BNSF Railway Safety Vision

We believe every accident or injury is preventable. Our vision is that BNSF Railway will operate free of accidents and injuries. BNSF Railway will achieve this vision through:

A culture that makes safety our highest priority and provides continuous self-examination as to the effectiveness of our safety process and performance...

A work environment, including the resources and tools, that is safe and accident-free where all known hazards will be eliminated or safe-guarded...

Work practices and training for all employees that make safety essential to the tasks we perform...

An empowered work force, including all employees, that takes responsibility for personal safety, the safety of fellow employees, and the communities in which we serve.

This version contains the following updated, deleted or added pages:

May 1, 2015: 34, 88, 103.

July 1, 2015: 44, 73.

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March 1, 2016: 30, 107, 108

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Air Brake and Train Handling Rules

No. 6

In Effect at 0001
Central, Mountain and Pacific
Continental Time

April 1, 2015
(Including updates through
April 1, 2016)

103.7.5 Regulating Valve Braking

Do not use the regulating valve to brake the train.

103.7.6 Retaining Valves

Use retaining valves when required by the timetable, general order or when requested by the engineer.

Setting Retaining Valves - To set retaining valves:

1. Stop the train.
2. Set the retaining valves as specified by the timetable or general order. If no quantity is specified, set all retaining valves.
3. Use High Pressure Position, except use Low Pressure Position on empty cars if equipped. Slow Direct Position must not be used.
4. Notify the engineer of the number of retainers set before proceeding.

Operating With Retainers - After the retaining valves are set, brake cylinder pressure is not retained until a brake pipe reduction and release has been made.

When retainers are set in HP (High Pressure) a 20 psi brake cylinder pressure will be retained or in LP (Low Pressure) a 10 psi brake cylinder pressure will be retained only after a brake pipe reduction of at least 10 psi has been made and released. Further brake pipe reductions will add to the pressure in the brake cylinder.

Do not exceed 15 MPH when operating with retaining valves set.

When retaining valves are not in use, place them in EX (Exhaust). Ensure that cars picked up en route have retaining valves in EX (Exhaust).

103.7.7 Not Used

103.8 Emergency Brake Applications

When conditions warrant, use an emergency brake application if any condition occurs in which there is doubt that service applications can control train speed and maximum authorized speed is exceeded by 5 MPH or more. Make an emergency brake application by moving the automatic brake valve handle quickly to EMERGENCY and leave it there until the train or locomotive stops. In addition, lift the red cover of the EMERGENCY SWITCH and activate the emergency valve on the end-of-train device (ETD) utilizing the head-of-train (HTD) telemetry device, if equipped. Use the following procedure when stopping from an emergency application:

1. Move the independent handle to a position in the application zone that will develop the desired brake cylinder pressure without sliding wheels or developing excessive buff or draft force, then actuate and hold the handle in the actuate position. Extra care must be used to prevent sliding wheels if in dynamic brake mode at the time of emergency application.
2. Adjust brake cylinder pressure by moving the handle in the application zone while actuating.
3. Maintain the current slack condition (bunched or stretched) by avoiding the development of excessive buff or draft force. Extra care must be used to prevent sliding wheels if in dynamic brake mode at the time of emergency application.
4. If in power, return throttle to idle.
5. When maximum locomotive brake cylinder pressure is desired, release the handle from the actuate position.
6. After stopping and once freight car vent valves have closed (approximately 60 seconds), if operating conditions permit, place automatic brake valve in RELEASE position to release brakes.

103.8.1 Lead Unit Not Equipped with DYNAMIC BRAKE HOLDING Feature

This D.B. Holding feature may not be available on some foreign locomotives. When operating with a foreign locomotive, to assure full dynamic braking effort during emergency applications on descending, heavy/mountain grades as described above, observe the following procedures:

1. Place automatic brake valve handle in EMERGENCY position.
2. Control independent brake cylinder pressure to maximum without sliding wheels.
3. Return dynamic brake lever to OFF position. (Required on GE controlling locomotives only)
4. After waiting approx. 30 to 50 seconds, move automatic brake valve handle to CONTINUOUS SERVICE (or HANDLE OFF) position to reset PCS.
5. Return dynamic brake lever to FULL position.
6. Dynamic braking will be restored if independent brake is actuated and locomotive brake cylinder pressure is kept below 15 psi.

103.8.2 Emergency Brake Application by Crew Member

When conditions warrant, use an emergency brake application when:

- Life, personal injury or property damage is imminent.
- The engineer cannot be informed to reduce train speed or stop the train, or
- The engineer does not respond to warnings or signals to reduce train speed or stop the train.

The trainman must know the location of the emergency air brake valves, and when making the emergency brake application must:

1. Notify other employees that an emergency brake application is in effect.
2. Determine if the emergency brake application is in effect on the entire train.

103.8.3 Undesired Emergency Brake Application

When an undesired emergency (UDE) brake application occurs, move the automatic brake valve handle to EMERGENCY and wait until the train stops. After stopping, if operating conditions permit, place the automatic brake valve handle in RELEASE to release the brakes and help locate the air hose separation or other problem.

103.8.4 Emergency Brake Applications — Reporting

All emergency brake applications that occur while moving, whether undesired or intentionally induced by a crew member, are considered an en route delay and must be reported to the train dispatcher. In addition, all undesired emergencies brake applications that occur during normal service braking (commonly referred to as “kickers” or “dynamiters”) should also be reported to mechanical desk as an air brake defect.

Refer to GCOR Rules 2.10 Emergency Calls and 6.23 Emergency Stop or Severe Slack Action that may also apply.

103.9 Unintentional Brake Release

If an unintentional brake release occurs while the brakes are applied, increase the brake pipe reduction at least 5 psi below the last effective brake pipe reduction.

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Glossary

Accelerometer
An indicator that displays in MPH per minute the rate of increase/decrease of speed.

AC Locomotive
AC locomotives are equipped with AC traction motors and are not affected by maximum continuous current ratings or short time operating ratings.

Actuating
Using of feature of the independent brake valve to charge the actuating pipe from the main reservoir and prevent or release a locomotive brake application from a brake pipe reduction.

Air Brake
A system of compressed air devices, controlled manually, electronically or pneumatically, that make the car or locomotive slow down or stop.

Air Brake Equipment
The equipment that supplies and exhausts air to and from the brake cylinders, but does not include foundation brake gear and hand brakes.

Air Brake Hose
A reinforced tubing. On each car or engine, the tubing is attached to a nipple that screws into the angle cock at the end of the brake pipe. The other end of the hose includes a coupling (glad hand) that fits into an identical coupling on the adjoining car. The complete arrangement connects air between the brake pipes of the cars and the locomotives throughout the train.

Air Brake System
All of the devices for operating air brakes to control the speed of and stop a locomotive or train. The system includes the operating devices, pipes, hoses, fittings, and foundation brake gear.

Air Compressor
A locomotive device, powered by the diesel engine or an electric motor, that compresses air for operating the air brakes and all other air-operated devices on locomotives and cars.

Air Compressor Control Switch
A device that controls the loading and unloading of the compressor at the proper main reservoir pressures.

Air Flow Indicator (AFI)
An instrument that indicates the volume of the air flowing through the automatic brake valve into the brake pipe.

Air Gauge
An instrument that indicates air pressure in pounds per square inch (psi).

Alignment Control Coupler
Specially equipped couplers, installed on most locomotives that only allow the coupler in buff to move laterally within certain limits. This equipment minimizes rail turnover, wheel climb and jackknifing.

Ampere (Amperage, Amps)
The standard unit for measuring electric current.

Angle Cock
A manually operated device located at each end of the brake pipe on locomotives and cars to permit or prevent air flow.

Articulated Multi-platform Car
A car with multiple units (segments) that have articulated couplings and which the units share a common truck.

Automatic Brake Valve
A manually operated electronic controller or pneumatic valve on the locomotive that controls the train and engine brakes.

Auxiliary Reservoir
A storage volume, charged from the brake pipe, to receive and store air to apply brakes on a car or locomotive. In freight car equipment, the auxiliary reservoir and emergency reservoir are combined in one structure.

“B” End (of car)
The end where the hand brake is located unless otherwise identified.

Back-up Valve or Hose
A device, either portable or permanently connected to the brake pipe, that controls brakes from the car that it is attached to. The device can apply the brakes with a service or emergency application.

Balanced Braking
Controlling train speed by making enough of a brake pipe reduction to stabilize speed on a grade, then allowing the automatic brake valve pressure maintaining feature to hold the brake application constant regardless of brake pipe leakage. This ordinarily is accomplished in combination with dynamic braking.

Bleed (Bleed-off)
Venting air pressure to the atmosphere, such as venting air pressure from the brake cylinder of individual cars, by using the release valve.

Blended Brake (Amtrak)
The combination of air and dynamic braking by making an automatic service brake application with the throttle in IDLE.

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Brake Application
A brake pipe pressure reduction (no matter how made) that causes the control or distributing valve to move to the service or emergency position.

Brake Cylinder
A metallic cylinder containing a piston. Compressed air forces the piston outward to apply the brakes. When the air pressure is released, the piston returns to its normal position by a release spring coiled around the piston rod inside the cylinder.

Brake Pipe
The section of air brake piping of a car or locomotive that supplies the reservoirs. It also connects the piping to allow the locomotive engineer to control the car brakes. The pipe is 1-1/4 inches in diameter and extends from one end of the car to the other. At the ends, flexible hoses connect the cars. When a train is made up and all brake pipes on the cars are joined together, the entire pipe line is called the brake pipe.

Brake Pipe Gradient
The difference in brake pipe pressure between the locomotive (or source of supply) and the rear car of the train. Brake pipe gradients may be:

- **Normal Gradient.** The gradient that exists when the system is fully charged.

  or

- **False Gradient.** The temporary gradient that exists when the system is less than fully charged (for example, the exaggerated difference between the head end and rear end after a release).

  or

- **Inverse Gradient.** The temporary condition when the brake pipe pressure is higher at the rear of the train than at the head end of the train (for example, during a service brake application).

Brake Pipe Pressure
The amount of pressure in pounds per square inch (psi) in the brake pipe (commonly expressed in pounds).

Brake Valve Cutoff Valve
A device on locomotives that can cut out the charging and service functions of the automatic brake valve. This valve also properly positions the brake valve for passenger or freight operation.

Branch Pipe Cutout Cock
A device on locomotives and cars that isolates the control valve from the brake pipe.

Control Valve
A device on locomotives or cars that charges the reservoirs and applies or releases brake cylinder pressure when brake pipe pressure reduces or increases.

DC Locomotive
DC locomotives are equipped with DC traction motors and are affected by maximum continuous current ratings or short time operating ratings.

Dead Engine Feature
A device near the locomotive control valve that is used when the unit is handled dead-in-tow. When the dead engine cutout cock is opened, the main reservoirs are charged from the brake pipe to operate the engine brakes.

Dead-in-Tow (also referred to as dead-in-train)
Refers to an inoperative locomotive that has been conditioned for it's brakes to function using only brake pipe pressure. This is accomplished by utilizing the dead engine feature to charge main reservoir from brake pipe. (This conditioning is done by mechanical forces who will assure main reservoir is bled down to below brake pipe pressure before utilizing this feature.)

Distributed Power
One or more locomotive consists that are remotely controlled from the lead, locomotive.

Disturbed Track
A section of passable track that has a temporary speed restriction imposed because various defects or track maintenance has affected the integrity of the track.

Draft Gear
The connection between the coupler rigging and the center sill. This connection receives and cushions the shocks associated with in-train forces or coupling.

Drawbar Forces (In-train Forces)
Forces at the couplers between cars and/or locomotives that may be either draft (stretched) or buff (compressed), depending on train operation.

Dynamic Brake
An electrical device that converts some of the energy developed by a moving locomotive into an effective retarding force.

Dynamic Brake Holding Feature
A feature of the lead, controlling locomotive that allows dynamic braking effort when a PCS open condition exists.

Dynamic Brake Interlock (DBI)
A device that will automatically keep the locomotive brakes from applying when automatic brakes are applied during dynamic braking.

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High Capacity Dynamic Brakes
Provide approximately 13,500 lbs. of effort per axle instead of 10,000 lbs. per axle as other dynamic brake systems.

Flat (Grid Control) Dynamic Brake System
A dynamic brake system that provides retardation that is controlled solely by the position of the dynamic brake lever. Maximum retardation occurs at Position 8.

Taper (Speed Control) Dynamic Brakes
A dynamic brake system that provides retardation relative to both speed and dynamic brake handle position. The higher the speed, the greater the retarding force developed for a given handle position. At higher speeds, full dynamic brake effort is reached at Position 4.

Electronic Alertness Control
A safety control system that senses the activity of the engineer. As the engineer goes about normal activities, any such changes will reset the control and start a timing circuit. If, during the timing period, no additional activity is detected, an audible and/or visual alarm occurs. If activity still doesn't occur for another period, approximately 6 seconds, a penalty brake application is initiated.

Electronic Controlled Brakes
An air brake system that can be controlled electronically is referred to as electronically controlled pneumatic brakes or ECP. The ECP systems that are being utilized are overlay brake systems. Overlay means the freight car brake system can be operated in either ECP or conventional pneumatic mode. All cars in the train must be equipped with ECP to operate in the electric mode.

Emergency Application
A rapid reduction of brake pipe pressure that causes the control valves to move to the emergency position and the vent valves to open. This equalizes auxiliary reservoir, emergency reservoir, and brake cylinder pressures.

Emergency Brake Valve
A manually operated device on equipment that initiates an emergency brake application.

Emergency Reservoir
A storage volume, charged from the brake pipe, to receive and store air used during emergency brake applications and certain recharge features.

Empty Bulk Commodity Unit Train
A train made up entirely of similar car types used to haul coal, grain, ore, potash, molten sulfur, soda ash, phosphate, rock, oil, ethanol, taconite or other bulk commodities. This includes empty tank car trains with loaded buffer car(s) placed at either end of the train where locomotive(s) are present.

End of Train Telemetry System
Telemetry Components

End-of-train telemetry devices is a radio end-of-train telemetry system that consists of:

- End-of-train device (ETD) mounted on the trailing coupler of the last car.
- Head-of-train device (HTD) mounted in the locomotive.

An ETD that has not been armed to, provides:

- Last car brake pipe pressure monitoring.
- Last car motion status (moving or stopped).
- Marker light status (on or off).
- ETD battery status.

An ETD that has been armed to (emergency enabled), provides capability to initiate an emergency brake application at the rear of the train. Both the HTD and ETD must be equipped for two-way communication and the HTD must be armed to the ETD (emergency enabled). An Emergency toggle switch associated with the HTD cab display is used to activate the ETD emergency valve.

A system of components that determines the rear car brake pipe pressure and transmits that information to the display on the controlling unit.

A 2-way ETD transmits and receives information between the head-end and rear-end units. The additional purpose of a 2-way ETD is to provide a way to initiate from the locomotive an emergency brake application at the rear of the train. For this to happen, both the head-end and the rear-end units must be equipped for two-way communication and armed (emergency enabled). An Emergency toggle switch associated with the ETD cab display is used to activate the ETD emergency valve located on the rear- end unit.

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Equalizing Reservoir
A small reservoir connected to a piston or diaphragm chamber and used in automatic air brake operations. It is only cut in on the controlling unit. The reservoir's purpose is to add a volume of air to one side of the chamber, which can be accurately controlled.

When a brake pipe reduction occurs, air is drawn from the equalizing reservoir. The reservoir then automatically draws the proper amount of air from the brake pipe. For this reason, the brake pipe pressure and the equalizing reservoir pressure are always the same, except when they are equalizing after a brake pipe reduction or a brake pipe charging operation.

Foundation Brake Gear
The levers, rods, brake beams, etc. that connect the brake cylinder piston rod to the brake shoes so that when air pressure forces the piston out, the brake shoes are forced against the wheels.

Full Service Application
A brake pipe reduction made only to the point at which the auxiliary reservoir and brake cylinder pressures equalize. Any further reduction in the brake pipe pressure, except an emergency application, will not affect the amount of pressure in the brake cylinder. Therefore, air is being wasted from the brake pipe (over reduction).

The chart below shows the reduction needed for a full-service application for various initial brake pipe pressures. Also listed is the brake cylinder pressure at full service for various initial brake pipe pressures:

Initial Brake Pipe Pressure	Service Equalization Pressure	Brake Pipe Reduction to Obtain Equalization
90 psi	64 psi	26 psi
105 psi	75 psi	30 psi
110 psi	78 psi	32 psi

Grade (of Track)
Grade is other than level track and is usually expressed as a percentage. The percentage is the number of feet the track rises or falls in a distance of 100 feet. For example, a 1-percent ascending grade means that the track rises 1 foot in elevation for every 100 feet the equipment travels on the track. Unsecured rail equipment may roll on a grade.

Grade designations include the following:

- Light Grade: Less than 1.0 percent.
- Heavy Grade: At least 1.0 percent for a distance of 3 miles or more.
- Mountain Grade: 2.0 percent or greater for a distance of 2 miles or more.

Hand Brake
A mechanical arrangement of levers, chains, rods, gears, and fulcrum. When applied manually by wheel or lever, the hand brake forces the brake shoes against the braking surfaces (wheel tread or disc) to control car or locomotive movement.

Head of Train Device (HTD)
A radio device located in the locomotive cab that communicates with an End of Train Device (ETD). The HTD displays:

- Last car brake pipe pressure.
- Last car motion status (moving or stopped).
- Marker light status (on or off).
- ETD battery status.
- Communication Status with ETD
- 2-Way Armed Status
- Distance measurement referenced to locomotive movement.

And provides:

- Audible alarms pertaining to status changes
- Arming capability to a selected 2-way ETD.
- Interface for Manual and Automatic initiated ETD emergencies

Helper
Distributed power or manned helper added to a train to assist movement.

Horsepower Per Trailing Ton (HPT)
The total horsepower of all working locomotives divided by the total trailing weight of the train and isolated locomotives in tons. For example, a train powered by 15,000 horsepower and a train weight of 4,285 tons with two isolated Locomotives weighing 400 tons has a 3.2 horsepower per trailing ton ratio (15,000 HP divided by 4,685 tons).

Independent Brake Valve
A brake valve that controls the locomotive brakes independent of the automatic brake valve handle position.

Independent Pressure Switch (IPS)
A device on a locomotive that cancels the extended range portion of dynamic braking or all dynamic braking when a sufficient independent brake application occurs. This switch prevents the locomotive wheels from sliding because of excessive braking.

Interchange
A location where railroads exchange rolling equipment.

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Intermodal Equipment
Equipment designed to carry trailers, containers, automobiles.

Intermodal Trains
Trains made up of entirely of intermodal equipment.

Isolation Switch
A switch on diesel electric locomotives that has two or three positions. In the RUN position, the unit is "on the line," responds to control, and develops power. In the ISOLATION (or Stop-Start) position, the unit is isolated from the consist and does not develop power or respond to control.

Linking
The process of electronically connecting the controlling lead unit to the controlling distributed power unit on a distributed power train.

Light Locomotive
One or more units, with or without a caboose, not coupled to cars.

Loaded Bulk Commodity Unit Train
A train made up entirely of similar car types weighing no less than 100 tons each, loaded with coal, grain, ore, potash, molten sulfur, soda ash, phosphate, rock, oil, taconite, or other bulk commodities. This includes loaded tank car trains containing loaded buffer cars weighing 75 tons or greater. Trains with any cars weighing less than 100 tons (excluding loaded buffer cars weighing 75 tons or greater) are not considered loaded bulk commodity unit trains in the application of train make up rules and/or in the application of GCOR 6.23 regarding visual inspection after an emergency stop or severe slack action.

Main Reservoir
An air reservoir on the locomotive for storing and cooling compressed air.

Minimum Continuous Speed
Minimum continuous speed is the slowest speed at which a DC locomotive can operate continuously in Throttle 8. Locomotive traction motors operating under these conditions develop the highest amperage possible before overheating. The minimum continuous speed varies and is indicated by the rating plate on the locomotive.

Minimum Reduction
The first position of the automatic brake valve that initiates a service application of 6 to 8 psi.

Manned Helper
A helper controlled by an engineer in the controlling unit of the locomotive helper consist.

MU Cutout Cock (MU-2-A, Dual-Ported Cutout Cock)
A device for cutting in or out the independent brake valve.

Non-articulated Multi-platform Cars
A car with multiple units (segments) that are connected with solid drawbars. Each unit is a stand-alone unit and does not share a common truck with another unit.

Off Air
Off air means when it is known that a brake system has not been connected to a continuous source of compressed air of at least 60 pounds per square inch (psi) for a period of 4 hours or more. The "source" of compressed air is brake pipe pressure being supplied at the locomotive(s) or yard air connection to the brake system. If brake pipe gradient is observed, no minimum brake pipe pressure at the opposite end of a brake system is required as long as 60 psi or more is being maintained at the charging end of the brake system.

Overcharge
Brake equipment charged to a higher pressure than the regulating valve is adjusted for or can maintain. In such a condition, brakes on a portion of the train may not release.

Penalty Brake Application
An automatic full service brake application caused by various safety devices.

Pneumatic Control Switch (PCS)
An air-operated switch, activated by an emergency or penalty brake application, that drops the engine speed to idle on EMD locomotives or throttle notch 1 on GE locomotives.

Pressure Maintaining Braking
Controlling train speed by making enough of a brake pipe reduction to stabilize speed on a grade, then allowing the automatic brake valve pressure maintaining feature to hold the brake application constant regardless of brake pipe leakage.

Pressure Maintaining Feature
A system designed to overcome brake pipe leakage both in the RELEASE and SERVICE positions of the automatic brake valve. This allows a constant brake application to be held as long as needed.

Reduction (of the brake pipe)
A decrease in brake pipe pressure at a rate and of an amount sufficient to cause a train brake application to be initiated or increased.

Reduction Relay Valve
A device on long cars that helps brake pipe pressure reduce during service and emergency brake applications. The valve compensates for the added length of brake pipe on long cars.

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Regulating Valve
The valve that reduces air pressure from the locomotive's main reservoir to the desired pressure in the brake pipe. The regulating valve will automatically maintain that pressure when the automatic brake valve is in the RELEASE position.

Retaining Valve
A manually operated valve used on cars to exhaust brake cylinder pressure completely or to maintain a predetermined pressure.

Service Application
When brake pipe pressure exhausts at a service rate to apply the train brakes.

Slack Action
Movement of part of a coupled train at a different speed than another part of the same train.

Slug
A unit with traction motors but no diesel engine and incapable of propelling itself. The unit receives electrical power through a power cable from an adjacent, specially equipped locomotive. Slugs are used where low speeds and high tractive effort are needed.

Solid Block (of cars)
Two or more freight cars coupled together and added to, or removed from a train as a single unit.

Thermal Cracks (in wheels)
Cracks in a railroad wheel, normally caused by heat generated on the tread and flange of the wheel from excessive braking.

Throttle Modulation
The action of adjusting the throttle one notch at a time between idle and position 8 to control train speed without the application of air brakes.

Tons per Dynamic Brake Axle
The total gross trailing tonnage of the train divided by the number of axles of locomotives, including helper locomotives, operating in dynamic brake. Refer to locomotive data tables in system special instructions for dynamic brake axle ratings.

When making this calculation, include in the gross trailing tonnage the weight of any locomotive, including a helper locomotive, not operating in dynamic brake or with dynamic brake cut out.

Tons per Operative Brake
The gross trailing tonnage of the train divided by the total number of cars having operative brakes. For example, a 100-car train with all brakes operating, having a total train weight of 6,000 tons, has 60 tons per operative brake (6,000 tons divided by 100 cars).

Train lists showing average tons per car or platform will equal tons per operative brake when:

- The train list is current (no additional pickups or setouts have been made).
- No brakes have been cut out.
- There is one brake per car or platform (Note: This is not the condition for some equipment, such as articulated intermodal cars).

Transfer Train Movement
A train that travels between a point of origin and a point of final destination not exceeding 20 miles. Such trains may pick up or deliver freight equipment while en route to destination.

Unattended
Means cars and/or locomotives left standing and unmanned in such a manner that the brake system of the cars and/or locomotives cannot be readily controlled. The hand brake is considered to be part of the brake system of a car/locomotive.

Vent Valve
A valve attached to the brake system of a car or locomotive. The valve responds to an emergency brake pipe pressure rate of reduction by venting the brake pipe at each vehicle to the atmosphere. As a result, the emergency application spreads throughout the train.

Wheel Sliding
When the wheel rotates slower than lengthwise movement dictates.

Wheel Slipping
When the wheel rotates faster than lengthwise movement dictates.

Yard Test Plant
A system of piping and fittings that supplies air at convenient locations to charge and to test cars without a locomotive.