Why It Is So Important
To Check Your Air Brake Chamber
(or Actuator) Pushrod Stroke?

As a commercial truck or bus professional, you know the brake systems on your vehicles must work well every time they are on the road and under all conditions. If they do not, you could be risking your life or the lives of others.

To be able to stop effectively in every braking situation, all components in the air brake system, including the foundation brakes, must be properly installed and maintained by qualified technicians. Air brake chamber (or actuator) pushrod stroke must be kept within the regulation limits (or re-adjustment limits if in reference to manual brake adjusters, which are permitted only on older vehicles) specified by U.S. and Canadian regulations.

Vehicles manufactured in the mid-1990s or later* must be equipped with self-adjusting brake adjusters (S-ABAs) to automatically account for normal brake system wear.

During day-to-day driving a driver cannot “feel” how well brakes will work during an extreme braking maneuver. The most effective check of air (drum) foundation brakes is to measure the pushrod stroke to confirm that it is within federal specifications. If pushrod stroke is beyond the regulation limit, the foundation brake may no longer be capable of providing full braking force, and the brake needs servicing.

Failure to properly service brake systems is the most common reason drivers (and motor carriers) are issued vehicle Out-of-Service (OOS) orders. When pushrod stroke exceeds the regulation limit, something is wrong with the brake and it is a violation. By following manufacturer recommended foundation brake maintenance intervals (for lubrication, lining replacement, wear tolerances, etc.), regularly measuring the pushrod stroke, and addressing issues as they arise, you lower your crash risk, help your company’s safety rating, and greatly reduce your chances of a violation or OOS condition.

Whenever checking pushrod stroke, look for signs of other violations such as: damaged, broken, or missing components; air leaks; rusty or cracked drums; damaged linings; worn linings; and brakes that simply are not working.

* see inside if your vehicle requires S-ABAs

In summary, when you have S-ABAs that exhibit chamber stroke beyond the regulation limit, consider the following facts before you try adjusting the S-ABA:

- You may be legally prohibited from readjusting S-ABAs in some jurisdictions.
- Your employer may prohibit you from adjusting the S-ABA.
- You shouldn’t re-adjust a S-ABA unless you have been trained on exactly how to do it. There are several S-ABA products and each has different procedures that must be followed to readjust them without damaging the S-ABA.
- Manually adjusting a S-ABA improperly can damage the brake adjuster. Manufacturer’s instructions for the S-ABA on the vehicle must be precisely followed.
- The brake chamber will return to the excessive stroke condition until the cause of the problem is repaired. Excessive stroke can return very quickly, in just a few brake applications.
- If you readjust the brake chamber stroke, you will have to take responsibility for doing so. This means you must continue to monitor the brake chamber stroke and report the excessive stroke problem to your employer or service provider at the first opportunity.
- If you hire someone to correct an excessive brake chamber stroke problem that is installed with a self-adjusting brake, be sure they are qualified brake technicians and fix the underlying cause for the excessive brake chamber stroke.
- If a brake chamber that is installed with S-ABAs exhibits excessive stroke, some of the possible contributing causes could include worn clevis or clevis pin connections, worn-slam backings, cracked chamber bracket or cam tube welds, worn rollers, cracked drums, worn linings, worn drums, and/or loose mounting hardware. A trained brake mechanic should investigate and diagnose the problems.

For further information regarding the Commercial Vehicle Safety Alliance and commercial motor vehicle safety & security

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www.cvsa.org
www.operationairbrake.com
What Is A Brake Chamber Pushrod Stroke Violation?
A brake violation occurs whenever the brake chamber pushrod stroke exceeds the regulation stroke limits set by safety regulations. The brake chamber pushrod stroke regulation limits are established to ensure there is sufficient pushrod travel to apply full force to the foundation brake under all operating conditions. The limits are based on the size of the brake chamber and whether the chamber is a standard or long stroke design (see Table 1 at right for further explanation). Pushrod stroke in excess of the regulation limit not only violates federal regulations but, more importantly, begins a decline in the force—eventually to zero—at the foundation brake, which will increase the distance it takes to stop the vehicle or combination. The only way to tell when you have a pushrod stroke violation is to measure the stroke while applying the service brakes at sufficient pressure. Most heavy vehicles on the road are equipped with self-adjusting (automatic) brake adjusters [S-ABAs]. Trucks and buses manufactured in the United States after October 20, 1994, and in Canada after May 31, 1996, equipped with air brakes must automatically adjust for normal wear in the brake system, thereby helping to maintain proper pushrod stroke. The use of S-ABAs has helped significantly reduce the rate of Out-of-Service (OOS) brake violations. However, even with properly working S-ABAs installed, abnormal or excessive wear or broken components can result in excessive pushrod stroke, so stroke should still be measured on a regular basis. If your vehicle has manual brake adjusters (allowed on vehicles manufactured before the dates above) they must be measured regularly and adjusted accordingly.

What About “Free-Stroke” & “Slack”
Measuring chamber “free-stroke” or chamber pushrod “slack”—the distance you can pull the brake chamber pushrod by hand using a bar or lever without applying air pressure to the chamber—does not confirm a brake is capable of working properly under all conditions. Chamber free-stroke longer than 3/8 to 3/4 inch may indicate a more serious issue, but shorter free-stroke does not confirm proper brake chamber stroke (see the dates above). How To Correctly Measure The Brake Chamber Stroke
To measure chamber pushrod stroke, you will need a ruler, chalk to mark pushrods, a flashlight, eye protection, and pencil and paper. You will also need a method (or preferably an assistant) to apply the service brakes to a specific air pressure level to measure the pushrod stroke.

Pushrod Stroke Measurement Procedure

1. First, put the vehicle in a safe location and mark the wheels are blocked (to prevent rolling). Release the spring brakes. Confirm your dash gauge indicates that you have 90 to 100 psi supply pressure in the air brake system reservoirs, and that the brake chambers (see Table 1 at right). Supply reservoir pressure exceeding 110 psi will result in incorrect pushrod stroke assessments.
2. Second, visit each brake, confirm it is in the normal released position with nothing obviously wrong or out of place, and mark each pushrod to establish a reference starting location (e.g., level with where the pushrod exits the brake chamber or the chamber mounting bracket—you will need to note where the pushrod mark started out and where it ends up, and then measure the difference in the next step; see Figure 1).

![Figure 1 Marking the pushrod before brakes are applied assists with measuring stroke.](image)

<table>
<thead>
<tr>
<th>Chamber Size</th>
<th>OUTSIDE DIAMETER (reference)</th>
<th>REGULATION STROKE LIMIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>4 1/2” (115 mm)</td>
<td>1 1/4” (32 mm)</td>
</tr>
<tr>
<td>9</td>
<td>5 1/4” (133 mm)</td>
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<tr>
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<tr>
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<td>6 25/32” (172 mm)</td>
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</tr>
<tr>
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<tr>
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<td>7 7/8” (198 mm)</td>
<td>2 1/4” (57 mm)</td>
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<tr>
<td>30</td>
<td>9” (228 mm)</td>
<td>2 1/4” (57 mm)</td>
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</table>

Table 1 — Regulation stroke limits are set by regulations based on chamber size and whether standard or long stroke (LS) design. You must know the size and type of brake chamber (i.e., standard or long stroke (LS)) design. Most vehicles are fully checked for brake stroke compliance. The stroke violator shows one brake at the regulation stroke limit (it will need service soon) and another exceeding the regulation limit (it is a violation and should be serviced). This table can be expanded to account for all axles in a vehicle or combination.

How To Correctly Measure The Brake Chamber Stroke
To measure chamber pushrod stroke, you will need a ruler, chalk to mark pushrods, a flashlight, eye protection, and pencil and paper. You will also need a method (or preferably an assistant) to apply the service brakes to a specific air pressure level to measure the pushrod stroke.

Figure 1 Marking the pushrod before brakes are applied assists with measuring stroke.

Third, fully press and hold the service brakes applied (pushing the brake pedal all the way down until it stops) while you measure and record the distance each pushrod mark has moved (or “strokeed”). Note that it is normal for pressure to drop slightly once brakes are applied. If any brake applications cause the pressure to drop below 90 psi, it is okay to pause the procedure to rebuild reservoir pressure to 90 - 100 psi, and resume.

Finally, compare your recorded pushrod stroke values with the regulation stroke limits for your brake chambers (see Table 1). If any chamber stroke measurements are near or at the regulation stroke limits for your particular chamber types and sizes, the complete foundation brake, brake chamber (SABA, drum, and wheels) need to be inspected in more detail and serviced at the next opportunity. If any chamber stroke measurements exceed the regulation stroke limits, you risk not only receiving a violation, being placed out of service, and impacting your safety ratings, but also operating a vehicle that may take longer to stop when you most need it.

Re-adjusting Manual Brake Adjusters
Manual brake adjusters, permitted on older vehicles, must be readjusted on a regular basis. This should be done only by qualified individuals. If regulations require your vehicle to be equipped with S-ABAs, based on its date of manufacture, installing and using a manual brake adjuster in place of the S-ABA is not acceptable.

Self-adjusting Brake Adjusters
Self-adjusting brake adjusters (S-ABAs) should not be manually adjusted—they will do so automatically. If a chamber with an S-ABA is found with excessive stroke, there is a problem with either the foundation brake, drum, S-ABA itself, or other components, and the entire wheel and chamber (S-ABA, drum, hub and other hardware) should be inspected and serviced by an authorized brake technician as soon as possible. A manual readjustment may temporarily improve the stroke length, but it can damage the S-ABA and it does not fix the underlying problem. The stroke violation may return even if the brake is adjusted again. An automated brake adjuster may be able to improve the stroke length, but there is no way to determine the underlying problem.

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For example, consider a truck-driver with Type 24LS (Long Stroke) chambers on the steer axle, and Type 30LS on the drive axles. Regulation stroke limits for Type 24LS and Type 30LS are 2 inches and 2.5 inches, respectively, and their shelf stroke measurements are taken on three occasions. Note the circled entries show one brake at the regulation limit (it will need service soon) and another exceeding the regulation limit (it is a violation and should be serviced). This table can be expanded to account for all axles in a vehicle or combination.

What To Do When Your Brake Chamber Stroke Violates the Regulations
When brake chamber pushrod stroke exceeds the regulation stroke limit, what you do about it depends on whether your vehicle is equipped with manual brake adjusters or S-ABAs.

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</table>

Table 2

What To Do When Your Brake Chamber Stroke Violates the Regulations
When brake chamber pushrod stroke exceeds the regulation stroke limit, what you do about it depends on whether your vehicle is equipped with manual brake adjusters or S-ABAs.

- Re-adjusting manual brake adjusters
  - Manual brake adjusters, permitted on older vehicles, must be readjusted on a regular basis. This should be done only by qualified individuals. If regulations require your vehicle to be equipped with S-ABAs, based on its date of manufacture, installing and using a manual brake adjuster in place of the S-ABA is not acceptable.
  - Self-adjusting brake adjusters
    - Self-adjusting brake adjusters (S-ABAs) should not be manually adjusted—they will do so automatically. If a chamber with an S-ABA is found with excessive stroke, there is a problem with either the foundation brake, drum, S-ABA itself, or other components, and the entire wheel and chamber (S-ABA, drum, hub and other hardware) should be inspected and serviced by an authorized brake technician as soon as possible. A manual readjustment may temporarily improve the stroke length, but it can damage the S-ABA and it does not fix the underlying problem. The stroke violation may return even if the brake is adjusted again.

Consider Keeping a Chamber Stroke Measurement Record
Many fleets and owner-operators have found success in preventing violations by tracking brake chamber stroke measurements at each wheel and as part of their periodic maintenance programs. This involves recording pushrod stroke each time you measure it (per the above procedure).