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Pinpointing Braking Failures

Is It the Slack Adjuster?
Or Is It the Foundation Brake?

A slack adjuster - regardless if it's manual or automatic - is a lever used to actuate brakes. As its name implies, it is also a device which takes up the slack or excess clearance caused by lining and drum wear. Although manual and/or automatic slack adjusters are required to apply the brakes, there are significant differences in operation and maintenance procedures.

A manual slack adjuster is typically adjusted at every inspection by the driver, or by driver request. Several methods exist for manually adjusting brakes. One method is to rotate the adjusting hex nut until the brake linings contact the drum, then back the adjustment off one-half turn. Another method is to pull on the slack arm while adjusting the hex nut and setting.

Two ways to check if the manual slack is in proper adjustment is to tap on the brake drum and listen for a ringing sound, or jack the vehicle up and rotate the tire to detect brake drag.

Conversely, an automatic slack adjuster should never have to be manually adjusted except at installation of the ASA or when repairing the brakes.

The method we prefer for checking brakes is the one suggested by the U.S. Department of Transportation which calls for stroke measurement to be taken at an 80-to-90 PSI brake application.

Using this method, a power stroke measurement will alert you to the following operating characteristics of the braking system. Each of these items affects braking performance and pushrod stroke.

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Al Factor: This is a measurement of leverage which is obtained by multiplying the area of the brake chamber by the effective length of the slack adjuster. Thus, the chamber size and slack adjuster arm length directly affect the amount of brake torque (force) which is generated. At an 85-PSI brake application, the difference in stroke between a 5-1/2" and a 6-1/2" slack adjuster can be as much as .40".

Brake Stiffness: The amount of give and take in a brake assembly can vary greatly with the stiffness of the brake drum and foundation hardware.

Shoe-to-Drum Clearance: An increase in shoe-to-drum clearance from the industry average of .025" to .050" can cause pushrod travel to increase by .625". Maintaining proper clearance is necessary in order for other components of the system to remain proportional and perform effectively.

Burnish Quality: Unburnished linings which do not properly mate with the brake drum increase the lining to drum clearance and result in lower braking force. High and low spots on the brake friction material can hinder full contact of the lining to the brake drum and can also weaken brake performance. Because of this, the power stroke will be greater immediately after brake relining, and will decrease as the brake lining becomes burnished.

Other Brake Hardware/Maintenance Deficiencies Associated With the Foundation Brake: The principal reason to take a brake stroke measurement is that it gives clues to the condition of the foundation brake and the lining-to-drum clearance. Severely worn, missing or broken brake components can cause you to fail roadside inspections even if lining-to-drum clearance is good. When inspecting brakes, don't overlook severely worn cam bushings, missing S-cam rollers, and cracked brake drums, since they can play as much havoc with your braking system as worn linings and drums.

Replace the camshaft bushing at every brake reline. It is the most overlooked part of the foundation brake. It centers the cam and brake shoe assemblies in the brake drum.

Always replace fittings, line sizes, and valves with the exact parts to prevent altering the brake balance. Changes in the line size and/or fittings will change air system performance. Longer lines or larger diameter lines will slow down delivery timing. Restricted fittings and 90-degree elbows slow air delivery to the brake chamber.

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Always replace brake linings with the same friction characteristics as the OEM lining that came with the new vehicle and never mix different linings with different friction ratings on the same axle.

Inspect brake shoe tables for rust pits, bent shoe tables and elongated rivet holes to ensure product quality. Brake shoes must be checked for wear at anchor pin holes and at roller pin seats to prevent noise and ensure brake performance. Each web must be checked for stretching and cracks.

Lubricate the brakes on a scheduled basis, but don't over-lube and never put any kind of lubricant on the cam head or rollers. Too much grease in the bushings can drip onto the lining and drum causing a brake that cannot effectively stop.

Although a free stoke measurement (the distance the slack adjuster travels from the release position until the shoes contact the drum) will not only tell you if the brakes are in adjustment, or have a dragging brake, it is a good method for mechanics to troubleshoot ASAs. When using this method you should have a free stroke between 3/8" to 5/8".

If the pushrod stroke is greater than the maximum, legally-allowable stroke for the appropriate chamber size, then the automatic slack adjuster should be tested for operation. All automatic slack adjusters can be easily tested to detect if they are functioning properly.

A simple check can be performed on the ASA by backing off the slack adjuster three-quarters of a turn. Be sure to follow the manufacturer's procedure. Mark the adjusting mechanism and apply the brakes several times. The mark should rotate indicating the slack adjuster is adjusting. If rotation does not occur, the slack adjuster should be replaced.

A function test of the automatic slack adjuster can also troubleshoot slack adjuster operation. Use a torque wrench to back off the slack adjuster as shown in the photo. Some manufacturers require a minimum torque value, others a maximum value. However, in either case, if torque values are not correct, the slack adjuster should be replaced. Consult the individual manufacturer for the correct torque values and procedures.

Aside from checking for operation, the only other maintenance required on an automatic slack adjuster is to inspect the unit for structural damage, and lubricate the slack adjuster

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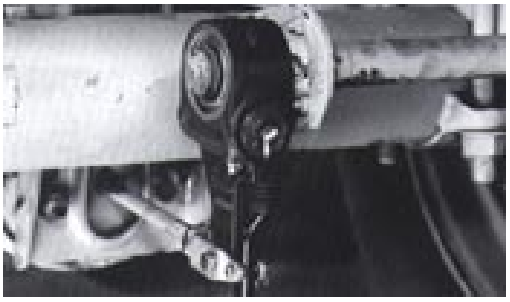
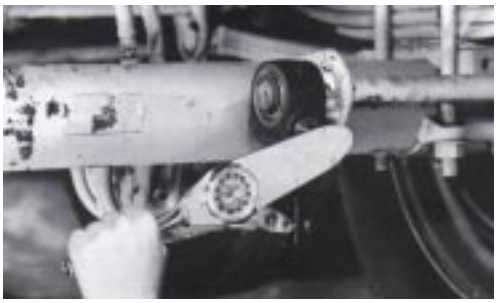
according to the manufacturer's recommendation. You should also pay close attention to the attaching hardware, such as clevis pins and bushings.

TMC has revised its Recommended Practice for slack adjusters (RP 609). The Recommended Practice will contain information on installation, inspection and maintenance of automatic slack adjuster.

Government testing and fleet usage have proven automatic slack adjusters are beneficial from a maintenance and safety aspect. However, successful operation depends largely on your employees' understanding the operation and maintenance required when using automatic slack adjusters.





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TMC's Automatic Slack Adjuster Prodedure

An automatic slack adjuster should not have to be manually adjusted after initial installation. Instead of manually adjusting the slack, the following procedure should be followed during inspection:

A power stroke at 80-to-90 PSI will check both adjustment and the foundation brake condition.

- Measure from the face of the brake chamber to the center of the clevis pin at all wheel locations (figure 1).
- Make brake applications until air reservoir gauge reads 90 to 100 PSI. Have someone make a full-on brake application and hold.
- Again, measure from the face of the brake chamber to the center of the clevis pin (Figure 2).
- The difference between the released and applied measurements is the power stroke. If the stroke is less than the maximum allowable stroke for the appropriate chamber size (see table below), the proper stroke has been maintained and the inspection is complete. If the power stroke is more than the maximum allowable stroke listed for the chamber size in the table below, refer to the troubleshooting section (last page).

Chamber Type	Maximum Stroke
16	less than 1-3/4"
20	less than 1-3/4"
24	less than 1-3/4"
24 long stroke	less than 2"
30	less than 2"
30 long stroke	less than 2-1/2"
36	less than 2-1/2"

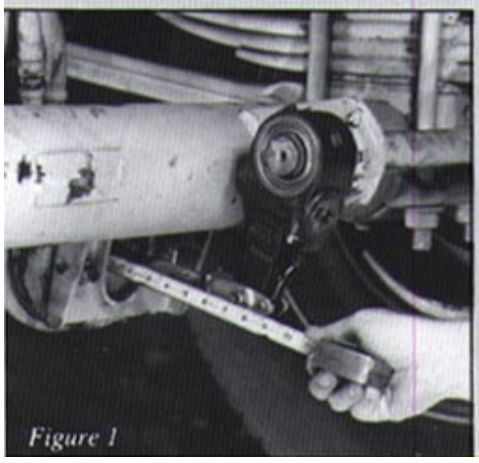

Figure 1

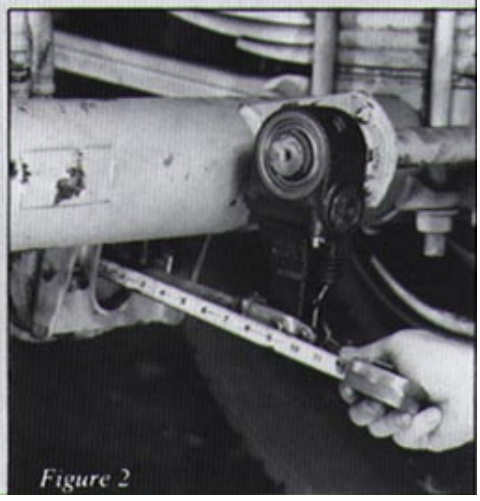

Figure 2

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Troubleshooting Automatic Slack Adjusters

If the power stroke is at or more than maximum stroke, a free stroke should be taken to determine if the slack adjuster is operating properly.

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Free Stroke

Free stroke is the amount of movement of the slack arm required to move the brake shoes against the drum.

- With the brakes released, measure from the face of the chamber to the center of the clevis pin.
- Use a lever to pry the slack adjuster (see fig. 3) until the brake shoes contact the drum.
- The difference between the released and applied measurements is the free stroke. The free stroke should be between 3/8" and 5/8".
- If the free stroke is found to be within limits, the long stroke can be attributed to a foundation brake problem. Check for missing or worn components, cracked brake drums, or improper lining-to-drum contact. If the free stroke is greater than recommended, a function test of the automatic slack adjuster should be performed.

Function Test

- Rotate the adjusting mechanism at least one complete turns as if you were backing the brakes off. (Remove the pawl with Rockwell automatic slack adjusters.)
- The pawl must be installed properly and tightened to 15-to-20 ft./lbs. Apply the brakes several times and observe whether the adjuster mechanism is rotating in the direction needed to reduce brake chamber push rod stroke.
- Check backoff torque by rotating the adjusting hex as follows:

Gunite: Minimum 15 ft./lbs.
Bendix: Minimum 15 ft./lbs.
Rockwell: Maximum 45 in./lbs. (pawl removed)
Haldex: Minimum 15 ft./lbs.

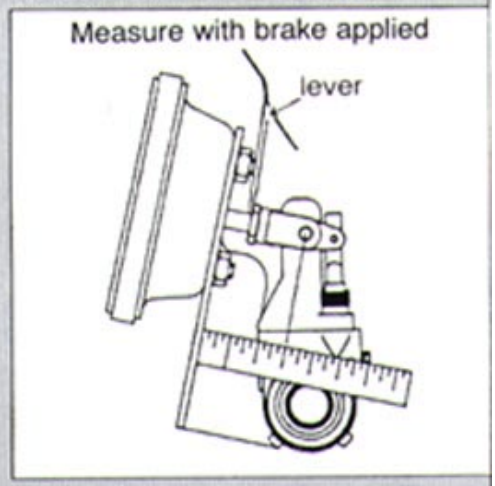

Figure 3

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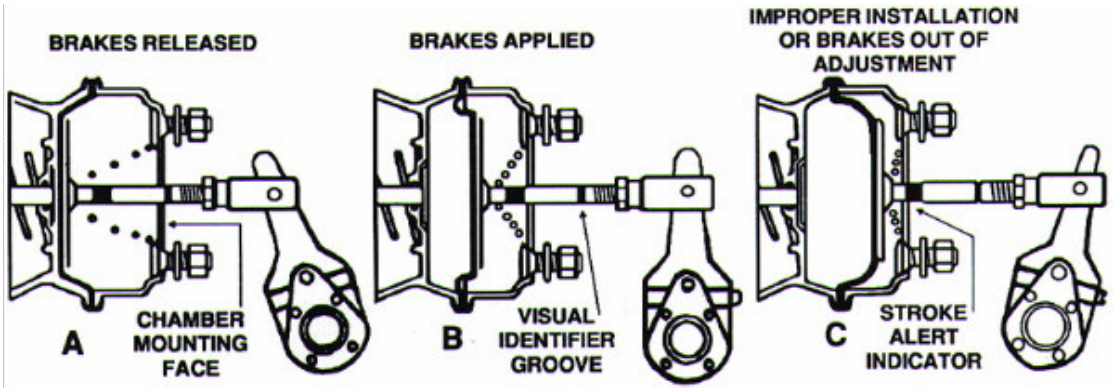

Some brake chamber push rods are marked to warn of an over-stroke condition. While the markings themselves vary, the marking system has two basic points. As shown in the figure above, there is a mark on the portion of the push rod near its clevis attachment to signal that it incorporates a stroke alert indicator. There is a mark on the brake chamber push rod opposite its clevis attachment and which is exposed from the brake chamber whenever over-stroke occurs.

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