

# PENNSYLVANIA RAILROAD

LINES EAST OF PITTSBURGH

## Locomotive Maintenance Instructions No. L-14-A

ISSUED ALTOONA, PA.  
DECEMBER 3, 1915

### TESTING, ADJUSTING AND REPAIRING AIR BRAKE APPARATUS, AIR SIGNAL AND STEAM HEAT EQUIPMENT ON LOCOMOTIVES AND TENDERS.

(SUPERSEDING LOCOMOTIVE MAINTENANCE INSTRUCTIONS No. L-14, DATED JUNE 9, 1914.)

#### GENERAL.

The air pipe and hose must be blown out with air pressure before attaching testing apparatus.

The test gauge must be maintained in perfect condition and tested once each week.

All air brake piping must be properly clamped, and when operating the various stop and angle cocks, they must be opened and closed slowly.

All compressor governors, feed valves, reducing valves, safety valves, and high speed reducing valves must be equipped with cap nuts, and securely locked, to prevent the adjustment from changing, due to vibration, or some unauthorized person tampering with it.

All main reservoirs must be drained after each trip.

Air compressors must be lubricated before conducting any tests, and a suitable swab must be maintained on the piston rod.

When air compressor strainers are dirty, they must be removed from the compressor and thoroughly cleaned.

When testing pressures in brake pipe, signal pipe, main reservoirs, and for testing locomotive gauges and the air compressor, the special apparatus shown on tracing No. 47280 must be used.

#### DAILY TESTS.

##### Standard Pressures.

Main reservoir pressure, freight, single top governor, 100 lbs.

" " " " double " " low, 100 lbs.

" " " " " " high, 130 lbs.

" " " " SF " low, 90 lbs.

" " " " " high, 110 lbs.

" " " " passenger, single top " 130 lbs.

" " " " " by special instructions, 140 lbs.

" " " " SF " low, 120 lbs.

" " " " " high, 140 lbs.

Brake pipe pressure, freight, 70 lbs.

" " " passenger, 110 lbs.



lbs., and should be observed in the whistle blows when independent application is made, it is because of dirt on the non-return in combined check and strainer, or the reducing valve being dirty and sluggish, allowing signal pressure to increase above the standard.

**Feed Valve.**—Open a port to atmosphere in test coupler. With the brake valve in running position, fluctuation on test gauge must not exceed 2 lbs. If it does, feed valve is dirty and sluggish and needs attention. If no fluctuations take place, the supply valve piston is too loose.

**Brake Pipe Leakage and Piston Travel Adjustment.**—Place brake valve on lap position. Make a 5-lb. reduction at the test coupler and note whether the brakes on the locomotive and tender are lightly set. If so, brakes will respond to a light application. Inspector should then return to the test gauge and note the brake pipe leakage, which must not exceed three pounds per minute. A further 20-lb. reduction must be made at the brake valve to ascertain the piston travel, which must not vary more than 1 inch in either direction from the following dimensions:

Equalized Driver Brake.....	5"
Locomotive Truck Brake.....	5"
Locomotive Trailer Brake.....	5"
Tender Brake .....	6"

#### **Brake Cylinder Leakage.**

After the maximum standard brake pipe pressure has been obtained on the locomotive, make a full service application (25 lbs. reduction of brake pipe pressure) with the automatic brake valve, and with communication to the brake cylinders closed the brakes on the locomotive and tender must remain applied not less than 5 minutes. Communication to the brake cylinders should be closed on locomotives equipped with the ET brake equipment by closing the cut out cock in the main reservoir supply pipe to the distributing valve. On locomotives equipped with triple valves, the exhaust port of the triple valve should be plugged and the brake valve handle placed in release position. This will close communication between the auxiliary reservoir and brake cylinders. (In plugging the triple valve exhaust, a suitable cock should be used, so that after the test has been completed, this cock may be opened to vent brake cylinder air to the atmosphere before the removal of the plugging device.)

In the event of brake cylinders failing to pass this test, each cylinder should be tested separately, as herein provided for at boiler-wash periods.

#### **Main Reservoir and Pipe Connection Leakage.**

Reduce the main reservoir pressure to 60% of the maximum, lap the brake valve, and shut off the compressor. The leakage from the main reservoir and related piping must not exceed an average of 2 lbs. per minute in a test of three minutes duration. If the leakage is greater than this, the necessary attention must be given to bring the leakage down to the required limits.

#### **Triple Valves.**

All triple valves must respond to a 5-lb. reduction at all times.

#### **Distributing Valves.**

To test the distributing valve for excessive friction in the moving parts, make a 5-lb. service reduction and note if brake starts to apply promptly. If it fails to apply there is undue friction in the application piston, valve, or equalizing slide valve and piston. If brakes do apply properly, make a further 5 lb. reduction, and note the cylinder pressure gauge, which should show approximately 25 lbs. If the cylinder pressure gradually increases beyond 25 lbs. for the 10-lb. reduction, the increase is probably caused by brake pipe leakage. However, a leak past the automatic rotary valve, independent rotary valve, equalizing slide valve, or graduating valve will also cause the cylinder pressure to increase after a partial automatic application. To determine the source of the leak, use 70 lbs. brake pipe pressure, for the reason that the trouble can be more readily located than with the higher pressure.

1. Distributing valve in release position and equipped with plain cap, a blow at the exhaust indicates a leaky application valve, or cylinder cap gasket.
2. Distributing valve in release position and equipped with quick action cap, a blow at the exhaust may indicate a leaky emergency valve. To distinguish the above leak, close cut out cock in supply pipe to the distributing valve. If the blow gradually ceases, it is the application valve; if blow continues, it is the emergency valve, or quick action cap gasket.
3. Make a 10-lb. application, and a continuous blow at the distributing valve exhaust indicates a leaky exhaust valve.
4. If distributing valve exhaust opens and closes intermittently while brake is applied, it indicates a leaky application valve.
5. Observe brake cylinder gauge, and if cylinder pressure increases to 50 lbs., and remains constant, it indicates brake pipe leakage.
6. If the brake cylinder pressure increases above the adjustment of the safety valve, 68 lbs., it is due to automatic rotary valve or distributing valve gasket leaking. To distinguish the above leak, lap the independent brake valve. If the cylinder pressure still increases, the defect is in the gasket, otherwise in the rotary valve of the automatic brake valve.
7. If brake cylinder pressure increases to 45 lbs. and stops, it is probably due to independent rotary valve leaking.
8. If increase of cylinder pressure is due to leaky equalizing slide valve, release the brake, and note if there is a leak at the direct exhaust of the automatic brake valve (when equipped with holding position feature), with both brake valves in running position.
9. If graduating valve is leaking sufficiently to increase application chamber pressure after partial application and causes the equalizing piston and slide valve to move to release position, it will not release the locomotive brakes (when equipped with the holding position feature) unless the locomotive is second in double-heading.
10. If brake releases after an independent application, but remains applied with the automatic application, it is caused by a leak in the release pipe between the distributing valve and the independent brake valve, or leak in the safety valve.
11. If brake releases after an automatic service or independent application, it is caused by a leak from the application cylinder pipe or cylinder cap gasket.
12. A broken application piston spring is indicated by a succession of quick exhausts from the distributing valve exhaust.
13. A weak or broken graduating spring is indicated by equalizing piston going into the emergency position, when making a partial service application, and a quick rise in cylinder pressure.
14. The following table shows the sizes of the various springs for use in the No. 6 distributing valve:

Name of Spring.	Material.	No. of Coils.	Free Height.	Outside Diam.
Application Piston				
Graduating Spring.	Nickeled Steel.	13½	2⅝"	1½"
Equalizing Piston				
Graduating Spring.	Phosphor Bronze.	12	2½"	1½"
Quick Action Cylinder Cap				
Check Valve Spring.	Phosphor Bronze.	8½	1½"	1½"

Any spring not conforming to these dimensions must be replaced by the proper spring, to avoid serious trouble with the valve while in service on the road.

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#### Air Signal System.

Attach test coupler to signal hose on rear of tender and note the pressure on test gauge, which must be 45 lbs. Open the  $\frac{1}{8}$ " opening in the test coupler and note if signal whistle responds promptly to each reduction in the signal line. Also note if the signal reducing valve is charging the signal line properly.

#### ADDITIONAL AIR BRAKE WORK TO BE PERFORMED AT BOILER WASH PERIODS.

##### Lying Out of Air Compressors.

Once a month when a locomotive boiler is washed, and at such other times as necessary, the air compressor must be washed out with a solution of lye water (1 pound can of lye to 6 gallons of water), using the device shown on tracing No. 52004, in the following manner:

Fill the reservoir of the device with lye water of the required strength up to the drain cock. Then heat with steam to a boil. Leave the steam line connected up to furnish a pressure on the water, but if the safety valve blows, the steam supply should be shut off. Couple the reservoir of the device to the inlet of the compressor and thoroughly wash the air end of the compressor by running it. All main reservoir drain cocks should be opened and the used lye water run through them to the pit or sewer. After the lye water is pumped out, fill the reservoir of the device two-thirds full of hot water, and run through the compressor and main reservoir until clean water appears at the main reservoir drain cock.

After this work has been performed, the receiving and discharge valves should be examined to see that they have the proper lift and given the necessary attention. The air cylinder and piston rod and its swab should be thoroughly lubricated, and the following test made.

This device should be tested every six months, as specified on the tracing.

#### Air Compressor Capacity Test.

This test must be conducted once a month when a locomotive boiler is washed and at such other times as may be found necessary as follows:

The main reservoirs and all pipe connections on the locomotive and tender must be tested and all leakage eliminated. The main reservoirs must then be drained to free them from all water, after which a special fitting, as shown on tracing No. 47280, must be attached to the air brake hose on the rear of the tender and the brake valve placed in full release position. The air compressor to be tested should then be started, and when the pressure in the main reservoirs has been raised to 60 lbs. <sup>and</sup> the pressure specified in the following table, the disc valve suitable for the type of compressor being tested should be opened to permit the main reservoir air to escape to the atmosphere.

The compressor, if in condition for further service, must maintain the air pressure in the main reservoir to 60 lbs. or over against this leakage, and not exceed the number of single strokes given:

Type of Compressor	Boiler Pressure Not Less Than	Size of Steam Supply Pipe	Speed of Compressor, Single Strokes Per Minute	Air Pressure to be Maintained in Main Reservoir	Diam. of Orifice
9 $\frac{1}{2}$ "	130 lbs.	$\frac{3}{4}$ "	120	60 lbs.	11"
9 $\frac{1}{2}$ "	100 lbs.	1"	120	60 lbs.	11"
8 $\frac{1}{2}$ "	150 lbs.	1 $\frac{1}{4}$ "	100	60 lbs.	11"

If the compressor fails to meet the above test, due to defective receiving or discharge valves, or any other minor defects, repairs should be made without removing the compressor from the locomotive, and the above test again conducted to determine whether the repairs made would place the compressor in condition for further service. After the compressor has received this attention, a tag must be securely fastened to the compressor steam pipe, as near to the compressor as possible, showing the date and place this test was made, in accordance with tracing No. 51558.

### Straight Air Brake (S. W. A.-B.) Equipment.

**Pressure and Leakage.**—Disconnect hose coupling between locomotive and tender and attach test coupler to hose at rear of locomotive. Place straight air brake valve in full service position and note the pressure on test gauge, which must be approximately 45 lbs. Place brake valve on lap position and note cylinder and pipe leakage, which must not exceed 5 lbs. per minute.

**Reducing Valve.**—Open the "A" port in the test coupler, place the brake valve in service position, when the fluctuation on the test gauge should not exceed 2 lbs. If more, the reducing valve is sluggish and dirty and needs attention.

**Double Seated Check Valve.**—Apply straight air and if air escapes at triple valve exhaust, the seat on the triple valve side is defective. Release straight air and apply the automatic. If air escapes at the straight air valve the other seat is defective.

**Safety Valve Adjustment.—Locomotive.**—Attach test coupler to hose on rear of locomotive. Place straight air valve in service position, adjust reducing valve to 58 lbs., alternate brake valve between service and lap positions and note the opening and closing point on the test gauge. The closing point should be approximately 55 lbs.

**Safety Valve Adjustment.—Tender.**—Remove test coupler and couple up hose to tender. Adjust the safety valve on the tender to lift at the same time that the one on the locomotive opens.

**High Speed Reducing Valve Adjustment.**—With test gauge attached to the triple valve exhaust, make a heavy application (35 lbs. reduction) and release immediately. With the high speed reducing valve blowing, the point at which the valve stops will indicate the adjustment, which should be 60 lbs.

**Brake Cylinder and Cylinder Pipe Leakage.**—Attach test gauge to the exhaust port of triple valve on both locomotive and tender. With standard piston travel, make a 25-lb. reduction at the brake valve and immediately release the brakes. The test gauge will then show the cylinder pressure and leakage.

### ET Brake Equipment.

**Brake Cylinder and Cylinder Pipe Leakage.**—Make a 25-lb. reduction and close cut out cock in main reservoir supply pipe to the distributing valve. The locomotive cylinder gauge will then show the cylinder pressure and leakage. Leakage must not exceed 5 lbs. per minute with an initial cylinder pressure of 50 lbs. To determine which cylinder has the most leakage, or how much each cylinder is leaking, close the various brake cylinder cut out cocks.

**E-6 Safety Valve on Distributing Valve.**—The standard adjustment for this valve is 68 lbs. for locomotives. Place the automatic brake valve in emergency position, and note the cylinder pressure when safety valve is blowing. Carefully note that the holes in the spring chamber and valve body are open and free from dirt; otherwise the proper adjustment cannot be obtained.

### All Brake Equipments.

**Soap Suds Test.**—When temperature will permit all air brake and signal hose on front end of locomotives between locomotive and tender, including straight air and rear of tender, must be tested with soap suds and any hose found porous or leaking must be renewed.

**Foundation Brake Gear.**—Levers, rods, brake beams, hangers and pins shall not be fouled in any way which will affect the proper operation of the brake. All pins shall be properly secured in place with cotter pins, split keys or nuts. Brake shoes must be properly applied and kept in line with the tread of the wheel. No part of the foundation brake gear of the locomotive or tender shall be less than 2½" above the rails.



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No part of the foundation brake gear of the locomotive or tender shall be less than  $2\frac{1}{2}$ " above the rails.

**Cleaning and Lubricating of Air Brake Equipment.**—When any part of the air brake or signal apparatus is removed from a locomotive on account of being defective, it should be forwarded to the shops for repairs, cleaning and testing, in accordance with Locomotive Maintenance Instructions No. L-4-A.

#### AIR BRAKE WORK TO BE PERFORMED EVERY THREE MONTHS.

The air gauges must be tested once every three months on a gauge testing apparatus and properly stenciled, showing date and shop abbreviation.

#### AIR BRAKE WORK TO BE PERFORMED EVERY SIX MONTHS.

The distributing valve, or triple valves, reducing valves, straight air double check valves, feed valves, dirt collectors and brake cylinders must be cleaned and lubricated not less frequently than once every six months in accordance with Locomotive Maintenance Instructions No. L-4-A, and a metal tag showing the date of testing or cleaning, and the shop abbreviation where the work was done, must be securely attached to the brake pipe near the automatic brake valve in accordance with tracing No. 51558.

#### AIR BRAKE WORK TO BE PERFORMED EVERY TWELVE MONTHS.

Main air reservoirs on locomotives must be tested not less frequently than once in twelve months, at the same time that the hydrostatic test of the boiler is made, as follows:

The entire surface of the main reservoirs should be hammer tested with a ball pein hammer, to detect evidence of the sheet being thin due to corrosion. After the hammer test has been completed, the reservoir should be subjected to an hydrostatic test at a pressure of 175 pounds. It should then be stenciled in accordance with tracing No. 44596, and notation as to the test made on the annual inspection report of that locomotive to the Interstate Commerce Commission.

#### STEAM HEAT SYSTEM.

The steam heat apparatus on locomotives and tenders must receive daily attention during the steam heat season. All of its various parts must be tested and be known to be in good condition before the locomotive is sent out for train service.

The main steam valve in cab must be kept wide open at all times and the pressure reduced to 25 lbs. by the pressure regulator. The end valve on the rear of the tender must be adjusted so that a small amount of steam will escape through the hose at all times when the locomotive is not in service to avoid freezing of pipes.

Standard steam heat regulators are the new Gold and Leslie types, which are interchangeable and have 1" inlet and  $1\frac{1}{2}$ " outlet. Pipes to suit these connections must be used.

Steam heat gauges must be tested daily with a dummy coupler and test gauge, as shown on tracing No. 47280, from rear of tender, and readings taken at 25, 50, 75, and 100 lbs. If gauge is out 5 lbs. or more it must be removed for the proper attention.

Metallic connections between locomotive and tender, steam pipe and covering, end valve, including hose, clamps, coupler, locks, and gaskets must receive daily attention.

**Regulator Capacity.**—Adjust pressure to 90 lbs., open wide end valve at the rear of tender. Regulator in an operative condition should maintain not less than 80 lbs. pressure.

J. T. WALLIS,

General Sup't Motive Power

Penna. Railroad Lines