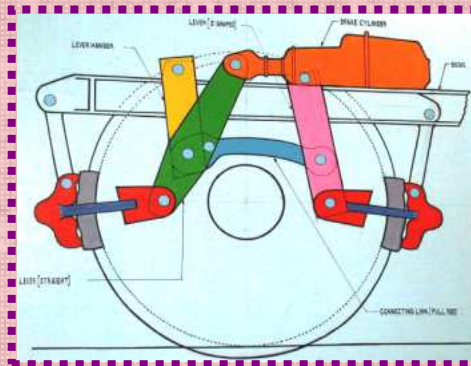




(Govt. of India)
(Ministry of Railways)

Handbook On *Bogie Mounted Brake system for ICF Coaches*



(For official use only)
IRCAMTECH/M/11-12/BMBS/1.0

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अभ्यास RDS
रेल अग्रदूत Transforming Railways



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PREFACE

BMBS system is the vital part of passenger coaches & other ICF fitted bogie coaches. BMBS system is recently introduced in Indian Railways. Proper up keeping and maintenance of BMBS system is necessary to ensure reliability and availability of coaches. This Handbook on BMBS system has been prepared by CAMTECH with the objective that those involved in maintenance of Passenger coaches & other ICF bogie fitted coaches, must be aware of BMBS system and its function with correct maintenance. This Hand Book not only describes in BMBS system but care has been taken to explain basic thing about BMBS system including introduction, working principle, testing procedure etc.

Technological up gradation and learning is a continuous process. Hence feel free to write to us for any addition/modifications or in case you have any suggestion to improve the Hand Book, your contribution in this direction shall be highly appreciated.

Date:

Place:

(K.P.Yadav)
Director(Mech)

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CORRECTION SLIPS

The correction slips to be issued in future for this handbook will be numbered as follows:

CAMTECH/2011/Mech/Corrosion/1.0/C.S. # XX date
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Where “XX” is the serial number of the concerned correction slip (Starting from 01 onwards)

CORRECTION SLIPS ISSUED

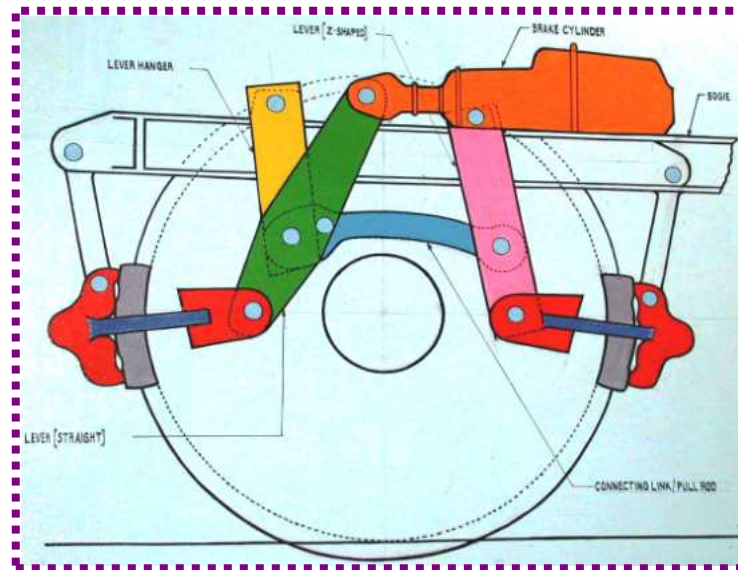
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Bogie Mounted Brake system for ICF Coaches

BOGIE MOUNTED BRAKE SYSTEM

1.0 INTRODUCTION

In the under frame mounted brake gear arrangement, there are 51 pin joints per bogie in the system. To reduce the number of pin joints, levers, pull rods and push rods, bogie mounted brake system for mainline coaches have become a viable alternative.

In order to overcome the problems faced due to the breakages and malfunctioning of SAB enroute, and also due to the frequent breakages and replacement of Cast Iron brake block, a new system called Bogie Mounted Brake System is introduced. In this system, the SAB's are eliminated by providing the cylinders directly mounted on the bogie frames itself, and the High friction composite K type brake blocks minimizes the frequent replacement and breakages of brake blocks.

The main purpose of providing the High friction composite brake block is to overcome the deficiency in brake power in the Bogie mounted system

Indian Railways is progressively switching over to Bogie mounted air brake system on coaching stock. All new coaches manufactured from ICF/RCF are being fitted with this brake system. Railway Workshops are also undertaking retro fitment of bogie mounted air brake system from conventional vacuum brake system and twin pipe graduated release standard air brake system.

SUMMARY

Brake gear or rigging is provided to control the speed of the coach by transferring the braking force from the brake cylinder to the wheel tread. Brake rigging can be divided

into two groups i.e. Bogie mounted brake rigging and coach under frame mounted brake rigging.

Under frame mounted brake rigging

In 16.25 t axle load bogie the four lever used in bogie brake rigging are each with lever ratio of **1:1.376** and hence the total Mechanical advantage in a bogie is **5.504**.

In 13 t axle load bogie the four lever used in bogie brake rigging are each with lever ratio of **1:1** and hence the total Mechanical advantage in a bogie is **4**.

SAB type Brake regulator is used to maintain the pre-determined constant clearance between brake block and wheel tread. This is known as Take-up operation. In case the clearance is reduced while replacing wheel, brake block or during brake gear adjustment SAB brake regulator also increase the clearance to maintain pre-determined constant clearance. This is known as Pay-out operation. The take-up and pay-out operation is performed automatically.

A-dimension is the clearance between control rod head and barrelhead face in brake released condition.

e-dimension is the maximum amount in millimeters that a SAB brake regulator can shorten its overall length during TAKE-UP operation, when wheels ,brake blocks, and other brake gear items are new.

The % braking is defined as the ratio of total brake block force on a coach to tare weight of that coach in a under frame mounted system. This value is different for different stock.

In order to overcome the problems of slack adjuster failure as well as problems associated with cast iron brake blocks, a design of brake system incorporating 8" size two

cylinders on each bogie along with 'K' type high friction composite brake blocks has been introduced.

Bogie mounted rigging

Bogie brake rigging has been modified to incorporate a total mechanical advantage of **7.644** per bogie for non-ac coaches and **8.40** per bogie for ac coaches.

The % braking is defined as the ratio of total brake block force on a bogie to the tare weight of that coach in a bogie mounted system. This value is different for different stock.

2.0 DESIGN FEATURES OF BOGIE MOUNTED BRAKE CYLINDER

This type of system is exactly similar to the standard air brake system except for the following:

- External slack adjuster is removed/ eliminated
- Four cylinder of 8" size is provided for each coach in place of two cylinders of 14" in standard air brake system. These cylinders have built in single acting slack adjuster for taking the slack created between wheel and brake block on account of wheel / brake block wear. Mounting of cylinders is done on either side of the bogie frame in between central longitudinal members connecting the bogie transom to the headstocks. Each cylinder controls the braking on one wheel set. Each cylinder has a piston take up stroke of up to **32 mm** and adjustment capacity of **305 mm** (Ref. Drg. RDSO Sk- 81057)
- High friction composite brake blocks of 'K' type have been used.
- Bogie brake rigging has been modified to incorporate a total mechanical advantage of **7.644 per bogie** for non-AC coaches and **8.40 per bogie** for AC coaches.

- These cylinders are mounted between central longitudinal members connecting the bogie transom and the headstock on either side.
- Provided with less number of brake fittings, therefore, easy to maintain.
- The overall weight saving per coach is about 492 kg.
- Number of pins and bushes reduced from 102 to 84.
- Braking distance has come down from 905 mm to 800 mm.
- The forces acting on the levers and truss beams is only 40% when compared to 100% in under frame mounted system, therefore the wear on the brake gear components are less, and hence the frequent replacements of these components are minimised.
- As the forces acting on the Truss beam is only 1 tonne, when compared to 3.2 tonnes in the under frame stock, 13 tonnes capacity truss beams are sufficient
- Curved profile pull rods have been used to interconnect levers controlling braking one wheel set. These pull rods provided with one additional hole for the adjustment of slack between wheel and block after specified amount of wear.

Since brake cylinders have been mounted on the bogie frame, 15 mm. bore pneumatic pipeline has been laid over bogie frame to inter connect the brake cylinders of one bogie. Output pipe line of distributor valve has been connected to bogie pneumatic line through flexible hoses to provide flexibility to all-round dynamic movement.

3.0 COMPOSITE BRAKE BLOCK

High friction composite brake blocks have the following benefits:

- Reduced braking distance due to uniform co-efficient of friction.
- Reduced weight
- Reduction in the replacement of brake blocks vis a vis cast iron due to higher wear life in train operation.
- Reduced wear and tear of brake rigging.
- Reduced noise during braking.

3.1 Characteristics of Composition Brake Blocks

i. Composition of material

The composition of material constituting the brake blocks must be chosen to give the best balance between:

- The braking characteristics
- The wear and service life of blocks
- Wear on the running surface of the wheels
- The effect on adhesion between the rail and wheel

ii Requirement concerning friction

- The average coefficient of friction is **0.25**.
- As far as possible the coefficient of friction must be independent of the initial braking speed, the state of bedding-in of the brake block, the specific pressure also the temperature and atmospheric conditions.

- Under the effect of dampness, the average coefficient of friction must not vary, with the other condition remaining the same, by more than **±15%** in relation to the value obtained during braking when dry.
- After prolonged braking followed by braking to a stop, particularly high temperature occur. Even in the case of these temperatures (**maximum 400 °C** on the opposing friction surface) the average coefficient of friction must not vary with the other conditions remaining the same – by more than **±15%** in relation to the value obtained during braking in cold and dry state.

iii Geometrical characteristics of the brake blocks

- The constructional features of the brake blocks must enable them to wear down to a thickness of **12 mm** including the back plate, without the latter coming into contact with the running surface of the wheel.

iv Mechanical and physical characteristics

- The various elements making up the brake blocks must be spread uniformly in the body of the block. There must be no pitting, flaws or other defects. The material must not attack the opposing friction surface or give rise to the formation of metal inclusions.

Composition brake blocks must not bring about more serious heat damage to the wheels (hot spots, cracks, flaking) than would be caused by cast iron blocks used in the same way on the same wheels.

- The values of specific weight, thermal conductivity, hardness, bending strength and the

modulus of elasticity must be given for acceptance purposes.

- No method is laid down for fixing the composite material part to the back plate. The back plate must be designed to support the stresses likely to occur.
- The composition blocks must not affect to an unacceptable degree the adhesion values between wheel and rail obtained on vehicles braked with cast iron inserts.

3.2 Non-Asbestos ‘K’ Type Composition Brake Block

- Non-asbestos ‘K’ type blocks shall generally conform to RDSO drawing No. 98066(latest alteration)
- The use of asbestos is prohibited.
- The use of lead or zinc in the metal state or in the form of compounds is not advised. The same applies to all other compounds, if in the form of powder, particles or gas produced during the use of the brake blocks, they may constitute a danger to health.

3.3 Asbestos Based ‘K’ Type Composition Brake

- Asbestos based ‘K’ type blocks shall generally conform to RDSO drawing No. 98146.

3.4 Marking

Each block must bear the following marks:-

- Name of manufacturer
- Date of manufacturer (month and year)
- Material code including ‘KA’ for asbestos type and ‘KNA’ for non-asbestos type.
- Type of service ML.

These marks, preferably punched, cut or stamped, must be applied so that the block can be identified, even after being fully worn in service.

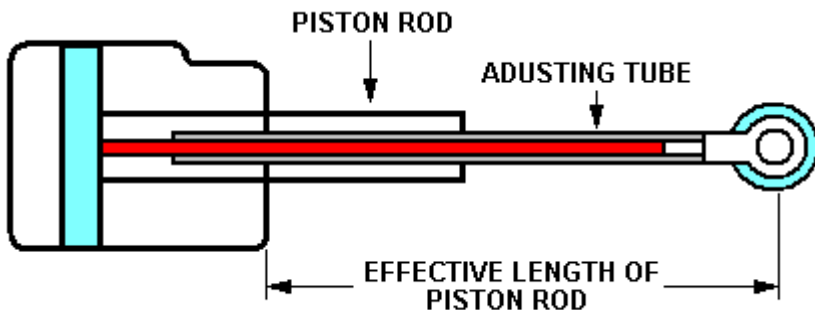
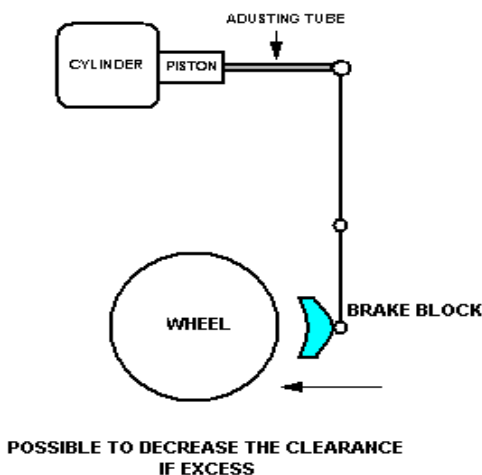
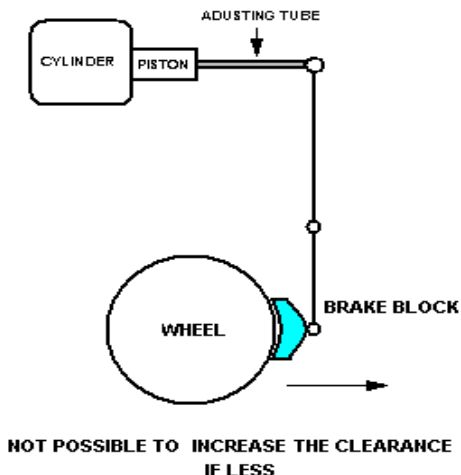
3.5 Comparison of Properties/Usage of Composition Brake Block Vs Cast Iron Brake Block

Param-eters	Type of Brake blocks in use on main line coaches		
	<i>'L' type CBB</i>	<i>'K' type CBB</i>	<i>CI</i>
Appli-cability	All coaches with underframe mounted air brake system	All coaches with bogie mounted brake system	All coaches with vacuum brake and under frame mounted brake system
Speed	Upto 110 KMPH	upto 110 KMPH	Upto 140 KMPH
Coefficient of friction	0.12 to 0.14	0.25 average.	0.12 to 0.14
Weight	Approx. 3 kg.	Approx. 3 kg	Approx. 9 kg.

4.0 DESCRIPTION OF BOGIE MOUNTED BRAKE CYLINDERS

The Bogie Mounted Brake Cylinders are provided with an in-built slack adjuster to maintain a constant brake block clearance automatically. It is a single acting slack adjuster by which the clearance between wheel and brake block

can be decreased automatically by increasing the effective length of piston rod whenever the piston stroke exceeds up to 32mm due to wear on the brake block and the wheel. During return stroke, the adjusting movement takes place.



If the clearance between wheel and the brake blocks is less due to any reason, it does not bring the required clearance automatically.

4.1 Bogie Mounted Brake Rigging

Bogie brake rigging has been modified to incorporate a total mechanical advantage of **7.644** per bogie for non-ac coaches and **8.40** per bogie for ac coaches.

The components of bogie mounted air brake (16 t bogie & 13 t bogie) are given below:

Sr.No.	Description	Quantity per Coach
1	Brake Head & block complete (LH)	8
2	Brake Head & Block complete (RH)	8
3	Brake beam	8
4	Safety wire rope	16
5	Lever	8
6	Lever	8
7	Lever Hanger	8
8	Pull rod	8
9	Brake block Hanger	16
10	Pin	44
11	Plain Washer	64
12	Split cotter	52
13	Pin	4

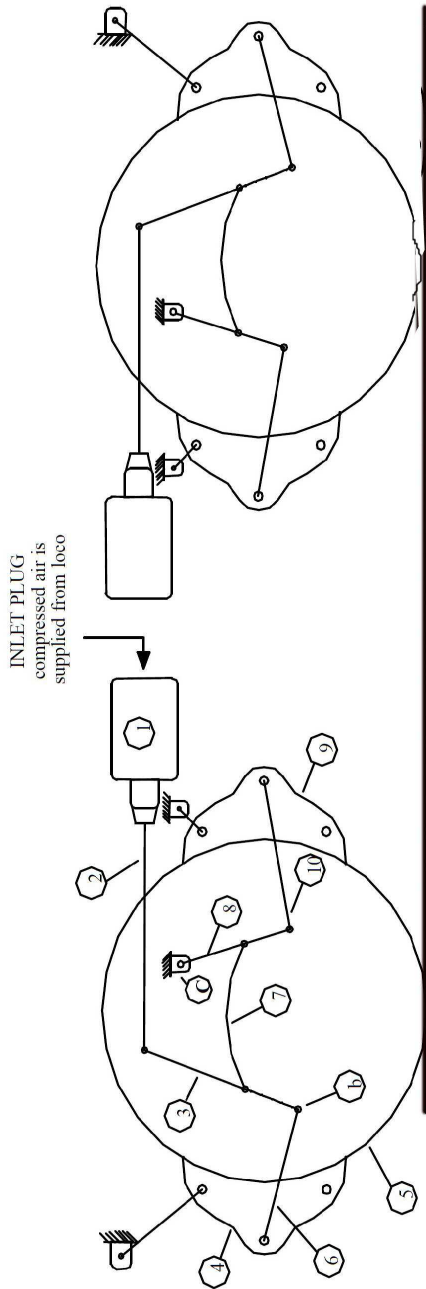
14	Plain Washer	4
15	Pin	4
16	Pin for lever Hanger	16
17	Pin for Safety wire rope	32
18	Pin Washer M 20	32
19	Split cotter	32

4.2 General Working of Bogie Mounted Brake Gear System

There is no change in the overall brake system in bogie-mounted arrangement up to the action of distributor valve. Here the system will respond to action on A-9 valve in similar fashion as in the case of standard air brake system. Working of bogie mounted brake system beyond distributor valve is explained below.

Application

For application of brakes, driver moves the handle of A-9 valve in the application position. By this movement the brake pipe pressure is reduced which is sensed by distributor valve to operate brake cylinder (1). Pneumatic pressure in the brake cylinder causes piston assembly (2) to move outward thereby causing lever (3) to rotate about its fulcrum (a) thus bringing brake block (4) to come in contact with the wheel (5) through the brake beam (6). Since lever (3) is hung on the bogie frame through lever hangers, it will start moving forward about fulcrum (b) after brake block (4) has contacted wheel (5).



**SCHEMATIC BOGIE BRAKE GEAR ARRANGEMENT FOR
BOGIE MOUNTED BRAKE SYSTEM**

This forward motion of the lever (3) about fulcrum (b) will cause pull rod (7) to move forward thereby causing lever (8) to swing about fulcrum (c) and hence resulting in contact of brake block (9) against wheel (5) through brake beam (10).

Extent of brake cylinder pressure developed in the brake cylinder will depend upon the extent of reduction in brake pipe pressure. Maximum brake cylinder pressure developed is **3.8 +/- 0.1 kg/cm²** as in the case of standard air brake.

Release

For release of the brakes, driver moves handle of A-9 valve to release position. This movement charges the brake pipe charged to the required pressure of **5 kg/cm²**. This actuates the distributor valve and brake cylinder is cut off from the auxiliary reservoir. The air from brake cylinder is exhausted to atmosphere and brakes are released.

Slack take - up Action

Cylinders of bogie mounted brake system are provided with automatic slack take up features. As soon as the piston stroke exceeds a pre determined value (on account of either brake block or wheel or both) a ratchet with adjusting screw fitted inside the cylinder turns thereby increasing the length of the piston of bogie brake system with conventional air brake system for various parameters is as follows:-

During return stroke, the adjusting movement takes place. A red paint mark on the adjusting tube assembly indicates that piston unit has extended over its full range and requires resetting of pull rod (7).

4.3 Hand Brake Attachment

On the Piston trunk of brake cylinder hand brake trunions are fitted whenever it is required. During the service application the hand brake trunion does not move. The maximum hand brake stroke required at the trunion corresponds to maximum brake cylinder stroke.

4.3.1 Re-Setting

A red paint mark on the Adjusting tube sub-assembly indicates that the piston unit has extended over its full range and requires re-setting. The design of brake rigging unit is done in such a way that range of slack adjuster covers the life of brake blocks so that resetting and replacing the brake blocks will be done at the same time. While keeping the adjusting screw stationary, by turning the adjusting tube sub-assembly in clock wise direction the distance between piston to cross head is reduced to minimum level. The resetting of unit takes place at position.

4.3.2 Procedure for Re-setting

Hold the latch out of engagement with the resetting plate. The adjusting tube should be turned in clockwise direction by means of the lugs until it reaches the inner end. Then reengage the latch

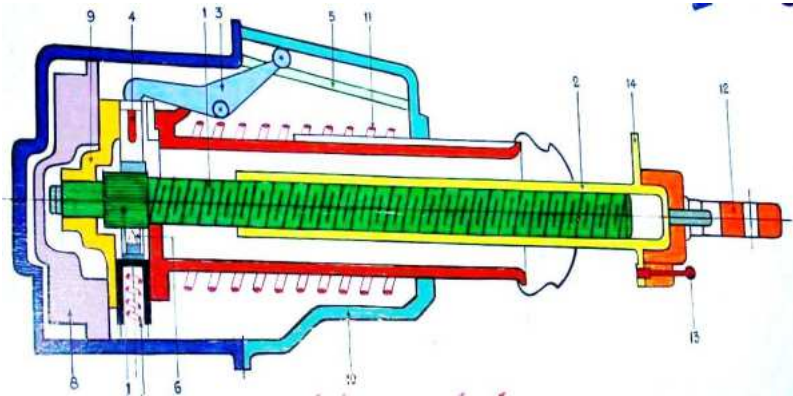
4.4 Manual Adjustment of BMBC

A red paint mark on the adjusting tube sub-assembly indicates that the piston unit has extended over its full range and requires re-setting. The design of the brake-rigging unit is done in such a way that range of slack adjuster covers the life of brake blocks so that re-setting and replacing brake blocks will be done at the same time.

4.4.1 Procedure of Manual Adjustment

- Disengage the cross head from the adjusting tube, by pulling the latch.
- Turn the adjusting tube clockwise to decrease the length of the adjusting tube (Effective length of piston rod).
- After replacing the brake blocks, apply to brake and check the piston strokes.
- If piston stroke is correct, engage the cross head with the resetting plate by releasing the latch.
- If the piston stroke is less, decrease the length of adjusting tube to increase to clearance between wheel and brake block.
- If the piston stroke is more, increase the length of adjusting tube to decrease the clearance between wheel and brake block.
- After adjusting the piston stroke, ensure the cross head is locked with adjusting tube with the latch.

5.0 COMPONENTS OF BOGIE MOUNTED BRAKE CYLINDER



parts of bogie mounted brake cylinder is -

- Adjusting screw with ratchet
- Adjusting tube
- Rocker arm
- Plunger pin
- Roller plate
- Pawl housing ring
- Pawl
- Piston
- Turnion body
- Front cover
- Piston return spring
- Cross head
- Latch

- Resetting plate
- Pawl spring
- Plunger spring

5.1 Function of Main Components

Adjusting screw

The adjusting screw is connected with a ratchet and forms a single unit. The adjusting screw is provided with a pitch of $1/8''$ (3.15 mm). The ratchet is provided with 18 teeth.

The function of adjusting screw is to move the adjusting tube forward to increase the effective length of the piston rod automatically or to decrease the effective length of the piston rod manually.

When the adjusting screw completes one full rotation it makes adjusting tube to move forward or backward by $2 \times 3.15 \text{ mm} = 6.30 \text{ mm}$.

If the ratchet is moved/rotated by one tooth, the adjusting screw is rotated by $360 \text{ degree}/18 = 20 \text{ degree}$, which in turn moves the adjusting tube outward/inward by $6.30/18 \text{ mm} = 0.33 \text{ mm}$ ($1/72''$).

From the above, it is clear that to move the adjusting tube forward automatically by $1''$, it requires 72 return strokes.

Functions of adjusting screw and the spindle-

The functions of adjusting screw and the spindle are

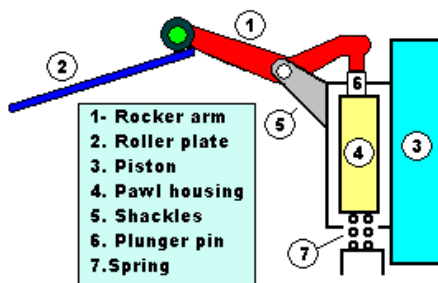
1. It increases the effective length of piston rod automatically, whenever the piston stroke increases up to 32 mm due wear on the wheel and the brake block.

2. It facilitates to increase or decrease the effective length of piston rod manually, whenever brake blocks are changed or piston stroke is adjusted.

Rocker arm:

The rocker arm is fitted with piston head by means of shackles and it moves along with the piston head.

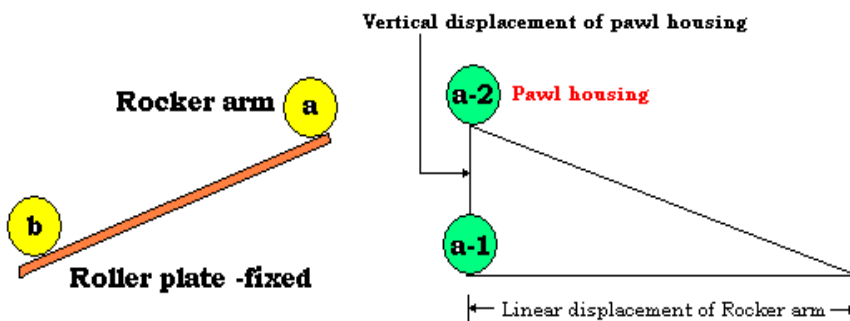
The roller end of the rocker arm slides over the roller plate and the other end of the rocker arm rests on the pawl housing through plunger pin. (Fig 4a & 4b)



Roller plate:

The roller plate is fixed at an angle with the front cover by means of bolts. The function of roller plate is to displace the pawl housing vertically when the rocker arm moves horizontally. It converts the linear displacement of rocker arm into vertical displacement of pawl housing.

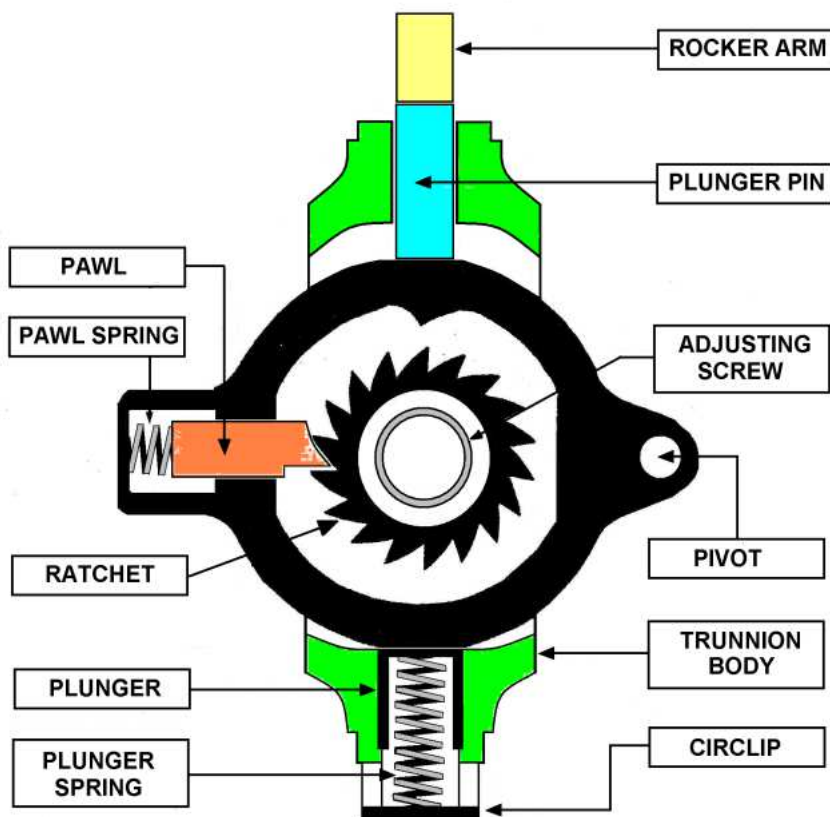
Pawl housing ring:



Note: When rocker arm at 'a', the pawl housing ring at 'a-1'

The pawl-housing ring is pivoted with the pivot pin of the trunion body at one end and the other end of the pawl housing ring moves/turns freely.

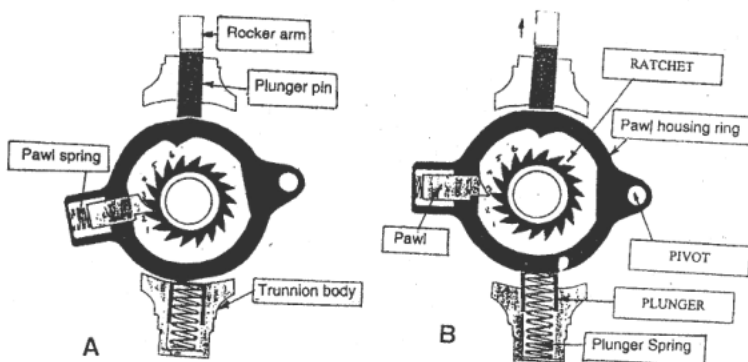
A spring-loaded pawl is housed at the free end of the pawl housing. At the bottom of the pawl housing a spring loaded plunger / sleeve is kept between the trunion body and the pawl housing to move the pawl housing upward/outwards during forward stroke. At the top, a plunger is kept between the rocker arm and the pawl-housing ring to move the pawl housing downward during return stroke.



The function of the pawl housing and the pawl is to move / turn the ratchet by one tooth whenever the piston stroke exceeds up to 32 mm to increase the effective length of the piston rod during return stroke automatically.

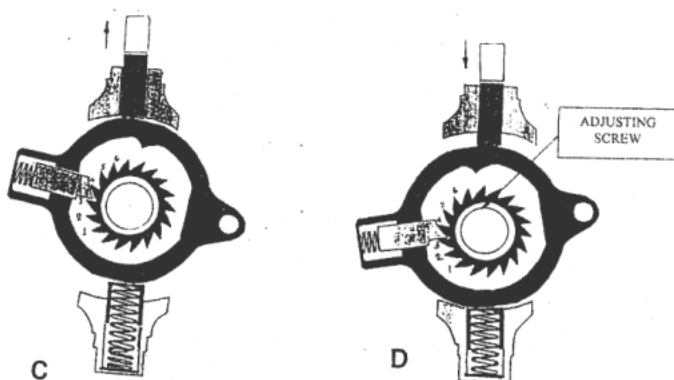
6.0 WORKING OF IN-BUILT SLACK ADJUSTER

When the piston stroke is within 32mm, the spring-loaded pawl in the pawl housing moves between the two teeth of



A. POSITION OF PAWL & RATCHET, WHEN THE BRAKE IS IN RELEASED POSITION

B. POSITION OF PAWL & RATCHET, WHEN THE PISTON STROKE IS WITH IN 60mm.



the ratchet and keeps the effective length of piston rod unaltered.

When the piston stroke exceeds up to 32mm during the forward stroke due to the wear on the brake block and the wheel, the pawl slips and takes the position of next tooth in the ratchet.

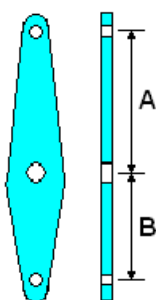
During the return stroke, the rocker arm pushes the plunger pin inwards/downwards which in turn turns the pawl-housing ring clockwise. The pawl which is housed in the pawl housing turns the ratchet with the adjusting screw by 20^0 causing the adjusting tube to move forward by $1/72''$ to increase the effective length of the piston rod.

7.0 TYPES OF LEVERS AND HANGERS ARE USED IN BMBS

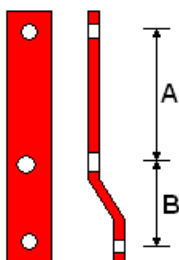
The following parts are used in the Brake Rigging.

- Lever- Straight.
- Lever – Z shaped
- Lever Hanger
- Connecting Link.

DIMENSIONS OF BRAKE RIGGING -BMBS

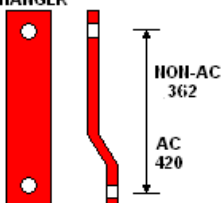


LEVER -STRAIGHT	A	B
NON-AC	302	158
AC	366	174

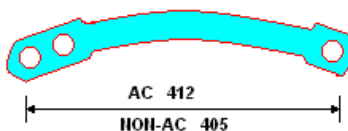


LEVER- Z SHAPED	A	B
NON-AC	256	134
AC	311	148

HANGER

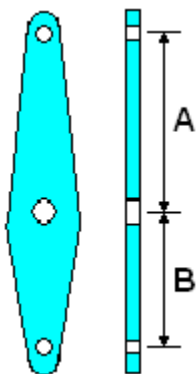


CONNECTING LINK



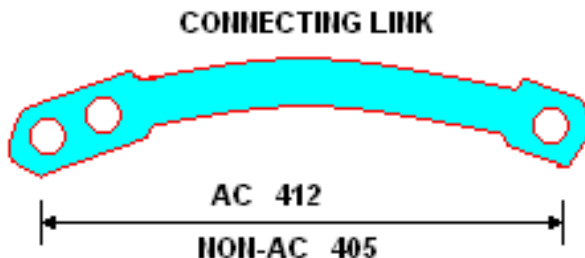
8.0 MAINTAINING THE BOGIE MOUNTED BRAKE SYSTEM

1. Ensure the bogies are provided with the high friction composite “K” type brake blocks. Average Co-efficient of Composite K-type brake block is 0.25
2. Ensure that the floating levers are not interchanged between AC and Non AC coaches.



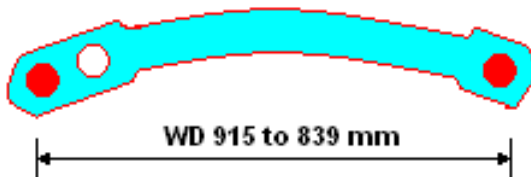
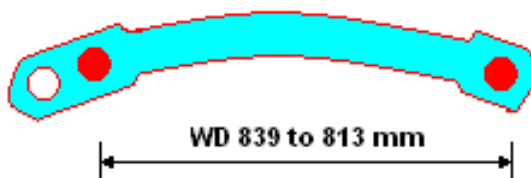
LEVER -STRAIGHT	A	B
NON-AC	302	158
AC	366	174

3. Ensure the levers are not reversed.
4. Ensure the connecting links (pull rod) are not interchanged between AC and Non-AC coaches.

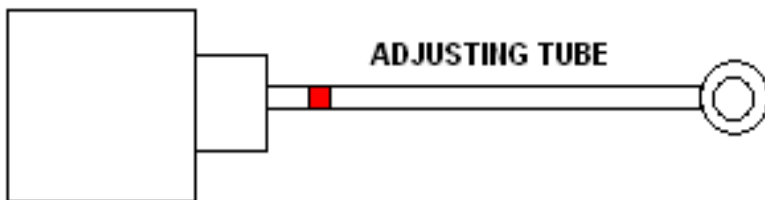


5. Ensure the connecting link (pull rod) is not reversed.

6. Whenever the wheel diameter is reduced to 839 mm, ensure the brake gear connection is shifted to next inner hole of pull rod.



7. Ensure 38 mm packing is given between dashpot and the axle box wing whenever the wheel diameter is reduced to 839 mm.
8. Whenever the red mark is seen on the adjusting tube, replace all the brake blocks since further take up of clearance is not possible.
9. Ensure correct size of brake gear pins and bushes are used in brake rigging.



10. Ensure the piston stroke is within up to 32 mm. If more, the in-built slack adjuster is defective and the replace the brake cylinder.
11. Ensure the rocker arm end is kept horizontal and facing towards the gauge face of the wheel.

9.0 PERCENTAGE BRAKING:

The % braking is defined as the ratio of total brake block force on a bogie to the tare weight of that coach in a bogie mounted system. This value is different for different stock.

The table below shows % braking of some important self generating Air conditioned coaching stock fitted with bogie mounted brake system.

TYPE OF COACH	TARE WEIGHT IN TONNES	% OF BRAKING
WGSCZAC	50.95	40.56
WGSCWAC	52.10	39.66
WGFAC	49.90	41.41
WGFSCZ	50.00	41.33
WSCZAC	48.90	42.26
WSCWAC	49.40	41.83
WFAC	46.20	44.73
WCBAC	47.90	43.14

Similarly the % braking for different Non-AC coaches fitted with bogie mounted brake system is given below.

TYPE OF COACH	TARE WEIGHT IN TONNES	% OF BRAKING
GS	36.00	52.23
SCN	37.55	50.08
SDC	36.50	51.52
WCB	40.40	46.54
SLR	40.60	46.32
WFC	41.80	44.99

10.0 COMPARISION OF IMPORTANT PARAMETERS BETWEEN UNDER FRAME AND BOGIE MOUNTED SYSTEM

Sl.No	Description	U/F Mounted brake System	Bogie Mounted brake System
1	Slack Adjuster	External	Internal
2.	Type of Slack adjuster	Double Acting	Single Acting
3.	Capacity of Slack adjuster	450 mm	305 mm
4.	Size brake cylinder	14 Inches	08 Inches
5.	Number of Cylinders	02/Coach	04/Coach
6.	Brake Force available on the Brake head	3 Tonne (Non mod) 2.2 Tonne (Modified)	1 Tonne
7.	Type of Brake block	Low friction Composite L-Type brake block	High friction Composite K-Type Brake block
8.	Co-efficient of brake block	0.17 – 0.25	0.17 – 0.25
9.	Thickness of brake block	60 mm	50 mm

10.	Piston Stroke	80–100 mm (Non mod) 60-70 mm (Mod H/L)	Working Stroke- up to 32 mm
11.	Capacity of Truss beam	16 Tonnes	13 Tonnes
12.	Weight of brake block	3.06 Kgs	2.5 Kgs
13	Anti vibration Bkt	Required	Eliminated
14	Horizontal lever	Required	Eliminated
15.	Bogie pull rod	Required	Eliminated
16	Life of the brake gear Components including wheel	Less	More
17.	Number brake gear adjustments	07	02
18.	Weight reduction (as compared to conventional air brake system)	-	492 kg.
19.	Braking distance at 110 kmph (18 coaches)	905 m	800 m
20.	No. of pins and bushes	102	84

10.1 Procedure to be Followed for Replacing the Brake Blocks/Adjusting the Piston Stroke

1. Disengage the cross head from the adjusting tube, by pulling the latch.
2. Turn the adjusting tube clockwise to decrease the length of adjusting tube (effective) length of piston rod.
3. After replacing the brake blocks, apply the brake and check the piston strokes.
4. If piston stroke is correct, engage the cross head with the resetting plate by releasing the latch
5. If the piston stroke is more, increase the length of adjusting tube, to decrease the clearance between wheel and brake block
6. If piston stroke is more, increase the length of adjusting tube, to decrease the clearance between wheel and brake block
7. After adjusting the piston stroke, ensure the cross head is locked with adjusting tube with the latch

10.2 Differentiate Between Maximum Stroke and Working Stroke of Bogie Mounted Brake Cylinder

Maximum Stroke: This is the stroke beyond which the piston cannot come outward. It is up to 32 mm for coaching stock.

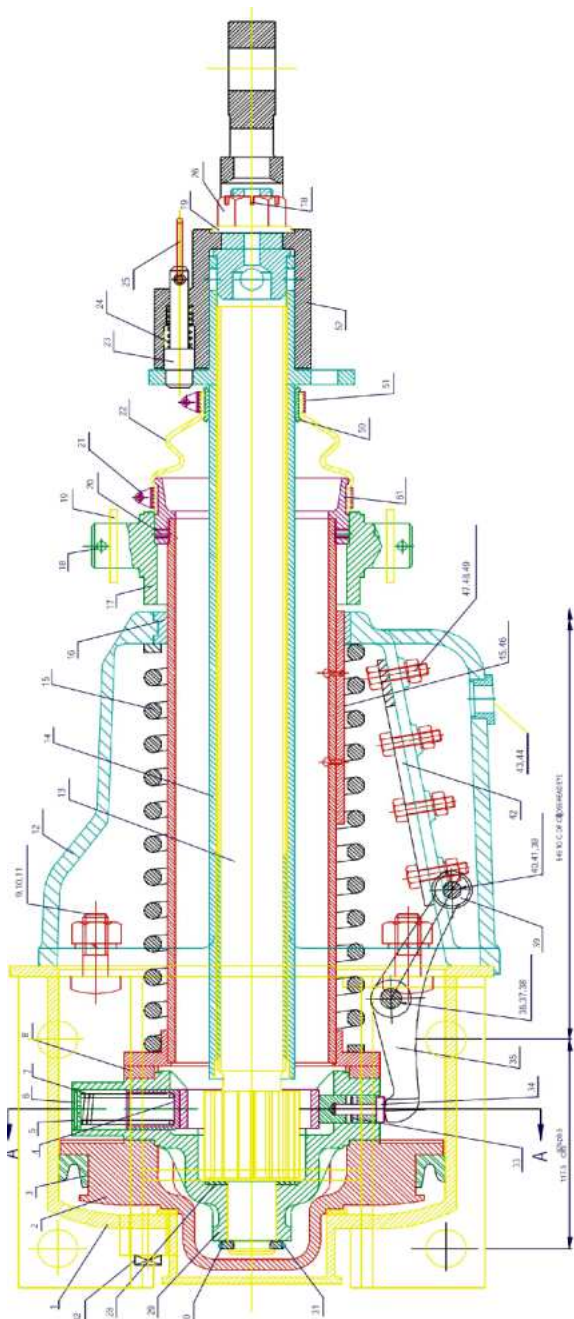
Working stroke: This is the stroke at which, the in-built slack adjuster increases the effective length of the piston rod automatically whenever the clearance increases due to wear on the brake block and the wheel. It is up to 32 mm for coaching stock.

11.0 MAINTENANCE OF BOGIE MOUNTED BRAKE CYLINDERS

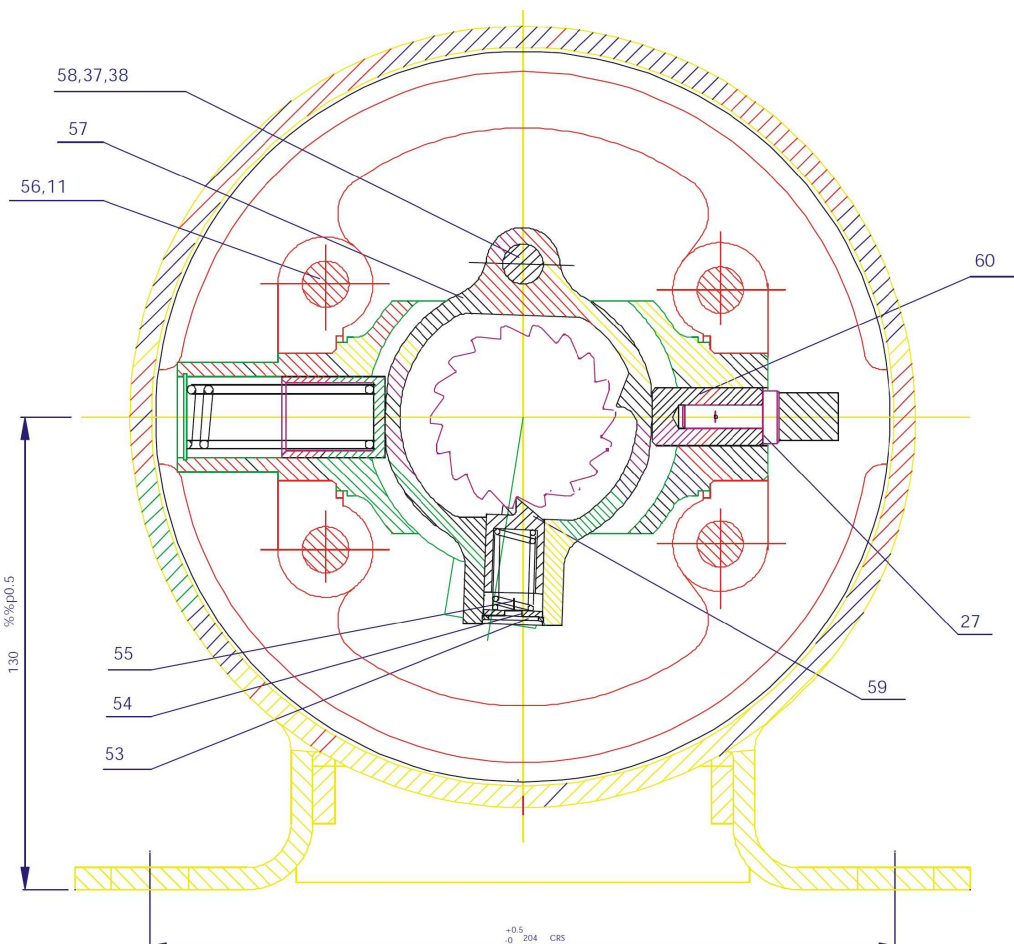
(RDSO sketch. 81200) gives the details of brake cylinders and the part number list is indicated in the table.

Dismantling

- i) Unscrew cross head and adjusting tube sub-assembly.
- ii) Loose jubilee clips and remove dust excluder and bush.
- iii) Admit compressed air in brake cylinder, unscrew grub screw. Vent compressed air and unscrew collar by using C-spanner. remove hand brake trunion.
- iv) Unscrew hex nuts M12 slowly. Please note that release spring compressed with force of **60 kg**. **Note:** The release spring exerts severe force while dismantling the unit, the front cover should be removed very carefully. The dismantling can not be done by a single person. Atleast two persons are necessary.
- v) Remove front cover, release spring, piston trunk sub-assembly with trunion body and ratchet with adjusting screw.
- vi) Remove split pin, pin and rocker arm.
- vii) Remove allen bolts and piston and piston trunk sub-assembly. Please note that piston and piston trunk sub-assembly are matched pair and are not interchangeable. Always put some identification mark.
- viii) Remove circlip, collar, ratchet with adjusting screw, pawl, pawl spring, Plunger, turnion body, thrust washer.
- ix) Remove Piston packing from piston.



203 mm Air Brake Cylinder With Slack Adjuster



Section A-A of 203 mm Air Brake Cylinder With Slack Adjuster

Cleaning and Inspection

Wash all the parts in suitable cleaning fluid and wipe them carefully. Inspect pawls, Pawl housing ring, ratchet, tooth rollers, roller plate, thrust washer for wear and damage. Inspect threads of ratchet with adjusting screw and adjusting tube for the possible damage. Replace packing. Check all the springs for possible corrosion and distortion. It is advisable to change the springs on every POH. Give all other parts a thorough visual inspection to detect apparent defects. Replace worn or damaged parts.

Item	Description & dimensions	No. off	Ref. Drg.	Mtl. & spec.	Remarks
1	Cylinder Body	1	SK-81201		Item 1, 3,4 & 5
2	Piston	1	SK-81203		Item - 1
3	Piston packing	1	SK-81204		Item -10
4	Plunger	1	SK-81206		Item - 2
5	Cirdlip Light B22	1	-	IS:3075	Galv.
6	Special Washer	1	SK-81206		Item-14
7	Plunger Spring	1	SK-81206		Item-18
8	Piston Trunk	1	SK-81204		Item-1 & 2
9	Tee bolt M12x35 Alternatively M12x45	4	-		Galv.
10	Hex. head nut	4	-	IS:1363	Galv.

	M12				
11	Spring washer M12 type A	8	-	IS:3063	Galv.
12	Dome cover	1	SK-81202		Item-1
13	Ratchet with adjusting screw	1	SK-81204		Item-9
14	Adjusting tube	1	SK-81204		Item-6, 7 & 8
15	Release Spring	1	SK-81206		Item-20
16	Guide bush	1	SK-81202		Item-2
17	Hand brake trunnion	1	SK-81205		Item-12
18	Split pin $\phi 5 \times 40$	3	-	IS:549	Galv.
19	Washer M22 type -C	3	-	IS:2016	Galv.
20	Slotted head grub screw 'C' M6x6	2	-	IS:2388	Galv.
21	Jubilee clip size-5	1	-		Galv.
22	Dust excluder	1	SK-81204		Item-11
23	Latch	1	SK-81206		Item-3
24	Latch spring	1	SK-81206		Item-21
25	Ring	1	SK-81206		Item-23
26	Slotted Nut	1	-		Galv.

	7/8" B.S.W. (20 mm high)				
27	Shims for plunger	As requi red	SK-81206		Item-16
28	Special washer	1	SK-81206		Item-12
29	Trunion Body	1	SK-81205		Item-1
30	Collar	1	SK-81206		Item-4
31	Circlip light A32	1	-	IS:3075	Galv.

Assembly

After cleaning and inspection of all the parts and before re-assembly apply uniform layer of grease Esso Becon 2 on all the moving parts. Grease cylinder body and piston packing liberally with Esso Becon 2.

- i) Put washer and insert ratchet with adjusting screw in turnion body. Put two collars in the groove of ratchet with adjusting screw and lock it with circlip.
- ii) Insert spring retaining cup plunger spring, washer and internal circlip with circlip plier in the longer side of trunion body.
- iii) Insert pawl (ensure proper position) pawl spring in the square hole of the trunion body and lock it with strip. Bend the ends of the strip.
- iv) Place pawl housing ring on trunion body so that it pivots on the pivot pin of turnion body. Check that tooth of pawl housing ring matches with teeth of ratchet with adjusting screw. If required, tooth of pawl housing ring may be filed.

- v) Insert plunger pin with required No. of shims. Insert this sub-assembly in the shorter side of trunion body.
- vi) Place the above sub-assembly (consisting of all the above parts) on piston (ensure proper position as indicated in the assembly drawing. Place piston trunk sub-assembly on it and lock it with piston by 4 Nos. allen screw and spring washer with a tightening torque of **200 kg.cm**. Insert packing on piston.
- vii) Insert rocker arm roller pin in roller and then insert it in rocker arm. Insert roller and washer on the roller side of roller pin and lock it with split pin.
- viii) Place rocker arm sub-assembly within two shackles of piston trunk ring sub-assembly and insert rocker arm pivot pin and washer and lock it with split pin.
- ix) Tighten roller plate with front cover with 8 Nos. hex. bolts spring washers and hex. nuts .
- x) After applying grease Esso Becon 2 on all the moving parts, piston packing, cylinder body, insert the above sub-assembly (consisting of piston trunk sub-assembly, piston in cylinder body.
- xi) Place release spring on piston trunk sub-assembly.
- xii) Place front cover in required position A,B,C on the release spring and compress the spring with a force of 60 kg approximately. Tighten front cover with body with 4 Nos. hex. head bolts, spring washer and hex. nut with a tightening torque of 200 kg cm.
- xiii) Place hand brake trunion sub-assembly on piston trunk sub-assembly. Screw collar on piston trunk sub-assembly and screw in grub screw. Put latch spring and latch in cross head. Insert ring in the latch.

- xiv) Put cross head sub-assembly on adjusting tube sub-assembly consisting of adjusting tube, adjusting tube screwed and resetting plate). Lock cross head with adjusting tube sub-assembly by washer, hex. slotted nut and split pin.
- xv) Clamp dust excluder on bush with jubilee clip and insert adjusting tube sub-assembly in bush. Screw adjusting tube sub-assembly in bush. Screw adjusting tube sub-assembly on ratchet with adjusting screw till it reaches its dead end.
- xvi) Clamp dust excluder on collar with jubilee clip.
- xvii) Screw 1/2" plug with O-ring in body.

Testing Procedure

The testing procedure of brake cylinder is given below

PREPARATION FOR TEST

The test layout is shown in the attached **figure 6.5** (RDSO's Sk 98108). A special pin will be required to locate the cross head between the angle iron slots. During testing cock 2 must be opened slowly whenever the cock is used to admit air under pressure to the cylinder. Connect the air supply to the cylinder body. Commence with all cocks closed

TEST NO. 1 Leakage:

Open Cock 1 to charge the MR to **7 kg/cm²** pressure

Open Cock 2 to charge the cylinder **0.7 kg/cm²** pressure

The piston stroke must be limited to 32mm, wait for one minute for settlement and there must be no drop in pressure shown in the leakage volume gauge for a further minute. Also observe that leakage does not exceed **0.1 kg/cm² in 10 minutes.**

Repeat this test with the cylinder charged to **3.8 kg/cm²** pressure and with cock 3 closed limiting the maximum piston stroke up to **32 mm**. Observe that the leakage does not exceed **0.1 kg/cm² in 10 minutes**.

Open Cock 3 to exhaust the cylinder pressure to zero.

TEST NO. 2 - OPERATION:

A. Full Stroke

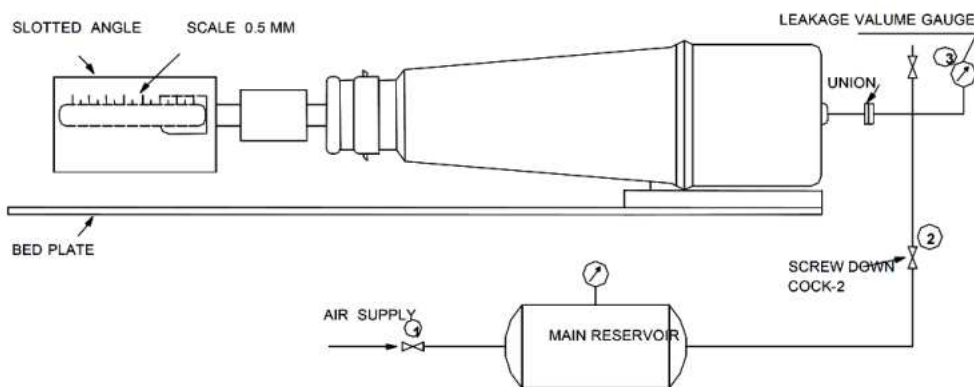
- Close cock 3 and open cock 2.
- Observe the full stroke of the piston.
- This must be within $\pm$ **1.0 mm** of the maximum stroke value.

B. Take-up Stroke

- Close cock 2 and open cock 3 to exhaust the cylinder pressure to zero.
- Close cock 3.
- Open cock 2 and allow the piston to move out slowly until the operating pawl is heard to “click over” then close cock 2.
- Measure the take up stroke .
- This must be 32 mm for main line self generating coaches of 32 mm stroke.
- Close cock 2 and open cock 3.
- As the cylinder returns to release the locking pawl must be heard to click into position

Note:

1. Operate the piston at full stroke at least 18 times to test all ratchet teeth.
2. Observe that the adjuster operates at each release and the adjusting tube and cross head being 'inched' out along the stroke.
3. The movement of the Piston must be smooth without any tendency to stick at any part of the stroke.



TEST LAYOUT FOR BRAKE CYLINDER WITH BUILT IN SLACK ADJUSTER

C. Take-up Length (without Quick Resetting Gear)

- Close cock 2 and open cock 3.
- Remove the pin from the cross head and unscrew the adjusting tube until the red resetting mark on the adjusting Tube is visible.
- Disengage resetting latch and screw in the Adjusting Tube.

- Re-engage resetting latch.
- Check that the Dust Excluder Collar is free and does not twist when the Adjusting Tube is being rotated.
- Close cock 1 and open cock 2.
- Close all cocks when the system is at atmospheric pressure.

D. Take-up Length (With Quick Resetting Gear)

- Close cock 2 and open cock 3.
- Remove the pin from the cross head and turn the resetting screw until the red resetting mark on Adjusting tube is visible.
- Screw in the Adjusting Tube with the resetting screw.
- Check that the Dust Excluder Collar is free and does not twist when the Adjusting tube is rotated . Close cock 1 and open cock 2.
- Close all cocks when the system is at atmospheric pressure

12.0 IMPORTANT INSTRUCTIONS FOR REASSEMBLING THE BRAKE CYLINDER AT THE WORKSHOPS

- i) While fixing the Roller plate with front cover 4 pairs of hex. Bolts M 6x25 along with spring washer A6 and hex nut M6 are required. Before fixing the roller plate, the inner surface of front cover should be checked for perfect plane. At the time of fixing the roller plate with front cover 2 Nos. of spring washers are kept inside in between them (one each side) in first two bolts, so that the rollers can move smoothly in the cover plate in angular position.
- ii) While matching the holes of plunger and plunger pin number of shims are added (say 2 or 3) as per the

requirement, in the plunger pin so that spring Dowel pin $\Phi 2 \times 14$ easily locks the plunger and plunger pin by inserting the dowel pin in the holes.

- iii) At the time of re-assembly check that the tooth of pawl housing ring matches with the teeth of Ratchet with adjusting screw. The pawl housing ring must go smoothly inside the teeth of Ratchet. If it is not matching then the notch portion of the tooth of pawl housing ring should be filed till it matches with the teeth of Ratchet screw.
- iv) Before final assembly of piston and piston trunk sub-assembly ensures that the threads of adjusting tube (turns in clock wise direction) smoothly matches with the threads of Ratchet screw.
- v) Before fixing the front cover in the cylinder body check visually the red paint mark appears in the Adjusting tube. If it is not visible then repaint.

13.0 Calculate the Percentage of braking and the force available on each brake head for the Bogie mounted AC Coach

Technical Data's

- | | | |
|-----------------------------|------|-------------------------|
| 1. Diameter of the cylinder | | = 20.3cm (8") |
| 2. Area of piston | (A) | = 323.65 cm^2 |
| 3. Maximum BC pressure | (B) | = 3.8 kg/cm^2 |
| 4. Leverage ratio of levers | (C) | = 366:174 |
| 5. No. of levers per axle | (D) | = 2 |
| 6. No. of brake blocks | (N) | = 16 |
| 7. Cylinder efficiency | (CE) | = 0.9 |
| 8. Rigging efficiency | (RE) | = 0.9 |
| 9. Tare weight of the coach | | = 50 Tonnes |

Brake Power Calculations:

- | | | |
|---|------|------------------------------|
| 1. Force available on the piston | (F) | = (A) X (B) |
| | | = 323.65×3.8 |
| | | = 1230 kg |
| | | = 1.23 Tonnes |
| 2. Mechanical advantage/axle | (MA) | = (C) X (D) |
| | | = $\frac{366}{174} \times 2$ |
| | | = 4.2 |
| 3. Theoretical braking force available on an axle | | = (F) X (MA) |
| | | = 1.23×4.2 |
| | | = 5.166 Tonnes |
| 4. Theoretical braking force available on a coach | | = 5.166×4 |
| | | = 20.664 |
| | | Tonnes |

5. *Theoretical braking force available on each brake block*

$$(TF) = 20.664/16$$

$$= 1.3 \text{ Tonnes}$$
6. *Actual brake force on each brake*

$$(AF) = (TF) \times (CE) \times (RE)$$

$$= 1.3 \times 0.9 \times 0.9$$

$$= 1.046 \text{ Tonnes}$$
7. *Actual brake force available on a coach*

$$= (AF) \times (N)$$

$$= 1.046 \times 16$$

$$= 16.736 \text{ Tonnes}$$
8. *Percentage of braking - theoretical*

$$= \frac{\text{Theoretical braking force available on a coach}}{\text{Tare weight of the Coach}}$$

$$= (20.664/50) \times 100$$

$$= 41.328 \%$$
9. *Percentage of braking - actual*

$$= \frac{\text{Actual brake force available on a coach}}{\text{Tare weight of the Coach}}$$

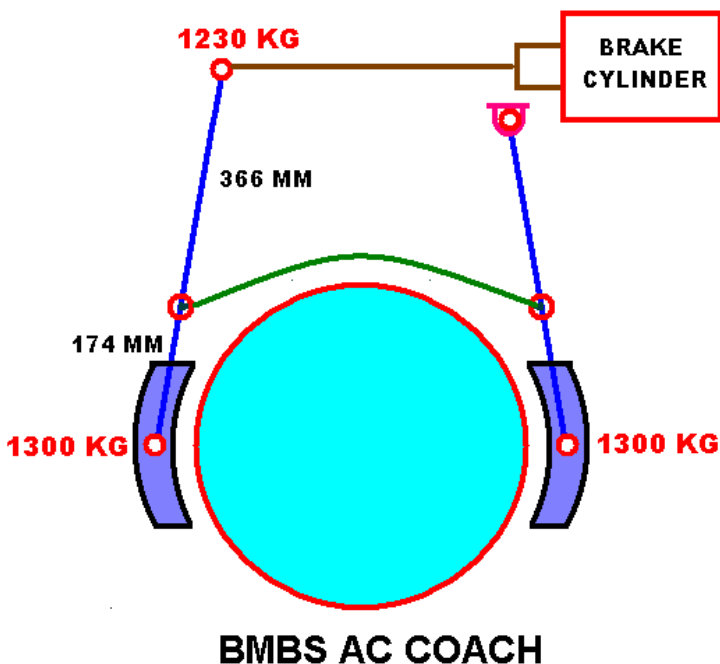
$$= (16.736/50) \times 100$$

$$= 33.472 \%$$

Summary:

1. Brake force available on each brake head = 1.046 Tonnes
= 33.472 %
2. Percentage of braking

BRAKE POWER CALCULATIONS

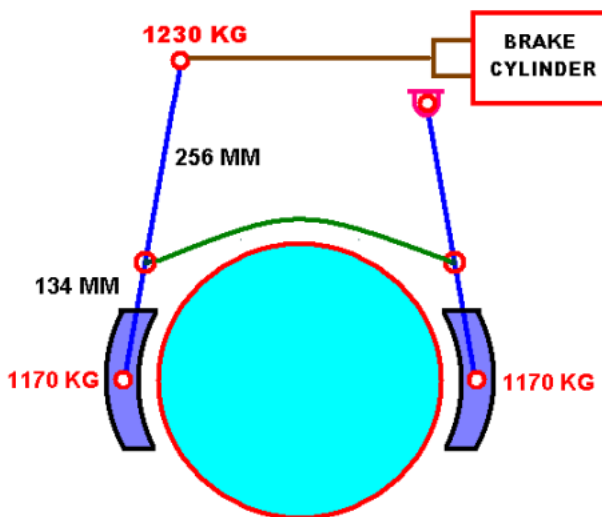


Note: In the similar way the brake power of non AC coaches can be calculated by taking the following Technical datas-

Technical Data's

- | | | |
|---------------------------------|---|------------------------|
| 1. Diameter of the cylinder | = | 20.3cm (8") |
| 2. Area of piston (A) | = | 323.65 cm ² |
| 3. Maximum BC pressure (B) | = | 3.8 kg/cm ² |
| 4. Leverage ratio of levers (C) | = | 256:134(1.91) |
| 5. No. of levers per axle (D) | = | 2 |
| 6. No. of brake blocks (N) | = | 16 |
| 7. Cylinder efficiency (CE) | = | 0.9 |
| 8. Rigging efficiency (RE) | = | 0.9 |
| 9. Tare weight of the coach | = | 37.55 Tonnes |

BRAKE POWER CALCULATIONS



BMBS NON - AC COACH

14.0 Special Tools

Description	No. off
Ball peen hammer 1/2 kg	1
Screw driver big	1
Screw driver small	1
Double end spanner to tighten/loosen M6 nut	1
Press machine to apply 60 kg force for assembling front cover with body	1
Scriber to remove Split pin	1
5 mm Allen key	1
Torque wrench with 200 kg cm	1