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No. MW/APB/BMB/Knorr

Dated: 01.05.2025

The Principal Chief Mechanical Engineers,

1. Northern Railway, Baroda House, New Delhi-110 001
2. Central Railway, CST, Mumbai-400 001
3. Eastern Railway, Fairlie Place, Kolkata-700 001
4. Western Railway, Churchgate, Mumbai-400 020
5. Southern Railway, Park Town, Chennai-600 003
6. South Central Railway, Secunderabad-500 071
7. South Eastern Railway, Garden Reach, Kolkata-700 043
8. North Eastern Railway, Gorakhpur-273 001
9. Northeast Frontier Railway, Maligaon, Guwahati-781 011
10. East Central Railway, Hajipur, Bihar 844 101
11. North Western Railway, Jaipur-302 006
12. North Central Railway, Allahabad.-211 001
13. South Western Railway, Hubli – 580 023
14. East Coast Railway, Bhubaneswar, Orissa-751 023
15. West Central Railway, Jabalpur-482 001
16. South East Central Railway, R.E. Complex, Bilaspur – 495 004

Sub: Manuals for **(1)** Piston Stroke Indicator usage during Brake System Test of M/s KBPIL upgraded 11" BMBS & **(2)** Description & Maintenance of upgraded 11" Bogie Mounted Brake System for wagons.

Ref: i) Railway Board letter no. 2022/M(N)/60/3 (E3387858) dated 08.08.2023.
ii) RDSO letter no MW/APB/BMB/Knorr Dated: 31/08/2023.
iii) M/s KBIPL letter no. KBI/BMBS/AG dated 23.04.25.

1. In line with ref (i) and (ii) above, exiting 10" Brake Cylinder of M/s Knorr is being upgraded to 11" Brake Cylinder in the wagons fitted with the BMBS designed and supplied by M/s Knorr Bremse India Private Limited (KBIPL). As on 30.04.2025, 28,815 wagons have already been upgraded.
2. Vide under reference iii) above; M/s Knorr Bremse India Pvt. Ltd. has submitted the manuals for:
   i. Piston Stroke Indicator usage during Brake System Test of M/s KBPIL upgraded 11" BMBS.
   ii. Description & Maintenance of upgraded 11" Bogie Mounted Brake System for wagons.
3. Zonal Railways are requested to follow the attached manuals for maintenance of modified (11" dia) BMBS designed and supplied by M/s Knorr Bremse India Private Limited (KBIPL).

Encl: As above

APURVA
Digitally signed by APURVA
DN: cn=APURVA, c=IN, st=Uttar Pradesh, o=Indian Railways, serialNumber=271e15674f0356c540db2a07aca7a284298f258d9576c97e5e23f3ca83a331fc
Date: 2025.05.01 16:05:17 +05'30'

(Apurva)
Jt. Director Std. (Wagon)
For Executive Director Std. (Wagon)

Copy to –

1. EDME (Freight), Railway Board for kind information.
2. PED/CAMTECH & IRIMEE for kind information and n/a.
3. M/s KBIPL for distribution of above said Manuals in ZRs and to organise training.in depots/Workshop

Rail Vehicle Systems

IP-344

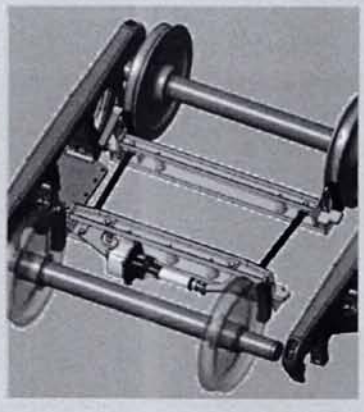
Rev. 2 - en

Piston Stroke Indicator Usage during Brake System Test

TMB60I

P/Ns KP1796330 and KP1802890

India



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Confidentiality

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Revision History

Rev	Date *(MM/DD/YYYY)*	Name	Paragraph	Description of change
0	12/19/2023	Konrad Van der Merwe	All	New Document
1	2/9/2024	Konrad Van der Merwe, Vinay Ganjoo, Anuj Gupta	Page 1 1.2&1.5 1.3 2.1. 2) 2.1. 3) 2.1. 5) c. 2.2	KBI request, change TMB60 systems numbers to KP1842858. Add 2 Cylinder Part Numbers Add 2 definitions for pay-in and pay-out, change wording. Add Isolating to Cut-out cock. Add check clogging of wire mesh. Add after repair to check the wear liner with side pocket gauge for free movement. Update flow diagram.
2	14 Jan. 25	Konrad Van der Merwe	Page 1 2.1 5) d. 2.1 5) e. 2.2	P/Ns KP1796330 and KP1802890 was KP1842858 Change adapter visual wear inspection, from wear ridge to inspect for cracks, broken, displaced or if wide jaw adapter retaining nut and bolt is present. Was 190+2-1mm, changed to 187+1-0.5mm Carry changes over to flow diagram

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Approval

Prepared By	Title	Date *(MM/DD/YYYY)*
Konrad Van der Merwe	System Development Engineer	3/17/2025
Approved By	**Title**	**Date** *(MM/DD/YYYY)*
John W. LaDuc	Manager, Systems Engineering	03/31/2025
Reviewed By	**Title**	**Date** *(MM/DD/YYYY)*
Kevin Deon	Manager, Systems Development	3/24/2025
Michael L. Parisian	Sr. Director Sys Eng	3/27/25
Jeanine Shippee	Sr. Technical Writer	04/17/2025

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1.0 Purpose and Scope

1.1 Purpose

The Purpose of this document is to describe how to use the Piston Stroke Indicator during a train brake test to determine if the Bogie Mounted Brake System (BMBS) or Bogie has cause for attention or not and how to inspect the Bogie and BMBS to determine what is the cause for attention.

1.2 Scope

This document is applicable to the TMB60I systems deployed on Indian Railways, with part numbers 778038, 778039, I.3.5113, I.4.2034, KP1796330 & KP1802890.

1.3 Definitions, Acronyms, and Abbreviations

BMBS	Bogie Mounted Brake System
TMB60	Truck Mounted Brake 60 (KB deployed in the USA, Canada & Australia)
TMB60I	Truck Mounted Brake 60 India (KB deployed in India)
mm	Millimeter
ø	Diameter
Kg/cm²	Kilogram per square centimeter (Pressure measurement)
BPC	Brake Power Certificate FOR AIR BRAKE (GOODS)
"	Inch measurement designator
APD	Anti Pilferage Device
Brake Block clearance	Clearance between Brake Block and Wheel with brakes released
Slack Adjuster pay-in	When the slack adjusts to shorten the cylinder
Slack Adjuster pay-out	When the slack adjusts to lengthen the cylinder

Table 1 - Definitions, Acronyms, and Abbreviations

1.4 References

Document Number	Document Title	Revision
IRCAMTECH/GWL/MECH/WMM/22	MAINTENANCE MANUAL FOR WAGONS Volume-1 (System Documentation)	2.0
WD-89067-S-9	Adapter [Narrow Jaw] Class 'E' 6"x11"	09
WD-89067-S-3	CASNUB-22N,22NLB & 22 HS Bogie Cast Steel Side Frame	18

Table 2 - References

The original document was issued in English language.

1.5 Overview

This document is written to be used together with the normal Train Brake Test Procedure, when a normal train brake system test is done on a routine basis, for example when the train brake system test is done for the "Brake Power Certificate" in Indian Railways.

This document describes checks, actions, and measurements.

The Piston Stroke Indicator for the 10" cylinders with part numbers 778038 & 778039 , I.3.5113 & I.4.2034 are only marked in red color for 63mm, where the 11" cylinders with part numbers KP1796330 & KP1802890, have Piston Stroke Indicators marked in red color for 75mm.

The Piston Stroke Indicator on 10" cylinders and on cylinders where the red color is not visible anymore should be measured to determine if the indicator has extended less or more than 75mm.

2.0 Inspection of BMBS in Bogie

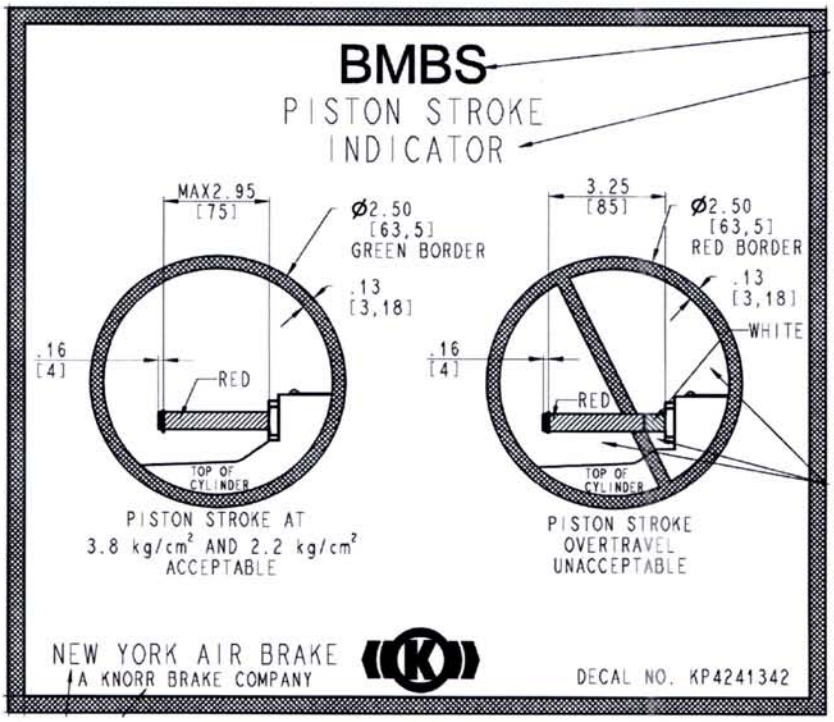

Figure 1: Piston Stroke Indicator decal

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2.1 Inspection during Train Brake test

For Empty or Loaded wagon tests with 10" cylinder and upgraded 11" Cylinder:

1) Check if the brake cylinder is cut-out/isolated or is not cut-out/isolated.

2) If the cylinder is cut-out/isolated count the cylinder as a non-working bogie brake system.

3) If the cylinder is not cut-out, check that the piston indicator retracts fully when the brakes are released. If the indicator pin does not retract fully check if the wire mesh in the breather is clogged, clean the wire mesh and re-apply and release the brakes and if the indicator pin still does not retract fully the cylinder must be replaced.

4) If the cylinder is not cut-out: Apply a Full-service brake application and inspect the piston stroke indicator.

    a. If the piston stroke indicator did not extend, count the wagon as a non-working brake system and flag wagon as requiring further attention to the overall brake control system.
    b. If the piston stroke indicator extended less than 75mm (Only red color showing), then the BMBS and the bogie has no cause for attention.
    c. If the piston stroke indicator extended more than 75mm, (Two colors showing), then make another application. If, after the second Full-service application, the piston stroke indicator extended less than 75mm (Only red color showing – See Figure 2), then the BMBS and the bogie has no cause for attention.

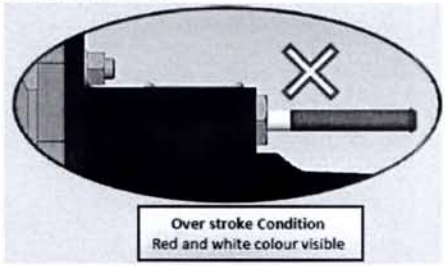

Figure 2: Piston Over Stroke Condition

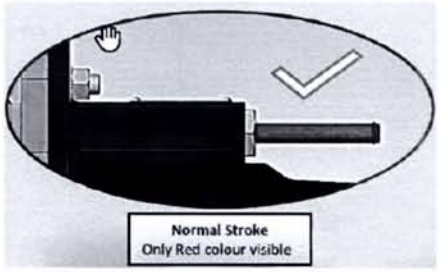

Figure 3: Piston Normal Stroke Condition

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5) If, after the second Full-service application, the piston indicator still extended more than 75mm (Two colors showing – see Figure 3), then the BMBS and the bogie have cause for attention. Check/Measure/Test the following:

   a. Check if all four (4) Brake Blocks and wheels are outside the wear limit. Replace Brake Blocks and wheels that are outside the wear limit.
   b. Check if one or more brake blocks does not touch the wheel , and check if APD's are incorrectly installed and obstructing brake levers causing brake blocks not to touch the wheels. Remove all incorrect APD's and refit correct APD's.

Figure 4: Incorrect APD fitted. APD is in contact with the primary brake beam preventing full rotation of the lever.

   c. Check the side frame unit guide pocket wear liners if broken, loose, obstructing the brake beam guide plate or obstructing the beam stop. Repair the unit guide pocket wear liners where necessary. After the repair use the side pocket gauge and check free movement of gauge in the liner.

Loose. Skew Fitted. Bent bottom Lip.

Figure 5: Incorrect side pocket wear liner fitment.

d. Visually inspect the adapter:
   - If found cracked, broken, remove from service.
   - If found displaced, remove from service.
   - If the retaining nut and bolt is missing on a wide jaw bogie, remove from service.

e. Measure the side frame pedestal jaw thrust lug surface for wear and repair the side frame if necessary.

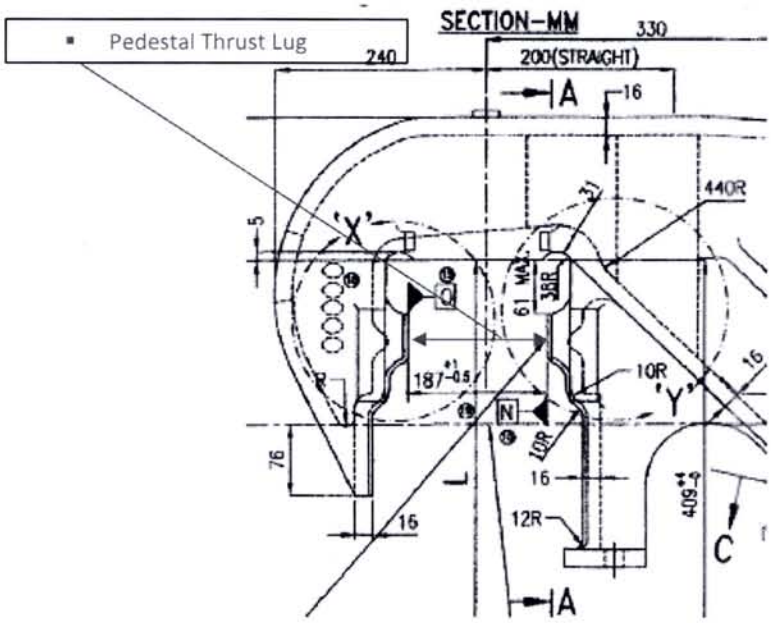
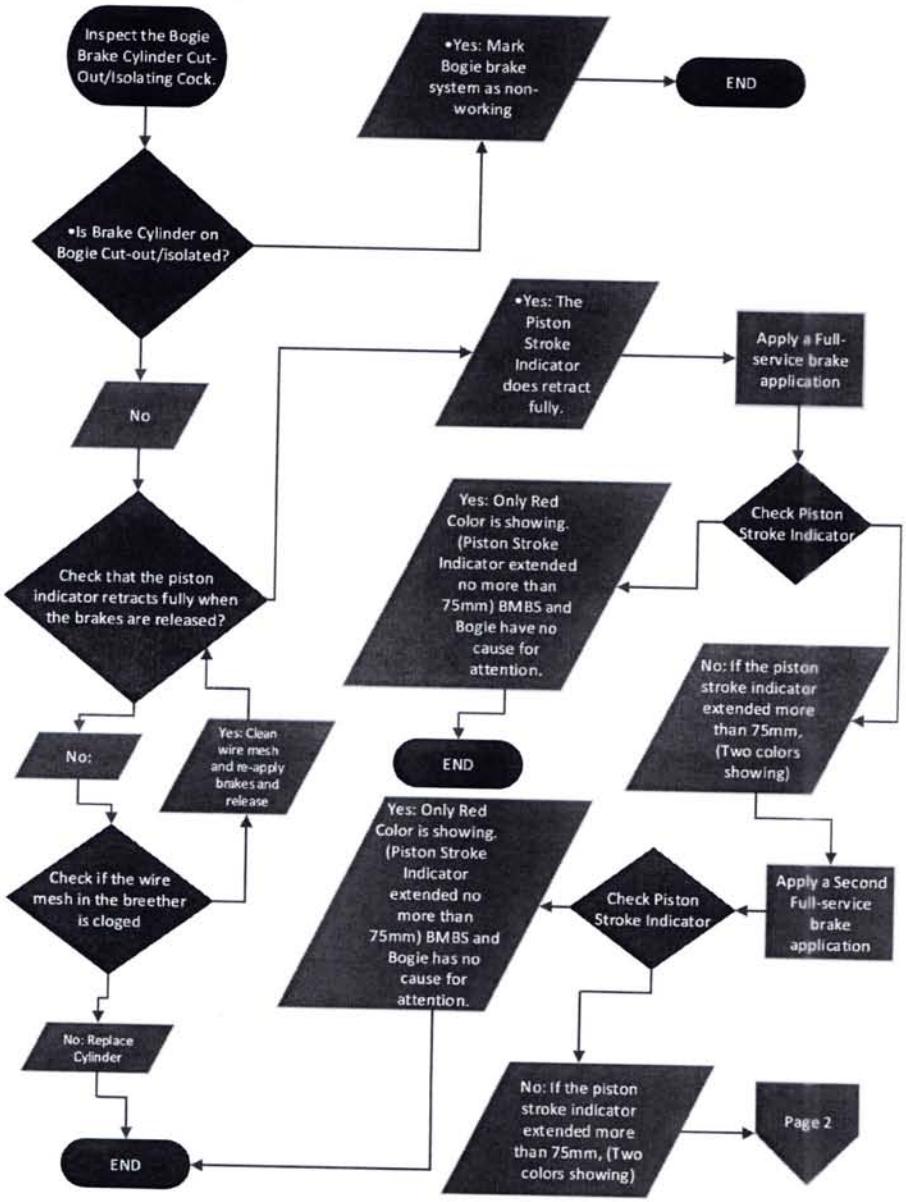


Figure 6: Side Frame Pedestal Jaw Measurements

f. Test the Slack Adjuster in the cylinder:
   - Release the Full-Service Brake application on the wagon.
   - Pull the brake block clearance to one block with a bar, without compressing the Slack Adjuster. (Slight Slack Adjuster compression is acceptable)
   - Place a spacer, 25mm thick (Wood Block) between brake block and wheel.
   - Apply a Full-Service Brake application and check if the wood spacer is gripped tight between the brake block and wheel, then release the application and pull the brake block away from the wood spacer to test if the Slack Adjuster paid-in to accommodate for the wood spacer. The Slack Adjuster must create the correct brake block clearance again with the spacer in-between the brake block and wheel.
   - Remove the wood spacer and reapply a Full-Service Brake application, check that the Slack Adjuster paid-out by checking that the brake blocks are tight against the wheels.
   - If the slack does not pay-out or pay-in then the cylinder must be replaced.

2.2 Flow Diagram



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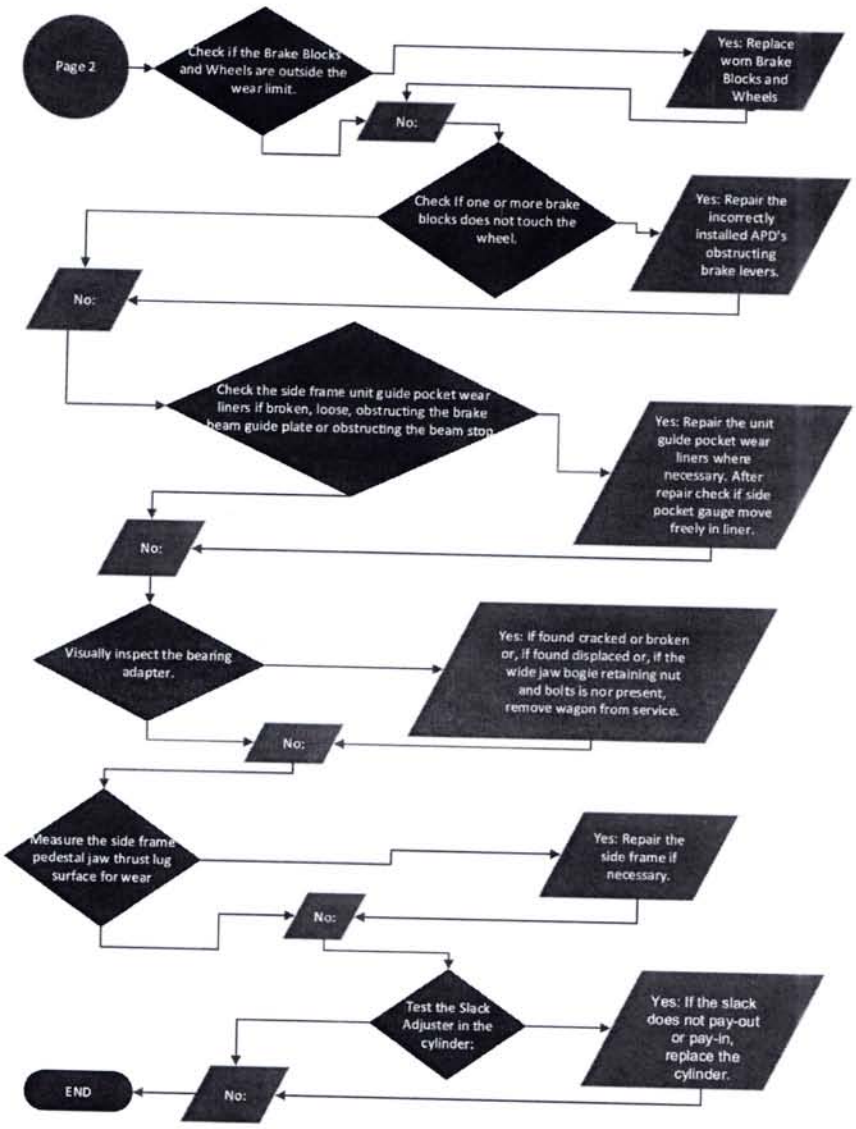

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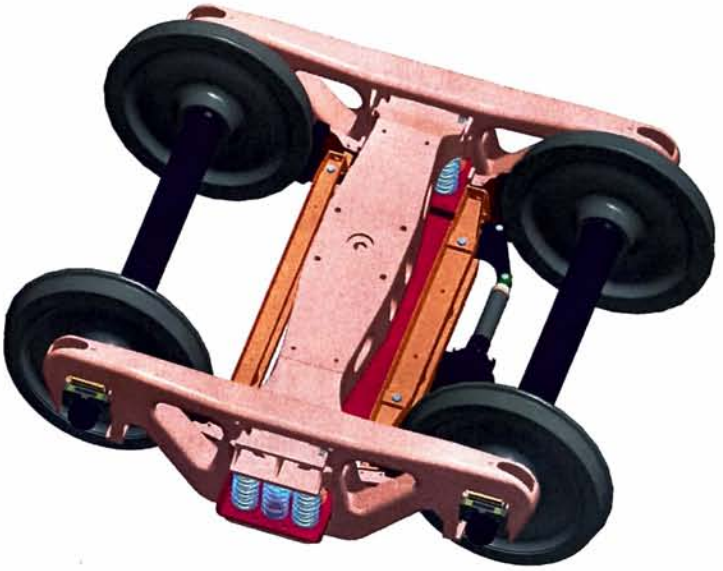
Bogie Mounted Brake System (BMBS) For Freight Cars Fitted With Upgraded 11" Brake Cylinder



Description and Maintenance Manual

This manual is divided into three different Sections as following:

- Section– A: Description and Maintenance Manual of BMBS
- Section- B: Description and Maintenance instructions for Bogie Mounted Brake Cylinder 11".
- Section- C: Description and Maintenance Instructions for APM (EL - 60).

Section-A: DESCRIPTION AND MAINTENANCE MANUAL OF BMBS

CONTENTS

GENERAL DESCRIPTION

Existing 10" Brake cylinder is being upgraded to 11". The BMBS equipment (see figure-1) consists of a transversely mounted pneumatic actuator (11" 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 actuator is 11" 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 actuators (one per bogie) to deliver reliable braking performance and is light in weight. It fits into any standard IR casnub bogie and uses 58mm 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.

Any Brake cylinder reaches end of stroke indications (i.e. piston indicator stroke 85 mm) or brake block not touching the wheel during brake application found during regular checks should be mandatorily reported. A Decal / Sticker (KB part no KP4241342) for the 11" Brake cylinder Piston indicator stroke would be pasted on the wagons.

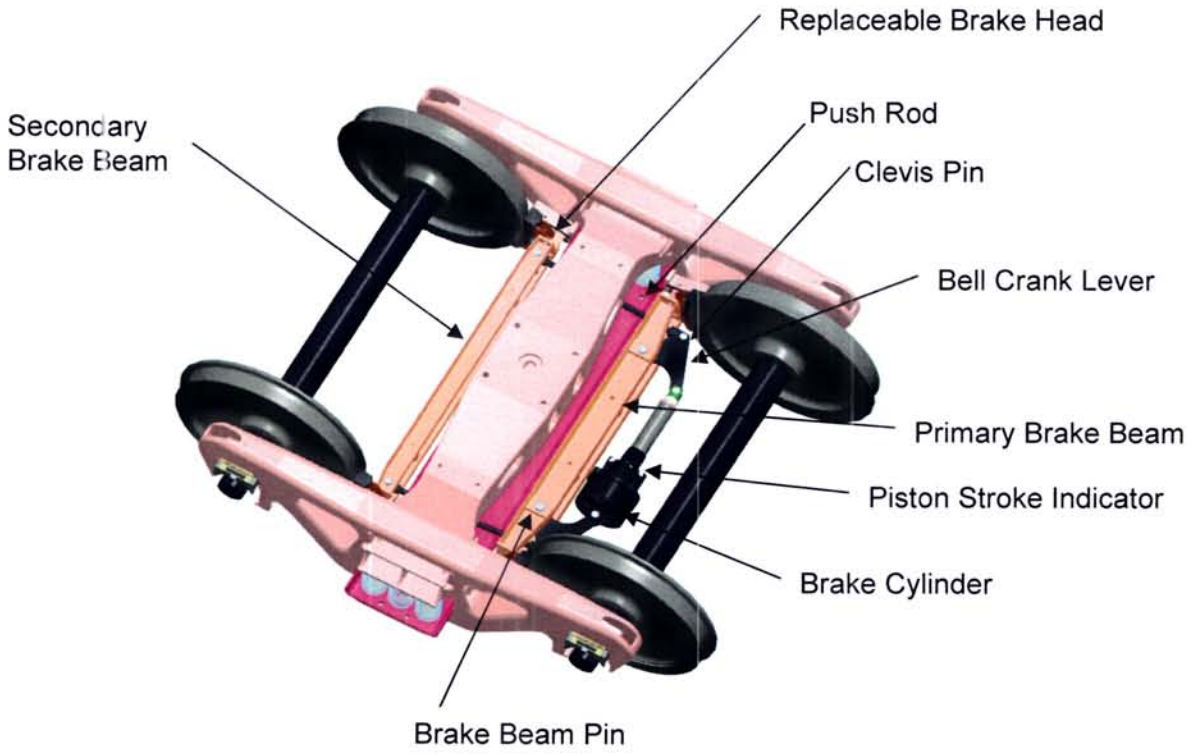


Figure 1

WORKING DESCRIPTION OF BMBS

(Refer figure 2.)

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 (which is on primary brake beam) 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.

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 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.

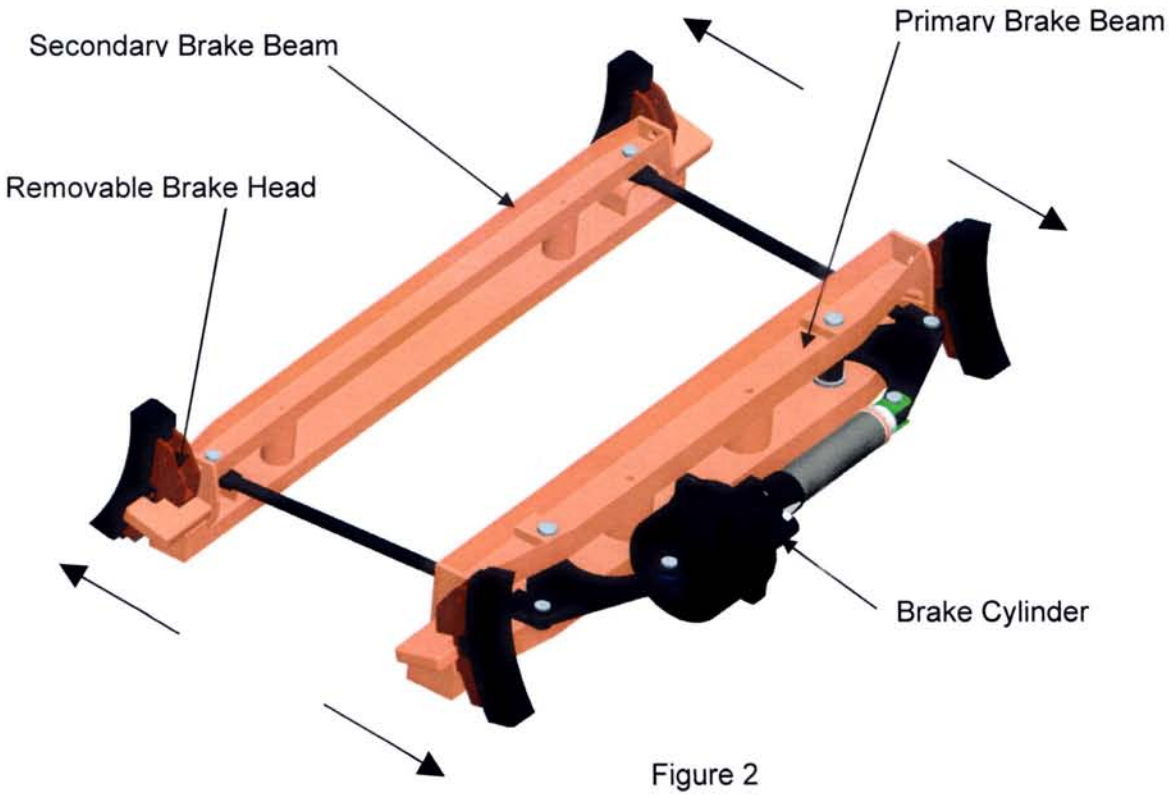


Figure 2

FEATURES

- The system can be easily fitted on any IR standard Casnub bogie without making any modifications. This is a drop in fit system and does not require any special tools and training for installation/assembly.
- To achieve uniform wheel loading, the loads are applied to the ends of the brake beam instead of center.
- The system uses IR standard 58mm 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.
- 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.
- The integral double acting slack adjuster of the brake cylinder maintains a constant piston stroke. The slack adjuster has a total make-up capacity of 500mm, which will compensate for total combination of shoe wear, wheel wear and clearance.
- Re-screwing of slack adjuster is automatic and can be done from the side of the wagon by a pry bar.
- All cylinders are equipped with an automatic piston stroke indicator.
- The hand brake systems uses two steel handbrake 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.
- The system also has an automatic pressure modification (APM) device (EL-60 valve) for two stage braking (empty / loaded). It is fitted between wagon under frame and the bogie side frame.
- To identify visually, 2" wide red colour Tape / Paint strip is pasted on the guide tube (NPH assembly) of 11" Brake cylinder.
- A Decal / Sticker (KB part no. KP4241342) for the 11" Brake cylinder Piston indicator stroke would be pasted on Wagons.

AIR BRAKE SYSTEM WITH 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. 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 sketches 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/cm^2 through the compressor of the locomotive. Brake pipe is charged to 5 kg/cm^2 through the compressor of the locomotive. Feed pipe is charged to 6 kg/cm^2.

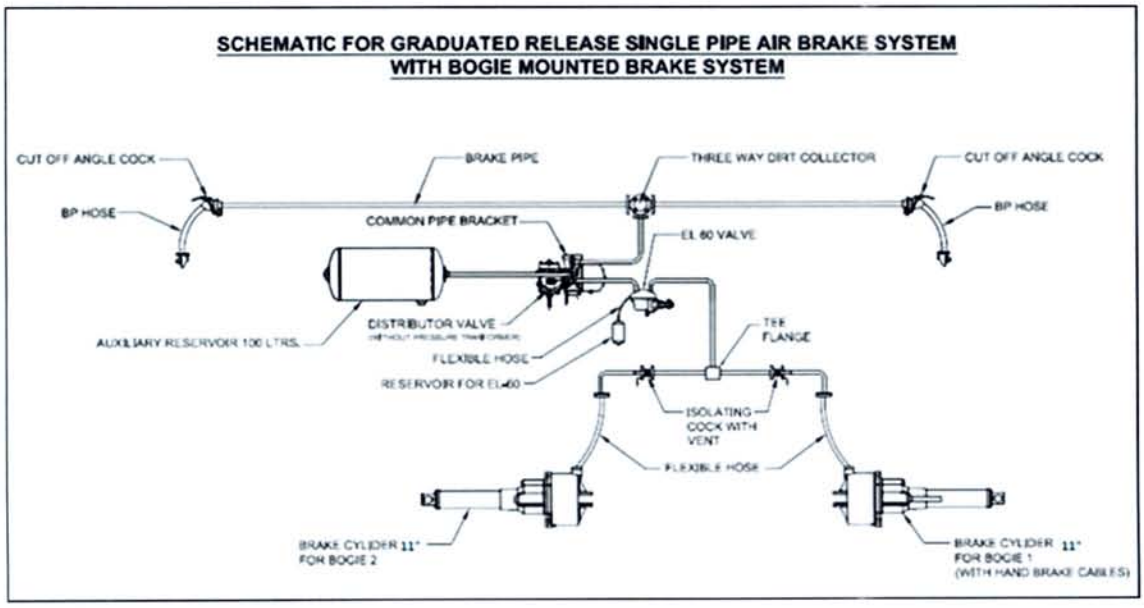
The wagons are provided with automatic pressure modification (APM) device EL-60 valve to cater for higher brake power in loaded condition instead of the conventional manual empty load device.

With the provision of this, brake cylinder pressure of 2.2 ± 0.25 kg/cm^2 is obtained in empty condition and 3.8 ± 0.1 kg/cm^2 is obtained in the loaded condition.

To obtain this a changeover mechanism, APM under-frame and side frame of the bogie. The mechanism gets actuated at a pre-determined change overweight of the wagon and changes the pressure going to the brake cylinder from 2.2 ± 0.25 kg/cm^2 to 3.8 ± 0.1 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 APM device (EL-60 valve) and thereby applying the brake.

SCHEMATIC FOR GRADUATED RELEASE SINGLE PIPE AIR BRAKE SYSTEM WITH BOGIE MOUNTED BRAKE SYSTEM

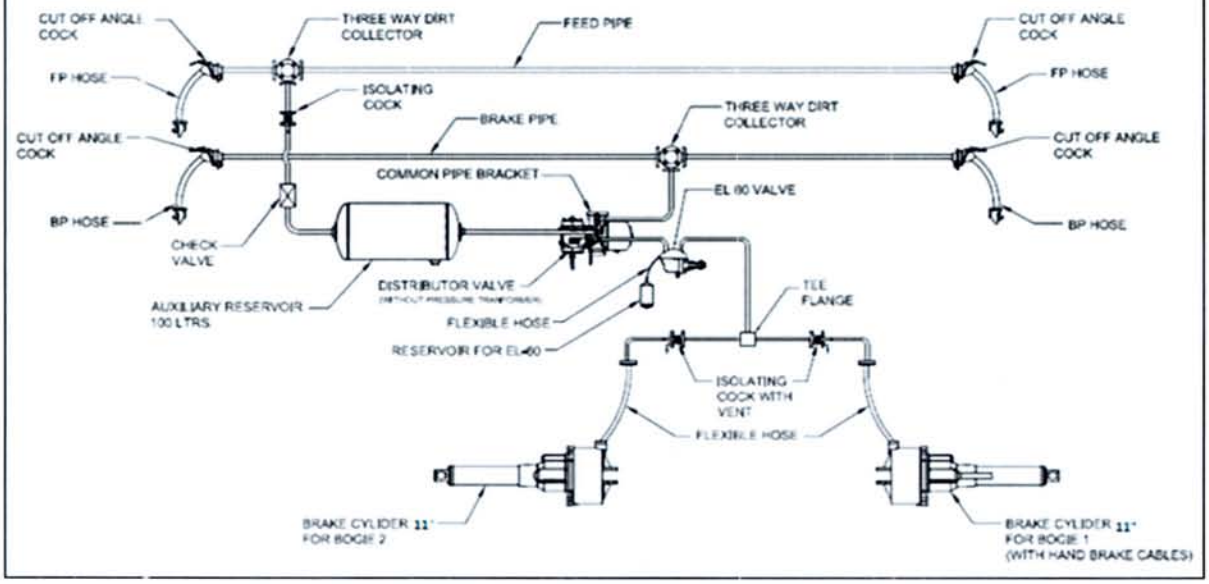


The distributor valve gives an output pressure of 3.8 kg/cm² for the brake cylinder which is routed through the APM device (EL-60 valve). Based on the position of sensor arm of APM device (EL-60 valve), it gives an output of 2.2 ± 0.25 kg/cm² for empty position braking and an output of 3.8 ± 0.1 kg/cm² 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 brake cylinder 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. 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 result 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/cm², the brake cylinder pressure exhausts completely and the brakes are completely released.

SCHEMATIC FOR GRADUATED RELEASE TWIN PIPE AIR BRAKE SYSTEM WITH BOGIE MOUNTED BRAKE SYSTEM



DESCRIPTION OF EQUIPMENT'S

Distributor Valve with Common Pipe Bracket and Control Reservoir

The distributor valve assembly consists of distributor valve, common pipe bracket, adapter, control reservoir and gasket. All pipe connection to distributor valve is through the common pipe bracket. The distributor valve along with the adapter can be removed from the pipe bracket without disturbing the pipe connection for maintenance purpose.

The control reservoir of 6 Liters volume is directly mounted to the pipe bracket. An isolating cock (R-charger handle) is provided on the distributor valve to isolate the distributor valve when found defective. The handle of the R-charger will be placed in vertical position when the distributor valve is in open position and horizontal when the distributor valve in closed position. A manual release handle is provided at the bottom of the distributor valve by which the brake in a particular wagon can be released manually by pulling the handle.

The distributor valve used with bogie mounted brake system has a different set of Application & Release chokes to achieve the timings as specified in the RDSO specification 02-ABR. The choke sizes to be used for Distributor valve fitted on wagons with BMBS for KE Version of distributor valve are 1.42 mm for Application & 1.52 mm for release. The other makes of distributor valves should be adopted with suitable choke sizes to achieve Brake Application & release timings as specified in 02-ABR but with a stroke of 110mm of 14" Brake Cylinder. For identification, the Distributor Valve is equipped with a name plate " BMBS " on choke cover.

Brake Cylinder with built-in Double acting Slack Adjuster

The brake cylinder receives pneumatic pressure from auxiliary reservoir after being regulated through the distributor valve and APM device (EL-60 valve). Brake cylinder develops mechanical brake power by outward movement of its piston with ram assembly.

The piston rod assembly is connected to the brake shoes through a system of rigging arrangement to amplify and transmit the brake power. The compression spring provided in the brake cylinder brings back the Piston thus the rigging is also brought to its original position when brake is released.

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 brake cylinder has got a double acting slack adjuster as a result the actuator of brake cylinder will continue to move out till all the slack in the system is take care off and reaction force of the wheels is encountered.

The brake cylinder compensates for any change in gap between brake block and wheel through the inbuilt slack adjuster. Therefore, it maintains a constant gap between the shoe and wheel. The slack adjuster works in both the condition whether there is an increase or decrease in gap.

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 (i.e., wheel dia. reduces 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. The brake cylinder with hand brake cables is used for interface with the hand brake arrangement on the wagons.

Brake cylinders are provided with dirt protection caps. It should be removed only when making connection with hose and after removing the cap, same bolts are to be used to connect the BC Hose with the Brake Cylinder.

Dust protection cap

APM Device (EL-60 valve)

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 brake cylinder pressure coming from the Distributor valve to 2.2 ± 0.25 kg/cm^2 in empty condition of the wagon and allows the brake cylinder pressure of 3.8 ± 0.1 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.

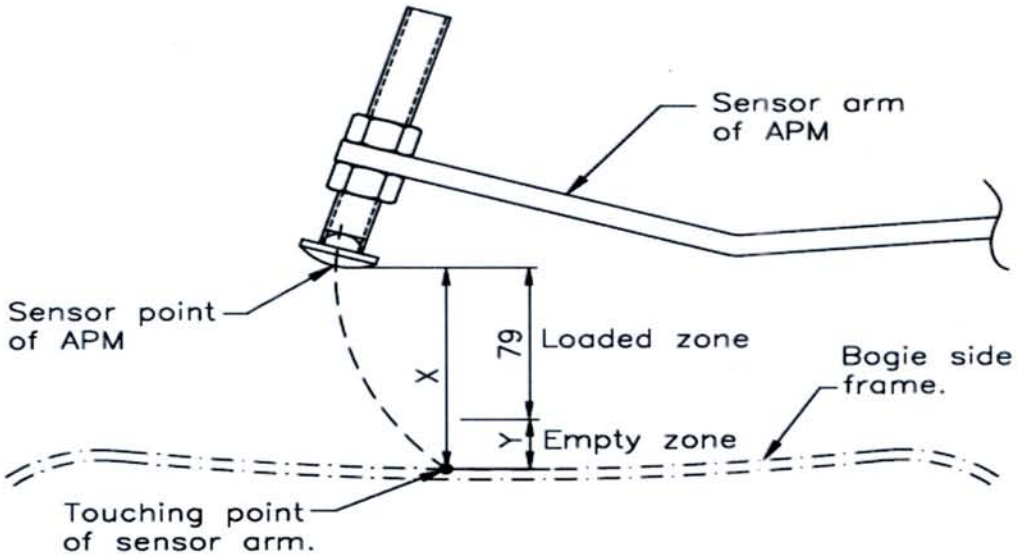
The factory setting for the movement of the sensor point is 104 mm which is consisting of loaded and empty zone. First 79 mm of the sensor point is for the loaded zone and the balance is for the empty zone. After 79mm movement, changeover from loaded to empty takes place. For each wagon, the changeover from empty to loaded has to be aligned to this valve.

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 ± 0.25 kg/cm². When there is no indication in the indicator, it is loaded condition with 3.8 ± 0.1 kg/cm² going to the brake cylinder. It has a quick connect nipple to connect the gauge to the check the pressure through the pressure gauge.

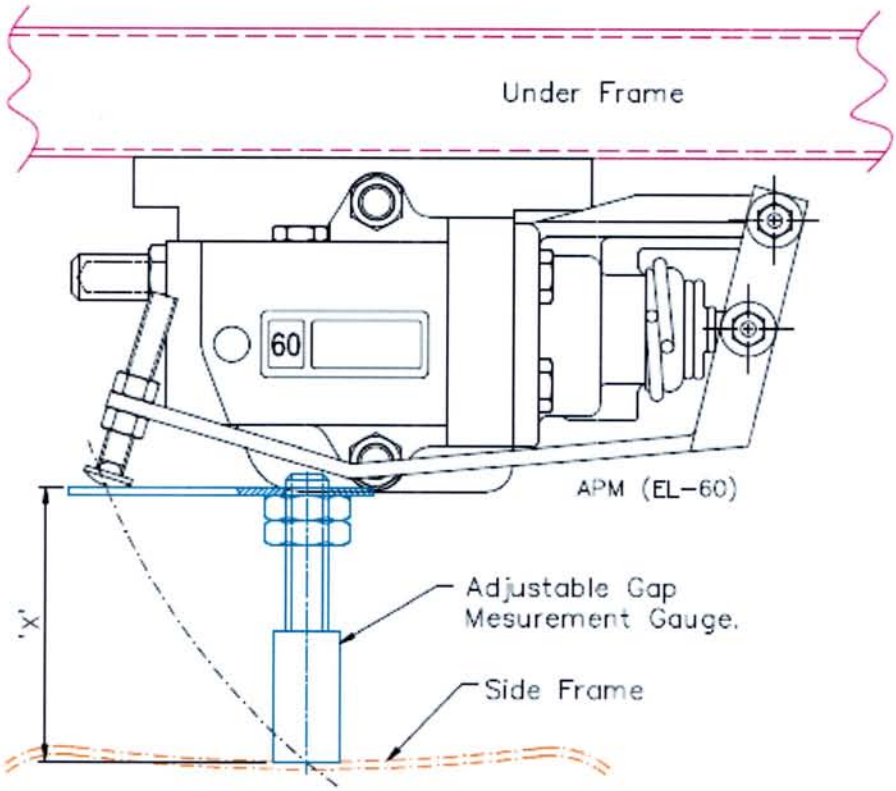
A pressure gauge can be connected via two methods:

1. Quick Connect Coupling with pressure gauge arrangement (KBI Part no. KND-00134) directly with the quick connect nipple provided in the EL-60 valve. Detail of KND-00134 is given under title of Special tools & gauges required during the maintenance at page 35.
2. We also can connect the pressure gauge with the EL-60 after removing the quick connect nipple. There is ¼" NPTF tapping in the housing of EL-60 valve.



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 & changeover weights of the wagon.

To check the load pressure in Empty Wagon, Kindly place a block of 25 mm thickness between the sensor point of APM and Side frame of bogie.



Auxiliary Reservoir

An auxiliary reservoir of 100 liters is provided on each wagon to store compressed air. It is charged to 5 Kg/cm^2 pressure through the distributor valve in case of single pipe system. However, in case of twin pipe system, it is charged to 6 Kg/cm^2 through the feed pipe.

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

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.

Hose Coupling for Brake / Feed pipe

The hose couplings are provided to connect brake pipeline & feed pipeline 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.

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.

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.

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.

Pipes

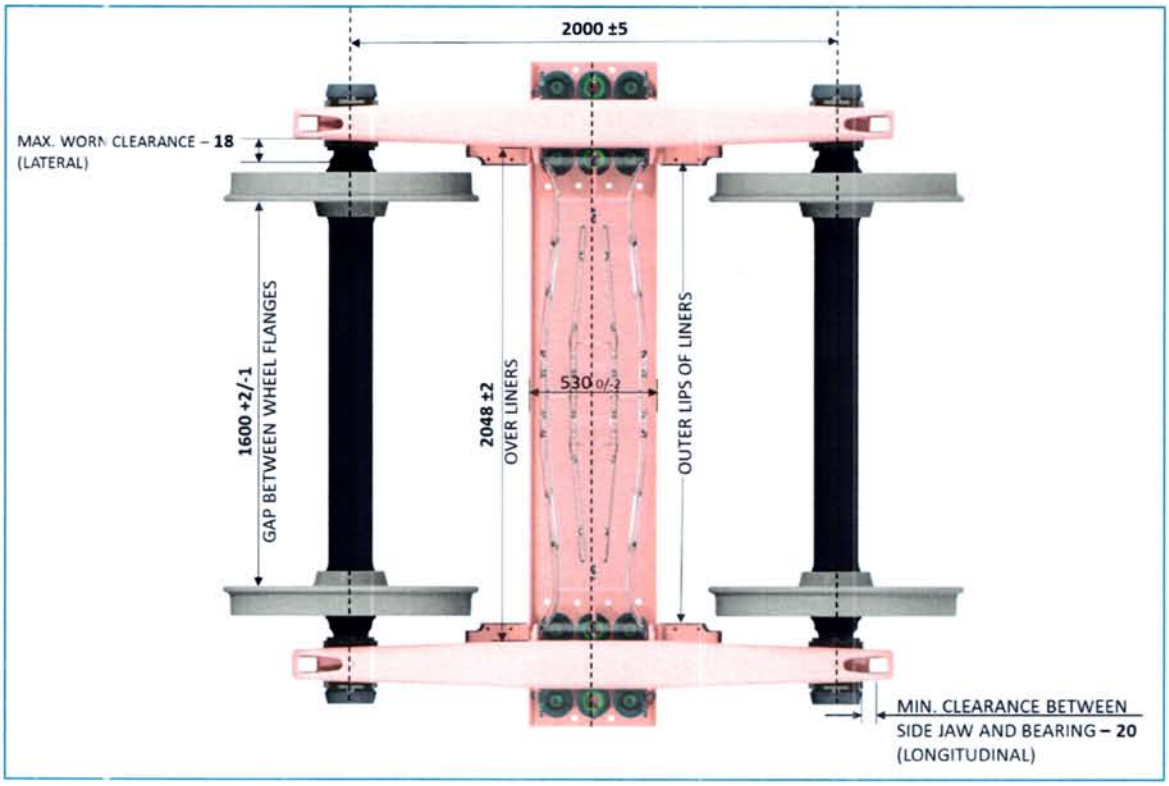
ERW stainless steel pipes as per RDSO specification 04-ABR are used for wagons with Bogie Mounted Brake System. Pipes of 32 & 20 mm nominal bore are generally employed. The pipes are cold bend with the help of bending equipment. The radius of the bends is to be kept to the maximum possible so as to reduce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

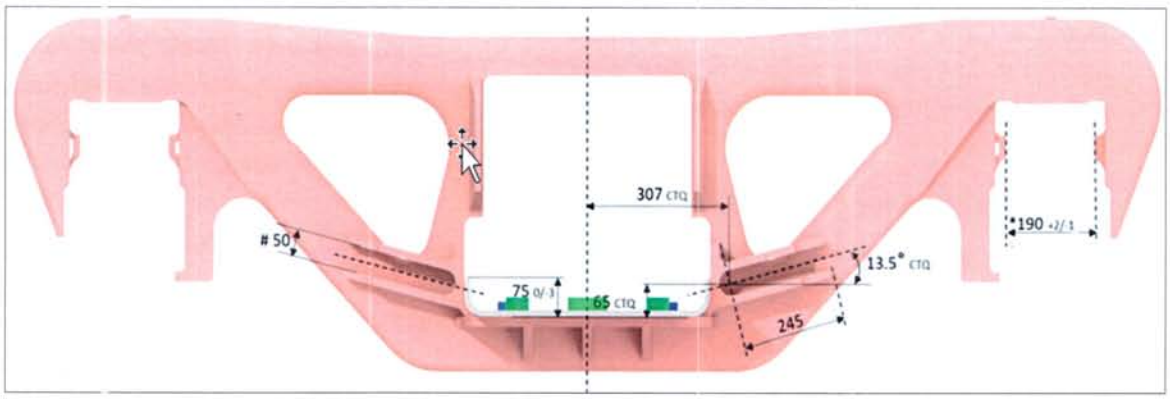
Pipe fittings

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.

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 to be checked before fitment and maintained during maintenance. (All dimensions are in mm)





Note: No fouling of Push Rod assembly with any contact surface during any condition of Bogie is allowed.

All dimensions are in mm.

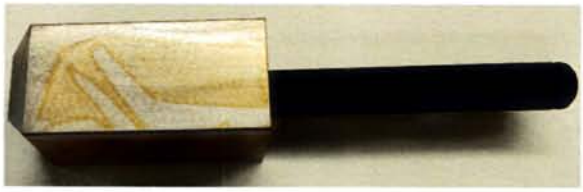
*Refer RDSO drg.no. WD-89067-S-03 Rev. 18.

Side frame pocket guides (Casting)-The side frame unit guide pocket must be gauged for depth width and length and must be free from casting protrusions. The holes in the side frame unit guide pocket must also be gauged for position and size and must be open and free from casting material or sand cores.

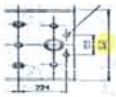
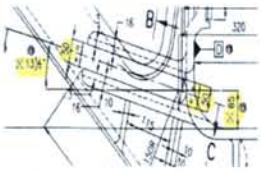
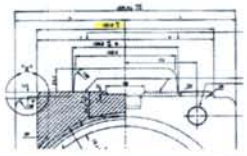
CTQ – Critical to Quality

Side pocket Gauge for checking bogie liner gap:

To ensure correct shape & size of CASNUB bogie liner gap, A special Side pocket Gauge (KBI Part no. KN0011151) should be move freely to the complete depth throughout the length. Image of Side pocket Gauge is shown below:



Important dimensions of Casnub bogie for BMBS:

S.no.	Item description	Reference Drawing no.	Snap shop of Critical Dimensions	Description	Specified Value (mm)
1	Spring Plank Bogie details (CASNUB 22W, CASNUB 22W[M], NL & NLB Bogie)	SK-69594		Spring Plank width	530 +0/-2
				Spring Plank height	75 +0/-3
2	Wheel & Axle Assembly (22.9t Axle load)	WD-89025/S-1		Distance between Wheel Flanges	1600 +2/-1
3	Cast Steel Side Frame (CASNUB - 22NL, 22NLB & 22 HS Bogie)	WD-89067/S-3		Dimesion of Side frame Jaw	190 +2/-1
				Distance between the side frame center to center of side fram pocket	307
				Angle of Side Frame Pocket	13.5°
				Side Frame Pocket gap height	50
				Distance between Spring Plank to center of Side frame Pocket	65
4	Adaptet [Narrow Jaw]	WD-89067-S/9		Dimension of bearing adoptor	181 +2/-0

INSTALLATION OF BMBS ON BOGIE

Tools Required

Pry Bar, Pliers, hammer.

Installation Procedure

Refer figures 3, 4, & 5 for Installation of Equipment and its adjustments.

1. To install the beams, it is necessary to split the bogie. Lift the bolster and move the axles with wheels outside the side frame. Slide the primary beam assembly 3 inside the side pockets in the side frame. Place the bell crank levers 5 & 6 in the primary beam assembly 3. Push the Pin 9 through the beam 3 and bell crank levers 5 & 6. Bend the bulb cotter 14 after inserting inside the Pin 9. Slide the secondary beam assembly 4 inside the side pockets on the other side.
2. Install the push rods 7 between the bell cranks and the secondary beam 4. Secure the push rods to the secondary beam with the pin 10 and bulb cotter 14.
3. Secure the push rod 7 with bell crank levers with pin 8 and bulb cotter 14 on primary beam sides.
4. Attach the Brake Cylinder 1 or 2 to the bell crank levers with two sets of pins 11, bush 19 and dowel sleeve 20 after aligning the mounting holes in the brake cylinder and the bell crank levers.

Note

a. Air connection flange and Ram of brake cylinder 1 or 2 to be oriented / fitted as per the Air Brake Equipment and Under Frame Gear Arrangement drawings. Cylinder with hand brake is to be installed considering the location of Cable Bracket.
b. Brake cylinder 1 or 2 ram should be in fully retracted position prior to installation.

5. Place the brake heads 16 on the guide plates of the brake beams 3 & 4. Secure the brake heads to brake beams with pin 12 and lock the same with cotter pin 13. Don't forget to place the washer before bending the cotter pin. After bending the cotter pin, tack weld the same with washer.
6. Assemble the bogie by lowering the bolster with side frame on the axle and wheel assembly.
7. Install new 58mm K-type brake shoe to beam assemblies (3 & 4) on brake heads 16. Insert brake block keys 17 to hold brake blocks to the removable brake heads.
8. Connect flexible air hose 20 from BC pipeline to the flange on top of brake cylinders 1 & 2.

For Brake cylinders with Hand Brake Cables

9. Bracket for cable end support is welded to a convenient place on the under frame of the wagon such that the bend radius of the cables is not less than 255 mm. (Refer under frame equipment installation drawings of the concerned wagon).
10. Attach the cable conduits to the cable bracket (welded on the under frame of the wagon) by placing one nut and one washer on each side of cable bracket.
11. Tighten the lock nut to secure the cables to the bracket properly.
12. Connect both cables on the brake cylinder to the cable equalizer 27 using pins 28 and cotter pins 29.

Hand brake rigging

13. Handbrake system requires a set of rigging between cable equalizer 27 and the handbrake wheel as per requirement of particular type of wagon.
14. Apply brakes 2-3 times from SWTR to ensure correct piston stroke is achieved. Release air pressure.

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.

Adjustments

Adjustment is completely automatic and is accomplished by the in-built slack adjuster. The slack adjuster in the brake cylinder is double acting. It automatically maintains a constant piston stroke by taking up or letting out slack with each brake application. The piston stroke indicator is mounted on top of the non-pressure body of the brake cylinder (See figure 1). The extension of the brake cylinder ram will increase as the shoes and wheels wear. On a wagon in service, it will be clearly visible as a shiny ring near the ram scraper on the cylinder.

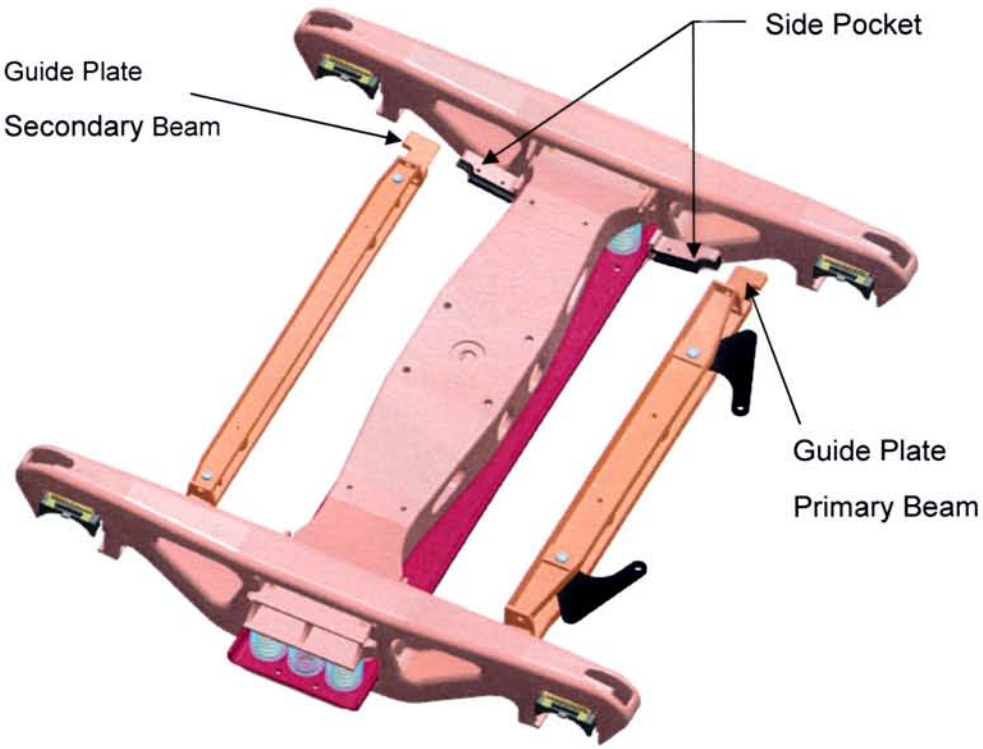


Figure 3

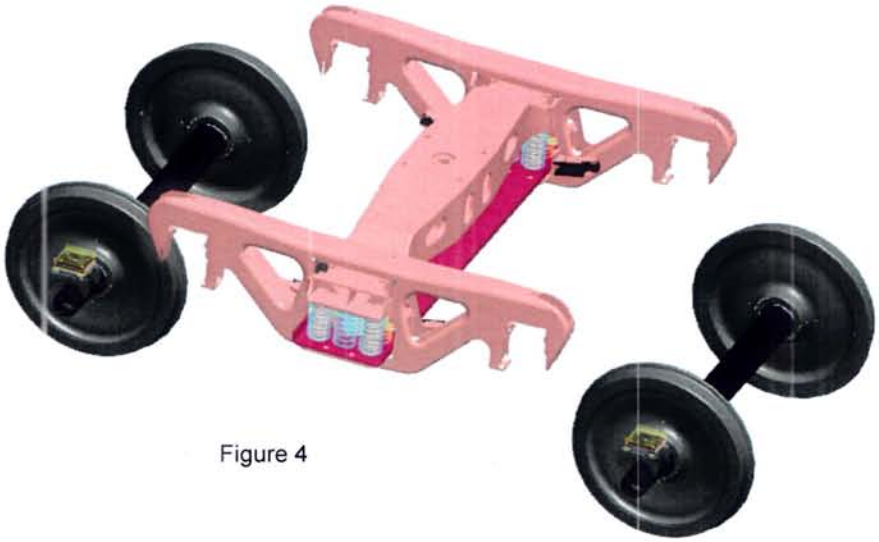


Figure 4

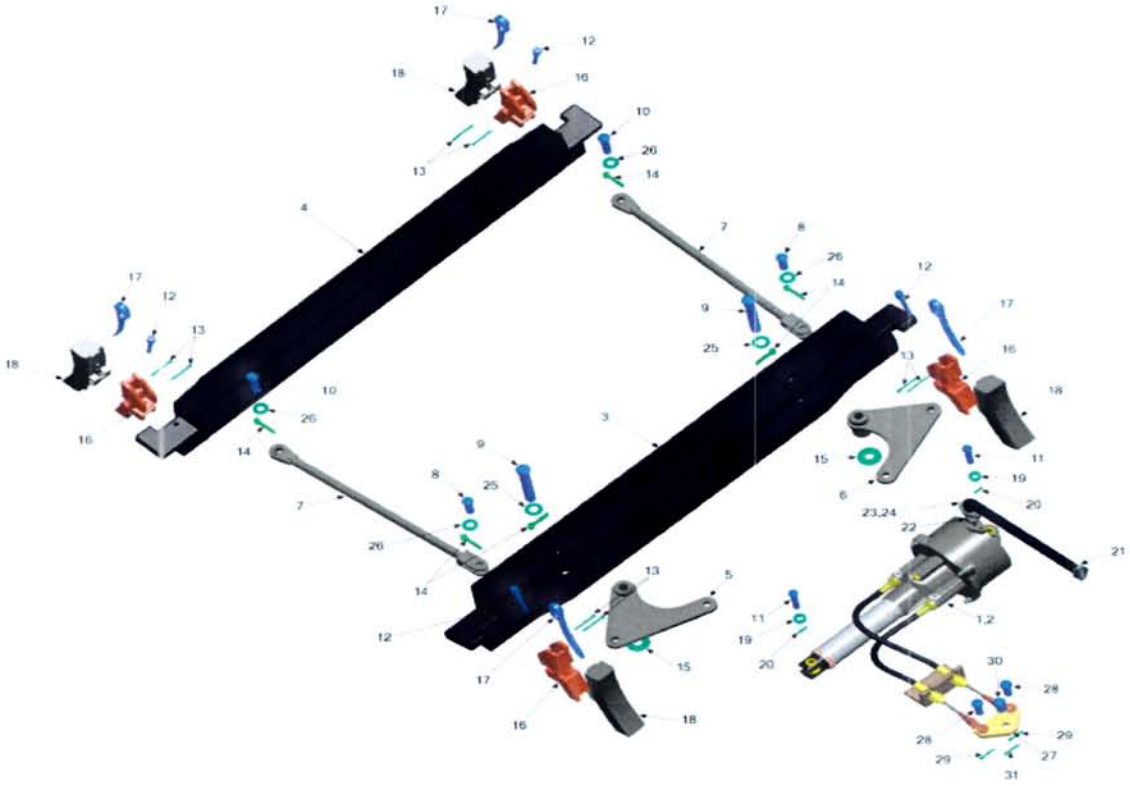


Figure 5 (Bogie with BMBS Arrangement)

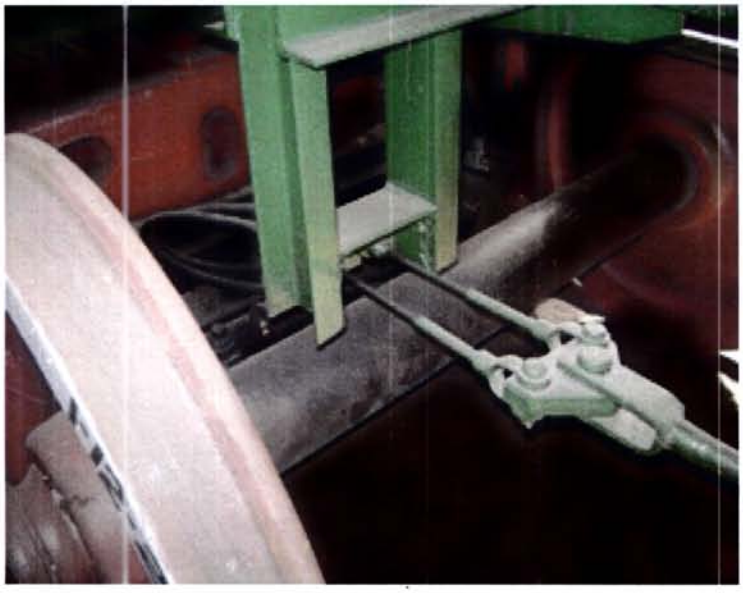
List of BMBS Parts after upgraded 11" Brake cylinder

S. No.	Part Description	KB Part No.	Qty / Wagon
1	Cylinder Assembly without Handbrake Cables	KP1796330	1
2	Cylinder Assembly with Handbrake Cables	KP1802890	1
3	Primary Brake Beam with Beam stops	I.3.5111	2
4	Secondary Brake Beam with Beam stops	I.3.5112	2
5	Lever Assy; Right Hand	I.3.5108	2
6	Lever Assy; Left Hand	I.3.5109	2
7	Push Rod Assy	I.3.5110	4
8	Pin; Clevis (Push Rod)	C162088	4
9	Pin; Clevis (Primary Brake Beam)	C162086	4
10	Pin; Clevis (Secondary Brake Beam)	C162087	4
11	Pin; Clevis (Brake Cylinder)	778111	4
12	Pin; Brake Head	778112	8
13	Pin; Cotter Ø 6.3 X 90 (Brake Head)	476858	16
14	Bulb Cotter	C162098	12
15	Washer;	778084	4
16	Brake Head;	778113	8
17	Brake Block Key*	I.F.2172	8
18	'K' – Type Brake Block*	I.F.1217	8
19	Bush	C140445	4
20	Dowel Sleeve	C140446	4
21	Hose Assy. 1" With Flange	I.4.2036	2
22	O-Ring	A27763/17	2
23	Screw, Hex Head; Zinc Plated	748645	8
24	Washer, Lock; Cad Plated	735734	8
25	Washer	C162060	4
26	Washer	C162641	8
27	Equalizer; Cable	776622	1
28	Pin; Cable	776621	2
29	Split Pin (BMBS)	I.4.2063	2
30	Pin Tie Rod	I.3.2044	1
31	Split Pin (BMBS)	I.4.2062	1

**Item is not in the KB Scope of supply.*

Procedure to connect the Hand Brake Cable with the Cable Equalizer and Tie Rod

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



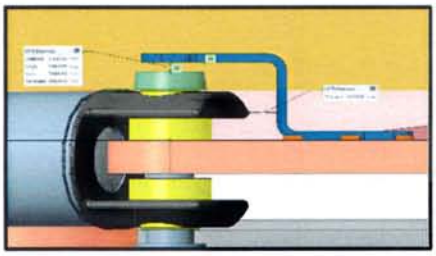
7. Apply service brake to check that during the service brake application, cables should not move/bend.
8. Secure the cable pins and tie rod pin with the APD.

APDS TO BE PROVIDED ON BOGIE MOUNTED BRAKE SYSTEM

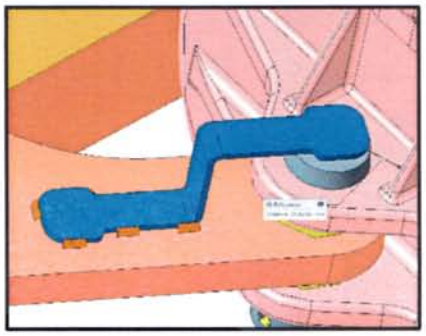
On Brake cylinder Pins

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

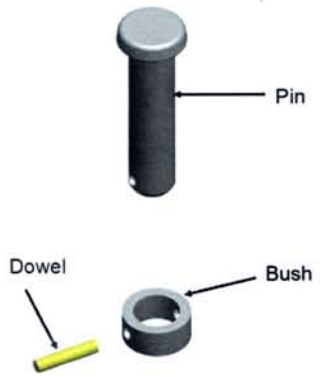
Brake Cylinder Front End



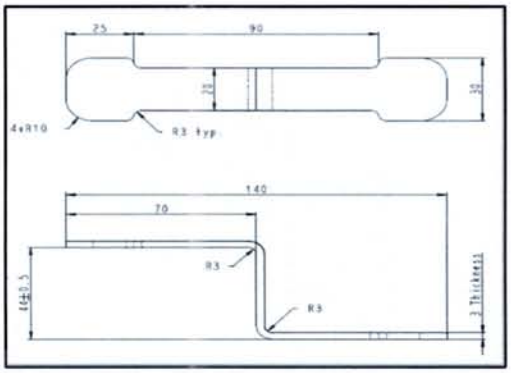
Brake Cylinder Rear End



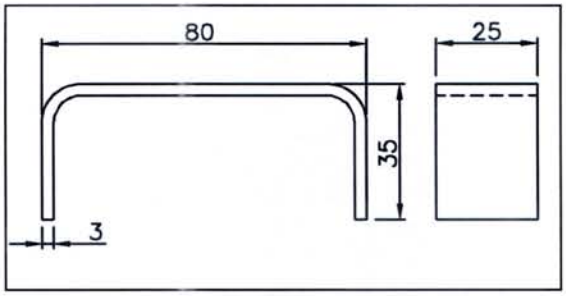
Exploded view of Assembly



APD for Brake cylinder



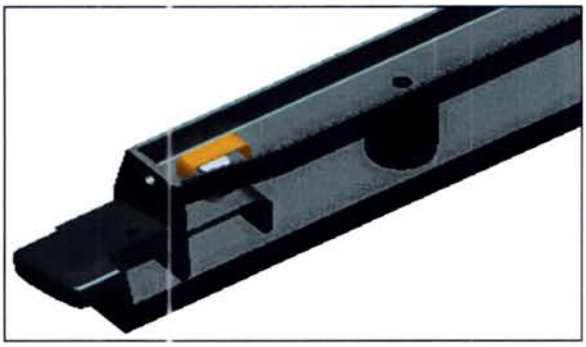
APD for Primary & Secondary Beams



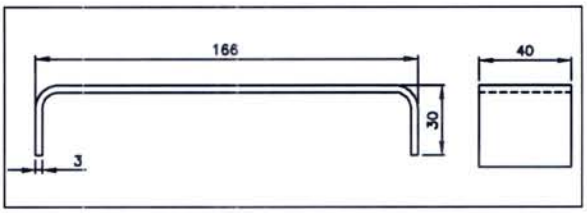
APD on Primary Beams

APD on Primary Beams

APD on Secondary Beams

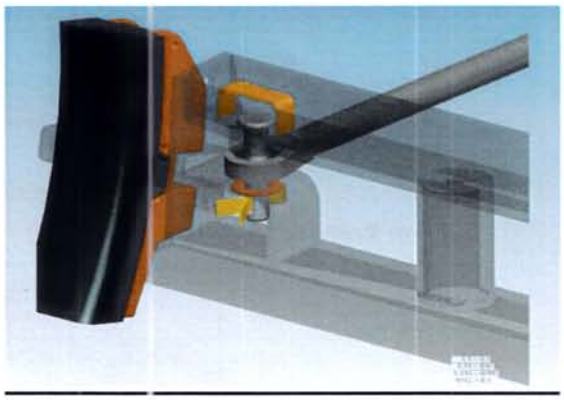


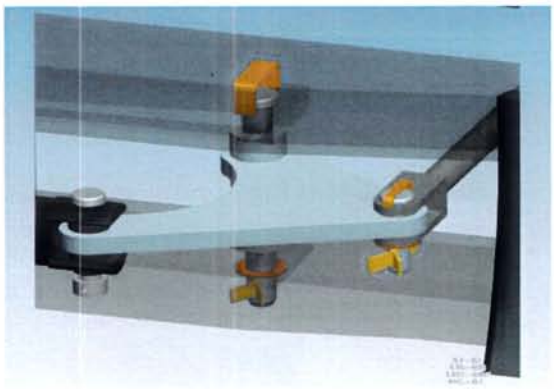
APD for Cable equalizer



APD for Push Rod

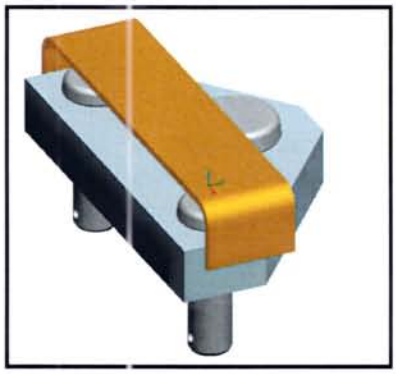
APD on Secondary Beams

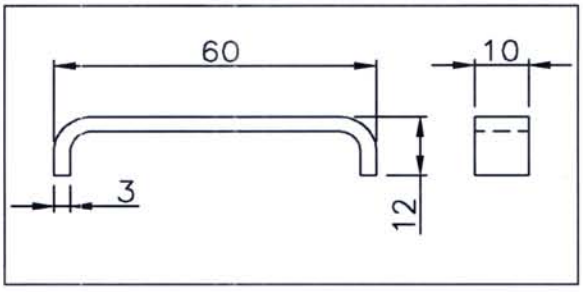




APD on Push Rod

APD on Cable Equalizer

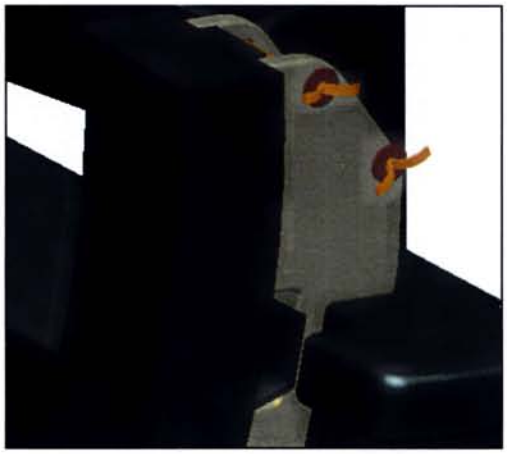




Note: Kindly ensure that oversize APD's should not be used at all, as it may infringing with the movement of Bogie rigging & seriously impact its functionality

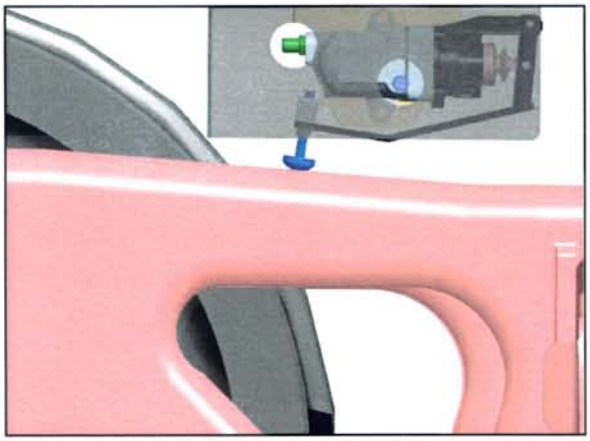
On Brake Head Pin

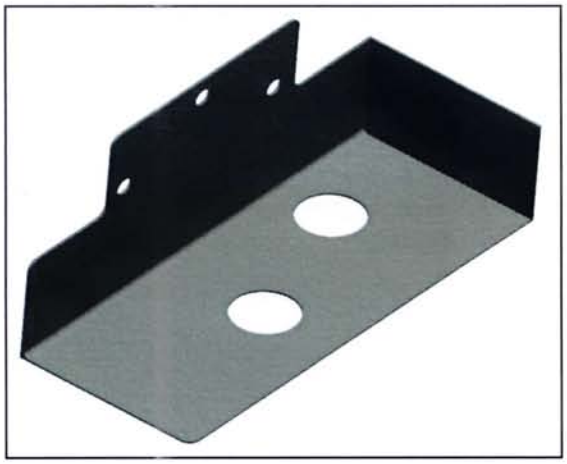
Split pins over the brake pin have to be Tack welded with washers as shown below.



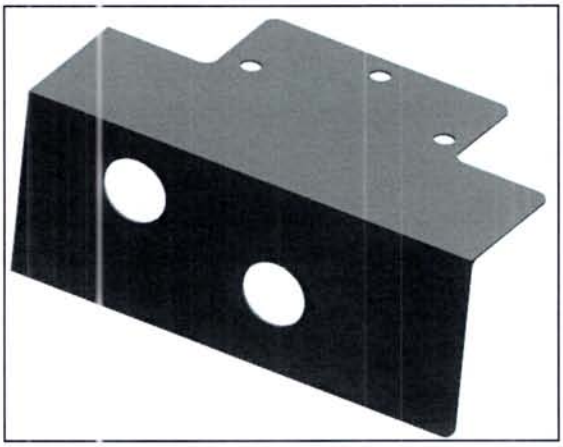
Washer Details
OD 20 mm
ID 8 mm
Thickness 2-3 mm

APD on APM Device (EL-60 valve)

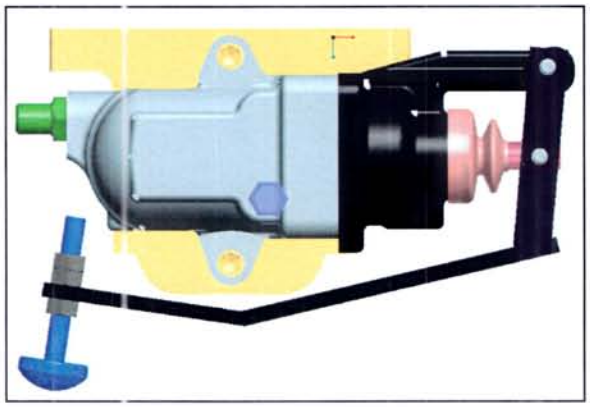




APD for APM Device (EL-60 Valve)



Lock nut on sensor arm



Additional Lock nut has to be provided on the sensor arm screw after the Gap has been adjusted.

DO'S & DON'TS FOR KB BOGIE MOUNTED BRAKE SYSTEM

Do's

Bogie Rigging

- ✓ Do ensure that the fitment dimensions in Bogie, critical for fitment of BMBS are maintained within their specified limits.
- ✓ Do ensure that the side frame pockets are of correct dimension and free of all restriction.
- ✓ Do ensure that all the side frame pocket liners are properly cleaned & are within the specified limits.
- ✓ Do ensure that Side pocket gauge shall move freely throughout complete depth & the length of Bogie pocket liner.
- ✓ 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 to check the gap between side frame & bearing adopter in every inspection & maintained it within specified limit.
- ✓ Do ensure that correct shape & size of 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.
- ✓ Do ensure to regularly check the Piston stroke indicator during every routine inspection. Take necessary action if the stroke is beyond the specified limit. Any over stroked (>75 mm) Brake cylinder, brake block not touching the wheel during Brake application should be mandatorily reported & rectified.
- ✓ 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.
- ✓ Always use a suitable test bench, holding fixture for testing the Brake cylinder
- ✓ Use hand brake cable removal tool for dis-assemble of Hand brake cables from Brake cylinder.
- ✓ Do ensure that correct shape & size of APD's to be use on the Brake cylinder pins.

APM Valve (EL-60)

- ✓ Do ensure correct gap between the sensing point of APM valve & 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 to loaded position after putting 25mm block below the sensor point on side frame.
- ✓ Do ensure that empty / load indicator of the APM valve (EL 60) (Orange coloured) is visible during empty condition.
- ✓ Do ensure that the reservoir for EL-60 valve is secured properly with the underframe.

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 (EL 60) hose with under frame.
- ✓ Do ensure that there is no rubbing of rubber hoses with axle, wheel or underframe members.

Hand Brake Arrangement

- ✓ Do ensure to weld the hand brake cable bracket at its current location. It should be welded straight, and cables should be properly tightened to the bracket.
- ✓ 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. After applying the hand brake, there should not be any ringing sound after striking wheels.
- ✓ 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.
- ✓ Always use a suitable test bench, holding fixture for testing of brake cylinder.

Don'ts

- ✗ Do not fit BMBS system if the Bogie parameters are not within the specified limits.
- ✗ Do not tacks weld the BMBS pins / split pins on the bogie.
- ✗ Do not hammer on beams and brake block.

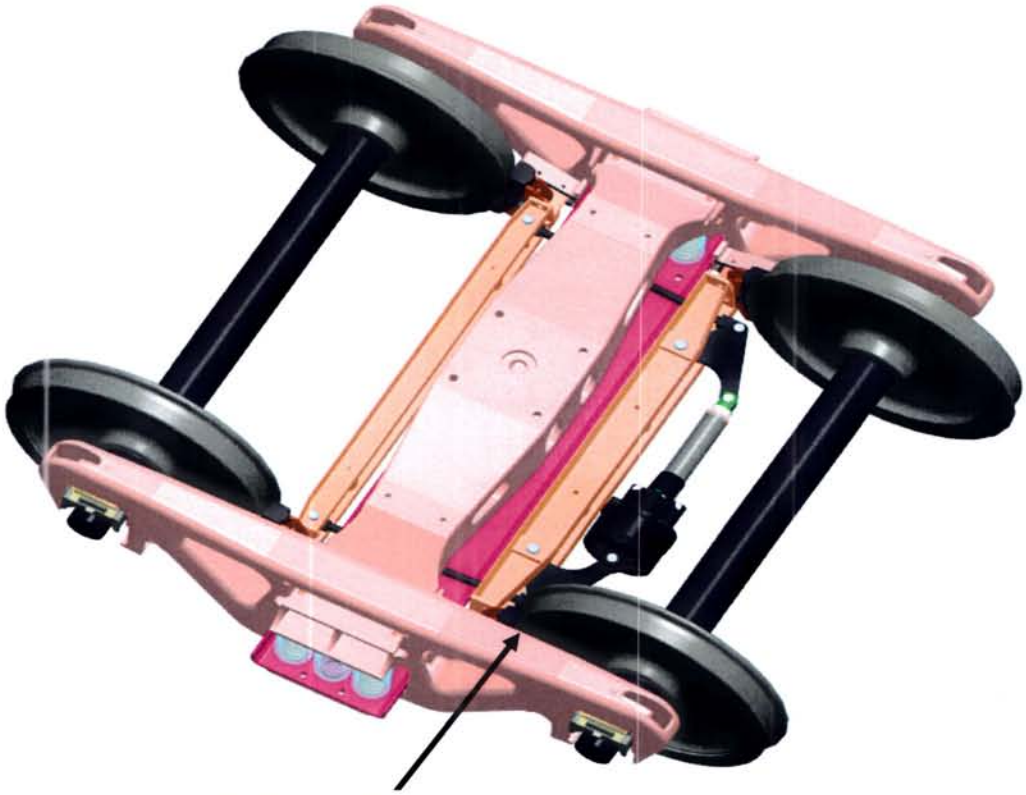
- ✘ Do not hit the indicator on the brake cylinder.
- ✘ Do not test the Brake cylinder without fixing it on Test bench.
- ✘ Do not test the Brake cylinder in open area.
- ✘ Do not carry bogies by cranes fitted with cylinder and without wheeling, by fastened by chain wrapped in center. Use fork lifter or chain should hook in side frame holes only.
- ✘ 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.
- ✘ Do not use oversized APD's.
- ✘ Do not use gas cutter to remove the Brake cylinder bush dowel pin. Use Dowel pin removal tool for the same.
- ✘ Do not weld the beam stops on the Beam if guide plate surface has dirt, rust etc. Before welding the beam stops on the Beam guide plate, clean the surface with wire brush.
- ✘ Do not test the brake cylinder into open area.
- ✘ Do not apply the pressure into brake cylinder without proper fixing on test bench or bogie.

Wagon operating procedures

PROCEDURE FOR CHANGING OF BRAKE BLOCKS

a. 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 any one 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.

b. 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 in order

to change the Brake Block

Figure 6

TYPICAL SERVICE / OPERATING PROCEDURES

Isolation of Brake Cylinder (1 & 2)

(See figure 5)

a. There are two isolating cocks with vent in BC line for isolating each brake cylinder in the wagon.

b. To isolate any Bogie / Brake Cylinder, move the isolating cock (OLP types) handle to closed position. This will stop the further feeding of corresponding brake cylinder and the air already present in the brake cylinder will get exhausted to atmosphere, thus, releasing the brakes in that particular bogie.

Brake Head (16) Changing

(See figure 5 & 6)

a. Ensure that the brakes are released. Slip in a pry bar between the brake block 18 & wheel on any one wheel of the bogie. Force back the brake block from the wheel, thus retracting the double acting slack adjuster (figure-6) and creating the space between the brake block and the wheel.

b. Remove the brake block key 17 and then the brake block 18.

c. After obtaining enough clearance between the wheel & the brake heads 16, remove the cotter pin 13 & the brake head pin 12 consecutively to remove the desired brake head.

d. Install a new brake head 16 and secure it with brake head pin 12 then a cotter pin 13. Bend cotter pin legs outwards.

e. Place brake block 18 on the new brake head and secure the brake block with the brake block key 17 and the cotter pin 13.

f. 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 one to three brake applications.

Brake Cylinder (1 & 2) Changing

(See figure 5 & 6)

a. Ensure, the brakes are released, and the brake cylinder is completely vented. Retract the brake cylinder, use pry bar between wheels & brake blocks on both the secondary beam 4 & the primary beam 3. Force the brake cylinder to retract completely.

b. Disconnect the flexible air hose 21 from the cylinder assembly flange.

c. Remove the dowel pin 20 by **using dowel pin removal tool** & bush 19. Then remove the pin 11 from both sides of the cylinder. Install the new brake cylinder assembly, being sure the cylinder is of the same size and aligned in the same way as the previous cylinder, using pin 11. Secure the brake cylinder with bush 19 & dowel pin 20.

d. Reconnect the flexible air hose 21 to the cylinder assembly flange.

e. Apply partial brakes 2 - 3 times in order to restore the internal slack adjuster's position.

Note

For cylinders equipped with the hand brake cables (see fig. 5), it is necessary to:

f. Disconnect the cable equalizer 27 from the hand brake cables by removing the two split pins 29 and cable pins 28.

g. Remove the two cables from the cable bracket.

h. Use hand brake cable removal tool for dis-assemble of Hand brake cables from Brake cylinder.

i. Always use a suitable test bench, holding fixture for testing the Brake cylinder.

Lever Assembly Changing RH (5) & LH (6)
(See figure 5)

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

a. After removing the APD, remove the bulb cotter 14 and the pin 8 with pull rod. Now, remove the bush 19, dowel sleeve 20 and the pin 11 with brake cylinder. Remove the bulb cotter 14 and pin 9 with the primary brake beam 3. Pull the bell crank lever RH 5 & LH 6 from the beam assembly 3. Install a new lever RH 5 or LH 6 as applicable using the pin lever 9 and the bulb cotter 14. Install pin 8 and bulb cotter 14 with pull rod 7. Install pin 11 with bush 19 & dowel sleeve 20. Bend cotter pin legs and provide the required APDs.

b. 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 one to three brake applications.

Push Rod (7) Changing
(See figure 5)

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

a. Remove the bulb cotter 14 and the pin 8 with bell crank lever 5 or 6. Remove the bulb cotter 14 and the pin 10 with secondary brake beam 4. Remove the pull rod from lever assembly RH 5 or LH 6. Remove the rod from the secondary beam. To install a new push rod, align the rod end hole with the mounting holes in the secondary beam 4 and then insert the pin 10 and the bulb cotter 14.

b. Do the same procedure on the other end of the pull rod by aligning the pull rod with the lever assembly RH 5 or LH 6 with pin 8 and bulb cotter 14. Bend the cotter pin legs and provide the required APDs.

c. 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 2-3 brake applications.

Lifting of under frame from Bogie

1. Disconnect the flexible air hose 21 from the flange of brake cylinder without hand brake cables by unscrewing the bolts.
2. Disconnect the flexible air hose 21 from the flange of brake cylinder with hand brake cables by unscrewing the bolts.
3. Disconnect both the cables from the equalizer cable 27 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.

CONDEMNING LIMITS OF SYSTEM COMPONENTS

Brake Head (16)
(See figure 7)

Brake Head 16 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.

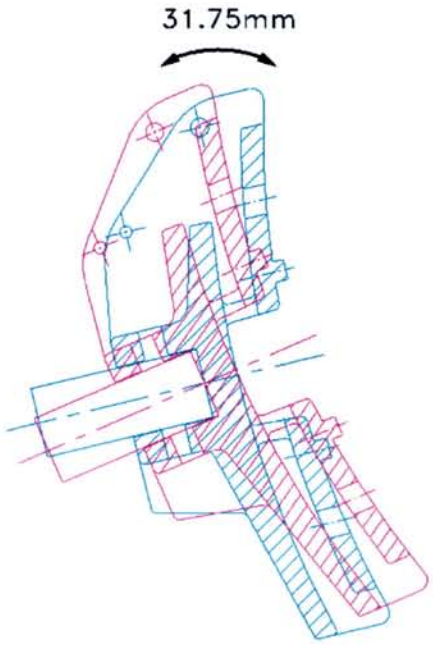


Figure 7

Bell Crank Lever Assembly RH (5) & LH (6)

Bell Crank Levers should be replaced if any one of the following exists:

1. Excessive Wear on any surface, anything > 1.6 mm
2. Worn, Damaged or Broken Spherical Bearing
   - 25.4 mm Hole exceeds 26.7 mm in any direction (i.e.: oval condition)
   - 32 mm Hole exceeds 33 mm in any direction (i.e.: oval condition)

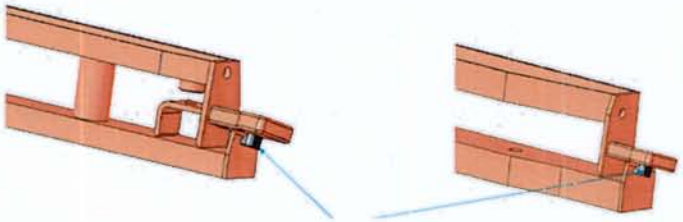
Push Rod (7)

Push Rods should be replaced if any one of the following conditions exist:

- Any part of the push rod is Bent
- Cracked or Damaged Welds
- Excessive Wear on any surface, anything > 1.6 mm
- 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)
- Clevis End Gap Exceeds 27.9 mm.

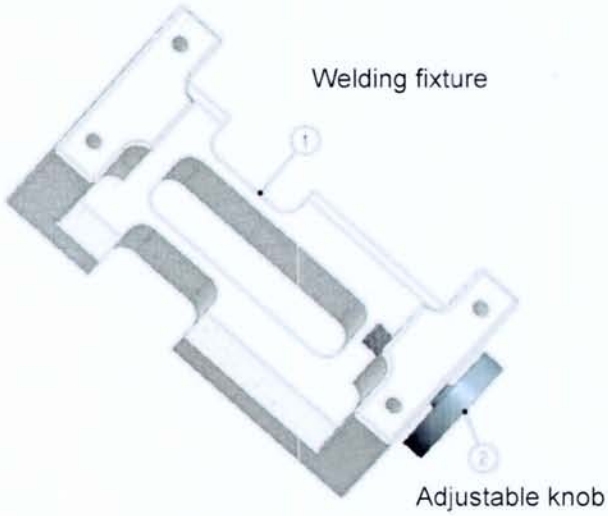
Brake Beams with Beam stops (Lug)

Purpose of Beam stops weldment on Brake Beam:
Beam stops will centralize the Brake beams in the bogie. It will prevent that one side the beam could be barely in the guidance while the other side is sticking too much in the pocket. In this case one side would wear out and the other side would show high friction and could block the slack adjustment. (See figure below)



Beam stops (Lug) on both ends of Beam guide plate

The whole welding process of Beam stops (Lug) on the Beam guide plate is to be done with the help of special welding fixture (Part no. KN0011153) as shown below in the picture.

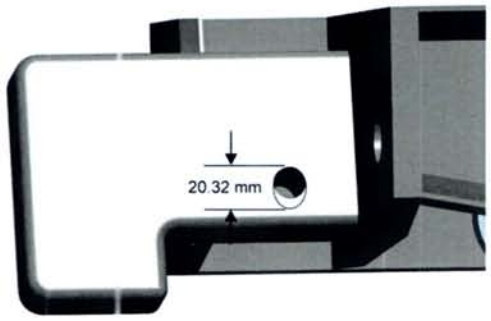


Welding of Beam stops (Lug) on Brake beams guide plate (both end)

S.No.	WORK DESCRIPTION	RESOURCES REQD	REMARKS/ PHOTOGRAPHS
1	Place the fixture at Bottom side of guide plate. Place the Lug in the fixture slot as shown in image.	Welding fixture (part no. KN0011153) 	
2	Tight the Fixture with the adjustable knob provided in Fixture	-	
3	Do tack weld on Lug as shown in image.	Welding equipment	
4	Remove the fixture & do welding on whole length as shown. Remove the spatters.	-	 
5	Repeat the Process "1-4" for other end of Beam guide plate.	-	

Brake Beam should be replaced if the following exists. (See figure 8)

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

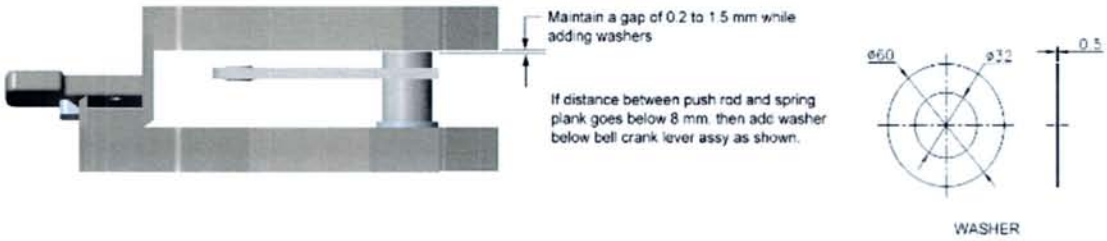


Gap between Bell crank lever RH 5 & LH 6 and the upper channel of Primary brake beam 3
(See figure 9)

Measure the bell crank lever dimension with reference to the lever being supported inside the primary brake beam. Measure the maximum pass-through gap.

Note the locations of the measurement for the lever and the position of the lever in regard to the primary brake beam. (See sketch below.)

Use washers as demonstrated below to adjust the gap.



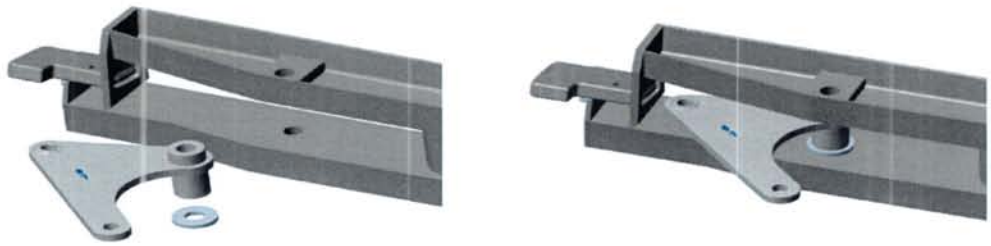


Figure 10

MAINTENANCE IN OPEN LINE

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

a) Check the components for missing or any physical damage, if found replace them.
b) Check all the pin joints for any missing parts (pins, split pins, spring dowel, etc), if missing, provide the same.
c) Check that the APD is provided on all the pins and on the EL-60 valve.
d) Check that all hoses are properly tightened and are not threatened to be damaged by axle or wheel. If so, properly clamped them.
e) Check the thickness of Brake Block. It should be sufficient for complete trip.

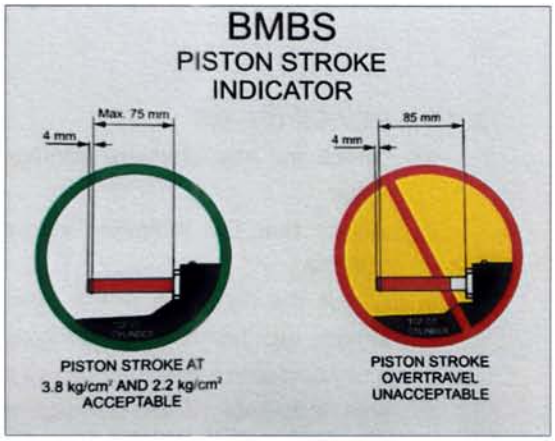
2. BRAKE CYLINDER

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

2.1 Brake Cylinder Piston Stroke Indicator General Overview, End of Stroke Condition & Their Checking Procedure in Wagon:

A two-coloured, integrated piston indicator pin indicates the stroke of the piston. Under normal conditions the piston shows only the red colour (up to 75 mm piston stroke). If the stroke of the piston is too long, the pin shows an additional silver surface. **After 85 mm piston stroke the piston reaches end of stroke. Any end of stroke indications or brake block not touching the wheel during brake application found during the regular inspections should be mandatorily reported & to rectify it as per the process.**

Brake cylinders reach end of stroke during normal service and even blocks are not touching the wheel. End of stroke position (piston indicator) is visible from the outside of the bogie. The end of stroke indicates an issue with the brake which should be reported and acted upon.
The elastomeric spring between the axle box and the side frame pedestal jaw, plays an important role. The spring can "store" the block force even when end of stroke is reached. Therefore, end of stroke is an indication for a problem in the bogie, but there is still a block force available. Only when a block doesn't touch the wheel, there is no block force.

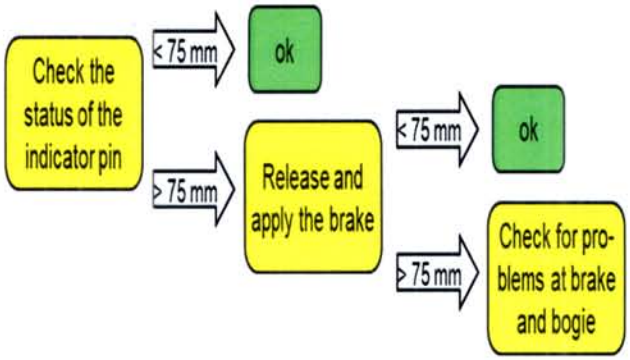


(KB Decal no. KP4241342 for Brake cylinder Piston indicator stroke)

piston indicator at brake cylinder

2.2 Brake cylinder Piston stroke indicator & their over stroke root cause identification and related corrective action (Refer KB doc no. IP-344, rev.02)

Knorr-Bremse recommends carrying out the investigation to resolve Brake cylinder overstroke condition in the following way:



3. APM DEVICE (EL-60)

a) Check for any physical damage to the valve.
b) Check that the indicator in during the release.
c) 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 EL-60 gap adjusting gauge.
d) 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.

Bogie Equipment			
	Component Description	**KB Part No.**	**Qty/ Wagon**
1	Cylinder Assy; without Handbrake	KP1796330	1
2	Cylinder Assy; With Handbrake	KP1802890	1
3	Valve Assy; EL-60	I.3.5114	1
4	Reservoir; EL-60	I.3.5115	1
5	Primary Beam	I.3.5111	2
6	Secondary Beam	I.3.5112	2
7	Lever Assy; Right Hand	I.3.5108	2
8	Lever Assy; Left Hand	I.3.5109	2
9	Push Rod Assy;	I.3.5110	4
10	Brake Head;	778113	8
Pins, Split Pins (Bogie Equipment)			
1	Pin; Clevis	C162088	4
2	Pin; Clevis	C162086	4
3	Pin; Clevis	C162087	4
4	Pin; Clevis	778111	4
5	Pin; Brake Head	778112	8
6	Split Pin	476858	16
7	Bulb Cotter	C162098	12
8	Washer	C162641	8
9	Washer	C162060	4
10	Washer;	778084	4
Hoses & Hardware's (Bogie Equipment)			
1	Hose Assy. 1/2" With Flange	I.4.2037	1
2	Hose Assy. 1" With Flange	I.4.2036	2
3	O-Ring	I.4.1050	2
4	O-Ring	A27763/17KI	2
5	Spring Washer	I.H.0062	2
6	Screw, Hex Head; Zinc Plated	748645	8
7	Washer, Lock; Cad Plated	735734	8
8	Locknut: Zinc Plated	755896	1
9	Screw, Hex Head; Zinc Plated	734734	2

Spares of M/S KNORR- BREMSE to be maintained in open lines / ROH Depots

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

ROUTINE OVERHAUL (ROH) OF BMBS SYSTEM FOR FREIGHT CARS

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.

1.1 Brake Cylinders

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 fully in released condition.

1.2 BRAKE BEAMS

Check for any physical damage, crack, etc, if found replace them. Check for rusting & corrosion and if found repaint them.

(a) Replace all the PINS, washer, split pins, dowel pins from OEMs.
(b) Check the GAP at pivot pin on the primary brake beam as shown in the condemning limit of the system components.
(c) Check brake head for loosening or damage as shown in the condemning limit of the system components.

1.3 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.

1.4 APM VALVE (EL-60)

(a) Clean the Indicator.

(b) Check the APM valve:

I. Any physical damage

II. Valve's sensing arm is moving freely and is fully in.

III. Check the leakage.

IV. 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 readjust as specified.

1.5 HAND BRAKE RIGGING

(a) Check the pin joints / components for missing or any physical damage, if found replace them.
(b) Replace all the PINS, washer, split pins, dowel pins, plastic bushes.

1.6 HOSES & PIPE JOINTS

(a) Check the hoses for any cracks / damage. If so, replace them.

(b) Check that the hoses are properly tightened and are not threatened to be damaged by axle or wheel. If so, properly clamped them.

(c) Check the pipe joints for leakages, if so, tighten them properly.

1.7 Bogie pocket liner & Side fram jaw gap

a) Check the bogie pocket liner gap by using side pocket gauge. Ensure trouble free movement of Side pocket gauge throughout the complete length & depth in the Bogie pocket liner.

b) Check the gap between side frame jaw & bearing adopter in every inspection & maintained it within specified limit.

PERIODIC OVERHAUL (POH) OF BMBS SYSTEM FOR FREIGHT CARS

BOGIE RIGGING

Replace all the must change items as listed in the list below on the Bogie.

BRAKE BEAMS

a) Check the beams for rusting & corrosion and if found repair & repaint them.

b) Check the GAP at pivot pin on the primary brake beam as shown in the condemning limit of the system components.

c) Check brake head for loosening or damage as shown in the condemning limits of the system components.

BELL CRANKS LEVERS & PUSH RODS

a) Replace the Bell Crank levers, if the critical parameters found to in condemning limits as specified.

b) Replace the Push Rod, if the critical parameters found to in condemning limits as specified.

HAND BRAKE RIGGING

a) Check for any physical damage of components, if found replace them.

b) Brake rigging brackets, bolts and nuts should be examined for rusting, looseness, damaged threads, etc and replaced.

c) Replace all the PINS, washer, split pins, dowel pins from OEMs.

d) The plastic bushes should be changed.

BRAKE CYLINDER

a) Overhaul the brake cylinder as per procedure explained in the manual.

b) Replace the must change items.

c) Check the condition base items, if found worn or damaged, replace them.

d) Test the brake cylinder as per the procedure given in the manual.

e) Always use a suitable test bench, holding fixture for testing the Brake cylinder.

APM DEVICE (EL-60 VALVE)

a) Overhaul the EL-60 valve as per procedure explained in the manual.

b) Replace the must change items as enlisted in the manual.

c) Check the condition base items, if found worn or damaged, replace them.

d) Test the EL-60 valve as per the procedure given in the manual.

e) Check the Gap between the sensor point and the side frame surface and readjust the same as specified for the wagon type.

HOSES, PIPES & PIPE JOINTS

a) Check the hoses for any cracks / damage. If so, replace them.

b) Clean the pipes as per the procedure laid down by RDSO in spec. WD-04-ABR-02.

BOGIE POCKET LINER & SIDE FRAM JAW GAP

a) Check the bogie pocket liner gap by using side pocket gauge. Ensure trouble free movement of Side pocket gauge

throughout the complete length & depth in the Bogie pocket liner.

b) Check the gap between side frame jaw & bearing adopter in every inspection & maintained it within specified limit

Must change items during POH) For M/S KNORR- BREMSE brake system

	Component Description	KB Part No.	Qty/ Wagon
Bogie Equipment			
1	Pin; Clevis	C162088	4
2	Pin; Clevis	C162086	4
3	Pin; Clevis	C162087	4
4	Pin; Clevis	778111	4
5	Pin; Brake Head	778112	8
6	Split Pin	476858	16
8	Bulb Cotter	C162098	12
9	Washer	C162641	8
10	Washer	C162060	4
11	Washer;	778084	4
Hand Brake Equipment			
1	Pin, Cable	776621	2
2	Pin, Tie Rod	I.3.2044	1
3	Pin Cotter, Cable pin	I.4.2063	2
4	Split Pin (BMBS)	I.4.2062	1

Items to be replaced on conditional basis

	Component Description	KB Part No.	Qty/ Wagon
1	Hose Assy. 1/2" With Flange	I.4.2037	1
2	Brake Head;	778113	8
3	Hose Assy. 1" With Flange	I.4.2036	2
4	Spring Washer	I.H.0062	2
5	O-Ring	I.4.1050	2
6	O-Ring	A27763/17KI	2
7	Screw, Hex Head; Zinc Plated	748645	8
8	Washer, Lock; Cad Plated	735734	8
9	Screw, Hex Head; Zinc Plated	734734	2

DETAILS OF SPECIAL TOOLS AND GAUGES REQUIRED DURING MAINTENANCE.

Quick connect coupling with pressure gauge.

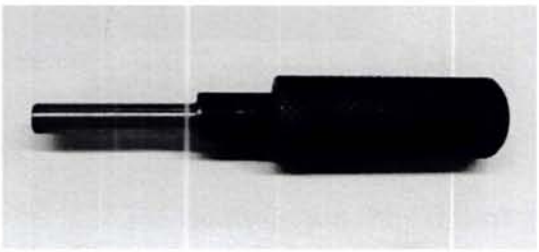
To check the brake cylinder pressure there is a quick connect nipple provided in the EL-60 valve.

An arrangement of quick connect coupling with pressure gauge can be connected with this nipple to measure the BC pressure. Knorr-Bremse part no. for quick connect coupling with pressure gauge is KND-00134.

*Quick connect coupling with pressure gauge (*KND-00134).

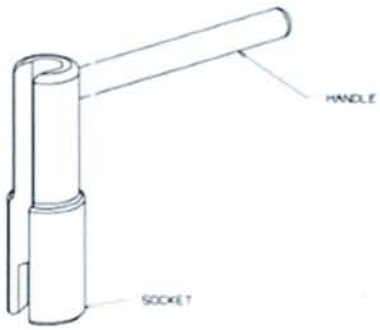
Tool for spring dowel sleeve

To remove the spring dowel sleeve from the brake cylinder pin during the replacing/changing of brake cylinder a special tool (Part no.KN0011152) is required as shown in the below picture.



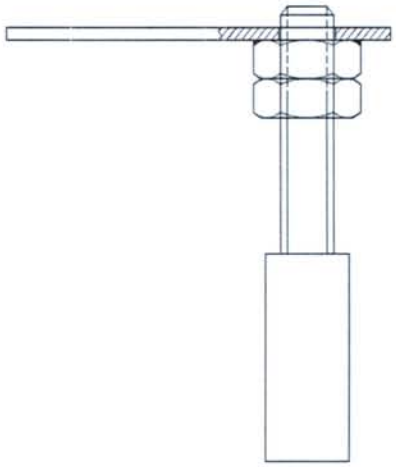
Tool for removal of Brake cylinder Hand Brake cable

To remove the spring dowel sleeve from the brake cylinder pin during the replacing/changing of brake cylinder a special tool (Part no.KN0011203) is required as shown in the below picture.



EL-60 gap measuring Gauge

To adjust the gap between the side frame of bogie and adjuster screw of EL-60, this gauge (Part no. KN0011154) is required. It is adjustable. Adjust it as per required gap and place it on the side frame. Now touch the head of adjuster screw by loosening/tightening it. Lock the position of adjuster screw by tightened the lock screw.



SECTION- B:

Description & Maintenance Instructions for Bogie Mounted Brake Cylinder 11"

CONTENTS

CONSTRUCTION & WORKING

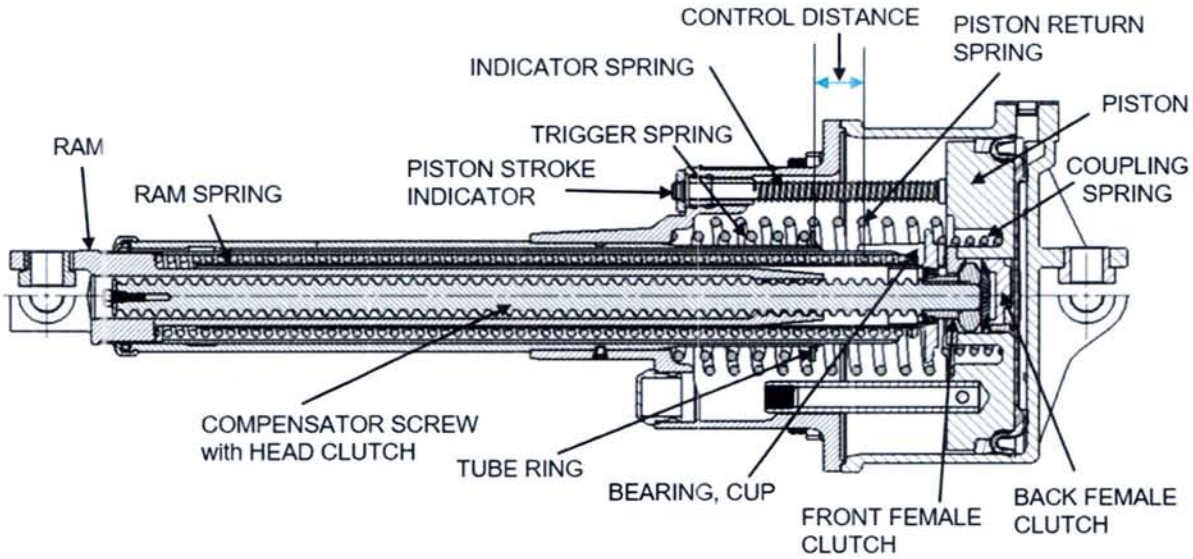
Air from the EL60 valve goes into the Brake Cylinder through the flange in the housing of the brake cylinder. The air pushes the piston assembly forward against the compression springs 2 and 3. This causes the RAM assembly to move forward till the bearing contacts the Tube Ring i.e. as the Brake Shoes touch and apply the brake force on the wheels. The clutch head on the compensator screw remains engaged with the Front Female clutch on the piston. Thus there is no extension of the RAM assembly on the compensator screw. The internal construction (springs, location of tube ring etc.) ensures that the stroke of the brake cylinder is constant when no slack adjustment is there.

When the Brake Shoes and the Wheel has worn out then the slack is created. When the air from EL60 valve goes into the Brake Cylinder the piston assembly moves forward. It moves beyond the control distance as the slack is there (there is no restraint to the ram extension). As the piston moves beyond the control distance the bearing gets in contact with the tube ring.

As the piston still moves forward the compression spring 1 in the clutch assembly side gets compressed thus disengaging the compensator screw clutch head. This allows the RAM assembly to extend due to the force exerted by the RAM compression spring 4 till the point the slack is taken up. Thus the Brake Shoe comes in contact with the Wheel. After the slack has been accommodated, the brake cylinder functions normally giving a constant stroke.

The inbuilt slack adjuster is double acting. If one wants to retract the slack adjuster one should apply force on the RAM side. This allows the RAM to collapse moving on the compensator screw. This can also be achieved by rotating the RAM on the compensator screw.

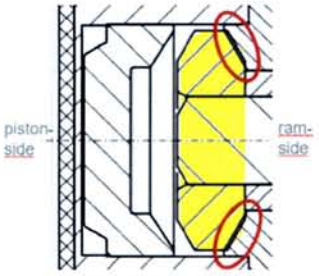
The slack adjuster defines the normal clearance between the block and the wheel ("application stroke") and as a double acting slack adjuster (working in both directions) it adjusts either a clearance which is too small or a clearance which is too large. The resetting of the slack adjuster



e.g., for a block change happens by pushing back the ram in released position with a high force (e.g., using a pry bar).

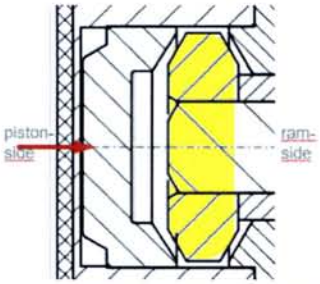
The main feature of the slack adjuster is the toothed coupling. During normal brake application there are three different phases of the coupling:

In released position, the coupling is closed on the ram-side by the force of the coupling and ram spring.



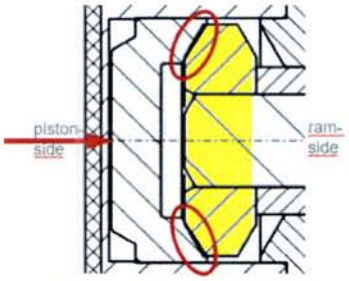
The spindle cannot rotate, it is blocked by the coupling. The coupling will open, if the external force overcomes the coupling spring

During brake application the coupling moves from one side to the other side



The rotation of the spindle is not hindered, the spindle can rotate and shorten or lengthen the ram

When the external force exceeds internal counter forces, the coupling is closed on the piston-side



The spindle cannot rotate, it is blocked by the coupling. The coupling cannot open as long as there is external force

During the coupling change the spindle is not locked and can rotate, therefore the gap can be adjusted. For this adjustment, the ram spring provides the actuating force, and it must overcome all resistances of the BMBS and mainly the resistance of the pockets.

The coupling change is visible in comparing the stroke of the piston and the ram. During coupling change only, the piston continues to move while the ram stands still. The difference between the piston and the ram stroke is the coupling distance.

TOOLS REQUIRED

1. Socket Wrench, 9/16"
2. Socket Wrench, 3/4"
3. Impact Wrench, 1/2"
4. Socket Extension, 4"
5. Allen Wrench, 3/16"
6. Hammer
7. Pressing Tool (Fig. 2)
8. Pressing Fixture (Fig. 3)
9. Pressing Plug (Fig. 4)
10. Washer Guide (Fig. 5)
11. Pressing Tool (Fig. 6)
12. AAR SPEC. M-914 grease (Interlube)

DISASSEMBLY

(See Figure 1)

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/cm^2. EXCEEDING THIS LIMIT COULD RESULT IN PERSONAL INJURY OR DAMAGE TO EQUIPMENT.

NOTE

For ease of disassembly and safety, cylinder must be in a vertical position with the ram (29) facing up.

1. Insert a 22mm dia. rod through bushings (30) in ram (29). Fully collapse ram (29) and spring (28) by rotating and applying a steady downward pressure on the 22mm dia. rod further movement of the ram is observed.
2. Remove and discard expansion plug (31) from ram (29).
3. With an impact wrench and 9/16" socket wrench to remove cap screw (13) and spacer (12) from screw (11). Discard screw (13).

WARNING

PARTS MAY BE INADVERTENTLY EXPELLED BY FORCE OF SPRING (28).

WEAR EYE PROTECTION AND EXERCISE CARE DURING DISASSEMBLY.

FAILURE TO OBSERVE THESE SAFETY PRECAUTIONS CAN LEAD TO INJURY.

4. Carefully unscrew ram (29) clockwise and remove from screw (28). Remove spring.

WARNING

PARTS MAY BE INADVERTENTLY EXPELLED BY FORCE OF SPRING (21).

WEAR EYE PROTECTION AND EXERCISE CARE DURING DISASSEMBLY.

FAILURE TO OBSERVE THESE SAFETY PRECAUTIONS CAN LEAD TO INJURY.

5. Remove four nuts (33), four lock washers (32) and four tee head bolts (1) from non-pressure head (25) and body (2). Remove non-pressure head (25) from body (2).
6. Remove spring (21) and spring tube (20).
    a. Remove and discard gasket (4) from body (2).

WARNING

THE USE OF AIR PRESSURE MAY BE REQUIRED IN NEXT STEP. USE 0.7Kg/cm² MAX.

7. While holding compensator screw (11), carefully apply 0.7Kg/cm² to the body (2) so that the removal of piston assembly (7 through 19) can be accomplished and /or may also be removed by holding compensator screw (11) and pulling straight up.
    a. Remove and discard packing cup (5) and guide ring (6). Then place piston assembly (7 through 19) vertically in a press.
    b. Place Pressing Fixture (see figure-3) on compensator screw (11). When tool comes in contact with bearing cup (16), compress slack adjuster spring (15) and remove snap ring (19). Carefully remove tool from compensator screw (11).
    c. Remove bearing cup (16) and slack adjuster spring (15) from piston (9).
    d. Remove retaining ring (18) and bearing (17) from bearing cup (16).
    e. Using a 3/16" Allen wrench applying a steady downward force remove and discard four flat head socket screws (7) that hold the front female clutch (14) to the piston (9).
    f. Remove front female clutch (14) and compensator screw (11) from piston (9).
    g. Using a 3/16" Allen wrench applying a steady force to remove and discard two flat head socket screws (8) and remove back female clutch (10) from piston (9). Remove piston (9) from fixture.
8. Remove and discard wiper rings (26 and 27) from non- pressure head (25).

NOTE

The use of a press is required for disassembly of the retaining ring (22), tube ring (23) and slack adjuster spring (24).

9. Place non-pressure head (25) in press and compress spring (24) by pressing on ring (23). Remove retaining ring (22). Carefully release the load from the press, remove tube ring (23) and slack adjuster spring (24).
10. Remove plug (35) and "O" Ring (36). Discard "O" Ring (36).
11. Remove breather assembly (44) from non-pressure head (25).
12. Remove piston indicator assembly (37 thru 43) from non-pressure head (25).
    a. Remove two retaining rings (37), flat washer (43), spring (42), piston position indicator (40) and "O" Rings (39 and 41) from indicator fitting (38). Discard "O" Rings (39 and 41).

CLEANING, INSPECTING, AND REPAIRING

WARNING

SOLVENTS AND SOLVENT FUMES CAN BE HARMFUL TO HEALTH. WHEN USING SOLVENTS, BE SURE TO:

- ❖ WEAR EYE, SKIN, AND RESPIRATORY PROTECTION
- ❖ WORK IN A WELL-VENTILATED AREA
- ❖ AVOID REPEATED OR PROLONGED CONTACT
- ❖ KEEP SOLVENT CONTAINER CLOSED
- ❖ KEEP SOLVENT AWAY FROM SPARKS, FLAMES, AND HEAT.

FAILURE TO OBSERVE THESE SAFETY PRECAUTIONS CAN LEAD TO INJURY OR INTOXICATION.

CLEANING USING COMPRESSED AIR CAN CAUSE PARTICLES TO BECOME AIRBORNE, BE SURE TO:

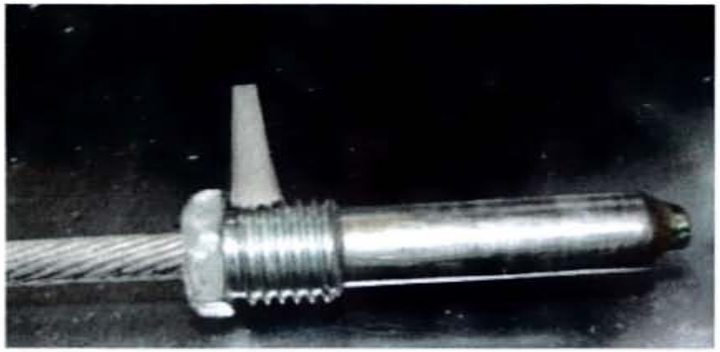
- ❖ WEAR EYE PROTECTION
- ❖ DO NOT USE AIR PRESSURE EXCESS OF 2 Kg/cm²

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 (i.e. mineral spirits). Then dry with a jet of dry, compressed air.
2. Replace all rubber parts, wiper rings. "O" Rings, gaskets, expansion plugs and self-locking screws.
3. In general, replace all parts that are cracked, broken, worn, damaged, or in such a condition as would result in unsatisfactory operation.
4. Inspect all springs for rust pits, distortion, or permanent set. Replace wherever necessary.
5. Replace any retaining ring or snap ring that is not elastic enough or is stretched too much to clamp on securely or has deformation.
6. Hand Brake Cable Assembly (for brake cylinders with hand brake)
    a. Inspect the hand brake cable. If damaged or not usable, the cable must be replaced.
    b. If repair is necessary, hand brake cable removal tool for dis-assemble of Hand brake cables from Brake cylinder. Always use a suitable test bench, holding fixture for the Brake cylinder during dis-assembly & assembly of hand brake cable.
    c. Tight the mounting flange (see figure-7) using ½"- UNC bolts. Apply air pressure up to 2Kg/cm².Remove four self-locking set screw (34) using _ wrench.
    d. Pull the hand brake cables in outward direction.
    e. Remove both the screw from the anti-rotation tubes of Piston assembly (9) using socket (see figure-8) and impact wrench.
    f. Refer the hand brake cable assembly procedure in detail on the next page:

Hand brake cable assembly procedure

S. No.	Job description	Qty	Tools used	Parameter/ Precautions	Drawings, Photographs, etc.
1	Take 11" Brake cylinder (KB Part no. KP1802890) & fix it on a suitable test bench	1	Brake cylinder holding fixture, Pins, Test bench	Open inlet port of Brake cylinder. Ensure proper connection of pressure pipeline to the Brake cylinder.	 
2	Apply 0.7 – 1.0 kg/cm2 pressure to the Brake cylinder	-	Pressure line, Test bench	Ensure anti-rotation tube should be visible in the NPH. Ensure trouble free movement of RAM up to 500 mm	

S. No.	Job description	Qty	Tools used	Parameter/ Precautions	Drawings, Photographs, etc.
3	Take cable assembly (KB Part no. C177846).	2	Manual	-	
4	Take O-rings (KB Part no. 755559) and put them in the the groove of cable assembly.	2	Manual	-	 

S. No.	Job description	Qty	Tools used	Parameter/ Precautions	Drawings, Photographs, etc.
5	Apply loctite activator 7471 on the threads of cable assy.	-	Loctite activator 7471 	Apply Loctite activator on the thread.	

S. No.	Job description	Qty	Tools used	Parameter/ Precautions	Drawings, Photographs, etc.
6	Apply Loctite 243 to full thread length and diameter of the cable assy.	-	Loctite 243 	Use only enough Loctite as not to create excess or carry over into bore of anti-rotation tubes.	

S. No.	Job description	Qty	Tools used	Parameter/ Precautions	Drawings, Photographs, etc.
7	Tightening the cable assembly on anti-rotation tubes, and apply torque 35 LBS.	-	Torque Wrench, Hand brake tool (KB part no.KN0011203)	Apply torque: 35 ± 2 FT-LBS.	
8	Secure the cable assembly using set screws (747847)	4	Spanner 13 mm, Torque Wrench Range: 8~60 Nm), Hand brake tool (KB part no.KN0011203)	Apply Torque: 12 ± 2 FT- LBS.	

S. No.	Job description	Qty	Tools used	Parameter/ Precautions	Drawings, Photographs, etc.
9	Release the pressure & remove Brake cylinder from test bench.	-	-	-	

7. Body Assembly (2)

   a. Inspect body (2). If damaged or worn, the body (2) must be replaced.

   b. Inspect the two bushings (3). If damaged or worn, the bushings (3) must be replaced.

   c. If repair is necessary, use the proper tools to press bushings (3) from body (2). Press new bushings (3) into place in body (2).

8. Inspect compensator screw (11) for damage or surface wear. If damaged or not usable in any way, the compensator screw must be replaced.

   a. Inspect male clutch on compensator screw for damage or surface wear. If damaged or worn in any way, the compensator screw must be replaced.

9. Ram assembly (29)

   a. Inspect ram (29) for damage or wear. If damaged or not usable in any way, the ram (29) must be replaced.

   b. Inspect threads of ram (29) for damage or surface wear. If damaged or not usable in any way, the ram must be replaced.

   c. Inspect the two bushings (30). If damaged or worn, the bushings (30) must be replaced.

   d. If repair is necessary, use the proper tools to press the bushings (30) from the ram (29). Press new bushings (30) into place in the ram (30).

10. Non – Pressure Head (25).

   a. Inspect guide tube for damage or wear. If damaged or not usable in any way, the tube must be replaced.

   i) If repair is necessary, use Pressing Tool (see figure-2) to press the guide tube from the non-pressure head (25). Discard damaged guide tube.

   ii) Apply LOCTITE 242 to sealant grooves (3 places) on new guide tube, align grease fitting hole on guide tube with indicator hole on non-pressure head (25) and, using Pressing Tool (see figure-6), press new guide tube into place in the non-pressure head (25) until guide tube shoulder seats against non-pressure head (25).

11. Inspect piston (9) for damage or not usable. If damaged or worn in any way, the piston must be replaced.

12. Inspect back female clutch (10). If damaged or not usable in any way, the clutch must be replaced.

13. Inspect front female clutch (14). If damaged or not usable in any way, the clutch must be replaced.

LUBRICATING AND RE-ASSEMBLY

(See Figure - 1)

NOTE

Grease to be used - AAR SPEC.M-914 (Interlube)

1. With two new screws (8), install back female clutch (10) into its key slot on piston (9). Apply a thin layer of grease to the face of back female clutch (10). Tighten screws (8) to 13.5-19 Nm (10-14 ft. lbs dry torque).

   a. Place compensator screw (11) onto back female clutch (10). Apply a thin layer of grease to face female clutch (14). Slide front female clutch (14) onto compensator screw (11) and secure with four new screws (7). Tighten screws (7) to 13.5-19 Nm (10-14 ft. lbs dry torque).

   NOTE

   Piston (9) must be in a vertical position in order to assemble.

   b. Install bearing (17) and retaining ring (18) into bearing cup (16).

   NOTE

   It is not possible to stretch any retaining ring during assembly.

   c. Apply a thin layer of grease to inside cavities of piston (9) and spring (15).

   d. Place slack adjuster spring (15) and bearing cup (16) and retaining ring (19) onto piston (9). Place piston (9) in a spring press. Using Pressing Fixture (see figure-3), compress slack adjuster spring (15) and bearing cup (16). Install retaining ring (19) into its groove on compensator screw (11). Slowly release the press to be sure retaining ring (19) is securely in its groove.

   NOTE

   Retaining Ring (19) to be fully seated in its groove on compensator screw (11).

   e. Place a new guide ring (6) onto piston (9) and tap lightly to seat against piston (9) shoulder.

   f. Install new packing cup (5) onto piston (9) and burp to release air trapped during installation of packing cup (5). Lubricate the outer surface of packing cup (5) and guide ring (6) with grease.

   IMPORTANT NOTE

   Do not grease dome of packing cup (5).

2. Lubricate the bore of body (2) with grease. Install piston assembly (7 through 19) into body (2) with anti-rotation tubes at 90° to the 1/2" flange surface on body (2).

   a. Apply a thin layer of grease to the threads on compensator screw (11).

   b. Apply a thin layer of grease to OD and ID of spring tube (20) and install spring tube (20) into the slots on bearing cup (16).

   c. Apply a thin layer of grease to spring (21) and install spring (21) onto piston (9).

   NOTE

   All inner surfaces to be liberally greased with grease.

3. Place non-pressure head (25) in press and liberally lubricate the ID of non-pressure head (25) and OD of the guide tube inside of non-pressure head (25).

   a. Apply a thin layer of grease to slack adjuster spring (24) and install onto guide tube inside of non-pressure head (25).

b. Place Washer Guide (see figure-5) over guide tube and install tube ring (23).

c. Using Pressing Plug (see figure-4) apply press on tube ring (23) so that spring (24) is compressed to allow space to install retaining ring (22). Install retaining ring (22) to secure tube ring (23). Slowly release the press to make sure retaining ring (22) is securely in its groove. Remove from press.

4. Install wiper rings (26 and 27) into their grooves on non-pressure head (25).

5. Place a new gasket (4) onto body (2).

NOTE

Anti-rotation tubes to be greased inside and outside with grease.

6. Place non-pressure head (25) onto body (2) with nameplate flat in line with cylinder body flange, then place non-pressure head (25) and body (2) into a press with cylinder flange facing forward. Press down on non-pressure head (25) lining up Piston anti-rotation rods into non-pressure head and install four tee head bolts (1) and four lock washers (32). And four nuts (33). Tighten nuts (33) to 39-47 Nm (29-35 ft. lbs.) dry torque.

7. Apply a thin layer of equivalent grease to spring (28) and install spring (28) into non-pressure head (25).

CAUTION

RAM (29) IN NEXT STEP IS SUBJECT TO SPRING PRESSURE.

8. Apply grease to the internal threads on ram (29).

9. Apply a thin layer of grease to ram (29) and place ram (29) onto spring (28), press down and screw ram (29) onto compensator screw (11) three turns then firmly press down on ram (29) to get excess slack out.

10. Place spacer (12) onto compensator screw (11). Secure spacer (12) with a new cap screw (13). Tighten cap screw (13) to 13.5-19 Nm (10-14 ft. lbs.) dry torque.

NOTE

Hold ram (29) with a 22mm dia. Rod while tightening cap screw (13).

11. Install new expansion plug (31) into end of ram (29).

12. Seat expansion plug (31) by lightly tapping it with a hammer.

13. Apply LOCTITE 242 to fitting of filter (44). Install Wire mesh filter (44) into non-pressure head (25).

14. Assemble piston indicator assembly (37 thru 43).

b. Lubricate "O" Ring (39) and place into its groove inside indicator fitting (40). Place indicator (38) into indicator fitting (40) with red portion of indicator (38) located at hex head end of fitting (40). Apply thin layer of grease to spring (42). Install spring (42) and flat washer (43) onto indicator and secure each end with retaining rings (37).

c. Lubricant "O" Ring (41) and install on piston indicator assembly. Install indicator assembly into non-pressure head (25). Torque assembly to 39-47 Nm (29-35 ft. lbs.) dry torque.

15. TESTING - At the completion of the above, the TMB-60 Cylinder Assembly must be tested in accordance with the test specifications.

16. Always use a suitable test bench, holding fixture for testing the Brake cylinder.

LIST OF MUST CHANGE ITEMS:

S. No.	Fig. Ref.	ITEM DESCRIPTION	PART NO.	QTY / BRAKE CYLINDER
1	1	BOLT, TEE HEAD,	768330	4
2	3	BUSHING,	776539	2
3	4	GASKET, BRAKE CYLINDER,11	790685	1
4	5	PACKING CUP,11"	790666	1
5	6	GUIDE RING, BRAKE CYLINDER PISTON	790683	1
6	8	SCREW, FLAT HEAD; ZINC PLATED	766925	2
7	12	SPACER,	765823	1
8	-	SCREW, HEX HEAD, ZINC PLATED	748645	2
9	15	COMPRESSION SPRING, COUPLING	KP2186893	1
10	16	CUP, BEARING	KP2345429	1
11	18	RETAINING RING,	764058	1
12	21	SPRING COMPRESSION	777776	1
13	22	RETAINING RING,	765847	1
14	24	COMPRESSION SPRING, TRIGGER	KP2186892	1
15	26	WIPER RING,	772262	1
16	27	WIPER RING,	769953	1
17	28	COMPRESSION SPRING, RAM	KP2186891	1
18	30	BUSHING,	776539	2
19	31	PLUG, EXPANSION	759488	1
20	32	WASHER, LOCK, ZINC PLATED	735734	6
21	33	NUT, HEX, ZINC PLATED	734497	4
22	13	SCREW, HEX HEAD, ZINC PLATED	734734	1
23	36	O-RING,	755559	2
24	-	RETAINING RING, ZINC PLATED	759564	1
25	-	O-RING,	751374	1
26	-	O-RING,	760069	1
27	44	BREATHER ASSEMBLY	II95097	1
28	-	WIRE MESH FILTER	A40108	1
29	-	INDICATOR ASSEMBLY***	KP4032896	1
30	-	SCREW, FLAT HEAD, DIN50979-Zn8/Cn/T2	765834	4
31	-	RETAINING RING, ZINC PLATED	752543	1
32	-	SCREW, DRIVE, ZINC PLATED	736839	4
33	-	SCREW, SET,	765861	2
34	-	PIN,	756018	2
35	-	GREASE	506621	0.5
36	-	BLANKING FLANGE**	C173313	1
37	-	DOWEL SLEEVE*	C140446	2
38	-	BUSH*	C140445	2

S. No.	Fig. Ref.	ITEM DESCRIPTION	PART NO.	QTY / BRAKE CYLINDER
39	-	PIN; CLEVIS*	778111	2

Note - Old material to be discarded.
*Item no. 37, 38 & 39 provided for mounting of overhauled brake cylinder on bogie.
**Dust protection cap to be mounted on inlet flange of overhauled brake cylinder.
***Indicator assembly inclusive of items at position no. 37, 38, 39, 40, 41 & 42 as shown in Figure 1 below.

LIST OF CONDITIONAL CHANGE ITEMS:

S. No.	Fig. Ref.	ITEM DESCRIPTION	PART NO.	QTY / BRAKE CYLINDER	OVERHAUL DISPOSITION CONDITON
a	2	BODY, CYLINDER, TMB60,11"	790675	1	Replace if bore diameter is greater than 279.9 mm.
b	3	BUSHING	776539	2	Replace if hole Ø25.4mm exceeds to 26.7mm in any direction (i.e. oval condition)
c	9	PISTON HEAD, BRAKE CYLINDER	KP1796321	1	Replace if damage or deformation observed in threaded holes.
d	11	COMPENSATOR SCREW ASSY	778058	1	Replace if found damaged.
e	14	FRONT FEMALE CLUTCH	765814	1	Replace if found damaged.
f	10	BACK FEMALE CLUTCH	765809	1	Replace if found damaged.
g	25	NON-PRESSURE HEAD	KP1796316	1	Replace if found damaged.
h	29	RAM ASSY;	778065	1	Replace if found damaged.
i	8	SCREW, FLAT HEAD; ZINC PLATED	766925	2	Replace if found damaged or deformed.
j	7	SCREW, FLAT HEAD; ZINC PLATED	765834	4	Replace if found damaged or deformed.
k	22	RETAINING RING	765847	1	Replace if found damaged or deformed.
l	32	LOCK WASHER	735734	4	Replace if found damaged or deformed.
m	33	HEX NUT	734497	4	Replace if found damaged or deformed.
n	19	RETAINING RING	773679	1	Replace if found damaged or deformed.
o	18	RETAINING RING	764058	1	Replace if found damaged or deformed.
p	37	RETAINING RING	759564	1	Replace if found damaged or deformed.
q	-	INDICATOR ASSY.	KP4032896	1	Replace if found jammed.
r	-	CABLE ASSEMBLY	C177846	2	Replace if found damaged or jammed.

IMPORTANT NOTE - REPLACE THE WIRE MESH FILTER (PART NO. - A40108) AT (44) DURING THE ROUTINE OVERHOULING (ROH) OF WAGON.

BRAKE CYLINDER ASSEMBLY

1. Tee Head Bolt
2. Body
3. Bushing
4. Gasket
5. Packing Cup
6. Guide Ring
7. Flat Head Socket Screw
8. Flat Head Socket Screw
9. Piston Assembly
10. Back Clutch
11. Compensator Screw Assembly
12. Spacer
13. Hex Head Cap Screw
14. Front Clutch
15. Slack Adjuster Spring
16. Bearing Cup
17. Bearing
18. Retaining Ring
19. Retaining Ring
20. Spring Tube Assembly
21. Compression Spring
22. Retaining Ring
23. Tube Ring
24. Slack Adjuster Spring
25. Non-pressure Head Assembly
26. Wiper Ring
27. Wiper Ring
28. Ram Spring
29. Ram Assembly
30. Bushing
31. Plug
32. Lock Washer
33. Hex Nut
34. Self-locking Set Screw
35. Plug
36. O-Ring
37. Retaining Ring
38. Indicator
39. O-ring
40. Piston Position Indicator Fitting
41. O-Ring
42. Spring
43. Flat Washer
44. Breather Assembly

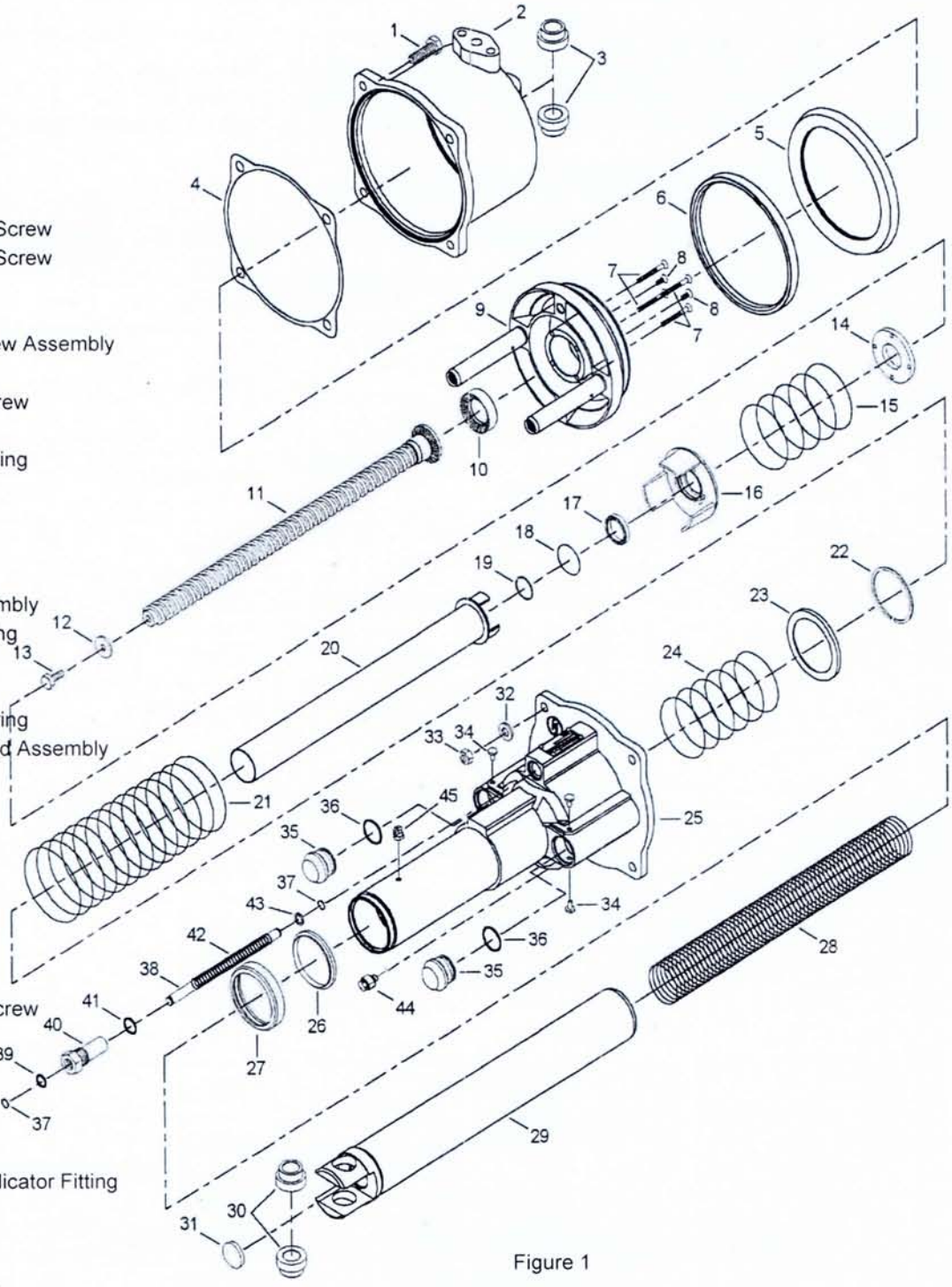


Figure 1

FIXTURES / PRESSING TOOLS

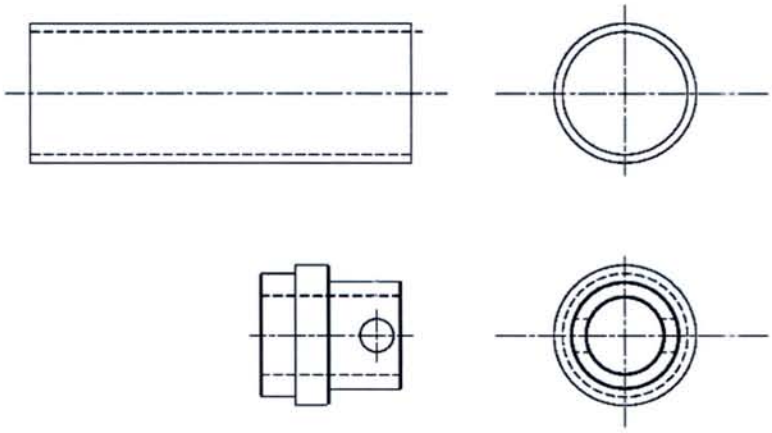


FIGURE - 2 (PRESSING TOOL)

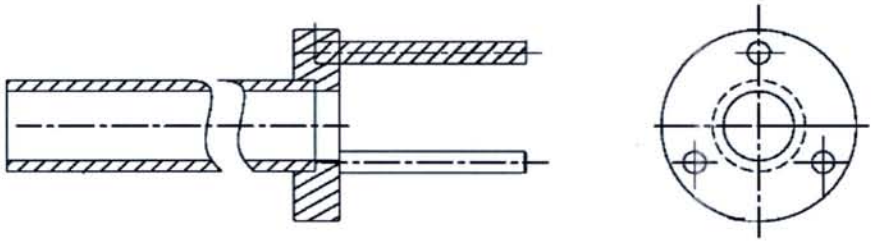


FIGURE - 3 (PRESSING FIXTURE)

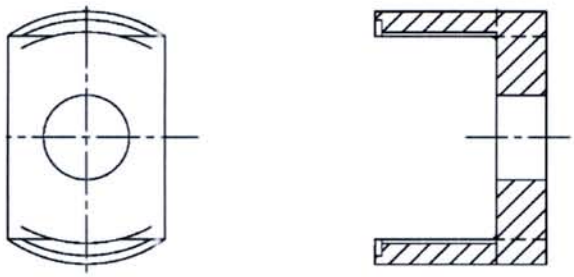


FIGURE - 4 (PRESSING PLUG)

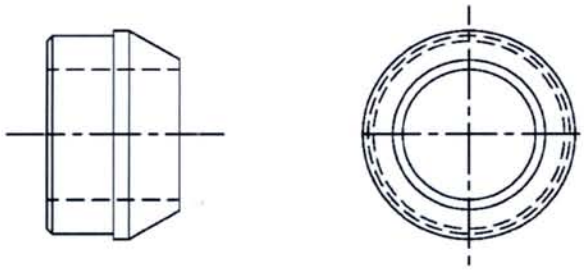


FIGURE - 5 (WASHER GUIDE)

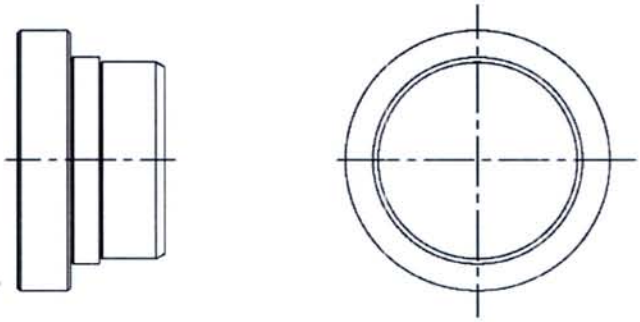


FIGURE - 6 (PRESSING TOOL)

TESTING PROCEDURE

Schematic and arrangement of test bench for brake cylinder is shown in figure – 7.

WARNING

HIGH PRESSURE AIR IS PRESENT IN THE TEST RACK AND ASSEMBLY BEING TESTED. PRESSURE WILL VENT FROM COCKS AND/OR VALVE EXHAUST PORTS WHEN TEST RACK COCKS ARE MANIPULATED OR WHEN CONTROL DEVICES ARE OPERATED. TO MINIMIZE THE RISK OF PERSONAL INJURY FROM PRESSURE EXHAUSTING, ENSURE THAT ALL PERSONS STAND CLEAR OF THE EXHAUST PATH AND THAT HEARING PROTECTION AND EYE PROTECTION ARE WORN AT ALL TIMES.

The following items are needed to assemble the Test Fixture;

1. Brake Cylinder holding fixture
2. Pressure gauge
3. 4 nos. non-vented cut out cocks
4. 2.4 mm choke installed in Exhaust Cock "B"
5. 2 nos. Pressure Regulators
6. Pipes and hoses

NOTE

Shop supply pressure must be maintained at 8 Kg/cm^2 minimum.

INITIAL CONDITION

Pressure regulators will be set as follows:

Regulator no.1 to 0.7 kg/cm^2

Regulator no.2 to 3.8 kg/cm^2

TEST NO. 1 – LOW PRESSURE LEAKAGE

Commence test with all cocks closed.

1. Open cock 1, then "A" and apply 0.7 kg/cm^2 to the cylinder.

   Note that the ram extends completely out and contacts the other end of the test setup at 0.7 kg/cm^2.

NOTE:

If the ram has not fully extended with 0.7kg/cm^2, it is allowable to adjust regulator no.1 to upto 0.9 kg/cm^2, and then readjust regulator no.1 back to 0.7 kg/cm^2 for the remainder of tests.

2. Close cock "A", then cock 1 and allow one minute temperature effect.
3. Note the reading at pressure gauge. Note the pressure drop for 10 minutes. No leakage is allowed.
4. Open cock "A" & then open exhaust cock "B" and pressure reduces to 0 kg/cm2. Close cock "B".
5. Open cock 1 and apply nominal 0.7 kg/cm2 to the cylinder. Close cock 1 and open cock "B" and pressure reduces pressure to 0 kg/cm^2.

TEST NO. 2 – HIGH PRESSURE LEAKAGE

1. Commence test with cock "A" open
2. Open cock 2 and apply a pressure of 3.8 kg/cm 2 to the brake cylinder.
3. Close cock "A", then cock 2 and allow one minute temperature effect.
4. Note the reading at pressure gauge. Note the pressure drop for 10 minutes. No leakage is allowed.
5. Open Exhaust cock "B" and pressure reduces to 0 kg/cm2.

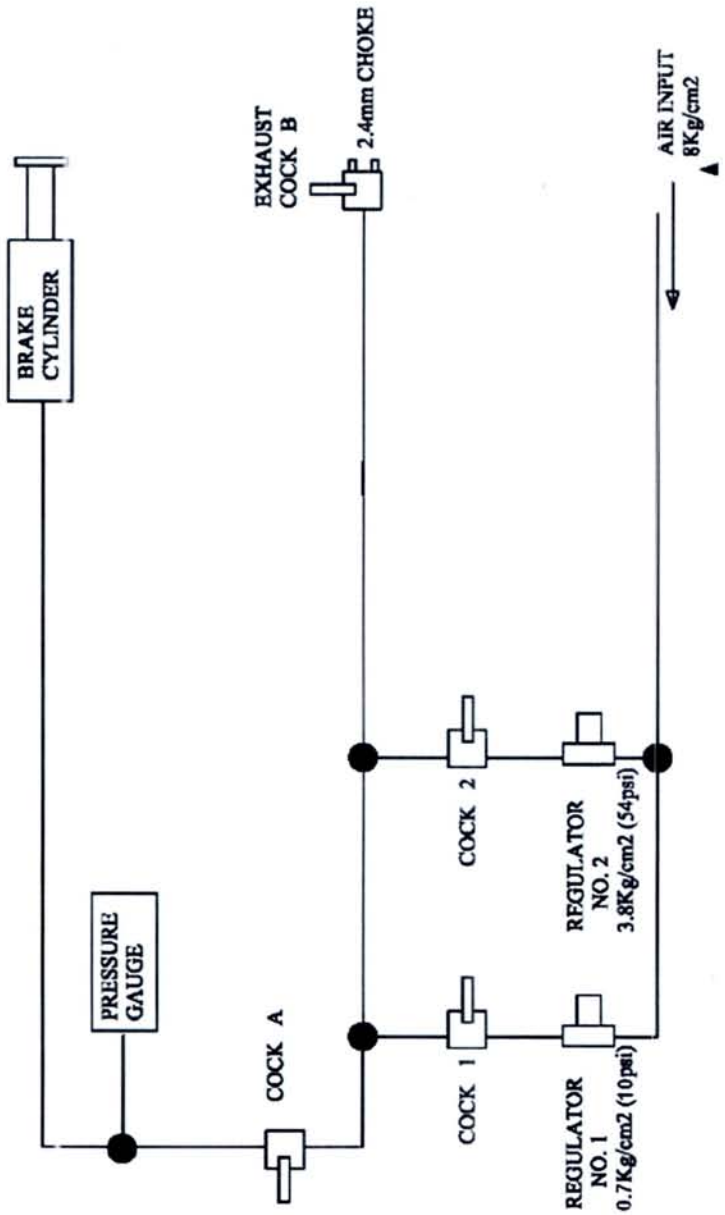
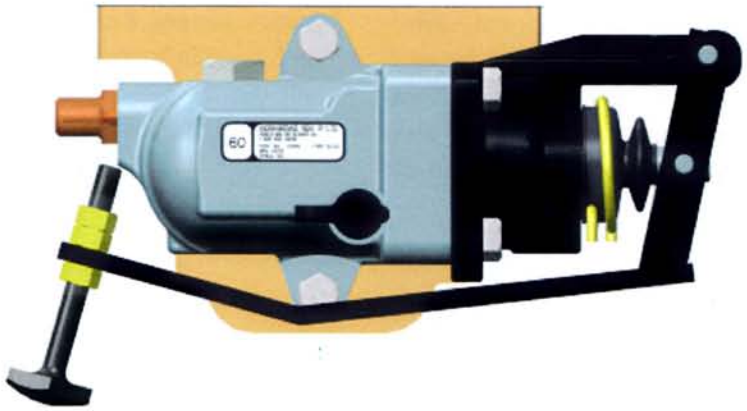


FIGURE - 7 (SCHEMATIC DIAGRAM FOR BRAKE CYLINDER TEST BENCH)

SECTION- C:

Description & Maintenance Instructions for APM (EL - 60)

(Automatic Brake Cylinder Pressure Modification Device)

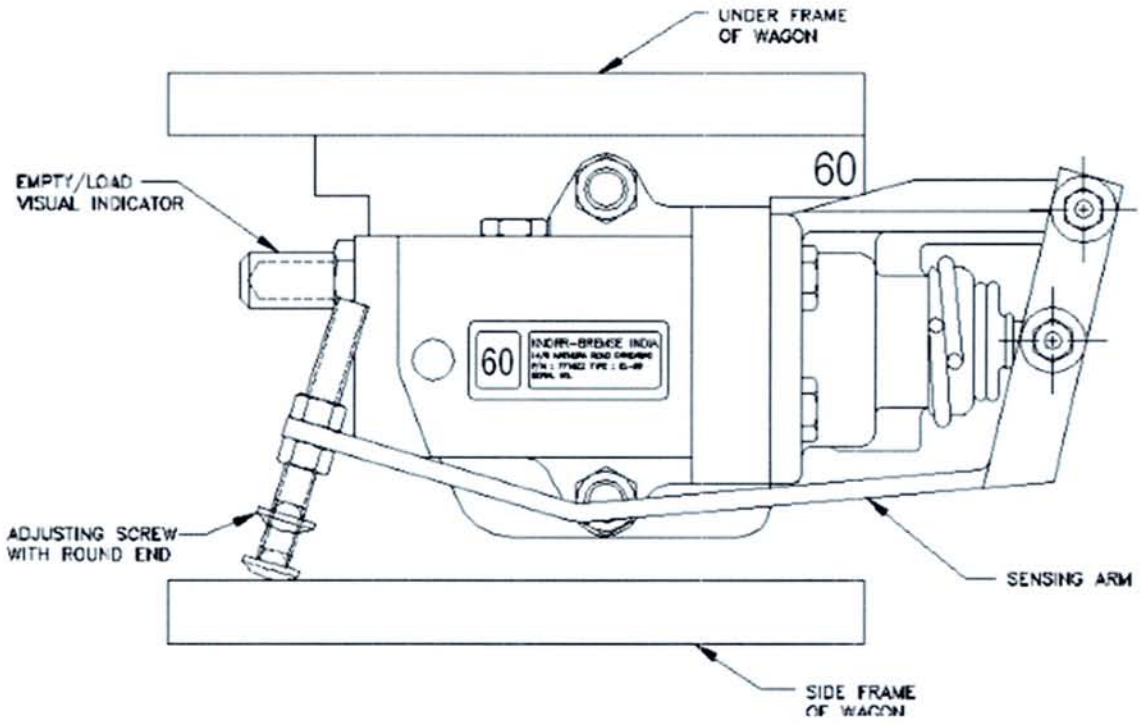


CONTENTS

GENERAL DESCRIPTION

The EL-60 valve is used to achieve 2 stages of braking i.e. empty and loaded in a wagon. The brake system on each bogie pushes the brake shoes against the wheels and this shoe force causes friction, which resists wheel rotation. There is also a friction between the wheel and rail and if the brake shoe pushes too hard the wheel will slide. To overcome this EL-60 model is offered for two stages braking i.e. empty and loaded. This prevents wheel slides on empty wagons and provides means to improve stopping distance of loaded trains.

EL-60 is a contact type of load sensing device. EL-60 is provided with a sensing arm (figure-1), 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 visual indicator, which shows empty brake condition of the wagon.



(Figure-1)

FEATURES

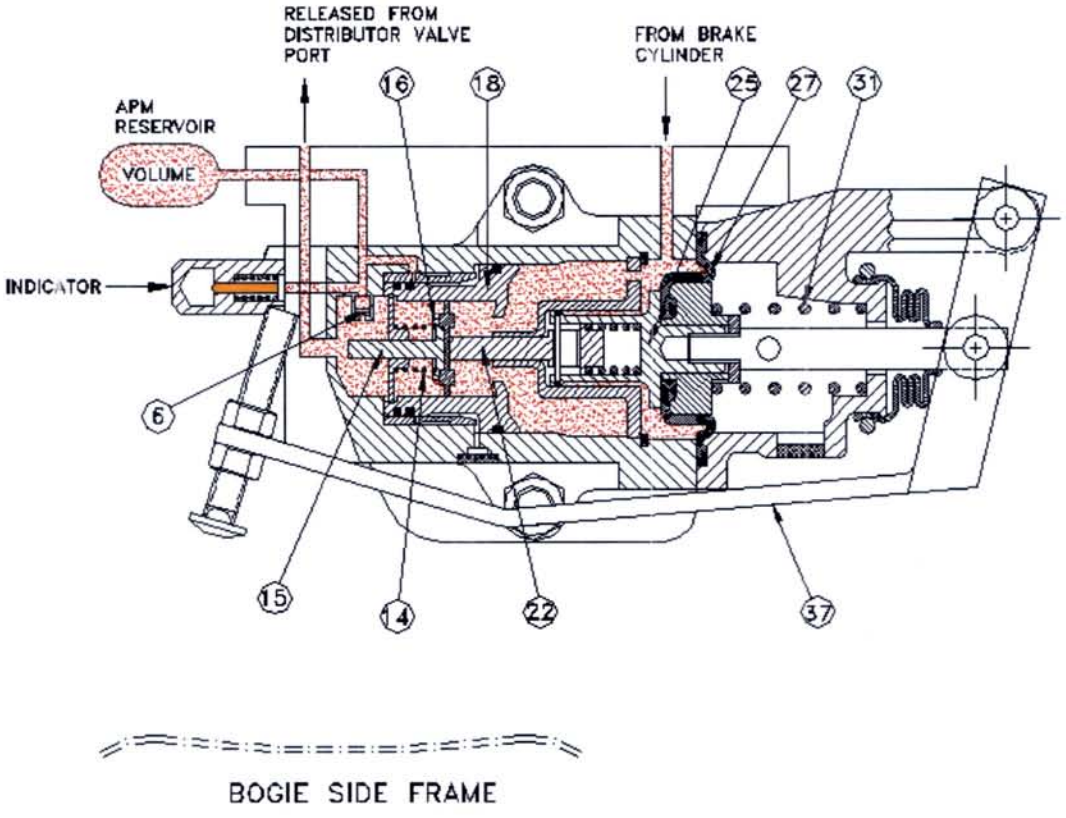
- The valve is designed such that it does not require two stages distributor Valve. Standard wagon type distributor valve can be used.
- The device does changeover of brake cylinder pressure from empty to load and vice-versa.
- The mounting and pipeline connecting parameters of the device are according 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 EL-60.
- The EL-60 load-sensing device is lightweight, with a minimum no. of parts.
- Load and empty adjustment can be easily done on the wagon.

DESCRIPTION OF OPERATION

Release Position

See Figure -2

In release position, the ratio piston (18) is held to the left of the portion by the movement of the sensor arm (37) against the piston check valve (16) and the force of the piston check valve spring (14) against the ratio piston (18). The piston check valve (16) is fully open and the upstream volume (reservoir) is connected via back flow valve (6) to the distributor valve.



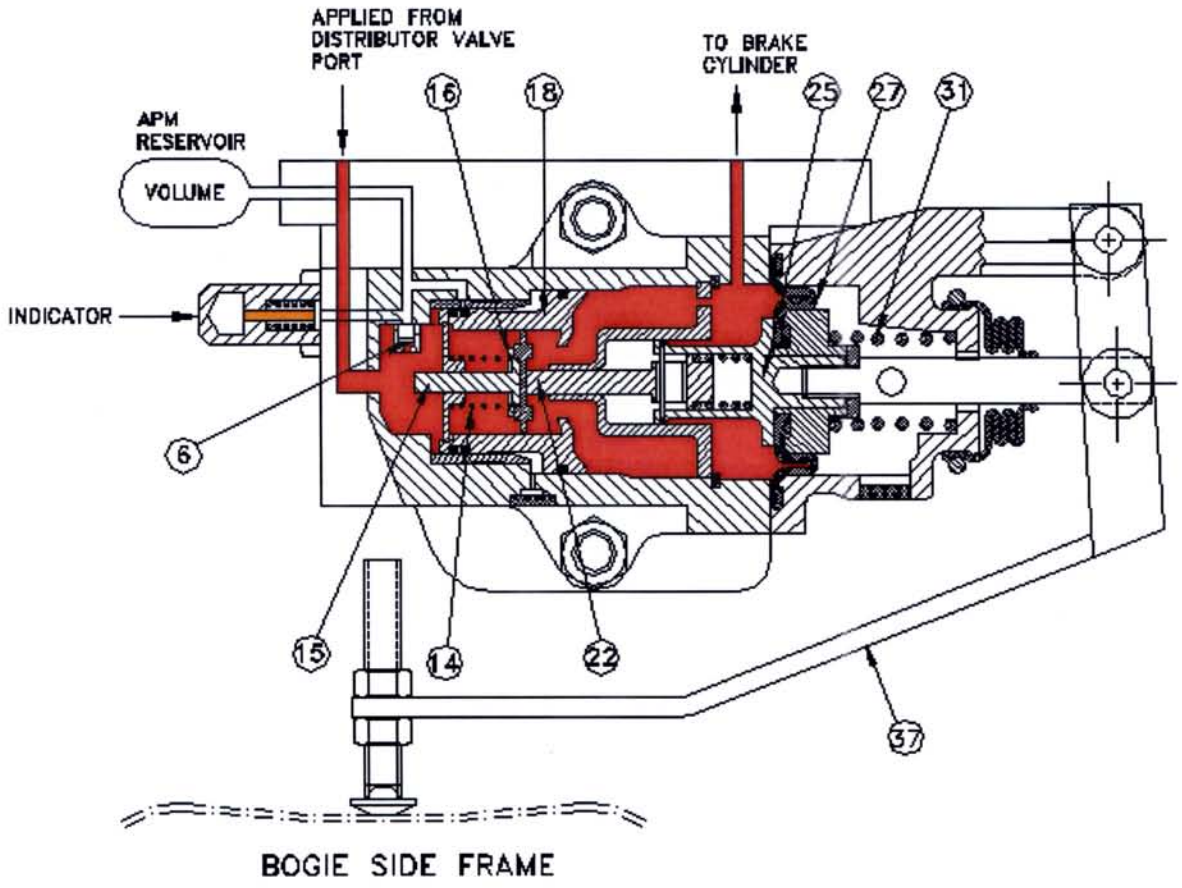
(Figure-2)

Load Position

See Figure – 3

In load position, pressure from the distributor valve port flows past the open piston check valve (16), behind the sensor diaphragm (27), and acts against the return spring (31) to move the sensor arm (37) down at normally 1 kg/cm² (15psi) pressure to contact the side frame of the bogie. Pressure then flows out to the brake cylinder.

Brake cylinder pressure build-up will be unaffected by the device in the load position because the ratio piston (18) will remain to the left of the portion and the piston check valve (16) will remain open, permitting the air from distributor valve port air to flow directly to the brake cylinder. The air passage to the volume is cut off by the ratio piston (18) and the back flow valve (6).



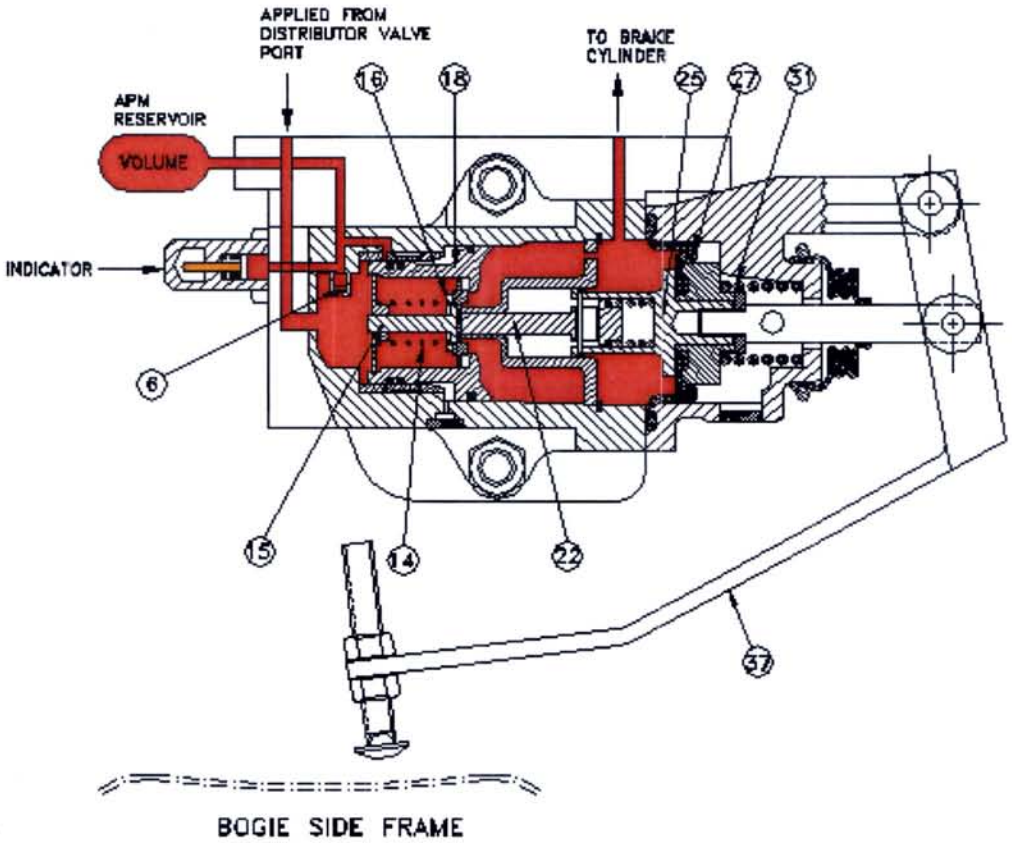
(Figure-3)

Changeover Position

See figure – 4

In the changeover position, pressure from the distributor valve port flows behind the sensor diaphragm (27) and acts against the return spring (31), moving the sensor arm (37) down at normal 1 kg/cm² (15psi) pressure to nominally 95mm of sensor arm (37) travel. The piston check valve (16) within the ratio piston (18) will close, terminating flow between the distributor valve port and the brake cylinder.

As pressure increases in the distributor valve port, the ratio piston (18) will move to right to open, when the force of the distributor valve port pressure on the check valve (16) side of the ratio piston (18) is more than the force of the brake cylinder pressure on the larger right side of the ratio piston (18). As the ratio piston (18) moves to the right, the port to the equalizing volume is uncovered, permitting pressure from the distributor valve to flow into the equalizing volume. In this design, the pressure in the control valve input and equalizing volume will be the same and brake cylinder pressure is proportioned by the different areas on the ratio piston (18) and check valve (16).



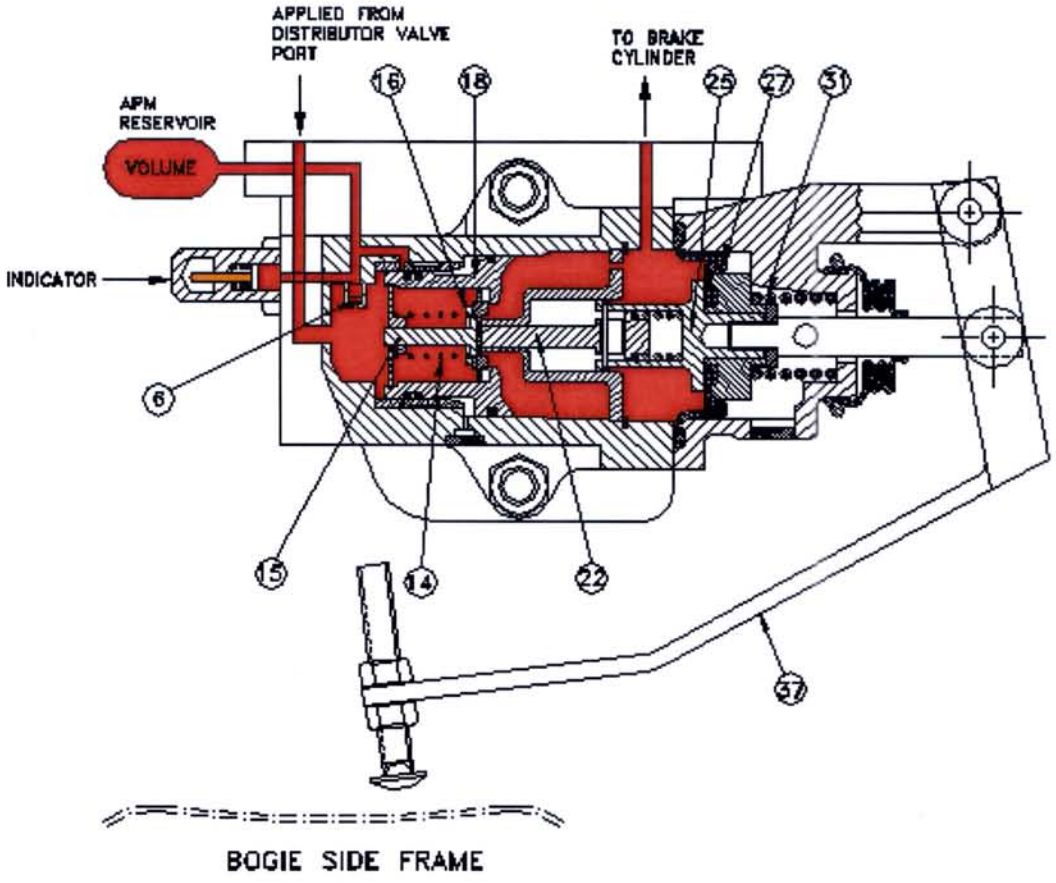
(Figure-4)

Empty Position

See figure – 5

As previously described in the changeover position, in the empty position the ratio piston (18) will move to the right as required to open the piston check valve (16) and satisfies the requirements dictated by the ratio piston (18). When the requirement of the ratio piston (18) is met, the ratio piston (18) will move back to the left, closing the piston check valve (16).

For example, with a 60% ratio piston (18), if the distributor valve pressure was 3.8 kg/cm², then the volume (reservoir) pressure would be 3.8 kg/cm² and the brake cylinder pressure would be 2.2 kg/cm². In release, as previously described, pressure from the brake cylinder will flow back through the ratio piston (18) to the distributor valve while pressure from the volume will flow through the back flow valve (6) to the distributor valve.

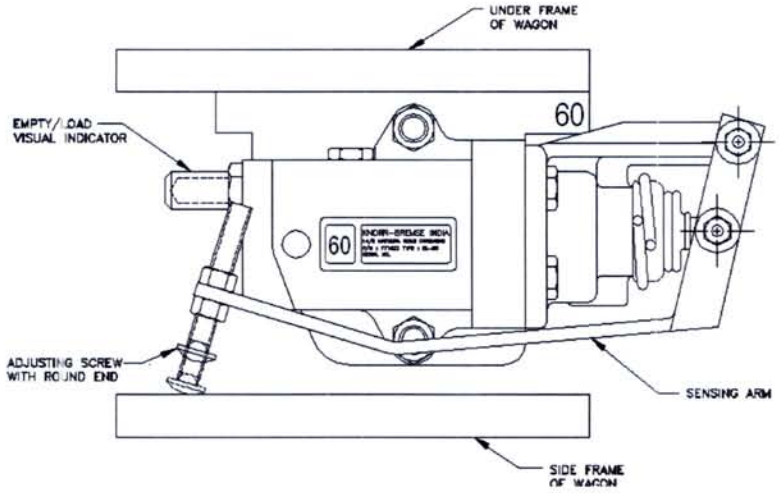


(Figure-5)

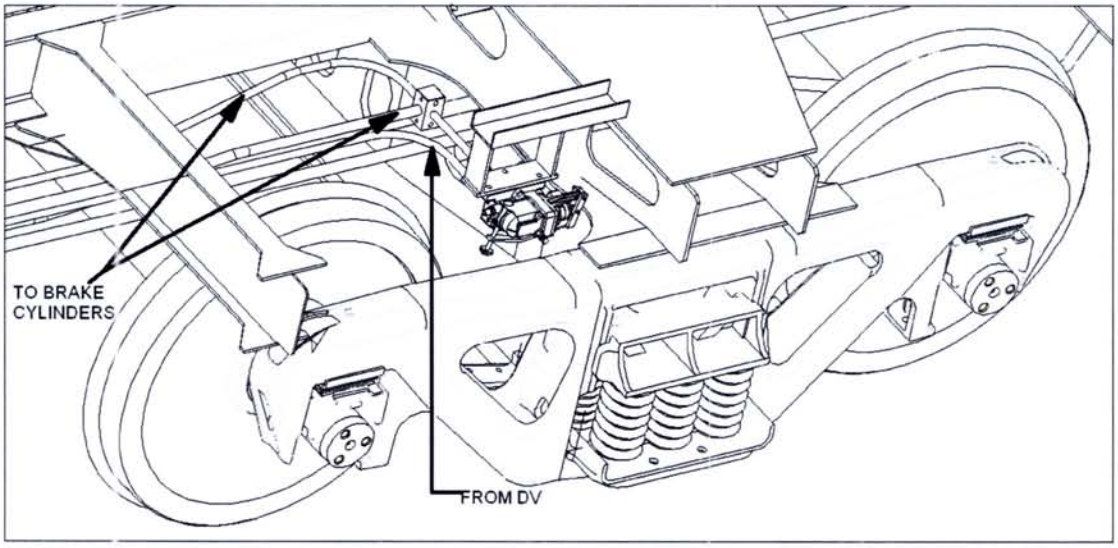
INSTALLATION AND ADJUSTMENT

The pipeline from Distributor Valve to brake cylinder splits up in two pipes as EL-60 valve is inserted in between the circuit to deliver the air to two Brake Cylinders (see figure – 6).

The EL-60 valve is mounted on the bracket which is welded on the wagon under frame. The EL-60 valve has 3 ports, 2 on the back of the bracket for connection from distributor valve & to the brake cylinders and on the side to connect to the reservoir.



(Figure-6)



Installation Inspection

Before proceeding with installation / adjustment of the Empty Load equipment the following examination should be performed.
(See fig. 7 for Empty Load Valve)

- Ensure that the Sensor Arm is not damaged or bent. Move the arm down manually to confirm appropriate location on the side frame, and check for excessive side play, beyond the effective side frame width. Inspect the two sensor arm securing bolts.

- Inspect the adjusting screw for damage on the contact ball, and that both lock nuts are present.

- Inspect the Sensor Boot damage.

- Inspect for Indicator Lens damage.

Installation Adjustments

In order to perform the adjustments, a Single Wagon Test Rig must be connected to the wagon.

TOOLS REQUIRED:
9/16" and 3/8" open ended wrenches.

- Loosen the two 9/16" lock nuts and adjust the screw until the contact ball just touches the side frame when the sensor arm is manually pulled down through it full travel.

- Apply the brakes by reducing BP to 3.6 kg/cm² by using SWTR.

- Adjust the screw so that it makes positive contact with the side frame (no slack in the arm assembly), hold the screw with the 3/8" wrench and using the 9/16" wrench tightly secure the two lock nuts.

NOTE:

1. Check that the empty load indicator is extended and is visible. (See fig. 7).

2. Check the leakage from the vent strainers, the indicator assembly, or the equalizing volume and piping.

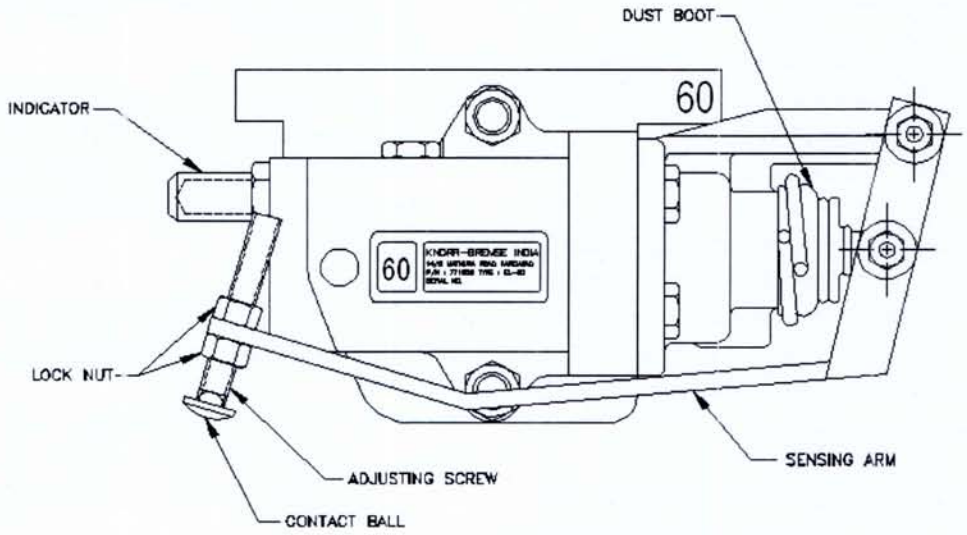
- Release the brakes by using SWTR.

- Now, place a 25mm thick BLOCK on the side frame. Apply the brakes by reducing BP to 3.6 kg/cm² by using SWTR.

NOTE:

1. Check that the empty load indicator is not extended and is not visible. (See fig. 7).

- If the indicator extends during this test, release the application and re-adjust the adjusting screw downward (decreasing set adjustment two 360 deg. turns).



(Figure-7)

The factory setting for the movement of the sensor point is 104 mm which is consisting of loaded and empty zone. First 79 mm of the sensor point is for the loaded zone and the balance is for the empty zone. After 79mm movement, changeover from loaded to empty takes place. For each wagon, the changeover from empty to loaded must be aligned to this valve. Accordingly, the total movement to be maintained in each type of wagon is listed below:

OVERHAUL INSTRUCTIONS

TOOLS REQUIRED

1. Wrench, Open End, 1"
2. Wrench, Open End, 7/8"
3. Wrench Open End, 9/16"
4. Wrench, Hex Key, 5/32"
5. Pliers, Retaining Ring, Internal
6. Pliers, ring Clamp
7. Pliers, Needle Nose
9. Wrench, Torque, Min. Range 13.5 Nm (10 Ft.-Lbs).
10. Silicone grease (Dow Corning 55/55M)

DISASSEMBLING

(See figure – 8)

1. Place a 20mm block between the cover (32) and lever (37) to assist in disassembly then remove four hex head cap screws (33) from body (1). Remove cover (32) from body (1)

2. Remove retaining ring (21) from body (1).
   a. Remove guide sleeve (20) and ratio piston (18) from body (1).
   b. Remove and discard two "O" rings (17) and "O" ring (19) from ratio piston (18).
   c. Remove retaining ring (12), spring seat and stop (13), spring (14), guide pin (15), and check valve (16) from ratio piston (18). Discard check valve (16).

3. Remove tube port plug (2) and check body (5) from body (1). Remove and discard "O" ring (3) from tube port plug (2), umbrella valve (6) and "O" ring (4) from check body (5).

4. Remove indicator (7) from body (1). Remove piston (10), and spring (9) from indicator (7). Remove and discard "O" ring (8) from indicator (7) and "O" ring (11) from (10).

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 INJURIES.

5. Remove and discard "O" ring (24) from piston follower (25).

   a. Push out pin (26), remove push rod (22) and spring (23) from piston follower (25).If spring (23) is red discard it.

   b. Place hand onto Piston Follower (25) and hold piston follower (25) from flying out, then remove elastic stop nut (38), shoulder screw (36) that connects piston rod (30) to lever (37). Discard elastic stop nut (38).

   c. Remove Piston Follower with assembled piece (25 thru 30) from valve cover (32).

   d. Remove spring (31) from piston rod (30).

   e. Place Piston Followers (25) in a bench vice and remove piston rod (30). Remove washer (29), piston (28) and diaphragm (27) from piston follower (25). Discard diaphragm (27). Remove piston follower (25) from vise.

6. Remove shoulder screw (36) and elastic stop nut (38) from cover (32). Remove lever (37) from cover (32). Discard elastic stop nut (38).

NOTE:

Step 7 is required only if there are visible signs of wear, damage or corrosion to quick disconnect nipple (41).

7. Remove dust cap (42) and quick disconnect nipple (41) from body (1). Discard quick disconnect nipple (41).

CLEANING, INSPECTING, AND REPAIRING

WARNING

SOLVENTS AND SOLVENT FUMES CAN BE HARMFUL TO HEALTH, WHILE USING SOLVENT, BE SURE TO:

- WEAR EYE, SKIN AND RESPIRATORY PROTECTION.
- WORK IN A WELL-VENTILATED AREA.
- AVOID REPEATED OR PROLONGED CONTACT.
- KEEP SOLVENT CONTAINERS CLOSED.
- KEEP SOLVENT AWAY FROM SPARKS, FLAMES AND HEAT.

FAILURE TO OBSERVE THESE SAFETY PRECAUTIONS CAN LEAD TO INJURY OR INTOXICATION.

CLEANING USING COMPRESSED AIR CAN CAUSE PARTICLES TO BECOME AIRBORNE, BE SURE TO:

- WEAR EYE PROTECTION
- DO NOT EXCEED 2 Kg/cm² (30PSI).

FAILURE TO OBSERVE THESE SAFETY PRECAUTIONS CAN LEAD TO INJURY.

1. Wash all parts in a suitable solvent that will dissolve oil and grease and permit all parts to be thoroughly cleaned without abrasion (i.e. mineral spirits). Then blow dry with a jet of dry, compressed air (max. at 2 kg/cm²).

2. Replace all rubber parts.

3. Examine all springs for rust pits, distortion, or permanent set and replace where necessary.

4. Replace any other parts that are cracked, broken, cut, worn, damaged, or in such a condition as would result in unsatisfactory operation.

   To assist in determining if wear or damage has occurred to the wearing parts of this assembly, the allowable tolerances for these parts are listed in the text that follows. If a part fails to meet a requirement, the part should be replaced, unless otherwise stated.

   a. Piston Rod (30)
      Piston rod holes to be free of scratches, nicks, or dents and shall exhibit no elongation.
   b. Shoulder Screw (36)
      Shoulder screw to be free of flat spots, dirt, and corrosion.
   c. Adjusting Screw (39)
      End or adjusting screw to be free of surface wear, dents, and burrs.

5. Replace any retaining ring, which is not elastic enough to clamp securely.

REASSEMBLING & TESTING

Consumable Required

Apart from the must change items and the replacement against the damaged items, the following consumables are required while assembling;

S No.	List of Consumable Items	Remarks
1	Loctite 680	5 ~ 7 ml/pc
2	Loctite Primer T 7471	7 ~ 10 ml/pc
3	Isopropyl Alcohol	5 ~ 10 ml/pc
4	DOW CORNING #55 Silicone grease (M 55).	5 ~ 7 gms/pc
5	Loctite 271	5 ~ 7 ml/pc

List of must change Items are listed in this manual.

REASSEMBLING

1. Rubber O-Rings must be lubricated individually with Silicone Grease. Prior to assembly, the O-Ring shall be coated with grease. After installing the new O-Ring in its groove, remove only the excess grease before inserting the assembly into the coated bushing.

2. Place lever (37) in cover (32) then insert shoulder screw (36) and new elastic stop nut (38) into lever (37) and cover (32).

   NOTE:

   Install diaphragm (27) with numbers facing up so that numbers go into the groove in the cover (32).

3. Place piston follower (25) in a vise. Install new diaphragm (27) onto the piston (28), then install piston (28), washer (29) and piston rod (30) onto diaphragm follower (25). Securely tighten piston rod (30) to diaphragm follower (25).

   a. Install spring (31) onto piston rod (30)

b. Insert piston follower with assembled pieces (25 thru 31) into cover (32).

c. Place hand on piston follower (25) and press on piston follower (25) to compress spring (31). Insert shoulder screw (36) through lever (37) and piston rod (30). Attach elastic stop nut (38) to shoulder screw (36).

d. Insert spring (23) and lightly greased push rod (22) into diaphragm follower (25). Then insert pin (26) into hole in piston follower (25) and push rod (22).

e. Install new "O" ring (24) onto piston follower (25).

4. Install new "O" ring (8) onto indicator (7) and "O" ring (11) onto piston (10).

a. Insert spring (9) and piston (10) into indicator body (7).

b. Insert indicator (7) into body (1) and securely tighten.

5. Insert new umbrella valve (6) into check body (5).

a. Install new "O" ring (3) onto tube port plug (2).

b. Install new "O" ring (4) onto body check (5).

c. Insert check body (5) and tube port plug (2) into body (1).

6. Insert new check valve (16), lightly greased guide pin (15) stem, spring (14), spring seat and stop (13) and retaining ring (12) into the ratio piston (18).

a. Install two new "O" ring (17) and new "O" ring (19) onto ratio piston (18).

b. Insert ratio piston (18) and guide sleeve (20) into body (1).

NOTE:

Guide sleeve (20) recess should be aligned with the hole in the body (1) to help in the ease of installing and removing of retaining ring (21).

c. Insert retaining ring (21) into body (1).

NOTE:

Installation of retaining ring (21) should be with the plier holes located within the cut-out in the guide sleeve (20).

7. Place a 20mm block between the cover (32) and the lever (37) to assist in assembly then carefully align push rod (22) into guide sleeve (20) and install cover (32) onto body (1) and secure in place with four hex head cap screws (33). Tighten screws (33) to 20.3 +2 Nm (15+1.5 Ft.-lbs).

NOTE:

Step 8 is only required if quick disconnect nipple was discarded during disassembly.

NOTE:

Use Key-Tite pipe sealant when installing quick disconnect Nipple (46) unless nipple has pre applied thread sealant.

8. Install quick disconnect nipple (46) into body (1).

LIST OF MUST CHANGE ITEMS:

S N	Fig. Ref.	DESCRIPTION	PART NO.	Qty / Valve
1.	3	TUBE PORT PLUG WITH O-RING	760837	1
2.	4	O-RING	738362	1
3.	6	UMBRELLA VALVE	772345	1
4.	8	O-RING	756728	1
5.	11	O-RING	783649	1
6.	17	O-RING (Old Part No. 781694)	789842-047	2
7.	19	O-RING; SPECIAL (Old Part No. 771637)	789842-023	1
8.	24	O-RING	749475	1
9.	27	DIAPHRAGM	755749	1
10.	34	DUST BOOT	772308	1
11.	38	NUT, ELASTIC STOP	733883	2
12.	44	SCREENED GASKET	772401	1
13.	45	SCREENED GASKET	781215	2
14.	16	CHECK VALVE	771329	1
15.	7	VISOR CAP	771071	1
16.	13	SPRING SEAT & STOP	770828	1
17.	39	SCREW; ADJUSTING	782169	1
18.	22	PUSH ROD	771224	1
19.	15	GUIDE PIN,	771197	1
20.	42	DUST CAP, QUICK DISCONNECT	776207	1
21.	9	SPRING, COMPRESSION	771112	1
22.	14	SPRING, COMPRESSION	771630	1
23.	10	PISTON, INDICATOR	771113	1
24.	23	SPRING, COMPRESSION	771629	1
25.	40	LOCKNUT, HEX, ZINC PLATED	755896	2
26.	21	RETAINING RING, ZINC PLATED	770824	1
27.	26	PIN	771693	1
28.	31	SPRING COMPRESSON	752173	1
29.	36	SCREW, SHOULDER, ZINC PLATED	752089	2
30.	41	NIPPLE, QUICK DISCONNECT	776156	1

Note - Discard old part.

LIST OF CONDITIONAL CHANGE ITEMS:

S. N.	Fig. Ref.	DESCRIPTION	PART NO.	Qty / Valve
a	46	PIPE BRACKET ASSY	770821	1
b	1	BODY ASSY	770831	1
c	32	COVER ASSY	771111	1
d	37	LEVER	772073	1
e	10	PISTON	772331	1
f	18	PISTON; 60% RATIO	770826	1
g	25	PISTON FOLLOWER	771075	1
h	30	PISTON ROD	752088	1
i	16	CHECK VALVE	771329	1
j	39	SCREW; ADJUSTING	782169	1
k	22	PUSH ROD	771224	1
l	13	SPRING SEAT & STOP	770828	1
m	7	VISOR CAP	771071	1

EL-60 ASSEMBLY (EXPLODED VIEW)

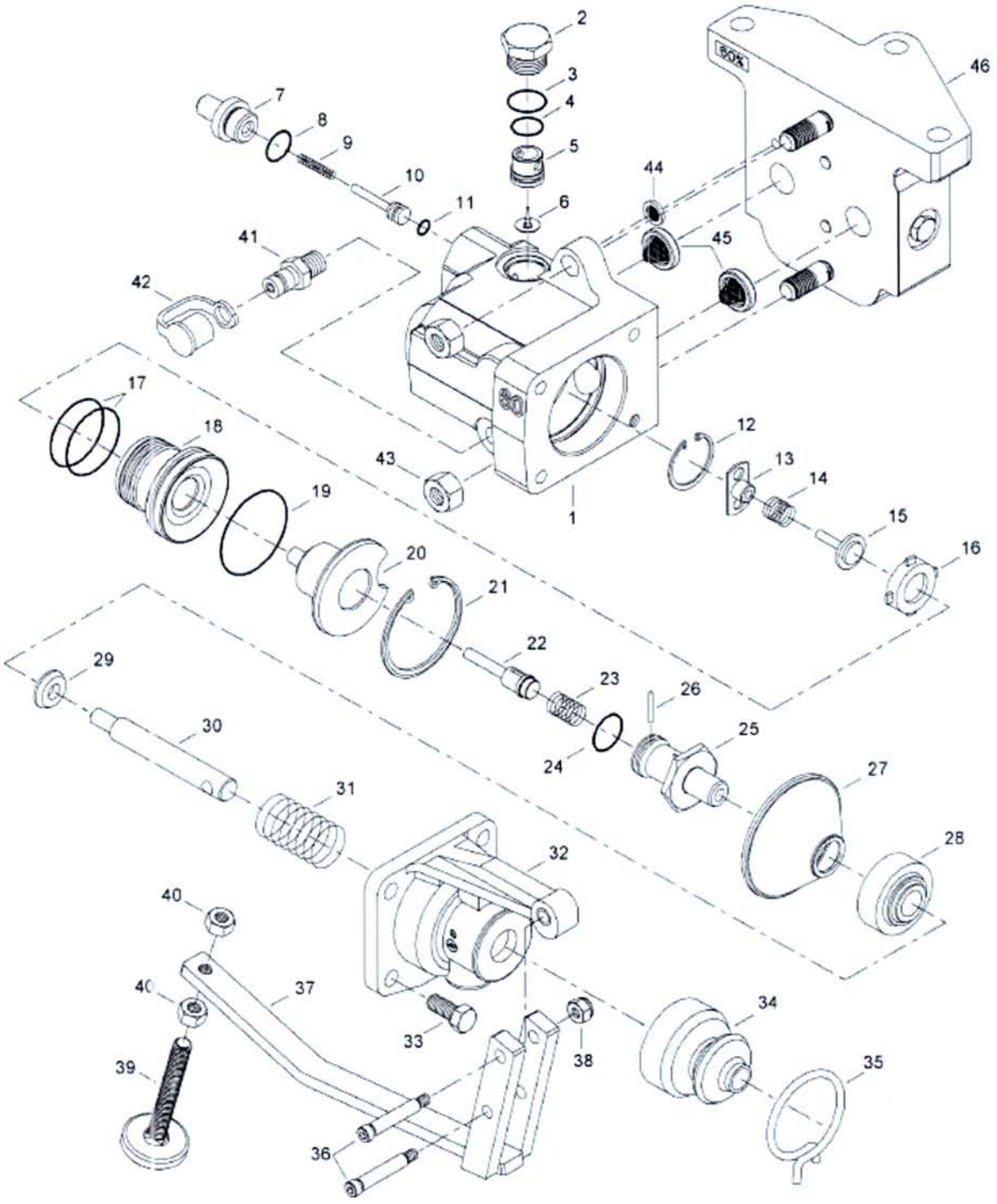


Figure-8

S.No.	Description	Part No.	Qty.(Nos)
1	Body	770831	1
2,3	Tube Port Plug with O-ring	760837	1
4	O-ring	738362	1
5	Check Body	771534	1
6	Umbrella Valve	772345	1
7	Indicator	771071	1
8	O-Ring	756728	1
9	Spring	771112	1
10	Piston	771113	1
11	O-Ring	783649	1
12	Retaining Ring	770825	1
13	Spring Seat and Stop	770828	1
14	Spring	771630	1
15	Guide Pin	771197	1
16	Check Valve	771329	1
17	O-Ring	781694	2
18	Ratio piston	770826	1
19	O-ring	771637	1
20	Guide Sleeve	771509	1
21	Retaining Ring	770824	1
22	Push Rod	771224	1
23	Spring	771629	1
24	O-Ring	749475	1
25	Piston Follower	771075	1
26	Pin	771693	1
27	Diaphragm	755749	1
28	Piston	772331	1
29	Washer	772332	1
30	Piston Rod	752088	1
31	Spring	752173	1
32	Valve Cover	771111	1
33	Hex Head Cap Screw	747053	4
34	Dust Boot	772308	1
35	Clamp	752109	1
36	Shoulder Screw	752089	2
37	Lever	772073	1
38	Elastic Stop Nut	733883	2
39	Adjusting Screw	782169	1
40	Lock Nut	755896	2
41	Quick Disconnect Nipple	776156	1
42	Dust Cap	776207	1
43	Nut	734497	2
44	Ring Gasket	772401	1
45	Ring Gasket	781215	2
46	Pipe Bracket	II90520	1

TESTING

After the completion of the above, the EL-60 Empty/ Load Valve must be tested in accordance with the test specifications.

Test Preparation

The following items are needed to assemble the Test Fixture.

1. Load Sensing Device holding fixture
2. 2 nos. pressure gauge
3. 10liter reservoir
4. 6.6liter reservoir
5. 2 nos. - cut out cocks with vent.
6. Pressure Regulator
7. 25mm high block
8. Pipes and hoses

WARNING:

High pressure air is present in the test rack and assembly being tested. Pressure will vent from cocks and/or valve exhaust ports when test rack cocks are manipulated or when control devices are operated. To minimize the risk of personal injury from pressure exhausting, ensure that all persons stand clear of the exhaust path and that hearing protection and eye protection are worn at all times.

Test Instruction

1. Diagrammatic view and arrangement of test rack is shown on figure – 9.
2. Shop supply pressure must be maintained at 8kg/cm2 minimum.
3. Open cock A and set the pressure regulator to 3.8kg/cm2
4. Set the sensor arm travel to 104mm from the sensor arm adjusting screw to the stopper plate.

Test Procedure

LOAD POSITION & LEAKAGE

1. Place a 25mm high block between the adjusting screw and the stopper plate.
2. Open cock A and apply the main supply pressure. Pressure gauge no.1 should show 3.8kg/cm² pressure otherwise adjust the regulator to get 3.8kg/cm².
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 empty load indicator. It should remain retracted.
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.

TEST NO. 2 – EMPTY POSITION & LEAKAGE

1. Open cock A and apply the main supply pressure. Pressure gauge no.1 should show 3.8kg/cm² pressure otherwise adjust the regulator to get 3.8kg/cm².
2. Open cock B and apply 3.8kg/cm2 pressure to the load-sensing device.
3. As the sensor arm stops moving further down, note the reading at pressure gauge no.2. It should be 2.2 +/- 0.1kg/cm2.
4. Check the empty load indicator. It should be completely extended.
5. Check the leakage at all joints and ports. No leakage is allowed.
6. Close cock A and B and reduce pressure to 0kg/cm2.

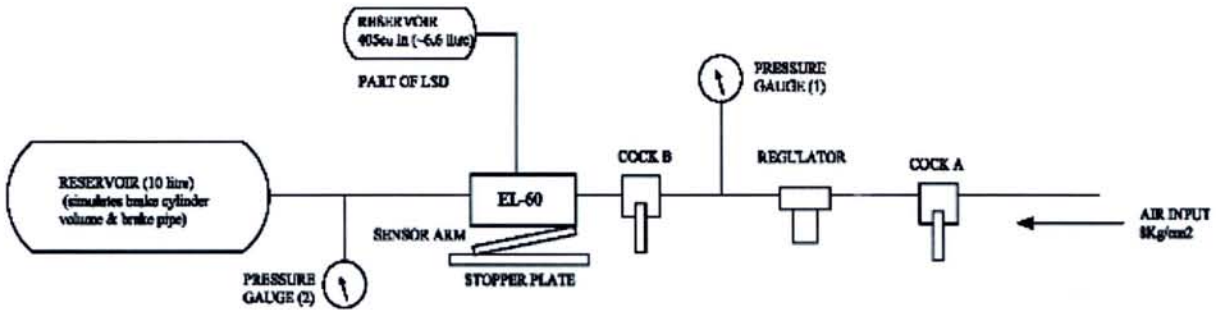


Figure-09

Pneumatic schematic diagram for testing of EL-60 Valve