CHAPTER 5

VACUUM BRAKE SYSTEM

501 GENERAL DESCRIPTION

501a Vacuum brake system has been improved gradually over the years by increasing the brake rigging ratio, effecting modifications to the vacuum brake cylinders, hose pipe cages and adopting direct admission valves and slack adjusters **(See figure 5.1)**.

502 MAINTENANCE AT WORKSHOP

502a During POH all components of the brake gear system shall be examined, repaired and replaced as necessary. The pins and bushes shall be examined for wear and replaced if the radial clearance exceeds **0.75 mm**.

502b Following items should receive particular attention during POH:

i) Safety brackets provided for brake gear components should be in accordance with the approved drawings and shall be examined for proper condition and secured according to the prescribed method.

ii) Vacuum cylinders and their trunnion brackets, vacuum reservoirs and train pipes, rubber hose & syphon pipes, alarm chain apparatus including the chain, disc and locking arrangement, brake beams, hangers, and brake blocks shall be secured as prescribed. All brake gear pins (should be chromium plated) shall be secured with washers and split cotters.

iii) Vacuum gauges shall be properly tested and adjusted using master gauges before being fitted.

503 LIFTING SHOP

503a After lifting the coach body and placing it on trestles, dismantle the following parts of the vacuum brake system and send to the respective repair/ maintenance sections for thorough cleaning in the washing plant and overhaul.

Slack adjuster
D.A.Valve
Vacuum cylinder with release valve
Vacuum reservoir
Alarm chain apparatus
Guard van valve

503b **Train pipe**

i) Check the train pipe with compressed air of 2 kg/cm^2 for leakage specially at threaded joints, bends and portions where clamps are fitted, tee joints, swan neck, etc. with one end dummy.

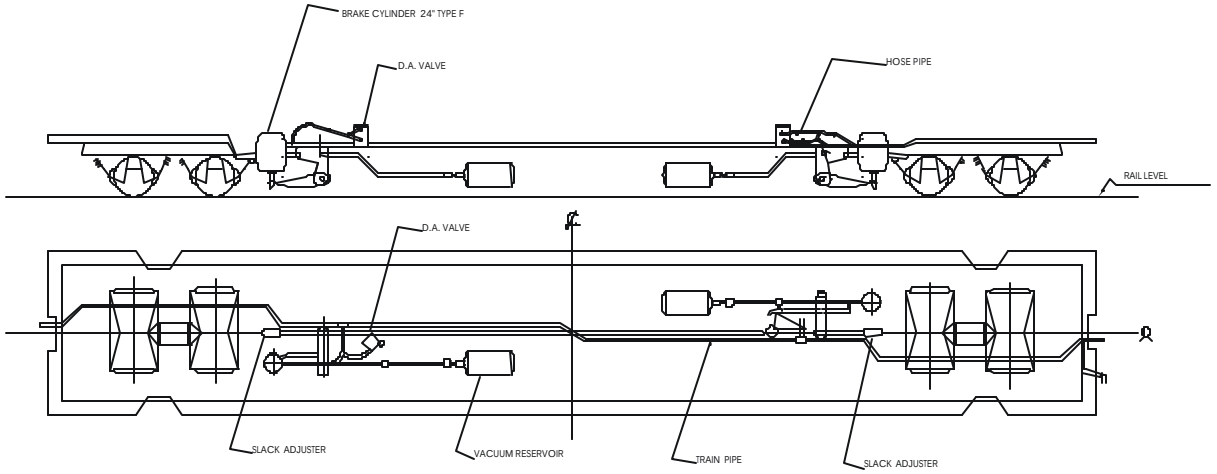
ii) Check and replace corroded, dented, bent more than **10 mm**, or thin walled portions of the train pipes. Spiked hammer should be used to check thin wall, corrosion, etc. While renewing the pipe, it should be ensured that bending do not decrease the cross sectional area of pipe passage at the bends. New brake pipe should be given a coat of anti-corrosive paint before fitting.

iii) Renew the damaged/ missing brackets or clamps used for clamping the train pipe.

iv) All the pipe threads must be cleaned and applied with white lead before couplings are fitted. Clean the grooves on swan neck.

v) After attending to all the repairs, test the train pipe for sound joints and bends with compressed air at **2 kg/cm^2** pressure. There should not be any leakage of air over the entire length of the train pipe.

vi) After repairs and testing, the train pipe should be given a coat of anti-corrosive paint.



LINE DIAGRAM OF VACUUM BRAKE

FIGURE 5.1

503c **Rubber hose pipe and syphon pipe**

i) Renew the hose pipe and syphon pipes if they had cracked or lost the bond between the various layers/ components.

ii) Reusable hose/ syphon pipes should be tested for vacuum retention. For this test, the hose should be connected by means of a cylindrical nozzle of size corresponding to the vacuum/ syphon hose bore to a chamber of **1640 cu. cm**. volume and the free end of hose closed with a cylindrical plug. **510 mm** Hg of vacuum should be created in the chamber and hose system. On isolation from the source of vacuum, the drop of vacuum should not be more than **75 mm Hg** in one hour on the chamber gauge. The pipe should not be clipped or otherwise bound to the chamber nozzle or plug for this test. The hose should also be bent around a mandrel of **228 mm** diameter till the ends of the hose are parallel. This should not result in any displacement or distortion of wire.

iii) Cracks, porosity, tears, etc., of the hose should be detected by giving it a stretch test. For this purpose, hose pipe should be secured to a special jig and should be stretched to **20% over** its original length and released 100 times. Thereafter, in the stretched position, its surface should be examined to detect the defects, if any. Cracked, torn, porous, or collapsed hose pipes or hose pipes with coiled wire loose or missing, or length reduced below **50 cms**. should be rejected.

iv) Serviceable hose pipe should be secured on swan neck (after applying rubber solution on swan neck) with clip and tighten with spanner.

v) Renew the corroded or damaged hose pipe clips.

vi) Broken, damaged, or distorted cages should be replaced with modified cages to drg.No.VB 409/M.

vii) Universal coupling should be examined for broken, cracked and distorted lugs and renewed on condition basis. Rubber solution should be applied on the mating surfaces and cages fitted before the couplings are inserted into the hoses. They should be clipped firmly.

503d Vacuum Reservoir Straps

Vacuum reservoir straps should be examined for slackness, corrosion and thinning, and damaged or worn out threads at their ends. and entire straps or threaded ends, as required, should be replaced. If the securing holes in the under frame are worn more than **3 mm**, build up by welding and redrill the holes. The reservoir straps should be double secured with spring washer and check nuts. After all repairs, the reservoir straps should be given a coat of anti-corrosive paint. FRP tissue should be placed in between reservoir and safety straps. APD should be done.

503e Vacuum cylinder trunnion bracket

Where bushes are provided in the brackets, they should be renewed and a light coat of graphite grease applied before fitting a cylinder. Trunnions of the cylinder must neither be too loose nor too tight in their brackets. Lateral clearances on the trunnions (on each side) should not exceed **3 mm**. It should be adjusted by renewing the bushes. If there are no bushes, the trunnions should be bored and bushes of correct size fitted to get the required clearance.

503f **Brake shaft**

Brake shaft should be examined for straightness, bending and wear on its bearing surfaces. The shaft bearing worn beyond **3 mm** should be built up by welding and machined to its original size. Before the shaft is fitted into its brackets its bearing surfaces should be smeared lightly with grease. The fork arm should also be examined for bending, distortion and wear on its forked ends and restored to its original shape and size as required. The brake shaft mounted in its brackets under a coach should be parallel to the trunnions on which the cylinder swings to avoid setting up of side or crosses stresses and hence damage to the arm. The brake shaft should not have a side play in its bracket bushes in excess of **2 mm** after POH.

503g **Brake shaft brackets**

Brake shaft bracket bolts and nuts should be examined for rusting, looseness, thinning and worn out or damaged threads and replaced, if required. Good bolts and nuts should otherwise be reused after greasing their threads. The brackets should be checked for cracks, corrosion and thinning or damage and repaired/ replaced as required. The brake shaft bracket bushes should invariably be changed.

503h **Slack adjuster support bracket on coach**

The support brackets should be stripped and examined for missing or worn out rollers and bent, defective or missing springs. The defective or missing roller and springs should be replaced. Defective spring should be repaired by restoring them to their original shape and size and hardened and tempered to give correct tension. The securing brackets and nuts as well as pins should also be checked and replaced or repaired as required.

503i **Alarm chain apparatus**

i) During POH, alarm chain apparatus should be opened, cleaned and overhauled.

ii) The chain must be of the prescribed specification and each link must be physically examined for crack/ wear/ elongation. Proper fitment/ anchoring of all the components should be checked and ensured to avoid their failure/ non-operation/ mal-functioning during service.

iii) The clappet valve should be removed from the coach for overhauling. Replace the rubber washer. The clappet valve cover should be checked and repaired or replaced as necessary. The clappet valve operating rods, levers, indicating discs and other moving parts should be cleaned and checked and straightened if bent, or replaced if broken or deficient. The pins if worn should be renewed, if not they should be cleaned before reuse.

iv) The vertical pipe connecting the clappet valve with train pipe should be examined to ensure that it is neither leaking nor blocked. The air passage in the vertical pipe should be blown clear with compressed air and the pipe threads should be checked before the assembly is connected to train pipe.

v) All moving parts including spring should be greased and checked for proper movement.

vi) The clappet operating chain and the pipe through which the chain passes should be dismantled, examined and renewed with standard chain or **6 mm** wire. If in normal position of the clappet valve, the chain hangs loose in any of the compartment openings, its length should be adjusted by cutting it out to the extent necessary. Wooden handles provided in the compartment openings for pulling the chain should also be checked and replaced where found broken or cracked.

vii) After the clappet valve assembly is overhauled and refitted, its chains, etc., are checked and replaced, the alarm chain apparatus should be tested at the outgoing pit for its operation in accordance with the following procedure.

503j **Alarm chain apparatus test**

i) Create **460 mm to 510 mm** of vacuum, pull the chain, using a spring balance, at both sides of the coach from the end where the chain is anchored, ie., from the end which is farthest away from the clappet valve.

ii) The alarm chain should not operate the clappet valve if the pull applied vertically down wards is less than **6.4 kgs**. It should also not require a pull of more than **10 kgs**. for its operation.

iii) When the chain is pulled, the brakes should apply on the coach and the drop of vacuum in the train pipe should be between **180 mm and 200** mm if one coach is being tested, or between **130 mm** and **180 mm** when a rake as a whole is being tested. If the drop in vacuum is less than **130 mm** and still the brakes are applied, it shows an obstruction in the vertical pipe, in which case it is necessary to locate and clear the obstruction in vacuum vertical pipe.

iv) On resetting the clappet valve, it should automatically come to lap position. After restoration of **460 mm to 510 mm** of vacuum, the exhauster should be isolated and the drop in vacuum noted. The drop in vacuum should not be more than **25 mm** in one minute. This check should be carried out twice.

504 OVERHAUL OF COMPONENTS

504a Vacuum reservoir

i) The vacuum reservoir should be examined for corrosion, damages, distortion, cracks, etc. If the extent of corrosion, etc., are only about **5%** of total area, it should be cut off and replaced with another plate by welding. Otherwise the whole barrel should be replaced. Open the drain plug and blow compressed air into the reservoir to remove dusts, dirt and water particles, accumulated inside the reservoir.

ii) After thorough cleaning, refit the drain plug smeared with small quantity of graphite grease on the threads and tighten it firmly. Clean the pipe threads with a brass wire brush in both the dish ends to fit the syphon nipples. Replace the missing or damaged syphon in the dish ends of the reservoir.

iii) After attending the defects and before painting the reservoir, a pneumatic pressure of **2.0 kg/cm^2** by gauge should be applied in it for the purpose of ensuring sound fabrication and finish. With the pressure applied, the welded seams all over the body should be thoroughly checked for leakage with soap and water solution.

iv) Vacuum reservoir should be tested for vacuum retaining capacity with **510 mm** of vacuum throughout the assembly. It should not, on isolation from the source of vacuum, record a drop of more than **13 mm in 30 minutes** on test gauge.

v) After all repairs and tests, the reservoir should be given a coat of anti-corrosive paint and FRP tissue pasted at the areas where suspension straps are located.

504b Guard Van Valve

i) During overhaul of guard van valve, its rubber diaphragm and rubber washer should be invariably changed. Passage through the valve connecting its train pipe side to its chamber should be cleaned. If the passage hole diameter exceeds **6 mm**, the valve should be replaced.

ii) The chamber space of the guard van valve should be checked for leakage, cracks and damage and repaired or replaced as necessary. The valve itself should be checked for easy and correct lift. The valve cover holes should be cleaned, blocked holes opened and bent/deficient lever replaced. The vacuum gauge nipple provided on the guard van valve chamber should be checked for damaged or worn out threads. The loose nipple should be secured firmly on the chamber.

iii) All studs and nuts with worn or damaged threads should be placed. The threads in the body of the chamber should also be good enough to ensure no leakage past them. The guard van valve body threads on which train pipe is secured should also be checked for damage and wear and the body replaced if the threads are bad.

iv) After overhaul, the entire guard van valve assembly should be tested for satisfactory functioning, as given below:

- **Vacuum retaining capacity test:** Guard van valve connected to a chamber of **1640 cu. cm**. volume throughout the assembly, should not, on isolation from the source of vacuum, record a drop of more than 25 mm in 1 minute on the chamber gauge.

- **Operation test**

  1) On release of operating handle, the valve should, with atmospheric pressure throughout the assembly, re-set itself by its own weight.

2) With **460** to **510 mm** of vacuum throughout the assembly, and the source of vacuum isolated, gradual admission of air to the train pipe should show a corresponding drop in vacuum on the van valve gauge.

3) With vacuum throughout the assembly, the guard van valve should automatically lift on a rapid destruction in the train pipe of approximately **225 mm** of vacuum, and on the operating handle of the test apparatus being placed in the "running" position, the guard van valve should re-set itself within **3 to 5 seconds**.

Note:- Above tests 2 & 3 apply only to automatic type of guard van valves having a diaphragm and dome above the atmospheric valve.

504c **Vacuum gauge**

Vacuum gauge which is permanently fitted in guard's van should be removed and calibrated with master gauge before refitting. If defective, it should be repaired and again calibrated with master gauge and refitted. The vacuum gauge guard must be invariably provided to protect the gauge from damage or theft.

504d **Vacuum brake cylinder**

Strip the vacuum cylinder completely. Thoroughly clean and dry the components and check for defects like cracks, damages and wear.

504e **Pan (Cylinder cover)**

Replace the cracked/ broken cover or if the welded lugs are more than **50% of the total lugs**. Broken/ cracked lugs should be replaced with new lugs by welding and grinding. After attending to the defects, the pan should be painted with one coat of anti-corrosive paint.

504f **Gland box (Stuffing box)**

Table 5.1

Guide Bush	
Inside diameter	44.52 +0/-0.03 mm
Outside diameter	54 +0/-0.1 mm

Renew all the rubber items like the neck ring and gland box joint washer invariably. Renew the worn/ loose guide bush. Replace the worn, damaged, or broken studs. Secure the gland box on the cylinder cover with spring washers and nuts.

504g **Piston rod**

Dismantle the piston rod from the piston. Renew the bent, damaged, dented, worn, corroded, or pitted piston rods. If the threads of the piston rod are damaged, the rod should be replaced.

504h **Piston**

The cracked piston should be replaced. The piston skirt serrations should be cleaned free of dust, rust and sediments. Visually check the piston for worn or cracks. Replace the piston if found damaged beyond salvage. Measure the out side diameter with micrometer of range 575-600 mm & record the dimensions. While assembling the Piston and Vacuum cylinder the diametrical difference between the two should be **20.3 mm**. The blind holes for the piston rod cover bolts should be tapped and eased.

504i **Ball valve cage**

The ball valve should be opened, thoroughly cleaned free of dust, dirt and sediments and lightly lapped. Four holes in the cage which should be of 6 mm diameter should be cleaned thoroughly. The ball valve cage cover should be checked for good threads. The ball should be replaced even when slightly worn. Ball valve should be changed when its seating is worn out or pitted and the surface is not smooth to provide good seating for the ball. the ball and the ball seat should otherwise be cleaned with emery paper and lapped together before assembly. The cage cover should be replaced if its threads are damaged.

504j **Piston assembly**

Select the serviceable/ new piston assembly components and assemble the piston assembly as per drawing No.VBA - 16 / M. The piston should then be painted all over except over the working surface ie., serrated portion. The date of overhauling and the code of the shop of overhauling should then be stenciled on the cover end of the piston disc.

504k **Barrel (Cylinder body)**

Cracked barrel including the one with cracked trunnions should be replaced. Lugs cracked or broken should be replaced with new lugs by welding and grinding. The barrel should be replaced if the number of original lugs (ie., those which have not been repaired at all) goes down below **50%.** Thoroughly clean the serrations and check for wear. Measure the inside diameter with micrometer of range 600-625 mm. Replace the barrel if serrations are found worn or damaged. Dry the barrel with hot air after wiping out all the traces of water particles. Clean the release valve seat and the holes for proper seating and free passage of air respectively. After attending to the defects and cleaning, inside of the barrel should be painted with one coat of anti-corrosive paint except the serrated surface, which should be left unpainted.

504 **Joint rings**

Every time a vacuum cylinder is opened, the joint ring should invariably be replaced. After fitting the joint ring in the correct position between flange of cylinder and cover, it can be retained in the correct alignment while fitting the cylinder cover to the cylinder by suitably designed clips.

504m **Rolling ring**

i) Twisted, cut, worn out or perished rolling rings should be replaced. While fitting a rolling ring on a piston surface, it should be ensured that it is of the correct size, i.e. diameter is either **13.1mm** or **13.5 mm** depending upon the wear on the serrated surfaces of the piston and the cylinder and, that the ring does not get twisted. The seam line of the rolling ring should be even and horizontal, when the ring is in its piston groove.

ii) In order to test the ring for twist, it should be hung on a stretched finger and examined. A good ring should hang straight and should not make a figure of 8 and show a twist. The rolling ring should also be stretched by hand and examined. If any cracks appear, it should be considered as perished and replaced.

iii) New rolling rings should be tested for compression and stretching. A 50-mm long test piece cut from the ring should be compressed to half of its sectional diameter and kept in the compressed condition for 3 hours. On release, if its diameter does not come back within **2%** of its original diameter within an hour, it should be rejected as defective. Similarly, the ring should be stretched to **300%** of its original length and kept in the stretched condition for 3 hours. If on release, the ring does not come back to within **5%** of its original length within an hour, it should be rejected as defective.

504n **Release valve**

i) Open the release valve and renew all the rubber items like diaphragm, seating washer, etc., invariably during overhaul. Dry the release valve after wiping out all the traces of water. Check the release valve operating lever and renew if found cracked. The release valve studs should be cleaned and replaced if found damaged or worn. While assembling the valve, nuts should be smeared with graphite grease. It should also be ensured that all the sharp edges on the seat of the spindle washer are rounded off. After assembly, the release valve should be tested as given below:

A) **Vacuum retaining capacity test**

- Release valve, connected through the cylinder port to chamber of 1640 cu. cm. volume with **510 mm** of vacuum throughout the assembly, shall not, on isolation from the source of

vacuum, record a drop of more than **20 mm** in one minute on the chamber gauge.

- Release valve, connected through the chamber port to a chamber of 1640 cu. cm. volume with **510 mm** of vacuum throughout the assembly, shall not, on destruction of the vacuum, record a drop of more than **20 mm in 1 minute** on the chamber gauge.

B) **Operation test:**

- Release valve, connected through the chamber port to a reservoir with vacuum throughout the assembly shall, when the vacuum is destroyed in the train pipe by pulling on the operating lever wire thus operating the valve, remain in the open position till there is pull on the lever wire. It should re-set immediately on removal of the pull.
- On re-creation of not more than 205 mm of vacuum, the valve shall re-set itself.

505 ASSEMBLING AND TESTING OF VACUUM CYLINDER

505a After attending to the defects of vacuum cylinder parts, assemble the Parts as per IRS drawing No.VBA - 16 / M. alt 6. Care should be taken to invariably replace all the rubber items like rolling ring, joint ring, release valve joint washer, piston cap washer, etc. While assembling the Piston and Vacuum cylinder the diametrical difference between the two should be **20.3 mm**. After complete assembly, the vacuum cylinder should be tested on the test bed and stencil the date of overhaul, the date of testing and shop code on the vacuum cylinder body.

505b **Testing of Brake cylinder (Balanced Vacuum Test)**

i) Attach the overhauled brake cylinder to test stand train pipe and test reservoir. The balanced vacuum control valve is connected in between vacuum exhauster and train pipe. This valve will automatically control the vacuum to a maximum of **460 mm** with lever in horizontal position and a minimum of **356 mm** with the lever in vertical position with, exhauster working.

ii) Create **460 mm** of vacuum (lever of control valve horizontal).

iii) Destroy the vacuum.

iv) 20 minutes after destruction, create the balancing vacuum of **356 mm** (lever of control valve vertical). The piston of cylinder in good condition should partly descend but not completely. That which completely descends is faulty and should be dismantled and repaired again.

v) Increase vacuum to **460 mm** (lever of control valve in horizontal) when piston should completely descend. That which does not descend completely is faulty and should be dismantled and repaired again.

After successful BVT testing, supply the brake cylinder to lifting shop for fitting on coach.

506 D.A.VALVE (ESCORT- KNORR D.A. VALVE)

506a Open the two halves of DA valve by removing the four M8 hexagonal nuts. Clean all the components and sub assemblies like lower locking screw subassembly of the lower housing, housing upper subassembly, diaphragm sub assembly, valve seat subassembly, etc. All the rubber items should be replaced invariably and other parts should be changed on condition basis.

List of Rubber Items which should be changed

Table 5.2

Part Name	***Drawing Number***
Diaphragm	*4A 38266*
Seal	*48174*
Nylon guide bush	*KB 408*
Sealing ring A 35 x 41	*Dln 7603*
Sealing ring A 30 x 36	*Dln 7603*
K Ring	*N 891 / 20.2*
Joint ring	*KB 115*

506b The filter element of **(Escort-Knorr D.A.Valve)** should be thoroughly washed in kerosen and blow with compressed air to remove the entire collected dirt. Before fitting back, the filter element should be immersed in light machine oil and the oil allowed to be drained.

The filter element of **(Greysham D.A.Valve)** should be thoroughly washed in parafin to remove the entire collected dirt.

List of Items to be Changed in Escort type DA valve on Condition Basis

Table 5.3

Part Name	Drawing Number
Pin and screw assembly	*4KB 613*
Diaphragm seat	*4A 50314*
Valve seat	*4A 50807*
Locking screw	*4A 55757*
Valve seat	*4A 54952*
Locking screw	*4A 69805*
Hex. nut	M8, DIN 934
Spring washer	B8, DIN 127
Hexagonal bolt M8x35	DIN 931
Self tapping screw 4x5/16"	
Filter assembly	KB 137
Cup plate	KB 409
Hex. nut M10 x 1.5	DIN 439
Washer	DIN 433
Compression spring	4A 30485 / 8

506c The DA valves should be closely examined and seats ground lightly to avoid leaks. While assembling care should be taken for fitting the diaphragm on to the lower housing groove properly. The end corners must be pressed inside the groove. Free movement of the diaphragm subassembly should be checked by hand. During the final assembly of upper and lower housing, tightening of hexagonal nuts should start from the O-ring end and the 4 nuts must be tightened evenly.

506d Testing of DA valve: After the DA valve is overhauled and assembled, it should be tested on the test bench as indictated in **figure 5.2** for its functional performance and leakage.

i) **Retention test :** Mount the DA valve on the test stand and create vacuum till **530 mm Hg** is indicated on both gauges A and B of the test stand. Close stop cock "Y" and then stop cock "X". Record the drop of vacuum in both the gauges A & B, which should not be more than **12.5 mm in 10 minutes**.

ii) **Operation test :** The stop cock "X" is opened till the gauges A & B again record **530 mm of vacuum**. Then stop cock "X" is closed and "Y" is opened. Record the drop in gauge B (brake cylinder) from **530 mm to 25** mm which should be within 3 seconds.

iii) **Proportionality test :** Open stop cock "X". Vary vacuum in gauge A by opening and closing cock "Y". It will be observed the gauge B follows gauge A very closely both during creation of vacuum and brake application.

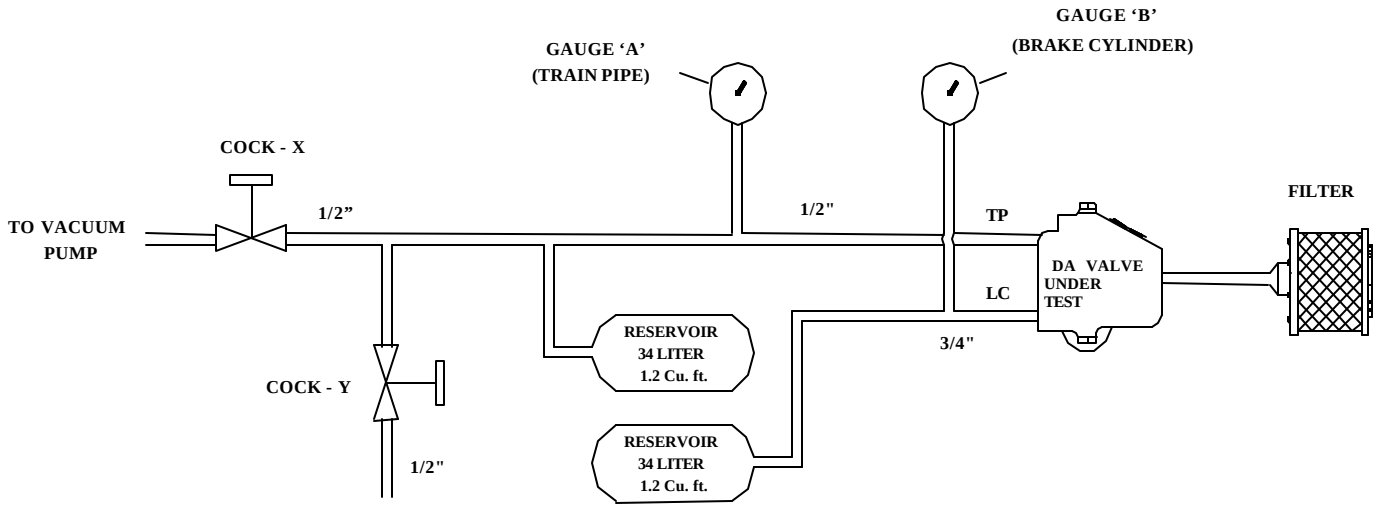
507 SLACK ADJUSTER (SAB DRV2-450)

Refer to write-up on Slack adjuster in para 413 of Air Brake Chapter.

507a End piece for slack adjuster pull rod

Prepare end piece for pull rod as per the RDSO SK - 96102 alt. 3 to be used in modified vacuum brake system to provide horizontal movement to slack adjuster:

Type of coaches	Length of end piece
WFSCN, SL, SCNLR	265 mm
All other vacuum braked coaches	155 mm



TESTING OF DA VALVE
Figure 5.2

508 ASSEMBLING BRAKE SYSTEM ON COACH

After receiving the overhauled brake system components, these should be fitted on the coach in proper order and in their respective locations. Then lower the coach on overhauled bogies and connect the pull rod end of slack adjuster to vertical levers of the bogie brake rigging.

509 **ADJUSTMENT OF BRAKES**

509a A vacuum cylinder as fitted shall have a minimum clearance of **13 mm** between the piston cotter and fork end arm of the brake shaft when both are in their lowest positions. The brake gear adjustment should be such that the piston stroke is within limits specified for different types of stock. With the piston in fully lifted up position, there must be a minimum clearance of **25 mm** between the top of the fork end arm and the cylinder stuffing box.

509b **Testing of vacuum brake system (Balance vacuum test)**

i) Adjust brake gear to ensure that the piston stroke is within prescribed limits i.e,. **203 –3 mm** (This is important as the balancing vacuum is based on the correct piston stroke). While this is being done, the train pipe should be tested with **255 mm** vacuum to detect and attend porous or leaky hose pipe and or joints.

ii) The balanced vacuum control valve is connected in between vacuum exhauster and train pipe. This valve will automatically control the vacuum to a maximum of **460 mm** with lever in horizontal position and a minimum of **356 mm** with the lever in vertical position with exhauster working. Although the vacuum reading at the valve applies to the front of the coach, it will control the necessary drop of **102 mm** for balancing throughout the train during test.

iii) After the vacuum is created up to the end of the coach completely destroy the vacuum.

iv) 20 minutes after destroying, create the balancing vacuum of **356 mm** (lever of control valve vertical). The pistons of cylinders in good condition should partly descend but not completely. That which completely descends is faulty and should be replaced and checked again.

v) Increase vacuum to **460 mm** (lever of control valve in horizontal) when piston should completely descend. That which does not descend completely is faulty and should be replaced and checked again.

510 ADJUSTMENTS OF SLACK ADJUSTER

510a Control dimension `A' Slack adjuster: After the Brake Regulator has been installed or when checking an existing installation, carry out the following:

i) Make sure that the hand brake and the vacuum brake are fully released and the whole rigging is in proper order.
ii) Make three or four brake applications at correct vacuum to ease the rigging.
iii) Once again ensure that the whole brake rigging is in the fully release position. The installation can not be correctly adjusted or checked if the brake rigging is only partly released.
iv) Now set the dimension `A' between the control rod head and the barrel head which is **16 +4/-0 mm** and **22 +4/-0 mm** for ICF coaches with 13t and 16.25t bogies respectively and rotate to suit refitting control rod and pin when the dimension `A' is correct.
v. Make a few more brake applications at the correct vacuum, this time checking piston strokes which should be within the limits specified. Also recheck dimension `A' again with brake fully released and correct if necessary.
vi) Lock the control rod head firmly with nut and tooth lock washer. Secure pin with split pin.

510b **Dimension `e'**

The dimension `e' which is **375 ± 25 mm** represents the capacity available for adjustment and will decrease as wear takes place at brake shoes, wheel and pin joints.

The maximum value of dimension `e' should be within the permissible limits for each value when:

i) All brake shoes are new.
ii) All pin joints have new pins and bushes.
iii) All wheels are new.

If it is not within permissible limits, after ensuring that all other relevant parts in the rigging are correct to the drawing, the length of one of the pull rods may be adjusted and the piston stroke checked again.

511 LIST OF TOOLS AND PLANT

Table 5.4

Lifting shop	**Vacuum brake shop**	**Slack adjuster shop**
Ball peen hammer	Ball peen hammer	Ball peen hammer
Chisel	Chisel	Chisel
Spanner set	Spanner set	Steel measuring type
Gas cutting plant	Single girder electric hoist	Pipe vice
Welding plant	Box spanner set	Spanner set
Jack for brake cylinder fitting	Vacuum exhauster	Jacking tool
BVT test equipment	BVT valve	Screw driver
Pallets	D.A. Valve test rig	soaking tank
Platform truck	Compressed air supply	Inspection guages
	Guard van valve test rig	Box spanner set
	Clapet valve test rig	Spring testing rig
	Vacuum gauge test bench	Gas cutting plant
	Train pipe test rig	Welding plant
	Vacuum test rig	
	D.A. Filter cleaning plant	
	Fork lift	
	Plat form truck	
	Cleaning plant	
	Hot water jet system	
	Waste water treatment plant	

512 **TROUBLE SHOOTING ON VACUUM BRAKE**

Table 5.5

Sr. No.	Defects	Probable cause	Method of Testing	Remedies
i)	Coaches not provided with Slack Adjuster			
	Brake Power Weak	a) Brake Blocks slack & not braking wheels	Check the piston travel. Brake shaft arm will be touching the cylinder when brakes are applied.	Adjust brake gear. If even then the brake power is weak, change the brake blocks.
		b) Brake blocks slack but braking wheels without requisite force.	Check whether the piston travel is more than 125 mm or not.	Adjust the brake gear or change the brake blocks.
		c) Brake gear bushes worn out.	Shake brake hangers with hand to see whether bushes come out along with the hangers or pins rattle in bushes.	Adjust the brake gear or Change all bushes and pins as necessary.
		d) Brake rigginng stiff and brake release spring too strong.	Brake shaft arm remains up even after release of brake, though the piston comes down.	Ease the brake shaft & replace the strong release spring with that having proper tension.
ii)	Coaches provided with Slack Adjuster			
	Brake Power weak	e) Excessive free lift	Measure free lift.	Adjust free lift to 14 mm.
		(f) Defective cylinder	See whether the piston goes up when vacuum is destroyed.	Repair or replace vacuum cylinder.
		(g) Excess 'A' dimension	Measure 'A' dimension	Adjust as specified for the type of coach.
		h) Defective brake rigging	Check that all brake rigging components are as per drawing and the clearance between brake gear pins & bushes are within the permissible limit.	Change brake gear compo-nents, pins and bushes as necessary.
		(i) Manual adjustment in respect of wear of wheel has not been made	Measure wheel diameter and check "e" dimension.	Adjust 'e' dimension in respect of wear of wheels

Sr. No.	Defects	Probable cause	Method of Testing	Remedies
		j) SAB Slack Adjuster pin defective.	On application & release of brake see whether the Slack adjuster barrel rotates.	Replace slack adjuster.
2)	Brake on a coach do not release.	(a) Brake rigging pin & brake shaft jammed.	Move or shake by hand and feet.	Ease the jammed compo-nents.
		(b) External leak in the train space of vac. cylinder commonly due to worn out neck ring or scored piston rod	Test by a flame which will be drawn in at places of leakage or close the valve connecting the source of vacuum, after creation of vacuum and check the train needle in the vacuum gauge which will come down.	Rectify the leak or change the neck ring or the piston rod as required.
		(c) Engine not creating the same amount of vacuum as was prior to an application of brakes	Visual examination	Release train vacuum cylinders.
3)	Fall in vacuum on run by 125 to 175 mm reported by Driver.	(a) Clappet valve spring defective. (b) Syphon pipe getting disconnected.	a) Drop of vacuum by 125 to 175 mm. b) Drop of vacuum by 125 to 175 mm.	Adjust the clappet valve or blank it. If can not be adjusted, adjust and secure the syphon pipe.
4)	Vacuum cannot be created on the train.	a) Leakage at joints of train pipe, train pipe nipple, hose pipe, Syphon pipe.	Check vacuum in the brake van and the engine. Listen for hissing sound to detect leaks.	Starting with the last coach, check all joints and rectify all leaks with a sealing compound, or/and replace defective hose pipe clips and rubber washer, as necessary. after checking all coaches upto the engine and rectifying defects as noticed, if vacuum still cannot be created, then devide the train into two equal parts and test each part separately. Again subdivide the part found defective and test each sub-part. This is continued till the defective vehicle is located.
		(b)Rubber washers in hose pipe joints missing or twisted.		
		(c)Rearmost hose pipe of the train not secured on its dummy.		
		(d)Leakage in vacuum chamber.		
		(e)Guard' s van valve leakage.		
		(f) D.A. Valve leaking.	Check for leakage.	Replace or by-pass D.A. Valve.

Sr. No.	Defects	Probable cause	Method of Testing	Remedies
5.	Abnormal variation in the amount of vacuum between engine gauge and brake van gauge.	a) Partial obstruction of hose pipes of the train pipe		Create the vacuum 460 to 510 mm and destroy it. Now observe closely the extent of piston travels of all coaches. The travel of the piston would be greater on coaches between the locked portion and the engine, than that of the coaches in the portion beyond the blockage i.e. between the blocked coach and the rear brake van. In case there is a complete blockage, the piston travel would indicate where the vacuum brake has not functioned, at all.
		b) Vacuum gauge of Guard Van valve defective.		Replace the defective vacuum gauge.
6)	Piston applies brakes when the vacuum is created	a) Leak at neck.	Destroy vacuum and see if the piston comes down.	Change the neck ring or blank off the vacuum cylinder and advise the next train examining station to change the neck-ring.
		b) Wrong connection of syphon pipe on the triple way release valve	Ditto	Correct the syphon pipe connection.

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