

Bogie Mounted Brake System for Freight Stock



STC/SPJ

INTRODUCTION

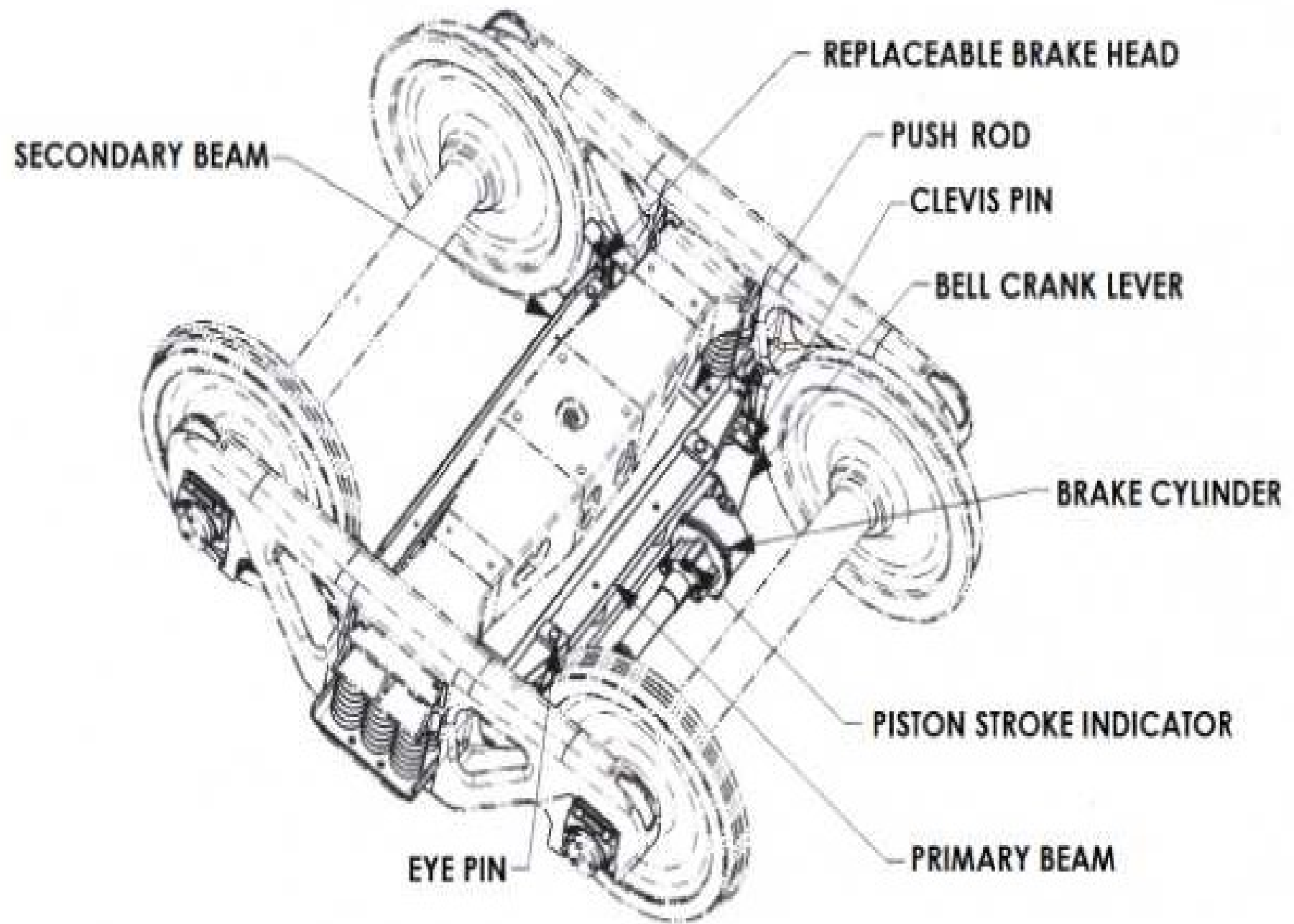
Bogie mounted Brake System (BMBS) has been introduced for freight stock. Recently, Air Brake freight stocks with BMBS on Indian Railway are working with single pipe/ twin pipe graduated release air brake system. Air brake system with BMBS is most efficient and reliable braking system used to run heavy and long trains at high speeds.

DESCRIPTION OF BMBS

The Bogie Mounted Brake system (BMBS) equipment (Given in figure) consists of a transversely mounted pneumatic Brake Cylinder with a self-contained, double acting slack adjuster, two brake beams, two bell crank levers and interconnecting push rods. The hand brake arrangement is available as a mechanical model with two flexible handbrake cables. The pneumatic Brake Cylinder is 10" in diameter for application with high friction brake shoe (K-type) on CASNUB type bogies.

The system consists of a unique design with two pneumatic Brake Cylinder (one per bogie) to deliver reliable braking performance and is light in weight. It fits into CASNUB bogie and uses 58 mm thick brake shoes.

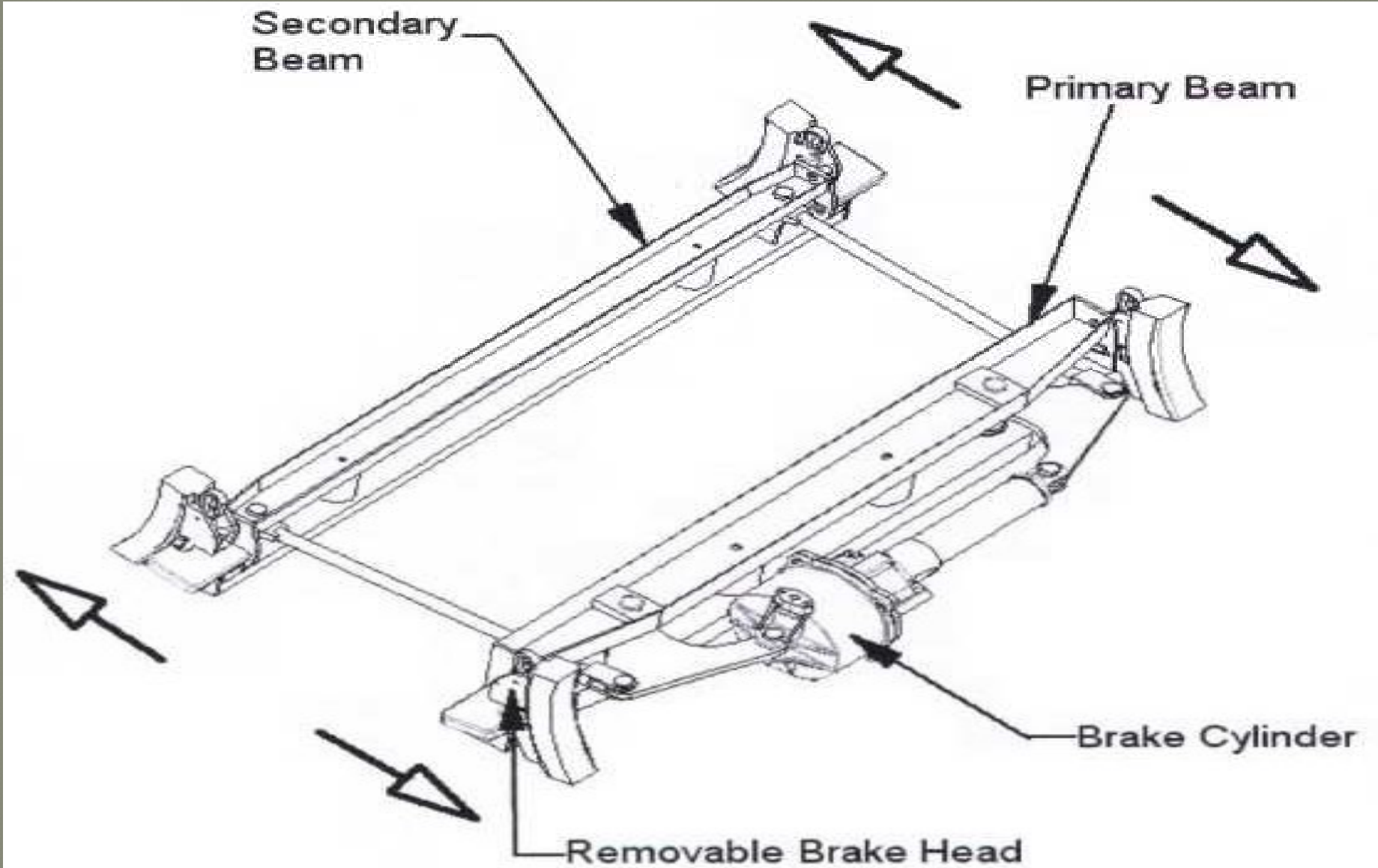
Brake cylinder contains an integral double acting slack adjuster, which provides optimal braking force and minimizes shoe & wheel wear. The design is with high strength and minimal brake beam deflection.

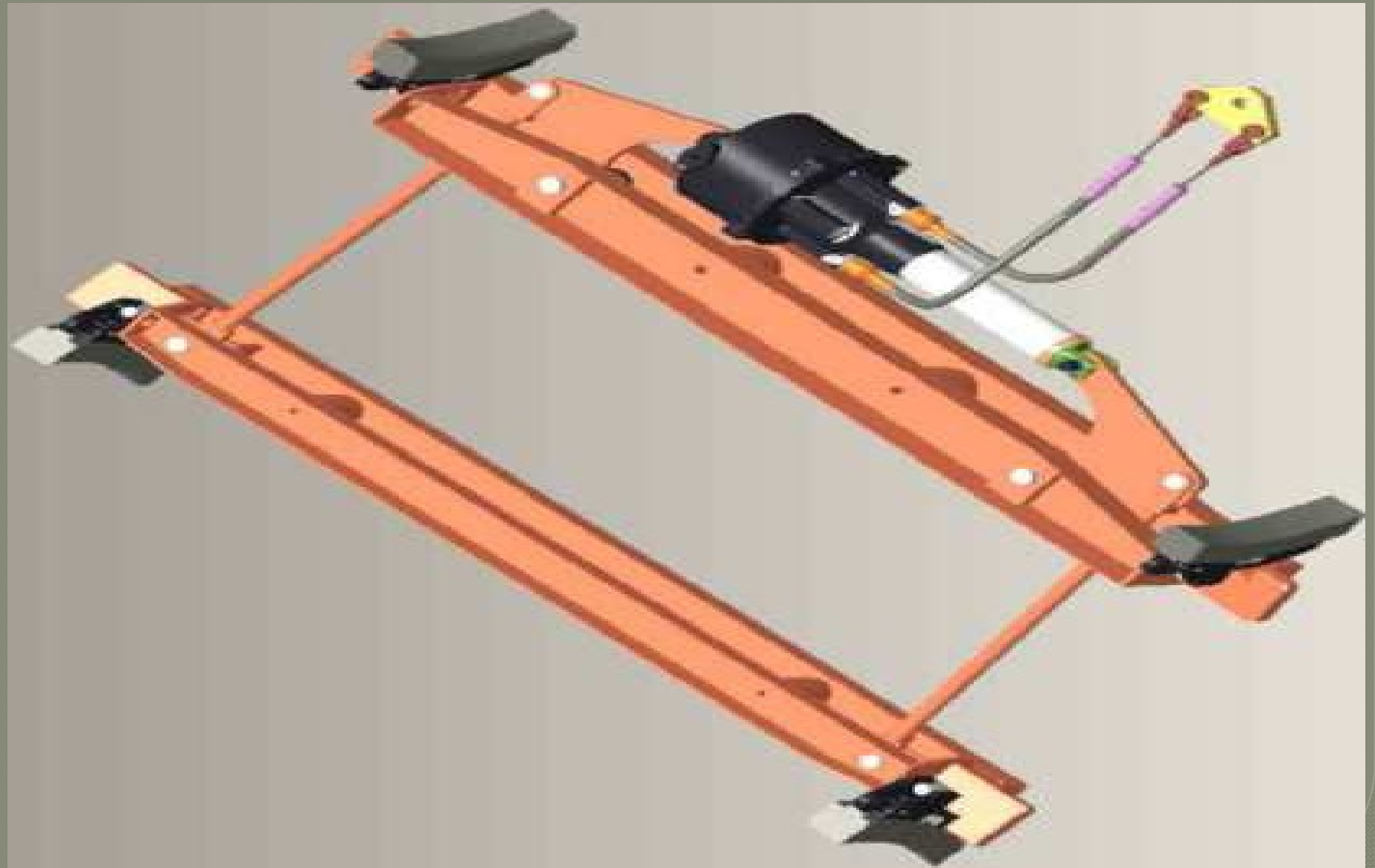


WORKING DESCRIPTION OF BMBS

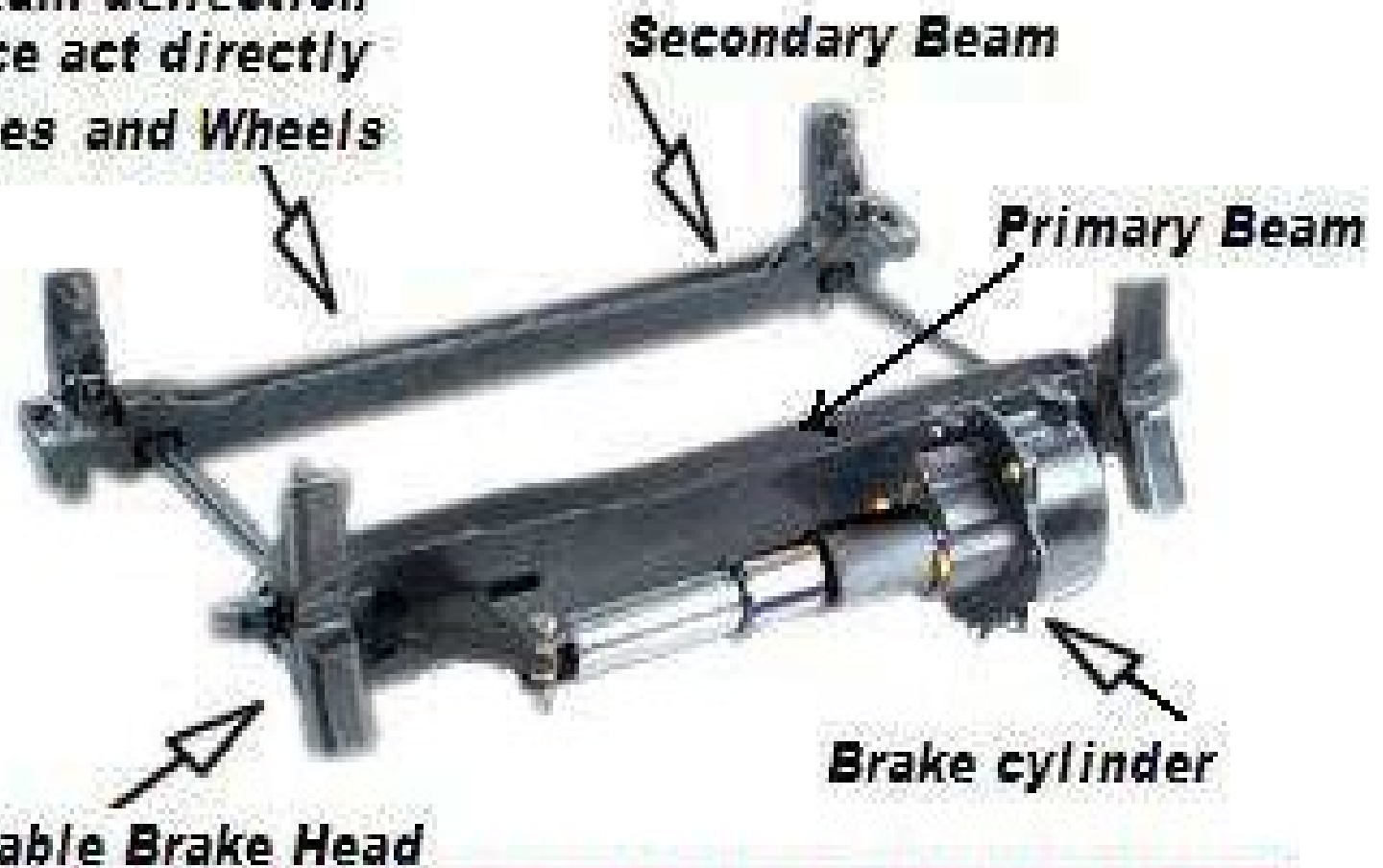
During application, the air is introduced into the brake cylinder, which forces out the piston along the ram assembly. The brake cylinder is floating in nature, as result the brake cylinder extends equally on both the sides. This extension of brake cylinder causes the rotation of the bell crank levers on their pivot and forces the push rod to move towards the secondary beam.

This movement causes the secondary brake beam to move towards the wheels and apply force on the wheels. Simultaneously a reaction force is developed which causes the primary brake beam (along with levers and brake cylinder) to move towards the wheels. The primary brake beam continues to move until it touches the wheels and apply force on the wheels.





*Minimum beam deflection
push rod force act directly
on Brake shoes and Wheels*



BOGIE MOUNTED BRAKE SYSTEM FOR FREIGHT STOCK

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

SELIANT FEATURES

Two nos. of 10" brake cylinders with inbuilt double acting slack adjuster have been used. Along with this an automatic load-sensing device has been used for two stage braking (empty / loaded).

Easy Retro fitment-

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

Simplified Hand Braking Installation-

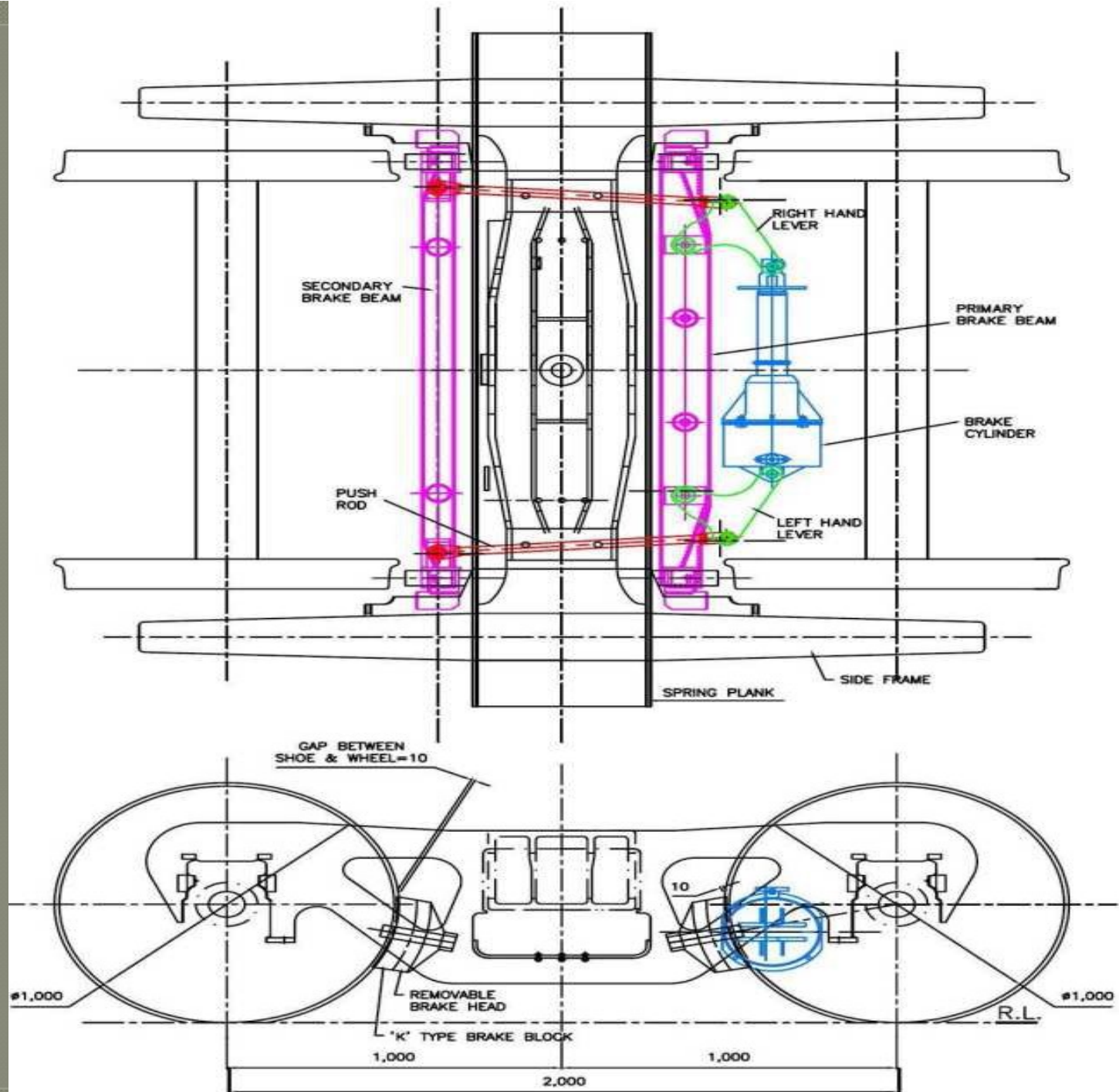
In this system, hand brake is easy to install provides improved reliability and safety. There is minimum number of levers in the hand brake mechanism.

Replaceable Brake Heads-

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

Integral Double Acting Slack Adjuster-

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



SOME OTHER FEATURES

- The brake cylinder is mounted parallel to the brake beams and transfers forces through the bell cranks. This parallelogram design improves the efficiency and aligns the braking forces with the wheels, which reduces the shoe and wheel wear.
- The system delivers optimum braking performance while minimizing weight.
- The system can be easily fitted on any IR standard CASNUB bogie without making any modifications.

- To achieve uniform wheel loading, the loads are applied to the ends of the brake beam instead of center.
- The system uses IR standard 58 mm thick K type brake blocks.
- A replaceable brake head design permits the reuse of the beam in the event that the brake heads gets damaged. Replacement of the brake head is quickly accomplished by removal of only one pin.

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- The push rods are positioned under the bolster. With this system the track clearance has been increased, as there is nothing under the spring plank of the bogie.
 - Instead of one 14" cylinder, the system uses 2 nos. of 10" brake cylinders per wagon, one per bogie. This increases the system reliability as in case of failure of one brake cylinder, the wagon can be moved on with other brake cylinder with the isolation of failed brake cylinder.

- The integral double acting slack adjuster of the brake cylinder maintains a constant piston stroke resulting in uniform brake performance even as the brake shoes and wheels wear. The slack adjuster has a total make-up capacity of 500 mm, which will compensate for total combination of shoe wear, wheel wear and clearance.
- All cylinders are equipped with an automatic piston stroke indicator.

- **The hand brake systems uses two steel hand brake cables pulled through standard hand brake rigging as a means to apply the hand brakes. The cables provide a flexible and lightweight interface to the hand brake actuator.**
- **Even shoe wear helps extend the turn round time between wagon maintenance intervals.**
- **The system also has an automatic pressure modification (APM) device for two stage braking (empty / loaded).**





WORKING PRINCIPLE OF BMBS HAVING APM VALVE

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

The wagons are, provided with Automatic pressure modification (APM) device to cater for higher brake power in loaded condition. With the 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 a change over mechanism, APM under-frame and side frame of the bogie. The mechanism gets actuated at a pre-determined change over weight of the wagon and changes the pressure going to the brake cylinder from $2.2 \pm 0.25 \text{ kg/cm}^2$ to $3.8 \pm 0.1 \text{ kg/cm}^2$ in case of changeover from empty to loaded and vice versa.

The reduction of the BP pressure, positions the DV in such a way that the AR is connected to the BC through the APM device and thereby applying the brake. The DV gives an output pressure of 3.8 kg/cm^2 for the BC which is routed through the APM device. Based on the position of sensor arm of 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/cm² takes, a maximum BC pressure of 3.8 ± 0.1 kg/cm² in loaded condition and 2.2 ± 0.25 kg/cm² in empty condition is achieved. Any further reduction of brake pipe pressure has no effect on the brake cylinder pressure.

EQUIPMENTS DESCRIPTION OF BMBS

Distributor Valve

The DV used with BMBS has a different set of Application & Release chokes to achieve the timings. The choke sizes to be used for DV fitted on wagons with BMBS for KE Version of DV valve are 1.42 mm for Application & 1.52 mm for release. The other makes of DV should be adopted with suitable choke sizes to achieve Brake Application & release timings.

For identification, the DV is equipped with a name plate " BMBS " on choke cover.

Brake Cylinder with built-in Double acting Slack Adjuster-

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



**10" BRAKE CYLINDER
(Without hand brake)**



**10" BRAKE CYLINDER
(With hand brake)**

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

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



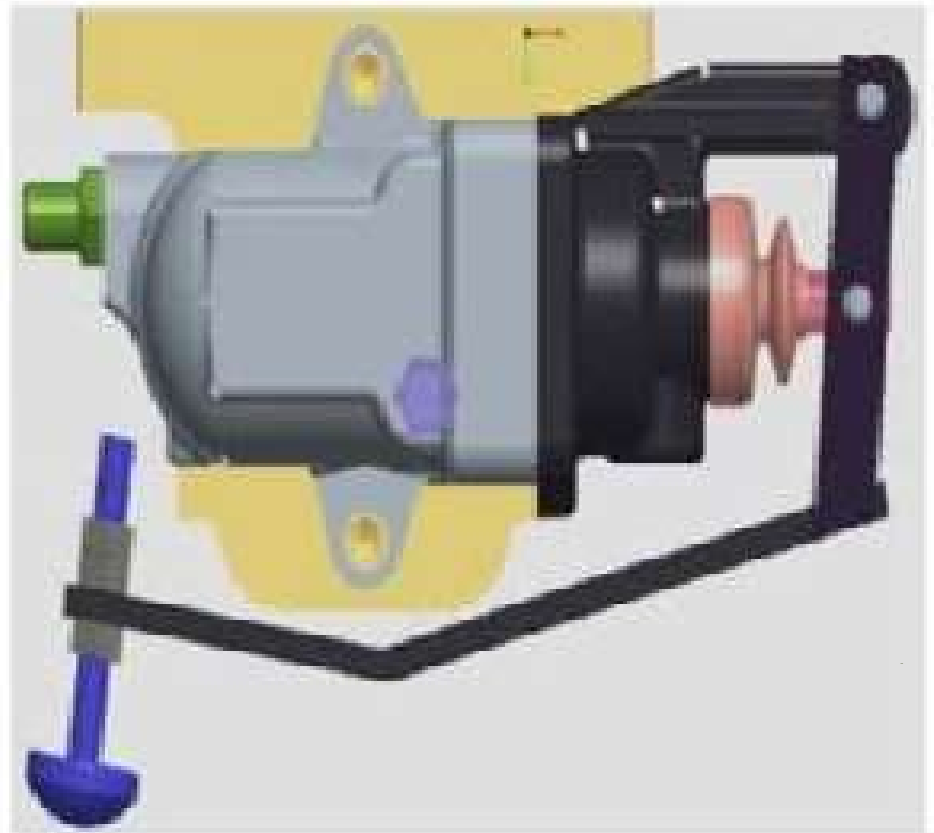
There is an indicator on the brake cylinder to show the "APPLIED" or "RELEASED" condition of the Brake Cylinder. Don't hit the indicator, it may retract slowly. Hitting can bend / damage the indicator.

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

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

APM Device

APM device is interposed between bogie side frame of CASNUB bogie and the under frame of the wagon. It is fitted for achieving 2-stage load braking with automatic changeover of brake power. Only one APM is required per wagon. It restricts the BC pressure coming from the Distributor valve to $2.2 \pm 0.25 \text{ kg/cm}^2$ in empty condition of the wagon and allows the brake cylinder pressure of $3.8 \pm 0.1 \text{ kg/cm}^2$ in loaded condition of the wagon.

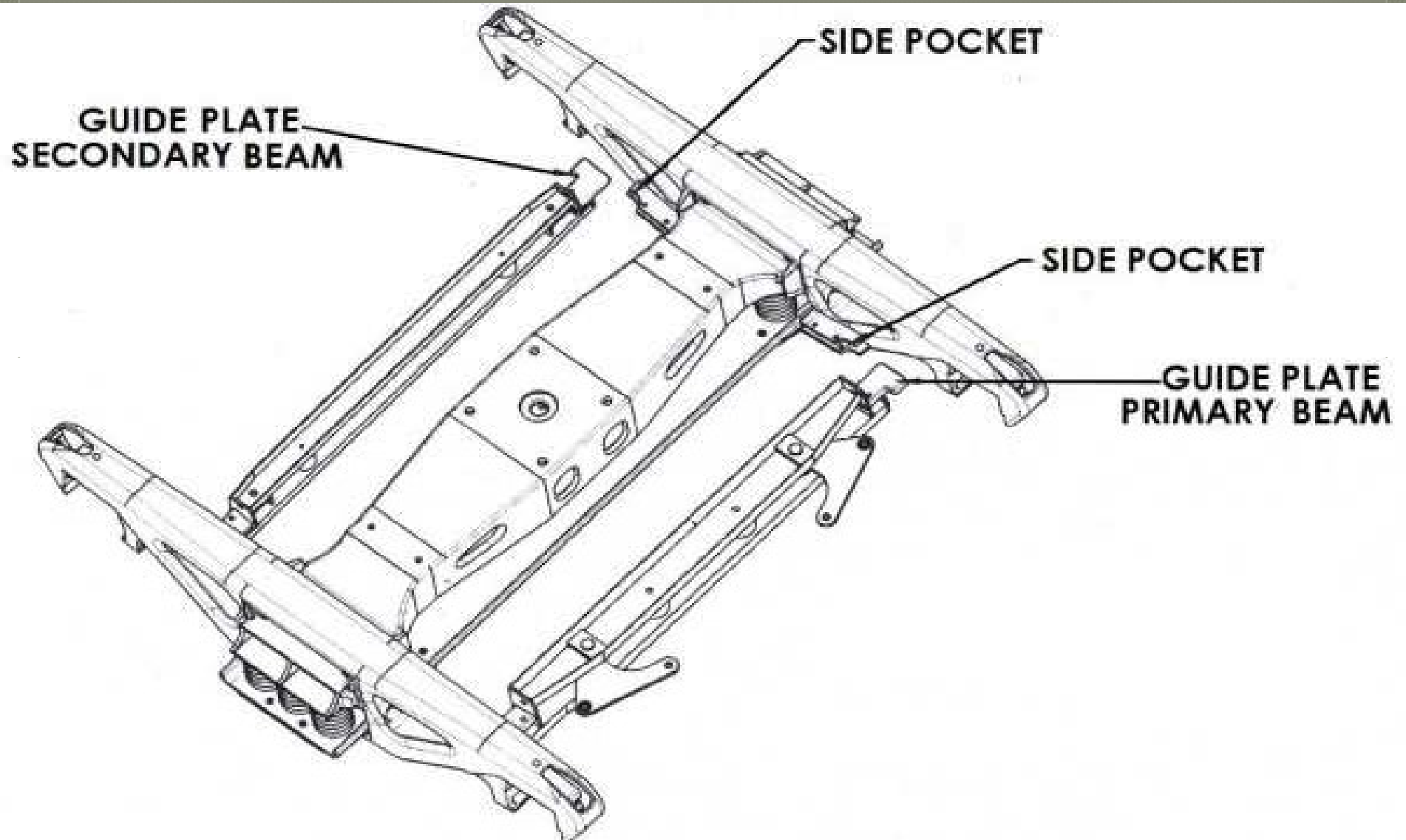


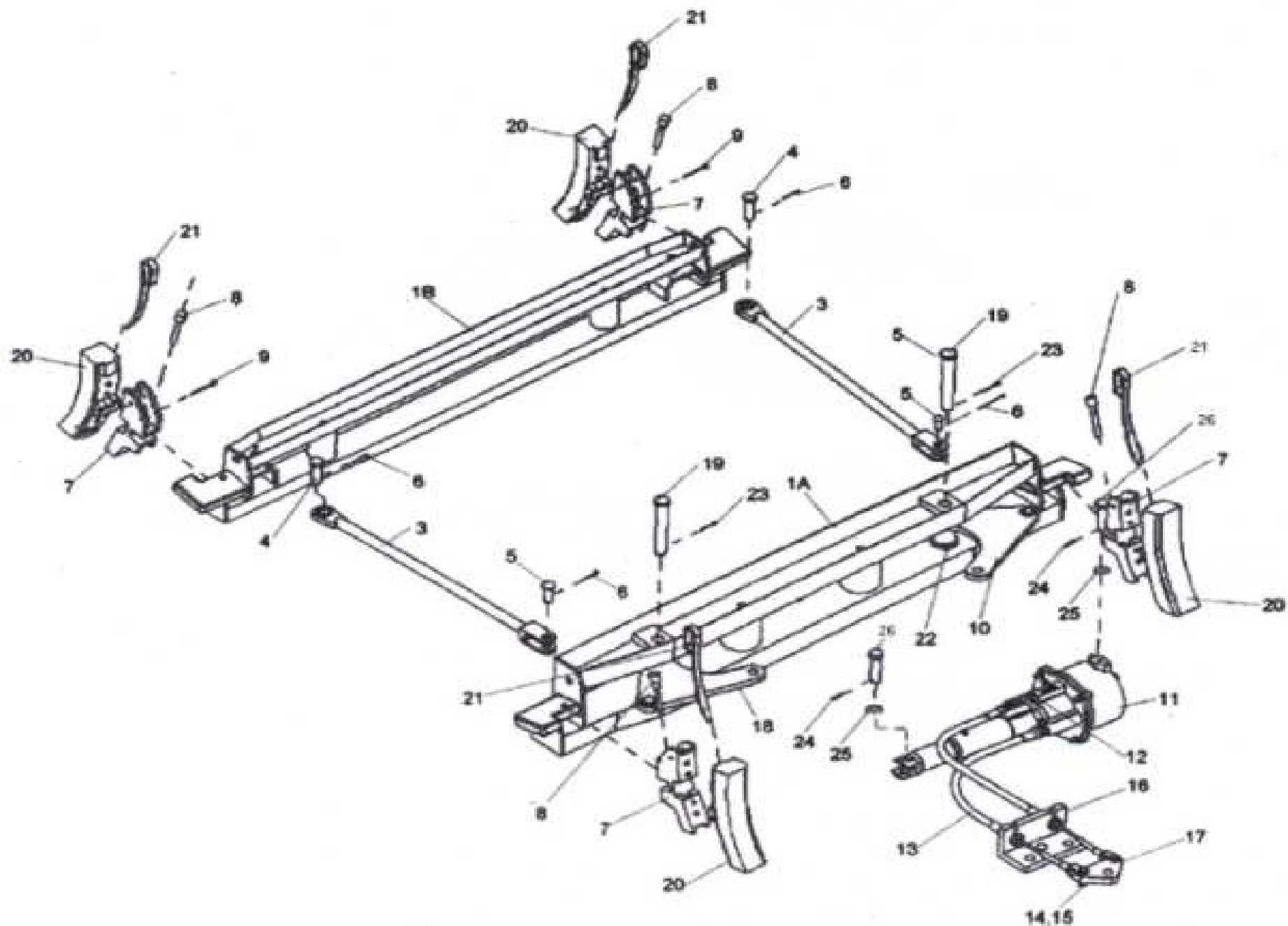
The sensor arm of the APM device comes down for sensing only during the brake application.

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

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

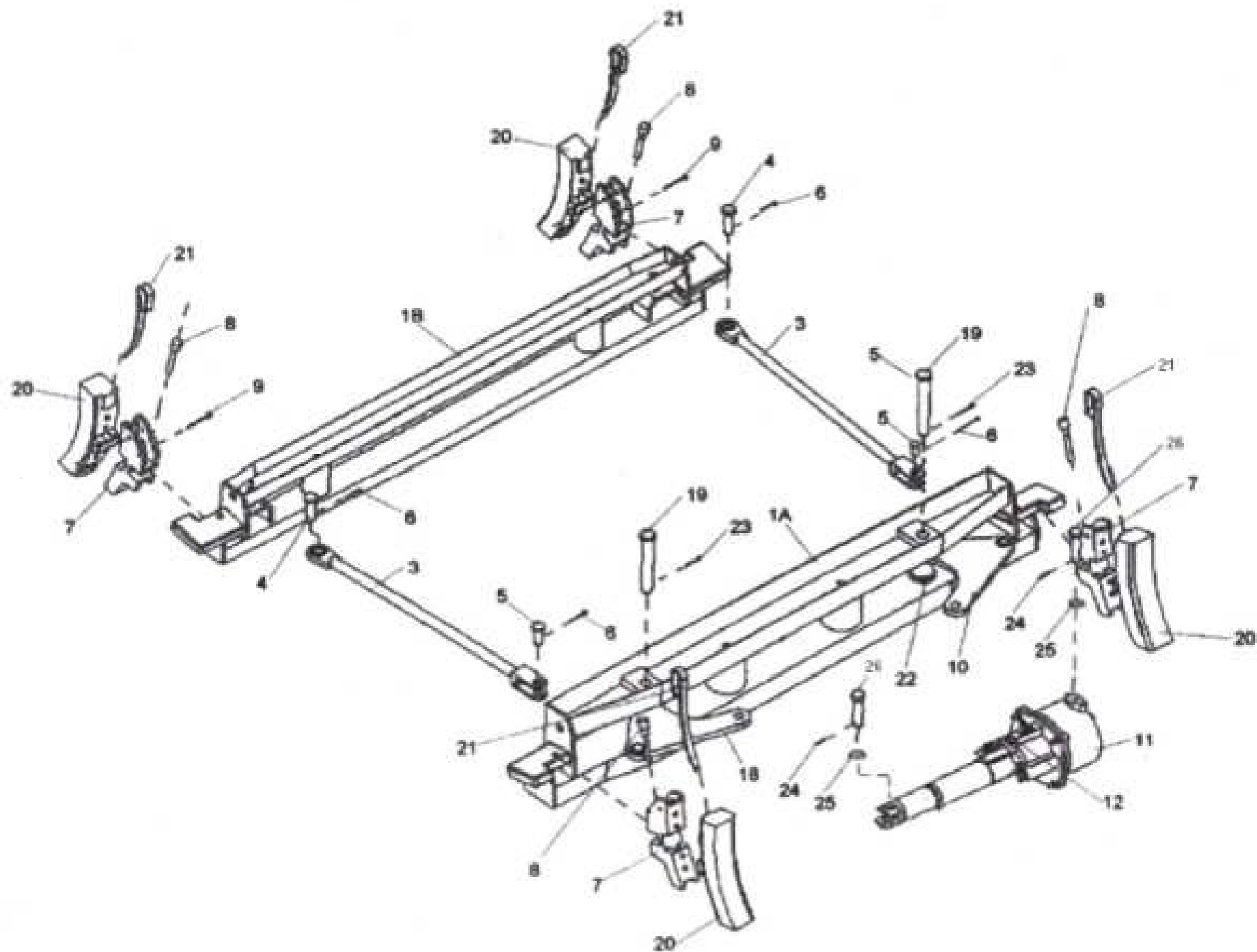
PROCEDURE FOR INSTALLATION OF BMBS ON CASNUB BOGIE





Components of Bogie with Hand Brake Arrangement

1A	Beam, Primary	14	Pin, Cable
1B	Beam, Secondary	15	Pin, Cotter
3	Push Rod Assy.	16	Cable Bracket
4	Secondary Beam Pin	17	Cable Equalizer
5	Push Rod Pin	18	Lever Assy. (bell crank)(LH)
6	Pin, Cotter (6.3mm dia x 50mm)	19	Primary Beam Pin
7	Brake Head	20	Brake Block
8	Pin, Brake Head	21	Brake Block Key
9	Pin, Cotter (6.3mm dia x 75mm)	22	Washer, Thrust
10	Lever Assy. (bell crank) (RH)	23	Pin, Cotter (8mm dia x 50mm)
11	Cylinder Assy.	24	Dowel Sleeve
12	Piston Stroke Indicator	25	Bush
13	Cable Assy.	26	Brake Cylinder Pin



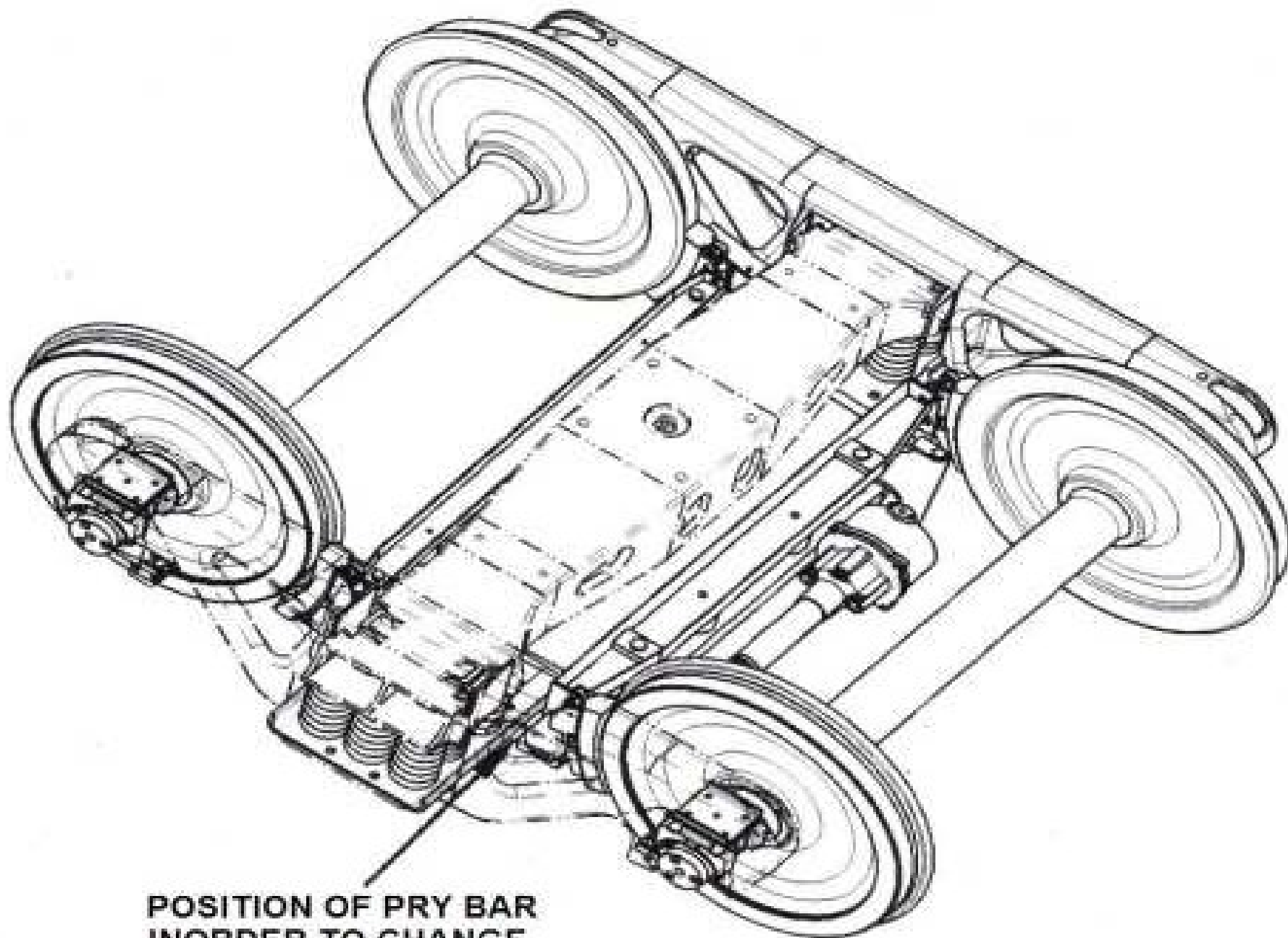
Components of Bogie without Hand Brake Arrangement

1A	Beam, Primary	12	Piston Stroke Indicator
1B	Beam, Secondary	18	Lever Assy. (bell crank) (LH)
3	Push Rod Assy.	19	Primary Beam Pin
4	Secondary Beam Pin	20	Brake Block
5	Push Rod Pin	21	Brake Block Key
6	Pin, Cotter (6.3 dia x 50mm)	22	Washer, Thrust
8	Pin, Brake Head	24	Dowel Sleeve
9	Pin, Cotter (6.3 dia x 75)	25	Bush
10	Lever Assy. (bell crank)(RH)	26	Brake Cylinder Pin
11	Cylinder Assy.		

Procedure for changing of Brake Blocks

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

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

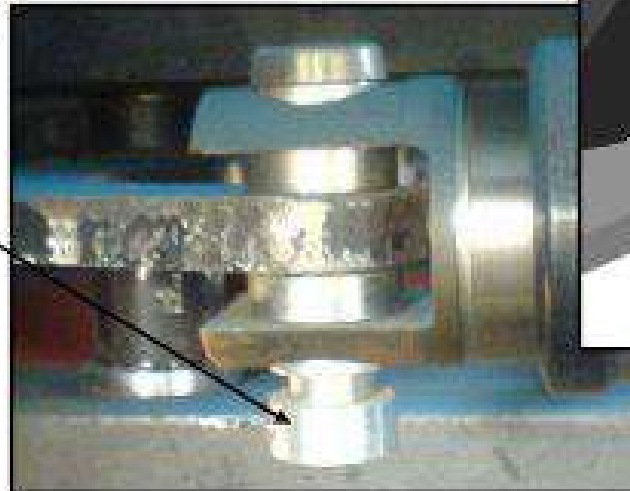


**POSITION OF PRY BAR
IN ORDER TO CHANGE
THE BRAKE SHOE**

Anti Pilferage Devices (APDs)

(A) APD for Pins on Bogie Brake Cylinder

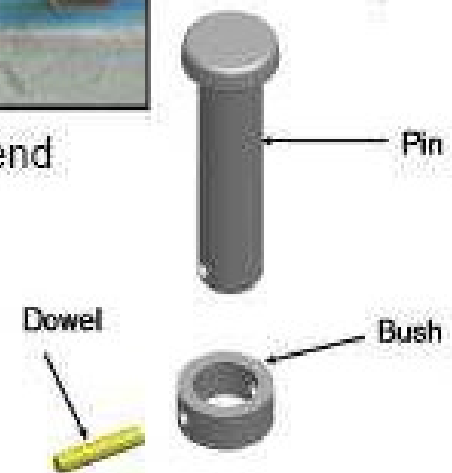
The pin connecting the brake cylinder with lever are to be fitted with Bush & Dowel Sleeve.



Brake Cylinder front end

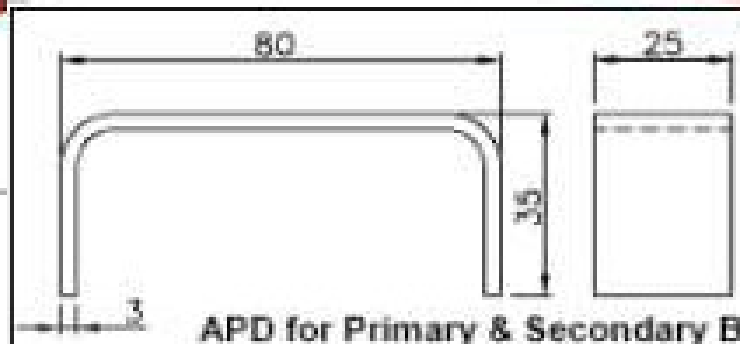
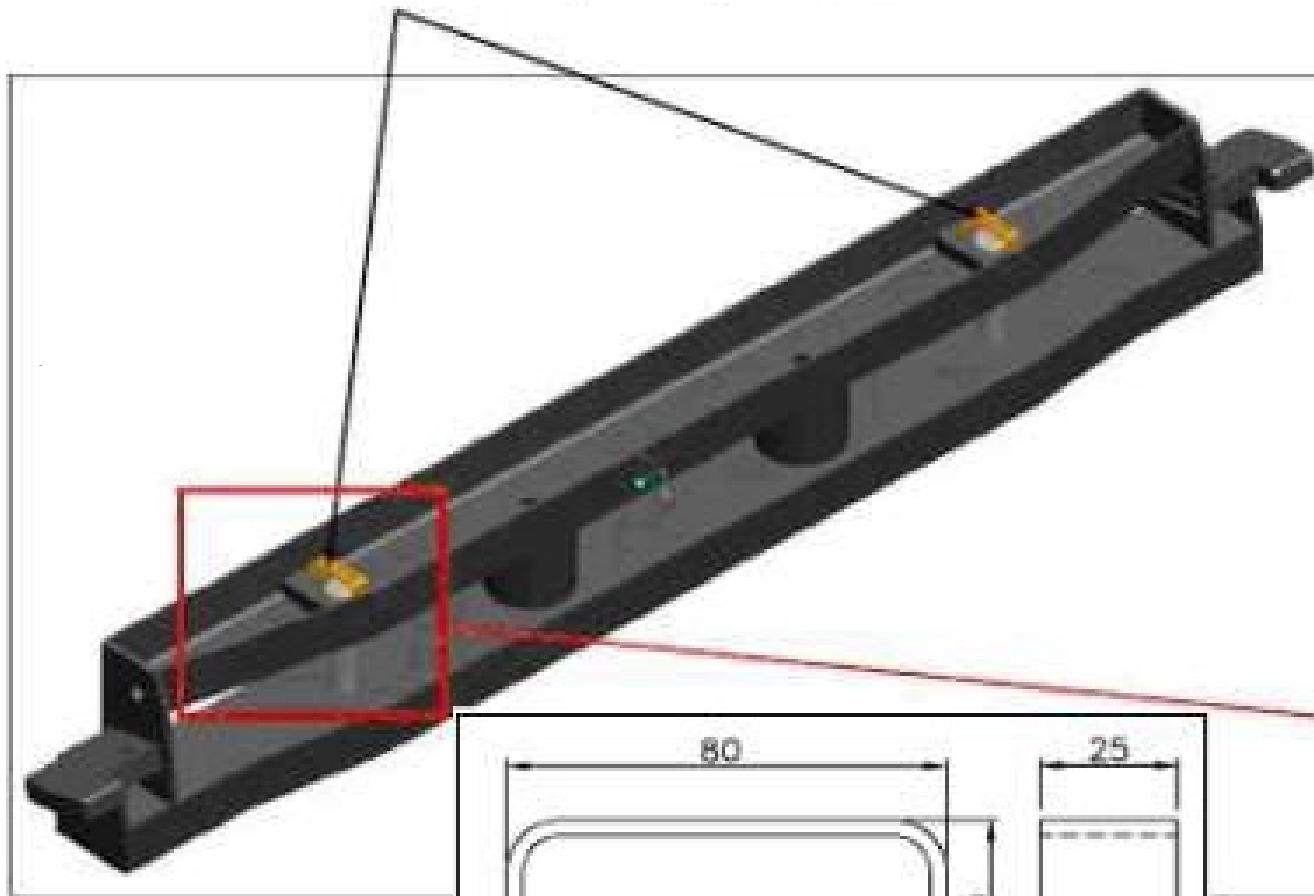
Brake Cylinder rear end

Components

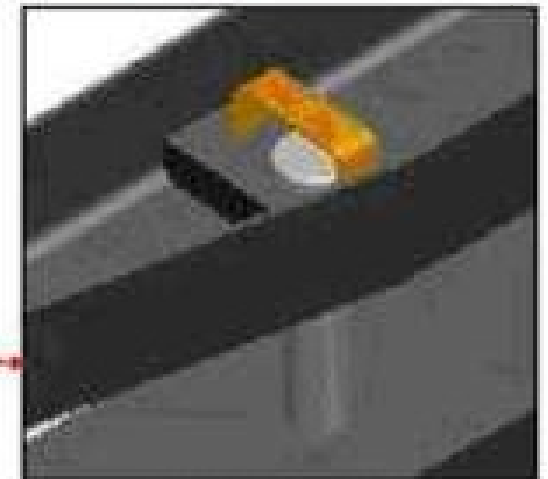


(B) APD for Primary Brake Beam

APD to be Tack Welded above the Pin after assembly of lever to prevent pin removal.



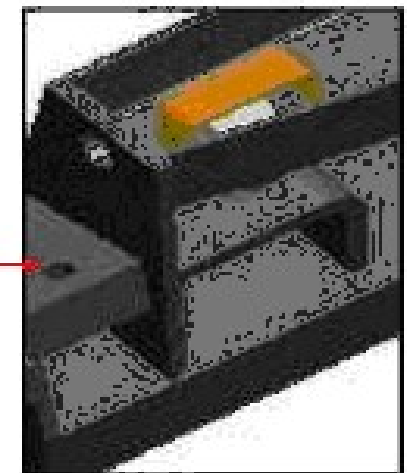
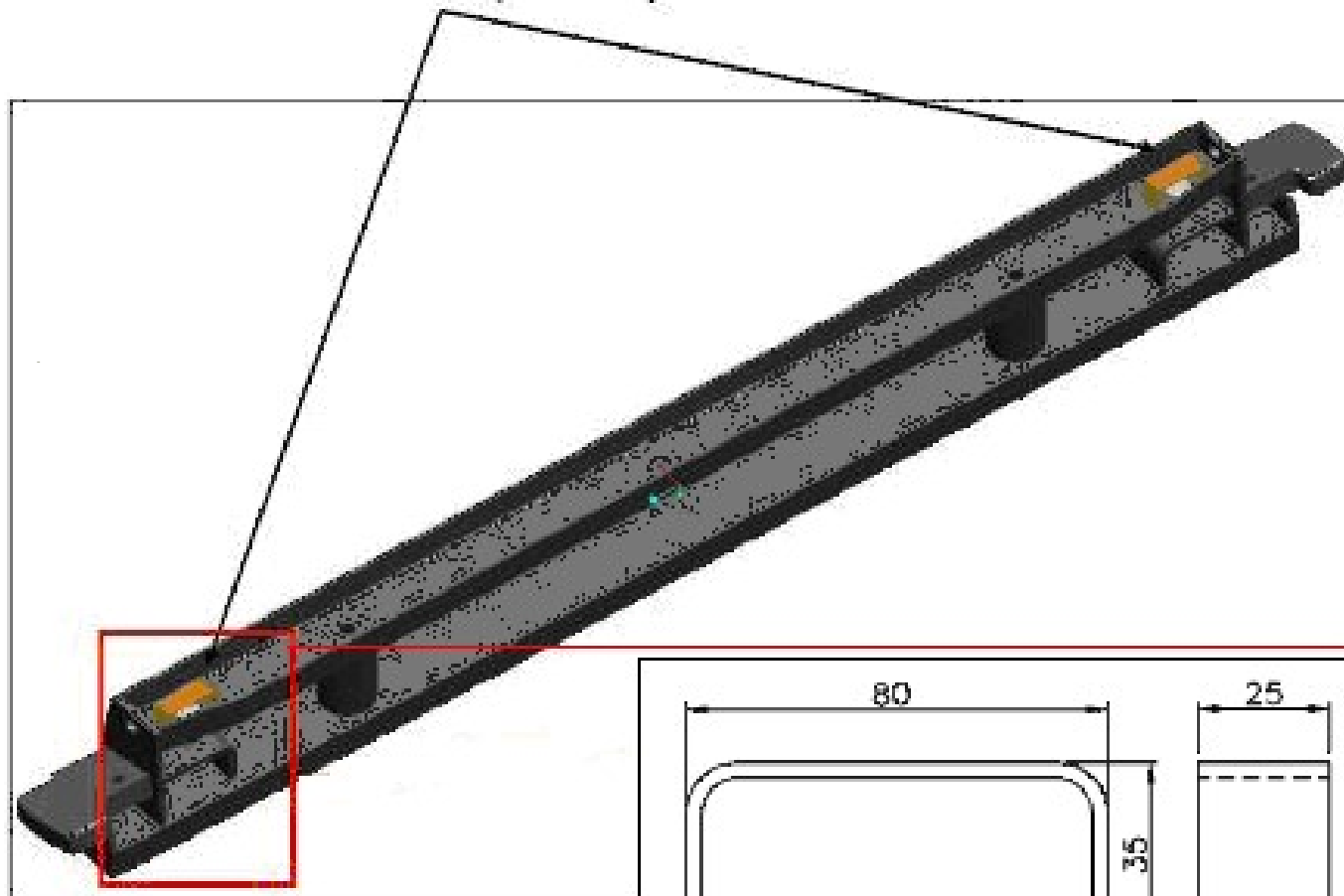
APD for Primary & Secondary Beams



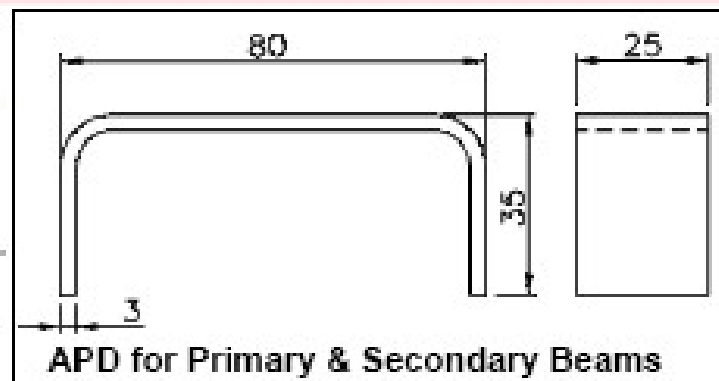
Enlarge view

(C) APD for Secondary Brake Beam

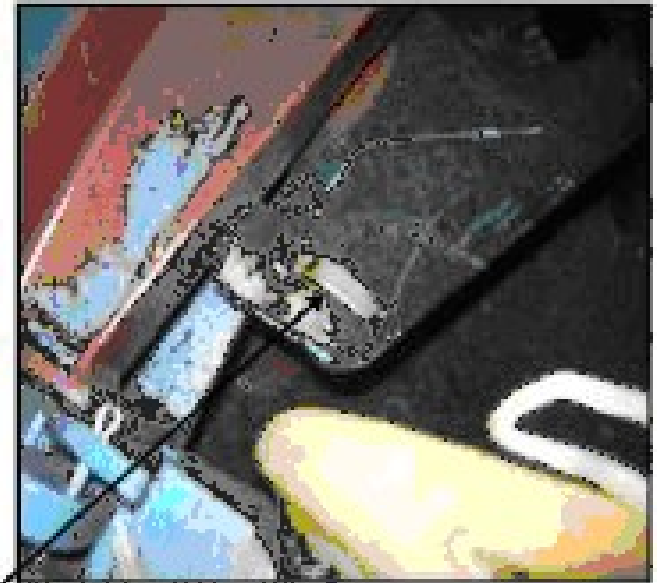
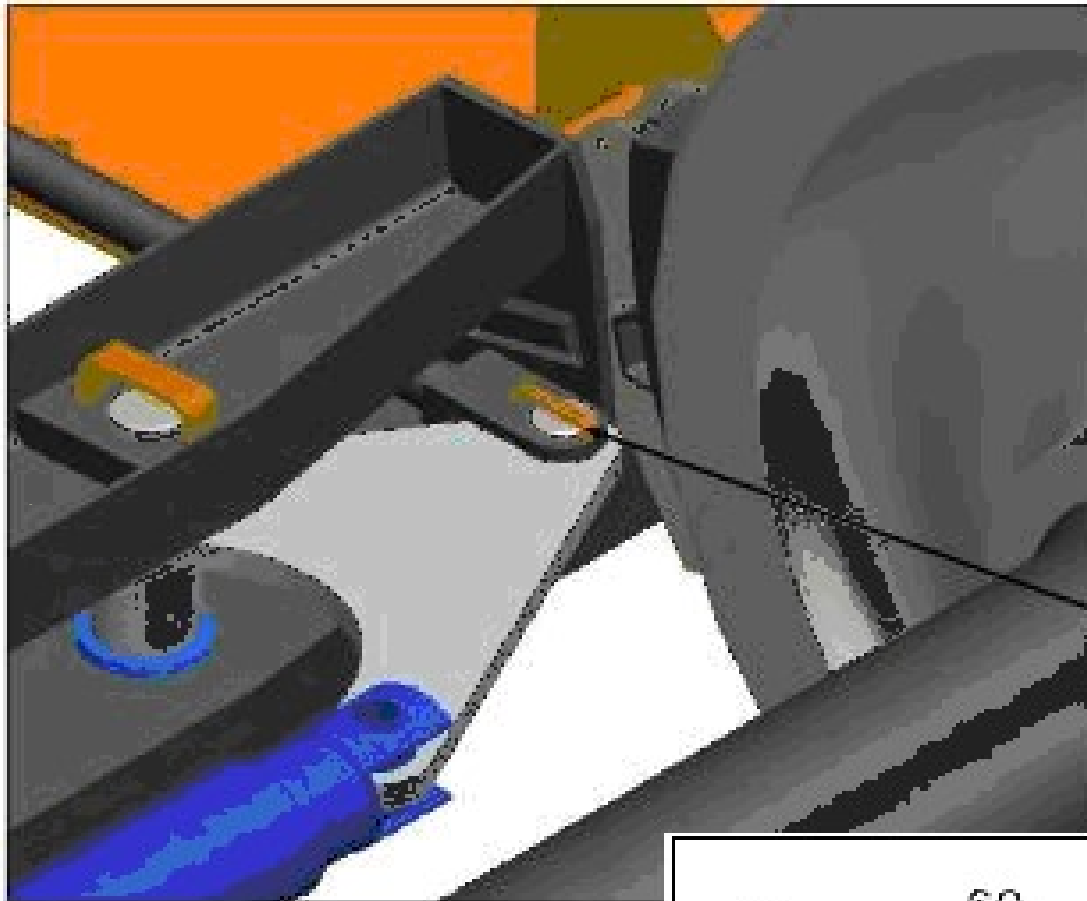
APD to be Tack Welded above the Pin after assembly of push rod to prevent pin removal.



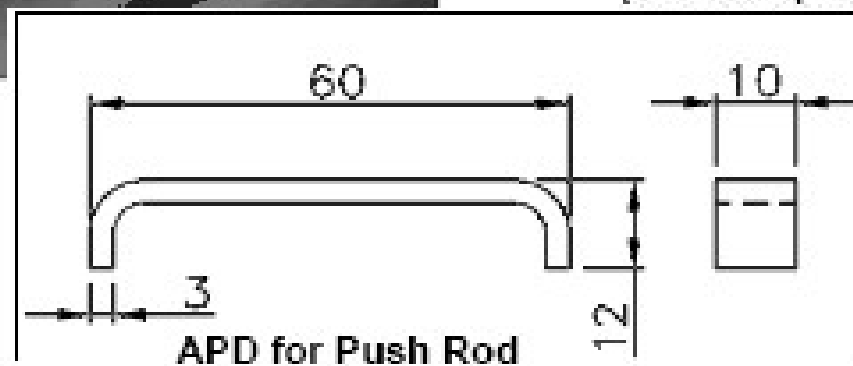
Enlarge View



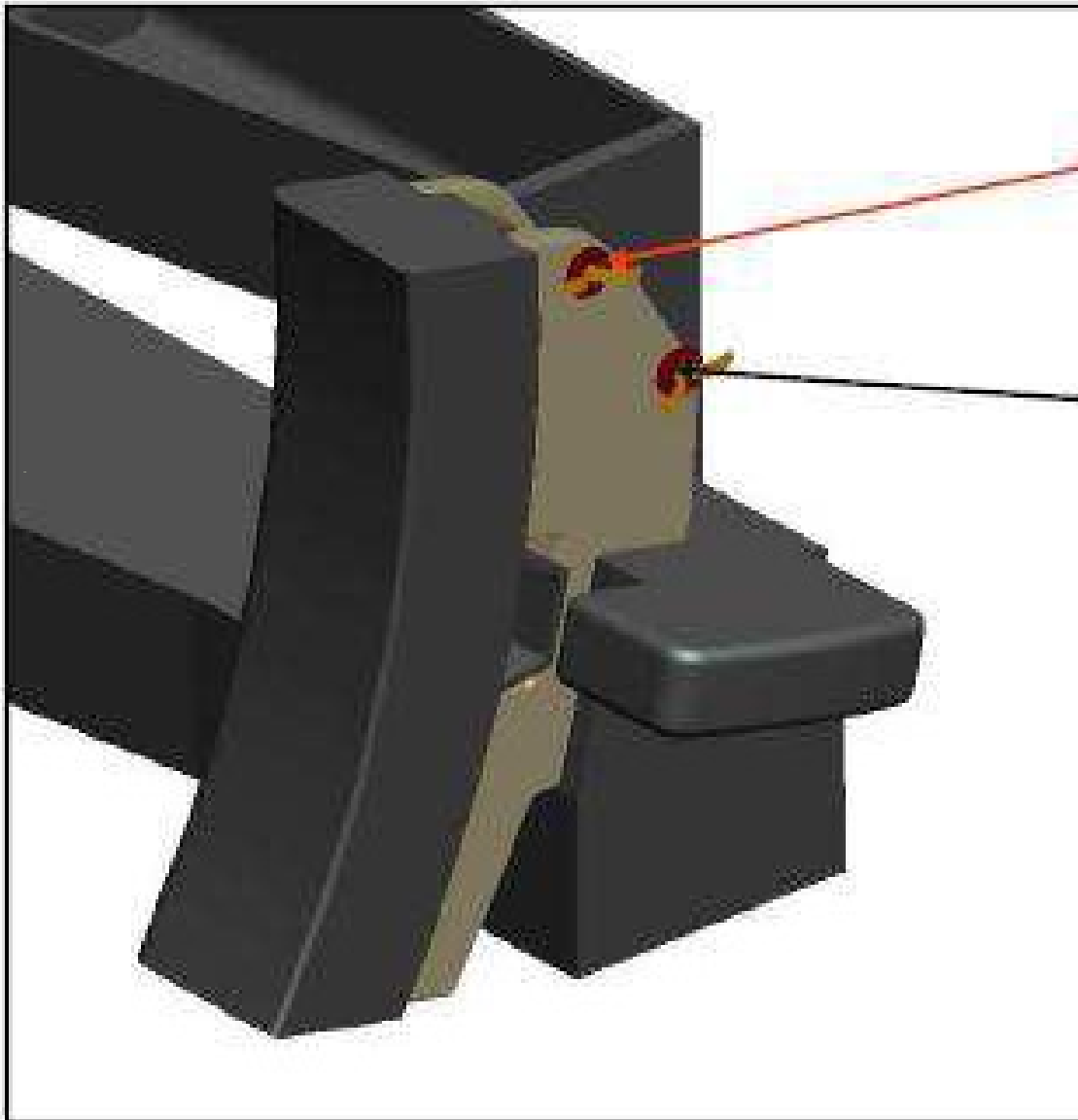
(D) APD for Push Rod



APD to be Tack Welded above the Pin after assembly as shown, to prevent pin removal.



(E) APD for Brake Head

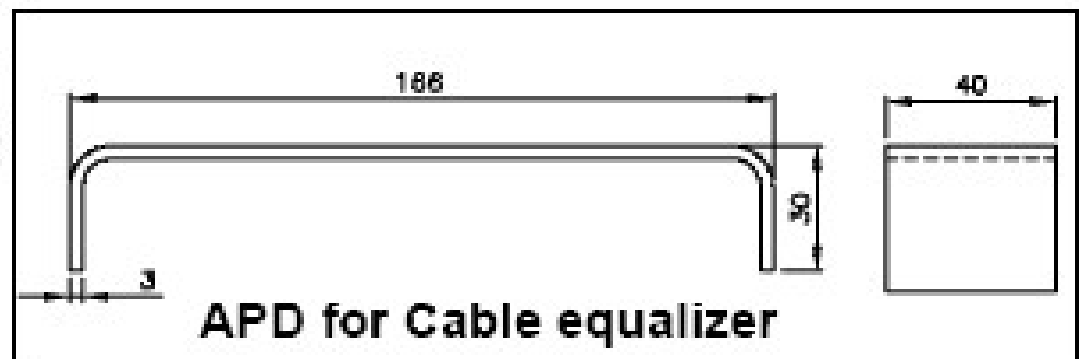
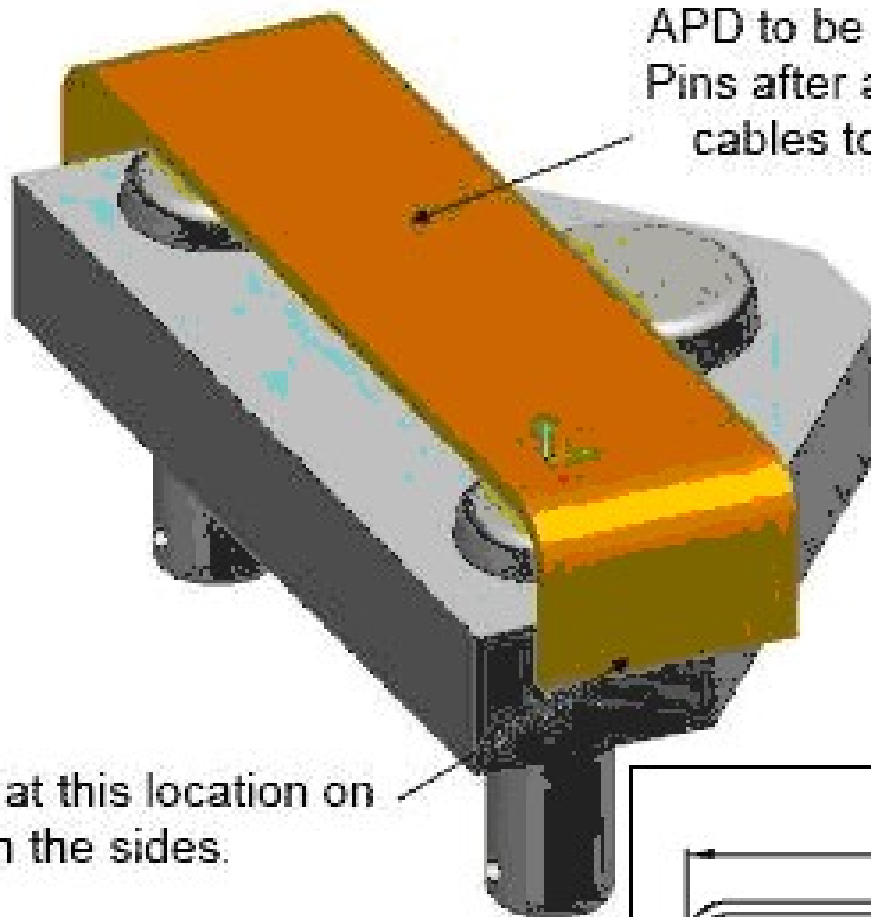


The split pin on Brake Block Key is not to be Tack welded.

Split pin on Brake Head Pin to be Tack welded with washers as shown below.

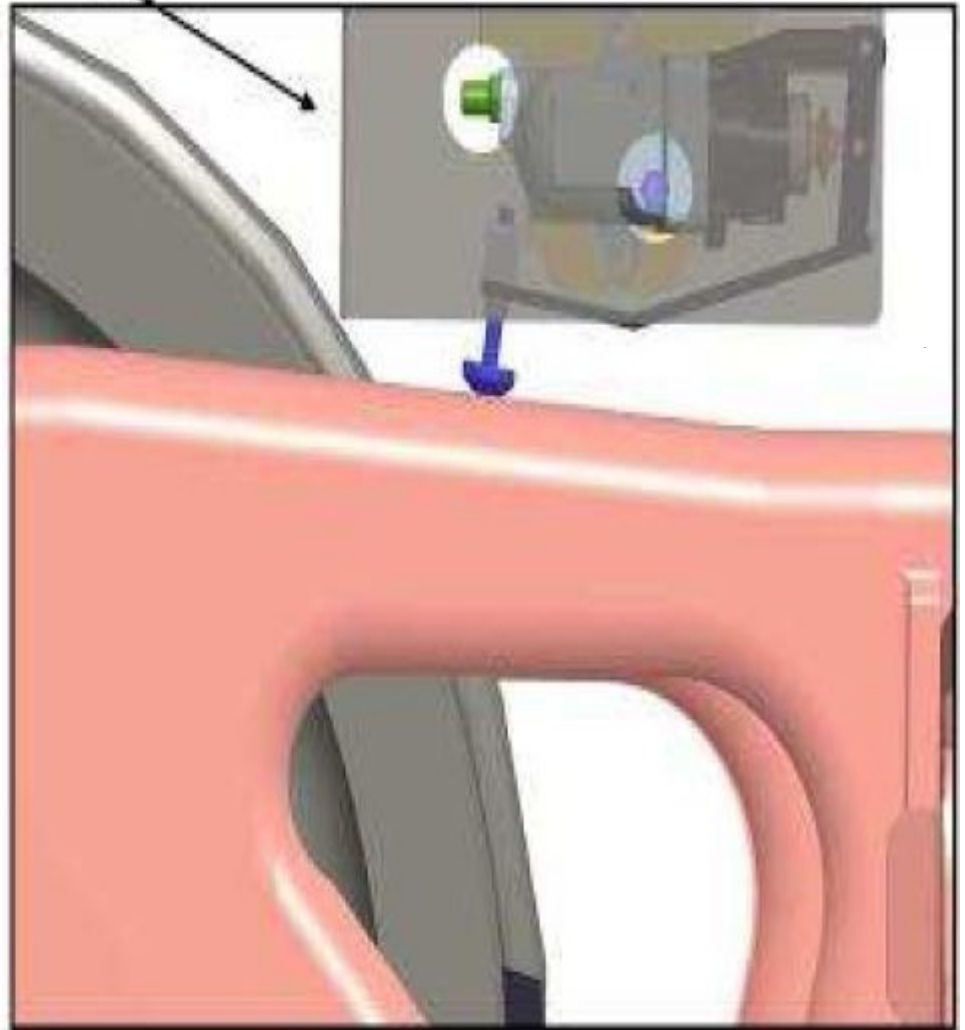
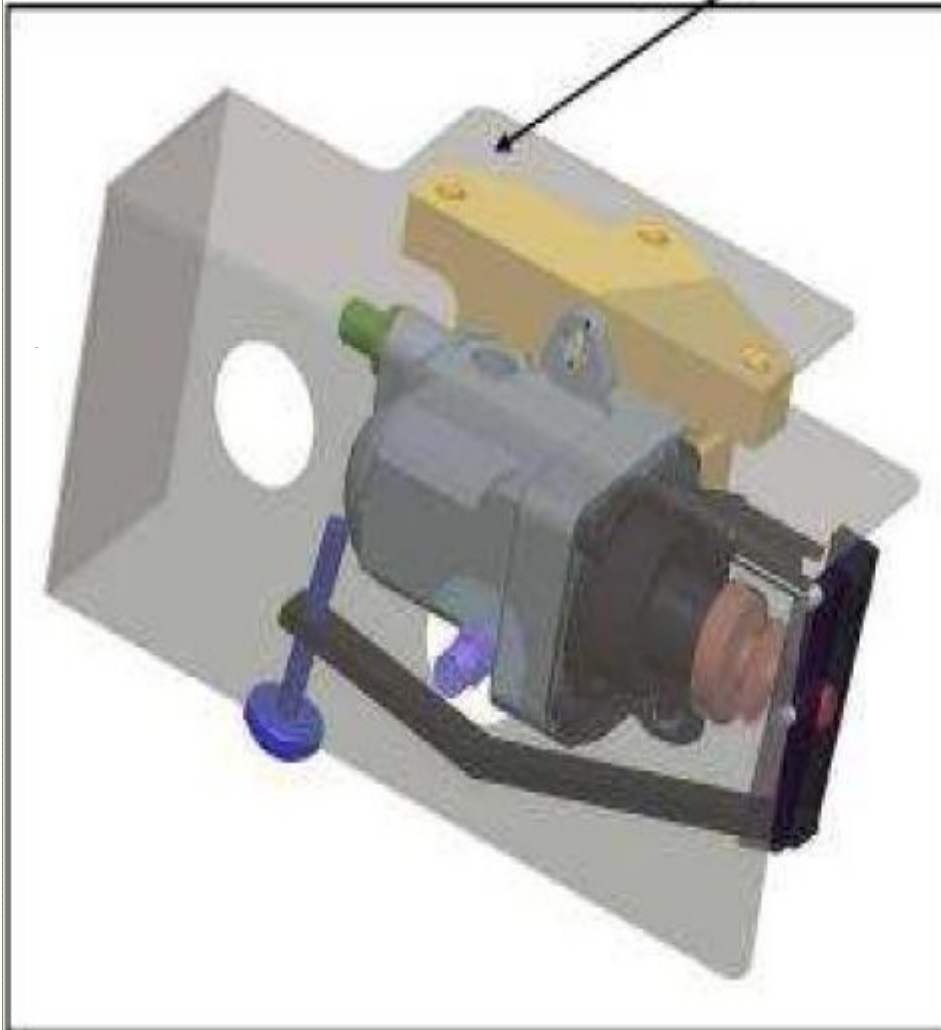


(F) APD for Cable Equalizer

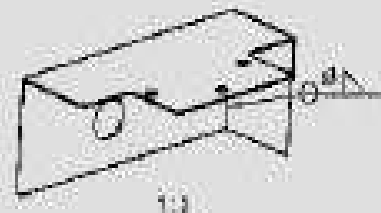
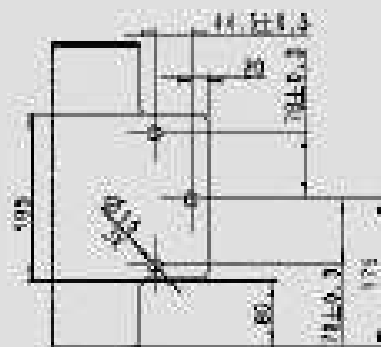
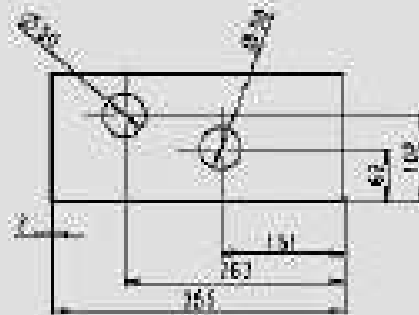
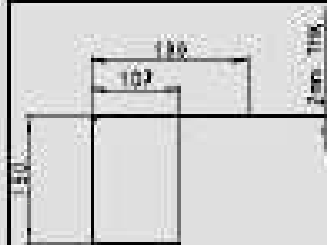


APD on APM

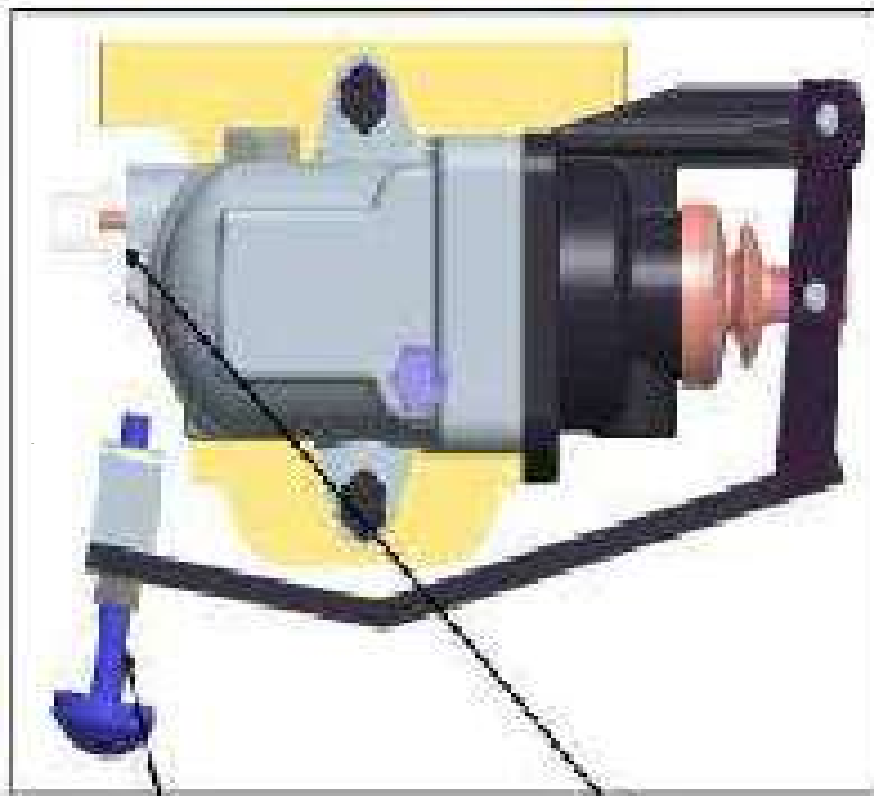
APD on APM to be provided as shown.



Details of APD on
APM to be provided.

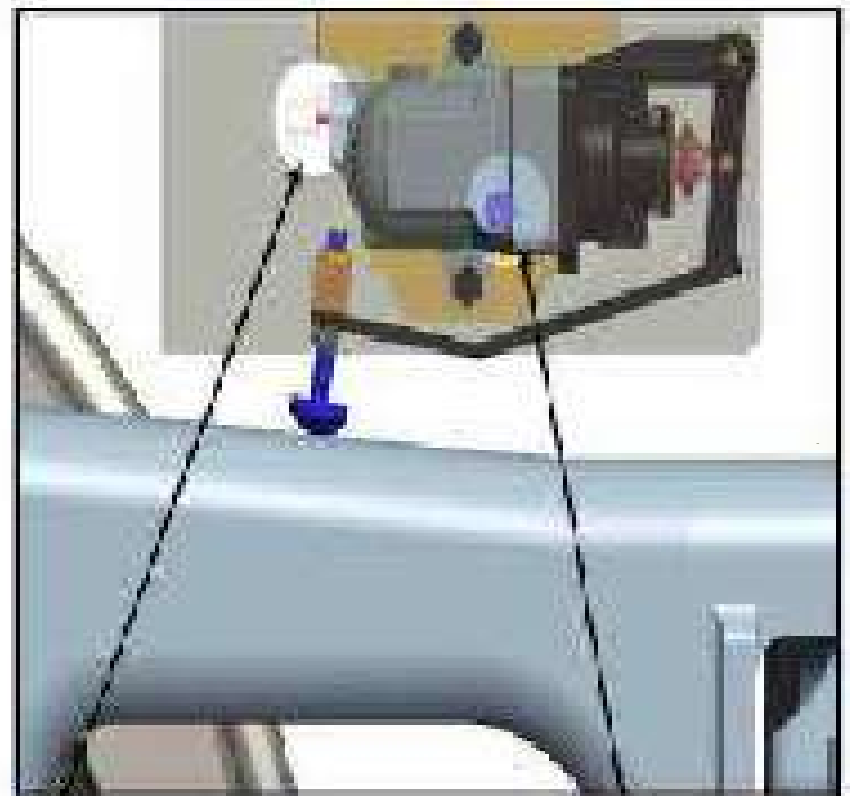


(H) Lock nut on APM



Sensor Arm fitted with Adjustable Screw for adjustment on wagon

When the indicator (Orange) is out, it shows empty position.
When the is inside, it shows loaded position



Port to connect the gauge to check EC pressure

MAINTENANCE IN OPEN LINE

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

- a) Check all the pin joints for any missing parts (pins, split pins, spring dowel, etc), if missing, provide the same.
- b) Check the components for missing or any physical damage, if found replace them.
- c) Check that the APD is provided on all the pins and on the APM.
- d) Check that the all hoses are properly tightened and are not threatened to be damaged by axle or wheel. If so properly clamped them.

2. BRAKE CYLINDER

- a) Check for any physical damage of components or leakage.
- b) Check that the piston indicator is fully in released condition.
- c) In case of brake cylinder with hand brake cables, the cables are not entangled or resting / touching the axle check the movement, cable is free.

3. APM DEVICE

- a) Check for any physical damage to the valve.
- b) Check that the indicator in during the release.
- c) Clean the Indicator.
- d) Check the tightness of the lock nuts on sensor arm lever, if found loose, tighten them and also verify the Gap as specified.
- e) Check that the valve's sensing arm is moving freely.

4. HAND BRAKE RIGGING

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

ROH FOR WAGONS FITTED WITH BMBS

1. BRAKECYLINDER

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

- (a) Check the brake cylinder for any physical damage or leakage.
- (b) In case of brake cylinder with hand brake cables, check that the movement of cables is free
- (c) Ensure that the piston indicator is in fully released condition.

2. BRAKE BEAMS

- (a) Check for any physical damage, crack, etc, if found replace them. Check for rusting & corrosion and if found repaint them.
- (b) Replace all the PINS, washer, split pins, dowel pins.
- (c) Check the GAP at pivot pin on the primary brake beam as in the condemning limit of the system components.
- (d) Check brake head for loosening or damage as shown in the condemning limit of the system components.

3. LEVERS & PUSH RODS

- (a) Replace the Bell crank lever, if any of the parameters specified in the condemning limits is observed.
- (b) Replace the push rod, if any of the parameters specified in the condemning limits is observed.

4. APM DEVICE

(a) Clean the Indicator.

(b) Check the APM valve;

- Any physical damage Valve's sensing arm is moving freely and is fully in.

- Check the leakage.

- Tightness of the lock nuts on sensor arm lever, if found loose, tighten them.

(c) Check the Gap between the sensor arm and the side frame, if required re-adjust.

Do's & Don'ts for BMBS

Dos

Bogie Rigging

- Do ensure that the side frame pockets are of correct dimension and free of all restriction.
- Do ensure that the fitment dimensions in Bogie, critical for fitment of BMBS are maintained within their specified limits.
- Do ensure that all the side frame pocket liners are properly cleaned & are within the specified limits.

- Do ensure there is free sliding of Brake Beams inside the side frame pocket liners.
- Do ensure that there is proper push rod & spring' plank clearance. If push rod clearance is less, then check the necessary bogie dimensions.
- Do ensure that there is proper fitment of brake block key with Brake block and brake head.

- Do ensure that there is sufficient gap (after the system is retracted) to change the brake blocks.
- Do ensure to use bush and dowel pin to lock the brake cylinder pins.
- Do ensure that all split pin are in place and are bent properly with their arms 90° apart.
- Do ensure that APDs are provided on all the pins of the bogie rigging.

Brake Cylinder

- Do ensure to blow the steel pipes connecting the brake cylinder before fitment to prevent the dirt particles going into the brake cylinder. This can be done by making 2-3 brake applications before connection of Hose pipe with Brake Cylinder.
- Do ensure that the cables are not pulled out of the brake cylinder on making hand brake connections.
- Do ensure that there is no rubbing of two hand brake cable together or resting on the axle.

APM Device

- Do ensure correct gap between the sensing point of APM device & surface of side frame. If not, then adjust the same.
- Do ensure to put the additional check nut on the adjusting screw to lock the same in position.
- Do ensure that changeover takes place after putting 25mm block between the sensor point and side frame.

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- Do ensure that empty / load indicator of the APM device (Orange coloured) is visible during empty condition.
 - Do ensure that the reservoir for APM device is secured properly with the under frame.

Piping layout and fitment

- Do ensure proper orientation of Check Valve & Bogie Isolating Cocks. The vent side of the isolating cock with vent should be on the brake cylinder side.
- Do ensure to use the correct size of bolts, screws, nuts and washers as specified. Use of wrong size bolts / screw could damage the threads on the brake cylinder / APM valve. Do ensure proper clamping of APM Valve hose with under frame.
- Do ensure that there is no rubbing of rubber hoses with axle, wheel or under frame members.

Hand Brake Arrangement

- Do ensure to weld the hand brake cable bracket at its correct location.
- Do ensure to weld the horizontal lever bracket at its correct location.
- Do ensure that the horizontal lever is properly supported by support brackets and have unrestricted movement.
- Do ensure that there is proper hand brake arrangement movement.

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- Do ensure that there is no obstacle during return of hand brake cable after releasing hand brake. Investigate the restriction for the cables and do the necessary rectification.
 - Do ensure to properly lubricate the hand brake screw, nut and pivots to reduce the friction and ensure smooth movement.

Don'ts

- Do not fit BMBS system if the Bogie parameters are not within the specified limits.
- Does not tack weld the BMBS pins / split pins on the bogie.
- Do not hammer on beams and brake block.
- Do not hit the indicator on the brake cylinder.
- Do not use L-type brake blocks with Bogie Mounted Brake system.
- Do not use the non-standard pin, bolts for the fitment of BMBS items.

THANKS