

CHAPTER 4

AIR BRAKE SYSTEM

401 INTRODUCTION

In Air Brake system compressed air is used for operating the brake system. The locomotive compressor charges the feed pipe and the brake pipes throughout the length of the train. The feed pipe is connected to the auxiliary reservoir and the brake pipe is connected to the brake cylinder through the distributor valve. Brake application takes place by dropping the pressure in the brake pipe.

402 CLASSIFICATION OF AIR BRAKE SYSTEM

The schematic layout shown in figure 4.1 illustrates the underframe mounted twin pipe graduated release air brake system on main line coaches. The components and their relative location is indicated in the schematic layout.

403 PRINCIPLE OF OPERATION OF TWIN PIPE GRADUATED RELEASE AIR BRAKE SYSTEM (See figure 4.1)

403a Charging the brake system

- Brake pipe throughout the length of train is charged with compressed air at 5 Kg/cm^2 .
- Feed pipe throughout the length of train is charged with compressed air at 6 Kg/cm^2 .
- Control reservoir is charged to 5 Kg/cm^2 .
- Auxiliary reservoir is charged to 6 Kg/cm^2 .

403b Brake application stage

- For brake application the brake pipe pressure is dropped by venting air from the driver's brake valve. Subsequently the following actions take place
 - The control reservoir is disconnected from the brake pipe.

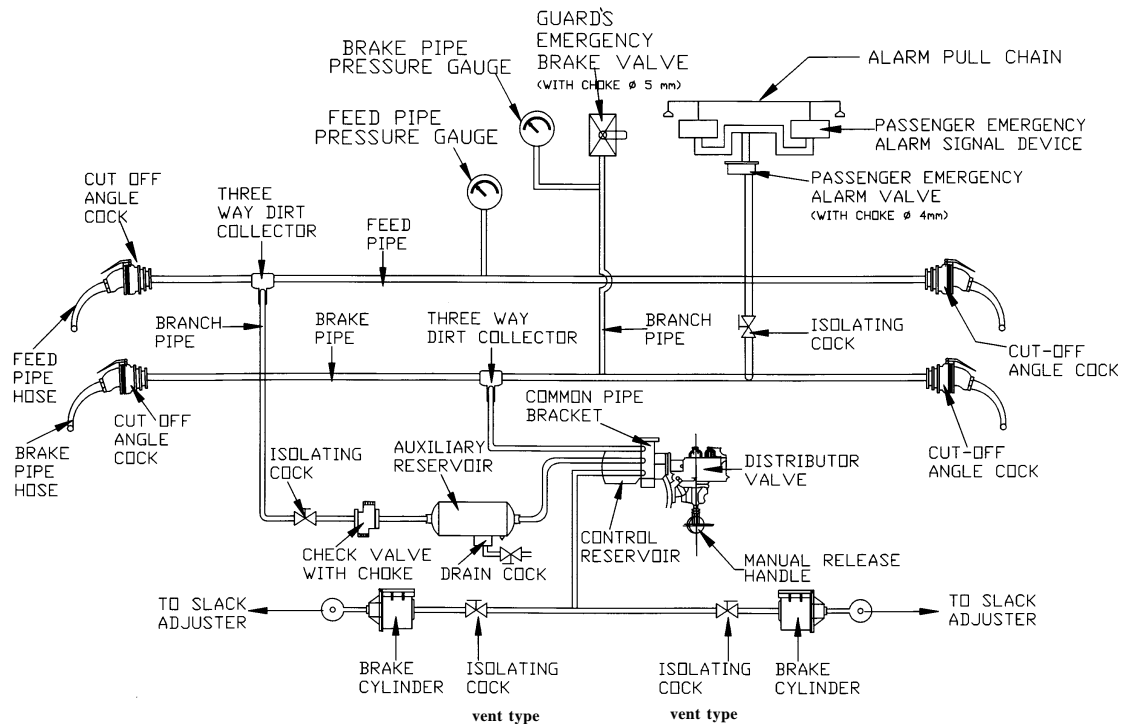


Figure 4.1 SCHEMATIC LAYOUT OF TWIN PIPE GRADUATED RELEASE AIR BRAKE SYSTEM

Note: Pressure gauges are installed only in guard's brake van.

- The distributor valve connects the auxiliary reservoir to the brake cylinder and the brake cylinder piston is pushed outwards for application of brakes.
- The auxiliary reservoir is however continuously charged from feed pipe at **6 Kg/cm²**.

Table 4.1

Description	Reduction in B. P. Pressure
Minimum Brake Application	0.5 to 0.8Kg/cm ²
Service Brake Application	0.8 to 1.0Kg/cm ²
Full Service Brake Application	1.0 to 1.5Kg/cm ²
Emergency Brake Application	Brake pipe is fully exhausted and its pressure reduces to almost zero.

403c Brake release stage:

- Brakes are released by recharging brake pipe to **5 Kg/cm²** pressure through the driver's brake valve.
- The distributor valve isolates the brake cylinder from the auxiliary reservoirs.
- The brake cylinder pressure is vented to atmosphere through DV and the Brake cylinder piston moves inwards.

404 AIR BRAKE SUB ASSEMBLIES

The various Air Brake sub-assemblies and components are:

- i) Common pipe bracket
- ii) Intermediate piece
- iii) Brake pipe and feed pipe
- iv) Brake pipe coupling
- v) Cut-off angle cock
- vi) Brake cylinder
- vii) Dirt collector
- viii) Auxiliary reservoir
- ix) Slack adjuster
- x) Distributor valve
- xi) isolating cock
- xii) PEASD
- xiii) PEAV
- xiv) Check valve

The brief details of the air brake components and its maintenance and test procedure is described below:

405 COMMON PIPE BRACKET

Common pipe bracket is mounted on the coach under frame and is suitable for use with all type of distributor valves presently in use on main line coaches.

406 INTERMEDIATE PIECE (SANDWICH PIECE)

An intermediate piece is mounted on the common pipe bracket to fit the distributor valve on the common pipe bracket. The intermediate piece serves the purpose of blanking all the other ports on the common pipe bracket 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.

407 AIR BRAKE HOSES

407a Brake Pipe & Feed Pipe Hoses (see figure 4.2)

To maintain continuity through out the length of train, the brake pipe (BP) and feed pipe (FP) are fitted with flexible hoses. Each hose is provided with palm end coupling. For easy identification, coupling heads are painted with green colour for B.P and white colour for F.P. Also raised letters 'BP' and 'FP' are embossed on coupling heads representing Brake Pipe and Feed Pipe respectively. Hose couplings must be checked for leakage of air as per the test procedure given below:

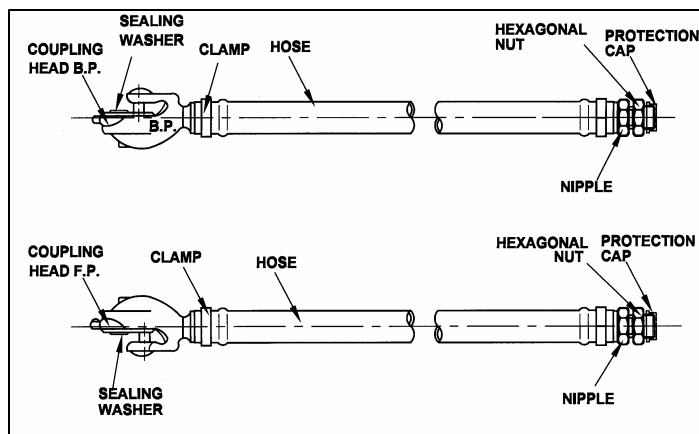


Figure 4.2 - AIR BRAKE HOSES

407b Test Procedure (see figure 4.3)

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

- Use a dummy coupling head to block the outlet port of the hose coupling.
- Connect to hose coupling under test to the end of flexible hose.
- Open isolating cock 1(a)
- Adjust pressure regulator (2) so that pressure gauge (6a) shows **10Kg./cm²** air pressure.
- Immerse the hose coupling assembly completely in the tub of water.
- Open isolating cock (1b) and see that (6b) shows **10 Kg/cm²** pressure.

- Observe leakage, if any from all parts of the hose coupling.
- Close the isolating cock 1(b).
- Disconnect the hose coupling from test bed.
- If the leakage is observed through the coupling head, replace the gasket and test again.
- If leakage persist 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.

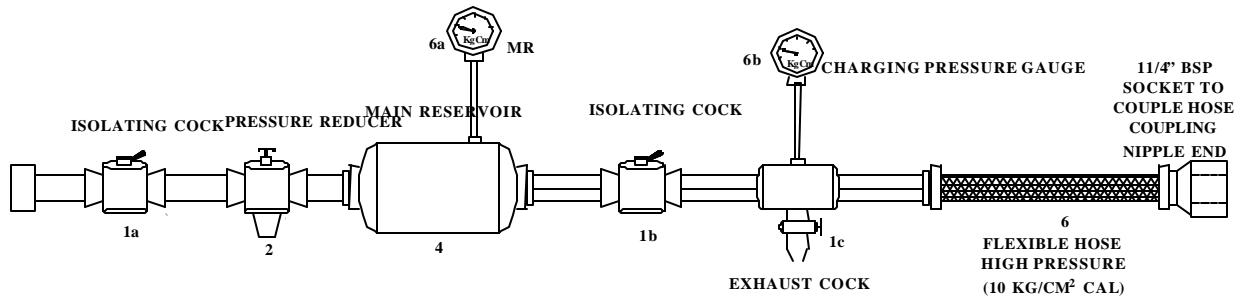


figure 4.3 – TEST BENCH FOR HOSE COUPLING

408 CUT OFF ANGLE COCK (see figure 4.4)

(Ref: Drg. No. WD-88123-S-01 and WD-88123-S-01)

Cut off angle cocks are provided both on brake pipe & feed pipe

on either end of each coach to facilitate coupling and uncoupling of air hoses. 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.

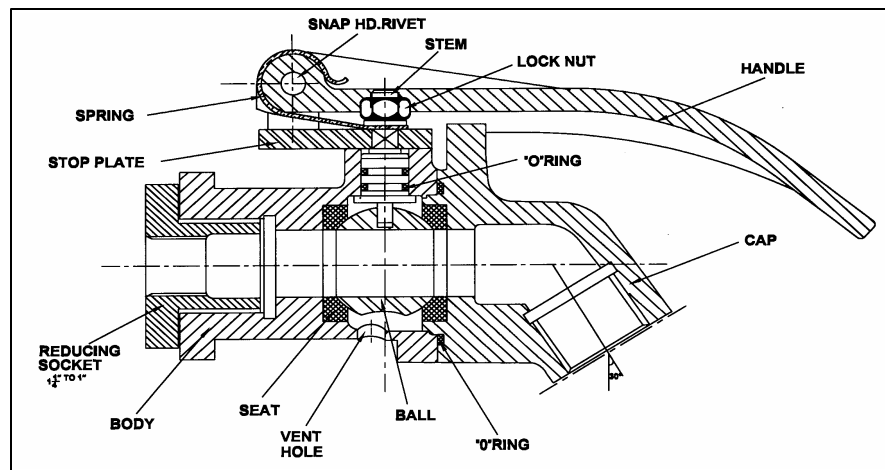


Figure 4.4 - CUT OFF ANGLE COCK

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 seated is on nitrile 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 cocks of BP are kept open except the rear end angle cocks (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.

408a Overhauling of Cut Off Angle Cock

The cut-off angle cock is to be completely dismantled and overhauled in every POH or when there is some specific trouble. During overhauling, it is dismantled for cleaning, replacement of parts and checking for effective functioning. The POH kit should be as per annexure 4.3.

408b Tools & Equipment

The following tools and fixtures are required for overhauling

- (a) Single end spanner.
 - 1) A/F 17 for M10 nut pivot screw.
 - 2) A/F 10 for M6 nut.

- (b) Screw driver 12"/300 mm long.
- (c) Vice.
- (d) Light hammer.

408c Procedure

i) Dismantling

- Hold the cut – off angle cock in a 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.

ii) 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.

iii) 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.

iv) 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.
- Check pressure drop in gauge (6b) there should not be any leakage from flange joints, vent and outlet port of the angle cock.
- Close cock (1c) and tighten the dummy plug and seal the outlet of the angle cock.
- Move the handle to the open position. Open cock 1c.
- Check for leakage from body and cap joint, vent and all over the stem periphery using soap water. No leakage is permissible.
- Move the handle to closed position and notice a short blast of air through the vent.
- Close cock 1c then Open cock (1d) and exhaust the pressure to zero.
- Remove the angle cock.
- Report results of the test.

408d Testing of Cut Off Angle Cock

i) Tools and Equipment

- Test Bench
- Compressor to build pressure upto **10 kg/cm²**.
- Single ended spanner as per IS 2027
 - a) Across face 17 (for M10 lock nut) 1No.
 - b) Across Face 13 (for M8 studs) 2 No.
- Screw Driver –300mm, 1 No.
- 1 ¼ “ BSP dummy Plug with seal.
- Dummy plug for angle cock.

ii) Test Procedure (*refer figure 4.9*)

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

- Mount the angle cock on the base of the test bench (Part No. 7 of the figure 4.9 of the test bench).
- Move the handle to the closed position.
- See that cock (1e) and (1c) are in closed position.
- Now open cock 1(a) and 1(b) till MR indicates a pressure of **10 Kg/Cm²**.
- If necessary, adjust pressure regulator (2) to maintain the pressure at **10 kg/Cm²**.
- Open cock (1c) and check the leakage with soap solution. There should not be any leakage.

iii) 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.

409 BRAKE CYLINDER (see figure 4.5) (Refer Drg. RDSO SK-97015)

On every coach fitted with air brake system two brake cylinders are provided for actuating the brake rigging for the application and release of brakes. During application of brakes the brake cylinder develops mechanical brake power by outward movement of its piston assembly after receiving air pressure from Auxiliary reservoir through the distributor valve. This is transmitted to the brake shoes through a combination of levers. 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

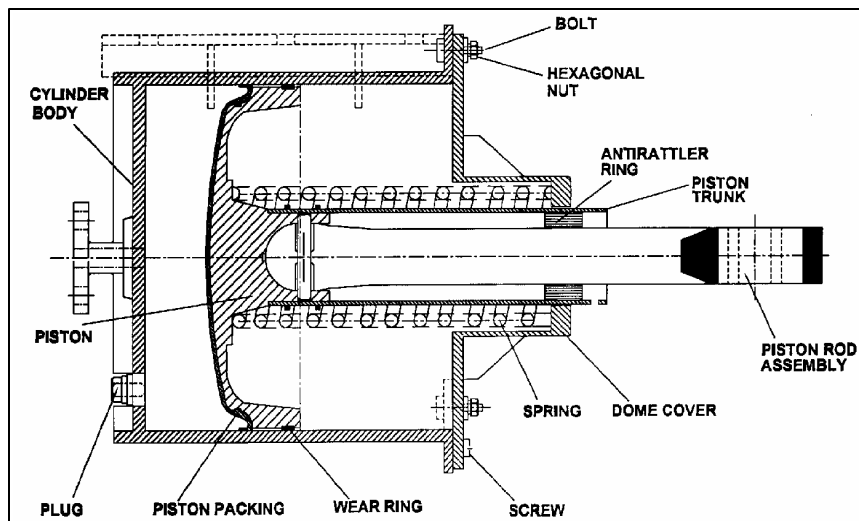


Figure 4.5 – BRAKE CYLINDER

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 is of oil and abrasion resistant rubber material and is snap fit to the piston head. The packing 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. For preventing knocking during running, a rubber anti rattler ring is also provided.

409a 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 every POH of the coach.

409b Tools & Equipments

Sr. No.	Description
1.	Torque Wrench 0-3 Kg m range
2.	Double End Spanner 24x27 mm across face (For M16)
3.	Double End Spanner across face 13x14 (For M12)

Sr. No.	Description
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

409c Dismantling of Brake Cylinder

Before dismantling the dome cover insert a bolt **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.

- 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 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, and piston trunk & piston rod assembly.
- Unscrew the brake cylinder plug at the rear end.

409d 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.

409e 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.

409f Inspection and Repairs of the Parts

- Examine visually that the internal surface is free from scratches, rust.
- Brake cylinder bore to be checked for ovality with 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.

409g 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/cm²** for 5 minutes. No leakage is permitted.

409h 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.

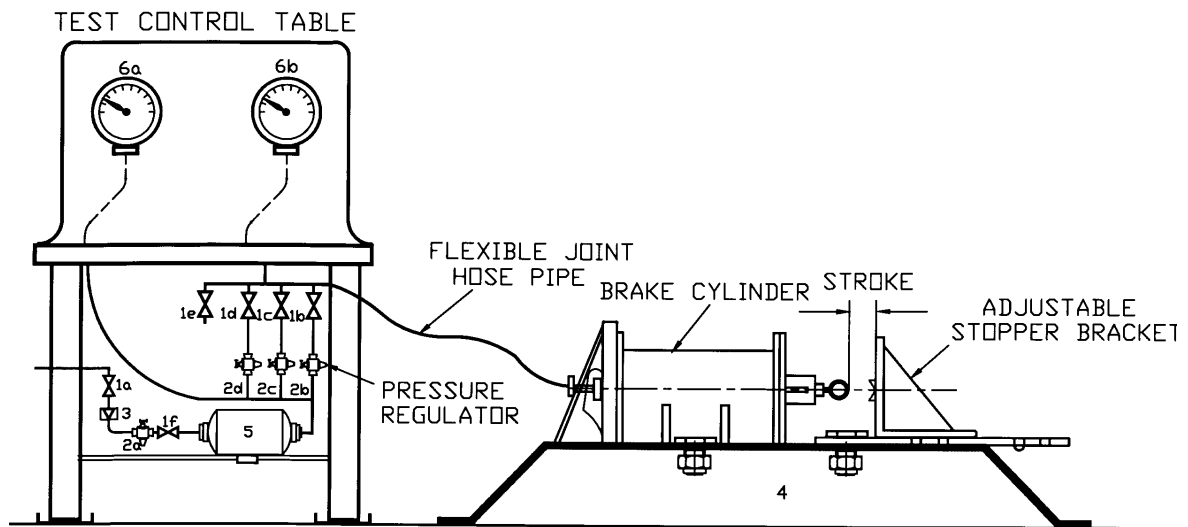
409i Testing of Brake Cylinder (see figure 4.6)**i) Brake Cylinder Test Bench**

Test bench consists of the following main parts

- a) 5 nos. of isolating cocks (1a, 1b, 1c, 1d, 1e and 1f).
- b) Pressure reducing valves as below
- c) 2a - to be set on **10 Kg/cm²**.
- d) 2b - to be set on **6 Kg/cm²**.
- e) 2c - to be set on **0.8 Kg/cm²**.
- f) 2d - to be set on **3.8 Kg/cm²**.
- g) Pressure gauges
- h) 6a - to measure supply pressure.
- i) 6b- to measure brake cylinder pressure.
- j) Pipe line filter – Item no 3
- k) Brake cylinder pressure mounting base with fixture –Item no 4
- l) Air reservoir – Item no.5

ii) Tools required during Testing

- a) Torque wrench range (2-3 kgm capacity) – One number.
- b) Double ended spanner (M16) across face 24x27 – One number.
- c) Socket wrench (M12) across face 19 – One Number.
- d) Double ended spanner (M8) across face 13x14 – One number.
- e) Screw Driver– 300mm –One number.



Ref. No. of	Description	No. of	Ref. No. of	Description	No. of
Isolating cock			Pressure Reducing valve		
1a	Supply angle cock	1	2a	Set on 10 kg/cm ²	1
1b	Angle cock	1	2b	Set on 6 kg/cm ²	1
1c	Angle cock	1	2c	Set on 0.8 kg/cm ²	1
1d	Angle cock	1	2d	Set on 3.8 kg/cm ²	1
1e	Exhaust cock	1	3	Pipe line filter	1
1f	Angle cock	1	4	Brake Cylinder pressure mounting base	1
			5	Air reservoir	1
			Pressure Gauge		
			6a	Supply Pressure	1
			6b	Brake Cylinder Pressure	1

Figure 4.6 – TEST BENCH FOR BRAKE CYLINDER

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.

- a) Strength test
- b) Pressure Tightness Test.

iii) Strength Test

For strength test, procedure described below should be follow:

- Place the repaired/overhauled brake cylinder body on mounting base of the test stand. This mounting base (4) is provided with a safety guard.
- Connect the air pressure line to the brake cylinder.
- Check the brake cylinder piston stroke at **0-5 kg/Cm²** pressure for its jerk free smooth movement.
- Close the safety guard.
- Close the cock (1b), (1c) and (1d).
- Open cock (1a) and (1f) and let the reservoir pressure increase.
- Set pressure regulator (2a) at **10Kg/cm²**.
- Monitor the pressure in the reservoir with the help of the MR Gauge (6a).
- Let the pressure reach upto **10 kg/cm²**.
- Open cock (1b) so that air collected in the reservoir is transferred to the brake cylinder.
- Adjust the pressure in the brake cylinder with the help of the pressure regulator (2b).

- Monitor the pressure in the brake cylinder with the help of the pressure gauge (6b).
- Close the cock 1(b) as soon as pressure reaches **6 kg/cm²**.
- Wait for 2 minutes.
- Brake cylinder should withstand this pressure.
- Open cock (1e), this will discharge the air pressure from the brake cylinder and the piston assembly will come back.

iv) Pressure Tightness Test

Brake cylinder when fully assembled must be tested for leakage. For pressure tightness test, procedure described below should be followed.

- Mount the brake cylinder on the test stand and tighten the mounting bolts and nuts.
- Set the brake cylinder, piston stroke at **85± 10 mm** and the pressure regulator (2c) at **0.8 Kg/cm²**.
- Open cock (1c) and let the air be transferred to the brake cylinder till the air pressure reaches upto **0.8 kg/cm²**. Monitor this pressure with the help of the pressure gauge (6b).
- Close cock (1c) as soon as the pressure reaches upto **0.8 kg/cm²**.
- Wait for 1 minute till the pressure stabilizes in the gauge (6b). Measure the final pressure in the gauge (6b).
- Check for the pressure drop, which should not be more than **0.1 kg/cm²** in 10 minutes.
- Open cock (1e).
- Close cock (1c) and open cock (1d).
- Repeat the test by setting the piston stroke at **130±10 mm**. This time the air pressure is to be maintained in the cylinder at **3.8 kg/cm²** with the help of the pressure regulator (2d) at **3.8 Kg/cm²**. As above, the leakage should not exceed **0.1 kg/cm²** in 10 minutes.
- After the test is over, close the cock (1d) and the open cock (1e).

This will discharge the brake cylinder.

- Remove the brake cylinder from the test stand.
- If operation is not correct or leakage rate is higher, dismantle the brake cylinder and examine the piston packing wear ring for proper fitment, examine the fitment of the plug for leakage, reassemble the components and retest.

v) 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.

410 DIRT COLLECTOR (See figure 4.7 & 4.8) (Ref. Drg. RDSO. SK-97005)

410a Salient features of Dirt Collector

Dirt Collector is placed in the brake pipe line and feed pipe line at a point from where a branch is taken off to the distributor valve and the auxiliary reservoir. The air entering into the dirt



Figure 4.7 - COMPONENTS OF DIRT COLLECTOR

collector from the brake pipe and feed pipe is guided through suitably shaped passages in the 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.

The dirt collector is to be completely dismantled and overhauled in every POH.

410b Tools and Fixtures for overhauling

The following tools and fixtures are required for overhauling:

- a) Spanner 19 x 22mm
- b) Vice.
- c) Screw Driver

410c Procedure for Overhauling

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 if found punctured or damaged.

Check spring washer and replace in case defective or excessively corroded.

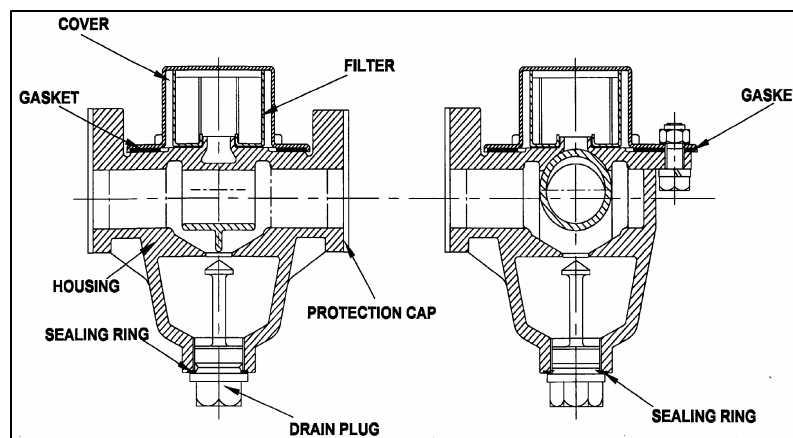


Fig. 4.8 - SECTIONAL VIEW OF DIRT COLLECTOR

- Remove the dummy flange from the outlet port (which feeds to the distributor valve).
- Check for free flow of air from the outlet port. (If air is not flowing freely it means that the filter is choked).
- The pressure will soon exhaust through the outlet port.
- Remove the dirt collector from the test stand.

411 AUXILIARY RESERVOIR (refer figure 4.10)

411a 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 connections. One end of the auxiliary reservoir is connected to the brake pipe through the distributor valve. Auxiliary reservoir is charged through the feed pipe to a pressure of 6kg/sq cm. At the bottom of the auxiliary reservoir, a drain cock is provided for draining out the condensate /moisture. The auxiliary reservoir should be overhauled in every POH.

Note: The dimension & tolerances of the auxiliary reservoir shall be as indicated in latest revision of RDSO drawing number SK-96081.

411b Tools and Equipment for overhauling

Spanner A/F 19x22.
Light hammer

411c Procedure for Overhauling

i) Dismantling

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

ii) 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.

iii) Replacement of Parts

- Replace the plug washer.
- Replace the plug if threads are rusted or damaged.

iv) Assembly

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

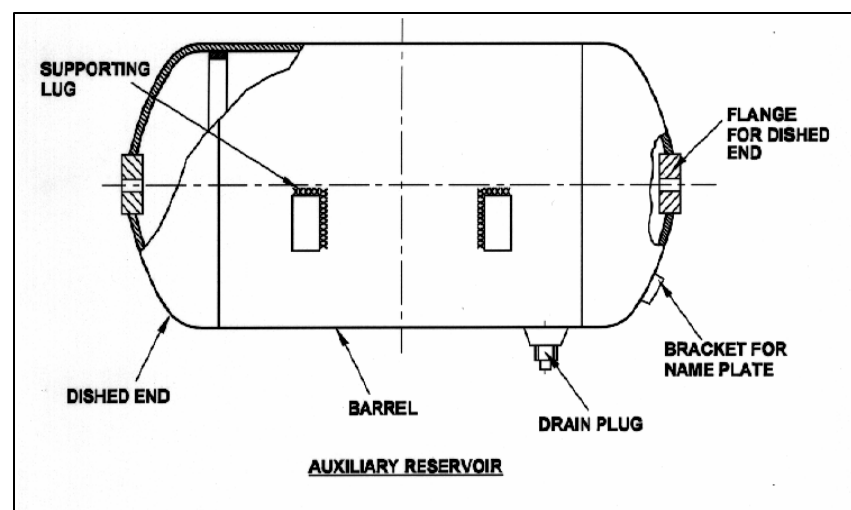


Figure 4.10 – AUXILIARY RESERVOIR

411d Testing of Auxiliary Reservoir**i) 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/cm²**.
- Check the leakage at the weld seams, with soap water solution.
- No leakage is permitted.

ii) Hydraulic Test

- With a hydraulic pump, apply a pressure of **16 Kg/cm²** 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 or bulging is permitted.
- Drain out the water completely and allow the reservoir to dry, by directing a jet of air.

411e 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.

412 GUARD'S EMERGENCY BRAKE VALVE (refer figure 4.11)**412a 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 5mm is fitted in the exhaust port for controlling the rate of BP exhaust. The inlet port of the valve is connected to the brake pipe. In case of an emergency, the guard moves the handle of the guard's emergency brake valve so that it is placed parallel to the inlet pipe. This action causes the air from the brake pipe to be exhausted to the atmosphere through a choke of **5 mm**. The drop in pressure in the brake pipe can also be observed in the air flow meter provided in the locomotive cabin and 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 recharged.

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 in every POH.

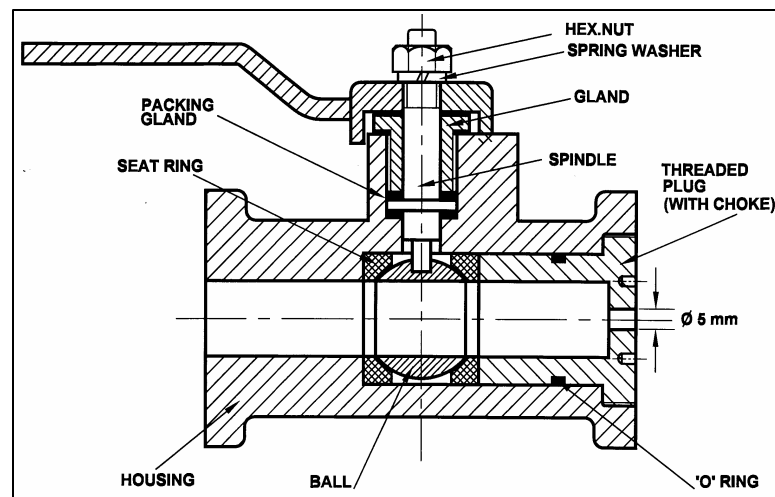


Figure 4.11 – GUARD'S EMERGENCY BRAKE VALVE

412b Tools and Fixtures for overhauling

The following tools and fixtures are required for overhauling

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

412c Procedure for Overhauling**i) 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.

ii) 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.

iii) 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.

iv) 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.

412d Testing of Guard's Emergency Brake Valve

- After overhauling, fix the valve to the test bench. (refer figure 4.9 & 4.11)
- Put the handle of the valve in off position (close position).
- Charge the inlet port with a pressure of **10 Kg./cm²**.
- 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.

412e Safety Precautions

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

413 SLACK ADJUSTER (see figure 4.12)**413a 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-450 is used in passenger coaches, It is composed of the following parts

- Adjuster spindle with screw thread of quick pitches (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-450 are:

Fully Automatic i.e. once initially set, no manual adjustment is further necessary at any time during its operation.

Double-Acting i.e. 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').

Rapid working i.e. correct brake shoe clearance is automatically restored after one or two applications of the brake.

Verification i.e. 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 slack

adjuster does not pay out slack immediately, but indexes the amount of slack to be paid out. If the slack really is too small, the slack adjuster will pay out this indexed slack at the next brake application. Thus false payout will not occur.

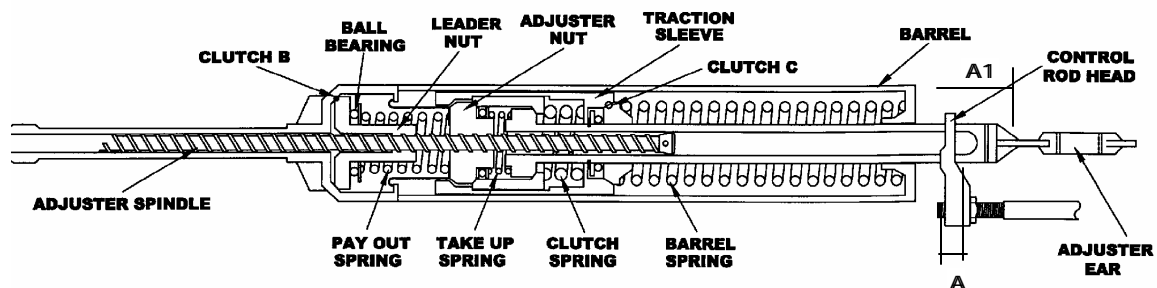
True Slack Adjuster i.e. The slack adjuster adjusts incorrect slack only, thus giving the brake its best possible pre-adjusted limit of piston strokes, ensuring a smooth and efficient braking force at all times.

Shock Resistant i.e. Train shocks will not cause false take-up or payout of slack. When brakes are released, the moving parts of the slack adjuster are securely locked.

413b Overhauling of Slack Adjuster**i) 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 pliers (external) (spring type) 18 mm to 25 mm-external
- (iv) Bend nose pliers (internal) 25 -30 mm –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) SAB test bench



Note: The Slack Adjuster takes up 100 mm per braking. Dimension A1 will be 98 + 1/4 mm (refer G-92)

Figure 4.12 – SLACK ADJUSTER

413c Procedure for Overhauling

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(October-91).*

The minimum desired characteristic of each spring should be taken as under [Ref: RDSO Technical pamphlet No. G-92 (October -91)]:

Table 4.3

Sr. No	Description of spring	Part No.	Spring length compression	Minimum permissible force
1.	Barrel spring	21	330 mm	140 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.

The following parts must be replaced during POH of the slack adjuster[Ref: RDSO Technical pamphlet No. G-92 (October -91)]:

- 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)

413d Lubrication

After cleaning and inspection all parts of slack adjuster should be coated with semi-fluid grease SERVOGEM -RR3 or MALMEROL MULTIGREASE LL3 (refer G-92) before undertaking re-assembly.

413e Safety Precautions

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

- The place of overhauling must be clean and free from dust.
- Ensure that no foreign matter/particle remain inside the sub-assemblies during re-assembly.
- All rubber gasket, seal ring, washers must be replaced during overhaul.
- Specified tools and fixtures are used for disassembly and assembly operations.

413f Testing of Slack Adjuster (refer figure 4.13)

After overhauling, testing of slack adjuster in carried out in a test rack 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) 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 ± 5 mm tolerance field of the scale).

ii) Pay-out test

- Turn up control rod and make two brake applications letting the slack adjuster pay out.
- Repeat the above pay in and pay-out tests a couple of times.
- 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.

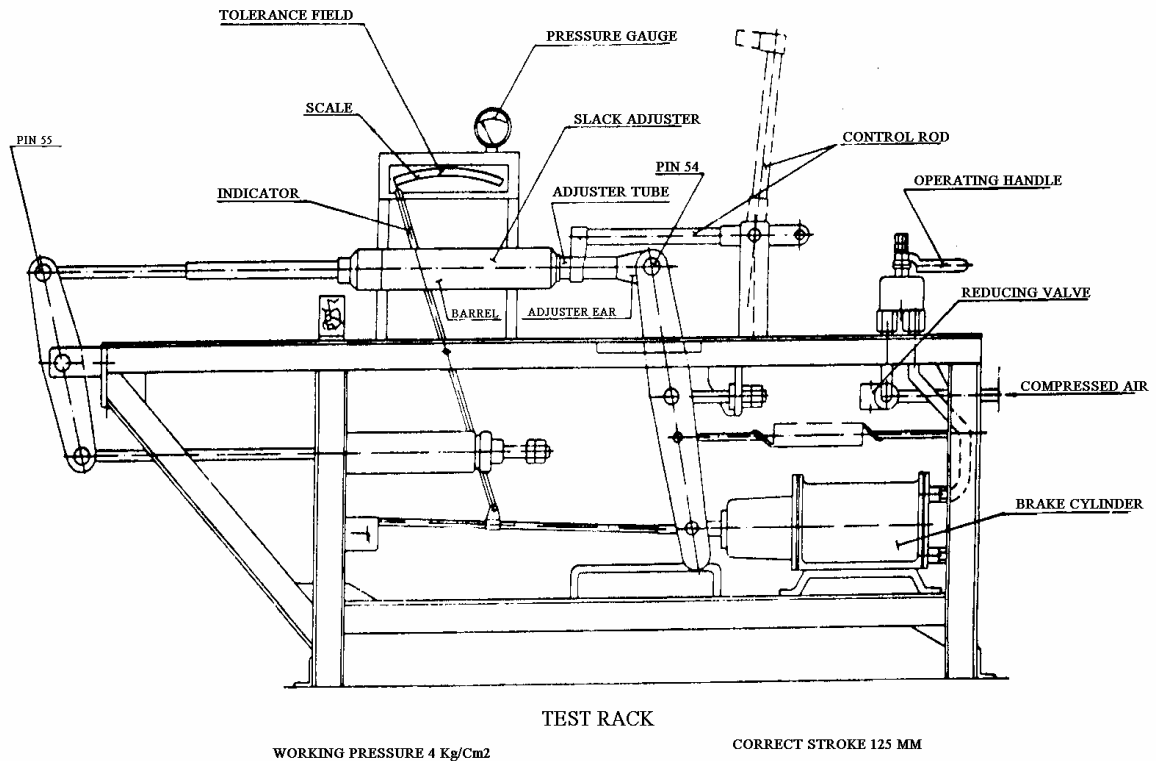


Figure 4.13 – TEST RACK FOR SLACK ADJUSTER

Give adjuster spindle 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. Put the safety collar 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 back into the Slack Adjuster enough to make room for the adjuster ear.

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

Note : Hold adjuster tube firmly with a pipe wrench. Secure lock washer. 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.

413g Painting

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

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

413h 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:-

For ‘A’ dimension (16 +2/-0 mm for 13 t bogie and 22 +2/-0 mm for 16.25 t bogie) (refer G-92)

- (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

1. Remove pin securing the control rod in U bracket.
2. 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.
3. Apply brakes two to three times.
4. Check the ‘A’ dimension using the gauge.
5. Recheck dimension ‘A’ with brakes fully released after every brake release.
6. Lock the control rod head firmly with check nut and tooth lock washer.
7. Secure pin with split pin.

For ‘e’ dimension

- (i) If slack is in excess beyond the capacity of slack adjuster (‘e’ dimension **375±25mm**) 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. **375±25mm**.

413i Safety Precautions

- Always use wedge between wheel and rail before application and release operations for setting and measuring A and e dimension to prevent rolling of coach.
- Ensure no part of the worker's body is in touch with moving brake rigging gears during application and releasing of brakes.
- Do not touch or hold slack adjuster barrel while it is in motion.
- 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 than **20 mm**).
- 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.
- 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. **375±25 mm**.