



**Dorman Training Center
Presents:**

HOSES, LINES AND FITTINGS

“WHAT YOU NEED TO KNOW”


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What will be covered

- Regulations pertaining to hoses, lines and fittings.
- Requirements pertaining to hoses, lines and fittings.
- Hose, line and fitting descriptions.
- Worst and best practices pertaining to hoses, lines and fittings.



How is your observation skills?
Be aware of your surroundings.

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Instructor

- 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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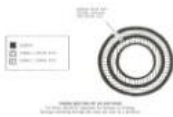


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Why do we care about hoses?

Inspection Item

e. Brake Hose.



Out-Of-Service Condition

- (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 out-of-service. (393.45(a))**
- (2) Bulge/swelling when air pressure is applied. **(393.45(a))**
- (3) Hose with audible leak at other than a proper connection. **(393.45(a))**



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Why do we care about hoses?

Inspection Item



Out-Of-Service Condition

- (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. (When, at the point of the splice, hoses can be moved or separated by hand.) (393.45(a))
- (5) **Air hoses cracked, broken, or crimped in such a manner as to restrict air flow.** (393.45(a)(1))

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Why do we care about hoses and lines?

Inspection Item



Out-Of-Service Condition

- (3) Power assist unit fails to operate. (396.3(a)(1))
- (4) Seeping or swelling brake hose(s) under application of pressure. (396.3(a)(1))
- (5) Missing or inoperable "Breakaway" braking device. (393.43)
- (6) **Hydraulic hose(s) abraded (chafed) through outer cover-to-fabric layer.** (393.45)
- (7) **Fluid lines or connections restricted, crimped, cracked, or broken.** (393.3(a)(1))

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Why do we care about hoses and lines?

Inspection Item

n. Vacuum system.



Out-Of-Service Condition

- (1) Insufficient vacuum reserve to permit one full brake application after engine is shut off. (393.50)
- (2) Vacuum hose(s) or lines restricted, abraded (chafed) through outer cover –to-cord ply, crimped, cracked, broken, or has collapse of vacuum hose(s) when vacuum is applied. (393.3 (a)(1))

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

Violation

<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.

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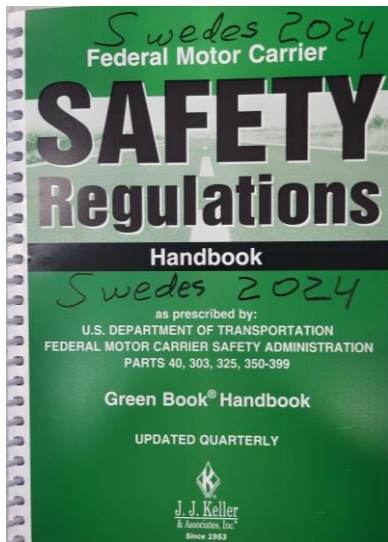
How much do you know?

Are these, okay to use?



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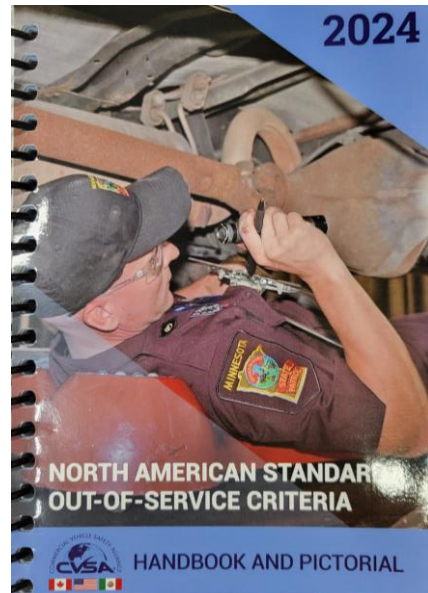
Must have books !!!



Commercial Vehicle Safety Alliance

CVSA.Org

Note: See previous lunch and learns on regulations and inspections.



“These are your bibles”



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Why do we care about hoses, lines and fittings?



Hose Assemblies
(Swivel-Fixed)

Are you replacing hose with the right size?
If not, can it affect the braking?

Why do we care about hoses, lines and fittings?

PNEUMATIC BALANCE

Fittings

It is said that a 90-degree elbow is equivalent to 7 feet of air line



Delivery ports can be on bottom of valves.

Delivery ports can be on Sides of valves.



Should you change valves or fittings to make it "work"?

Brake system Components

- Brake hoses are one the most government-regulated components on a vehicle.
- Any manufacturer making brake hose assemblies must be registered with the DOT and pass very rigorous tests.
- **All hoses must conform to FMVSS 106 and SAE J1401.**
- **The standards basically require that brake hoses are flexible in a wide range of temperatures while having a predictable expansion rate so the pedal feel and ABS response if applicable is the same in winter and summer. Also, the hoses must be able to bend and twist at certain angles without collapsing, kinking or bursting.**

Requirements

Examples of various required markings.



Requirements

Requirements for Air Brake Hose, Assemblies and Fittings:

- **Each air brake hose assembly shall be equipped with permanently attached brake hose end fittings or reusable brake hose end fittings.**



Requirements

Requirements for Air Brake Hose, Assemblies and Fittings:

Labeling

- **Hose.** Each air brake hose shall be labeled, or cut from bulk hose that is labeled, at intervals of not more than 6 inches measured from the end of one leg-end to the beginning of the next, in block capital letters and numerals at least one-eighth of an inch high, with the information listed in paragraphs (a) through (e) in(571.106) (S7.2.1).

Note: The information need not be present on hose that is sold as part of a brake hose assembly or a motor vehicle.

Reminder: 571.106 is the hose standard section of the “Federal Motor Vehicle Safety Standards” (FMVSS)



Requirements

Requirements for Air Brake Hose, Assemblies and Fittings:

- **End Fittings.** Except for an end fitting that is attached by deformation of the fitting about a hose by crimping or swaging, at least one component of each brake hose fitting shall be etched, embossed, or stamped in block letters and numerals at least one-sixteenth of an inch high with the following information:

DOT symbol, constituting a certification by the manufacturer of that component, that the component conforms to all applicable motor vehicle safety standards



The letter “A” shall indicate intended use in air brake systems. In the case of end fitting intended in a reusable assembly with brake hose subject to Table III, “AI: or “AII” shall indicate use with Type I or Type II hose, respectively.

Requirements

Requirements for Air Brake Hose, Assemblies and Fittings:



Manufacturer

Hose Size

Requirements for Plastic Air Brake Tubing, Plastic Air Brake Tubing Assemblies and End Fittings:

- **Construction:** Each plastic air brake tubing assembly shall be equipped with permanently attached end fittings or reusable end fittings.



Requirements for Plastic Air Brake Tubing, Plastic Air Brake Tubing Assemblies and End Fittings:

- **Labeling:** Plastic air brake tubing shall be labeled, or cut from bulk tubing that is labeled, at intervals of not more than 6 inches, measured from the end of one legend to the beginning of the next, in block letters and numerals at least one-eighth of an inch high.



Date of Manufacturer

Nominal Outside Diameter

Letter "A". Intended use in air brake systems.

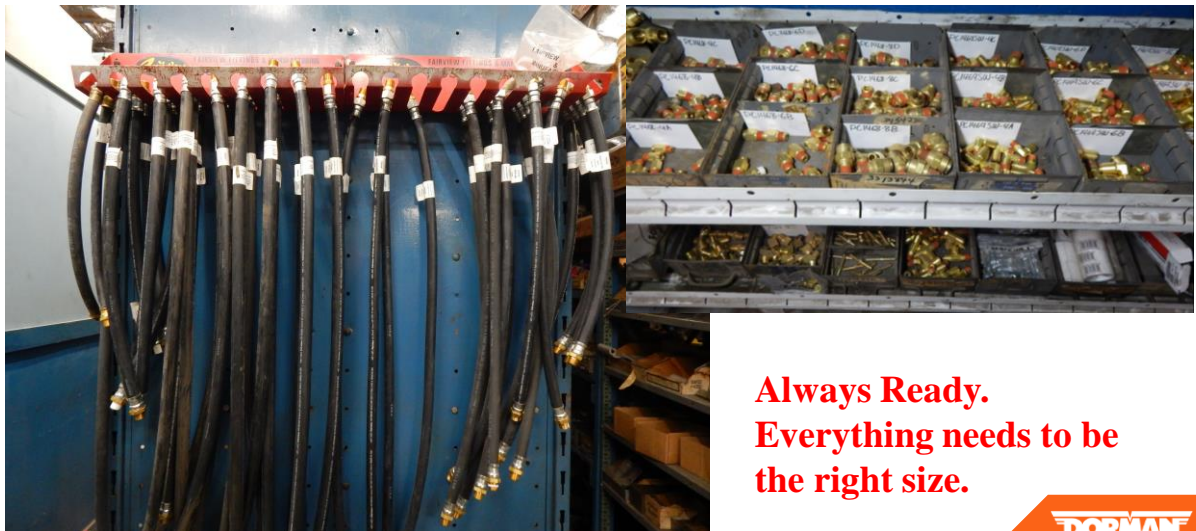
Requirements for Plastic Air Brake Tubing, Plastic Air Brake Tubing Assemblies and End Fittings:

- **End Fittings:** Except for an end fitting that is attached by deformation of the fitting about the tubing by crimping or swaging, at least one component of each plastic air brake tubing end fitting shall be etched, embossed, or stamped in block capital letters and numerals at least one-sixteenth of an inch high the following: DOT, Letter A (designated air brake use) and nominal OD of the plastic line that will be used with the fitting.



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**Always Ready.
Everything needs to be
the right size.**

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Replaceable Ends.



Finished Product.

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Hydraulic Lines and Hoses

Most brake lines are double walled and bonded by a metallurgical process. Some are made from separate strips welded but seams must be 120° apart. Seamless tubing and double walled must meet bursting requirements of 8000 psi bending properties, flaring test, fatigue resistance, heat resistance, salt spray tests, impact resistant, brake fluid compatibility and **meet many design guidelines for installation to guard against gravel impact, being crushed by hoists or towing fixtures, exhaust system temperature, electrolysis due to protective conduit, clips, fittings and mounting surfaces.** Tubing is available in various lengths with the ends already flared and provided with fittings or you can cut it to length and flare it. Before flaring steel tubing, select the type of flare depending on the type of fitting used. In most cases the flare will be a double flare. An (ISO) International Standards Organization flare may also be used. Special tools are required to flare hydraulic lines.

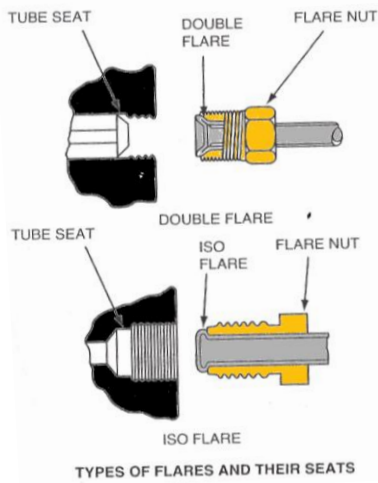
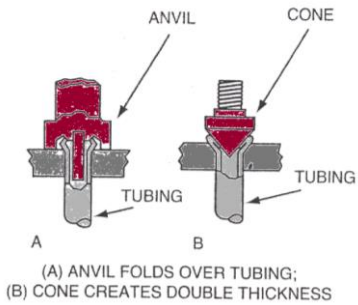
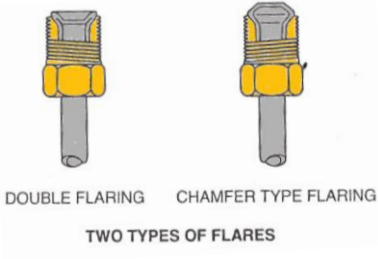
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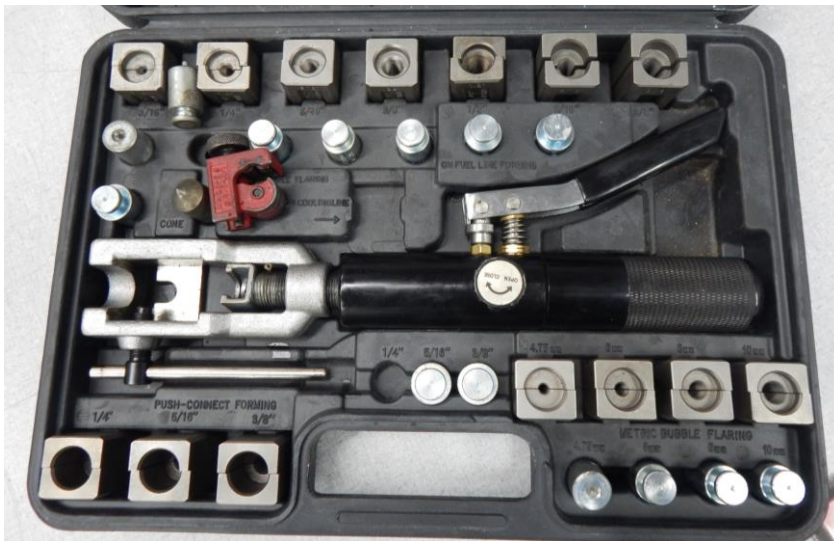
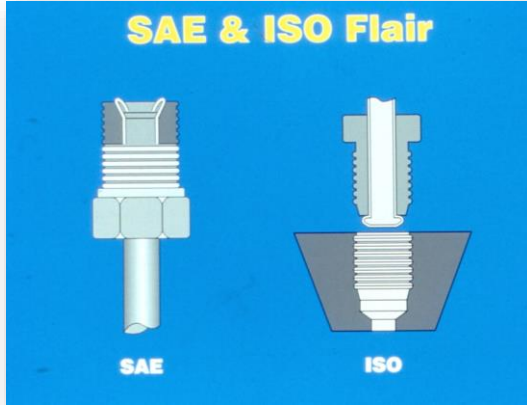
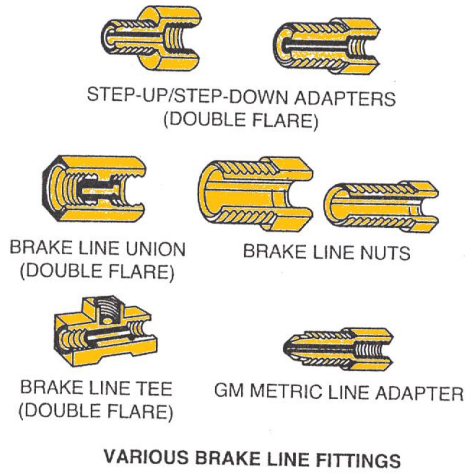
Always ready. Time savers.



Hydraulic Lines and Hoses



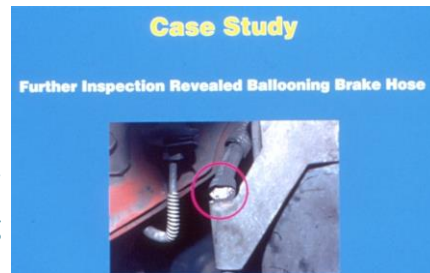
Hydraulic Lines and Hoses



Hydraulic Lines and Hoses

“Hydraulic Hoses” provide the flexible connections in the hydraulic system between the brakes and chassis. They must be strong enough to withstand high fluid pressures without **expanding** yet be free to flex during motion of the suspension and steering.

As hoses get old, they become hard and brittle, and ultimately develop cracks. Hoses may appear blistered. This is an indication that leakage has penetrated to the outer hose covering. Sometimes the inner liner tears and acts as a check valve trapping fluid to the wheel and causing the brakes to drag, or not allowing fluid to reach the wheel until sufficient pressure forces past the obstruction



Hydraulic Lines and Hoses

Brake hoses are also tested for burst strength. The minimum acceptable burst strength is 5000 psi. Along with burst strength, the hoses are tested for expansion. Design factors and installation are length, twist, tension and severe bends, tire and wheel clearance, and dynamic effects. Therefore, **brake hose installation is highly critical. The most important consideration besides diameter and length is installation.** Hoses must be properly routed to avoid wear due to rubbing against a moving component, stretch or kink during up and down movement, or as the wheels are turned to their extreme limit of travel.

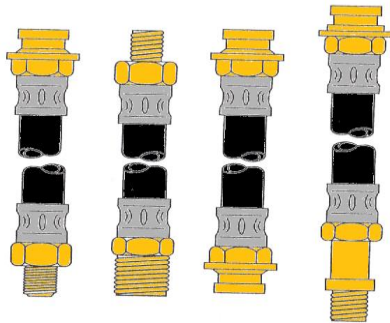
Hydraulic Lines and Hoses

Brake hoses are often manufactured with a stripe running the length of the hose. **The stripe is used to show hose twist.** It should have less than 15° twist from end-to-end after installation, to provide normal service life. The stripe makes the technician aware of any hose twist that has taken place during installation.



Hydraulic Lines and Hoses

Note: Most hoses have a male fitting on one end and a female fitting on the opposite end. **When installing hose, connect the male end first, if a copper gasket is used, replace with a new gasket.** Then the female end should be placed in position and check for interference. Brake hoses should not be tightened by the male end or end which will cause twist.



Real World



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Real World

Hydraulic or vacuum lines, hoses, or connections are restricted, crimped, broken or damaged through the outer reinforcement ply.
393.45(a)



**Collapsed
Hose**

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Real World

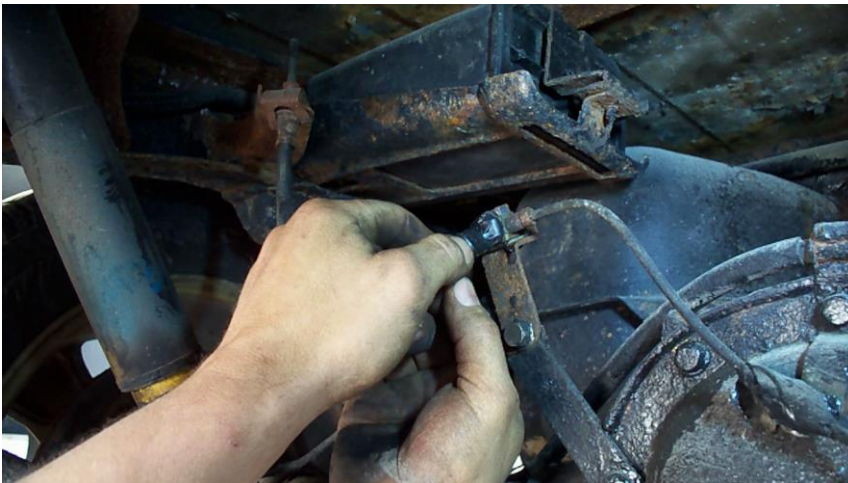


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Real World

Tape, Gorilla Glue and Clamps are not a good idea.



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Real World

Why and How. Common Sense??????????????



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Real World

What are we seeing here?



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Real World

There is absolutely no excuse for this.



Real World

Discovered during "Roadside" Inspection.

New line leaking.

WHY?



Real World

Can you tell me what we are looking at?



Real World

One more chance to show your age.



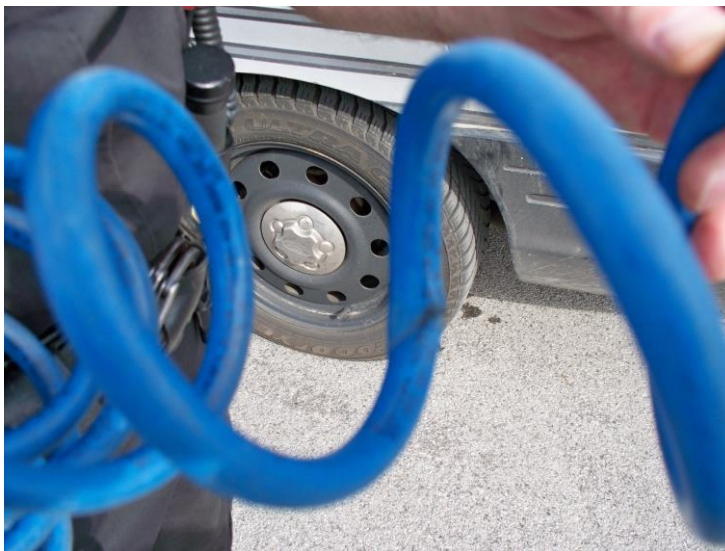
Real World Copper



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Real World

Violation discovered during "Roadside Inspection"



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Hoses and Lines Real World

The following few slides are due to a good question from one of my enforcement trainings.



Hose was kinked at some point.



Hoses and Lines Real World



Hoses and Lines Real World



Hoses and Lines Real World

Requirements for Plastic Air Brake Tubing, Plastic Air Brake Tubing Assemblies and End Fittings:

h. Air Brake Hose/Tubing
 (1) Any damage extending through the reinforcement ply.
 (393.45(a)) (as per 4 or 5 below)

Ref #	Visual Characteristics	OOS Status
1	Wear extends into outer protective material.	Not "OOS"
2	Wear extends through outer protective material into outer cover.	Not "OOS"
3	Wear makes reinforcement ply visible, but ply is intact.	Not "OOS"
4	Reinforcement ply is visible and ply is frayed, severed, or cut through.	"OOS"
5	Wear extends through reinforcement ply.	"OOS"

Hoses and Lines Real World

Requirements for Plastic Air Brake Tubing, Plastic Air Brake Tubing Assemblies and End Fittings:



Hoses and Lines Real World

Requirements for Plastic Air Brake Tubing, Plastic Air Brake Tubing Assemblies and End Fittings:

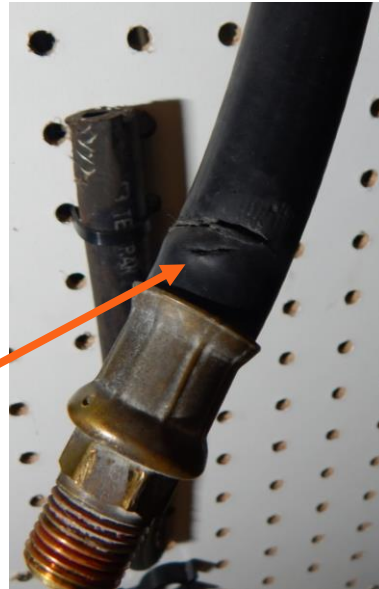
For “Roadside Inspection” purposes the main question is it a Violation or OOS condition?



Hoses and Lines Real World

Requirements for Plastic Air Brake Tubing, Plastic Air Brake Tubing Assemblies and End Fittings:

Is this a violation or OOS?
How would you treat this if you were performing an “Annual Periodic” inspection?



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Hoses and Lines Real World

Requirements for Plastic Air Brake Tubing, Plastic Air Brake Tubing Assemblies and End Fittings:



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Hoses and Lines Real World

Requirements for Plastic Air Brake Tubing, Plastic Air Brake Tubing Assemblies and End Fittings:



Hoses and Lines Real World

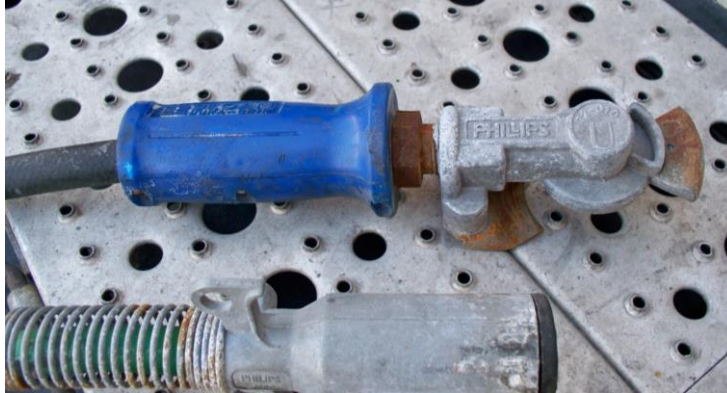
Requirements for Plastic Air Brake Tubing, Plastic Air Brake Tubing Assemblies and End Fittings:



Hoses and Lines Real World

Requirements for Plastic Air Brake Tubing, Plastic Air Brake Tubing Assemblies and End Fittings:

What are you seeing? What are the requirements? Is it okay?

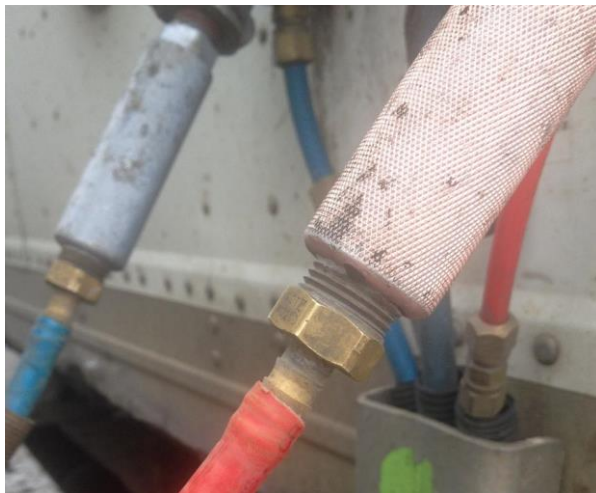


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Hoses and Lines Real World

Requirements for Plastic Air Brake Tubing, Plastic Air Brake Tubing Assemblies and End Fittings:



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Hoses and Lines Real World

Requirements for Plastic Air Brake Tubing, Plastic Air Brake Tubing Assemblies and End Fittings:



This is a neglected visual check with drivers and shops.

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Hoses and Lines Real World

Is this a violation? Is this, okay?



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Hoses and Lines Real World

Preventable? Who is to blame?

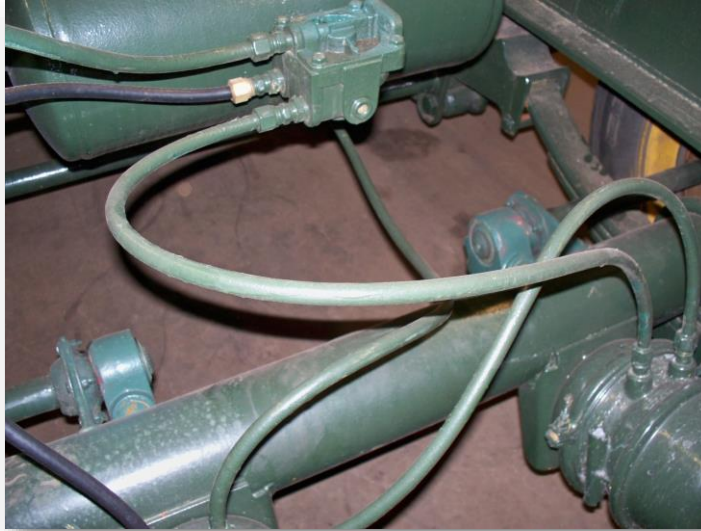


Hoses and Lines Real World



Hoses and Lines Real World

Is this, okay?

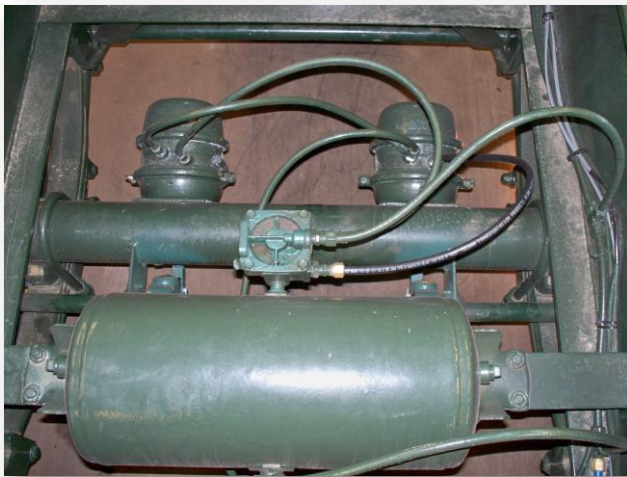


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Hoses and Lines Real World

This view shows a lack of common sense.



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Hoses and Lines Real World

Is this a violation even if the line hasn't been damaged yet?



Part 393.45(b)(2):
Be secured against chaffing,
kinking, or other mechanical
damage; and

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Hoses and Lines Real World

By now there is no need to even discuss this.



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Hoses and Lines Real World

Roadside Violation



How many people in this company failed with their responsibilities?



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**In Shop LIVE
TRAINING**
gtruglia@
dormanproducts.com

Instructor: Swede Oun

"Dorman Training"

"Important Announcement"

New for 2025!

Due to numerous requests for live HD trainings, we are going to roll out classes that will range from 3-hours to 2-day classes.

Examples:

- **2-day HD brake classes**
- **2-day HD electrical classes**
- **1-day Regulations and Inspection classes**

Classes will take place at O&K Truck Repairs classroom in Tonawanda, NY and any other location convenient throughout the country. For specific class requests:

Contact: gtruglia@dormanproducts.com

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Classroom pictures

For more class content and description, you can also reach me at: okswede1@aol.com
Tel: 716-874-5450

Dorman Products is ready to expand the HD truck Training.
We can also tailor trainings to your needs.



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Questions?



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Thank You !



Please click or scan the **QR codes** to fill out a quick **survey** about this webinar, join our **Facebook group** or sign up for our **newsletters**.



Webinar Survey



Facebook Group



Newsletters