SOUTHERN PACIFIC COMPANY

(PACIFIC SYSTEM)

RULES AND REGULATIONS

GOVERNING

CARE AND OPERATION OF AIR BRAKE AND AIR SIGNAL APPARATUS

EFFECTIVE MAY 1ST, 1915

NO. 4487

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(PACIFIC SYSTEM)

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The rules herein set forth govern the railroads operated by these companies, and supersede all previous rules and instructions inconsistent therewith.

Special instructions may be issued by proper authority.

T. W. HEINTZELMAN,
Gen'l Supt. Motive Power.

APPROVED:

W. R. SCOTT,
Vice-President and General Manager.

AIR BRAKES AND AIR SIGNALS

1. Every employe whose duties are connected with the operation of air brakes, must be examined by the Inspector of Air Brakes or other proper authority, who will use the authorized list of questions and answers as issued by the Railroad Company, as to its practical workings and rules governing the same, and all employes will be required to visit the air brake instruction car or room at every opportunity.

All Locomotive Firemen will be obliged to pass a progressive examination at the end of their first, second and third year in the service, which will be given by the Road Formen of Engines, and the results of such examinations will determine the fitness of Firemen for promotion.

The examination to be used is a progressive examination for Locomotive Firemen, or for the Examination of Locomotive Engineers, Firemen and Trainmen who are seeking employment, and will be such as to embody a general knowledge of the air brake equipment as used on the road.

The answers to questions asked in such examinations must be in the applicant's handwriting.

When promoting Firemen to Engineers, if more than a year's time has elapsed from the time of his third year's examination for promotion, he will be obliged to pass an examination which will be a review of the previous examinations.

Engineers and Trainmen will be examined every three years in air brake rules and equipments.

The progressive examination will be issued from the office of the General Superintendent Motive Power.

2. Roundhouse Foremen and Locomotive Watchmen in charge of locomotives must see that compressor and main reservoir drain cocks are kept open while locomotives are in their charge, and that air inlet strainers and piston rod swabs are kept in good condition and are of the sizes specified.

Roundhouse and Shop Foremen must see that main reservoirs on locomotives are tested each twelve months or when locomotives are in shops for general repairs. Such reservoirs must be tested under 175 pounds hydraulic pressure, afterwards with 155 pounds air pressure, the place and date of test stenciled on reservoir.

Centrifugal Dirt Collectors on Locomotives and Tenders must be cleaned each thirty days.

All air gauges on locomotives must be tried out with inspector's test gauge each trip. Feed valves must be tested for sensitiveness each trip and if they permit of a variation of over 2 pounds they must be replaced by a feed valve in good condition.

Distributing and control valves, also triple valves, on locomotives must be cleaned and tested each 30 days, and date of cleaning stenciled on some convenient place near the valve.

Locomotive truck brakes must be maintained in good condition and must be operated at all times.

Driver brakes on all locomotives must be maintained in good condition and must be operated at all times, except when operating on long, heavy grades, if the tires should become over-heated, it is permissible to relieve the pressure on them until the tires have cooled off.

Specially prepared, dry, pulverized graphite must be used for lubricating all slide valves and slide valve seats in air brake equipment. Triple valve oil must be used for lubricating pistons,

bushings and packing rings of the air brake apparatus, and the oil must be applied to the bushing after the piston has been inserted. Brake cylinder compound must be used for lubricating packing leathers and brake cylinders and care must be taken that an excessive amount of lubricant is not supplied to the walls of the cylinder.

3. Compressors must be started slowly to allow the water of condensation to escape gradually, also to prevent piston heads from striking the cylinder heads. After compressors have accumulated approximately 30 pounds pressure in the main reservoir, the compressor steam throttle must be opened fully, but speed of 9½-inch compressors shall not exceed 140 single strokes per minute.

After the compressor has started, the lubricator of the steam end of compressor should be opened and oil fed to the steam end to the amount required for ordinary compressors, but the amount of oil supplied the 8½-inch C. C. compressor steam cylinders should be appoximately from four to eight drops per minute, depending upon the character of the service.

In oiling the air end of compressors with the Nathan lubricator attachment, this should be adjusted to feed as closely as possible, and the emergency valve on main lubricator should be opened until from five to eight drops of oil have passed to the air cylinders, then the sight feed and emergency valves must be closed, after which the compressor should be oiled as the service requires. Sight feed and emergency valves should always be kept closed tightly except when in actual use.

4. The standard brake pipe pressure for all locomotives shall be 80 pounds, but additional pressures shall be carried as follows:

On all freight and passenger locomotives where Duplex brake pipe pressure control apparatus is installed, the high pressure feed valve shall be set to carry a brake pipe pressure of ~~110~~ 90 pounds.

The standard brake pipe pressure to be used on freight trains for all divisions shall be 80 pounds, but on heavy grades where, if the train should be hard to control, it is permissible to use ~~110~~ 90 pounds brake pipe pressure.

The brake pipe pressure to be carried on all passenger locomotives shall be ~~110~~ 90 pounds on all divisions, except on small branch lines, or in mixed passenger and freight service, where the standard pressure of 80 pounds shall be carried.

On all passenger and freight locomotives **not equipped** with either ET or LT brake apparatus, the low main reservoir governor head shall be adjusted to carry ~~130~~ 120 pounds pressure, and the high main reservoir governor shall be adjusted to carry ~~140~~ 125 pounds pressure.

On all passenger and freight locomotives which **are equipped** with ET or LT equipment, the excess pressure head of the governor shall be adjusted to carry 20 pounds excess pressure, and the maximum governor head shall be adjusted to carry ~~140~~ 125 pounds main reservoir pressure.

All switch locomotives which handle passenger trains shall have Duplex brake pipe pressure control apparatus installed on them, and when switching passenger trains they must carry ~~110~~ 90 pounds brake pipe pressure.

On all switch locomotives the maximum main reservoir pressure shall be ~~140~~ 125 pounds.

Exceptions to the above: Locomotives equipped with B, Plate 21, brake equipment with Triplex governor, must have one governor head adjusted for 80 pounds brake pipe pressure, the other governor head adjusted to carry ~~110~~ 90 pounds brake pipe pressure, and the maximum main

reservoir governor head must be adjusted to carry ~~140~~ 125 pounds main reservoir pressure, and the excess pressure valve spring must carry 20 pounds excess pressure.

On all passenger, freight and switch locomotives, the reducing valve to the straight air brake apparatus must be adjusted to carry 45 pounds pressure. Safety valves to driving brake cylinders must be adjusted to carry 50 pounds pressure. Reducing valve to signal apparatus must be adjusted to carry 45 pounds pressure.

On locomotives equipped with high speed brake apparatus, the Westinghouse automatic reducing, or New York compensating valves must be adjusted to carry 50 pounds pressure in the brake cylinders, but on engines equipped in this manner, safety valves must not be used in the brake cylinders having the automatic reducing or compensating valves.

Mallet locomotives used in passenger service will carry the same air pressures as other locomotives in the same service.

Mallet locomotives used in freight service must carry the same pressures as other locomotives in freight service, except that the reducing valve to the independent brake valve must be adjusted to carry 35 pounds pressure, and the safety valve to the distributing or control valve must be adjusted to carry 40 pounds pressure.

All locomotives used in passenger service must carry ~~110~~ 90 pounds brake pipe pressure when handling passenger trains, and must not couple on to a passenger train until such pressure adjustment as required by these rules has been made.

5. Piston travel for driver brakes on compound locomotives shall be from 6 to 8 inches. On simple locomotives with cam driver brakes it shall be from 1 to 2 inches.

Piston travel on all locomotives equipped with equalized driver brakes shall be from 4 to 8 inches. On tenders, from 5 to 7 inches. Locomotive truck brakes, from 4 to 6 inches.

Piston travel on all cars, both freight and passenger, shall be from 5 to 7 inches, and on cars equipped with slack adjuster, the adjuster shall be screwed back until the piston travel is approximately 7 inches whenever any change is made in the adjustment of the brake rigging.

6. Automatic slack adjusters should be adjusted for not less than 7 inches travel. All hand adjustments after the application of brake shoes and the adjustment of brake rigging, should be made to 7 inches piston travel when the slack adjuster is standing at zero.

Automatic slack adjusters should be cleaned and oiled each time the brake cylinder is cleaned.

On all cars equipped with Acme slack adjuster, if the brakes are adjusted too tightly or new shoes have been applied, block up the flat spring on top of the connecting rod and throw the pawl back at the top of the dead lever, which will allow the brake heads to drop away from the wheels to give sufficient clearance. When new shoes have been put on or sufficient shoe clearance has been obtained, it will only be necessary to take out the block under the flat spring and throw the pawl forward at the top of the dead lever, when a few applications of the brake will give the proper piston travel.

7. Air brake and signal hose on locomotives must be given soap suds test when the terminal inspection of air brake equipment is being made at roundhouses.

Air brake equipment, including hose and angle cocks, on all locomotives in shops undergoing repairs must be removed from the locomotives,

cleaned, repaired and tested on racks provided for that purpose, while the locomotive is in shop.

8. On arrival of freight trains at inspection terminals, an ordinary stop will be made with the automatic brake, after which sufficient hand brakes will be set on rear end of train to secure the train. The air brakes will then be released and when the auxiliary reservoirs are properly recharged, the locomotive will move forward a sufficient distance to stretch the train in order to facilitate the inspection of draft gear.

Before uncoupling the locomotive from the train, a 15-pound reduction of brake pipe pressure shall be made, when the inspectors will start from the end of train, making inspection of the air brake equipment only, marking all defects and piston travel on the sides of the cars for a guide in switching and for making repairs. After the air brake inspection of a train has been completed, and during the safety appliance inspection, the air hose must be separated and the auxiliary reservoirs drained, if the train is to be broken up. After repairs have been made and the outgoing locomotive has been coupled to the train, it shall be charged to the standard pressure and inspection of train shall be made as follows:

Freight trains, Rules 10, 11 and 12.

Passenger trains, Rules 10 and 13.

9. When putting locomotive on a train, before backing up on the train, place the automatic brake valve on lap position and put the locomotive on the train with the straight air brake equipment. This will permit accumulating 140 pounds main reservoir pressure before coupling on to the train, which will assist in charging the train promptly.

10. Terminal inspection of Hose and Angle Cocks:

At points designated by special instructions from the General Superintendent Motive Power, all air brake hose, signal hose, and angle cocks must be tested with soap suds while they are charged with standard pressure, and all leaking angle cocks or porous hose must be removed.

This inspection must be made on all trains by the inspectors.

The above inspection must be made by repair men on all cars undergoing repairs on repair tracks or in shops.

11. Terminal Inspection of a Freight Train:

After a freight train has been made up and locomotive attached, an inspector will attach a gauge to the brake pipe at the rear of the caboose, and when the train has been charged to standard pressure of 80 pounds, he will signal the Engineman to apply the brakes, which must be done by making a reduction of from 6 to 12 pounds pressure (Rule 40), then wait 15 seconds and make a further reduction of brake pipe pressure so that the total amount of reduction shall be 25 pounds. As soon as the brake valve exhaust ceases the Engineman shall take the brake pipe leakage of the train for 30 seconds, which he will report to the inspectors. This leakage must not exceed 3 pounds in 30 seconds from an initial pressure of 55 pounds, nor must it exceed 8 pounds per minute from an initial pressure of 70 pounds. The inspectors will pass along the train and see if all brakes have applied, and those which have not must have the defects remedied before they will be permitted to leave the yard. When inspectors have noted whether the brakes have applied they will signal the Engineman to release the brakes, which must be done by placing the

brake valve handle in full release position until the brake pipe pressure is restored to within 5 pounds of the pressure carried, before returning the brake valve handle to running position. To avoid brakes sticking from an overcharge of the brake system on the head end of the train, it is necessary in handling freight trains, after the brakes have been released, and the brake valve handle has been returned to running position, to make at least two short releases by moving the automatic brake valve handle from running to full release position, momentarily, and return to running position. The inspectors will pass over the train and note if all the brakes have released satisfactorily, and will report to the Engineman if any cars in the train are piped or cut out.

In addition to the terminal test, an inspection of retaining valves will be made at such terminal points as are designated by the General Superintendent Motive Power, and retaining valve test will be made as follows:

12. Retaining Valve Test:

When the outgoing locomotive is coupled to the train and it has been charged to standard pressure, the inspectors will signal the Engineman to apply the brakes, which will be done by making a brake pipe reduction of from 6 to 12 pounds (Rule 40), and then waiting 15 seconds, when he will make a further reduction so that the total amount of reduction shall be 25 pounds. One of the inspectors will then pass over the top of the train, turning up all retaining valves, and on arriving at the other end of train he will signal the Engineman to release the brakes which must be done by placing Engineer's brake valve handle in full release position until the brake pipe pressure has been restored to within 5 pounds of the pressure carried, before returning the brake

valve handle to running position. The inspector will wait 1 minute after signaling Engineman to release the brakes, and will then pass back over the train, turning down the retaining valves and noting if there is any discharge of air from the retaining valve. On cars having irregular discharge of air the retaining valves must be repaired, and on cars from which there is no discharge of air, the retaining valve pipe or brake cylinder packing leathers must be repaired before leaving the terminal.

NOTE.—The above inspection of retaining valves shall be made only at points designated, which should be sufficiently distributed to cover the entire system.

13. Terminal Inspection of a Passenger Train:

During the inspection at either terminal or intermediate points, the inspectors must see that the supplementary reservoirs on all cars equipped with LN schedule are cut-in and charged up before the brakes are applied.

After the entire train has been coupled up, inspector will attach a gauge to the rear end of train, connecting to both brake and signal pipe hose, and when the train has been charged to standard pressure, the inspector at the rear end of train shall signal Engineman to apply the brakes, which will be done by making a 6 to 10 pound reduction of brake pipe pressure (see Rule 15), and then wait 15 seconds, when a further reduction of brake pipe pressure shall be made so that the total amount of reduction shall be 25 pounds. As soon as the brake valve exhaust ceases, the Engineman will take the brake pipe leakage of the train for 30 seconds and will report it to the inspectors. This leakage must not exceed 5 pounds per minute as a maximum amount. The inspectors will then go over the train noting the condition of brakes and attachments, remedy-

ing such defects as are necessary, and, after having passed to the rear end, the inspector will signal the Engineman by four blasts of the air signal whistle (using the signal cord of rear car) to release the brakes, which will be done by placing the Engineer's brake valve handle in full release position until the brake pipe pressure has been restored to within 5 pounds of the pressure carried, before returning the brake valve handle to running position, after which a **short release** must be made by moving the automatic brake valve handle from running to full release position momentarily, returning to running position immediately. The inspectors will then return along the train and note if all brakes have released satisfactorily, and report to both Conductor and Engineer the number and type of brake equipments in the train, and condition of brakes. The train will then be ready to depart and will be so reported to the proper authority at the station by the inspectors. In case the train is held at a station 10 minutes after regular leaving time, the inspectors must have Engineman apply and release the brakes before leaving, and see that brakes work throughout the entire train.

14. At intermediate points where locomotives are changed on passenger trains, the air brake inspection shall be made as follows:

The incoming locomotive will apply the brakes and leave them set. The inspectors will then pass along the train making the regular inspection. When the outgoing locomotive is coupled on to the train it will charge the train to standard brake pipe pressure, thereby releasing the brakes, and when the train has been charged, the inspectors will signal the Engineman to apply the brakes, which will be done by making a 6 to 10 pound reduction of brake pipe pressure, then waiting

15 seconds and make a further brake pipe reduction so that the total amount will be 25 pounds. The inspectors will then pass along the train, noting if all the brakes have applied, and on arriving at the rear end of the train they will signal the Engineman by four blasts of the air signal whistle (using the signal cord of rear car), to release the brakes, which will be done by the Engineer placing brake valve handle in full release position until the brake pipe pressure is restored to within 5 pounds of the pressure carried, before returning it to running position, after which a short release, as per Rule 11, must be made.

15. The minimum amount of brake pipe reduction which will apply the brakes throughout a passenger train is as follows:

6	pound	reduction	for	1 to	8 cars.
7	"	"	"	10	"
8	"	"	"	12	"
9	"	"	"	14	"
10	"	"	"	16	"

NOTE:—Demonstrations have shown that it requires approximately 6 seconds for the brake to commence applying on rear car of a long passenger train.

It requires 20 seconds to release the brakes entirely on a long passenger train after a heavy service application, when retaining valves are **not used.**

It requires 40 seconds to release the brakes on a long passenger train after an emergency application, when retaining valves are **not used.**

When retaining valves are being used it requires 1 minute for the brake cylinder pressures to reduce the holding value of the retaining valves (normally 15 pounds), after a heavy service application.

16. With a passenger train, after it has attained a speed of approximately 8 to 10 miles per hour after leaving an initial or inspection station, or any point where locomotives have been changed or hose has been separated, also at least one mile from railway crossings, drawbridges, or before descending a heavy grade, without shutting off steam, the brakes should be applied, as per Rule 15, to ascertain whether they are working properly.

When such test is made the rear brakeman must station himself on the end of the rear car, having retaining valve, and notice if air escapes from it, while the brakes are releasing. If air escapes from it he will give Engineman proceed signal, and if not, the train must be stopped and the cause for the failure of the brakes to operate ascertained and remedied before the train proceeds.

If, for any reason, the view is obstructed, the rear brakeman will give proceed signal by five blasts of the signal whistle, operating the car discharge valve 1 second for each intended blast of signal whistle and allowing a period of at least 4 seconds between each blast.

17. Rear End Test Between Terminals:

When locomotive has been coupled to a train, or when two or more parts of a train have been coupled together, all brake pipe and signal pipe connections must be connected up and cocks in signal and brake pipes opened except on the rear end of the last car which must be closed. After train is properly charged the Engineman will signal the crew by one blast of the steam whistle, and place automatic brake valve handle on lap position. The rear brakeman will then open the angle cock at the rear end of the last car gently, allowing oniy enough air to escape to apply the

brakes slowly and firmly without making an emergency application. The Engineman will note if the brake pipe gauge hand in the cab falls, and when it has fallen he will answer it with two blasts of the steam whistle. The brakeman will then close the angle cock and the Engineman will release the brakes by placing the brake valve handle in full release position until the brake pipe pressure is restored to at least within 5 pounds of the pressure carried, before returning the brake valve handle to running position, and make short release (Rules 11 and 13).

This rear end test will be made in the manner prescribed, at times and points designated by special instructions from the Division Superintendent.

18. In making up trains examine brake pipe and signal pipe couplings, and signal discharge valves to see if they are tight. If a triple valve be found which is defective, cut it out by closing the cut-out cock in the branch pipe leading to triple valve, notifying the inspector or conductor immediately, who will report same to the proper authority.

When picking up passenger cars equipped with LN equipment, if cars are placed in a **freight train,** the supplementary reservoirs must be cut out and drain cock on same left open.

If cars are placed in **passenger trains,** the supplementary reservoirs must be cut in and drain cocks closed.

When picking up passenger cars equipped with PC equipment, if placed in **freight trains,** the emergency reservoir must be cut out and the drain cock left open.

If such cars are placed in a **passenger train,** the emergency reservoir must be cut in unless its pipe has been disconnected and capped.

To use the signal whistle apparatus, pull the signal cord one full second for each intended blast of the whistle, and allow at least four seconds between blasts.

Conductors and Engineman handling trains equipped with air whistle signal apparatus, must know that the device is in good working order, and trains so equipped must be tested by operating the signal whistle from the rear car before leaving a terminal station, and at every other station, where locomotives or cars have been detached or hose couplings have been separated.

Do not test the air signal apparatus by opening the signal pipe cut-out cock at the rear end of train, but always use the car discharge valve for this test.

19. When trains are to be moved backwards, and air brakes operated by backup or tail hose cock, the following test of same must be made:

With train fully charged, the Engineman will place automatic brake valve handle on lap, and brakes will be applied by suitable reduction at backup or tail hose cock. After it has been ascertained that all brakes have been applied, the Engineman shall be signaled to release brakes, and if all brakes release from the locomotive, then Engineman shall return brake valve handle to running position. The train will then be ready to proceed.

20. When helper locomotives are coupled on to head end of trains at points other than terminal points, the incoming Engineman on road locomotive will apply the brakes and close the cut-out cock underneath the Engineer's brake valve, and when the helper locomotive is coupled on, the helper Engineman will release the brakes and charge train to standard pressure. When this

test is being made, a trainman must station himself opposite last car and note if brake is applied and released promptly, and if the brakes operate satisfactorily the train will be ready to proceed.

This method of testing will be made in reverse order when helper locomotives are detached.

21. When two or more locomotives are coupled together, the brake must be operated from leading locomotive only, and the cut-out cock in the brake pipe underneath the Engineer's brake valve on other locomotives must be closed and the air compressor kept working. If compressor on leading locomotive fails, the brake must be operated from the next locomotive until the defect can be repaired.

Special attention is called to the fact that when locomotives are equipped with ET or LT equipment, both the automatic and independent brake valve handles must be placed in running position when the cut-out cock underneath Engineer's brake valve is closed, for, unless the brake valve handles are in this position, the driver and tender brakes on these locomotives cannot release.

22. Charging and recharging of brake pipe and application of brakes for testing must be done from the leading locomotive only, and by Enginemen.

23. Car inspectors and trainmen must at every opportunity look over trains carefully for leaks, improper piston travel and other defects.

NOTE:—Employes when working on a train must protect themselves according to Rules 26 and 26A of the Rules and Regulations of Transportation Department.

24. When defects in the air brake apparatus develop on either passenger or freight trains

between repair stations, which cannot be remedied without serious delay, cut out the brake and **card the car,** and if necessary, place it in the rear end of train. Air brake on rear car of any passenger train must not be cut out unless it is absolutely necessary, and if cut out, the necessary connections to carry brake pipe pressure through to the last car must be provided. Also, a brakeman must be stationed on such car and the hand brake known to be operative. If it is necessary to cut out the brake on the last car of any passenger train, it must be switched ahead of other air braked cars at the first siding.

Passenger cars must not be carded on account of air brake being cut out, but air brake defect card must be made out by the Conductor and handed to the Car Foreman at the first repair station.

To cut out a brake, close the cut-out cock in the cross-over or branch pipe underneath the car, and open the release valve in the auxiliary reservoir until all the air escapes, but on all passenger cars leave the drain cocks open. Do not cut out any brake unless it is absolutely necessary, and when cut out, the Conductor must advise the Engineman.

When cutting out the air brake on a car equipped with LN Schedule, after closing the cut-out cock in the branch pipe leading from the brake pipe to the cylinder head, open the drain cocks on both the auxiliary and supplementary reservoirs and leave them open.

25. When making an ordinary service stop with a passenger train, an initial reduction of brake pipe pressure of from 6 to 10 pounds (Rule 15) should be made at a distance which will not be quite enough to stop the train at the point desired, and then when nearing the point

of stop, an additional brake pipe reduction should be made to stop the train, and the brakes released just before the train stops, by placing the brake valve handle in release position until the pressure in the brake pipe is restored to within 5 pounds of the pressure carried (the locomotive brakes must be cut in). The brake valve handle should then be returned to either running or holding position and the locomotive brake cylinder pressure reduced the desired amount and held applied until the stop is made, the object being to prevent the locomotive surging away from the train. (If the cylinder pressure is high the draft gear will be compressed and shock result.) In making a short release (kick-off), if it is made before stop is completed, the brake valve handle should be returned to holding instead of running position in order to hold the desired brake cylinder pressure on locomotive.

With locomotives equipped with other than the ET or LT apparatus, the locomotive brake cylinder pressure must be regulated with the straight air brake valve, and the New York "B" brake valve handle left in full release position.

When making a stop with a passenger train at a water station, fuel station, or platform where an accurate stop is required, it should be made in the following manner:

The brakes should be applied at a sufficient distance to permit of reducing the speed to approximately 8 miles per hour, then the brakes must be entirely released and recharged, after which the train can be stopped with a light application of the brakes at the point desired, holding the brakes applied until the stop is made.

In making a service stop with a passenger train when a locomotive is equipped with either ET or LT equipment, and the train is wholly

equipped with graduated release brake apparatus (LN, PC or UC equipment), the brakes should be applied hard while the speed of train is high, and then the brakes should be graduated off by operating the brake valve handle between lap and running positions, bringing the train to a stop with little or no pressure in the brake cylinders as the conditions require.

When making the last graduation the brake valve handle should be moved from lap to full release position and back to running or holding position as the conditions require.

26. With all freight trains, before leaving a terminal point or points where other cars may have been picked up, the Conductors must report to Engineers how the train is made up, showing where the heavy loads and empties have been placed in the train, or if the weight of the train is distributed fairly even throughout the entire length.

27. In making a service stop with a freight train, the locomotive throttle should be closed gradually to allow the slack to adjust itself, and after the slack has been adjusted, a brake pipe reduction of sufficient amount to stop the train at the desired point should be made. The amount of brake pipe reduction will vary in accordance with the length and speed of the train. (From 6 to 12 pounds brake pipe reduction is usually sufficient to apply the brakes throughout an ordinary freight train.)

After the initial reduction has been made and train has reached a point about 40 feet from where it would stop, a further brake pipe reduction should be made of sufficient amount to have the brake valve exhausting at the time the stop is completed, and straight air brake should be used

to maintain locomotive driving brake cylinder pressure.

NOTE:—If the train is made up with empty cars on the head end and heavy loads on the rear, care should be taken that the initial reduction of brake pipe pressure is of sufficient amount and made at a distance which will insure the train stopping short of the desired point, for it is not desirable to make a further reduction of brake pipe pressure to complete the stop account of the liability of damaging equipment in the middle of train.

28. In making a service stop with a freight train moving slowly near the point of desired stop, apply the brakes by a continuous reduction of brake pipe pressure, permitting air to flow from the brake pipe continuously until the stop has been made.

Short movements with heavy trains must be avoided, to prevent slack action, and if absolutely necessary to be made, a sufficient number of hand brakes must be applied throughout the train to control the slack.

NOTE:—In making an initial reduction of brake pipe pressure the handle of the engineer's brake valve must be moved promptly to service position.

29. In making a service stop with a freight train backing up with a locomotive on the head end of train only, cut out the driver brakes and make a moderate reduction of brake pipe pressure, at the same time keep the slack crowded in by working steam until the stop is made. When such a movement is made, trainmen must set hand brakes on rear end of the train.

In backing up a freight train with helper locomotives in the rear end of the train, all Enginemen on the head end will cut out their driver brakes and the helper Enginemen will assist in holding up the slack by applying the straight air brake, or if the locomotives are not equipped with straight air brake apparatus, the

reverse lever must be put in the forward motion and the slack held up by working steam. In all cases where this movement is made the trainmen must set hand brakes on the rear cars.

The practice of transferring the handling of the air brakes from front to rear end of train when making a back-up movement is positively forbidden.

30. On heavy descending grades Enginemen will charge train to standard pressure before leaving the summit, and regulate the application of brakes so as to maintain a uniform speed.

In handling freight trains on heavy grades the "one-reduction" method is recommended, making a brake pipe reduction of sufficient amount to hold the train, and in recharging, keep the brake valve handle in full release position until the brake pipe pressure is entirely restored before returning it to running position.

To avoid brakes sticking from an over-charge of the brake system on the head end of train, it is necessary in handling freight trains, after the brakes have been released, and the brake valve handle has been returned to running position, to make at least two short releases by moving the automatic brake valve handle from running to full release position momentarily, and return to running position.

Enginemen handling locomotives which are equipped with the "B," Plate 21, brake valve, should keep the valve handle in full release position at all times when the brakes are released.

Air brakes on freight trains, exceeding 50 cars in length, must not be released at any speed less than 15 miles per hour.

Air brakes on freight trains of less than 50 cars in length must not be released at any speed less than 10 miles per hour.

When all the retaining valves are being used, air brakes on freight trains can be released at any speed not less than 8 miles per hour.

31. Enginemen and Trainmen must accustom themselves to frequent observations of air gauges, both when brakes are being used and at other times, noting by varying pressure any irregularity of the apparatus as well as the operation of the brake.

32. If it is found that the brakes are sticking, the Engineman will endeavor to release them as follows:

Assuming that the brake pipe pressure is less than the standard pressure carried, with excess pressure in the main reservoir, move the brake valve handle to full release position for a few seconds and then return it to running position.

Assuming that the brake pipe is charged to standard pressure, make a 6 to 12 pound reduction according to the length of the train, and release the brakes in accordance with Rule 30.

If the brakes cannot be released by the above means the train must be stopped and the cause ascertained by the Trainmen.

When releasing brakes on passenger trains in which there are LN equipments, it must be understood that unless the brake pipe pressure is restored promptly to within 5 pounds of the pressure at which the brakes had been applied, the LN equipments will perform graduated release and will not release in uniformity with PM equipments.

In handling passenger trains in which there are LN equipments, in case it is desired to reduce the brake pipe pressure from a higher to a lower pressure, it will be necessary to bleed both the supplementary and auxiliary reservoirs, for it

cannot be reduced by making a heavy reduction of brake pipe pressure such as can be done with the PM equipment.

Helper or other locomotives which are coupled on to a train containing LN equipments, must carry a brake pipe pressure of the same amount as was carried by the locomotive which was handling the train, for if the brake pipe pressure should be less on the locomotives which are coupled on to the train, the brakes cannot be released.

33. After starting freight trains, the speed for the first train length must not exceed 8 miles per hour, to enable trainmen to watch the running gear and brake equipment.

34. If the brakes should apply suddenly, with a rapid fall of brake pipe pressure, due to opening Conductor's valve, train parting, or serious leakage from any cause, the Engineman must close the throttle, and if the locomotive is equipped with the older type of brake apparatus, place the brake valve handle on lap to prevent escape of main reservoir pressure, leaving it in such position until the train has stopped. The Engineman will then allow sufficient air to pass to the brake pipe to enable the Trainmen to locate the defect.

In case the locomotive should be equipped with ET or LT equipment under the above circumstances, if on a passenger train, the brake valve handle should be moved to emergency position and left there until train has stopped.

If locomotive should be equipped with ET or LT equipment on a freight train, under the above circumstances, the brake valve handle should be moved to lap position and left there until train stops.

35. If a hose should burst or a train part, Conductors must protect train as per Rule 99 of Rules and Regulations of the Transportation Department. Before attempting to release the brakes, Trainmen must close both angle cocks in the brake pipe at the point of break until the hose is repaired.

36. Locomotives must not be reversed and driver brakes used at the same time.

37. Two short and one long blast of the steam whistle thus: oo————, is a signal that air on leading locomtive has failed and that Engineman on the second locomotive is to take control of the train, who, as soon as he has obtained control of the air brake, must repeat the signal oo————.

Two short blasts of the steam whistle repeated with an interval, thus: oo oo, is signal from leading Engineman to the second Engineman to assist in recharging the train, and as soon as second Engineman knows that the train is fully recharged, or increased speed of train shows that brakes should be again applied, he must close cut-out cock underneath Engineer's brake valve.

NOTE:—This practice should be resorted to only in case of extreme emergency.

Two short blasts of the steam whistle repeated three times is the signal for brakes sticking.

NOTE:—See Rule 14, Sections n, o and p, Rules and Regulations of the Transportation Department.

38. Frequent application and release of the brakes without allowing sufficient time to recharge the auxiliary reservoirs to standard pressure, reduces the brake efficiency and must be avoided, but in handling trains on descending grades, in order to maintain a uniform speed, application and release of brakes should be made as often as is necessary.

In handling freight trains on descending grade it is desired that the short cycle one-reduction method must be used, and must be operated as follows:

Charge the train to standard pressure before leaving the initial point or summit of grade. After leaving summit make two or three applications and allow train to attain the desired speed. When the speed has been attained, with the brakes set, they should be released just at the instant train starts to slow down. Immediately before releasing, the pressure on brake pipe gauge should be noted. Brake valve handle should be left in release position until brake pipe pressure is restored before placing same in running position (ET or LT brake valve), (The N. Y. brake valve left in release position.) Just before the train starts to gain speed, one reduction of brake pipe pressure should be made, bringing the brake pipe pressure down to where it was immediately before releasing. After brake valve exhaust ceases and train is about to slow down again, the brake pipe pressure should be noted and release made as before. This operation should continue until the foot of grade is reached, the speed of train being low enough to permit of gaining on each recharge, the amount of air used on the previous application.

Short releases should be made as per Rule 30 to eliminate overcharge on head cars.

39. After releasing the brakes on a passenger train, steam must not be used to start the train until after 20 seconds time has elapsed from the time brake valve handle was placed in full release position, except where starting on heavy ascending grades with two locomotives on head end of train, then the head Engineman should release the brakes and start to work steam at once, taking

out the slack, and after sufficient time has elapsed for the brakes to be fully released, the second Engineman will commence to work steam.

40. In order to have the brakes apply fully throughout a long freight train in which there are both H and K triple valves, an initial reduction of less than 6 pounds should not be made, and from 6 to 12 pound reductions should be made in accordance with the length of the train.

NOTE:—The exact amount of reduction necessary to apply brakes throughout the train cannot be given on account of the fact that trains do not consist entirely of K equipment.

41. The straight air or independent brake should not be used to stop trains, and in using it to control slack action great care must be exercised or it will cause a severe run-in with damage to lading and equipment.

42. Engineman must report on Roundhouse Work Book, defects in air brake or signal apparatus.

43. A number of freight cars have been equipped with Empty and Load brake apparatus on which the braking power in empty position is the same as that on an ordinary car, but in loaded position it is practically double that of an ordinary car. When such cars are handled in freight trains, the following rules will apply:

(a) When cars are empty or contain less than one-half load, the handle on side sills of car should be placed with pointer in empty position.

(b) When cars contain more than one-half load, the handle on side sills of car should be placed with pointer in loaded position, and the locking rod should be turned so as to lock the pointer in this position.

(c) These cars are equipped with the 10-20 spring type of retaining valve which has three positions of the handle as follows:

Vertical position when it is off.

Midway position between vertical and horizontal holds 20 pounds in the brake cylinder.

Horizontal position, holding 10 pounds in the brake cylinder.

When using retaining valves, if the brake apparatus is in loaded position, the 10 pound or horizontal position of the retaining valve handle should be used.

If in empty position and car is empty, the 10 pound position of retaining valve handle should be used, but if the car is being used in grade work, when loaded to one-half capacity, the 20 pound position of the retaining valve handle should be used.

(d) Since the brake apparatus on these cars will return to empty position as the air is exhausted down to about 20 pounds in the auxiliary reservoir, when these cars are taken into a terminal yard or set out, it will be necessary to unlock the change-over handle. Then when the air leaks off of the car the brake apparatus will return to empty position, but if it is necessary to change the position of the braking apparatus immediately, it must be done by placing the change-over handle from loaded to empty position.

(e) To cut out an Empty and Load brake, close the cut-out cock in the cross-over or branch pipe and open the release valve on the auxiliary reservoir the same as is done with other types of freight cars.

(f) No special instructions are required by the Engineman to handle trains partially or wholly equipped with the Empty and Load brake.

The automatic brake valve should be handled as good practice requires in handling freight trains.

44. When freight or passenger cars are picked up, Trainmen must see that hand brakes are released and air brakes cut in before moving the car (unless car has defect card on it), and that piston travel is between 5 and 7 inches.

45. When freight cars are set out, release the air and apply the hand brakes. If hand brakes are defective, card the car with an air brake defect car, erasing the word "air," and block the car securely.

When passenger cars are set out apply the air brakes with service application then set the hand brake, after which release the air brake, and block car securely if standing on grade.

46. When necessary to release the air brakes on freight cars, open the release valve on the auxiliary reservoir until the brake begins to release and then close it.

When necessary to release the brake on a passenger car equipped with PM equipment, open the drain cock on the auxiliary reservoir until the brake begins to release and then close it.

When necessary to release the brake on a passenger car equipped with LN equipment, open the drain cock on the auxiliary reservoir, holding it open until the brake cylinder piston has released entirely, and then close it. If the brake reapplies it will be necessary to drain a portion of the pressure from the supplementary reservoir.

When necessary to release the brake on a passenger car equipped with PC equipment, open the drain cock on the service reservoir until the brake begins to release and then close it.

When cutting out the brake on any passenger

car, after closing the cut-out cock in branch pipe, open the drain cocks on all reservoirs and leave them open.

47. When freight trains are standing on a grade where it is necessary to keep the brakes applied, hand brakes must be set and straight air brake applied on locomotive or locomotives, then the automatic brake released so as to have train charged to maximum brake pipe pressure before starting. When trains are standing on descending grade, hand brakes must be set on head end of the train, and when standing on ascending grade, hand brakes must be set on rear end of train.

When a freight train is standing on a descending grade of 2% or over for a short space of time, straight air brake on the locomotive must be applied to its full capacity, and the automatic brakes must be released and train charged to maximum pressure, then a brake pipe reduction of 12 to 15 pounds must be made. After holding the automatic brakes applied for not to exceed one minute, they must be released, recharged, and reapplied once every two minutes while the train is standing. Thus, when the train is ready to leave, there will be pressure in all of the brake cylinders which will prevent the slack from running in from the rear end, causing a severe shock to the train.

When a freight train containing helper locomotives is standing on a grade and the leading locomotive has been detached, all the helper Enginemen will apply the straight air brake fully. When the road locomotive is detached the Engineman will signal the leading helper Engineman to take control of the train, who will cut in the automatic brake and charge the train to standard pressure. When the road locomotive is again attached to the train the helper Engineman

must apply the automatic brakes with a 15 pound brake pipe reduction and close the cut-out cock underneath the Engineer's brake valve.

48. On grades where places are designated for freight trains to stop to permit cooling of wheels, the first place designated for this purpose should not be more than 5 to 7 miles from the point at which heavy braking commences after leaving the summit of the grade.

Freight trains descending grades where special instructions require them to stop for inspection and cooling of wheels, must remain at such point ten minutes to accomplish the object desired.

49. In case of a complete air brake failure, a train must not be moved unless it can be done with absolute safety, and no open telegraph office must be passed with train in such condition, without authority from Division Superintendent. If it is considered unsafe to move the train to a telegraph office, it must be placed on the first side track and secured by hand brakes.

If a train cannot be controlled safely by the air brakes the following data concerning the train must be obtained by the inspectors at the first inspection point and forwarded to the Division Superintendent and Master Mechanic:

Number of Locomotives and name of Engineman.
Initial, number and tonnage of cars.
Number of operative air brakes.
Piston travel of each car.
Brake leverage of each car.
Brake pipe leakage.
Brake cylinder leakage.
Condition of retaining valves.

50. In case the air compressor should stop while running on a descending grade, train must

be immediately brought to a stop and secured by hand brakes before the Engineman begins an investigation for the defects, and in case the trouble cannot be remedied, movement of the train must be in accordance with Rule 49.

51. Trainmen are cautioned to see that wheels are not slid flat by retaining valves being turned up at points where it is unnecessary, and they will be held responsible for such damaged wheels.

52. To apply the brakes from the train, open the Conductor's valve suddenly to full extent, leaving it open until train stops. This valve should be used only in cases of emergency.

53. Pressure retaining valves are ordinarily located on ends of cars near the brake staff on freight cars, and on the vestibule of passenger cars.

Retaining valves for freight cars are of two types known as 15 pound retaining valve and either a 10-20 or 15-30 pound retaining valves. Retaining valves for passenger cars are known as 10 or 15 pound retaining valves.

These retaining valves are used to retain a portion of the pressure in the brake cylinders in order to give more time for recharging the the auxiliary reservoirs, and the use of retaining valves on the various grades must be governed by local conditions.

The 10 or 15 pound retaining valve for passenger cars has two positions of the handle, viz.: Vertical position is when the retaining valve is not in use. In horizontal position they will retain either 10 or 15 pounds pressure in the brake cylinder.

The 10-20 or 15-30 pound retaining valve for

freight cars has three position of the handle. In vertical position retaining valve is not in use. In midway position or at an angle of 45 degrees, they will retain either 20 or 30 pounds in the brake cylinder. In horizontal position they will retain either 10 or 15 pounds in the brake cylinder.

The placing of retaining valve handles in any other positions than those above indicated, is **positively forbidden.**

When practicable, on descending grades, all retaining valves must be used, but the following general rules will apply:

54. On freight trains retaining valves should be handled as follows:

If the train is heavy and all retaining valves can be used, they must all be turned up before beginning descent of the grade, and they should remain in this position until train has descended the grade, unless it is found that some of the wheels are becoming overheated, then those may be turned down, but care must be exercised in not turning too many of them down so as to destroy the holding power, rendering it difficult for the Engineman to control the train.

If the train consists of loads and empties and all of the retaining valves are not required, it is advisable to turn up the retaining valves on all of the loads and every second or third one on the empties. If the train consists of empties only, it may be advisable to turn up every second or third retaining valve throughout the train.

On long grades if retaining valves are used on a portion of the cars, those turned up on first part of the grade should be turned down later and others turned up in their place, in order to avoid the liability of over-heating some of the wheels.

In turning down retaining valves to allow

trains to start, or to run over flats, trainmen should commence turning them down from the rear end of the train.

When trainmen discover over-heated wheels, the retaining valve on that car should be turned down, piston travel taken, and the same noted on defect card which should be delivered to inspector at next inspection point, and the inspector should examine the triple valve, retaining valve pipe and valve for the defect.

Where practical, all retaining valves on passenger trains must be used, and if this number is found to be excessive, every alternate one can be used.

55. The Westinghouse high speed, automatic reducing valve and New York compensating valves on passenger cars must be adjusted to close when the brake cylinder pressure is reduced to 60 pounds, and must receive the same attention as regards cleaning as is given to the triple valve and brake cylinder.

All cars equipped with PM equipment and used in high speed brake, trains must be equipped with these valves or with temporary safety valves set at 60 pounds. If neither valve can be applied, the brake pipe pressure must be reduced to 80 pounds.

56. When the air brake apparatus on any car has been cleaned, the brake cylinder must be tested for leakage by charging car to standard pressure, attaching gauge to exhaust port of triple valve or retaining valve, apply brakes with a 25 pound reduction and release them. The gauge will then show the amount of brake cylinder leakage which must not exceed 5 pounds per minute from a 50 pound brake cylinder pressure.

57. Car Inspectors must not permit a car to leave terminals or repair points without brake cut in and operative.

58. Car Inspectors must see that all brakes on passenger and freight cars are cleaned, oiled, tested and stenciled according to M. C. B. Rules. All old stenciling must be erased when new stenciling is applied. Air brakes on cabooses and water cars must be cleaned each three months. Air brakes on S. P. oil cars must be cleaned each six months.

59. (See Rule 2.) Air gauges on cabooses must be tested and corrected every ninety days, and date of correction stenciled on the face.

60. Whenever air or signal hose on passenger cars or cabooses are not coupled between cars they must be coupled to the dummy couplings provided for that purpose, to prevent injury to the hose or admission of dirt to the pipes.

61. Extra air brake and signal hose must be carried in baggage cars and in cabooses.

62. On descending grades of 1.8% or over, the tonnage per brake will be prescribed by the Division Superintendent, and on grades of less than 1.8% the tonnage may be handled without restriction.

GENERAL INFORMATION

FOR THE

MAINTENANCE OF AIR BRAKES, AIR SIGNALS AND TRAIN HANDLING

The safe control of trains is dependent on the efficiency of maintenance and manipulation of the air brakes. Those who make use of the apparatus must have a knowledge thereof to the extent herein given, which is also a guide to further investigation.

1. Q. What power is used to operate the brakes on locomotives and trains?
A. Compressed air.

2. Q. How is the air compressed?
A. By an air compressor on the locomotive.

3. Q. How does the compressed air apply the brakes?
A. It is admitted into a brake cylinder on each car, and it pushes out a piston in that cylinder, which pulls the brake on.

4. Q. What two systems are in use?
A. Straight air and automatic.

5. Q. Where is the automatic used?
A. On locomotives, tenders and cars.

6. Q. Where is the straight air brake used?
A. On locomotives, tenders and motor cars.

7. Q. What equipment is necessary on locomotives, tenders and motor cars for operating straight air brake?
   A. A compressor, main reservoir, reducing valve, straight air brake valve, safety valve, and on locomotives a double check valve.

8. Q. With the straight air brake, where is the air stored?
   A. In a main reservoir.

9. Q. How is this brake operated?
   A. By admitting air to the brake cylinders, direct from the main reservoir.

10. Q. What is the straight air brake valve used for?
    A. To apply and release the brakes on locomotive and tender, independent of the automatic brake.

11. Q. What is the straight air reducing valve used for?
    A. To reduce the main reservoir pressure to the proper pressure for the brake cylinders.

12. Q. What is the straight air brake safety safety valve used for?
    A. To limit brake cylinder pressure.

13. Q. What prevents air from escaping from triple valve exhaust when the straight air brake is applied?
    A. The double check valve.

14. Q. What prevents air from escaping from straight air brake valve exhaust when automatic brake is applied?
    A. The double check valve.

15. Q. What pipe connections lead to ends of double check valve?

   A. The pipe from the triple valve, and the pipe from the straight air brake valve.

16. Q. What pipe connections lead to sides of double check valve?
    A. The brake cylinder and safety valve pipes.

17. Q. When straight air brake is used on road locomotives, what is its purpose?
    A. To keep the slack together while releasing automatic brakes, or controlling slack of train at any time, and in handling light locomotives.

18. Q. How many types of automatic brakes are used on locomotives and tenders?
    A. Two. The old type automatic and new automatic control system.

19. Q. What equipment is necessary on locomotives and tenders to operate old type automatic brake?
    A. Air compressor, main reservoir, engineer's automatic brake valve, brake pipe, plain triple valves, auxiliary reservoirs and brake cylinders.

20. Q. Where is the compressed air kept ready for use in the automatic air brake?
    A. In the main reservoir on the locomotive, in the smaller or auxiliary reservoir on each car and in the brake pipe.

21. Q. Where does the air come from directly that enters the brake cylinder when the old style automatic brake is applied?
    A. From the auxiliary reservoir.

22. Q. How does it get into the auxiliary reservoir?
    A. Through the triple valve from the brake pipe, when brakes are released.

23. Q. Where is the brake pipe supplied from?
A. From main reservoir through the Engineer's brake valve.

24. Q. How does the new automatic control equipment differ from the old automatic?
A. The Westinghouse distributing valve and reservoir, or the New York control valve and reservoir, is substituted for the triple valves and auxiliary reservoirs.

25. Q. What are the principal parts of the distributing and control valves, and their reservoirs?
A. Equalizing piston and slide valves, application piston and slide valves, pressure chamber and application chamber and cylinder combined, and safety valve.

26. Q. Where is the air in the brake cylinders supplied from?
A. From main reservoir.

27. Q. What controls the pressure admitted to the brake cylinders?
A. The pressure applied to the control or application pistons and is limited by the safety valve.

28. Q. Where does the pressure applied to the control or application piston come from, from an automatic application?
A. From the pressure chamber.

29. Q. What advantage has this system over the old automatic?
A. Brake cylinder leakage is automatically supplied, also variations in piston travel does not affect the brake cylinder pressure.

30. Q. How many types of automatic brake valves are in service on this road?
A. Westinghouse G-6 and H-6; New York B and L brake valves.

31. Q. What controls the main reservoir and brake pipe pressure with the G-6 brake valve?
A. A compressor governor connected to the main reservoir controls this pressure. Brake pipe pressure is controlled by a feed valve when brake valve is in running position.

32. Q. What controls the main reservoir pressure with H-6 and L brake valves?
A. When brake valve is in full release, running and holding positions by a compressor governor head connected to the brake valve, known as the excess pressure head. When the brake valve handle is on lap, service or emergency positions, by a governor head connected direct to the main reservoir, known as the maximum pressure head.

33. Q. What controls the brake pipe pressure with the H-6 and L brake valves?
A. Brake pipe pressure is controlled by a feed valve in holding and running position.

34. Q. What controls the brake pipe pressure with the B brake valve?
A. A compressor governor connected direct to the brake pipe pressure.

35. Q. What controls the main reservoir pressure with the B, Plate 21, brake valve?
A. When the brake valve is in release and running positions the brake pipe

governor has control, but when brake valve is on lap, service and emergency, it is controlled by a maximum governor head connected direct to the main reservoir pressure.

36. Q. How many types of independent brake valves have we in use?

A. Three. Westinghouse S-6 independent, S-3, and New York Plate 22 straight air brake valves.

37. Q. How is the brake applied with the Westinghouse independent brake valve?

A. By admitting air direct from the main reservoir through a reducing valve to the application chamber of the distributing valve.

38. Q. At what pressure should the Independent reducing valve be set?

A. 45 pounds.

39. Q. What air brake equipment is necessary on cars?

A. Angle cocks, hose, brake cylinder, auxiliary reservoir, triple valve, brake pipe, brake pipe strainer or centrifugal dirt collector, pressure retaining valve, and on passenger cars and cabooses, a conductor's valve.

40. Q. Why does the compressed air not enter directly into the brake cylinder from the brake pipe?

A. Because the triple valve used with the automatic brake prevents the air from entering directly from the brake pipe to the brake cylinder.

41. Q. What is the use of the angle cocks?

A. They are used to close the brake pipe at both sides of any hose coupling

which is to be parted, as when the train is cut in two, and to close the brake pipe at both ends of the train.

42. Q. Why is it necessary to close the brake pipe on both sides of the hose coupling before it is parted?

A. To prevent the escape of air from the brake pipe, which would apply the brakes.

43. Q. How must the hose couplings be parted when it is necessary to do so, and why?

A. Must be by hand, to prevent the possibility of injury to the rubber gasket in the coupling.

44. Q. In coupling or uncoupling the hose between cars, what must be done if there is ice in the couplings?

A. The ice must first be removed and the couplings thawed out, so as to prevent injury to the rubber gaskets in uncoupling, and to insure tight joints in coupling the hose.

45. Q. What must be done with a hose coupling which is not coupled up, such as the rear hose of a train, or any hose on a car which is standing or running, but not in use?

A. It must be coupled to the dummy coupling.

46. Q. What pressure should be carried in the brake pipe and auxiliary reservoir?

A. The authorized pressure, as per standard instructions.

47. Q. Why should the authorized pressure be maintained?

A. Because this pressure is necessary to get the full braking force which each car

is capable of using, and if it is exceeded, there will be danger of sliding the wheels.

48. Q. How many types of triple valves are used on freight cars?
A. Two. Standard quick action and K type triple valves.

49. Q. How many types of triple valves are used on passenger cars?
A. Two. Old type quick action and pipeless or L triple valves.

50. Q. What other types of brake equipment are used on passenger cars?
A. The PC (Passenger Control) and the Universal Control equipment.

51. Q. What three things does the triple valve do?
A. Charges the auxiliary reservoir, applies and releases the brakes.

52. Q. At what rate does an auxiliary reservoir charge on a freight car?
A. Approximately 1 pound per second.

53. Q. What causes the automatic brake to apply?
A. Reducing the brake pipe below the auxiliary reservoir pressure.

54. What causes the automatic brake to release?
A. Increasing the brake pipe pressure above the auxiliary reservoir pressure, or reducing the auxiliary reservoir pressure below the brake pipe pressure.

55. Q. How does the brake cylinder piston get back when the brakes are released?
A. There is a spring around the piston rod which is compressed when the brakes

are applied, and when the air is allowed to escape, this spring reacts and pushes the piston back.

56. Q. Name working parts of plain triple valve.
A. Triple piston, slide and graduating valves.

57. Q. Are the same parts contained in quick action triple valves?
A. Yes, and in addition, an emergency valve, piston and check valve.

58. Q. Are all valves fastened to triple piston?
A. No, only slide and graduating valves.

59. Q. What is the duty of triple piston?
A. To operate both slide and graduating valves, and open and close feed groove and ports.

60. Q. What moves the triple piston?
A. The difference of air pressure on either side of triple piston.

61. Q. What two pressures are carried on sides of triple piston?
A. Brake pipe pressure on one side, and auxiliary reservoir pressure on the the other.

62. Q. To have triples respond promptly on reduction, how must these pressures stand?
A. Equal.

63. Q. With 80 pounds brake pipe pressure what service reduction will fully apply a brake?
A. 25 pounds.

64. Q. Why does 25 pounds reduction from the brake pipe fully apply the brakes?

A. It causes the auxiliary reservoir and brake cylinder pressures to equalize.

65. Q. How much pressure is then in the auxiliary reservoir and brake cylinder?
A. 60 pounds.

66. Q. Why does 25 pounds from the auxiliary reservoir make 60 pounds in the brake cylinder?
A. The auxiliary reservoir is approximately two and one-half times the capacity of the brake cylinder.

67. Q. What kind of a reduction should be made from the brake pipe to get service application?
A. A gradual reduction.

68. Q. Can the brakes be applied so as to get only a portion of this 60 pounds pressure in the brake cylinder, and how?
A. Yes, they can be so applied by making limited reductions of brake pipe pressure.

69. Q. How is this graduated action obtained?
A. By means of a graduated reduction of brake pipe pressure.

70. Q. If the brake pipe pressure be reduced 10 pounds what will be the pressure in the brake cylinder?
A. About 25 pounds.

71. Q. Is it important to keep all the air brake apparatus tight and free from leaks?
A. Yes.

72. Q. Why is this important?
A. In order to get full service from the air brakes, and to prevent the waste of air, and also to prevent the brakes

applying automatically by reason of leaks in the brake pipe.

73. Q. Is it important to know that the brake pipe is open throughout the train and closed at the rear end before starting out?
A. Yes, this is very important.

74. Q. Why is this very important?
A. Because if any cock in the brake pipe were closed, all the brakes back of the cock which is closed would be inoperative.

75. Q. How can you ascertain that the angle cocks are all open when the train is made up?
A. By testing the brakes; that is, by applying and releasing them, and observing whether they all operate.

76. Q. Do you understand that no excuse will be acceptable for starting the train without first testing the air brakes?
A. Yes.

77. Q. Why is this rule absolute?
A. Because the safety of passengers and of property depends upon the brake being properly coupled up and in an operating condition before the train is started.

78. Q. At what other times should the brakes be tested?
A. After each change in the make-up of the train and before starting the train down grade.

79. Q. What kind of a reduction should be made from the brake pipe to get quick action?
A. A quick reduction.

80. Q. What is the difference between service and quick action with the old type quick action triple?

A. In service, air is admitted to the brake cylinder from the auxiliary reservoir only, while in emergency, air is admitted to the brake cylinder from both brake pipe and auxiliary reservoir.

81. Q. Why is brake pipe air admitted to the brake cylinder?

A. To increase the brake cylinder pressure, and secure a local brake pipe reduction.

82. Q. Why is a local brake pipe reduction needed?

A. To secure quick action of the next triple, insuring serial quick action, throughout the train.

83. Q. What additional features has the K triple valve over the old standard, quick action triple?

A. Quick service, retarded release and uniform recharge.

84. Q. How is quick service obtained?

A. By venting a small amount of brake pipe pressure to the brake cylinder in service application.

85. Q. How is retarded release obtained?

A. By a considerable increase of brake pipe pressure over the auxiliary reservoir pressure, which moves the triple piston to a position restricting the triple valve exhaust.

86. Q. When and how will the retarded recharge be obtained?

A. At the same time and under the same conditions as retarded release.

87. Q. How far back from the locomotive can the retarded release be obtained?

A. About twenty-five cars.

88. Q. Why is the recharge retarded?

A. To prevent overcharging the head auxiliary reservoirs in the train, permitting a heavier flow of air to rear of train.

89. Q. What equipment is necessary for the complete LN Schedule?

A. Brake Cylinder, L Type Triple Valve, Auxiliary and Supplementary Reservoirs, Angle Cocks, Hose, Dirt Collector and Retaining Valve.

90. Q. How is the supplementary reservoir charged?

A. From the brake pipe through the triple valve and auxiliary reservoir.

91. Q. What is the pressure in the supplementary reservoir used for?

A. Quick recharge, graduated release and high pressure in emergency.

92. Q. How much larger is the supplementary reservoir than the auxiliary reservoir?

A. About two and one-half times as large.

93. Q. Is the supplementary reservoir pressure used during a service application?

A. No, it is cut off by the triple valve.

94. Q. How is the quick recharge accomplished?

A. When the brake pipe pressure is increased enough to move triple valve to release position, a port is opened from the supplementary to the aux-

iliary reservoir, which allows the supplementary reservoir pressure to increase that in the auxiliary.

95. Q. How much will the auxiliary reservoir pressure be increased?

A. Equal to the increase of the brake pipe pressure, but not greater than the equalizing point of the supplementary and auxiliary reservoirs.

96. Q. After a full service application and release, at what point will the supplementary and auxiliary reservoir equalize?

A. Within about 5 pounds of the brake pipe pressure carried.

97. Q. How is the remaining 5 pounds restored to the supplementary and auxiliary reservoirs?

A. From the brake pipe pressure through the feed ports of triple valve.

98. Q. What prevents the supplementary reservoir pressure increasing the auxiliary above the increase in brake pipe pressure?

A. When the auxiliary increases slightly above the brake pipe, the slide valve in triple is moved to a position that closes the port from the supplementary to the auxiliary, also the exhaust port from the brake cylinder.

99. Q. What are the advantages of the quick recharge?

A. First: After a full release of brakes, practically full braking power is available at once.

Second: After a partial release and recharge, auxiliary and brake pipe

pressures are equal, insuring a prompt response of brakes to a reduction of brake pipe pressure.

100. Q. How is a complete release obtained?

A. By increasing brake pipe pressure to within 5 pounds of the pressure at which the brakes were applied.

101. Q. How is graduated release obtained?

A. By increasing brake pipe pressure slightly above the auxiliary reservoir pressure.

102. Q. How should the brake valve be handled to obtain graduated release?

A. Place the brake valve handle in running position until the desired increase of brake pipe pressure is obtained, then return the handle to lap position, to be repeated for further graduation.

103. Q. How should the brake valve be handled to release the brakes without graduation?

A. Place the brake valve handle in full release position until the brake pipe pressure is restored to within 5 pounds of pressure carried and then return to running position, after which make "short release."

104. Q. How is a short release or "kickoff" made?

A. By moving the automatic brake valve handle from running to full release position momentarily and returning to running position immediately.

105. Q. What is a short release usually called?

A. A "kick-off."

106. Q. Why is a short release necessary after a full release and returning brake valve handle to running position?

A. To release any brake which may have reapplied and especially to assure that the equalizing portion of distributing or control valve of locomotive equipment has returned to full release position.

107. Q. How many short releases should be made after releasing the brakes on a passenger train?

A. One, usually.

108. Q. Explain the high pressure emergency feature of the LN equipment.

A. When triple valve is in emergency position, direct communication is opened from the supplementary to auxiliary reservoir and the brake cylinder, the combined capacity of both reservoirs will equalize with the brake cylinder at a pressure about 10 pounds lower than the pressure carried.

109. Q. When it is necessary to bleed a brake with the supplementary reservoir cut in, how should it be done?

A. By bleeding the supplementary and auxiliary reservoirs.

110. Q. How may the quick recharge, graduated release and high pressure emergency features be made inoperative in an LN equipment?

A. By closing the cut-out cock in the pipe between the supplementary reservoir and brake cylinder head.

111. Q. With the supplementary reservoir cut out, how does the brake operate?

A. Same as with the old standard quick action triple valve.

112. Q. What undersirable result might obtain if the supplementary reservoir were cut out?

A. There would be liability of an overcharge of the auxiliary reservoir and a subsequent reapplication of the brake.

113. Q. Why will this action occur?

A. Account of the supplementary reservoir being two and one-half times the volume of the auxiliary reservoir and the feed ports in the L triple valve are made of proper capacity for this volume, then when the supplementary reservoir is cut out the feed ports are too large for the auxiliary reservoir volume.

114. Q. What feature is operative with the supplementary reservoir either cut in or cut out?

A. The quick service feature.

115. Q. Describe the quick service feature.

A. A small amount of brake pipe pressure is admitted to the brake cylinder during service application.

116. Q. Is the usual method of train handling affected by the quick service feature?

A. No.

117. Q. How many valves on an engine for operating signal whistle?

A. Two, reducing valve and signal valve.

118. Q. Where is the reducing valve located?

A. Between main reservoir and signal pipe

119. Q From where does the air signal apparatus receive its pressure?
A From the main air reservoir through the reducing valve

120. Q What are the duties of reducing valve?
A To reduce main reservoir pressure to a suitable pressure for operating the air signal apparatus.

121. Q. What pressure is required for operating same?
A. 45 pounds.

122. Q. Is it important that this signal pipe and its connections be also kept tight?
A. Yes.

123. Q. If signal whistle regulating valve blows every time the brake is released, what is wrong?
A. Dirt under the valve in the reducing valve, or combined strainer check valve off seat.

124. Q. How does this affect the whistle?
A. Allows pressure in main reservoir to equalize with signal pipe pressure and when brakes are released, main reservoir pressure being lowered, the pressure in signal pipe flows back to the main reservoir, which reduction causes whistle to blow.

125. Q. If whistle fails to blow, and you know signal pipe is charged, where should you look for the defect?
A. In signal valve, car discharge valve, or signal whistle.

126. Q. Before reporting same, what inspection should be made?
A. Inspect all connections for leaks, and see if signal whistle needs adjusting or cleaning.

127. Q. What operates the train air signal?
A. A reduction in the train air signal pipe-pressure made by opening the car discharge valve.

128. Q. How does the handle of the cut-out cock in cross-over pipe stand when open?
A. Crosswise (at right angles) with the pipe, and grove in top plug parallel to pipe.

129. Q. How does the handle and groove stand when the cock is closed and brake cut out?
A. Straight (parallel) with cross-over pipe, and the groove at right angles to pipe.

130. Q. How is the brake pipe coupled up between the cars?
A. By means of a hose on each end of the brake pipe, fitted with a coupling.

131. Q. How is the brake pipe closed at the rear of train?
A. By closing the angle cock in brake pipe at the rear end of last car.

132. Q. How many angle and cut-out cocks in brake and signal pipes on each car?
A. Two each in brake and signal pipes.

133. Q. How many kinds of cocks in brake and signal pipes at ends of car?
A. Two.

134. Q. Describe each, and give position of the handle and groove for open and closed position in each case.

A. The older form of brake pipe cock is a straight cut-out cock located in the brake pipe, close to the hose connection; the handle stands crosswise (at right angles) with pipe when it is open and straight (parallel) to the pipe when closed. It is now used principally on the signal pipe and front end of brake pipe on locomotives.

The other form of cock used on the brake pipe is an angle cock placed at the end of the brake pipe and hose screwed into it. The handle of the angle cock stands straight (parallel) with the pipe when it is open, and crosswise (at right angles) to the pipe when it is closed. The groove in top of plug is a guide to tell whether open or closed.

135. Q. In addition to closing brake and signal pipes at end of train, what are these angle and cut-out cocks used for?

A. To close brake and signal pipe at hose connections, before hose is uncoupled for any purpose.

136. Q. What is the pressure retaining valve, and what is its use?

A. The pressure retaining valve is a small valve placed at the end of a pipe from the triple valve, through which the exhaust takes place from the brake cylinder. It is used to retard the brake release on heavy grades, and holds the brakes partially

applied, so as to allow more time for the Engineman to recharge the auxiliary reservoir.

137. Q. What is the function of the retaining valve?

A. To hold a certain pressure in brake cylinder, varied according to type of retainer, thus keeping the brakes applied sufficiently to allow a longer period for recharging auxiliary reservoirs.

138. Q. To what part of triple valve is retainer pipe attached?

A. To exhaust port, making exhaust passage from triple valve to retainer.

139. Q. Where are they used?

A. On descending grades.

140. Q. Why used on such grades?

A. To control speed of train and give the Engineman time to recharge auxiliary reservoirs.

141. Q. How many kinds of retaining valves are there?

A. Four. The 10 pound, 15 pound, 10-20 pound and 15-30 pound retaining valves.

142. Q. How many positions has the 10 pound and 15 pound retaining valves?

A. Two. Handle vertical or parallel to the pipe when the retaining valve is not in use. Horizontal, or at right angles to the pipe, when the retaining valve is in use, holding either 10 or 15 pounds in the brake cylinder.

143. Q. How many positions has the 10-20 or 15-30 type of retaining valve?

A. Three. Handle vertical or parallel to pipe when not in use. Horizontal or at right angles to the pipe when holding either 10 or 15 pounds in the brake cylinder. Midway between horizontal and vertical, or at an angle of 45 degrees, when holding either 20 or 30 pounds in the brake cylinder.

144. Q. Will a retaining valve operate satisfactorily if placed in any other position than vertical?

A. No, for the weighted valve is seated by gravity on a ground seat, therefor if it is not vertical it will not seat properly and will allow all the pressure to escape from the brake cylinder.

145. Q. If air pressure is found blowing through a retaining valve, should it be plugged up?

A. No, for that would prevent the brake releasing. The defect is in the triple valve.

146. Q. Do retainers hold air in the brake cylinders before or after brake is set?

A. After brake is set and released.

147. Q. What position should handle be in for full release?

A. Down, or parallel to retainer pipe.

148. Q. In what position to hold air in brake cylinder?

A. See Questions 142 and 143.

149. Q. If this pipe is broken or retaining valve is gone, should brake be cut out?

A. No, only the retaining feature would be lost.

150. Q. What does a heavy blow at the exhaust of retaining valve indicate?

A. A defective triple valve.

151. Q. What should be done?

A. Cut-out cock in cross-over pipe should be closed and triple valve tapped lightly, and the cut-out cock then opened quickly. If the blow at the retaining valve does not cease after this treatment, the brake should be cut out and air brake defect card (Form 2399) applied to the car marked, "Triple valve blows at exhaust."

152. Q. After taking up the slack of the brake shoes, how far should the piston travel out of the brake cylinders on cars and tenders with a full application of the brake?

A. Not less than 5 inches, nor more than 7 inches.

153. Q. What would happen if the piston traveled less than $3\frac{1}{2}$ inches when brakes are fully applied?

A. An application of the brakes would not force the piston beyond the leakage groove in the brake cylinder provided for the escape of small amounts of air.

154. Q. Why should the piston travel not be permitted to exceed 7 inches on passenger cars, tenders or freight cars?

A. Because if it travels farther than this a little wear of the brake shoes will

cause the piston to travel far enough to rest against the non-pressure cylinder head when the brakes are applied, and this cylinder head would then take the pressure instead of its being transmitted to the brake shoes.

155. Q. How far should the driver brake piston travel with a full application of the brakes?

A. Not less than 1 inch nor more than 2 inches for the cam type of brake, and from 4 to 6 inches for other forms.

156. Q. If the brakes stick upon a freight car so that the Engineman cannot release them, how should they be released?

A. By opening the release valve in the auxiliary reservoir, holding it open until air begins to escape from the retaining valve, and then close it again.

157. Q. When there is pressure in the brake pipe how long should release valve be held open to release the brake?

A. Until the brake starts to release.

158. Q. When there is no pressure in the brake pipe how long should the release valve be held open?

A. Until the brake is fully released.

159. Q. If the locomotive is coupled to the train and air brake does not release when all pressure is bled from auxiliary, where would you locate the trouble?

A. Retaining valve handle may be turned up, if not, the triple valve exhaust, retainer pipe or retainer is stopped up.

160. Q. How can the brake be released?

A. First: Remove the plug in the exhaust port on the opposite side of the triple valve, or disconnect the retainer pipe.

Second: Close cut-out cock in branch pipe, bleed the brake off, and apply air brake defect card (Form 2399) marked "Exhaust stopped up."

161. Q. If a brake repeatedly fails to release from the locomotive what should be done?

A. Cut out brake and apply air brake defect card (Form 2399) marked "Brake Sticks."

162. Q. If a brake with auxiliary reservoir charged, fails to apply or remain applied when a brake pipe reduction is made, what is the cause?

A. Leaky brake cylinder packing leather.

163. Q. Should the brake be cut out for above defect?

A. No, but apply air brake defect card (Form 2399) marked "Brake leaks off."

164. Q. How many brakes in a train may be cut out in series, and why?

A. Not more than two. With three or more brakes cut out in series, quick action would not carry through train in emergency application.

165. Q. Should brake on head car be cut out when two engines are coupled to head end of train?

A. No. Quick action cannot be obtained.

166. Q. What should be done with signal or

brake pipe hose couplings that have broken stop pins?

A. They should be discarded by car inspectors.

167. Q. If a 9½ inch air compressor stops what should be done?

A. First: See that lubricator is feeding oil to steam end of compressor.

Second: Shut off compressor steam throttle for a short time and open it again.

Third: Tap the compressor head lightly with steam turned off, then turn steam on quickly.

168. Q. If compressor then fails to start what should be done to locate the trouble?

A. Open drain cock in steam passage to ascertain if compressor governor or throttle allows steam to reach the compressor.

169. Q. If drain cock test proves the trouble to be in the compressor how should the examination be conducted?

A. Remove the plug in the lower air cylinder head and examine the piston rod nuts.

170. Q. If an 8½ inch Cross Compound Air Compressor stops what should be done?

A. Proceed the same as with 9½ inch compressor.

171. Q. If an 8½ inch C. C. compressor is running fairly well but pounds badly, what is often the trouble?

A. The air inlet strainers are partially clogged, so the compressor cannot get sufficient air to fill the low pressure cylinder properly.

172. Q. How much oil should be given to the steam cylinders of an 8½ inch C. C. compressor?

A. From 4 to 8 drops per minute.

173. Q. How much oil should be given the air cylinders of an 8½ inch C. C. compressor?

A. From 5 to 8 drops for from 20 to 50 miles, depending upon the service.

174. Q. If an 8½ inch C. C. compressor's high pressure steam piston is making irregular stroke, what may be the trouble?

A. Ascertain of the suction on both top and bottom inlet strainers is the same. If it is, it is due to steam piston valve trouble. If the suction is irregular it is due to air valve not operating properly.

175. Q. If the low pressure steam piston is making irregular strokes on an 8½ inch C. C. compressor, what is usually the trouble?

A. Discharge valves on the high pressure air cylinder are not operating properly.

176. Q. If an 8½ inch C. C. compressor is making regular strokes but runs slow, what is often the trouble?

A. Low steam pressure, but if steam pressure is high, then trouble is often due to ports and passages being stopped up in the air cylinders, due to using too much cylinder oil, particularly superheater valve oil.

177. Q. How can this trouble often be remedied?

A. Give the compressor a lye bath through air cylinders when reaching the Roundhouse.

178. Q. How much higher must the steam pressure be than the air pressure for an 8½ inch C. C. compressor to operate properly?

A. Not less than 40 pounds

179. Q. If an 8½ inch C. C. compressor runs fairly well, but after the governor has stopped the compressor, it does not start promptly, what is the usual cause?

A. A sluggish compressor governor.

180. Q. What are some of the other causes?

A. Not enough oil in the steam end of compressor; steam throttle on boiler head not open enough to permit a sufficient flow of steam to the compressor; or discharge valves leaking.

181. Q. If New York Air Pump stops, what should be done?

A. Endeavor to start it same as the 9½ inch compressor.

182. Q. If the compressor then does not start, what further can be done to locate the trouble?

A. Shut off the steam, take out the oil cups, and push both pistons to the lower end of their stroke, and turn on the steam slowly.

183. Q. If the right piston travels up and stops, and left piston remains down, where would defect be located?

A. Broken valve stem on right or low pressure side.

184. Q. If both pistons go up and stay?

A. Probably broken valve stem on left or high pressure side.

185. Q. Which steam valve operates the right or low pressure piston?

A. The left one.

186. Q. Which steam valve operates the left or high pressure piston?

A. The right one.

187. Q. If the right piston travels up very slowly but returns fast, what is the trouble?

A. Upper intermediate passage choked, or valve is stuck to its seat.

188. Q. If the left or high pressure piston travels up very slowly, but returns fast, what is the trouble?

A. Upper discharge valve is broken or passage choked.

189. Q. If right or low pressure piston goes up normally, but returns quickly, what is the trouble?

A. Upper intermediate valve broken or cracked, or copper gasket blown out between the two cylinders.

190. Q. When a locomotive is equipped with two compressors, should both of them be operated?

A. Yes, as long as both are in good order.

191. Q. When necessary to cut out a defective compressor on a locomotive which has two, how should it be done?

A. Close the valve in branch steam pipe, open drain cocks on compressor.

192. Q. If a compressor governor will not stop the compressor, where is the trouble?

A. If no air is escaping from the vent port, the passage from the pressure head to the governor piston, or possibly the air pipe to the governor is stopped up. If air is escaping from the vent port the piston is stuck in open position.

193. Q. If a compressor governor will not allow the compressor to run, where is the trouble?

A. If air is escaping at the vent port, the diaphragm or pin valve leaks. If no air is escaping from the vent port the piston is stuck in closed position.

194. Q. If compressor governor stops the compressor at the proper pressure but does not start the compressor promptly when the pressure is reduced, where is the trouble?

A. The vent port is stopped up.

195. Q. If the vent port is open and a considerable variation of pressure is required to stop and start the compressor, where is the trouble?

A. The diaphragm is buckled, or the pin valve is too long or too short.

196. Q. To adjust feed valves and pressure controllers with G-6, H-6 and L brake valves, where should the brake valve handle be placed?

A. In running position.

197. Q. To adjust brake pipe compressor governors or pressure controllers with the B brake valve, where should brake handle be placed?

A. In full release position.

198. Q. To adjust the main reservoir compressor governor top with B brake valve, where should the brake valve handle be placed?

A. In lap position.

199. Q. To adjust low pressure governor top with the G-6, H-6 and L brake valves, where should the brake valve handle be placed?

A. In running position.

200. Q. To adjust the high pressure top with G-6, H-6 and L brake valves, where should the brake valve handle be placed?

A. In lap position.

201. Q. To adjust governor does it matter where the brake valve handle is placed when locomotive is equipped with single governor?

A. No.

202. Q. Is there any difference between the H-6 and L brake valves?

A. No. These valves are interchangeable with ET or LT equipment.

203. Q. Is there any difference in the small pipe connections to brake valves with ET and LT equipment?

A. Yes.

204. Q. How many positions have these brake valves and what are they?

A. Six. Full release, running, holding, lap, service and emergency.

205. Q. What function has the full release position?

A. To release brakes, charge the brake pipe quickly and hold the locomotive

and tender brakes applied while the train brakes are being released.

206. Q. How is the holding feature accomplished?

A. A copper pipe connects the exhaust from control or application chamber with a port in the brake valve. This port is open to the atmosphere in the running position only. Hence, locomotive and tender brakes will be held on in all other positions.

207. Q. What function has the running position?

A. To supply the brake pipe through the feed valve and release the locomotive and tender brake.

208. Q. What function has the holding position?

A. To supply the brake pipe through the feed valve and hold the locomotive and tender brakes applied.

209. Q. How is the retain pipe connected with the ET equipment?

A. Direct from control chamber exhaust to the automatic brake valve.

210. Q. How is the distributing valve release pipe connected with the ET equipment?

A. From application chamber exhaust direct to independent brake valve, thence to automatic brake valve.

211. Q. What is accomplished by connecting this pipe through the independent brake valve?

A. When the independent brake valve is in running position the ports in its rotary make a continuous connection

from distributing valve to automatic brake valve, and it provides a means of controlling the locomotive brakes independently.

212. Q. How may the locomotive and tender brakes be released independent of the train brakes?

A. With the independent brake valve by placing same in full release with ET, and by opening the independent release valve with LT equipment.

213. Q. What is the function of the lap position of the automatic brake valve?

A. To close all ports.

214. Q. What is the function of the service position?

A. To make service reductions in brake pipe pressure.

215. Q. What is the function of the emergency position?

A. To make emergency reductions in brake pipe pressure and supply from the main reservoir possible leakage from application or control cylinders.

216. Q. How is this latter function accomplished?

A. Through a small port in rotary of brake valve open in emergency position, and the copper pipe connecting brake valve to control or application cylinders.

217. Q. How is pressure in control or application cylinders prevented from equalizing with main reservoir?

A. By safety valve attached to control or distributing valve.

218. Q. To what pressure should this safety valve be adjusted?

A. To close at 50 pounds, except on Mallet freight locomotives.

219. Q. How many ¾ inch pipe connections are there to the control or distributing reservoirs and what are they?

A. Three. A branch from the brake pipe, a brake cylinder pipe, and a supply pipe from the main reservoir.

220. Q. How many ½ inch copper pipe connections are there to the control or distributing valve reservoirs?

A. Two. The retain or release pipe connected to exhaust of control or application chamber, and the control reservoir or application cylinder pipe connected to the control or application cylinders direct.

221. Q. How can the pipe connections to the control or distributing valve reservoirs be identified?

A. By raised letters on the reservoir near the pipe connections.

222. Q. How are these connections marked on the control valve reservoir?

A. The branch pipe from the brake pipe is marked "B. P."
The brake cylinder pipe is marked "B. C."
The main reservoir supply pipe is marked "M. R."
The retain pipe is marked "3."
The control reservoir pipe is marked "C. R."

223. Q. How are these connections marked on the distributing valve reservoir?

A. The branch from brake pipe is marked "B. P."
The brake cylinder pipe is marked "CYLS."
The main reservoir supply pipe is marked "M. R."
The release pipe is marked "4."
The application cylinder pipe is marked "2."

224. Q. If the brake pipe connection breaks off, what should be done?

A. Close the cut-out cock or plug the pipe from the brake pipe. The automatic brake on the engine and tender will be inoperative. Use the straight air or independent brake instead.

225. Q. If a brake cylinder pipe breaks off, what should be done?

A. If it is broken between either the locomotive or tender brake cylinders and the cut-out cocks, cut out the defective brake and go on. If it is broken between the cut-out cocks and the "T" near the control or distributing valve, plug the pipe from the control or distributing valve, and use the remaining brake. If it is broken between the "T" and the control or distributing valve, close the cut-out cock in the main reservoir supply pipe. The locomotive and tender brakes will then be inoperative.

226. Q. If the main reservoir pressure falls rapidly when an application of brake is made, what is the trouble?

A. Either a brake cylinder pipe is broken or a cylinder gasket has blown out.

A. Whether on an engine tender or passenger car I would cross the brake pipe hose with the signal hose between the engine and tender, and cross the signal hose on the rear of the tender with the brake pipe hose on the car, or make the same arrangement of crossing the hose on any car on which the brake pipe may be broken. In both cases the signal line would be inoperative back of the car on which the hose had been crossed.

230. Q. If there is a bad blow from the exhaust of the control valve when the brake is released, what is the trouble, and what should be done?

A. Dirt under control valve check valve, or its seat is defective. Close cut-out cock in main reservoir supply pipe and proceed. The automatic brake on locomotive and tender will be inoperative. Use the straight air brake instead.

231. Q. How may this defect be remedied?

A. Close the cut-out cock in the main reservoir supply pipe, remove the check valve and clean it.

232. Q. If the retain pipe on the LT equipment breaks off what should be done?

A. Proceed. The holding feature in full release and holding positions of the automatic brake valve will be inoperative. The straight air brake valve can be used to hold locomotive and tender brakes on.

233. Q. If the release pipe on the ET equipment breaks off, what should be done?

A. First: Proceed. The holding feature in full release and holding positions of the automatic brake valve and all functions of the independent brake valve except independent release are inoperative.

Second: Plug the opening from the distributing valve and proceed. The locomotive and tender brakes can be applied by either automatic or independent brake valves but can be released only by using full release position of the independent brake valve.

234. Q. If the control reservoir pipe of the LT equipment leaks or breaks off, what should be done?

A. First: Proceed. The automatic brake on locomotive and tender will be inoperative. Use the straight air brake instead.

Second: Plug the opening from the control valve. Then all the features of the automatic brake are inoperative except the pressure maintaining feature in emergency.

235. Q. If the application cylinder pipe of the ET equipment leaks, what should be done?

A. Proceed. The automatic brake on locomotive and tender will leak off. Use the independent brake instead.

236. Q. If the application cylinder pipe of the ET equipment breaks off, what should be done?

A. Plug the opening from the distributing valve and proceed. The brake cannot be operated with the indepen-

dent brake valve but it must be carried in running position. The pressure maintaining feature of the automatic brake is lost.

237. Q. If, with the G-6, H-6 and L brake valves the black hand of air gauge continues to fall with brake valve on lap and service exhaust continues to blow, what is the trouble?

A. A broken equalizing reservoir pipe, broken gauge pipe or other serious leak from equalizing reservoir pressure.

238. Q. What should be done in above case?

A. Put a blind gasket on "T" fitting on brake valve and carry brake valve in running position. Before making application of the brake, close the cut-out cock underneath the brake valve, place brake valve in service position and open cut-out cock until required reduction is made. To release brakes, place brake valve in full release and open cut-out cock.

239. Q. If the supplementary reservoir pipe of a "B" brake valve breaks off, what should be done?

A. Plug the opening from the brake valve and return the brake valve handle to lap, to close service exhaust.

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240. Q. What is the standard brake pipe pressure carried on passenger, freight and switch locomotives?

A. 80 pounds brake pipe pressure, except when locomotives are being used in passenger service.

241. Q. What brake pipe pressure is carried in passenger service?

A. ~~110~~ 90 pounds brake pipe pressure, in all passenger service, except some small branch line or mixed trains.

242. Q. What brake pipe pressure must be carried on switch locomotives when handling passenger trains?

A. ~~110~~ 90 pounds brake pipe pressure.

243. Q. Are freight locomotives adjusted to carry a higher brake pipe pressure?

A. Yes, all freight locomotives are adjusted to carry ~~110~~ 90 pounds brake pipe pressure.

244. Q. When is this pressure to be used?

A. When the locomotive is being used in passenger service and when handling a **hard holding train** on a grade.

245. Q. How should the air pressures be adjusted on a locomotive equipped with G-6 equipment?

A. Brake pipe feed valve to carry 80 and ~~110~~ 90 pounds.
Minimum main reservoir governor ~~130~~ 110 pounds.
Maximum main reservoir governor ~~140~~ 125 pounds.

246. Q. How should the air pressures be adjusted on a locomotive with "B," Plate 21, equipment?

A. First compressor governor (with brake valve in full release position) to carry 80 pounds brake pipe pressure. Second compressor governor (with brake valve in full release position and 80 pound governor cut out) to carry ~~110~~ 90 pounds brake pipe pres-

sure. Third compressor governor connected to the main reservoir (with brake valve on lap position) to carry 140 pounds pressure. Excess pressure valve spring (with brake valve in running position) to carry 20 pounds excess pressure.

247. Q. How should the air pressures be adjusted on a locommotive equipped with either No. 6 ET or LT equipment?

A. The double pressure feed valve adjusted to carry 80 and ~~110~~ 90 pounds pressure.

The excess pressure head of the compressor governor adjusted to carry 20 pounds excess pressure.

The maximum pressure head to the compressor governor to carry ~~140~~ 125 pounds pressure.

248. Q. How should the signal line pressure be adjusted on all locomotives?

A. On locomotives equipped with No. 6 ET or LT equipment, the single pressure reducing valve to the independent air brake valve should be adjusted to carry 45 pounds, and as the signal apparatus is attached to this reducing valve, this pressure will flow to the signal line through C1-3-6 combined strainer and check valve, but, owing to the 3 pound spring on the check valve, the pressure will be reduced to 42 pounds in the signal line.

On all other locomotives which are equipped with separate reducing valve for the signal line, it should be

adjusted to carry 45 pounds which will flow direct to the signal line.

249. Q. How can you ascertain the amount of pressure in the signal line of a locomotive equipped with No. 6 ET equipment?

A. Apply the driver brakes fully with the independent brake valve, and note amount of pressure obtained in cylinders, as shown by the red hand of the small duplex gauge. The signal line pressure will be 3 pounds less than the driver brake cylinder pressure.

250. Q. To what pressure should the Automatic reducing and Compensating valves, used on locomotives equipped with the old high speed brake equipment, be adjusted?

A. To hold 50 pounds pressure in the brake cylinders.

251. Q. How should the air compressor be started?

A. It should be started slowly, so as to allow the condensation to escape from the steam cylinder and prevent pounding, which is more likely to occur when the air pressure is low.

252. Q. Why should the piston rod on the air compressor be kept thoroughly packed?

A. To prevent the waste of air and steam.

253. Q. How often should the brake valve be thoroughly cleaned and oiled?

A. At least once every two months.

254. Q. If the rotary valve in the brake valve is unseated by dirt or by wear, what may be the result, and what should be done?

A. It may be impossible to get the excess pressure; when the brakes have been applied they may keep applying harder until full on, or when they have been applied they may release. The rotary valve should be thoroughly cleaned, and if worn, it should be faced to a seat.

255. Q. If the piston in the brake valve becomes gummed or corroded from neglect to clean it, what would be the result?

A. It will be necessary to make a large reduction of pressure through the preliminary exhaust port before the brakes will apply at all, and then the brakes will go on too hard and will have to be released.

256. Q How and why should the brake pipe under the tender always be blown out thoroughly before connecting up to the train?

A By opening the angle cock at the rear end of the tender and allowing the air from the main reservoir to blow through. This blows out the oil, water, scale, etc., which may accumulate in the pipe, and which would be blown back into the brake pipe and triple valves if not removed before coupling to the train.

257. Q. When the locomotive is coupled to the train, why is it necessary to have have excess pressure in the main reservoir?

A. So that the brakes will all be released and the train quickly charged when the Engineer's valve is placed in the release position.

258. Q. Why should the driver brakes be operated automatically with the train brakes

A. Because it adds greatly to the braking force of the train, and the brakes can be applied alike to all the wheels for ordinary stops, and in emergency the greatest possible braking force is at once obtained by one movement of the brake valve handle.

259. Q. In making a service application of the brakes, how much reduction of the brake pipe pressure from 80 pounds does it require to get the brakes full on?

A. About 25 pounds reduction.

260. Q. What should be the first reduction in a service application?

A. Not less than 6 to 12 pounds, so as to insure moving the pistons in the brake cylinders past the leakage grooves.

261. Q. What is the result of making a greater reduction of pressure than 25 pounds?

A. A waste of air in the brake pipe, without getting any more braking force, and therefore requiring more air to release the brakes.

262. Q. Why is it dangerous to apply and release the brakes repeatedly in making stops?

A. Because every time the brakes are

released the air in the brake cylinders is thrown away, and if it is necessary to apply them again before sufficient time has elapsed to recharge the auxiliary reservoirs the application of the brakes will be weak, and after a few such applications the brakes are almost useless on account of the air being exhausted from the auxiliary reservoirs.

263. Q. In releasing and recharging the train, how long should the handle of the brake valve be left in the release position?

A. Until the brake pipe pressure has risen nearly to authorized pressure.

264. Q. In making service stops with passenger trains, why should you release the brakes just before coming to a stop?

A. So as to prevent stopping with a lurch; it also requires less time for the release of the brakes.

265. Q. In making stops with freight trains why should the brakes not be released until after the train has come to a stop?

A. Because long freight trains are apt to be parted by releasing the head and brakes before rear brakes are released.

266. Q. In making service stops, why must the handle of the brake valve not be moved past the position for service application?

A. So as to prevent unnecessary jerks to the train and the emergency action of the triple valve when not necessary.

267. Q. If you find the train dragging from the failure of the brakes to release, how can you release them?

A. By placing the handle of the brake valve in full release position, if the brake pipe pressure is not up to the authorized amount; but if maximum pressure is in the brake pipe, the brakes should be applied with from 6 to 12 pound reduction, according to length of train, and released in the usual manner.

268. Q. When the brakes go on suddenly when not operated by the brake valve, and the gauge pointer falls back, what is the cause and what should you do?

A. Either hose has burst, conductor's valve has been opened, or train has parted. In any event the locomotive throttle should be closed and the handle of the brake valve should immediately be placed on lap position to prevent escape of air from main reservoir.

269. Q. Are the brakes liable to stick after an emergency application, and why?

A. The brakes are harder to release after an emergency application because they are applied with full force and it requires higher pressure than usual in the brake pipe to release them. In this case it is necessary to have in reserve excess pressure in the main reservoir to aid in releasing. With the quick action triple valve this is especially necessary, because air from the brake pipe as well as from the auxiliary reservoir is vented into the brake cylinder when a quick

application of the brake is made, thus increasing the pressure in the brake cylinder without the usual reduction of pressure in the auxiliary reservoir, and requiring a correspondingly high pressure in the brake pipe to release the brakes.

270. Q. In using the brakes to hold the train while descending grades, why should the air compressor throttle be kept full open?

A. So that the compressor may quickly accumulate a full pressure in the main reservoir for use in recharging the brake pipe and auxiliary reservoir when the brakes have been released.

271. Q. In descending a grade how can you best keep the train under control?

A. By commencing the application of the brakes early enough so as to prevent too high a speed being reached. By making an initial reduction of brake pipe pressure heavy enough to hold the train, noting to what point the brake pipe hand on duplex gauge falls, and as soon as the brakes take effect, release them by placing the brake valve handle in full release position until the brake pipe pressure is fully restored. As soon as the speed begins to increase, make another reduction of brake pipe pressure of the same amount as the first one, and as soon as the brakes take effect, release them, etc. In practicing this method it is desired that on ordinary freight trains the

brakes should be applied and released not less than once per mile.

272. Q. If the train is being drawn by two or more locomotives, upon which locomotive should the brakes be controlled, and what must the Engineman of the other locomotive do?

A. The brakes must be operated from the leading locomotive. When other locomotives are equipped with either ET or LT equipment, both the automatic and independent brake valve handles must be in running position, and cut-out cock underneath Engineer's brake valve closed. Air compressor must be kept running.

273. Q. If the air signal gives only a weak blast, what is the probable cause?

A. Either the reducing valve is out of order so that the pressure is considerably less than 45 pounds, or the whistle itself is filled with dirt or not properly adjusted, or the port under the end of signal valve is partly closed by gum or dirt.

274. Q. If the reducing valve for the air signal is allowed to become clogged with dirt, what will the result probably be?

A. The signal pipe might get the full main reservoir pressure, and the whistle will blow when the brakes are released.

275. Q. If you discover any defect in the air brake or signal apparatus while on the road, what must be done?

A. If it is something that cannot be readily remedied at once, it must be reported to the Roundhouse Foreman as soon as the run is completed.

276. Q. What is the result if water be allowed to collect in the main reservoir of the brake apparatus?

A. The room taken up by the water reduces the capacity for holding air, and the brakes are more liable to stick. In cold weather the water may freeze and prevent the brakes from working properly.

SPECIAL FOR ENGINE REPAIR MEN

277. Q. How often must the air brake and signal apparatus on locomotives be examined?

A. After each trip.

278. Q. Under what pressure must it be examined?

A. Under full pressure.

279. Q. Should the brake pipe pressure exceed the maximum, where would you look for the cause of the trouble?

A. In the devices controlling brake pipe pressure.

280. Q. How often must the main reservoir and the drain cup under the tender be drained?

A. After each trip.

281. Q. How often must the triple valves and the cylinders of the driver and tender brakes be cleaned and lubricated?

A. They must be thoroughly cleaned and lubricated once every three months.

If the driver brake cylinders are so located that they become hot from the boiler, they may require lubrication more frequently.

282. If there are any leaks in the pipe joints or anywhere in the apparatus, what must you do?

A. Repair them before the locomotive leaves the terminal.

283. Q. How is the brake shoe slack of the cam driver brake taken up, and what precautions are necessary?

A. By means of the cam screws, and it is necessary to lengthen both alike, so that when the brake is applied the point of contact with the cams will be in line with the piston rod.

284. Q. How is the brake shoe slack of driver brakes on a locomotive with more than two pairs of driving wheels taken up?

A. By means of a turnbuckle or screw in the connecting rods.

285. Q. How is the slack of the tender brake shoes taken up?

A. By means of the truck dead levers. If they will not take it up enough, it must be taken up in the underneath connection, and then adjusted by the dead lever.

SPECIAL FOR TRAINMEN

286. Q. How should you proceed to test the air brakes before starting out, after a change in the makeup of a train, or before descending certain specially designated grades?

A. After the train has been fully charged with air, the Engineman must be required to apply the brakes; when he has done so the brakes must be examined upon each car to see that the air is applied and that the piston travel is not less than 5 nor more than 7 inches. The Engineman must then be required to release the brakes; after he has done so, each brake must be examined again to see that all are released. The Engineman and Conductor must then be notified that the brakes are all right, if they are found so. (In testing passenger brakes, signal must be given from discharge valve on rear car).

287. Q. In starting a passenger train from an inspection point, how many cars must have the brakes in service?

A. Every car upon the train.

288. Q. When can a brake be cut out on a passenger car?

A. Only when it gets out of order on a run, in which case it must be reported to the inspector at the end of the run, or upon the first opportunity which may give sufficient time to repair it.

289. Q. If a hose bursts, what must be done?

A. The hose must be replaced and the Engineman then signalled to release the brakes. The train must not proceed until the brakes have been tested to see that they are working properly.

290. Q. If the train breaks in two, what must be done?

A. The angle cock in the brake pipe at the rear end of the first section must be closed and the Engineman signalled to release the brakes. The two parts of the train must then be coupled, the hose connected and the brakes tested. When it is ascertained that the brakes are operative, the train may proceed.

291. Q. If the brake of any car is found to be defective, how should it be cut out?

A. By closing the cock in the cross-over pipe to the triple valve, opening the release cock in the auxiliary reservoir, leaving it open, if a passenger car, or holding it open until the brake is entirely released, if a freight car.

292. Q. When it is necessary to cut out a defective brake upon a car, why should it always be cut out at the triple valve and never by the brake pipe cock at the end of the car even if it is the last car in the train?

A. The brake pipe should always be open from the locomotive to the rear end of the last car, so if the train breaks in two the brakes will be automatically applied before the parts of the train have separated sufficiently to permit damage by their coming together again, and so that the brakes may be applied by the conductor's valve.

293. Q. What is the conductor's valve and what is its use?

A. It is a valve at the end of a pipe leading from the brake pipe upon each passenger car and caboose. It can be opened from the car in any emergency when it is necessary to stop the train quickly. When used, it must be held open until the train is stopped, and then it must be closed.

294. Q. What is the air signal for, and how is it operated?

A. It is used to transmit signals from the train to the Engineman, and is operated by opening the car discharge valve one second for each intended blast of the signal whistle and allowing four seconds between blasts.

295. Q. If the discharge valve on the air signal system is out of order or leaking on any car, how can you cut it out?

A. By closing the cock in the branch pipe leading from the train signal pipe to the discharge valve; to do so the handle of this cock should be placed lengthwise with the pipe.

296. Q. How is the slack taken up so as to secure the proper adjustment of piston travel?

A. By means of the truck dead lever, and if that is not sufficient, one or more holes must be taken up in the underneath connection and the adjustment then made by the truck dead lever. Where automatic slack adjusters are applied to any car, such adjuster must be fully released before the slack is taken up elsewhere.

SPECIAL FOR INSPECTORS

297. Q. Do you understand that no train may be started out of a terminal with any of the brakes cut out?

A. I do.

298. Q. Why is it important that no leaks shall exist in the air brake service?

A. Because they would interfere with the proper working of the brakes and might cause serious damage.

299. Q. What must be done with the air brake or air signal couplings when not united to other couplings, on cars equipped with dummy couplings?

A. They must be secured in the dummy coupling so that the face of the dummy coupling will cover the opening of the hose coupling so as to prevent dust and dirt from entering the hose.

300. Q. If the air blows from the exhaust port of the quick action triple valve when the brakes are off, what is the cause?

A. It is probably due to dirt on the rubber seated emergency valve.

301. Q. How often must the cylinder and triple valves be examined, cleaned and lubricated?

A. Every three months on passenger cars and once in twelve months on freight cars, unless otherwise specified. The dates of the last cleaning and lubrication must be stenciled with white paint on the cylinders.

302. Q. How may a passenger triple valve be distinguished?

A. By having one exhaust outlet, or suitable lettering designating the class of service.

303. Q. How may a freight triple valve be distinguished?

A. By its two exhaust outlets, or letters cast on body.

304. Q. How many sizes of high speed brake reducing valves are there in use, and how will it be known to which size of cylinders they should be connected?

A. There are three sizes, viz.: one for 8-inch, one for 10-inch and 12-inch, and a third for 14-inch and 16-inch cylinders, and they can be distinguished by the raised figures cast on their body.

305. Q. To what pressure must the high speed reducing valve be adjusted on passenger cars?

A. Sixty pounds pressure.