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-end as part of their periodic maintenance programs. This involves recording pushrod stroke each time it is measured. See Table 2.

For example, consider a truck-tractor with Type 24L chambers on the steer axle and Type 30LS on the drive axles. Stroke limits in the regulation for Type 24L and Type 30LS are 2 inches and 2 1/2 inches, respectively.

The table below shows pushrod stroke measurements recorded on three occasions. Note the circled entries show one brake at the regulatory limit (it is a violation and must be serviced). This table can be expanded to account for all axles in a vehicle or combination.

Table 2

<table>
<thead>
<tr>
<th>Chamber Size</th>
<th>Type 24L</th>
<th>Type 24L</th>
<th>Type 30L</th>
<th>Type 30L</th>
<th>Type 30L</th>
<th>Type 30L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulation Stroke Limit</td>
<td>2”</td>
<td>2”</td>
<td>2 1/2”</td>
<td>2 1/2”</td>
<td>2 1/2”</td>
<td>2 1/2”</td>
</tr>
<tr>
<td>Date</td>
<td>Diameter</td>
<td>L-Steer</td>
<td>B-Steer</td>
<td>LF Drive</td>
<td>RF Drive</td>
<td>LR Drive</td>
</tr>
<tr>
<td>1/8</td>
<td>225/32 inches</td>
<td>1 1/2”</td>
<td>1 1/2”</td>
<td>1 1/4”</td>
<td>1 1/4”</td>
<td>1 1/4”</td>
</tr>
<tr>
<td>3/8</td>
<td>245/32 inches</td>
<td>1 1/2”</td>
<td>1 3/8”</td>
<td>1 1/4”</td>
<td>1 1/4”</td>
<td>1 1/4”</td>
</tr>
<tr>
<td>7/16</td>
<td>3/8, 3/16 inches</td>
<td>1 1/2”</td>
<td>1 1/2”</td>
<td>1 1/4”</td>
<td>1 1/4”</td>
<td>1 1/4”</td>
</tr>
</tbody>
</table>

Regulation Stroke Limits for Clamp-Type Brake Chambers

<table>
<thead>
<tr>
<th>Chamber Size</th>
<th>Type 24L</th>
<th>Type 24L</th>
<th>Type 30L</th>
<th>Type 30L</th>
<th>Type 30L</th>
<th>Type 30L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulation Stroke Limit</td>
<td>2”</td>
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<td>2 1/2”</td>
<td>2 1/2”</td>
</tr>
<tr>
<td>Date</td>
<td>Diameter</td>
<td>L-Steer</td>
<td>B-Steer</td>
<td>LF Drive</td>
<td>RF Drive</td>
<td>LR Drive</td>
</tr>
<tr>
<td>1/8</td>
<td>225/32 inches</td>
<td>1 1/2”</td>
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<td>1 1/4”</td>
<td>1 1/4”</td>
<td>1 1/4”</td>
</tr>
</tbody>
</table>

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The brake system on a commercial motor vehicle must work well every time, under all conditions. If not, the driver’s life and the lives of others are at risk.

To stop effectively in every braking situation, all components in the air brake system, including the foundation brakes, must be properly installed, adjusted and maintained by qualified technicians. The brake system on a commercial motor vehicle must work well every time, under all conditions. If not, the driver’s life and the lives of others are at risk.

During day-to-day driving, a driver cannot tell how well the brakes will work during an extreme braking maneuver. The most effective way to confirm that S-cam drum brakes are within regulatory limits is to measure pushrod stroke. Pushrod stroke is the length in inches or millimeters that the pushrod travels when the brake is fully applied. If the pushrod stroke is beyond the limit in the regulation, the foundation brake may no longer be able to provide full braking force and the brake may need servicing.

Brake system violations represent the most common reason commercial motor vehicles are placed out of service during roadside inspections. When pushrod stroke exceeds the regulatory limit, a violation exists and something may be wrong in the foundation brake system or with the slack adjuster.

By following manufacturers’ recommended foundation brake maintenance intervals (for lubrication, lining replacement, wear tolerances, etc.), regularly measuring the pushrod stroke and proactively addressing issues identified during that process, crash risk can be mitigated, safety ratings may improve, and the chances of a violation or out-of-service order can be reduced.

**What is a brake chamber pushrod stroke violation?**

A brake violation occurs when the brake chamber pushrod stroke exceeds the stroke limits set by regulations. Keeping a brake chamber pushrod stroke within regulatory stroke limits ensures 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.

Pushrod stroke that exceeds regulatory limits not only violates federal, state, provincial or territorial regulations but, more importantly, results in a decline in the braking force – eventually to zero – provided by the foundation brake, which will increase the distance it takes to stop the vehicle.

Vehicles manufactured in the U.S. after Oct. 20, 1994, or in Canada after May 31, 1996, must be equipped with self-adjusting brake adjusters (SABAs) to automatically account for normal brake system wear. Manual brake adjusters are only permitted on legacy vehicles manufactured prior to the dates above and must be regularly adjusted by hand.

The use of SABAs has helped to significantly reduce the rate of out-of-service brake violations. However, even with properly working SABAs, normal or excessive wear or broken components can result in excessive pushrod stroke and must be properly serviced.

**How to correctly measure the brake chamber stroke**

To measure chamber pushrod stroke, you will need a ruler, chalk, flashlight, eye protection, pencil and paper. You will also need another person to apply the service brakes. The procedure is as follows:

**Step One** – Ensure the vehicle is in a safe location and make sure the wheels are properly chocked to prevent rolling. Release the service brakes. Confirm your dash gauge indicates 90 to 100 psi (620 to 690 kPa) supply pressure in the air brake system reservoirs. Then, shut off the engine. **Note:** Supply reservoir pressure exceeding 110 psi (725 kPa) will result in incorrect pushrod stroke assessments.

**Step Two** – Visit each brake and confirm it is in the normal released position with nothing wrong or out of place. Mark each pushrod to establish a reference starting location. This should be level with where the pushrod exits the brake chamber or the chamber mounting bracket. Note where the pushrod mark started out and where it ends up, then measure the difference in the next step. See Figure 1.

**Step Three** – Have the other person press and hold the service brakes (pushing the brake pedal all the way down until it stops) while you measure and record the distance each pushrod mark moved (or “stroked”).

**What to do when the brake chamber stroke violates the regulations**

When brake chamber pushrod stroke exceeds the regulatory stroke limit, what you do about it depends on whether your vehicle is equipped with manual or self-adjusting brake adjusters.

- **Self-adjusting brake adjusters** – SABAs should not be manually adjusted; they will do so automatically. If a chamber with a SABA has excessive stroke, there is a problem with the foundation brake, the drum, the SABA itself or other components. The entire wheel end (chamber, SABA, 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 cause damage and does not fix the underlying problem. The stroke violation may return within a few brake applications and, most importantly, stopping ability may be significantly impaired.

- **Manual brake adjusters** – Manual brake adjusters, permitted on older vehicles, must be readjusted by a qualified individual on a regular basis. If regulations require the vehicle to be equipped with SABAs based on its date of manufacture, installing and using a manual brake adjuster in place of the self-adjusting one is a violation.

**Notes about self-adjusting brake adjusters**

When SABAs exceed the regulation limit, consider the following before adjusting the brakes:

- **Drivers** may be legally prohibited from adjusting SABAs in some jurisdictions.
- The motor carrier may prohibit the driver from adjusting SABAs.
- Do not readjust a SABA unless you have been specially trained to do so.
- Manually adjusting a SABA improperly can damage it. The manufacturer’s instructions 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 quickly, in just a few brake applications.
- If the driver readjusts the brake chamber stroke, he or she must continue to monitor the brake chamber stroke and report any excessive stroke problems to the motor carrier or service provider.
- Be sure that any technician hired to correct an excessive brake chamber stroke is qualified and will fix the underlying cause.
- If a brake chamber with SABAs exhibits excessive stroke, some of the contributing causes could include worn or seized clevis pin connections, worn S-cam bushings, cracked chamber bracket or cam tube welds, worn rollers, cracked drums, worn linings, worn drums and/or loose mounting hardware. A trained brake technician should diagnose and correct the underlying problem(s).