

Dorman Training Center Presents:

AIR BRAKE PRIMER WITH A PURPOSE "PREPARING FOR A 1-DAY LIVE CLASS"

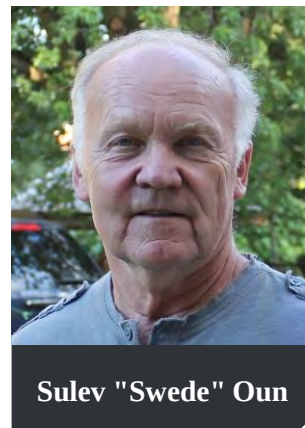


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Your Instructor For This Webinar

- **Owner, O&K Truck and Auto Repairs Ltd.**
- **ATTP Master Instructor, New York State**
- **Author, "Medium/Heavy Duty Truck Electricity and Electronics"**
- **Training provider for various Associations, industry and various NY State agencies**
- **Developed trainings that range from four hours to multiple days, specializing in brakes, electrical, regulations and many other subjects relating to our industry.**
- **Member of various organizations such as SAE, CVSA, TANY**



Sulev "Swede" Oun

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What Will Be Covered

Instructions For This Webinar

This webinar will be approx. 1 hour long

- All slides that are presented are in your handout and are numbered
- Have a pen or pencil and paper for notes
- Questions can be asked at anytime

- 01 **Reasons for having air brake system knowledge.**
- 02 **Overview of various air brake circuits**
- 03 **Visuals of various brake component defects.**
- 04 **Introduction to various brake classes**



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QUESTION OF THE DAY

Why Do We Seem To Have Problems

**After All, There Is Nothing Complicated About Our Goals.
And That Is To Save Lives And Properties**

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RESPONSIBILITIES

- **Technicians:** Perform his/her duties within the **Laws and Regulations** governing the Commercial Vehicle Industry.
- **IMPORTANT:** Regardless of whether or not there are specific laws governing repairs, a technician is always liable for damage or injuries resulting from repairs performed in an unprofessional or unworkmanlike manner.
- Considering the lives and property that depend on good repairs, there is only one acceptable goal when making vehicle repairs and or inspections:
- To restore or maintain the vehicle systems and their components so they perform to original specifications. To do any less could result in an accident, injury or death, and may leave you and you business to legal action.

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Food For Thought

- 80 Percent of Issues we Encounter are Man Made.
- WHY???????
- Can we do better with more and proper training?



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“Real World Solutions For Reducing Top Roadside Violations”

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This is what companies fear the most. The consequences affect them.



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2023 Industry Statistics

Types of Inspections 2022

Driver Inspections 2,879,966

- With OOS Violations 198,493
- Driver OOS Rate 6.9%

Vehicle Inspections 2,016,103

- With OOS Violations 455,079
- Vehicle OOS Rate 22%

Hazmat Inspections 170,967

- With OOS Violations 7,757
- Hazmat OOS Rate 4.5%

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Most Frequent Vehicle Violations in Inspections, 2021 (same for every year)

<u>Violation Code</u>	<u>Category</u>	<u>Violation Description</u>
393.9	Lighting	Inoperable Required Lamp.
396.17(c)	Periodic Inspection	Operating CMV without proof of periodic inspection.
393.47(e)	Brakes, Out Of Adjustment	Clamp or Roto type brake out-of-adjustment.
393.95(a)	Emergency Equipment	No/discharged/unsecured fire extinguisher.
393.9TS	Lighting	Inoperative turn signal
396.3(a)(1)	All other Vehicle Defects	Inspection, repair and maintenance of parts and accessories.
393.75(a)(3)	Tires	Tire-flat and/or audible air leak.

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Most Frequent Vehicle Violations in Inspections, 2021 (same for every year)

<u>Violation Code</u>	<u>Category</u>	<u>Violation Description</u>
393.11	Lighting	No or defective lighting devices or reflective material as required.
393.53(b)	Brakes, all others	CMV manufactured after 10/19/94 has an automatic airbrake adjustment system that fails to compensate for wear.
393.78	Windshield	Windshield wipers inoperative/ defective.
393.75(c)	Tires	Tire-other tread depth less than 2/32 as measured in a major tread groove.
396.5(b)	All other Vehicle Defects	Oil and/or grease leak.
393.95(f)	Emergency Equipment	No/insufficient warning devices.

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Most Frequent Vehicle Violations in Inspections, 2021 (same for every year)

<u>Violation</u>		
<u>Code</u>	<u>Category</u>	<u>Violation Description</u>
393.9H	Lighting	Inoperable head lamps.
393.45(b)(2)	Brakes, All Others	Brake hoses or tubing chafing and/or kinking.
396.3(a)1BOS	Brakes, Out Of Adjustment	Brakes OOS: the number of defective brakes is equal to or greater than 20% of the service brakes on the vehicle or combination.
393.48(a)	Brakes, All Others	Inoperative/defective brakes.
393.55(e)	Brakes, All Others	No or defective ABS Malfunction indicator lamp for trailer manufactured after 03/01/1998.

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Came in for Annual Inspection from a fleet with a shop, safety people etc. Look at the angle of the pushrod on this newly installed chamber.



Question: If you are the safety person, owner, manager etc. Would you be able to find this yourself, explain this and train your people how to find this for a pre-trip training? More important, who needs to take responsibility for this?

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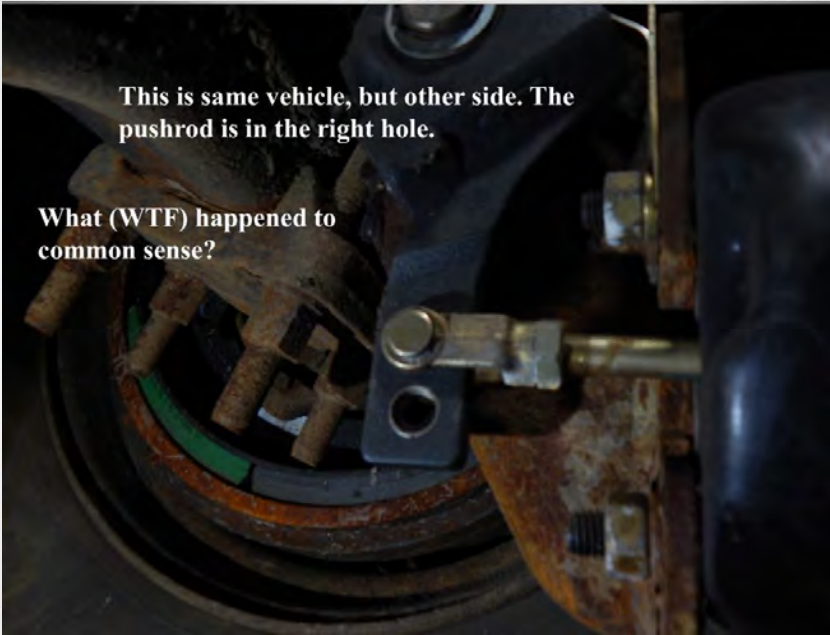
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This is same vehicle, but other side. The pushrod is in the right hole.

What (WTF) happened to common sense?



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Another inspection.
What do you see?
But more important, WHY?????



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Periodic Inspection 396.17- 396.23

- The regulations require that commercial vehicles operated in interstate or foreign commerce pass an inspection at least annually.
- The inspection requirements may be met through periodic inspection programs administered by the state, or by self-inspection, a roadside inspection, or an inspection performed by a commercial garage or similar commercial business, so long as the inspection complies with federal standards or compatible state standards.
- The Motor carrier that has possession of the vehicle is responsible for the inspection. If the vehicle has not been inspected according to the federal standard or if there is no proof of inspection, the carrier may not place it in service.

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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 and accessories set forth in appendix A of this subchapter.

Very Important concept:

Get comfortable with the regulations in Part 393 (PARTS AND ACCESSORIES NECESSARY FOR SAFE OPERATION)

- The regulation in Part 393 and Appendix A provide the conditions the vehicle must meet in order to be operated on the roadways.

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Federal Annual Periodic Inspection

Side Note: [396.25](#) provides the qualification requirements for anyone inspecting, repairing, servicing, or maintaining the brakes on a CMV.

This “Brake Inspector” is an employee of a motor carrier that is responsible that all tasks related to brakes meet applicable safety standards.

Qualifications to be a brake inspector are similar to qualifications required to perform Annual inspections.

“However, the qualifications are specific to brake service and inspection”.

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Federal Annual Periodic Inspection

Inspector Qualifications

Found in [Part 396.19](#)

Motor carriers are responsible for ensuring that individual(s) performing an annual inspection under [396.19](#) are qualified as follows:

- ☐ Understands the inspection criteria set forth in Part 393 and Appendix A and can identify defective components.
- ☐ Is knowledgeable of and has mastered the methods, procedures, tools and equipment used when performing an inspection.
- ☐ Is capable of performing an inspection by reason of experience in one of the following categories:

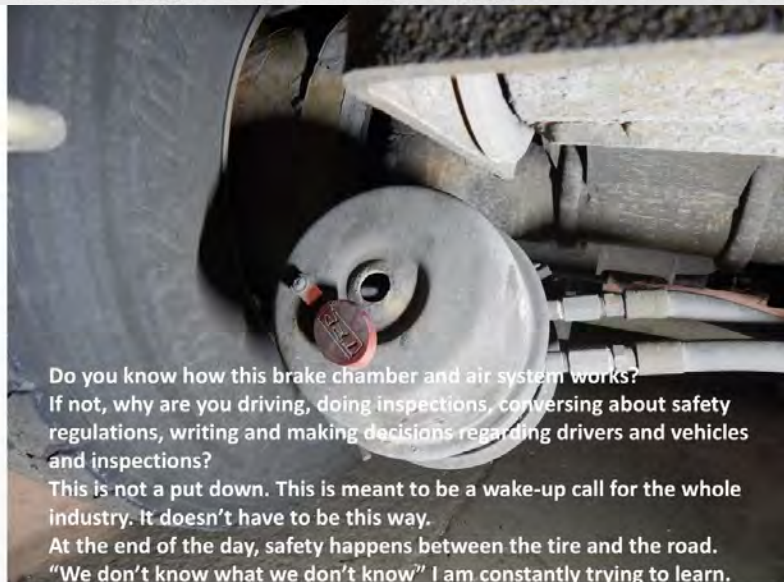
I. Successfully completed a State or Federal training program or has certificate from a State or Canadian Province which qualifies the person to perform commercial vehicle inspections.

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What do you see here, and can you explain this?
Does a driver know how this chamber works?



Do you know how this brake chamber and air system works? If not, why are you driving, doing inspections, conversing about safety regulations, writing and making decisions regarding drivers and vehicles and inspections? This is not a put down. This is meant to be a wake-up call for the whole industry. It doesn't have to be this way. At the end of the day, safety happens between the tire and the road. "We don't know what we don't know" I am constantly trying to learn.

Swede Oun-O&K Truck Repairs

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Part 393.40 cont.

c. Interconnected systems.

1. If the brake system specified in paragraph (b) of this section are interconnected in any way, they must be designed, constructed, and maintained so that, upon the failure of any part of the operating mechanism of one or more of the systems (except the service brake actuation pedal or valve):

i. The vehicle will have operative brakes; and

ii. In the case of a vehicle manufactured on or after July 1, 1973, the vehicle will have operative brakes capable of performing as specified in SS 393.52(b).

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Annual Inspection Requirements.

Automatic Slack Adjuster important addition:

“Any brake that is found to be out of adjustment on initial inspection must be evaluated to determine why the automatic brake slack adjuster is not functioning properly” and the problem must be corrected in order for the vehicle to pass inspection. It is not acceptable to manually adjust automatic brake adjusters without first correcting the underlying problem.

This requires to look at possible the whole system and other components that can cause the automatic slack adjuster to maintain the proper push-rod stroke.

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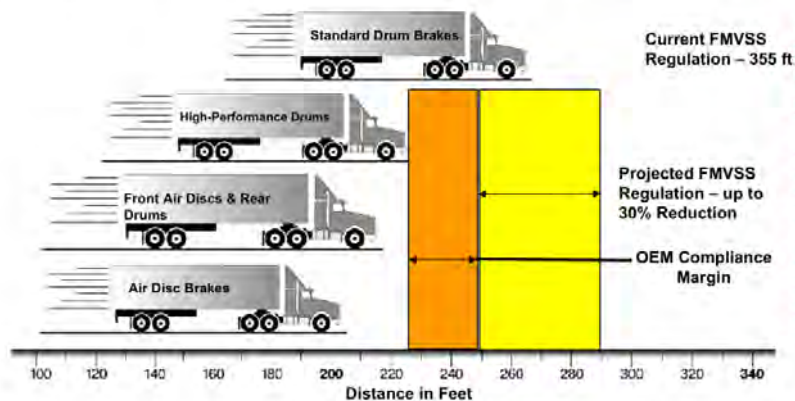
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Anticipated Stopping Distance Change

Testing conducted per standard FMVSS-121 vehicle test procedure:
60 mph, tractor brakes active, trailer brakes inactive, 56,600 lbs. Gross Combined Weight.



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Stopping Distance Final Rule

- Phase I went into effect in 2011.
 - Impacted tractors grossing up to 59,600 pounds.
 - A loaded tractor is required to stop within 250 feet at 60 miles per hour.
- Phase II went into effect August 2013.
 - Applied to more vehicles including trucks with just 2 axles and trucks with 4 or more axles.
 - Also, trucks with three axles but with a GVWR greater than 59,600 pounds
 - Were included under the standard.
 - Under the 2013 Phase II standard, most loaded trucks are required to stop within 250 feet.

NOTE: Certain trucks with 4 or more axles or extremely high GVWR have a required stopping distance of 310 feet.

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Stopping Distance Bullet Points

- To meet the stopping distance mandate, many manufacturers went from 15-in to 16.5 in. brakes on steer axles. (Load transfer from rear of vehicle forward).
- Suspension, steering and other structural requirements had to be considered and addressed by manufacturers in order to absorb an increase and transfer of load and torque on the front end.
- Quite often implement changes to the drive axle brakes to maintain overall vehicle balance.
- **NHTSA's stopping distance rule is meant for manufacturers to satisfy.**
- **The rule doesn't require any specific method used to meet the requirements.**
- **This rule doesn't include any requirements for motor carriers to maintain the brake performance capabilities on the new vehicles once in service.**
- No requirements for any specific components.

Caution: What happens if there is a liability issue, and a decreased performance is discovered????

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AUTOMATIC ADJUSTERS

12,224 BRAKES INSPECTED BY NTSB

(With Type 30 Chambers)

Manual Slacks (9541)

$\geq 2''$ - 26%

$\geq 2\text{-}1/4''$ - 13%

Auto Slacks(2683)

$\geq 2''$ - 15%

$\geq 2\text{-}1/4''$ - 4%

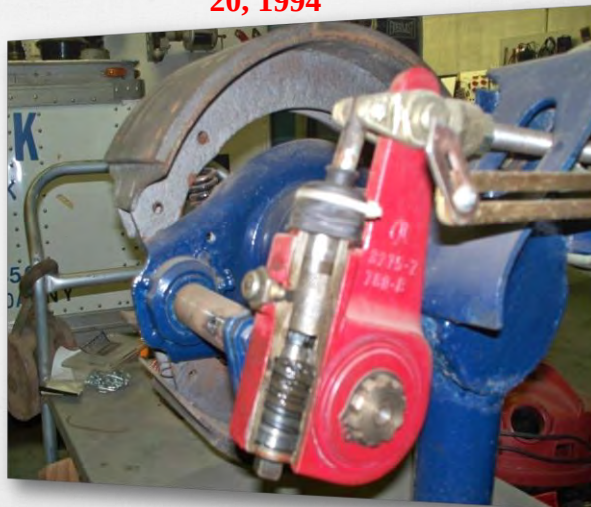
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Automatic Slack Adjusters are mandated on
all vehicles manufacture on or after October
20, 1994



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Simple Manual Slack Adjusters



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Clearance Sensing and Stroke Sensing

Automatic slack adjusters are either clearance-sensing or stroke-sensing.

- A Stroke sensing adjuster will adjust the slack when it senses the set stroke is exceeded.
- A clearance sensing adjuster will adjust when the proper clearance between the brake drum and brake shoe is not maintained

NOTE: Haldex, Gunitex and Stemco(Crewson Brunner)

**Automatic Slack Adjusters are all clearance sensing.
(They maintain a nominal distance or clearance between lining and drum)**

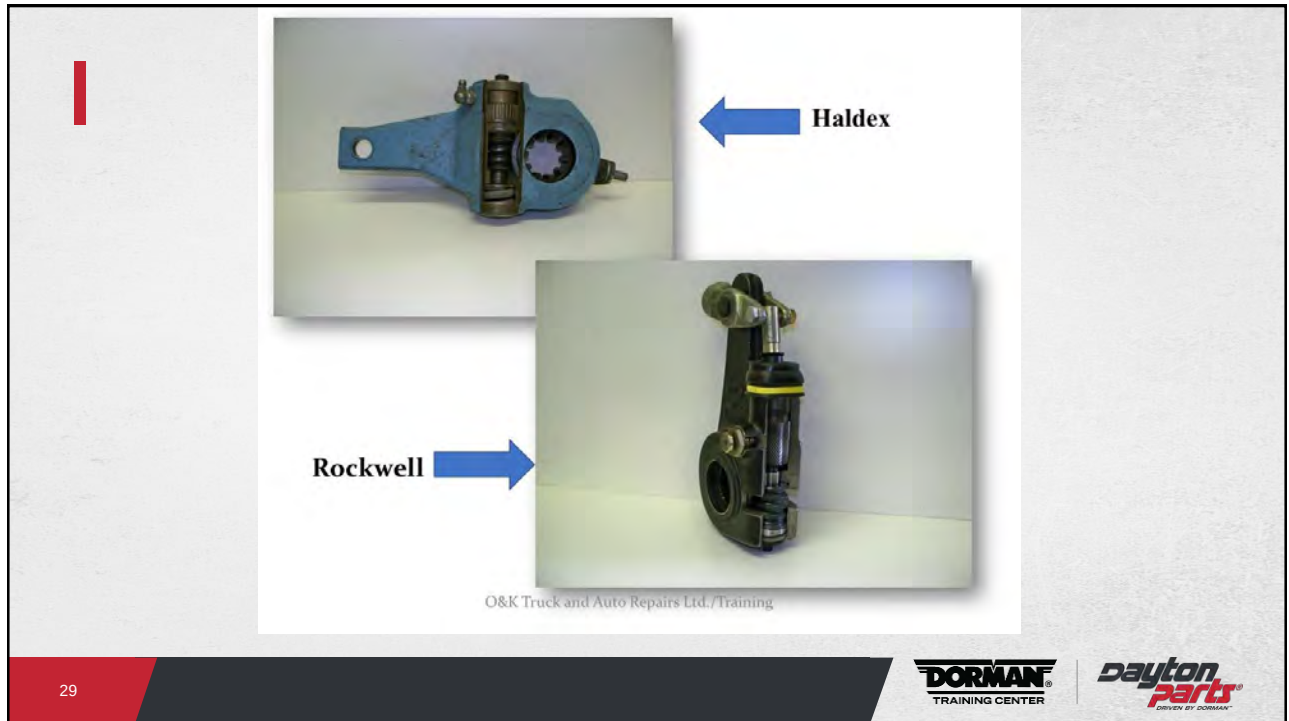
Meritor produces stroke sensing adjusters, maintaining the total stroke of the air chamber.

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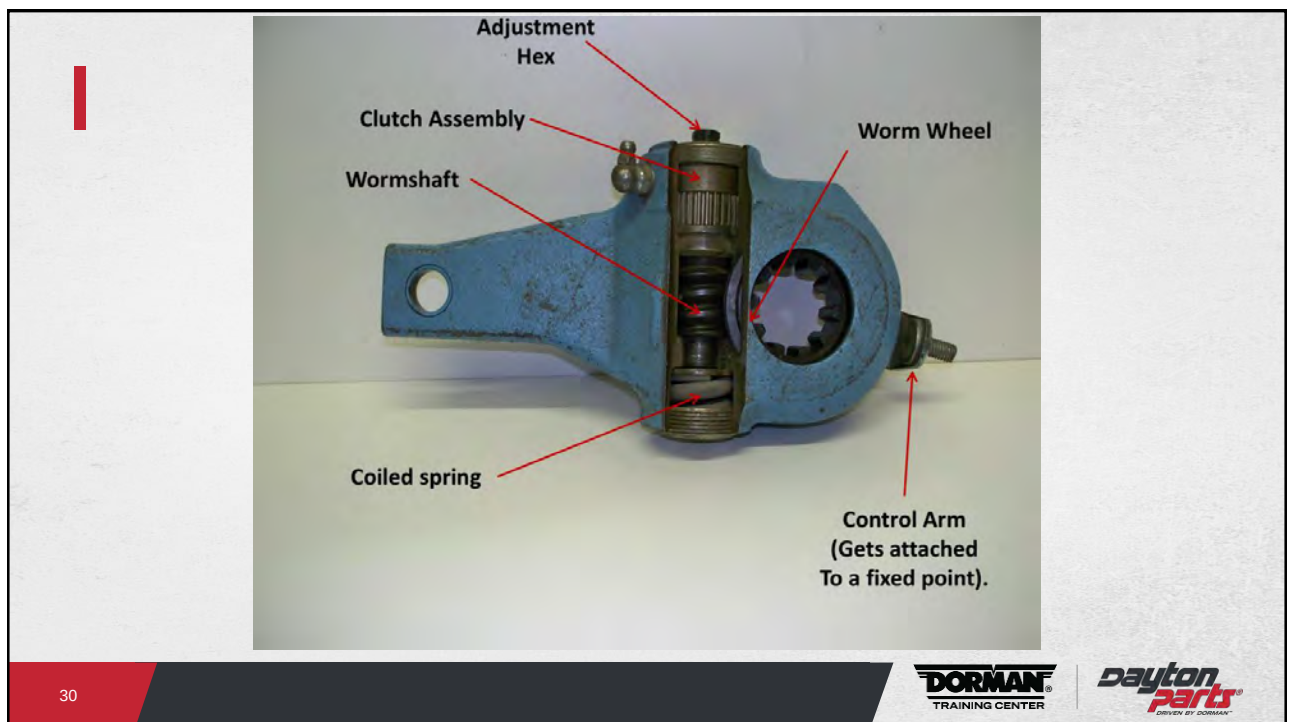
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Automatic Slack Adjuster Pointers

- Some automatic slack adjusters have the ability to back-off or increase the slack when it has over adjusted the brake.
- Never take it for granted that the brakes will always be in adjustment.
Many factors can could result in the automatic slack adjuster not capable if maintaining the proper push rod stroke.
 - Improper installation.
 - Worn cam bushings.
 - Bent or binding push rods.
 - Inadequate maintenance.
 - Deformed brackets.
 - Excessive premature wear and internal contamination.
- As an automatic slack adjuster ages, components that sense when an adjustment is required wear. When that happens, more stroke might be required for the lining to contact the drum.

That is why a periodic brake adjustment check is required.

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Automatic Slack Adjuster Pointers

- A slack adjuster that over adjusts can cause the brakes to drag. This can cause brakes to overheat during severe braking applications (down grades).
- **This can cause drums to expand to a larger diameter.**
- Prolonged condition can lead to longer push rod strokes to achieve the required braking forces.
- It is possible for a slack adjuster to interpret this as a need to adjust the brake stroke to take up the slack.
- **When the drum cools and returns to normal diameter, we have brake drag again.**

Note : Drivers, during the course of the day should make some full brake applications to help maintain proper adjustment.

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VEHICLE OUT-OF-SERVICE CRITERIA

NOTE: Service chambers with housings that are permanently crimped and sealed together are considered clamp type chambers even though they do not have a separate band clamp.

NOTE: Rated stroke is indicated on a tag and is only used to identify chamber size.
“LONG STROKE CHAMBERS”



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VEHICLE OUT-OF-SERVICE CRITERIA

CLAMP TYPE BRAKE CHAMBER DATA

TYPE	OUTSIDE DIAMETER		BRAKE ADJUSTMENT LIMIT
6	4-1/2	(114mm)	1-1/4 (31.75mm)
9	5-1/4	(133mm)	1-3/8 (34.93mm)
12	5-11/16	(145mm)	1-3/8 (34.93mm)
16	6-3/8	(162mm)	1-3/4 (44.45mm)
20	6-25/32	(172mm)	1-3/4 (44.45mm)
24	7-7/32	(184mm)	1-3/4 (44.45mm)
30	8-3/32	(206mm)	2 (50.80mm)
36	9	(229mm)	2-3/4 (57.15mm)

NOTE: Permanently crimped and sealed service chamber housings are also considered as clamp type chambers. Also, a brake found at the readjustment limit is not a defect for the purpose of the 20% rule.

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VEHICLE OUT-OF-SERVICE CRITERIA

'LONG STROKE' CLAMP TYPE BRAKE CHAMBER DATA

<u>TYPE</u>	<u>OUTSIDE DIAMETER</u>	<u>BRAKE ADJUSTMENT LIMIT</u>
12	5-11/16 (145mm)	1-3/4 (44.45mm)
16	6-3/8 (162mm)	2 (50.80mm)
20(2-1/2" rated stroke)	6-25/32 (172mm)	2 (50.80mm)
20(3" rated stroke)	6-25/32 (172mm)	2-1/2 (63.50mm)
24(2-1/2" rated stroke)	7-7/32 (184mm)	2 (50.80mm)
24(3" rated stroke)	7-7/32 (184mm)	2-1/2 (63.50mm)
30	8-3/32 (206mm)	2-1/2 (63.50mm)

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VEHICLE OUT-OF-SERVICE CRITERIA

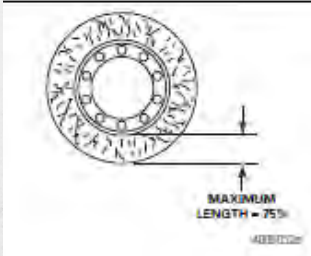
Inspection Item

**Brake drums or
Rotors (discs)**

Out-of-Service Criteria

- (3) Any rotor with a crack in length of more than 75% of the friction surface and passes completely through the rotor to the center vent from either side or completely through a solid rotor.

(393.47(a))



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VEHICLE OUT-OF-SERVICE CRITERIA



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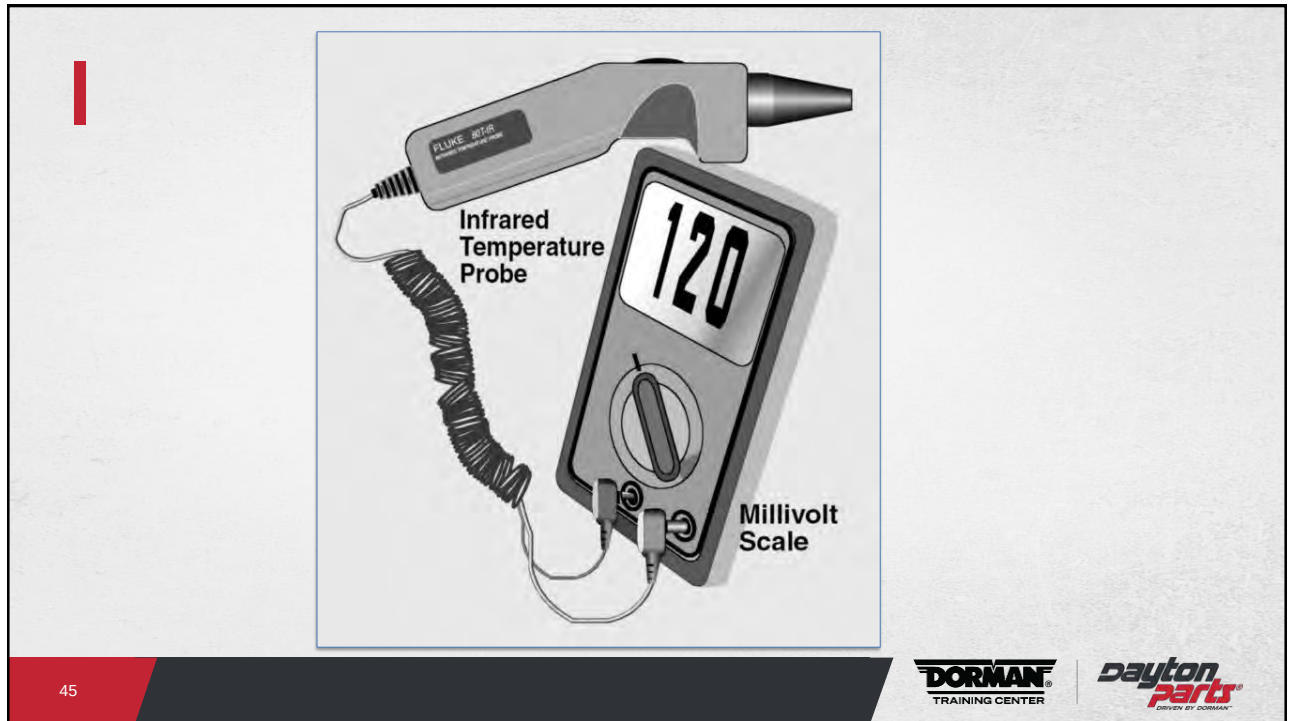
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BALANCED BRAKE SYSTEM

The Following Major Components Of Application And Release Performance Are:

1. The distance that the air must travel.
2. Tubing size.
3. Fittings.
4. Valves.
5. Chambers.

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BALANCED BRAKE SYSTEM

PNEUMATIC BALANCE

THE DISTANCE THE AIR HAS TO TRAVEL.

Foot Valve
To Brake
Chamber
Front.

Note:The
Shorter
Distance
Compared
To rear.



Foot
Valve
To Brake
Chamber
Rear.

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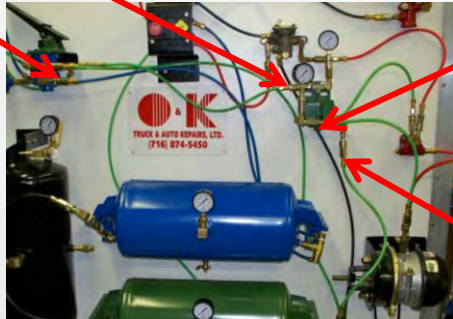
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BALANCED BRAKE SYSTEM

Control line
from foot
valve.

PNEUMATIC BALANCE

Relay Valves



Delivery

Supply



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BALANCED BRAKE SYSTEM

PNEUMATIC BALANCE

Spring Brake Chambers.

Service Brake
Chamber

Park Brake
Chamber



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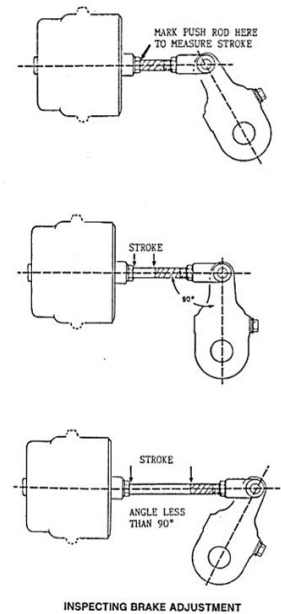
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BALANCED BRAKE SYSTEM

Adjustment.

Whether cam or wedge type adjustment, it is crucial that all brakes are adjusted for the proper stroke to ensure equal application.



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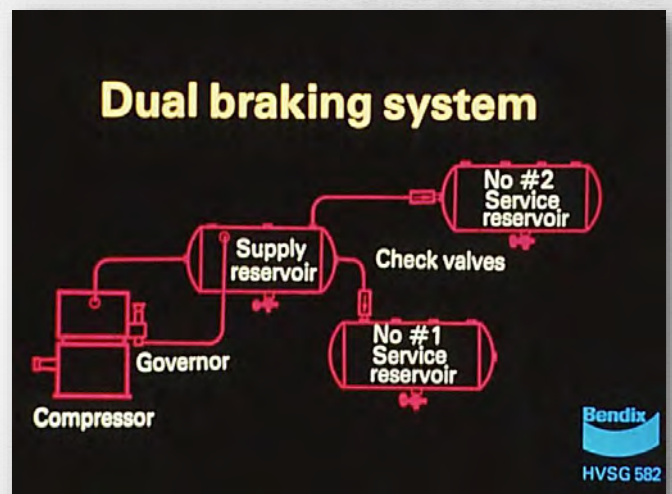
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AIR BRAKE CIRCUITS

Supply System

- a. Compressor.
- b. Governor.
- c. Reservoirs.
- d. Check Valves.
- e. Safety Valves.
- f. Indicators,
Warning Devices.



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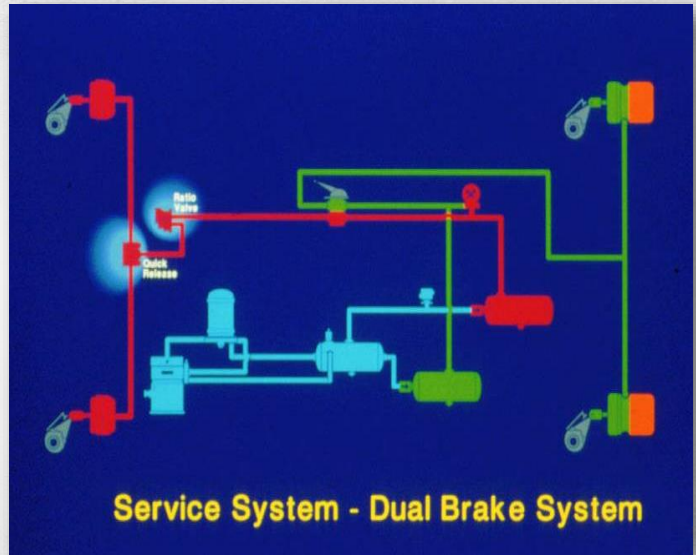
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AIR BRAKE CIRCUITS

Service System

- a. Application Valves (foot, hand).
- b. Control Valve (relay).
- c. Service Chamber(s).
- d. Quick Release Valves



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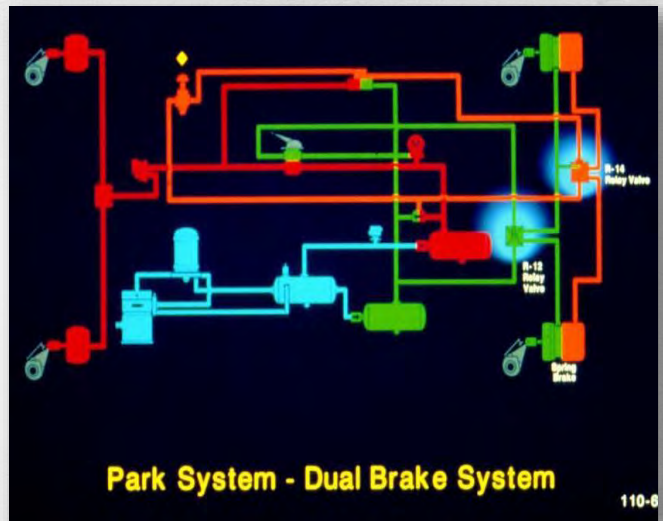
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AIR BRAKE CIRCUITS

Parking - Emergency

- a. Spring Brake Chamber(s).
- b. Park Control Valves.
- c. Two Way Check Valves.
- d. Inversion Valve.
- e. Spring Brake Control Valves.
- f. Tractor Protection Valves (combination units).
- g. Quick Release Valves.



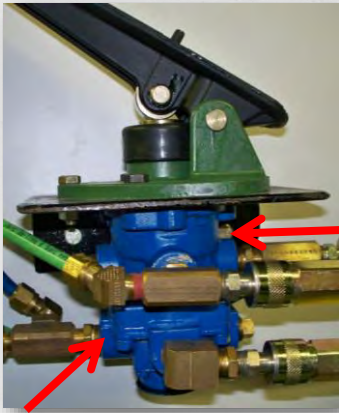
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Dual Foot Control Valve

This valve gives modulated control of the vehicle's service brakes.

There are several styles of the dual foot valve. However, one thing common to all is that the **primary** section of the valve is normally closest to the pedal and is mechanically applied

The **secondary** is the furthest section from the pedal and is also mechanically (somewhat) applied with an air assist. Typically, the primary section allows 3-5 psi of air to the secondary section to get the secondary to start apply.

Most (not all) manufacturers send secondary air to the steer axle and primary air to the drive axles and the dominant air to the trailer.

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Service Relay Valve

Used to send a modulated signal from the foot valve to the service chambers to help balance out brake balance when air travel requires longer distance.

A relay valve works somewhat like a quick release valve. The difference is that it has a supply line, which is not on a quick release valve.

As mentioned earlier, quick release valves may have a differential pressure, relay valves may have "crack-pressure". Crack pressure is similar to differential pressure except differential pressure is through out the whole range of the valve. Crack pressure is used during the start of the application. It is the amount of air pressure it takes to open the valve before any air gets delivered.

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Questions?

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