“FMCSA Brake Regulations 101”

Build your foundation on the knowledge of the brake regulations

393.40 – 393.55

396.19 & 396.25

Appendix G

2/27/17

Required FMCSA Brake Regulations to Teach, Train, and Test
To bring to the fore-front the Federal Motor Carrier Safety Regulation (FMCSR) requirements to personnel involved in teaching, training, and testing the control systems and foundation brakes of air drum brakes including other types, i.e. air disk brakes, hydraulic, and electric.


To reduce the occurrence of incorrect maintenance, repairs, and inspection practices due to the lack of knowledge and training of the FMCSA Brake Regulations.

Reduce down time, Roadside violations, and CSA points
Audience

- Third Party Repair Shop Technicians
- Carrier Maintenance Personnel & Technicians
- Equipment Manufacturers
- CDL Class 8 & 7 Drivers
- Brake Technical Training/Testing Organizations
  - Training Publications
  - State Tech/Driver Colleges & Institutes
  - Manufacture Training Seminars & Publications
- Testing Content
- Air Brake Book Material Publications
Format

- FMCSA Regulation Codes with FMCSR description
- Maximum Push-Rod Stroke Table
- Instructions to properly measure Push-Rod Travel
- National Transportation Safety Board (NTSB) Self Adjusting Brake Adjuster Warning Statement & Information
- FMCSR – Appendix G / Federal Periodic Brake Inspection Standards

For additional information on the Federal Motor Carrier Safety Regulations visit FMCSA.DOT.GOV
Inform  Educate  Train  Test

- FMCSA CFR 396 – Requirement to Inspect/Repair/Maintenance
  i. Personnel required to have knowledge of Regulations
  ii. Who must inspect, repair, & maintain
  iii. Federal Periodic Inspections & Technician Certification Requirements
  iv. Technician Brake Qualifications & Certification Requirements

- FMCSA CFR 393 Brake Component Regulations
- NTSB Warning Statement – Dangers of manually adjusting Self Adjusting Brake Adjusters
- Properly Measure Push-Rod Travel
- Appendix G – Minimum Periodic Brake Inspection Standards
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Brake Inspector Qualifications 396.25..............................................................................................Page 13, 14, 15, 16, 17
Inspect, Repair, & Maintain motor vehicles 396.3(a) ........................................................................Page 8
Inspector Qualifications 396.19.....................................................................................................Page 10, 11, 12
Knowledgeable & comply with Inspection, Repair, & Maintenance Regulations 396.1(a)..................Page 8
Parts & accessories shall be in safe & proper operating condition 396.3(a)(1) ...............................Page 8
Periodic Inspection 396.17(a)(c)..................................................................................................Page 9

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Every motor carrier, its officers, drivers, agents, representatives & employees directly concerned with inspections or maintenance must be knowledgeable & comply with the rules of this part.

Every motor carrier must systematically inspect, repair, & maintain all motor vehicles subject to its control.

Parts & accessories shall be in safe & proper operating condition at all times. These include those specified in Part 393....
Part 396 - INSPECTION, REPAIR, & MAINTENANCE

396.17 – **Periodic inspection**

(a) Every commercial motor vehicle must be inspected as required by this section. The inspection must include, at a minimum, the parts & accessories set forth in Appendix G of this subchapter. The term “commercial motor vehicle” includes each vehicle in a combination vehicle.

(c) A motor carrier must not use a commercial motor vehicle unless each component identified in Appendix G of this subchapter has passed an inspection in accordance with the terms of this section at least once during the preceding 12 months.

APPENDIX G – MINIMUM PERIODIC INSPECTION STANDARDS

A Vehicle does not pass if it has one of the following defects.
396.19 – Inspector Qualifications

(a) Motor carriers must ensure that individuals performing annual inspection under 396.17(d) or (e) are qualified as follows:

1) Understand the inspection criteria set forth in part 393 and Appendix G and can identify defective components;

2) Are knowledgeable of and have mastered the methods, procedures, tools, and equipment used when performing an inspection, and

3) Are capable of performing an inspection by reason of experience, training, or both as follows:
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Part 396 - INSPECTION, REPAIR, & MAINTENANCE

- **396.19 – Inspector Qualifications – continued...**

  (i) Successfully completed a Federal- or State-sponsored training program or have a certificate from State or Canadian Province that qualified the individuals to perform commercial motor vehicle safety inspections, or

  (ii) Have a combination of training or experience totaling at least 1 year. Such training or experience may consist of:
Part 396 - INSPECTION, REPAIR, & MAINTENANCE

(A) Participation in a commercial motor vehicle manufacture-sponsored training program or similar commercial training program designed to train students in commercial motor vehicle operator and maintenance;

(B) Experience as a mechanic or inspector in a motor carrier or intermodal equipment maintenance program;

(C) Experience as a mechanic or inspector in commercial motor vehicle maintenance at a commercial garage, fleet leasing company, or similar facility; or

(D) Experience as a commercial motor vehicle inspector for a State, Provincial or Federal government.
396.25 – Qualifications of Brake Inspectors

(a) Motor carriers must ensure that all inspections, maintenance, repairs or service to the brakes of its commercial motor vehicles, are performed in compliance with the requirements of this section.

(b) For purposes of this section, brake inspector means any employee of a motor carrier or intermodal equipment provider who is responsible for ensuring that all brake inspections, maintenance, service, or repairs to any commercial motor vehicle subject to the motor carrier’s equipment provider's control, meet the applicable Federal standards.
(c) No motor carrier or intermodal equipment provider may require or permit any employee who does not meet the minimum brake inspector qualifications of paragraph (d) of this section to be responsible for the inspection, maintenance, service or repairs of any brakes on it commercial motor vehicles.

(d) The motor carrier or intermodal equipment provider must ensure that each brake inspector is qualified as follows:
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FMCSA Regulations

Part 396 - INSPECTION, REPAIR, & MAINTENANCE

396.25 – Qualifications of brake inspectors – continued....

1) Understands the brake service or inspection task to be accomplished and can perform that task; and
2) Is knowledgeable of and has mastered the methods, procedures, tools, and equipment used when performing an assigned brake service or inspection task; and
3) Is capable of performing the assigned brake service or inspection by reason of experience, training, or both as follows;
396.25 – Qualifications of brake inspectors – continued….

(i) Has successfully completed an apprenticeship program sponsored by a State, a Canadian Province, a Federal agency or a labor union, or a training program approved by a State, Provincial or Federal agency, or has a certificate from a State or Canadian Province that qualifies the person to perform the assigned brake service or inspection task (including passage of Commercial Deriver’s License air brake tests in the case of a brake inspection); or

(ii) Has brake related training or experience or a combination thereof totaling at least one year. Such training or experience may consist of:
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FMCSA Regulations

Part 396 - INSPECTION, REPAIR, & MAINTENANCE

396.25 – Qualifications of brake inspectors – continued….

(A) Participation in a training program sponsored by a brake or vehicle manufactures or similar commercial training program designed to train students in brake maintenance or inspection similar to the assigned brake service inspection tasks; or

(B) Experience performing brake maintenance or inspection similar to the assigned brake service or inspection task in a motor carrier or intermodal equipment provider maintenance program; or

(C) Experience performing brake maintenance or inspection similar to the assigned brake service or inspection task at a commercial garage, fleet leasing company, or similar facility.
Inform  Educate  Train  Test

FMCSA Regulations

**Part 393 – COMPONENTS NECESSARY FOR SAFE OPERATION**

- **393.1(b)(1)** – *Every motor carrier & it’s employees must be knowledgeable of & comply with the requirements & specifications of this part*

- **393.1(c)** – *No motor carrier may operate a commercial motor vehicle unless it is equipped in accordance with the requirements & specifications of this part*
FMCSA Brake Regulations
Subpart C-Brakes 393.40 - 393.55

393.40(a) – Each commercial motor vehicle must have brakes adequate to stop & hold... Each commercial motor vehicle must meet the applicable service, parking, and emergency brake system requirement provide in this section.

(b) Service Brakes
   (1) Hydraulic brake systems
   (2) Air brake systems
   (4) Electric Brake Systems

(c) Parking Brakes

(c) Emergency brakes-partial failure of service brakes
FMCSA Brake Regulations
Subpart C-Brakes 393.40 - 393.55

393.42 Brakes required on all wheels – Every commercial motor vehicle shall be equipped with brakes acting on all wheels.

**Exceptions: Older tractors (before 7/25/80), specialized vehicles, etc.**
FMCSA Brake Regulations
Subpart C-Brakes 393.40 – 393.55

393.43 Breakaway & emergency braking – (a) Towing vehicle protection system. .... For air braked towing units, the tractor protection valve (TPV) shall operate automatically when the air pressure on the towing vehicle is between 20 psi & 45 psi.

393.45 Brake tubing & hoses....
(b)(1) Be long & flexible enough to accommodate without damage...

(b)(2) Be secured against chaffing, kinking, or other mechanical damage
393.47 Brake slack adjuster, lining/pads & drums

(b) Service brake & spring brake chambers on each end of an axle must be the same size.

c) Effective length of the slack adjuster on each end of an axle must be the same.

d) Thickness of the brake lining/pad shall meet the applicable requirements:

1. **Steering axle brake lining/pad thickness**
   - Shoe center with continuous strip; shall not be less than 3/16
   - Shoe center with two pads; shall not be less than ¼
   - Air disk brakes; shall not be less than 1/8
   - Hydraulic disk & electric brakes; shall not be less than 1/16

2. **Non-steering axle brakes**
   - Shoe center for drum brakes; shall not be less than ¼
   - Air disk brakes; shall not be less than 1/8
   - Hydraulic disk & electric brakes; shall not be less than 1/16
393.47 Brake slack adjuster, lining/pads & drums

(e) Clamp-Type brake chambers

(1) The pushrod stroke must not be greater than the values specified in the following table:
### 393.47 Brake slack adjuster, lining/pads & drums

#### Clamp-Type Brake Chambers

<table>
<thead>
<tr>
<th>Type</th>
<th>Outside diameter</th>
<th>Brake adjustment limit: Standard stroke chamber</th>
<th>Brake adjustment limit: Long stroke chamber</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>4 1/2 in. (114 mm)</td>
<td>1 1/4 in. (31.8 mm)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>5 1/4 in. (133 mm)</td>
<td>1 3/8 in. (34.9 mm)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>5 11/16 in. (145 mm)</td>
<td>1 3/8 in. (34.9 mm)</td>
<td>1 3/4 in. (44.5 mm).</td>
</tr>
<tr>
<td>16</td>
<td>6 3/8 in. (162 mm)</td>
<td>1 3/4 in. (44.5 mm)</td>
<td>2 in. (50.8 mm).</td>
</tr>
<tr>
<td>20</td>
<td>6 25/32 in. (172 mm)</td>
<td>1 3/4 in. (44.5 mm)</td>
<td>2 in. (50.8 mm).</td>
</tr>
<tr>
<td>24</td>
<td>7 7/32 in. (184 mm)</td>
<td>1 3/4 in. (44.5 mm)</td>
<td>2 1/2 in. (63.5 mm).</td>
</tr>
<tr>
<td>30</td>
<td>8 3/32 in. (206 mm)</td>
<td>2 in. (50.8 mm)</td>
<td>2 in. (50.8 mm).</td>
</tr>
<tr>
<td>36</td>
<td>9 in. (229 mm)</td>
<td>2 1/4 in. (57.2 mm)</td>
<td></td>
</tr>
</tbody>
</table>

1For type 20 chambers with a 3-inch (76 mm) rated stroke.  
2For type 24 chambers with a 3-inch (76 mm) rated stroke.
How to Measure Push-Rod Travel

1) Block/Chock wheels.
2) Build air pressure to 90-100 psi. Shut off engine.
3) Spring/park brakes fully released.
4) Chalk or mark each push-rod at chamber. (diagram A).
5) Full brake application; brake pedal fully depressed—measure push-rod travel, (diagram B).

- Mark push-rod at the entrance of the chamber
- Spring brakes released
- Service brakes applied—Full brake application
- Measure travel from the mark to the chamber
Self adjusting brake adjusters should **not** be manually adjusted in an effort to correct excessive pushrod stroke.

**Excessive pushrod stroke indicates** that a problem exists with the self adjusting brake adjuster, with the installation of the self adjusting brake adjuster, or with related foundation brake components which manual adjustment will **not** fix.

Manual adjustment of self adjusting brake adjusters is a **dangerous** practice that could have serious consequences because it gives the operator a false sense of security about the effectiveness of the brakes which are likely to go out of adjustment again soon.
Don’t adjust for purpose of Repair/PM/Inspections
Measure & Track Push Rod Travel

Out of Adjustment: Maximum stroke allowed is based on the size of brake chamber and depending if it is a Long or Regular Stroke chamber. If stroke travel is beyond measurement allowed by DOT Standards it is “out of adjustment”.

a) Measure push-rod travel and track changes on the movements
b) If over the travel allowed, do NOT adjust, have the brakes checked for possible defects
c) Continuously adjusting automatic slacks is not recommended, have foundation brakes checked and make necessary repairs
393.47 Brake slack adjuster, lining/pads & drums

(g) Drums - Thickness of the drums shall not be less than the limits established by the drum manufacture

393.48 Brakes to be operative

(a) .....all brakes with which a motor vehicle is equipped must at all times be capable of operating.

(6) Raised lift axles - Brakes on lift axles need not be capable of being operated while the lift axle is raised. However, brakes on lift axles must be capable of being applied whenever the lift axle is lowered and the tires contact the roadway.
393.53 Automatic brake adjusters

(b) (air brake systems)

Each commercial motor vehicle manufactured on or after October 20, 1994, and equipped with an air brake system must meet the automatic brake adjustment system requirements.

**Semi Tractor & Trailers, manufactured after this date must be equipped with Automatic Slack Adjusters**

“Manual Slacks not allowed!”
FMCSA Brake Regulations
Subpart C-Brakes 393.40 - 393.55

393.55 Antilock brake systems (ABS)

(c) Air brake systems

(1) Tractors manufactured on or after March 1, 1997 shall be equipped with ABS

(2) Trailers manufactured on or after March 1, 1998 shall be equipped with ABS
393.55 Antilock brake systems (ABS)

(d) ABS malfunction circuits & signals for air brake systems

(1) Tractors manufactured on or after March 1, 1997 shall be equipped with an electrical circuit capable of signaling a malfunction on the Tractor’s dash (ABS malfunction light)

(2) & (3) Tractors manufactured on or after March 1, 2001, pulling a Trailer with ABS (manufactured on or after March 1, 2001), shall be equipped with an electrical circuit capable of transmitting a malfunction signal to the Trailer’s malfunction lamp in the Tractor cab (ABS trailer malfunction dash light)
393.55 Antilock brake systems (ABS)

(e) Exterior ABS malfunction indicator lamp for trailers

Trailers manufactured on or after March 1, 1998 shall be equipped with an ABS malfunction lights on the exterior of the trailer (amber light located on the driver side at the rear)
Federal Motor Carrier Safety Regulations

Appendix G to Subchapter B —
Minimum Periodic Inspection Standards

Brake Inspection

A vehicle does not pass an inspection if it has one of the following defects or deficiencies:

1. *Brake System.*
   a. *Service Brakes.*

(1) Absence of braking action on any axle required to have brakes upon application of the service brakes (such as missing brakes or brake shoe(s) failing to move upon application of a wedge. S-cam, cam, or disc brake).

(2) Missing or broken mechanical components including: shoes, lining pads, springs, anchor pins, spiders, cam rollers, push rods, and air chamber mounting bolts.
Appendix G to Subchapter B — Minimum Periodic Inspection Standards Brake Inspection

(3) Loose brake components including air chambers, spiders, and cam shaft support brackets.

(4) Audible air leak at brake chamber (Example ruptured diaphragm, loose chamber clamp, etc.).

(5) Readjustment limits.

(a) The maximum pushrod stroke must not be greater than the values given in the tables below and at §393.47(e). Any brake stroke exceeding the readjustment limit will be rejected. Stroke must be measured with engine off and reservoir pressure of 80 to 90 psi with brakes fully applied.
### Clamp-Type Brake Chambers

<table>
<thead>
<tr>
<th>Type</th>
<th>Outside diameter</th>
<th>Brake readjustment limit: standard stroke chamber</th>
<th>Brake readjustment limit: long stroke chamber</th>
</tr>
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<tbody>
<tr>
<td>6</td>
<td>4 1/2 in. (114 mm)</td>
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</table>

1For type 20 chambers with a 3-inch (76 mm) rated stroke.  2For type 24 chambers with a 3-inch (76 mm) rated stroke.

(b) For actuator types not listed in these tables, the pushrod stroke must not be greater than 80 percent of the rated stroke marked on the actuator by the actuator manufacturer, or greater than the readjustment limit marked on the actuator by the actuator manufacturer.
Appendix G to Subchapter B — Minimum Periodic Inspection Standards

Brake Inspection

(6) Brake linings or pads.

(a) Lining or pad is not firmly attached to the shoe;

(b) Saturated with oil, grease, or brake fluid; or

(c) Non-steering axles: Lining with a thickness less than 1/4 inch at the shoe center for air drum brakes, 1/16 inch or less at the shoe center for hydraulic and electric drum brakes, and less than 1/8 inch for air disc brakes.

(d) Steering axles: Lining with a thickness less than 1/4 inch at the shoe center for drum brakes, less than 1/8 inch for air disc brakes and 1/16 inch or less for hydraulic disc and electric brakes.
Appendix G to Subchapter B — Minimum Periodic Inspection Standards

Brake Inspection

(7) Missing brake on any axle required to have brakes.

(8) Mismatch across any power unit steering axle of:

(a) Air chamber sizes.

(b) Slack adjuster length.

b. Parking Brake System.

No brakes on the vehicle or combination are applied upon actuation of the parking brake control, including driveline hand controlled parking brakes.
Appendix G to Subchapter B — Minimum Periodic Inspection Standards
Brake Inspection

c. Brake Drums or Rotors.

(1) With any external crack or cracks that open upon brake application (do not confuse short hairline heat check cracks with flexural cracks).

(2) Any portion of the drum or rotor missing or in danger of falling away.
**Appendix G to Subchapter B — Minimum Periodic Inspection Standards**

**Brake Inspection**

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**d. Brake Hose.**

(1) Hose with any damage extending through the outer reinforcement ply. (Rubber impregnated fabric cover is not a reinforcement ply). (Thermoplastic nylon may have braid reinforcement or color difference between cover and inner tube. Exposure of second color is cause for rejection.

(2) Bulge or swelling when air pressure is applied.

(3) Any audible leaks.

(4) Two hoses improperly joined (such as a splice made by sliding the hose ends over a piece of tubing and clamping the hose to the tube).

(5) Air hose cracked, broken or crimped.
Appendix G to Subchapter B — Minimum Periodic Inspection Standards
Brake Inspection

e. **Brake Tubing.**
(1) Any audible leak.

(2) Tubing cracked, damaged by heat, broken or crimped.

f. **Low Pressure Warning Device** missing, inoperative, or does not operate at 55 psi and below, or 1/2 the governor cut-out pressure, whichever is less.

g. **Tractor Protection Valve.** Inoperative or missing tractor protection valve(s) on power unit.
Appendix G to Subchapter B — Minimum Periodic Inspection Standards

Brake Inspection

h. Air Compressor.

(1) Compressor drive belts in condition of impending or probable failure.

(2) Loose compressor mounting bolts.

(3) Cracked, broken or loose pulley.

(4) Cracked or broken mounting brackets, braces or adapters.
FMCSA.DOT.GOV
Click on Vehicles under Rules & Regulations
Parts 393, 396, & Appendix G

OperationAirBrake.com

CSA INFORMATION
csa.fmcsa.dot.gov