

Freight Car Brake Rigging Arrangements



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Contents

Introduction	3
Part 1: Freight Car Locations.....	3
Part 2: Freight Brake Rigging.....	4
A. Foundation Brake Rigging	3
1. Push Rod	
2. Brake Levers	
3. Dead Lever Guide	
4. Truck Lever Connections	
5. Brake Rods & Pins	
6. Brake Beams	
7. Brake Shoes	
8. Automatic Slack Adjusters	
9. Brake Levers & Rod Carrier Supports	
10. Brake Badge Plate	
11. Truck Brake Rigging	
B. Hand Brake Arrangements	12
1. Body Mounted Brake Arrangement	
2. Truck Mounted Brake Arrangement	
3. Bell Cranks and Sheave Wheels	
C. Special Brake Arrangements	14
Part 3: Brake Rigging Adjustments	15
1. Lever Angularity	
2. Piston Travel	

Review Exercise

Introduction

Understanding the operation of the brake rigging provides a carman with the ability to make repairs that will ensure the rigging components function as designed, proper braking forces are achieved and there is reduced possibility of personal injury or property damage while working on the equipment.

Body mounted or conventional brake rigging on freight cars uses a body mounted brake cylinder located approximately in the center of the car.

The majority of coal cars (open top hoppers or gondolas) are equipped with body mounted brake assemblies mounted on the end of the car. This design has the brake cylinder in close proximity to the control valve and other brake devices.

Early conventional rigging arrangements used rods and levers attached to the underside body of the car with a manual type slack adjuster. To ensure there was minimal slack in the brake rigging and the piston travel stayed consistent, the carman or inspector had to adjust the rigging through moving the manual adjuster on the brake rigging assembly. Conventional rigging today uses automatic or self adjusting slack adjusters to do the same job of manually adjusting the brake rigging.

Other car designs use truck mounted brake arrangements. This design eliminates a lot of the rigging necessary for conventional rigging by having the brake cylinder attached directly to the truck rigging assembly.

In this manual the various types of brake rigging is covered showing the relationship of the levers, rods, pins, brake cylinders, slack adjusters and handbrakes have on the overall operation of a typical rail car.

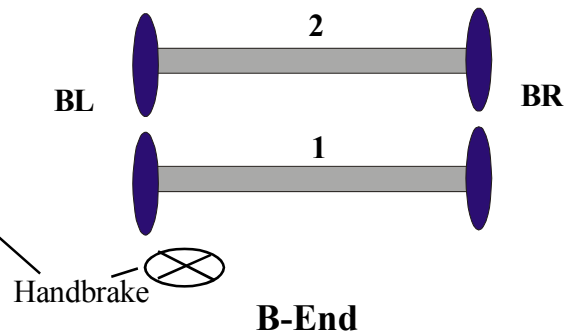
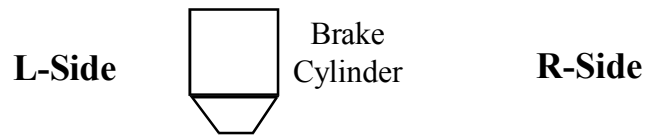
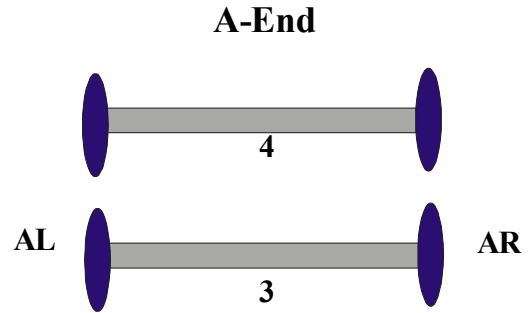
Part 1: Freight Car Locations

Understanding the locations on a freight car is basic to identifying and repairing items requiring attention or finding defects on the car. The basic locations are generally the same on all freight cars.

This diagram shows how locations are identified on a typical freight car. The end of the car with the handbrake is the “B” end. The opposite end of the car is the “A” end. When standing at the B-end facing the car, everything on the right is the “R” or right side, everything on the left is the “L” or left side.

Multiple component parts such as wheels and axles are numbered consecutively starting at the B-end.

The car is also divided into quarters using the end and side location as a reference (i.e. “AR” is A-end, right side. “BL” is B-end, left side.).



Conventional brake rigging may have the brake cylinder under the car body. In such cases, the brake cylinder piston push rod points to the B-end. This provides a more direct connection of the handbrake to the brake cylinder and rigging assembly.

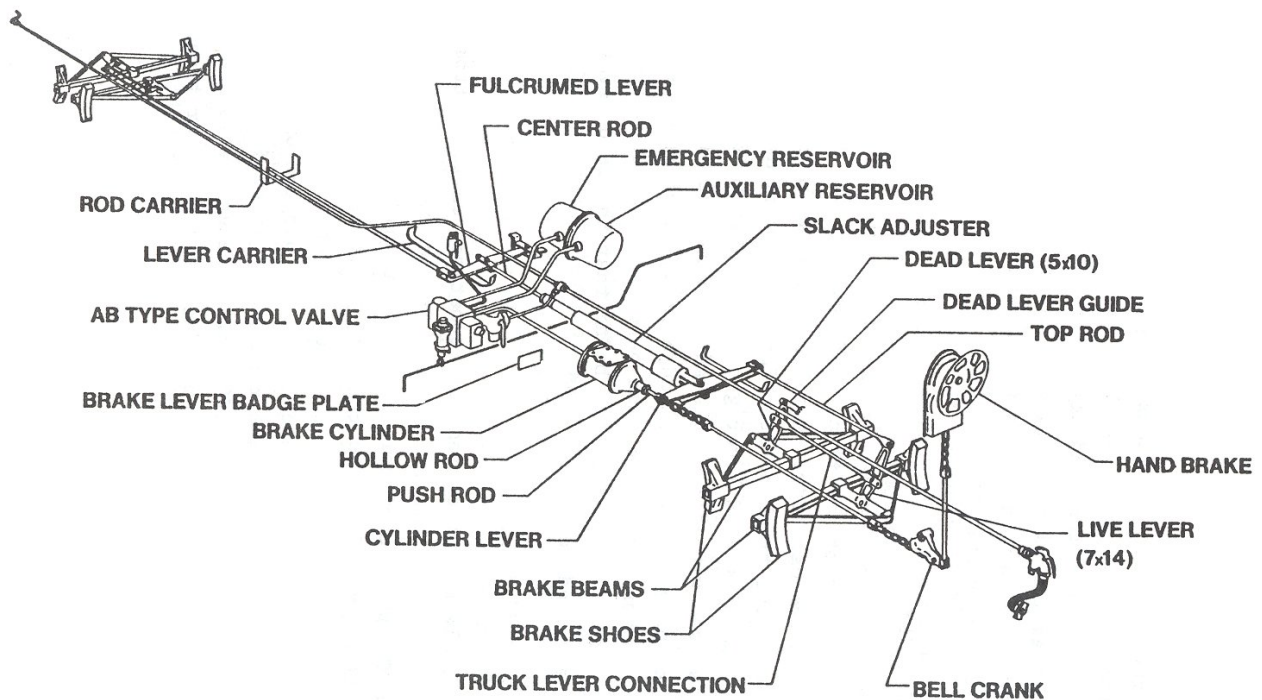
On cars with more than one handbrake, check the brake cylinder to indicate the B-end of the car. Cars with multiple handbrakes and brake cylinders generally have the locations stenciled on the side of the car. See AAR Field Manual Rule 83 for more information.

Part 2: Freight Brake Rigging Arrangements

The freight car brake rigging is the metal components assembled together to transmit a brake application directed by either the handbrake or the air activation of the brake cylinder(s). Brake rigging can be in the form of a body mounted brake assembly with foundation brake rigging or truck mounted brake assemblies.

A. Conventional or Foundation Brake Rigging

This is an example of foundation brake rigging. Various cars may be slightly different depending on the car body design. The main components covered in the following pages have the same function on all cars.

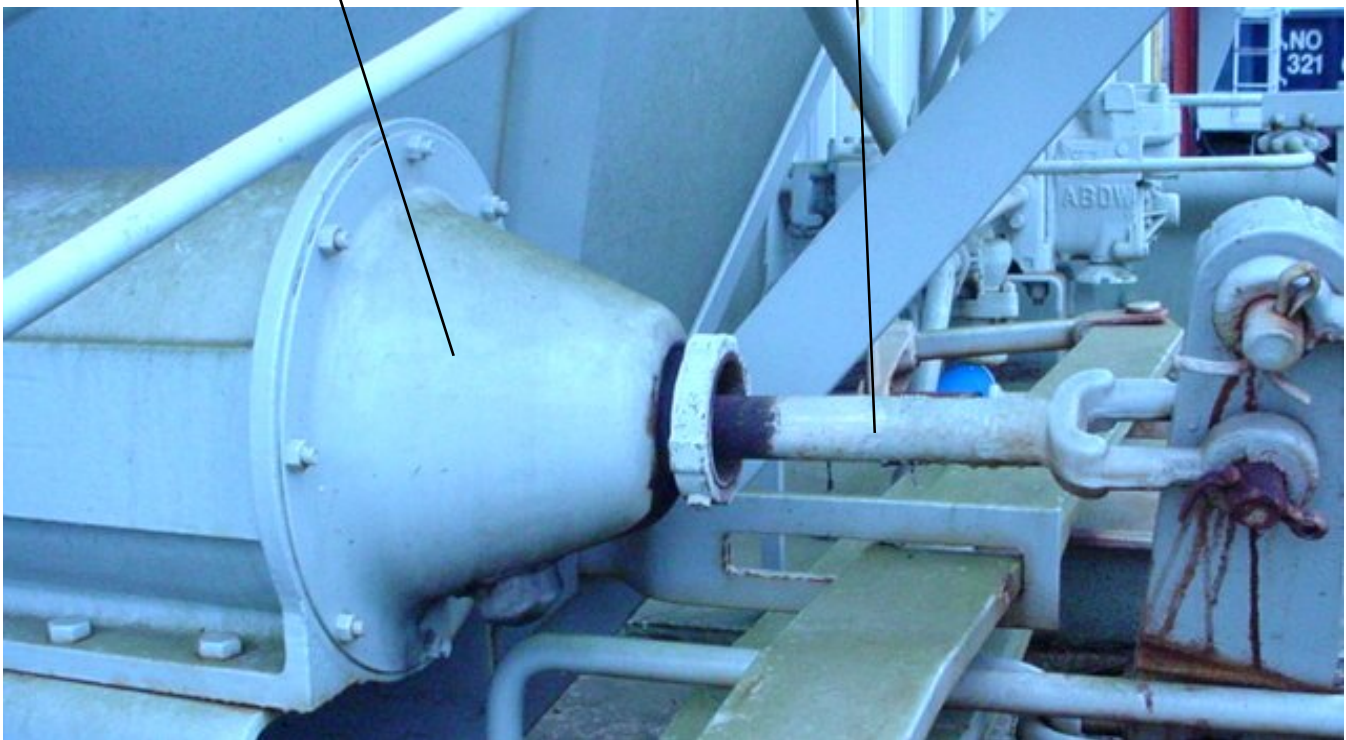


1. Push Rod

The brake cylinder push rod is a solid rod with a jaw formed on one end. A brake pin is inserted into the jaw end to make the connection to the brake rigging. The push rod transmits the force caused by the “push” of air entering the brake cylinder or by the “pull” of the hand brake, through levers and rods to the brake shoes. The push rod is not connected to the piston. The push rod end fits loosely in the tube of the piston hollow rod. At one time, push rods were of different lengths; however, most present day push rods used for 10 x 12 brake cylinders are a standard length of 26-1/4” from the ball end to the center line of the hole in the jaw. The push rod is designed to provide adequate movement of the jaw end without binding in the piston-hollow rod. When performing a Single Car Test in accordance with AAR S-486, one of the requirements is to make sure the push rod will go all the way back into the hollow rod assembly of the piston. This check is done to ensure the movement of rods and levers is not binding or fouling.

Brake Cylinder

Push Rod



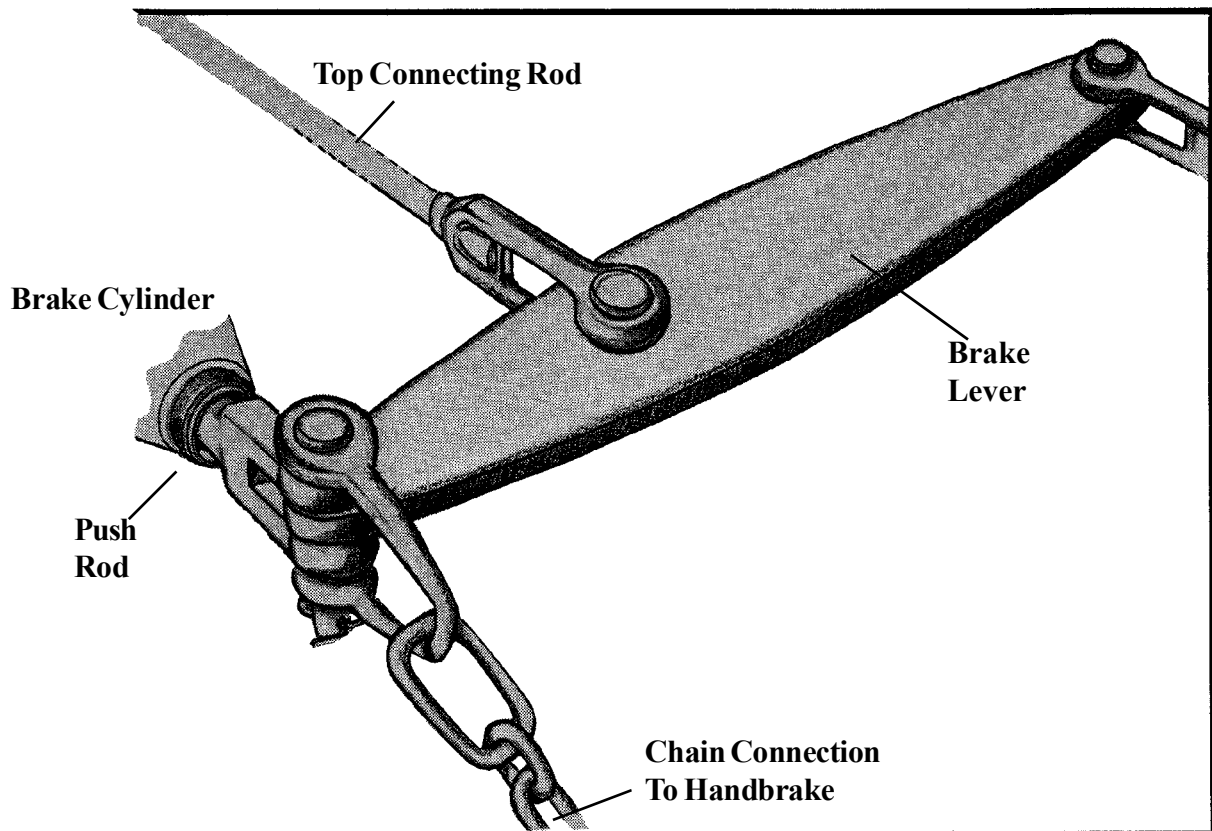
2. Brake Levers

Brake levers are used throughout the brake system to transmit, increase, or decrease braking force. They are also used to transfer or change direction of force. Levers are named for the various conditions and positions that they serve in the system. There are body levers, such as the cylinder lever and fulcrum lever. There are truck levers, such as the live lever, dead lever, and horizontal truck lever. Minimum thickness for levers is 1", with minimum 1-1/8" diameter pin holes.



3. Brake Connecting Rods

The brake connecting rods are used to connect the body levers with the truck levers. The center top rod (shown here) connects two body levers joining one end of the brake rigging to the other. The levers and rods are connected together by brake pins. It is very important that these connecting rods and pins in the brake rigging be of proper length and size. Improper lengths may cause binding or fouling. Check the car badge plate for the correct length when replacing connecting rods. Wear limitation for connecting rods is in accordance with AAR Field Manual Rule 11. The AAR has designated that rod diameters must not be less than 3/4" and pin diameters must not be less than 1-3/32".

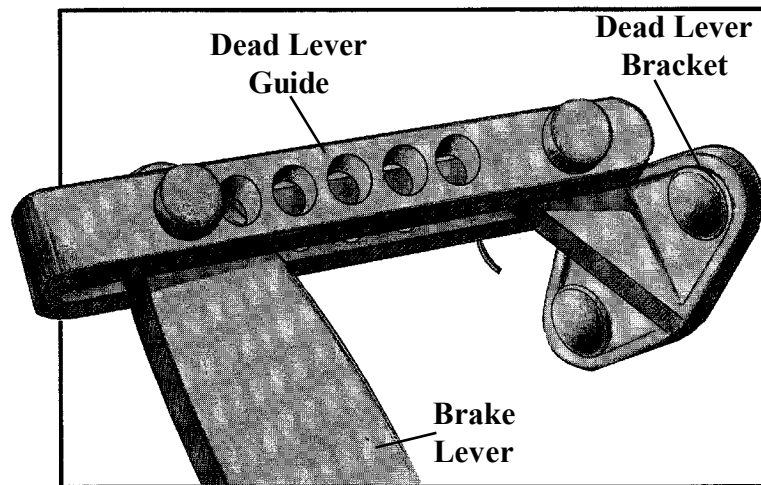


4. Brake Levers

Brake levers are mounted as part of the brake rigging under the car body and as part of the truck brake assembly. The levers are used to transmit the pulling or pushing forces exerted by the connecting rods. Each brake lever is a specific size designed to amplify or reduce the brake force. This is determined by the distance between the pin connections. Check the badge plate for the proper distance between the holes for each lever. When the holes in the lever become elongated or show excessive wear they do not provide correct braking force. Check AAR Field Manual Rule 11 for wear limits.

5. Dead Lever Guide

The dead lever guide and bracket are used to fulcrum one end of the truck dead lever to the truck bolster or to the car body. This provides an anchor for the brake arrangement. A multi-hole dead lever guide is attached to the dead lever bracket. Some dead lever brackets may be anchored to the truck bolster or the center sill of the car. The dead lever guide allows for manual adjustment of the brake rigging. A one-hole dead lever guide, attached to the truck bolster, is used with all double-acting automatic slack adjusters to prevent the manual adjustment of brakes. A dead lever anchor serves the same purpose as the one-hole dead lever guide, the difference being the dead lever anchor is attached to the car body.



6. Truck Lever Connections

Truck lever connections are sometimes called bottom rods. There are two types of bottom rods, one that passes through the truck bolster and one that passes under the truck bolster. The purpose of this rod is to transfer the force from the truck live lever to the truck dead lever. The truck lever connections are furnished in various lengths with two or three holes in each end. The purpose of these holes is to provide adjustment required to maintain good truck lever angularity when different diameter wheels are applied; i.e., two wear wheels machined to a one wear tread contour.



7. Brake Beams

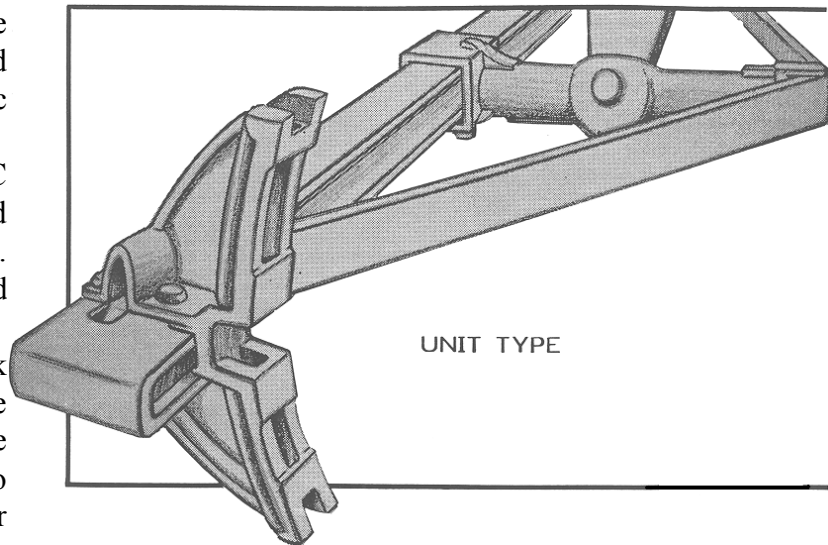
Brake beams are used to transfer the force from the truck levers to the brake shoes. They are of truss construction consisting primarily of tension and compression members attached at the ends where the brake heads are located and separated at the middle by a strut, at which point the truck lever is attached. Brake beams are designated according to the capacity. For example, an A.A.R. Number 24 beam has an 24,000 pound design capacity. The size of the brake beam to be used is determined by the braking forces required for the car.



Most brake beams today are sliding or unit type. Unitized brake beams are equipped with an extension on each end of the beam. This extension fits into a slot in the truck side frame, it will align the beam to move or slide at the correct angle for the brake shoes to make contact with the wheels. There are several types of sliding or unitized beams that are designed for specific applications.

WABCOPAC/NYCOPAC brake beams are much larger and heavier than the one pictured here. They have a brake cylinder mounted on each beam.

On Wabtec TMX Truck Mounted brake equipment, the brake beams are designed with the center area bent down. This is to allow for the brake cylinder connecting rod and the automatic slack adjuster passing through the openings in the bolster. See the section on truck mounted brake equipment in this manual for more information.



Brake Beam Orientation

Brake beams are either left or right hand according to the angled direction of the brake lever slot in the brake beam strut. This provides for proper lever angularity of the brake rigging. To determine the correct slot direction, the beam must be sitting with the AAR printing on the top side or the word "TOP" showing on the beam. Stand on the back end of the beam and check the direction the slot opens, to your right hand or left hand. If the brake beam opens to the right, it is a right hand beam. Left hand beams are orientated the same way. (see picture below of left hand beam)

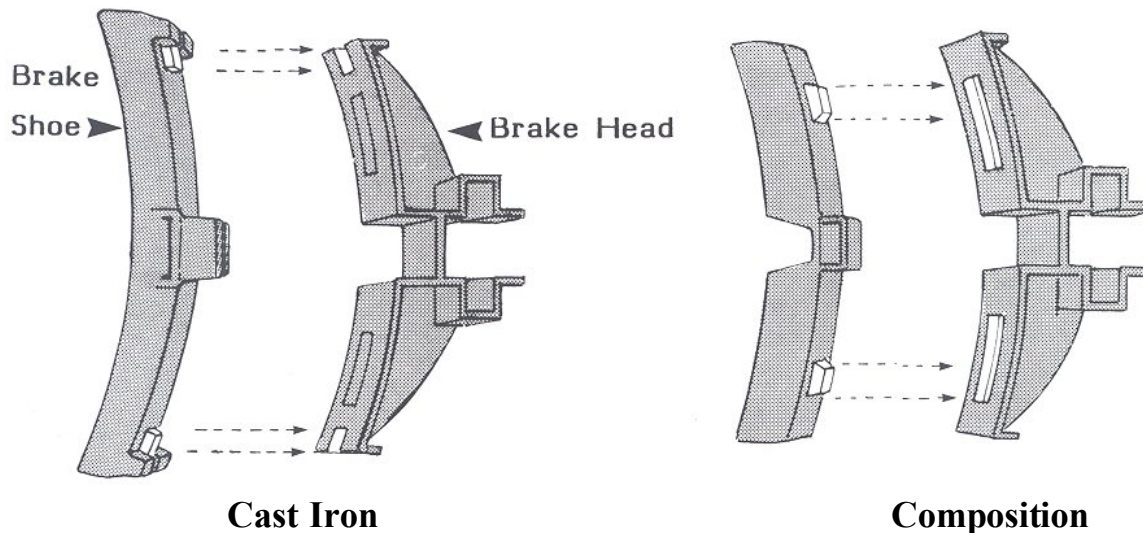
The brake beam heads located at each end of the beam are designed to accept or reject either cast metal or composition type brake shoes. The brake shoes are set up with rejection lugs designed to fit the correct type of brake head. The car brake configuration will determine the type of brake shoes standard to the car.



8. Brake Shoes

Brake shoes transmit the braking force to the wheels providing a retarding motion on the car. Brake shoes are designated by type and thickness to fit the proper brake heads. There are two general types of brake shoes: cast metal (cast iron) and composition.

Cast Iron brake shoes were used on older cars. New cars are designed with composition shoes. High Friction Composition shoes have approximately twice the stopping ability of cast metal shoes. For this reason cast iron brake shoes are not interchangeable with composition brake shoes. As shown below the brake head is designed for only one type of brake shoe.



a. Cast Iron Brake Shoes

Cast Iron brake shoes were the original shoe used for railroad brake equipment. Typically used on cars with hanger type brake beams, body mounted brake equipment and AB control valves. They require higher braking force to stop or slow a car/locomotive than high friction composition shoes. Drawbacks with the cast iron shoes include sparking and uneven wheel wear. **Note: AAR Circular Letter c-9736 adds to AAR Field Manual Rule 12 “The application of cast iron brake shoes is prohibited effective on 1/1/05.”** Converting a car from cast iron to High Friction Composition shoes, the brake equipment of the freight car must be adjusted in one of several ways.

1. Change brake lever ratios - cast iron requires more braking force than high friction. Simply changing the shoes will result in excessive brake force on the wheel with brake related wheel defects.
2. Change brake cylinder size - Having a smaller brake cylinder will result in less force of the shoe on the wheel providing that the full service brake application equalization pressure remains within AAR limits.
3. Use a modulating valve - A modulating valve will divert some of the air from the brake cylinder to a separate volume.

Note: Conversion of a locomotive from cast iron to High Friction Composition shoes requires changing the J type relay valve or as a simpler alternative switch to Low Friction Composition shoes.



Modulating Valve Applied to Brake Cylinder

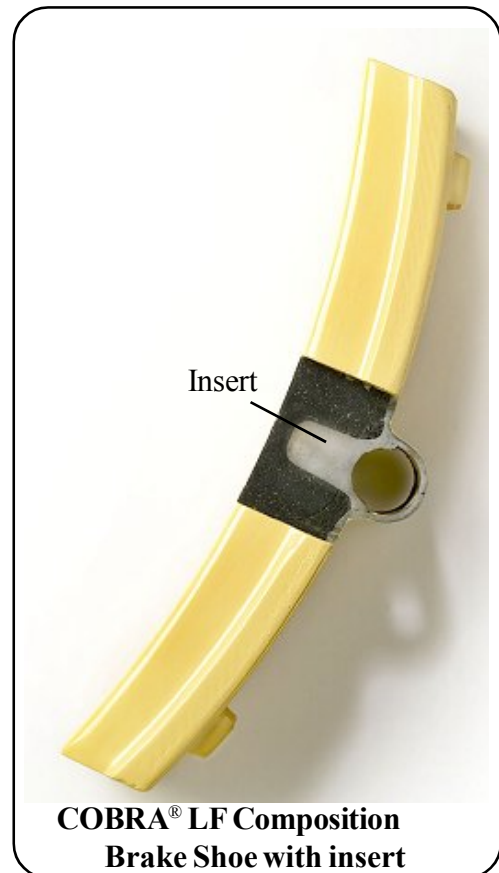
b. Low Friction Composition

The COBRA® LF low friction composition brake shoes are designed as a cost effective alternative to cast iron shoes. Introduced in 1997, the low friction shoe was designed for use on locomotives equipped with cast iron shoes as a direct replacement for the cast shoes. The benefits of using the LF shoe is longer life, lighter weight and less maintenance. Low friction composition shoes are also used on freight equipment.

COBRA LF shoes will fit into the brake heads designed to accept cast iron shoes, but the rejection lugs will not permit the shoes to be applied to the brake heads designed for high friction composition shoes.

Every new COBRA LF Composition shoe is painted bright yellow for immediate identification. This will alert the installer as to the type of replacement shoe required even before the old shoe is renewed.

The new COBRA® LF Composition Brake Shoe has a cast iron insert in the center of the shoe. The insert conditions the wheel tread, thereby reducing the potential for wheel damage.



c. Hi-Friction Composition

High Friction Composition brake shoes were designed as an alternative to the cast iron brake shoe. The HF composition shoe has a higher coefficient of friction that provides better brake control with less brake head force than the cast iron shoe.

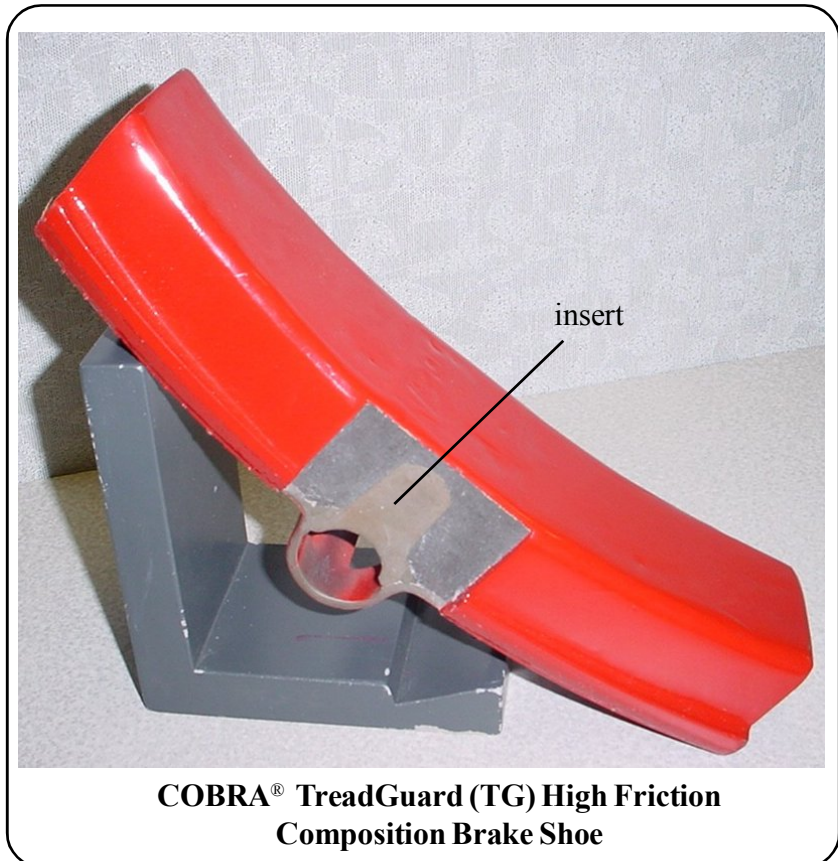
COBRA[®] AP Advanced Performance High Friction Composition Brake Shoes are designed to better adjust to the curvature of the wheel.

d. TreadGuard Shoes

Tread damage, such as shells and spalls, can create major expenses in maintenance. The COBRA TG Brake shoe is designed to reduce wheel tread damage. Designed with the same tapered shape as the COBRA AP Brake Shoes, the COBRA TG Brake Shoes have added value built into them. The shoes have a metal insert molded into the friction material in the center of the shoes that works in two ways.

First, it slightly roughens the tread surface to improve wheel adhesion, thereby decreasing the likelihood of wheel slides. Second, because the insert is more abrasive than the base composition material, it works continuously to remove minor tread damage and improve the condition of the tread.

COBRA[®] TG Brake shoes are painted red for immediate identification. If changing brake shoes due to wear, ensure that the correct replacement shoe is applied. When removing a TreadGuard Shoe they should be replaced in kind in accordance with the car owners specifications. The TreadGuard Brake Shoe also has a decal applied to the inside portion of the shoe for identification.



9. Automatic Slack Adjusters

Mechanical automatic slack adjusters are designed to compensate for slack caused by wear, that occurs to the brake shoes, wheels, and other components in the brake rigging. By controlling this slack, the air brake piston travel is maintained at the correct length to ensure maximum efficiency in the brake system.

Most automatic slack adjusters are double jawed and designed for application on;

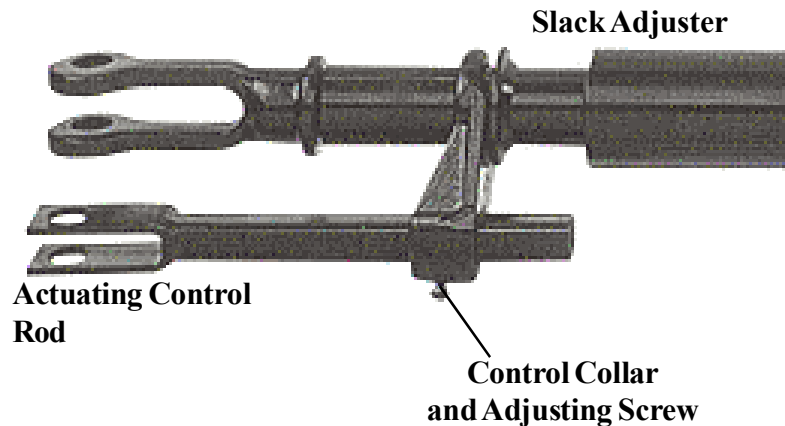
1. Conventional or Foundation brake rigging
2. Truck mounted brake assemblies.

The main difference in the two designs is the size and operation. Body mounted automatic slack adjuster used for foundation brake rigging are designed for center rod or top rod application. Body mounted slack adjusters take up slack as the components wear down. Truck mounted slack adjusters have the same function however they operate to extend as the brake shoes wear down. Truck mounted slack adjusters are also much smaller than body mounted adjusters. They are attached in place of a bottom rod connection on the truck assembly.

a. Body Mounted Slack Adjuster

The body mounted slack adjuster operates as an adjustable rod that automatically shortens as the wear occurs or extends as new brake shoes or new wheels are applied. The total length of a body mounted slack adjuster fully extended is 84". The installed length on a new car is nominally 81", measured from center to center of the pin holes located in the adjuster jaws. This dimension will vary on a car in service according to the amount of brake shoe and wheel wear. The Group E or double jaw model slack adjusters, along with their designed control mechanism, are interchangeable with each other.

The body mounted automatic slack adjuster is equipped with a actuator control rod that is connected to the body of the slack adjuster by a control collar with an adjusting screw. The actuator control rod is pinned to the top rod end of the cylinder lever and fulcrumed at the control lever fulcrum bracket. The purpose of the control lever (drilled in proportion to the cylinder lever hole drilling) is to activate the slack adjuster. It does not transfer or regulate the braking force on the car. The actuator control rod collar is moved depending upon the piston travel adjustment required. Once the piston travel has been adjusted to the correct length, the adjusting screw is secured. To ensure the adjustment does not change the collar on the actuator control rod must be welded in place in accordance with AAR Field Manual Rule 4.



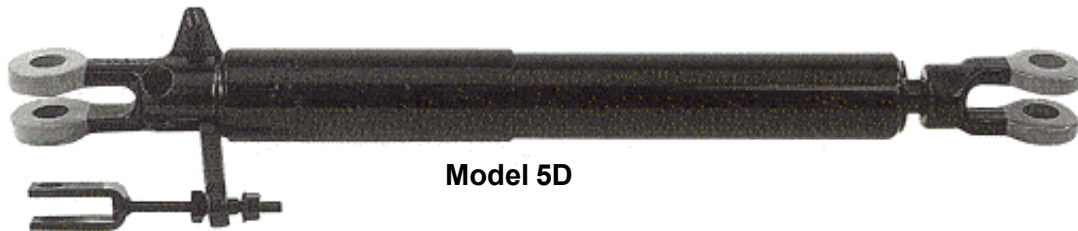
Universal Model 2300 DJ (body mounted)

b. Truck Mounted Adjusters

Truck mounted slack adjusters work the opposite of body mounted slack adjusters. As the brake shoes wear down, because of their location on the truck assembly, the slack adjuster gets longer. They maintain the correct slack through the use of an actuator control rod or a control lever (see the following types).

Universal Model 5D

- Used on Thrall/Davis truck mounted brake assembly
- Has a 5" let out capacity
- Is the replacement for the Model 7D



Model 5D

Universal Model 85

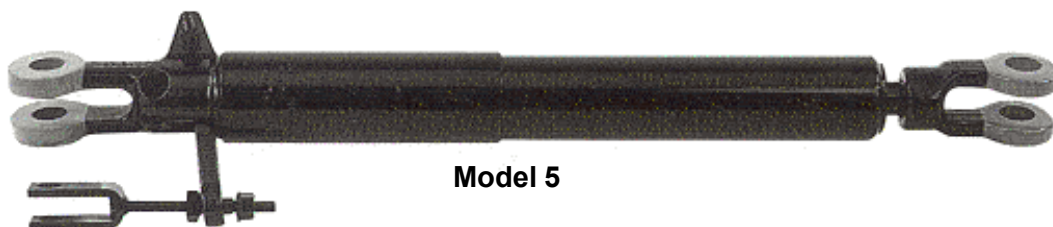
- AAR approved, used to upgrade WABCOPAC truck mounted brake arrangement to WABCOPAC II
- 8-1/2" let out capacity



Universal Model 85

Universal Model 5

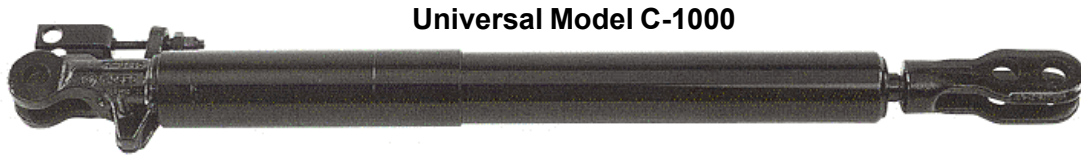
- Used on TTX truck mounted brake assembly
- 5" let out capacity
- Replacement for the Model 7
- Jaws painted orange for identification



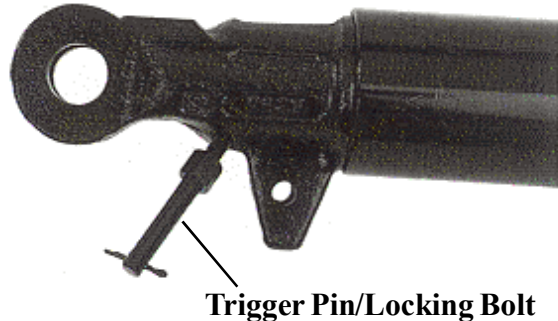
Model 5

Universal Model C-1000

- AAR approved, used in TMX truck mounted brake system
- 9-3/4” let out capacity



* Note; the Model 5, 5D and Model C-1000 are equipped with a Trigger Pin/Locking Bolt assembly designed to prevent slack adjuster extension until the Universal compression slack adjuster is properly installed.

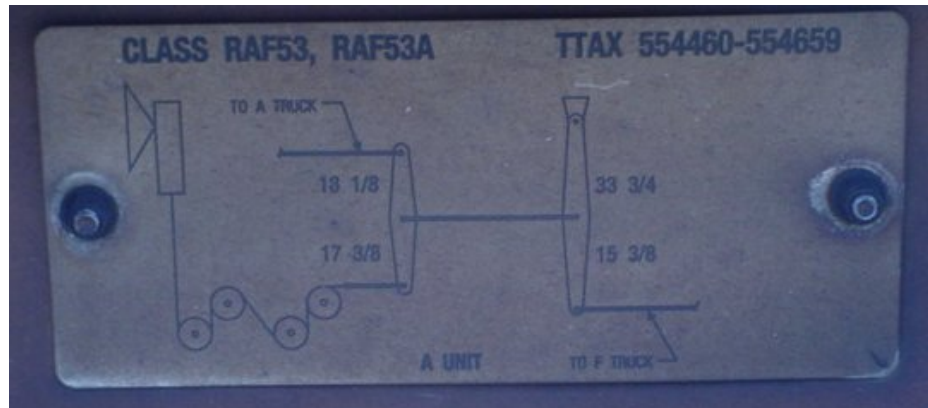


10. Brake Levers and Rod Carrier Supports

Brake lever and rod carrier supports are applied to the car at various locations to support the levers and rods in their respective positions. Importance is stressed on the size and location of the carriers because of the movements of the levers as the brakes are applied and released and as the shoe and wheel wear changes. Care should be given in application of these carriers to prevent any binding in the brake rigging.

11. Brake Badge Plate

The brake badge plate is a metal plate designed to provide brake rigging dimensions that may not be readily available. The information on a badge plate may include brake lever-drilling dimensions, handbrake chain length, piston travel, length of top connecting rods, bottom connecting rod length, etc.



The badge plate is especially useful for repairs to the brake rigging or to verify the correct piston travel or to check proper lever dimensions. The badge plate is generally located near the air brake cylinder or control valves.

12. Truck Brake Rigging

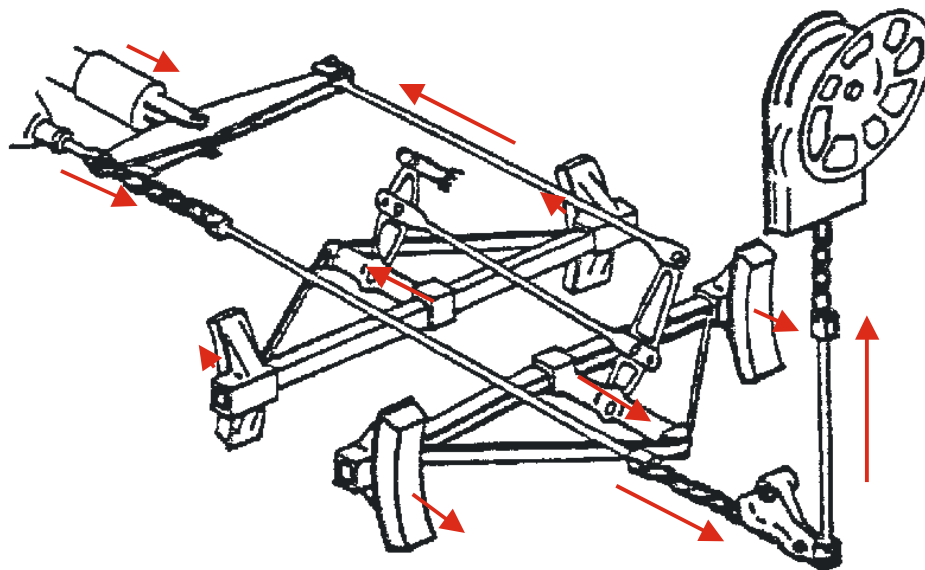
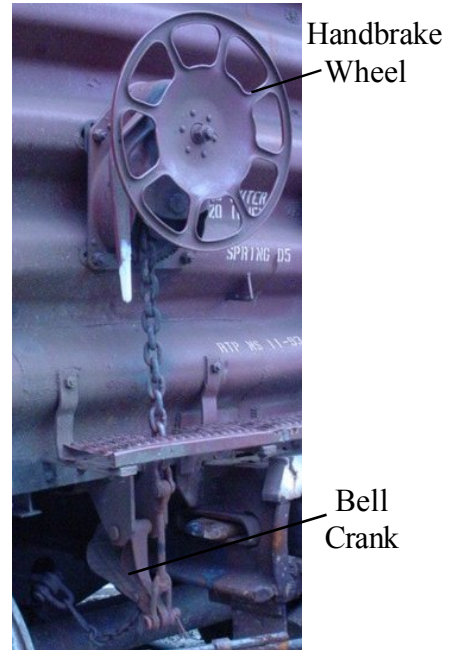
The freight car trucks not only support the car but also assist in stopping or holding the car through the use of the air brake or hand brake forces exerted through the brake shoes to the wheels. Freight car trucks are designated by the truck lever arrangements. Truck mounted brake cylinder, lever arrangements generally use less component parts to provide the same braking effectiveness as body mounted brakes.

Part 3: Handbrake Arrangements

1. Body Mounted Brakes

Body mounted brake equipment has the bottom connecting rod running through the opening in the bolster or the bottom rod under the truck bolster. The picture below shows a rod-through design. Notice the truck lever connection passing through the truck bolster is pinned to the center hole of each truck levers. The bottom holes of the truck levers are pinned to the brake beams. The top rod, which is pinned to the top of the live lever, must pass over the truck bolster to connect to a body lever. The top end of the dead lever is usually fulcrumed to the truck bolster by the dead lever guide. The truck levers usually have a 2 to 1 ratio so the forces exerted at the brake shoes are twice that of the top rod force. Conversely, the top rod movement is 4 times the movement of the brake beam. When the handbrake is applied, the levers and rods move in direct relationship to the movement of the body lever. The body lever is connected to the piston push rod. In this way the brake shoes are force against the wheel on an application of the brakes whether the application is directed by the handbrake or the force of the brake cylinder piston as shown in the diagram handbrake. Note the dead lever bracket and guide are used as an anchor to maintain the correct force applied at the shoes.

Handbrake Applied to Boxcar

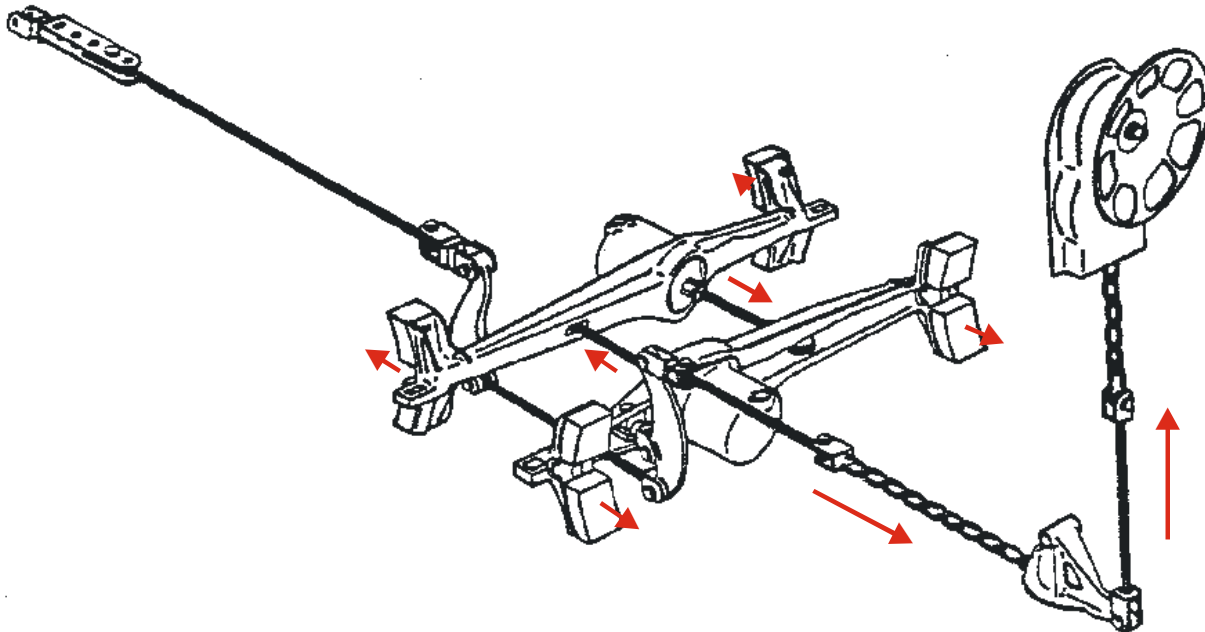


Truck assemblies with the bottom connecting rod under the truck bolster function in a similar manner with a couple of exceptions. The bottom rod or connecting rod being under the bolster is pinned to the bottom hole of each truck lever. The center holes of the truck levers are connected to the brake beams and the top lever holes are for the top connecting rod and dead lever guide. AAR Rule 11 provides for inspection and wear limitation on this type of connection.

2. Truck Mounted Handbrake Arrangement

The operation of truck mounted handbrake assemblies is similar to body mounted handbrake arrangements except there are less components. In the diagram below is a typical WABCOPAC. Note the handbrake is connected to the brake beam through levers and connecting rods. This will ensure there is a direct brake application similar to what is provided by the air activated brake cylinder.

New truck mounted brake equipment and changes to car design has resulted in more types of truck mounted brake assemblies available. Some common types of truck mounted handbrake arrangements in use are on Cardwell/WABCO TMX, Ellcon National TMB, Thrall Davis TMB and TTX TMB and NYAB has several types available. Each of these designs has the brake cylinder(s) mounted on the brake beam or applied directly to the truck bolster. The cylinder force acts directly on the brake beams without intermediate levers and rods to push the brake shoes against the wheels. The forces exerted at the brake shoes are the actual output force of the cylinders. Each of these types of truck mounted brake arrangements is discussed in the Single Car Test Workbook and Booklet (WAB/SCT-1 , 2).



The WABCOPAC shown here uses two brake cylinders per truck. In 1966, it became a mandatory requirement to apply automatic slack adjusters on all new cars. Since 1968 this also applied to all rebuilt cars. However there still are many cars equipped with WABCOPAC and NYCOPAC truck mounted brakes.

3. Bell Cranks and Sheave Wheels

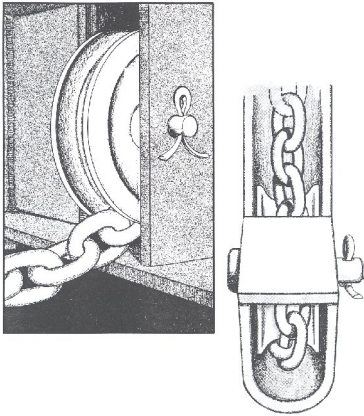
Handbrakes are designed to provide a brake force of the shoes against the wheel by indirect pull of the rods and levers on the truck assembly. The bell crank is common on older style cars where a lot of new cars use sheave wheels. In both cases they are used to change the vertical pull of the handbrake to a horizontal pull on the rigging.

When performing a Single Car Test per AAR S-486, the carman must check the position of the bell crank with the brakes applied. This is because the bell crank has fixed positioning. When the handbrake is applied the pull of the handbrake will cause the fulcrum of the handbrake to rise pulling the horizontal chain. If the bell crank rises too high, there will not be enough force on the shoes to hold the car in position. On cars with an automatic slack adjuster, as the shoes wear down the bell crank should stay in the correct position. On cars without an automatic slack adjuster (WABCOPAC/NYCOPAC) as the brake shoes wear down the positioning of the bell crank will change. The inspector must consider this when checking the positioning of the bell crank during the air test.

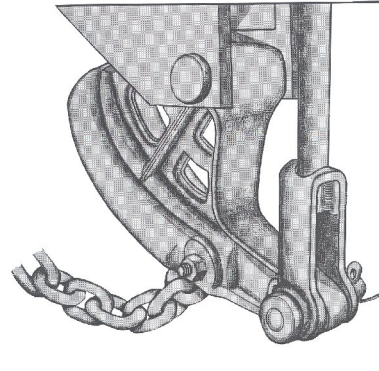
The use of either device depends upon the design of the car. Both handbrake designs shown in the previous pages use a bell crank. Sheave wheels are used extensively on cars carrying intermodal and automobile traffic.

4. Special Brake Arrangements

Specialized cars such as depressed center flat cars and other cars of higher capacity may have trucks equipped with six, eight, ten or twelve-wheel sets. These cars may also have more than one handbrake, typically one at each end. The brake arrangement of each car will vary according to the brake shoe forces that are applicable to the car design and the car weight on the rail. The braking arrangement will normally employ many of the items identified in this booklet.



Sheave Wheel



Bell Crank

Part 4: Foundation Brake Rigging Adjustments

To ensure the proper braking forces are exerted by the shoe against the wheel, the brake rigging must be in good condition and applied correctly to the car. Wear, improper applications and damaged brake rigging components have a detrimental effect on the braking efficiency and must be corrected to ensure adequate braking for that car. Even though most cars are now equipped with automatic slack adjusters, the truck levers may occasionally be out of adjustment.

This section of the booklet will deal with some adjustments that can be made to the body mounted brake rigging to ensure that braking forces are sufficient to effectively stop a freight car. Before performing any adjustments to the brake rigging, ensure that the car brakes are released and there is no air in the brake system. This is done to prevent unintentional brake applications while someone is working on the brake equipment.

1. Lever Angularity

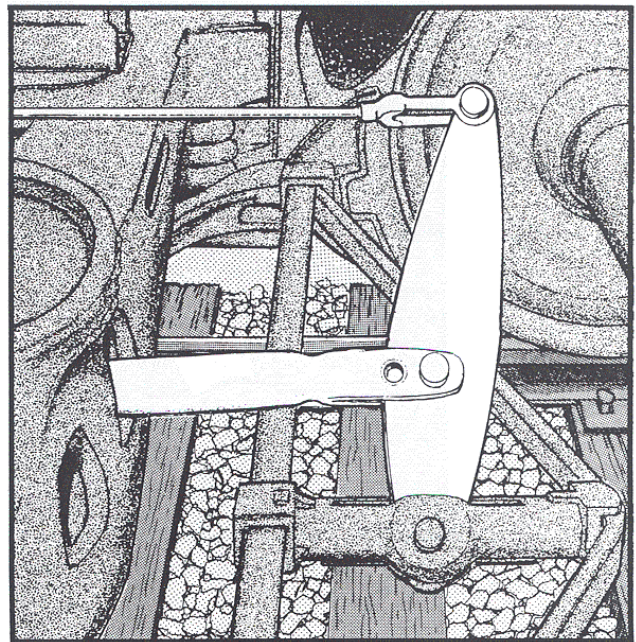
Angularity is the angle relationship of levers within the brake rigging assembly. If the angularity of the car brake rigging is incorrect, the rods and levers may bind or foul on other car and/or brake rigging components. This conditions would provide ineffective braking forces on that car.

Truck Lever Angularity

Truck lever angularity changes when brake shoes and wheels wear. The automatic slack adjuster will compensate for the wear of the shoes and wheels in normal applications. When wheels are changed, it may effect the lever angularity. Therefore as common practice, the brake lever angularity should be checked each time wheels are changed. For this reason, the lever angularity could be different on each truck of the same car.

Correct truck lever angularity is when the live truck lever is perpendicular to the top rod, when the brakes are fully applied.

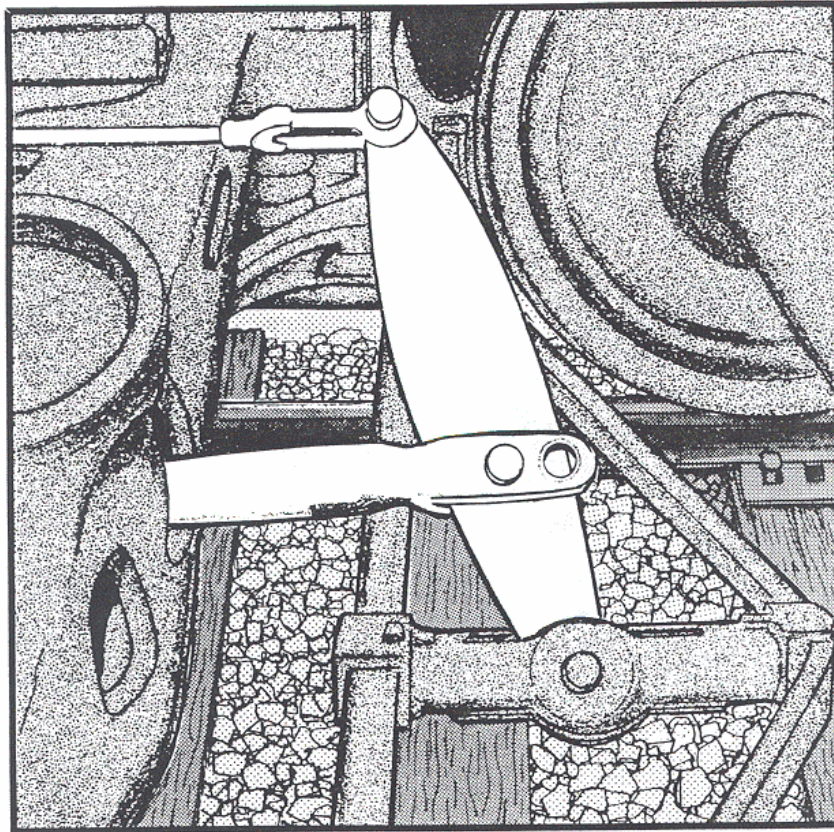
Application of new wheels and brake shoes improper application of brake rigging components, and wear to rigging components can cause poor truck lever angularity. If the truck lever angularity is incorrect, adjustment should be made to maintain correct brake shoe pressure on the wheel for each brake application.



Correct Truck Lever Angularity

The common location for adjustment of truck lever angularity is at the bottom rods (truck lever connections). Bottom rods may have more than one set of holes at each end of the rod. Any brake shoes that are worn beyond AAR limits should be changed before making adjustments to the truck levers and rod connections. The dead lever guide can also provide a location for lever angularity adjustment. To correct the incorrect truck lever angularity shown below:

1. Cut-out the car's air brake
2. Disconnect the brake rigging to the automatic slack adjuster or manual slack adjuster
3. Remove the brake pin from the bottom rod/live lever connection
4. Move the live lever to line up the bottom rod next outside hole
5. Apply the brake pin.
6. Physically move the lever by hand to apply the shoes to the wheel to check adjustment
7. If the lever angularity requires more adjustment repeat steps 4, 5 and 6 until correct angularity is obtained.
8. Movement of the bottom rod must not set up a situation where the live lever rests on the axle. If this happens adjustment of the dead lever guide may be necessary. Note that movement of the dead lever has a more dramatic effect on the live levers than movement of the bottom rod connection.

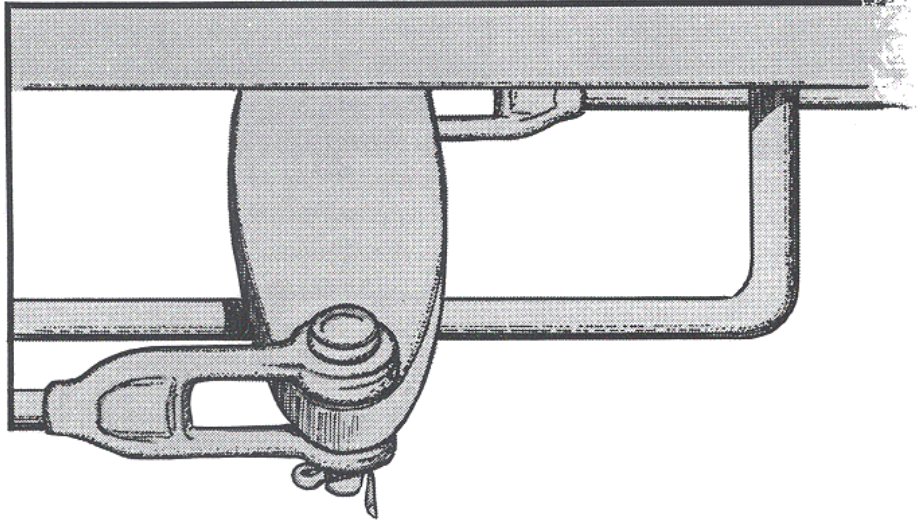


Poor Truck Lever Angularity

Body Lever Angularity

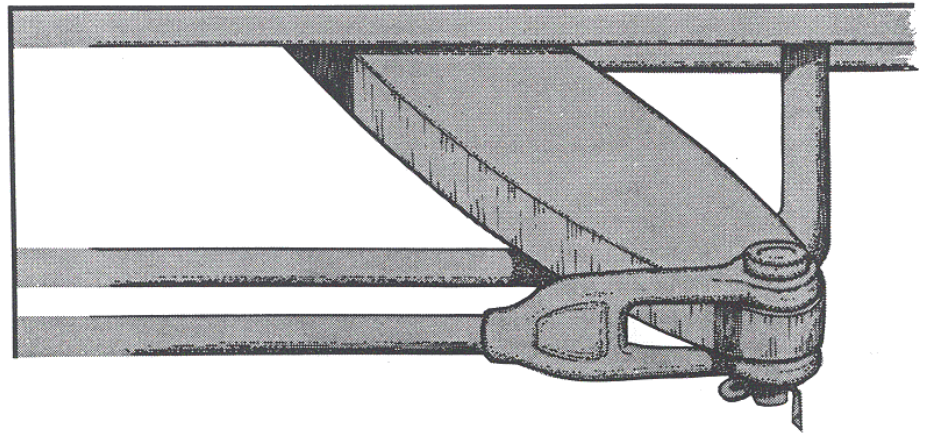
The movement of the truck levers will affect the body lever angularity. If a car is equipped with brake rods and levers of the proper length, correct truck lever angularity will produce correct body lever angularity.

Correct body lever angularity is when the levers are perpendicular to the brake rods when the brake shoes and wheels are one-half worn.



Correct Body Lever Angularity

Incorrect brake rod lengths and lever lengths will produce incorrect body lever angularity.



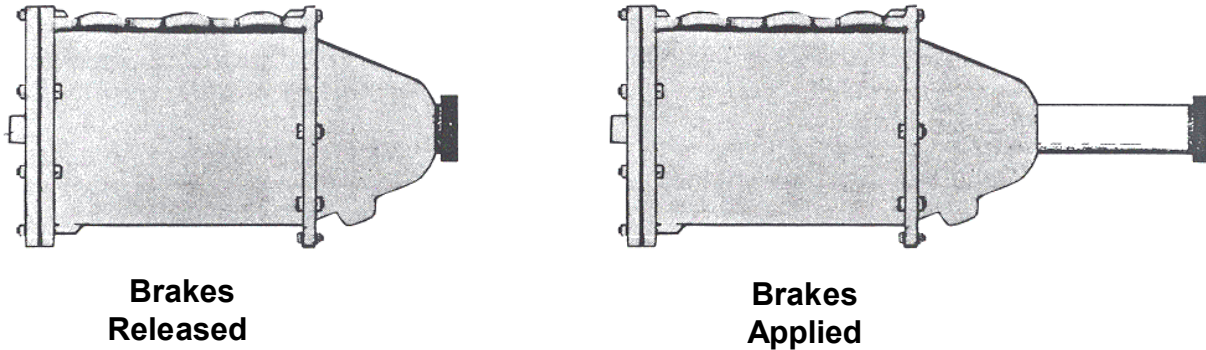
Incorrect Body Lever Angularity

If the body lever angularity is incorrect, first measure the levers and rods and ensure the measurements on the rods and levers correspond to the badge plate dimensions. If they do not match the badge plate corrective action is necessary before changing angularity. With correct truck lever angularity and correct body lever dimensions, body lever angularity can only be adjusted by changing rod length.

2. Piston Travel

Piston travel is the distance the brake cylinder piston moves from the “brakes released” position to the “brakes applied” position. Of the various types of brake cylinders, each design has a specific piston travel allowed by design to provide maximum braking force required to control and stop that particular car. Body mounted brake cylinders are designated by size. A 10 X 12 brake cylinder has a 10” diameter and a 12” stroke.

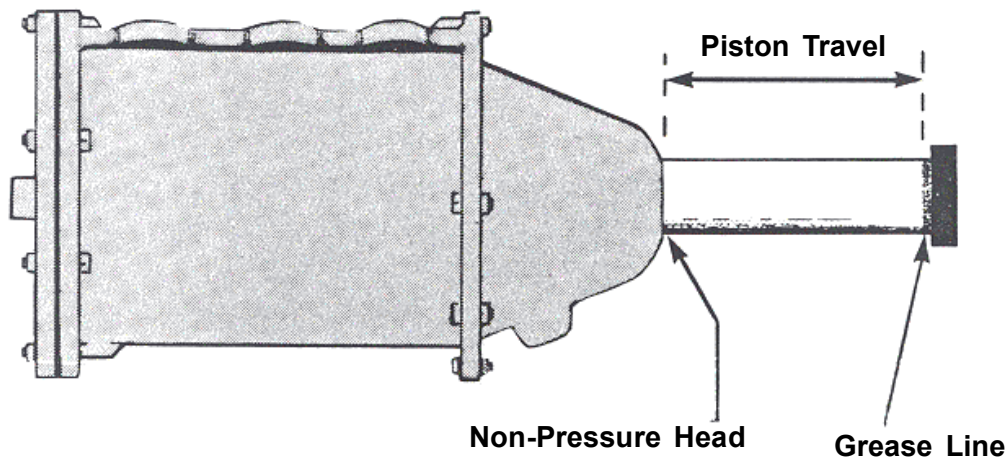
Body Mounted Brake Cylinder



Piston travel on a car with a standard body mounted brake cylinder is initially set at 8 inches for equalization purposes per AAR S-401. Piston travel must be set to proper length in accordance with AAR S-486 before car is allowed into service. Piston travel with body mounted brake rigging and an automatic slack adjuster is normally set at seven and one-half (7 1/2) inches. When testing cars in accordance with the AAR S-486, allowable piston travel for this type of brake cylinder is seven to nine (7-9) inches. Piston travel of less than seven inches or more than nine inches must be adjusted to a nominal seven and one-half inches.

Piston travel on a standard body mounted brake cylinder is measured from the face of the brake cylinder non-pressure head to the “grease line” near the piston collar. This “grease line” has been established by the AAR as the measuring point for the brake cylinder piston shown.

Measuring Piston Travel



Piston travel for other types of brake cylinders as identified in the AAR Field Manual Rule 3.

FREIGHT EQUIPMENT PISTON TRAVEL				
Brake Cylinder Type	Proper Travel	+/-	Air Test Allowance	Maximum Travel
*Body Mounted 10" x 12"	7 ¹ / ₂ "	1/4"	6" to 9"	10 ¹ / ₂ "
*Body Mounted 8 ¹ / ₂ " x 12"	7 ¹ / ₂ "	1/4"	6" to 9"	10 ¹ / ₂ "
*Body Mounted 7 ¹ / ₂ " x 12"	7 ¹ / ₂ "	1/4"	7" to 9"	10 ¹ / ₂ "
*Body Mounted 12" x 10"	5 ¹ / ₂ "	1/4"	5" - 7"	8 ¹ / ₂ "
*7 ⁵ / ₈ " x 12"x 9" UC	5 ¹ / ₂ "	1/4"	5" - 6"	7 ¹ / ₂ "
* Triax-II	1 ³ / ₄ "	1/8"	1 ¹ / ₂ " - 3"	3 ¹ / ₄ "
WABCOPAC/NYCOPAC	1 ¹ / ₄ "	1/4"	3/4" to 3"	4"
WABCOPAC II	2 ¹ / ₄ "	1/4"	1- ³ / ₄ " to 3"	3 ¹ / ₄ "
WABCO TMX	2"	1/4"	1 ¹ / ₂ " to 3"	3 ¹ / ₄ "
NYCOPAC IIA	N/A	N/A	N/A	2 ¹ / ₄ "
Ellcon National	2 ³ / ₄ "	1/4"	2 ¹ / ₄ " to 3- ³ / ₄ "	4"
Thrall Davis	3 ¹ / ₄ "	1/4"	2 ³ / ₄ " to 4 ¹ / ₄ "	4 ¹ / ₂ "
TTX TMB (Misner)	8"	1/8"	7 ¹ / ₂ " - 10"	10 ¹ / ₄ "

* Not shown in this booklet, see AAR Field Manual Rule 3
 * For piston travel not shown or identified in the AAR Field Manual, contact the car owner.

1. By AAR designation the top connecting rods must be a minimum of _____.
2. The handbrake end of the car is generally designated as the _____.
3. Body mounted slack adjusters generally use an _____ to maintain the proper piston travel.
4. Brake Lever dimensions may be found on the _____ which is usually located close to the brake valves.
5. The Universal _____ are equipped with a Trigger Pin/Locking Bolt for safety.

Part 4: Truck Mounted Brake Equipment

A. TMX Truck Mounted Brake Equipment

Safety Procedures & Warnings

Regular yard and shop safety procedures **MUST BE** followed when working on this assembly.

- When performing any test or work on devices or equipment while they are on the vehicle (on car test, etc.) special precautions must be taken to insure that vehicle movement will not occur which could result in injury to personnel and/or damage to equipment.
- The use of an air jet, which must be less than 30 p.s.i.g., to blow parts clean or to blow them dry after being cleaned with a solvent will cause particles of dirt and/or droplets of the cleaning solvent to be airborne. Wire brushing may also cause particles of dirt, rust, and scale to become airborne. These conditions may cause skin and/or eye irritation.
- Personal eye protection and gloves must be worn when performing any work on this device or its components parts to avoid personal injury.
- Assembly may be under a spring load. Exercise caution during disassembly so that no parts “Fly Out” and cause bodily injury.
- All air supply to this device and/or to any components part must be cut-off before this device and/or any component part is removed from the equipment arrangement.
- Brake Cylinder and Slack Adjuster assemblies are under spring load. Extreme caution must be taken when working around or removing the slack adjuster since inadvertent operation of the trigger mechanism may cause severe bodily harm. Care must be taken during disassembly of both brake cylinders and slack adjuster to prevent personal injury from parts that may “fly out”.
- When applying and releasing air pressure to this assembly, all personal must stand clear to minimize the potential for bodily injury from moving parts.
- Prior to removing any of the TMX components, all air must be depleted to guard against personal injury from inadvertent movement of any of the parts.
- After any work is performed on this assembly an operational test must be performed to insure the unit on the truck and the total car brake system operates as intended before the car is released for service.

1. Checking & Adjusting Piston Travel

Refer to the car badge plate and the piston travel indicator decal to determine the proper operating range for the piston.

Apply air to the brake cylinder and measure piston travel (See Figure 1). If the correct piston travel is not obtained, (see Figure 1) readjustment must be done as follows:

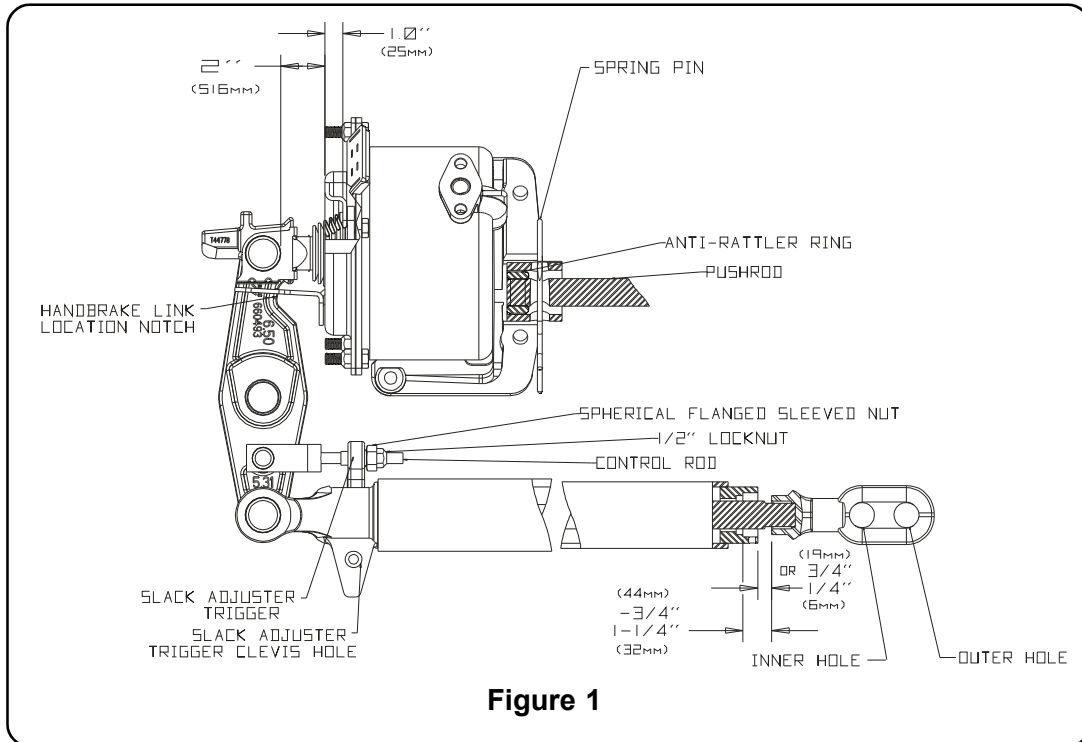


Figure 1

1. Deplete air from brake cylinder.
2. If the piston travel is too long, unlock the 1/2" locknut (3) on the slack adjuster control rod (5) and turn the spherical flanged sleeved nut (4) clockwise.
3. If the piston travel is too short, unlock the 1/2" locknut (3) on the slack adjuster control rod (5) and turn the spherical flanged sleeved nut (4) counterclockwise.
4. Reapply air to brake cylinder.
5. When the required piston travel is met and repeatable, turn 1/2" locknut (3) clockwise against the spherical flanged sleeved nut (4) and torque against each other to 55 ft. lbs (75 Nm). The TMX brake assembly must be adjusted per badge plate shown on the car.
6. If the piston travel is still outside the operating range after adjustment of the spherical flanged sleeved nut (4), it is recommended that you perform a slack adjuster test is to be performed to determine if the device is in accordance with that outlined in AAR Pamphlet No. SAM-C-12-99.

7. The car is not to be released for service until the piston travel is within the specified range.

2. Brake Cylinder Removal

Make sure all air is depleted in the brake system to preclude personal injury. Refer to Figure 2 for this procedure.

1. Remove brake cylinder hose from the brake cylinder air flange face and protect all exposed piping from dust and contaminants. Remove the truck from under the car, if possible.

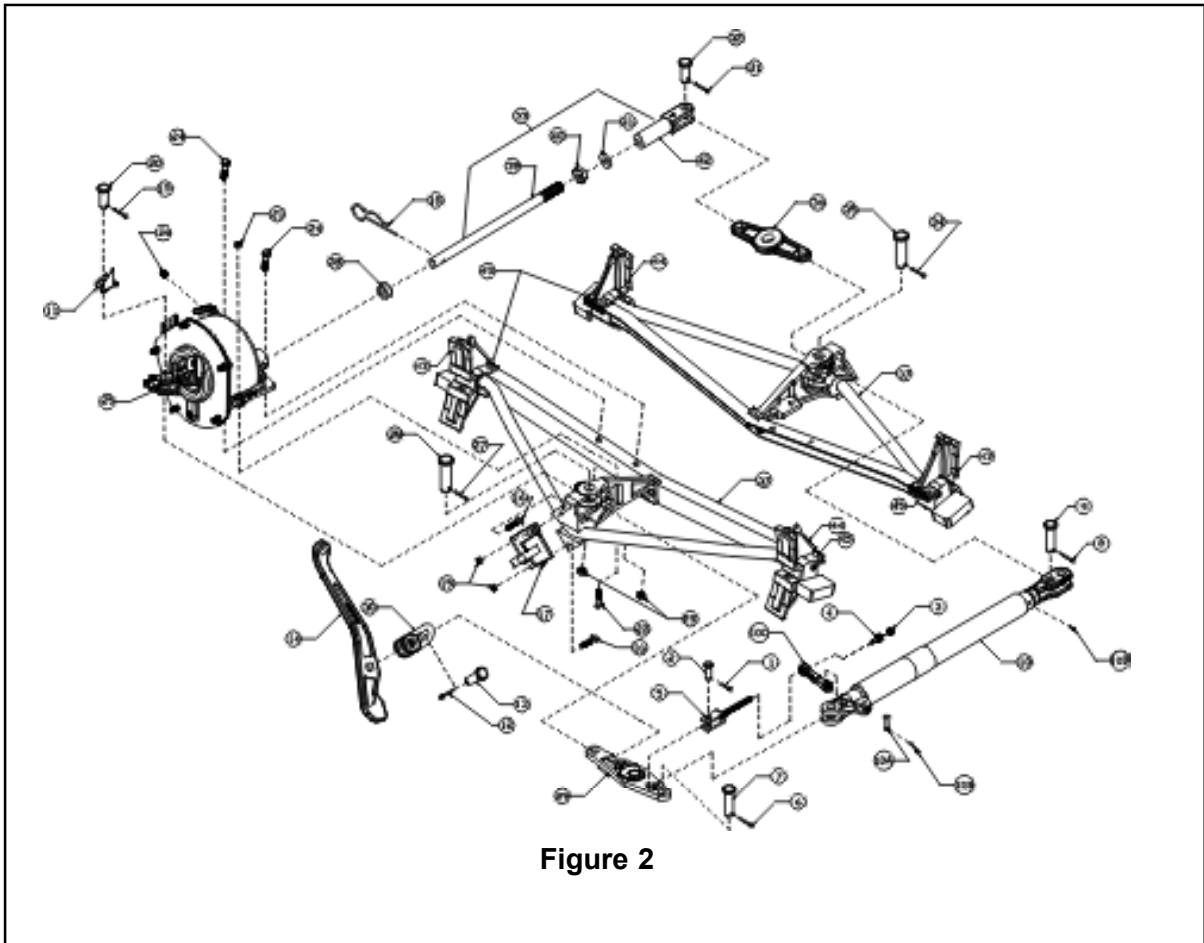


Figure 2

⚠ WARNING: DO NOT BUMP THE SLACK ADJUSTER TRIGGER! IF BUMPED, THE SLACK ADJUSTER COULD ACTIVATE AND SUDDEN LET-OUT OF THE RACK EXTENSION COULD OCCUR AT THE REAR JAW. PERSONAL INJURY MAY RESULT.

2. Deactivate the slack adjuster by loosening the $\frac{1}{2}$ " locknut (3) from the spherical flanged sleeved nut (4) and remove both nuts from the slack adjuster control rod (5). Also, screw in a $\frac{5}{8}$ " X 2" bolt (10D) in the threaded hole in the slack adjuster housing weldment (10).

3. Remove the cotter pin connection (1) from the slack adjuster control rod pin (2) and remove the control rod pin.
4. Remove cotter pin connection (10B) from the slack adjuster trigger pin (10A). Remove the slack adjuster trigger pin (10A) from the slack adjuster (10).

For hand braked trucks only – remove the cotter pin (12) from the transfer link pin (13) and remove the transfer link pin (13) from the handbrake lever (14) and the handbrake transfer link (30). Lift the handbrake lever out of the handbrake strut bracket (17).

5. Remove cotter pin connections (19, 27) from the transfer pin (20) and the center strut pin (28).

⚠ WARNING: PROTECTION SHOULD BE TAKEN AGAINST HEAT DAMAGE TO THE CYLINDER DUST BOOT.

6. Remove the transfer pin (20), and the center strut pin (28) from the transfer lever (29).
7. Remove the spring pin (18) from the cylinder (25) and return push rod assembly (33).
8. Remove the $\frac{1}{2}$ " locknut (21) on the topside of the cylinder bracket from the $\frac{1}{2}$ " T-Head bolt (22). Then, from the underside of the compression member, remove the two $\frac{5}{8}$ " hex bolts (24). Remove the cylinder (25) from the brake beam (37).

NOTE: *The transfer lever (29), slack adjuster (10), handbrake link (30) and slack adjuster control rod (5) may be slid to the side of the bolster window in order to gain easier access for removal of the cylinder.*

- 2.9 The TMX Brake Cylinder should be taken to a designated repair facility to be dismantled, cleaned, necessary parts replaced, oiled and tested per WABCO Operation and Maintenance Publication No. 4251-1. The brake cylinder must pass the stated operational test before being placed back into service.

3. Installation of Brake Cylinder

- 3.1 Position the cylinder (25) to the brake beam (37). Insert the non-clevis end of the push rod assembly (33) into the rear of the cylinder (25). Insure that the rubber anti rattler ring (38) is inside the cylinder body (25).
- 3.2 Align the three mounting holes of the cylinder with the holes on the compression member of the brake beam (37) and the hole in the strut pad. From the topside, install two $\frac{5}{8}$ " hex bolts (24) and secure with $\frac{5}{8}$ " locknuts (23) from the underside. Do not tighten at this time.
- 3.3 Install $\frac{1}{2}$ " T-Head bolt (22) from the underside of the strut and secure with the $\frac{1}{2}$ " locknut (21). Tighten and torque the two $\frac{5}{8}$ " locknuts to 110 ft. lbs (150 Nm) and the $\frac{1}{2}$ " locknut to 85 ft. lbs (115 Nm).

NOTE: For the 12" (304.8 mm) cylinders, please install the $\frac{1}{2}$ " T-Head Bolt (22) from the top of the cylinder bracket and secure with the $\frac{1}{2}$ " locknut (21).

NOTE: For the installation of brake beams, proceed to Section 7.0, the control rod pin (2) will be inserted at a later step.

3.4 Reconnect the transfer lever (29) to the strut and cylinder (25) by installing the transfer pin (20), PT indicator arrow (11), the control rod pin (2) and the center strut pin (28).

NOTE: It may be necessary to overcome some slight cylinder bail or angularity to insert the center strut pin.

For hand braked trucks only – Place the hand brake lever (14) into the hand brake strut bracket (17) and secure the handbrake transfer link (30) to the hand brake lever (14) with Transfer pin (13).

3.5 Install new cotter pins (1, 12, 19, 27) respectively into the control rod pin (2) the hand brake transfer pin (13), the push rod transfer pin (20), and the center strut pin (28).

3.6 When installing the brake cylinder only proceed back to Section 8.0 to set up piston travel and the slack adjuster rack extension.

4. Slack Adjuster Removal

Extreme caution must be taken when working on the slack adjuster since it is under heavy spring load. WARNING: DO NOT BUMP THE SLACK ADJUSTER TRIGGER! IF BUMPED, THE SLACK ADJUSTER COULD ACTIVATE AND SUDDEN LET-OUT OF THE RACK EXTENSION COULD OCCUR AT THE REAR JAW. PERSONAL INJURY MAY RESULT.

1. Install a $\frac{5}{16}$ " X 2" long locking bolt in the threaded hole on the slack adjuster housing weldment.
2. Deactivate the slack adjuster by loosening the $\frac{1}{2}$ " locknut (3) from the spherical flanged sleeved nut (4) and remove both nuts from the slack adjuster control rod (5).
3. Remove the cotter pin connection (1) from the slack adjuster control rod pin (2) and remove the control rod pin.
4. Remove the cotter pin connections (6, 8, 10B) from the transfer pin (7, 9) slack adjuster trigger pin (10A).
5. Remove slack adjuster trigger pin (10A) from the slack adjuster (10).
6. Remove transfer pin (7) from the cylinder transfer lever (29).

7. Slide the trigger end jaw of the slack adjuster (10) away from the cylinder transfer lever (29) so that the trigger (10C) is free of the control rod (5) and slide the control rod (5) off the cylinder transfer lever (29).
8. From the cylinder side of the slack adjuster (10), remove the trigger (10C) from the trigger end jaw.
9. Remove the transfer pin (9) from the non-cylinder transfer lever (36).
NOTE: The return push rod assembly (33) and the non-cylinder transfer lever (36) may be slid to the side of the bolster window in order for easier removal of the slack adjuster (10).
10. Carefully remove the slack adjuster (10) entirely through the bolster window for service or replacement. **NOTE:** *Slack adjuster service must be performed at an AAR certified repair facility. Appropriate repairs and test must be made before reapplying slack adjuster brake rigging.*

5. Installation of Slack Adjuster

1. Carefully insert the slack adjuster (10) through the bolster window with the trigger end jaw of the slack adjuster toward the cylinder brake beam. Cut the plastic shipping strap from the slack adjuster front jaw.
2. Align the non-cylinder transfer lever (36) with the proper slack adjuster rack end jaw hole and pin with a transfer pin (9). **NOTE:** Please refer to the proper TMX installation or assembly drawing or ask your air brake supervisor for the correct pinning of the non-cylinder (36) to the inner or outer hole of the slack adjuster rear jaw (See Figure 2). Insert the trigger (10C) into the trigger end jaw slot of the slack adjuster (10) from the cylinder side, then slide the slack adjuster control rod (5) into the trigger (10C). Both the slack adjuster (10) and the control rod (5) should be set onto the cylinder transfer lever (36) simultaneously. Insert the trigger pin (10A) through the trigger pin hole on the slack adjuster (10).
3. Secure the slack adjuster (10) to the cylinder transfer lever (29) with transfer pin (7). Insert the control rod pin (2) through the control rod clevis and the small hole of the cylinder transfer lever. Turn the spherical flanged, sleeved nut (4) clockwise onto the control rod (5) with the sleeved side toward the trigger of the slack adjuster. Turn the nut clockwise until a $\frac{1}{4}$ " gap is left between the nut and the trigger. **NOTE:** *For the installation of brake beams proceed to Item 7.0.*
4. Remove the slack adjuster locking bolt (10D). (See Figure 3) **IMPORTANT:** *Failure to the slack adjuster may occur if the locking bolt is not completely removed.*

⚠ WARNING: DO NOT BUMP THE SLACK ADJUSTER TRIGGER! IF BUMPED, THE SLACK ADJUSTER COULD ACTIVATE AND SUDDEN LET-OUT OF THE RACK EXTENSION COULD OCCUR AT THE REAR JAW. PERSONAL INJURY MAY RESULT.

5. Install new cotter pins (1, 6, 8, 10B) to the control rod pin (2), transfer pins (7, 9) and the trigger pin (10A).
6. For slack adjuster installation, proceed to Section 8.0 to Set-Up Piston Travel and Slack Adjuster Rack Extension.

6. Brake Beam Removal

1. Return to Sections 2.1 through 2.8 for Brake Cylinder Removal and Sections 4.4 to 4.9 for Slack Adjuster Removal.
2. Remove cotter pin connection (31) from the transfer lever pin (32) and remove the transfer lever pin (32) from the push rod assembly (33).
3. Slide the push rod assembly (33) and the anti-rattler ring (38) through the bolster window.
4. Remove the transfer levers (29, 36) from the brake beams (37).
5. **For hand braked trucks only** - Remove handbrake transfer link (30) from the cylinder side transfer lever.
6. The brake beams should be removed using normal shop practices.

NOTE: *If the brake beam - handbrake side is to be replaced, it will be necessary to remove the handbrake strut bracket (17) from the brake beam (37) by loosening the $\frac{1}{2}$ " locknuts (15) from the $\frac{1}{2}$ " T-Head bolts (16). The handbrake strut bracket must be reapplied to the replacement brake beam (37). Check brake beam assembly for wear, cracks or distortion. If damaged, replace immediately.*


NOTE: *Check the brake heads on the brake beams for cracks, distortion, wear in the pin hole or in the brake shoe mounting surface. If damaged, brake head must be replaced before returning brake beam to service. For replacement brake heads, it is recommended that the brake beams be returned to Cardwell Westinghouse for reconditioning. Brake heads are furnished for 12°, 14° or 18° end guide angles.*

7. Installation of the Brake Beams

1. The brake beam should be installed using normal shop practices. NOTE: Make sure brake beam wear on end guides and brake heads are within specified limits before applying to truck. **For hand braked trucks only** - position the handbrake transfer link (30) into the notch of the transfer lever (29). Position the lever with the notch side towards the cylinder.
2. Insert the transfer lever (29) and the handbrake link (30) (if applicable) through the slot in the brake beams (37).
3. Install brake cylinders as noted earlier.

4. Install slack adjuster as noted earlier.
5. Insert the non-cylinder transfer lever (36) into the brake beam (37) from the return push rod side of the strut. Refer to the car badge plate, ask your air brake supervisor or look at the installation drawings to determine which side of the non-cylinder transfer lever is located towards the slack adjuster.
6. Secure the slack adjuster (10) and return push rod (33) to the lever with the transfer pins (9, 32).


NOTE: Please refer to the proper TMX installation or assembly drawing or ask your air brake supervisor for the correct pinning of the non-cylinder transfer lever (36) to the inner or outer hole of the slack adjuster rear jaw (See Figure 3).

- 7.7 Secure all pins with respective cotter pins (8, 31, 34).
- 7.8 Secure the slack adjuster control rod (5) to the transfer lever (29) with the slack adjuster control rod pin (2).
- 7.9  Install the trigger pin (10A) through the slack adjuster (10C) and trigger (39). Pin the cotter pin connection (10B) to the slack adjuster trigger pin (10A). Secure the pins with respective cotter pins (1 & 10B).
- 7.10 Screw the spherical flanged sleeved nut (4) onto the control rod with the spherical side towards the trigger of the slack adjuster until it is $\frac{1}{4}$ " away from the trigger. Install the $\frac{1}{2}$ " locknut (3).
- 7.11 Install 2" high friction composition brake shoes.
- 7.12 Proceed to Section 8.0 setup piston travel and slack adjuster rack extension.

8.0 INITIAL SETUP OF PISTON TRAVEL AND SLACK ADJUSTER RACK EXTENSION

Refer to Figure 3

- 8.1 With the car de-trucked, it is necessary to shim between the side frame and roller bearing to prevent outward axle and wheel movement.

 **WARNING: DO NOT BUMP THE SLACK ADJUSTER TRIGGER! IF BUMPED, THE SLACK ADJUSTER COULD ACTIVATE AND SUDDEN LET-OUT OF THE RACK EXTENSION COULD OCCUR AT THE REAR JAW. PERSONAL INJURY MAY RESULT.**

8.2 ⚠️ Install the thimble-type strainer and attach a regulated air supply to the cylinder air flange and slowly apply 50 psi (3.45 bar) to the cylinder. Release and reapply several times. With 50 psi (3.45 bar) applied, measure and record piston travel then release and adjust if necessary.

8.3 If the piston travel is too long, turn the spherical flanged sleeved nut (4) clockwise onto the control rod (5). If the piston travel is too short, turn the nut counterclockwise.

Measurement should be $3" \pm \frac{1}{4}"$ (76 ± 6 mm). This will achieve actual piston travel of $2" \pm \frac{1}{4}"$ (51 ± 6 mm) (See Figure 1).

8.4 ⚠️ When the required piston travel is met and is repeatable, secure the spherical flanged sleeved nut (4) with $\frac{1}{2}"$ locknut (3).

⚠️ NOTE: To measure the slack adjuster rack, the brake system should be applied several times. Rack extension readings must be taken with air applied.

8.5 With 50 psi (3.45 bar) applied, measure and record the slack adjuster rack, which is the space between the rear jaw and the rear of the housing of the slack adjuster. The slack adjuster rack extension should be $1\frac{1}{4}"$ (32 mm) to $1\frac{3}{4}"$ (44 mm) (if measured from the inside of the cap to the rear jaw) or $\frac{1}{4}"$ (6 mm) to $\frac{3}{4}"$ (19 mm) (if measured from the end of the cap to the rear jaw). (See Figure 3 and the Service Bulletin 2000-02 for details.)

If the slack adjuster rack is too short, release the brake assembly and shorten the return push rod (39) by turning it counterclockwise if facing the back of the cylinder. If the rack is too long, lengthen the return push rod (39) by turning it clockwise if facing the back of the cylinder. The return push rod (39) can be lengthened or shortened to achieve the proper rack extension. There is approximately a 1 to 1 adjustment ratio.

8.6 Secure the return push rod assembly (33) to the cylinder by inserting the spring pin (18) through the hole in the cylinder (25) and push rod. Insure that the anti-rattler ring (38) is contained in the cylinder by the pin.

8.7 When the required slack adjuster rack is met and repeatable, tighten the hex jam nut (40) until the lock washer (41) is closed.

For hand braked trucks only – With the air applied insert the handbrake lever (14) into the pocket of the handbrake strut bracket (17). Align the handbrake lever center hole with the hole in the handbrake transfer link (30) and insert the transfer pin (13) and secure with the cotter pin.

8.8 Remove the shims from the outboard side of all the journals.

8.9 Check all the brake pin connections to insure proper cottering and position the trucks under the car body. Attach the handbrake chain and cylinder hose. With 50 psi (3.45 bar) in the cylinder, verify that the piston travel and slack adjuster rack are correct or make any necessary adjustments.

- 8.10 On a car equipped with 2W wheels, it becomes necessary to make a manual adjustment in the TMX® Truck Mounted Brake rigging to ensure that the automatic slack adjuster will be capable of compensating for additional wear.

When replacing a worn or damaged wheel set with a turned down two wear wheel set, the return push rod must be lengthened one inch as follows:

Measure and record the length of the push rod from the spring pin (18) to the centerline of the transfer pin (32). Then loosen the hex nut and remove the spring pin so that the push rod can be turned by hand out of the push rod adjuster (42). Turn the push rod counterclockwise (out of the adjuster) until the rod has been lengthened one inch. If two turned down wheels are applied, the push rod must be lengthened two inches or to the maximum length of the push rod (See the note below). Reapply the spring pin (18) and retighten the nut (40).

In reverse when a new 36" wheel set is installed to replace a turned down worn two wear wheel, the push rod must again be shortened by one inch per wheel set.

NOTE: THE MAXIMUM LENGTH OF THE RETURN PUSH ROD MUST NOT EXCEED 35" FOR THE STANDARD RETURN PUSH ROD PART NUMBER 660414. THE NONSTANDARD PUSHRODS WILL VARY IN THE MAXIMUM LENGTH. NONSTANDARD RETURN PUSH RODS ARE DESIGNATED BY 660414 -"XXXX".

IMPORTANT: After the complete TMX Truck Mounted Brake Assembly is appropriately secured on the truck and the trucks are placed under the car body,, a brake test is to be made to insure the TMX Assembly functions properly on the total vehicle brake systems, including both air and hand brake operations.

B. UBX Truck Mounted Brake Assembly

1. INSTALLATION INSTRUCTIONS

1. Please refer to your UBX assembly or installation drawings to determine which UBX equipment combination is being applied.
2. The UBX brake beams (8) are to be installed during truck assembly normal to your existing shop practice. It is optional to mount the brake actuator (19) to the brake beam prior to the truck assembly.
3. Mount the brake actuator (19) to the brake beam (8). Align the two rear mounting holes of the brake actuator (19) with the two corresponding holes on the brake beam (8). Align the one side-mounting hole of the brake actuator (19) to the one corresponding hole on the strut side-pad. The brake actuator will be facing outboard from the bolster. Using two 5/8" hex bolts (18) through the topside of the compression member, fasten the rear-mounting portion of the brake actuator (19) with the two 5/8" hex locknuts (17); do not tighten at this

time. Using a ½” T-head bolt (16) from the underside of the center strut pad, fasten the side mounting with a ½” hex locknut (15). Tighten and torque the two 5/8” hex locknuts (17) to 110 ft-lbs. (150 N-m) and the ½” hex locknut (15) to 85 ft-lbs (115 N-m).

CAUTION: When tightening or applying torque to any UBX fastener, always use a mechanical mean; adjustable wrench, box end wrench, socket, etc. To avoid personal injury, **DO NOT MANUALLY HOLD FASTENERS!**

4. Install transfer lever (6) to the brake actuator brake beam. For hand-braked trucks, install handbrake/cylinder transfer lever (1) to the brake actuator brake beam. Insert lever (6 or 1) through the slot in the brake beam strut from the brake actuator side. Secure lever (6 or 1) with transfer pin (14) through the brake actuator push rod clevis. For hand-braked trucks, install the washer (12) between the topside of lever (1) and the strut lever slot opening. Secure lever (6 or 1) to the brake beam strut with the center strut pin (23).

NOTE: It may be necessary to overcome some slight actuator bail or angularity to insert the center strut pin.

5. Insert the slack adjuster (10) through the bolster window with the trigger end jaw of the slack adjuster toward the actuator brake beam. Cut the plastic shipping strap from the slack adjuster front jaw.
6. Install transfer lever (29) to the non-actuator brake beam. The transfer lever (29) will determine your lever ratio. Refer to the car badge plate, ask your air brake supervisor, or look at the installation drawings to determine which side of the transfer lever (29) is located toward the slack adjuster (10). Insert transfer lever (29) through the slot in the brake beam strut from the return push rod side. Align the center hole of transfer lever (29) with the strut hole and pin to the strut with the center strut pin (28).

UBX INSTALLATION INSTRUCTIONS

7. Slide the rubber anti-rattler ring (25) onto the non-clevis end of the return push rod assembly (27). Position the anti-rattler ring (25) between the spring pinhole and the end of the return push rod (24). Insert this end of the return push rod assembly (27) through the bolster window and into the rear of the brake actuator (19). Ensure that the anti-rattler ring is between the spring pinhole and the actuator body. (See Figure 2). Line up the pinhole on the return push rod assembly (27) with the spring pinhole on the brake actuator bracket. Align the return push rod clevis hole to the transfer lever (29) hole and secure with transfer pin (26).
8. Align transfer lever (29) with the proper slack adjuster rack end jaw hole and secure with a transfer pin (9).

NOTE: Please refer to the proper UBX installation or assembly drawing or ask your air brake supervisor for the correct pinning of transfer lever (29) to the inner or outer hole of the slack adjuster rear jaw. (See Figure 2)

Insert trigger (10C) into the trigger end jaw slot of the slack adjuster (10) from the brake actuator side. Next, slide the slack adjuster control rod (5) into the trigger (10C). Both the slack adjuster (10) and the control rod (5) should be set onto the transfer lever (6 or 1) simultaneously. Insert the trigger pin (10A) through the trigger pinhole on the slack adjuster (10).

Secure the slack adjuster (10) to transfer lever (6 or 1) with transfer pin (7). Insert the control rod pin (2) through the control rod clevis and the small hole of transfer lever (6 or 1). Turn the spherical flanged sleeved nut (4) clockwise onto the control rod (5) with the sleeved side toward the trigger of the slack adjuster until a ¼" gap is left between the nut and the trigger.

9. Remove the slack adjuster locking bolt (10B). (See Figure 1 and the Service Bulletin 2000-02)

CAUTION: *Do not bump the slack adjuster trigger (10C). If bumped, the slack adjuster could activate and sudden let-out of the rack extension could occur at the rear jaw.*

10. Install the 2" brake shoes and shim the outboard side of all journal bearings using 1/8" shims to prevent outward wheel and axle movement.
11. Attach a regulated air supply to the brake actuator inlet flange and slowly apply 50 psi (3.45 bar) to the brake actuator.

CAUTION: *This will activate the truck mounted brake assembly. All personnel must be clear of the slack adjuster, brake beams, brake shoes, transfer levers, and all other parts of the assembly.*

UBX INSTALLATION INSTRUCTIONS

12. Release the brake assembly and re-apply 50 psi (3.45 bar) to the brake actuator. Re-apply 54 psi (3.72 bar) to the brake actuator for European applications. For short piston travel applications, a measurement of 3-3/4" ± ¼" (95 ± 6mm) should be taken to achieve the desired piston travel. For long piston travel applications, a measurement of 4-1/2" ± ¼" (114 ± 6mm) should be taken to achieve the desired piston travel. (Measurements illustrated in Figure 2). Refer to the car badge plate, ask your air brake supervisor, or look at the installation drawings to determine the proper piston travel application. If piston travel is long, turn the spherical flanged sleeved nut (4) clockwise. If piston travel is short, turn the spherical flanged sleeved nut (4) counter-clockwise. There is a 1 to 2 adjustment ratio from spherical flanged sleeved nut travel to piston travel.

When the required piston travel is met and repeatable, turn the ½" locknut (3) clockwise against the spherical flanged sleeved nut (4) and torque against each other to 55 ft-lbs. (75 N-m).

13. With air applied, measure and record the slack adjuster rack, the distance between the rear jaw of the slack adjuster and the rear of the housing. (See Figure 2). The slack adjuster rack should be 1- $\frac{1}{4}$ " (32mm) to 1- $\frac{3}{4}$ " (44mm) (if measured from the inside of the cap to the rear jaw) or $\frac{1}{4}$ " (6mm) to $\frac{3}{4}$ " (19mm) (if measured from the edge of the cap to the rear jaw). See Figure 2 and Service Bulletin 2000-02 for details. If the rack is too short, release the brake assembly and turn the return push rod (24) counter-clockwise if facing the back of the brake actuator. If the rack is too long, release the brake assembly and turn the return push rod (24) clockwise if facing the back of the brake actuator. There is approximately a 1 to 1 adjustment ratio from return push rod clevis travel to slack adjuster rack extension.

When the required slack adjuster rack is met and repeatable, align the hole in the return push rod (24) with the hole in the brake actuator bracket and insert the spring pin (21). Tighten the hex jam nut (22) on the return push rod (24) until the lock washer (13) is closed against the return push rod clevis (11).

14. Remove the shims from the outside of all the journal bearings.
15. Using cotter pins (30 thru 37), cotter all 8 remaining brake pin connections and verify the actuator piston travel and slack adjuster rack with trucks installed under the car body. Make any necessary adjustments.

Ensure that the thimble type strainer (20) is installed in the brake actuator air inlet flange prior to attaching the car brake cylinder hose.

Review Exercise Answers

1. By AAR designation the top connecting rods must be a minimum of **3/4" Diameter**
2. The handbrake end of the car is generally designated as the **B-End**.
3. Body mounted slack adjusters generally use an **actuator control rod** to maintain the proper piston travel.
4. Brake Lever dimensions may be found on the **badge plate** which is usually located close to the brake valves.
5. The Universal **Models 5, 5D and C-1000** are equipped with a Trigger Pin/ Locking Bolt for safety.