NEW YORK STATE
DEPARTMENT OF TRANSPORTATION
BUS INSPECTION PROGRAM

3 HOUR AIR BRAKE SEMINAR
(Revised October 1, 2004)
The purpose of this seminar is to enable every Inspector to do their best when conducting an inspection of an air brake system. This seminar is not intended to teach the Inspector *everything* about air brake systems. It is provided as instructional guidance to compliment training previously received and is a living document that will be modified as rules, regulations and policies change. The information contained in this seminar is based on currently available data and policies. The seminar will go over all of the basic inspection items that must/should be checked at a minimum, during any air brake equipped vehicle inspection. The seminar will also go over the reasons these items are inspected and how to do so in a uniform and efficient manner. This is to assist in the Program’s goals of State wide Inspector consistency. By providing clear guidance and information that gives the Inspector the reason(s) to look at, and for, specific component functions on an air brake system, the Inspector is provided the best tools to conduct an inspection well. Although The seminar will use school vehicles for this seminar, the same principles apply to all air brake vehicles.

**SAFETY FIRST!**

Prior to the conduct of any inspection, take a moment to determine that you and those around you will be safe from harm during the inspection process. If you are inspecting a vehicle sitting on a flat surface, at least one drive axle wheel must be chocked at both the front and rear. If working on a pit, make certain you have two clear means of egress from the pit, where the egress steps are free of slip or trip hazards and have a minimum of 7 feet clear over each step at all times. Make sure your walking area is a minimum of 28 inches around the vehicle and that it is free of slip or trip hazards. If working with the vehicle on jack stands, make sure they are rated for the weight they must support. If working on a lift, make certain it is rated for the wet curb weight of the vehicle you are inspecting and that it has functioning and properly set safety locks. Make certain that the vehicle has an exhaust hose on it and that it vents to the outside of the building. Know your environment and where safety aid devices and equipment are located. Establish a clear line of communication with the Operator provided assistant.
INTERIOR COMPONENT

There are several safety item’s condition that must be determine from inside the vehicle:

1) Gauges – do they function [use OOS Item 16.00.1 (A)] and are they illuminated [use item 16.04 (C)] (Refer to Section (720.4 (Z) (1) (d) and FMVSS 571.121 S5.1.4 Pressure gauge. - A pressure gauge in each service brake system, readily visible to a person seated in the normal driving position that indicates the service reservoir system air pressure. The accuracy of the gauge shall be within plus or minus 7 percent of the compressor cut-out pressure.) (On a system that has a governor cut out of 120 p.s.i. that would be a variable of approximately 8.5 p.s.i.);

2) Compressor and governor – does the compressor system build pressure adequately. [Use OOS item 50.00 and specify “at high idle of 1200 – 1700 rpm (if equipped with a tachometer use the exact rpm the procedure is conducted at) compressor builds from 90 – 105 p.s.i. in (and state the number of seconds it took to build up in total, must exceed 40 seconds to be placed OOS)] (Never state that a compressor is defective. There are a multitude of component defects that could cause this condition and the compressor is not the only one. In almost all instances of reporting a defect, any defect, we should state the procedure and cite our observance.) What is the cut out and cut in pressure [use OOS item 50.00 (A) and specify the compressor cuts in at (specify the p.s.i. it cut in) or compressor fails to cut out, causing the pressure relief valve to activate] (FMVSS 571.121 S5.1.1.1 Air compressor cut-in pressure. The air compressor governor cut-in pressure for each bus shall be 85 p.s.i. or greater.) (Generally the cut in pressure should be within 25 p.s.i. of the cut out pressure. The cut out pressure is usually 110 to 130 p.s.i. The cut out pressure may not exceed the setting of the pressure relief valve.);

3) Warning devices – do they meet minimum requirements and activate at not less than one half of governor cut out pressure. [Use OOS item 16.01 (A) or 16.03 (A) as appropriate] (Refer to Section 720.4 (Z) (1) (e) and 720.4 (Z) (2) (a) and (b);

4) Does the parking brake self apply at 10 p.s.i. or more below the activation of warning devices. [Use OOS item 40.01 (A)] (Refer to Section 720.4 (Z) (1) (e); NOTE: There is no requirement for the parking brake to self apply.

5) Are there any audible or otherwise detectable air leaks [Use OOS item 40.01 (A), or 40.03.1 (A), or 40.04.3 (A), or 42.02.3 (A) or 50.01 as is appropriate for the detected defect];
6) On ABS equipped vehicles (required if manufactured on or after 3/1/98)
does the ABS system self test function indicate any defects and are the
warning device(s) functioning properly. [Use OOS item 16.03 (A) or 40.01
(A) as appropriate for the defect condition detected.] (Some ABS equipped
vehicles require driving at low speeds for several seconds before the
system completes the self diagnosis. The MVI shall rely on the Operator to
know whether or not the vehicle being inspected is so equipped. If so
equipped, the light will be on at the beginning of the road and brake
performance test. It is advisable to check the ABS control module for an
error code. MVIs may allow the operator to clear an ECU error code and
retest the system once prior to the road and brake performance test,
provided there are no defects detected in the foundation brake
components or any portion of the ABS system components during the
inspection. Prior to the road and brake performance test the operator
provided assistant must make a full service brake application at a low
speed, to check the foundation brake system and ABS system for nominal
function as a safety precaution. If the ABS warning light comes on prior to
the road test, the road and brake performance test shall not be
conducted.)

All of this may all be done in a simple and efficient manner taking only a few
minutes:

First, currently it is state policy that the Inspector may not be seated in the
driver’s seat when the vehicle is running, or to check the neutral safety switch.
Therefore these procedures are intended to be conducted with the Operator’s
provided assistant in the driver’s seat operating the controls. When this policy is
modified to allow the MVI to operate the vehicle controls while the engine is
running, use all stipulated safety protocols.

All vehicles are supposed to be at operating temperature(s) and should be up to
full system pressure when the Inspector enters the vehicle. If operator(s) are not
doing this, MVIs should notify their SMVI.

With the engine off and the headlights or parking lights in the on position note the
air pressure gauges condition. So long as the air pressure is well above the point
at which the warning devices would activate you may start the procedure even if
it is not at cut out pressure. If necessary, build up air pressure to cut out and shut
off the engine. (If this is done now, note the pressure that the governor cuts out at.)

Make a single full service brake application with the parking brake applied
and the ignition off. Note the gauges and listen for air leaks. Release the
service brake. Make certain the parking brake remains applied without
holding the control. Release the parking brake and make another service
brake application. Note the gauges and listen for air leaks.
Turn the ignition to the on position. On ABS equipped vehicles listen for the click and pop of the ABS self test on each wheel's solenoid. Watch the ABS warning light on the dash to observe its function. Release the service brake. Make slow steady service brake applications until the warning device(s) are activated. Note the pressure at which the required devices have all activated. (This must be at least \( \frac{1}{2} \), or more, of the governor cut out pressure.) Continue making slow steady service brake applications until the parking brake self applies. Did the parking brake self apply at 10 p.s.i. or more below the point at which all the warning devices were activated? (There are some models that will not self apply and must be activated by hand control manually.)

Start the engine and build up pressure at a high idle of approximately 1200 to 1700 rpm. Release the parking brake at approximately 80 p.s.i. When the pressure has reached 90 p.s.i., use a second hand equipped watch and determine how many seconds it takes to reach 105 p.s.i. at a high idle. (This may be accomplished from 85 to 100 p.s.i. on vehicles where the air pressure gauge(s) do not have a 90 p.s.i. increment indication.) On all air compressor equipped vehicles it may not exceed 40 seconds. Continue building pressure until governor cut out and note that pressure if you haven’t already determined cut out.

NYSDOT will use the above method on all compressors to determine minimum adequacy. For all vehicles equipped with a compressor, FMVSS requires the following: 571.121 S5.1.1 Air compressor. An air compressor of sufficient capacity to increase air pressure in the supply and service reservoirs from 85 p.s.i. to 100 p.s.i. when the engine is operating at the vehicle manufacturer’s maximum recommended rpm within a time, in seconds, determined by the quotient (Actual reservoir capacity \( \times 25 \)) / Required reservoir capacity.

**WALK AROUND COMPONENT**

Having completed the interior inspection procedure component, exit the vehicle and begin the walk around component. During the walk around inspection component (or when this is not feasible, prior to beginning the brake and under carriage inspection component once the vehicle is safely positioned on a lift, etc.) you must turn all wheels 360 degrees in both directions to determine adequate drum to shoe clearance.
If the wheels cannot be turned freely in either direction, the bus should be placed OOS using item 99.00 (A) per NYSDOT PPM Section 4.2 and state “Unable to rotate wheel (which wheel) 360 degrees using moderate strength.”

**UNDERCARRIAGE COMPONENT**

During the course of the inspection of the foundation brake components on vehicles equipped with air brake chambers utilizing an external automatic adjustment mechanism and having an exposed pushrod, if it is determined that the vehicle is not equipped with a brake stroke indicator, or that the device is no longer in the correct position by simple visual observation, use Item 99.02 and cite FMVSS section 571.121 S5.2.2 (b). Specify which chamber does not have a stroke indictor. Refer to section FMVSS 571.121 S5.2.2 (b) Brake indicator.

(Note: There is no need to make any additional effort to try to determine if the vehicle is equipped with brake indicators, beyond what is normally done during the foundation brake component inspection. If the determination can’t be made visually, proceed without further effort than the visual observation. Automatic slack adjusters are required on vehicles manufactured on or after 10/20/94 pursuant to 49 CFR571.121.)

A brake stroke indicator may be of any design that complies with the intent of the FMVSS standard 571.121 S5.2.2 (b). Common indicators are a colored band on the push rod at the point of a long stroke, or an external indicator that marks where the point of a long stroke will be. If the vehicle does not have a brake stroke indicator, for each brake equipped with an external automatic adjustment mechanism and having an exposed pushrod, the condition of service brake under-adjustment shall be displayed by a brake adjustment indicator in a manner that is discernible when viewed with 20/40 vision from a location adjacent to or underneath the vehicle, when inspected pursuant to S5.9.

With the air pressure at 90 p.s.i. and the parking brake released, (specify 90 p.s.i. whenever the gauges have that designation and always get confirmation that instructions are understood and carried out) have the operator assistant fully apply and hold the service brake. Measure all slack adjuster throws from the center of the clevis pin to the backing plate or chamber housing on each wheel in line with the throw rod. Begin at the right front and proceed to the left front, left rear and then right rear.

Having made and recorded all measurements, there are baseline measurements to determine the adequate function of the slack adjusters at the end of the inspection process.
Have the assistant release the service brake and measure the released positions of all slack adjuster throws in the same manner in reverse order from right rear to left rear to left front and then right front. This allows the determination of the throw of each slack adjuster. The difference between the fully applied position measured at 90 p.s.i and the released position is the total throw.

Use the table at the end of the OOS criteria to determine an OOS throw condition for the specific size chamber measured. Use OOS item 40.01 (A), specify which wheel, cite the chamber size, the measured throw and the pressure it was measured at.

If there is a difference of length in push rods across an axle either applied or released that exceeds ½ inch, place the vehicle OOS using item 40.03.3 d (A).

Having completed these measurements, commence the under carriage inspection process beginning at the right front wheel. Make three applications at each wheel and observe the function of each brake shoe (observe brake shoes directly when applicable, or by observing the expansion of the brake drum when shoes cannot be observed directly) and the chamber and slack adjuster. (Later, at the end of the air drain down procedure component of the inspection procedure, obtain the final brake throw measurements after having achieved a minimum total of 12 service brake applications with the pressure at a point that keeps the parking brake from self applying. This will determine whether or not the slack adjusters are OOS.)
The seminar will not cover the entire foundation brake system inspection. The seminar will go over the entire air drain down process and what should be done during that process. There are some key things that should be known about the brake system which will be discussed here.

Here are some of the key components the seminar will go over and some definitions of their use or function:

Compressor, governor, reservoir, pressure relief valve, one way check valve, two way check valve, application or treadle valve, PP1 valve, quick release valve, relay valve, inversion or parking brake application valve or emergency brake application valve, brake chamber, parking brake and emergency brake.

AIR SUPPLY SYSTEM - The primary function of the air supply system is to deliver clean, dry, compressed air at a regulated pressure in sufficient quantity to operate the brake system. The supply system must also maintain an adequate reserve in case of failure.

The air supply system on many vehicles also has a secondary function of providing air to other operating systems. These systems may include engine starting, vehicle steering, transmission and axle shifting, vehicle suspension, windshield wipers, doors and even air cushion seats.

The air supply system consists of an air intake (filter), a compressor, a governor, a reservoir, check valves, a safety valve, a drain valve and a low pressure device. Optional equipment may consist of air dryers, automatic drain valves, alcohol evaporators.

Air Intake: For optimum system performance the intake air must be free flowing and clean. Air intake is achieved through one of three methods determined primarily by engine design factors and under hood conditions. The three methods of air intake are:

1. Engine intake manifold; used on turbocharged engines.

2. Engine air cleaner; used on naturally aspirated engines.

Separate breather filter mounted either on the compressor or remotely mounted with a source line to the compressor, also used on naturally aspirated engines. Air intake filters, whether separate or shared with the engine, must be checked periodically and replaced whenever necessary to insure optimum system performance.
Air Compressor: The air compressor must be able to build up and maintain the required air flow and pressure to operate the air brake system along with any additional air powered auxiliary systems. Air compressors are rated by cubic feet per minute (CFM) at a given RPM. The rating size is determined by system requirements and government requirements for buildup and recovery time.

Air compressors are driven by the engine. They can be either flange mounted and gear driven or bracket mounted and belt driven. Flange mounted gear driven types usually mesh directly with the camshaft or idler gear and have a very low drive mechanism failure rate.

The compressor is usually driven continuously whether or not air is required. Based on need, the compressor is loaded or unloaded by means of a governor.

Governors: Air governors may vary in design but not in performance. The air governor is the component of the supply system that provides the signal to actuate and terminate compressor pumping cycles.

The governor operates in conjunction with the compressor unloading mechanism, automatically controlling air pressure in the system between the desired predetermined maximum and minimum pressure limits.

Reservoir air pressure enters the governor at one of its reservoir ports and acts on the area of the piston beneath the inlet exhaust valve. As air pressure builds up, the piston moves against the pressure setting spring.

The piston and inlet exhaust valve move up when reservoir air pressure reaches the cut out setting of the governor. The reservoir air can now pass by the open inlet valve, flow around the lower part of the exhaust valve stem, through the cross drilled piston passage and into the unloading mechanism of the compressor. This action causes the compressor to stop pumping.

As the compressor's unloading action is completed, the air pressure above and below the inlet valve is equal, and the valve spring offsets the balance sealing the inlet valve and trapping the air pressure to the unloader mechanism.

Air Reservoirs: The reservoir serves the air brake system as a storage tank for a volume of compressed air.

SUPPLY RESERVOIR, PRIMARY RESERVOIR, SECONDARY RESERVOIR:

The vehicle manufacturers are mandated to size the reservoirs to provide an adequate volume of air for use by the braking system. These reservoirs can come in various configurations. They can either be a single, dual, or multiple compartment type.
Because they are storage tanks, they collect contaminants, water condensed from air, and small amounts of oil from the compressor. All air reservoirs must have a means to be manually drained.

One Way Check Valves: To protect the reservoir air pressure against a reverse air flow, one way check valves are used. These valves can be shuttle, disk, or ball design. Check valves are used to isolate primary and secondary systems in case of failure. Some European models use a circuit protection valve instead.

Two Way Check Valve: These valves are used as safety valves or directional valves, depending on their location within the air system. (It may also be called a double check valve in some applications or manuals.) The most common type of these valves is the shuttle type. This valve is basically composed of a shuttle guide and a shuttle inside its body. Two independent air supply line ports are threaded into the valve. The outlet port leads to an air valve. Some valves have an additional outlet port to accommodate a stoplight switch, or contain an integral stoplight switch. When the air pressure at one inlet port is higher than at the other inlet port, the shuttle valve is forced against the seat, sealing the lower pressure port, and delivers the higher of the two pressures.

Safety Valve: To protect the air system from becoming over-pressurized in the event of governor malfunction, a pressure relief valve is installed in the supply reservoir. This valve is usually a spring loaded ball check type. Safety valves are commonly adjusted to release at 150 p.s.i.

Air Dryers: Air dryers are optional on vehicles equipped with air systems. The primary function of the air dryer is to remove moisture which prevents downstream freeze ups and corrosion of air lines, air tanks, and air components. It also functions as an oil and contamination removal system which increases the service life of air components. Air dryers, like most components in the air system, are made by various manufacturers. A desiccant type - in line filtration system - uses a replaceable desiccant material (All porous particles that have a unique ability to strip water vapor from moisture laden air). The desiccant material is usually regenerative; meaning its adsorption properties are renewed each time the compressor is unloaded.
Automatic Drain Valve: The automatic reservoir drain valve is usually mounted on the bottom of the reservoir through the valve’s top port. The valve works independently requiring no signal lines or manual assistance. During system charging the valve inlet port opens allowing contaminants to collect in the sump. When minimum pressure is reached the inlet valve closes. During brake system operation any 2 p.s.i. drop causes a pressure differential in the valve which opens the exhaust port and ejects contaminants. The valve then equalizes itself and waits for the next air pressure drop. Some valves employ an electrically heated sump to prevent freeze up.

Alcohol Evaporator: The alcohol evaporator in installed on the intake side of the compressor and allows alcohol to be drawn into the brake system during operation. This alcohol acts as an antifreeze preventing system freeze up. During operation, a low pressure is created above the alcohol by the compressor intake. This low pressure causes the alcohol to boil or evaporate which allows it to enter the compressor intake as a vapor. An atmospheric vent tube is installed into the alcohol reservoir. By controlling the size of the vent orifice, the rate of evaporation can be controlled.

SERVICE BRAKE SYSTEM: The service system consists of a series of reservoirs, valves, and components that direct and control air pressure flowing to and from the brake actuators (chambers). The degree of desired braking, whether gradual or severe, is controlled directly by the driver. The service system is used for normal stopping functions, providing no pneumatic failure occurs in either the primary or secondary circuits.

Brake Valve: (Treadle or foot valve) This valve allows the driver to motor (deliver) the air (pressure) into the application lines, to hold the applied pressure, and to reduce or fully release the applied air pressure. All application valves operate on the same principle. These brake valves come in various mounting configurations and generally are either floor mounted or suspended. The actuation of these valves can be accomplished by pedal, treadle, or with a lever/linkage arrangement. All brake valves are designed to provide a gradual means of applying air to brake actuators. Because they are control valves, the feel is different from a hydraulic brake system.

Brake valves can be separated into two types: A single circuit valve generally used on pre 121 vehicles, and dual circuit valves used primarily on 121 air brake systems.
To better understand these valves, the seminar will start with a single circuit for two reasons. First, there are still some pre 121 vehicles in service. Secondly, it will be easier to comprehend the dual foot valve once the concept of the single circuit valve is understood. Also, as with most control valves, in the released position, the exhaust port is always open.

On a single circuit valve, when the pedal is depressed, the exhaust seat closes. As the exhaust closes, the inlet valve moves off its seat allowing air pressure from the reservoir to flow through the inlet valve and out the delivery ports to a quick release or relay valve, and ultimately to the brake actuators (chambers). There is also a holding or balanced position. When movement of the pedal is stopped, air pressure acting on the lower area of the application piston equalizes with the force of the graduating spring. The valve then comes to a hold or balanced position. Once additional force is applied on the application plunger, the application piston moves, this once again opens the inlet valve, allowing more air to enter the delivery line, thereby increasing the air pressure. Reduction in force on the application plunger reduces the force on the graduating spring. This time air pressure acting on the lower area of the application piston is now greater in force, which moves the application piston. The exhaust valve opens, allowing air from the delivery line to escape past the open exhaust valve, through the center bore of the poppet valve, into the atmosphere.

Dual Brake Valve: (Treadle or foot valve) The dual brake valve is used primarily since the advent of FMVSS121. This valve has two independent application valves in one body. The “primary circuit” (operated directly by the pedal or treadle plunger) consists of components similar to those of a single foot valve. The "secondary circuit" serves the same function as a relay valve. This allows for a "split" system with the rear axle (or axles) brakes normally controlled by the "primary circuit" and the front axle or axles brakes normally controlled by the "secondary circuit". Both valves of the dual application are controlled by the movement of one pedal. The dual valve is also designed in such a manner that if air is lost in either circuit, the other circuit will continue to function. However, the brakes controlled by the failed circuit become inoperative. For example, with a failed primary circuit, air from the secondary circuit reservoir can then pass by the open inlet valve and out through the secondary delivery port or ports.

Relay Valve: The relay valve is a remote control application and release valve and is pneumatically controlled. It is actuated by air pressure, unlike the foot valve which uses mechanical force to actuate. In the air brake system this valve is used to reduce the time lag of brake application and release times. These relay valves come in various "crack pressures and pressure "differentials".
"Crack," or differential pressure, is the air pressure required at the input from the foot valve before the relay valve will send air pressure to the brakes controlled by the relay valve. "Crack pressure" is then overcome and ultimately input and output pressure will always be less than input.

Operators must not alter a brake system that in any way affects these crack or pressure differentials as they are extremely crucial to pneumatic brake balance.

Quick Release Valve: A quick release valve is used to allow brake actuation air to be quickly exhausted near the brakes it serves, rather than having this air travel back the full distance to the application valve.

Service Brake Actuators (Chambers): The brake chambers convert the energy of the air pressure into mechanical force. The "clamp" type brake chamber can best be described as a double dish type unit, containing a diaphragm, a push plate and rod assembly and a return spring.

Brake chambers are identified by different types and sizes. These chambers are sized by the effective area of the diaphragm. For example: A type 16 brake chamber would have an effective diaphragm area of 16 square inches. Type 24 would have an effective diaphragm area of 24 square inches. Pushrod force is determined by multiplying the delivered air pressure by the effective area of the diaphragm. For example: If 50 p.s.i. in delivered to a type30 brake chamber, the pushrod force will be 1500 lbs. Clamp ring chambers are the most common types used.

Rotochambers: A rotochamber was designed to replace the conventional type brake chamber. They offer greater braking capacity in the same overall size, which permits a wider range of application. This is accomplished because of the rolling type diaphragm and piston design, which also allows a constant output force throughout the entire stroke. The rotochamber operation is similar to the conventional type brake chamber.

Wedge Brake: As opposed to a brake applied by an “S” Cam, this type of brake is applied by a single or double wedge type mechanism. This type of brake does not utilize a slack adjuster.

Stroke: Refers to total distance traveled by a brake chamber push rod or slack adjuster arm during brake application.

Slack Adjuster: A lever connecting the brake chamber push rod with the foundation brake camshaft which provides torque to rotate the brake camshaft when the brake treadle is depressed. Used on a cam actuated brake, it also provides a means to adjust the air gap between brake shoes and the drum to compensate for lining wear.
Spitter Valve: Slang for Automatic Drain Valve (see Drain Valve)

Spring Brake: Generally refers to a tandem brake chamber or brake actuator that incorporates air-applied service brake chambers and air-released/spring-applied parking or emergency brake chamber. Spring brakes apply upon sudden air loss (emergency mode) or activation of a dash mounted parking brake control. Spring brakes remain applied until that chamber is recharged or the spring is manually compressed. Some spring brake actuators do not incorporate a service air chamber and are solely parking and/or emergency brakes.

Roll Over: Jargon denoting that a brake cam has traveled beyond its designed stopping position during brake application. Also called “cammed over”.

S” Cam Brake: Type of brake where mechanically induced rotation of an “S” shaped cam forces brake linings against the brake drum.

Push Rod: A rod, protruding from a brake chamber, which is connected to the arm of a slack adjuster via a clevis pin.

Lock Up: The point at which braking power overcomes the traction of the vehicle’s tires and skidding occurs. The most efficient stopping occurs just before lock up is reached.

Inversion Valve: Normally open, an air control valve often used in interlocking applications where components must operate in a specific sequence.

Lining: The actual friction material that contacts the brake disc or drum when the brakes are applied.

Emergency Brake System: Emergency braking (In the event of air loss) may involve various portions of the parking and service brake systems. [FMVSS 571.121 S5.7 Emergency brake system ... buses. Each vehicle shall be equipped with an emergency brake system ... (that) with a single failure in the service brake system ... except failure of a common valve, manifold, brake fluid housing, or brake chamber housing ... (shall be capable of making a single brake application and stop the vehicle.) The emergency brake system shall be applied and released, and be capable of modulation, by means of the service brake control.]

Foundation Brake System: Term inclusive of mechanical components involved in mechanically providing braking force: brake chambers, slack adjusters, brake drums, and brake linings.

Dual Brake System: Mandated by FMVSS - 121, the use of a dual air system, primary and secondary, in order to retain braking ability in the event one system fails.
Check Valve: A one-way check valve is used, for example, to prevent air from bleeding back into a reservoir. A two-way check valve activates selectively for instance, by drawing air for brake application from the most highly pressurized reservoir (primary or secondary).

Clevis Pin: Pin connecting the arm of a slack adjuster to a brake chamber push rod yoke.

Brake Fade: There are many types and causes of brake fade. Fade may result, for example, from a reduction in friction between linings and drums caused by exposure to water. Most typically, however, fade involves a reduction in braking force experienced from dragging brakes on a long downgrade. If the brakes are maladjusted, an overheated drum may expand to the degree that push rod travel is insufficient to fully actuate the brakes. This is one example of mechanical fade, which also may result from defects (i.e. scored drums) within, the foundation brake system. In contrast, heat fade occurs when linings over heat and become less aggressive (Less able to dissipate heat).

Anti-Compounding: Basically, an optional system that prevents application of service brakes from compounding (adding to) the force exerted by parking brakes. Functionally, this guards against brake drum cracking and lining damage.

What affects a brake performance test? Two key things you may visually detect that will affect the function of the braking system and subsequently a brake performance test are angle of application and missing or incorrectly installed 90 and 45 degree fittings.

Angle of application refers to the interior angle formed by an imaginary straight line through the center of the push rod and the center of the slack adjuster when applied and at a maximum legal throw. When this angle is less than 90 degrees, it looses efficiency and will cause a poor brake performance stop. At this time the angle of application is not part of the NYSDOT inspection criteria, but be aware that this will affect brake performance testing. Ninety degree fittings are the equivalent of 7 feet of air hose resistance and forty five degree fittings are the equivalent of 3.5 feet of air hose resistance. Brake balance is, in part, created by the manufacturer’s placement of these fittings. Removing or incorrectly placing these fittings will alter the brake balance. When improperly altered brake fittings is detected due to removal of or incorrect installation of a 90 or 45 degree fitting, place the vehicle OOS using OOS item 40.00.5 (A). When no clear determination of the suspected OOS condition can be made, refer the vehicle to an SMVI.

In addition to these visible conditions that will affect brake performance testing, here are several others that you may not see: New tires, defective shocks and springs, improper friction material, “lazy brake”, improper crack pressures of various system valves and defective power springs in spring brake chambers.
The Vericom will detect and these various conditions during the brake performance test procedure.

Additional guidance regarding checking spring brake chambers for a defective “power spring”. The only manufacturer method for checking a spring brake chamber, for a broken power spring, is to remove the chamber from the vehicle, properly cage the spring and then shake the assembly to detect rattling. Then, if no rattling is detected, bench pressure test the spring.

Since it is not safe to visually inspect the power spring during the NYSDOT inspection, other methods must be used. While nothing an MVI may physically do during an inspection can confirm a broken power spring, there are two visual checks that can be made on most vehicles as part of the brake inspection procedure that may indicate a defective power spring. With full pressure, or adequate pressure to keep the spring brake fully released, check the following:

1) Dose the push rod jump or retract and apply sluggishly during application and release of the parking brake.
2) Does the push rod return completely with the spring brake fully released.

Having looked for these two possible indications of a defective spring brake power spring, there is no way to confirm that the power spring is in fact defective. Therefore, the vehicle cannot be placed OOS solely from these observations. These observations are simply a possible indicator of a potential defect condition, not a method of placing a vehicle OOS. To place the vehicle OOS, the vehicle must be taken for a road test. When the parking brake performance test is performed, the Vericom will detect anything that will not meet minimum brake performance standards. Place the vehicle OOS for this. It is the operator’s responsibility to determine why the vehicle doesn’t pass the performance test.

In the circumstance where the visual condition leads the inspector to believe that the vehicle may have a defective power spring, but the vehicle passes the performance brake test by a narrow margin, (If it passes within normal parameters, the visual indicators mentioned may be an aberration or due to a poorly positioned chamber housing, which is not an OOS condition.) Inspectors may request the Operator cage the spring brake assembly according to manufacturer’s procedures and prove the spring is nominal. Under this circumstance, if there is no other OOS condition, the vehicle will pass with a 99.00 (N). In the defect area the Inspector will write, … “Operator to check (specific chamber side/location) spring brake chamber’s power spring condition, following manufacturer’s recommended procedures prior to placing vehicle into service.” If there are other OOS defects detected, use the same code but write in the defect area, … “Operator to check (specific chamber side/location) spring brake chamber’s power spring condition following manufacturer’s recommended procedures prior to re-inspection.”
At the completion of the undercarriage component inspection, drain the air tanks and check the remainder of the air brake system. Begin with full pressure and the engine off. First, if not already checked, check the pressure relief valve. Then drain the wet tank until it is at 0 p.s.i. Ask the assistant what the gauges and warning devices show.

On vehicles with a single warning device sender, there must be either an audible or visible warning of low pressure (School buses must have both an audible and visible warning device in addition to a wig wag. If equipped with a single wig wag, the wig wag must activate at this point.) and the gauges for the front and rear brake reservoirs should remain at full pressure. (On vehicles with two warning device senders, one may indicate loss of pressure from the front brake reservoir and one from the rear brake reservoir to comply with requirements. On school buses with two wig wags, one may be on the front brake reservoir and one on the rear reservoir.)

If these conditions are met, proceed to the secondary brake reservoir (or front brake reservoir) and drain it to 0 p.s.i. If there are any failures within the system at this point, use the OOS criteria and state the procedure and cite the observance.

One gauge should drop (or on a vehicle with a single gauge and dual needles one needle should drop) If there was no warning device activated when the wet tank was drained there must be one activated now. Have the assistant make and hold a service brake application and check to see that the brake lights are on all dual brake equipped vehicles. (Only the rear brakes will apply at this time.) If these conditions are met, have the assistant build up full pressure again and then shut the vehicle off. If there are any failures within the system at this point, use the OOS criteria and state the procedure and cite the observance.

Once back to full pressure with the engine off, drain the Primary (or rear brake reservoir) to 0 p.s.i. The spring brake must have remained released. If there was no warning device activated when the wet tank was drained there must be one activated now. Have the assistant make and hold a service brake application and check to see that the brake lights are on.

There should be a distinct audible release of air, indicating the activation of the spring brake on most dual brake equipped vehicles. Make two applications like this.
Check brake applications. On most vehicles the front and rear brakes will apply at this time. This is the activation of the emergency brake system. It is comprised of one of the following brake components: Activation of front and rear brakes on most school buses and dual brake coaches; activation of just the drive axle brakes on some coaches; activation of the front and tag axle brakes on some coaches and activation of just the front axle brakes on some vehicles equipped with 6” wedge brakes.

Function of the service brake, an emergency brake and a parking brake are different, even when the components are integrated. Basically, the service brake system is designed and intended to slow a vehicle, bring the vehicle to a stop and hold it stationary by means of a service brake application. A parking brake system is designed and intended to hold the vehicle stationary, even on an incline, once it has been brought to a stop by application of a parking brake control or PP1 valve.

The emergency brake system is designed and intended to slow a vehicle equipped with power brakes, bring it to a stop and hold it stationary by means of a service brake application in the event there is a loss of any single air brake reservoir system pressure.

The only way to perform brake performance testing on an emergency brake system is to deplete the air from the primary brake system and conduct brake stops on a rolling dynamometer. This currently is not a part of the NYSDOT inspection procedure. NYSDOT does require that the parking brake (which on many vehicles is a part of the emergency brake system) function to specific standards the same as an emergency brake system and is brake performance tested instead.

If a vehicle is equipped with an air powered accessory(s) utilizing a separate air reservoir supply tank, rebuild the system to full pressure and drain the accessory reservoir. Two means of protecting the service brake system from a debilitating loss of pressure in the accessory system are commonly used. One: A separate accessory reservoir supplied from the wet tank and therefore protected by a one way check valve. Two: A separate accessory reservoir supplied by one of the service brake reservoirs and protected with a pressure protection valve.

On a vehicle equipped with an accessory reservoir supplied by the wet tank and therefore protected by means of a one way check valve, no further action is necessary. The service brake reservoirs will hold full pressure when the accessory tank is drained if they retained pressure when the wet tank was drained.
On a vehicle equipped with an accessory reservoir tank supplied from one of the service brake reservoirs and protected by means of a pressure protection valve, the service brake reservoir it is connected to will drain to the pressure protection valve’s pre-set pressure. It may not deplete the pressure below 60 p.s.i. If there is a loss of pressure below 60 p.s.i., place the vehicle OOS using 40.00.4 (A), site the procedure and state the observance.

Having completed the air brake component inspection procedure, have the assistant build up full pressure and complete the process of getting 12 application of the service brakes at a pressure that keeps the parking brake from self applying.

Once the 12 applications have been achieved, have the assistant return the pressure to 90 p.s.i. Have the assistant make and hold a single full service brake application with the parking brake released. Beginning again at the right front wheel, measure all the brake throws and compare them to your initial baseline measurements. (Neither manual nor automatic slack adjusters should back off more than 1/8 inch from the baseline measurement. If they do, inform the operator. If any one or more slack adjusters have backed off ½ inch or more from the baseline measurement, place the vehicle OOS using OOS item 40.03.2 (A) and cite NYSDOT PPM Section 4.2)

Regarding air leaks detected during brake applications, or from air accessories.

If there is a minor air leak (reasonably defined as a leak that is so slight that the compressor, at an idle, can keep up with the leak and maintain full pressure in the service brake system) detected at the exhaust port of a valve (i.e. quick release valve port) on application of the service brakes, this should not be considered an OOS condition. If there is any leak detected at any other location in the brake system during a service brake application, it is an OOS condition. If there is a minor leak detected at the exhaust port of a valve (i.e. quick release valve port) when the service brakes are released, this is an OOS condition.

If there is an air leak in an accessory system that does not affect the operation of the accessory item and the accessory system is supplied by a reservoir that is protected with a one way check valve, it is not an OOS condition. If the same leak is on an accessory system that is supplied by a reservoir that is protected with a pressure protection valve or no protection valve, it is an OOS condition since it is affecting the service brake air supply directly. Place the vehicle OOs using Item 40.01 (A).

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