve will remain closed, isolating CR pressure from brake pipe pressure.

(iii) Quick service valve: When the BP pressure is increased, then as explained above for the main valve, the BC pressure gets exhausted to atmosphere. This action gradually reduces the BC pressure. When BC pressure reduces to 0.8 kg/cm^2 during brake release, the force at the top of the quick service valve becomes comparatively less than BP pressure present in Quick Service Valve. As a result, the valve at the top gets lifted thereby giving passage to blocked BP pressure to atmosphere. With the exhaust of BP pressure, the Quick Service Valve of the Distributor Valve again gets ready for next brake application.

(iv) Manual release: Double release valve provides for accelerated manual brake release, which is particularly useful during shunting operation. A short pull on the lever of double release valve is all that is needed. This action opens the control reservoir release check valve, which is then held open by the locking rod. Venting of control reservoir through the open control reservoir release check valve brings the main valve to release position and exhausts the brake cylinder pressure through the hollow stem.

E. SPECIFICATION OF C3W DISTRIBUTOR VALVE

The C3W distributor valve is a graduated release type of valve and has been approved by UIC to comply with requirement of its specification no. 540 and 547.

F. PERIODIOCITY OF OVERHAULING

The overhauling of the distributor valve is carried out during POH or when there is some specific problem.

G. MAINTENANCE

C3W Distributor Valve consists of various sub-assemblies possessing highly finished, accurate and sophisticated small parts and therefore need a well arranged work-shop equipped with standard tools as well as specially designed tools and fixtures. It is also important to state that the work place (DV-overhauling section of the workshop) should be a clean, well organized, dust & dirt free and a properly developed space where the following activities should be adjacently and separately organized:-

- dismantling and cleaning
- assembling and testing
- storage of assembled distributor valve &
- storage of spare parts including POH kits stocking store etc.

The tools and fixtures required for the disassembly and assembly of C3W distributor valve are given in table below.

H. TOOLS AND FIXTURE FOR C3W DISTRIBUTOR VALVE

Sr.No.	Description
1	Open end spanners of 24-27 mm, 20-22 mm, 17-19 mm & 11-13 mm
2	Socket wrenches of size 13mm, 17mm, 19mm, 22mm, 27mm & 32mm with driving handles – a. Simple L Shaped b. Reversible ratchet and c. Torque calibrated for (1.5 to 6 Kg.m) range
3	Ring spanner (32-36 mm)
4	Allen key (6 mm)
5	Circlip pliers internal & external both (Small & Medium)
6	Plier general design and long nose separately
7	Screw drivers (5 mm and 8 mm blade sizes)
8	Nylon hammer
9	Special tools 1. SCT-6014-pin end tool 2. SCT-6016-pin end tool 3. SCT-6015-'O' ring set tool 4. SCT-6017-hollow stem-lead-tool 5. SCT-6026-spetula (bent tool) 6. SCT-6092-socket spanner 7. RPBF-0003-) fixture for holding guide (76) 8. Air jet gun with flexible hose
10	Bench mounted DV - holding fixture

I. OVERHAULING PROCEDURE

Before opening the distributor valve, it needs to be dusted and cleaned externally. The disassembling and assembling of the distributor valve in the workshop is facilitated by using a bench mounted DV-holding fixture, with facility to rotate through 3600 in the vertical plane and locking it after every 900 rotation.

The distributor valve is mounted on the fixture and can be locked in any desired position. The sub assemblies of different valve are dismantled in the sequence. It is imperative that components of each sub assembly have to be carefully handled and arranged in an identifiable group sequence. For part numbers and name of components of various sub-assemblies / valves, refer to the concerned manufacturer's maintenance manual.

For POH kit, refer RDSO Technical pamphlet No. G-97 (Latest amendment) Annexure XIII.

715. TESTING OF DISTRIBUTOR VALVE

For the proper functioning of the Air Brake System, it is necessary to test the Distributor Valve. The following tests are carried out to ensure the proper functioning of Distributor valve:

The following tests are conducted on the distributor valves:

(i) Pressure tightness test – (during charging, application and release test & emergency application test).

(ii) Charging time.

(iii) Full service application and release.

(iv) Overcharge protection test.

(v) CR overcharge reduction test

(vi) Emergency application.

(vii) Sensitivity test.

(viii) Quick service test.

(ix) Insensitivity test.

(x) Re-feeding test.

(xi) Graduated application test.

(xii) Graduated release test.

(xiii) Quick release test

(xiv) Control reservoir check valve reset test.

715 A. PURPOSE OF CONDUCTING VARIOUS TESTS

a) Pressure Tightness Test

Before conducting any other performance test (to ensure the efficiency of the DV it is advisable to check for the leakage from any part of the DV). For this purpose BP is charged to regime pressure and then DBV is brought to full application, Emergency and release positions respectively, and in each of the above positions DV is tested by soap solution to confirm no leakage. This is done so that every valve of

DV operates at least once and leakage from every part of the DV is checked. If DV is leakage free then it can be said with high probability that its maintenance or overhaul and assembly is carried out properly and generally it should perform as per specifications in other tests also. However, if other tests are conducted before conducting leakage test, and leakage is detected during any test then that leakage is to be attended and tests are to be repeated. Therefore to avoid reworking it is always advisable to test the DV first for leakage and once leakage free operation is assured only then other tests are to be conducted.

However in KE type of valves, it is possible to test subassemblies of the DV also before finally assembling it. In this type of valve, three main assemblies i.e. R–charger with isolating valve, Choke cover & Bottom cover with Quick release valve can be tested for leakage before fully assembling the DV and the chances of leakage from the DV are than highly reduced.

b) Charging Time

Charging time for initially charging the control reservoir and auxiliary reservoir up to desired pressure is specified. Operation of the DV should be such that time required to charge the CR and AR should neither be more nor less than the specified limits. It is necessary because if the DV of different wagons operate with different timings, then brakes will be applied and released in different wagons with different timings, and this may create problems.

c) Full Service Application and Release.

For efficient operation of brakes, it is necessary that after operating the DBV for applying the brakes, brake cylinder pressure should rise to the desired level, very quickly (i.e. from 0 to 3.6 kg/cm^2 in 18 to 30 seconds). Therefore all the distributor Valves are to be tested for the time required to raise the brake cylinder pressure. This time should neither be more nor less than the specified limits. In this test it is also checked that brake should release quickly and it means that brake cylinder pressure should be released within specified time period, and hence the DV is tested for release timings also. If the brakes of different wagons operate with different speeds then it can prove disastrous and hence this test ensures that speed of operation of various DV are more or less same.

d) Overcharge Protection

Sometimes driver overcharges the brake pipe for short duration so that brake pipe is completely charged till last wagon and brakes in every wagon are released quickly.

But this overcharging of brake pipe should not result in overcharging of control reservoir and auxiliary reservoir, because the pressure of control reservoir works as reference pressure for the DV and if the control reservoir is overcharged then it may result in malfunctioning of the DV. And hence the DV should be such that it should avoid overcharging of CR and AR even if brake pipe is slightly overcharged (In this test, brake pipe is charged up to 6 kg/cm^2 for 25 seconds and it is assured that CR and AR should not get overcharged by 0.1 kg/cm^2.)

e) CR Overcharge Reduction Test

Some times when locomotive connected with a rake is changed, in that case there may be problems due to different regime pressures of locomotive and rake. In these type of cases control reservoir is overcharged for short duration for adjustments, but control reservoir pressure should come back to brake pipe pressure when release valve handle of the distributor valve is pulled for 3 seconds.

f) Emergency Application Test

The purpose of this test is similar to that of full application and release test i.e. in this test time taken to raise the brake cylinder pressure during emergency application is measured. It is also seen that maximum rise in the brake cylinder pressure is within limits.

g) Sensitivity Test

The DV should be sensitive enough to sense the drop in brake pipe pressure quickly and to respond accordingly by raising the brake cylinder pressure so that brakes are applied. Therefore sensitivity test is conducted on DV for checking the fastness of response of DV. In this test it is expected that DV should respond to apply brakes when BP pressure is reduced by 0.6 kg/cm2 in 6 seconds.

h) Quick Service Test

This test is conducted to ensure proper functioning of quick service valve of C3W type DV. While in case of KE type DV it ensures proper functioning of U-controller .

i) Insensitivity Test

As explained in the above test, DV should be sensitive enough but at the same time it should not be very sensitive. Since if it is very sensitive, then it may operate even when there is a small leakage from brake pipe i.e. even when there is a small drop in pressure of the brake pipe. Therefore it is expected that DV should be insensitive enough so that it does not operate due to small drop in pressure in brake pipe due to leakage. And hence insensitivity test is conducted On DV and it is assured that it should not operate if brake pipe pressure is reducing @ of 0.3 kg/cm^2 in 60 seconds.

j) Re-feeding Test

If brakes are in applied position and brake cylinder starts leaking due to some problem then brake cylinder pressure may drop and it may result in releasing of brakes, which may prove disastrous. Therefore the DV is designed in such a way that it continues to supply air to the brake cylinder so that the brake cylinder pressure is maintained at desired level, even when it is leaking. The re-feeding test assures the proper functioning of main valve in case of C3W type DV and three pressure valve in case of KE type DV.

k) Graduated Application Test

This test is conducted to prove that brakes can be applied gradually or slowly. This test ensures response of the distributor valve when brake pipe pressure is gradually reduced i.e. brake cylinder pressure should increase accordingly when brake pipe pressure is reduced gradually.

l) Graduated Release Test

Similarly air brake system should be such that brakes can be released gradually or slowly. To ensure this in this test, brake pipe pressure is increased in steps and it is seen that brake cylinder pressure should reduce accordingly.

m) Quick Release Test

This test is also known as automatic exhausting of brake cylinder. When a wagon is disconnected from the rake, its brake pipe pressure becomes zero. In this condition, brakes of the wagon will be automatically in applied position. To release the brakes a manual handle is provided on the DV. When this handle is pulled, it results in complete draining of AR and CR and brake cylinder, and in other words, the brakes are released.

But at the same time on pulling this lever when brakes are in released position (i.e. when brake pipe is in charged condition) it should not result in releasing of CR & AR. Similarly when brakes are in applied condition and if some one pulls the release lever even then ideally brake cylinder pressure should not exhaust. But DV design is such that in this condition brake cylinder pressure exhausts to some extent but it should not exhaust beyond 1 kg/cm^2 i.e. even after pulling release lever when brakes are in applied position, the brake cylinder pressure should not fall below 1 kg/cm^2.

This test ensures proper functioning of the DV when release lever is pulled.

n) CR Check Valve Reset Test

This test is also known as "automatic repositioning of quick release system". If brake pipe pressure is again increased in the above test (CR is in discharged condition) by pulling the release lever in emergency operation or detached wagon condition (i.e. when brake pipe pressure is zero), double release valve (which is responsible for discharging the control reservoir) should close automatically so that CR is again charged.

715 B. TOOLS AND EQUIPMENT FOR TESTING

i) Test bench

ii) Compressed air supply source for supplying air pressure at 7.5 Kg/cm2

iii) Stopwatch – 2 No

iv) Soap water solution

716. TESTING OF C3W DISTRIBUTOR VALVE

A. DESCRIPTION OF THE TEST BENCH

The schematic diagram of the test bench for C3W valve is shown in the Fig. 7.21.

TEST RACK FOR C3W DISTRIBUTOR VALVE

- P1 – Pressure in feed pipe (not applicable in single pipe)
- P2 – Input pr. regulated at 5 Kg/cm2 in the brake pipeline.
- P3 – Brake pipe reservoir pressure.
- P4 – Pressure in the Control Reservoir (CR)
- P5 – Pressure in the brake cylinder.
- P6 – Pressure in the auxiliary reservoir.

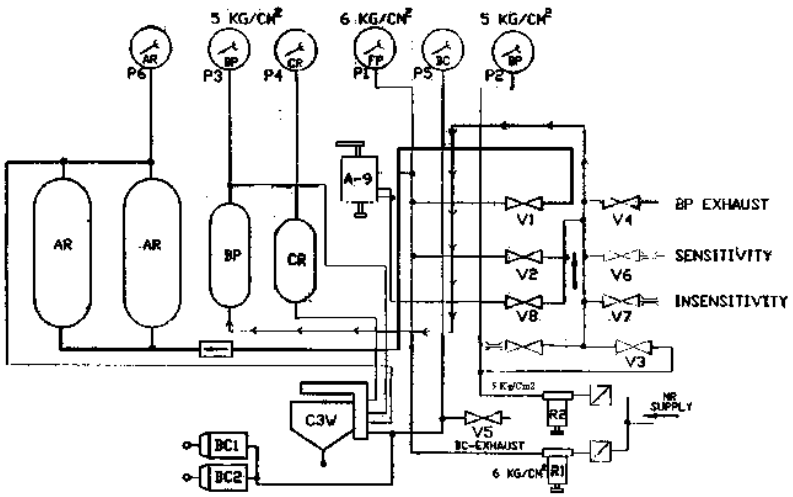


Fig. 7.22

Isolating cocks as given below –

- V1 – for isolating the supply of air to the auxiliary reservoir at 6 Kg/Cm2 (i.e. to test the system in single pipe).
- V2 – To connect/isolate BP pressure.
- V3 – for controlling the supply of air to the brake pipe at 5 kg/cm2.
- V4 – for exhausting the brake pipe pressure.
- V5 – for exhausting the brake cylinder pressure.
- V6 – It is an isolating cock with a choke for releasing the brake pipe pressure at a desired rate for sensitivity test and for graduated application test.
- V7 – It is a isolating cock with a choke for releasing the brake pipe pressure at a desired rate for insensitivity test
- V8 – For controlling air pressure in the brake pipe with the help of the drivers brake valve.
- V9 – Isolating cock with a choke for increasing the brake pipe pressure in the desired steps for graduated release test and for CR check valve reset test.

The test bench consists of the following components :

(i) Source of compressed air supply at 7.5 kg/cm2

(ii) Pressure regulator R1 - to supply air at 6 kg/cm2.

(iii) Pressure Regulator R2 - to supply air at 5 kg/cm2

(iv) Brake cylinders – 2 No. i.e. BC (1) and BC (2)

(v) Auxiliary reservoir AR (1) and AR (2) each having a capacity to store 100 litre of air at 6 kg/cm2.

(vi) Brake pipe pressure reservoir having a capacity to store 18 litres of air at 5 kg/cm2.

(vii) Control reservoir cylinder having a capacity to store 6 litres of air at 5 kg/cm2.

(viii) Automatic brake valve (A9), which is used as the drivers brake valve in the locomotive along with the C2 relay valve. This is supplied compressed air at 6 Kg/cm2. With the help of the A9 valve, the pressure in the brake pipe can be increased or decreased.

(ix) Six Pressure Gauges to indicate pressures at different locations.

B. PREPARATION OF TEST BENCH

Preparation of the test bench requires the following steps –

- Setting of the pressure regulators and the brake valve
- Leakage testing of automatic pipe network
- Calibration of chokes

C. SETTING OF THE REGULATOR AND AUTOMATIC BRAKE VALVE

(i) Block C3W distributor connections by putting blanking gasket in between the distributor and its pipe bracket.

(ii) Close all isolating cocks (i.e. V1 to V9).

(iii) Supply compressed air at 7.5 kg/cm2 at the test rack intake.

(iv) Adjust the regulators R1 and R2 so that the pressure gauges P1 and P2 indicate the pressure as 6 kg/cm2 and 5 kg/cm2 respectively

(v) Open isolating cock V3 and note that both the gauges P3 (i.e. Brake pipe reservoir pressure) and P2 (brake pipe pressure) show 5 kg/cm2

(vi) Close isolating cock V3 and open cock V4 to vent out BP. reservoir pressure.

Gauge P3 will indicate zero pressure in this condition

(vii) Adjust drivers brake valve A9 at 5 Kg/cm2, check this adjustment by opening isolating cock V8. This will increase BP reservoir pressure to 5 Kg/cm2 and this can be checked by gauge P3.

(viii) Close the cock V8

D. LEAKAGE TESTING OF PIPE NETWORK

- Open isolating cock V1 to charge the auxiliary reservoir to 6 kg/cm2
- Check this pressure from the pressure gauge P6
- Open isolating cock V2 to overcharge the brake pipe pressure to 6 kg/cm2. Check this pressure from the pressure gauge P3
- When pressure in the pressure gauges P6 and P3 are stabilised at 6 kg/cm2 then close isolating cocks V1 and V2. Wait for one minute for stabilising of pressure in gauges P3 and P6.
- Leakage must not exceed 0.1 kg/cm2 in one minute as shown by these gauges
- If there is any leakage. Identify its location with the help of soap solution and arrest the leakage before proceeding further.

E. TEST PROCEDURE

Tests are conducted in a particular sequence for reducing the time required in opening and closing of various valves. In the test bench described above, following test sequence is optimum as far as the time required in testing distributor valves are concerned. In any other type of test bench arrangement, some other test sequence may be optimum. The valve V1 is kept closed during testing.

Note : Although pressure tightness test is supposed to be conducted in the beginning for every position of the distributor valve. But in this arrangement of test bench, it is convenient to conduct charging time test before pressure tightness test.

(I). Charging time of auxiliary reservoir and control reservoir.

a) Close all the isolating cocks.

b) Set air pressure regulator R1 and R2 at 6 and 5 Kg/cm2 respectively.

c) Check pressure in the pipe by P1 and P2. It should be 6 and 5 Kg/cm2 respectively. If required, adjust the pressure regulator R1 and R2 to achieve these pressures.

d) Open isolating cock V3 and with the help of a stopwatch, note time taken by gauge P4 (CR) and P6 (AR) to rise from 0 to 4.8 Kg/cm2. Two separate stopwatches will be required. It is better if two persons monitor these pressures separately.

e) For control reservoir, the charging time should be 260±20 seconds and for auxiliary reservoir it should be 270±30 seconds.

(II). Pressure tightness test

a) Apply soap water all over C3W valve. No leakage is permissible.

b) Close isolating cock V3 after pressure gauges. P3 (Brake pipe), P4 (Control reservoir) and P6 (Auxiliary reservoir) indicates 5 Kg/cm2. Wait till reading in gauges settle.

c) Switch on a stopwatch and monitor pressure in these gauges. There should be no

drop in pressure in one minute duration.

(III). Full service application and release test.

a) Automatic brake valve should be set at 5 Kg/cm2 (as done during setting of the test bench). Bring handle in release position.

b) Open isolating cock (V8) and note gauges P4 (CR) and P6 (AR) shows exactly 5Kg/cm2.

c) Move A9 handle to service application position, so that P3 (Brake pipe pressure) falls from 5 to 3.4 Kg/cm2.

d) Switch on the stopwatch as soon as the handle of A9 is moved to service application position in the above step and note the time taken by brake cylinder pressure (P5) to rise from 0 to 3.6 Kg/cm2. This time should be 18 to 30 seconds.

e) Wait for brake cylinder pressure (P5) to settle and note the maximum pressure to which it reaches. The maximum pressure should be 3.8±0.1 Kg/cm2.

f) Move A9 handle to release position and switch on the stopwatch immediately to note the time taken by brake cylinder pressure (P5) to fall from 3.8 to 0.4 Kg/cm2. This time should be within 15 to 20 seconds.

(IV). Overcharge protection test

a) When A9 handle is in release position, brake pipe, auxiliary reservoir and control reservoir pressures i.e. pressures in gauges P3, P4 and P6 should be at 5 Kg/cm2.

b) Move A9 handle to emergency position. In this case brake pipe pressure (as per gauge P3) will fall to zero and brake cylinder pressure (as per P5) will reach to its maximum value.

c) Close isolating cock V8 and move A9 handle to release position. In this position brake pipe pressure (P3) will again rise to 5 Kg/cm2 and brake cylinder pressure (P5) will fall to zero, while auxiliary reservoir pressure (P6) and control reservoir pressure (P4) will be around 5 Kg/cm2.

d) Open isolating cock V2 and overcharge brake pipe to 6 Kg/cm2 for 25 seconds (see it in gauge P3) and then immediately close isolating cock V2 and open cock V8. But during this, control reservoir should not be overcharged by 0.1 Kg/cm2 over regime pressure of 5 Kg/cm2 (as seen by gauge P4).

(V). CR over charge reduction test

a) Allow over charging of CR and AR at 5.7 Kg/cm2 and bring back BP pressure to 5 Kg/cm2 by closing the isolating cock V2 and V1.

b) Pull the double release lever of DV for 3 seconds and note down the fall in pressure of control reservoir.

c) The control reservoir pressure should return back to brake pipe pressure i.e. 5 Kg/cm2 as seen by P3.

(VI). Emergency application test

a) With brake pipe, control reservoir and auxiliary reservoir (i.e. P3, P4 and P6) charged to 5 Kg/cm2. Move A9 handle to emergency application position.

b) As soon as handle is moved to emergency application position, switch on the stopwatch and note down the time taken by the brake cylinder pressure (P5) to rise from 0 to 3.6 Kg/cm2. This time should be between 3 to 5 seconds.

c) Also note the maximum pressure to which brake cylinder is charged. This pressure should be 3.8±0.1 Kg/cm2.

(VII). Sensitivity test

a) Move A9 handle to release position to recharge the brake pipe pressure (P3) to 5 Kg/cm2.

b) Close isolating cock V8.

c) Open isolating cock V6. Switch on the stopwatch as soon as isolating cock V6 is opened and note the time taken by brake pipe pressure to drop by 0.6 Kg/cm2. This time should be 6 seconds.

d) Brake cylinder pressure (P5) should start rising within 1 second and within 6 seconds piston should start moving for application of brakes.

(VIII). Quick service test

Close isolating cock V6 and immediately observe the applied brakes, they should remain applied.

(IX). Insensitivity test

a) Open isolating cock V3 to recharge BP, CR and AR to 5 Kg/cm2 (as seen by P3, P4 and P6).

b) Close isolating cock V3 and open isolating cock V7.

c) As soon as isolating cock V7 is opened, start stopwatch and check that BP pressure (P3) drops by 0.3 Kg/cm2 in 60 seconds.

d) There should not be any rise in brake cylinder pressure and brake cylinder piston should not start moving i.e. brakes should not apply.

(X) Re-feeding test

a) Close isolating cock V7 and open V3 to recharge brake pipe, control reservoir and auxiliary reservoir to 5 Kg/cm2 (As seen by P3, P4 and P6 respectively).

b) Bring A-9 valve handle to full service application position. BC pressure will become 3.8±0.1 Kg/cm2 (as seen by P5).

c) Exhaust the brake cylinder by slightly opening the isolating cock no V5.

d) Observe brake cylinder pressure in the gauge no. P5. It should not become zero and should stabilize at some particular value (since re-feeding to brake cylinder is available via distributor valve).

e) Fall in brake cylinder pressure should not be more than 0.15 Kg/cm2 from 3.8±0.1 Kg/cm2 (i.e. it should not fall below 3.65±0.1 Kg/cm2).

f) Close exhaust cock no. V5.

(XI). Graduated application test

a) See that brake pipe, control reservoir and auxiliary reservoir are at 5 Kg/cm2 (as seen by P3, P4 and P6 respectively).

b) Close isolating cock V3.

c) Decrease P3 (BP) pressure in steps of 0.2 Kg/cm2 (min 7 steps) by slowly opening and closing cock V6 i.e. starting from 4.6 Kg/cm2 and then to 4.4, 4.2, 4.0, 3.8, 3.6 and 3.4 Kg/cm2.

d) Note down the corresponding increase in brake cylinder pressure (P5).

e) Also note the brake pipe pressure (P3) at maximum brake cylinder pressure (P5). This BP pressure (P3) should be 3.4 to 3.7 Kg/cm2.

(XII). Graduated release test

a) Close isolating cock V6.

b) Increase brake pipe pressure (P3) in steps of 0.2 Kg/cm2 by opening and closing cock V9. The Brake pipe pressure will rise from 3.6 to 3.8 Kg/cm2.

c) Note corresponding decrease in the brake cylinder pressure (P5).

d) Also note the maximum pressure of brake pipe (P3) at which brake cylinder pressure (P5) is exhausted completely. This pressure should be 4.85 Kg/cm2.

(XIII). Quick release test

a) Close isolating cock V9.

b) Open isolating cock V3 to charge brake pipe, auxiliary reservoir and control reservoir pressure (P3, P4 and P6) to 5 Kg/cm2. Close isolating cock V3 when pressure in P3, P4 and P6 stabilizes.

c) Open isolating cock V4 for emergency application and see that. Brake cylinder (P5) is charged to 3.8 Kg/cm2.

d) Make a short pull on the release valve handle. As soon as this handle is pulled, control reservoir (P4) and brake cylinder (P5) should be completely vented.

e) Close cock V4.

(XIV). CR check valve reset test

a) Continue to pull the release valve handle of the distributor valve to completely vent out auxiliary reservoir (P6).

b) Recharge by opening cock V9.

c) Control reservoir (gauge P4) should be isolated from the atmosphere when brake pipe (gauge P3) pressure exceeds 0.2 Kg/cm2.

717. KE DISTRIBUTOR VALVE

These valves are also referred as KEO and KEGiSL in some publications. The KE distributor valve consists of the following main subassemblies:

(a) Three pressure valve
(b) U controller
(c) R charger
(d) Choke cover
e) Minimum pressure limiter
f) Maximum pressure limiter
g) A controller
h) Quick release valve

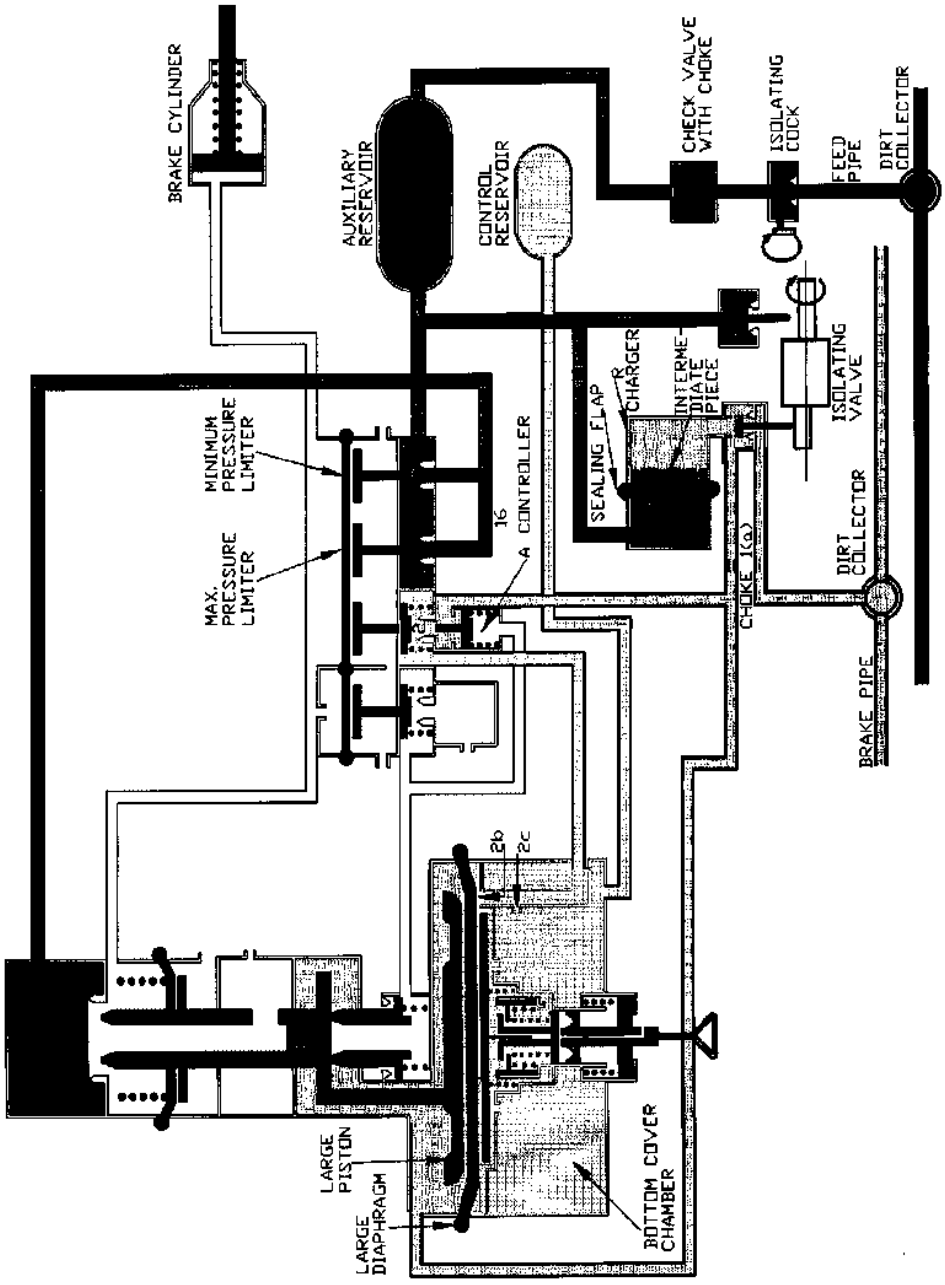


Fig. 7.23 KE DISTRIBUTOR VALVE

A. DESCRIPTION OF VARIOUS SUB-ASSEMBLIES OF KE GiSL DISTRIBUTOR VALVE

(a) THREE PRESSURE VALVE

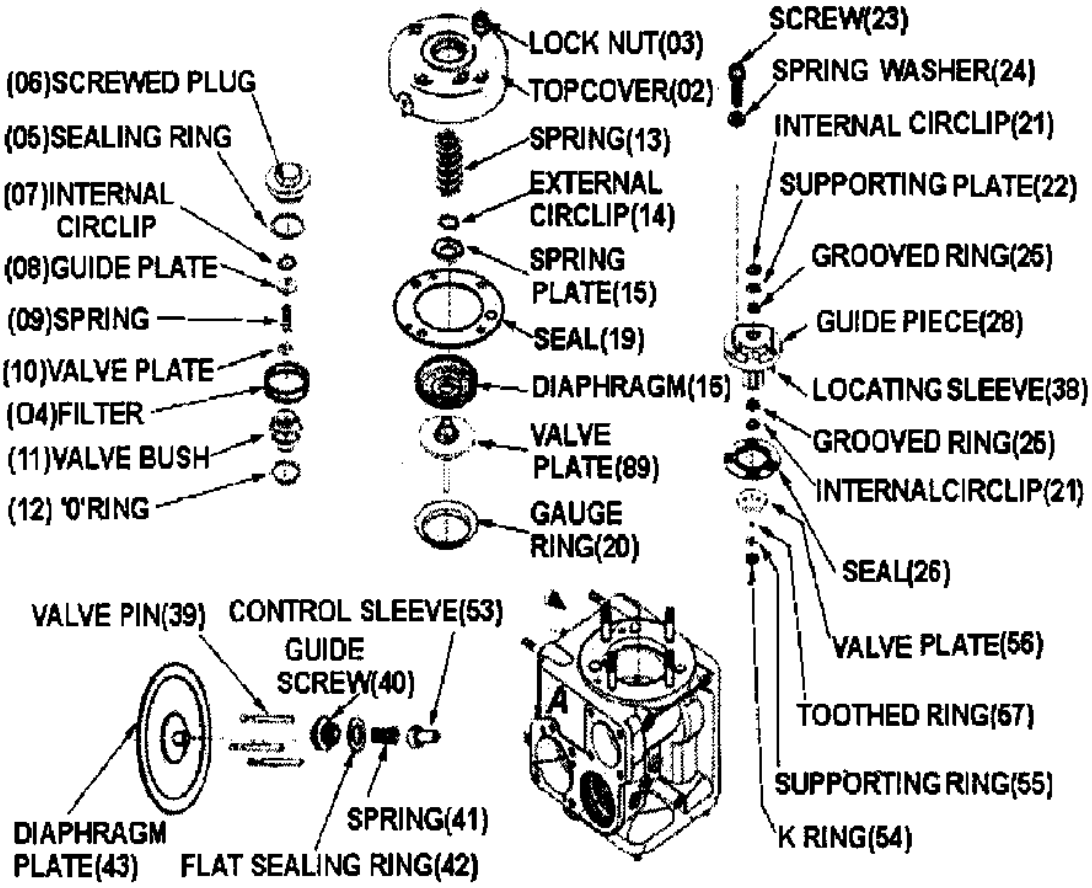


Fig. 7.24 THREE PRESSURE VALVE

The three pressure valve is housed in the vertical central bore between the top and bottom face. The function of the three pressure valve is to control charging and discharging of the brake cylinder in accordance with the change in the brake pipe pressure. The three pressure valve responds to the slightest variation of brake pipe pressure. The U controller, R charger and choke cover are housed on one face of the distributor valve.

(b) U-CONTROLLER

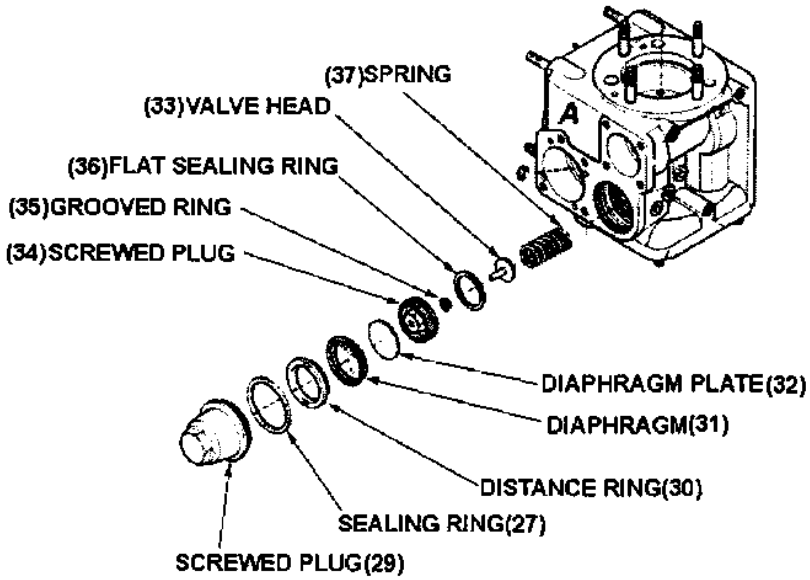


Fig. 7.25 U CONTROLLER

The function of the 'U' controller is similar to the function of quick service valve of C3W Distributor Valve. The U-controller gets activated during start of the brake application and taps off a small amount of brake pipe pressure from Distributor Valve during initial brake application. This action increases initial pressure reduction & causes simultaneous rapid propagation of braking impulse throughout the length of the train.

(c) 'R' CHARGER

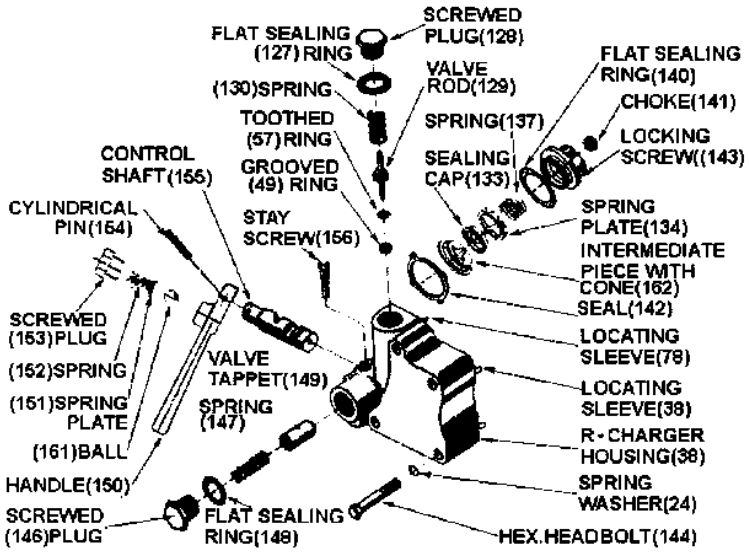


Fig. 7.26 R-CHARGER

The function of the 'R' charger is to supply compressed air from the brake pipe to the auxiliary reservoir 'R' charger also separate the auxiliary reservoir from the brake pipe through check valve (which is located inside 'R' charger) when BP pressure is less than AR pressure.

(d) CHOKE COVER

The choke cover has application & release chokes inside it. The application and release chokes help in regulating the application and release times of brake.

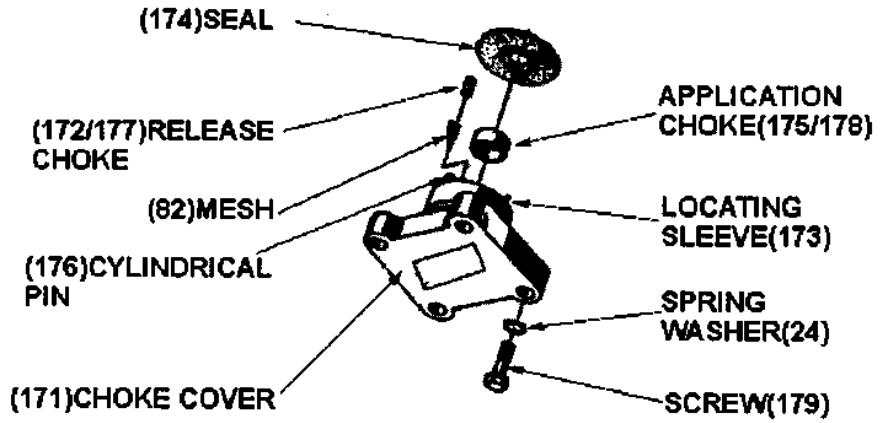


Fig. 7.27 CHOKE COVER

On the face opposite to face 'A' are housed, maximum pressure limiter, minimum pressure limiter and 'A' controller.

(e) MINIMUM PRESSURE LIMITER

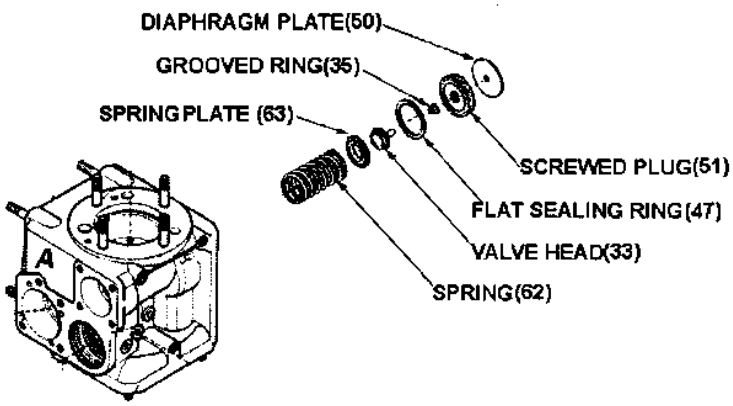


Fig. 7.28 MINIMUM PRESSURE LIMITER

The minimum pressure limiter gets activated during initiation of brake application. The minimum pressure limiter helps in rapid charging of brake cylinder upto a determined pressure to overcome rigging resistance.

(f) MAXIMUM PRESSURE LIMITER

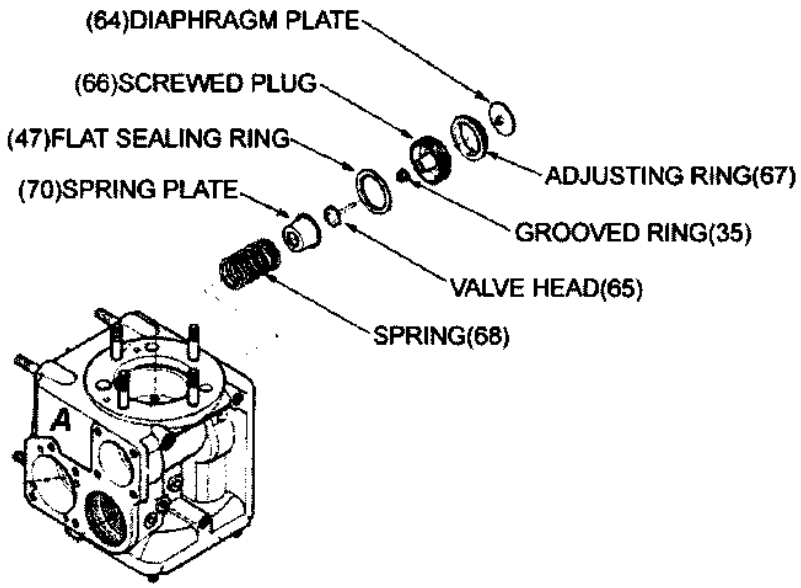


Fig. 7.29 MAXIMUM PRESSURE LIMITER

The function of maximum pressure limiter is similar to the limiting device in the C3W Distributor valve. The maximum pressure limiter limits the maximum brake cylinder pressure to 3.8 ± 0.1 kg/cm^2 irrespective of the auxiliary reservoir pressure.

(g) 'A' CONTROLLER

The function of 'A' controller is similar to that of cut off valve of the C3W Distributor Valve.

Besides charging control reservoir during charging operation 'A' controller isolates control reservoir pressure when brakes are applied. 'A' controller also protects control reservoir from overcharging.

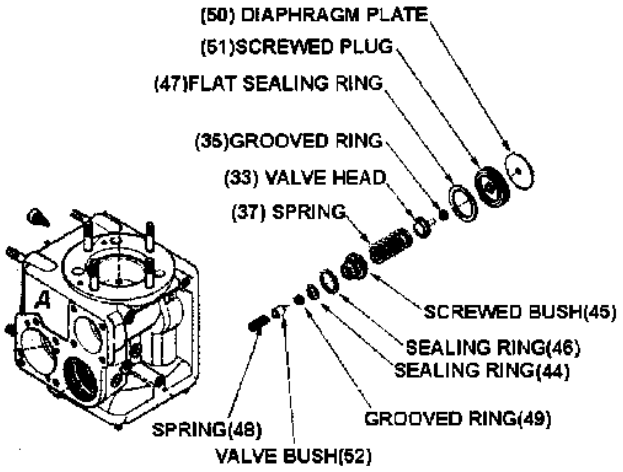


Fig. 7.30 A-CONTROLLER

(h) QUICK RELEASE VALVE

The quick release valve allows the brakes of the wagons to be fully released by means of manually pulling of handle.

For effective functioning of the air brake system, the KE Gisl distributor valve has to operate effectively during :

- Charging stage
- Application stage and
- Release stage

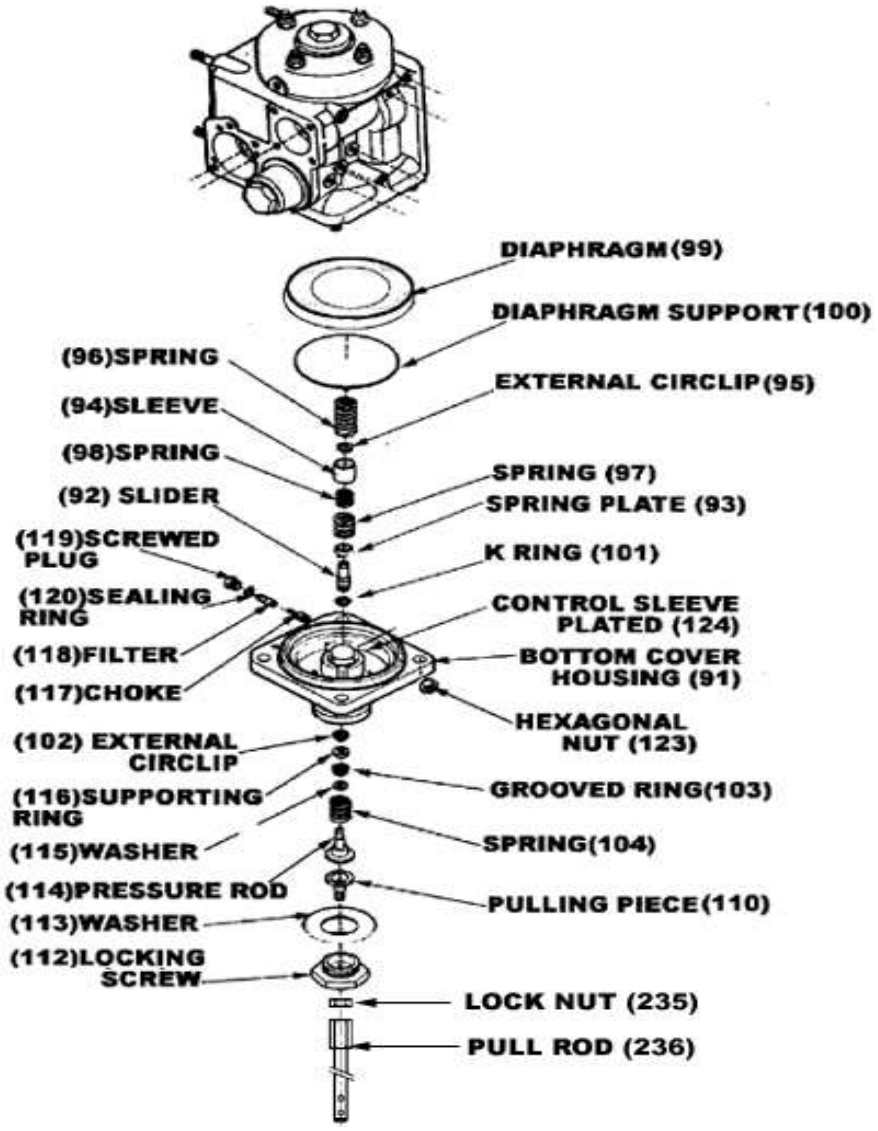


Fig. 7.31 QUICK RELEASE VALVE

717 A. FUNCTIONING OF KE DISTRIBUTOR VALVE

(a) CHARGING STAGE

During this stage, the compressed air flows from the driver's brake valve into the brake pipe which charges the control reservoir, bottom cover chamber and auxiliary reservoir. During charging stage, the path followed by compressed air is as follows.

(i) Charging of control reservoir

During charging, the compressed air flows from brake pipe, dirt collector, isolating valve and through choke to brake pipe chamber above the large piston and to the 'A' controller. Due to brake pipe pressure acting on top of the large piston, the three pressure valve is pushed down and the port gets closed by the large diaphragm.

Air also flows to the 'A' controller through choke. It passes through sensitivity port, and from there to the bottom cover chamber through port. From the bottom cover chamber, the air enters the control reservoir. When the BP pressure above the large diaphragm gets equal to control reservoir pressure (at bottom cover chamber), the large piston diaphragm gets lifted up and opens the port.

(ii) Charging of Auxiliary Reservoir

For charging the auxiliary reservoir, air from BP passes from dirt collector to the 'R' charger via the isolating valve. Air entering the 'R' charger passes through the intermediate piece and opens the sealing flap. There from, air enters the auxiliary reservoir and charges it to 5kg/cm2.

(b) APPLICATION STAGE

The application of brakes can either be emergency, full service or graduated.

(i) Emergency application:

When the brake pipe pressure is reduced from 5kg/cm2 to zero the passage from auxiliary reservoir to the brake pipe is closed by the sealing flap in the 'R' charger, because of differential pressure acting on either side of the sealing flap. At the same time pressure differential acts across the large diaphragm of the three pressure valves which pushes the piston unit (large & small) upwards. The upward movement of the piston unit closes the outlet port by uplifting of the control sleeve.

In addition to this, the outlet port at the top of the three pressure valve closes and the inlet port opens. The air from auxiliary reservoir through the minimum pressure limiter, the maximum pressure limiter and the choke, enters the top of the three pressure valve and through the open inlet port, the air enters into the brake cylinder.

When the pressure in the brake cylinder reaches 0.8 kg/cm2, first minimum pressure limiter gets closed and there after maximum pressure limiter gets closed when the pressure in the brake cylinder reaches 3.8 kg/cm2. With the rise in BC pressure the 'A' controller gets closed, maintaining the pressure in the control reservoir.

During full brake application, the brakes are applied at slower rate than in emergency application. BP pressure to be reduced by 1.5 kg/cm2 instead of 5 kg/cm2.

Note: At the beginning i.e. when BP pressure is reduced and control sleeve lifts outlet port of BP, air from top of the control sleeve reaches U-chamber that is already open to atmosphere and some BP air thus vents off. This causes a sudden extra drop in the remaining BP pressure inside the DV and accelerates the effect of brake application, propagating this action throughout the length of the train.

By this action brake cylinder pressure starts rising. The brake cylinder pressure also acts on diaphragm at U-controller, A controller, Minimum Pressure limiter and maximum pressure limiter. As BC start to rise the A controller valve is closed isolating BP and CR. Also the U controller is closed and local reduction of BP is stopped. As BC reaches 0.8 kg, it closes the minimum pressure limiter and now the rising BC pressure can pass through maximum limiter through choke which regulates the rate of BC rising. As BC reaches 3.8±0.1 kg per sq. cm., maximum pressure limiter also closes and no further rise of BC is possible. This rise of BC to 3.8± .1 kg per sq. cm. comes to effect at BP pressure dropping to 1.5 kg/sq. cm.

(ii) Graduated application

When the brake pipe pressure is reduced in steps for graduated application of brakes, the increase in brake cylinder pressure is at a controlled rate and in proportion to brake pipe pressure reduction.

As soon as the brake cylinder pressure rises in proportion to brake pipe pressure reduction, it causes the piston unit (large & small) to move down into lap position thereby closing the top inlet port without opening the top outlet port. Thus feeding of air from the auxiliary reservoir to the brake cylinder is cut off. This cycle is repeated every time BP is reduced in steps effecting graduated application of brakes.

(c) RELEASE STAGE

For releasing the brakes, the pressure in the brake pipe is increased and the pressure above the large piston increases. Thus the differential pressure across the large piston reduces. As a result, the piston unit (large & small) moves down thereby opening the top outlet port and closing the top inlet port. The brake cylinder pressure thus passes through the outlet port and gets exhausted to atmosphere through the release choke. As the BP pressure reaches 4.85 kg/cm2, the brake cylinder is almost completely drained and the three pressure assembly attains its charging/running position again.

(i) Graduated release

If the pressure in the brake pipe is increased in steps, the releasing procedure starts as before. However the top outlet port get closed and come to lap position as soon as piston unit (large & small) moves up due to fall of brake cylinder pressure.

ii) Manual Release

Sometimes manual release of brakes is very helpful and thus provision is made in the distributor valve for manually releasing the brakes. When a short pull is given to pulling lever, it tilts the pressure piece. As a result, the pressure rod and pin are pushed upwards against force of spring. The air thus flows from control reservoir and passes through port and then from narrow passage to atmosphere. This will continue until the brake pipe pressure acting on large piston moves the supporting plate down. This results in downward movement of the pin thereby closing the passage of air to exhaust.

If however, there is no more pressure in brake pipe (i.e. after emergency application), when short pull is given to release handle then pressure piece is tilted & pin remains in top position. As a result control reservoir pressure is completely exhausted. The tilted pressure piece is then immediately restored to its initial position by spring. The brake cylinder pressure starts exhausting after control reservoir is exhausted upto 1.2 kg/cm2. and then simultaneously both get exhausted completely.

During refilling, the pressure in brake pipe rises more rapidly via choke and port so that the large piston immediately moves down causing the pin to move to lap position.

717 C. SPECIFICATION OF KE DISTRIBUTOR VALVE

KE distributor valve is a graduated release type of valve and has been approved by UIC to comply with requirement of its specification no. 540 and 547.

718. TESTING OF KE TYPE DISTRIBUTOR VALVE

Schematic diagram of the test bench for KE valve is shown in Fig. 7.32. Test bench consists of the following components:-

(i). Source of compressed air supply at 7.5 Kg/cm2.

(ii). Pressure regulator (Item no. 4) : to supply air at 6.5 Kg/cm2.

(iii). Pressure regulator (Item no. 24): to supply air at 6 Kg/cm2.

(iv). Brake cylinders (Item no. 17) : two numbers

(v). Auxiliary reservoir [Item no 21(A) and 21(B)] each having capacity to store 100 liters of air at 6 Kg/cm2.

(vi). Brake pipe reservoir (item no. 9) having capacity to store 60 liters of air at 6 Kg/cm2.

(vii). Equalizer reservoir (Item no. 7) to store air at 6 Kg/cm2 pressure. This reservoir supplies air to drivers brake valve whenever it is needed by DBV due to loss of air.

(viii). Drivers brake valve (item no. 6). It is same as provided in the locomotive. Its purpose is to control the brake pipe pressure.

(ix). Item no. 2 : Filter in supply to filter out any oil, grease etc.

(x). Item no. 22 : Auxiliary reservoir check valve. This prevents back flow of air i.e. flow of air from auxiliary reservoir to supply.

(xi). Item no. 5 : Main reservoir to store 60, liters of air at 6.5 Kg/cm2.

(xii). Item no. 14 : Common pipe bracket, KE type distributor valve which is under test is to be mounted on this.

(xiii). Five pressure gauges to indicate the pressure in different locations as given below –

Item no. 25 : Main reservoir pressure.

Item no. 26 : Brake pipe pressure

Item no. 27 : Control reservoir pressure

Item no. 28 : Auxiliary reservoir pressure

Item no. 29 : Brake cylinder pressure.

(xiv). Isolating cocks as given below-

- Item no. 1: Supply of compressed air to main reservoir.
- Item no. 3 : For exhausting main reservoir pressure.
- Item no. 8 : For controlling air pressure in brake pipe with the help of drivers brake valve.

- Item no. 10 : For isolating common pipe bracket from the brake pipe reservoir.
- Item no. 11 : For exhausting brake pipe pressure.
- Item no. 12 : It is with a choke for releasing brake pipe pressure at a desired rate for insensitivity test.
- Item no. 13 : It is with a choke for releasing brake pipe pressure for sensitivity test.
- Item no. 15 : Provided between brake pipe line and control reservoir. Normally it is kept closed and is used only for quick charging (or direct charging) of the control reservoir.
- Item no. 16 : Isolating cock with a choke for exhausting brake cylinder pressure at a desired rate.
- Item no. 19 : For isolating auxiliary reservoir from common pipe bracket.
- Item no. 20 : Provided between brake pipe and auxiliary reservoir for direct charging of brake pipe (I.e. by bypassing the driver's brake valve).
- Item no. 23 : It is the cock which connects the auxiliary reservoir with feed pipe in twin pipe system. This valve is kept closed in single pipe operation.
- Item no. 30 : For exhausting auxiliary reservoir.

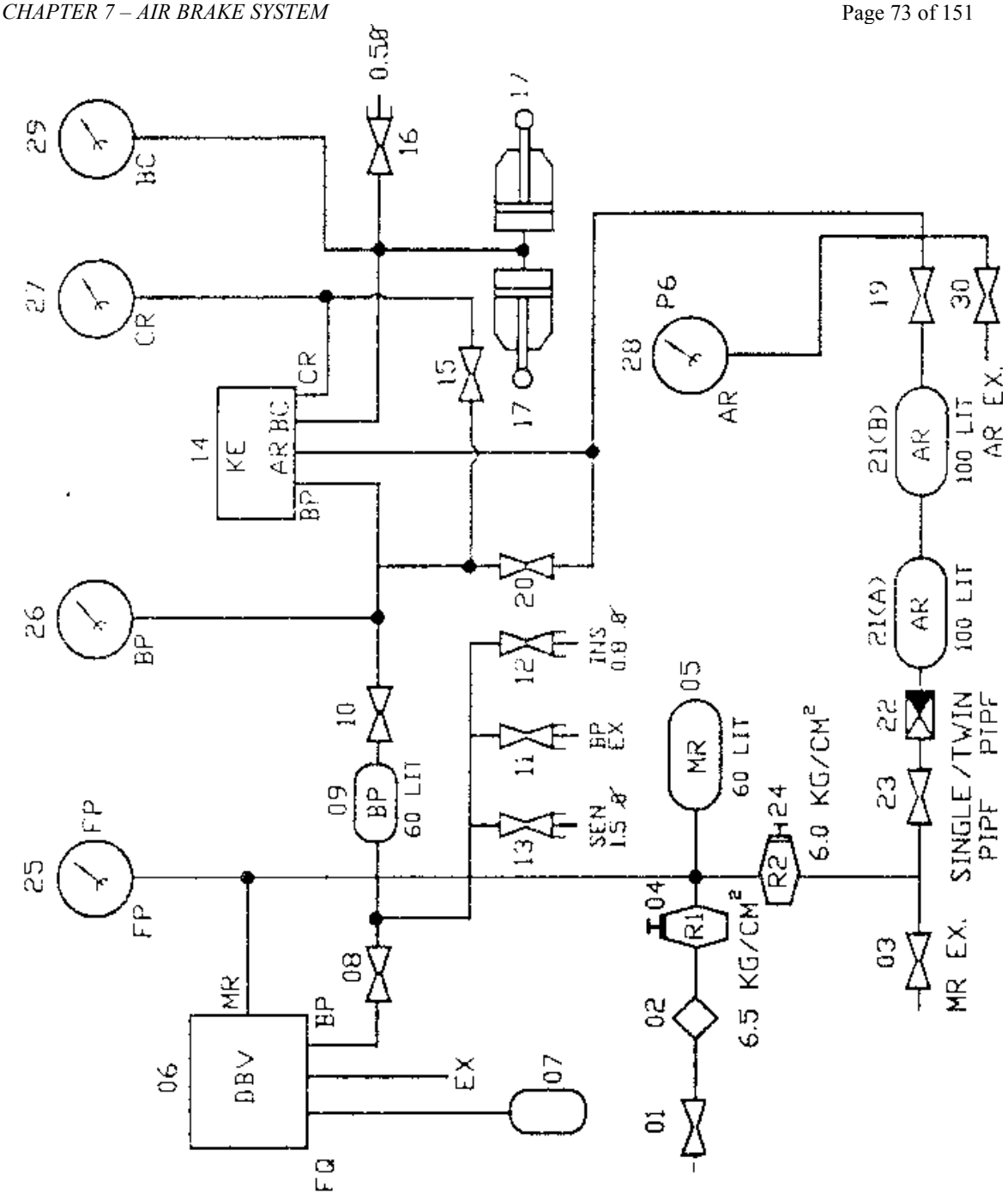


Fig. 7.32 TEST BENCH FOR KE DISTRIBUTOR VALVE

719. TEST REPORT PROFORMA FOR C3W/KE DISTRIBUTOR VALVE

Type of Valve …… Sr. No. ……

Sr. No.	Description of Test		Observation
1.	AR Charging Time from 0 to 4.8 Kg/ cm2 (Main Reservoir pressure > 7.5 Kg/ cm2)		
2.	CR Charging Time from 0 to 4.8 Kg/cm2 (Main Reservoir pressure >7.5 Kg/cm2)		
3.	Leakage Test (Brake Release) Check DV Leakage by Soap water only at joints.		
	FULL SERVICE APPLICATION & RELEASE		
3.1	Brake Cylinder filling time from 0 to 3.6 Kg/cm^2	18 to 30 seconds ±0.1	
3.2	Maximum Brake Cylinder Pressure	3.8 Kg/cm^2	
3.3	Leakage Test (Application) Check Leakage in DV by Soap water only at joints		
3.4	Brake Cylinder Release Time from Max.B.C. Pressure i.e. from 3.8 +/-0.1 Kg/cm2 to 0.4 Kg/cm2	45 to 60 Seconds	
4.1	**OVERCHARGE PROTECTION** (BP pressure 6 Kg/cm2)	CR pressure should not increase by more than 0.1 Kg/cm^2 in 25 sec.	
5.1	CR overcharge reduction test Overcharge CR to 5.7 Kg/cm2 and pull double release lever for 3 seconds.	Overcharged CR should come to regime pressure of 5 Kg/cm2.	
	EMERGENCY APPLICATION		Single pipe
6.1	Brake Cylinder filling Time from 0 to 3.6 Kg/cm2	18 to 30 Seconds	
6.2	Maximum Brake Cylinder Pressure	3.8 ± 0.1 Kg/cm2	
6.3	Leakage Test (Emergency) Check Leakage in DV by Soap water only at joints	No Leakage	
6.4	Brake Cylinder Release Time from Max. B. C. Pressure i.e. from 3.8 ± 0.1 Kg/cm2 to 0.4 Kg/cm2	45 to 60 Seconds	
	SENSITIVITY & INSENSITIVITY		
7.1	BP pressure drop at the rate of 0.6 Kg/cm2 in 6 Seconds	Brake should start applying within 1 Sec.	
8.1	With a pressure drop stopped immediately after the operation of Quick Service Valve	Brakes must remain applied.	
9.1	BP pressures drop of 0.3 Kg/cm2 maximum in 60 seconds.	Brakes must not apply.	

Sr. No.	Description of Test		Observation
	REFEEDING		
10.1	Create leak in BC through a 2 mm choke	BC pressure should decrease initially but re-feeding should be available and BC pressure should get stabilized at some pressure.	
11.1	**GRADUATED APPLICATION** Decrease BP pressure in steps as below - BP Pressure (Kg/cm2) 4.8 4.6 4.4 4.2 4.0 3.8 3.6		
11.2	Continue Graduated Application until max. BC Pressure is obtained	BP pressure drop must be between 1.4 and 1.6 Kg/cm2	
11.3	BP Pressure at maximum brake application	BP pressure drop must be between 3.4 & 3.7 Kg/cm2	
12.1	**GRADUATED RELEASE** Increase BP pressure in steps as below – BP Pressure (Kg/cm2) 3.6 3.8 4.0 4.2 4.4 4.6 4.8		BC Pressure
12.2	Check BP Pressure when BC pressure is 0.4 Kg/cm2 (Recharging pressure to release BC Fully)	4.85 Kg/cm2 approx.	
13.1	**QUICK RELEASE TEST** Apply emergency brake & pull briefly the double release valve lever	Brake cylinder & CR are automatically exhausted to zero	
14.1	CR check valve reset test. Start recharging of the system	Control reservoir should be isolated from atmosphere when brake pipe pressure exceeds 0.2 Kg/cm2.	

720. SINGLE WAGON TEST

'Single wagon Test' is performed on a wagon to ensure proper functioning of the air brake system. It is generally performed on the sick wagon attended in the sick line or whenever a subassembly of the air brake system is replaced either in depot or workshop. Single wagon test is also carried out after POH and after every change of distributor valve in the workshop.

The different tests to be performed on the subassemblies of a wagon are as follows:

Test1: Leakage Test.

Test2: Sensitivity and Insensitivity Test.

Test3: Brake Application and Release Test.

Test4: Graduated Application and Release Test.

Test5: Check and adjust Slack Adjuster.

A. TOOLS AND EQUIPMENT

1. Test Rig
2. Spanners 10mm, 12mm

B. CONCEPT

Single Wagon Test is performed, by using a portable device called 'Test Rig'. This test rig provides all facilities similar to a driver's brake valve. The source of compressed air for conducting the test is through a compressor installed in depots and workshops for conducting various tests without the need of a locomotive. The part description and specification are given in table below.

C. PROCEDURE FOR SINGLE WAGON TESTING (Single Pipe)

A systematic lay-out of Single Wagon Test Rig (SWTR) is shown in fig. 7.33. This SWTR is utilised for testing the air brake system fitted on single wagon. The wagon should not be connected with the locomotive at the time of testing. The following procedure shall be followed for testing.

i. The wagon under testing is to be coupled at one end with the SWTR coupling head BP and the other end should be closed with dummy coupling head. Pressure gauge should be fitted on brake cylinder.

ii. Couple the SWTR to the main line of compressor.

iii. Place the isolating cock of distributor valve on the wagon in open position i.e. the handle should be vertically down wards.

iv. Set the pressure reducing valve (1) to 5 $\pm$ 0.1 Kg/cm2 Open the cocks (2) and (8) and so the angle cocks on the both ends of the wagons. Move the driver's brake valve (3) in the charging and release position.

v. Wait for about 5 minutes to charge the complete system.

vi. Check the pressure in BP pressure gauge (7). Pressure should be 5+ 0.1 Kg./cm2 in BP. If there is pressure drop in the gauge (7) detect the source of leakage and eliminate it.

vii. Close cocks (2) & (8). Check the leakage on BP for one minute.

viii. Open cock (2). Bring Driver's brake valve in full service application position.

ix. Record the brake cylinder filling time from 0 to 3.6 Kg./cm2 in brake cylinder pressure gauge.

x. Record maximum pressure in brake cylinder.

xi. Record the pressure drop in BP from pressure gauge (4).

xii. Record the piston stroke of brake cylinder.

xiii. Bring Driver's brake valve in the charging and release position.

xiv. Record the brake cylinder draining time from 3.8 $\pm$ 0.1 to 0.4 Kg./cm2 in brake cylinder pressure gauge & check complete release of brakes i.e. piston should reach its initial position.

xv. Open cock (8) for charging the reservoirs to 5 Kg./cm2 and close cock (2).

xvi. Open cock (6) for checking sensitivity of brakes. Record time within which brakes get applied.

xvii. Close cock (6) and open cock (2). Wait till brakes are released.

xviii. Close cock (2) and open cock (7) for checking the insensitivity of brakes. The brakes should not apply.

xix. Close cock (7) and (8) and open cock(2), BP pressure should rise to 5 Kg./cm2

xx. Close cock (2) and open cock (5) for emergency application.

xxi. Record the brake cylinder charging time from 0 to 3.6 Kg./cm2 in BC pressure gauge.

xxii. Record maximum BC pressure.

xxiii. Check the leakage in BC for 5 minutes.

xxiv. Pull the manual release lever of distributor valve for about 10 sec. Brake cylinder pressure should become zero automatically.

xxv. The above tests should be done in both empty and loaded condition.

xxvi. The results of test shall be recorded in the test proforma attached herewith.

720-A PROCEDURE FOR SINGLE WAGON TESTING (Twin Pipe)

A Schematic lay-out of Single Wagon Test Rig (SWTR) is shown in the attached **Figure** 7.33A. This SWTR is utilized for testing the air brake system fitted on single wagon. The wagon should not be connected with the locomotive at the time of testing. The following procedure shall be followed for testing.

1 The wagon under testing is to be coupled at one end with the SWTR coupling head BP & FP respectively and the other end should be closed with dummy coupling heads. Pressure gauge should be fitted on brake cylinder.

2 Couple the SWTR to the main line of compressor. .

3 Check the following on the wagon.

1) Isolating cock of distributor valve should be in open position i.e. the handle should be vertically down wards.
2) Isolating cock in FP line should be in open position i.e, handle should be vertically down wards.

4 Set the pressure regulator (1) to 6 +0.1 kg/cm2 open the cocks (2), (5) and (11) and also the angle cocks of both FP and BP on both the ends of the wagons. Move the driver's brake valve (6) in charging and release position.

5 Wait for about 5 minutes to charge the complete system.

6 Check the pressures in FP pressure gauge (3) and BP pressure gauge (7). Pressure should be 6+ 0.1 kg/cm2 in FP and 5 +0.1 kg/cm2 in BP. If there is pressure drop in any of the gauges detect the source of leakage and eliminate it.

7 Close cock (2) and check the leakage in FP for one minute.

8 Close cocks (5) and (11) and check the leakage on BP for one minute.

9 Open cock (2) and (5), bring Driver's brake valve in full service application position.

10 Record the brake cylinder filling time from 0 to 3.6 kg/cm2 in brake cylinder pressure gauge.

11 Record maximum pressure in brake cylinder.

12 Record the pressure drop in BP from pressure gauge (7).

13 Record the piston stroke of brake cylinder.

14 Bring Driver's brake valve in charging and release position.

15 Record the brake cylinder draining time from 3.8 to 0.4 kg/cm2 in brakecylinder pressure gauge & check complete release of brakes i.e. pistonshould reach its initial position.

16 Close cock (5) and open cock (11) for charging the reservoir to 5 kg/cm2

17 Open cock (9) for checking sensitivity of brakes. Record the time within which brakes applied.

18 close cock (9) and open cock (5). Wait till brakes are released.

.19 Close cock (5) and open cock (10) for checking the insensitivity of brakes.

20 Close cock (10) and (11) and open cock (5). BP pressure should rise to 5 Kg/cm2.

21 Close cock (5) and open cock (8) for emergency application.

22 Record the brake cylinder charging time from 0 to 3.6 kg/cm2 in BC pressure gauge.

23 Record maximum BC pressure.

24 Check the leakage in BC for 5 minutes.

25 The above tests should be done in both empty and loaded condition.

26 The results of test shall be recorded in the test proforma as given below..

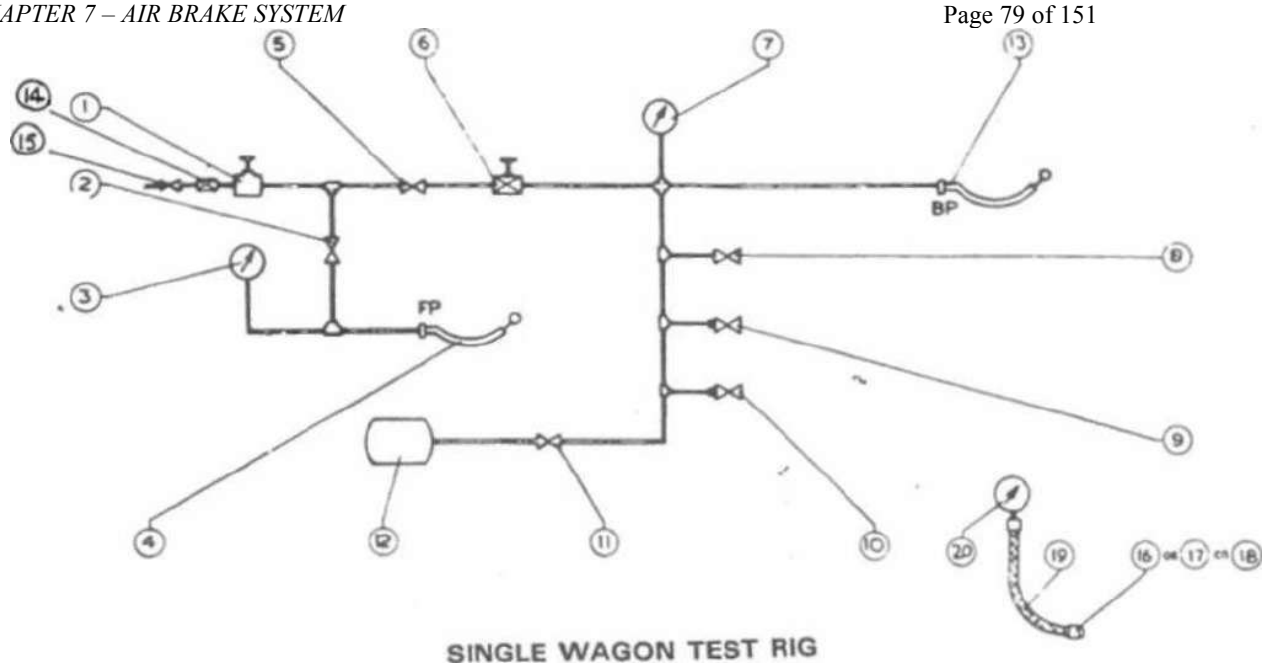


FiG. 7.33A SWTR-Twin pipe

Fig. Ref. No.	Description	Qty.
1.	Pressure reducing valve	1
2.	Isolating cock 15 mm	1
3.	Pressure gauge for FP	1
4.	Flexible hose FP 2.5 M long	1
5.	Isolating Cock 15 mm	1
6.	Drivers brake valve	1
7.	Pressure Gauge for BP	1
8.	Isolating Cock 15 mm	1
9.	Isolating Cock 15 mm with choke	1
10.	Isolating cock 15 mm with choke	1
11.	Isolating Cock 15 mm	1
12.	Air Reservoir 40 L	1
13.	Flexible hose BP 2.5 M long	1
14.	Check valve 15 mm	1
15.	Isolating cock 15mm	1
16.	Adapter for AR	1
17.	Adapter for CR	1
18.	Adapter for BC	1
19.	Flexible Hose 15mmx2 m long	3
20.	Pressure gauge for BC,CR and AR	3
21.	Trolley (Not Shown)	1

D. PROFORMA FOR SINGLE WAGON TEST FOR WAGONS OTHER THAN BOBR & BOBRN (Single pipe/ Twin pipe)

S.No.	Check	Specified
1.	Pressure in BP	5 ± 0.1 Kg./cm2
1a	Pressure in F.P (In case of Twin pipe)	6 ± 0.1 Kg./cm2
2.	Pressure in AR (in case of single pipe)	5 ± 0.1 Kg./cm2
2a	Pressure in AR (In case of Twin pipe)	6 ± 0.1 Kg./cm2
3.	Leakage from the system after charging	0.1 kg/cm2 in one minute
4.	Full service application	
4.1	Brake cylinder filling time	
	(Pressure rise from 0 to 3.6 kg/cm2)	
	a) Empty	18 to 30 sec.
	b) Loaded	18 to 30 sec.
4.2	Maximum brake cylinder pressure	
	a) Empty	3.8 ± 0.1 kg/cm2
	b) Loaded	3.8 ± 0.1 kg/cm2
4.3	Reduction in BP pressure required for full service application	1.3 to 1.6 kg/cm2
5.	Release after full service application	
5.1	Draining time (Brake cylinder pressure to fall from 3.8 + 0.1 kg/cm2 to 0.4 kg/cm2	45 to 60 sec.
6.	Sensitivity of brakes Isolate brake pipe from mainline. Check the response of brakes when the brake pipe pressure is reduced at the most equal to	Brake should apply within 6 sec.
	0.6 kg/cm2 in 6 sec.	
7.	Insensitivity of brake. Isolate brake pipe from mainline. Check the response of brakes when brake pipe pressure is reduced at least equal to 0.3 kg./cm2 in 60 seconds.	Brake should not apply.
8.	Emergency application	
8.1	Brake Cylinder filling time	
	(Pressure to rise from 0 to 3.6 kg/cm2)	
	a) Empty	18 to 30 sec.
	b) Loaded	18 to 30 sec.
8.2	Maximum brake cylinder pressure	
	a) Empty	3.8 ± 0.1 kg/cm2
	b) Loaded	3.8 ± 0.1 kg/cm2
9.	Piston stroke	
	a) Empty	See note below
	b) Loaded	
10.	Leakage from brake cylinder after emergency application	0.1 kg/cm2 within 5 minutes
11.	Automatic exhausting of brake cylinder and control	Chamber.

12.	Apply emergency brakes (i.e. BP= 0 kg/cm2). Check the brake cylinder pressure after giving a brief pull to release hook.	Brake cylinder and control reservoirs should exhaust automatically.

Date: Signature & Name of testing Authority.

E PROFORMA FOR SINGLE WAGON TEST FOR WAGONS BOBRN TYPES (Single pipe/ Twin pipe)

S.No.	Check	Specified
1.	Pressure in BP	5 ± 0.1 Kg./cm2
1a	Pressure in F.P (In case of Twin pipe)	6 ± 0.1 Kg./cm2
2.	Pressure in AR (In case of single pipe)	5 ± 0.1 Kg./cm2
2a	Pressure in AR (In case of Twin pipe)	6 ± 0.1 Kg./cm2
3.	Leakage from the system after charging	0.1 kg/cm2 in one minute
4.	Full service application	
4.1	Brake cylinder filling time In Empty (Pressure rise from 0 to 2.1 kg/cm2)	18 to 30 sec.
	Brake cylinder filling time In Loaded (Pressure rise from 0 to 3.6 kg/cm2)	18 to 30 sec.
4.2	Maximum brake cylinder pressure	
	a) Empty	2.2 ± 0.25 kg/cm2
	b) Loaded	3.8 ± 0.1 kg/cm2
4.3	Reduction in BP pressure required for full service application	1.3 to 1.6 kg/cm2
5.	Release after full service application	
5.1	Draining time (Brake cylinder pressure to fall from 2.2 + 0.25 kg/cm2 to 0.4 kg/cm2) In Empty Condition	45 to 60 sec.
	Draining time (Brake cylinder pressure to fall from 3.8 + 0.1 kg/cm2 to 0.4 kg/cm2) In Loaded Condition	45 to 60 sec.
6.	Sensitivity of brakes Isolate brake pipe from mainline. Check the response of brakes when the brake pipe pressure is reduced at the most equal to 0.6 kg/cm2 in 6 sec.	Brake should apply within 6 sec.
7.	Insensitivity of brake. Isolate brake pipe from mainline. Check the response of brakes when brake pipe pressure is reduced at least equal to 0.3 kg./cm2 in 60 seconds.	Brake should not apply.
8.	Emergency application	

8.1	Brake cylinder filling time In Empty (Pressure rise from 0 to 2.1 kg/cm2) Brake cylinder filling time In Loaded (Pressure rise from 0 to 3.8 kg/cm2)	18 to 30 sec. 18 to 30 sec.
8.2	Maximum brake cylinder pressure	
	a) Empty	2.2 $\pm$ 0.25 kg/cm2
	b) Loaded	3.8 $\pm$ 0.1 kg/cm2
9.	Piston stroke	
	a) Empty	100 $\pm$ 10mm
	b) Loaded	110$\pm$ 10mm
10.	Leakage from brake cylinder after emergency application	0.1 kg/cm2 within 5 minutes
11.	Automatic exhausting of brake cylinder and control chamber	
12.	Apply emergency brakes (i.e. BP= 0 kg/cm2). Check the brake cylinder pressure after giving a brief pull to release hook.	Brake cylinder and control reservoirs should exhaust automatically.

Date:

Signature & Name of testing Authority.

F. PROFORMA FOR SINGLE WAGON TEST FOR WAGONS BMBS TYPE (Single pipe/ Twin pipe)

S.No.	Check	Specified
1.	Pressure in BP	5 ± 0.1 Kg./cm2
1a	Pressure in F.P (In case of Twin pipe)	6 ± 0.1 Kg./cm2
2.	Pressure in AR (in case of single pipe)	5 ± 0.1 Kg./cm2
2a	Pressure in AR (In case of Twin pipe)	6 ± 0.1 Kg./cm2
3.	Leakage from the system after charging	0.1 kg/cm2 in one minute
4.	Full service application	
4.1	Brake cylinder filling time In Empty (Pressure rise from 0 to 2.1 kg/cm2)	18 to 30 sec.
	Brake cylinder filling time In Loaded (Pressure rise from 0 to 3.6 kg/cm2)	18 to 30 sec.
4.2	Maximum brake cylinder pressure	
	a) Empty	2.2 ± 0.25 kg/cm2
	b) Loaded	3.8 ± 0.1 kg/cm2
4.3	Reduction in BP pressure required for full service application	1.3 to 1.6 kg/cm2
5.	Release after full service application	
5.1	Draining time (Brake cylinder pressure to fall from 2.2 + 0.25 kg/cm2 to 0.4 kg/cm2) In Empty Condition	45 to 60 sec.
	Draining time (Brake cylinder pressure to fall from 3.8 + 0.1 kg/cm2 to 0.4 kg/cm2) In Loaded Condition	45 to 60 sec.
6.	Sensitivity of brakes Isolate brake pipe from mainline. Check the response of brakes when the brake pipe pressure is reduced at the most equal to 0.6 kg/cm2 in 6 sec.	Brake should apply within 6 sec.
7.	Insensitivity of brake. Isolate brake pipe from mainline. Check the response of brakes when brake pipe pressure is reduced at least equal to 0.3 kg./cm2 in 60 seconds.	Brake should not apply.
8.	Emergency application	
8.1	Brake cylinder filling time In Empty (Pressure rise from 0 to 2.1 kg/cm2)	18 to 30 sec.
	Brake cylinder filling time In Loaded (Pressure rise from 0 to 2.1 kg/cm2)	18 to 30 sec.

8.2	Maximum brake cylinder Empty	
	a) Empty	2.2 ± 0.25 kg/cm2
	b) Loaded	3.8 ± 0.1 kg/cm2
9.	Piston stroke	
	a) Empty *	54± 10mm
10.	Leakage from brake cylinder after emergency application	0.1 kg/cm2 within 5 minutes
11.	Automatic exhausting of brake cylinder and control chamber	
12.	Apply emergency brakes (i.e. BP= 0 kg/cm2). Check the brake cylinder pressure after giving a brief pull to release hook.	Brake cylinder and control reservoirs should exhaust automatically.
13.	Empty load change over by APM Dvice	
13.1	unrestricted movement of lever arm of APM Device.	Brake cylinder pressure 2.2 ± 0.25 kg/cm2
13.2	Restrict the movement of lever arm of APM Device by more than 25 mm (by putting a block of 25 mm thickness) from its initial position.	Brake cylinder pressure 3.8 ± 0.1 kg/cm2
13.3	APM arm movement from fully retracted Position to bogie side frame top	APM Setting (A) See Table-I
13.4	Brake cylinder pressure with unrestricted movement of lever arm of APM Device.	Brake cylinder pressure 2.2 ± 0.25 kg/cm2
13.5	Restrict the movement of lever arm of APM Device with B mm block. placed on bogie frame	Brake cylinder pressure 3.8 ± 0.1 kg/cm2
13.6	Restrict the movement of lever arm of APM Device with C mm block. placed on bogie Frame	Brake cylinder pressure 3.8 ± 0.1 kg/cm2
14.	Hand Brake	
14.1	Apply hand brakes (by one person and strike All wheels with hammer)	There should not be ringing sound.

Date: Signature & Name of testing Authority.

Note:- For APM Setting A mm, B mm block and C mm block see table- I as given below.

* However, if in few cases, the piston stroke at empty pressure during testing on SWTR exceeds the specified range, the piston stroke is to be tested by locking the wheels with wedges.

APM SETTING (KNOOR BMBS SYSTEM) TABLE-I

S.No.	Wagon	Check	A	B	C
1	BOSTHSM2	APM arm movement from fully retracted position to bogie side frame top.	$99^{+1/-0}$ mm	20mm	18mm
2	BOXNHL	APM arm movement from fully retracted position to bogie side frame top.	$96^{+1/-0}$ mm	17mm	15mm
3	BCNHL	APM arm movement from fully retracted position to bogie side frame top.	$96^{+1/-0}$ mm	17mm	15mm
4	BOXN NLB 20.32 T	APM arm movement from fully retracted position to bogie side frame top.	$92^{+1/-0}$ mm	13mm	11mm
5	BOXN NLB 22.9 T	APM arm movement from fully retracted position to bogie side frame top.	$90^{+1/-0}$ mm	11mm	9mm
6	BOXN HS 20.32 T	APM arm movement from fully retracted position to bogie side frame top.	$94.5^{+1/-0}$ mm	15.5mm	13.5mm
7	BOXN HS 22.9 T	APM arm movement from fully retracted position to bogie side frame top.	$94^{+1/-0}$ mm	15mm	13mm
8	BTFLN 20.32 T	APM arm movement from fully retracted position to bogie side frame top.	$94^{+1/-0}$ mm	15mm	13mm
9	BOBSN	APM arm movement from fully retracted position to bogie side frame top.	$88^{+1/-0}$ mm	9mm	7mm
10	BRN 22.9	APM arm movement from fully retracted position to bogie side frame top.	$95.5^{+1/-0}$ mm	16.5mm	14.5mm
11	BOBRNHSM1	APM arm movement from fully retracted position to bogie side frame top.	$90.5^{+1/-0}$ mm	11.5mm	9.5mm

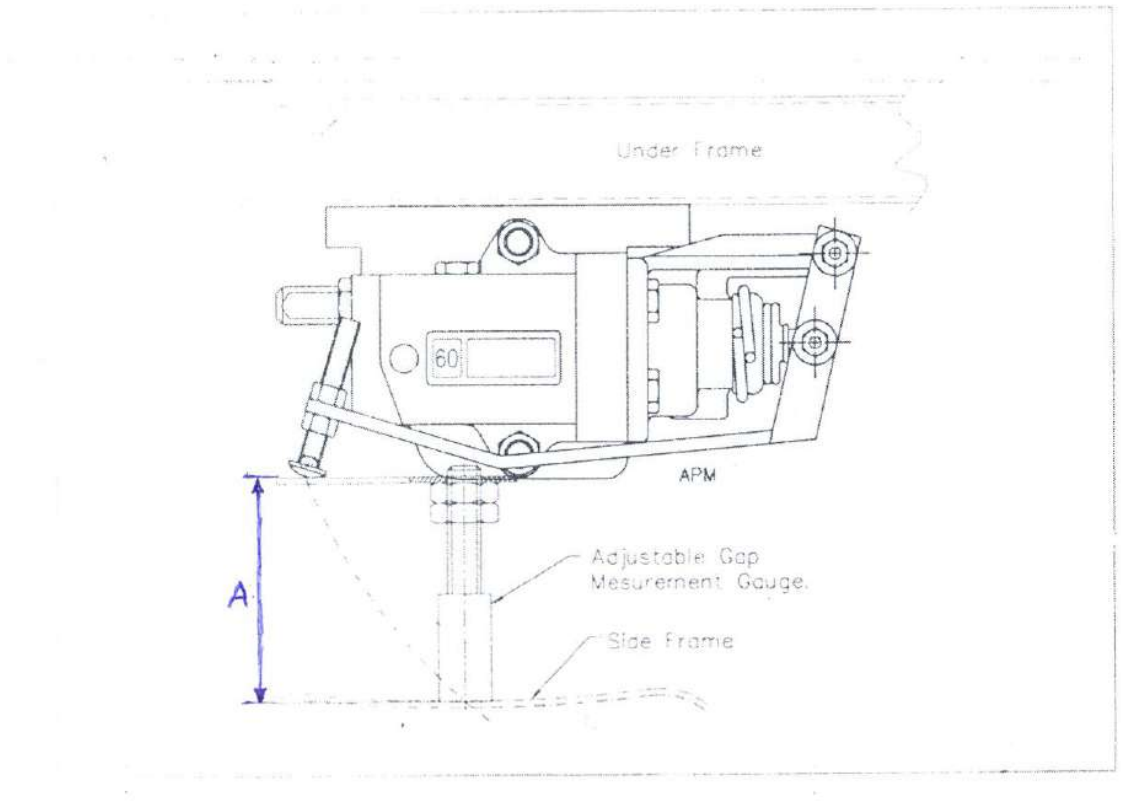


Fig.

APM SETTING

NOTE: **Piston strokes for different types of wagons shall be as given below-**

Type of wagon	Piston Stroke	
	Empty	**Loaded**
BOXN, BCN/BCNA, BRN, BTPGLN	85 mm +/- 10	130 mm +/- 10
BOXNHL, BCNHL	85 mm +/- 10	120 mm +/- 10
BTPN	85 mm +/- 10	130 mm +/- 10
BOY	90 mm +/- 10	135 mm +/- 10
BVZC	70 mm +/- 10	--
BOBRN	100 mm+/-10	110 mm+/- 10
BOBYN	100 mm+/-10	110 mm+/- 10
BLC	95 mm +/- 10	120 mm +/- 10
BVZI	32 mm	
BOSTHS, BOBSN	85 mm +/- 10	130 mm +/- 10
ALL TYPES OF WAGON BMBS (**KNORR** BREMSE DESIGN)	54 mm +/- 10	--
ALL TYPES OF WAGON BMBS (**ESCORTS** DESIGN)	55 mm +/- 10	70 mm +/- 10

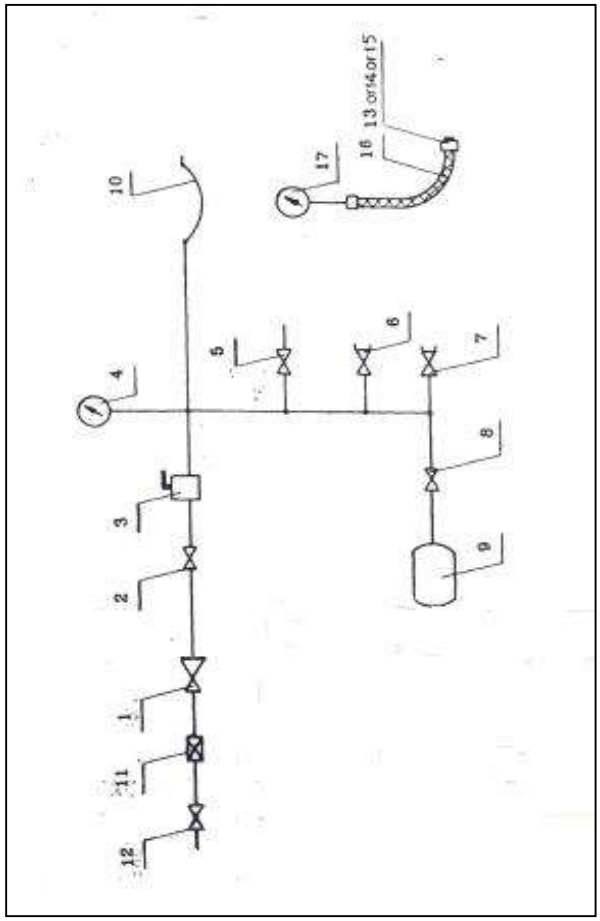


Fig. 7.33 SINGLE WAGON TEST RIG (SWTR) (Single Pipe)

Fig. Ref. No.	Description	Qty.
1	Pressure reducing valve	1
2	Isolating cock 15 mm	1
3	Drivers brake valve	1
4	Pressure Gauge for BP	1
5	Isolating Cock 15 mm	1
6	Isolating Cock 15 mm with choke	1
7	Isolating Cock 15 mm with choke	1
8	Isolating cock 15 mm	1
9	Air Reservoir 40 L	1
10	Flexible hose BP 1 M long	1
11	Check valve 15 mm	1
12	Isolating cock 15mm	1
13	Adapter for AR	1
14	Adapter for CR	1
15	Adapter for BC	1
16	Flexible Hose 10mmx2 m long	3
17	Pressure gauge	3
18	Trolley (Not Shown)	1

721. Rake Test : (Conventional Brake System and BMBS System)

RAKE TEST RIG FOR SINGLE PIPE

A schematic layout of rake test rig (RTR) is shown in fig. 7.33 A rake consisting of 58 wagons can be tested with this rig. This rig may be used for testing the train in yard before attaching the engine.

Description:

The rake test rig has air supply and mobile test rig. The mobile test rig is having a cubical structure and is mounted on wheels. It can be taken to the yards and sick lines.

Air Supply System:

a. This consists of a compressor (1), after cooler (2), check valve (3) main reservoir (4), safety valve (5) and filter (6). All these items are to be installed in a room in a yard.

b. The compressor generates pneumatic pressure of 10 kg./cm^2 and compressed air is stored in main air reservoir MR (4). The safety valve (5).opens out if the pressure exceeds 10 kg./cm^2. The oil and dirt will be separated out in the filter (6). The check valve (3) prevents back flow of air while compressor is off.

c. The compressed air line is connected to the pipe line in the sickline/yard. Angle cock and hose couplings (BP) are provided at various points depending upon the train formation and check points in sickline.

Mobile Test Rig.

a. The rig consists of brake hose coupling BP (8) and isolating cock (12) at : the inlet of the mobile test rig. The air connection can be tapped from one of the points of sickline. The mobile test rig is provided with driver's brake valve (10).

b. Brake pipe in the rake is charged while driver's brake valve (10) is kept in released and running position. The driver's brake valve inlet is connected to MR. It regulates the pressure to 5 kg./cm^2 through the relay valve (11). Isolating cock (12d) is provided to isolate BP from driver's brake valve (10).

c. The relay valve (11) has been provided in the system for augmenting the feeding capacity of driver's brake valve.

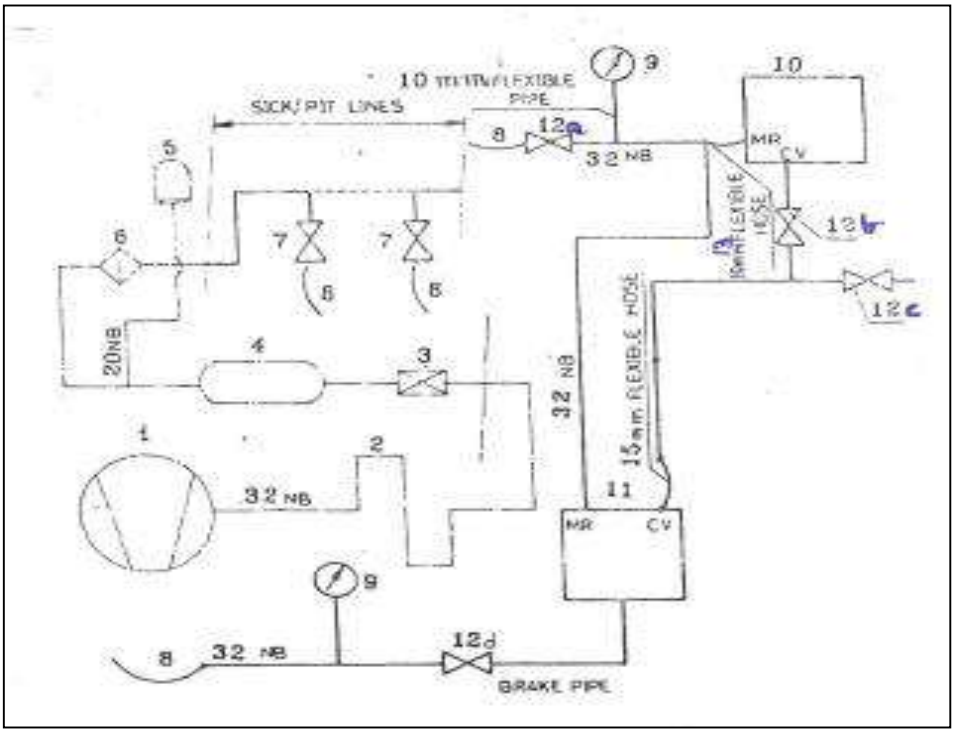
d. The hose coupling of BP is connected to the brake pipe coupling of the rake.

Testing Procedure:

Attach the rake test rig to the rake through the couplings. Carry out tests as per the procedure given in {MP guide No.11 (Rev.01) amendment No.01 of Jan-2010}

Note: In case rake test rig is not available testing shall be done by Locomotive.

Fig. 7.33 (Single Pipe)



721-A. Rake Test :(Conventional Brake System and BMBS System)

Procedure of Rake Testing for Freight Stock Twin pipe:

A schematic layout of rake test rig (RTR) is shown in Fig 7.34. A rake of wagon stock can be tested with this Test Rig. This Rig may also be used for testing the train in yards before attaching the engine.

The Rake Test Rig unit has air supply and mobile test rig. The mobile test rig is having a cubical structure and is mounted on wheels. It can be taken to the yards and sick lines. The procedure is as follows:

A. Carry out Visual Examination of rake.

B. Prepare Test Rig for Rake Test.

C. Conduct Leakage, Service Application and Release Test.

Visual inspection is a check of air brake sub-assembly for any damage on the brake pipe, hose coupling etc and then rectifying it. The steps are :-

i) Inspect loose suspension brackets and anti-pilferage devices of all air brake sub-assemblies.

ii) Visually inspect for any defect/damage in the brake pipe, hose pipe, coupling etc.

iii) Rectify or replace the problematic part/sub-assembly.

Rake Test can be performed by using a portable device called ‘Test Rig’ or by Locomotive. The Test Rig provides all facilities like locomotive to conduct the test. The source of

compressed air supply to the Test Rig is through a compressor installed
in the wagon depot for Brake Pipe and Feed Pipe of the test rig. The Air Dryer should also be provided just before connecting brake pipe and feed pipe for supply of dry air.

AIR SUPPLY SYSTEM OF RAKE TEST RIG:

- This consists of a compressor (1), after cooler (2), check valve (3) main reservoir (4), safety valve (5) and filter (6). All these items are to be installed in a room in a yard.
- The compressor generates pneumatic pressure of 10 kg./cm2 and compressed air is stored in main air reservoir MR(4). The safety valve (5) opens out if the pressure exceeds 10 Kg./cm2. The oil and dirt will be separated out in the filter (6). The check valve (3) prevents back flow of air while compressor is off.
- The compressed air line is connected to the pipe line in the sick line/yard. Angle cock and hose coupling (BP) are provided at various points depending upon the train formation and check points in sick line.

MOBILE TEST RIG

- The rig consists of brake hose coupling BP (8) and isolating cock (13) at the inlet of the mobile test rig. The air connection can be tapped from one of the points of sickline. The mobile test rig is provided with driver's brake valve (10) and an equalizing reservoir (15).
- Brake pipe in the rake is charged while driver's brake valve (10) is kept in released and running position. The driver's brake valve inlet is connected to MR. It regulates the pressure to 5 kg./cm^2 through the relay valve (11). Isolating cock (13) is provided to isolate BP from driver's brake valve (10).
- The relay valve has been provided in the system for augmenting the feeding capacity of driver's brake valve. The hose coupling of BP is connected to the brake pipe coupling of the rake.
- The MR line is connected to the feed valve (12) and regulatory pressure of 6 kg/cm^2 is obtained from the outlet. Feed pipe in the rake will be charged through feed valve (12), isolating cock (13) and brake hose coupling FP (14).

Attach the rake test rig to the rake through the couplings. Carry out following tests as per the procedure given in G-97 Annexure-XI {MP guide No.11 (Rev.01) amendment No.01 of Jan-2010} for checking capability of locomotives for Charging/Releasing of train brakes, checking of leakage in the train, checking leakage in feed pipe, brake cylinder operative percentage, and procedure to be followed at way side.

Note: In case rake test rig is not available testing shall be done by locomotive.

Following examination must be carried out before rake testing

- Hand Brakes of all wagons are fully released.
- Operating handle of empty load box is in correct position i.e. 'Empty' position when wagon is empty or lightly loaded and in 'Loaded' position when wagon is loaded beyond the specified value.
- Hose couplings of brake pipe & feed pipe on consequent wagons are coupled to one another to form a continuous air passage from the locomotive to the rear end of train.
- All the angle cocks except those at the rear end of the train are kept OPEN.

- Hose coupling at the rear end of the train is placed on hose coupling support.
- Isolating cocks of Distributor Valve on all wagons are in OPEN position.

1. Checking of Continuity and Leakage in Rake:

A. Attach the Diesel/Electric locomotive/Test Rig to the rake fitted with twin pipe air brake system and couple brake pipes and feed pipes. Ensure correct coupling with brake and feed pipe in a manner that there is no leakage of air from coupled joints.
B. The coupling should be done with angle cocks in closed position.
C. Open the angle cocks of loco after coupling feed pipe and brake pipe.
D. Open the angle cock of the brake pipes and the feed pipes on all the wagons and check for continuity and leakage of brake pipe and feed pipe by reducing and rebuilding brake pipe and feed pipe pressure operating by A9 brake valve & angle cock fitted in feed pipe on locomotive (on wagon side) respectively. The verification should invariably to be carried out through the pressure gauges (BP& FP) provided in Guard's Brake Van.

Brake Pipe pressure in train (kg/cm²)

S. N.	Length of the train	RTR/Locomotive	Brake Van
I	UP TO **56** BOXN WAGONS	5.0	4.8
2	BEYOND **56** BOXN WAGONS	5.0	4.7

Feed Pipe pressure in train (kg/cm²)

S.N.	Length of the train	RTR/Locomotive	Brake Van
I	UP TO **56** BOXN WAGONS	6.0	5.8
2	BEYOND **56** BOXN WAGONS	6.0	5.7

NOTE: If the pressure is not within specified limit as given above then check for leakage in rake and correct it.

Leakage Rate Test:

E. After the stabilizing pressure as given in above table, move the driver's automatic brake valve handle (A-9) towards application position to reduce brake pipe pressure from 5.0 kg/cm² to 4.0 kg/cm².
F. After the brake pipe pressure has been stabilized –
    i) Close the brake pipe isolating cock provided between additional C2W Relay valve and brake pipe of the locomotive or isolating cock of Test Rig for checking BP leakage.
    ii) Close the isolating cock provided between feed valve and feed pipe of the locomotive or isolating cock of FP for checking FP leakage.
G. Wait for 60 sec for temperature and gauge settlement then note the drop in pressure in brake pipe & feed pipe pressure gauge in locomotive for 05 minutes.
H. The drop in brake pipe & feed pipe pressure gauge shall not be more than **0.25 kg/cm²/min.**
I. If the leakage rate is more than the value indicated in (H), check for excessive leakage on individual wagon as indicated below –
    1. A hissing sound would be audible at points where leakage is heavy.
    2. Once the hissing sound is heard from a particular area, pin-point the location of leakage by applying soap water solution.
    3. Use of permitted material viz. Teflon tape arresting the leakage.

J. In case leakage is heavy and cannot be arrested, the wagon may have to be isolated/detached.

K. In case where leakage can be arrested temporarily by tap and the nature of leakage is such that it requires attention at primary depot, clear marking on the wagon should be to draw attention of primary depot for adequate attention.

L. In case the leakage is from the distributor valve and cannot be arrested, isolation of the wagon can be carried out by closing the distributor valve isolating cock. In such condition, clear marking should be provided on the wagon to indicate this defect to primary depot. Do not close brake pipe angle cocks under any circumstances, either for isolation of wagons or for any purpose whatsoever, except for carrying out shunting operation after which the angle cocks should again be opened to ensure continuity of brake pipe.

2. Service application and Release Test:

A. Move the driver's automatic brake valve handle (A-9) towards service brake application position and drop the value of brake pipe pressure(BP) between **1.3 to 1.6 kg/cm².**

B. Brake blocks of all wagons should apply after brake application and brake blocks on wagons are mating with the wheels after brake application.

C. Check the piston stroke of all wagons, all should be within specified limit for piston strokes for different types of wagons as per given in Para 720.

D. If the piston stroke is incorrect then, record "A" Dimension, it should be 70^{+2}_{0} mm in empty and loaded condition.

E. Check all brake cylinders. Wagons with inoperative brake cylinders should be marked unfit and detached.

F. After the release of brake, the piston of brake cylinder should fully inside and brake blocks are away from the wheels.

G. Guard's emergency brake valve: Ensure that Guard Emergency brake valve is working properly by operating it.

H. BPC (Brake Power Certificate): Ensure that Loco Pilot, Guard and TXR have checked the details given in the certificate and signed for its compliance.

3. Brake cylinder operative %:

1. The trains originating from primary depot should have a brake cylinder operating percentage of 100% in case of CC rake. For premium rakes, minimum originating brake power percentage is 95% and for end to end rake is 90%.
2. Train examination staff should check the operative percentage by observing gripping of brake blocks on wheels.

4. Procedure to be followed at Way-Side Station:

1. If the leakage rate is found more than the value indicated in 1(H), locate the source and arrest the leakage as per the procedure given in 1(I).
2. In case the leakage can be arrested temporarily by tape and the nature of leakage is such that it requires attention at primary depot, clear marking on the wagon should be done to draw the attention of primary depot for adequate attention.
3. In case the leakage is from distributor valve, follow the procedure given in 1(L).
4. In case the leakage is heavy and can not be arrested and wagon has to be detached, contact the control and obtain further advice.

NOTE:1. It is clarified that the maximum originating brake power for air braked goods trains running on end to end pattern of examination shall be **90%** except wherever local restrictions have specified higher levels of brake power to meet specific requirements. Exception shall only be made after prior personal approval of Chief Rolling Stock Engineer has been obtained for each individual.

NOTE:2. Whenever a rake is stabled, it must be secured properly as per rules given in G&SR of Zonal Railways.

PROFORMA FOR RAKE TEST

Type of rake :

Type of Wagons :

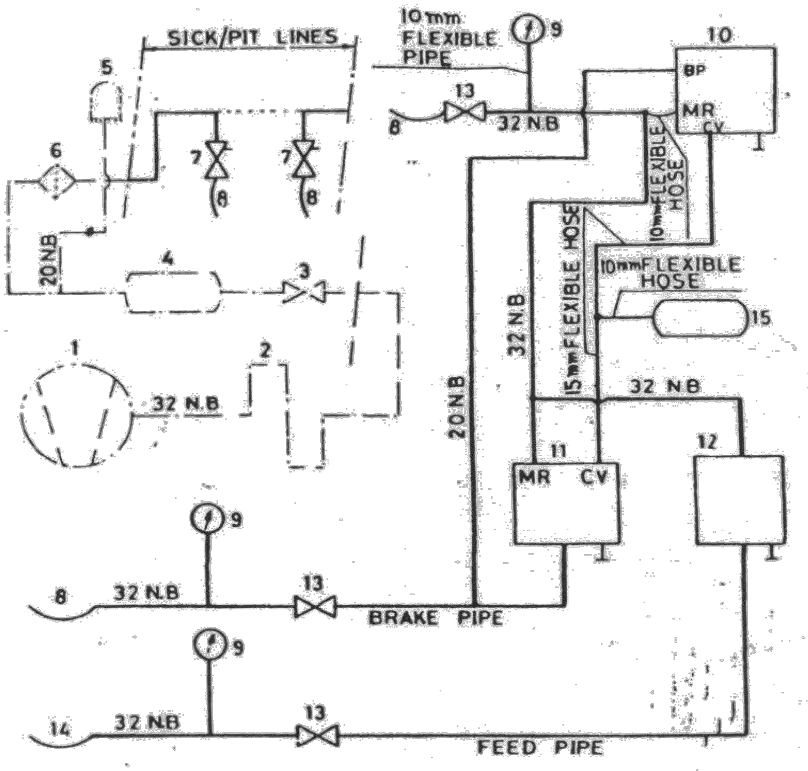
Type of DVs :

BP pressure :

FP pressure :

S.N.	Check	Specified	Actual
1.	**Pressure at last Wagon**		
	a) Brake pipe	Up to 56 wagons 4.8 Kg/cm² (min.) Beyond 56 wagons 4.7 Kg/cm² (min.)	
	b) Feed pipe	Up to 56 wagons 5.8 Kg/cm² (min.) Beyond 56 wagons 5.7 Kg/cm² (min.)	
2.	**Leakage Rate**		
	a) Brake pipe	0.25 Kg/cm²/min.	
	b) Feed pipe	0.25 Kg/cm²/min.	
3.	**Service Application and Release Test**		
	a) Brake application when B.P. pressure reduced between 1.3 to 1.6 Kg/cm²	Brakes should apply	
	b) Observe Piston stroke of brake cylinder	Piston in applied position and brake blocks are matting the wheels	
	c) Record the piston stroke	Piston stroke should be within specified limit.	
	d) Releasing of the brake when B.P. Pressure charge upto 5 Kg/cm²	Piston should be fully inside the brake cylinder.	
4.	Brake cylinder operating %	Trains originating from primary depot should have a brake cylinder operating percentage of 100%**.(In case of CC Rake)**	

RAKE TEST RIG (RTR)
FOR TWIN PIPE AIR BRAKE SYSTEM



Note :—The equipments shown after the pit line are the parts of mobile test stand.

Item	Description	No. off	Item	Description	No. off
1.	Compressor 2000L/min. pressure 8-10 kg/cm²	1	8.	Brake hose coupling BP	2
2.	After cooler	1	9.	Single pressure gauge 6"	3
3.	Check valve	1	10.	Driver's Brake valve	1
4.	Main reservoir 300L.	1	11.	Relay valve DU-22	1
5.	Safety valve	1	12.	Feed valve F-2	1
6.	Filter	1	13.	Isolating cock	3
7	Angle cock	2	14.	Brake hose coupling FP	1
			15.	Equalising reservoir 9L	1

Fig. 7.34 RAKE TEST RIG

TOOLS AND EQUIPMENT

1. Rake Test Rig/Locomotive.
2. Open End spanner 18x19”
3. Spanner 10mm, 12mm

722. REPAIR AND MAINTENANCE IN SICKLINE

i. Check for any missing component and replace them, wherever necessary.

ii. Charge the BP pressure and check for leakage

iii. Check whether the application and release of brakes is taking place properly. Also check for the free movement of brake rigging.

iv. Drain the brake pipe, control reservoir and auxiliary reservoir fully and ensure that there is no pressure in the system.

v. Remove the drain plug of auxiliary reservoir, control reservoir and centrifugal dirt collector and allow the draining of the condensate. Then charge the brake pipe and allow air to come out to the plug holes for some time so that all the dirt and other impurities may be driven out.

vi. Remove filter housing of the common pipe bracket, clean the filter and refit making replacements, if necessary.

vii. Remove the brake cylinder breather hole strainer, clean it and refit making replacements, wherever necessary.

viii. Check the handles of the cut off angle cock and isolating cock are moving freely. If there is any resistance, open the assembly, overhaul it, reassemble and ensure that there is free movement.

ix. Refer to the defects observed during checking of the arrival of the rake and make necessary rectifications.

x. The following items on individual sub assembly to be checked :-

- **Distributor Valve**

  Clean filter of the common pipe bracket

  Ensure ease of movement and function of quick release valve. Ensure valve is switched on i.e. isolating valve handle is vertically down. Ensure free movement of handle.

- **Brake Cylinder**

  Clean the brake cylinder breather filter at regular intervals. Ensure that the piston rod is fully in.

- **Air Reservoir.**

  Remove the condensate by opening the drain plug. Replace drain plug seal if needed.

- **Cut off Angle Cock**

  Replace sealing ring and dowel pin, put any lubricating oil on top of handle at regular intervals. Ensure cock is open i.e. handle is parallel to the pipe.

- **Dirt Collector**

  Remove condensate by opening drain plug. Replace drain plug sealing ring, if necessary. Open the cover and clean the filter.

- **Pipe Joints and Air brake Hose Coupling**

  Replace rubber seals, if needed. Replace hose coupling assembly, if required. If there is any leakage, arrest the leakage by using appropriate sealing compound or by tightening the joints or by changing the seals as required.

xi. Check the working of Slack adjuster and adjust "A" dimension, if required as given in para 820.

xii. After complete maintenance of the wagons testing should be done as given in para 820.

723. REPAIR AND MAINTENANCE DURING ROH

A. In routine overhaul first test the brake system using single wagon test rig as per procedure given in RDSO publication G-97 Annexure (XII) (Latest amendment). Following action should be taken for the defects/discrepancies identified during testing.

a) Replace DV by a DV tested in test bench if any of the following defects identified: (Ref: test proforma at Annexure-XII)

i. AR pressure not as specified

ii. CR pressure not as specified

iii. Maximum brake cylinder pressure in full service application/Emergency application not as specified.

iv. Brake cylinder filling time/draining time after full service and/or emergency application not as specified.

v. Insensitivity/sensitivity parameters are not as specified.

vi. Leakage through distributor valve.

vii. Brake cylinder pressures in empty & loaded condition are not within the specified limit.

b) Replace brake cylinder by tested brake cylinder, if following defects are identified.

i. Leakage from brake cylinder after emergency application is not as specified.

ii. If any visual damage is noticed.

c) Examine and repair or replace Seals/Gaskets of pipe and joint fittings if leakage rate of system is not within specified limits.

i) Replace the angle cock if it is leaking or damaged

ii) Replace leaking Guard's Emergency Brake Valve, isolating cock, and quick coupling of brake van.

iii) Examine rigging/Slack Adjuster if Piston Stroke is not as specified. (See Annexure - XV & XVI of G-97)

B. Carry out following checks and examinations.

a) Cut off Angle Cock

Check for easy operation of cut-off angle cock. If found jammed put a few drops of light lubricating oil on top of the cock and give light hammer shocks on the top of the cock simultaneously trying to operate the handle. Operate handle 10-12 times to ensure smooth movement. If working of angle cock even after lubrication is not smooth replace by tested angle cock.

b) Dirt Collector

Open the drain plug and drain out the Condensate and replace the drain plug. If the leather washer is found defective it should be changed.

c) Brake Cylinder

Check the brake cylinder for smooth movement of piston. Lubricate the piston by injecting 2 cc of lubricating grease through the gauge point. Brake cylinder movement even after lubrication is not smooth, replace by tested brake cylinder.

d) Auxiliary Reservoir/Control Reservoir

Open the drain plug and drain out the condensate and replace the drain plug. If the Leather Washer is found defective it should be changed.

e) Hose Coupling

i. Check serviceability of hose coupling.

ii. Check the Gasket for any visual damage and replace if found necessary.

f) Guard's Emergency Brake Valve

Check easy operation of Valve. Operate 5 to 6 times. Defective valve should be replaced.

g) Isolating Cock for BVZC Brake Vans

Check easy operation of cock. Operate 5 to 6 times. Replace defective isolating cock.

h) Quick Coupling for BVZC Brake Vans

Check for proper working and replace if defective.

i) Load Sensing Device (Fig. 4, 5, 7, 23 & 24 of G-97) for BOBR/BOBRN Wagons

Check that wagons fitted with C3W2 OR KEO DV are provided with single piece as per RDSO drawing No. WD- 01065 – S- 01 LSD type.

i. Check proper working of single piece load sensing device fitted on bogie. For checking the proper working of LSD in loaded condition press the piston of operating valve by inserting a bar.

C. Ensure the following :-

i. Hose coupling support at both ends are fitted properly.

ii. All mounting nuts and bolts of various equipment, pipe fitting and pipe joints are secured and tight in position.

iii. APD of the following are as per RDSO drawings and specifications.

(a) Angle cock

iv) Examine and ensure that the Air Brake equipment are not physically, damaged from outside.

D. After carrying out all the work, test the brake system in single wagon test rig for all parameters as per procedure given in Annexure XII of G-97. Rectify the defects if identified during testing. In no case wagon with brake system not meeting requirement be allowed to come out from ROH repair.

E. Attend to special modifications, as ordered from time to time in the nominated Depots.

F. Touch up paint and lettering where necessary.

G. Details of replacement of DV shall be marked on the sole bar as indicated in RDSO Drg. No. WD - 93003 - S - 01.

H. Defective equipment replaced should be taken to test bench for repair and after repair use them as spare unit for further ROH of wagons.

a) For the repair of Air Brake Equipment necessary spares shall be spare parts procured from approved Air Brake Supplier shall be readily available with the Depot. A maintenance kit for different equipment is given at Annexure XII of G-97. The Depot shall make assessment of the total quantity required and procure the same in Kit form. Small quantity of spares, which are not covered in maintenance kit may also be require. Such spares can be purchased as non stock item or by cash imprest.

b) Only used for repairs. Under no circumstances Shop made/duplicate spares shall be used. The marking on items shall be seen to verify the Supplier.

c) ROH Maintenance Depot should have sufficient Nos. of various spare assemblies for unit exchange.

d) ROH Maintenance Depot should have following Repair and Maintenance facilities for various assemblies :-

- Facilities for opening, repair, assembly and testing of all type of DVS.
- Facilities for Opening, Repair, Assembly and Testing of Angle cock, Dirt collector, Brake Cylinder, Isolating Cock, Guard's emergency brake valve isolating cock and quick coupling.
- The maintenance facilities for repair of various assemblies should be similar for what has been recommended for POH.

e) Do not allow wagon to come out from ROH repair without APD & additional APD of DV and APD of angle cock.

f) After complete maintenance of the wagons testing should be done as given in para 20.

724. PERIODICAL OVERHAUL OF AIR BRAKES SYSTEM

The following procedure shall be followed for the POH of Air Brake Equipment

i. Remove APD of DV & Angle Cocks from wagon.

ii. Remove all assembly i.e. DV, Brake cylinder, Angle cock, Auxiliary Reservoir and Dirt Collector from Wagon.

iii. Remove Guard's emergency brake valve, Isolating cock and quick coupling also form brake van.

iv. Remove automatic load changeover device also from wagon in case of BOBR/BOBRN Wagons

v. Remove pipe bracket, pipe clamps, pipe joints and strip all pipes.

vi. The pipes should be slightly hammered to loosen the rust and scale.

vii. After de-scaling, pipe must be blown with dry compressed air to ensure complete cleaning of rust and scale.

viii. Clean the outside of all pipes thoroughly.

ix. Examine all pipes for damage, cut, corrosion, etc. Damaged and heavily corroded pipe must be replaced.

x. Examine joints for the following damage:

a) Sockets for cracks

b) Fixed Flanges for straightness

c) Sockets and flanges for Corrosion/damages &

replace defective parts.

xi. Replace all rubber items of pipe joints irrespective of conditions of old items.

xii. Assemble pipe joints. Tight bolts properly and secure them by spring washer and nut.

xiii. Fit, properly overhauled and tested, following assembly.

a) DV. In case new DV is fitted it should be ensured that casting tag is available on DV.
b) Pipe bracket
c) Dirt Collector
d) Both Angle Cocks
e) Brake Cylinder
f) Auxiliary Reservoir
g) Guard's emergency brake valve in case of BrakeVan.
h) Isolating cock in case of Brake Van.
i) Quick Coupling in case of Brake Van.
j) Automatic empty load change over device in case of BOBR/BOBRN Wagons.

Use new rubber items for joints between pipe and equipment irrespective of condition of old items.

xiv Properly secure nut and bolts of joints between pipe and equipment.

xv Examine all pipe and pipe fittings and brackets and properly secure them. Pipes should not be loose inside the pipe clamps.

xvi Fit following APD :

a) APD of Angle Cock

xvii Fit overhauled Hose Couplings at both ends of Brake Pipe.

xviii PAINTING

All items shall be painted black as per standard practice.

xix. MARKING

Besides standard marking, details shown in Drg. No. WD-93003-S-01 shall also be stencilled on the sole bar.

xx. For overhauling of various assemblies removed from wagon, follow the procedure given in various Annexures of RDSO publication No. G-97 (Latest amendment) as mentioned below :-

xxi. TESTING OF WAGON BRAKE EQUIPMENT

Single Wagon Test

This test shall be conducted on the wagon with Single Wagon Test Rig. The procedure and the specified values are given at para 720.

If the values obtained are not within the specified limits, identify the defects and rectify the defects. Single Wagon Test shall be carried out once again after rectification.

Wagons with air brake system not meeting the complete requirement of single wagon test should not be allowed to come out from POH. In case of new DV, the casting tag shall be removed after the wagon has passed the test.

xxii PRECAUTIONS

a) It must be ensured that rubber items of pipe to pipe joints and pipe to equipment joint do not get damaged during fitment.

b) It must be ensured that pipes are properly secured so that these do not vibrate on run and consequently result in leakage from joints.

c) During assembly, it must be ensured that foreign particles or dust etc. are prevented from entering inside the pipes and equipment.

d) It must be ensured that POH wagons coming out of workshop are fitted with hose coupling support at both ends.

725. DETAILS OF TOOLS, FIXTURES AND EQUIPMENT

List of tools, fixtures and equipment's with specification required to mount/dismantle the subassemblies of air brake system are as under-

Sr. No	Description	Size
1.	***General Tools :*** Open End spanner	11-13 mm 17-19 mm 20-22 mm 24-27 mm
2.	Ring Spanners (Hexagonal or bi-Hexagonal)	17 mm,19 mm, 32 mm,36 mm, 37 mm, 47 mm, 57 mm, 58 mm
3.	Box Spanners	A/F 9 mm,13 mm, 14 mm,16 mm, 26 mm, 27 mm, 28 mm.
4.	Allen keys	A/F 5 mm, 6 mm, 8 mm, 17 mm
5.	Screw driver	6 mm blade, 3 mm blade and 10 mm blade
6.	Circlip pliers set (Internal & External)	Small, medium & large
7.	A. General Plier B. Long Nose Plier	200 mm 150 mm
8.	Socket wrenches with Driving handle 1. 'L' shaped 2. Ratchet (R&L) 3. Torque calibrated	13 mm, 17 mm,19 mm, 22 mm, 27 mm, 32 mm & 50 mm.
9.	A. Hammer (Nylon) B. Hammer (Steel)	200 mm 150 mm
10.	Torque wrench	1.7 to 6.5 m-kg. (Range)

Special Tools: KE- Type	
11.	Diaphragm Tool 4A54802
12.	Adjustment Tools 4A59318
13.	Tools for Locking screw of bottom cover 3KB3349
14.	Clamping fixture or DV holding fix
15.	Wrench for Max. Limiter 4A47740
16.	Installation Tools (Assembly punch) 4A93186
17.	Thrust piece
18.	Installation hook
19.	Adjusting key
20.	Guide Tool for pin (92)

	Pressure rod (1A) sub assembly
Special Tools: C3W –Type	
21.	SCT6014 Two-pin tool for part no. 74
22.	SCT6016 Two-pin tool for part no. 72
23.	RPBF 0003 Holding fixture for guide 76
24.	Socket Spanner (SCT6092) 50 mm
25.	Stem leading Tool (SCT6017)
26.	Bent Tool (SCT6026) for removing air from diaphragm
27.	"O" Ring positioning (SCT 6015) Tool

(b). DIRT COLLECTOR

Sr.No	Description	Size
1.	*General tools :* Single end spanner	A/F 27 mm
2.	Socket spanner	19, 22, 24 mm
3.	Double Ended spanner	(17-19); (22-24)
4.	DC- holding fixture or vice with semi-circular jaws	125 mm
5.	Screw driver	8 mm (Blade)

(c). BRAKE CYLINDER

Sr.No.	Description	Size
1.	Brake cylinder Assembly Fixture	
2.	*General Tools :* Torque wrench	Torque of 200 cm-kg.
3.	Socket wrench	19 mm
4.	Ring spanner	Bi-hex (19-24)
5.	Screw driver	8 mm blade
6.	Double Ended spanner	A/F 13x14 mm, 32x36 mm

(d). AIR RESERVOIR

Sr.No.	Description	Size
1.	Open end spanner	A/F 28 mm A/F 22X24 (17-19) (22-24)
2.	Socket spanner	19,22 mm, 24
3.	Screw driver	8 mm Blade

(e). CUT OFF ANGLE COCK

Sr.No.	Description	Size
1.	Open end spanner	A/F 63
2.	Double open end spanner	(11-13), (17-19)
3.	Screw driver	8 mm Blade

(f). SLACK ADJUSTER

Sr.No.	Description	Size
1.	Double Ended Spanner	(11-13)
2.	Special spanner (E)	
3.	Circlip plier spring type (C) (External)	203.2 mm to 250 mm
4.	Circlip plier bend nose type (Internal)(D)	250 mm to 304.8 mm
5.	*Special Tools :* Jacking Tool (B)	

(g). HOSE COUPLING

Sr.No.	Description	Size
1.	Pipe wrench	450 mm
2.	Open end tool	55, 65

726. BRAKE POWER CALCULATIONS FOR BOXN WAGON

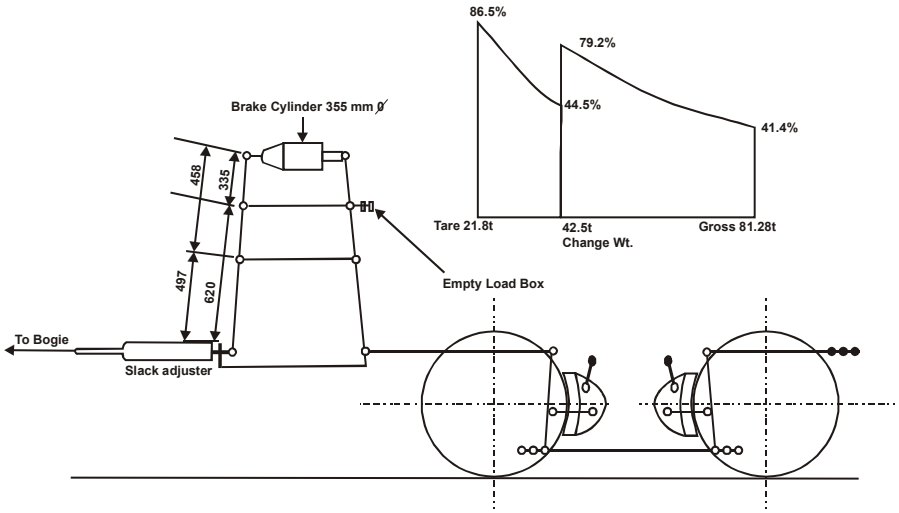
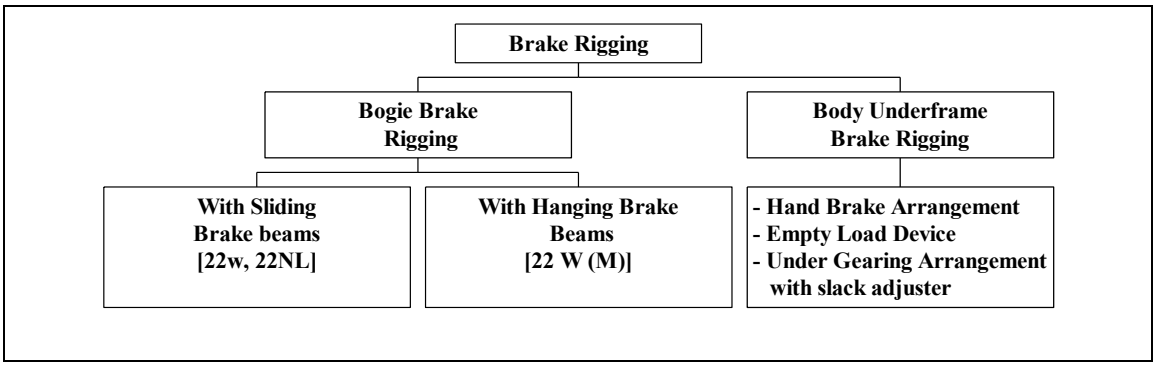


FIG. 7.35
BRAKE POWER CALCULATIONS FOR BOXN WAGON

TYPE OF BRAKE SYSTEM	= AIR BRAKE
BRAKE CYLINDER DIA	= 355 mm
NO OF CYLINDERS	= ONE
TOTAL EFFECTIVE PISTON FORCE (K) AFTER SUBTRACTION OF RESTORING SPRING FORCE AT A STORKE OF 135mm	= 3600 Kg
LEVERAGE	
EMPTY	= $\frac{335}{620}$ x 12 =6.5
LOADED	= $\frac{458}{497}$ x 12 =11.05
TOTAL BRAKE BLOCK PRESSURE	$P=(K\ i - 12Q)\ \eta$
RIGGING EFFICIENCY	$\eta = 0.9$
FORCE OF SLACK ADJUSTER SPRING	Q = 200 Kg
	P Empty 18900 Kg
	P Loaded 33642 Kg
BRAKE PERCENTAGE	$\frac{P \times 100}{\text{Tare or gross}}$
BRAKE PERCENTAGE EMPTY	= $\frac{18900}{21800}$ x100 = 86.5 %
BRAKE PERCENTAGE LOADED	= $\frac{33642}{21800}$ x 100 = 41.4%
BRAKE POWER AT CHANGE WEIGHT $\frac{P(TARE)100}{CHANGE\ WT}$	= $\frac{18900}{42500}$ x100 = 45.5%
$\frac{P(GROSS)x\ 100}{CHANGE\ WT}$	= $\frac{33642}{42500}$ x 100 =79.2%

727. BRAKE RIGGING



A. INTRODUCTION

The Brake Rigging is provided to control the speed of a wagon by transferring the braking force from Brake Cylinder to wheel treads.

The Brake Rigging can be divided into two groups, as can be seen in the figure above.

I. Hand Brake

General

The Hand Brake provides a means of attaining retarding force with the brake shoe. The BOXN & BCN wagons are equipped with side operated Hand Brake.

However in newly designed BCNHL wagon, the hand brake wheel is on end wall portion.

Constructional details

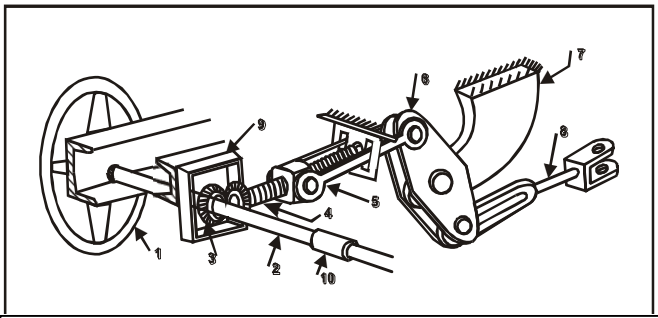


Fig. No. 7.36 Hand Brake Arrangement

The Hand Brake arrangement consists of the following components:-

1. Hand Brake equalising levers
2. Support Bracket
3. Hand Brake pull rod
4. Bevel gear box
5. Sleeve for spindle.
6. Hand Brake Wheel
7. Hand Brake Spindle rod
8. Bevel Gear set
9. Hand Brake screw rod with nut
10. Hand Brake connecting links

II. The Empty Load device

General

The Empty Load device is provided in the Brake Rigging. It is a device by means of which lower leverage ratio for tare/empty condition and higher leverage ratio for loaded condition of the wagon can be obtained by a simple manual operation of a handle.

Constructional details

This device comprises of the followings :-

1. Horizontal lever "live'
2. Horizontal lever "dead'
3. Empty Tie rod in two pieces with sleeve nut
4. Loaded Tie rod
5. Empty load box assembly
6. Empty load shaft
7. Change over handle
8. Toothed segment
9. Sign plate
10. Connecting rods-one is plane & another is single twist
11. Bell crank and pins

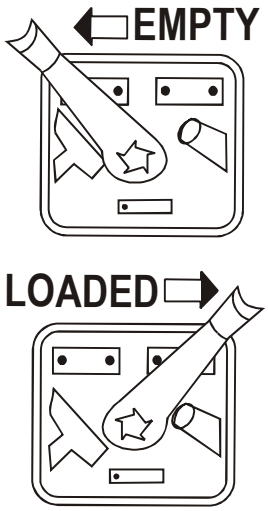


Fig. No. 7.37 EMPTY LOAD DEVICE

The Sign Plate is painted with two colours. Half yellow (empty) and half black (loaded) portions indicate positions respectively, to which the change over handle in set.

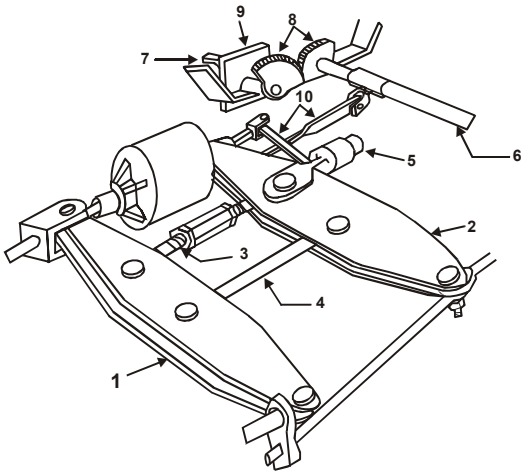


Fig. No. 7.38 EMPTY LOAD DEVICE

III. Components

Depending on the brake beam arrangements, brake rigging can be of following two types.

Sliding Brake Beam

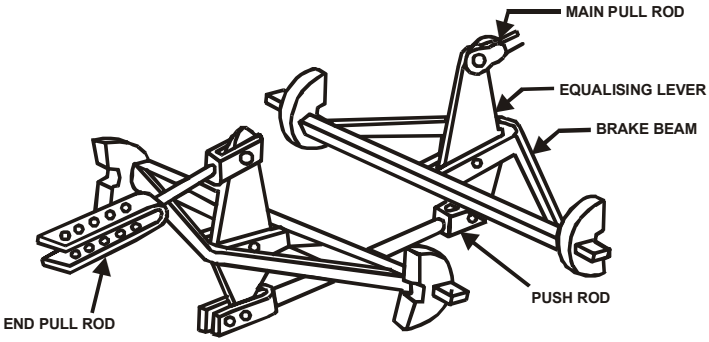


Fig. No. 7.39 Sliding Brake beam

For CASNUB 22 W, 22-NL, NLB, NLM, HS, HS (Mod- I), HS (Mod- II) & NLC bogies, the brake beam is of sliding type, having fabricated box-steel structure with integral cast steel pieces for strut & brake-heads.

Hanging Type Brake Beam:-

Hanging brake beam without additional brake beam support

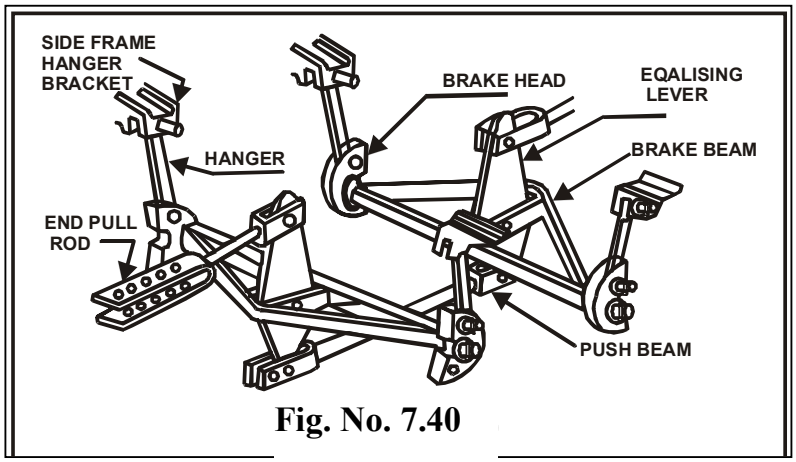


Fig. No. 7.40

For CASNUB 22W(M) bogie, hanging type cast steel brake beams are provided. Brake heads and blocks are secured by key and they are further assembled with brake beams through spring loaded brake shoe adjuster.

Hanging brake beam with additional brake beam support.

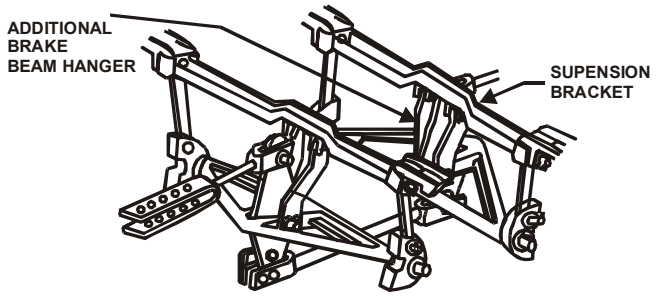


Fig. No. 7.41

Body Under frame Components

Details of components and assemblies used in various types of brake rigging arrangements are given below and shown in figure;

11. End pull rod
12. Equalising lever
13. Push rod
14. Brake beam
15. Brake head assembly
16. Brake beam hanger
17. Brake block
18. Brake show key
19. Brake wear plate
20. Brake gear pins, washers, cotters

1. Short pull rod
2. Long pull rod
3. Control rod with head
4. Horizontal lever
5. Empty tie rod with sleeve nut
6. Loaded tie rod
7. Empty load device
8. Hand brake pull rod
9. Hand Brake arrangement
10. Slack Adjuster

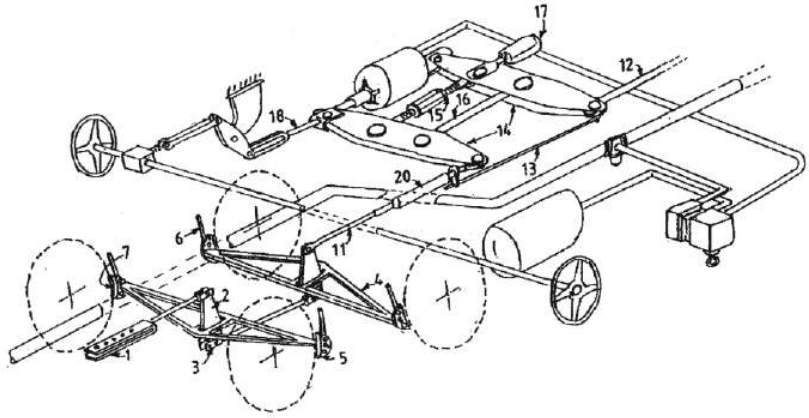


Fig. No. 7.42 : Body Underframe

BRAKE-HEAD REPLACEMENT

CASNUB-22NL, 22NLB, 22W, 22NLM, 22HS, 22HS (Mod-I), 22HS (Mod-II) & 22 NLC Brake Beams

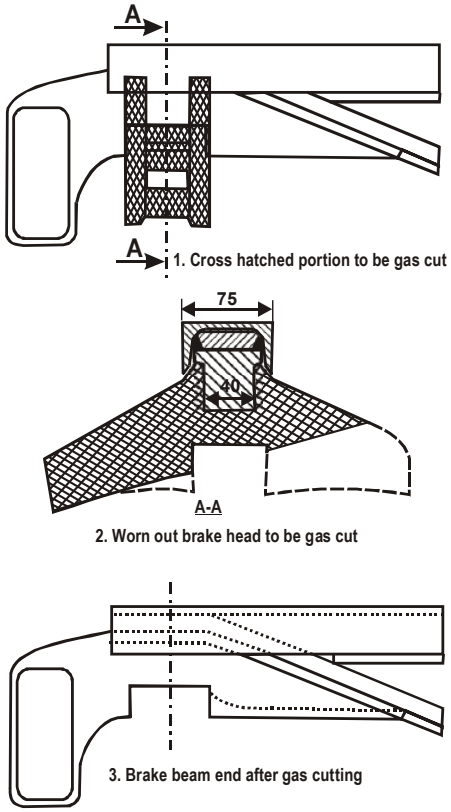


Fig. No. 7.43

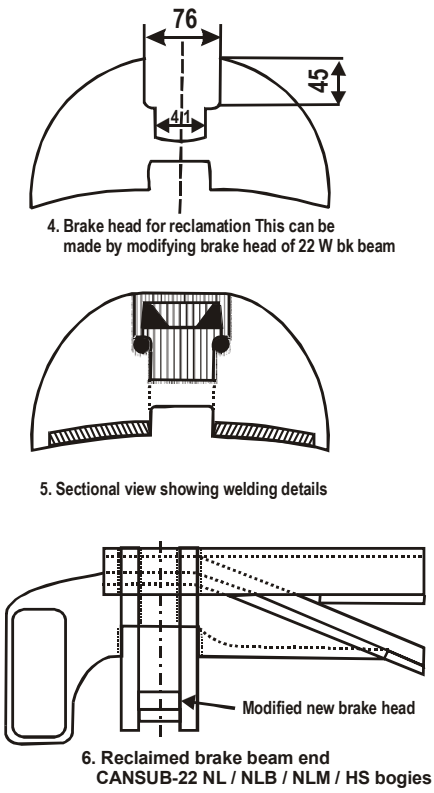


Fig. No. 7.44

a) Remove worn-out brake head. Other members, if damaged, should be built up by welding, followed by proper cleaning and finishing operation, as shown in figure to the right

b) Weld new brake head at correct position.

CASNUM 22W (M) Brake beam:

a) Remove split pin and washer from brake beam ends. Remove pin securing brake shoe adjuster with brake beam by removing

b) Take the Brake Heads out of the Brake Beam along with Brake shoe adjuster

c) Disengage brake shoe adjuster form brake head by removing bolt after disengaging split pin, nut, cover, spring and adjusting piece.

d) Assemble the new brake head with brake shoe adjuster.

e) Secure brake heads on brake beam end by putting washer and split pin.

Holes of end pull rod pins to be used for brake adjustment as per diameter of wheels.

Hole	**Wheel diameter on tread**
A	Between 1000 & 982
B	Between 981 & 963
C	Between 962 & 944
D	Between 943 & 925
E	Between 924 & 906

The figure on next page shows where the holes are.

The push rod is provided with two holes at either end. During service, in case of wear in brake blocks, manual adjustment to outer hole may be done for maintaining brake power.

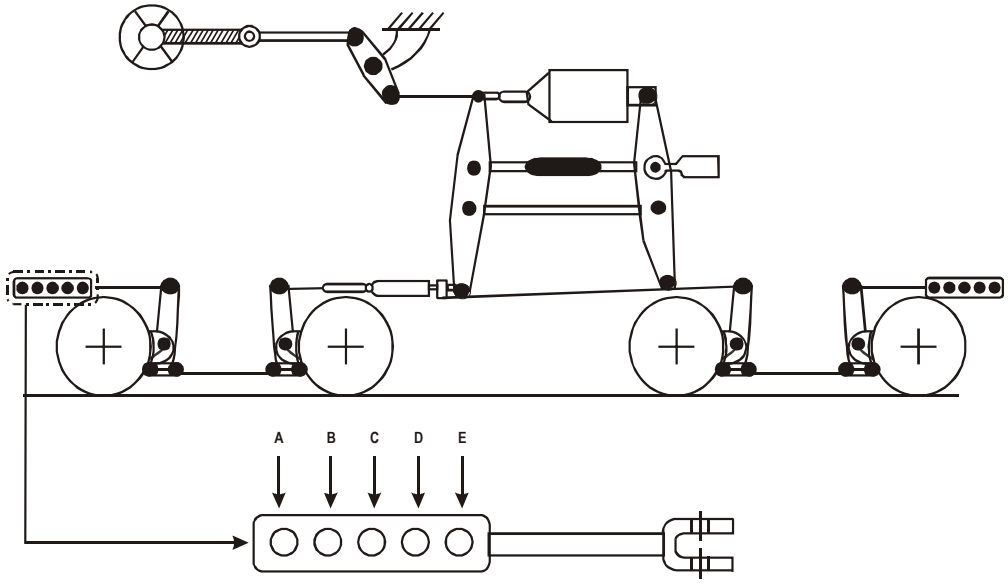


Fig. No. 7.45

728. COMPOSITION BRAKE BLOCK

Indian Railways using cast iron brake blocks for braking on freight stock. The frictional properties of cast iron brake blocks decline with the increase in speeds resulting in increased braking distance. The composition brake block has the following benefits as compared to cast iron brake blocks:-

i) Reduced braking distance due to uniform coefficient of friction.

ii) Reduced weight.

iii) Longer life due to reduced wear of composition brake blocks.

iv) Reduced noise during braking.

Initially L—type composition brake blocks were developed and tried out. After successful trials the decision was taken to progressively switch over to L- type composition brake blocks. Presently following firms are approved for regular supply of L- type composition brake blocks:-

1. M/s Rane Brake Lining, Chennai.
2. M/s BIC Auto Pvt. Ltd. Faridabad.
3. M/s Escorts Ltd,. Faridabad.
4. M/s Allied Nippon
5. M/s Cemcon engineering Co. Pvt. Ltd Rohtak.
6. M/s Hindustan composites Ltd. Aurangabad.
7. M/s ILPL Mumbai
8. M/s Bony Polymers Ltd. Faridabad.
9. M/s Greysham (International) super friction Pvt. Paonta Sahib
10. M/s Sundram Brake lining Ltd. Chennai.

Cast iron brake blocks can be replaced by L- type composition brake blocks and condemning limit is the same as that of CI.

K-type composition brake blocks having higher average coefficient of friction are being developed. Moreover adoption of K-type brake block requires change in brake rigging. Development of K-type brake blocks at testing stage at present. Presently following firm are approved for regular supply of L –Type composition brake block.

1. M/s Rane Brake lining, Chennai
2. M/s BIC Auto Pvt. Ltd. Faridabad
3. M/s Hindustan composites Ltd. Aurangabad
4. M/s ILPL Mumbai
5. M/s Greysham (International) super friction Pvt. Paonta Sahib

Do's and Don'ts for fitment of Composition Brake Blocks

The following procedure shall be followed to ensure proper fitment of composition brake blocks;

To be done

i) Brake block shoe key shall be of spring steel as per RDSO drawing

ii) Brake head shall be of spring steel as per RDSO drawing

iii) Brake block taper should match with the wheel taper i.e. lower thickness of brake block towards flange of wheel disc and higher thickness towards other side of wheel flange

iv) Sufficient clearance should be created by rotating the barrel of slack adjuster for fitment of brake block

v) The brake block should be fitted from the top of wheel and pressed down so that it sits properly on brake head.

vi) Key shall be inserted from the top and slightly hammered so that it sits properly with the brake head. Slight hammering requirements indicate that the brake shoe key is made of proper material and as per drawings.

vii) Split pins shall be inserted through the brake head whole passing the edge of brake shoe key and ends of split pins should be bent.

Not to be done:

i) No hammering should be done for fitment of brake blocks.
ii) Brake blocks should not be dropped.
iii) Brake blocks should be handled properly and carefully to avoid damages such as chipping / cracking.
iv) Do not store on radius side. (the best way is to store them on the side ways).
v) Do not strike key if stopped by brake block nib.
vi) Composition and cost iron brake blocks shall not be fitted on same brake beam.
vii) Avoid fitment of composition and cast iron brake block on the same rake to get optimum wear life out of the composition brake blocks.

729. BOGIE MOUNTED BRAKE SYSTEM (BMBS)

A DESCRIPTION OF BMBS

The Bogie Mounted Brake system (BMBS) equipment (Given in figure-7.46) consists of a transversely mounted pneumatic Brake Cylinder with a self-contained, double acting slack adjuster, two brake beams, two bell crank levers and interconnecting push rods. The hand brake arrangement is available as a mechanical model with two flexible handbrake cables. The pneumatic Brake Cylinder is 10" in diameter for application with high friction brake shoe (K type) on casnub type bogies. The system consists of a unique design with two pneumatic Brake Cylinder (one per bogie) to deliver reliable braking performance and is light in weight. It fits into CASNUB bogie and uses 58 mm thick brake shoes.

Brake cylinder contains an integral double acting slack adjuster, which provides optimal braking force and minimizes shoe & wheel wear. The design is with high strength and minimal brake beam deflection.

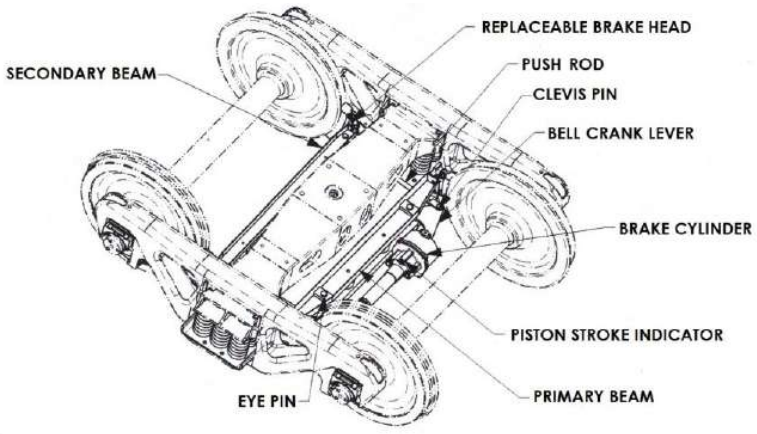
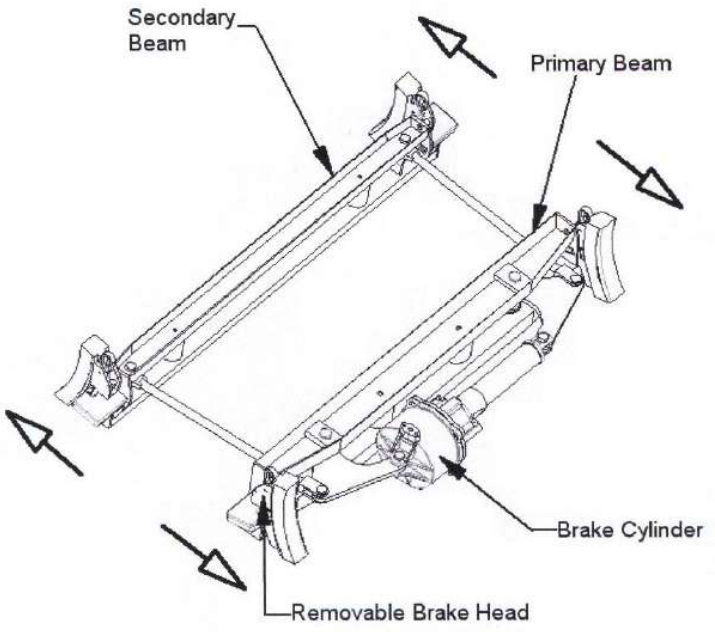


FIGURE -7.46

B WORKING DESCRIPTION OF BMBS

During application, the air is introduced into the brake cylinder, which forces out the piston along the ram assembly. The brake cylinder is floating in nature, as result the brake cylinder extends equally on both the sides. This extension of brake cylinder causes the rotation of the bell crank levers on their pivot (which is on primary brake beam) and forces the push rod to move towards the secondary beam. This movement causes the secondary brake beam to move towards the wheels and apply force on the wheels. Simultaneously a reaction force is developed which causes the primary brake beam (along with levers and brake cylinder) to move towards the wheels. The primary brake beam continues to move until it touches the wheels and apply force on the wheels.



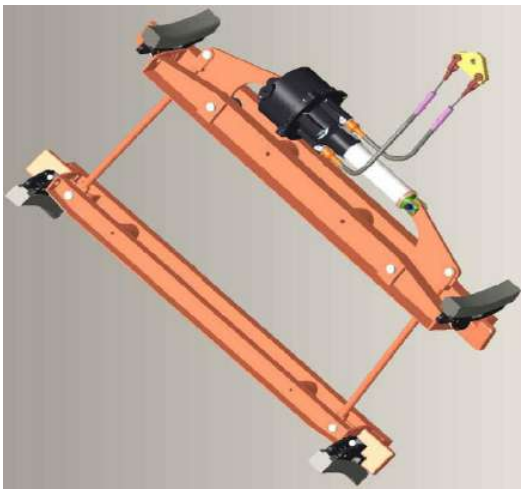


FIGURE -7.47

FIGURE -7.48

When the brakes are released, the air from the brake cylinder is exhausted to the atmosphere through the Distributor valve. The return spring inside the brake cylinder pushes the piston along with the ram assembly back to its original position. The bell crank levers rotate back, causing the beams to move back to their earlier positions. The brake cylinder is equipped with a double acting slack adjuster. If there is any wear (Brake Shoe/Wheel) or any slackness in the structure, it will be automatically compensated by the built in slack adjuster which pays out to fill the gap.

C SALIENT FEATURES

More Safety

Two nos. of 10" brake cylinders with inbuilt double acting slack adjuster have been used per wagon. Along with this an automatic load-sensing device has been used for two stage braking (empty / loaded). This delivers optimum braking performance and hence increases safety parameters. .

Reliability

Instead of one 14” cylinder, two 10” cylinders have been provided per wagon (one per bogie)., This increases the system reliability as in case of failure of one cylinder the wagon can be moved on another cylinder with the isolation of failed cylinder.

Cost Reduction

a) Maintenance cost

Two cylinders are provided with inbuilt slack adjuster, re-screwing of slack adjuster is automatic and can be done from the side of the wagon by a crow bar. The system simplified installation and even shoe wear helps extend the turn round time between wagon maintenance intervals.

b) Fitment cost

The BMBS is drop in fit product as new brake beams are provided to slide in the existing chutes of bogie. It is very easy to assemble, no special training or tools are required for assembly.

c) Pay load cost

A unique design that delivers optimum braking performance while minimizing weight. With the system has reduced the tare weight of wagon..

Easy Retro fitment

This brake system can be easily fitted on any standard bogie without making any modifications. This is a drop in fit system and does not require any kind of modifications in the existing bogie.

Simplified Hand Braking Installation

In this system, hand brake is easy to install provides improved reliability and safety. There is minimum number of levers in the hand brake mechanism.

Replaceable Brake Heads

Improved features replaceable brake heads which do not require disassembly of the bogie for installation. This system is a direct acting system and does not require levers or reverse direction devices.

Integral Double Acting Slack Adjuster

Integral double acting slack adjuster maintains a constant 56mm piston stroke, resulting in uniform and efficient braking performance even as the brake shoes and wheel wear. The slack adjuster has a total make up of 500 mm, compensating for 192 mm of nominal brake shoe wear and 188 mm of nominal wheel wear.

Patented Beam Design

The Beam design dramatically reduces bending loads in the beams, enabling the use of lighter structure with no sacrifice in the performance. In this system, cylinder is mounted parallel to the brake beams and transfers forces through the bell cranks. This parallelogram design improves the efficiency and aligns the braking forces with the wheels, which reduces the shoe and wheel wear.

Under Bolster Design

In this system push rods are positioned under the bolster and can be configured to work with all bogie designs.

- BMBS is reduces bending loads in the beams, enabling the use of lighter structure with no sacrifice in the performance. The brake cylinder is mounted parallel to the brake beams and transfers forces through the bell cranks. This parallelogram design improves the efficiency and aligns the braking forces with the wheels, which reduces the shoe and wheel wear.
- The system delivers optimum braking performance while minimizing weight.
- The system can be easily fitted on any IR standard casnub bogie without making any modifications. This is a drop in fit system and does not require any special tools and training for installation/assembly.
- To achieve uniform wheel loading, the loads are applied to the ends of the brake beam instead of center.
- The system uses IR standard 58 mm thick K type brake blocks.
- A replaceable brake head design permits the reuse of the beam in the event that the brake heads gets damaged. Replacement of the brake head is quickly accomplished by removal of only one pin.
- The push rods are positioned under the bolster. With this system the track clearance has been increased, as there is nothing under the spring plank of the bogie.

- Instead of one 14" cylinder, the system uses 2 nos. of 10" brake cylinders per wagon, one per bogie. This increases the system reliability as in case of failure of one brake cylinder, the wagon can be moved on with other brake cylinder with the isolation of failed brake cylinder.
- The integral double acting slack adjuster of the brake cylinder maintains a constant piston stroke resulting in uniform brake performance even as the brake shoes and wheels wear. The slack adjuster has a total make-up capacity of 500 mm, which will compensate for total combination of shoe wear, wheel wear and clearance.
- Re-screwing of slack adjuster is automatic and can be done from the side of the wagon by a pry bar.
- All cylinders are equipped with an automatic piston stroke indicator.
- The hand brake systems uses two steel hand brake cables pulled through standard hand brake rigging as a means to apply the hand brakes. The cables provide a flexible and lightweight interface to the hand brake actuator.
- Simplified installation and even shoe wear helps extend the turn round time between wagon maintenance intervals.
- The system also has an automatic pressure modification (APM) device for two stage braking (empty / loaded). It is fitted between wagon under frame and the bogie side frame.

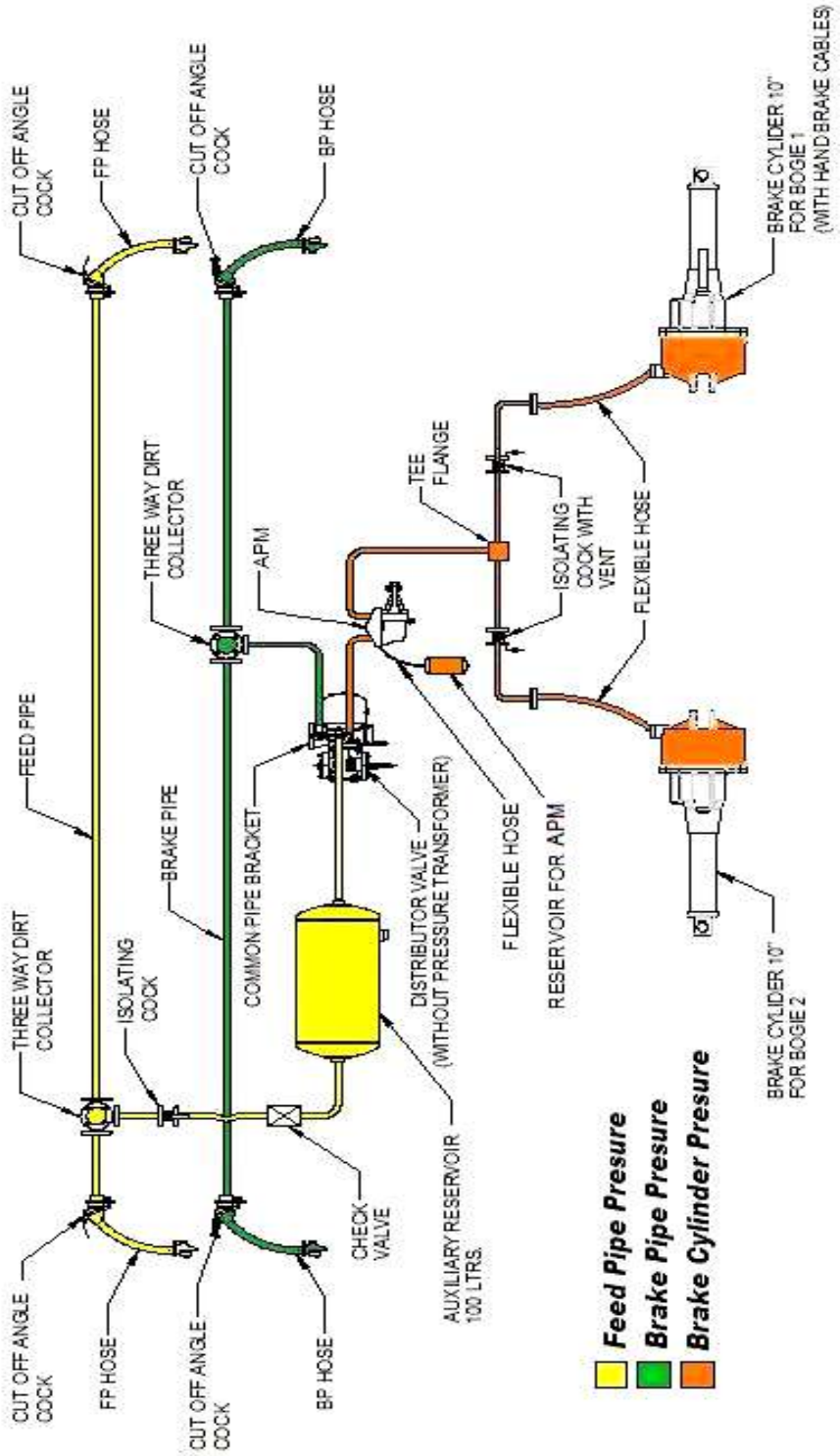


FIG.7.49. LAYOUT OF TWIN PIPE AIR BRAKE SYSTEM (BMBS)

D WORKING PRINCIPLE OF BMBS HAVING APM VALVE

The brake system provided on the wagons with BMBS is single / twin pipe graduated release system with automatic two stage braking. Its operating principle is as follows.

Schematic layout of single / twin pipe graduated release air brake system as provided on the wagons is shown in figures 7.1 & 7.49. Brake pipe / Feed pipe runs through the length of wagon. Brake pipes / Feed pipes on consecutive wagons in a train are coupled to one another by means of hose coupling to form a continuous air passage from the locomotive to the rear end of the train. Brake pipe is charged to 5 kg/cm^2 through the compressor of the locomotive. Brake pipe is charged to 5 kg/cm^2 through the compressor of the locomotive. Feed pipe is charged to 6 kg/cm^2.

The wagons are, provided with Automatic pressure modification (APM) device to cater for higher brake power in loaded condition instead of the conventional manual empty load device. With the provision of this, brake cylinder pressure of 2.2 ± 0.25 kg/cm^2 is obtained in empty condition and 3.8 ± 0.1 kg/cm^2 is obtained in the loaded condition.

To obtain this a change over mechanism, APM under-frame and side frame of the bogie. The mechanism gets actuated at a pre-determined change over weight of the wagon and changes the pressure going to the brake cylinder from 2.2 ± 0.25 kg/cm^2 to 3.8 ± 0.1 kg/cm^2 in case of changeover from empty to loaded and vice versa

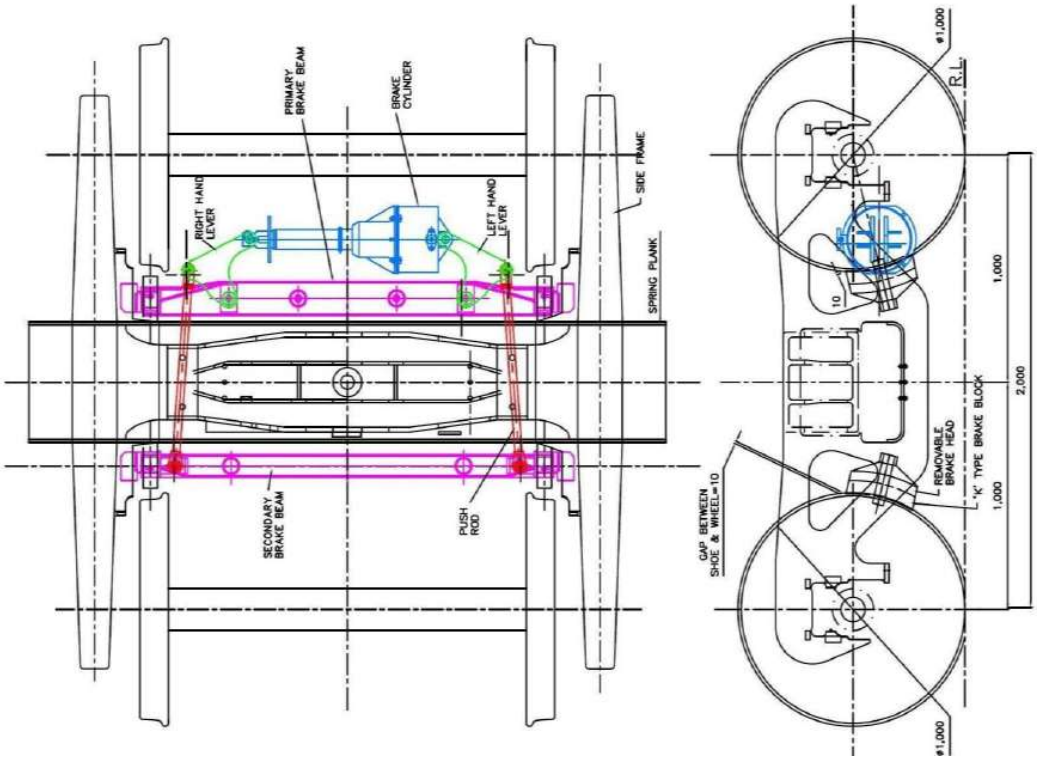


FIG. 7.50. DIAGRAM OF BOGIE FITTED WITH BMBS

For application of brake, air pressure in the brake pipe is reduced by venting it to the atmosphere from driver's brake valve in the locomotive. The reduction of the brake pipe pressure, positions the distributor valve in such a way that the auxiliary reservoir is connected to the brake cylinder through the APM device and thereby applying the brake. The distributor valve gives an output pressure of 3.8 kg/cm^2 for the brake cylinder which is routed through the APM device. Based on the position of sensor arm of APM device, it gives an output of 2.2 ± 0.25 kg/cm^2 for empty position braking and an output of 3.8 ± 0.1 kg/cm^2 for loaded position braking in the wagon.

During full service brake application, a reduction of 1.3 to 1.6 kg/cm^2 takes, a maximum brake cylinder pressure of 3.8 ± 0.1 kg/cm^2 in loaded condition and 2.2 ± 0.25 kg/cm^2 in empty condition is achieved. Any further reduction of brake pipe pressure has no effect on the brake cylinder pressure. During emergency brake application, the brake pipe is vented to atmosphere very quickly; as a result the distributor valve acquires the full application position also at a faster rate. This result in quicker built up of brake cylinder pressure but the maximum brake cylinder pressure will be the same as that obtained during a full service brake application.

For release of brakes, air pressure in the brake pipe is increased through driver's brake valve. The increase in the brake pipe pressure results in exhausting the brake cylinder pressure through the Distributor valve. The decrease in the brake cylinder pressure corresponds to the increase in the brake pipe pressure. When the brake pipe pressure reaches 5 kg/cm^2, the brake cylinder pressure exhausts completely and the brakes are completely released.

E EQUIPMENTS DESCRIPTION OF BMBS

Distributor Valve with Common Pipe Bracket and Control Reservoir

The distributor valve assembly consists of distributor valve, common pipe bracket, adapter, control reservoir and gasket. All pipe connection to distributor valve is through the common pipe bracket. The distributor valve along with the adapter can be removed from the pipe bracket without disturbing the pipe connection for maintenance purpose.

The control reservoir of 6 litres volume is directly mounted to the pipe bracket. An isolating cock (R-charger handle) is provided on the distributor valve to isolate the distributor valve when found defective. The handle of the R-charger will be placed in vertical position when the distributor valve is in open position and horizontal when the distributor valve in closed position. A manual release handle is provided at the bottom of the distributor valve by which the brake in a particular wagon can be released manually by pulling the handle.

The distributor valve used with bogie mounted brake system has a different set of Application & Release chokes to achieve the timings as specified in the RDSO specification 02-ABR. The choke sizes to be used for Distributor valve fitted on wagons with BMBS for KE Version of distributor valve are 1.42 mm for Application & 1.52 mm for release. The other makes of distributor valves should be adopted with suitable choke sizes to achieve Brake Application & release timings as specified in 02ABR but with a stroke of 110 mm of 14" Brake Cylinder. For identification, the Distributor Valve is equipped with a name plate" BMBS " on choke cover.

Brake Cylinder with built-in Double acting Slack Adjuster

The brake cylinder receives pneumatic pressure from auxiliary reservoir after being regulated through the distributor valve and APM device. Brake cylinder develops mechanical brake power by outward movement of its piston with ram assembly.

The piston rod assembly is connected to the brake shoes through a system of rigging arrangement to amplify and transmit the brake power. The compression spring provided in the brake cylinder brings back the ram thus the rigging is also brought to its original position when brake is released.

FIG. 7.51. BRAKE CYLINDER - 10”DIA.

The built-in slack adjuster compensates for the wear of brake blocks during the brake application through equivalent pay-out. For paying-in, a pry bar is applied between the brake shoe and wheel and the rigging is pushed in.

The brake cylinder has got a double acting slack adjuster as a result the actuator of brake cylinder will continue to move out till all the slack in the system is take care off and reaction force of the wheels is encountered. This ensures that every time every time the brake application takes place, sufficient brake force is delivered on the wheels.

The brake cylinder compensates for any change in gap between brake block and wheel through the inbuilt slack adjuster. Therefore it maintains a constant gap between the shoe and wheel and hence a constant piston strike. The slack adjuster works in both the condition whether there is an increase or decrease in gap. Since the brake cylinder maintains a constant piston stroke, there is no need to measure the piston stroke time and again.

There is an indicator on the brake cylinder to show the "APPLIED" or "RELEASED" condition of the Brake Cylinder. Don't hit the indicator, it may retract slowly. Hitting can bend / damage the indicator.

The brake cylinder has slack adjustment of 500 mm which could compensate of brake block wear of 48 mm (From 58 to 10 mm) and wheel wear of 47 mm (i.e., wheel dia reduce from 1000 mm to 906 mm).

The brake cylinders used on the bogie mounted brake system are of two types; with hand brake cables and without hand brake cables. The brake cylinder with hand brake cables are used for interface with the hand brake arrangement on the wagons.

APM Device

APM device is interposed between bogie side frame of casnub bogie and the under frame of the wagon. It is fitted for achieving 2-stage load braking with automatic changeover of brake power. Only one APM is required per wagon. It restricts the brake cylinder pressure coming from the Distributor valve to 2.2 ± 0.25 kg/cm^2 in empty condition of the wagon and allows the brake cylinder pressure of 3.8 ± 0.1 kg/cm^2 in loaded condition of the wagon. The sensor arm of the APM device comes down for sensing only during the brake application.

FIGURE: 7.52- APM DEVICE (El-50 VALVE)

The complete movement of the sensor point is 104 mm. The first 80 mm of the sensor point is for the loaded zone and the balance is for the empty zone. The deflection of the bogie from tare to changeover weight is added to 80 mm to arrive at the total movement of the sensor point to be adjusted on the wagon. The gap between the sensor point and the bogie is to be measured at the point it touches the top surface of the side frame. Also ensure that the sensor point touches in the middle of the side frame.

It has an indicator to show the empty or loaded position. Whenever the indication is "ON" i.e., it is showing the orange colour, it is indicating the empty condition with brake cylinder pressure of 2.2 ± 0.25 kg/cm^2. When there is no indication in the indicator, it is loaded condition with 3.8 ± 0.1kg/cm^2 going to the brake cylinder. It has a quick connect socket to connect the gauge to the check the pressure through the pressure gauge.

Auxiliary Reservoir

An auxiliary reservoir of 100 litres is provided on each wagon to store compressed air. It is charged to 5 Kg/cm^2 pressure through the distributor valve in case of single pipe system. However in case of twin pipe system, it is charged to 6 Kg/cm^2 through the feed pipe.

The auxiliary reservoir is made out of sheet metal. On both the ends of the reservoir, flanges are provided for pipe connection. One end of the reservoir is kept blanked for operation with single pipe brake system. A drain plug is provided at the bottom of the reservoir for draining the condensate.

Cut-Off Angle Cock

Cut off angle cocks are provided at the ends of brake pipe / feed pipe on each wagon. These cocks are closed at the time of uncoupling of wagons. The vent provided in the cock facilitates easy uncoupling of hose coupling by venting the air trapped in the hose coupling when the cock is closed. The handle of angle cock is spring loaded having a self locking type of arrangement to avoid any inadvertent movement from open to close position or vice versa. The handle has to be lifted to operate the angle cock. When the handle is parallel to the pipe the cock is in open position and when at right angles to the pipe it is in closed position.

Hose Coupling for Brake *I* Feed pipe

The hose couplings are provided to connect brake pipeline & feed pipe line throughout the train. It consists of rubber hose connected to coupling head and nipple by "Band it" type of clamps. The nipple goes into the angle cock and the coupling heads are coupled together. Rubber gasket is used in the coupling head to make the joint leak proof.

Dirt Collector

Dirt collector is provided at the junction of the main brake pipe and branch pipe. This is meant for removing dust from the air prior to entering the distributor valve. This is achieved by centrifugal action.

Isolating Cock

Isolating cock without vent is provided in the FP line of the twin pipe wagons. The isolating cock is used to isolate the FP pressure to the Auxiliary reservoir. The isolating cocks are OLP type meaning that when the handle is parallel to the body, it is an open position for the cock.

Isolating Cock with vent

Isolating cocks with vent are provided in BC lines for isolating the mal-functioning brake cylinders on the wagon. The vent side of the isolating cock is to be maintained towards the brake cylinders in order to exhaust the pressure from the brake cylinder whenever the need arise. The isolating cocks are OLP type meaning that when the handle is parallel to the body, it is an open position for the cock.

Pipes

ERW stainless steel pipes as per ROSO specification 04-ABR is used for wagons with Bogie Mounted Brake System. Pipes of 32 mm & 20 mm nominal bore are generally employed. The pipes are cold bend with the help of bending equipment. The radius of the bends is to be kept to the maximum possible so as to reduce restriction of air flow.

Pipe fittings

Welded and swivel flange fittings are used for pipe joints. Fixed flanges are rigidly welded to pipes; whereas the Swivel flanges are used to align to the fixed locations. Rubber gaskets are used to seal the joints.

F CRITICAL BOGIE DIMENSION FOR FITMENT OF BMBS

In order to ensure trouble free fitment of the Bogie mounted brake system, it is necessary that the following Bogie dimension are checked and maintained before fitment.

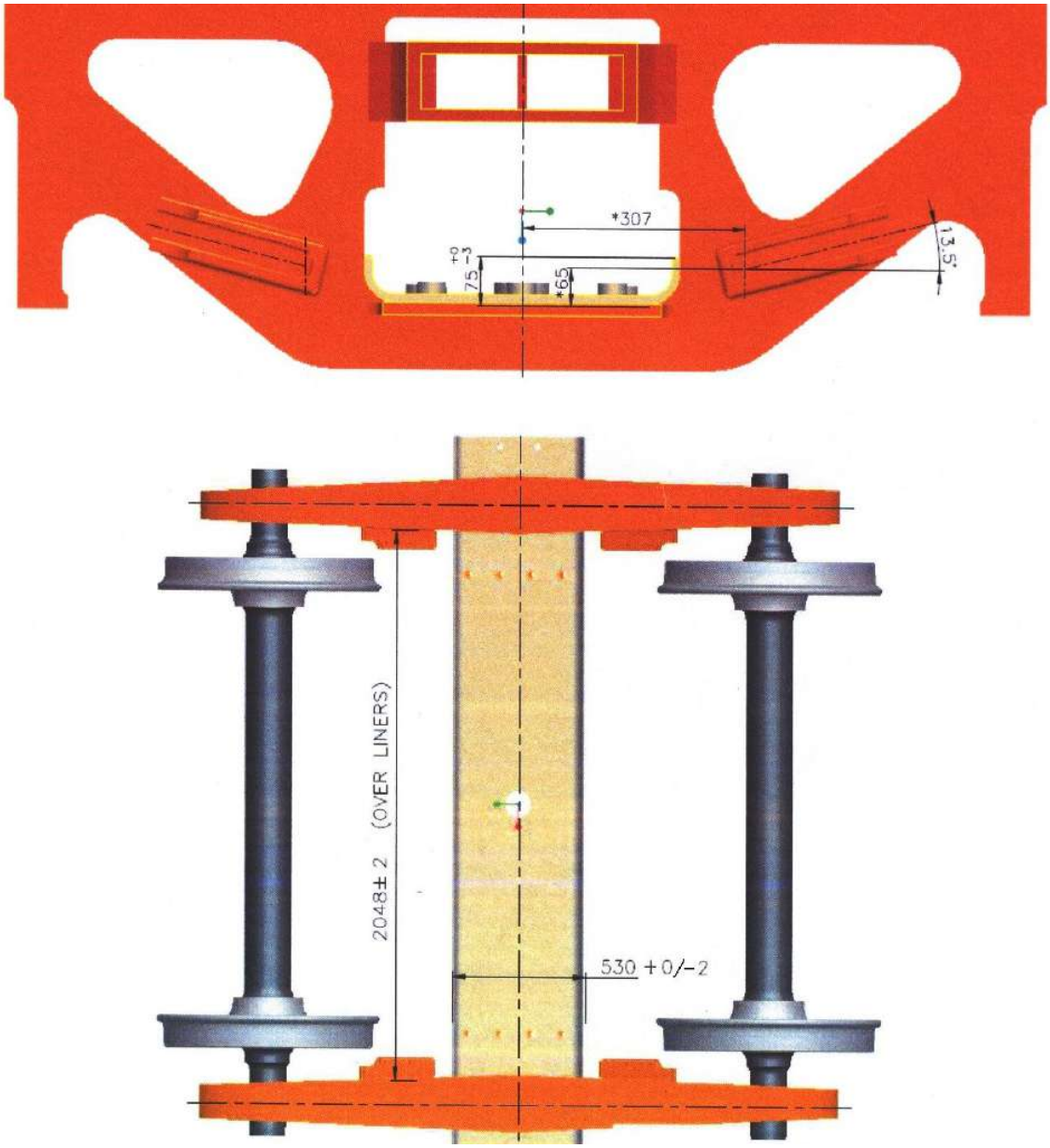


FIGURE: 7.53- CRITICAL BOGIE DIMENSION

G PROCEDURE FOR INSTALLATION OF BMBS ON CASNUB BOGIE

Installation Procedure:

Refer for Installation of Equipment and its adjustments;

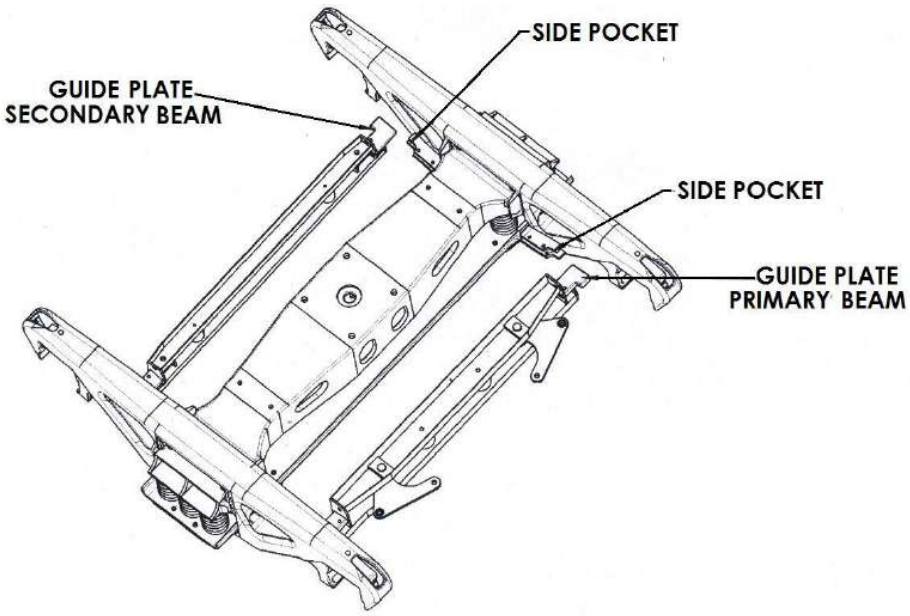


FIGURE: 7.54

Tools Required

i. Pry Bar
ii. Pliers

1. To install the beams it is necessary to split the bogie. Lift the bolster and move the axles with wheels outside the side frame. Slide the primary beam assembly 1A inside the side pockets in the side frame. Place the bell crank levers 10 & 18, as per their respective position on the primary beam assembly 1A. Push the Pin 19 through the beam 1 A and bell crank levers 10 & 18. Bend the Cotter pin 23 after inserting inside the Pin 19. Slide the secondary beam assembly 1 B inside the side pockets on the other side.
2. Install the push rods 3 between the bell cranks and the secondary beam 1 B. Secure the push rods to the secondary beam with the pin 4 and cotter pin 6.
3. Secure the push rod 3 with bell crank levers with pin 5 and cotter pin 6 on primary beam sides.
4. Attach the Brake Cylinder 11 to the bell crank levers with two sets of pins 4, bush 25 and dowel sleeve 24 after aligning the mounting holes in the brake cylinder and the bell crank levers.

Note

- Air connection flange and Ram of brake cylinder 11 to be oriented / fitted as per the Air Brake Equipment and Under Frame Gear Arrangement drawings. Cylinder with hand brake is to be installed considering the location of Bracket 16.

- ❖ Brake cylinder 11 ram should be in fully retracted position prior to installation.

5. Place the brake heads 7 on the guide plates of the brake beams 1A & 1 B. Secure the brake heads to brake beams with pin 8 and lock the same with cotter pin 9.
6. Assemble the bogie by lowering the bolster with side frame on the axle and wheel assembly.
7. Install new 58mm K-type brake shoe to beam assemblies (1A & 1B) on brake heads 7. Insert brake block keys 21 to hold brake blocks to the removable brake heads.
8. Connect air hose from BC pipe line to the flange on top of cylinder 11.

For Brake cylinders with Hand Brake Cables

9. Bracket for cable end support is welded to a convenient place on the under frame of the wagon such that the bend radius of the cables is not less than 255 mm. (Refer under frame equipment installation drawings of the concerned wagon).
10. Attach the cable conduits to the bracket 16 by placing one nut and one washer on each side of bracket 16.
11. Tighten the lock nut to secure the cables to the bracket properly.
12. Connect both cables 13 to the cable equalizer 17 using pins 14 and cotter pins 15.
13. Connect air hose from BC pipe line to the flange on top of cylinder 11.

Hand brake rigging

14. Handbrake system requires a set of rigging between equalizer 17 and the handbrake wheel as per requirement of particular type of wagon.
15. Apply brakes, 2-3 times to the brake cylinder 11 to ensure correct piston stroke is achieved. Release air pressure.

Warning

To avoid personal injury from movement of the various parts when operating the system, all personnel must be clear of Bogie and Brake pads before the cylinder is pressurized.

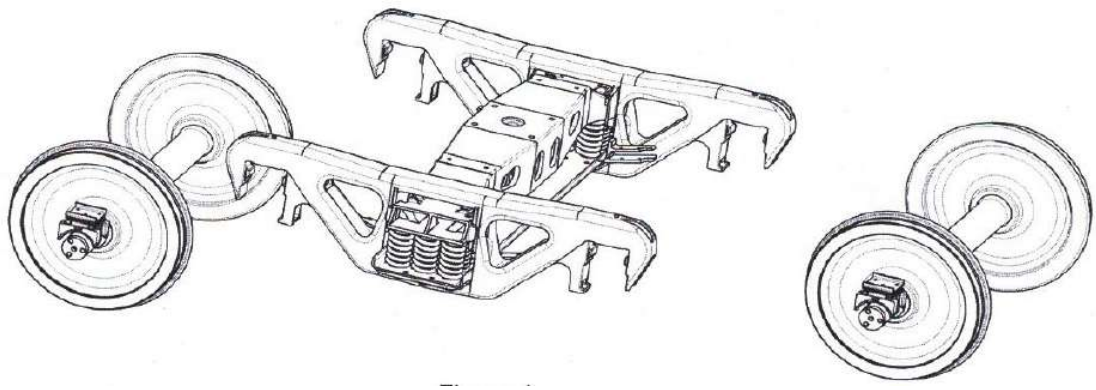


FIGURE: 7.55

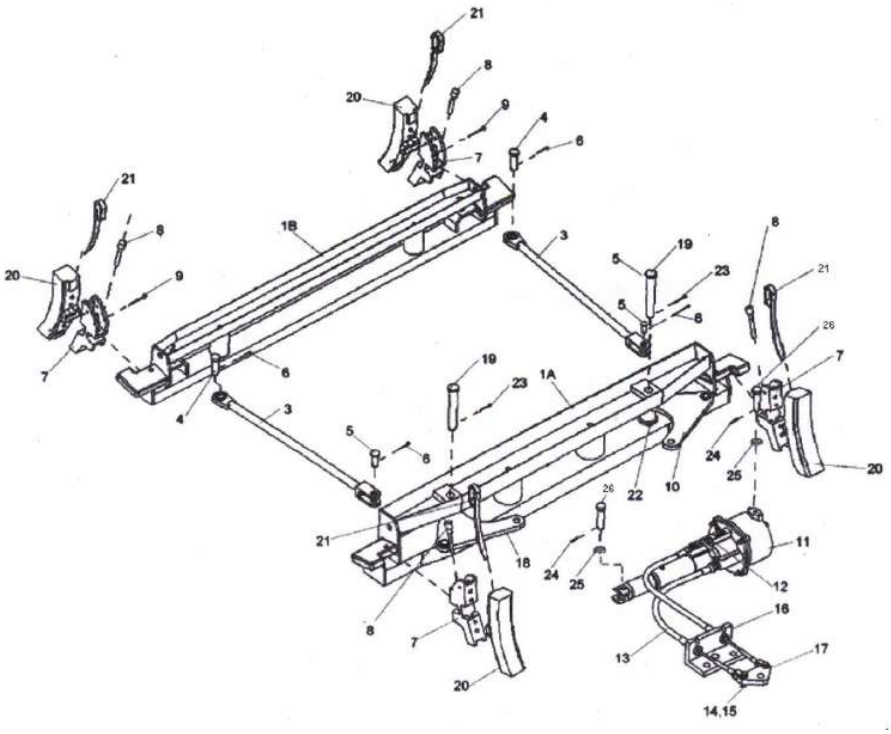


FIGURE: 7.56

Adjustments

Adjustment is completely automatic and is accomplished by the inbuilt slack adjuster. The slack adjuster in the brake cylinder is double acting. It automatically maintains a constant piston stroke by taking up or letting out slack with each brake application. The piston stroke indicator is mounted on top of the non-pressure body of the brake cylinder. The extension of the brake cylinder ram will increase as the shoes and wheels wear. On a wagon in service, it will be clearly visible as a shiny ring near the ram scraper on the cylinder.

Components of Bogie with Hand Brake Arrangement (See Figure – 7.41)

1.	**Set of Brake Beams**
1(A)	Beam, Primary
1(B)	Beam, Secondary
3)	Push Rod Assy.
4)	Secondary Beam Pin
5)	Push Rod Pin
6)	Pin, Cotter (6.3mm dia x 50mm)

7)	Brake Head
8)	Pin, Brake Head
9)	Pin, Cotter (6.3mm dia x 75mm)
10)	Lever Assy. (RH)
11)	Cylinder Assy. 10" with Hand Brake

Cylinder Assy. 10" with Hand Brake	
12)	Piston Stroke Indicator
13)	Cable Assy.
14)	Pin, Cable
15)	Pin, Cotter
16)	Cable Bracket
17)	Cable Equalizer
18)	Lever Assy. (LH)
19)	Primary Beam Pin
20)	Brake Block
21)	Brake Block Key
22)	Washer, Thrust
23)	Pin, Cotter (8mm dia x 50mm)
24)	Dowel Sleeve
25)	Bush
26)	Brake Cylinder Pin

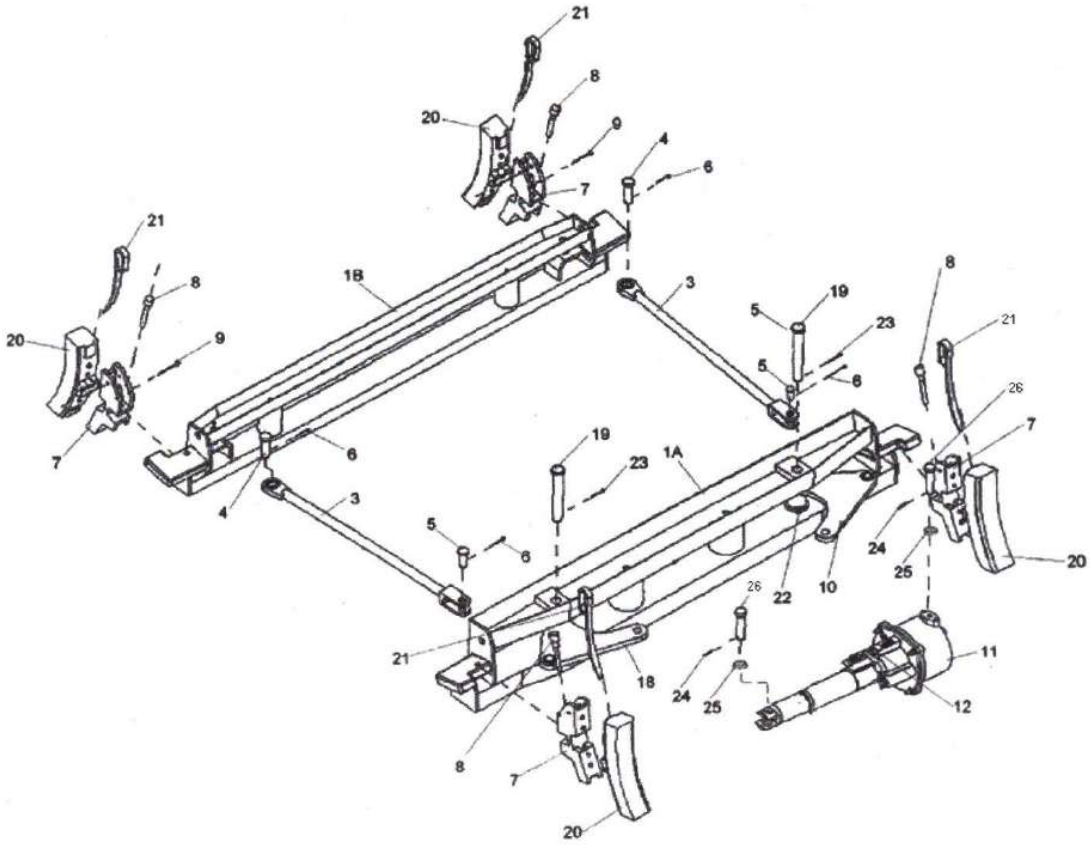


FIGURE: 7.57

Components of Bogie without Hand Brake Arrangement (See Figure – 7.41)

1)	Set of Brake Beams
1A)	Beam, Primary
1B)	Beam, Secondary
3)	Push Rod Assy.
4)	Secondary Beam Pin
5)	Push Rod Pin
6)	Pin, Cotter (6.3 dia x 50mm)
7)	Brake Head
8)	Pin, Brake Head
9)	Pin, Cotter (6.3 dia x 75)
10)	Lever Assy. (RH)

Cylinder Assy. 10" without Hand Brake	
11)	Cylinder Assy. 10" without Hand Brake
12)	Piston Stroke Indicator
18)	Lever Assy. (LH)
19)	Primary Beam Pin
20)	Brake Block
21)	Brake Block Key
22)	Washer, Thrust
23)	Pin, Cotter (8 mm dia x 50)
24)	Dowel Sleeve
25)	Bush
26)	Brake Cylinder Pin

Procedure for changing of Brake Blocks (Refer figure 7.41

a. Changing the brake shoe with BMBS is easy and fast. Ensure that the brakes are released. Slip in a pry bar between the brake block & wheel on anyone wheel of the bogie. Force back the brake block from the wheel, thus retracting the double acting slack adjuster and creating space for inserting new brake blocks between the brake head and wheel. To get more gap push the beam across the side pockets

b. Remove the brake block keys and replace the brake blocks. Secure the new brake blocks with the brake block keys. The slack adjuster will automatically adjust the brake shoe clearance to the proper value when the brakes are' applied and released. This usually takes from two to three brake applications.

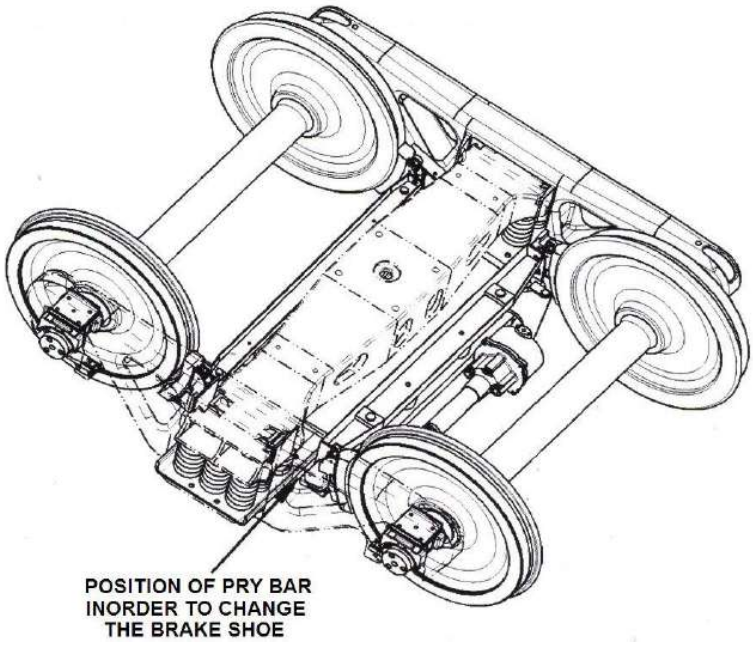


FIGURE: 7.58

H PROCEDURE FOR CHANGING OF PARTS AND LIFTING OF UNDERFRAME

Isolation of Brake Cylinder

a. There are two isolating cocks with vent in BC line for isolating each brake cylinder in the wagon.

b. To isolate any particular Bogie / Brake Cylinder, move the isolating cock (OLP types) handle to closed position. This will stop the further feeding of corresponding brake cylinder and the air already present in the brake cylinder will get exhausted to atmosphere, thus, releasing the brakes in that particular bogie.

Changing of Brake Head (7) (See figure 7.40 & 7.41)

a. Ensure that the brakes are released. Slip in a pry bar between the brake block 20 & wheel on anyone wheel of the bogie. Force back the brake block from the wheel, thus retracting the double acting slack adjuster (figure-6) and creating the space between the brake block and the wheel.

b. Remove the brake block key 21 and then the brake block 20.

c. After obtaining enough clearance between the wheel & the brake heads 7, remove the cotter pin 9 & the brake head pin 8 consecutively to remove the desired brake head.

d. Install a new brake head 7 and secure it with brake head pin 8 then a cotter pin 9. Bend cotter pin legs outwards.

e. Place the brake block on the new brake head and secure the brake block with the brake block key.

f. The slack adjuster will automatically adjust the brake shoe clearance to the proper value when the brakes are applied and released. This usually takes from one to three brake applications.

Changing of Brake Cylinder (11) (See figure 7.40 & 7.41)

a. Ensure, the brakes are released and the brake cylinder is completely vented. Retract the brake cylinder 11, use pry bar between wheels & brake blocks on both, the secondary beam 1 B & the primary beam 1 A. Force the brake cylinder 11 to retract completely.

b. Disconnect the air hose from the cylinder assembly (11) flange.

c. Remove the dowel pin 24, bush 25 then rod eye pin 4 on both sides of the cylinder. Install a new brake cylinder assembly 11, being sure the cylinder is of the same size and aligned in the same way as the previous cylinder, using rod eye pin 4. Secure the brake cylinder with bush 25 & dowel pin 24.

d. Reconnect the air hose to the cylinder assembly 11 flange.

e. Apply partial brakes 2 - 3 times in order to restore the internal slack adjuster's position.

Note

For cylinders equipped with the hand brake cables (see fig. 15), it is necessary to:

f. Disconnect the cable clevises from the equalizer 17 by removing the two cotter pins 15 and cable pins 14.

g. Remove the two cables 13 from the cable bracket 16.

Changing of Lever Assembly {RH (10) & LH (18)}

(See figure 7.40 & 7.41)

This change will be required if this part has been damaged or worn out.

a. Remove the cotter pin 6 and the rod clevis pin 5 with pull rod. Remove the bush 25, dowel sleeve 24 and the rod eye pin 4 with brake cylinder. Remove the cotter pin 23 and pin lever 19 with the primary brake beam 1A. Pull the bell crank lever RH 10 & .LH 18 from the beam assembly 1 A. Install a new lever RH 10 or LH 18 as applicable using the pin lever 19 and the cotter pin 23. Install pins 5 and cotter pin 6. Install pin 4 with bush 25 & dowel sleeve 24. Bend cotter pin legs.

b. The slack adjuster will automatically adjust the brake shoe clearance to the proper value when the brakes are applied and released. This usually takes from one to three brake applications.

Changing of Push Rod (3) (See figure 7.40 & 7.41)

This change will be required if this part has been damaged or worn out.

a. Remove the cotter pin (6) and the rod clevis pin (5) with bell crank lever. Remove the cotter pin (6) and the pin rod eye (4) with secondary brake beam 1 B. Remove the pull rod from lever assembly RH 10 or LH 18. Pull the rod from the secondary beam. To install a new push rod, align the rod end hole with the mounting holes in the secondary beam 1 B and then insert the pin 4 and the cotter pin 6. Bend the cotter pin legs. Do the same procedure on the other end of the rod by aligning the rod with the lever assembly RH 10 or LH 18 with pin 5 and cotter pin 6.

b. The slack adjuster will automatically adjust the brake shoe clearance to the proper value when the brakes are applied and released. This usually takes from one to three brake applications.

Lifting of under frame from Bogie

1. Disconnect the air hose from the flange of brake cylinder without hand brake cables by unscrewing the bolts.
2. Disconnect the air hose from the flange of brake cylinder with hand brake cables by unscrewing the bolts.
3. Disconnect both the cables from the equalizer cable by removing the split pins and the pins.
4. Detach the cables from the cable bracket by loosening the nuts on either side of the cable bracket. Remove the cables from the bracket after the nuts have been loosened and enough space is created for easy removal.

After the removal of brake cylinder hoses and the hand brake cables from the under frame, the wagon under frame can be lifted from the bogies.

The bogie can be dismantled or assembled with the bogie mounted parts by following maintenance instruction described earlier.

I. CONDEMNING LIMITS OF SYSTEM COMPONENTS

Brake Head (7) (See figure 7.42 & 7.43)

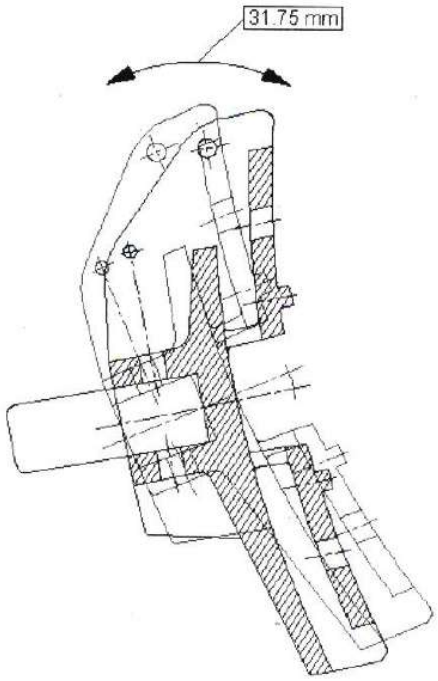


FIGURE -7.59 - Brake Head

Brake Head 7 should be replaced if the following exists.

Check brake head tip. Push brake head forward and measure travel by pulling brake head all the way back. Tip travel should NOT exceed 31.75 mm.

Bell Crank Lever Assembly RH (10) & LH (18) (See figure 7.42)

Bell Crank Levers should be replaced if anyone of the following exists:

1. Excessive Wear on any surface

- Excessive is anything> 1.6 mm

2. Worn, Damaged or Broken Spherical Bearing

- Worn/Enlarged Pin Holes
  - 25.4 mm Hole exceeds 26.7 mm in any direction (i.e.: oval condition)
  - 32 mm Hole exceeds 33 mm in any direction (i.e.: oval condition)

Push Rod (3) (See figure 7.42)

Push Rods should be replaced if anyone of the following exists:

- Any part of the push rod is Bent

- Cracked or Damaged Welds
- Excessive Wear on any surface
  - Excessive is anything> 1.6 mm
- Worn, Damaged or Broken Spherical Bearing
- Worn/Enlarged Pin Hole
  - 25.4 mm Hole exceeds 26.7 mm in any direction (ie.: oval condition)
- .Clevis End Gap Exceeds 27.9 mm.

Brake Beams 1 A & 1 B (See figure 7.59 & 7.60)

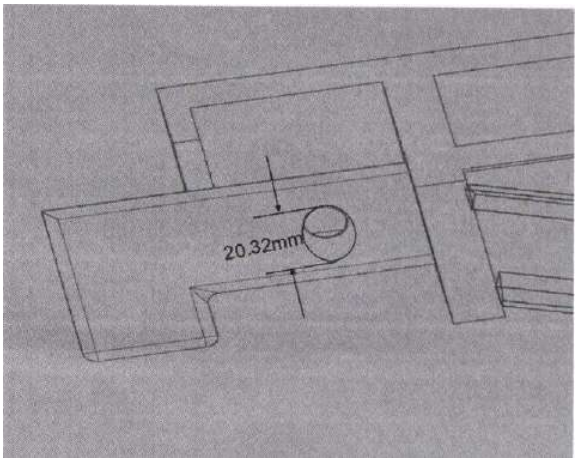


FIGURE -7.60– Worn Condition

Brake Beam should be replaced if the following exists.

Remove Brake Head and inspect Brake Head pin hole in Beam. If hole exceeds 20.32 mm in length, replace Beam. If not, replace brake head and recheck tip as described earlier. Tip should not exceed 31.75 mm (from FIRST check above). If tip does exceed 31.75 mm, replace Beam and Brake Head

Gap between Bell crank lever RH 10 & LH 18 and the upper channel of Primary brake beam 1A (See figure 7**.61** below)

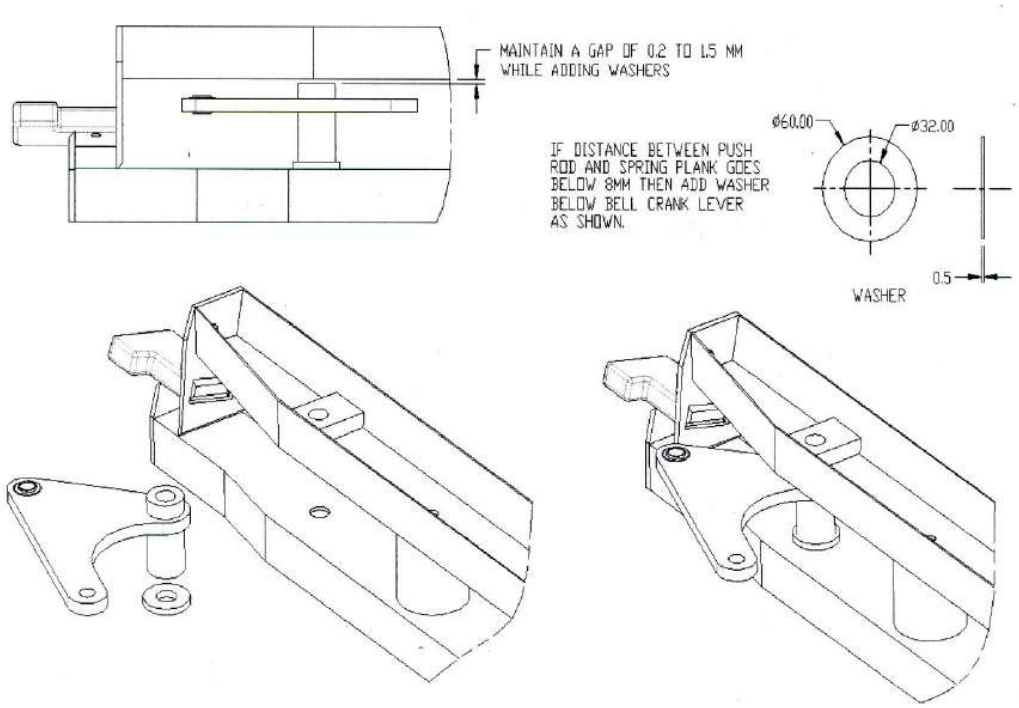


FIGURE -7.61 – Worn Condition

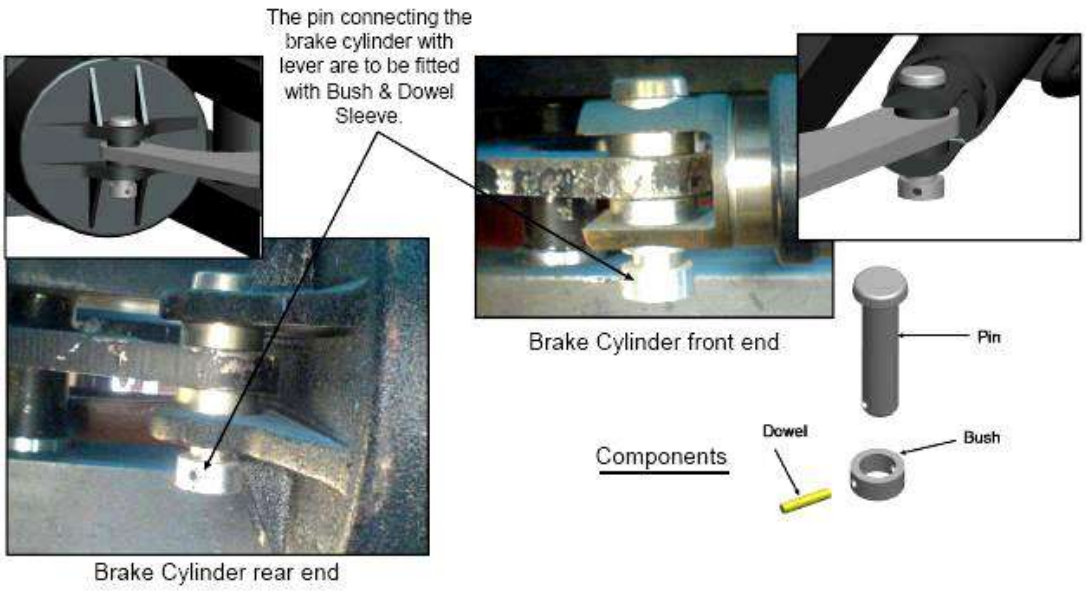
Measure the bell crank lever dimension with reference to the lever being supported inside the primary brake beam. Measure the maximum pass through gap.

Note the locations of the measurement for the lever and the position of the lever in regards to the primary brake beam.

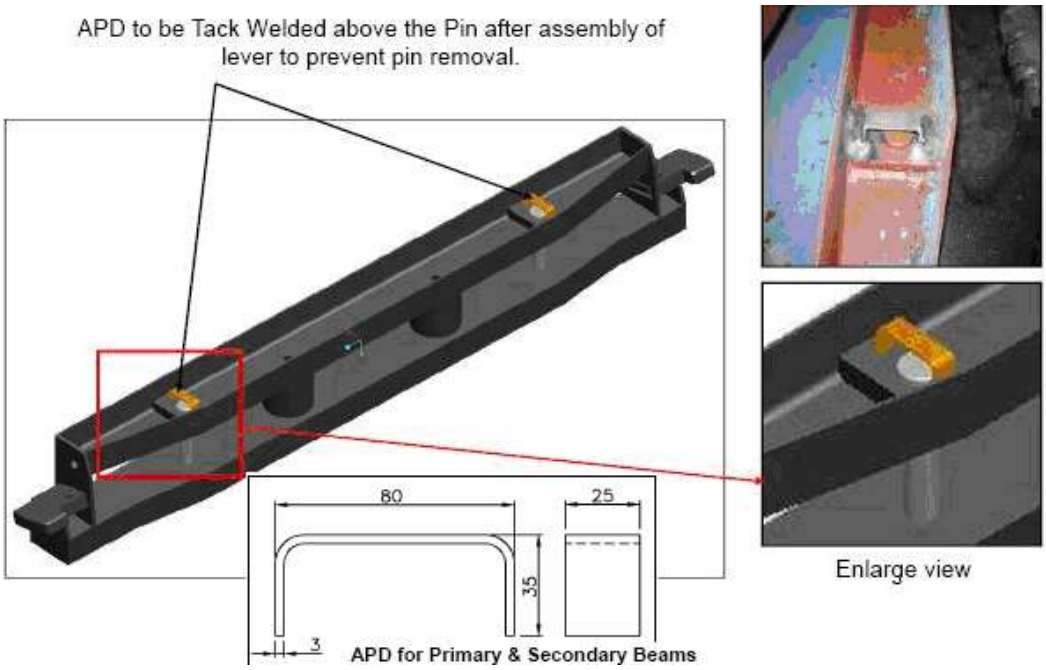
Use washers as demonstrated to adjust the gap.

J. Anti Pilferage Devices (APDs)

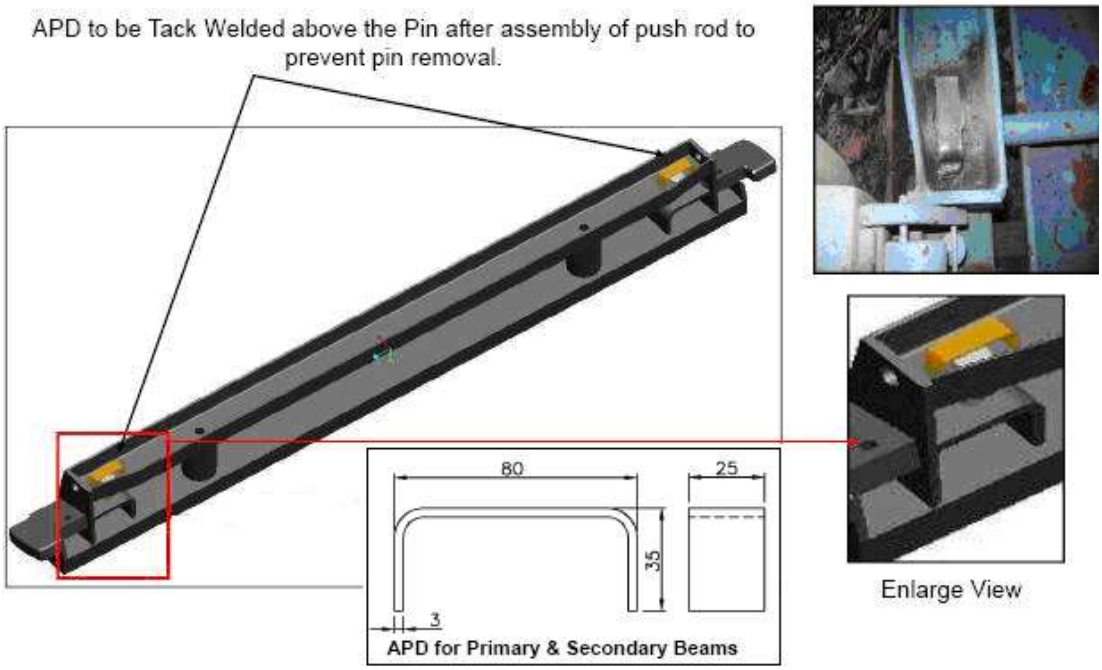
(A) APD for Pins on Bogie Brake Cylinder



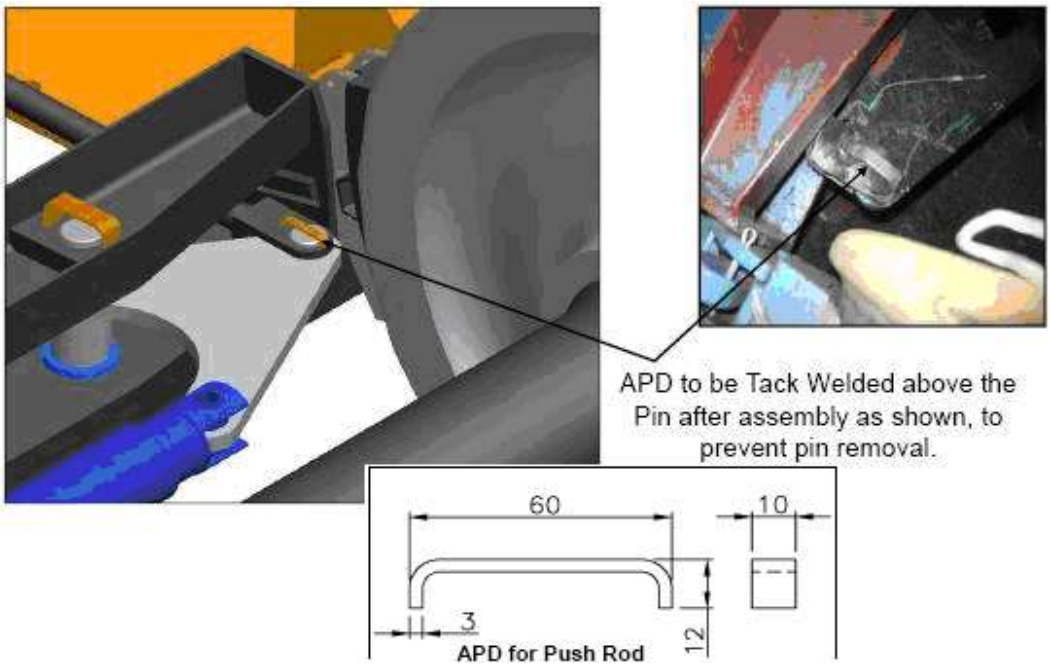
(B) APD for Primary Brake Beam



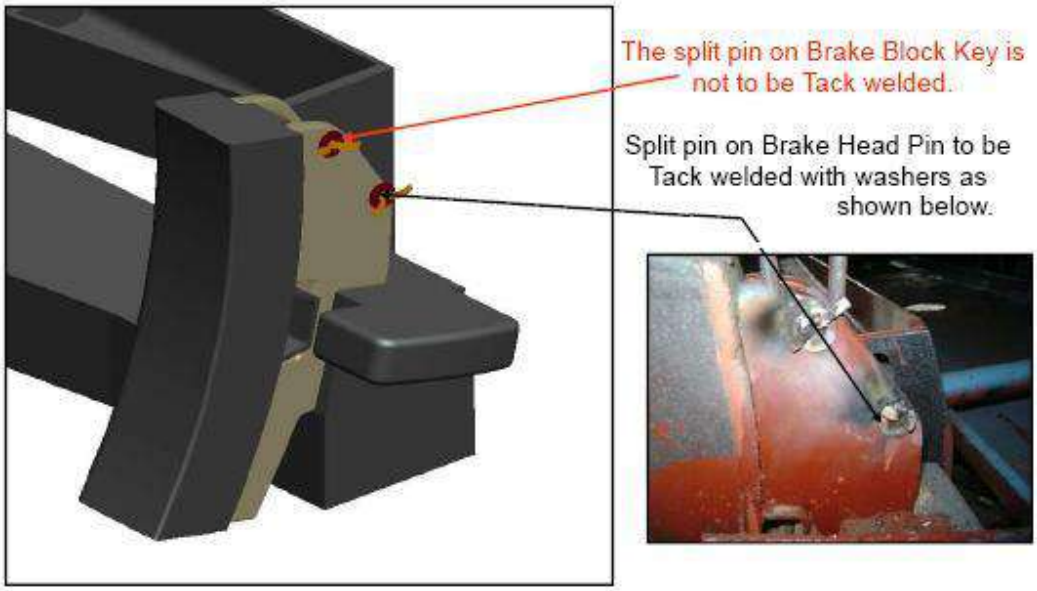
C) APD for Secondary Brake Beam



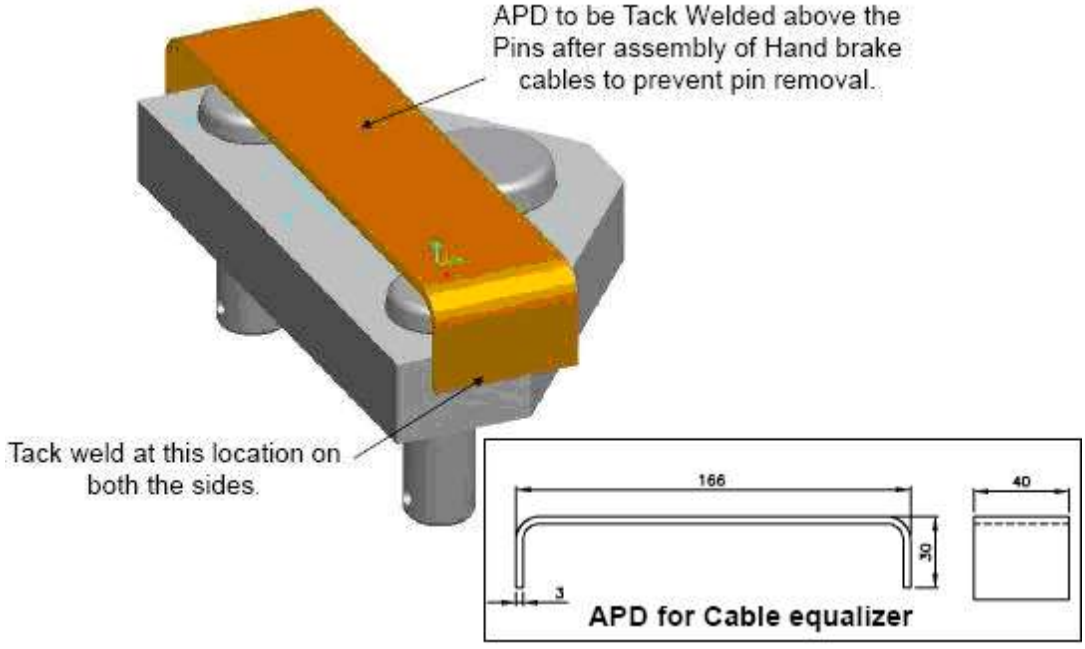
(D) APD for Push Rod



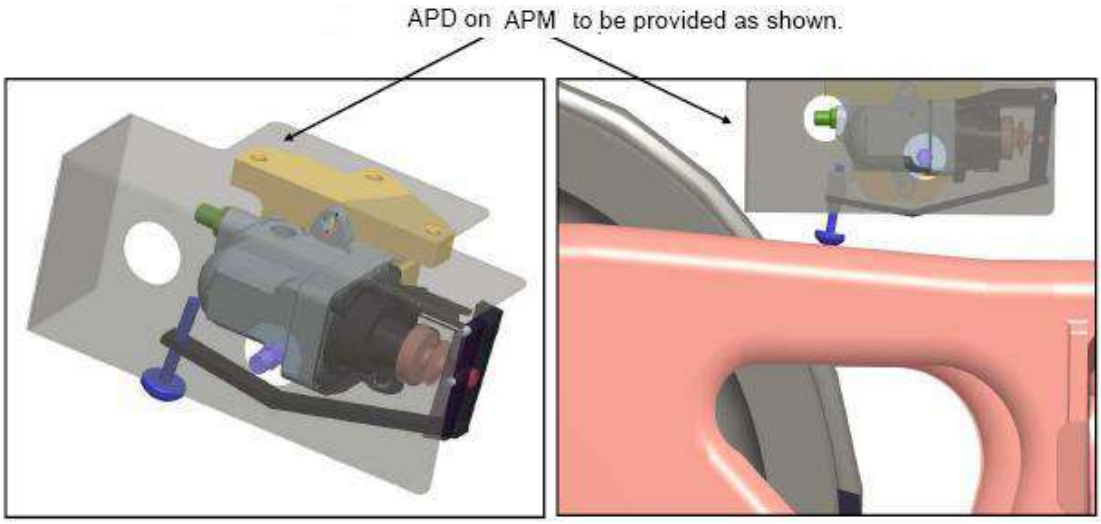
(E) APD for Brake Head

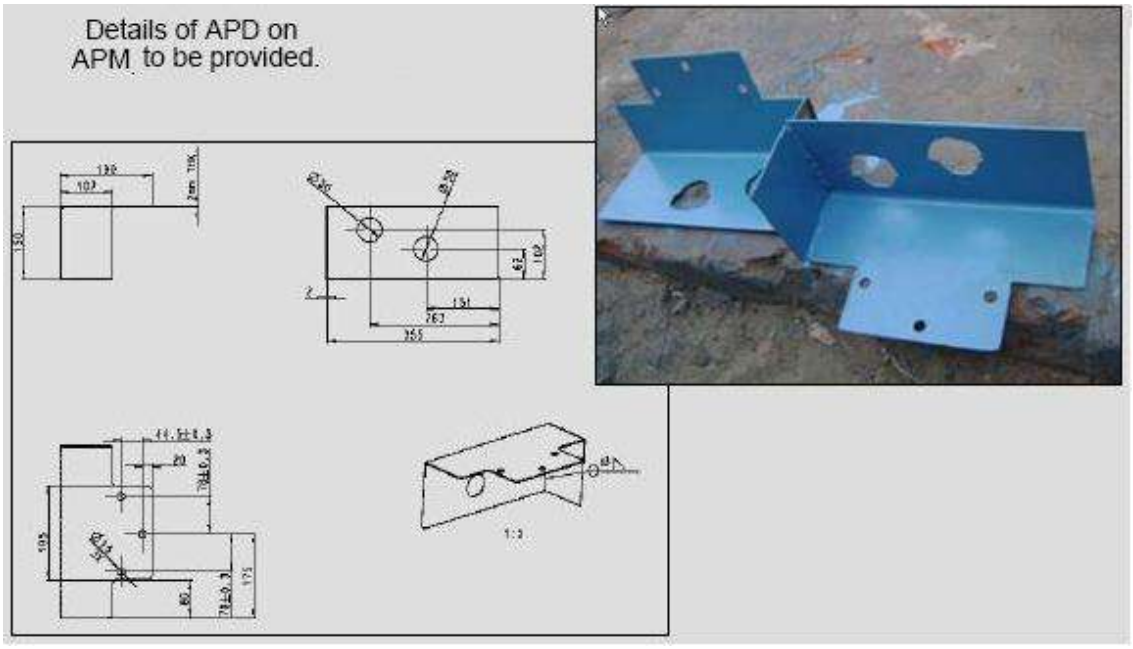


(F) APD for Cable Equalizer

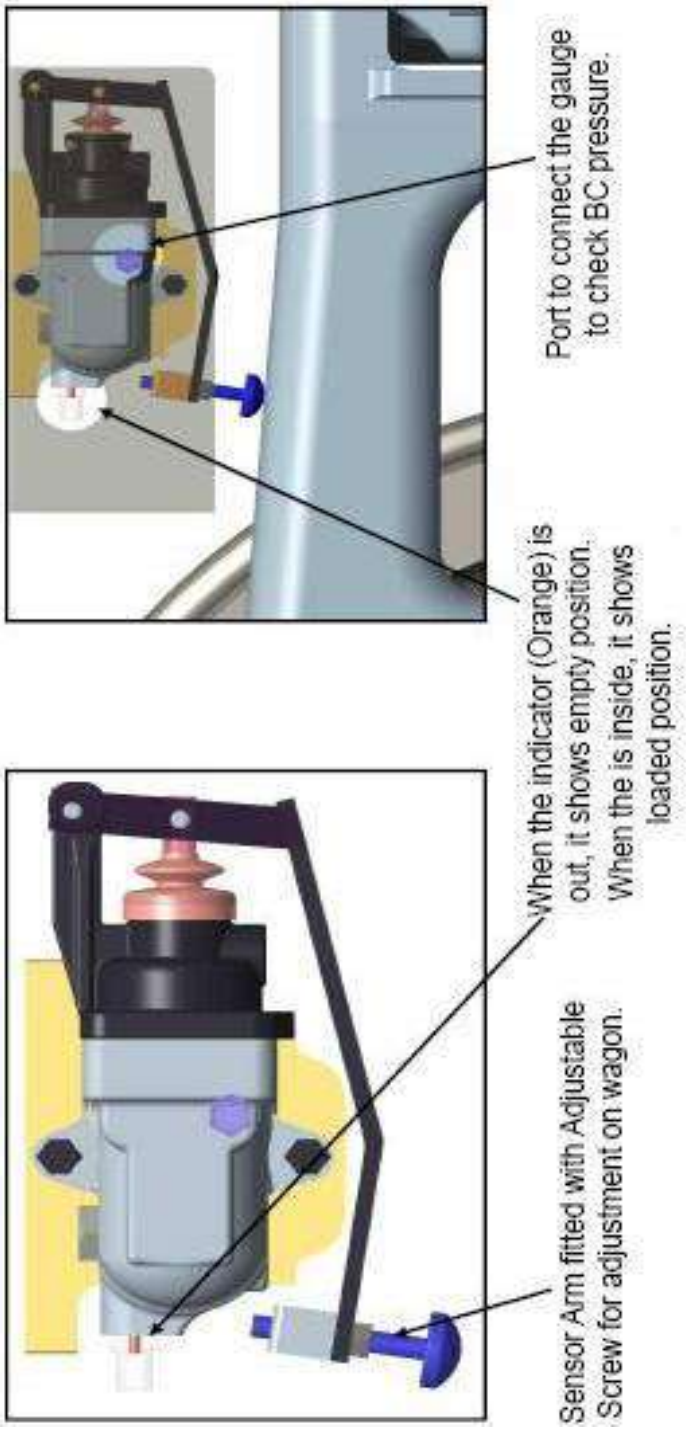


(G)APD on APM


APD on APM to be provided as shown.


Details of APD on
APM to be provided.

(H) Lock nut on APM



K. MAINTENANCE IN OPEN LINE

1. BOGIE RIGGING; BRAKE BEAMS, BELL CRANKS LEVERS & PUSH RODS

a) Check all the pin joints for any missing parts (pins, split pins, spring dowel, etc), if missing, provide the same.

b) Check the components for missing or any physical damage, if found replace them.

c) Check that the APD is provided on all the pins and on the APM.

d) Check that the all hoses are properly tightened and are not threatened to be damaged by axle or wheel. If so properly clamped them.

2. BRAKE CYLINDER

a) Check for any physical damage of components or leakage.

b) Check that the piston indicator is fully in released condition.

c) In case of brake cylinder with hand brake cables, the cables are not entangled or resting / touching the axle, check that movement cable is free.

3. APM DEVICE

a) Check for any physical damage to the valve.

b) Check that the indicator in during the release.

c) Clean the Indicator.

d) Check the tightness of the lock nuts on sensor arm lever, if found loose, tighten them and also verify the Gap as specified.

e) Check that the valve's sensing arm is moving freely.

4. HAND BRAKE RIGGING

a) Check all the pin joints for any missing parts (pins, split pins, spring dowel, etc), if missing, provide the same.

b) Check the components for missing or any physical damage, if found replace them.

Spares to be maintained in open lines /ROH Depots

Following items to be maintained in the open lines /ROH depot for replacement against missing or damaged parts.

Bogie Equipment

S. No.	Component Description	Qty/ Wagon
1	Cylinder Assembly without Handbrake	1
2	Cylinder Assembly with Handbrake	1
3	APM valve Assembly	1
4	Reservoir for APM	1
5	Primary Beam	2
6	Secondary Beam	2
7	Lever Assembly (Right Hand)	2
8	Lever Assembly (Left Hand)	2
9	Push Rod Assembly	4

10	Brake Head	8

Pins, Split Pins (Bogie Equipment)

S. No.	Component Description	Qty/ Wagon
1	Pin; Clevis	4
2	Pin; Clevis	4
3	Pin; Clevis	4
4	Pin; Clevis	4
5	Pin; Brake Head	8
6	Pin	16
7	Pin	4
8	Pin	8
9	Washer	4

Hoses & Hardware (Bogie Equipment)

S. No.	Component Description	Qty/ Wagon
1	Hose Assy. 1/2" With Flange	1
2	Hose Assy. 1" With Flange	2
3	O-Ring	2
4	O-Ring	2
5	Spring Washer	4
6	Screw, Hex Head; Zinc Plated	8
7	Washer, Lock; Cad Plated	8
8	Locknut; Zinc Plated	1
9	Screw, Hex Head; Zinc Plated	4

L. ROH SCHEDULE FOR WAGONS FITTED WITH BMBS AIR BRAKE SYSTEM

In routine overhaul, first test the brake system of BMBS using single wagon test rig. Following action should be taken for the defects / discrepancies identified during testing.

Brake Cylinders

Check & replace brake cylinder by tested brake cylinder if following defects are identified:

(a) Check the brake cylinder for any physical damage or leakage.

(b) In case of brake cylinder with hand brake cables, check that the movement of cables is free

(c) Ensure that the piston indicator is in fully released condition.

BRAKE BEAMS

(a) Check for any physical damage, crack, etc, if found replace them. Check for rusting & corrosion and if found repaint them.

(b) Replace all the PINS, washer, split pins, dowel pins from OEMs.

(c) Check the GAP at pivot pin on the primary brake beam as shown in the condemning limit of the system components.

(d) Check brake head for loosening or damage as shown in the condemning limit of the system components.

LEVERS & PUSH RODS

(a) Replace the Bell crank lever, if any of the parameters specified in the condemning limits is observed.

(b) Replace the push rod, if any of the parameters specified in the condemning limits is observed.

APM VALVE

(a) Clean the Indicator.

(b) Check the APM valve;

- ❖ Any physical damage
- ❖ Valve's sensing arm is moving freely and is fully in.
- ❖ Check the leakage.
- ❖ Tightness of the lock nuts on sensor arm lever, if found loose, tighten them.

(c) Check the Gap between the sensor arm and the side frame, if required re-adjust.

HAND BRAKE RIGGING

(a) Check the pin joints / components for missing or any physical damage, if found replace them.

(b) Replace all the PINS, washer, split pins, dowel pins, plastic bushes.

HOSES & PIPE JOINTS

(a) Check the hoses for any cracks / damage. If so, replace them.

(b) Check that the hoses are properly tightened and are not threatened to be damaged by axle or wheel. If so properly clamped them.

(c) Check the pipe joints for leakages, if so, tighten them properly.

M. Critical check points for wagons fitted with BMBS

SWTR Testing

1. SWTR test for wagon to be done as per para 720F

Bogie & Brake cylinder

1. Push rod & spring plank clearance (min 10mm).
2. The split pin over the Brake head pin is tack welded with washer.
3. The brake cylinder pins are locked with bush and dowel sleeve.
4. Split pins are provided on all pins, bent properly & provided with APDs.

APM Device

1. The APM valve is mounted properly and its sensor arm is touching in middle of side frame.
2. The gap between the sensing point and side frame bottom is adjusted as specified for the wagon and is provided with additional check nut and APD.
3. Check that the APM hose is properly tightened & secured through clamp on under-frame.

Under frame & Piping

1. The BC isolating cocks in the BC line have their vent side towards the Brake cylinder (Both sides) and their handles are parallel to pipe line.
2. The brake hoses for Brake cylinder are properly secured and not resting on axle or rubbing with any other under frame members.
3. The brackets for hand brake arrangement are properly secured, the movement of the hand brake system is smooth and unrestricted.

N. POH SCHEDULE FOR WAGONS FITTED WITH BMBS AIR BRAKE SYSTEM

BOGIE RIGGING

Replace all the must change items as listed in the list below on the Bogie.

BRAKE BEAMS

a) Check the beams for rusting & corrosion and if found repair & repaint them.

b) Check the GAP at pivot pin on the primary brake beam as shown in the condemning limit *of* the system components.

c) Check brake head for loosening or damage as shown in the condemning limits *of* the system components.

BELL CRANKS LEVERS & PUSH RODS

a) Replace the Bell Crank levers, if the critical parameters found to in condemning limits as specified.

b) Replace the Push Rod, if the critical parameters found to in condemning limits as specified.

HAND BRAKE RIGGING

a) Check for any physical damage components, if found replace them.

b) Brake rigging brackets, bolts and nuts should be examined for rusting, looseness, damaged threads, etc and replaced.

c) Replace all the pins, washer, split pins, dowel pins from OEMs.

d) The plastic bushes should be changed.

BRAKE CYLINDER

a) Overhaul the brake cylinder as per procedure explained in the manual.

b) Replace the must change items.

c) Check the condition base items, if found worn or damaged, replace them.

d) Test the brake cylinder as per the procedure given in the manual.

APM DEVICE

a) Overhaul the APM Device as per procedure explained in the manual.

b) Replace the must change items as enlisted in the manual.

c) Check the condition base items, if found worn or damaged, replace them.

d) Test the APM Device as per the procedure given in the manual.

e) Check the Gap between the sensor point and the side frame surface and readjust the same as specified for the wagon type.

HOSES, PIPES & PIPE JOINTS

a) Check the hoses for any cracks / damage. If so, replace them.

b) Clean the pipes as per the procedure laid down by ROSO specification No. 04-ABR.

[*Must change items during POH for Bogie Mounted brake system Bogie Equipment*

SNo.	**Component Description**	**Qty/Wagon**
1	Pin; Clevis	4
2	Pin; Clevis	4
3	Pin; Clevis	4
4	Pin; Clevis	4
5	Pin; Brake Head	8
6	Pin;	16
8	Pin;	4
9	Pin;	8
10	Washer;	4

Hand Brake Equipment

1	Pin, Cable	2
2	Pin, Tie Rod	1
3	Pin Cotter, Cable pin	2
4	Split Pin (BMBS)	1

Items to be replaced on conditional basis

SNo.	**Component Description**	**Qty/ Wagon**
1	Hose Assy. 1/2" With Flange	1
2	Brake Head;	8
3	Hose Assy. L" With Flange	2
4	Spring Washer	4
5	a-Ring	2
6	a-Ring	2
7	Screw, Hex Head; Zinc Plated	8
8	Washer, Lock; Cad Plated	8
9	Screw, Hex Head; Zinc Plated	4

O. Do's & Don'ts for Bogie Mounted brake System

Do's

Bogie Rigging

- Do ensure that the side frame pockets are of correct dimension and free of all restriction.
- Do ensure that the fitment dimensions in Bogie, critical for fitment of BMBS are maintained within their specified limits.
- Do ensure that all the side frame pocket liners are properly cleaned & are within the specified limits.
- Do ensure there is free sliding of Brake Beams inside the side frame pocket liners.
- Do ensure that there is proper push rod & spring' plank clearance. If push rod clearance is less, then check the necessary bogie dimensions.
- Do ensure that there is proper fitment of brake block key with Brake block and brake head.
- Do ensure that there is sufficient gap (after the system is retracted) to change the brake blocks.
- Do ensure to use bush and dowel pin to lock the brake cylinder pins.
- Do ensure that all split pin are it place and are bent properly with their arms 90° apart.
- Do ensure that APDs are provided on all the pins of the bogie rigging.

Brake Cylinder

- Do ensure to blow the steel pipes connecting the brake cylinder before fitment to prevent the dirt particles going into the brake cylinder. This can be done by making 2-3 brake applications before connection of Hose pipe with Brake Cylinder.
- Do ensure that the cables are not pulled out of the brake cylinder on making hand brake connections.
- Do ensure that there is no rubbing of two hand brake cable together or resting on the axle.

APM Device

- Do ensure correct gap between the sensing point of APM valve & surface of side frame. If not, then adjust the same.
- Do ensure to put the additional check nut on the adjusting screw to lock the same in position.
- Do ensure that changeover takes place after putting block between the sensor point and side frame as indicated at clause no. 721F table-1
- Do ensure that empty / load indicator of the APM valve (Orange coloured) is visible during empty condition.
- Do ensure that the reservoir for APM valve is secured properly with the underframe.

Piping layout and fitment

- Do ensure proper orientation of Check Valve & Bogie Isolating Cocks. The vent side of the isolating cock with vent should be on the brake cylinder side.
- Do ensure to use the correct size of bolts, screws, nuts and washers as specified. Use of wrong size bolts / screw could damage the threads on the brake cylinder / APM valve.
- Do ensure proper clamping of APM Valve hose with under frame.
- Do ensure that there is no rubbing of rubber hoses with axle, wheel or underframe members.

Hand Brake Arrangement

- Do ensure to weld the hand brake cable bracket at its correct location. It should be welded straight and cables should be properly tightened to the bracket.
- Do ensure to weld the horizontal lever bracket at its correct location.
- Do ensure that the horizontal lever is properly supported by support brackets and have unrestricted movement.
- Do ensure that there is proper hand brake arrangement movement. After applying the hand brake, there should not be any ringing sound after striking wheels.
- Do ensure that there is no obstacle during return of hand brake cable after releasing hand brake. Investigate the restriction for the cables and do the necessary rectification.
- Do ensure to properly lubricate the hand brake screw, nut and pivots to reduce the friction and ensure smooth movement.

Don'ts

- ❖ Do not fit BMBS system if the Bogie parameters are not within the specified limits.
- ❖ Does not tack weld the BMBS pins / split pins on the bogie.
- ❖ Do not hammer on beams and brake block.
- ❖ Do not hit the indicator on the brake cylinder.
- ❖ Do not carry bogies by cranes fitted with cylinder and without wheeling, by fastened by chain wrapped in centre. Use fork lifter or chain should hook in side frame holes only.
- ❖ Do not use L-type brake blocks with Bogie Mounted Brake system.
- ❖ Do not use the non-standard pin, bolts for the fitment of BMBS items.

P. TESTING OF APM :

After the completion of the above, the El-60 Empty/ Load Valve must be tested in accordance with the test specifications.

Test Preparation:

The following items are needed to assemble the Test Fixture.

1. Load Sensing Device holding fixture
2. 2 nos. pressure gauge
3. 10 litre reservoir
4. 6.6 litre reservoir
5. 2 nos. - cut out cocks with vent.
6. Pressure Regulator
7. 25mm high block
8. Pipes and hoses

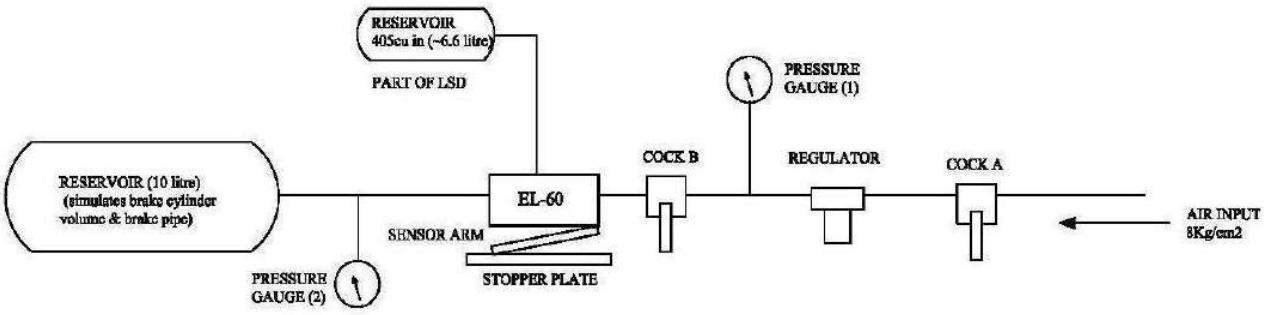
WARNING:

High pressure air is present in the test rack and assembly being tested. Pressure will vent from cocks and/or valve exhaust ports when test rack cocks are manipulated or when control devices are operated. To minimize the risk of personal injury from pressure exhausting, ensure that all persons stand clear of the exhaust path and that hearing protection and eye protection are worn at all times.

Test Procedure for APM :

A. LOAD POSITION & LEAKAGE TEST:

1. Place a 25mm high block between the adjusting screw and the stopper plate.
2. Open cock A and apply the main supply pressure. Pressure gauge no.1 should show 3.8 kg/cm^2 pressure otherwise adjust the regulator to get 3.8 kg/cm^2.
3. Open cock B and apply 3.8 kg/cm^2 pressure to the load-sensing device.
4. As the sensor arm comes in contact with the block, note the reading at pressure gauge no.2. It should be 3.8 +/- 0.1kg/cm2.
5. Check the empty load indicator. It should remain retracted.
6. Check the leakage at all joints and ports. No leakage is allowed.
7. Close cock A and B and reduce pressure to 0 kg/cm2.
8. Remove the 25mm block from between the sensor arm adjusting screw and the stopper plate.



Pneumatic Schematic Diagram for Testing of APM

B. EMPTY POSITION & LEAKAGE TEST:

1. Open cock A and apply the main supply pressure. Pressure gauge no.1 should show 3.8kg/cm^2 pressure otherwise adjust the regulator to get 3.8kg/cm^2.
2. Open cock B and apply 3.8kg/cm2 pressure to the load-sensing device.
3. As the sensor arm stops moving further down, note the reading at pressure gauge no.2. It should be 2.2 +/- 0.1kg/cm2.
4. Check the empty load indicator. It should be completely extended.
5. Check the leakage at all joints and ports. No leakage is allowed.
6. Close cock A and B and reduce pressure to 0kg/cm2.

Q. TESTING PROCEDURE OF BMBC(10")

Schematic and arrangement of test bench for brake cylinder is shown in figure

WARNING

HIGH PRESSURE AIR IS PRESENT IN THE TEST RACK AND ASSEMBLY BEING TESTED. PRESSURE WILL VENT FROM COCKS AND/OR VALVE EXHAUST PORTS WHEN TEST RACK COCKS ARE MANIPULATED OR WHEN CONTROL DEVICES ARE OPERATED. TO MINIMIZE THE RISK OF PERSONAL INJURY FROM PRESSURE EXHAUSTING, ENSURE THAT ALL PERSONS STAND CLEAR OF THE EXHAUST PATH AND THAT HEARING PROTECTION AND EYE PROTECTION ARE WORN AT ALL TIMES.

The following items are needed to assemble the Test Fixture;

1. Brake Cylinder holding fixture
2. Pressure gauge
3. 4 nos. non-vented cut out cocks
4. 2.4 mm choke installed in Exhaust Cock "B"
5. 2 nos. Pressure Regulators
6. Pipes and hoses

NOTE: Shop supply pressure must be maintained at 8 Kg/cm^2 minimum.

INITIAL CONDITION:

Pressure regulators will be set as follows: Regulator no.1 to 0.7 kg/cm^2

Regulator no.2 to 3.8 kg/cm^2

TEST NO. 1 – LOW PRESSURE LEAKAGE:

Commence test with all cocks closed.

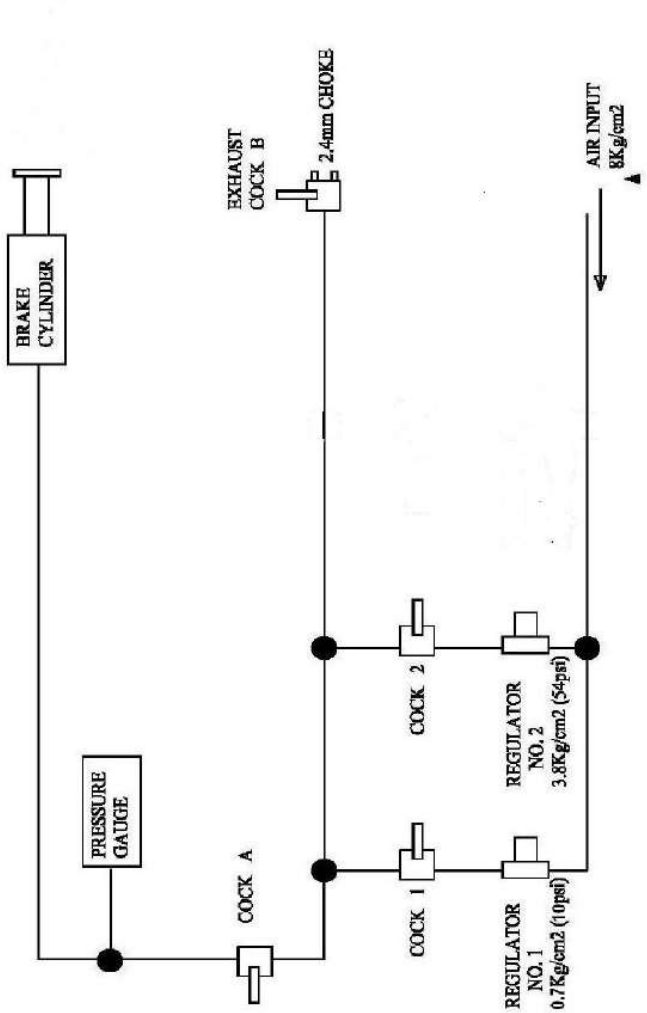
1. Open cock 1, then "A" and apply 0.7 kg/cm ^{2} to the cylinder. Note that the ram extends completely out and contacts the other end of the test setup at 0.7 kg/cm^2.

NOTE: If the ram has not fully extended with 0.7 kg/cm^2, it is allowable to adjust regulator no.1 to upto 0.9 kg/cm^2, and then readjust regulator no.1 back to 0.7 kg/cm^2 for the remainder of tests.

2. Close cock "A", then cock 1 and allow one minute temperature effect.
3. Note the reading at pressure gauge. Note the pressure drop for 10 minutes. No leakage is allowed.
4. Open cock "A" & then open exhaust cock "B" and pressure reduces to 0 kg/cm2. Close cock "B".
5. Open cock 1 and apply nominal 0.7 kg/cm2 to the cylinder. Close cock 1 and open cock "B" and pressure reduces pressure to 0 kg/cm^2.

TEST NO. 2 – HIGH PRESSURE LEAKAGE:

1. Commence test with cock “A” open
2. Open cock 2 and apply a pressure of 3.8 kg/cm 2 to the brake cylinder.
3. Close cock “A”, then cock 2 and allow one minute temperature effect.
4. Note the reading at pressure gauge. Note the pressure drop for 10 minutes. No leakage is allowed.
5. Open Exhaust cock “B” and pressure reduces to 0 kg/cm2.



(SCHEMATIC DIAGRAM FOR BRAKE CYLINDER TEST BENCH)