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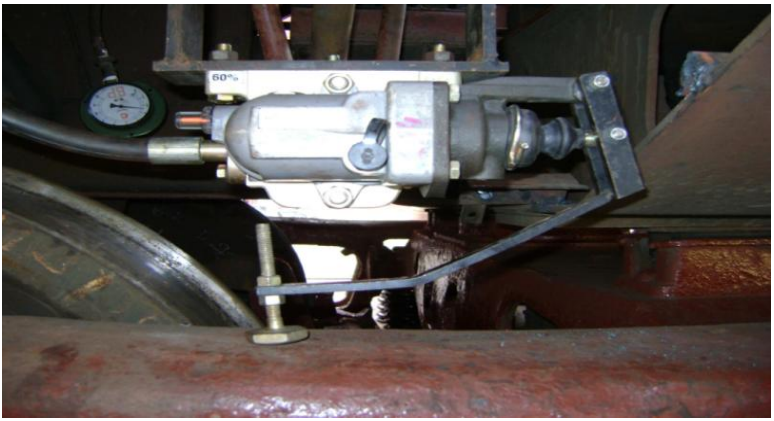
सत्यमेव जयते

(भारत सरकार - रेल मंत्रालय)

(Government of India - Ministry of Railways)

Load Sensing Device (LSD)
&
Automatic Brake Cylinder Pressure Monitoring Device (APM)



(**केवल कार्यालयीन प्रयोग हेतु -** For official use only)

IRCAMTECH/GWL/M/Wagon/LSD

(**जून -** June – 2020)

अग्रमा संRDS
रेल अग्रदूत Transforming Railways

An ISO 9001:2015 Certified Organization
उच्च अनुरक्षण प्रौद्योगिकी केन्द्र
EXCELLENCE IN MAINTENANCE

Indian Railways
Centre for Advanced Maintenance Technology

MAHARAJPUR, GWALIOR – 474005 (INDIA)

FOREWORD

Load Sensing Device (LSD) and Automatic Brake Cylinder Pressure Monitoring System (APM) has been introduced for achieving 2- stage braking i.e. empty and loaded with automatic changeover of brake power in wagons to prevent wheel skidding on empty wagons and improving stopping distance of loaded wagons.

This hand book contains introduction with specifications, application & installation, function and special features of the devices.

I am sure that the Handbook on "LSD & APM" will be very much useful to the field staff, to ensure trouble free service.

30 June, 2020
CAMTECH, Gwalior

(Jitendra Singh)
Principal Executive Director

PREFACE

Proper knowledge of Load Sensing Device & Automatic Brake Cylinder Pressure Monitoring System in freight stock is necessary to ensure reliability and proper functioning of brake system in freight stock. This handbook on LSD & APM in freight stock has been prepared by CAMTECH with the objective that those involved in operation and maintenance of wagon stock must be aware of sufficient knowledge of LSD and APM to avoid wheel skidding in empty wagons and to improve stopping distance of loaded wagons.

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

30 June, 2020
CAMTECH, GWALIOR

(Manoj Kumar)
Director/Mechanical

CORRECTION SLIPS

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

CAMTECH/GWL/M/WAGON/LSD # XX date ----------
Where "XX" is the serial number of the concerned Correction Slip (starting from 01 onwards).

CORRECTION SLIPS ISSUED

Sr. No. of Correction Slip	Date of issue	Page No. and Item No. modified	Remarks

CONTENTS

1.0 Introduction

1.1 Load Sensing Device (LSD)

- To effect the automatic change of a change over valve of distributer valve depending on whether the vehicle is in "EMPTY" or in "LOAD" condition, a load sensing device is employed.
- The Load Sensing Devices are provided on Container (CONCOR) Wagons, BOBR Wagons, Bogie Mounted Wagons for automatic load changeover.

1.2 Automatic Brake cylinder Pressure Monitoring Device (APM)

- The APM device protects the wheels by reducing empty-stock braking forces that can result in costly wheel skidding, especially under adverse weather or track conditions. The device is a body mounted valve to sense loaded or empty conditions and provides a visual indicator of brake cylinder pressure. This valve is designed to optimize trouble-free performance on any application.
- The Automatic Pressure Modification Devices are provided on all types of Railway freight wagons having maximum axle load of 22.9 tons such as BOBRN, BOBRNHSM1, BOXN, BOXNHL, BCN, BCNA.

2.0 Why is LSD required?

- The brake system on each bogie pushes the brake block against the wheels and this produces braking force which resists the wheel rotation.
- There is also friction between the wheel and the rail and if the brake block pushes too hard, the wagon wheel will skid.

- The lighter the wagon, the more likely it is to skid.
- To overcome this problem, Load Sensing Device (LSD) is fitted for achieving 2-stage braking i.e. empty and loaded with automatic change-over of brake power.
- This prevents wheel skidding on empty wagons and provides means to improve braking distance of loaded trains.

3.0 Load Sensing Device (LSD) Specifications

At present, there are two types of LSDs

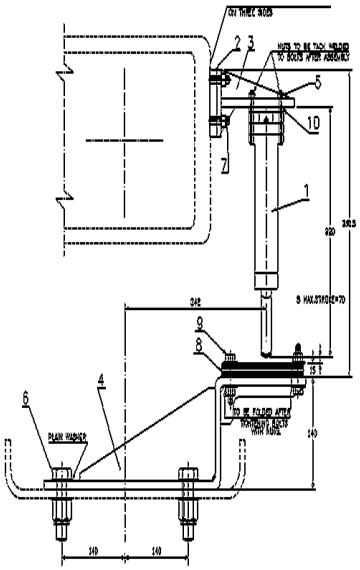
1. Two Piece LSD
2. Single Piece LSD

As now population of two pieces LSD is negligible on wagon stock. The single piece LSDs are running in the system.

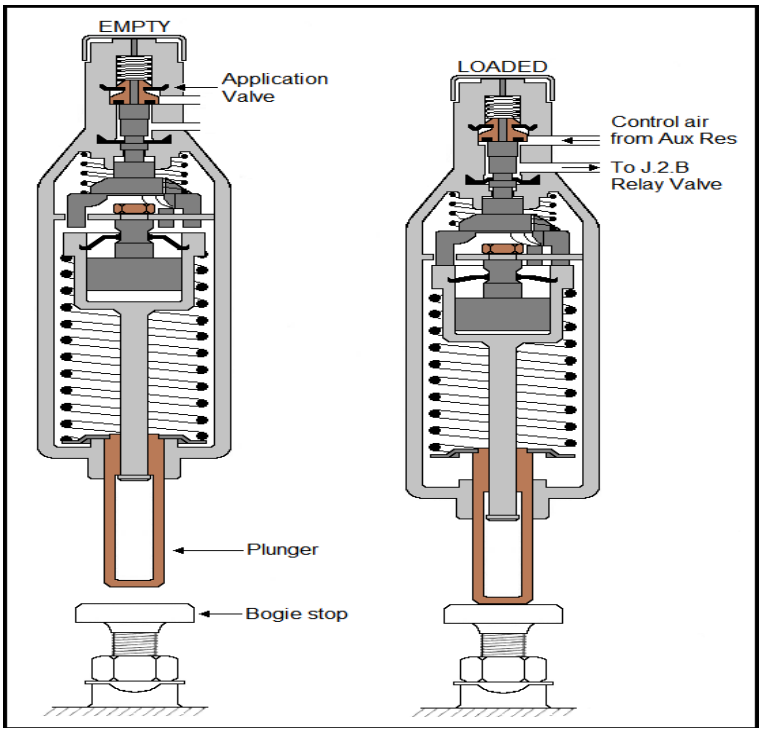
The technical data of M/s. Faiveley and M/s. Gresham make LSDs are given in the list.

Sr. No.	Description	Setting valve
1.	Over all piston Stroke in Faiveley	75 MM
2.	Sensing Pressure in Faiveley	5.0 Kg/CM^2
3.	LSD Pressing Piston in Faiveley	5 mm in side
4.	Filling time 5.0 Kg/CM^2 in Faiveley	In 10 $\pm$ 2 Sec.
5.	Empty Piston Stroke in Greysham	66 mm
6.	Loaded Piston stroke in Greysham	70 mm $\pm$ 2 mm
7.	Operating Stroke in Greysham	06 mm $\pm$ 0.5 mm
8.	Working Pressure in Greysham	5.0 Kg/CM^2
9.	Filling Time in Greysham LSD	65 $\pm$ 2.0 Sec
10.	Draining Time in Greysham LSD	38 $\pm$ 2.0 Sec.

3.1 Single Piece LSD



3.2 Two Piece LSD



4.0 Functioning

- When the wagon is in the empty weight range, the piston is in its lower position. Output connection leading to the change over valve is then exhausted through Exh. port via upper chamber.
- When the weight reaches the "LOADED" range, piston is pushed up. This causes the air seal to pass over output connection, thus interrupting communication from output connection to exhaust.
- When the wagon is in the empty weight range, the piston is in its lower position. Output connection leading to the change over valve is then exhausted through Exh. port via upper chamber.

- When the weight reaches the "LOADED" range, piston is pushed up. This causes the air seal to pass over output connection, thus interrupting communication from output connection to exhaust.
- Input connection and output connection now communicate via lower chamber, so that air from the (AR) Auxiliary Reservoir can flow to the change over valve.
- When weight falls to within the "EMPTY" range again, the piston returns to its lower position and output connection is once exhausted to Ex. port.

5.0 Installation of LSD

- LSD can be mounted from top or from side as required.
- It is mounted on bolster through mounting bracket.
- Below the LSD is a base plate mounted on spring plank.
- The LSD must be so located that its longitudinal axes are parallel to the deflection direction of the sprung bogie part.
- The angle formed by the longitudinal axes of the LSD and the contact surface (base plate) must be 90°±10º.
- The inlet connection of the LSD is connected to Air Reservoir and outlet connection is connected to change over valve of DV.

6.0 Problems in open line:

- LSD on wagons are non functional or deficient despite repeated special efforts for fitment during POH/ROH. This is also pointed out by NTXRs and 174 BOBRN wagons were turned out from KGPW (from Sept., 08 to Feb.'09) without fitment of LSD. The necessity and feasibility of LSD may be reviewed by RDSO while granting exemption of fitment of LSD as rejectable item.

7.0 Suggestions by open lines:

- Fitting of LSD on BOBRN wagons should be exempted. RDSO may review the necessity and feasibility of LSD.
- APM should be provided in place of LSDs.

8.0 RDSO's Comments

Design issues with existing LSD

- Existing LSD has inherent tendency of fatigue failure due to constant contact.
- LSD is in constant touch with the bracket when the wagon is in loaded condition.
- Because of the vibrations in the wagon during run, the mounting arrangement gets loose. Due to loosing of bracket, K-ring gets worn-out and the piston bends.
- The breakage of LSD bodies from the neck also takes place because of the same reason.
- Breakage/tilting of brackets of LSD and theft of LSDs etc. have been reported from Railways.

8.1 Shifted Z-Plate and LSD

8.2 Tilted LSD

8.3 LSD mounting bracket tilted

8.4 Adjusting plates of Z-plate found deformed And position shifted

8.5 Nipples found broken on the LSD

9.0 Action Taken by RDSO

- Spring buffer assembly of two piece LSD on BOBRN wagon was getting tilted. RDSO modified the two piece design to single piece design. The defect of tilting was rectified.
- RDSO has developed new improved design of LSD. This new design is known as APM- Automatic Pressure Modification Device.

10.0 Overhaul LSD testing procedure on test bench:

1. Tighten the overhaul LSD with two bolts on the LSD mounting bracket on the test bench.
2. Make a pressure of at least 6.5 kg / cm^2 through MR compressor and charge the air brake system of the test bench with 5 kg / cm^2 pressure with the help of A9 valve.
3. Connect the pipe coming from AR to the in-let port of LSD and connecting LSD to out-let port with pressure gauge of LSD on test bench.
4. Open the LSD cock on the test bench and charge the LSD at 5 kg /

cm^2 pressure and test the leakage of the LSD, there should be no leakage in LSD.

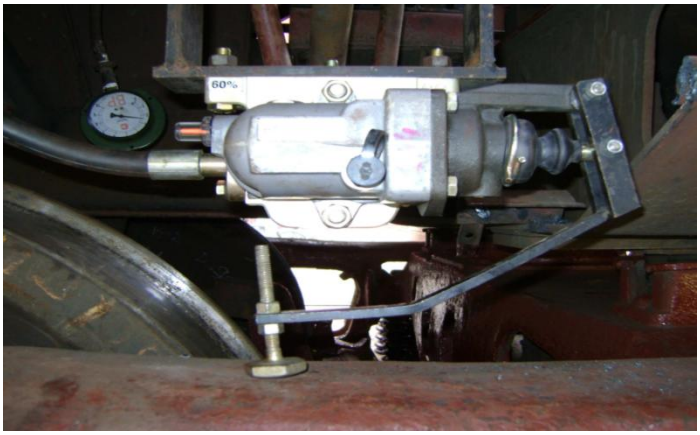
5. Now turn the hand wheel on the LSD brake clockwise and press the LSD piston and the pressure gauge of LSD should see pressure of 5 kg / cm^2 and there should be no leakage in LSD.
6. Turn the hand wheel on the LSD bracket anti-clockwise and the pressure on the LSD pressure gauge on the test bench should be reduce from 5 kg / cm^2 to 0 kg / cm^2 and there should be no leakage in the LSD.
7. Now separate the LSD by opening the mounting bracket nut bolt.
8. Type the station code and date on the tested LSD and place it on the LSD test bench.

11.0 APM (Automatic Brake Cylinder Pressure Monitoring Device)

- APM is a two stage automatic brake cylinder pressure modification device.
- The APMs are supposed to sense the gap at the time of air brake application and normally they are not in contact with the bogie side frame.
- This will prevent fatigue failures due to vibrations arising from constant contact.
- An extensive trial of this new LSD has been conducted on ECOR for the last 6 years and there have been no reported failures of the same.
- Testing facility for this APM has been created at RDSO and APM of Knorr make (EL-60) has already been tested and approved with BMBS.
- M/s. Faiveley has also offered its Ratio- valve which is similar to APM. It is being tested at RDSO.
- Improved design specification of this Load change-over Device (APM) is being developed at RDSO and will be made available very soon. Anti theft features are also being included in this new design.

11.1 Design Features of APM

- This device does change-over of brake cylinder pressure from empty to load.
- This valve is designed such that it does not require two stages distributor Valve. Normal distributor valve can be used.
- The mounting and pipeline connecting parameters of the design is modified according to the standard pipes and flange used in Indian Railways, so no major change is required in the piping arrangement. 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 load brake conditions.
- 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.

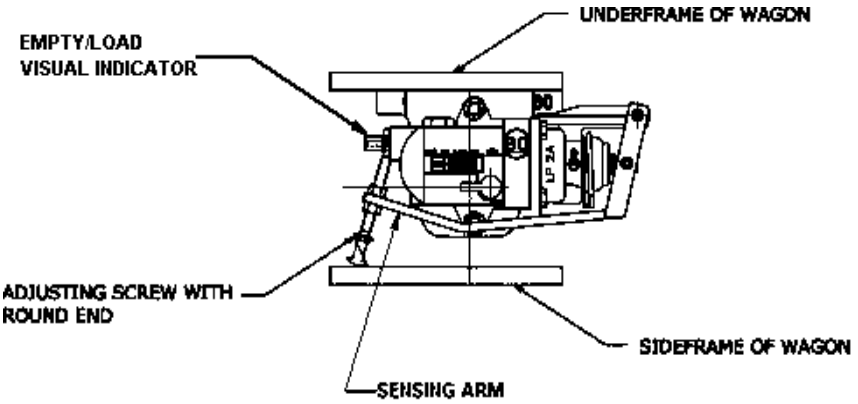


EL-60 type APM supplied by Knorr Bremse

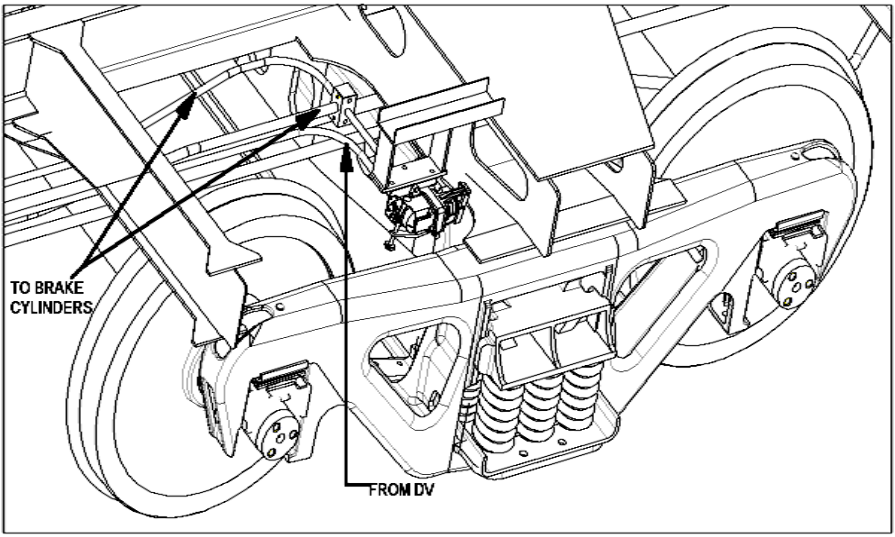
11.2 Fitment of APM

- APM is interposed between bogie side frame of casnub bogie and the under frame of wagons.
- It is fitted on one of the bogies of the wagon.
- It restricts the brake cylinder pressure coming from the Distributor valve to 2.2 kg/cm^2 in empty condition of the wagon and allows the brake cylinder pressure of 3.8 kg/cm^2 in loaded condition of the wagon.
- APM is provided with a sensing arm which senses the empty and loaded condition of the wagon during braking.
- It can be mounted on under frame of the wagon or on the bolster of the bogie.
- The valve installed on the under frame of the wagon senses the gap between the under frame and the side frame of the bogie whereas on installation on the bolster of the bogie it senses the gap between any fixed member of bogie and bolster.
- It is also provided with the visual indicator, which shows empty load brake condition of the wagon.

12.0 APM Schematic diagram



13.0 Fitment Location of APM



14.0 Advantages of APM over LSD

- **Installation:** APM is easier to install and no shims are required for adjustment as in LSD. Piping's and joints are considerably reduced and no pressure reducing valve or double check valve are required
- **Maintenance:** APMs are easier to maintain as one does not have to go under the bogie (as required in LSD) and for lifting the wagon (fitted with APM) or taking out the bolster nothing needs to be removed as compared to LSD fitted wagons.
- **Functional:** APM systems does not require two stage DVs as compared to LSD systems and the visual indicator provided on the valve of the APM clearly shows the empty/loaded condition.

15.0 Automatic Brake Cylinder Pressure Modification Device

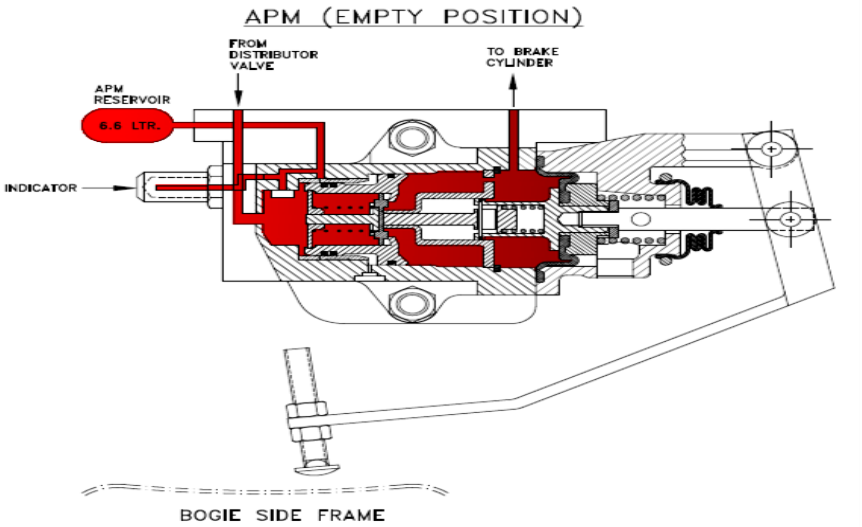
Two stages APM whose functioning based on the gap between under frame and bogie side frame of the wagon shall be as per firm's own design. APM should sense the gap only at the time of air brake application. During remaining time it should not be in contact with the bogie side frame. APM shall be a proven design and must meet the space envelope shown in RDSO's drawing number WD-08096-S-01. One number of APM shall be used per wagon. No human intervention shall be required for operation of APM.

APM shall ensure brake cylinder pressure of 3.8 Kg/cm^2 when the gap between wagon under frame and bogie side frame is as prescribed in applicable drawings. After the gap between under frame and bogie side frame becomes more than as prescribed in the applicable drawings, the brake cylinder pressure shall be reduced to 2.2 Kg/cm^2. Performance testing of APM shall generally conform to AAR standard S-4002 (Latest). Specific procedure and parameters for testing shall be prescribed by the contractor/manufacturer and will be approved by RDSO.

16.0 Operation of APM

16.1 Empty Position

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

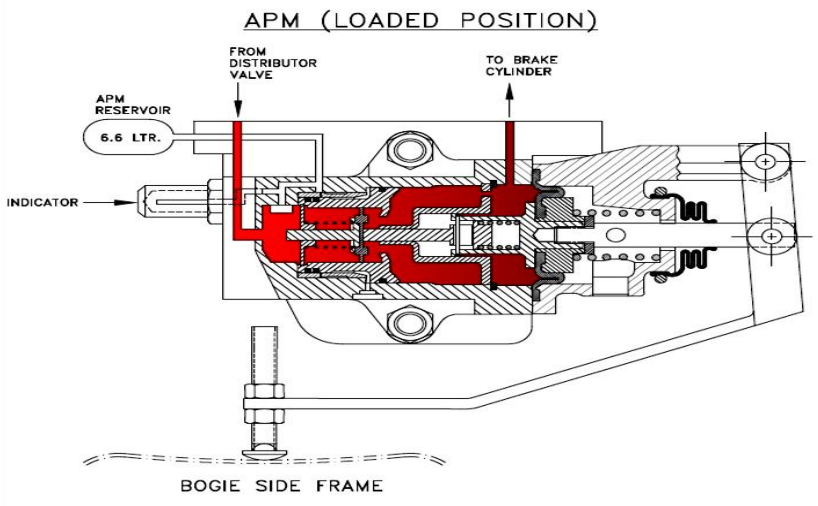


For example, with a 60% ratio piston, if the control valve pressure was 4.5 kg/cm² (64psi), then the volume pressure would be 4.5 kg/cm² (64psi) and the brake cylinder pressure would be 2.67 kg/cm² (38psi). If an emergency occurred over this typical full service pressure, then each pressure would increase by 15%-20%. In release, as previously described, pressure from the brake

cylinder will flow back through the ratio piston to the control valve (retainer) while pressure from the volume will flow through the back flow valve to the control valve (retainer).

16.2 Loaded Position

In load position, pressure from the control valve #3 port flows past the open piston check valve, behind the sensor diaphragm, and acts against the return spring to move the sensor arm down at normally 1 kg/cm² (15psi) pressure to contact the side frame. Pressure then flows out to the brake

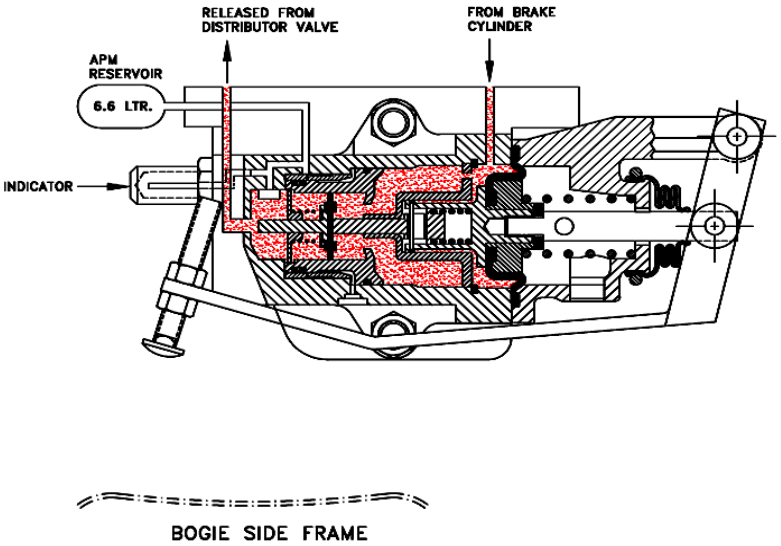


Cylinder pressure build-up will be unaffected by the device in the load position because the ratio piston will remain to the left of the portion and the piston check valve will remain open, permitting #3 port air to flow directly to the brake cylinder. The air passage to the volume is cut off by the ratio piston and the back flow valve.

16.3 Release Position

The ratio piston is held to the left of the portion by the movement of the sensor arm against the piston check valve and the force of the piston check valve spring against the ratio piston. The piston check valve is fully open and the upstream volume is connected via the back flow valve to the control valve.

APM (RELEASED POSITION)



17.0 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 Corning55/55M)

17.1 Disassembling

(See figure – below)

1. Place a 20 mm 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), um-

brella 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).

17.2 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 (30 psi).

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 2kg/cm²).
2. Replace all rubber parts and springs previously discarded.
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.

18.0 Reassembling & testing

Consumable Required

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

Sr. No.	List of Consumable Items	Remarks
1	Loctite 680	5 ~ 7 ml/pc
2	Loctite Primer T7471	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 book.

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). Place piston follower (25) in a vise. Install new
3. 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 cutout 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+1.5Ft.-lbs).

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

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

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

19.0 List of must change items:

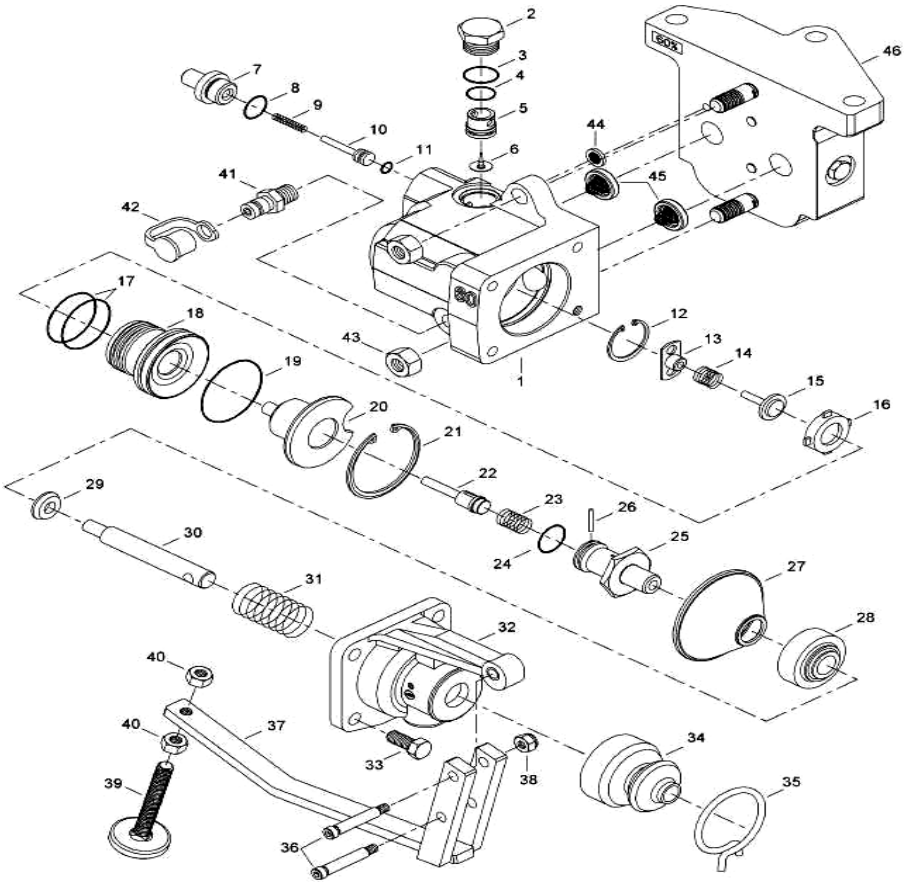
S. N.	Fig. Ref.	DESCRIPTION	PART NO.	Qty/ Valve
a	2, 3	Tube port plug with o-ring	760837	1
b	4	O-ring	738362	1
c	6	Umbrella valve	772345	1
d	8	O-ring	756728	1
e	11	O-ring	783649	1
f	17	O-ring	781694	2
g	19	O-ring; special	771637	1
h	24	O-ring	749475	1

i	27	Diaphragm	755749	1
j	34	Dust boot	772308	1
k	38	Nut, elastic stop	733883	2
l	44	Ring gasket	772401	1
m	45	Ring gasket	781215	2

20.0 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	Indicator	771071	1

21.0 EL-60 Assembly (Exploded View)



Figure—EL-60

21.1 EL-60 part list:

Sr. 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	1190520	1

22.0 Testing

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

22.1 Test preparation

The following items are needed to assemble the Test Fixture.

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

22.2 Test instruction

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

22.3 Test procedure

22.3.1 Load position & leakage test

1. Place a 25 mm 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 3.8 kg/cm^2 pressure otherwise adjust the regulator to get 3.8 kg/cm^2.
3. Open cock B and apply 3.8kg/cm^2 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 +/-0.1 kg/cm^2.
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 0 kg/cm^2.
8. Remove the 25 mm block from between the sensor arm adjusting screw and the stopper plate.

22.3.2 Empty position & leakage test

1. Open cock A and apply the main supply pressure. Pressure gauge no.1 should show 3.8kg/cm^2 pressure otherwise adjust the regulator to get 3.8 kg/cm^2.
2. Open cock B and apply 3.8kg/cm^2 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/cm^2.
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/cm$^{2.}$

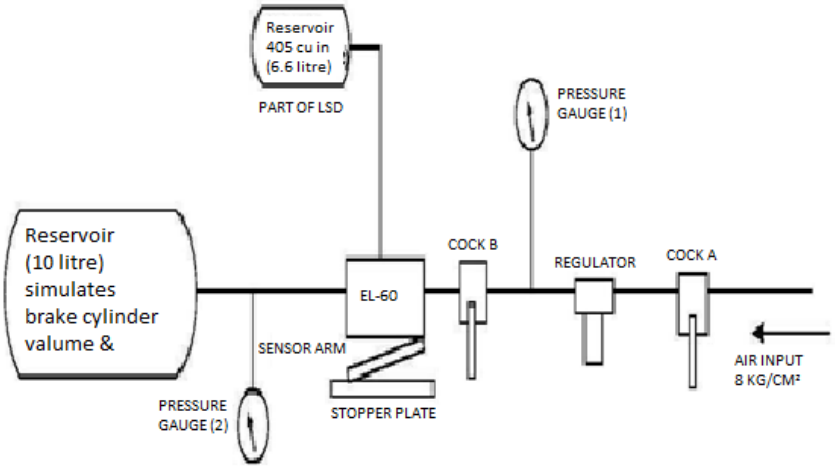


Figure - Pneumatic schematic diagram for testing of EL-60 Valve

23.0 Air Brake System with BMBS having APM valve:

23.1 Single Pipe air brake system

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.

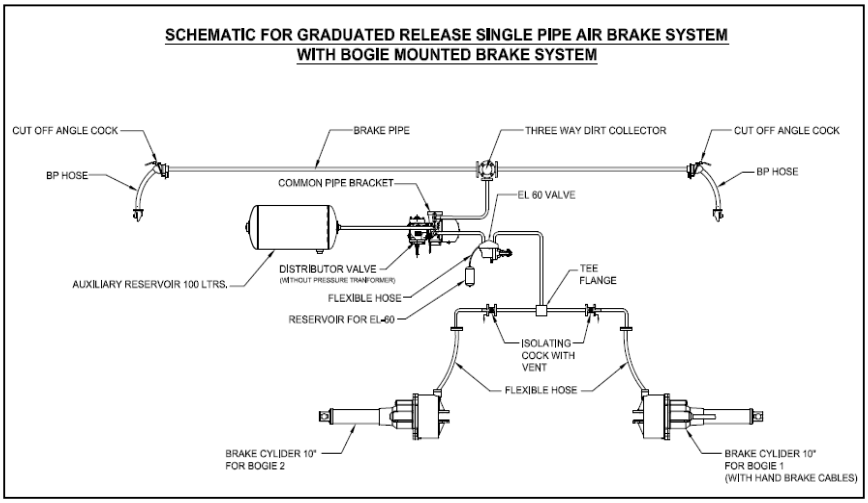
Schematic layout of single / twin pipe graduated release air brake system as provided on the wagons is shown in sketches below. Brake pipe/ Feed pipe runs through the length of wagon. Brake pipes / Feed pipes on consecutive wagons in a train are coupled to one another by means of hose coupling to form 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 6kg/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 change over mechanism, APM under-frame and side frame of the bogie. The mechanism gets actuated at a pre-determined change over weight of the wagon and changes the pressure going to the brake cylinder from 2.2± 0.25 kg/cm^2 to 3.8 ± 0.1 kg/cm^2 incase of changeover from empty to loaded and vice-versa.

For application of brake, air pressure in the brake pipe is re-

duced 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.

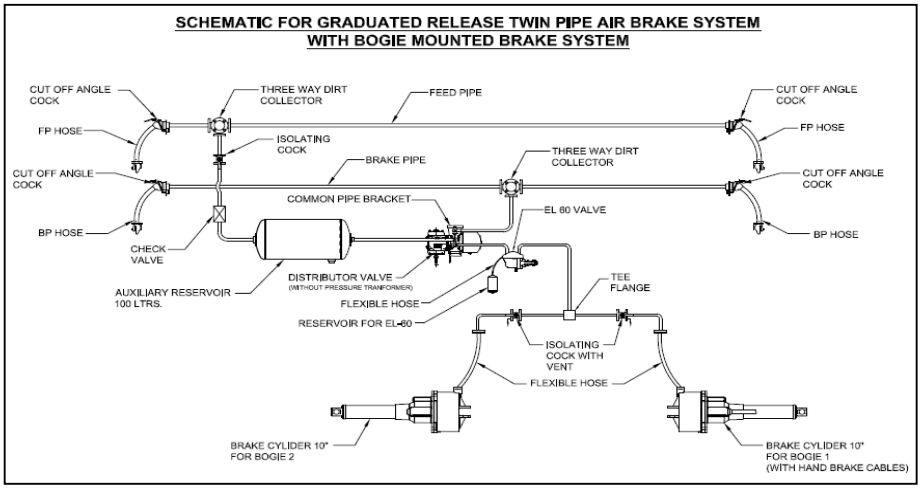


23.2 Twin pipe air brake system

The distributor valve gives an output pressure of 3.8 kg/cm^2 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/cm^2 for empty position braking and an output of 3.8 ± 0.1 kg/cm^2 for loaded position braking in the wagon.

During full service brake application, a reduction of 1.3 to 1.6 kg/cm^2 takes, a maximum brake cylinder pressure of 3.8 ± 0.1 kg/cm^2 in loaded condition and 2.2 ± 0.25 kg/cm^2 in empty condition is achieved. Any further reduction of brake pipe pressure has no effect on the brake cylinder pressure. During emergency brake application, the brake pipe is vented to atmosphere very quickly; as a result the distributor valve acquires the full application position also at a faster rate. This 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/cm^2, the brake cylinder pressure exhausts completely and the brakes are completely released.



24.0 Operating Instructions in Drivers & C&W

Do's:

- Before starting the train, move the brake valve handle (A-9) to release position.
- Wait for 3 minutes to release the brakes for single pipe brake system. If train brakes have not been released fully, it may result in brake binding and excessive force on coupler
- Ensure that air flow indicator white needle coincide with fixed red needle and light and buzzer are not giving any indication.

Don'ts:

- Do not move train if the air flow indicator light is glowing, the buzzer is giving sound and its white needle has not coincided with a red needle.
- Do not start train after stopping the train at least for 3 minutes in case of single pipe air brake system.
- Do not move train unless the brakes on the entire train are released fully.
- Do not operate D-1 emergency brake valve in case of train parting.
- Do not move train unless specified pressure is achieved.

OUR OBJECTIVE

To upgrade maintenance technologies and methodologies and achieve improvement in productivity and performance of all Railway assets and man power which inter- alia would cover reliability, availability, utilization and efficiency.

If you have any suggestions and any specific comments, please write to us.

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