Southern Pacific
Transportation Company

DEFINITIONS AND FUNCTIONS OF EQUIPMENT USED IN CONNECTION WITH THE AIR BRAKE AND TRAIN HANDLING RULES

Effective October 31, 1976

ST. LOUIS SOUTHWESTERN RAILWAY COMPANY

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R. L. KING
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DEFINITIONS AND FUNCTIONS OF EQUIPMENT

"A" Unit. An engine equipped with a cab and operating controls.

AB Control Valve (Including schedules such as ABD, etc.). The operating device used on freight cars which directs air from the brake pipe to replenish the auxiliary and emergency reservoirs, accomplishes the release of air in the reservoir to the brake cylinder for the various types of brake applications, and also directs the release of the car brake by releasing the pressure in the brake cylinder. It performs each of these operations by sensing a difference in pressure between the brake pipe and the auxiliary reservoir.

ABD Control Valve. Incorporates the same basic features and function as the AB valve, plus an accelerated service release feature, and a modified means of bleeding cars.

Accelerated Emergency Release. A brake release feature of AB brake equipment (including ABD) whereby the brake system of each car assists in recharging the brake pipe after an emergency brake application by permitting air under pressure from the brake cylinder and auxiliary reservoir at each car to flow into the brake pipe, adding to the initial surge of the brake pipe recharge.

Accelerated Service Release. A brake release feature designed into ABD freight brake equipment which functions to assist brake pipe recharging after a service application by permitting air under pressure from the emergency reservoir at each car to flow into the brake pipe, increasing brake pipe pressure, which serially transmits release rapidly through the train. Brake release on a train equipped with ABD brakes is much faster because of this feature.

Adhesion. The coefficient of friction between the wheel and the rail in the longitudinal direction, for acceleration and retardation. It is a direct indicator of the amount of turning force the wheel can impart on the rail before wheel slip occurs. Example: High adhesion (dry, sanded rail) would mean a higher tractive effort can be achieved before wheel slip occurs.

Low adhesion (wet rails) would mean less tractive effort can be achieved before wheel slip occurs. An engine, with good rail conditions, can normally transfer between 20% and 25% of its weight into tractive effort.

Adverse Dynamic Behavior. Motion which is unfavorable to the movement of trains or individual cars, and will, in extreme cases, cause the derailment of a train, or damage the track structure. Examples of adverse dynamic behavior include harmonic roll, truck hunting and vertical bounces.

Air Brake Hose. A reinforced tubing attached to a nipple that screws into the angle cock at the end of the brake pipe of each car or engine. The other end of the hose is fitted with a coupling (gladhand) which engages with an identical coupling on the adjoining car. The complete arrangement forms a flexible air connection between the brake pipes of the cars and engines throughout the train.

Air Compressor. A device, usually of the piston and cylinder form, used to compress air. A compressor can be found on all engines, for the purpose of supplying compressed air to the brake system and other air operated devices, such as pneumatic relays, air horns, windshield wipers, bell, etc.

Air Gauge. An instrument installed on all engines and cabooses, for indicating air pressures of the engine and train air brake pipe. The ability of air gauge to indicate air pressures in the brake pipe and associated components is of significant importance to overall train operation. Measurement of the train brake pipe pressure, main reservoir pressure, pressure in the engine brake cylinders, and the pressure in the equalizing reservoir are all observed on air gauges on the engines.

Alignment Control Couplers. Specially equipped couplers installed on most engines that will allow only limited lateral movement when in buff. This reduces lateral forces on the track, when in buff, and therefore reduces the possibility of rail turnover and jackknifing of the engine consist. Coupler stops have been applied to certain engines that do not have alignment control couplers.

Ampere (Amperage, Amps). The standard unit for measuring the flow of electrical charge. The electrical term "ampere" is analogous to water flow in piping measured in gallons per minute.

Anti-Wheel Slip Control. A system to detect a sliding or slipping wheel of an engine consist. The Anti-Wheel Slip Control will attempt to correct some such occurrences by reducing the power supplied to the traction motors and applying sand.

Auxiliary Reservoir. A storage volume for compressed air, charged from the brake pipe, which provides air pressure for use in service and emergency brake applications. An auxiliary reservoir is located on every car and is contained in the same structure as the emergency reservoir.

"B" End of Car. The end on which the hand brake is located, or as otherwise designated.

"B" Unit. A unit without a cab and complete operating controls. It may be equipped with hostler controls for independent operation, although they are usually used only at terminals or places where the unit must be moved under its own power.

Back Up Hose (Tail Hose). A portable back up valve.

Back Up Valve. An air valve, either portable, as in the case of a tail hose, or permanently connected to the brake pipe (as found on the platform of cabooses), for the purpose of applying the brakes from the rear of a train when it is necessary to make a back up movement. In the case of the portable back up valve (tail hose), it is connected by a hose and coupling to the brake pipe hose.

Balance Speed. The equilibrium speed at which the drawbar force exerted by the engine is equal to the train resistance, resulting in a constant speed. A change in drawbar force (i.e. raising or lowering the throttle or dynamic brake position) or a change in train resistance (i.e. variation in grade) will cause a corresponding change in speed until a new balanced speed is reached.

Bleed or "Bleed Off". A term commonly used for the venting of air pressure to the atmosphere, as in the venting of the air pressure from the brake cylinder of individual cars by manual manipulation of a release valve. This is done at desired times to release the air application from the brake equipment on the cars to be switched. The operation of the release valve depends on the type of brake equipment.

Bleeding of AB Equipment. A release valve of large capacity (which can be operated from any angle) is provided for bleeding the auxiliary and emergency reservoirs. The construction is such that both reservoirs can be discharged at the same time, or just the auxiliary reservoir alone. During either operation brake cylinder air is also being released. On some cars a second rod may be found next to the regular release valve rod, which is connected to a brake cylinder release valve. In this case the brake cylinder release valve may be activated by pulling or pushing the rod connected to it, thus venting the air from the brake cylinder, but leaving both reservoir air pressures intact.

Bleeding of ABD Equipment. Incorporates the same features of the AB equipment; however, the second release rod is not needed because its function is also performed by the first release rod. A momentary pull on this one release rod will release only the brake cylinder air pressure.

Blocking of Couplers. A means of greatly limiting lateral coupler movement of engines by the insertion of metal blocks (coupler stops) next to the drawbar in the coupler pocket.

Bolster (Body). The transverse member of the underframe of a car over the truck which transmits the load carried by the longitudinal sill to the truck through the center plate.

Bolster (Truck). A beam placed across the frame of a truck to receive, through the center plate, the weight of the car body and transfer it to the truck frame and wheels through the springs on which it is carried.

Bolster Blocks (Bolster Stops). Metal blocks affixed to the engine bolster to restrict its movement relative to the truck side frame and thereby reduce the jackknifing tendencies of the engine car body during high buff situations.

Brake Cylinder. A cylinder with a piston and rod, located on each car and engine, that is operated by directing compressed air from the vehicle's reservoir to the piston, forcing it outward. This outward force is transmitted through the brake rigging to the brake shoes, and applies them to the engine or car wheels. When the compressed air is exhausted from the cylinder, the piston is returned to its normal position by a release spring coiled around the piston rod within the cylinder.

Brake Cylinder Release Valve (Car). A valve located on the control valve structure under a car for quickly releasing air from a brake cylinder without draining the auxiliary or emergency reservoirs. It is activated by either pushing or pulling a particular rod on either side of the car, which is linked mechanically to this valve.

Brake Cylinder Release Valve (Engine). A device for the automatic bleeding of air from an underslung hand brake cylinder when hand brake is applied.

Brake Pipe (Train Line.) That section of the air brake piping of a car or engine which acts as a supply pipe for the reservoirs and is the sole connecting means by which the car brakes are controlled by the engineer. The pipe is 1¼ inches (inside diameter), and extends from one end of the car to the other. At the ends, flexible hoses provide connections between the cars. When a train is made up and all brake pipes on the cars are joined together, the entire pipe line comprises what is commonly called the brake pipe.

Brake Pipe Gradient. The relative difference in brake pipe pressure, head to rear, due to air leakage and the air flowing through a pipe, causing air pressure of the brake pipe to vary from a higher value at the head end of a train to a lower value at the rear.

Brake Pipe Vent Valve. A valve attached to the brake system of a car or engine which responds to an emergency rate of reduction of the brake pipe pressure, by locally venting the brake pipe to the atmosphere, thereby serially transmitting the emergency application throughout the train. On freight cars, this valve is held open on each car by the air from the quick action chamber, and will seat only after the quick action chamber is exhausted (usually 70 seconds), thus making immediate recovery from an emergency application impossible. Until such time as the brake pipe vent valve seats, the brake pipe has a direct connection to the atmosphere and the pressure in the brake pipe will remain at zero.

Braking Power. A term used to describe the ability of a train to stop, based on tons per operative brake, with the effect of increasing braking power when the tons per operative brake is reduced.

Buff. A term used to describe compressive coupler forces.

Bunch Braking. A term used to describe the deceleration of a train by allowing the train to slowly run in against the engine, and then braking the train. This has the effect of stopping the train with all of the slack in a buff condition.

Cab Signal. A device or devices whereby the indication of signals on the track ahead is indicated in the cab of the engine by a display of colored lights or other signals. Used on "hump" engines.

Center Plate. One of a pair of plates which fit one into the other and which support the car body on the trucks, allowing them to turn freely under the car. The center pin passes through both. The body or male center plate is attached to the under side of the body bolster; or in cast steel bolsters it is made an integral part of the casting. The truck or female center plate is attached to the top side of, or cast integral with, the truck bolster. When the car is tilted, as on a curve, part of the weight is carried on the side bearings.

Center Sill. The central longitudinal member of the underframe of a car, which forms the backbone of the underframe and transmits most of the buffing shocks from one end of the car to the other. In freight cars with cushioned underframe, there is a special type of floating center sill construction.

Compensated Grade. A grade, the curved portion of which has been reduced by an amount sufficient to compensate for the resistance due to the curvature.

Compression of a Train. A term used to describe the application of opposite longitudinal inward (buff) forces along a single axis of a train. Compression and bunching of a train may be considered synonymous.

Control Stand. The upright column upon which the throttle control, reverser handle, transition lever, and dynamic braking control are mounted within convenient reach of the engineer on an engine. The air gauges and some control switches are also included on the control stand.

Control Unit. The unit from which the engineer operates the engine consist under his control.

Control Valve. A three-way valve on engines and cars which charges the reservoirs and controls the application and release of air pressure to or from the brake cylinder in response to the reduction or increase of brake pipe pressure.

Cresting Grade. A long ascending grade which rapidly changes to a long descending grade, both of significant magnitude, to require a change in the train handling procedures.

Draft. A term used to describe tension coupler forces.

Draft Gear. The name of that unit which forms the connection between the coupler rigging and the center sill. The function of this unit is to receive the shocks associated with train movements and the coupling of cars, and to cushion the force of impact so that the maximum unit stress is brought within the capacity of the car structure for freight service. The types of draft gear now in use are friction, spring, rubber, and hydraulic.

Drag Rating. The amount of drawbar pull available from an engine consist calculated at the minimum continuous speed.

For mixed engine consists, the highest minimum continuous speed of any unit in the consist is used for the whole consist in calculating the drag rating.

Drawbar Forces. Longitudinal forces at the couplers between cars and/or engines that may be either tension (draft) or compressive (buff), depending on the handling of the train at the time.

Dynamic Brake Interlock (D.B.I.). A device installed on an engine that will automatically prevent the engine brakes from applying when an automatic brake application is made during dynamic braking operation.

Dynamic Braking. An electrical means used to convert some of the power developed by the momentum of a moving engine into an effective retarding force.

The traction motors, being geared to the axles, are rotating when the train is moving. When using the dynamic brake, electrical çircuits are set up which change the traction motors into generators when the engine is running and "on the line." Since it takes power to rotate

a generator, this action retards the speed of the train. The power generated by the traction motors is fed to the resistor grids and dissipated as heat. The dynamic brake produces a braking effect similar to an independent brake. The load indicating meter indicates the amperage each traction motor is developing. The higher the amperage, the more retarding force is being generated. (See Field Loop Control and Potential Control.)

Dynamically Stable Train. A train where all the dynamic forces are in equilibrium in such a way that critical conditions are not exceeded and, therefore, there will be little tendency towards derailment.

Dynamiter. A term defining a defective control valve which will create an emergency application and serially transmit the emergency application throughout the train, even though such action was not desired by the crew. Common causes are stuck valves in the car's control valve, or the movement of these valves due to the vibration and/or slack action of the car. (See Undesired Emergency.)

Electronic Alertness Control. A type of safety control system involving a low-powered radio frequency circuit that senses the movements of an engineer.

Emergency Application. A rapid, heavy exhausting of air pressure from the brake pipe which exceeds the service rate of reduction and actuates the brake pipe vent valves at each car. This insures the transmission of the emergency application throughout the train. This rapid loss of air pressure can be caused intentionally by opening any valve connected to the brake pipe (which is capable of quickly lowering the pressure of the brake pipe), or unintentionally by the train parting, a burst air hose, or other sources. To initiate an emergency application, a minimum of approximately 50 psi is needed in the brake pipe.

Emergency Reservoir. A storage volume for compressed air, recharged by the brake pipe, to provide air pressure for use in emergency brake applications and certain recharge features (accelerated service release feature of ABD valve for example). An emergency reservoir is located on every car, contained in the same structure as the auxiliary reservoir.

Emergency Stop. A stop which necessitates stopping in the shortest possible distance.

End-of-Car Cushioning Device. A unit installed at the ends of some cars which develops energy-absorbing capacity through a hydraulic piston arrangement supplemented by springs to assure positive repositioning of the unit, in order that the maximum designed longitudinal cushioning for that device can be realized in both directions.

Equalizing Reservoir. A small reservoir which is connected to an equalizing piston or diaphragm chamber for use in automatic air brake applications. The reservoir-piston chamber or diaphragm arrangement is a part of the automatic brake valve and is cut in on the controlling unit of a multiple unit consist. The reservoir's main purpose is to add volume to one side of the piston chamber.

When a brake pipe reduction is made, air is reduced from this reservoir which automatically reduces the proper amount of air from the brake pipe. For this reason the brake pipe pressure and the pressure in the reservoir are always the same, except when they are equalizing during a brake pipe reduction, or brake pipe charging. The equalizing reservoir lends stability to and reduces air from the brake pipe at a controlled rate.

Field Loop Control. A type of dynamic brake control which requires a special jumper cable in addition to the main jumper cable between units that are coupled in multiple control.

Flange Lubricator. A track mounted device, which is used to apply grease or oil to the flanges of a wheel for the purpose of reducing track and flange wear.

Flat Spot. Loss of roundness of the tread of a wheel, caused by wheel sliding.

Flow Indicator. An instrument which indicates the rate of flow of air through the automatic brake valve to the brake pipe.

Foundation Brake Gear. The levers, rods, brake beams, etc., by which the piston rod of the brake cylinder is connected to the brake shoes in such a manner that when air pressure forces the piston out the brake shoes are forced against the wheels.

Gauge (of the Track). The distance between the rails measured from the inside head of each rail at a right angle ½ inch below the top of the rail. The standard for this dimension is 4 ft. 8½ inches.

Generator. A rotating electrical machine which changes mechanical energy into electrical energy. The main generator on a diesel unit receives power from the diesel engine and delivers electrical energy to the traction motors.

Gross Weight. The total weight of a car, including the lading.

Ground Relay. A protective device that will unload an engine (not allowing it to develop power) in the event of a short circuit or ground in the electrical equipment. This is done to insure the safety of the crew on the engine and to prevent further damage to the equipment.

Hand Brake. An arrangement of levers, rods, gears and fulcrum, actuated manually by a wheel or ratchet lever, used on cars or engines, to force the brake shoes against the braking surfaces (wheel tread or disc) to prevent movement of cars or engines when in the APPLIED position.

Harmonic Roll. A term for the excessive lateral rocking of cars and engines, usually at low speeds and associated with jointed rail. The speed range at which this cyclic phenomenon occurs is between 10 and 25 MPH, with the exact speed determined by such factors as the wheel base, height of the center of gravity of each individual car or engine, the spring dampening associated with each vehicle's suspension system, and the relative difference in elevation between successive joints in jointed rail territory.

Hazardous Materials. Materials with chemical and/or physical properties that are dangerous to life.

Examples are: explosives, poisons, flammable liquids and solids, corrosive liquids, compressed gasses, oxidizing materials and radioactive materials.

Heavy Ascending or Descending Grade. A grade 1.5% or more.

Helper. An engine entrained to assist in the movement of the train.

H.P./Ton Ratio (Horsepower per Ton Ratio). The ratio of the total amount of horsepower available to move a train divided by the total weight of the train in tons. This ratio will then yield the amount of horsepower being used to move one ton of the train.

Hump (Crest). The act of switching and classifying a train with gravity being used as the prime mover, and movement of car or cars controlled by some form of retardation.

Independent Pressure Switch (I.P.S.). A device installed on an engine that will automatically cut out the extended range dynamic braking when an independent brake application of 15 psi with cast iron shoes and 23 psi with composition shoes is made. The purpose is to assist in preventing the wheels of the engine from sliding due to excessive braking forces.

Isolation-Engine Run Switch. An electrical switch which disconnects the controls of that unit from the cab control circuits. The switch on a unit has two positions. In the "run" position, the unit is "one the line," and will respond to control and develop power in operation. In the isolation or "start-stop" position, the unit is isolated from the consist and will not develop power or respond to control, but will remain in an "idle" condition. The isolation position is also used for setting up controls to normally stop or start the diesel engine.

Kinetic Friction. Friction of motion, such as that between the brake shoe and wheel (when the wheel is turning) or as between a wheel and rail (during sliding or slipping). Kinetic friction is always less than static friction.

Light Ascending or Descending Grade. A grade less than 1.5%.

Load Indicating Meter (Ammeter, Load Meter). This meter monitors the amperage of an engine traction motor, usually the number two motor. Since the amperage should be the same for all traction motors of a unit, the amperage in all the motors is effectively known. It will not monitor the amperage of other units in the consist.

Main Reservoir. An air reservoir on an engine for storing and cooling compressed air.

Minimum Continuous Speed. The minimum speed at which an engine can operate continuously under heavy load conditions, without damaging the traction motors. This speed is based on the maximum amperage the traction motor can accept without overheating.

Mixed Consist. Operation of other than identical units in a single engine consist.

Multiple Unit (M.U.). Two or more units operated from a single control stand.

Node. The point of zero buff or draft coupler forces in a train using helpers. The node location fluctuates in a train due to changes in the terrain or in the control settings of the engine consist.

Overcharge. A situation in which the brake equipment of cars and/or engines is charged to a higher pressure than the maximum brake pipe pressure that can normally be achieved in that part of the train.

Overspeed Control. A safety device that will cause a penalty brake application when the speed (MPH) of the engine exceeds that of the overspeed setting.

Performance Control System (Power Matching). A system which automatically controls the horsepower output of a unit during low speed operation to provide maximum tractive effort within the adhesion capabilities of the unit. This system also allows compatible operation with lower horsepower units.

Pneumatic Foot Valve. A type of safety control system which must continuously depressed with the engineer's foot while operating the engine to avoid the train or engine being automatically stopped.

Potential Control. A type of dynamic braking control by which each unit in potential dynamic braking adds to the braking effort. No field loop cable is required.

Power Control (P.C.). An electrical device that will automatically reduce the engine to idle. Power Control can be initiated by an emergency, safety control or overspeed brake application. Automatic sanding will occur during a Power Control situation.

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

Regulating Valve (26-L Brake Equipment Only; Feed Valve on All Other Equipment). The valve that reduces air pressure from the main reservoir of the engine to the pressure desired in the brake pipe. The valve will automatically maintain that pressure when the automatic brake is in RUNNING or RELEASE position.

Release Rod. A bleed rod.

Retaining Valve. A spring-loaded check valve or a restricting exhaust choke in series with the brake cylinder exhaust located on each car which when turned to an operating position will maintain a retarding force on cars on a descending grade while the brake system is being recharged.

Ruling Grade. That section of track which will offer the most resistance to train movement due to an increase in elevation between two specific points.

Run-In. The relative movement of the cars in the train to a state of compression.

Run-Out. The relative movement of the cars in the train to a state of tension.

Running Release. Release of an automatic brake service application while the train is in motion.

Sanders. A pneumatic or electric device which applies sand to the rails in front of the driving wheels to improve adhesion.

Service Application. Exhausting the brake pipe at a service rate to apply the train brakes. This may be one reduction or a series of reductions initiated by the movement of the automatic brake valve handle.

Service Rate. The rate, slower than emergency, at which the brake pipe pressure is reduced during a service application, to cause the control valve at each car to assume its service position and vent air from the auxiliary reservoir to the brake cylinder on each car.

Sliding Center Sill Cushioning Devices. Equipment installed between a fixed center sill and an auxiliary sliding sill that absorbs shock to the car. The sliding sill travels longitudinally through the fixed sill and acts as a single unit throughout the car.

Slug. A cabless unit which has traction motors, but no power supply. Power is provided by power cables from an adjacent unit. Slugs are used where low speeds and high tractive effort or dynamic brake is needed.

Snubbers. Damping devices which are used to reduce the harmonic roll of a car. Snubbers are very similar to shock absorbers.

Split Service Reduction. A brake pipe reduction less than the fully desired reduction, followed by further light reductions until the desired total amount is reached. A smoother slowdown or stop is the principal advantage of this method.

Stretch Braking. The decelerating of a train by application of the automatic brake while the engine is still working in power. This tends to keep the slack of the train stretched out, thus the reason for the term "stretch" braking.

Stringlining. The tendency of cars to pull off the inside of curves, trying to approach a straight line when the train is in draft.

Surprise Stop. A stop necessitated by conditions which are unplanned, unanticipated and when sufficient time does not exist for slack adjustment.

Tare Weight. The stencilled weight of an empty car.

Tension (of a Train). A term used to describe the application of two opposite outward forces (draft) along a single axis of a body. The terms tension and stretching (of a train) are synonymous.

Thermal Cracking of Wheels. Cracks in a wheel caused by excessive heat normally generated by extreme braking forces on the tread and flange of the wheel.

Track-Train Dynamics. A term used to describe the dynamic motion and the resulting forces due to the interaction of the engines and cars coupled into a train interacting with the track, under given climatic conditions, train handling, train makeup, grades, track curvature and operating policies.

Track-Train Environment. All the conditions which affect the track and/or the train, such as grades, track curvature, engine and car characteristics, train handling, train makeup and climatic conditions.

Traction Motor. A device that converts electrical energy into mechanical energy which drives the engine wheels. It is mounted directly on each driving axle between the wheels of an engine truck.

Traction Motor Cut-Out Switch. A switch to cut out defective traction motors.

Truck Hunting. An instability at high speed of a wheel set (truck), causing it to weave down the track, usually with the flanges striking the rail.

Undesired Emergency. An emergency application serially transmitted throughout the train caused by a car or engine having a defective brake pipe, hose or control valve.

Undulating Grade. A track profile with grade changes so frequent that a train passing over the track may have cars on three or more alternating ascending and descending grades.

Vertical Bounce. An instability at high speed where the car or engine oscillates vertically on the suspension system.

DESCRIPTION AND OPERATION— AIR EQUIPMENT

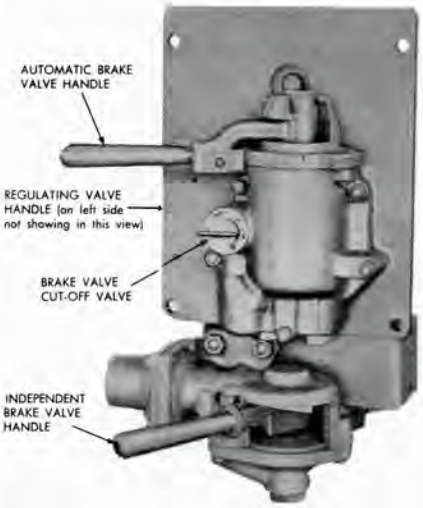
26-L BRAKE EQUIPMENT

The 26-L Brake Equipment is designed to meet present day train handling requirements for freight and passenger locomotives. This equipment can be conditioned for either type of service without altering the piping or devices. Also this equipment is suitable for multiple unit operation with previous types of equipment.

Important features of this equipment are as follows:

1. Prompt, flexible brake applications and releases for smooth operation.
2. Pressure maintaining of brake pipe and brake cylinder pressures.
3. Safety control.
4. Overspeed control.
5. Penalty brake applications.
6. Power and dynamic brake cut-off during penalty brake applications.
7. Break-in-two protection

26-C Automatic Brake Valve:



The 26-C Automatic Brake valve is a self-lapping brake valve and consists of two portions: the automatic portion regulating the brake pipe pressure controlling both engine and train brakes. The independent portion applies and releases engine brakes independent of the train brakes and releases engine brakes after an automatic application.

The automatic brake valve also provides a brake pipe pressure maintaining feature which maintains brake pipe pressure against overcharge and leakage, as related to equalizing reservoir pressure, except when the brake valve cut-off valve is placed in OUT position.

The regulating valve takes the place of the feed valve that is common on other types of brake equipment. This valve regulates the supply and exhaust of air pressure to the equalizing reservoir, which in turn regulates brake pipe pressure.

The automatic brake valve handle has six handle positions arranged from left to right as follows:

Release (Running) Position.

This position is for charging the equipment and releasing the engine and train brakes. It is located with the brake valve handle at the extreme left of the quadrant and is the normal running position.

Minimum Reduction Position.

This position is located with the brake valve handle against the first raised portion on the quadrant to the right of RELEASE position. With the brake valve handle moved to this position, a five to seven pound brake pipe reduction is obtained.

Service Position.

This position consists of a sector of brake valve quadrant to the right of MINIMUM REDUCTION position. Movement of the brake valve handle from left to right through this sector will cause the degree of brake application to be increased and automatically lapped (brake pipe pressure maintained according to position of handle) until a 26 pound brake pipe reduction is obtained. Additional brake pipe reductions may be made by moving the brake valve handle farther to the right on the second raised portion of the quadrant toward HANDLE OFF position until the desired reduction of equalizing reservoir pressure has been made. A continuous service brake pipe reduction is obtained in HANDLE OFF position.

Suppression Position.

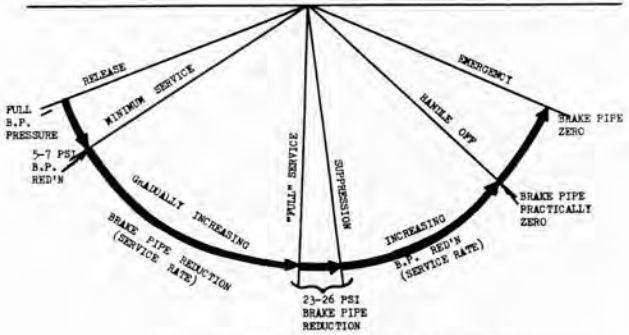
This position is located with the brake valve handle against the second raised portion of the quadrant to the right of RELEASE position. The brake valve handle must be placed in this position to recover the PC switch after a safety control brake application has occurred.

Handle Off Position.

This position is the first quadrant notch to the right of SUPPRESSION. This is the position in which the handle must be placed and removed on trailing units of a multiple unit engine or on unit(s) being towed Dead-In-Train, or in helper service. A continuous service brake pipe reduction is obtained in this position to zero pounds.

Emergency Position.

This position is located to the extreme right of the brake valve quadrant. It is used to make brake valve emergency brake applications. When an emergency brake application is initiated from other than the automatic brake valve, the handle must be moved to EMERGENCY and left in this position until train stops. After 70 seconds or longer, reset the A-1 Charging Cut-Off Pilot valve by placing the handle in RELEASE position.

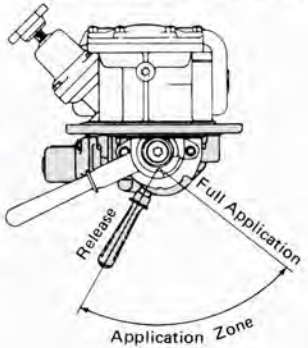


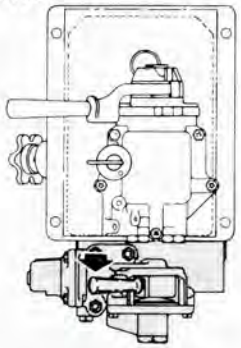
26-C AUTOMATIC BRAKE VALVE
HANDLE POSITIONS

The brake valve cut-off valve is provided to cut in and cut out the automatic brake valve. The handle is spring loaded and must be depressed before the valve can be turned. Two position type cut-off valves are employed with positions IN and OUT. IN position provides direct release operation only when handle is placed in RELEASE position. OUT position is used when the brake valve is cut out on trailing units, double heading or hauled Dead-In-Train. The use of OUT position also causes the pressure maintaining feature to cease functioning and the brake valve cut-off valve handle is therefore turned to this position when conducting brake pipe leakage tests.

The three position cut-off valve has FREIGHT, PASSENGER and OUT positions. In PASSENGER position, the graduated release feature provides for an increase in equalizing reservoir pressure as the handle is moved toward RELEASE position. FREIGHT position provides the same function as the IN position on the two position brake valve cut-off valve.

SA-26 Independent Brake Valve:





Independent
Brake Valve Handle
Positions

Press Handle Down To Release
Automatic Application Of
Locomotive Brakes

The SA-26 Independent Brake Valve, mounted on the front of the pipe bracket of the 26-C Brake Valve provides independent control of the engine brake cylinder pressure irrespective of the train brakes. The brake valve handle has two positions; namely, RELEASE position at the extreme left end of the quadrant and FULL APPLICATION position at the extreme right end of the quadrant. From RELEASE to FULL APPLICATION position is an APPLICATION ZONE or sector and the farther the handle is moved to the right into the sector, the greater will be the application until a full application is obtained at the extreme travel of the handle. The valve is a self-lapping pressure maintaining type valve and holds constant pressure.

The self-lapping feature allows the engine brakes to be graduated on or off.

Following an automatic brake application, depressing the independent brake valve handle when the handle is in RELEASE position will cause the release of engine brake cylinder pressure. Depressing the independent brake valve handle in the APPLICATION ZONE will release the engine brake cylinder pressure only to the value corresponding to the position of the handle in the APPLICATION ZONE.

MU-2-A Valve, MU-2-A-1 Valve, or Dual Ported Cut-Out Cock:

The independent brake valve is cut in or out by positioning the MU-2-A valve, MU-2-A-1 or the dual ported cut-out cock.

The MU-2-A valve enables a 26-L equipped unit to operate in multiple with other 26-L or 24-RL units. The MU-2-A and MU-2-A-1 are spring loaded valves the handle must be depressed before the valve can be positioned in the LEAD or DEAD or one of the TRAIL positions. The dual ported cut-out cock positions are identified as IN or OUT.

Regulating valve on the 26-C brake valve is used for setting the brake pipe pressure desired. Turning of the adjustment handle with the automatic brake valve in RELEASE position determines the equalizing reservoir pressure which, by means of a self-lapping valve, governs the brake pipe pressure.

26-F Control Valve:

An automatic type of control valve consisting of a service portion and a quick release portion. The control valve responds to service or emergency rates of brake pipe reductions. Brake cylinder pressure is developed through a control reservoir by these brake pipe reductions.

The service valve portion contains a service spool valve and two rubber diaphragms selected to provide proper brake cylinder pressure development by reduction in brake pipe pressure. The application and release valve controls movement of the air from the auxiliary reservoir to the brake cylinder.

When a reduction in brake pipe pressure occurs, the service spool valve assembly moved upward and opens the application valve. The service valve spool also serves to exhaust the brake cylinder pressure whenever the brake pipe pressure is increased. The diaphragm area ratios and spring arrangement in the service valve portion permit stable operation of the automatic brake with proper development of brake cylinder pressure to operate satisfactorily with other systems of automatic air brake control. The service portion also includes a charging valve that cuts off the flow of air from the quick service volume to atmosphere.

A direct or graduated release cap is located on the service portion. The position is determined by the type of service in which the engine is to be used. It is necessary to drain air pressure in the control valve before positioning this cap by reducing brake pipe air to zero. The letters DIR over the letters REL indicate the valve is set for direct release and the letters GRA over the letters REL indicate the valve is set for graduated release.

The service portion also contains two brake cylinder pressure limiting valves. One limits the maximum brake cylinder pressure obtained during service brake applications and the other limits the maximum brake cylinder pressure obtained during emergency brake applications.

Independent Quick Release Valve:

The quick release valve portion is designed to permit independent release with an automatic brake application in effect. Depressing the independent brake valve handle causes the operation of the small diaphragm and spool valve assembly in the quick release valve portion. Movement of this diaphragm and spool valve vent to atmosphere the air pressure developed in the service application pipe to the relay valve. **This prevents re-applicgtion of the engine brake upon release of the independent brake valve handle until another reduction is made.**

P-2-A Brake Application Valve:

Provides a service penalty brake application when activated by Safety Control (foot pedal or overspeed). The valve makes the necessary port connections to charge the equalizing reservoir. When the application valve is moved to APPLIED position, the ports are aligned to allow equalizing reservoir air to be reduced, resulting in a penalty brake application.

During such an application, main reservoir air is connected to the PC switch.

Incorporated in the P-2-A is a suppression valve. The automatic brake handle must be placed in SUPPRESSION position to reset the P-2-A valve after a penalty brake application. During normal service braking or when the independent brake is applied and brake cylinder pressure has reached approximately 25 psi, the P-2-A suppression valve will be actuated, thus nullifying a penalty brake application.

J Type Relay Valves:

Diaphragm operated, self-lapping type valves used to develop brake cylinder pressure during brake applications and exhaust this pressure during release of engine brakes from either an automatic or an independent brake application. The maintaining feature of this valve will operate to maintain brake cylinder pressure should an air leak be present.

The type of brake shoes used on an engine determines which type "J" relay valve is used.

All SA-26 independent brake valves are set at 45 psi. When 45 psi is delivered to the J-1 relay valve on an engine equipped with cast iron brake shoes, the valve will reproduce 100% of this pressure (45 psi) to the brake cylinders. The J-1.6-16 relay valve used on engines equipped with composition brake shoes will deliver to the brake cylinders 60% more pressure than is supplied from an independent brake application only. For example, when 45 psi is delivered to the J-1.6-16 relay valve from the independent brake valve, the J-1.6-16 will reproduce 72 psi in the brake cylinders. The reproduction of an automatic brake application remains 100%.

Other types of relay valves will provide different brake cylinder pressure, however, brake cylinder equalizing pipe pressure is maintained at 45 psi. (See badge plate on engine for type of relay valve.)

A-1 Charging Cut Off Pilot Valve:

Operates in emergency applications other than those initiated by the automatic brake valve to provide automatic timed sanding, power knockout (PC), dynamic cut-off, and brake pipe cut-off. These features are provided on some engines by means of H-type Relayair Valves.

Reset is accomplished by placing the automatic brake valve handle in EMERGENCY position for approximately 70 seconds and then to RELEASE position.

Vent Valve:

Ensures rapid propagation of an emergency brake application throughout the train by locally venting brake pipe pressure when actuated.

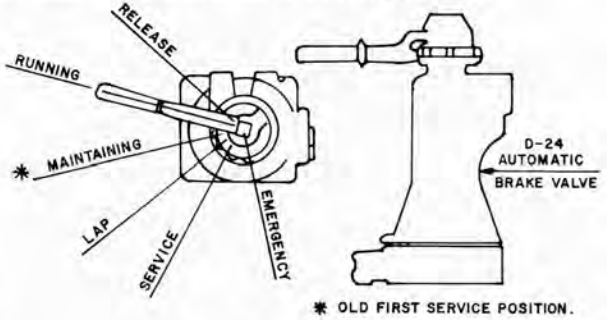
Dead Engine Feature:

An arrangement consisting of a cut-out cock, reducing valve and check valve located between the brake pipe and 2 main reservoir that when cut in, charges main reservoir with air from the brake pipe. This provides air pressure for the brake cylinder relay valve to put into the brake cylinders when the control valve calls for a service or emergency brake application when engine is hauled Dead-In-Train.

24-RL BRAKE EQUIPMENT

This equipment can be used in any type of freight or passenger service.

D-24, DS-24 and DS-24-M Automatic Brake Valves are used in the operation of 24-RL equipment.



* OLD FIRST SERVICE POSITION.

D-24 MAINTAINS IN FIRST SERVICE POSITION ONLY
DS-24-M MAINTAINS IN FIRST SERVICE AND LAP POSITIONS.

NO. 24 RL BRAKE EQUIPMENT

The brake valve portion is attached to the rotary valve seat portion. The automatic brakes are controlled by the automatic brake valve handle which has six positions. Movement of the handle is transmitted through the rotary key to rotary valve which is thereby rotated to establish port connections according to its position.

The six positions of the automatic brake valve from left to right are:

Release Position.

In RELEASE position, a warning port is open in the brake valve and the sound of exhausting air is audible. The brake system cannot be overcharged with this equipment as the selector valve handle has been removed and a blanking plate applied. Feed valve air is supplied to brake pipe in this position and will charge brake pipe to setting of feed valve.

Running Position.

This position is for charging the equipment and releasing the engine and train brakes. Feed valve air is supplied to the brake pipe in this position and will charge brake pipe to setting of feed valve. With both the independent and automatic brake valve handles in RUNNING position, the engine brakes will remain released due to the control valve being in RELEASE position. When the brakes are not being used, this is the normal position for the brake valve handle.

Pressure Maintaining Position.

This position on D-24 and DS-24 brake valves, which have been converted for pressure maintaining, provides for maintaining a service brake pipe reduction against brake pipe leakage. The service brake reduction is made in SERVICE position then the brake valve handle is returned to PRESSURE MAINTAINING position while air is exhausting from the service exhaust port (DO NOT PAUSE ON LAP). The brake valve handle must not be moved from PRESSURE MAINTAINING position to RUNNING or LAP, then returned to PRESSURE MAINTAINING. More than one service application can be made by moving the brake valve handle from PRESSURE MAINTAINING position to SERVICE position, then return directly to PRESSURE MAINTAINING position.

LAP Position.

In LAP position, the pressure maintaining feature is cut out on D-24 and DS-24 brake valves. All operating ports are closed in this position, therefore, brake pipe leakage will cause engine and train brakes to apply.

On DS-24-M brake valves with maintaining cut-off valve handle turned to IN position, the brake valve maintains in LAP position. When handle is turned to OUT position, the maintaining feature is cut out and the brake valve will function in the same manner as a brake valve not equipped with maintaining feature.

Service Position.

In this position, feed valve supply to brake pipe is cut off. The equalizing reservoir is exhausted to atmosphere through preliminary exhaust port, actuating the equalizing discharge valve to exhaust brake pipe air a corresponding amount through discharge valve and rotary valve exhaust at a service rate.

NOTE: Maintaining feature must be cut out when performing air brake leakage test.

Emergency Position.

When the brake valve handle is in EMERGENCY position the rotary valve connects the various passages to provide a large direct exhaust passage from the brake pipe to atmosphere so that an emergency rate of brake pipe reduction is obtained.

S-40-F Independent Brake Valve:

The independent brake valve used with 24-RL brake equipment is the S-40-F type. This is a self-lapping brake valve and controls engine brake cylinder pressure independent of the train brakes.

The valve has two handle positions with an APPLICATION ZONE as follows:

Release Position:

Normal position of the handle with engine brakes released. The handle may be depressed in this position when it is desired to release the engine brakes with an automatic brake application in effect.

Application Zone.

The zone between the extreme positions. Movement of the handle to the right into this zone will provide increased brake cylinder pressure in relation to the position of the handle within the zone, until maximum pressure is reached in the FULL APPLICATION position. Movement of the handle to the left will decrease the pressure accordingly.

Depressing the independent brake valve handle in RELEASE position, following an automatic brake application, will cause the release of engine brake cylinder pressure. Depressing the independent brake valve handle in the APPLICATION ZONE will release engine brake cylinder pressure only to the value corresponding to the position of the handle in the APPLICATION ZONE.

Full Application Position.

This position provides maximum brake cylinder pressure as determined by the self-lapping portion adjustment. A notch can be felt in this position and provides a locking arrangement to prevent the handle from being easily moved.

K-2-A Rotair Valve or Dual Ported Cut-Out Cock:

The K-2-A valve has four positions: PASSENGER, PASSENGER LAP, FREIGHT, and FREIGHT LAP. Its purpose is to cut in the independent brake valve in PASSENGER or FREIGHT position. In either LAP position, independent brake valve is cut out.

The purpose of the dual ported cut-out cock is to cut in or out the independent brake valve.

The K-2-A or dual ported cut-out cock enables a 24-RL equipped unit to operate in multiple.

Feed Valve:

The feed valve is located on the bottom of the brake valve pedestal to the front. Its purpose is to control the pressure in the brake pipe and maintain it at a predetermined setting.

D-24 Type Control Valve:

The D-24 type control valve, when actuated by the brake valve, charges, applies and releases the brakes of the engine and consists of the following portions:

Service Portion:

Controls the application and release of the engine brakes in accordance with the automatic brake valve handle movement or actuation of engine safety devices.

Emergency Portion:

Controls the emergency brake application to provide high emergency application pressure and also provide accelerated release after emergency application.

Independent Application and Release Portion.

Provides independent engine brake application and release as controlled by the independent brake valve as well as quick independent release.

Dead Engine Portion.

Permits charging of the main reservoir when the engine is hauled Dead-In-Train. A cock is located on this portion which is used for cutting in and cutting out the dead engine feature.

Changing Change-Over Cock.

On engines so equipped, the charging change-over cock on the service portion of D-24 control valves determines fast or retarded charging or recharging of the auxiliary reservoir. Cast letters on the cock body FRGT and PASS indicate positions of the cock, for freight and passenger service, respectively. In FRGT position, the rate of recharge is retarded.

Relay Valve.

The relay valve relays the application and release operation of the control valve by reproducing in the brake cylinders the equivalent air pressure established in the control pipe from either an automatic or an independent brake application.

NO. 6 BRAKE EQUIPMENT

This equipment is used primarily in switching service.

The positions of the No. 6 Automatic Brake Valve are: RELEASE, RUNNING, HOLDING, LAP, SERVICE and EMERGENCY. The flow of air through the automatic brake valve is as follows:

Release Position.

The air in the main reservoir is in communication with the brake pipe and equalizing reservoir.

Running Position.

Is for charging the equipment and releasing the engine and train brakes. Feed valve air is supplied to the brake pipe and will charge the brake pipe to setting of feed valve.

Holding Position.

Performs the same function as RUNNING position except engine brake is held applied.

LAP Position.

All ports in the rotary valve are closed.

Service Position.

The air above the equalizing piston is exhausted to the atmosphere. The brake pipe air raises the piston and the exhaust port is then opened, which allows brake pipe air to flow to the atmosphere until pressure in brake pipe and equalizing reservoir equalize.

Emergency Position.

Large and direct openings are made through ports in the rotary valve which permits the air in the brake pipe and equalizing reservoir to escape to the atmosphere.

Independent Brake Valve.

The independent brake valve used with No. 6 brake equipment may vary, but the most common used is the LA-6-P type. This is a self-lapping brake valve, by means of which the engine brake cylinder pressure is controlled independently of the train brakes according to the position of the handle.

The valve has two handle positions with an APPLICATION ZONE:

Release Position:

Normal position of the handle with engine brakes released. The handle may be depressed in this position when it is desired to release the engine brakes when an automatic brake application is in effect. Either a full or partial release is possible, depending on the amount of application cylinder air vented before the handle is allowed to return to normal position.

Application Zone.

The zone between the extreme positions. Movement of the handle toward the right through this zone will provide increased engine brake cylinder pressure.

Full Application Position.

This position provides maximum brake cylinder pressure as determined by the self-lapping portion adjustment.

Feed Valve:

Regulates the pressure supplied to the brake pipe through the automatic brake. Main reservoir air is reduced to the desired brake pipe pressure and is automatically maintained when the brake valve handle is in RUNNING position.

A clockwise movement of the feed valve adjusting handle will increase the brake pipe pressure setting and a counter-clockwise movement will decrease the pressure setting.

Distributing Valve.

The distributing valve controls the flow of air to apply or release the engine brakes, with either the automatic or independent brake valve.

The valve consists of two portions called the "Equalizing Portion" and the "Application Portion." The equalizing portion is used in automatic brake applications and the application portion is utilized in independent applications.

Vent Valves.

Most units are equipped with a brake pipe vent valve that acts to rapidly transmit emergency brake applications by locally venting brake pipe pressure.

Dead Engine Feature:

Allows brake pipe air to charge the main reservoir and the brake equipment operation when engine is hauled Dead-In-Train.

ENGINE SANDING EQUIPMENT

The sanding system on an engine provides a means of applying sand to the rail to increase adhesion between the wheel and rail, thereby preventing the wheels from slipping. It can be a pneumatic system, a combination electro-pneumatic system, or an electric system and can be operated either manually or automatically.

The combination electro-pneumatic system is the most common and consists of the sander switch or valve (lead axle or full sanding), relay valves, control valves, solenoid operated valves, and sand traps.

Movement of the sander switch or valve to either forward or reverse position admits air to operate a duplex (forward or reverse) solenoid valve. Air passes through the solenoid valve to the sander relay valve which acts to allow main reservoir air to flow through the sanding trainline and to the control valves. The solenoid also acts to energize the electrical sanding system components and the trainline wire. The control valves are then positioned to let main reservoir air actuate the sand traps which control the amount of sand delivered to the rail.

If an emergency or safety control application occurs, the entire sanding system is automatically actuated to provide both forward and reverse sanding at the same time.

To provide optimum operation, the sand traps are set to deliver 12 ounces of sand per minute at the rail.

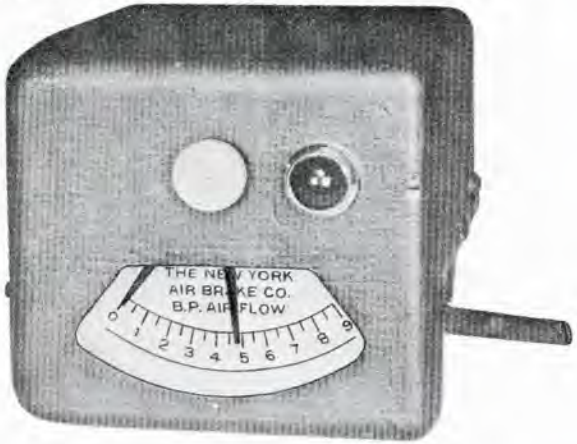
Safety Valves:

Safety valves are used to restrict pressures within predetermined limits.

If the main reservoir safety valve opens intermittently, the cause is usually one of the following items:

1. Control switch on engineer's control stand not closed.
2. Improper adjustment of compressor control switches.
3. Obstruction in pipe to compressor or control switch.
4. Compressor control switch sticking in LOAD position.

Brake Pipe Flow Indicator:



The brake pipe flow indicator is used on road engines to provide useful information concerning flow of air in train air brake system.

Type B Brake Pipe Flow Indicator:

The figures on the dial are reference figures and do not show brake pipe leakage in pounds per minute. The black hand on the instrument measures the flow of air from the feed or regulating valve through the automatic brake valve. The red hand should be used as a fully charged brake system marker by moving it to coincide with the black hand once the brake system has been fully charged. Any movement of the black hand from this point will indicate a greater or lesser demand for air flow to brake pipe.

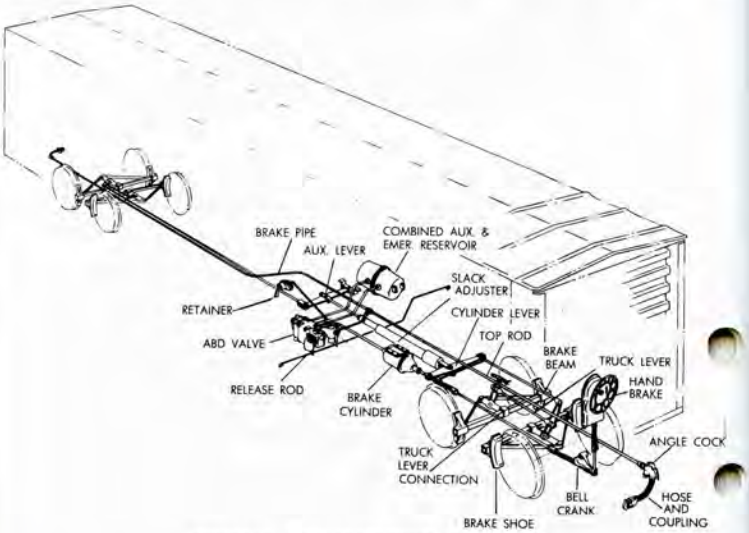
The amber light warns the engineer that there is a heavy flow of air through the feed or regulating valve. The light will be displayed when the black hand is over the figure 4 or to the right of it. The light should extinguish when the black hand moves to the left of the figure 4 to indicate the brakes on the rear of train should be releasing.

Attempts to start a long freight train too soon can be avoided by observing indicator to determine when train is properly recharged to assure brakes have released.

Brake pipe leakage due to burst air hose, broken pipe, or applying brakes from rear will be shown by black hand moving to right. The engineer must reduce power and take necessary action to avoid train separation.

In cold weather, the flow indicator can indicate whether difficulty in obtaining sufficient pressure on the rear is due to leakage, possible freeze-up, restriction in the engine brake pipe, or on the first few cars of the train.

Freight Car Brake Equipment — AB Brake Equipment:



TYPICAL ARRANGEMENT OF BRAKE EQUIPMENT ON A FREIGHT CAR

The AB Freight Car Brake Equipment is the standard for all freight cars and includes equipment having AB or ABD control valves or ABC-1 service portions.

The following parts make up the AB freight brake equipment:

AB Control Valve.

Operates to control the admission of air and exhaust from the brake cylinder and to charge the reservoir.

Brake Cylinder.

Piston and rod is so connected through the brake levers and rods to the brake shoes that when the piston is forced outward by air pressure, this force is transmitted through the rods and levers to the brake shoes and applies them to the wheels.

Two Compartment Reservoir.

Contains the auxiliary and emergency reservoir volumes. The auxiliary volume supplies air for service brake applications and both volumes supply air for emergency applications. The emergency volume also assists in the recharge of the auxiliary volume after a service application.

Combined Dirt Collector and Cut-Out Cock.

The purpose of the dirt collector is to prevent entrance of foreign particles into the AB valve. The cut-out cock provides a means of closing the pipe connection between the AB valve and the brake pipe.

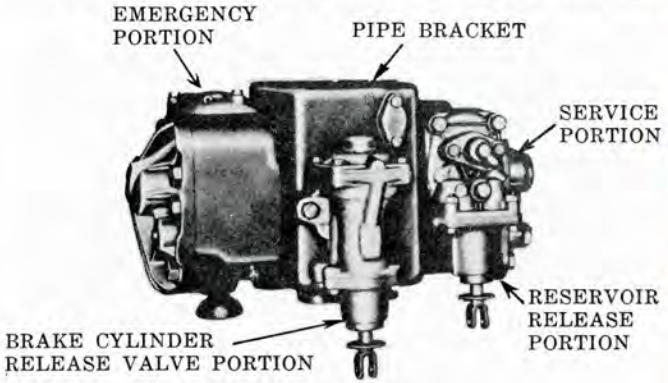
Pressure Retaining Valve.

This valve is connected by piping to the AB valve exhaust. Its purpose, when the handle is placed in RETAINING position, is to retard the rate of brake cylinder exhaust while recharging the equipment and when brake cylinder pressure has been reduced to a predetermined amount, retains the pressure in the brake cylinder.

Angle Cock.

Located at each end of the brake pipe with hose connections and couplings which provide a means of flexible connection between the brake pipe on adjoining cars.

The AB Control Valve Consists of Three Portions:



AB VALVE WITH QRB BRAKE CYLINDER RELEASE VALVE

Pipe Bracket.

To which the service and emergency portions are bolted. The bracket is bolted to the car under-framing and all pipe connections are made permanently to the bracket so that no pipe joints need be disturbed when removing or replacing the operating portions. This bracket contains a removable strainer and a quick action chamber.

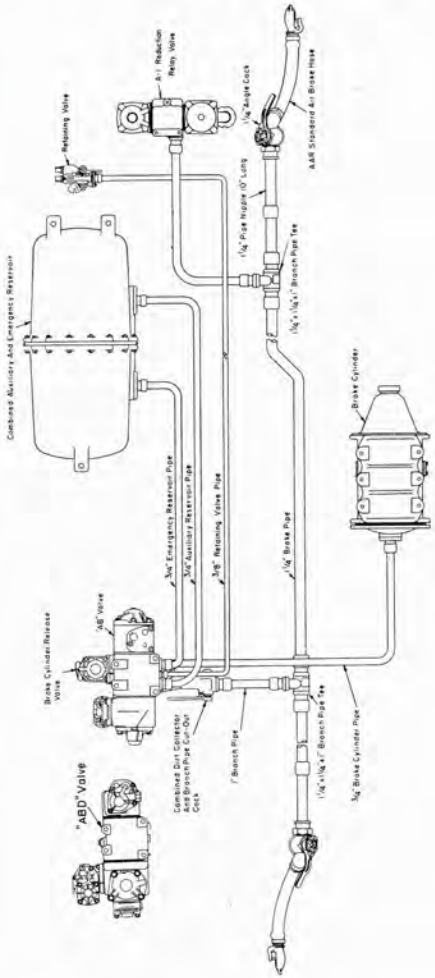
Service Portion.

Controls (either directly or through the emergency portion) the charging of the reservoirs and the service application and release of the brakes. Attached to the service portion is the duplex release valve, which controls the opening of the auxiliary reservoir release valve and the emergency reservoir release valve, permitting manual reduction or depletion of auxiliary reservoir pressure alone or both reservoirs together.

Emergency Portion.

Controls the quick action feature, controlled brake cylinder pressure build-up (three stage) and the accelerated emergency release feature.

AB OPERATION:



TYPICAL "AB" TYPE FREIGHT BRAKE EQUIPMENT

Release and Charging Position.

Brake pipe air from the automatic brake valve passes through the combined dirt collector and cut-out cock into a passage in the pipe bracket, through the strainer to the faces of the service and emergency pistons.

Brake pipe air on the face of the service piston moves the piston and attached slide valve. Brake pipe air passes through two charging chokes uncovered by the piston, to the slide valve side of the piston, through a passage in the service portion body and into a pipe to the auxiliary reservoir.

The emergency reservoir is also charged with brake pipe air flowing by way of the service slide valve chamber, through a port in the slide valve to a passage in the control valve body, through a pipe and into the emergency reservoir.

Brake pipe air on the face of the emergency piston also flows through a charging choke to the slide valve side of the piston and into the quick action chamber. (A small volume in the pipe bracket.)

An AB system being charged through the two small chokes just described is being charged at the maximum possible rate and the time required to completely charge a car is approximately seven minutes. The brake cylinder is connected to the atmosphere through a pipe connection from brake cylinder to brake cylinder passage in the pipe bracket and through a pipe to the retainer valve (exhaust). This completes the charging operation and when the pressure in the auxiliary and emergency reservoirs become equal to that pressure supplied by brake pipe, the AB system is charged.

Preliminary Quick Service.

Occurs during the first action of a service application by means of porting brake pipe air to a quick service volume, located in the service portion. This results in a local drop in brake pipe pressure and produces a brake pipe reduction of approximately six psi and a brake cylinder pressure of about 10 psi.

As quick service activity is completed, the brake pipe air flow to the quick service volume is terminated and directed to the brake cylinder. When the brake cylinder pressure reaches approximately 10 psi, the brake pipe

air flow ceases due to action of the quick service limiting valve. The valve then assumes a LAP position, in which the flow of all air ceases.

Service.

Further brake pipe reductions will cause additional auxiliary reservoir air to be ported to the brake cylinder, but the connection of the brake pipe air to the quick service volume and brake cylinder is blanked. After the brake pipe reduction is completed, the valve again assumes a LAP position.

Release.

An increase of brake pipe pressure over that in the auxiliary reservoir will release an AB control valve after service or emergency application. The valves are designed to give a uniform release throughout the train. Front end retarded recharge accomplishes this by recharging the auxiliary reservoirs near the head end of a train through one charging choke while auxiliary reservoir pressures are built up on the rear portion at an increased rate, being charged through two charging chokes. This provides uniform recharge. In addition, a more positive and prompt release of all brakes is made by recharging the auxiliary reservoirs from emergency reservoirs. Therefore, a faster build-up of brake pipe pressure throughout the train results than would be possible if all recharge was from the brake pipe. This feature is possible because the emergency reservoirs remain at the pressures charged previous to the brake application.

Emergency.

When an emergency rate of brake pipe reduction takes place from any cause, the AB control vaves throughout train will provide maximum brake cylinder pressure in three different stages. For example, an emergency brake application initiated at the automatic brake valve on the engine will result in rapid venting of brake pipe pressure, causing a pressure differential at the AB valve emergency portion piston. As a result of this pressure differential, the emergency piston will move to allow quick action chamber air to unseat the vent valve, thereby opening a large and direct passage from the brake pipe to atmosphere.

This rapid venting of brake pipe pressure passes serially and rapidly through the train.

Quick action chamber air is required to dissipate through a small choke and for this reason, the vent valve piston is held open for 70 seconds. This serves to prevent a release of an emergency brake application before the train is brought to a complete stop.

In the first stage, the reduction in brake pipe pressure causes the service piston and slide valve to move to the extreme left position and uncover ports which allow auxiliary reservoir to join with emergency reservoir air in its flow to the brake cylinders.

This combined air pressure will flow at an unrestricted rate through an inshot valve to the brake cylinders until approximately 15 pounds brake cylinder pressure is developed.

In the second stage, brake cylinder pressure build-up continues, but at a slower rate because the inshot valve is closed and the air pressure to the brake cylinder flows through a small choke, delaying build-up.

This delayed build-up is continued until increased brake cylinder pressure unseats a timing valve, which begins the third and final stage in the development of emergency brake cylinder pressure.

The timing valve combines emergency and auxiliary reservoir pressure to the brake cylinder producing a faster rate of final brake cylinder pressure build-up until equalization is reached which is accomplished in approximately 10 seconds.

The controlled brake cylinder pressure development is modified when a partial service brake application precedes an emergency application and is completely annulled when a service brake application has developed 30 pounds (or more) brake cylinder pressure prior to an emergency application being made.

Since an emergency application results in air from both the emergency reservoir and the auxiliary reservoir flowing to brake cylinder until pressures equalize, a higher brake cylinder pressure is obtained than is possible from a full service application.

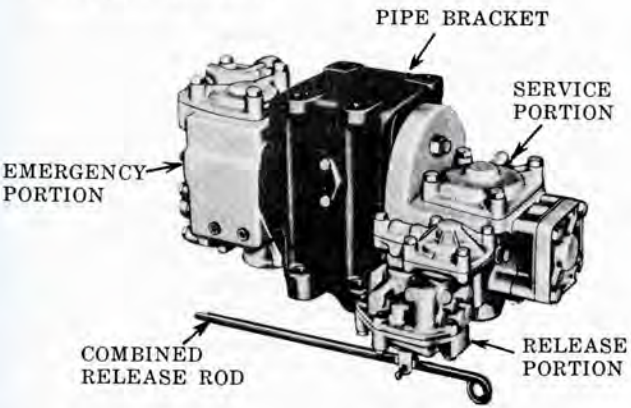
Accelerated Emergency Release.

The release after an emergency application is accomplished by again supplying brake pipe air from the automatic brake valve into the brake pipe. When the air

pressure on the face of the AB valve emergency piston has increased sufficiently, the piston moves and permits brake cylinder and auxiliary reservoir air to flow into the brake pipe. This flow will continue until the pressures are within 10 pounds of equalization, thus providing a quick initial build-up of brake pipe pressure.

Auxiliary reservoir pressure is being partially reduced while the brake pipe pressure is being initially built up throughout the train and the development of that brake pipe pressure needed to release the brakes is accomplished much sooner than it would be by raising brake pipe pressure through the brake valve alone. Therefore, a more prompt and positive release of the brakes is accomplished.

ABD Control Valve:



ABD VALVE

This equipment is comparable in its operation and is interchangeable with the AB freight car brake equipment with AB valve. Improvements in the ABD valve include provision for increased release sensitivity. The improvements incorporated in the ABD control valve are in the service and the emergency portions. The pipe bracket is the standard AB pipe bracket portion.

The changes in the service portion of the ABD control valve include use of a piston containing a rubber diaphragm structure. Further, the piston and slide valve are mounted vertically for more efficient and uniform operation. Likewise, the emergency portion utilizes a piston containing a rubber diaphragm structure and graduating valve, which are also mounted vertically for more efficient and uniform operation. Included in the arrangement is a feature to accelerate the release of service brake applications by use of air from the emergency reservoir to speed recharge of brake pipe during release.

This accelerated release feature is different from the standard AB since on the ABD, emergency reservoir air flows into brake pipe. This improved feature allows for a more rapid release of service applications than is available with the standard AB valve.

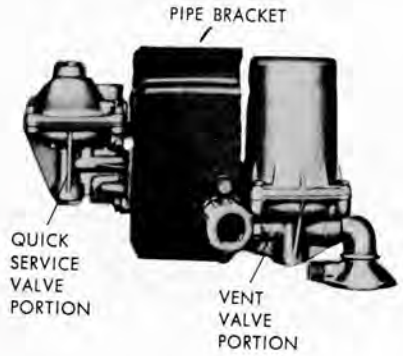
An undesired release of brakes on a train may occur due to improper operation of an angle cock. Under certain conditions a "wave effect" is set up by the rushing of air toward the engine brake valve exhaust which is suddenly stopped by the closing of an angle cock, with the result that the air wave is reflected and directed in the reverse direction, causing a sufficient differential in brake pipe pressure to produce a release of brakes. For this reason, angle cocks on cars must be left open when detached from engine, except as provided in Air Brake Rule 24-E.

Emergency can be obtained at any time, except when brake pipe has been reduced to 50 psi or below, at which point it becomes questionable whether or not emergency brake cylinder pressure will be obtained on the entire train. Emergency brake cylinder pressure is approximately 20% higher than that obtainable from a full service brake application.

The development of emergency brake cylinder pressure is in two stages (at a predetermined controlled rate) rather than three stages as found in the standard AB.

The parts of the AB freight car brake equipment with ABD valves are the same as the standard AB valve except the release valve portion. This performs the same function as the duplex release valve in the AB valve, but may also be used to release brake cylinder pressure manually after a brake application as well as permitting manual reduction or depletion of auxiliary reservoir pressure alone or both auxiliary and emergency reservoirs together.

A-1 Reduction Relay Valve:



Freight cars with brake pipe of longer lengths require the use of an A-1 Reduction Relay Valve.

The A-1 Reduction Relay valve consists of a pipe bracket with a B-1 Quick Service Valve portion mounted one one face and a No. 8 Vent Valve portion mounted on the other face. A single brake pipe connection to the bracket is required for operation.

The function of the A-1 Reduction Relay Valve is to provide additional local venting of brake pipe pressure both in service and emergency brake applications on cars 65 feet in length and longer to compensate for the increased brake pipe volume.

The B-1 Quick Service Valve produces the equivalent rate of service brake transmission and brake cylinder pressure development on long cars as is obtained on shorter cars.

The No. 8 Vent Valve operates during an emergency brake application to vent the additional brake pipe volume and transmit the emergency brake application throughout the train.

If the No. 8 Vent Valve should fail to reset after an emergency brake application resulting in a continuous blow at the exhaust port, the valve must be plugged by removing the vent protector and inserting the plug, which is an integral part of the vent protector, into the exhaust port.

Plugged vent valves must be reported at the next terminal.

Retaining Valves:

Pressure retaining valves in service retain a predetermined pressure in brake cylinders while control valves are in RELEASE position and auxiliary reservoirs are being recharged. The amount of pressure retained in brake cylinders depends on the type of retaining valve used. This valve performs no function when in EXHAUST position (handle perpendicular or down) as it then allows brake cylinder pressure to be discharged freely.

The retaining valves used on PASSENGER cars are of the 10 and 15 pound types having two positions of the control handle, i.e., perpendicular or down position when not in use, and horizontal or up position when in use.

There are two types of pressure retaining valves used on FREIGHT cars and the handle positions are as follows:

1. **Four-Position Release Control Retainer:**

   (EX) Direct Exhaust position (handle turned downward). Allows unrestricted passage of brake cylinder pressure to exhaust to atmosphere.

   (HP)—High Pressure Position (handle 45° below horizontal). Restricts exhaust of brake cylinder pressure at a controlled rate and retains 20 psi brake cylinder pressure.

   (LP)—Low Pressure Position (handle horizontal). Restricts exhaust of brake cylinder pressure at a controlled rate and retains 10 psi brake cylinder pressure.

   (SD)—Slow Direct Exhaust Position (handle 45° above horizontal). Restricts exhaust of brake cylinder pressure at a controlled rate to provide a blowdown time of approximately 86 seconds and continues to exhaust until all pressure is vented to atmosphere.

2. **1967-Three Position Retainer:**

   (EX)—Direct Exhaust Position (handle turned downward). Allows unrestricted passage of brake cylinder pressure to exhaust to atmosphere.

   (HP)—High Pressure Position (handle 30° below horizontal). Restricts exhaust of brake cylinder pressure at a controlled rate and retains 20 psi brake cylinder pressure.

(SD)—Slow Direct Exhaust Position (handle 45° above horizontal). Restricts exhaust of brake cylinder pressure at a controlled rate to provide a blowdown time of approximately 86 seconds and continues to exhaust until all pressure is vented to atmosphere.

Brake Cylinder Release Valve:

The brake cylinder release valve is used with AB freight brake equipment and is manually operated to provide release of brake cylinder pressure without draining the reservoirs, thereby retaining the stored air.

Cars equipped with a brake cylinder release valve may be identified by a small white diamond-shaped stencil located outside of car near the release rod or the release rod will have a small closed loop at the end of the rod.

Some cars are equipped with one release rod which operates both the brake cylinder release valve and the duplex release valve. Those cars equipped with two rods are identified by stencil to indicate which rod controls the brake cylinder release valve.

When bleeding cars for switching, operate the brake cylinder release valve, on cars so equipped, by giving one pull on the brake cylinder release valve rod. This will release the air in the brake cylinder, retaining the air stored in the car reservoirs. The air remaining in the reservoirs reduces time required to charge an outgoing train for air test. The brake cylinder release valve automatically resets itself when brake pipe pressure is again restored and the control valve portion moves to RELEASE position.

To release stuck brakes, or drain car reservoirs, use the AB valve duplex release valve, leaving the brake cylinder release valve in normal position.

The ABD service portion has the brake cylinder release valve integral with the duplex release valve. The operation of this valve is the same as the separate brake cylinder release valve, except that only one rod is used.

Caboose Valve: (Conductor's Valve)

An air valve connected to the brake pipe for the purpose of applying the brakes of a train should it become necessary for the crewmen to bring the train to a stop. Examples of caboose valves are back-up valves, emergency vales, the A-1 and the A-2 valves.

The A-1 and A-2 caboose valves have definite service positions. Braking is increased as the handle is moved to the higher positions. The difference between the two valves is that the A-2 valve has a self latching mechanism that makes it impossible to return the handle to the RUNNING position until the handle is first moved to the FULL or EMERGENCY position. The A-1 valve can be returned to the RUNNING position at any time.

EMERGENCY BRAKE VALVE

1¼" Emergency Valve.

This valve (emergency brake valve) may be permanently installed in an engine or caboose and can be used to make an emergency air brake application to the train. Unlike the A-1, A-2 valves, this valve has only two positions, closed RUNNING, and EMERGENCY.

Cutting Out Brakes on Freight Cars:

Car with AB or ABD brake equipment: Close the branch pipe cut-out cock and drain both auxiliary and emergency reservoirs by fully opening release valve. If brakes fail to release, drain supply reservoir if car is so equipped.

Car with AC-1B air brake equipment: Close the branch pipe cut-out cock and drain both auxiliary and emergency reservoirs by fully opening release valve.

PASSENGER CAR BRAKE EQUIPMENT:

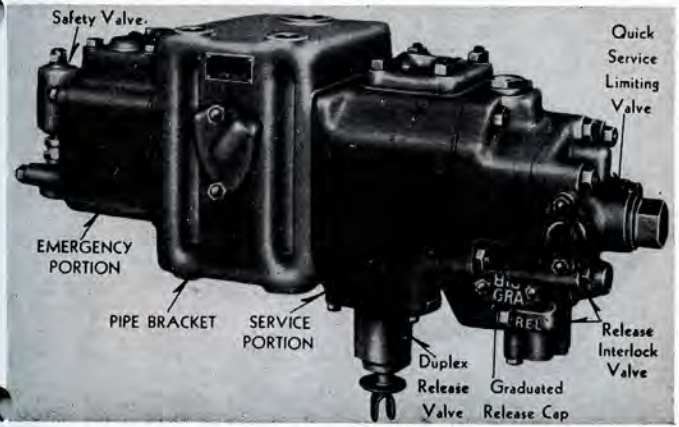
D-22 Brake Equipment:

The D-22-P passenger car brake equipment was designed primarily for high speed passenger service.

The basic operation principle is quite similar to that of the AB control valve.

The parts of the D-22-P equipment are:

D-22-AR Control Valve.



Controls charging, application, and releases the brakes.

It consists of three (3) portions; the pipe bracket, service, and emergency portions. The valve portions have pistons, slide valves, and graduating valves which operate with other parts to provide the various features of operation.

Relay Valve.

Used in conjunction with the control valve to reproduce the brake cylinder pressure as indicated by the displacement reservoir.

Combined Auxiliary, Emergency and Displacement Reservoir.

The auxiliary reservoir is used to operate parts of the control valve and supplies air used in the relay valve and displacement reservoir during service and emergency brake applications. Emergency reservoir air is used to provide graduated release, quick recharge, and high brake cylinder pressures during emergency brake applications. The displacement reservoir provides the required volume so the relay valve can develop the brake cylinder pressure in relation to the brake pipe reduction made.

Supply Reservoirs.

Provide the air for the brake cylinders.

Emergency Brake Valves.

One at each end of the car, permits the trainmen to apply the brakes in case of emergency.

Combined Dirt Collector and Cut-Out Cock.

Mounted on the control valve bracket. The purpose is to prevent entrance of foreign particles into the control valve. The cut-out cock provides a means of closing the pipe connection between the control valve and the brake pipe.

Pressure Retaining Valve.

Is connected by piping to the control valve exhaust. Its purpose, when the handle is placed in RETAINING position, is to retain brake cylinder pressure while recharging the brake system.

Brake Cylinders.

With pistons, rods, and levers so connected to apply the brake shoes to the wheels.

Automatic Slack Adjuster.

Used with each brake cylinder, maintains a predetermined brake cylinder piston travel.

Duplex Release Valve.

Controls the opening of the auxiliary reservoir valve and emergency reservoir valve, permitting manual reduction of auxiliary reservoir pressure alone or both reservoirs together.

Graduated Release Cap.

On the service portion, conditions the control valve for Graduated or Direct release. The letters REL are cast on the body below the graduated release cap. The letters DIR and GRA are cast on the cap. When the letters DIR are over the letters REL the valve is conditioned for Direct Release; when the letters GRA are over the letters REL, the valve is conditioned for Graduated Release. The cap is set by removing two nuts and turning the cap so that either DIR or GRA line up with REL on the body.

A-2 Car Discharge Valve.

Allows the reduction of signal line pressure to sound the communicating signal on the engine.

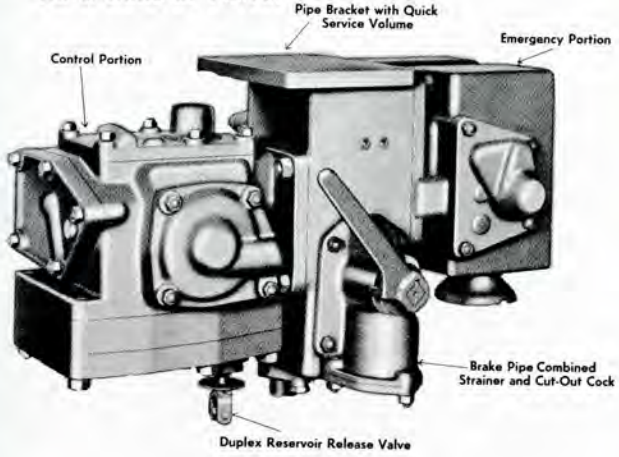
26-C BRAKE EQUIPMENT:

The 26-C Passenger Car Brake equipment is designed for cars operating in high speed passenger service.

Like the ABD valve, the 26-C equipment utilizes rubber diaphragms and "O" rings in place of pistons and rings.

The following parts make up the 26-C Brake Equipment:

26-C Control Valve.



Controls the flow of air to or from the brake cylinders on a car in response to increase or decrease in brake pipe pressure.

Emergency Vent Valve.

Provides a large local opening for exhaust of brake pipe air during an emergency application.

Reservoir Release Valve.

Provides a means of manually venting control reservoir air to atmosphere, thus releasing a brake application.

Combined Selector Volume and Control Reservoir, and Auxiliary Reservoir.

The Selector Volume acts as a stabilizing volume during quick service and graduated release operations. The Control Reservoir provides a reference force to control the development of brake cylinder pressure.

Brake Cylinders.

With pistons, rods, and levers so connected to apply the brake shoes to the wheels.

A-2 Car Discharge Valve.

Allows the reduction of signal line pressure to sound the communicating signal on the engine.

Emergency Brake Valves.

Located at each end of the car to permit trainmen to apply the brakes in case of emergency.

Automatic Slack Adjuster.

Used with each brake cylinder, maintains a predetermined brake cylinder piston travel.

Pressure Retaining Valve.

Is connected by piping to the control valve exhaust. Its purpose, when the handle is placed in RETAINING position, is to retain brake cylinder pressure while recharging the brake system.

Combined Dirt Collector and Cut-Out Cock.

Prevents entrance of foreign particles into the control valve. The cut-out cock provides a means of closing the pipe connection between the control valve and the brake pipe.

THE GENERAL OPERATION OF THE 26-C BRAKE EQUIPMENT IS AS FOLLOWS:

Charging.

Air flows through the automatic brake valve to the brake pipe and the 26-C control valve to charge the combined selector volume and control reservoir, and the auxiliary reservoir.

Service.

A reduction in brake pipe pressure causes the service piston of the 26-C control valve to move to SERVICE position. Auxiliary reservoir air is connected to the brake cylinder to apply the brake.

Service LAP.

Upon termination of the brake pipe reduction, auxiliary air continues to flow to the brake cylinders until pressure acting on the 26-C control valve service piston moves the service piston to LAP position.

The control valve service piston remains in LAP as long as the brake pipe and brake cylinder pressures do not change. In case of a further brake pipe reduction or loss of brake cylinder pressure due to leakage, the control reservoir air pressure moves the service piston to SERVICE position permitting an additional flow of auxiliary reservoir air to the brake cylinders.

Release.

When the brake pipe is recharged and the increase of pressure moves the 26-C control valve service piston to RELEASE position, the auxiliary reservoir is recharged and the brake cylinder air exhausts to release the brake. The amount of brake release, with the graduated release cap set for GRA release, is proportional to the amount of brake pipe recharge as controlled by the automatic brake valve.

A partial recharge of the brake pipe provides for partial release of the brake and a full recharge provides for a total brake release.

Emergency.

When an emergency rate of brake pipe reduction occurs, the emergency valve of the 26-C control valve is operated to provide a local brake pipe reduction at the control valve. This rapid drop of brake pipe pressure operates the control valve quickly and delivers a higher brake cylinder pressure than with a service brake application.

A graduated or direct release feature is available on the 26-C control valve. A cap on the control valve may be positioned for Graduated Release, GRA (as read from the outer edge of the valve body), or Direct Release, DIR, by removing two nuts and turning the cap to the desired position, the same as with the D-22 equipment.

ANTI- WHEEL SLIDE DEVICES:

1. **Decelostat.**

   The decelostat equipment provides a mechanical-pneumatic means of improving braking on passenger cars by protecting against wheel sliding during brake applications. It functions automatically, when a wheel slide occurs, to rapidly decrease brake cylinder pressure to a low value, permitting the wheel speed to return to train speed. After an interval sufficient to enable the wheel speed to have regained train speed, brake cylinder pressure is quickly restored.

   Any recurrence of wheel sliding causes the decelostat equipment to repeat this function.

2. **Rolokron.**

   The Rolokron equipment performs the same function as the Decelostat except that electrical means are employed to monitor wheel sliding and adjust brake cylinder pressure.

UC PASSENGER CAR BRAKE EQUIPMENT:

The U-12-BD universal valve consists of the following portions:

Pipe Bracket.

To which are bolted the quick-action and equalizing portions, and a blanking flange. The bracket is bolted to the underframing of the car, all pipe connections being made permanently to this bracket, so that none need to be disturbed in the removal or replacement of any operating portions of the universal valve. This bracket contains two chambers, the quick-action chamber and the quick-action closing chamber.

Equalizing Portion.

Controls (either directly or indirectly through the medium of the other portions of the universal valve) the desired charging of the reservoirs, the application of the brakes, whether in service or in emergency, and the release of the brakes.

Quick-Action Portion.

Includes the various parts controlling the quick-action and high pressure functions.

Strainer Filling Piece.

Interposed between the quick-action portion and the high speed pressure cap.

Graduated Release Cap.

The word "graduated" and "direct" are cast on the flange of the cap and the word "release" is cast on the body. Large letters "G" and "D" are cast on the faces of the cap coinciding with the word on the flange. To change from direct to graduated release, or vice versa, first close the cut-out cock, drain reservoirs, then remove cap studs and turn cap until the proper letters coincide with the arrow on the equalizing portion body in which the flange wording also gives proper reference.

LN EQUIPMENT:

LN control valve

Utilizes the type L triple valve and has the following features:

1. Quick Service.
2. Graduated Release.
3. Quick Recharge.
4. High Emergency Brake Cylinder Pressure.

CUTTING OUT BRAKES ON PASSENGER CARS:

Car With'LN Brake Equipment.

Close cut-out cock and drain both auxiliary and supplemtary reservoirs.

Car With UC Brake Equipment.

With double equipment having independent brake rigging for each truck, the brakes can be cut out individually by opening brake cylinder side vented cut-out cock on each end of car. If this is not practicable, close branch pipe cut-out cock and drain all reservoirs.

Car with D-22 or 26-C Control Valve.

This equipment has side vented cut-out cocks for each brake cylinder which should be used as required. If this is not practicable, close the branch pipe cut-out cock (which is combined with the dirt collector) and drain both the auxiliary and the emergency reservoirs by pulling the duplex valve handle its full travel and holding until the pressure is depleted. If brakes fail to release, cut-out cock in branch pipe to the relay valve should be closed if car is so equipped.

The Following Method Will be Used When Necessary To Release Air Brakes Manually When There Is No Pressure in the Brake Pipe:

With LN Equipment.

Open the drain cock on the auxiliary and supplementary reservoirs, leaving them open until the brake is released.

With UC Equipment.

Open the drain cocks on the auxiliary and emergency reservoirs, leaving them open until the brake is released.

With UC, D-22 and 26-C Control Valves.

Completely drain all reservoirs.