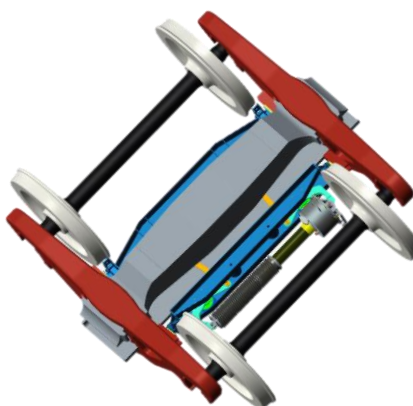
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	Operational & Maintenance Manual	Rev.00
	Doc. No. RED-RD-BS-019-OM-01	Date 04/03/2017
	RDSO Spec. No. WD-23-BMBS-2008 Rev.-01	
	Amendment No.1 of Sept.-2016	


OPERATION AND MAINTENANCE MANUAL **Of** **BOGIE MOUNTED BRAKE SYSTEM (BMBS)** **for** **FREIGHT STOCK WITH CASNUB BOGIE**

**RDSO Spec No. WD-23-BMBS-2008 (Rev.01) Amendment
No.1 of Sept.-2016**




ESCORTS
RAILWAY EQUIPMENT DIVISION



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1 DESCRIPTION AND MAINTENANCE MANUAL

1.1 GENERAL DESCRIPTION OF M/S ESCORTS MAKE BMBS

In continuation to the tradition of launching latest and technologically advanced products for Indian Railways, Escorts Ltd. India, has introduced Bogie Mounted Brake System for freight cars designated as BMBS.

The developed BMBS unit is compatible with all type of railway wagons, currently in application, including BOBRN, BOXN, BOXNHL, BCN, BCNA, etc.


The BMBS unit (Refer Fig.2) consists of two major structural items named as Primary Beam and Secondary Beam. It consists of Push Rods and Bell crank levers. The actuation of rigging arrangement is done with an 11 inch brake cylinder having inbuilt automatic double acting slack adjuster. This BMBS system is capable of fitment into any standard CASNUB bogie and used with K Type 58 mm Composite brake block. The brake cylinder is mounted transversely to the track. The load sensing device for automatic changeover of brake cylinder pressure is also developed by Escorts Ltd. This Automatic Pressure Modulation Device is able to convert pressure from 3.8 ± 0.1 Kg/cm² to 2.2 ± 0.25 Kg/cm² depending on load situation. The Escorts make BMBS system is also provided with a hand brake mechanism. One Brake Cylinder per Bogie.

The brake beams are well tested in static as well as dynamic mode and complied to the RDSO specification WD-23-BMBS-2008 (Rev.01) Amendment No.1 of Sept.-2016. The Brake system has successfully completed Function test, Environmental test, Vibration Test also as per the specification and field trial of one and half year.

1.2 TECHNICAL FEATURES OF M/S ESCORTS MAKE BMBS


- This system is designed according to Indian railways specification No. WD – 23 – BMBS – 2008 – Rev.1 Amendment No.1 of Sept.-2016.
- BMBS pipes are as per RDSO drawings and specification no. 04-ABR-2002 for different types of wagons and can be fitted easily with inlet and outlet of all components supplied by Escorts Ltd.



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- BMBS hand brake items, as per RDSO drawings can be fitted easily with bogie items supplied by Escorts Ltd.
- All air brake items, as per RDSO specification 02-ABR-2002 (Latest) can be fitted easily with bogie items supplied by Escorts Ltd.
- Escorts BMBS is very unique and can be easily fitted on any standard bogie without making any modification. All rigging items remain same for all wagons, whether it is Tanker wagon, Flat wagon or Hopper wagon.
- This system is designed for fitment of BMBS during manufacturing of new wagons as well as during retro fitment of BMBS on existing In-Service wagons.
- Escorts BMBS is designed for Casnub Bogie with a wheel base of 2000 ± 5 mm.
- Escorts BMBS consist of one Brake Cylinder per bogie which generates the required braking force for complete wagon, to achieve the specified stopping distance.
- Escorts BMBS utilizes the existing K Type Composite Brake Block with 58 mm thickness and no new brake block variant is added for Indian railways.
- Escorts BMBS is capable of generating two stage (Empty/Loaded) braking using the ERV (APM) device. This device is developed for BMBS unit which is able to convert pressure to 60% of max value in case the wagon is running empty. This prevents the train from toppling while hard braking, reduces wheel wear, and increases brake block life.
- Uniform wheel loading is achieved through well designed rigging arrangements.
- Escorts BMBS is equipped with Hand Brake provision through two heavy duty flexible metallic ropes. These ropes are attached to the main rigging arrangement and can be easily actuated by using hand brake wheel, with maximum force of 25 Kg.
- Escorts BMBS works with both solid and through hole bolster truck designs. It results in less weight and lower application cost.



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- All brake cylinders (With Hand Brake & Without Hand Brake) are equipped with stroke indicator arrangement. This helps in easy visualization of brake application status in fitted condition.

1.3 GENERAL INSTALLATION OF ESCORTS MAKE BMBS

Refer fig. 1A, 1B, 1C, 1D, 6 & 31 for details.

1. Install bell crank levers(5,6) in the primary beam along with Spherical bearing, Ball bearings and Lever seat using T- head bolts(14), Spring Washers (16) and Hex Nylock nuts (15) .(Ref. Fig 1A , 31 & 6)
2. Fit the Brake head (8) on both ends of the beams (1,2) in the slot provided.(Ref. Fig 6,1B).
3. Put the Brake head Pin (12) and lock it with a split pin (26).
4. If retro-fitment is being done in existing wagons, then in order to install Escorts BMBS in CASNUB Bogie, it is required to dismantle the complete bogie and also remove both the axles. Now slide both of the brake beams (Primary & Secondary) in the side frame pockets.
5. If being installed fresh, first install both beams in side frame and then assemble it with both the axles.(Ref. Fig 1C & 1D).
6. Fit all K Type Composite brake blocks (WD-00006-S-01 Alt Latest) on the brake head (8) of brake beam (1,2) using key (W/BG-6150).
7. Once the proper position of brake beams (1,2) is achieved, install both the push rods (7) connecting with bell crank lever using Pin dia. 24x80 (11) & Bulb Cotter with plain washer (40) (Left & Right are similar). The push rod on other side is connected to secondary beam using pin dia. 24x120 (9) & Bulb Cotter with plain washer (40)
8. Install the brake cylinders (3,4) in between bell crank levers (5,6) with indicator facing outwards using Pin dia. 24x70 (10), Bush (13) and spring Dowel sleeve (17).
9. Join the cables of brake cylinder with hand brake to the equalizing lever (32) through Pin for Cable (36), Washer (46) and Split Pin 4x35 (47) .





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10. Attach the equalizer lever (32) and extension piece with vertical lever through pin joint.

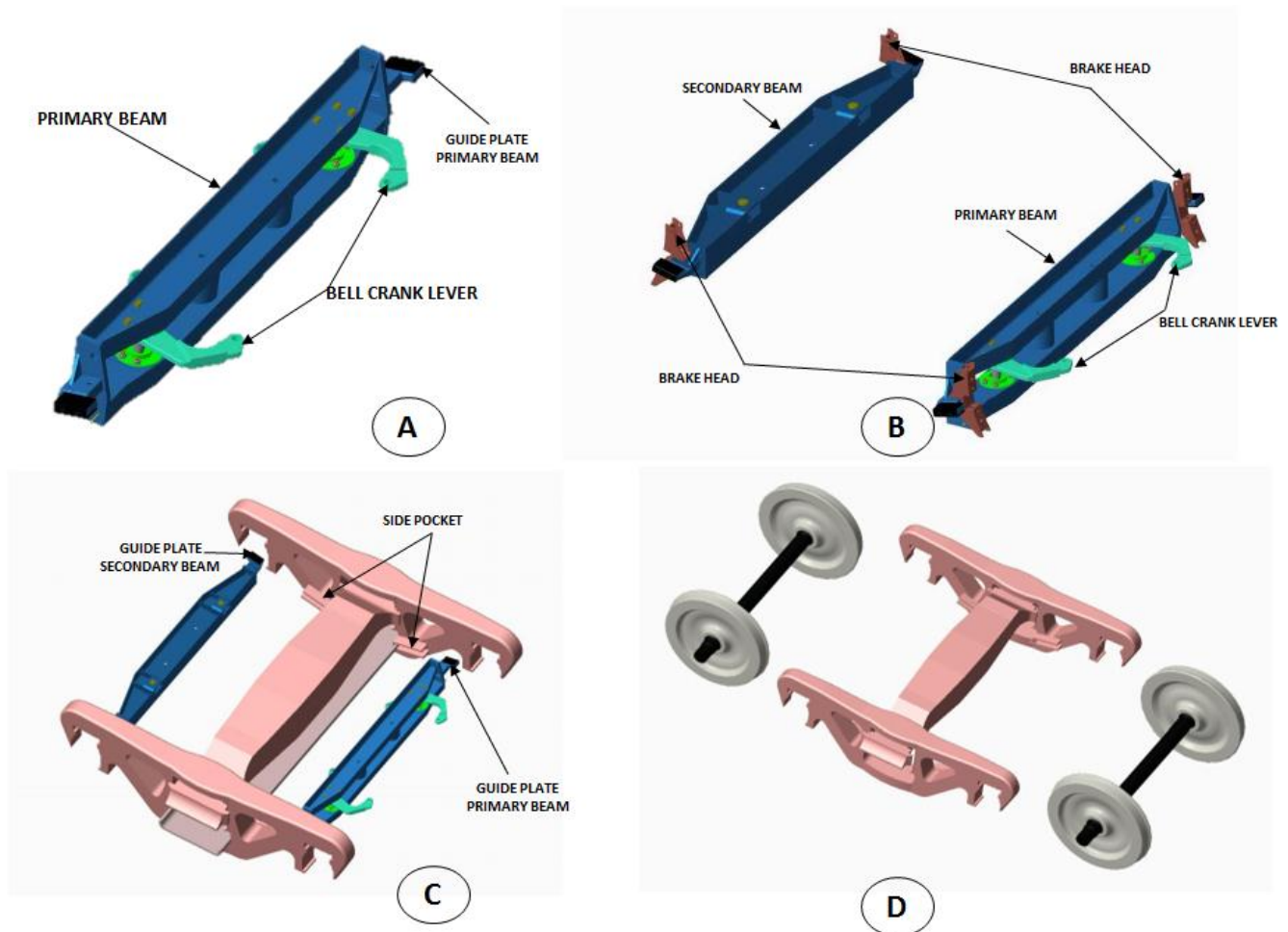


Figure 1: Sequence detail of general Arrangement of Bogie Mounted Brake System (BMBS)





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Caution!


- The wagon has to be placed in a Sick-line/ ROH Depot
- Use Overhead crane for lifting heavy parts
- The workmen has to wear helmet, Hand gloves and Safety shoes.
- Use of proper tools



Warning!

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



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1.4 AIR BRAKE SYSTEM WITH BMBS HAVING ERV/APM VALVE

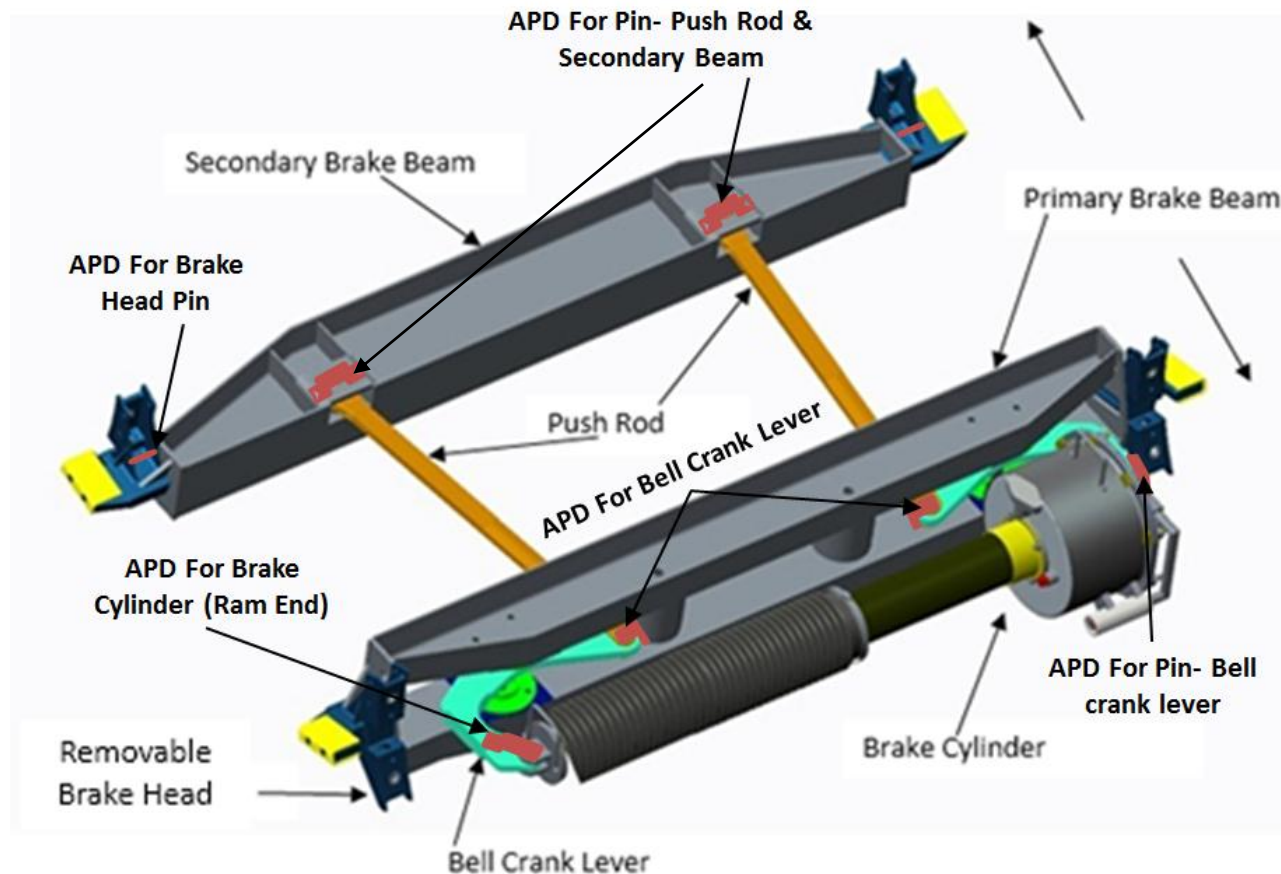



Figure 2: General Arrangement of Bogie Mounted Brake System (BMBS)

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

Schematic layout of single / twin pipe graduated release air brake system as provided on the wagons is shown in figures below Brake pipe / Feed pipe runs through the length of wagon. Brake pipes / Feed pipes on consecutive wagons in a train are coupled to one another by means of hose coupling to form a continuous air passage from the locomotive to the rear end of the train. Brake pipe is charged to 5 kg/cm² through the compressor of the locomotive. Feed pipe is charged to 6 kg/cm².

The wagons are, provided with Automatic pressure modification (APM) device to cater for higher brake power in loaded condition instead of the conventional manual empty load device. With the



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provision of this, brake cylinder pressure of $2.2 \pm 0.25 \text{ kg/cm}^2$ is obtained in empty condition and $3.8 \pm 0.1 \text{ kg/cm}^2$ is obtained in the loaded condition.

To obtain this change over mechanism between ERV/APM underframe and side frame of the bogie. The mechanism gets actuated at a pre-determined change over weight of the wagon and changes the pressure going to the brake cylinder from $2.2 \pm 0.25 \text{ kg/cm}^2$ to $3.8 \pm 0.1 \text{ kg/cm}^2$ in case of changeover from empty to loaded and vice versa.

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

During full service brake application, a reduction of 1.3 to 1.6 kg/cm^2 takes, a maximum brake cylinder pressure of $3.8 \pm 0.1 \text{ kg/cm}^2$ in loaded condition and $2.2 \pm 0.25 \text{ kg/cm}^2$ in empty condition is achieved. Any further reduction of brake pipe pressure has no effect on the brake cylinder pressure.

During emergency brake application, the brake pipe is vented to atmosphere very quickly; as a result the distributor valve acquires the full application position also at a faster rate. This results in quicker built up of brake cylinder pressure but the maximum brake cylinder pressure will be the same as that obtained during a full service brake application.

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





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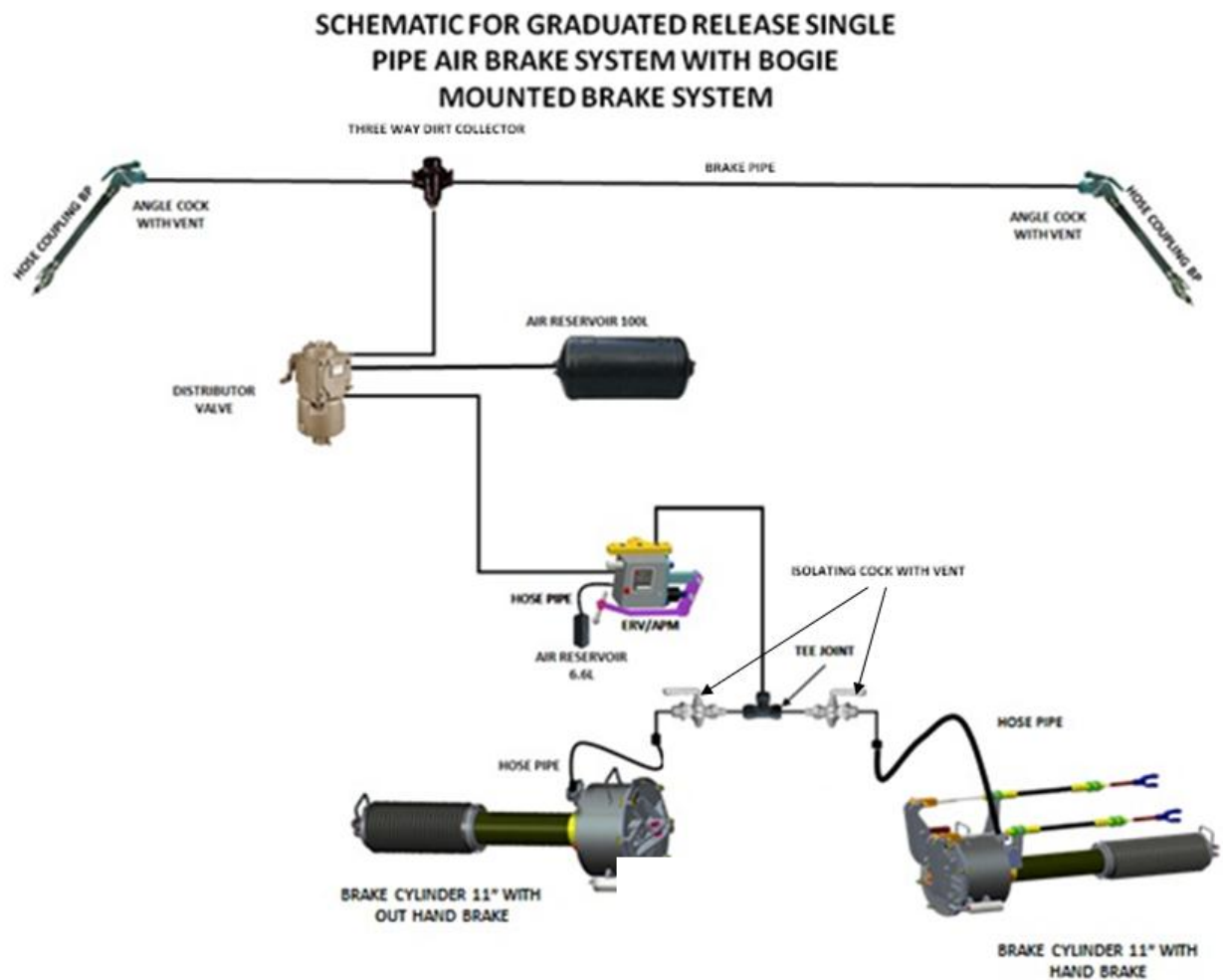


Figure 3: Schematic for graduated release Single Pipe Air Brake System with Bogie Mounted Brake System (BMBS)





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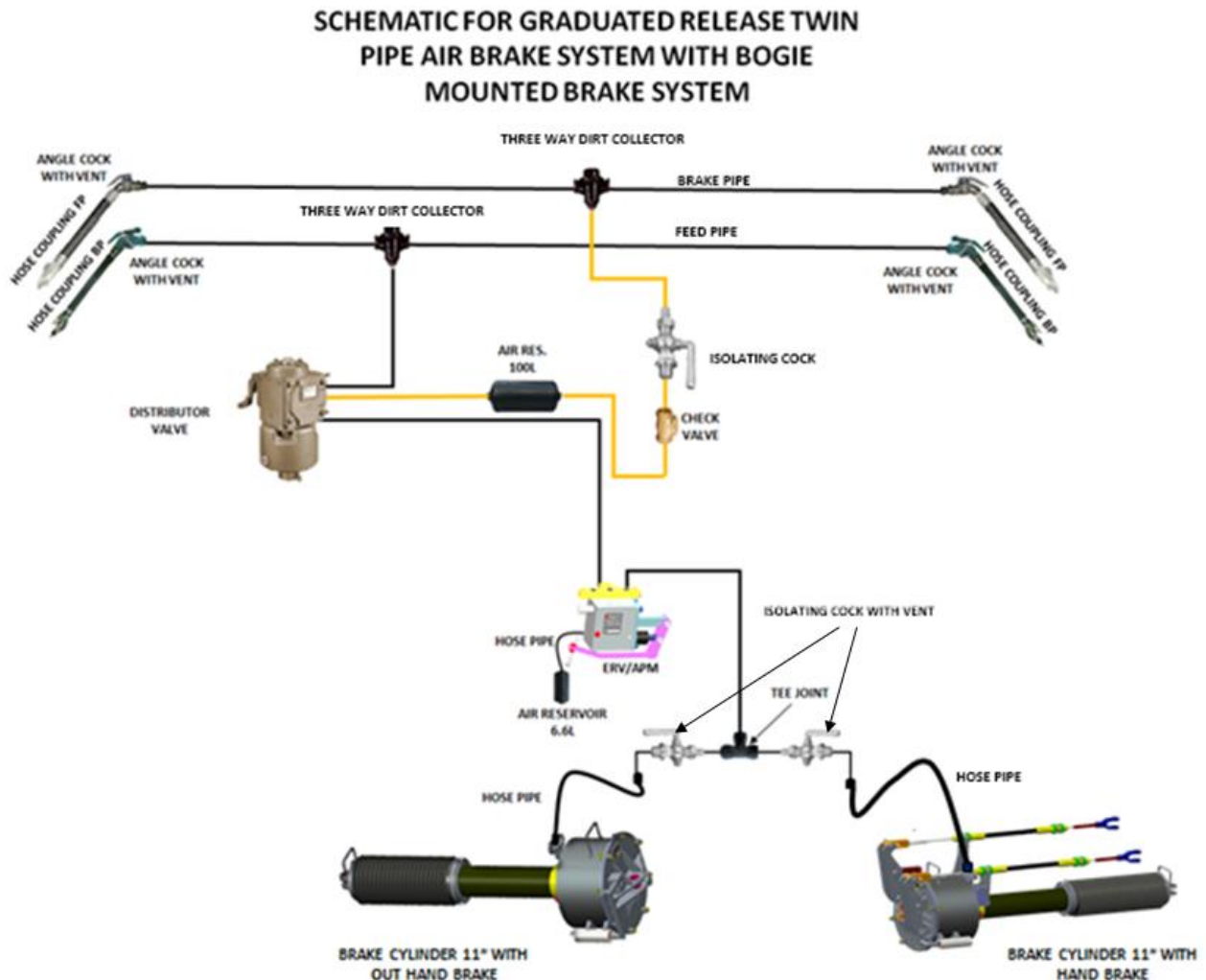



Figure 4: Schematic for graduated release Twin Pipe Air Brake System with Bogie Mounted Brake System (BMBS)

1.4.1 AUXILIARY RESERVOIR

An auxiliary reservoir of 100 litres is provided on each wagon to store compressed air. It is charged to 5 Kg/cm² pressure through the distributor valve in case of single pipe system.

However in case of twin pipe system, it is charged to 6 Kg/cm² through the feed pipe. The auxiliary reservoir is made out of sheet metal. On both the ends of the reservoir, flanges are provided for pipe connection. One end of the reservoir is kept blanked for operation with



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single pipe brake system. A drain plug is provided at the bottom of the reservoir for draining the condensate.

1.4.2 CUT-OFF ANGLE COCK

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

1.4.3 HOSE COUPLING FOR BRAKE / FEED PIPE

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


1.4.4 DIRT COLLECTOR

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

1.4.5 ISOLATING COCK

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



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1.4.6 ISOLATING COCK WITH VENT

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

1.4.7 PIPES

ERW stainless steel pipes as per RDSO specification 04-ABR-2002 (Latest) are used for wagons with Bogie Mounted Brake System. Pipes of 32 & 20 mm nominal bore are generally employed. The pipes are cold bend with the help of bending equipment. The radius of the bends is to be kept to the maximum possible so as to reduce restriction of air flow.

1.4.8 PIPE FITTINGS

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

1.4.9 CRITICAL BOGIE DIMENSION FOR BMBS

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





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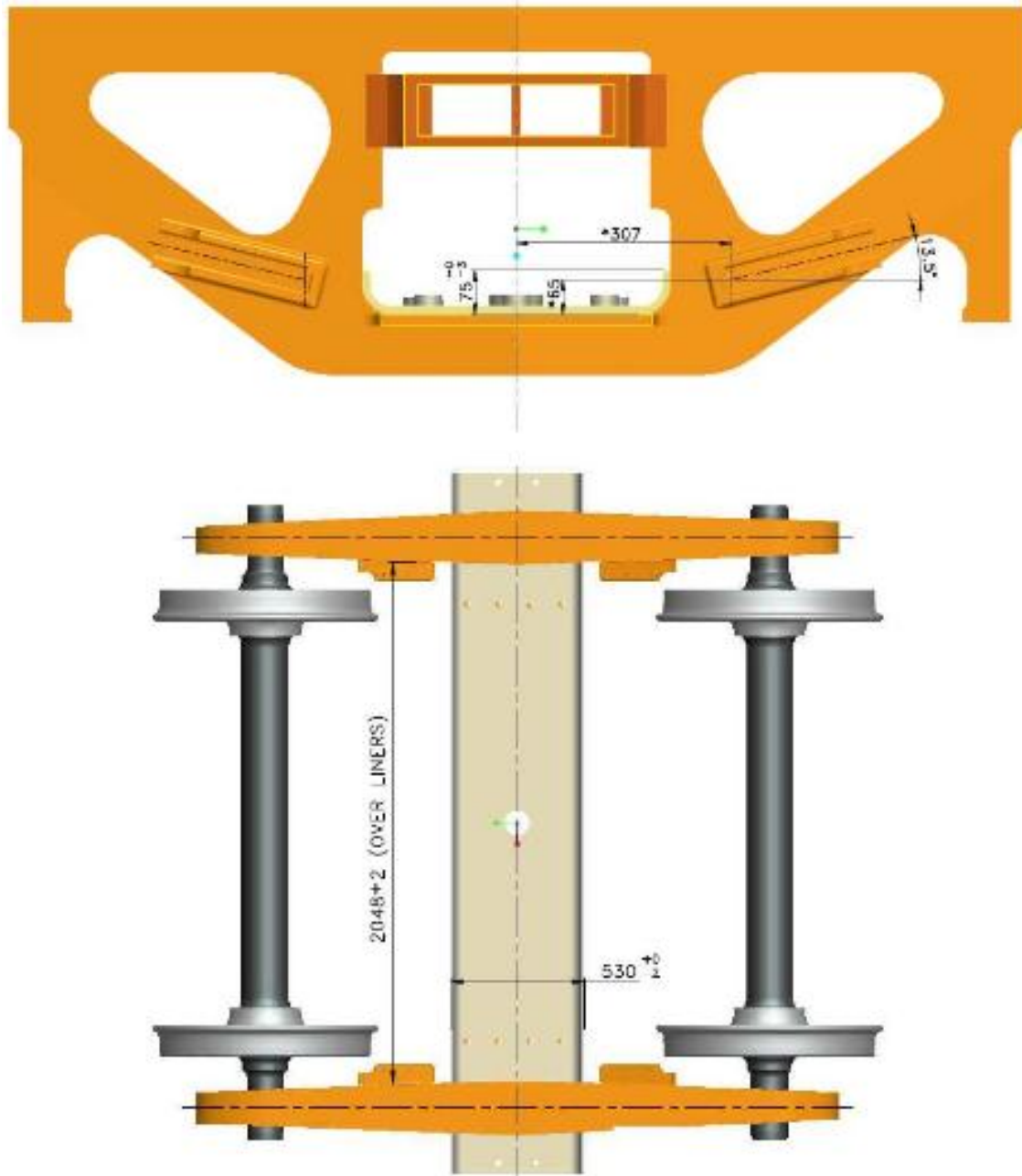


Figure 5: Critical Bogie dimensions for BMBS Bogie





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1.5 MAJOR COMPONENTS OF BMBS

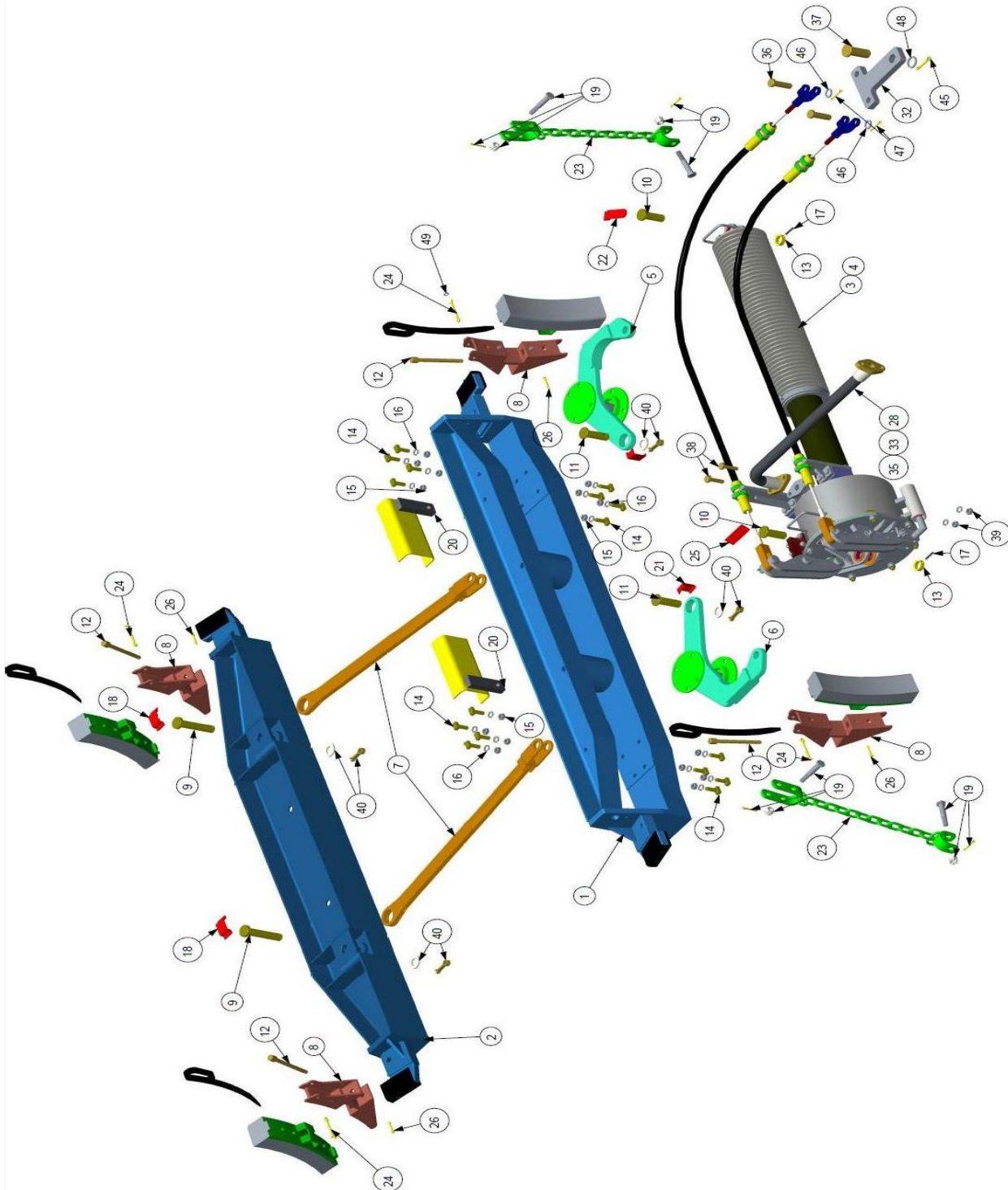


Figure 6: Exploded View of BMBS system



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SL No.	Name	Drg. No.	Qty/Wagon
1	PRIMARY BRAKE BEAM ASSY.	3EB5521 Alt-10	2
2	SECONDARY BRAKE BEAM ASSY.	3EB5522 Alt-09	2
3	BRAKE CYLINDER 11" WITH DOUBLE ACTING AUTOMATIC SLACK ADJUSTER	3EB7347 Alt-08	1
4	BRAKE CYLINDER 11" WITH DOUBLE ACTING AUTOMATIC SLACK ADJUSTER & HAND BRAKE CABLE	3EB7348 Alt-08	1
5	BELL CRANK LEVER- LH ASSY	3EB9792 Alt-00	2
6	BELL CRANK LEVER- RH ASSY	3EB9791 Alt-00	2
7	PUSH ROD ASSY	3EB9790 Alt-00	4
8	BRAKE HEAD	3EB7375	8
9	PIN Ø24x120	4EB10264	4
10	PIN Ø24x70	4EB10262	4
11	PIN Ø24x80	4EB10263	4
12	BRAKE HEAD PIN	4EB9764	8
13	BUSH	4EB10261	4
14	T-HEAD BOLT M12x35	4EP5042	32
15	HEX NYLOCK NUT M12	DIN982/EQV.	32
16	SPRING WASHER B12	DIN127/EQV.	49
17	SPRING DOWEL SLEEVE 6x35	4EB10260	4
18	ANTI PILFERAGE DEVICE	4EB8149	4
19	M16x90 BOLT WITH NUT & SPLIT PIN	4EB10272	8
20	BC CHAIN HOLDING BRACKET	3EB10268	4
21	ANTI PILFERAGE PLATE	4EB9573	4
22	ANTI PILFERAGE PLATE	4EB9572	2
23	BC HOLDING CHAIN	4EB10266	4
24	SPLIT PIN 6.3x75	IS 549/EQV.	8
25	ANTI PILFERAGE PLATE	4EB10265	2
26	SPLIT PIN 5x32	IS 549/EQV.	8
27	BRAKE HOSE (6.6 LTS RESERVOIR)	3EB9763 Alt-02	1
28	BRAKE HOSE(BC)	3EB5536 Alt-03	2
29	ANTI PILFERAGE DEVICE FOR APM	2EB8148	1
30	AIR RESERVOIR (6.6 LTS)	WD-09048-S-01	1
31	ERV(APM)	3EB7346 Alt-07	1
32	EQUALIZER	As per different types of wagon drawings -	1
33	O-RING	4EB9786	2
34	O-RING	4KB1889	2
35	GASKET	4EB10043	2
36	PIN FOR CABLE	4EB5567	2
37	PIN FOR TIE ROD	4EB9975	1
38	HEX HEAD BOLT M12x50	DIN931/EQV.	11
39	HEX NUT M12	DIN934/ EQV.	13
40	BULB COTTER WITH PLAIN WASHER 25mm	4EB10271	8
41	HEX HEAD SCREW M12x30	DIN933/EQV.	6
42	SPRING WASHER B8	DIN127/EQV.	4
43	HEX HEAD SCREW M8x30	IS 13726/EQV.	2
44	HEX HEAD SCREW M8x25	DIN933/EQV.	2
45	SPLIT PIN 6.3x50	IS 549/EQV.	1
46	WASHER B20	IS 2016/EQV.	2
47	SPLIT PIN 4x35	DIN 94/EQV.	2
48	PUNCHED WASHER A30	IS 2016/EQV.	1
49	PLAIN WASHER B6	DIN125/EQV.	8



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1.6 DESCRIPTION FOR BOGIE MOUNTED BRAKE CYLINDER 11" (WITH HAND BRAKE-3EB7348 & WITHOUT HAND BRAKE CABLE-3EB7347)

Brake cylinder (With Hand Brake) and Brake Cylinder (Without Hand Brake) are similar in construction internally. Pull lever assembly and cable mounting bracket are externally added in case of Brake cylinder with hand brake. Brake cylinder also has in built automatic double acting slack adjuster.

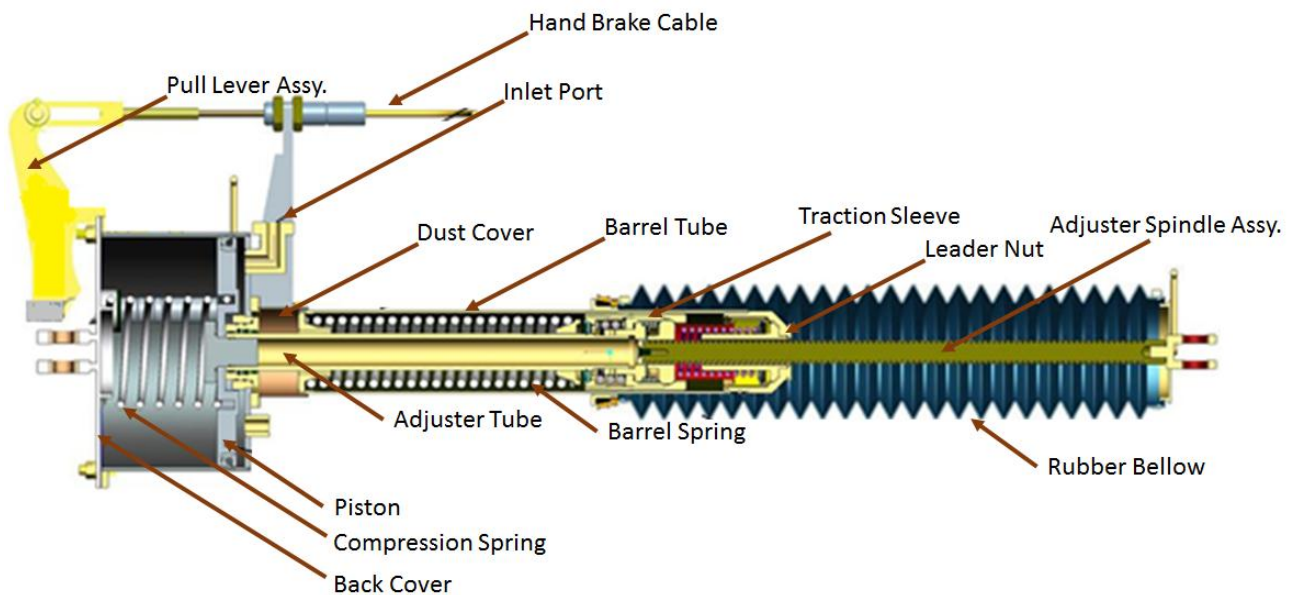


Figure 7: Sectional view of Brake Cylinder – 11 Inch with hand brake arrangement

1. Extended length is 1380mm
2. Minimum length is 885 mm
3. Stroke length at pressure $3.8 \pm 0.1 \text{ kg/cm}^2$ on loaded condition is $70 \pm 10 \text{ mm}$.
4. Stroke length at pressure $2.2 \pm 0.25 \text{ kg/cm}^2$ on Empty condition is $55 \pm 10 \text{ mm}$. The integral automatic double acting slack adjuster of the brake cylinder maintains a constant piston stroke resulting in uniform brake performance even as the brake shoes and wheels wear. The automatic double acting slack adjuster has a total make-up capacity of 500mm, which will compensate for total combination of shoe wear, wheel wear and clearance.





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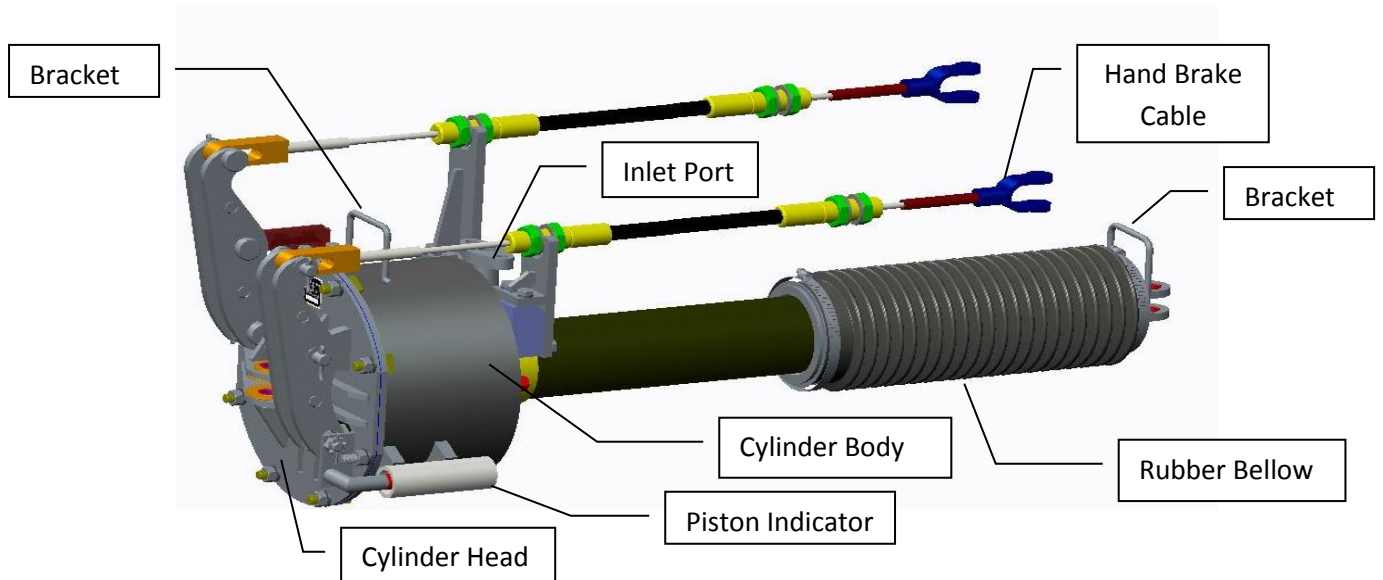


Figure 8: Brake Cylinder – 11 Inch with hand brake arrangement (Drg. No.3EB7348 Alt. Latest)

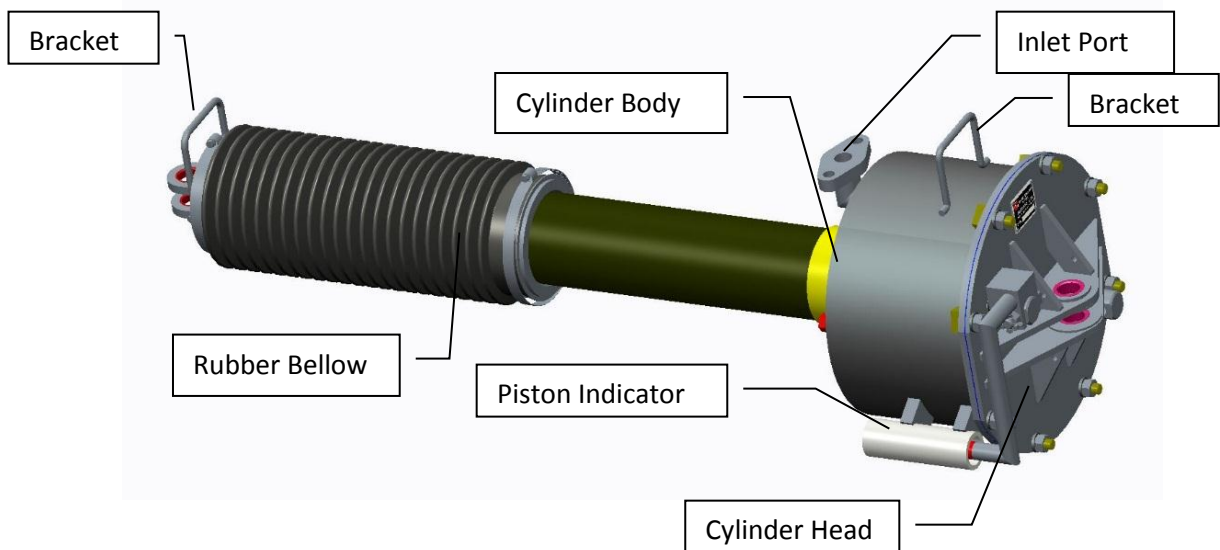


Figure 9: Brake Cylinder – 11 Inch without hand brake arrangement (Drg. No.3EB7347 Alt. Latest)





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1.7 BRAKE BEAMS

Brake beams are integral part of BMBS system. There are two kind of brake beams viz. Primary & Secondary which transmits brake force.

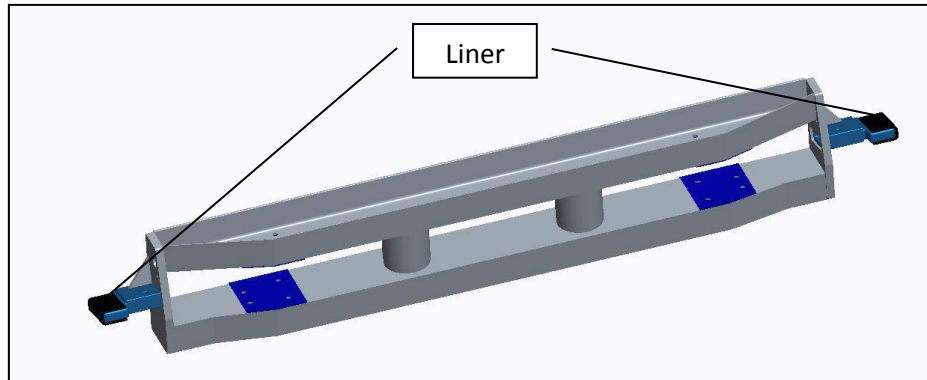


Figure 10: Primary Brake Beam Assy. (Drg. No.3EB5521 Alt Latest)

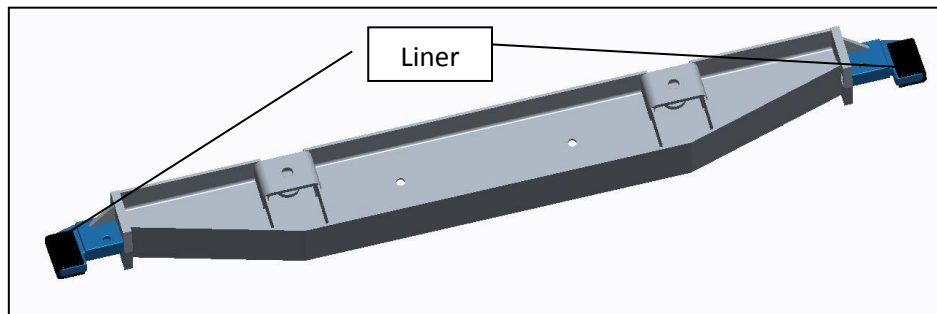


Figure 11: Secondary Brake Beam (Drg. No.3EB5522 Alt Latest)





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2 PRINCIPAL OF OPERATION

BMBS Brake Cylinder is an actuation device and is different from the traditional actuators. Its end distance (centre to centre) reduces while applying force on brake blocks, and centre to centre distance increases when brakes are released.

It works in following two modes of operations –

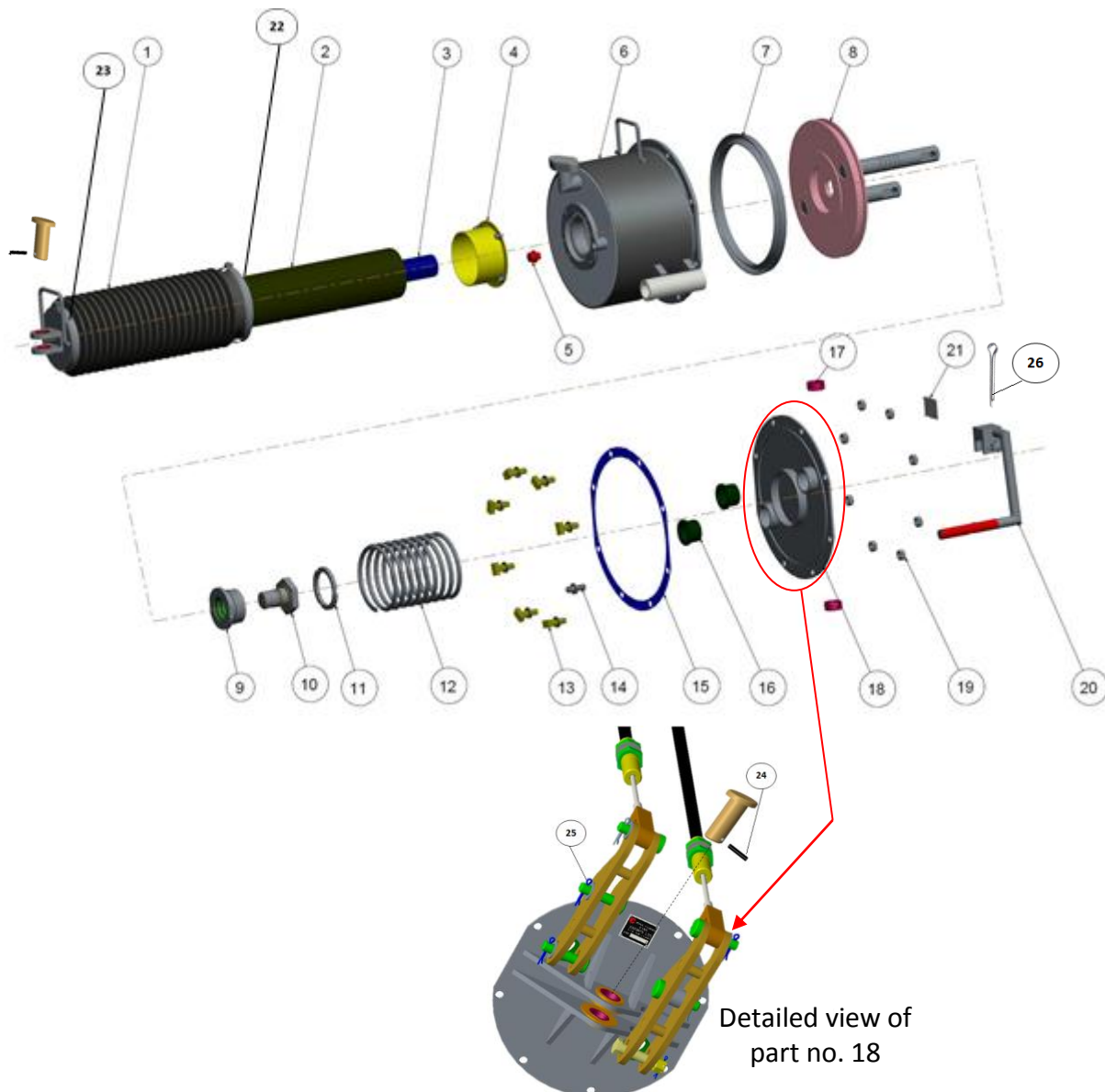


Figure 12: Brake Cylinder-11 Inch with Hand Brake Cable



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S. No.	Description	Drg. No.	Qty/Br. Cyl.
1	Bellow	4EB7440	1
2	Barrel Pipe	3EB7510	1
3	Adjuster Tube	3EB7407	1
4	Dust Cover	4EB7820	1
5	Plug	4EB9808	1
6	Brake Cylinder Body	2EB7720	1
7	Piston Packing	3EB6112	1
8	Piston Assembly	3EB7623	1
9	Gland Bush (with Seal Kit)	3EB7712	1
10	Locking Screw	4EB7583	1
11	Check Nut for Gland	4EB7707	1
12	Compression Spring	4EB7619	1
13	T-Head Bolt M12 (with Spring Washer B12)	4EP5042	7
14	Stud M12 (with Spring Washer B12)	4EB8973	1
15	Sealing Ring	4EB7397	1
16	Bush	4EB7715	2
17	Bush	4EB7529	2
18	Back Cover	3EB7719	1
19	Hex Nut M12	DIN934/ EQV.	8
20	Indicator	3EB9534	1
21	Name Plate	4EB7844	1
22	Jubilee Clamp-Dia 130	4EB8935	1
23	Jubilee Clamp-Dia 150	4EB8936	1
24	Spring Dowel Sleeve 6x35-st	4EB10260	2
25	Split Pin (Only for BC with hand brake)	IS:549/EQV.	6
26	Split Pin	IS:549/EQV.	1

2.1 BRAKE APPLICATION (Ref. Fig. 6 & 12)

Air enters in the brake cylinder from the ERV/APM Device. Compressed air is admitted through Inlet port in brake cylinder (3,4) between piston (8) and cylinder body (6). The compressed air forces the piston (8) and allows the automatic double acting slack adjuster assembly to move inside.

The automatic double acting slack adjuster assembly moves inward against the main compression spring of Brake Cylinder (3,4). The cross head can move in a curved path to suit the brake rigging.





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The stroke indicator is attached with the piston rod (8). This enables stroke indicator (20) to move out from the white coloured tube welded over cylinder body. The RED coloured portion of stroke indicator displays brake application.

In case of Brake Cylinder with Hand Brake (4) provision, all internal components and brake application procedure remain similar to that of Brake Cylinder without hand brake (3). The piston rods which are coming out of back cover (18) are attached to the pull lever assembly. Pull lever assembly is hinged to back cover (18). When the wire rope is pulled (using hand brake wheel), the piston (8) movement initiates brake application.

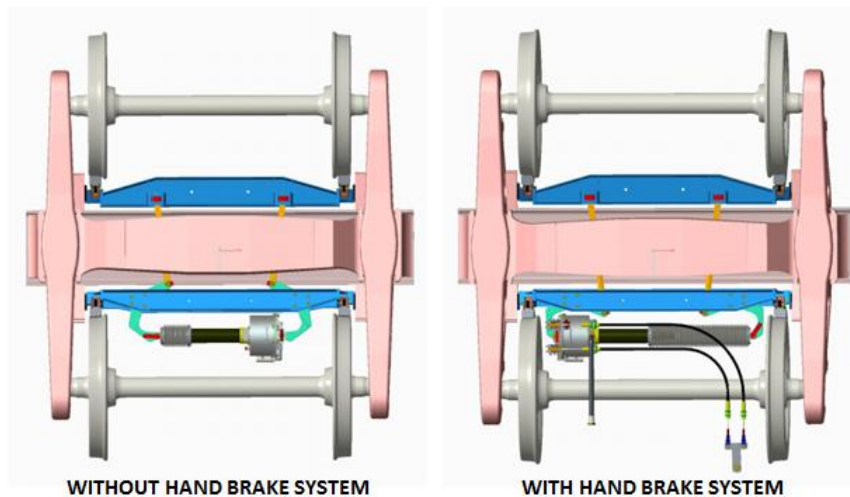


Figure 13: Brake Application condition in BMBS

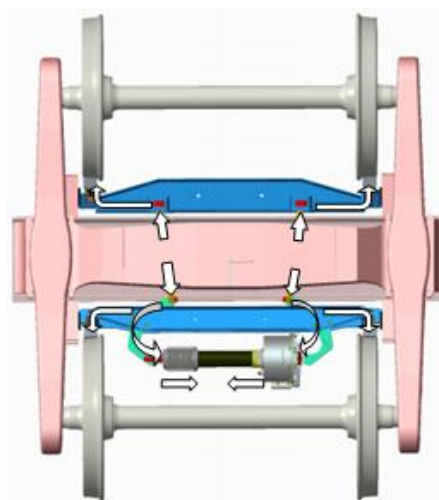


Figure 14: Force Transfer from Brake Cylinder to Wheels





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2.2 BRAKE RELEASE (Ref. Fig. 6 & 12)

During release mode, the air is released through Distributor Valve. This decreases the brake cylinder pressure and as a result the piston (8) moves back. This motion is transmitted to the automatic double acting slack adjuster assembly also and as a result centre to centre distance of brake cylinder (3,4) increases.

The stroke indicator (20) also moves in and its RED colour disappears showing brake release condition.

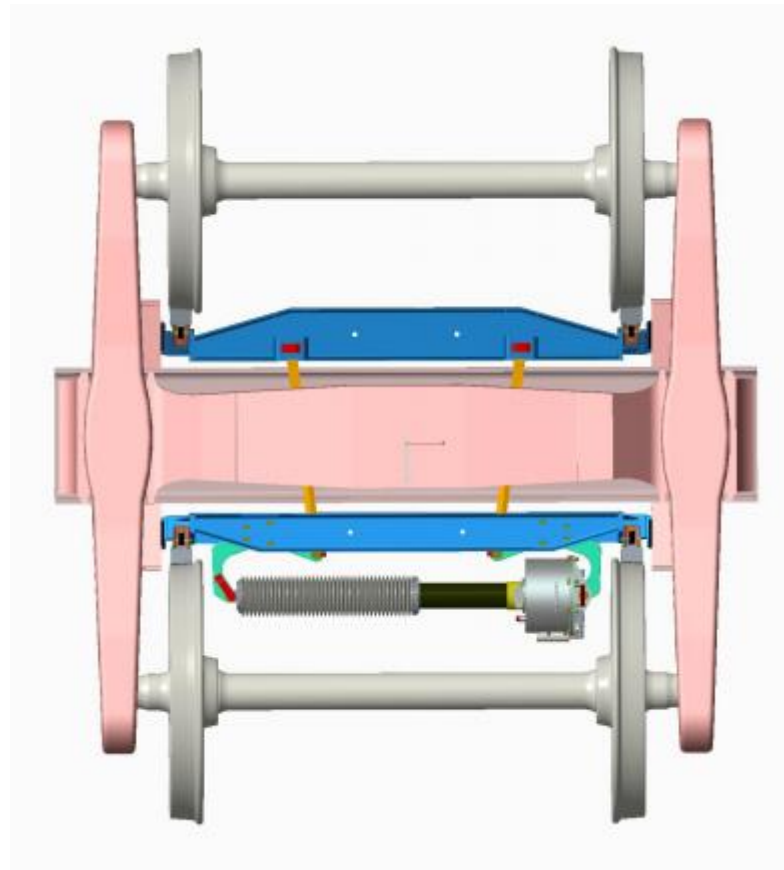


Figure 15: Brake Release condition in BMBS





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2.3 PROCEDURE TO CONNECT THE HAND BRAKE CABLE WITH THE CABLE EQUALIZER AND TIE ROD

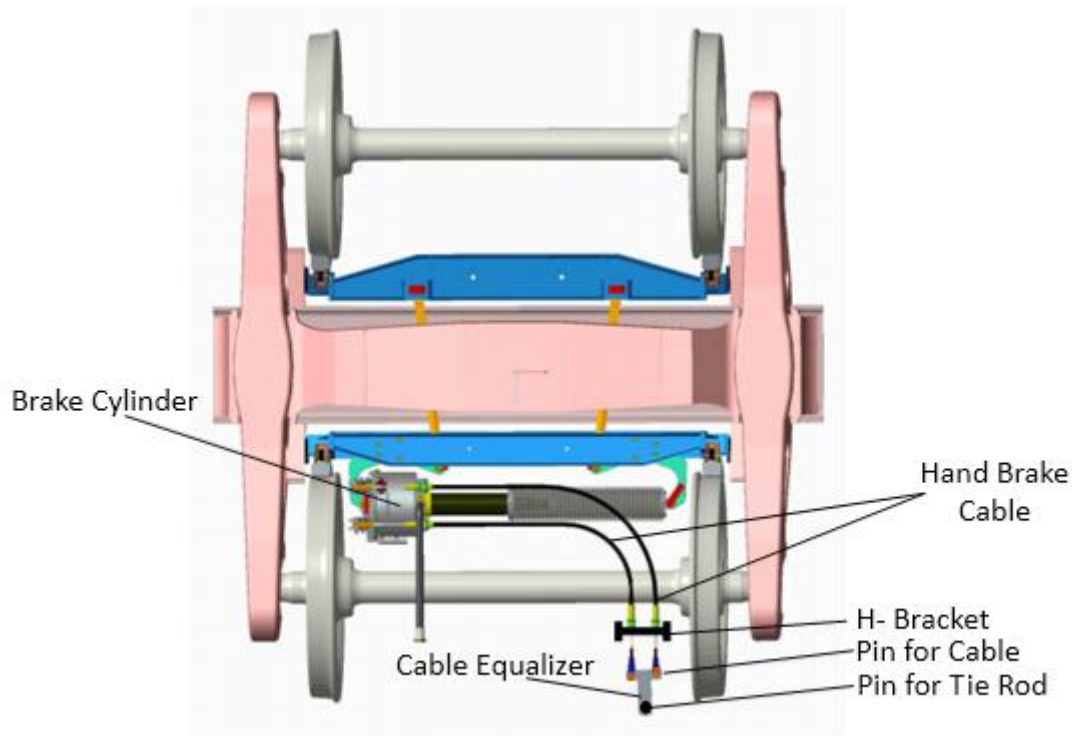



Figure 16: Hand Brake Cable with the Cable Equalizer and Tie Rod

1. Connect the outer cover of Hand Brake cables with cable H-bracket
2. Ensure that the hand brake wheel and air brake are in fully released condition
3. Pull out the cables fully from the brake cylinder in outward direction manually
4. Connect cable with the cable equalizer
5. Now connect the cable equalizer to the Tie rod
6. Apply to check that during the service brake application, cables should not move/bend.
7. Secure the cable pin and tie rod pin with APD.



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2.4 ESCORTS RATIO VALVE (ERV/APM) (Ref. Fig. 18)

Automatic Brake Cylinder Pressure Modification Device is an Empty/Load Changeover valve for Railway Wagons. The Empty/Load type brake cylinder pressure control device for a railway freight car employs a two stage valve, which adjusts the pressure required to actuate the Brake cylinder. Automatic Brake Cylinder Pressure Modification Device as shown below is an ERV/APM device. Empty position refers to the condition when the wagon is unloaded while loaded position refers to the condition when the wagon is loaded, it gives maximum braking pressure of $2.20 \pm 0.25 \text{ kg/cm}^2$ and in loaded position it gives maximum braking pressure of $3.80 \pm 0.1 \text{ kg/cm}^2$. ERV/APM is provided with a sensing arm, which senses the empty and loaded condition of the wagon during braking. ERV/APM is also provided with a empty/load indicator, which shows the condition of the air brake application. Brake cylinder pressure check point is also provided in ERV/APM.

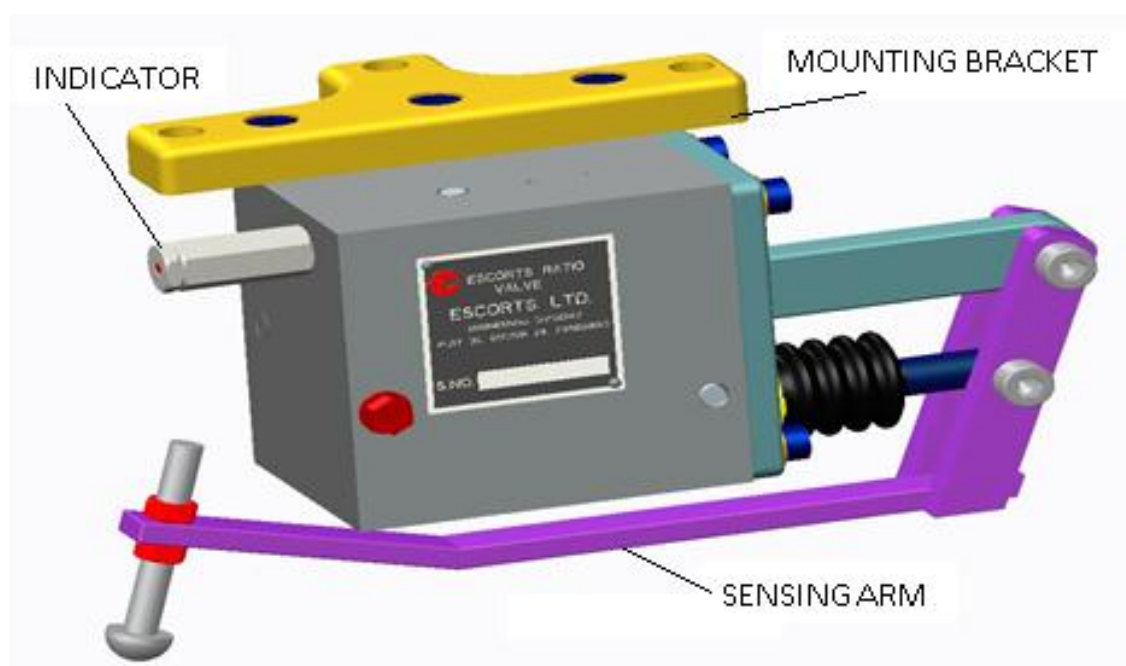


Figure 17: 3D view of ERV/APM device



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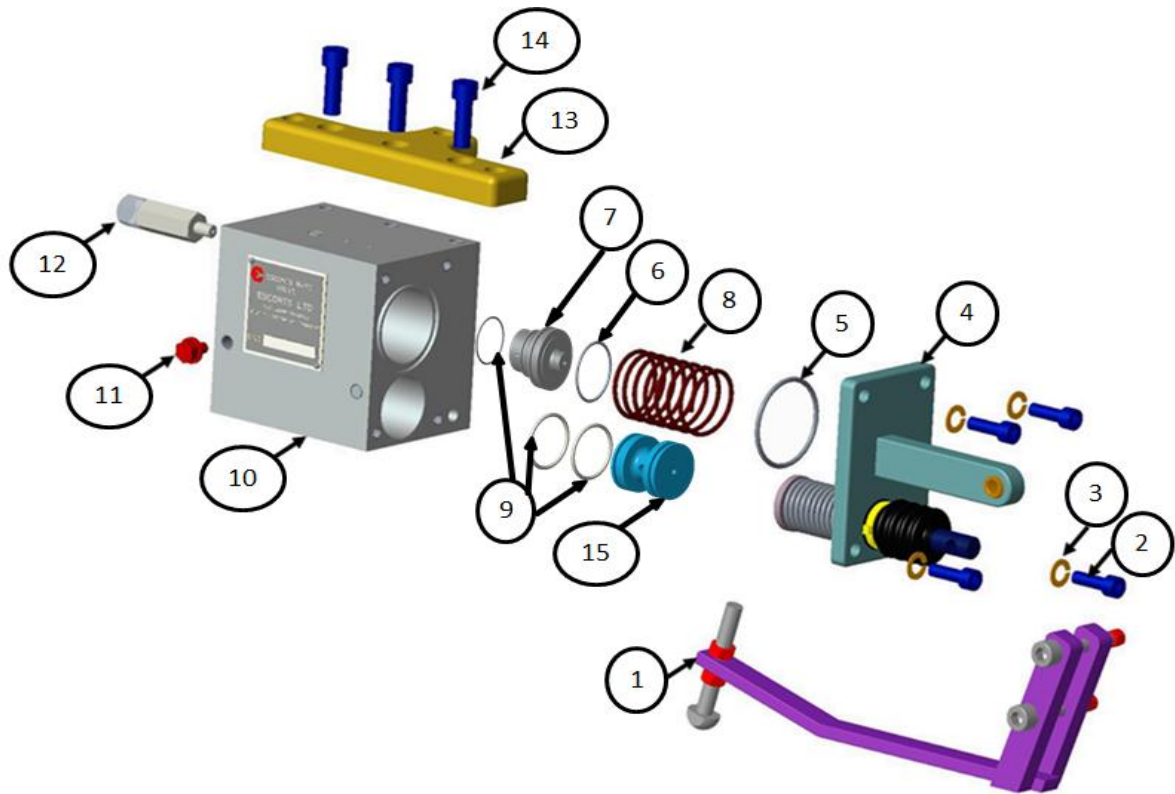



Figure 18: Exploded view of ERV/APM device

S. No.	Description	Drg. No.	Qty/ERV
1	SENSOR ARM	3EB7385	1
2	M8x25 SOCKET HEAD SCREW	IS:6761/EQV.	4
3	SPRING WASHER B8	DIN127/EQV.	4
4	SIDE COVER ASSEMBLY	3EB7472	1
5	'O'RING	4EB7442	1
6	O'RING	4EB7430/2	1
7	RATIO PISTON	4EB7537	1
8	COMPRESSION SPRING	4EB7461B	1
9	'O'RING	4EB7430/1	3
10	ERV HOUSING	1EB8837	1
11	PLUG	4EB9943	1
12	INDICATOR ASSEMBLY	4EB9509	1
13	MOUNTING FLANGE	4EB7443	1
14	M10x25 SOCKET HEAD SCREW	DIN912/EQV.	3
15	MOVEMENT PISTON	4EB9031	1




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2.5 ADJUSTMENTS OF ERV/APM DEVICE (Ref. Fig. 18)

1. Ensure that all the bolts of ERV/APM assembly are properly tightened.
2. Check the sensing arm (1), for any unwanted bending or damage. Move the arm downward and confirm proper working of the valve.
3. ERV/APM is installed using a mounting bracket (14) for mounting with the under frame before the pipe assembly.
4. After successful installation, ERV/APM device can be tested using Single Wagon Test Rig (SWTR). Ensure the wagon is not loaded before the testing of ERV Device.
5. Check ERV/APM Valve for leakage from all ports, no Leakage is permitted.
6. In empty condition brake cylinder pressure must be $2.2 \pm 0.25 \text{ kg/cm}^2$
7. Release brakes using SWTR. Put a block of 1 inch between 'sensing arm bolt head' and 'side frame' (Refer Fig 21). ERV/APM device is acting in loaded mode now. Apply brakes by SWTR. The output pressure of ERV/APM device shall display $3.8 \pm 0.1 \text{ kg/cm}^2$
8. Check ERV/APM Valve for leakage from all ports, no Leakage is permitted.
9. Release brakes and remove the block. Adjustment & Installation of ERV device is now completed.
10. The ERV/APM is mounted in such a fashion that all standard pipes can be fitted as per RDSO pipe drawing.
11. ERV/APM indicator shows the empty/load condition of the air brake application. It is also provided with a pressure test plug (11) for checking brake cylinder pressure.



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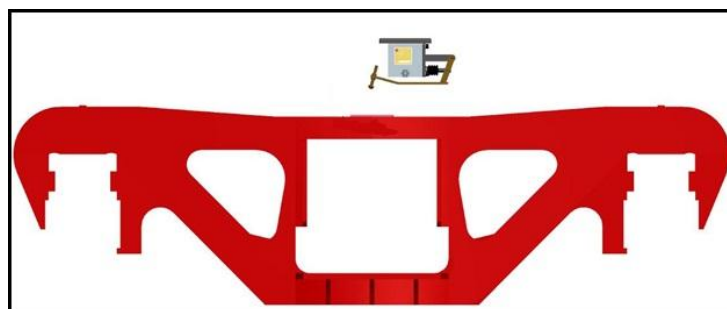


Figure 19: ERV (APM) Installation position

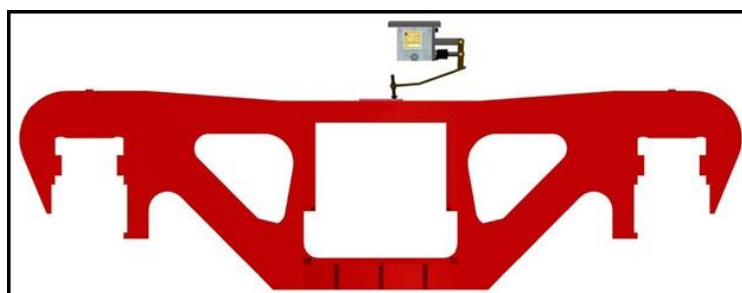


Figure 20: ERV (APM) No load position

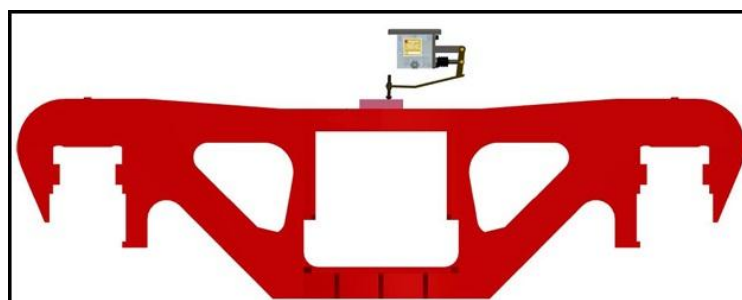


Figure 21: ERV (APM) Loaded position (Block added)



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2.6 GAP BETWEEN SENSOR POINT AND SIDE FRAME

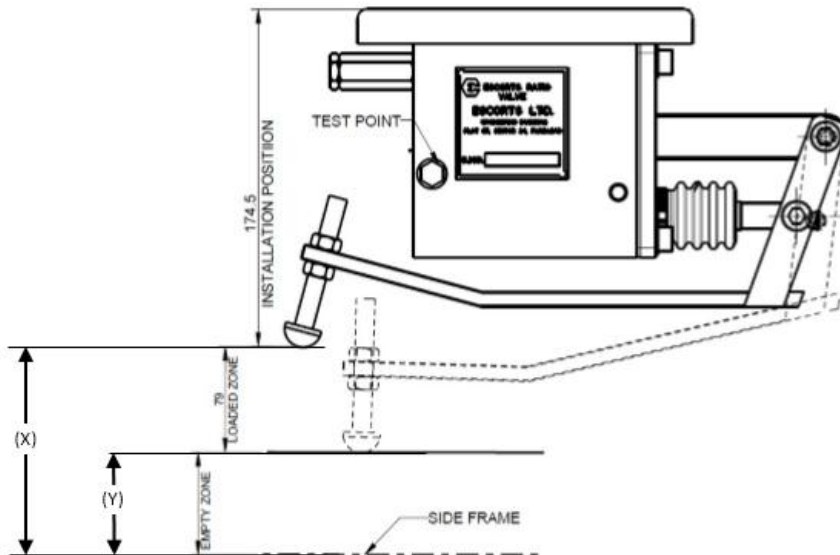


Figure 22: ERV (APM) Loaded & Empty zones

Depending on the type of wagon:

$$X = 79 + Y$$

Y = Deflection of the bogie from tare to changeover weight. Which is dependent on the spring characteristic of bogie, tare and changeover weight of the wagon.

Sl. No.	Wagon	Check	Specified
1	BOSTHSM2	ERV/APM sensor arm movement from initial position to bogie side frame top.	99±1 mm
2	BOXNHL (MBS) & BCNLH MBS	ERV/APM sensor arm movement from initial position to bogie side frame top.	96±1 mm
3	BOXN NLB 20.32 T	ERV/APM sensor arm movement from initial position to bogie side frame top.	92±1 mm
4	BOXN NLB 22.9 T	ERV/APM sensor arm movement from initial position to bogie side frame top.	90±1 mm
5	BOXN HS 20.32 T	ERV/APM sensor arm movement from initial position to bogie side frame top.	94.5±1 mm
6	BOXN HS 22.92 T	ERV/APM sensor arm movement from initial position to bogie side frame top.	94±1 mm
7	BTFLN 20.32 T	ERV/APM sensor arm movement from initial position to bogie side frame top.	94±1 mm





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2.7 APD for ERV/APM

APD for ERV/APM mounted on the same mounting holes of ERV/APM as shown below

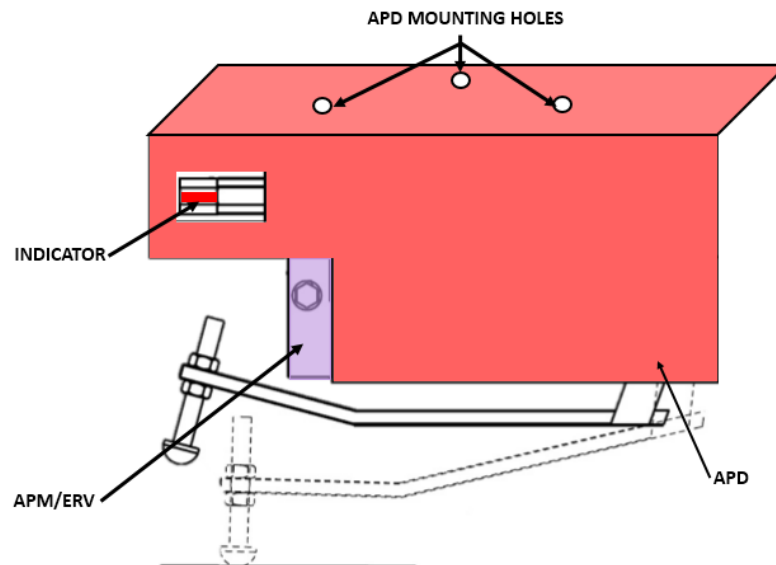


Figure 23: APD for ERV (APM)

2.8 PROCEDURE FOR INSTALLATION OF BMBS PARTS

2.8.1 PRIMARY AND SECONDARY BRAKE BEAMS


Slide the Primary and Secondary Brake Beams in the side pockets of side frame of the Bogie without wheel and axle assembly.

Fix the Push rod to both the beams with Pins. Then lock the Pins with Bulb Cotter and washer.

2.8.2 BRAKE CYLINDER 11" (WITH HAND BRAKE-3EB7348 AND WITHOUT HAND BRAKE CABLE-3EB7347)

Mount the Brake Cylinder on the Bell Crank Lever fitted on the Primary Beam with the help of pins. Then lock the Pins with Bush and spring dowel sleeve. Now tighten the pneumatic hose flange with Bolt, Nut and Spring Washer.



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In case of Brake Cylinder with Hand Brake Cable, mount the Hand Brake Cables to H-Bracket of the Under Frame and connect the cable fork to the equalizer with pins and then lock the pins with split pins which further connect to the tie rod.

2.8.3 ESCORTS RATIO VALVE (ERV/APM)

Mount the ERV/APM on the under frame just above the side frame of the bogie with 3 nos. M12 Bolt, Spring Washer and Nut.

Now fit all the three hoses to the ERV/APM as below and tighten them.

1. Hose to Brake Cylinder
2. Hose to DV
3. Hose to 6.6 lit. Reservoir

2.8.4 BRAKE HEAD AND BRAKE BLOCK

Place the Brake Heads on to the Primary and Secondary Brake Beams (with locking position on top) and fit the pins to hold the Brake Heads in their respective location. Lock the Pins with Split Pins.

Mount the Brake Block on the Brake Head matching the wheel profile and insert the brake block keys. Now lock the keys with split pins.





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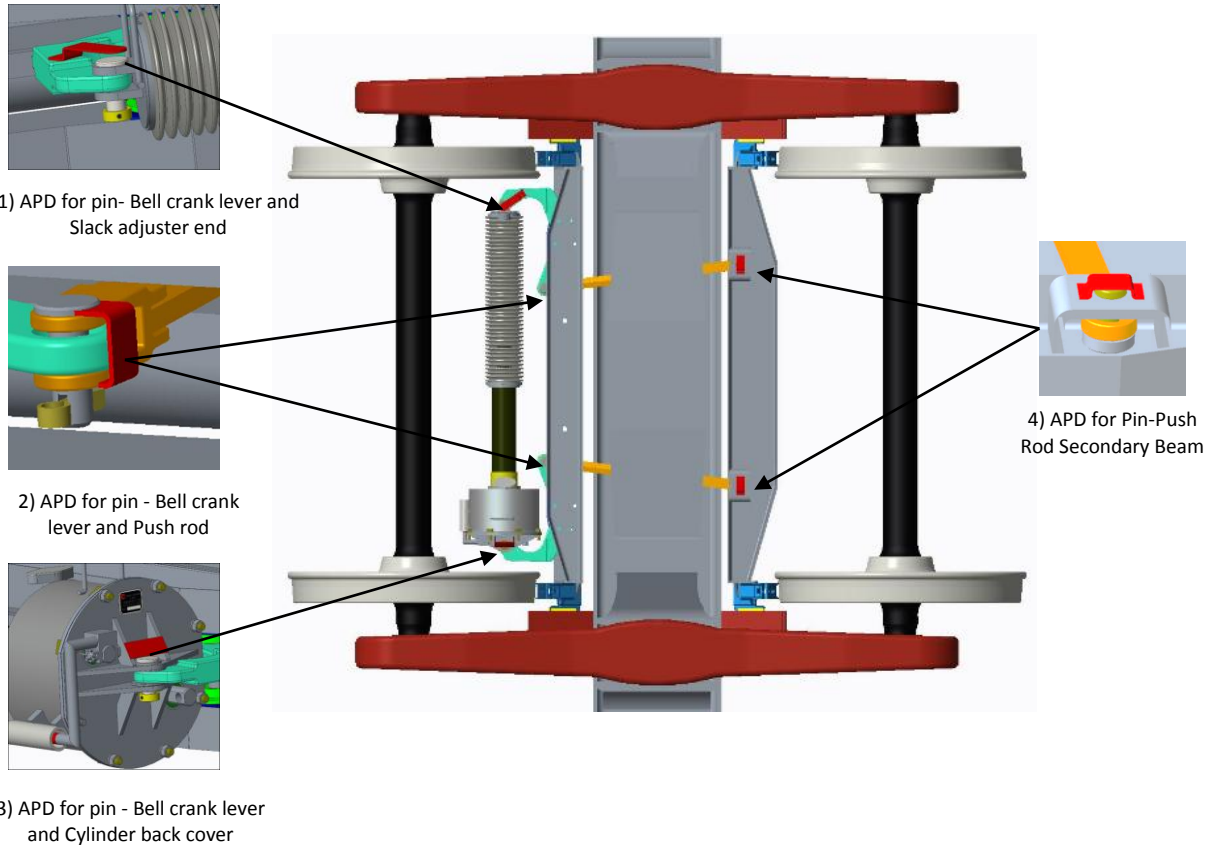
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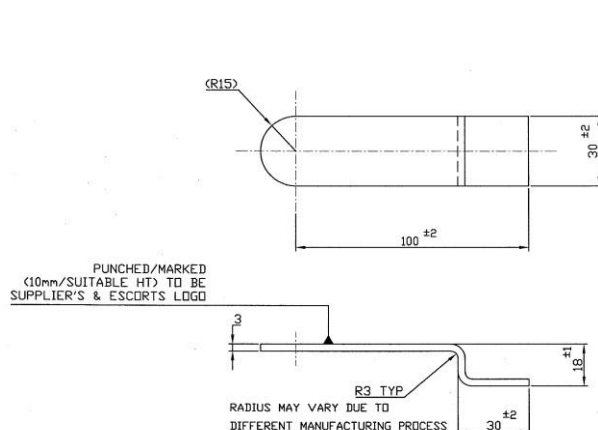
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2.9 APD FOR BRAKE CYLINDER AND RIGGING ARRANGEMENTS.

Weld the suitable APD's at following locations as shown in the figure:-



1) APD For Brake Cylinder (Ram End)



2) APD for pin - Bell crank lever and push rod

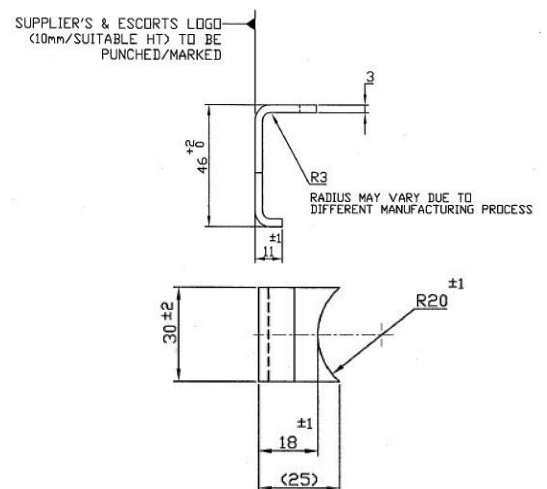

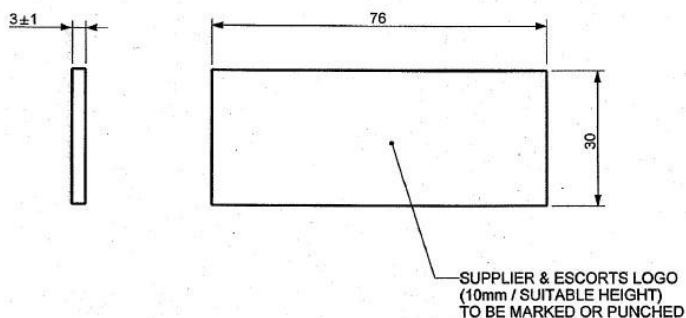


Figure 24: APD Locations

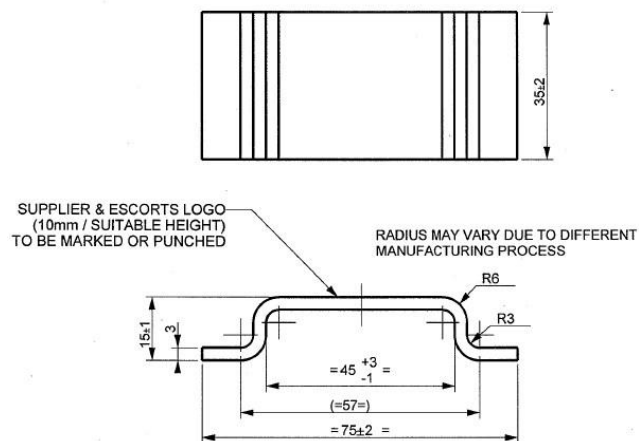


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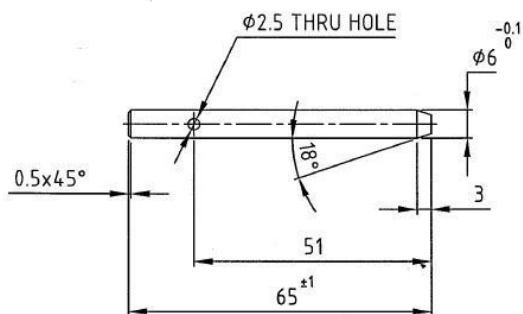
3) APD for pin - Bell crank lever



4) APD for Pin-Push Rod Secondary Beam



5) APD for Brake Head Pin



6) APD for Equalizer Pin

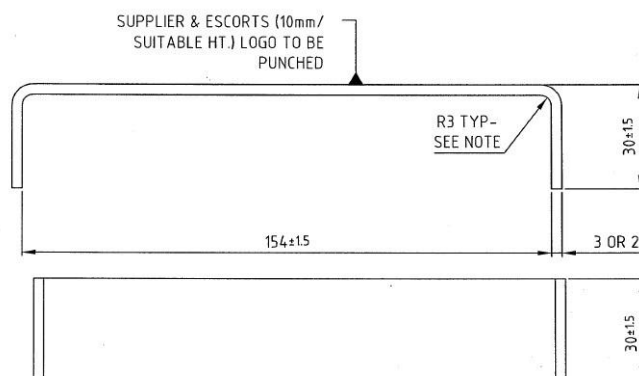


Figure 25: APD Locations (Brake Cylinder and Rigging Parts)

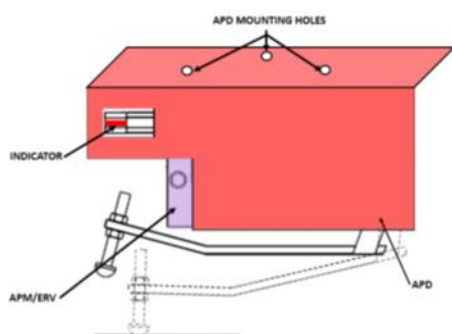


Figure 26: APD Location (ERV/APM)

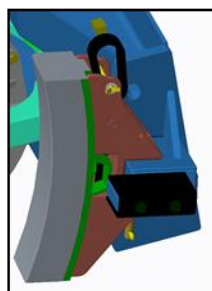
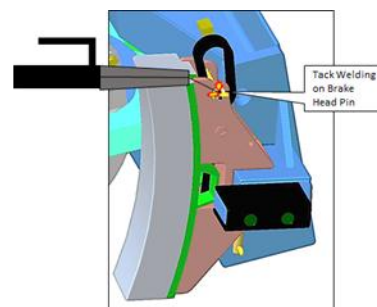


Figure 27: APD Location (Brake Block Key)





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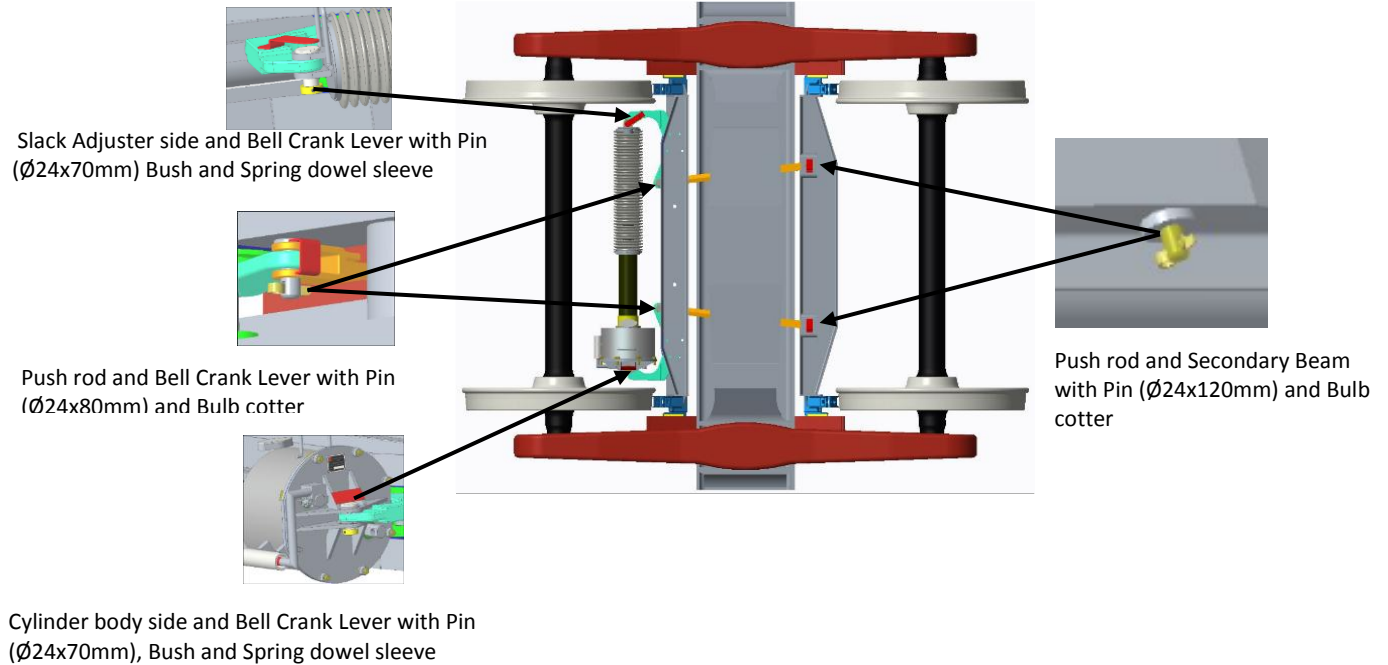
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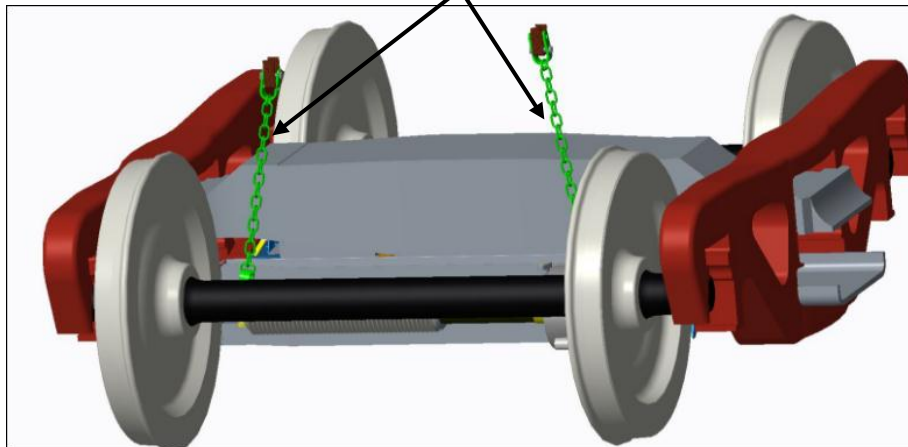
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2.10 MOUNTING ARRANGEMENT OF BMBS



Chain clamped to welded U bracket on the underframe with bolt and nut



Chain arrangement for securing Brake cylinder mounting

Figure 28: Mounting Arrangement of BMBS





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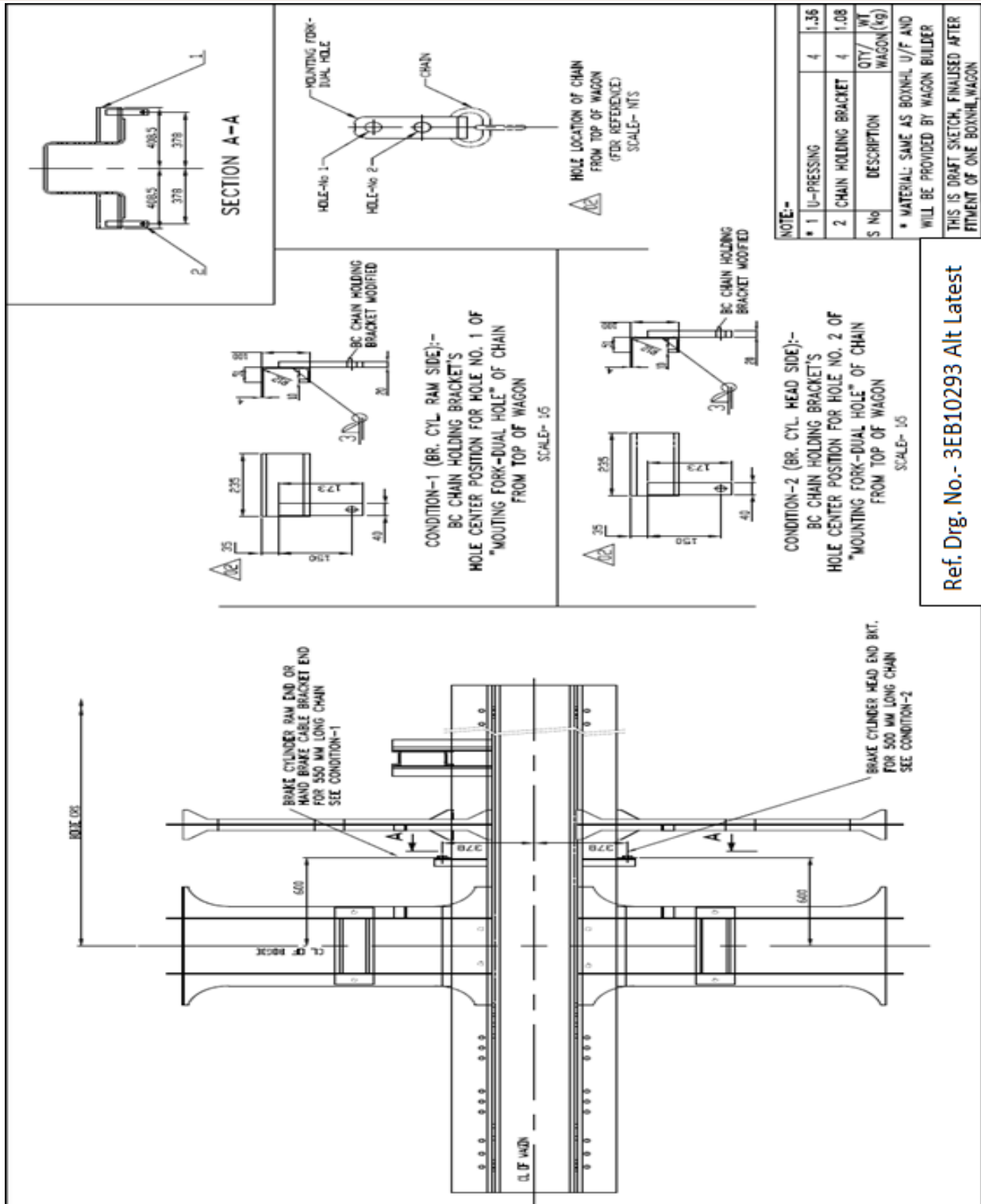



Figure 29: Brake Cylinder chain holding brackets hole center position (BOXNHL WAGON)



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3 PROCEDURE FOR CHANGING OF BMBS PARTS


3.1 ISOLATION OF BRAKE CYLINDER (3 & 4) (Ref. Fig. No. 6 & 4)

1. There are two isolating cocks with vent in BC line for isolating each brake cylinder in the wagon.
2. To isolate any particular Bogie / Brake Cylinder, move the isolating cock handle to closed position. This will stop the further feeding of corresponding brake cylinder and the air already present in the brake cylinder to be exhausted to atmosphere, thus, releasing the brakes in that particular bogie.

3.2 CHANGING OF BRAKE HEAD (8) (Ref. Fig. No. 6)

1. Rotate the barrel tube of brake cylinder creating the space between the brake block and the wheel.
2. Remove the brake block key and then the brake block
3. After obtaining enough clearance between the wheel & the brake heads, remove the split pin (26) & the brake head pin (12) consecutively to remove the desired brake head (8).
4. Install a new brake head (8).and secure it with brake head pin (12) then a split pin (26). Bend the split pin legs outwards.
5. Place the brake block on the new brake head and secure the brake block with the brake block key.
6. The automatic double acting slack adjuster will automatically adjust the brake shoe clearance to the proper value when the brakes are applied and released. This usually takes after a few brake applications.



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3.3 CHANGING OF BRAKE CYLINDER WITH AND WITHOUT HAND BRAKE (3 & 4)

(Ref. Fig. No. 6)

1. Ensure, the brakes are released and the brake cylinder is completely vented. Retract the brake cylinder (3) (4). Rotate the barrel tube to force the brake cylinder to retract completely.
2. Disconnect the air hose (28) from the cylinder assembly flange.
3. In case of brake cylinder with hand brake cable (4), remove the pins (36,37) from both ends of equalizer (32) i.e. tie rod end as well as hand brake cable end. Then, loosen the nuts from H-bracket to free the hand brake cable.
4. Remove the pin (10) on both sides of the cylinder. Install a new brake cylinder assembly, secure the brake cylinder with pins, dowels and APD.
5. Reconnect the air hose (10) to the cylinder assembly flange.
6. Apply partial brakes 2-3 times in order to restore the internal slack adjuster's position



Notification!

For cylinders equipped with the hand brake cables

1. Disconnect the cable clevises from the equalizer by removing the two pins and cable pins.
2. Remove the two cables from the cable bracket.



Caution!

- The wagon has to be placed in a Sick-line/ROH depot
- The workmen has to wear helmet, Hand and gloves and Safety shoes.
- Use of proper tools





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Warning!

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

3.4 CHANGING OF BELL CRANK LEVER ASSEMBLY (5 & 6) (Ref. Fig. No. 6)


1. This change will be required if this part has been damaged or worn out.
2. Remove the split pin and the pull rod pin with push rod. Remove the pin with brake cylinder. Loosen the T-head M12 mounting bolts, remove 8 nos M12 bolts, M12 nuts and B12 spring washers. Pull the bell crank lever (5, 6) RH & LH from the beam assembly. Install a new lever RH & LH as applicable by mounting and tightening the 8 nos M12 bolts, M12 nuts and B12 spring washers. Install push rod pins (9) and split pins. Install pins with the brake cylinder (11), bend the split pin legs.
3. The automatic double acting slack adjuster will automatically adjust the brake shoe clearance to the proper value when the brakes are applied and released. This usually takes from one to three brake applications.



Caution!

- The wagon has to be placed in a shed
- The workmen has to wear Helmet, Hand gloves and Safety shoes.
- Use of proper tools



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3.5 CHANGING OF PUSH ROD (7) (Ref. Fig. No. 6)

This change will be required if this part has been damaged or worn out.


1. Remove the split pin and the rod pin with bell crank lever (5,6). Remove the split pin and the pin rod eye with secondary brake beam (2). Remove the Push rod (7) from bell crank lever assembly RH and LH. Push the rod from the secondary beam (2). To install a new Push rod, align the rod end hole with the mounting holes in the secondary beam and then insert the pin and the split pin. Bend the split pin legs. Do the same procedure on the other end of the rod by aligning the rod with the bell crank lever assembly RH and LH with pin and split pin.
2. The automatic double acting slack adjuster will automatically adjust the brake shoe clearance to the proper value when the brakes are applied and released. This usually takes from one to three brake applications.

3.6 LIFTING OF UNDER FRAME FROM BOGIE

1. Disconnect the air hose from the flange of brake cylinder without hand brake cables by unscrewing the bolts.
2. Disconnect the air hose from the flange of brake cylinder with hand brake cables by unscrewing the bolts.
3. Disconnect both the cables from the equalizer cable by removing the split pins and the pins.
4. Detach the cables from the cable bracket by loosening the nuts on either side of the cable bracket. Remove the cables from the bracket after the nuts have been loosened and enough space is created for easy removal.

After the removal of brake cylinder hoses and the hand brake cables from the under frame, the wagon under frame can be lifted from the bogies. The bogie can be dismantled or assembled with the bogie mounted parts by following maintenance instruction described earlier.



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3.7 CONDEMNING LIMITS OF SYSTEM COMPONENTS

3.7.1 BRAKE HEAD

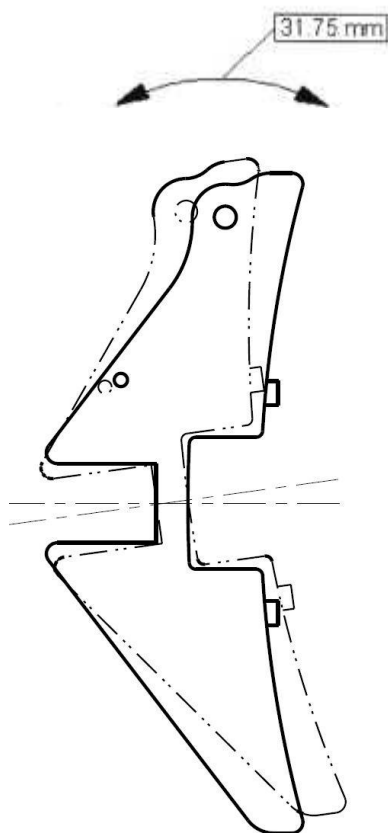


Figure 30: Brake Head

Brake Head should be replaced if the following exists. Check brake head tip. Push brake head forward and measure travel by pulling brake head all the way back. Tip travel should NOT exceed 31.75 mm.





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3.7.2 BELL CRANK LEVER ASSEMBLY RH & LH

Bell Crank Levers should be replaced if anyone of the following exists.

3. Excessive Wear on any surface

- Excessive is anything > 1.6 mm

4. Worn, Damaged or Broken Spherical Bearing

Worn/Enlarged Pin Holes 25.4 mm Hole exceeds 26.7 mm in any direction (i.e.: oval condition)

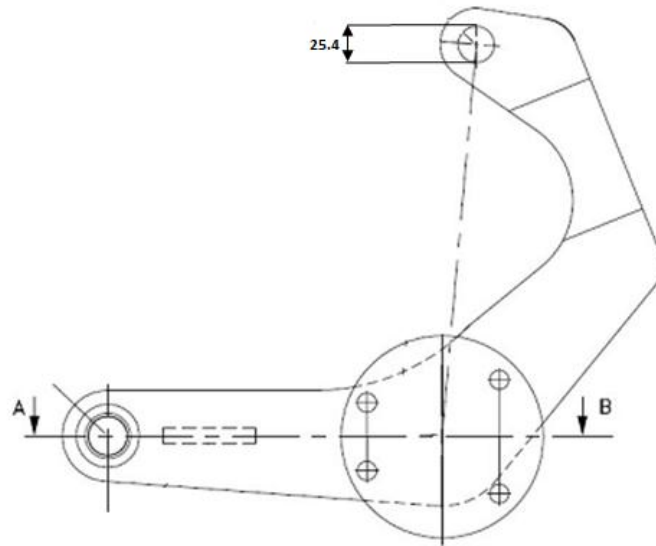
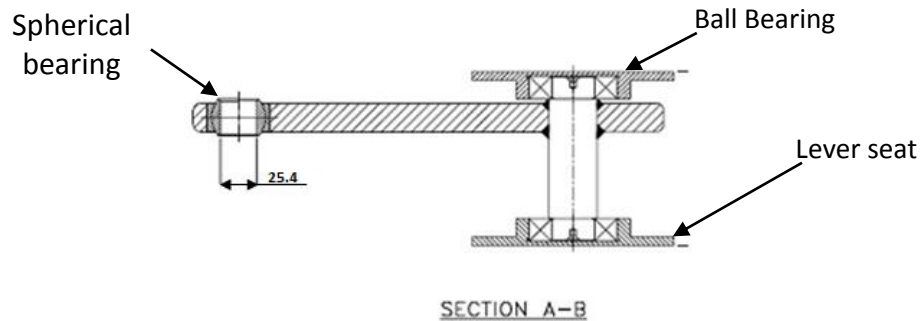



Figure 31: Bell Crank Lever Assembly



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3.7.3 PUSH ROD


Push Rods should be replaced if anyone of the following exists:

5. Any part of the push rod is Bent
6. Cracked or Damaged Welds
7. Excessive Wear on any surface
 - Excessive is anything > 1.6 mm
8. Worn, Damaged or Broken Spherical Bearing
9. Worn/Enlarged Pin Hole 25.4 mm Hole exceeds 26.7 mm in any direction (ie. oval condition)
10. Pin End Gap 25.5mm exceeds 27.9 mm.



Figure 32: Push Rod Assy



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3.7.4 BRAKE BEAMS

Brake Beam should be replaced if the following exists. Remove Brake Head and inspect Brake Head pin hole in Beam. If hole exceeds 20.32 mm in length, replace Beam. If not, replace brake head and recheck tip as described earlier. Tip should not exceed 31.75 mm (from FIRST check above). If tip does exceed 31.75 mm, replace Beam and Brake Head

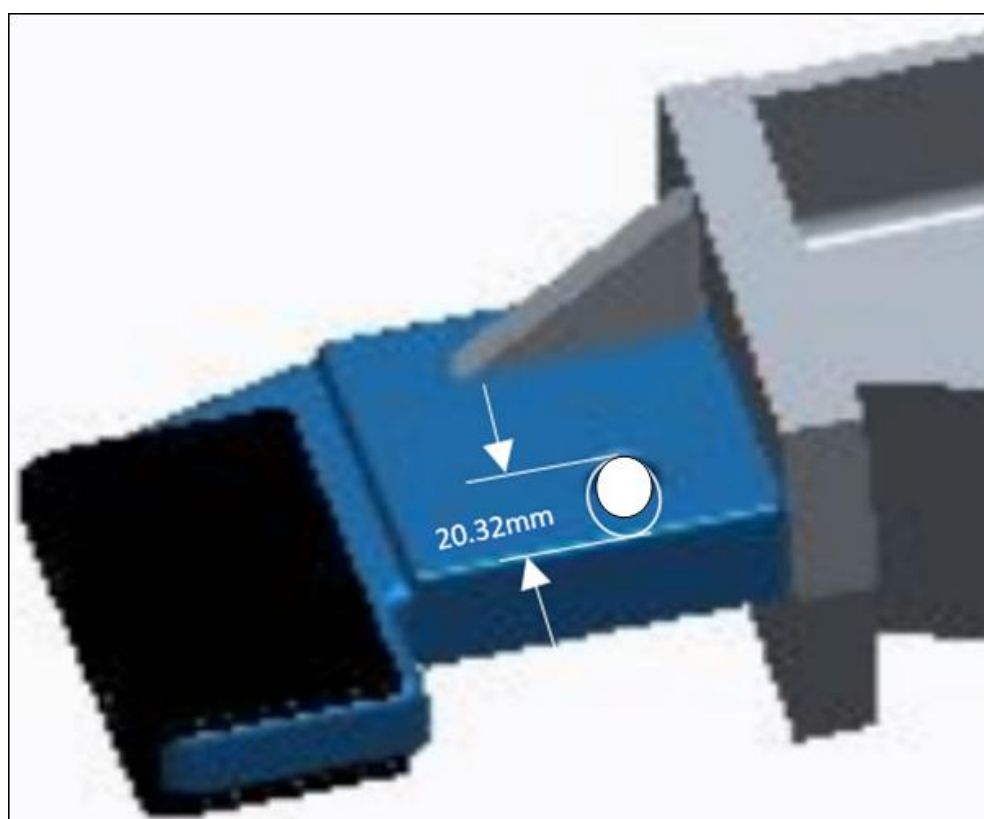



Figure 33: Brake Beam End Worn Condition



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4 MAINTENANCE INSTRUCTION FOR BOGIE MOUNTED BRAKE SYSTEM (BRAKE RIGGING ITEMS) IN OPEN LINE /ROH DEPOT

1. Check all the pin joints for any missing parts (pins, split pins, spring dowel, etc), if missing, provide the same.
2. Check the components for missing or any physical damage, if found replace them.
3. Check that the APD is provided on all the pins and on the ERV/APM.
4. Check that all hoses are properly tightened and are not damaged by axle or wheel, if so properly clamp them.
5. Check thickness of CBB it should be adequate for the complete trip.

4.1 GENERAL ADJUSTMENTS FOR BRAKE SHOE CHANGE

Adjustment of all components is done after final assembly only. Once the air connection (3.8 kg/cm²) is attached to the brake cylinder, the brake cylinder starts adjusting the stroke and ensures the gap between brake block and wheel.

The brake cylinder automatically adjusts pay-out and pay-in of the gaps. The Escorts BMBS brake cylinder is equipped with In-Built Automatic double acting slack adjuster. It maintains automatically a constant piston travel by taking up or paying out slack with each stroke of brake application. The piston stroke indicator, which is mounted on brake cylinder body ensures visibility of indicator during brake application and release.


In order to change the brake shoe, rotate the automatic double acting slack adjuster barrel to create gap between brake shoe and wheel.

Put a new brake block of 58 mm thickness in the brake head and fix it using brake block key.

4.2 GENERAL MAINTENANCE FOR HAND BRAKE RIGGING

1. Check all the pin joints for any missing parts (pins, split pins, spring dowel, etc), if missing, provide the same.
2. Check the components for missing or any physical damage, if found replace them.



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3. Check the condition of wire rope at bends, if damaged to be replaced.

4.3 ROH SCHEDULE FOR WAGONS FITTED WITH BMBS AIR BRAKE SYSTEM

In routine overhaul, first test the brake system of BMBS using single wagon test rig. Following action should be taken for the defects / discrepancies identified during testing.




Caution!

- The wagon has to be placed in an Open -line/ROH depot
- The workmen has to wear Helmet, Hand gloves and Safety shoes.
- Use of proper tools

4.3.1 LIST OF TOOLS REQUIRED DURING ROH OF BMBS (BRAKE CYLINDER, ERV, RIGGING)

1. Hammer
2. Flat Chisel
3. Ring Spanner 19
4. Spanner 16-17
5. Tool for Spring Dowel Sleeve (Ref. Fig.-34)
6. Allen Key M8
7. Allen Key M12
8. Special Tool 1 (Ref. Fig.44)
9. Open Spanner 20-22 2 nos.
10. Open Spanner 36-41
11. Ring Spanner 20-22



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4.3.2 BRAKE BEAMS

1. Check for any physical damage, crack etc, if found replace them. Check for rusting & corrosion and if found repaint them.
2. Replace all the PINS, washer, split pins, dowel pins from OEMs.
3. Check the GAP at pivot pin on the primary brake beam as shown in the condemning limit of the system components.
4. Check brake head for loosening or damage as shown in the condemning limit of the system components.

4.3.3 LEVERS & PUSH RODS

1. Replace the Bell crank lever, if any of the parameters specified in the condemning limits is observed.
2. Replace the push rod, if any of the parameters specified in the condemning limits is observed.

4.3.4 HAND BRAKE RIGGING

1. Check the pin joints / components for missing or any physical damage, if found replace them.
2. Replace all the PINS, washer, split pins, dowel pins.


4.3.5 HOSES & PIPE JOINTS

1. Check the hoses for any cracks / damage, if so replace them.
2. Check that the hoses are properly tightened and are not threatened to be damaged by axle or wheel, if so properly clamp them.
3. Check the pipe joints for leakages, if so tighten them properly.

4.3.6 PIPING

1. The BC isolating cocks in the BC line have their vent side towards the Brake cylinder (Both sides) and their handles are parallel to pipe line.



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2. The brake hoses for Brake cylinder are properly secured and not resting on axle or rubbing with any other under frame members.
3. The brackets for hand brake arrangement are properly secured, the movement of the hand brake system is smooth and unrestricted.

4.4 SWTR TESTING

SWTR test for wagon to be done as per RDSO format.

4.4.1 BOGIE & BRAKE CYLINDER 11" (WITH AND WITHOUT HAND BRAKE CABLE)

1. Push rod & spring plank clearance (min 10mm).
2. The split pin over the Brake head pin is tack welded with washer.
3. The brake cylinder pins are locked with bush and dowel sleeve.
4. Split pins are provided on all pins, bent properly & provided with APDs.

4.4.2 PIPING

1. The BC isolating cocks in the BC line have their vent side towards the Brake cylinder (Both sides) and their handles are parallel to pipe line.
5. The brake hoses for Brake cylinder are properly secured and not resting on axle or rubbing with any other under frame members.
6. The brackets for hand brake arrangement are properly secured, the movement of the hand brake system is smooth and unrestricted.


4.5 POH SCHEDULE FOR WAGONS FITTED WITH BMBS AIR BRAKE SYSTEM



Caution!

- The wagon has to be placed in a Workshop.
- The workmen has to wear Helmet, Hand gloves and Safety shoes.
- Use of proper tools




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4.5.1 LIST OF TOOLS REQUIRED DURING POH OF BMBS (BRAKE CYLINDER, ERV, RIGGING)

1. Socket Wrench, M8
2. Socket Wrench, M12
3. Impact Wrench, M12
4. Socket Extension, 4"
5. Allen Wrench, M4
6. Hammer
7. Special Tool 1 (For Adjuster Tube Assembly-9 of Fig.37)
8. Special Tool 2 (For Circlip -14 of Fig.37)
9. Special Tool 3 (For Clutch sleeve -6 of Fig.37)
10. Flat Chisel
11. Ring Spanner 19
12. Spanner 16-17
13. Tool for Spring Dowel Sleeve (Ref. Fig.-34)
14. Allen Key M8
15. Allen Key M12
16. Special Tool 1 (Ref. Fig.44)
17. Open Spanner 20-22 2 nos.
18. Open Spanner 36-41
19. Ring Spanner 20-22



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4.5.2 BOGIE RIGGING

Replace all the Pins, Clevis, Washers and split pins

4.5.3 BRAKE BEAMS

1. Check the beams for rusting & corrosion and if found repair & repaint them.
2. Check the GAP at pivot pin on the primary brake beam as shown in the condemning limit of the system components.
3. Check brake head for loosening or damage as shown in the condemning limits of the system components.

4.5.4 BELL CRANKS LEVERS & PUSH RODS

1. Replace the Bell Crank levers, if the critical parameters found in condemning limits as specified.
2. Replace the Push Rod, if the critical parameters found in condemning limits as specified.

4.5.5 HAND BRAKE RIGGING

1. Check for any physical damage components, if found replace them.
2. Brake rigging brackets, bolts and nuts should be examined for rusting, looseness, damaged threads etc and replaced.

4.5.6 PIPING

1. The BC isolating cocks in the BC line have their vent side towards the Brake cylinder (Both sides) and their handles are parallel to pipe line.
2. The brake hoses for Brake cylinder are properly secured and not resting on axle or rubbing with any other under frame members.
3. The brackets for hand brake arrangement are properly secured, the movement of the hand brake system is smooth and unrestricted.



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4.5.7 TOOL FOR SPRING DOWEL SLEEVE

To remove the spring dowel sleeve from the brake cylinder pin during replacing/changing of brake cylinder a special tool is required as shown in the figure below.

To adjust the gap between the side frame of bogie and adjuster screw of APM (ERV), this gauge is required. It is adjustable and can be adjusted as per the required gap and place it on the side frame. Now touch the head of the head of adjuster screw by loosening/tightening it. Lock the position of adjuster screw by tightening the lock screw.

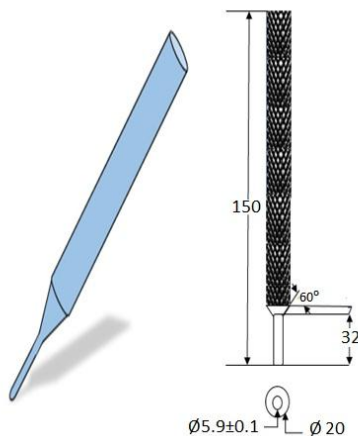


Figure 34: Tool for spring dowel sleeve

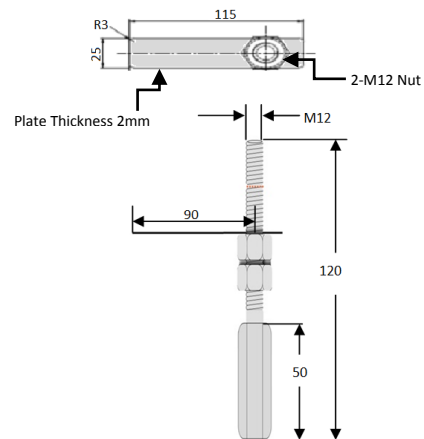



Figure 35: Gap measuring Gauge

4.5.8 MAINTENANCE IN OPEN LINE

4.5.8.1 BOGIE RIGGING; BRAKE BEAMS, BELL CRANKS LEVERS & PUSH RODS

1. Check the components for missing or any physical damage, if found replace them.
2. Check all the pin joints for any missing parts (pins, split pins, spring dowel, etc), if missing, provide the same.
3. Check that the APD is provided on all the pins and on the ERV/ APM valve.
4. Check that the all hoses are properly tightened and are not threatened to be damaged by axle or wheel. If so, properly clamped them.
5. Check the thickness of Brake Block. It should be sufficient for complete trip



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4.5.8.2 BRAKE CYLINDER

1. Check for any physical damage of components.
2. Check that the piston indicator is fully in.
3. In case of brake cylinder with hand brake cables, the cables are not entangled or resting / touching the axle.
4. Check that hand brake cables should not bend during the service brake application.

4.5.8.3 ERV/APM DEVICE

1. Check for any physical damage to the valve.
2. Check that the indicator is during the release.
3. Check the tightness of the lock nuts on sensor arm lever, if found loose, tighten them and also verify the Gap as specified with the help of ERV/ APM gap adjusting gauge.
4. Check that the valve's sensing arm is moving freely.

4.5.8.4 HAND BRAKE RIGGING

1. Check all the pin joints for any missing parts (pins, split pins, spring dowel, etc), if missing, provide the same.
2. Check the components for missing or any physical damage, if found replace them.

4.5.8.5 SPARES OF ESCORTS TO BE MAINTAINED IN OPEN LINES / ROH DEPOTS

List of items to be maintained for replacement against missing or damaged parts

Bogie Equipment			
Sl.No.	Component Description	Escorts Drg. No./ RDSO Drg. No.	QTY/Wagon
1	BRAKE CYLINDER 11" WITH DOUBLE ACTING AUTOMATIC	3EB7347 Alt-08	1
2	BRAKE CYLINDER 11" WITH DOUBLE ACTING AUTOMATIC SLACK ADJUSTER & HAND BRAKE	3EB7348 Alt-08	1
3	ERV (APM)	3EB7346 ALT-07	1



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4	AIR RESERVOIR (6.6 LTS)	WD-09048-S-01	1
5	PRIMARY BRAKE BEAM ASSY.	3EB5521 Alt-10	2
6	SECONDARY BRAKE BEAM ASSY.	3EB5522 Alt-09	2
7	BELL CRANK LEVER- LH ASSY	3EB9792 Alt-00	2
8	BELL CRANK LEVER- RH ASSY	3EB9791 Alt-00	2
9	PUSH ROD ASSY	3EB9790 Alt-00	4
10	BRAKE HEAD	3EB7375	8

Pins, Split Pins (Bogie Equipment)

Sl.No.	Component Description	Escorts Drg. No.	QTY/Wagon
1	PIN Ø 24X120	4EB10264	4
2	PIN Ø 24X70	4EB10262	4
3	PIN Ø 24X80	4EB10263	4
4	BRAKE HEAD PIN	4EB9764	8
5	SPLIT PIN 6.3x75	IS 549/EQV.	8
6	SPLIT PIN 5X32	IS 549/EQV.	8
7	PIN FOR CABLE	4EB5567	2
8	PIN FOR TIE ROD	4EB9975	1
9	BULB COTTER WITH PLAIN WASHER	4EB10271	8
10	SPLIT PIN 6.3x50	IS 549/EQV.	1
11	SPLIT PIN 4x35	DIN 94/EQV.	2



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Hoses & Hardwares (Bogie Equipment)

Sl.No.	Component Description	Escorts Drg. No.	QTY/Wagon
1	BRAKE HOSE (6.6LTS RESERVOIR)	3EB9763 ALT 02	1
2	BRAKE HOSE (BC)	3EB5536 ALT 03	2
3	"O" RING	4EB9786	2
4	GASKET	4EB10043	2
5	SPRING WASHER B12	DIN 127/EQV.	8
6	M12 X 50 HEX HEAD BOLT	DIN 931/EQV.	8
7	M12 HEX NUT	DIN 934/EQV.	8
8	SPRING WASHER B8	DIN 127/EQV.	4
9	M8 X 30L HEX HEAD SCREW	IS13726/EQV	2
10	M8 X 25L HEX HEAD SCREW	DIN933/EQV	2



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4.5.8.6 Must change items during POH For M/S Escorts brake system

During POH, below items must be changed			
S.No	Item Description	Drg. No.	Qty/Wagon
Bogie equipment			
1	PIN Ø24x70	4EB10262	4
2	PIN Ø24x80	4EB10263	4
3	PIN Ø24x120	4EB10264	4
4	Brake head pin	4EB9764	8
5	Dowel pins	4EB10260	4
6	Bush	4EB10261	4
7	Split Pin 6.3x75	IS:549/EQV.	8
8	Split Pin 4x35	IS:549/EQV.	2
9	Split Pin 5x32	IS:549/EQV.	8
10	Split Pin 6.3x50	IS:549/EQV.	1

During POH, below items must be changed			
S.No	Item Description	Drg. No.	Qty/Wagon
Hand brake equipment			
1	Pin for cable	4EB5567	2
2	Pin for tie rod	4EB9975	1
3	Split pin	IS:549/EQV.	2
4	Split pin	IS:549/EQV.	1

On conditional basis below items to be replaced			
S.No	Item Description	Drg. No.	Qty/Wagon
1	Hose 1" with flange	3EB5536	2
2	Hose 1/2" with flange	4EB9763	1
3	O-ring	4EB9786	2
4	O-ring	4KB1889	2
5	T-head bolt	4EP5042	32
6	Hex nut	DIN934/EQV.	40
7	Hex head screw	DIN933/EQV.	4
8	Spring washer	DIN127/EQV.	8
9	Spring washer	DIN127/EQV.	40
10	Liner	4EB7354	8
11	CSK Screw	4EB7376	16
12	Rope arrangement set	3EB6158/..	1



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5 DESCRIPTION & MAINTENANCE INSTRUCTION FOR BRAKE CYLINDER 11" (WITH AND WITHOUT HAND BRAKE)



Caution!

- The wagon has to be placed in a Sick-Line/ROH Depot
- The workmen has to wear Helmet, Hand gloves and Safety shoes.
- Use of proper tools

1. Check for any physical damage of components or leakage.
2. Check that the piston indicator is fully in released condition.
3. In case of brake cylinder with hand brake cables, the cables are not entangled or resting / touching the axle check the movement, cable is free.
4. Check for any damage in the dust protector bellow. If found remove and replace the bellow.


5.1 WORKING OF BRAKE CYLINDER 11" (WITH AND WITHOUT HAND BRAKE CABLE)

Bogie Mounted Braking System (BMBS) is a Braking system used in Wagons. This system is designed according to Indian railways specification No. WD-23-BMBS-2008 (Rev01) Amendment No.1 of Sept.-2016. This system is designed for fitment of BMBS during manufacturing of new wagons as well as during retro fitment of BMBS on existing In-Service wagons.

This system has the following advantages:

1. Improved Braking Efficiency
2. Reduced weight
3. Less number of parts
4. Uniform brake shoe wear & wheel wear
5. Increased reliability
6. Easy maintenance



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BMBS (Bogie Mounted Brake System) is used in railway. During Brake application, the air is supplied to brake cylinder, which pushes the piston along with double acting slack assembly. The brake cylinder is floating in nature, as a result the brake cylinder end-to-end distance shortest equally both the sides. This shortening of brake cylinder causes the rotation of the Bell crank lever on their pivot (which is on primary brake beam) and forces the push rod to move towards secondary beam. This movement causes the secondary brake beam to move towards wheels and applies force on the wheel. Simultaneously reaction force is developed, which causes the primary brake beam continue to move until it touches the wheels and apply force on the wheel.

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

Brake cylinder with In – Built automatic double acting slack adjuster has following features:

5.1.1 DOUBLE ACTING

The brake shoe clearance is adjustable to its correct value in both directions, either wheel it has become too large owing to wear of the brake blocks and wheels, or when it has become too small, e.g. owing to renewal of worn brake blocks, or due to loading of the wagon altering the brake shoe clearance.


5.1.2 RAPID ACTION

Correct brake shoe clearance is automatically restored after one or two brake application.

5.1.3 VERIFICATION

If resistance occurs in the brake application, caused by corrosion, icing on brake blocks etc., it does not pay out slack immediately, but indexes the amount of slack to be paid out. If the



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slack really is too small, the automatic double acting slack adjuster will pay out this indexed slack at the next brake application. Thus false pay-out will not occur.

5.1.4 TRUE SLACK ADJUSTER

Adjustment based on total piston stroke must cause verification of the slack. The automatic double acting slack adjuster adjusts on slack only, thus giving the brake its best possible range of piston strokes, and ensuring a smooth and efficient braking force at all times.

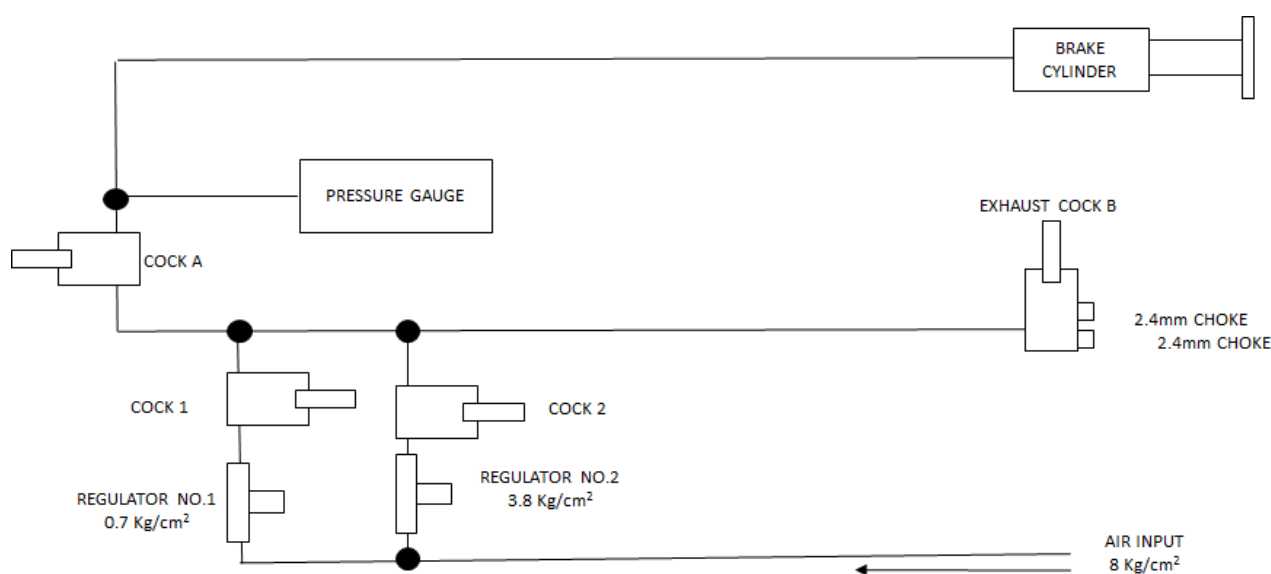


Figure 36: Schematic Diagram for Brake Cylinder Test Bench

5.2 ROH SCHEDULE FOR WAGONS FITTED WITH BMBS BRAKE CYLINDER 11" (WITH HAND BRAKE-3EB7348 AND WITHOUT HAND BRAKE-3EB7347)

In routine overhaul, first test the brake system of BMBS using single wagon test rig. Following action should be taken for the defects / discrepancies identified during testing.



Caution!

- The wagon has to be placed in a Sick-Line/ROH Depot
- The workmen has to wear helmet, Hand gloves and Safety shoes.
- Use of proper tools





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5.2.1 TOOLS REQUIRED FOR ROH & POH OF BRAKE CYLINDER (WITH & WITHOUT HAND BRAKE CABLE)

1. Socket Wrench, M8
2. Socket Wrench, M12
3. Impact Wrench, M12
4. Socket Extension, 4"
5. Allen Wrench, M4
6. Hammer
7. Special Tool 1 (For Adjuster Tube Assembly-9 of Fig.37)
8. Special Tool 2 (For Circlip -14 of Fig.37)
9. Special Tool 3 (For Clutch sleeve -6 of Fig.37)

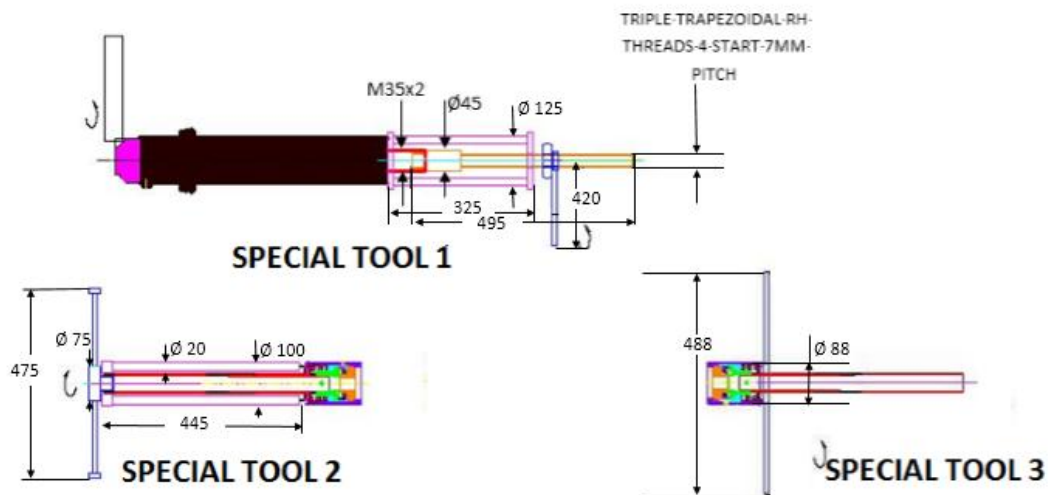



Figure 37: Special Tools



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5.2.2 DISASSEMBLY OF BRAKE CYLINDER (WITH & WITHOUT HAND BRAKE CABLE) (Ref. Figure 12)



Warning

- Component springs within this unit are under compressive loads. Exercise care when disassembling this unit to prevent parts from inadvertently flying out and causing personal injury. While dismantling, when air pressure is required, use a maximum of 0.7kg/cm² exceeding this limit could result in personal injury or damage to equipment.
- Parts may be inadvertently expelled by force of spring wear eye protection and exercise care during disassembly. Failure to observe these safety precautions can lead to injury.


For ease of disassembly and safety, cylinder must be in a horizontal position

1. Rotate the barrel pipe (2) with the help of hands and fully expand the barrel pipe (2)
2. Proper clamping to be done to hold the Back cover with cylinder body.
3. Loosen the back cover bolts using M12 Torque wrench (Caution under spring Pressure)
4. Remove the indicator (20), then back cover (18) & spring (12).
5. Unlock the locking screw (10) & check nut for gland (11).
6. Remove the piston assy. (8) and check for piston packing condition.

5.2.2.1 BODY ASSEMBLY (6)

1. Inspect body (6). If damaged or worn, the body (6) must be replaced.
2. Inspect the two bushes on back cover (18). If damaged or worn, the bushes must be replaced.
3. If repair is necessary, use the proper tools to press bushes from body (6). Press new bushes into place in back cover (18)



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5.2.3 CLEANING OF BRAKE CYLINDER

1. Wash all parts in a suitable solvent that will dissolve oil or grease and permit all the parts to be thoroughly cleaned without abrasion. Then dry with compressed air.

5.2.4 INSPECTION AND REPAIR OF BRAKE CYLINDER

1. Replace all rubber parts, seal kits,. "O" Rings and self-locking screws.
2. In general, replace all parts that are cracked, broken, worn, damaged, or in such a condition as would result in faulty operation.
3. Inspect all springs for rust pits, distortion, or permanent set. Replace wherever necessary

5.2.5 HAND BRAKE CABLE ASSEMBLY (FOR BRAKE CYLINDERS WITH HAND BRAKE)

1. Inspect the hand brake cable. If damaged or not usable, the cable must be replaced
2. If repair is necessary, use proper tools to replace the cables.
3. Tight the mounting bracket using M12 bolts.
4. Pull the hand brake cables in outward direction.
5. Remove both the screw from the anti-rotation tubes of Piston assembly (8) using socket and impact wrench.





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5.2.6 SPARE PARTS OF ESCORTS MAKE AUTOMATIC DOUBLE ACTING SLACK ADJUSTER

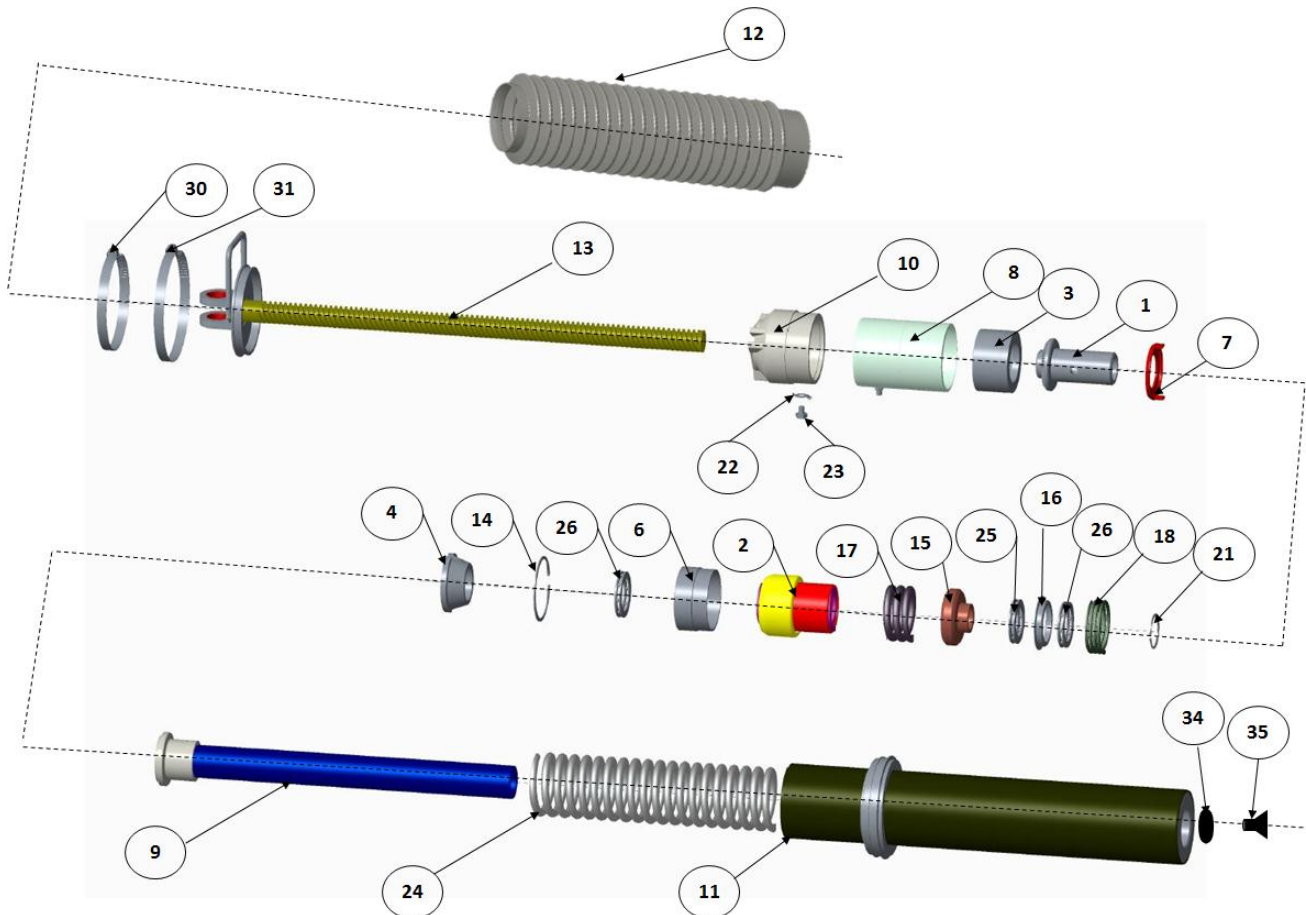


Figure 38: Automatic double acting slack adjuster Exploded view



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S. No.	Fig Ref	Description	Drg. No	Qty
1	1	LEADER NUT	3EB6196	1
	2	SPRING SLEEVE ASSY	3EB6197	1
3	3	ACTUATING SLEEVE	3EB6210	1
4	4	CLUTCH RING	3EB6213	1
5	6	CLUTCH SLEEVE	3EB6223	1
6	7	CLUTCH PLATE	3EB6225	1
7	8	TRACTION SLEEVE SUB-ASSY	3EB6236	1
8	9	ADJUSTER TUBE ASSY	4EB10366	1
9	10	LEADER NUT CASING	3EB7491	1
10	11	BARREL PIPE SUB-ASSY	3EB10367	1
11	12	BELLOW	3EB7517	1
12	13	ADJUSTER SPINDLE ASSY	3EB7528	1
13	14	CIRCLIP	4EB6200	1
14	15	ADJUSTER NUT	4EB6206	1
15	16	BEARING COVER	4EB6208	1
16	17	TAKE UP SPRING	4EB6209	1
17	18	CLUTCH SPRING	4EB6211	1
18	21	CIRCLIP	4EB6224	1
19	22	TAB WASHER	4EB6230	1
20	23	LOCKING SCREW	4EB6231	1
21	24	BARREL SPRING	4EB6400	1
22	25	BEARING	4EB6234	1
23	26	BEARING	4EB6233	2
24	30	JUBILEE CALMP-Ø130	4EB8935	1
25	31	JUBILEE CALMP-Ø150	4EB8936	1
26	34	SAFETY WASHER	4EB7580	1
27	35	SCREW M8	DIN933	1



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5.2.7 DISMANTLING THE AUTOMATIC DOUBLE ACTING SLACK ADJUSTER




Warning

- Springs are in loaded condition, so do not open the automatic double acting slack adjuster Assy without suitable tools

1. Hold the slack adjuster assy on a vice
2. Loosen the Jubilee clamps (30,31)on both ends of the Bellow (12)
3. Remove the Bellow (12)
4. Remove the safety washer (34) by unscrewing the screw (35)
5. Unscrew the Adjuster Spindle assy.
6. Insert the Jacking tool on the Adjuster Tube Assy.on the face of the Barrel Pipe Sub-Assy.
7. Load the Jacking tool and fix it.
8. Unscrew Locking screw (23) and remove the Tab Washer (22).
9. Unscrew the Leader Nut Casing (10). From the barrel pipe with the help of tool
10. Slowly release the Jacking Tool.
11. Remove the Traction Sleeve assy.(8) from barrel pipe.
12. Remove the Barrel pipe (11) from vice.
13. Hold the Traction Sleeve assy.(8) vertically on the vice.
14. Remove the clutch ring.(4)
15. Remove the bearing (26)
16. Insert Jacking tool and put load.



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17. Remove circlip (21) with the help of circlip plier
18. Remove the Spring Dowel sleeve inside Adjuster Tube assy.(8).
19. Unscrew the clutch sleeve.
20. Remove all components from inside
21. Remove the Leader nut casing Assy.
22. Remove the circlip (14) with the help of Circlip plier.
23. Remove all components from inside

5.2.7.1 CLEANING THE AUTOMATIC DOUBLE ACTING SLACK ADJUSTER PARTS

Clean all the parts with solvent which can remove Grease, Oil and Dirt.


5.2.7.2 INSPECTION

Inspect all the parts after cleaning and replace all the damaged and broken parts.

5.2.7.3 RE-ASSEMBLING OF AUTOMATIC DOUBLE ACTING SLACK ADJUSTER

1. Place the Adjuster nut (15), bearing (25), Bearing Cover (16), Take up Spring (17), Adjuster tube assy (9), Actuating Sleeve (3), Clutch Spring (18), Tighten Clutch Sleeve (6) inside the Traction Sleeve (8).
2. Fit the Spring Dowel matching the holes of Traction Sleeve (8) and Clutch Sleeve (6).
3. Insert the Clutch Plate (7) on Clutch Sleeve (6),
4. Put the Circlip by using Jacking Tool.
5. Insert bearing (26) and Clutch Ring (4)
6. Fill Grease Servo-Gem RR3 inside and outside the Assy.
7. Hold the Leader Nut Casing (10) vertically and fill grease inside, then insert Leader Nut (1), Bearing (26) and Spring Sleeve Assy (2). Then insert Circlip (14) to lock.
8. Grease the Barrel tube (11) inside and then insert greased Barrel Spring (24).
9. Grease the Traction Sleeve Assy (8) and insert it into the Barrel Pipe Assy (11)



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10. Put Jacking Tool and load the Jacking Tool By rotating its handle.
11. Fit the Leader Nut Assy (1) into the Barrel Pipe Assy (11) and tightening the Leader Nut Assy (1).
12. Put Tab Washer (22) and tighten with Locking Screw (23).and bend the washer to lock the screw.
13. Remove Jacking Tool from the Assy.
14. Grease the spindle.of the Adjuster Spindle Assy.(13).
15. Put the Adjuster Spindle Assy.(13) into the Barrel Pipe Assy.by rotating it on its thread.
16. Lock the Adjuster Spindle Assy.(13) with a Safety Washer (34) and Screw (35) by using anabond/loctite.



Caution


- Ensure that Tapped hole in the Adjuster Spindle Assy.(13) is clean and Dry

17. Fix the Bellow (12) on the Spindle (13) and Barrel Pipe (11) and clamp with Jubilee Clamps (30,31).

5.2.8 RE-ASSEMBLING OF BRAKE CYLINDER

1. For ease of Assembly and Safety, clamp the automatic double acting slack adjuster Assy. in vertical position.
2. Fix the Guideing tool on the Adjuster Tube.
3. Insert Body Assembly(6) from the top through the Guiding tool.
4. Remove Guiding Tool and fasten the Check Nut for gland (11)
5. Insert Piston Assy. (8), and fix it with Locking Screw (10)
6. Insert Spring (12), sealing Ring (15) and Back Cover (18)



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7. Proper clamping to be done to hold the Back cover (18) with cylinder body.
8. Tighten the Back Cover (18) with M12 T-Head Bolts (13) using M12 Torque wrench (Caution under spring Pressure).
9. Place the indicator (20) onto the piston rod.
10. Tighten the Test Plug (5).

5.2.9 TESTING OF BRAKE CYLINDER FOR REPLACEMENT

Check & replace brake cylinder by tested brake cylinder if following defects are identified

1. Check the brake cylinder for any physical damage or leakage.
2. In case of brake cylinder with hand brake cables, check that the movement of cables is free
3. Ensure that the piston indicator is in fully released condition.

5.2.10 SWTR TESTING

SWTR test for wagon to be done as per RDSO format.

5.2.11 BOGIE & BRAKE CYLINDER 11" (WITH AND WITHOUT HAND BRAKE CABLE)

1. Push rod & spring plank clearance (min 10mm).
2. The split pin over the Brake head pin is tack welded with washer.
3. The brake cylinder pins are locked with bush and dowel sleeve.
4. Split pins are provided on all pins, bent properly & provided with APDs.

5.3 POH SCHEDULE FOR WAGONS FITTED WITH BMBS AIR BRAKE CYLINDER 11" (WITH AND WITHOUT HAND BRAKE)



Caution!

- The wagon has to be placed in a Sick-Line/ROH Depot
- The workmen has to wear Helmet, Hand gloves and Safety shoes.





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- Use of proper tools

5.3.1 BRAKE CYLINDER 11" (WITH AND WITHOUT HAND BRAKE CABLE)

1. Overhaul the brake cylinder as per procedure explained in para no 5.2.2--5.2.8
2. Replace the must change items in para no 5.4
3. Check the condition base items, if found worn or damaged, replace them.
4. Test the brake cylinder as per the procedure given in the manual.



Notification!

- Brake Block force is also to be checked as per relevant RDSO Drawings for different types of wagons.

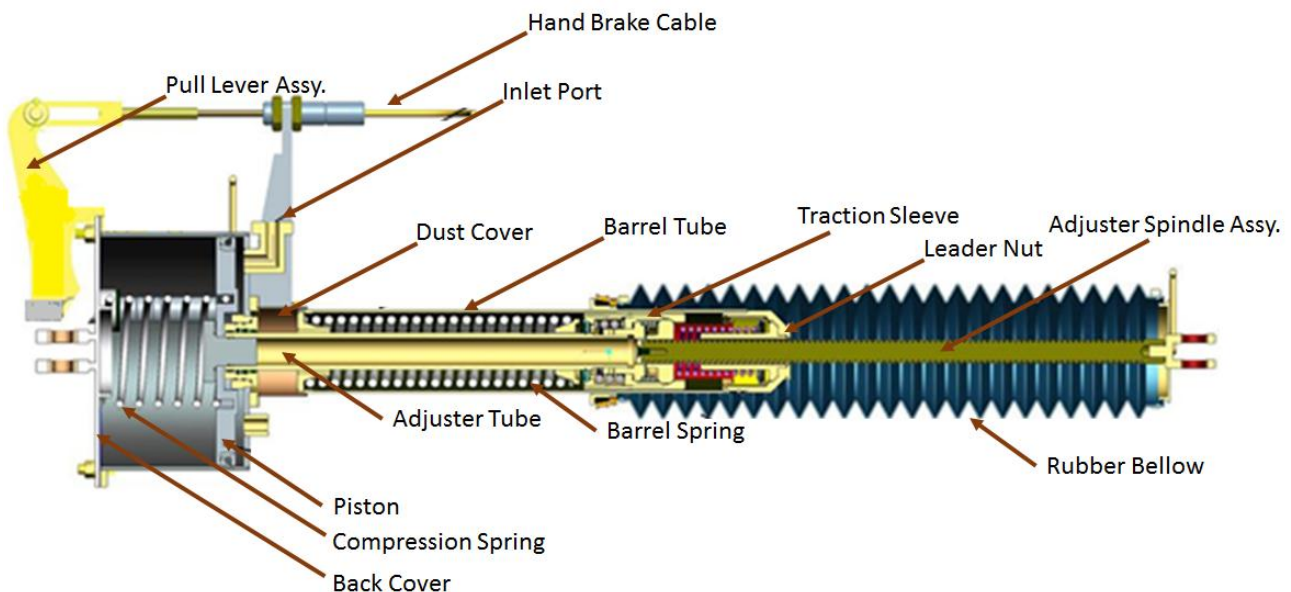



Figure 39: Brake Cylinder – 11 Inch with hand brake arrangement



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5.4 LIST OF ITEMS TO BE CHANGED DURING ROH & POH

5.4.1 LIST OF MUST CHANGE ITEMS

SL NO.	Fig. Ref.	DESCRIPTION	Drg. No.	QTY/BC	OVERHAUL DISPOSITION CONDITON
MUST CHANGE ITEM FOR BRAKE CYLINDER (Fig No. 12)					
1	7	PISTON PACKING (BC 11")	3EB 6112	1	Discard Old.
2	15	SEALING RING	4EB7397	1	Discard Old.
3	9	SEAL KIT FOR GLAND BUSH	4EB10364	1 set	Discard Old
4	10	SEAL KIT FOR LOCKING SCREW	4EB10365	1set	Discard Old
8	5	O-RING FOR PLUG 13X3.5	4EB 9420/10	1	Discard Old
9	1	BELLOW	3EB7517	1	Discard Old
10	22	JUBILEE CLAMP-DIA 130	4EB8935	1	Discard Old
11	23	JUBILEE CLAMP-DIA 150	4EB8936	1	Discard Old
12	25	SPLIT PIN DIA 4X36	IS:549	5	Discard Old
13	26	SPLIT PIN DIA 3.2X32	IS:549	1	Discard Old
14	24	SPRING DOWEL SLEEVE 6X35-ST	4EB10260	4	Discard Old
MUST CHANGE ITEM FOR AUTOMATIC DOUBLE ACTING SLACK ADJUSTER (Fig No. 38)					
15	14	CIRCLIP	4EB6200	1	Discard Old
16	21	CIRCLIP	4EB6224	1	Discard Old
17	25	BEARING	4EB6234	1	Discard Old
18	26	BEARING	4EB6233	2	Discard Old
19	12	BELLOW	3EB7517	1	Discard Old
20	22	TAB WASHER	4EB6230	1	Discard Old

5.4.2 LIST OF CONDITIONAL CHANGE ITEMS

SL NO.	Fig. Ref.	DESCRIPTION	Drg. No.	QTY/BC	OVERHAUL DISPOSITION CONDITON
CONDITIONAL CHANGE ITEM FOR BRAKE CYLINDER (Fig No. 12)					
1	8	PISTON ASSY.	3EB7623	1	Replace if damaged or deformation observed in Piston Rod
2	20	INDICATOR	3EB9534	1	Replace if red paint is removed
3	6	CYLINDER BODY	2EB7720	1	Replace if bore Dia is greater than 280.5 MM
4	13	ADJUSTER SPINDLE ASSY	3EB7528	1	Replace if found bent or damaged
5	1	LEADER NUT	3EB6196	1	Replace if found damaged



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6	10	LEADER NUT CASING	3EB7491	1	Replace if found damaged
6	17	BUSH	4EB7529	4	Replace if Hole Dia.25.5 MM ---
7	16	BUSH	4EB7715	2	Replace if Hole Dia.36 MM ---
7	7	PISTON PACKING (BC 11")	3EB 6112	1	Replace if found damaged
8	15	SEALING RING	4EB7397	1	Replace if found damaged
9	9	SEAL KIT FOR GLAND BUSH	4EB10364	1 set	Replace if found damaged
10	10	SEAL KIT FOR LOCKING SCREW	4EB10365	1set	Replace if found damaged
11	5	O-RING FOR PLUG 13X3.5	4EB 9420/10	1	Replace if found damaged
12	1	BELLOW	3EB7517	1	Replace if found damaged
13	22	JUBILEE CLAMP-DIA 130	4EB8935	1	Replace if found damaged
14	23	JUBILEE CLAMP-DIA 150	4EB8936	1	Replace if found damaged
15	25	SPLIT PIN DIA 4X36	IS:549	5	Replace if found damaged
16	26	SPLIT PIN DIA 3.2X32	IS:549	1	Replace if found damaged
17	24	SPRING DOWEL SLEEVE 6X35-ST	4EB10260	4	Replace if found damaged
CONDITIONAL CHANGE ITEM FOR AUTOMATIC DOUBLE ACTING SLACK ADJUSTER (Fig No. 38)					
18	1	LEADER NUT	3EB6196	1	Replace if found damaged
19	2	SPRING SLEEVE ASSY	3EB6197	1	Replace if found damaged
20	3	ACTUATING SLEEVE	3EB6210	1	Replace if found damaged
21	4	CLUTCH RING	3EB6213	1	Replace if found damaged
22	6	CLUTCH SLEEVE	3EB6223	1	Replace if found damaged
23	7	CLUTCH PLATE	3EB6225	1	Replace if found damaged
24	8	TRACTION SLEEVE SUB-ASSY	3EB6236	1	Replace if found damaged
25	9	ADJUSTER TUBE ASSY	4EB10366	1	Replace if found damaged
26	10	LEADER NUT CASING	3EB7491	1	Replace if found damaged
27	11	BARREL PIPE SUB- ASSY	3EB10367	1	Replace if found damaged
28	13	ADJUSTER SPINDLE ASSY	3EB7528	1	Replace if found damaged
29	15	ADJUSTER NUT	4EB6206	1	Replace if found damaged
30	16	BEARING COVER	4EB6208	1	Replace if found damaged
31	17	TAKE UP SPRING	4EB6209	1	Replace if found damaged
32	18	CLUTCH SPRING	4EB6211	1	Replace if found damaged
33	23	LOCKING SCREW	4EB6231	1	Replace if found damaged



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34	24	BARREL SPRING	4EB6400	1	Replace if found damaged
35	30	JUBILEE CALMP-Ø130	4EB8935	1	Replace if found damaged
36	31	JUBILEE CALMP-Ø150	4EB8936	1	Replace if found damaged
37	34	SAFETY WASHER	4EB7580	1	Replace if found damaged
38	35	SCREW M8	DIN933	1	Replace if found damaged



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6 DESCRIPTION AND MAINTENANCE INSTRUCTION FOR AUTOMATIC PRESSURE MODIFICATION DEVICE

The ERV/ APM is used to achieve 2 stages of braking i.e. empty and loaded in a wagon. To overcome the wheel slippage, ERV/ APM model is used for two stage braking i.e. empty and loaded. ERV/ APM is a contact type of load sensing device. ERV/ APM is provided with a sensing arm, which senses the empty and loaded condition of the wagon during braking. It can be mounted on under frame of the wagon or on the bolster of the bogie. The valve installed on the under frame of the wagon senses the gap between the under frame and the side frame of the bogie. It is also provided with the indicator, which shows empty as well as loaded brake condition of the wagon.





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6.1 WORKING OF ERV/ APM

6.1.1 INITIAL/RELEASE CONDITION

Ideally the ERV/APM Sensor Arm (1) remains close to the housing in the initial/release condition (Fig 40). Both Movement & Ratio Piston (2, 3) remain on the left side against spring (4,5) force.

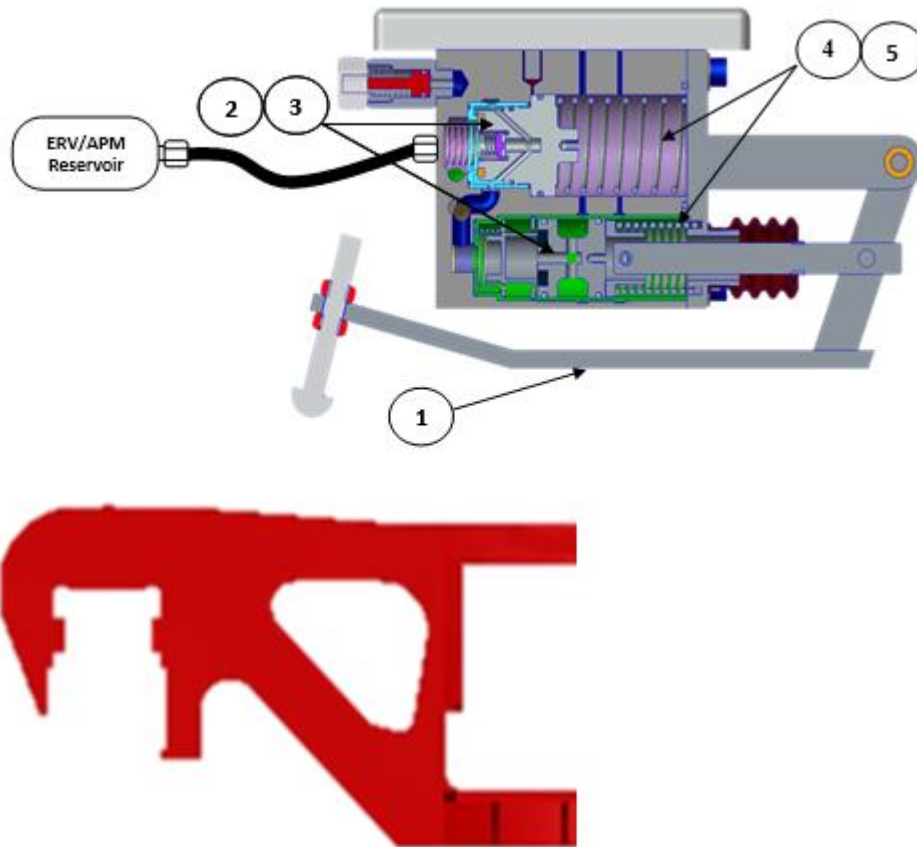


Figure 40: ERV /APM Initial Condition





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6.1.2 EMPTY CONDITION

In the empty position, the Movement Piston and Ratio Piston (2, 3) shifts towards the right side as air pressure is more than spring (4, 5) force. After crossing the transition position, air enter into the reservoir and empty condition is achieved delivering 2.2kg/cm² output.

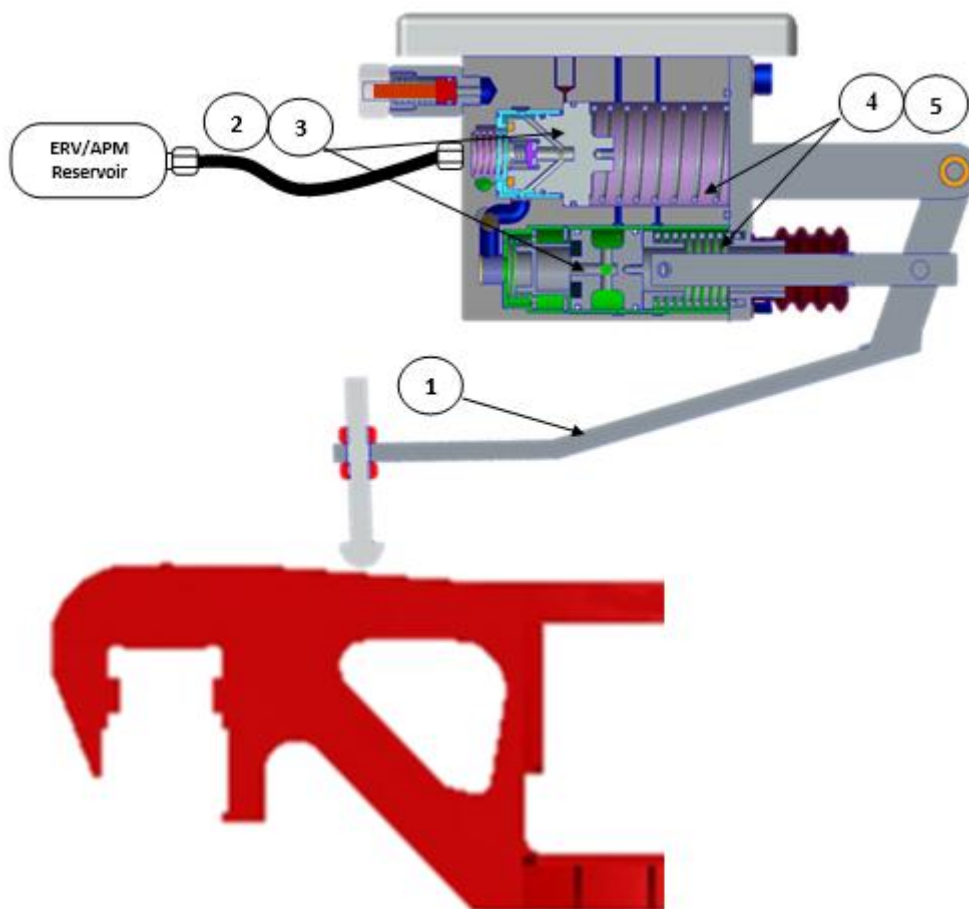


Figure 41: ERV /APM Empty Condition





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6.1.3 TRANSITION/CHANGEOVER CONDITION

In the Changeover position, the Movement Piston and Ratio Piston (2, 3) shifts towards the right side as air pressure is more than spring (4, 5) force. After reaching the transition position, air enter into the reservoir and transition condition is achieved. As pressure increases in the DV port it equalizes the volume with the brake cylinder by resetting the ratio piston.

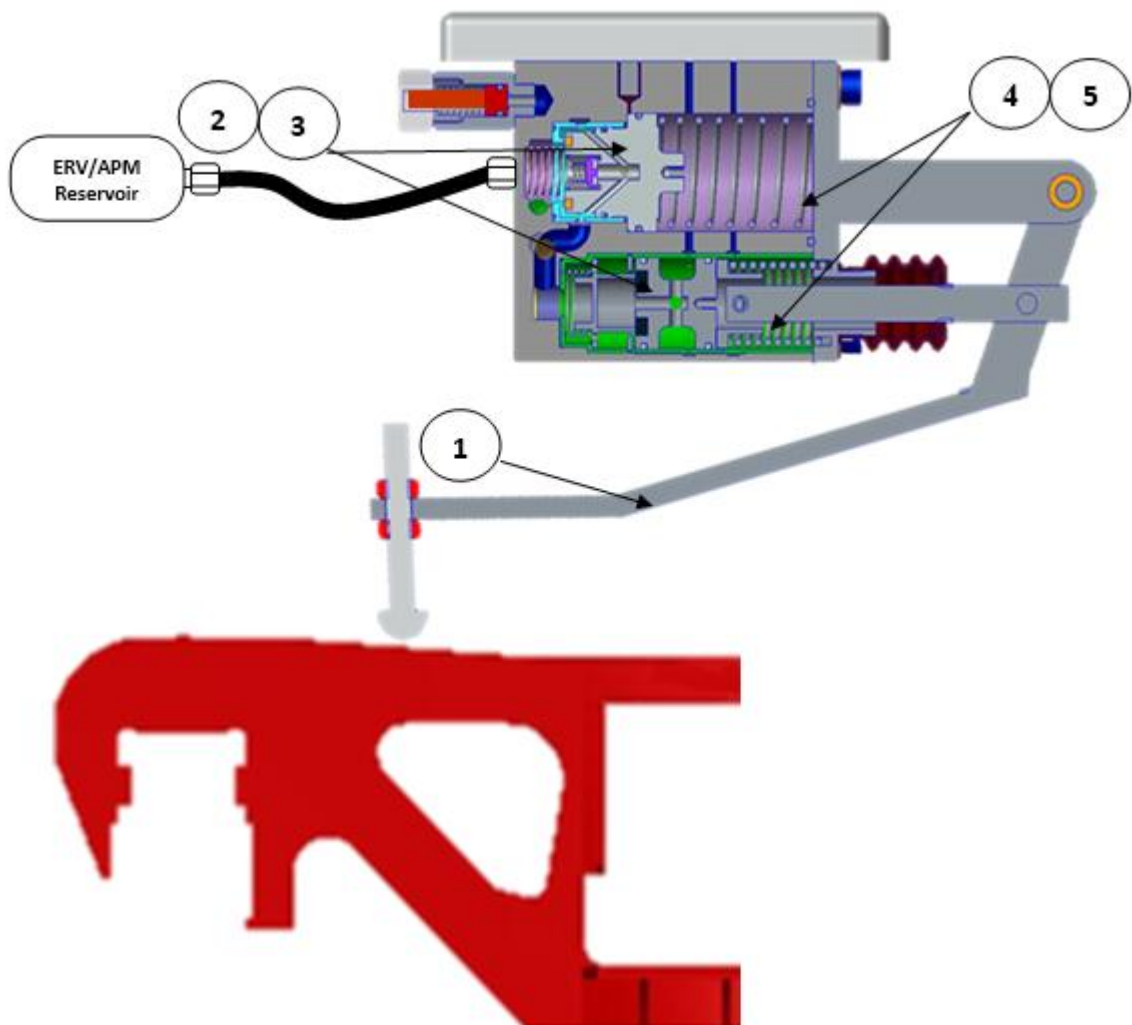



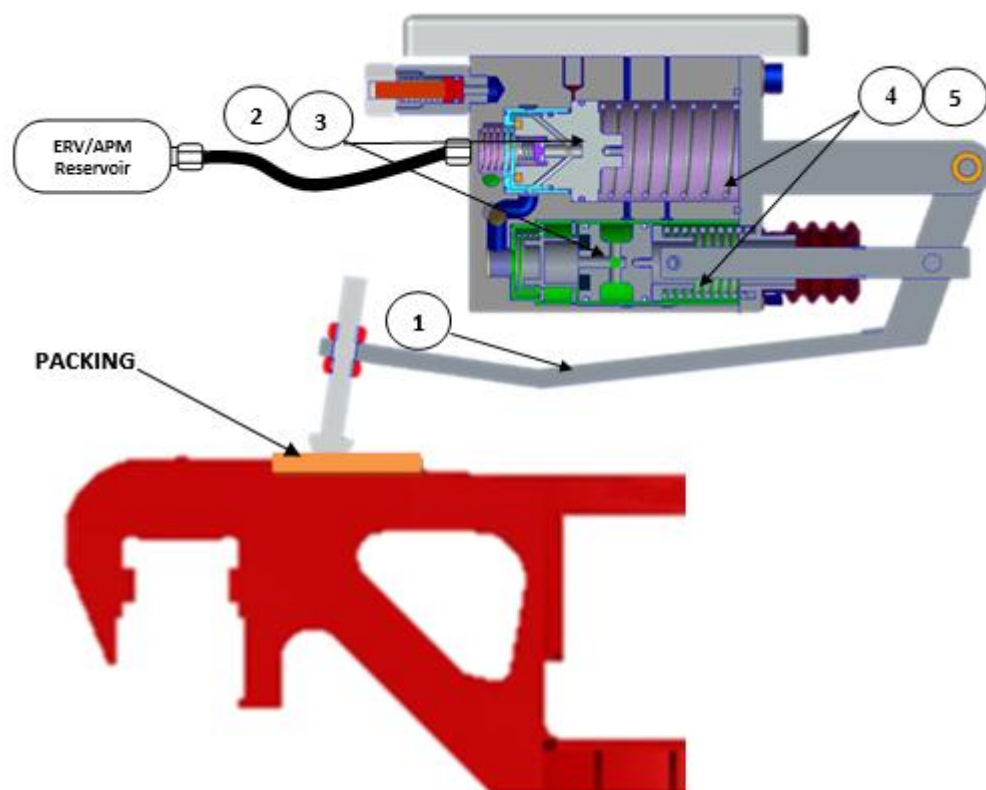
Figure 42: ERV /APM Changeover Condition



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6.1.4 LOADED CONDITION


In Loaded Position, Movement and Ratio piston (2, 3) moves towards the right side until sensor arm (1) touches the side frame. Hence movement Piston (2) stops before Transition



position resulting in output pressure of 3.8 kg/cm².

Figure 43: ERV /APM Loaded Condition



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6.1.5 SALIENT FEATURES

The valve is designed such that it does not require two stages distributor Valve. Standard wagon type distributor valve can be used. The device does changeover of brake cylinder pressure from empty to load and vice-versa. The mounting and pipeline connecting parameters of the device are according to the standard pipes and flange used in Indian Railways, so no change is required in the piping connections. Only brake cylinder pipeline between distributor valve and brake cylinder needs to be modified. A visual indicator is provided on the valve, which shows empty brake condition. There is no physical contact of the sensor arm of LSD with the side frame of the bogie during release & running (both Empty & Loaded condition). The contact of sensing arm with side frame of the bogie occurs during braking only. The sensing arm is angular type of lever; hence it does not lead to any bending movement. Simplified piping; requires only three connections for the ERV/ APM. The ERV/ APM load-sensing device is lightweight, with a minimum no. of parts. Load and empty adjustment can be easily done on the wagon.

6.2 ROH SCHEDULE FOR WAGONS FITTED WITH APM/ERV (Ref. Fig. 18)

In routine overhaul, first test the brake system of BMBS using single wagon test rig. Following action should be taken for the defects / discrepancies identified during testing.




Caution!

- The wagon has to be placed in a Sick-Line/ROH Depot
- The workmen has to wear helmet, Hand gloves and Safety shoes.
- Use of proper tools

6.2.1 TOOLS REQUIRED FOR ROH & POH

1. Allen key, M8
2. Allen key, M12



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3. Special Tool 1 (Ref. Fig 44)
4. Open Spanner 20-22 2 nos.
5. Ring Spanner 20-22
6. Spanner 24-27

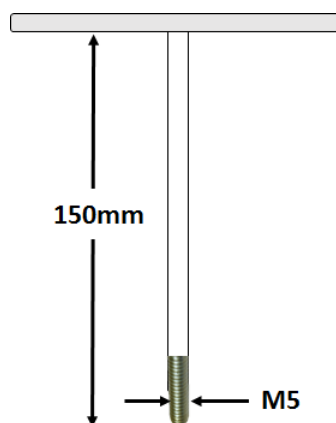


Figure 44: Special Tool 1

6.2.2 DISASSEMBLY OF ERV/APM (Ref. Fig. 18)




Warning

- Component springs within this unit are under compressive loads. Exercise care when disassembling this unit to prevent parts from inadvertently flying out and causing personal injury.
- Parts may be inadvertently expelled by force of spring wear eye protection and exercise care during disassembly. Failure to observe these safety precautions can lead to injury.

1. Remove all the three hoses connected to ERV housing with the help of Allen key M8 and Open spanner 20-22.
2. Remove all the three mounting bolts using two no. Open spanner 20-22.



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3. Hold the ERV properly on a vice and remove the side cover by dismantling 4nos M8 socket head bolts.
4. Remove the movement piston as well as ratio piston with the help of spl. tool
5. Remove the 'O' Ring (9) followed by spring removal.

6.2.3 CLEANING OF ERP/APM (Ref. Fig. 18)

1. Wash all parts in a suitable solvent that will dissolve oil or grease and permit all the parts to be thoroughly cleaned without abrasion. Then dry with compressed air.


6.2.4 INSPECTION AND REPAIR OF ERP/APM (Ref. Fig. 18)

1. Replace all "O" Rings
2. In general, replace all parts that are cracked, broken, worn, damaged, or in such a condition as would result in faulty operation.
3. Check the ERV/APM valve
 - Any physical damage
 - Valve's sensing arm is moving freely
 - Check the leakage
 - Tightness of the lock nuts on sensor arm lever, if found loose, tighten the same.
 - Check the gap between the sensor arm and the side frame, if required re-adjust.
4. Inspect all springs for rust pits, distortion, or permanent set. Replace wherever necessary

6.2.5 RE-ASSEMBLING OF ERV/APM (Ref. Fig. 18)

1. Fit the Ratio Piston and Movement Piston in the respective chamber of ERV housing.
2. Insert the spring behind the Ratio Piston.
3. Place the side cover in location and fasten it with 4nos. of M8 socket head bolt with the help of M8 Allen Key.
4. Adjust the Sensor Arm with the help of M12 nuts (Ref. table in Para 2.7)



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6.2.6 TESTING OF ERV/APM FOR REPLACEMENT

1. Check & replace ERV by tested ERV if following defects are identified
2. Check the ERV for any physical damage or leakage.
3. Ensure that the ERV indicator is in fully released condition i.e.red portion is not visible.


6.2.7 SWTR TESTING

1. SWTR test for wagon to be done as per RDSO format .ERV/APM DEVICE
2. The ERV/APM Device is mounted properly and its sensor arm is touching in middle of side frame.
3. The gap between the sensing point and side frame bottom is adjusted as specified for the wagon and is provided with additional check nut and APD.
4. Check that the ERV/APM Device hose is properly tightened & secured through clamp on under-frame.

6.2.8 TEST PROCEDURE

1. Place a 25mm high block between the sensor arm and the stopper plate.
2. Open cock A and apply the main supply pressure. Pressure gauge no.1 should show 3.8kg/cm² pressure
3. Open cock B and apply 3.8kg/cm² pressure to the load-sensing device.
4. As the sensor arm comes in contact with the block, note the reading at pressure gauge no.2. It should be 3.8 ± 0.1kg/cm².
5. Check the actuation of indicator.
6. Check the leakage at all joints and ports. No leakage is allowed.
7. Close cock A and B and reduce pressure to 0kg/cm².
8. Remove the 25mm block from between the sensor arm adjusting screw and the stopper plate.



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9. Now, open cock A and apply the main supply pressure. Pressure gauge no.1 should show 3.8kg/cm² pressure.
10. Open cock B and apply 3.8kg/cm² pressure to the load-sensing device.
11. As the sensor arm stops moving further down, note the reading at pressure gauge no.2. It should be 2.2 ± 0.1 kg/cm².
12. Check the leakage at all joints and ports. No leakage is allowed.
13. Close cock A and B and reduce pressure to 0kg/cm²

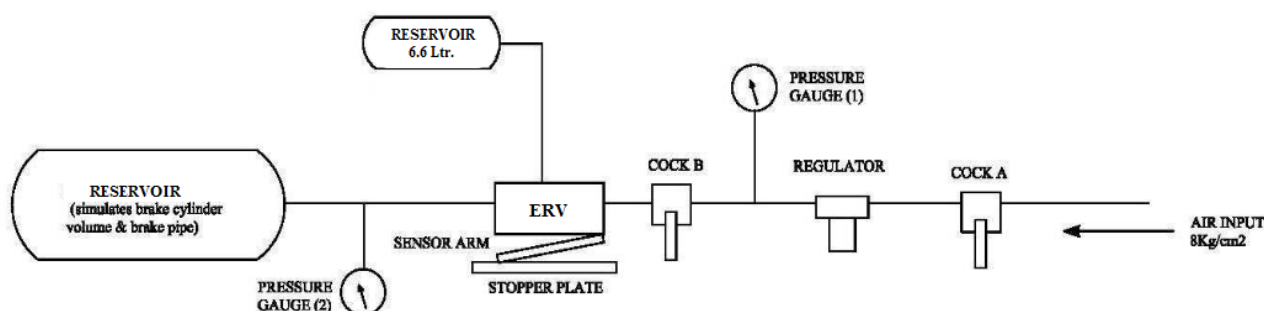


Figure 45:Schematic of ERV/ APM Testing

6.3 POH SCHEDULE FOR AUTOMATIC PRESSURE MODIFICATION DEVICE

6.3.1 ERV/APM DEVICE

1. Overhaul the ERV/APM valve as per procedure explained para no. 6.2.1 to 6.2.5.
2. Replace the must change items as enlisted in para no. 6.4.
3. Check the condition based items (Refer 6.4), if found worn or damaged, replace them.
4. Test the ERV/APM device as per the procedure given in para no. 6.2.8.
5. Check the gap between the sensor point and the side frame surface and readjust the same as specified for the wagon type in para no. 2.6



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6.4 LIST OF ITEMS TO BE CHANGED DURING ROH & POH (ERV/APM)

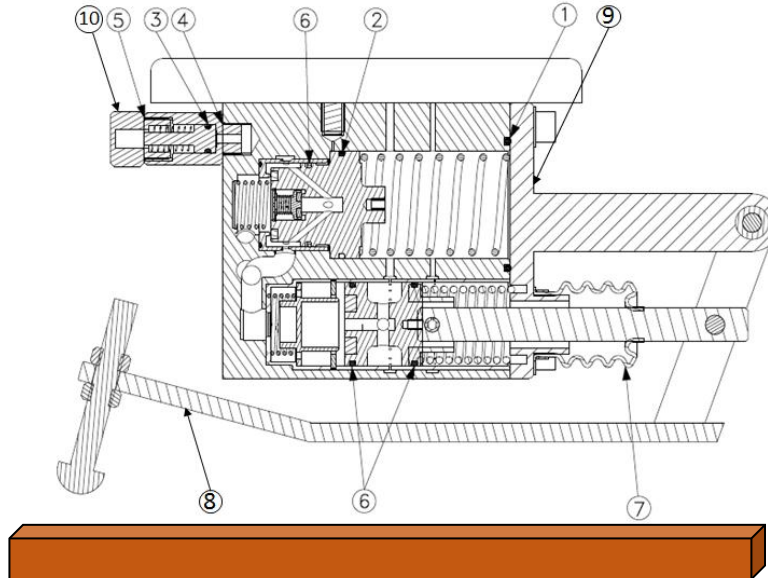


Figure 46: Must /Conditional change item marked on Sectional view of ERV device


LIST OF MUST CHANGE ITEMS (ERV/APM)

S.No.	Fig. Ref.	Description	Qty/APM	Drg. No
A	1	O-RING	1	4EB7442
B	2	O-RING WITH ID 40.6MM	1	4EB7430/2
C	3	O-RING	1	4A40125/13
D	4	O-RING	1	4EB5676
E	5	ROUND CORD RING	1	4A36518
F	6	O-RING	3	4EB7430/1
G	7	RUBBER BELLOW	1	4EB7440

LIST OF CONDITIONAL CHANGE ITEMS (ERV/APM)

S.No.	Fig. Ref.	Description	Qty/APM	Drg. No
A	1	O-RING	1	4EB7442
B	2	O-RING WITH ID 40.6MM	1	4EB7430/2
C	3	O-RING	1	4A40125/13
D	4	O-RING	1	4EB5676
E	5	ROUND CORD RING	1	4A36518
F	6	SEALING RING	3	4EB7430/1
G	7	RUBBER BELLOW	1	4EB7440
H	8	SENSOR ARM	1	3EB7385
I	9	SIDE COVER ASSY	1	3EB7472
J	10	INDICATOR ASSY	1	4EB9509



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7 TROUBLE SHOOTING FOR BMBS



Caution!

- The wagon has to be placed in a shed
- The workmen has to wear Helmet, Hand gloves and Safety shoes.
- Use of proper tools

7.1 BRAKE CYLINDER LEAKAGE

It is observed that dust and dirt enters the brake cylinder through the flange area, hereby causing leakage of Brake cylinder. Part of plastic cap etc. used on pipes are found inside the cylinder body. Dirt particles mixed with grease are also found inside the Brake cylinders.

7.1.1 ACTION BY OPERATING STAFF

Isolate the defective BC with the help of isolating cock.

7.1.2 ACTION BY DEPOT / WORKSHOP

Brake cylinder to be replaced and defective BC to be repaired.

7.1.3 PREVENTIVE ACTION


- The protection cap over the brake cylinder should be removed prior to its connection with hose pipe only.
- Blow the BC pipeline before connecting the Brake cylinder. This can be done by making few Brake applications

7.2 BRAKE CYLINDER - IMPROPER FITMENT OF BC FLEXIBLE HOSES

7.2.1 ACTION BY OPERATING STAFF

Tighten the bolts properly to prevent leakage, else isolate the defective BC with the help of isolating cock.



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7.2.2 ACTION BY DEPOT / WORKSHOP

Tighten the bolts properly if possible, else replace the bolts with correct size bolts.

7.2.3 PREVENTIVE ACTION

Care should be taken to ensure that correct size of hardware is used and is properly tightened to ensure trouble free service.

7.3 BRAKE CYLINDER - IMPROPER HANDLING & STORAGE RESULTING IN DAMAGE TO BRAKE CYLINDER

7.3.1 ACTION BY OPERATING STAFF

If the outer tube is damaged and the brake cylinder is not working, isolate the defective BC with the help of isolating cock.

If the hand brake cable is damaged, hand brake may become inoperative.

7.3.2 ACTION BY DEPOT / WORKSHOP

Replace the Brake cylinder and the defective BC is to be repaired.

7.3.3 PREVENTIVE ACTION

Proper care should be taken in storage & handling of brake cylinders. Use trolley for movement of wooden cases of Brake cylinders.

7.4 BRAKE CYLINDER NOT RELEASING


7.4.1 ACTION BY OPERATING STAFF

1. Due to malfunctioning of DV
2. Due to malfunctioning of BC

7.4.2 ACTION BY DEPOT / WORKSHOP

1. Move the handle of Isolating cocks to close position to vent the air from brake cylinder.
Isolate the DV by moving the R-charger handle to close position.



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2. The internal mechanism of brake cylinder is damaged. Isolate the defective BC with the help of isolating cock. It will release the air pressure from the Brake cylinder. If this doesn't work, remove the pin connecting the push rod and lever to free the system. Suitably tie the push rod and lever to prevent it from touching the wheel.

7.4.3 PREVENTIVE ACTION

- Repair / replace the DV.

3. Replace the Brake cylinder and same to be repaired. Re-connect the system and provide the necessary APDs. Apply brakes to adjust the system.

7.5 ERV/APM DEVICE – IMPROPER FITMENT

The bracket of ERV/APM Device is not properly fitted on the underframe, as a result, the sensor arm is not properly touching the side frame on the Bogie.

7.5.1 ACTION BY OPERATING STAFF

No action is possible

7.5.2 ACTION BY DEPOT / WORKSHOP

The position of the bracket is to be corrected to ensure that the working of ERV/APM valve is proper.

7.5.3 PREVENTIVE ACTION

Care should be taken during the welding of ERV/APM Device bracket on under-frame. It should be ensured that the sensor arm is correctly touching in the centre of the side frame.


7.6 ERV/APM DEVICE – IMPROPER FITMENT OF FLEXIBLE HOSES

If the ERV/APM Device flexible hoses are not properly fitted, they can get cut / damaged.

7.6.1 ACTION BY OPERATING STAFF

Tie the flexible hose properly through some suitable means to under-frame member.



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7.6.2 ACTION BY DEPOT / WORKSHOP

Provide suitable clamp to ensure that the flexible hose is not loosely hanging.

7.6.3 PREVENTIVE ACTION

Care should be taken during the fitment by providing suitable clamp / bracket.

7.7 ERV/APM DEVICE LEAKAGE FROM THE MOUNTING BRACKET CONNECTING THE PIPES

7.7.1 ACTION BY OPERATING STAFF

Tighten the bolts properly to prevent leakage.

7.7.2 ACTION BY DEPOT / WORKSHOP

Tighten the bolts properly if possible. In-case an incorrect bolt size has been used, it could have damaged the bracket also. Bracket needs to be replaced.

7.7.3 PREVENTIVE ACTION

Care should be taken to ensure that correct size of bolts are used and properly tightened to ensure trouble free service.

7.8 MISSING OF SPLIT PINS – BRAKE HEAD DAMAGE / MISSING

The absence of split pin above Brake head pin can result in pin moving out. Further, this could result in dropping of brake head and thereby causing the Brake Beam to touch the wheel and get damaged.


7.8.1 ACTION BY OPERATING STAFF

Isolate the bogie by operating the isolating cock to close position.

7.8.2 ACTION BY DEPOT / WORKSHOP

Install the new parts which have been damaged. Provide split pins & APDs in a proper manner.



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7.8.3 PREVENTIVE ACTION

Care should be taken to ensure that split pins and APDs are properly provided.

7.9 MISSING OF SPLIT PINS – BOGIE COMPONENTS DAMAGED

7.9.1 ACTION BY OPERATING STAFF

Isolate the bogie by operating the isolating cock to close position.

7.9.2 ACTION BY DEPOT / WORKSHOP

Install the new parts which have been damaged. Provide split pins & APDs in a proper manner.

7.9.3 PREVENTIVE ACTION

Care should be taken to ensure that split pins and APDs are properly provided.

7.10 MISSING OF APD SPLIT PIN USED ON BRAKE CYLINDER PIN

7.10.1 ACTION BY DEPOT / WORKSHOP

Provide the bush and dowel on the pin.

7.10.2 PREVENTIVE ACTION

Care should be taken to ensure that the bush and the dowel should be used on brake cylinder mounting pins.

7.11 MISSING OF APDs ON THE PIN OF PRIMARY BRAKE BEAM


7.11.1 ACTION BY DEPOT / WORKSHOP

APDs to be provided over the mounting pins.

7.11.2 PREVENTIVE ACTION

Care should be taken to ensure that the mounting pins are provided with APDs.



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7.12 MISSING OF APDs ON THE PIN OF SECONDARY BRAKE BEAM

7.12.1 ACTION BY DEPOT / WORKSHOP

APDs to be provided over the mounting pins.

7.12.2 PREVENTIVE ACTION

Care should be taken to ensure that the mounting pins are provided with APDs.

7.13 MISSING OF APDS ON THE PIN OF PUSH ROD

7.13.1 ACTION BY DEPOT / WORKSHOP

APDs to be provided over the mounting pins.

7.13.2 PREVENTIVE ACTION

Care should be taken to ensure that the mounting pins are provided with APDs.

7.14 INAPPROPRIATE APDs ON ERV/APM DEVICE

7.14.1 ACTION BY DEPOT / WORKSHOP

Proper APD to be provided over the ERV/APM Device.

7.14.2 PREVENTIVE ACTION

Care should be taken to ensure that the APD provided on the ERV/APM Device is appropriate so that it perform its intended function.

7.15 HAND BRAKE - INCORRECT LOCATION OF BRACKETS


7.15.1 ACTION BY DEPOT / WORKSHOP

Brackets to be moved to its correct location as per RDSO drawing.

7.15.2 PREVENTIVE ACTION

Care should be taken to ensure that the brackets locations are correct as per the drawing.
This can be checked by applying the brakes for proper functioning.



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7.16 MISSING OF APDs ON THE PIN OF PRIMARY BRAKE BEAM

7.16.1 ACTION BY DEPOT / WORKSHOP

APDs to be provided over the mounting pins.

7.16.2 PREVENTIVE ACTION

Care should be taken to ensure that the mounting pins are provided with APDs.

7.17 MISSING OF APDs ON THE PIN OF SECONDARY BRAKE BEAM

7.17.1 ACTION BY DEPOT / WORKSHOP

Do the necessary correction and check whether the brakes are functional.

7.17.2 PREVENTIVE ACTION

1. Care should be taken during the fitment of hand brake arrangement.
2. Check the working of the hand brake arrangement by applying the brakes.

7.18 MISSING OF APDs ON THE PIN OF SECONDARY BRAKE BEAM

7.18.1 ACTION BY OPERATING STAFF

Tie the hanging part to the under frame to prevent it from touching the moving parts of wagon.

7.18.2 ACTION BY DEPOT / WORKSHOP

Install new component. Provide the APDs to prevent reoccurrence.

7.18.3 PREVENTIVE ACTION

APDs should be provided to prevent the moving out of components during service.

7.19 WRONG USE OF ISOLATING COCK IN BC LINE

7.19.1 ACTION BY OPERATING STAFF

In case, wherein wrong isolating cock has been used, if required isolate the wagon through DV instead of bogie.



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7.19.2 ACTION BY DEPOT / WORKSHOP

Replace the isolating cock to with-vent type and check its working.

7.19.3 PREVENTIVE ACTION

Care should be taken to use isolating cocks with vent in the BC line. During the testing, check the vent position of isolating cock by moving the handle to close during application and ensuring that the BC pressure gets exhausted.

8 LIST OF SPARES

Spares to be maintained in open lines/ROH depots

S.No	Item Description	Drg. No.	Qty/Wagon
Bogie equipment			
1	Brake cylinder assy without hand brake	3EB7347	1
2	Brake cylinder assy with hand brake	3EB7348	1
3	ERV (APM)valve assy	3EB7346	1
4	Reservoir for ERV (APM)	3EB7408	1
5	Primary Beam	3EB5521	2
6	Secondary Beam	3EB5522	2
7	Bell Crank Lever assy RH	3EB9791	2
8	Bell Crank Lever assy LH	3EB9792	2
9	Push rod assy	3EB9790	4
10	Brake head	3EB9790	8
11	Pin Ø24x70	4EB10262	4
12	Pin Ø24x80	4EB10263	4
13	Pin Ø24x120	4EB10264	4
14	Brake head pin	4EB9764	8
15	Dowel pins	4EB10260	4
16	Bush	4EB10261	4
17	Split pin 6.3x75	IS:549/EQV.	8
18	Split pin 4x35	IS:549/EQV.	2
19	Split pin 5x32	IS:549/EQV.	8
20	Split pin 6.3x50	IS:549/EQV.	1
21	Liner	4EB7354	8
22	Rope arrangement set	3EB6158/..	1



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S.No	Item Description	Drg. No.	Qty/Wagon
Hardware and Hoses			
1	Hose 1" with flange	3EB5536	2
2	Hose 1/2" with flange	4EB9763	1
3	O-ring	4EB9786	2
4	O-ring	4KB1889	2
5	Spring washer	DIN127/EQV.	40
6	T-head bolt	4EP5042	32
7	Hex nut	DIN934/EQV.	40
8	Hex head screw	DIN933/EQV.	4
9	Spring washer	DIN127/EQV.	8
10	Hex head screw	DIN933/EQV.	4
11	CSK Screw	4EB7376	16

During POH, below items must be changed

S.No	Item Description	Drg. No.	Qty/Wagon
Bogie equipment			
1	PIN Ø24x70	4EB10262	4
2	PIN Ø24x80	4EB10263	4
3	PIN Ø24x120	4EB10264	4
4	Brake head pin	4EB9764	8
5	Dowel pins	4EB10260	4
6	Bush	4EB10261	4
7	Split Pin 6.3x75	IS:549/EQV.	8
8	Split Pin 4x35	IS:549/EQV.	2
9	Split Pin 5x32	IS:549/EQV.	8
10	Split Pin 6.3x50	IS:549/EQV.	1



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During POH, below items must be changed

S.No	Item Description	Drg. No.	Qty/Wagon
Hand brake equipment			
1	Pin for cable	4EB5567	2
2	Pin for tie rod	4EB9975	1
3	Split pin	IS:549/EQV.	2
4	Split pin	IS:549/EQV.	1

During POH, below items must be changed

S.No	Item Description	Drg. No.	Qty/Wagon
On conditional basis below items to be replaced			
1	Hose 1" with flange	3EB5536	2
2	Hose 1/2" with flange	4EB9763	1
3	O-ring	4EB9786	2
4	O-ring	4KB1889	2
5	T-head bolt	4EP5042	32
6	Hex nut	DIN934/EQV.	40
7	Hex head screw	DIN933/EQV.	4
8	Spring washer	DIN127/EQV.	8
9	Spring washer	DIN127/EQV.	40
10	Liner	4EB7354	8
11	CSK Screw	4EB7376	16
12	Rope arrangement set	3EB6158/..	1



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9 SCOPE OF SUPPLY

The generalized Scope of supply for complete BMBS system as per QAP is given below. This scope of supply may vary depending on scope of supply mentioned in the purchase order.

ESCORTS Scope of Supply (SOS-BMBS-003, Rev-03)Reference: WD-23-BMBS-2008 Rev 01, Amendment No.1 of Sept.-2016				
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SL No.	Name	Drg. No.	Qty	RDSO Drg. No.
1	PRIMARY BRAKE BEAM ASSY.	3EB5521 Alt-10	2	WD-08093-S/2 Item-1
2	SECONDARY BRAKE BEAM ASSY.	3EB5522 Alt-09	2	WD-08093-S/2 Item-2
3	BRAKE CYLINDER 11" WITH DOUBLE ACTING AUTOMATIC SLACK ADJUSTER	3EB7347 Alt-08	1	WD-08093-S/2 Item-3
4	BRAKE CYLINDER 11" WITH DOUBLE ACTING AUTOMATIC SLACK ADJUSTER & HAND BRAKE CABLE	3EB7348 Alt-08	1	WD-08093-S/2 Item-3
5	BELL CRANK LEVER- LH ASSY	3EB9792 Alt-00	2	WD-08093-S/2 Item-4
6	BELL CRANK LEVER- RH ASSY	3EB9791 Alt-00	2	WD-08093-S/2 Item-5
7	PUSH ROD ASSY	3EB9790 Alt-00	4	WD-08093-S/2 Item-6
8	BRAKE HEAD	3EB7375	8	NA
9	PIN Ø24x120	4EB10264	4	NA
10	PIN Ø24x70	4EB10262	4	NA
11	PIN Ø24x80	4EB10263	4	NA
12	BRAKE HEAD PIN	4EB9764	8	NA
13	BUSH	4EB10261	4	NA
14	T-HEAD BOLT M12x35	4EP5042	32	NA
15	HEX NYLOCK NUT M12	DIN982/EQV.	32	NA
16	SPRING WASHER B12	DIN127/EQV.	49	NA
17	SPRING DOWEL SLEEVE 6x35	4EB10260	4	NA
18	ANTI PILFERAGE DEVICE	4EB8149	4	NA
19	M16x90 BOLT WITH NUT & SPLIT PIN	4EB10272	8	NA
20	BC CHAIN HOLDING BRACKET	3EB10268	4	NA
21	ANTI PILFERAGE PLATE	4EB9573	4	NA
22	ANTI PILFERAGE PLATE	4EB9572	2	NA
23	BC HOLDING CHAIN	4EB10266	4	NA
24	SPLIT PIN 6.3x75	IS 549/EQV.	8	NA
25	ANTI PILFERAGE PLATE	4EB10265	2	NA
26	SPLIT PIN 5x32	IS 549/EQV.	8	NA
27	BRAKE HOSE (6.6 LTS RESERVOIR)	3EB9763 Alt-02	1	NA
28	BRAKE HOSE(BC)	3EB5536 Alt-03	2	NA
29	ANTI PILFERAGE DEVICE FOR APM	2EB8148	1	NA
30	AIR RESERVOIR (6.6 LTS)	-	1	WD-09048-S-01
31	ERV(APM)	3EB7346 Alt-07	1	NA
32	EQUALIZER	-	1	As per different types of wagon drawings
33	O-RING	4EB9786	2	NA



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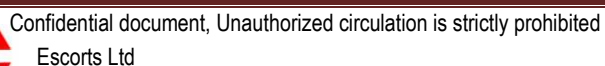
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34	O-RING	4KB1889	2	NA
35	GASKET	4EB10043	2	NA
36	PIN FOR CABLE	4EB5567	2	NA
37	PIN FOR TIE ROD	4EB9975	1	NA
38	HEX HEAD BOLT M12x50	DIN931/EQV.	11	NA
39	HEX NUT M12	DIN934/ EQV.	13	NA
40	BULB COTTER WITH PLAIN WASHER 25mm	4EB10271	8	NA
41	HEX HEAD SCREW M12x30	DIN933/EQV.	6	NA
42	SPRING WASHER B8	DIN127/EQV.	4	NA
43	HEX HEAD SCREW M8x30	IS 13726/EQV.	2	NA
44	HEX HEAD SCREW M8x25	DIN933/EQV.	2	NA
45	SPLIT PIN 6.3x50	IS 549/EQV.	1	NA
46	WASHER B20	IS 2016/EQV.	2	NA
47	SPLIT PIN 4x35	DIN 94/EQV.	2	NA
48	PUNCHED WASHER A30	IS 2016/EQV.	1	NA
49	PLAIN WASHER B6	DIN125/EQV.	8	NA



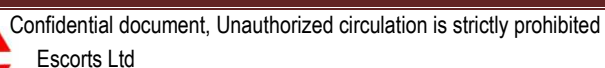



Bogie Mounted Brake System for Freight Stock with CASNUB Bogie	
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RDSO Spec. No. WD-23-BMBS-2008 Rev.-01	
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This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

 ESCORTS RAILWAY EQUIPMENT DIVISION Plot No.-115 Sector-24, Faridabad	Bogie Mounted Brake System for Freight Stock with CASNUB Bogie	
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