Air Brakes and Train Handling Rules

CONTENTS

60 LOCOMOTIVE ENGINEER RESPONSIBILITIES AND CERTIFICATION

60.1 General Responsibilities

Engineer certification must comply with these federal and company requirements:

1. Engineers must be certified in the appropriate class of service to operate a locomotive.
2. Engineers must certify according to federal regulations (49 CFR part 240) and ARRC certification requirements and programs.
3. Engineers must possess an engineer's certificate and display it at the request of a company manager or Federal Railroad Administration (FRA) representative.
4. Engineers must report convictions for:
   - Operating a motor vehicle while under the influence or impaired by alcohol or a controlled substance
   - Refusing to undergo testing by a law enforcement officer who wants to determine whether the engineer is operating a motor vehicle while under the influence of alcohol or a controlled substance

   State-sponsored diversion programs, guilty pleas, and completed state actions to cancel, revoke, suspend, or deny a driver's license are considered convictions under this rule.

   Engineers must report any conviction to his or her supervisor responsible for engineer certification no later than 5 business days following the day the engineer receives notice of the motor vehicle conviction.

60.2 Engineer Certification Requirements For Operating Locomotives

Certified engineers may operate locomotives under the following conditions:

1. A certified locomotive servicing engineer may not operate locomotives coupled to cars.
2. A certified locomotive servicing engineer may operate locomotives within a yard or terminal area for hostling purposes.
3. Only certified train service engineers may operate locomotives coupled to cars.
4. Certified student engineers may operate locomotives within the limits of their class of service under the direct supervision of the engineer instructor.

60.3 Territory Qualifications

Train service engineers are qualified on an assigned territory when they have operated over the territory in at least one of these capacities:

- As a train service engineer without a pilot
- As a train service engineer completing familiarization trips with a qualified train service engineer pilot
- As a crew member on board the controlling locomotive over the assigned territory

60.4 Familiarization Trips

A certified train service engineer who has not worked the assigned territory in any capacity must make a familiarization trip(s) with a qualified train service engineer pilot to learn the territory.

A certified train service engineer who has not worked the assigned territory in any capacity during the previous 24 months may make a familiarization trip(s) with a qualified train service engineer pilot to review the territory.

In both instances:

1. A crew member assigned to work on board the controlling locomotive may serve as pilot, provided he or she is currently a certified train service engineer and is qualified on the territory.
2. Supervisors of locomotive engineers will determine:
    - The number of required familiarization trips
    - If and when an engineer is qualified
3. No familiarization trips are required for yard assignments.

61 AIR BRAKE TESTS

61.1 General Responsibilities

61.1.1 Complying With FRA Regulations

Inspect and test brake equipment on locomotives and cars according to Federal Railroad Administration (FRA) regulations contained within these rules. The following requirements for inspecting and testing brake equipment will help engine and train crew members move their trains safely and efficiently.

61.1.2 Responsibility For Required Air Tests

Supervisors and inspectors are jointly responsible with the engineer and crew members for the condition of air brake equipment on locomotives and cars to the extent that it is possible to detect defective equipment by required air tests.

61.2 Requirements For Performing Air Brake Tests

These requirements apply to air brake tests and inspections:

- Air brakes on all cars must be operative unless brakes fail enroute.
- At least 85 percent of the cars in a train must have operative brakes under all circumstances.
- When departing terminals, engineers must allow their trains to be inspected where required.

NOTE: When determining the number of operative brakes, count each platform of a multi-platform car as one car.

61.2.1 Responsibilities Of Person In Charge

The person(s) performing the air brake test is in charge of the train while the tests are being conducted.

Before authority is given to apply or release the brakes or move the train, the person(s) in charge must determine that all employees are safely positioned.

61.2.2 Responsibilities Of Engineer During Test

Unless authorized by the person(s) in charge, an engineer must not:

1. Apply or release train brakes.
2. Move the train during or after the air test is complete.

61.2.3 Responding To Emergency Brake Application During Test

If an emergency brake application occurs during an air brake test:

1. Recover the air.
2. Recharge the system.
3. Reapply the air brakes.

61.2.4 Cutting Out Maintaining Feature

Cut out the maintaining feature on controlling locomotives or yard air brake testing devices *only* during air brake leakage tests.

61.2.5 Using End-Of-Train Telemetry Devices

When conducting an air brake test, you may verify that the brakes apply or release on the rear car by checking the end-of-train telemetry device as follows:

- When the rear brake pipe pressure decreases at least 5 psi, the brakes are applied.
- When the rear brake pipe pressure increases at least 5 psi, the brakes are released.

61.3 Initial Terminal Air Brake Test

A qualified employee must conduct an initial terminal air brake test to inspect air brake and safety appliances and to test air brake integrity.

Test brake pipe integrity using the:

- Air Flow Method (AFM)

  or

- Brake Pipe Leakage Method

61.3.1 Test Locations

Test all trains according to Rule 61.3, Initial Terminal Air Brake Test, at the following locations:

- Where the train is originally made up (initial terminal)
- Where the train consist is changed, unless the only change is adding or removing a solid block of cars

61.3.2 Air Flow Method (AFM)

AFM is the preferred method to test brake pipe integrity.

A. Equipment Required For AFM Brake Test

To qualify a train's air brake system using AFM, the train must be equipped as follows:

- The controlling locomotive has an operational self-lapping, maintaining-type automatic brake valve.
- The locomotive has an air flow indicator with a direct reading of air flow in increments no greater than 10 cubic feet per minute.
- The train has an end-of-train telemetry device or occupied caboose.

B. Procedure For Conducting AFM Brake Test

If the train meets the above conditions, conduct an AFM brake test as follows:

1. Charge the brake system to within 15 psi of the equalizing reservoir as indicated by an accurate gauge at the rear of the train.

NOTE: Air flow must not exceed 60 CFM.

2. When you receive a signal to apply the brakes, make a 20 psi brake pipe reduction.
3. Inspect the car(s) or train according to the appropriate air brake test.
4. When you receive a signal to release the brakes, move the automatic brake valve handle to RELEASE.

NOTE: After the air brake test is completed, the Air Flow Indicator does not need to return to its original position if the required air pressure has been restored to the rear of the train and the brakes have released.

61.3.3 Brake Pipe Leakage Method

The brake pipe leakage method tests brake pipe integrity by measuring the amount of leakage in a closed system.

A. When To Use Brake Pipe Leakage Method

If the train does not meet AFM test conditions, conduct a brake pipe leakage test.

B. Procedure For Conducting Leakage Test

To conduct a leakage test:

1. Charge the train brake system to within 15 psi of the equalizing reservoir as indicated by an accurate gauge at the rear of the train.
2. Wait for the signal to apply the brakes.
3. When you receive the signal, reduce brake pipe pressure by 20 psi.
4. Allow the brake pipe exhaust to stop.

5. Wait 60 seconds.
6. Move the automatic brake cutout valve to the OUT position.
7. Wait 60 seconds.
8. Measure the leakage for 60 seconds.
   a. Make sure leakage does not exceed 5 psi during this period.
   b. Do not actuate during the leakage test.
9. Use the appropriate air brake test to inspect the cars.
10. When you receive the signal to release the brakes, move the automatic brake valve handle to RELEASE and move the automatic brake cutout valve to the FRT position.

61.3.4 Procedure For Initial Terminal Air Brake Test and Inspection

A. Inspect Train For Air Brake System Defects

Begin the test by inspecting the train for air brake system defects.

1. Inspect the angle cocks and verify that they are properly positioned.
2. Inspect the air hoses and verify that they are in condition for service and properly coupled.
3. Inspect the system for leakage.
4. Make necessary repairs to reduce leakage to a minimum.
5. Inspect the retaining valves and verify that they are in EXHAUST (DIRECT RELEASE).

B. Test Brake Pipe Integrity

When the brake system is charged within 15 psi of the regulating valve setting:

1. Test brake pipe integrity with the AFM or brake pipe leakage method.

2. Verify that:
    a. Brakes apply on each car.
    b. Piston travel is correct.
    c. Brake rigging does not bind or foul.
    d. All brake equipment is properly secured.
3. When the inspection is complete, give the release signal.
4. After the release, inspect each brake to make sure all are released. The release may be verified during a roll-by inspection.

C. Test With Yard Test Plant

When the initial terminal air brake test has been performed with yard air and a locomotive has been added:

1. Make a 20 psi brake pipe reduction.
2. Verify that brakes apply and release on the rear car.

D. Before Leaving Test Location

Before leaving the test location, make sure that 100 percent of the air brakes are operative.

61.3.5 Performing an Initial Terminal Air Brake Test On a Train Not Kept Charged

If the train or portion of the train is not kept charged, perform an initial terminal air brake test on the part of the train not kept charged.

NOTE: A train considered "kept charged" has had its brake system charged to at least 35 psi within the last 2 hours.

61.3.6 Notifying the Engineer

A qualified employee who participated in the test and inspection or who knows the test was completed must notify the engineer either verbally or in writing that the initial terminal air brake test has been

completed satisfactorily. However, the qualified person must provide the notification in writing if the outbound crew will report for duty after the qualified person goes off duty.

Engineers receiving written or verbal notification of the air brake test must accept the notification as authority that the initial terminal air brake test has been completed satisfactorily.

61.4 Air Brake Test When Adding Cars

61.4.1 Adding Pretested Cars

When adding a block of cars pretested by the initial terminal air brake test:

1. Make a 20 psi brake pipe reduction.
2. Verify that the brakes apply and release on the rear car.
3. Verify that brake pipe pressure at the rear of the train is being restored.

61.4.2 Adding Cars Not Pretested

Conduct an air brake test if cars are added to the train when:

- The train is not at the initial terminal.
- One or more cars have not been pretested by the initial terminal air brake test.

To conduct the test:

1. Test brake pipe integrity with the AFM or brake pipe leakage method.
2. Make a 20 psi brake pipe reduction.
3. Verify that the brakes apply and release on each added car and on the rear car.

NOTE: When performing the brake pipe leakage test, verify that the brake system is charged to at least 60 psi.

61.5 Yard Movement Test

Test the air brake system on a train making a yard movement that does not exceed 20 miles in one direction. To conduct the test:

1. Couple brake pipe hoses between all cars.
2. Charge the brake system to at least 60 psi.

   NOTE: If a rear gauge is not available, determine brake pipe pressure by cutting out the automatic brake valve and noting the pressure at which the brake pipe pressure stabilizes, as indicated by the brake pipe pressure gauge.
3. Make a 20 psi brake pipe reduction.
4. Verify that the brakes apply on each car.

NOTE: Yard movements are not limited to movements made within yard limits. When setting out or picking up cars during a yard movement, a more stringent test is not required.

61.6 Air Brake Test When Cutting Off and Recoupling

Conduct an air brake test when one or more cuts are made in a train and the cars are recoupled in 2 hours or less. To test the air brake system:

1. Open the angle cock.
2. Make sure that brake pipe pressure is being restored and the brakes release on the rear car.

EXCEPTION: If the train does not have an operative end-of-train telemetry device or occupied caboose:

1. **Make a 20 psi brake pipe reduction.**
2. **Make sure the brakes apply and release on the rear car.**

If the cars are recoupled in more than 2 hours, refer to Rule 61.3.5, Performing an Initial Terminal Air Brake Test On a Train Not Kept Charged.

61.7 Application and Release Test

At a point other than an initial terminal, conduct an application and release test when:

- Any locomotive in the locomotive consist is changed (including changing operating ends).
- A caboose is changed.
- Helper locomotives are added or removed anywhere in the train.
- One or more consecutive cars are set out from the head or rear of the train.

61.7.1 Procedure For Application and Release Test

To conduct an application and release test:

1. Verify that the brake system is charged to within 15 psi of the regulating valve setting.
2. Make a 20 psi brake pipe reduction.
3. Verify that brakes on the rear car apply and release.

61.8 Running Air Brake Test

Conduct a running air brake test of all passenger trains when:

- The train leaves the initial terminal.
- Locomotive, engine or train crew, or operating ends have been changed.
- Any angle cocks or cutout cocks have been closed. However, the running test is not required when cars are cut off from the rear end of the train only.
- The train has struck debris on the track.

In addition, conduct a running air brake test of all passenger trains before:

- The train passes a summit in mountain grade territory.
- The train starts a descent on a grade where brakes are required to control train speed.
- The train meets another train. Conduct the running air brake test at least 2 miles before the trains meet.

61.8.1 Procedure For Running Air Brake Test

To conduct a running air brake test:

1. Before conducting the running air brake test, tell crew members that you will be conducting the test.
2. Begin the running test of the brakes as soon as train speed is high enough to prevent stalling.
3. While using enough power to keep the train stretched:
   a. Apply the train brakes with enough force to make sure the train brakes are operating properly.
   b. Keep the locomotive brakes released during the test.
   c. Verify that the train brakes create a noticeable retarding force.
4. If the train brakes are operating properly, release the brakes and proceed.

NOTE: Do not apply the locomotive or dynamic brakes during a running test.

61.8.2 Brakes Not Operating Properly

If the train brakes are not operating properly, stop the train immediately and:

1. Inspect the brakes to identify and correct the problem.
2. Before proceeding, conduct an application and release test as specified in Rule 61.7, Application and Release Test.

3. Once the train is proceeding, immediately repeat the running test as specified in Rule 61.8.1, Procedure For Running Air Brake Test.

61.9 Air Brake Test Chart

Use the chart in Figure 61-A to determine major steps in air brake tests. This chart does not contain all requirements. Refer to this chapter for complete rules.

TRAIN AIR BRAKE TESTS

This chart contains the main points of air brake tests. It does not supersede the requirements of ARRC Air Brake and Train Handling Rules.

Type of Test and ARRC Rule Number		Charge To System Is Within 15 psi Of Regulating Valve Feed Valve	Charge System To Not Less Than 60 psi	No Specified Change In Brake System	Air Flow Less Than 60 CFM	20 psi Brake Pipe Reduction	Brakes Applied			Brake Pipe Leakage Test	Brakes Released			Brake Pipe Pressure Being Restored
							Car(s) Picked Up	Rear Car	Entire Train		Entire Train	Rear Car	Car(s) Picked Up	
Initial Terminal 61.3	LKG	●				●			●	●	●			
	AFM	●			●	●			●		●			
Add Cars Not Pretested 61.4.2	LKG		●			●	●	● #		●		● #	●	● #
	AFM	●			●	●	●	● #				● #	●	● #
Add Pretested Cars 61.4.1				●		●		● #				● #		● #
Cut Off And Recouple Same Loco. & Train 61.6				●								● #		● #
Application and Release Test 61.7		●				●		● #				● #		● #
Yard Movement Less Than 20 Miles 61.5			●			●			●					
Locomotive On After A Yard Air Test 61.3.4C				●		●		● #				● #		

If available, use the EOT telemetry device to determine application and release on rear car (see Rule 61.2.5).

Figure 61-A. Air Brake Test Chart.

61.10 Locomotive Air Brake Test

Conduct a locomotive air brake test when:

- Making up a locomotive consist
- Adding or removing locomotives

  or

- Changing operating ends

From the ground, observe that the locomotive brakes apply and release during the air brake test.

61.10.1 Making Up, Adding, or Removing Locomotives

When making up locomotive consists, or when adding locomotives to or removing locomotives from a consist, use the following procedure:

1. Adjust the regulating valve to the required brake pipe pressure. (See Table 62-A, Standard Air Pressures, in Chapter 62.)
2. With the independent and automatic brake valve handles in RELEASE, apply the independent brake.
3. After the brakes apply on both sides of all locomotives in the consist, release the independent brakes and observe that the brakes release.
4. When the brakes are released on all locomotives and the equipment is fully charged, apply the automatic brakes by making a 20 psi brake pipe reduction.
5. Observe that the brakes apply on all locomotives.

   NOTE: You do not need to walk both sides of the consist after observing that the brakes applied during the independent brake test.
6. Cut out the automatic brake and observe the brake pipe pressure gauge. Verify that the brake pipe leakage does not exceed 5 psi per minute.

7. Cut the automatic brake back in and move the automatic brake valve handle to MINIMUM REDUCTION. Verify that the equalizing reservoir pressure does not increase.
8. Actuate the independent brake and observe that the brakes release on all locomotives.
9. With the independent brake in RELEASE (not actuated), place locomotives in FULL dynamics.
10. Put locomotives in EMERGENCY by opening the angle cock on the rear unit of the consist.

CAUTION: Do not perform this part of the air brake test over a fuel spill containment area, since the locomotive will deposit sand while the consist is in EMERGENCY.

11. Verify that the brakes apply as indicated by the brake cylinder pressure gauge.
12. Verify that:
    - Brake pipe pressure reduces to 0 psi.
    - The PCS opens.
    - Dynamic braking remains operable.

61.10.2 Changing Operating Ends

When operating ends have been changed but the consist otherwise remains unchanged, perform the following air brake test:

1. Release the independent brake and verify that the brakes release.
2. Make a full service brake application and verify that the brakes apply.
3. Actuate the independent brake and verify that the brakes release.

NOTE: If conditions permit, you may perform this test at 1 MPH to 3 MPH and allow the locomotive to drift with the throttle in IDLE.

61.11 Brake Cutouts On Locomotives

All ARRC locomotives are equipped with brake cutout cocks on each truck and on each side of the locomotive.

- The cutout cocks on the engineer's side control the brakes on both sides of the truck.
- The cutout cocks on the fireman's side control the brakes on that side only.

62 OPERATING LOCOMOTIVE EQUIPMENT

62.1 General Requirements

Engineers are responsible for the following:

1. If possible, position yourself so you can conduct a roll-by inspection of an incoming locomotive consist.
2. Keep the side and end doors of the locomotive closed when the doors are not being used.
3. Keep cab windows and doors of unoccupied, trailing locomotives closed.
4. Keep the locomotive's high voltage cabinets closed during operation.
5. Isolate locomotives before opening any electrical cabinet door marked "Danger."
6. During cold weather, make sure that cab heaters are on and working.
7. Check for sliding wheels at frequent intervals if:
   - The locomotive is dead.
   - The locomotive is isolated.
     or
   - The locomotive's traction motors are isolated.
8. Verify that brake pipe exhaust ports are not plugged or obstructed.
9. Verify that the independent brake valve handle is not blocked in the actuate position.
10. Verify that the reverser is centered when the locomotive is not moving.
11. Verify that the brake shoes are thick enough to last until the next maintenance or through the shift in yard service.

12. Position electrical switches and control equipment in the cab for proper operation.
13. Before each trip, verify that locomotive brakes and devices for regulating all pressures, including the automatic and independent brake valves, operate as intended.

62.2 Locomotive Daily Inspection

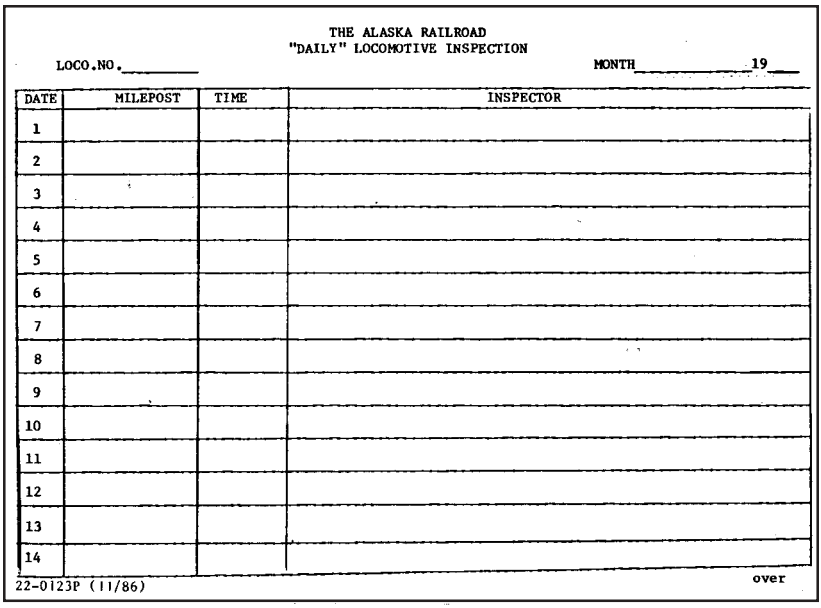
To comply with federal requirements, each locomotive in service must be inspected at least once during each calendar day. A calendar day is a 24-hour period from midnight to midnight.

Locomotive engineers are responsible for ensuring that each locomotive in their charge is inspected each calendar day. Locomotive engineers or other designated employees are considered qualified to make the inspection.

62.2.1 Locomotive Inspection Forms

The Alaska Railroad uses the following forms:

1. The **Alaska Railroad Daily Locomotive Inspection** card (ARRC Form 22-0123P), also known as the locomotive cab card. This form is completed by the employee who conducts the daily inspection. It indicates the date, time, location, and name of employee who made the inspection. See Figure 62-A.



THE ALASKA RAILROAD
"DAILY" LOCOMOTIVE INSPECTION

LOCO.NO._____ MONTH_____19___

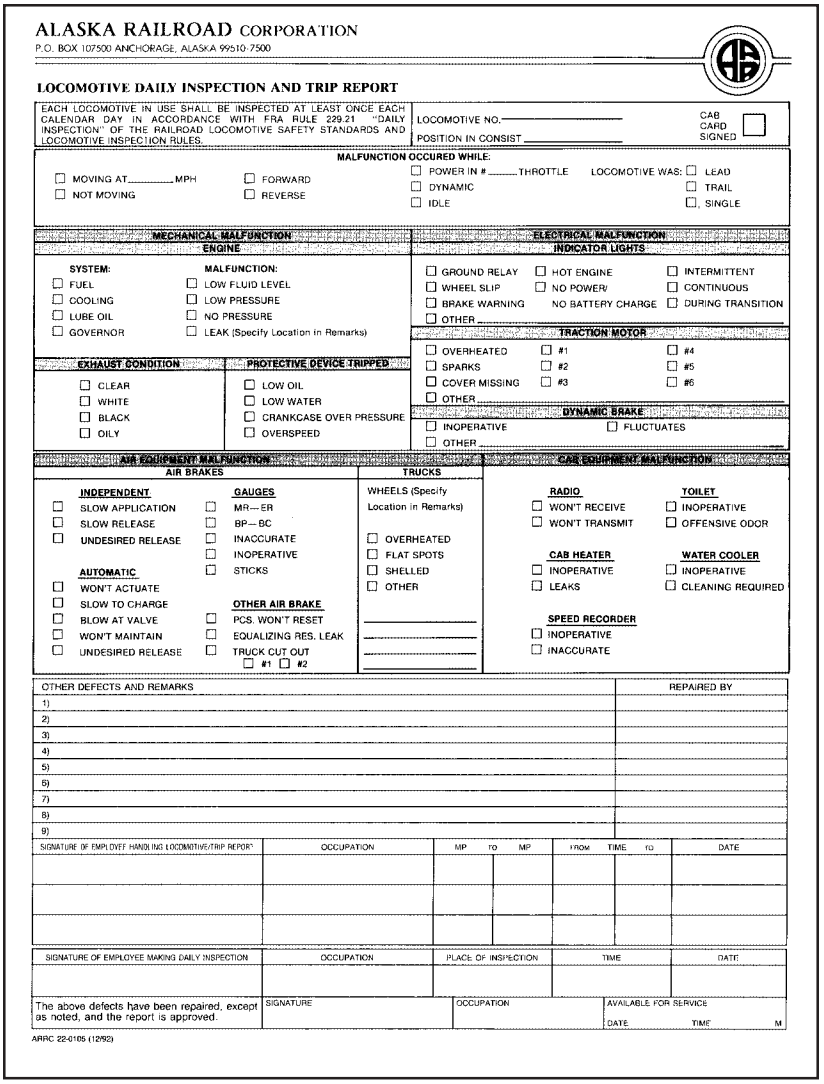
DATE	MILEPOST	TIME	INSPECTOR
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			

22-0123P (11/86) over

Figure 62-A. Alaska Railroad Daily Locomotive Inspection Card.

2. The **Locomotive Daily Inspection and Trip Report** form (ARRC Form 22-0105). This form is used for two purposes:

   - The locomotive engineer uses this form to indicate any malfunctions or defects while he or she operated the unit.
   - The employee making the daily inspection uses this form to note the inspection of the locomotive and the repair (if any) of any defects or malfunctions reported by the locomotive engineer. See Figure 62-B.



ALASKA RAILROAD CORPORATION
P.O. BOX 107500 ANCHORAGE, ALASKA 99510-7500

LOCOMOTIVE DAILY INSPECTION AND TRIP REPORT

EACH LOCOMOTIVE IN USE SHALL BE INSPECTED AT LEAST ONCE EACH CALENDAR DAY IN ACCORDANCE WITH FRA RULE 229.21 "DAILY INSPECTION" OF THE RAILROAD LOCOMOTIVE SAFETY STANDARDS AND LOCOMOTIVE INSPECTION RULES.

LOCOMOTIVE NO. _____ POSITION IN CONSIST _____ CAB CARD SIGNED ☐

MALFUNCTION OCCURED WHILE:

☐ MOVING AT _____ MPH ☐ FORWARD ☐ POWER IN # _____ THROTTLE LOCOMOTIVE WAS: ☐ LEAD
☐ NOT MOVING ☐ REVERSE ☐ DYNAMIC ☐ TRAIL
☐ IDLE ☐ SINGLE

MECHANICAL MALFUNCTION

ENGINE

SYSTEM:	MALFUNCTION:
☐ FUEL	☐ LOW FLUID LEVEL
☐ COOLING	☐ LOW PRESSURE
☐ LUBE OIL	☐ NO PRESSURE
☐ GOVERNOR	☐ LEAK (Specify Location in Remarks)

EXHAUST CONDITION

☐ CLEAR ☐ WHITE ☐ BLACK ☐ OILY

PROTECTIVE DEVICE TRIPPED

☐ LOW OIL ☐ LOW WATER ☐ CRANKCASE OVER PRESSURE ☐ OVERSPEED

ELECTRICAL MALFUNCTION

INDICATOR LIGHTS

☐ GROUND RELAY ☐ HOT ENGINE ☐ INTERMITTENT
☐ WHEEL SLIP ☐ NO POWER ☐ CONTINUOUS
☐ BRAKE WARNING ☐ NO BATTERY CHARGE ☐ DURING TRANSITION
☐ OTHER _____

TRACTION MOTOR

☐ OVERHEATED ☐ #1 ☐ #4
☐ SPARKS ☐ #2 ☐ #5
☐ COVER MISSING ☐ #3 ☐ #6
☐ OTHER _____

DYNAMIC BRAKE

☐ INOPERATIVE ☐ FLUCTUATES
☐ OTHER _____

AIR EQUIPMENT MALFUNCTION

AIR BRAKES

INDEPENDENT
☐ SLOW APPLICATION
☐ SLOW RELEASE
☐ UNDESIRED RELEASE

AUTOMATIC
☐ WON'T ACTUATE
☐ SLOW TO CHARGE
☐ BLOW AT VALVE
☐ WON'T MAINTAIN
☐ UNDESIRED RELEASE

GAUGES
☐ MR—ER
☐ BP—BC
☐ INACCURATE
☐ INOPERATIVE
☐ STICKS

OTHER AIR BRAKE
☐ PCS. WON'T RESET
☐ EQUALIZING RES. LEAK
☐ TRUCK CUT OUT ☐ #1 ☐ #2

TRUCKS

WHEELS (Specify Location in Remarks)

☐ OVERHEATED
☐ FLAT SPOTS
☐ SHELLED
☐ OTHER

CAB EQUIPMENT MALFUNCTION

RADIO
☐ WON'T RECEIVE
☐ WON'T TRANSMIT

TOILET
☐ INOPERATIVE
☐ OFFENSIVE ODOR

CAB HEATER
☐ INOPERATIVE
☐ LEAKS

WATER COOLER
☐ INOPERATIVE
☐ CLEANING REQUIRED

SPEED RECORDER
☐ INOPERATIVE
☐ INACCURATE

OTHER DEFECTS AND REMARKS	REPAIRED BY
1)	
2)	
3)	
4)	
5)	
6)	
7)	
8)	
9)	

SIGNATURE OF EMPLOYEE HANDLING LOCOMOTIVE/TRIP REPORT	OCCUPATION	MP	TO MP	FROM TIME	TO	DATE

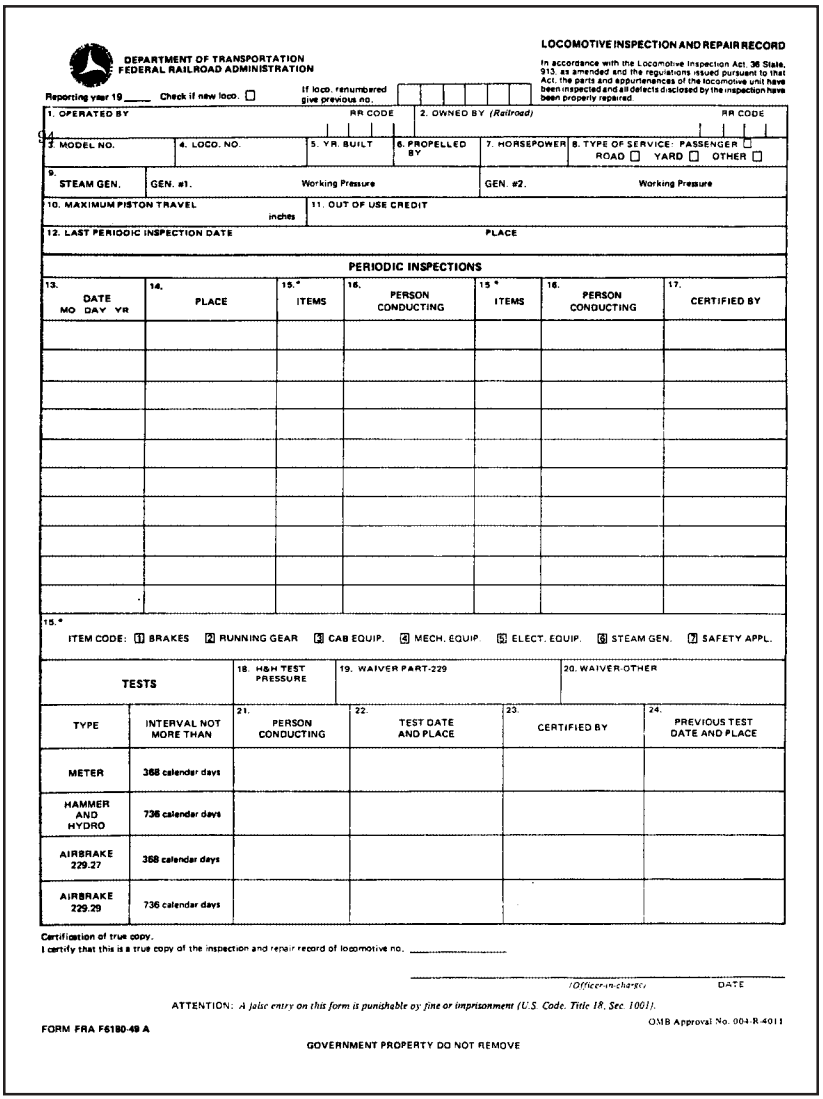
SIGNATURE OF EMPLOYEE MAKING DAILY INSPECTION	OCCUPATION	PLACE OF INSPECTION	TIME	DATE

The above defects have been repaired, except as noted, and the report is approved.	SIGNATURE	OCCUPATION	AVAILABLE FOR SERVICE DATE TIME M

ARRC 22-0105 (12/92)

Figure 62-B. Locomotive Daily Inspection and Trip Report.

3. The **Locomotive Inspection and Repair Record** form (FRA Form F6180-49A), also known as the blue card. Employees need only verify that this form is displayed under a transparent cover in the cab of each locomotive. See Figure 62-C.



DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION

LOCOMOTIVE INSPECTION AND REPAIR RECORD

In accordance with the Locomotive Inspection Act, 36 Stats. 913, as amended and the regulations issued pursuant to that Act, the parts and appurtenances of the locomotive unit have been inspected and all defects disclosed by the inspection have been properly repaired.

Reporting year 19____ Check if new loco. ☐ If loco. renumbered give previous no.

1. OPERATED BY — RR CODE — 2. OWNED BY *(Railroad)* — RR CODE

3. MODEL NO. — 4. LOCO. NO. — 5. YR. BUILT — 6. PROPELLED BY — 7. HORSEPOWER — 8. TYPE OF SERVICE: PASSENGER ☐ ROAD ☐ YARD ☐ OTHER ☐

9. STEAM GEN. — GEN. #1. — Working Pressure — GEN. #2. — Working Pressure

10. MAXIMUM PISTON TRAVEL inches — 11. OUT OF USE CREDIT

12. LAST PERIODIC INSPECTION DATE — PLACE

PERIODIC INSPECTIONS

13. DATE MO DAY YR	14. PLACE	15.* ITEMS	16. PERSON CONDUCTING	15.* ITEMS	16. PERSON CONDUCTING	17. CERTIFIED BY

15.* ITEM CODE: [1] BRAKES [2] RUNNING GEAR [3] CAB EQUIP. [4] MECH. EQUIP. [5] ELECT. EQUIP. [6] STEAM GEN. [7] SAFETY APPL.

TESTS — 18. H&H TEST PRESSURE — 19. WAIVER PART-229 — 20. WAIVER:OTHER

TYPE	INTERVAL NOT MORE THAN	21. PERSON CONDUCTING	22. TEST DATE AND PLACE	23. CERTIFIED BY	24. PREVIOUS TEST DATE AND PLACE
METER	368 calendar days				
HAMMER AND HYDRO	736 calendar days				
AIRBRAKE 229.27	368 calendar days				
AIRBRAKE 229.29	736 calendar days				

Certification of true copy.
I certify that this is a true copy of the inspection and repair record of locomotive no. _____

_____ *(Officer-in-charge)* DATE

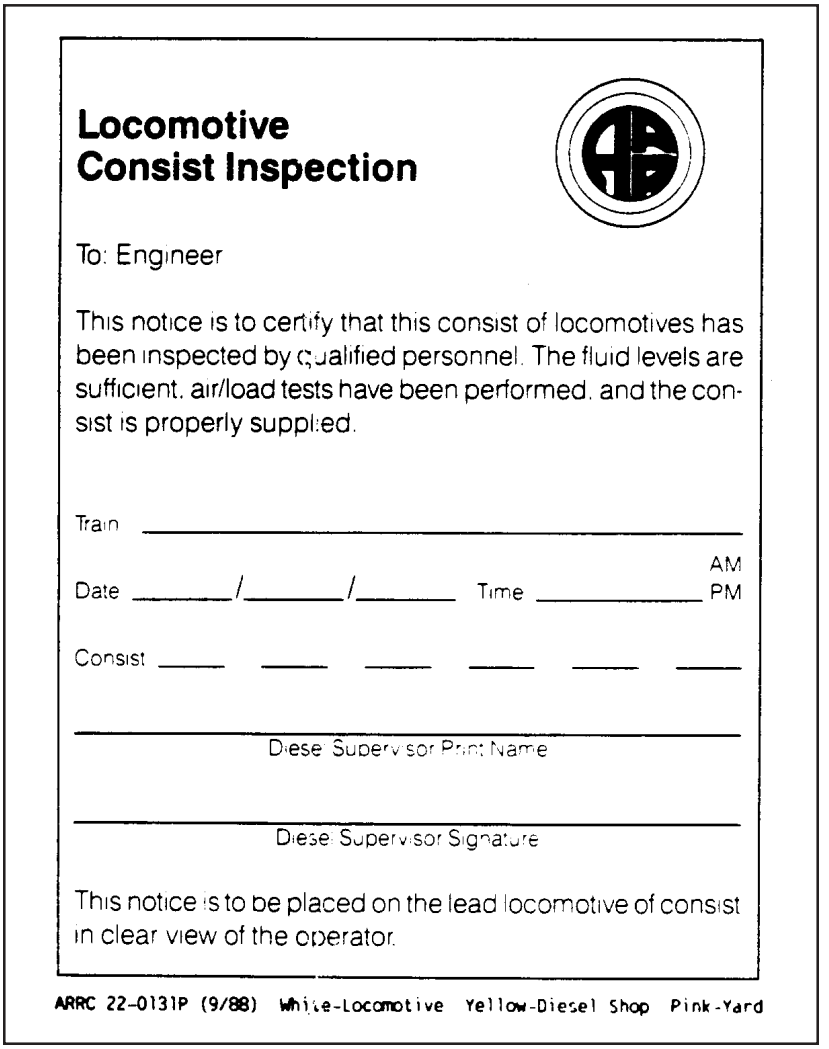
ATTENTION: *A false entry on this form is punishable by fine or imprisonment (U.S. Code, Title 18, Sec. 1001).*

FORM FRA F6180-49 A — OMB Approval No. 004-R-4011

GOVERNMENT PROPERTY DO NOT REMOVE

Figure 62-C. Locomotive Inspection and Repair Record.

4. The **Locomotive Consist Inspection Report** form (ARRC Form 22-0131P). Engineers on outbound trains are not required to perform locomotive daily inspections when this form is placed on the control stand of the leading locomotive. See Figure 62-D.



Locomotive Consist Inspection

To: Engineer

This notice is to certify that this consist of locomotives has been inspected by qualified personnel. The fluid levels are sufficient, air/load tests have been performed, and the consist is properly supplied.

Train _____

Date _____/_____/_____ Time _____ AM PM

Consist _____ _____ _____ _____ _____ _____

_____
Diesel Supervisor Print Name

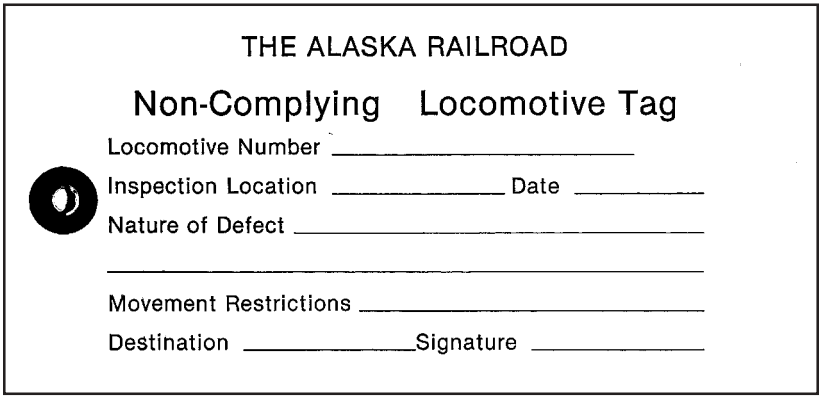
_____
Diesel Supervisor Signature

This notice is to be placed on the lead locomotive of consist in clear view of the operator.

ARRC 22-0131P (9/88) White-Locomotive Yellow-Diesel Shop Pink-Yard

Figure 62-D. Locomotive Consist Inspection Report.

5. The **Non-Complying Locomotive Tag** form (ARRC Form 2339). This form is used to indicate that a locomotive has one or more defective conditions that make it a non-complying locomotive. See Figure 62-E.


THE ALASKA RAILROAD

Non-Complying Locomotive Tag

Locomotive Number _____

Inspection Location _____ Date _____

Nature of Defect _____

_____

Movement Restrictions _____

Destination _____ Signature _____

Figure 62-E. Non-Complying Locomotive Tag.

62.2.2 Determine If Inspection Is Required

The locomotive cab card indicates where and when the last inspection was made and who made the inspection.

A. Previous Inspection Recorded

If the locomotive cab card indicates that the locomotive was inspected the previous calendar day, make the current daily inspection before 2359 hours. To allow the locomotive to remain in service, follow these guidelines:

1. If your tour of duty will go beyond 2359 hours, conduct the locomotive daily inspection before 2359 hours. Where trains are stopped by operating conditions, use the time to inspect the locomotive(s) and complete the required forms.

2. If you have time to reach your final terminal before 2359 hours, inspect the locomotive(s) at that terminal, unless the proper authority informs you that Mechanical personnel or the outbound engineer will perform the inspection.

B. Previous Inspection Not Recorded

If the locomotive cab card indicates that the locomotive was not inspected during the previous day, or if there is no record on the locomotive, inspect the locomotive before it is placed into service on the current day.

62.2.3 Locomotives Picked Up or Set Out On Line

When picking up or setting out a locomotive on line, follow the guidelines for determining whether an inspection is needed (see Rule 62.2.2). If the locomotive is idling or shut down, and it will not be used as a working unit during the current calendar day, then an inspection is not required.

62.2.4 Locomotives At Outlying Points

Inspect locomotives assigned to outlying points (Seward, Whittier, snow fleets, company work trains, etc.) as follows:

1. Complete a daily inspection of each locomotive.
2. Complete all forms and leave them in the designated holder on the locomotive.
3. Call the Anchorage Diesel Shop, extension 676.
    - If defects are found, notify the diesel foreman on duty, who will decide if the locomotive can be operated.
    - If no defects are found, either notify the diesel foreman on duty or leave a message on the recording machine that no exceptions were taken on the daily inspection.

62.2.5 Locomotive Inspection For Suneel Unit Coal Trains

Locomotive daily inspections on Suneel unit coal trains are performed as follows:

1. Mechanical personnel inspect the locomotives on the Sunday before each week's trips.
2. At Healy, the engineer who loads the train performs the locomotive daily inspection for that consist.
3. At Seward, the outbound engineer or the engineer who dumps the train arranges for the consist to be inspected.
4. When the consist arrives in Anchorage from either Healy or Seward, the inbound engineer delivers the Locomotive Daily Inspection and Trip Report to the crew dispatcher's office, where it is picked up by Mechanical personnel.

62.2.6 Perform the Daily Inspection

Inspect the locomotive for non-complying conditions and observe the following items. If the items are operational, they must be functioning properly to be in compliance.

Inspect these three general areas of each locomotive:

A. Control Compartment Of Locomotive Cab

Make sure that:

1. Each air gauge registers correctly and within 3 psi of the required pressure (see Table 62-A on page 62-17).
2. The locomotive cab is free of stumbling and tripping hazards.
3. Cab windows of the lead locomotive provide a clear view.
4. Containers are provided for carrying fusees and torpedoes. Torpedoes are kept in a closed metal container.

5. These functions are operational:

    - Headlight (At least one headlight bulb must be operational on each end of the unit.)
    - Gauge lights and overhead cab light
    - Horn
    - Bell
    - Sanders (They deposit sand in front of the lead wheels when the reverser position determines the direction.)
    - Speed indicator

      NOTE: After a daily inspection, if the speed indicator failure is identified on the lead locomotive as soon as it begins moving, the failure is considered a non-complying condition discovered during the daily inspection.

B. Walkway and Engine Compartment

Inspect both sides of each locomotive unit to make sure that:

1. Walkways and walk-in compartments are clear of debris, tools, and accumulated oil or grease.
2. Handrails, hand holds, steps, ladders, safety chains, and guards are secured and ready for service. Inspect for broken, bent, damaged, or loose equipment. Make sure safety chains are connected high enough for safe passage.
3. All electrical and rotating equipment guards are in place.
4. The diesel engine has no apparent exhaust, oil, water, or fuel leaks.
5. Fluid levels (water, lube oil, and governor oil) are adequate.
6. The hand brake is operational.
7. Walkway and engine compartment lights are working.

8. Cable and jumper connections between locomotives have good plugs, receptacles, and terminals. Cables and insulation are intact. No part of the jumper cable is lying on the coupler or is higher than the walkway platform. Unused jumper cables are stowed.

C. Ground Level

Set hand brakes, if necessary, and walk around both sides of the locomotive to make sure that:

1. Sand has been deposited on the rail in front of the lead wheels.
2. Fuel tank is not leaking.
3. No defects such as cracks and broken or missing parts are on the:
   - Locomotive trucks
   - Wheels
   - Gear cases
   - Draft gears
4. Brake cylinder piston travel is sufficient to provide brake shoe clearance when the brakes are released, but does not exceed 6 inches.
5. Foundation brake rigging does not bind or foul.
6. Brake shoes are secured and approximately in line with the tread of the wheel. Make sure the shoe has no obvious lips or overhangs.

62.2.7 Complete the Inspection Forms

A. Locomotive Daily Inspection and Trip Report (ARRC Form 22-0105)

Complete a Locomotive Daily Inspection and Trip Report for each locomotive inspected.

1. Leave the completed report in the controlling cab, unless otherwise instructed.

2. Immediately report any non-complying conditions to the train dispatcher or other proper authority.
3. Correct any non-complying conditions found during the daily inspection before the locomotive is placed in service.

B. Daily Locomotive Inspection Card (ARRC Form 22-0123P)

Complete an inspection card for each locomotive inspected.

NOTE: The operating or mechanical employee making the repairs must sign off any FRA defects as corrected before the locomotive is used.

62.2.8 Locomotive Is Safe To Move

If during the locomotive daily inspection you find one or more non-complying conditions, determine if the locomotive is safe to move. If unsure whether the locomotive is safe to move, contact the train dispatcher, mechanical supervisor, or other proper authority.

1. If the locomotive is safe to move, move it only:
   - As a single unit under power not attached to cars
   - In a locomotive consist not attached to cars
     or
   - Isolated or shut down when attached to cars
2. Complete a Non-Complying Locomotive Tag and attach it to the isolation switch of the non-complying locomotive. The tag must include this information:
   - "Non-complying locomotive" written on the tag
   - Locomotive initials and number
   - Inspection location and date
   - Nature of the defect
   - Movement restrictions, if any
   - Destination
   - Signature of the employee making the inspection
3. Secure a copy of the non-complying tag on the control stand of the controlling locomotive.

4. Make sure the engineer in charge of the locomotive movement receives written notification of the non-complying locomotive (a copy of a non-complying locomotive tag meets this requirement). The engineer must inform all other crew members of the non-complying unit and of any restrictions.

EXCEPTION: Without meeting the above requirements, a non-complying locomotive may be moved as a single locomotive or dead within a yard solely for repairs and at no more than 10 MPH.

62.2.9 Locomotive Is Not Safe To Move

If you determine the locomotive is not safe to move:

1. Notify the train dispatcher or other proper authority.
2. Complete a non-complying tag and attach the tag to the isolation switch of the non-complying locomotive. The tag must include this information:
   - "Non-complying locomotive" written on the tag
   - Locomotive initials and number
   - Inspection location and date
   - Nature of the defect
   - Signature of the employee making the inspection

62.3 Responding To Defects or Non-Complying Conditions Found Enroute

If defects or non-complying conditions on any locomotive unit are discovered enroute, the engineer must complete the appropriate forms and handle the locomotive properly to avoid unsafe movement.

62.3.1 Defects Found Enroute

A. Reporting Defect That Is Not a Non-Complying Condition

Examples of a defect or problem that is not a non-complying condition include:

- Weather stripping is defective.
- Windshield wipers are not working.
- Crossing lights are burned out.
- One headlight bulb is burned out.
- Ground relay is tripped.
- Safety valve on the air compressor or main reservoir is popping off.

If a defect or problem found enroute is not a non-complying condition:

1. Complete a Locomotive Daily Inspection and Trip Report (ARRC Form 22-0105) for each locomotive in the consist with a defect or problem.
2. Leave the form in the cab cardholder on the locomotive unit with the defect.
3. Report any locomotive not producing power to the train dispatcher or other proper authority.

B. Handling and Reporting Locomotives With Major Defects

If a locomotive enroute has a major internal defect:

1. If possible, isolate the locomotive.
2. Shut down the diesel engine immediately if noise indicates an internal mechanical defect in:
   - Diesel engine
   - Turbocharger

   or
   - Components related to the above

3. If you shut down the engine, do not restart the engine until the equipment has been inspected and can be operated without damaging the locomotive.

C. Setting Out Defective Locomotives

Set out a locomotive with a major defect only if the defect requires that the locomotive be set out. To set out the locomotive:

1. Leave the locomotive where maintenance personnel can access it.
2. Leave the Locomotive Daily Inspection and Trip Report, indicating the defect and its location, in the cab cardholder.
3. Notify the train dispatcher.

62.3.2 Protecting Engine From Freezing

Follow these steps to protect an engine from freezing:

1. If the ambient temperature is below 32 °F and the engine dies:
   a. Try to restart the engine within 5 minutes.
   b. If the engine cannot be restarted, drain the engine immediately.
2. If the ambient temperature is below 32 °F and the engine is idling:
   - If the temperature will not go below 0 °F, keep the engine idling.
   - If the temperature is below 0 °F, follow these steps to increase the engine RPM:
     a. Place the reverser in the CENTER position.
     b. Place the generator field switch in the OFF position.
     c. Place the throttle in throttle 4.
3. Take precautions to prevent an isolated locomotive from freezing up. Drain the engine if necessary.

4. When operating a locomotive with an RDC at temperatures less than 15° F, make sure the RDC is on line and working to maintain sufficient heat for passengers.

62.3.3 Non-Complying Condition Found Enroute

A locomotive that develops a non-complying condition enroute may continue operating if the engineer or other qualified employee determines the locomotive is safe to move. The locomotive may then be operated until the next daily inspection or until it reaches the nearest point where repairs can be made, whichever is first.

The engineer must:

1. Report any non-complying conditions on the Locomotive Daily Inspection and Trip Report.
2. Report non-complying conditions to the train dispatcher as soon as possible.
3. Notify the relieving engineer of any non-complying conditions when possible.

NOTE: Also refer to Figure 66-G, Numbering Wheels and Components On Locomotives, in Chapter 66.

62.4 Maintaining Standard Air Pressures

Adjust the air pressure regulating devices on locomotives and cars according to the standard pressures in Table 62-A.

Standard Air Pressures	
Service Type	**Pressure (psi)**
Main reservoir	
Minimum	130
Maximum	140
Brake pipe	
Yard service	90
Freight service	90
Mixed freight and passenger service	90
Passenger service	110
Loaded unit coal trains between Healy and Seward	100
Helper service in train or on rear of train Locomotive switching trains from the rear	Adjust regulating valve to 10 psi less than the brake pipe setting for the train being handled.
Independent brake cylinder pressure	
All locomotives	45
Rear of train pressure	
At least	45
Mountain grade, at least	65

Table 62-A. Standard Air Pressures.

62.5 Using Locomotive Safety Devices

62.5.1 Report Safety Device Function

If a safety device becomes defective enroute, inform the train dispatcher as soon as possible.

62.5.2 Avoid Tampering With Safety Devices

Do not cut out, tamper with, or defeat a safety device without proper authorization. When a locomotive is enroute, this authorization may come from the train dispatcher, mechanical supervisor, or other manager.

62.6 Positioning Locomotive Air Brake Equipment

Place air brake valves in the proper position on freight and helper locomotives. Position brake valves and cutout cocks as indicated in Table 62-B.

26 and 30 CDW Brake Equipment Positions				
	Freight		Helper	
	Lead	Trail	Lead	Trail
Automatic Brake Valve	Release	Continuous Service	Release	Continuous Service
Independent Brake Valve	Applied Full	Release	Release	Release
Automatic Brake Valve Cutout Valve	Frt or In Pass	Out	Out	Out
MU-2A Valve	Lead or Dead	Trail	Lead or Dead	Trail

Table 62-B. 26 and 30 CDW Brake Equipment Positions.

62.6.1 Connect Air Hoses In Multiple Unit Consists

Connect air hoses in a multiple unit consist to ensure that the brake system is operational throughout the consist. To connect the hoses:

1. Clean out all MU and brake pipe hoses before coupling them to other hoses.
2. Couple MU and brake pipe hoses.
3. Open cutout cocks and angle cocks fully between locomotives in the consist.
4. Refer to Figure 62-F for end hose identification and proper connections on locomotives.

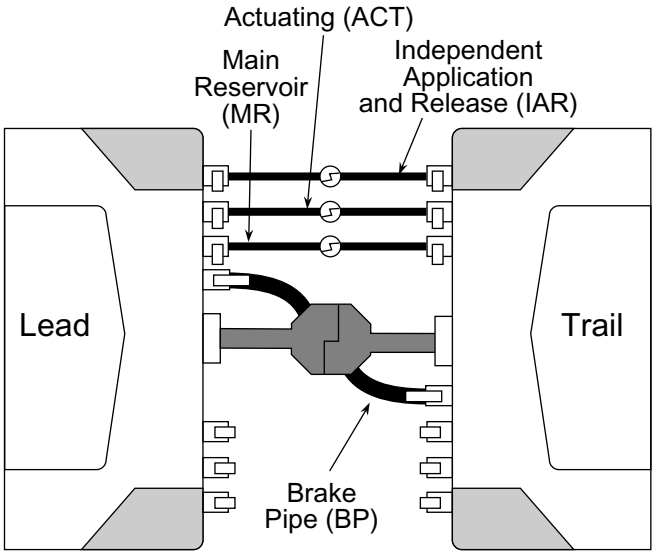


Figure 62-F. Multiple Unit Air Hose Connections.

62.7 Using Speed Indicators

A locomotive used as a controlling unit at speeds above 20 MPH must be equipped with an operative speed indicator. Follow these speed indicator requirements:

1. Locomotive speed indicators must be accurate within:
   a. ± 3 MPH at speeds between 10 and 30 MPH
   b. ± 5 MPH speeds above 30 MPH
2. If a speed indicator on a controlling locomotive fails enroute, the locomotive may continue as a controlling locomotive at normal track speed only to the next repair facility.

62.7.1 Verify Speed Indicator Accuracy

When leaving the terminal, the engineer must test the speed indicator of the controlling locomotive as follows:

1. Verify the accuracy of the speed indicator at the first opportunity.
2. Conduct the speed check in the 10 to 30 MPH range.
3. Conduct the speed check as near maximum speed as conditions permit.
4. Report inaccurate speed indicators as follows:
   a. Complete the Locomotive Daily Inspection and Trip Report.
   b. Report verbally to the dispatcher.

62.8 Moving Locomotives

62.8.1 Moving Locomotives—General

Follow these steps to move a locomotive safely:

A. Before Moving Locomotive

1. Verify that hand brakes are released on all locomotives.

2. If multiple locomotives will be operating from a single control:
   a. Couple hoses.
   b. Position cutout cocks and valves for MU operation.

B. When Starting Out

1. At a speed of 1 to 3 MPH, allow the locomotive to drift with the throttle in IDLE (if conditions permit).
2. Check that brakes or other conditions do not restrict the locomotive's movement.
3. Make an automatic brake pipe reduction to make sure the brakes apply.
4. Actuate to make sure the brakes release.

C. Hostling Locomotive

Multiple locomotive consists may be moved within a terminal area with only the brake pipe connected under these conditions:

- Distance traveled does not exceed 2 miles.
- Speed does not exceed 10 MPH.

When starting movement with only the brake pipe connected:

1. At a speed of 1 to 3 MPH, apply the automatic brake by making a 10 psi brake pipe reduction. Make sure the brakes apply.
2. After stopping, release the automatic brake and make sure all brakes release.

62.8.2 Moving Locomotives Within Mechanical Department Limits

When moving locomotives within mechanical department limits:

1. Charge and properly position brake equipment before moving the locomotive.
2. Apply and release locomotive brakes to verify brake cylinder pistons are operating, and brake cylinder lines to trucks are not cut out.

3. Use proper whistle signals and ring the locomotive bell to warn of movement.
4. Verify the way is clear before moving the locomotive.
5. Do not exceed 5 MPH within Mechanical Department limits unless authorized to do so.
6. When assisted by a hostler helper, do not move the locomotive until you are signaled to do so.

62.8.3 Moving Light Locomotive Consists

Operate a light locomotive consist from the cab nearest the direction of travel when:

- Distance to be traveled exceeds 2 miles.
- A member of the same crew does not control movement using hand signals or radio.
- Visibility is impaired.

62.9 Securing Unattended Locomotives

Properly secure unattended locomotives to prevent unsafe movement.

62.9.1 Applying Hand Brakes On Locomotives

When applying hand brakes to secure locomotives, test the hand brake as follows:

1. Apply the hand brake fully.
2. Verify that the hand brake is secure by releasing the air brake.
3. Reapply the independent brakes fully after the test.
4. Block the wheels if the locomotive has a defective or inoperative hand brake.

62.9.2 Securing Unattended Locomotives

When securing locomotives:

1. Place the throttle in IDLE unless you are protecting the engine from freezing (see Rule 62.3.2, Protecting Engine From Freezing).
2. Place the generator field switch or the circuit breaker on the control stand (if equipped) in the OFF position.
3. Remove the reverser handle from the reverser slot on the control stand, and place it in the receptacle, if equipped. Do not remove the reverser handle if you need to increase the throttle position to prevent freezing.
4. If the locomotive is not attached to a train, make a 20 psi automatic brake pipe reduction after allowing the brake system to charge for at least 5 minutes.
5. Leave the automatic brake valve cut in.
6. Fully apply the independent brake.
7. Apply a sufficient number of hand brakes.

62.10 Separating Locomotives

When separating locomotives:

1. Disconnect electric jumper cables.
2. Disconnect walkway safety chains.
3. Close cutout cocks.
4. After pressure is reduced to 0 psi, uncouple MU hoses.
5. Attach air hoses to the dummy couplings or place them in the pockets.

62.11 Changing Operating Ends

Change operating ends on a locomotive consist by cutting out the operating controls on the controlling end of the locomotive consist and proceeding immediately to the opposite end of the locomotive consist and restoring control.

62.11.1 Cutting Out Operating Controls

To cut out operating controls, use the following procedure:

1. Move the reverser handle to NEUTRAL and remove it.
2. Place the generator field switch in the OFF position.
3. Verify that the independent brake valve handle is in FULL APPLICATION.
4. Make a full service brake pipe reduction with the automatic brake valve.
5. Wait for the automatic brake valve to finish exhausting.
6. Rotate the automatic brake valve cutout valve to the OUT position.
7. Move the automatic brake valve handle to CONTINUOUS SERVICE and remove it. Place the handle in the proper holder.
8. Rotate the MU-2A valve to TRAIL.
9. Move the independent brake valve handle to RELEASE and remove it. Place the handle in the proper holder.

62.11.2 Restoring Operating Controls

To restore operating controls, use the following procedure:

1. Insert the independent brake valve handle and move it to FULL APPLICATION.
2. Rotate the MU-2A valve to LEAD or DEAD.
3. Insert the automatic brake valve handle and move it to RELEASE.
4. Wait for the equalizing reservoir pressure to exceed the brake pipe pressure.
5. Rotate the automatic brake valve cutout valve to FRT or IN.
6. Place the following switches in the ON position:
   - Generator field switch
   - Control switch
   - Fuel pump (engine run) switch
7. Conduct a locomotive air brake test (Rule 61.10).

62.12 Reducing Locomotive Overcharge

To reduce locomotive overcharge:

1. Adjust the regulating valve to the desired setting.
2. While actuating brakes, make an automatic brake pipe reduction to at least 20 psi below the regulating valve setting.
3. Allow pressure to equalize in the brake system.
4. Move the automatic brake to RELEASE.
5. Verify that the equalizing reservoir pressure is at the required setting.

63 TRAIN EQUIPMENT AND OPERATION

63.1 Ensuring Operative Brakes

The air brakes on all cars in a train must be operational. For the purpose of this rule, consider each platform of a multi-platform car to be one car.

EXCEPTION: In an emergency, at least 85 percent of the air brakes must be operational. This percentage applies only to brakes that require cutting out enroute.

63.2 Inspecting Freight Cars

Inspect each freight car placed in a train. If a car has a defect that makes the car unsafe for movement, either correct the defect or set the car out of the train.

1. Inspect each car for the following defects:
    - Car leaning to one side
    - Car sagging downward
    - Car positioned improperly on the truck
    - Object dragging under the car
    - Object extending from the side of the car
    - Door incompletely closed or insecurely attached
    - Broken or missing safety appliances (handrail, ladder, or stirrup)
    - Lading leaking from a placarded hazardous material car
    - Insecure coupling device
    - Overheated wheel or journal
    - Broken or cracked wheel
    - Brake that fails to release

- Retaining valve set to the EX (Exhaust) position
- Any other apparent safety hazard likely to cause an accident or injury before the train arrives at its destination

2. Make sure that open top loads, including trailers and containers on flat cars, are safely loaded.
3. If the width or height of a car appears close to clearance lines, check that the movement has been cleared with the proper authority.
4. If a car is carrying a bad order tag but is safe for movement, the car may be taken in train to the nearest point where repairs can be made.
5. Make sure that fifth wheel locking devices are properly seated.
6. Inspect placarded cars as follows:

   a. Before accepting a placarded car for movement in a train, make sure the car is in a safe condition for the movement. Reject any unsafe cars.

   b. Make sure that trucks and journal boxes are in proper condition for service.

      NOTE: Friction journal boxes must have at least 1/2 inch of visible oil.

7. When friction bearings on cars have been exposed to severe snow conditions and snow or ice may have accumulated in journal boxes, train crew members must mechanically inspect the bearings before the cars are moved.

63.3 Setting Out Defective Cars

Set out a defective car whenever it cannot be safely moved to the next repair location. When setting out defective cars:

1. Set out mechanically defective cars where maintenance crews can access them.

2. If the journal is overheated and the maintenance crew is not available, inspect the underside of the car immediately.
3. Put out any fires before leaving the car.
4. Promptly report set-out cars to the train dispatcher.
5. When a derailed car with roller bearings is re-railed by other than Mechanical Department employees, move it carefully to the nearest set-out point for inspection and maintenance.

63.4 Recording Repairs

Any time train equipment is repaired or set out bad order enroute, record the defects and repairs completely.

1. When a train crew changes a brake pipe air hose or knuckle, or makes other repairs to a car, complete ARRC Form 22-0156P, Conductor's Report Of Defective Cars On Trip (see Figure 63-A).

   NOTE: Also refer to Figure 67-E, Wheel Numbering On Cars, in Chapter 67.

2. Include the location and size of the failed bearing on a bad order report.
3. Give Form 22-0156P to the Operation Support Technician or mechanical personnel promptly after your tour of duty is complete.

63.5 Maintaining Train Air Brake Systems

Maintain the train air brake system to ensure it operates properly. Use these guidelines to maintain train air brake systems.

63.5.1 Avoid Foreign Substances

Do not put alcohol, methanol, or other similar substances into the air brake system of cars or locomotives.

ALASKA RAILROAD CORPORATION
P.O. BOX 107500 ANCHORAGE, ALASKA 99510-7500

Conductor's Report Of Defective Cars On Trip

Instructions

This report must be filled out in duplicate by Conductor at the end of every trip, one copy to be handed to Car Inspector immediately on arrival at terminal station, the other to be forwarded to Trainmaster with trip report. Under headings, Conductors will show all existing defects that may require attention, such as broken couplers or parts, brake beams, flat wheels, or defective air brake appliances, etc. All parts removed from cars between terminals must be taken to terminal station and turned over to Inspector. A & B ends of a car are determined by location of brake staff which is on B end. On cars equipped with two brake staffs, stenciling on car will govern. Boxes are numbered as follows: Beginning at B end of car, boxes on right side are numbered R1, R2, R3 and R4; on left side, L1, L2, L3, and L4. Thus boxes L1 and R1 would be on outside axle B end of car. All information called for by the different headings must be shown. If no trouble experienced or repairs made report shall so state.

From:	To:	Train No.:	Engine No.:	Date: 19

Hot Boxes And Brasses

Initial	Car No.	Station	Brass Applied				Brass Removed
			Yes Or No	Box Number	New Or S.H.	7" 8" 9" 10" Or 11"	Cause Of Removal

Air Hose

Initial	Car No.	Station	End Of Car	New Or S.H.	Cause Of Removal

Knuckles

Do not use the letters "ARA" or "AAR" in describing couplers or knuckles. Show Simplex, Sharon, type D or E or whatever kind of coupler or knuckle is referred to. Type D or E couplers and knuckles usually have the letters D or E cast on them.

Initial	Car No.	Station	Knuckle Applied			End Of Car	Type Of Coupler In Car	Knuckle Removed		
			Type D, E, Simplex, Ect.	Depth Of Face 9" Or 11"	New Or S.H.			Type D, E, Simplex, Etc.	Face 9" Or 11"	Cause

Miscellaneous Repairs

Initial	Car No.	Station	Material Applied	End Of Car	Cause Of Removal

Cars Damaged And/Or Defects Noted Between Terminals

Initial	Car No.	Station	Nature Of Damage

Other Comments

Conductor Signature	Date:

ARRC 22-0156P (6/91)

Figure 63-A. Conductor's Report Of Defective Cars On Trip.

63.5.2 Use Angle Cocks and Air Hoses Properly

A. Angle Cocks

When opening or closing angle cocks:

1. ***Do not*** leave angle cocks partially open or closed.
2. Do not use excessive pressure or force.
3. When cutting air in with the brake pipe charged:
   a. Make a 20 psi brake pipe reduction.
   b. Signal that the brake valve exhaust has stopped by sounding the horn once or using the radio.
   c. Open angle cocks slowly to prevent an emergency brake application.

If releasing the air brakes on locomotives or cars might cause the cars to move when the air is cut in, make a 40 psi brake pipe reduction before opening the angle cock.

B. Air Hoses

Before coupling air hoses between locomotives or cars:

1. Blow all condensation from the locomotive brake pipe or yard air line.
2. Inspect the air hose, gasket, and glad hand for damage.
3. Before coupling air hoses, remove all snow, ice, dirt, and other obstructions.
4. Whenever possible, secure air hoses on locomotives and cars during all movements to prevent the hoses and glad hands from dragging and becoming damaged.

63.6 Charging the Brake System

Conditions such as temperature, car length, leakage, and cars partially charged affect the time required to properly charge cars and trains.

Charge an empty brake system for the appropriate amount of time to make sure that the system functions as needed. When charging the system:

1. Repair as much of the brake system leakage as possible.
2. Do not charge the train brake system with more than one automatic brake valve in a locomotive consist cut in.
3. Do not increase diesel engine RPM to maintain main reservoir pressure, unless the pressure fails to stay 15 psi above the regulating valve setting.
    a. If engine RPM must be increased, do not exceed throttle position #4.

63.6.1 Charging Time Chart

When the brake system is empty, use Table 63-A to determine the minimum and maximum charging times.

Minimum and Maximum Charging Times When Brake System Is Empty			
Number of Cars	**Brake Pipe Length (in feet)**	**Minimum Charging Time (in minutes)**	**Maximum Charging Time (in minutes)**
50 or less	2,500 or less	8	25
60	3,000	10	30
80	4,000	15	35
100	5,000	20	40
120	6,000	26	55

Table 63-A. Charging Time Chart.

63.6.2 Inspecting For Leakage or Obstructions

Immediately inspect for leakage or obstructions if one or more of the following occurs during charging:

- The rear car brake pipe pressure stops rising before reaching the required pressure.
- The air flow indicator holds steady above 60 CFM.
- The maximum charging time has been reached but the brake pipe has not attained the required charge.

63.6.3 Reducing Brake Pipe Pressure

When higher than standard pressure is no longer required, reduce it as soon as possible, but no later than the next crew change point.

63.6.4 Reducing Pressure In Overcharged Train Brake Systems

Reduce pressure in an overcharged train brake system as follows:

1. Adjust the regulating valve to the desired pressure.
2. Move the automatic brake valve to EMERGENCY and leave it in that position for at least 60 seconds.
3. Move the automatic brake valve to RELEASE and leave it in that position until brake pipe pressure on the controlling locomotive reaches 20 psi.
4. Move the automatic brake valve to CONTINUOUS SERVICE and leave it in that position for at least 60 seconds.
5. Move the automatic brake valve to RELEASE and charge the system to the required pressure.

63.6.5 Applying Brakes After Train Separation

In the event of a train separation, make a full service brake application to prevent possible train overcharge after the train has been recoupled but before the air is cut in.

63.6.6 Correcting Sticking Brakes

Sticking brakes occur when brakes on a car(s) remain applied after a train brake release. When brakes stick:

1. Stop the train as soon as possible.
2. Determine why the brakes are sticking. Some reasons for sticking brakes include:
    - Overcharged air brake system
    - Hand brakes applied
    - Retaining valve not in EXHAUST
    - Leak in the air brake system
3. If necessary, cut out the control valve on the affected car.
4. Thoroughly inspect the affected wheels before proceeding.

63.6.7 Cutting Out Air Brakes

Cut out air brakes *only* if they are defective or if the brake rigging is being serviced.

If brakes must be cut out enroute, notify the train dispatcher of car number(s) and any other pertinent information.

A. Procedure To Cut Out Air Brakes

Cut out the air brakes as follows:

1. Close the branch pipe cutout cock.
2. Drain the air reservoirs completely by operating the brake cylinder release valve.

B. Handling Equipment With Air Brakes Cut Out

Follow these requirements when multiple cars have brakes cut out:

1. Do not handle a car with inoperative air brakes immediately behind locomotives.
2. The rear car must have operative air brakes.

   EXCEPTION: A single car with brakes cut out may be handled according to Rule 63.6.7C, Handling Car With Broken Brake Pipe.
3. When necessary to cut out brakes on two or more consecutive cars or locomotives, separate the cars or locomotives by at least one car with operative brakes.
4. Do not place more than two cars or locomotives with inoperative brakes together.

C. Handling Car With Broken Brake Pipe

Handle a car with a broken brake pipe behind the caboose or rear car as follows:

1. Using a chain or cable, make a “figure 8” wrap between the disabled car and the rear car.
2. Cut in the air between the rear car and the closed angle cock of the disabled car.

63.6.8 Bleeding Off Cars

Bleed off cars only in the following situations:

- When repairing the brake system
- When cutting out the brakes on a defective car
- When switching
  or
- After applying the hand brake

63.6.9 Making Emergency Air Repairs

Since there are many kinds of air brake systems, this manual cannot list emergency repairs for every possible emergency situation. Having an understanding of the brake equipment operation will help you make repairs and minimize delays.

When pipes are broken or leaking, try to stop the flow of air by any of these methods:

- Close a cutout cock whenever possible.
- Use a plug if one is available (for example, a No. 8 vent valve plug)
- Make a tight bend or smash the pipe.

NOTE: After making any temporary repairs, test the brake equipment for proper operation.

63.7 Correcting Hot Wheel Journal Bearings On Cars and Locomotives

63.7.1 Friction Bearing

Follow these steps to correct a hot friction bearing:

1. Stop the movement.
2. Check the journal boxes, dust guard, decking, and side of the car for fire. If necessary, remove the pad with a packing hook or other implement.
3. Extinguish any fire.
    - Do not use sand, dirt, or other abrasive material to extinguish a fire in a journal box.
    - Do not use water or snow to cool a hot journal, except in an emergency.
4. If snow or ice may have accumulated in journal boxes, make a mechanical inspection of the friction bearings before the cars are moved.

63.7.2 Roller Bearing

Follow these steps to correct a hot roller bearing:

1. Stop the movement.
2. Check the bearing's temperature by carefully passing your bare hand near the adapter and bearing. If the bearing is much hotter than the others, consider the bearing overheated.

CAUTION: Use extreme care to prevent injury.

3. When a hot journal bearing on a locomotive is indicated by a detector, check for an overheated support or armature bearing.

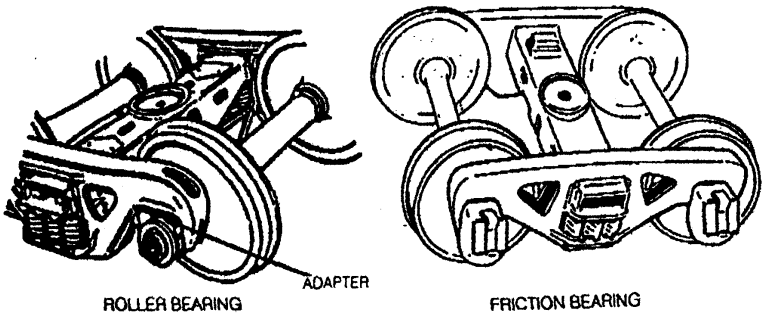


Figure 63-B. Roller and Friction Bearings.

63.8 Reporting Flat or Shelled Spots

If a flat or shelled spot develops on a car or locomotive wheel, report the defect as follows:

- On a locomotive or car, the engineer or conductor immediately determines the location and length of the defect and advises the train dispatcher.

- On a switch locomotive, the engineer immediately informs the maintenance facility, supervisor, or train dispatcher.
- If the defect is more than 2-1/2 inches, advise the train dispatcher for handling instructions before proceeding.

63.9 Detaching Locomotives and Cars

When detaching locomotives and/or cars at terminals where train brakes are immediately inspected, including 1,000-mile inspection points:

1. Make a 20-psi brake pipe reduction.
2. When the brake pipe exhaust stops, signal with one sound of the whistle or communicate by radio.
3. Close the angle cock on the locomotive, or on the car toward the locomotive where the cut will be made.
4. Close the angle cock on the leading car(s) to be left standing.
5. Signal the engineer to release the brakes.
6. Detach the locomotives and/or cars. When detaching each locomotive or car:
    a. Hold the air hose at the glad hand carefully to prevent injury.
    b. Open the angle cock gradually to prevent an emergency application on the lead end of the car(s) left standing.
    c. Leave the angle cock in the fully opened or closed position as required.
    d. If required, apply a sufficient number of hand brakes.

63.10 Securing Equipment Against Undesired Movement

All crew members are responsible for securing unattended equipment against undesired movement.

Do not depend on the air brakes to hold a locomotive, car, or train standing unattended.

Before making the final stop, engineers must ensure that brake shoes on the cars and locomotives in their train are sufficiently warmed up to prevent possible movement after the locomotives are cut off and the hand brakes are applied.

63.10.1 Applying Hand Brakes On Cars

When securing cars or a portion of a train, apply enough hand brakes to prevent movement.

1. When determining the number of hand brakes to be fully applied or the blocking needed to hold cars without air brakes, consider the following factors:
   - Grade and adhesion
   - Loaded or empty equipment
   - Weather, wind, and temperature
2. When applying hand brakes:
   a. Use proper body mechanics to prevent injury.
   b. Do not use a device for additional leverage, such as a bar, brake club, or your foot.
   c. Fully apply hand brakes by operating the mechanism until the slack is out of the chain and the brake shoes are snug against the wheels.
   d. Drain the auxiliary reservoir to ensure that the hand brake chain does not break or the hand brake "dog" does not slip and release the brake.
3. When removing locomotives from a consist, apply enough hand brakes to prevent movement of the unattended locomotives.
4. When setting out cars on a grade:
   a. Make sure the slack is bunched.
   b. Apply the hand brakes on the low end of the cut of cars.
5. When necessary, apply all hand brakes on multiple platform cars.

63.10.2 Securing a Train or Portion Of Train With Locomotive Attached

When securing a train or portion of a train with a locomotive attached:

1. Fully apply the independent brake.
2. Make a 20 psi brake pipe reduction.
3. Immediately apply a sufficient number of hand brakes directly behind the locomotives.
4. Increase the brake pipe reduction to 40 psi and leave the automatic brake cut in.

NOTE: It is not necessary to secure the hand brakes further.

63.10.3 Securing a Train or Portion Of Train Without Locomotive Attached

When securing a train or portion of a train without a locomotive attached:

1. Place the automatic brake valve handle in the CONTINUOUS SERVICE (handle off) position until:
   - The air is completely exhausted
     or
   - The brake pipe pressure is below 10 psi
2. Close the angle cock on the locomotive(s) or equipment that will remain with the locomotive(s).
3. After cutting away, leave the angle cock on the equipment left standing in the fully open or closed position as required.
4. Apply a sufficient number of hand brakes on the equipment left standing according to Rule 63.10.1.

CAUTION: Do not bottle the air or maintain air pressure in the brake pipe unless locomotives are attached or yard air is coupled.

63.11 Releasing Hand Brakes

To prevent wheel damage, fully release hand brakes before moving cars or locomotives. When releasing hand brakes:

1. Turn the hand brake wheel counterclockwise several times until the chain is as slack as possible.
2. If a hand brake is difficult to release, charge the car's air brake system and apply the brakes in emergency before attempting to release the hand brake again.
3. Check at least an additional three cars beyond the last applied hand brake to make sure that no other hand brakes are applied.
4. Do not move cars with hand brakes applied where it would cause wheel damage.

63.12 Blocking Wheels

For equipment with defective or inoperative hand brakes, block the wheels securely unless the cars or locomotives are attached to equipment with enough hand brakes to prevent movement.

To block wheels:

1. Obtain wood or chain locally.
2. Place the blocks securely against the front and back of enough wheels to prevent movement.
3. After applying blocking, release the air brakes to make sure that the blocking prevents movement.

63.13 Using Retaining Valves

The normal position for retaining valves is in the EX (Direct Exhaust) position. Retaining valves are not necessary if locomotive dynamic brakes and train brakes are functioning properly.

Use retaining valves only when the train crew decides that the train cannot be handled safely in the normal manner.

Follow these requirements when retainers are necessary:

1. Notify the train dispatcher immediately.
2. Apply the minimum number of retainers in the following positions:
   - Loaded cars—HP (high pressure) position
   - Empty cars—LP (low pressure) or SD (slow direct exhaust) position
3. Begin at the head end of the train in blocks of at least 10 cars.

NOTE: Also refer to Figure 67-F, Three-Position Retaining Valve, in Chapter 67.

64 TRAIN HANDLING

64.1 General Requirements For Train Handling

Locomotive engineers must exercise judgment and plan ahead to operate their train safely and efficiently. Good train handling requires the proper combination of throttle modulation, dynamic braking, and air braking to:

- Protect yourself and others from injury.
- Prevent damage to the track structure and equipment.
- Protect lading.
- Use the most fuel efficient method consistent with good train handling.

64.2 Controlling In-Train Forces

Controlling and limiting in-train forces is essential for safe train operation. Unless an emergency or other condition requires immediate speed reduction, change throttle positions and dynamic and air brake applications slowly to allow slack to adjust gradually.

Many locomotives can produce higher tractive effort than the average train's draft gear and couplers can withstand. Draft force limits for couplers and draft gears are:

- For Grade "C" steel couplers—280,000 pounds (applies to most mixed freight trains)
- For Grade "E" steel couplers—390,000 pounds (applies to unit train equipment and some freight equipment)

High retarding force during dynamic braking can cause excessive buff forces. To limit these forces observe dynamic braking limitations.

64.2.1 Slowing or Controlling Train Speed

Follow these train handling requirements when slowing or controlling a train:

1. When using the stretch braking method and the desired speed has been reached, reduce the throttle until train brakes are fully released.
2. When using dynamic and air brakes and the desired speed has been reached, maintain enough dynamic brake to control slack until the train brakes are fully released.
3. When operating in curved territory, keep the total braking effort from dynamic brakes, automatic air brakes, and independent brakes at the lowest practical level.

64.3 Train Braking

Ensure compliance with Rule 64.1, General Requirements For Train Handling, by using proper train braking.

64.3.1 Automatic Brake

Use the automatic brake as follows:

A. Applying or Reapplying Brakes

When applying or reapplying brakes, make brake pipe reductions according to these guidelines:

1. Make an initial brake pipe reduction as follows:
   a. For a fully charged system, reduce the brake pipe at least 5 psi.
   b. For an uncharged system, reduce the brake pipe 5 psi below the previous reduction.
2. Limit brake pipe reductions as follows:
   a. For light to heavy grade territory, limit the effective brake pipe reduction to 15 psi or less.

b. For mountain grade territory, limit the effective brake pipe reduction to 18 psi or less.

NOTE: Effective brake pipe reduction can exceed these limits if:

- **The train is not sufficiently recharged from the previous brake application.**
- **Conditions such as signal spacing require immediate speed reduction.**

B. Responding To Unintentional Brake Release

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

C. Releasing Brakes

To release the brakes:

1. At slow speeds, use judgment and evaluate the following before attempting a running release of the automatic brakes:

   - Train speed
   - Train makeup
   - Temperature
   - Physical characteristics of territory

   Attempting a running release at very low speeds may damage equipment, lading, or track.

2. Under normal circumstances:

   a. Increase the brake pipe reduction to 10 psi.

   b. Allow the exhaust at the automatic brake valve to stop before releasing the train brakes.

Do not attempt to release the brakes on a portion of the train by moving the automatic brake valve handle quickly from SERVICE to RELEASE to SERVICE.

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3. When a train brake application is in effect with pressure maintaining equipment, do not move the automatic brake valve handle toward RELEASE unless a brake release is desired.

D. Making an Emergency Brake Application

A crew member must initiate an emergency brake application when:

- Life or property is in danger.
- The engineer cannot be informed to reduce train speed or stop the train.

  or

- The engineer does not respond to warnings or signals to reduce train speed or stop the train.

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

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

E. Unintentional Emergency Brake Application

When an unintentional emergency brake application occurs, and conditions allow you to recover and release the air brakes to determine the location of the air hose separation or other problem, use the following procedure:

1. Move the throttle to IDLE.
2. Move the automatic brake valve to EMERGENCY until the train stops.
3. Wait 60 seconds.
4. Move the automatic brake valve handle to RELEASE to release the brakes and reset the PCS.

   NOTE: Before releasing the train air brakes, the train crew must secure the train so that no undesired movement will occur before the air brake system is sufficiently charged.

F. Emergency Brake Applications On 2001, 2002, and 2500 Series Locomotives

When 2001 locomotives, 2002 locomotives, or 2500 series locomotives are operated as lead or single locomotives and an emergency brake application occurs (that was not made by the engineer), the automatic brake application will automatically reset itself and begin releasing the train brakes.

During such an emergency brake application, move the automatic brake valve handle quickly to EMERGENCY. This will prevent the train brakes from releasing and will reduce the locomotive load back to idle.

64.3.2 Dynamic Brake

To allow for electrical current decay and to prevent a surge of dynamic braking, follow these dynamic braking rules:

1. Pause for 10 seconds before changing from power to dynamic braking.
2. When operating over a railroad crossing at grade (diamond):
    a. Reduce the dynamic braking level before the train reaches the crossing.
    b. Wait until the entire locomotive passes over the crossing before increasing the dynamic braking level.
3. If the wheel slip light or brake warning light comes on:
    a. Reduce the brake handle position and dynamic brake retardation until the light goes out.
    b. If the light does not go out, stop the train and inspect the locomotive.
4. If train speed exceeds 10 MPH, do not supplement the dynamic brake with the locomotive brakes.
5. To stop while operating at speeds below 10 MPH, apply the locomotive brakes as necessary to prevent slack run out.

A. Understanding Dynamic Brake Characteristics

Dynamic braking is most effective between 18 and 28 MPH. Specific characteristics of dynamic brakes include:

- Standard dynamic brakes can develop 10,000 pounds of retarding force per axle.
- Standard range dynamic braking force normally fades below 10 MPH.
- Extended range dynamic brakes maintain a high retarding force down to 6 MPH before fading.
- High capacity dynamic brakes can develop 13,500 pounds of retarding force per axle.
- No dynamic braking will occur if the locomotive brake cylinder pressure reaches 15 to 18 psi.
- When an emergency brake application is in effect, continuous dynamic braking maintains retarding force if the locomotive brake cylinder pressure is below 15 psi.

B. Limiting Dynamic Brake Retarding Force

High buff force generated by dynamic brake retarding force may cause a derailment or damage the track structure. Therefore, limit dynamic brake retarding force as follows:

1. When possible, use the dynamic brake in its most effective range—between 18 and 28 MPH, depending on the class of locomotive.
2. Do not use locomotive brakes to bunch a train before using dynamic braking.
3. Do not supplement the dynamic brake with locomotive brakes at speeds above 10 MPH.
4. When changing from power to dynamic braking, wait 10 seconds to allow for current decay and prevent a surge of dynamic braking.

5. When slowing or stopping at a speed between 5 and 10 MPH, apply the locomotive brakes as necessary to prevent the locomotive from running out.
6. If the wheel slip light or brake warning light comes on, reduce the brake handle position until the light goes out. If the light does not go out, stop the train and inspect the locomotive.

   NOTE: Dynamic braking will remain operational during an emergency brake application, whether initiated from the train or from the controlling locomotive.
7. If an emergency brake application occurs while the throttle is in position 1 through 8, place the throttle in IDLE.

   NOTE: Dynamic braking is immediately available without resetting the PCS.

When approaching and operating through turnouts or disturbed track areas, use the dynamic brake handle position to limit retarding force to 50 percent of maximum as indicated by amperage or braking effort.

64.3.3 Independent Brake (Locomotive Brake)

When using the independent brake, follow these rules:

EXCEPTION: When emergency braking is necessary to protect life or property, these rules do not apply. Use the maximum braking effort.

1. Do not use the independent brake to control or slow a train operating at speeds more than 10 MPH.
2. Do not use the independent brake alone to slow, control, or stop a train unless specific train handling procedures allow.

3. Limit the locomotive brake cylinder pressure in train operations according to Table 64-A. This table identifies limits for normal track conditions and temporary speed restrictions and turnouts.
4. When operating locomotives in multiple with other units, actuate (bail off) at least 5 seconds per locomotive in the consist for full release.
5. When operating 1800 (GP-7) series locomotives and bailing off independent brakes, allow extra time for air to exhaust from cylinders to ensure that locomotive brakes are fully released.

Locomotive Brake Cylinder Pressure Limitations	
Number of Axles	**Maximum Pressure**
24 or less	45 psi
28	35 psi
32	25 psi
36	15 psi
40 or more	10 psi

Table 64-A. Locomotive Brake Cylinder Pressure Limitations.

64.4 Throttle Handling

To allow the train to absorb in-train forces gradually, follow these throttle handling rules:

1. Make throttle changes one notch at a time.
2. Use this procedure if the wheel slip light comes on:
   a. If the light is on continuously, reduce the throttle on the locomotive until the light goes out.
   b. If the light does not go out, or if the light is blinking on and off, stop the locomotive immediately and make sure the wheels are rotating freely.

c. If the wheels rotate freely and the wheel slip light remains on during throttle reduction, isolate the locomotive unit affected.

d. If the wheels do not rotate freely, notify the dispatcher and set out the locomotive if safe to do so.

3. When operating over the crest of a grade:

   a. Reduce the throttle before the locomotive crests the grade.

   b. Continue to reduce the throttle to keep the speed from increasing until at least half of the train has crested the grade.

4. *Do not* apply power to hold a train stationary on a grade.

64.4.1 Short Time Ratings

A. Short Time Rating Limits

Short time rating limits apply to high amperage levels in any throttle position.

A rating plate is located near the load meter and gives the time limits for operating locomotives at various amperage levels. Always stay within the time limits indicated by the rating plate.

B. More Than One Consecutive Short Time Rating

When operating a locomotive consist at more than one consecutive short time rate:

1. Do not operate the locomotive for more than the maximum time at the most restrictive consecutive short time rate.

   EXAMPLE: Do not operate a locomotive at the 1/4 hour rating for 1/4 hour, then at the 1/2 hour rating for 1/2 hour, then at the 1 hour rating for 1 hour, etc.

2. If the locomotive exceeds the short time rating indicated on the rating plate, contact the train dispatcher.

3. If unable to contact the train dispatcher:

    a. Reduce the tonnage.

    b. Arrange for assistance from helper locomotives.

    or

    c. Double the hill.

C. Short Time Calculations

Follow these guidelines to determine when short time rating limits have been exceeded.

1. For locomotive operation in short time rating levels with less than 20 minutes between short time events:

    a. Make sure that the sum of the times does not exceed the level reached in the most restrictive zone indicated by the load meter.

2. For locomotive operation in short time rating levels with more than 20 minutes between short time events:

    a. Count each occurrence separately.

64.4.2 Minimum Continuous Speed

Minimum continuous speed is the slowest speed at which a locomotive can operate continuously in Throttle 8. Locomotive traction motors operating under these conditions develop the highest amperage possible before overheating. The minimum continuous speed varies according to the locomotive's:

- Gear ratio
- Type of performance control
- Power reduction

64.4.3 Minimum Continuous Speed and Short Time Rating Limits

Do not exceed the short time ratings or minimum continuous speeds without authority from the train dispatcher or a railroad manager. See the Continuous and Short Time Ratings chart (Table 64-B) to verify the limitations for locomotives.

Continuous and Short Time Ratings						
		Continuous		1 Hr	1/2 Hr	1/4 Hr
Loco. No.	Class	MPH	Amps	Amps	Amps	Amps
1503	GP-9	12.0	900	925	970	1,065
1551-1554	MP-15	9.6	920	1,020	1,070	1,150
1801-1810	GP-9	12.0	900	925	970	1,065
2001-2008	GP38-2	10.7	1,050	1,075	1,100	1,150
2501-2502	GP-35	12.0	1,000	1,010	1,050	1,125
2504	GP-30	12.0	980	990	1,030	1,115
2801-2809	GP49	9.7	1,170	1,200	1,230	1,315
3001-3016	GP40-2	11.3	1,050	1,075	1,100	1,150
3017-3020	GP-40	13.0	1,050	1,075	1,100	1,150
3021	GP40-2	11.3	1,050	1,075	1,100	1,150

Table 64-B. Continuous and Short Time Ratings.

64.5 Train Handling Conditions

Use the proper operating technique for each train handling condition. Understand and follow the requirements in these rules.

64.5.1 Train Status Information

The conductor or another train crew member must inform the engineer of the train's status so the engineer can make appropriate operating decisions. This status information includes:

- Number of loaded and empty cars
- Train length and tonnage
- Number and location of cars loaded with hazardous materials, or high or wide loads
- Any unusual conditions that might affect safe train operation, such as placing all empty cars at the head of the train

When the train is operating with an occupied caboose, the conductor or other train crew member at the rear of the train must provide the following status information:

- Release of air brakes and movement of the train when starting
- Any severe slack action
- Any abnormal change in rear brake pipe pressure

64.5.2 Operating Conditions

Several factors affect the distance needed to slow, control, or stop a train safely. These factors include:

- Tons per operative brake
- Speed
- Severity of the grade
- Type and axle limitations (if any) of the dynamic brake
- Temperature and weather conditions
- Throttle response
- Amount and type of slack in the train

64.5.3 Unusual Conditions

Recognize the proper procedures for unusual train handling conditions.

A. Unusual Changes In Brake Pipe Pressure

The engineer must stop and secure the train if:

- An abnormal change in or loss of brake pipe pressure occurs with the train brakes released and a true gradient established.

  or

- A brake application cannot be transmitted.

B. Increased Air Brake System Leakage Enroute

For trains with air brakes tested by the Air Flow Method, stop the train and repair the brake system if both of the following occur:

1. Brake pipe air flow or brake pipe gradient increases.

   and

2. The air flow pointer does not return to a reading below 60 CFM within the appropriate time (see Table 63-A, Charging Time Chart).

NOTE: If you cannot repair the brake system to reduce leakage within the required limits, proceed with caution. However, *do not* proceed if the brake pipe pressure on the rear car is less than 60 psi.

C. Reporting Unusual Air Brake Conditions

Follow this process when reporting unusual air brake conditions:

1. The person reporting must immediately notify the train dispatcher of any unusual air brake condition that affects safe train movement.
2. The dispatcher must then notify the trainmaster, road foreman of engines, or the superintendent.
3. The trainmaster, road foreman of engines, or superintendent will determine if the train can be moved safely or if it must be held for inspection.

64.6 Starting Train

Follow these steps to start the train:

1. Use the lowest throttle position possible to start the train moving.
2. Allow each locomotive to load up properly before advancing the throttle to the next higher position.
3. Once the train is moving, do not increase the throttle until either the amperage or the tractive effort decreases.
4. To accelerate, advance the throttle slowly, one notch at a time.
5. In curved territory, use only enough power to start the train. Regulate amperage to reduce the possibility of stringlining in curves because of excessive lateral forces.
6. Use light power to start a train on a descending grade with train brakes applied only under these conditions:
   a. All cars in the train are loaded and weigh at least 75 tons.
   b. No multi-platform cars are in the train.

64.7 Slowing and Controlling Train Speed

When choosing a method to slow or control train speed, consider these factors:

- Throttle response characteristics of the locomotive consist
- Type of dynamic brake and amount of dynamic brake available
- Weight, length, and load/empty distribution of the train
- Tons per operative brake
- Amount of slack in the train
- Weather and rail conditions
- Knowledge of the territory
- Amount of in-train forces and slack action

64.8 Making Shoving Movements

During shoving movements, a locomotive can generate excessive lateral forces at the head of the train. To avoid jackknifing, wheel climb, or rail turnover, consider these factors before making a shoving movement:

- Short car/long car combinations and their location in the train
- The number of empties near the head end of the train
- The tractive effort of powered axles
- Track curvature and grade

64.9 Making Switching Movements

When switching cars, follow these switching movement rules:

1. When starting or stopping switching movements, gradually stretch or bunch slack.
2. When using multiple locomotives, limit buff and draft forces.
3. To determine if cars need air cut in and brakes operative, consider these factors:
    - Rail conditions
    - Weight of the cars
    - Grade
    - Distance required to stop
    - Number and type of locomotives

64.10 Temporary Speed Restrictions

When moving through an area with a temporary speed restriction:

1. If possible, release train air brakes and dynamic brakes before entering the restricted area.
2. Use the lowest possible throttle position for running or starting.
3. Avoid changing train speed or slack condition.
4. Do not exceed the locomotive brake cylinder pressure as outlined in Table 64-A, Locomotive Brake Cylinder Pressure Limitations.

5. Do not exceed the 50 percent limit for dynamic brakes as outlined in Rule 64.3.2B, Limiting Dynamic Brake Retarding Force.

64.11 Train Handling Scenarios

Follow these train handling methods for ***planned*** starting, stopping, slowing, and controlling trains.

NOTE: These methods are guidelines. Heavy tonnage, heavy grades, or specific locations may require other combinations of throttle modulation, dynamic braking, or air braking.

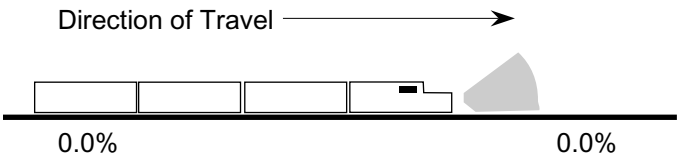
The shaded matrix in each train handling scenario identifies the conditions that apply to each train handling method.

64.11.1 Starting

Follow these steps to start the train:

A. Starting—Scenario 1

Level Grade
Ascending Grade
Descending Grade



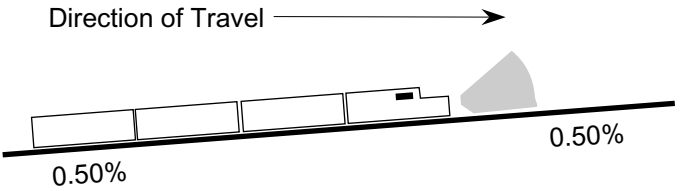
When starting the train on a level grade:

1. Release the automatic brake.
2. After the brakes have released on the entire train, move the throttle to RUN 1 and release the independent brake.
   a. If the locomotive moves too rapidly in RUN 1, control surge with the independent brake.
   b. If the train does not move, slowly advance the throttle.
3. Use the lowest possible throttle position to minimize in-train forces.

   NOTE: If the train does not move in RUN 4, return the throttle to IDLE, apply the independent brake, and determine the cause.
4. After the train starts to move, check to see if the amperage or tractive effort levels are decreasing.
5. If these levels are decreasing, you may advance the throttle to the next higher position.

B. Starting—Scenario 2

Level Grade
Ascending Grade
Descending Grade



When starting the train on an ascending grade:

1. Advance the throttle to RUN 1.
2. Reduce the independent brake.
3. Release the automatic brake.
4. As the brakes release toward the rear of the train, advance the throttle to RUN 2 or higher to start the train moving.
5. Slowly reduce the independent brake until it is fully released.
6. After the train starts to move, check to see if the amperage or tractive effort levels are decreasing.
7. If these levels are decreasing, you may advance the throttle to the next highest position.
8. Observe the load meter and limit the throttle position if necessary to avoid high draft forces.

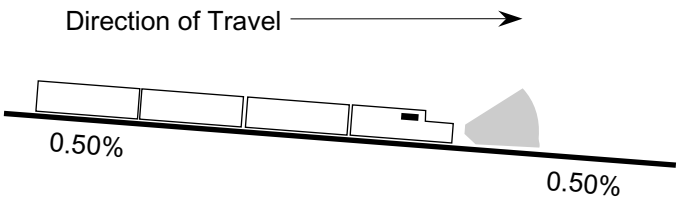
NOTE: If the train will not start, consider doubling. Applying power on a standing locomotive longer than necessary will damage DC traction motors.

CAUTION: Taking slack is not a recommended method for starting a heavy train on a heavy grade. Short brake release times will release the brakes on the entire train, and the rear

portion will begin rolling backward while the head portion is starting forward, easily causing a train separation.

C. Starting—Scenario 3

Level Grade
Ascending Grade
Descending Grade



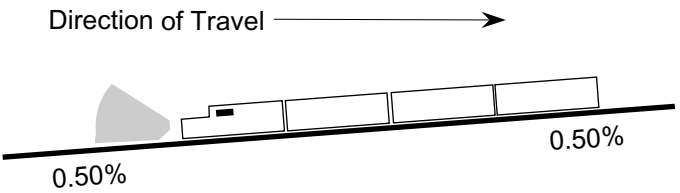
When starting the train on a descending grade:

1. Make sure that the independent brake is fully applied.
2. Release the automatic brake and wait for all brakes to release and slack to adjust.
3. Reduce the independent brake until the train begins to move gradually.
4. Once the entire train is moving, gradually reduce the independent brake to avoid abrupt changes in slack.
5. If available, activate the dynamic brake and slowly release the independent brake when the dynamic brake becomes effective.

64.11.2 Starting a Reverse or Shoving Movement

Follow these steps when starting a reverse or shoving movement:

Level Grade
Ascending Grade
Descending Grade



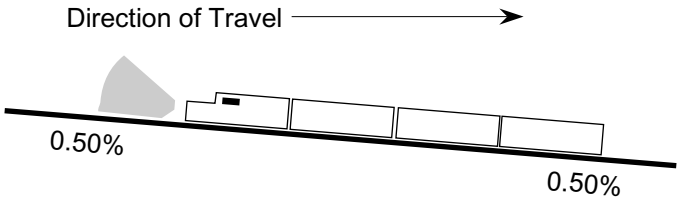
A. Starting a Reverse or Shoving Movement—Scenario 1

When starting a reverse or shoving movement on a level or ascending grade:

1. Release the automatic brake and wait for all brakes to release and slack to adjust.
2. Reduce the independent brake and use the lowest possible throttle position to start the movement.
3. As speed increases, continue to reduce the independent brake until it is fully released.
4. If you notice a significant increase in the load meter or train speed slows without a change in throttle position, stop immediately and determine the cause.
5. Refer to Rule 64.8, Making Shoving Movements, and determine which of the listed conditions apply.

B. Starting a Reverse or Shoving Movement—Scenario 2

Level Grade	Slack Bunched
Ascending Grade	Slack Stretched
Descending Grade	Slack Unknown

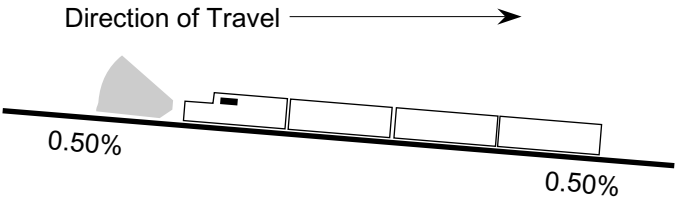


When starting a reverse or shoving movement on a descending grade with slack stretched:

1. Make sure that the independent brake is fully applied.
2. Release the automatic brake and wait for all brakes to release and slack to adjust.
3. Reduce the independent brake gradually as the train begins to move.
4. If available, activate the dynamic brake and slowly release the independent brake when the dynamic brake becomes effective.

C. Starting a Reverse or Shoving Movement—Scenario 3

Level Grade	Slack Bunched
Ascending Grade	Slack Stretched
Descending Grade	Slack Unknown



When starting a reverse or shoving movement on a descending grade with slack bunched or slack condition unknown:

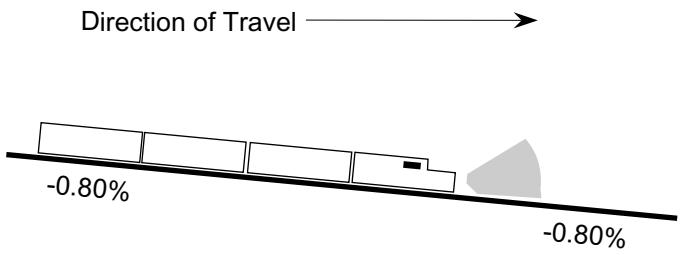
1. Reduce the independent brake by 50 percent to allow the locomotive to begin moving as slack adjusts.
2. Release the automatic brake and wait for all brakes to release and slack to adjust.
3. Continue to reduce the independent brake gradually as the train begins to move.
4. If available, activate the dynamic brake and slowly release the independent brake when the dynamic brake becomes effective.

64.11.3 Stopping

Follow these steps during planned stops:

A. Stopping—Scenario 1

Level Grade	Dynamic Brake Available	Slack Bunched
Ascending Grade	Dynamic Brake Not Available	Slack Stretched
Descending Grade		

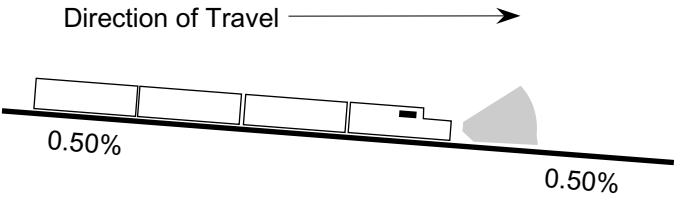


When stopping under these conditions:

1. Gradually reduce the throttle to IDLE.
2. Wait 10 seconds.
3. Activate the dynamic brake and gradually bunch the slack.
4. Increase braking to the desired level.
5. At a sufficient distance from the stop, make a minimum brake pipe reduction and actuate.
6. Make further split reduction(s) as needed and actuate.
7. As speed drops below dynamic brake range, supplement with the independent brake.
8. Make a final brake pipe reduction and allow the locomotive brakes to apply.

B. Stopping—Scenario 2

Level Grade	Dynamic Brake Available	Slack Bunched
Ascending Grade	Dynamic Brake Not Available	Slack Stretched
Descending Grade		

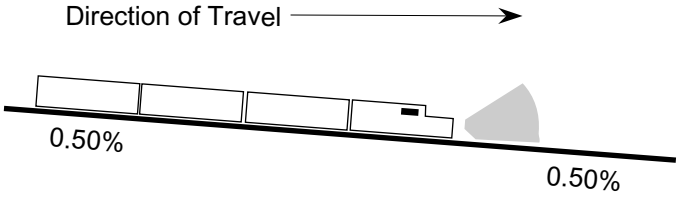


When stopping under these conditions:

1. If in power, gradually reduce the throttle to IDLE.
2. Wait for the slack to adjust.
3. At a sufficient distance from the stop, make a minimum brake pipe reduction and actuate.
4. Make further split reduction(s) as needed and actuate.
5. As the train comes to a stop, make a final brake pipe reduction and allow the locomotive brakes to apply.

C. Stopping—Scenario 3

Level Grade	Slack Bunched	Normal Speed
Ascending Grade	Slack Stretched	Speed Below 15 MPH
Descending Grade		



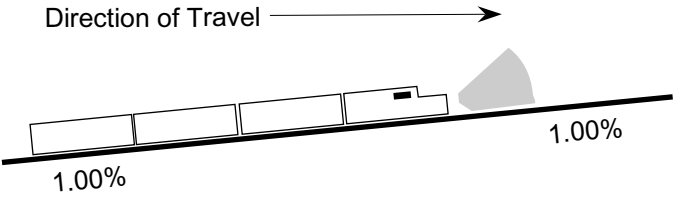
When stopping under these conditions:

1. If in power, gradually reduce the throttle to IDLE and allow the slack to bunch.
2. Gradually apply the independent brake to bunch slack further.
3. At a sufficient distance from the stop, make a brake pipe reduction and use the locomotive brake to keep the slack bunched.
4. As the train comes to a stop, make a final brake pipe reduction and allow the locomotive brakes to apply.

   NOTE: You may use the dynamic brake to bunch slack if available. However, as speed drops below the dynamic brake range, supplement with the independent brake.

D. Stopping—Scenario 4

Level Grade	Slack Bunched	Throttle Reduction
Ascending Grade	Slack Stretched	Throttle Modulation
Descending Grade		



When stopping under these conditions using the throttle reduction method:

1. Gradually reduce the throttle one notch at a time.
2. Maintain a slack stretched condition and allow the ascending grade to slow the train.
3. When the train stalls, place the independent brake in FULL APPLICATION.
4. After the independent brake is fully applied, reduce the throttle to IDLE.

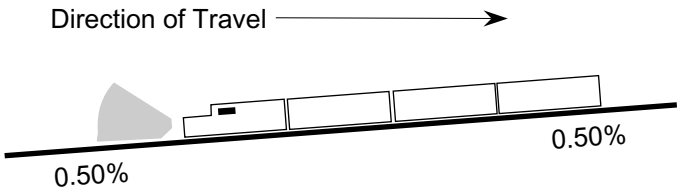
   NOTE: If the train brakes are needed to hold the train on the grade, make a brake pipe reduction as the train stops or just before it stops.

64.11.4 Stopping a Reverse or Shoving Movement

Follow these steps when stopping a reverse or shoving movement:

A. Stopping a Reverse or Shoving Movement—Scenario 1

Level Grade	Slack Bunched
Ascending Grade	Slack Stretched
Descending Grade	

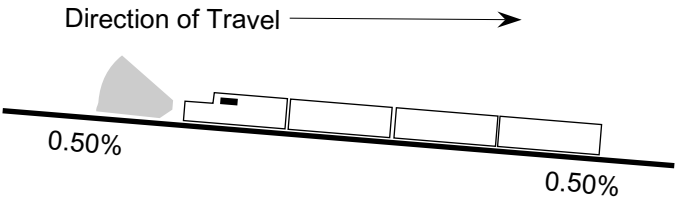


When stopping a reverse or shoving movement under these conditions:

1. Use the lowest possible throttle position to maintain a slack bunched condition.
2. At a sufficient distance from the stop, make a minimum brake pipe reduction and actuate.
3. Make further split reduction(s) as needed and actuate.
4. Observe the load meter and reduce the throttle as necessary to avoid high buff forces.
5. As the train stops, place the independent brake in FULL APPLICATION.
6. After the independent brake is applied, reduce the throttle to IDLE.

B. Stopping a Reverse or Shoving Movement—Scenario 2

Level Grade	Slack Bunched
Ascending Grade	Slack Stretched
Descending Grade	



When stopping a reverse or shoving movement under these conditions:

1. If in power, gradually reduce the throttle to IDLE and allow the slack to adjust.
2. Wait 10 seconds.
3. Activate the dynamic brake.
4. Gradually stretch the slack and increase braking to the desired level.
5. At a sufficient distance from the stop, make a minimum brake pipe reduction and actuate.
6. Make further split reduction(s) as needed and actuate.
7. As speed drops below the dynamic brake range, supplement with the independent brake.
8. Make a final brake pipe reduction and allow the locomotive brakes to apply.

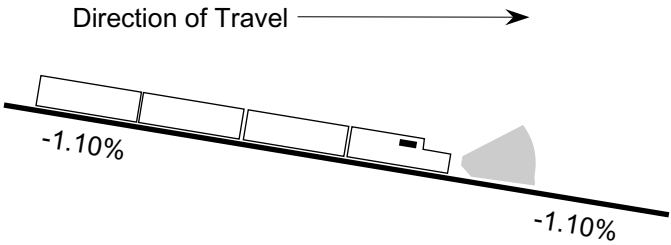
   NOTE: If the dynamic brake is unavailable or ineffective, use the independent brake to maintain a slack-stretched condition.

64.11.5 Slowing or Controlling Speed

Follow these steps when slowing or controlling speed according to the grade:

A. Slowing or Controlling Speed—Scenario 1

Level Grade	Dynamic Brake Available	Slack Bunched
Ascending Grade	Dynamic Brake Not Available	Slack Stretched
Descending Grade		



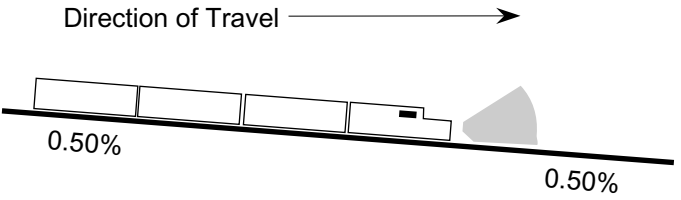
When slowing or controlling speed under these conditions:

1. If in power, gradually reduce the throttle to IDLE.
2. Wait 10 seconds.
3. Activate the dynamic brake and gradually bunch the slack.
4. Increase braking to the desired level.
5. At a sufficient distance from the speed restriction, make a brake pipe reduction and actuate.
6. Make further split reduction(s) as needed and actuate.
7. When the speed is controlled and the automatic brake is released, maintain enough dynamic braking to keep the slack bunched until the brakes release throughout the train.

   NOTE: If the dynamic brake alone will slow or control the speed sufficiently, do not use the train brakes.

B. Slowing or Controlling Speed—Scenario 2

Level Grade	Dynamic Brake Available	Slack Bunched
Ascending Grade	Dynamic Brake Not Available	Slack Stretched
Descending Grade		



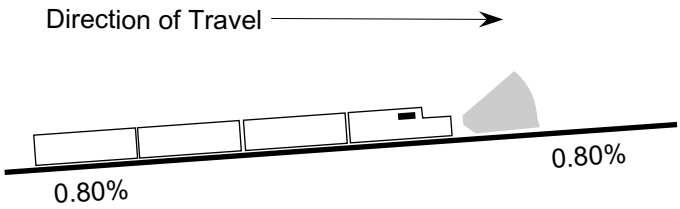
When slowing or controlling speed under these conditions:

1. If in power, gradually reduce the throttle to IDLE.
2. At a sufficient distance from the restriction, make a minimum brake pipe reduction and actuate.
3. Make further split reduction(s) as needed and actuate.
4. When the speed is controlled, release the automatic brakes.
5. As the train brakes release, keep the locomotive brakes released unless they are needed to avoid severe slack changes.

   NOTE: Before attempting a running release, consider the train makeup and speed. You may need to stop completely or choose an alternate braking method.

C. Slowing or Controlling Speed—Scenario 3

Level Grade	Slack Bunched	Throttle Reduction
Ascending Grade	Slack Stretched	Throttle Modulation
Descending Grade		

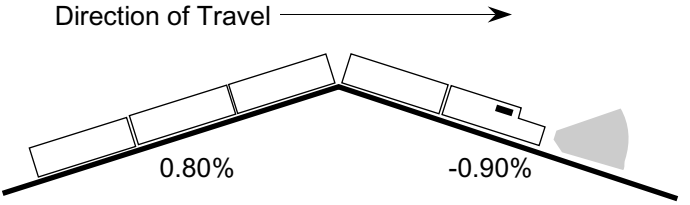


When slowing or controlling speed under these conditions:

1. Gradually reduce the throttle one notch at a time.
2. Maintain a slack stretched condition.
3. Allow the ascending grade to slow the train.

D. Slowing or Controlling Speed—Scenario 4

Sag	Throttle Reduction
Crest	Throttle Modulation



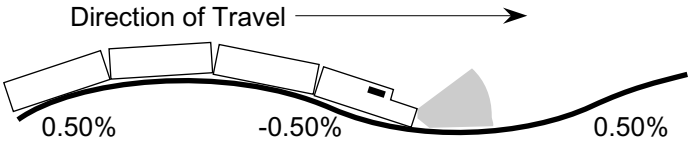
When slowing or controlling speed on a crest:

1. Reduce the throttle before the locomotive crests the grade.
2. Continue to reduce the throttle to keep the speed from increasing until at least half of the train has crested the grade.

64.11.6 Slowing or Controlling Speed—Throttle Modulation Method

Follow these steps when slowing or controlling speed using the throttle modulation method:

Sag	Throttle Reduction
Crest	Throttle Modulation



When slowing or controlling speed approaching a sag:

1. As you approach the sag, reduce the throttle as necessary to control train speed.
2. Reduce the throttle further as the head end of the train begins descending.
3. Just before the head end of the train reaches the ascending grade, increase the throttle.
4. Continue to increase the throttle as the train ascends the grade.
5. Reduce the throttle as the rear end of the train approaches the ascending grade.

64.12 Grade Operation

64.12.1 Operating On a Grade

Since train speed largely determines the amount of braking distance needed, control train speed in a grade operation as follows:

1. Do not exceed the speed limit.
2. If you cannot control the speed of the train, make an emergency brake application ***immediately***.
3. Early in the braking process, achieve a balance between the level of dynamic brake and the level of air brake needed to control train speed on a descending grade.
4. When controlling train speed while operating on a heavy or mountain grade, limit the effective brake pipe reduction to 18 psi or less.
5. When passing the summit of a heavy or mountain grade, do not exceed the maximum authorized speed for the descending grade.
6. At speeds below 10 MPH, use extended range dynamic brakes if available. Extended range dynamic brakes provide more retarding force than locomotive brakes.
7. To prevent the loss of dynamic braking, limit the locomotive brake cylinder pressure to 18 psi or less.

A. Stopping On a Grade

When stopped on a grade, leave the train brakes applied unless the independent brakes will hold the train.

B. Recharging the Air Brake System

If the independent brakes will not hold the train on a grade, recharge the air brake system as follows:

1. Apply a sufficient number of hand brakes or retainers.
2. Release the automatic brake.
3. Recharge the air brake system.

4. After recharging the system, make a sufficient brake pipe reduction to hold the train while releasing the hand brakes or retainers.

C. Starting On a Grade

If hand brakes were used to hold the train, before starting:

1. Release the hand brakes, beginning from the rear car, to allow the slack to adjust gradually to prevent break-in-two.

D. Passing Summit Of a Mountain Grade

Before passing the summit of a mountain grade, the train must meet one of these three requirements:

1. Make sure the rear car brake pipe pressure is within these limits:
   - For trains with 90 psi brake pipe pressure, at least 65 psi
   - For trains with 100 psi brake pipe pressure, at least 75 psi
   - For trains with 110 psi brake pipe pressure, at least 85 psi
2. If the train does not have an operative rear car gauge or end-of-train telemetry device, make sure the air flow meter pointer is below 60 CFM.

   or

3. Make sure the brake system is sufficiently charged. Refer to Table 63-A, Charging Time Chart.

   NOTE: If the train does not meet one of these requirements, stop and secure the train. Correct the problem before proceeding.

E. Using Pressure Maintaining

When using pressure maintaining while operating on a grade, apply the following:

1. When a constant level of braking is required for long distances, make a minimum brake pipe reduction and make further reductions of 1 or 2 psi until the train maintains the desired speed.

2. If the equalizing reservoir leaks and pressure maintaining is required for long distances, place the automatic brake valve cutout valve in PASSENGER, if equipped.

When operating in PASSENGER, use extreme care. Any movement of the automatic brake valve handle toward RELEASE will release the brakes throughout the train.

64.12.2 Regulating Valve Braking

Do not use the regulating valve to brake the train if:

- The brake pipe pressure maintaining feature is operative.

  or

- The brake valve will maintain equalizing reservoir pressure in FRT or PASS.

64.12.3 Using Retaining Valves

Follow these requirements for using retaining valves (retainers):

1. Retaining valves are not necessary if the locomotive dynamic brakes and train brakes are functioning properly. Use retaining valves only when the train crew decides that the train cannot be handled safely in the normal manner.
2. When retainers are necessary:
   a. Notify the train dispatcher immediately.
   b. Begin at the head end of the train and apply the minimum number of retainers in blocks of at least 10 cars.
   c. Apply retainers in the following positions:
      - Loaded cars—HP (high pressure) position

- Empty cars—LP (low pressure) or SD (slow direct exhaust) position

NOTE: The normal position for retaining valves is the EX (direct exhaust) position.

64.13 Helper Operations

To prepare and operate helper locomotives used in the mid or rear portion of a freight train, follow these guidelines:

64.13.1 Testing and Coupling Helper Locomotives

Follow these steps to test and couple helper lines:

1. To adjust and test the helper's air brake system:
   a. Adjust the regulating valve to 10 psi below the prescribed brake pipe pressure for the train being assisted.
   b. Perform the required air brake test.
2. To couple the helper:
   a. Make sure that all helper locomotives have alignment control couplers or bolster stops.
   b. Couple the brake pipe hose and cut the air in on the helper locomotive.
   c. Make sure that the helper locomotive is not cut off while the train is moving.

64.13.2 Adding Helper Locomotives To Other Than Head End

To prevent an unintentional brake release on the train being assisted, make the following changes on the helper locomotive after coupling the helper but before opening the angle cocks:

1. Make an automatic brake pipe reduction to the same pressure as the rear brake pipe pressure of the train being assisted.

   NOTE: If the train's rear brake pipe pressure is not known, make a 10 psi brake pipe reduction.

EXCEPTION: If the train being assisted does not have a brake application in effect, step 1 is not required.

2. Cut out the automatic brake.
3. Move the automatic brake valve handle to CONTINUOUS SERVICE.
4. Make sure the equalizing reservoir pressure is reduced to zero.
5. Open the angle cocks.

64.13.3 Operating Responsibilities

Comply with these helper operating responsibilities:

1. When more than one locomotive is attached to a train, the engineer in the lead locomotive must control the train's air brakes.
2. The engineer in the lead locomotive is in charge of train movement.
3. The engineer in charge will communicate with and direct the assisting engineer during helper operation.
4. The helper engineer must operate from the locomotive cab nearest the direction of travel, unless a manager authorizes otherwise.

A. Using Dynamic Braking

When dynamic braking is used on both road and helper locomotives:

1. The helper engineer should maintain constant dynamic braking force.
2. The lead engineer should control variations in train speed.

66 LOCOMOTIVE EQUIPMENT AND COMPONENTS

66.1 26L Brake Equipment

Identify 26L brake equipment to determine the proper handle positions used in train and locomotive operation.

66.1.1 26C Automatic Brake Valve

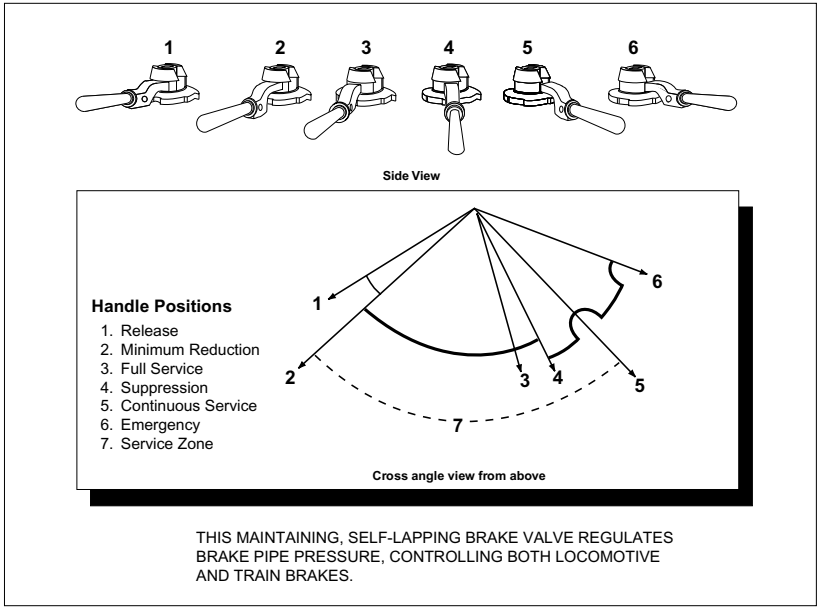


Figure 66-A. 26C Automatic Brake Valve.

A. Brake Valve Features

The 26C automatic brake valve has these features:

- Its maintaining feature maintains constant brake pipe pressure unless the cutout valve is in OUT.
- The regulating valve controls the supply of air pressure to the equalizing reservoir, which regulates brake pipe pressure.

B. Handle Positions

Handle positions include:

RELEASE. Charges the brake pipe to the regulating valve setting and releases the locomotive and train brakes.

MINIMUM REDUCTION. Reduces equalizing reservoir and brake pipe pressures 5 to 7 psi.

SERVICE ZONE. Gradually reduces equalizing reservoir and brake pipe pressures in increasing amounts as the brake handle is moved to the right.

Moving the brake handle to the left with the brake valve cutout valve in PASS will increase equalizing reservoir and brake pipe pressures.

23 PSI REDUCTION (FULL SERVICE). Reduces equalizing reservoir and brake pipe pressures 23 psi.

SUPPRESSION. Restores control of the locomotive after a safety control (penalty) brake application. To recover control, leave the brake handle in this position for 60 seconds.

Moving the brake handle further to the right toward CONTINUOUS SERVICE will progressively reduce brake pipe pressure at a service rate.

CONTINUOUS SERVICE. Reduces equalizing reservoir and brake pipe pressures to zero at a service rate. Use this handle position for:

- Trailing locomotives
- Helper locomotives that do not control the air brake system
- Locomotives hauled dead-in-train

EMERGENCY. Vents brake pipe pressure directly to the atmosphere, causing brakes to apply at an emergency rate.

66.1.2 SA26 Independent Brake Valve

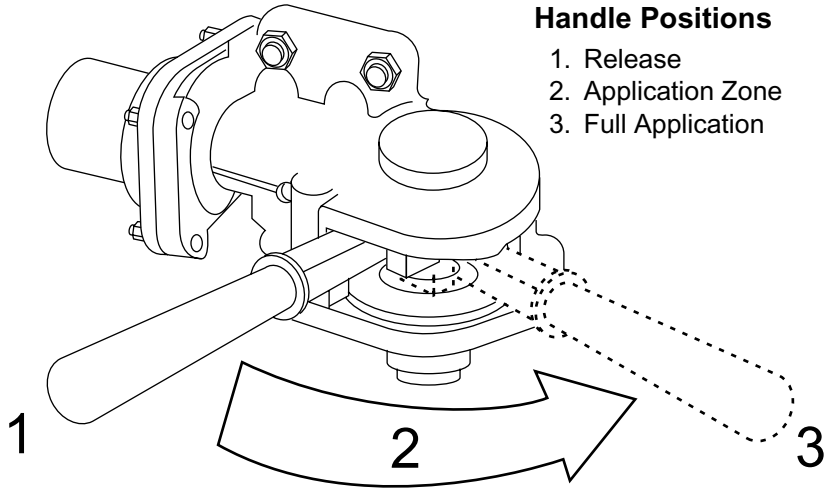


Figure 66-B. SA26 Independent Brake Valve.

The SA26 independent brake valve controls locomotive brake cylinder pressure independent of the automatic brake system. Handle positions include:

RELEASE. Normal position to release the locomotive brakes.

APPLICATION ZONE. Zone between RELEASE and FULL APPLICATION. Increases or decreases locomotive brake cylinder pressure as follows:

1. Increase by moving the brake handle to the right.
2. Decrease by moving the brake handle to the left.

FULL APPLICATION. Position for creating maximum locomotive brake cylinder pressure from the independent brake system. When the locomotive is left standing, move the independent brake handle into the notch at the far right to retain the handle in FULL APPLICATION.

ACTUATE. Releases the automatic brake application on the locomotive. Release all brake cylinder pressure by depressing the independent brake handle while it is in RELEASE.

NOTE: The independent brake may be applied and an automatic brake application released by:

- **Moving the independent brake handle to the desired position in the APPLICATION ZONE.**
- **Depressing the independent brake handle (ACTUATE).**

66.2 Automatic Brake Valve Cutout Valve

The automatic brake valve cutout valve determines when and how the automatic brake controls brake pipe pressure. Because the cutout valve handle is spring-loaded, push it in before changing positions.

NOTE: EMERGENCY is always available regardless of the position of the automatic brake valve cutout valve.

66.2.1 Two-Position Cutout Valve

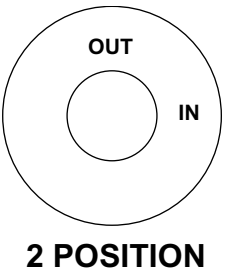


Figure 66-C. Two-Position Cutout Valve.

The two-position cutout valve has these positions:

IN. Provides control of brake pipe pressure from the automatic brake valve. Equalizing reservoir and brake pipe pressures will increase when the automatic brake valve is in RELEASE.

OUT. Disconnects control of brake pipe pressure from the automatic brake valve. Use this position when:

- Not using the automatic brake valve to control brake pipe pressure (trailing locomotives or locomotives hauled dead-in-train).
- Conducting brake pipe leakage tests.

66.2.2 Three-Position Cutout Valve

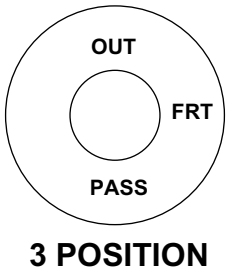


Figure 66-D. Three-Position Cutout Valve.

The three-position cutout valve has these positions:

FRT. Provides control of brake pipe pressure from the automatic brake valve. Equalizing reservoir and brake pipe pressures will increase only when the automatic brake valve is in RELEASE.

OUT. Disconnects control of brake pipe pressure from the automatic brake valve. Use this position when:

- Not using the automatic brake valve to control brake pipe pressure (trailing locomotives or locomotives hauled dead-in-train).
- Conducting brake pipe leakage tests.

PASS. Provides control of brake pipe pressure from the automatic brake valve. Equalizing reservoir pressure and brake pipe pressure will increase from ***any*** movement of the brake handle toward RELEASE.

In freight service, if the equalizing reservoir is leaking, PASS may be used to maintain constant brake pipe pressure during an automatic brake application.

66.3 MU-2A/Double-Ported Cutout Cock

The handle for the MU-2A cutout cock is spring-loaded; push it in before changing positions.

66.3.1 MU-2A Valve

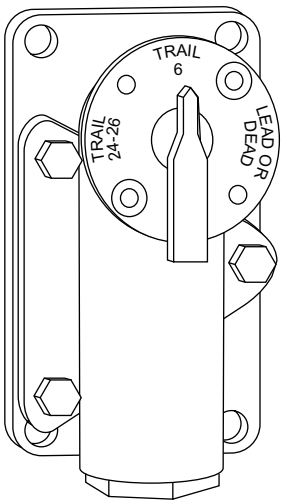


Figure 66-E. MU-2A Valve.

The MU-2A valve has two positions:

LEAD or DEAD. Engages control of the independent brakes on a single locomotive or on the controlling locomotive of a multiple unit consist.

Use LEAD or DEAD when a locomotive is hauled dead-in-train.

TRAIL. Disconnects control of the independent brakes from the independent brake valve.

Use TRAIL when a locomotive is trailing in a multiple unit consist. Move this valve to the position that indicates the locomotive brake equipment type on the lead locomotive.

66.4 Electronic Alertness Device

An electronic alertness device stops the train with a service rate brake application if the engineer does not respond properly. It functions as follows:

- The device begins functioning when locomotive brake cylinder pressure falls below 25 psi.
- At this point, the device monitors the operator's alertness.
- It resets when the operator changes the position of or operates one of these locomotive controls:
  - — Throttle
  - — Horn
  - — Dynamic brake
  - — Device reset button
  - — Automatic brake valve application
  - — Independent brake valve application
- If the device is not reset within the reset cycle identified in Rule 66.4.1, Intervals Between Resets:
  - — A warning light flashes
  - — A warning horn sounds off and on for 10 seconds, and then continuously for 10 seconds

- If the device is not reset within 20 seconds after the warning light and horn begin operating, the train brakes will automatically be applied at a service rate.

66.4.1 Intervals Between Resets

Table 66-A lists reset times for the electronic alertness device.

Train Speed	Time Between Cycles
0 to 49 MPH	60 seconds
50 to 59 MPH	48 seconds
60 to 71 MPH	40 seconds
72 MPH or above	5 seconds or continuous (Overspeed)

Table 66-A. Reset Times For Electronic Alertness Device.

66.4.2 Moving Unattended Locomotive Equipped With Electronic Alertness Device

Use this procedure to move an unattended locomotive equipped with an electronic alertness device when:

- The brake pipe is not connected and charged on the unattended locomotive.
- The device is not deactivated on the unattended locomotive.

To move the locomotive:

1. Cut in the automatic brake valve.
2. Move the automatic brake handle to SUPPRESSION.
3. Release the locomotive brakes completely by actuating after:
   a. Independent brake is cut in.
   b. Brake pipe pressure is reduced.
   c. Exhaust has stopped.

66.4.3 Making Automatic Brake Pipe Reduction With Device Deactivated

To make an automatic brake pipe reduction with the electronic alertness device deactivated:

1. Move the automatic brake handle toward CONTINUOUS SERVICE.
2. To release the brake, move the automatic brake handle back to SUPPRESSION.

66.4.4 Restoring Electronic Alertness Device Control

To restore the electronic alertness device control:

1. Cut out the automatic brake.
2. Move the automatic brake handle to RELEASE.
3. Adjust the regulating valve to the required pressure.
4. Move the automatic brake handle to the desired position.
5. Cut in the automatic brake.

66.5 Overspeed Control

The overspeed control prevents the train from running at speeds higher than the safe mechanical limits of the traction motors. It functions as follows:

- If train speed increases to an unsafe level, the safety control device sounds a warning.
- If the train does not slow within 6 to 12 seconds of the first warning sound, the overspeed control device applies the train brakes and trips the PCS.

66.5.1 Slowing Train During Warning Period and Recovering Overspeed Control

Follow these steps to slow the train during a warning period and recover overspeed control:

- Slow the train when the safety control device sounds a warning.

  or

- Recover when the overspeed control applies the train brakes by moving the automatic brake handle to SUPPRESSION.

66.6 Resetting the PCS After Emergency Brake Application

To reset the PCS after the emergency brake applies:

1. Move the automatic brake valve to EMERGENCY.
2. Move the throttle to IDLE.
3. Wait 60 seconds.
4. After the train stops, release the brakes and reset the PCS by moving the automatic brake handle to RELEASE.

66.7 Air Flow Meter

The air flow meter measures the rate in cubic feet per minute (CFM) that air flows into the brake pipe. The air flow method (see Rule 61.3.2) uses this meter to determine the brake pipe's integrity.

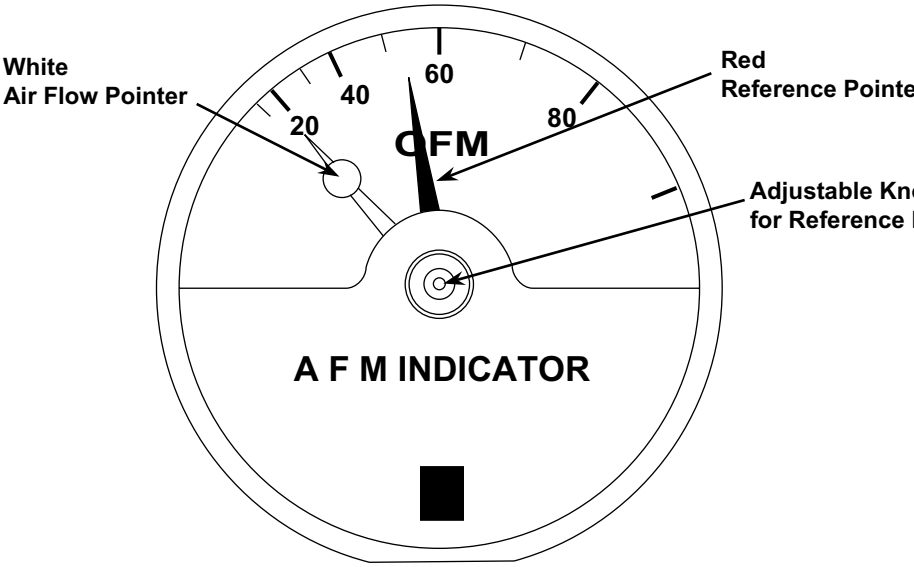


Figure 66-F. Air Flow Meter.

66.7.1 Brake Pipe Flow

A. Air Flow Meter Readings

The air flow meter provides the following brake pipe flow information:

- As the brake system begins charging, a high flow into the brake pipe is indicated by:
  - — Higher numbers (more than 60 CFM)
    or
  - — The pointer moving to the right
- As the brake system becomes charged, a lesser air flow into the brake pipe is indicated by:
  - — Lower numbers (less than 60 CFM)
    or
  - — The pointer moving to the left
- If the air flow meter shows a reading less than 60 CFM that is stabilized, the brake system is charged.

B. Responsibilities Of Engineer

Once the air flow meter shows a constant reading, the engineer should:

1. Note the rate of flow and use this number as a reference to determine when the brake system is charged.
2. If the air flow meter is equipped, adjust the reference pointer to agree with the flow pointer.

   NOTE: This reading is a reference value to use to monitor fluctuations in air flow to the brake pipe.

66.7.2 Train Brake System

The air flow meter also provides the following information about the train's brake system:

- After a brake application and release, the air flow meter will indicate high flow. As the brake system recharges, the brake pipe flow rate will decrease until the air flow pointer reaches the reference value, indicating that the brake system is recharged.
- Air flow less than the reference value may indicate a closed angle cock.
- Air flow greater than the reference value may indicate increased leakage to the brake system.
- With a brake application in effect, a decrease in air flow may indicate that an unintentional brake release is occurring.

66.8 Numbering Wheels and Components On Locomotives

The front of the locomotive is designated by the letter "F" on each side of the locomotive. Wheels, journals, and traction motors are numbered consecutively starting with "1" at the front of the locomotive (see Figure 66-G).

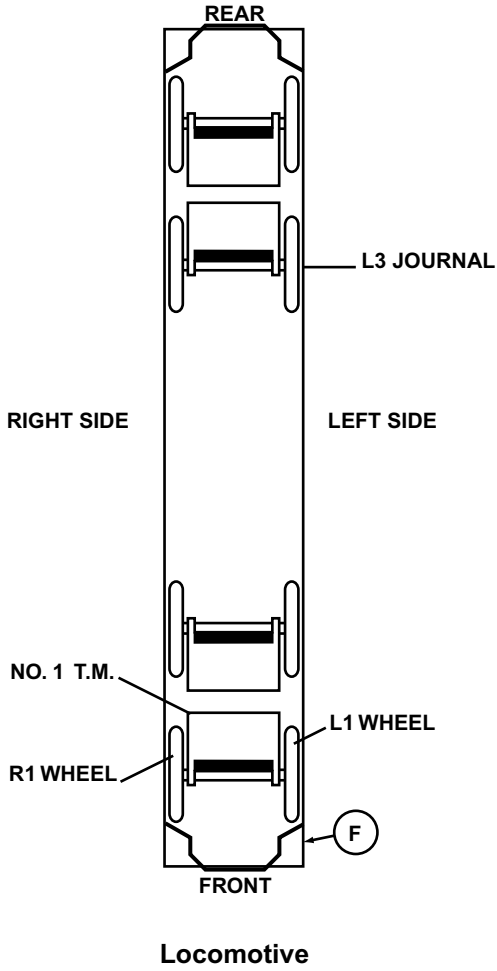


Figure 66-G. Numbering Wheels and Components On Locomotives.

67 CAR EQUIPMENT AND COMPONENTS

67.1 Hand Brakes On Cars

Hand brakes on cars may be used to:

- Secure cars against undesired movement
- Control and stop cars in motion when they are not coupled in a train or part of a switching movement

NOTE: Use blocking to secure cars with inoperative hand brakes or to prevent movement during short duration switching operations.

67.1.1 Determining Number Of Hand Brakes

The number of hand brakes depends on:

- Grade and adhesion
- Number of loaded and empty cars
- Weather conditions (wind and temperature)

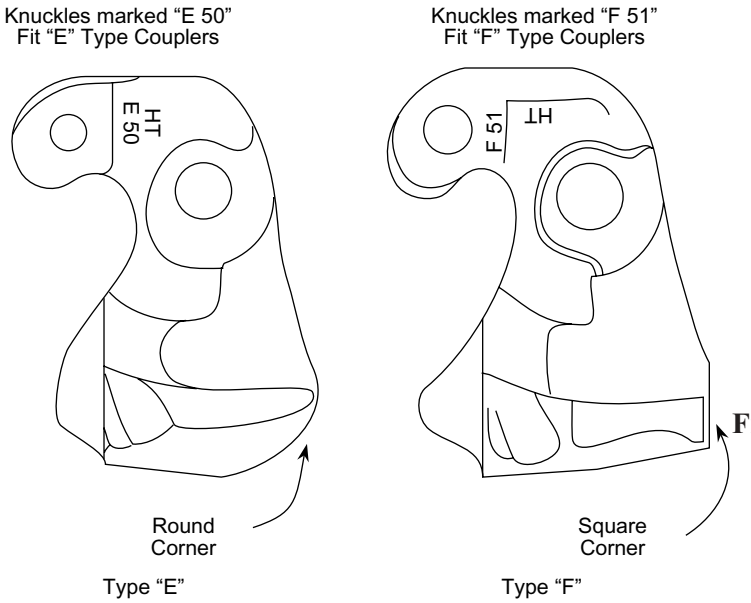
67.1.2 Identifying Car Ends

Identify car ends as follows:

- On cars with one hand brake, the “B” end of the car is the end with the hand brake. The other end is the “A” end.
- On cars with two hand brakes, the letters “A” and “B” are stenciled on the appropriate ends of the car.

67.2 Knuckle Identification

American railroads use three types of coupler assemblies. Each coupler head and knuckle is marked with a letter indicating its type (see Figure 67-A).



Figure

Knuckles are not interchangable.

67-A. Type E and F Knuckles.

Coupler assemblies include:

Assembly Type	Description
Type E	Most common. Used on all types of freight cars.
Type F	“Interlocking” coupler assembly. Used on most intermodal equipment and some unit train equipment.
Type H	“Tightlock” coupler assembly. Used on passenger equipment and some work equipment.

Table 67-A. Coupler Assemblies.

The knuckles for these three types of couplers are similar but not interchangeable.

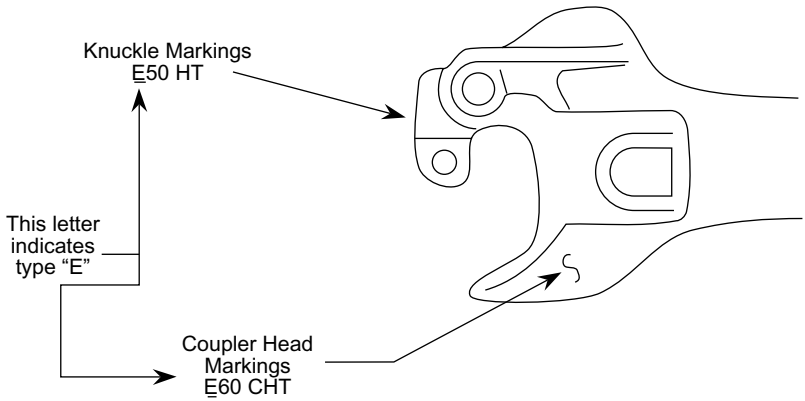


Figure 67-B. Type E Coupler Assembly.

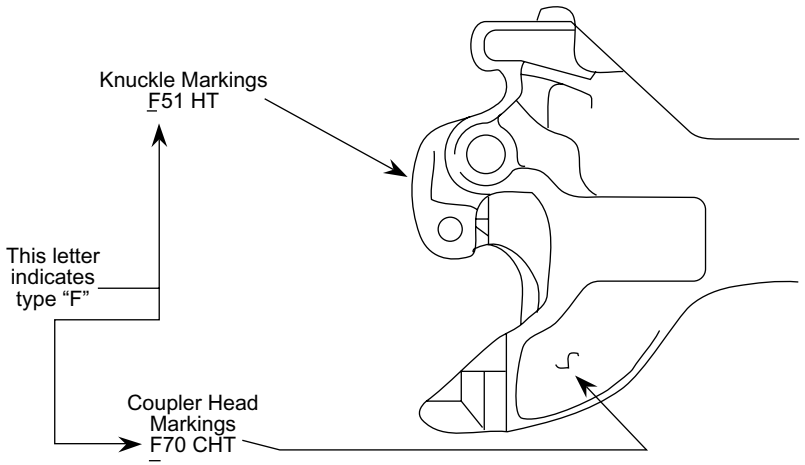


Figure 67-C. Type F Coupler Assembly.

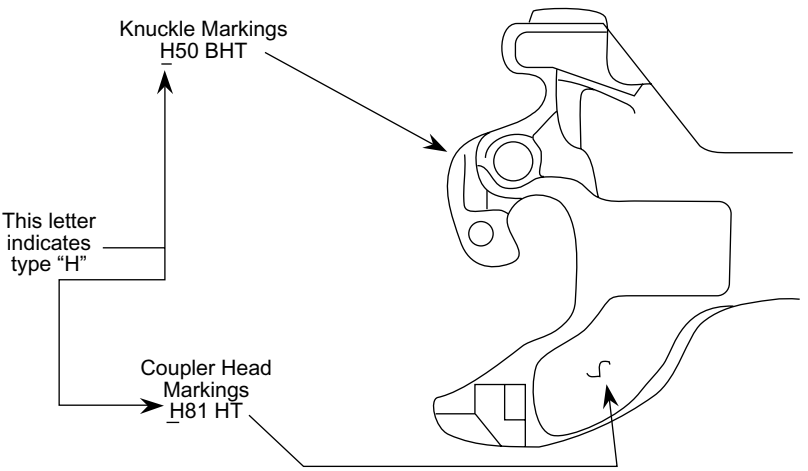


Figure 67-D. Type H Coupler Assembly.

67.3 Wheel and Journal Identification On Cars

To determine the correct wheel numbers on cars:

1. Face the "B" end of the car.
2. From the "B" end of the car, identify the designation of wheels, journals, and axles as follows (see Figure 67-E):
   - Axles are designated from the "B" end of the car with "1" for the axle closest to the "B" end.
   - Wheels and journals are designated left or right as viewed from the "B" end.
   - Specific wheels are identified using the axle and wheel designation.

     For example, R1 = the wheel on the right side nearest the "B" end of the car.

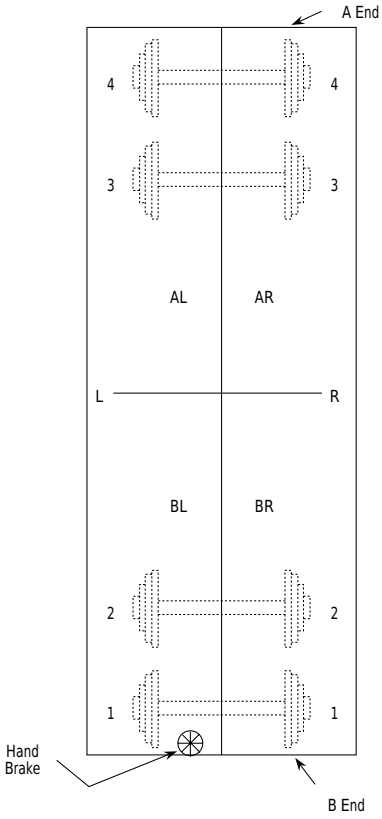


Figure 67-E. Wheel Numbering On Cars.

67.4 Freight Car Air Brake System

A freight car's air brake system has the following functions:

- Connects freight cars to the train brake system
- Transmits applications and releases of the air brakes between cars
- Automatically applies the brakes after any reduction in brake pipe pressure at a service or emergency rate
- Releases the brakes after any increase in brake pipe pressure

The following components make up the freight car air brake system:

- Angle cocks
- Brake pipe
- Combined dirt collector and cutout cock
- Control valve
- Two-compartment reservoir
- Brake cylinder
- Retaining valves
- Empty/load equipment
- A-1 reduction relay valve
- Automatic slack adjuster

67.5 Angle Cocks

Angle cocks are located at both ends of freight cars and locomotives and allow brake pipe air to flow between cars and locomotives.

An angle cock is open when the handle is in line with the brake pipe. An angle cock is closed when the handle is at a right angle to the brake pipe.

67.6 Brake Pipe

The brake pipe system distributes compressed air throughout the train. The brake pipe connects the automatic brake valve on the controlling locomotive with the brake equipment on all cars in the train.

67.7 Combined Dirt Collector and Cutout Cock

The dirt collector prevents foreign objects (dirt) from entering the control valve. The cutout cock:

- Allows the pipe connection between the control valve and the brake pipe to close
- Allows a malfunctioning car brake system to be cut out

The cutout cock is open when the handle is at a right angle to the pipe. The cutout cock is closed when the handle is parallel to the pipe.

67.8 Control Valve

The control valve applies and releases car brakes in relation to changes in brake pipe pressure.

Control valves respond rapidly during brake applications and releases, allowing the safe operation of long, heavy freight trains.

67.8.1 Control Valve Components

The control valve has three basic components:

A. Pipe Bracket

The pipe bracket:

- Attaches to the car and connects various piping to components
- Filters the air supply using its internal strainer
- Connects the service and emergency valve portions

B. Service Portion

The service portion includes the service piston, slide, and graduating valve. It functions as follows:

- Allows the emergency and auxiliary reservoirs to charge
- Performs all service braking

C. Emergency Portion

The emergency portion includes a piston, slide, and graduating valve similar to the service portion. When the emergency portion senses that brake pipe air is reduced at greater than a service rate, it moves to vent brake pipe air directly to the atmosphere and directs emergency reservoir air pressure to the brake cylinder.

NOTE: An emergency brake application is a result of a rapid drop in brake pipe pressure. The emergency brake application will apply the brakes quickly and evenly throughout the train.

67.8.2 Control Valve Types

Most freight cars have AB, ABD, or ABDW control valves.

A. AB Control Valve

Introduced in 1933, the AB control valve is found on less than 10 percent of the freight car fleet. The AB control valve introduced the quick service feature, which allows brake pipe pressure to vent locally at each car during the initial service application. As a result, brakes apply evenly and lightly throughout the train.

B. ABD Control Valve

Introduced in 1964, the ABD control valve includes quick service and is designed to improve reliability and reduce maintenance. The ABD control valve also includes accelerated service release, which helps recharge the brake pipe from the emergency reservoir on each car and rapidly transmits a release through the train.

C. ABDW Control Valve

Introduced in the 1970s, the ABDW control valve includes all of the features of the ABD valve plus the accelerated application feature.

67.8.3 Control Valve Features

A. Quick Service

The quick service feature:

- Allows 4 to 6 psi of brake pipe air to vent to the atmosphere at each car
- Allows quick service venting only when the control valve moves from RELEASE to SERVICE (Quick service does not allow local venting after the initial reduction is made or when the control valve moves from LAP to SERVICE during further reductions.)
- Includes a valve that limits brake cylinder pressure to 10 to 12 psi

NOTE: The quick service feature was introduced with the AB brake valve and is incorporated in all freight car control valves developed since 1933.

B. Accelerated Service Release

The accelerated service release feature:

- Is triggered by the release of a 10 psi or greater brake pipe reduction
- Rapidly transmits the brake release serially through the train
- Reduces train brake release times by 50 percent, which reduces in-train forces and allows a running release at lower speeds on long trains

NOTE: This feature is available on ABD, ABDW, and newer control valves.

C. Accelerated Service Application

The accelerated service application feature:

- Allows additional brake pipe air to vent at each car during each service brake application
- Results in faster service applications
- Reduces in-train forces
- Shortens stopping distances

NOTE: This feature is available on ABDW and newer control valves.

67.9 Two-Compartment Reservoir

The two-compartment reservoir houses the auxiliary and emergency reservoirs. An internal concave plate separates the two reservoirs.

67.9.1 Auxiliary Reservoir

The auxiliary reservoir provides compressed air for all service braking.

67.9.2 Emergency Reservoir

The emergency reservoir provides an additional supply of compressed air during an emergency brake application. This additional air to the brake cylinder increases brake cylinder pressure above full service by approximately 20 percent.

67.10 Brake Cylinder

The brake cylinder is a cast metal cylinder with a piston connected to rods and levers. When brake cylinder pressure is present, the piston moves out and applies the brakes by forcing the brake shoes against the wheel.

When brake cylinder pressure is released, a return spring in the brake cylinder moves the piston back into the brake cylinder, releasing the brakes.

67.11 Retaining Valves

The retaining valve on each car controls brake cylinder pressure exhaust. All freight cars have retaining valves located at the “B” end of the car or at the side near the control valve.

The retaining valve can be positioned to function as follows during a brake release:

- Allow the exhaust of brake cylinder pressure to atmosphere
- Retain brake cylinder pressure while the system is recharged

67.11.1 Three-Position Retaining Valve

The three-position retaining valve includes these positions (see Figure 67-F):

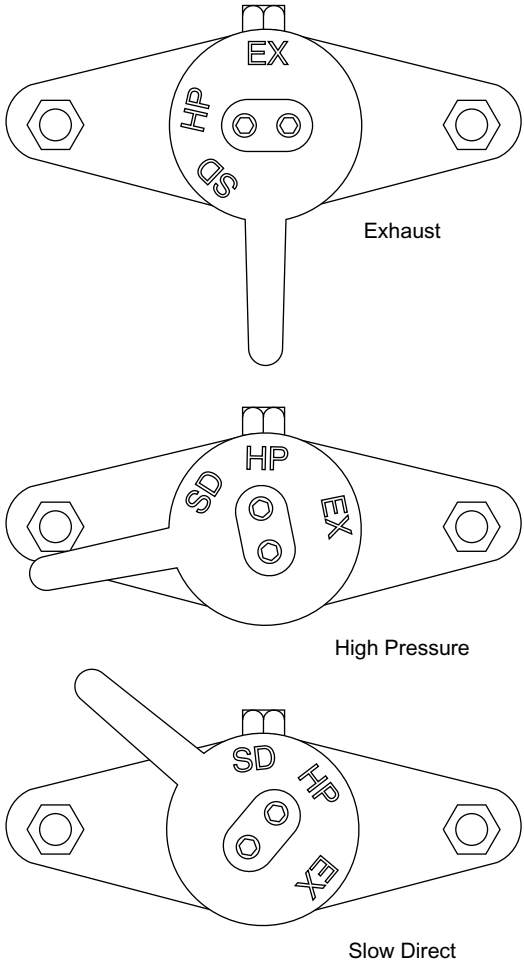


Figure 67-F. Three-Position Retaining Valve.

DIRECT EXHAUST (EX). Exhausts all brake cylinder pressure. Handle is turned down.

HIGH PRESSURE (HP). Exhausts brake cylinder pressure to 20 psi. Handle is 45 degrees below horizontal.

SLOW DIRECT EXHAUST (SD). Exhausts brake cylinder pressure for a blowdown time of approximately 86 seconds and continues to exhaust until all pressure is vented. Handle is 45 degrees above horizontal.

67.11.2 Four-Position Retaining Valve

The four-position retaining valve includes these positions:

DIRECT EXHAUST (EX). Exhausts all brake cylinder pressure. Handle is turned down.

HIGH PRESSURE (HP). Exhausts brake cylinder pressure to 20 psi. Handle is 45 degrees below horizontal.

LOW PRESSURE (LP). Exhausts brake cylinder pressure to 10 psi. Handle is horizontal.

SLOW DIRECT EXHAUST (SD). Exhausts brake cylinder pressure over a blowdown time of approximately 86 seconds, and continues to exhaust until all pressure is vented. Handle is 45 degrees above horizontal.

67.12 Empty/Load Equipment

67.12.1 Description Of Empty/Load Equipment

Empty/load equipment is two-step equipment that provides distinctly different braking characteristics for empty or loaded cars. Braking forces for empty cars are usually 35 to 60 percent of that provided for loaded cars.

This equipment is usually employed on cars handling specific lading. The cars are either empty or heavily loaded. Empty/load equipment allows enough stopping force when the cars are loaded, but it does not allow braking levels that could slide wheels on empty cars.

67.12.2 Load Proportional Valves and Sensor Valves

Sensor valves measure the load condition of a car by measuring truck spring deflection (see Figure 67-G).

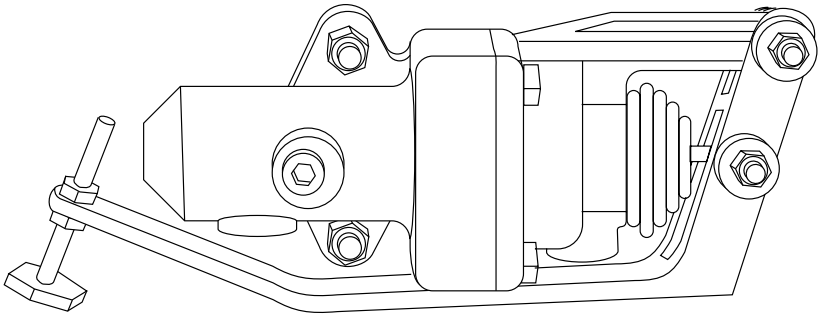


Figure 67-G. Empty/Load Sensor.

Load proportional valves hold brake cylinder pressure on empty cars to lower values during brake applications. The valves direct auxiliary reservoir air to a small equalizing volume in addition to the brake cylinder. The equalizing volume added to the brake cylinder volume lowers brake cylinder pressure during brake applications on empty cars and reduces the possibility of sliding wheels.

67.13 A-1 Reduction Relay Valve

Some long cars have an A-1 reduction relay valve that helps transmit a service or emergency brake pipe reduction by compensating for the added brake pipe length of the car (see Figure 67-H).

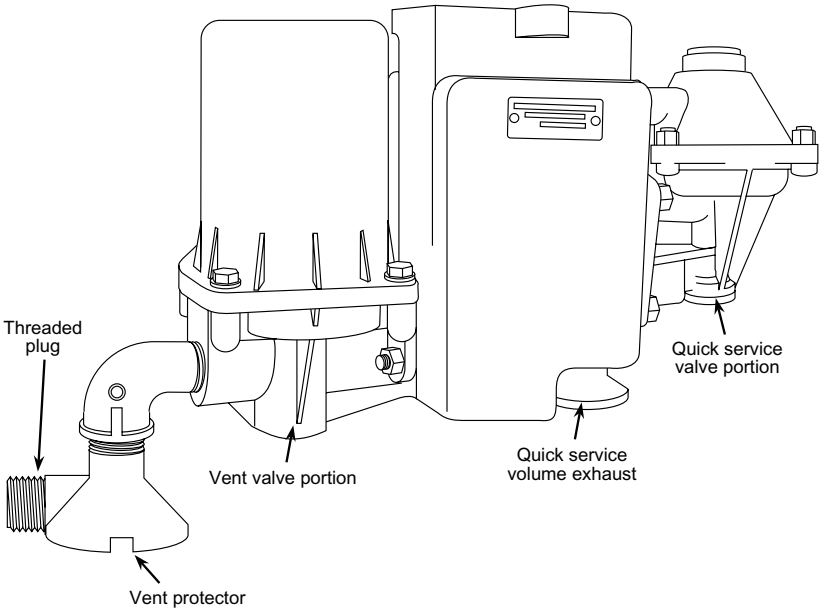


Figure 67-H. A-1 Reduction Relay Valve.

The relay valve functions as follows:

- Service brake reductions are assisted through the A-1 quick service portion.
- Emergency brake pipe reductions are transmitted by the No. 8 vent valve portion.

If the No. 8 vent valve fails to reset after an emergency brake application, causing a continuous blow at the exhaust port, plug the valve by removing the vent protector and screwing in the threaded plug.

67.13.1 Freight Cars Equipped With A-1 Reduction Relay Valve

The following freight cars are equipped with the relay valve:

- Cars with AB or ABD control valves and more than 75 feet of brake pipe between hose couplings
- Cars with ABDW control valves and more than 100 feet of brake pipe between hose couplings

  NOTE: Cars with ABDW control valves having between 75 and 100 feet of brake pipe have a No. 8 vent valve added.

67.14 Automatic Slack Adjuster

The automatic slack adjuster maintains piston travel limits as brake shoes, brake rigging, and wheels wear.

67.15 Piston Travel Limits

The following information identifies the piston travel limits for body mounted air brake cylinders, truck mounted air brake cylinders, or a TTOX AIR ACTUATOR single wheel truck air brake system.

67.15.1 Body Mounted Air Brake Cylinders

The cylinder diameter size is cast into the cylinder housing. On 12-inch cylinders, the housing is 90 degrees to the piston rod. On cylinders less than 12 inches, the housing is tapered.

Piston Travel Limits of Body Mounted Air Brake Cylinders			
Body Mounted Brake Cylinder Diameter	**Maximum Piston Stroke**	**Initial Terminal Requirements**	**Intermed. and 1,000 Mile Inspection Points**
12"	10"	5"	8-1/2" max.
7-1/2", 8-1/2", 10"	12"	7" to 9"	10-1/2" max.

67-B. Body Mounted Air Brake Cylinders.

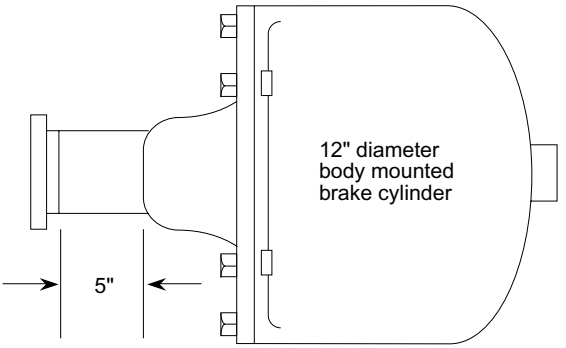


Figure 67-I. High-Capacity Body Mounted Brake Cylinder.

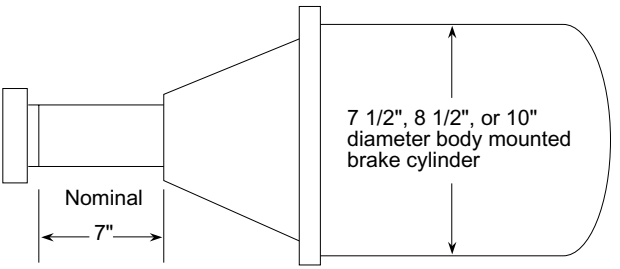


Figure 67-J. Standard Body Mounted Brake Cylinder.

67.15.2 Truck Mounted Air Brake Cylinders

Piston Travel Limits of Truck Mounted Air Brake Cylinders			
Truck Mounted Brake Cylinder Manufacturer	**Maximum Piston Stroke**	**Initial Terminal Operating Range**	**Intermed. and 1,000 Mile Inspection Points**
WABCOPAC/ NYCOPAC (One brake cylinder mounted on each brake beam.)	5-1/4"	4" max.	4" max.
WABCOPAC II (Same as above with slack adjusters in each truck.)	5-1/4"	3" max.	4" max.
ELLCON NATIONAL (One brake cylinder mounted to bracket on each truck bolster.)	4-1/4"	2-1/4" to 3-3/4"	4" max.
THRALL/DAVIS (Each brake cylinder mounted directly to truck bolster with a cylinder push rod extending through.)	6"	2-3/4" to 4-1/4"	4-1/2" max.
MISNER/TTX (Air bag designed actuator mounted to each truck bolster. Load indication pointer inside truck on slack adjuster.)	12"	7-1/2" to 9" LOADED 8-1/2" to 10" EMPTY	9-1/4" max. LOADED 10-1/4" max. EMPTY
WABCO TMX (One brake cylinder mounted to each beam within each truck. New models have piston travel indicator on brake cylinder.)	4-3/4"	1-1/2" to 3"	3-1/2" max.

Table 67-C. Truck Mounted Air Brake Cylinders.

A. WABCOPAK/NYCOPAK

Figure 67-K. WABCOPAK/NYCOPAK Truck Mounted Brake Cylinder.

On the WABCOPAK/NYCOPAK truck mounted air brake cylinders, one brake cylinder is mounted on each brake beam. The piston travel limits are:

Maximum Piston Travel Without Brake Shoe Renewal	
Range Of Travel	**WABCOPAK/NYCOPAK**
Repair Track	3"
Repair Range	When over 3", use spacing blocks to adjust per AAR procedure.
Initial Terminal Operating Range	7" to 9"
Intermediate Points	10-1/2"

Table 67-D. WABCOPAK/NYCOPAK Piston Travel Limits.

B. WABCOPAK II

Figure 67-L. WABCOPAK II Truck Mounted Brake Cylinder.

On the WABCOPAK II truck mounted air brake cylinders, the piston travel limits are:

Maximum Piston Travel Without Brake Shoe Renewal	
Range of Travel	**WABCOPAK II**
Repair Track	2" ± 1/8"
Initial Terminal Operating Range	1-3/4" to 3"
Intermediate Points	4"

Table 67-E. WABCOPAK II Piston Travel Limits.

C. ELLCON NATIONAL

Figure 67-M. ELLCON NATIONAL Truck Mounted Brake System.

NOTE: Piston travel is measured from the front face of the nonpressure head to the end of the piston sleeve.

On ELLCON NATIONAL truck mounted air brake cylinders, one brake cylinder is mounted to a bracket on each truck bolster. Piston travel is shown on the badge plate as “nominally 3.”

Trucks	70 Ton	100 Ton	100/125 Ton
Cylinder Diameter	7-1/2"	8-1/2"	10"
Maximum Stroke	4-1/4"	4-1/4"	5"

Table 67-F. ELLCON NATIONAL Cylinder Diameter.

Piston travel limits are:

Maximum Piston Travel Without Brake Shoe Renewal	
Range of Travel	**ELLCON NATIONAL**
Repair Track and Reset Range	2-3/4" ± 1/4"
Initial Terminal Operating Range	1-3/4" to 3"
Intermediate Points	4"

Table 67-G. ELLCON NATIONAL Piston Travel Limits.

D. THRALL/DAVIS

Figure 67-N. THRALL/DAVIS Truck Mounted Brake System.

NOTE: Measure piston travel as follows:

- **Scribe a line on the push rod where it enters the truck bolster when the brakes release.**
- **With the brakes set, measure the push rod extension from the scribe to determine the distance the line traveled.**

On THRALL/DAVIS truck mounted air brake cylinders, each brake cylinder is mounted directly to the truck bolster with a cylinder push rod extending through. The cylinder diameter is:

- 36X = 33 square inches, mounted on 70 ton and some 100 ton trucks
- 50X = 46 square inches for 100 ton and some 70 ton trucks
- 60X = 60 square inches for 125 ton trucks only

NOTE: Maximum piston stroke for each cylinder is 6 inches ± 1/8 inch.

Piston travel limits are:

Maximum Piston Travel Without Brake Shoe Renewal	
Range of Travel	**THRALL/DAVIS**
Repair Track and Reset Range	3-1/4" ± 1/4"
Initial Terminal Operating Range	2-1/2" to 4-1/4"
Intermediate Points	4-1/2"

Table 67-H. THRALL/DAVIS Piston Travel Limits.

E. MISNER/TTX

Figure 67-O. MISNER/TTX Truck Mounted Brake System.

NOTE: Measure piston travel between the rear mounting surface of the actuator end cap and the front face of the dowel plate, which bears against the horizontal level. Measure piston travel as follows:

- **Do not include the plate welded to the fulcrum lever.**
- **Do not include the front mounting plate.**
- **When working faces are not parallel, use a median (average) line.**

On MISNER/TTX truck mounted air brake cylinders, the air-bag-designed actuator is mounted to each truck bolster. A load indication pointer is located inside the truck on the slack adjuster.

The maximum stroke is 12-3/8 inches. Piston travel limits are:

Maximum Piston Travel Without Brake Shoe Renewal		
Range of Travel	**Loaded***	**Empty**
Repair Track and Reset Range	8" ± 1/4"	9" ± 1/4"
Initial Terminal Operating Range	7-1/2" to 9"	8-1/2" to 10"
Intermediate Points	9-1/4"	10-1/4"
* Loaded setting is when the load is heavy enough to move the Empty/Load indicator attached to the slack adjuster into the loaded position.		

Table 67-I. MISNER TTX Piston Travel Limits.

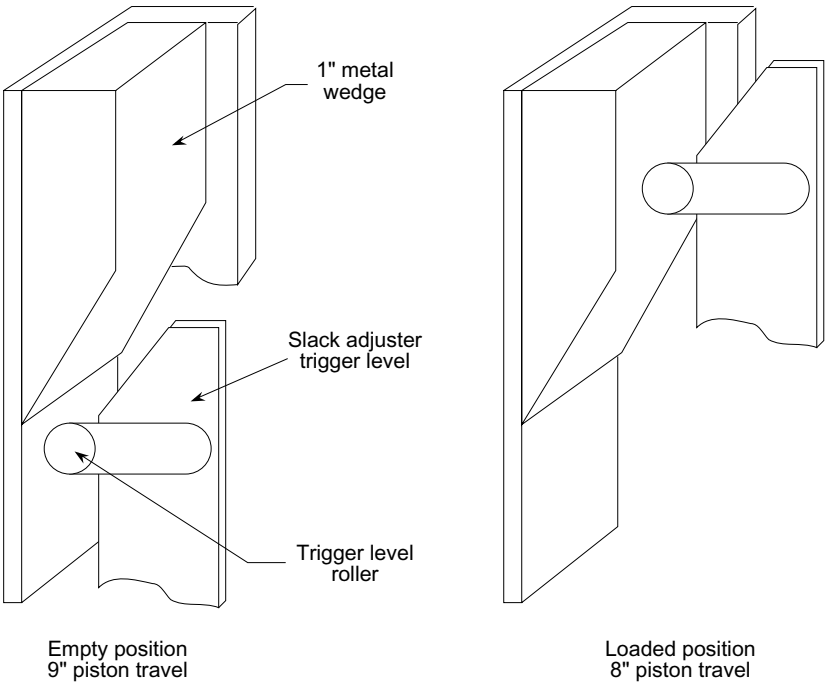


Figure 67-P. MISNER/TTX Empty Load Indicator.

Empty/Load Indicator. When the load is heavy enough to depress the freight car truck springs:

1. The freight car and the 1-inch metal wedge piece will move downward.
2. The trigger level roller will roll up the empty/load wedge and trigger the slack adjuster to make a change in the piston travel.
3. Usually the load will not be heavy enough to move the car down to the loaded position, and the piston travel will remain at 9 inches.
4. If the load is heavy enough to depress the springs and cause the trigger level to move to the loaded position, the piston travel will shorten to 8 inches to provide more brake cylinder force for under the load.

F. WABCO TMX

Figure 67-Q. WABCO TMX Truck Mounted Brake System.

NOTE: Piston travel is measured from the front face of the cylinder to the edge of the push rod connection pin.

On WABCO TMX truck mounted air brake cylinders, one brake cylinder is mounted to one brake beam within each truck. New models have a piston travel indicator on the brake cylinder.

Maximum stroke is 4-3/4 inches.

Truck	70 Ton	100 Ton	100/125 Ton
Cylinder Diameter	7" to 8"	8"	9-1/4"

Table 67-J. WABCO TMX Cylinder Diameter.

Piston travel limits are:

Maximum Piston Travel Without Brake Shoe Renewal	
Range of Travel	**WABCO TMX**
Repair Track and Reset Range	2" ± 1/4"
Initial Terminal Operating Range	1-1/2" to 3"
Intermediate Points	3-1/4"

Table 67-K. WABCO TMX Piston Travel Limits.

67.15.3 TTOX AIR ACTUATOR Single Wheel Truck Air Brake System

Figure 67-R. TTOX Air Actuator.

NOTE: On TTOX single axle cars only, measure piston travel on the indicator (brake on or off) under the standee at the "B" end of the car. This car has two actuators and one indicator.

On the TTOX AIR ACTUATOR single wheel truck air brake system, piston travel limits are:

Maximum Piston Travel Without Brake Shoe Renewal	
Range of Travel	**TTOX AIR ACTUATOR**
Repair Track and Reset Range	7" ± 1/4"
Initial Terminal Operating Range	With the brakes applied, shoes must be against the wheels and the indicator pointed to the ON position.
Intermediate Points	With the brakes applied, shoes must be against the wheels and the indicator pointed to the ON position.

Table 67-L. TTOX AIR ACTUATOR Piston Travel Limits.

67.16 Full-Service and Emergency Brake Cylinder Equalization Pressures On Freight Cars

Use Table 67-M to determine full-service and emergency brake cylinder equalization pressures.

Equalization Pressures (in psi)			
Charge In System	**Full Service Reduction**	**Full Service Brake Cylinder Pressure**	**Emergency Brake Cylinder Pressure**
70	20	50	60
80	23	57	69
90	26	64	77
100	29	71	85
110	32	78	93

Table 67-M. Full-Service and Emergency Brake Cylinder Equalization Pressures.

67.17 Train Brake Releases

Train brake release times depend on:

- Train length
- Brake pipe leakage
- Amount of brake pipe reduction being restored
- Type of air brake equipment (AB, ABD, or ABDW)

67.17.1 Time Chart For Starting Release On Last Car

Use Table 67-N to determine the time required to begin the release of a 10 psi brake pipe reduction if:

- Initial brake system pressure is 90 psi.
- Minimum brake pipe leakage is present.
- Train is equipped with ABD or ABDW control valves.

Train Length	Time Required To Start the Release On Last Car
2,500 feet	4.5 seconds
5,000 feet	8.4 seconds
7,500 feet	13.5 seconds

Table 67-N. Time Chart For Starting Release On Last Car.

68 EOT TELEMETRY DEVICES

An end-of-train telemetry device transmits data concerning train functions from the rear car to the locomotive cab. This data informs the engineer of any operating problems that require corrections.

68.1 Overview Of TRAINLINK II End-of-Train Telemetry Device

68.1.1 TRAINLINK II Components

TRAINLINK® II is a second-generation radio end-of-train (EOT) telemetry system that consists of:

- End-of-Train (EOT) Unit mounted on the trailing coupler of the last car
- Locomotive Cab Unit (LCU) mounted in the locomotive

68.1.2 TRAINLINK II Functions

TRAINLINK® II performs all basic functions of TRAINLINK® I and in addition can initiate EOT emergency braking. This emergency braking function requires a front-to-rear radio channel and the usual rear-to-front channel. Radio transmitters at both the locomotive and the last car perform this function.

End-of-Train (EOT) Unit. The EOT unit transmits last car data approximately every 55 seconds.

Locomotive Cab Unit (LCU). The LCU functions as follows:

- It automatically polls the EOT every 10 minutes by sending a request for status update. This polling verifies that the communications link is working properly.
- It has an internal audio alarm that alerts the engineer of an important change in status.
- In conjunction with the EOT, it provides train crews with status updates and functional capabilities including:

— Distance measurement referenced to locomotive movement
— Last car brake pipe pressure monitoring
— Last car low pressure alarm
— Last car motion status (moving or stopped)
— Marker light status (on or off)
— Battery status
— Loss of communications alarms
— Automatic and manual communications test
— Rear of train emergency braking

68.2 TRAINLINK II EOT Unit

The EOT unit of the telemetry device is installed on the trailing coupler of the last car. Correct installation, a functioning battery, proper ID coding, and an operational check enable the unit to communicate with the LCU and give status on brake pipe pressure, marker light operation, and emergency braking.

68.2.1 Installing the EOT Unit

To install the EOT unit on the trailing coupler of the last car:

1. On the trailing end of the last car, close the angle cock and disconnect the brake pipe hose.
2. Install the EOT unit onto the coupler as follows:
   a. Unscrew the handle on the EOT until the hook lies flat.
   b. Insert the hook into the top coupler coring hole.
   c. Turn the handle clockwise until the hook is upright and pulls the EOT unit firmly against the coupler.
   d. Secure the bottom of the V-jaw on the coring hole rib, then hand-tighten the handle.
3. Lock the EOT unit in place as follows:
   a. Align the handle with the lock hole.
   b. Lock the EOT unit with a lock or other device.

4. Connect the air hose to the brake pipe, and open the angle cock *slowly*.
5. Press the TEST button to check that the EOT unit is operational (see Rule 68.2.3).

Before removing the EOT, slowly close the angle cock and push the bleeder valve button on the glad-hand to bleed air pressure from the EOT hose.

68.2.2 Setting the Correct EOT ID Code Number

Once the EOT is installed properly, make sure its ID code number matches the ID code thumbwheel switch on the LCU. If you set an incorrect ID code, the LCU will reject all messages from the EOT and the EOT will not receive messages from the LCU. Also see Rule 68.3.3, LCU Code Selection/Input.

68.2.3 Checking the Operation of the EOT Unit

To check the operation of the EOT:

1. Press the TEST button on the EOT and:
   a. Make sure the EOT displays these functions:
      - Digital readout of the EOT software version number—VX.X
      - Battery charge units—C XXX

        NOTE: The number will be between 0 and 100 and represents the percent of battery charge *used*. A 100 means that all battery charge has been used.
      - Brake pipe air pressure—P XXX

        NOTE: The pressure gauge has a range of 0 to 125 psi.
      - A blank at the end of the test cycle.

b. Make sure the display on the LCU illuminates and the alarm sounds if the LCU has been armed previously to the EOT being tested.

NOTE: If the LCU has not been armed to the EOT being tested, the EOT will display the ARM NOW message on the LCU.

2. During the daylight, make sure the marker light functions by:

a. Ensuring that the marker light comes on for 30 seconds when the EOT TEST button is pressed.

or

b. Covering the light sensor in the display window for more than 1 minute and 30 seconds, which will activate the marker light.

NOTE: The marker light will operate for about 4 minutes after the sensor is uncovered.

68.2.4 Automatic Power Off

If the EOT is removed from the coupler and placed in a horizontal position, it will automatically shut off after 60 seconds. Returning the EOT to an upright position will restore power after a 2-second delay. If the EOT will not be used for an extended period, remove the battery to prevent battery drain.

68.2.5 Replacing the Battery

The battery may be replaced with the EOT unit installed on the coupler—TRAINLINK II only.

Replace the battery in the EOT unit as follows:

1. To unlock the EOT unit and remove the dead battery:
    a. Unlock the unit and swivel the handle down.
    b. Rotate the lock hasp off the battery latch and open both latches.
    c. Remove the latch hooks from the battery lid.
    d. Pull the battery out from the EOT enclosure.
2. To install a new battery:
    a. Install a fully charged battery in the EOT battery enclosure.
    b. Align the connector on the battery with the round mating connector at the bottom of the battery enclosure.
    c. Push the battery fully into the enclosure and latch the battery lid.
3. To resecure the EOT unit:
    a. Rotate the lock hasp and the handle together.
    b. Lock the unit through the lock hole.

68.3 TRAINLINK II Locomotive Cab Unit

The locomotive cab unit (LCU) is a self-contained telemetry transmitter/receiver with the displays and controls the engineer uses to monitor and operate the EOT unit.

68.3.1 LCU Displays and Controls

The LCU has the following displays and controls:

A. Distance Counter

The distance counter measures the net distance (whether forward or in the reverse position) a locomotive travels.

Activating the Distance Counter. To activate the distance counter:

1. Press the CONTROL button (on the left side of the LCU front panel) one time, which then displays the distance the locomotive has travelled in feet.

   NOTE: At first the distance increases whether the train is travelling forward or in the reverse position. However, if the train reverses direction, the distance counter begins decreasing.

2. Press the CONTROL button a second time, which holds the display at the net (forward or reverse) distance the locomotive traveled. The display will flash.

   NOTE: If the distance count reaches its maximum value of ± 19,999 feet, the count will freeze and the display will flash.

3. Press the CONTROL button a third time, which resets and turns off the distance counter display.

Calibrating the Distance Counter. To calibrate the distance counter:

1. Set the two-digit WHEEL DIAMETER switch (on the right side of the LCU rear panel behind a small access door) by dialing the second and third digits (which represent wheel diameter) on the switch. For example, for a 38.0-inch wheel, disregard the "3" and dial the "8" and "0" on the switch.

   NOTE: This two-digit switch accommodates wheel diameters from 35.0 to 44.9 inches.

2. Check the wheel diameter setting as follows:

   a. Press and hold the DISPLAY TEST button on the LCU, which displays the wheel size setting on the DISTANCE COUNTER display. For example, a wheel size setting of 38.0 inches would be displayed as "38.0."

      NOTE: Charge units are also displayed in the PRESSURE DISPLAY window.

b. Check wheel diameter size regularly (at least every 90 days) to make sure it matches the actual locomotive wheel size.

c. Check wheel diameter size whenever the wheels are turned or replaced.

B. Pressure Display

The last car brake pipe pressure display shows pressure to a maximum of 125 psi. This display is updated automatically and functions as a remote last car air gauge.

If the brake pipe pressure drops below 45 psi:

1. The LCU sounds an alarm (5 beeps for 5 seconds).
2. A LOW PRES message appears in the message display window and remains until the brake pipe pressure rises above 45 psi.

C. Marker Light Status Displays

The marker light status display reports whether the high visibility marker (HVM) light on the last car is on (HVM ON) or off (HVM OFF).

TRAINLINK® II also performs an automatic marker light test, allowing the locomotive engineer to check the marker light without another person operating the EOT TEST button. The test activates when:

- The EOT is on and operating with at least 45 psi of brake pipe pressure and no motion has occurred at the EOT for at least 30 seconds.
- Under these conditions, when the train begins to move, the HVM ON indicator on the LCU will illuminate.

  NOTE: If the train stops within the 30 second test, the marker light will go off. Also, this test cannot be performed at night since the light sensor keeps the marker light on.

D. Battery Status Displays

Dead Battery. When the EOT sends the dead battery message to the LCU, the LCU displays the DEAD BAT message in the message display window. Approximately 5 minutes after this message is transmitted, the EOT will stop functioning.

Weak Battery. When the EOT sends a weak battery message to the LCU, the LCU:

- Illuminates the BATTERY LOW indicator.
- Displays the REPL BAT message in the message display window.
- Sounds a single beep alarm.

E. Motion Indication Displays

The EOT transmits to the LCU the motion status of the train's last car. Either MOV (moving) or STP (stopped) is illuminated on the LCU display.

68.3.2 LCU Alarms and Alarm Messages

The LCU responds to six system alarm conditions by sounding one to five beeps combined with displaying one of six alarm messages. These alarms and alarm messages alert the locomotive engineer to system conditions requiring immediate attention.

The alarm conditions are prioritized as follows:

1. DEAD BAT
2. VALVFAIL
3. RF NOCOM
4. FR NOCOM
5. REPL BAT
6. LOW PRES

Any message appearing higher on the list will be displayed in place of an alarm message that appears lower on the list.

After an alarm condition has been cleared, the next radio transmission received by the LCU will reset the alarm and remove the alarm message from the message display.

A. Dead Battery

See Rule 68.3.1D, Battery Status Displays.

B. Emergency Valve Circuit Failure

If the emergency valve circuit in the EOT fails, the LCU will:

- Sound an alarm.
- Display the VALVFAIL alarm message on the message display window.

If this alarm occurs, check the EOT because the emergency braking function may not be operational.

C. Rear-To-Front Communications Failure

If no radio transmissions are received from the selected EOT for a period of 5 minutes 41 seconds, the LCU will:

1. Sound an alarm for 5 seconds.
2. Light the RADIO BREAK LED.
3. Display the RF NOCOM alarm message on the message display window.
4. Cause the pressure display to go blank.
5. Turn off the MOV (or STP) and HVM ON (or HVM OFF) LEDs.

The RF NOCOM message will remain displayed until the selected EOT unit sends a valid transmission. After the RF NOCOM alarm condition has cleared, the next radio transmission received by the LCU will remove the alarm message from the message display and allow normal operation to resume.

D. Front-To-Rear Communications Failure

One of these two conditions causes a front-to-rear communications failure alarm:

- The EOT sends no confirming message 15 seconds after the EMERGENCY SWITCH has been activated.

  or

- The EOT sends no confirming message for 6 minutes 30 seconds after an automatic communication test from the LCU.

When either of the above situations occurs, the LCU will:

1. Sound an alarm for 5 seconds.
2. Display the FR NOCOM alarm message on the message display window.

The FR NOCOM message will remain until front-to-rear communications are restored or a higher priority message overrides the alarm message.

The FR NOCOM message will be removed if a confirming message is received after:

- The COMMUNICATIONS TEST/ARM button is operated.
- A response is received to an automatic communications poll the LCU initiated.

E. Replace Battery

See Rule 68.3.1D, Battery Status Displays.

F. Pressure Display

See Rule 68.3.1B, Pressure Display.

68.3.3 LCU Code Selection/Input

The EOT telemetry device operates effectively if the EOT and LCU are communicating. To achieve a communication link, set the correct ID codes.

A. Controlling Locomotive

To make sure the LCU communicates with the correct EOT, set the LCU ID code thumbwheel switches to match the ID code of the selected EOT. As a result:

- The LCU will accept messages only from the selected EOT.
- When the LCU transmits messages to the EOT, only the selected EOT will respond.

To ensure that the ID code thumbwheel switches are functioning, press the DISPLAY TEST and DISTANCE COUNTER buttons at the same time. Verify:

1. The current settings of the thumbwheel switches appear in the distance counter and pressure display windows as follows:
   a. The first two digits appear on the distance counter display.
   b. The last three digits appear on the pressure display.
2. At the same time, THW CODE appears in the message display window.

If the displayed ID code matches the settings of the ID code thumbwheel switches, the ID code thumbwheel switches are working.

B. Trailing Locomotive

When a locomotive is used in trailing service, set its LCU ID code thumbwheel switches to 00000. As a result, the LCU will not be able to transmit or receive radio signals. Only the odometer function will operate.

68.3.4 LCU Operational Check

Test whether the LCU is operational using a manual or automatic test.

A. Manual Test

To manually test the LCU:

1. Make sure the EOT is installed correctly and connected to the brake pipe (see Rule 68.2.1, Installing the EOT Unit).
2. Set the LCU ID code thumbwheel switches to match the ID code of the EOT being used for testing (see Rule 68.3.3A, Controlling Locomotive).
3. Press and release the DISPLAY TEST button on the LCU.

   NOTE: If all LED indicators and displays light up, the display test is successful.

4. Test the front-to-rear and rear-to-front radio links by pressing the COMMUNICATIONS TEST/ARM button on the LCU. Make sure COM TEST appears in the message display window.

   NOTE: If the communications test is successful, COM OK will replace COM TEST in the message display window. If the communications test is not successful, NO COM will be displayed for 5 seconds.

B. Automatic Test

The LCU automatically sends a status update request to the EOT every 10 minutes, testing the radio links in both directions. Since this test is ongoing, no indications appear on the LCU display if the test is successful. During the test:

1. If an EOT reply is not received within a designated time period, the LCU sends another request 15 seconds later.
2. If the EOT does not respond to this retry, the LCU sends another request 6 minutes later.

3. If the EOT does not respond to this request, the LCU sends a final transmission 15 seconds later.
4. If the EOT does not respond to this final transmission, an FR NOCOM alarm message appears in the message display window accompanied by an audio warning alarm.

68.4 TRAINLINK II Rear Car Emergency Braking

Rear car emergency braking is a key feature of the EOT telemetry device. Arming the LCU activates the emergency braking function for a specific EOT.

68.4.1 Arming the LCU

Two people are needed to arm the LCU:

- One is needed at the LCU on the controlling locomotive of the train.
- One is needed at the EOT on the last car of the train.

To arm the LCU:

1. Set the LCU ID code thumbwheel switches to the ID code of the EOT on the last car.
2. Press the TEST button on the EOT, which will display the ARM NOW message on the message display window of the LCU.
3. Immediately press the COMMUNICATIONS TEST/ARM button on the LCU, which will display the ARMD message on the message display window of the LCU and light the EMERG ENABLED status LED at the same time.

   NOTE: If NOT ARMD appears on the LCU message display, the system did not accept the arming sequence. Repeat steps 1 through 3 above.

The system is now armed. If the emergency switch is operated, the EOT will open its emergency valve triggering an emergency application of the train brakes.

A. Making an Emergency Brake Application

Once a system is properly armed, an emergency brake application can be made at any time. To initiate an emergency brake application at the end of the train:

1. Lift the red cover of the EMERGENCY SWITCH located on the right side of the LCU.
2. Push the toggle switch up.
3. Verify that:
   a. The message EMERGNCY briefly appears in the message display window.
   b. The brake pipe pressure reading quickly drops to 0 psi.
   c. The LOW PRES message is displayed while the last car pressure is below 45 psi.

68.4.2 Disarming the LCU

Disarming the LCU disables the emergency command for all EOT ID numbers. To disarm the LCU:

1. Set the LCU ID code thumbwheel switches to 00000.
2. Press the COMMUNICATIONS TEST/ARM button.
3. Verify that:
   a. The LCU displays DISARMD in the message display window.
   b. The EMERG ENABLED status LED turns off.
   c. The EMERG DISABLED status LED turns on.

68.5 Calibrating the TRAINLINK II EOT Device

Calibrate the EOT every 85 days. This task is easier when:

- One person is at the EOT.
- Another person is at the LCU.

To calibrate the EOT:

1. Charge the brake pipe and connect the EOT.
2. Compare the pressure displayed at the EOT to the pressure displayed on the LCU.
3. Make sure the two readings are within ± 3 psi of each other.
4. Detach the EOT from the brake pipe and connect an accurate (calibrated) gauge.
5. Compare the pressure indicated on the gauge to the brake pipe pressure readout on the LCU.
6. Make sure the pressure indicated on the gauge is within ± 3 psi of the LCU readout.

   NOTE: Do not use an EOT that displays a pressure not within ± 3 psi of the LCU readout or the accurate (calibrated) gauge.

7. The person at the EOT uses a pen to enter the following information on the Calibration Date Tag:

   - Name
   - Date
   - Location of test

8. Attach the Calibration Date Tag to the EOT.

68.6 Overview Of Glenayre Digitair End-Of-Train Telemetry Device

The Glenayre Digitair is a radio end-of-train telemetry system that consists of:

- End-of-train (EOT) unit mounted on the trailing coupler of the last car
- Locomotive cab unit (LCU) mounted in the locomotive

68.7 Digitair EOT Unit

The EOT unit of the Digitair telemetry device is installed on the trailing coupler of the last car. Correct installation, a functioning battery, proper ID coding, and an operational check enable the unit to communicate with the LCU and give status on brake pipe pressure, marker light operation, and emergency braking.

The Digitair EOT unit has two versions: a large EOT unit and a small EOT unit.

68.7.1 Large EOT Unit

The large EOT unit has three basic components:

- Coupler mount
- Transmitter
- Battery compartment

Figure 68-A. Large EOT Unit.

A. Mounting the Large EOT Unit

Follow these precautions when mounting the large EOT unit on the trailing coupler of the last car:

1. Make sure the EOT unit is mounted securely to the coupler and cannot be damaged by car-mounted equipment, such as swinging chains or air hoses.
2. Make sure the angle cock on the last car is open.

B. Removing and Installing Batteries On the Large EOT Unit

Transmitter Batteries. Follow these steps to remove and install large EOT unit transmitter batteries:

1. Open the battery compartment lid.
    a. Move the clamping screw to the horizontal position, then release the two retaining latches.
    b. Lift the lid fully open.
2. Remove the thumbscrew retainer.
3. Gently remove the battery by pulling it straight out from its contacts.
4. Install a fully charged battery by pushing it onto its guide pins until the contacts are fully made.
5. Replace the thumbscrew retainer.
6. Replace the battery compartment lid.

Marker Light Batteries. Follow these steps to remove and install large EOT unit marker light batteries:

1. Open or remove the cover to the marker light battery compartment.
    a. On newer units, the cover swings open on its hinges. Raise the cover slightly and withdraw the pin at the lower left side about 1/2 inch. Then swing the cover open.

b. On older units, the cover comes off completely. Open the top and bottom clips that hold the cover in place, then remove the cover.

2. Remove each of the three batteries by unscrewing its retaining nut and pulling the battery straight out from its contacts.
3. Install three new batteries by pushing each battery onto its guide pins until the contacts are fully made.
4. Replace the retaining nuts. Tighten them securely but not excessively.
5. Close or replace the cover to the battery compartment.

68.7.2 Small EOT Unit

The small EOT unit has two basic components:

- Coupler mount
- Battery compartment

Figure 68-B. Small EOT Unit.

A. Mounting the Small EOT Unit

Follow these precautions when mounting the small EOT unit on the trailing coupler of the last car:

1. Make sure the EOT unit is securely fastened to the knuckle.
2. Make sure the angle cock on the last car is open.

B. Battery Compartment

The battery compartment of the small EOT unit has three components:

- Marker light
- Air gauge
- Battery storage compartment

68.7.3 Operating the Digitair EOT Unit

Since the EOT unit functions automatically, it does not need to be directly operated during use. However, the EOT should be checked after installation.

A. Inspecting the EOT Unit

Follow these steps to inspect the EOT unit:

1. Make sure the EOT unit is mounted securely to the coupler and cannot be damaged by car-mounted equipment, such as swinging chains or air hoses.
2. Make sure the angle cock on the last car is open.

B. Understanding Beeper Operation

The internal beeper on the EOT unit functions as follows:

- When the EOT unit is turned on, the beeper beeps once per second. The beeper automatically turns off after 1 minute.
- When the TEST button is pressed, the beeper beeps once per second for 1 minute.
- When the EOT unit transmits a report, the beeper sounds a double beep.

C. Checking the Operation of the EOT Unit

Follow these steps to check the operation of the EOT unit:

1. Press the TEST button on the EOT.
2. Make sure the EOT functions as follows:
   a. The EOT transmits a radio report to the LCU. This transmission is indicated by a double beep.
   b. The display shows the air pressure reading in psi.

      NOTE: This display appears for only 5 seconds.

   c. The beeper beeps once per second for 1 minute.

   NOTE: If the EOT was off, pressing TEST turns the EOT on. If no air is applied, the EOT will turn itself off in 5 minutes.

If the display remains blank or if the beeper does not beep, check the EOT transmitter batteries and replace them if necessary (see Rule 68.7.1B).

D. Reading the EOT Unit Display

When the EOT unit is turned on, the display will show one of four messages:

- Power-up message
- Normal display
- Battery fault message
- Antenna fault message

NOTE: The EOT unit automatically turns itself on when the air pressure is connected and exceeds 7 psi.

If the EOT is turned on and the display shows any message other than the power up message or the normal display, replace either the battery or the entire EOT unit.

Table 68-A lists the normal and alarm messages displayed by the EOT unit.

EOT Unit Display Messages		
Display	**Condition**	**Remarks**
[1 A1]	Power-up message	When the EOT unit is first turned on, the display shows this message for 1 second. • "1" is the unit's model number. • "A1" is the unit's software version number.
[123]	Normal display	The normal display shows the air pressure in psi using up to 3 digits on the right side of the display.
[123W]	Weak Battery	Battery has about 8 hours left.
[123F]	Failing Battery	Battery has only a few minutes left.
[123A]	Battery Abort	Battery voltage is so low that the EOT unit turned off before it could send a report.
[VSWR]	Antenna fault	The EOT unit antenna is using excessive power. This message can appear if someone is holding the antenna during transmission.

Table 68-A. EOT Unit Display Messages.

68.8 Digitair Locomotive Cab Unit

The locomotive cab unit (LCU) is a self-contained telemetry transmitter/receiver with the displays and controls the engineer uses to monitor the EOT unit.

The LCU has the following functions, displays, and controls:

- EOT unit identification
- Pressure display (normal display)
- Odometer function
  - — Distance button
  - — Calibration button
- Motion display
- Marker light display

NOTE: If the odometer function is not installed, the distance and calibration buttons do not work.

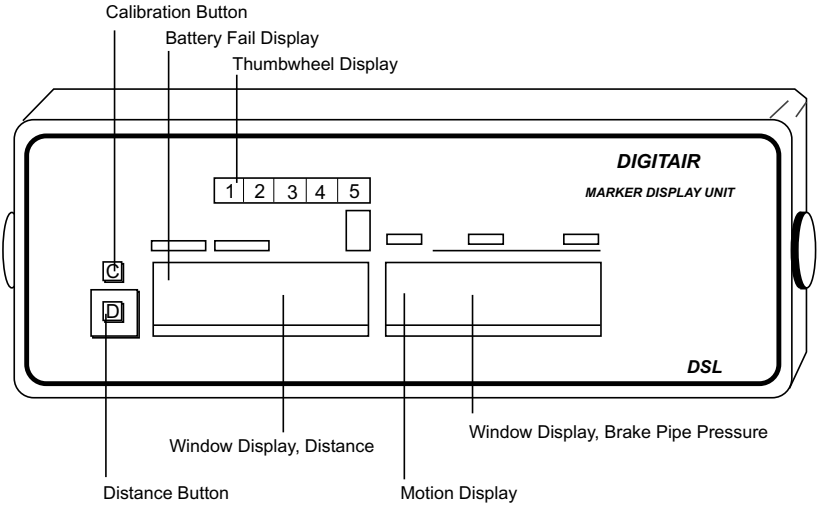


Figure 68-C. Locomotive Cab Unit (LCU).

68.8.1 EOT Unit Identification

Set the five thumbwheel switches on the LCU to the same 5-digit ID number used by your train's EOT unit. If you set an incorrect ID number, the LCU and EOT unit cannot communicate with each other.

68.8.2 Pressure Display (Normal Display)

Once the LCU turns on and receives a valid report from the EOT unit, the LCU shows the normal display. The normal display gives the air pressure in psi using up to three digits on the right side of the display.

[123]

68.8.3 Odometer Function

A. Understanding Odometer Operation

The odometer function allows the engineer to obtain a reading of the distance traveled by the locomotive. The odometer function uses the distance and calibration buttons.

The odometer function on the LCU operates as follows:

1. When the LCU is first turned on, the odometer is set for a locomotive wheel size of 38 inches. After the odometer is calibrated, the LCU will give the correct distance for wheel sizes from 36 to 42 inches.
2. After the odometer display shows 9999 feet, it starts over at 0000 feet.

   CAUTION: The odometer cannot distinguish between forward and reverse movement. If the train stops and moves in reverse, the odometer will continue to increase.

3. When the odometer display is in use, messages and alarms are suppressed as follows:

- A message from the EOT unit that would normally produce a display in the left 4 digits (such as a Weak Battery message) instead produces only beeps. A message from the EOT unit *does not* override the odometer display.
- An alarm from the LCU itself (such as a No Communications alarm) *does* briefly override the odometer display for the duration of the alarm.

B. Displaying a Distance Reading

The DIST button allows the engineer to obtain a reading of the distance traveled by the locomotive.

NOTE: If the odometer has been calibrated, the LCU will give a distance measurement that compensates for the wheel size. If the odometer has not been calibrated, the LCU will give an approximate distance. (See Rule 68.8.3C, Calibrating the Odometer.)

Follow these steps to display a distance reading:

1. Press DIST. The left 4 digits of the display start at 0000 (feet) and change as the train moves forward or backward.
2. Press DIST again to stop the display and show the total distance traveled in feet.
3. Press DIST again to cancel the display and return to the normal display.

C. Calibrating the Odometer

The CAL button allows the engineer to calibrate the odometer over a measured mile while compensating for wheel size variations. This gives a more accurate distance measurement.

Follow these steps to calibrate the odometer:

1. At the start of a measured mile, press CAL. The display shows [CAL ON] for 1 second, then shows a 4-digit display of the distance traveled in feet.

2. At the end of the measured mile, press CAL again. The display beeps once and stops.
   - If the odometer is successfully calibrated, the display shows the distance traveled for 2 seconds and then shows [5280].
   - If the odometer is not successfully calibrated, the display shows only the distance traveled.
3. Press CAL again to cancel the display. The LCU will remember the calibration while the unit is left on.

D. Avoiding Calibration Mistakes

The calibration feature will *not* work in the following situations:

- In step 1 or step 2, you press DIST instead of CAL.
- In step 2, you press CAL before the locomotive has traveled approximately 1 mile.

  NOTE: For a 40-inch wheel, the LCU will accept a "mile" that measures between 4928 and 5984 feet.

In these situations, the LCU will display the distance traveled but will *not* calibrate the odometer.

E. Odometer Displays

Table 68-B lists odometer displays for distance measurement and calibration when the odometer is operated correctly.

Odometer Displays During Correct Operation	
Odometer Display	**Comments**
Distance Measurement	
[80]	Normal display (showing typical 80 psi pressure).
[0000 80]	DIST button is pressed.
[0340 80]	Train has traveled 340 feet.
[0620 80]	DIST is pressed at 620 feet. This display stays on until DIST is pressed again.
[80]	DIST is pressed a third time and normal display resumes.
Calibration Over Measured Mile	
[80]	Normal display.
[CAL ON]	CAL button is pressed. Display lasts 1 second.
[0010 80]	Train has traveled 10 feet.
[5160 80]	Train has traveled an uncalibrated distance of 5160 feet.
[5280 80]	CAL is pressed as the milepost is passed. The display beeps. Two seconds after CAL is pressed, the display shows 5280 feet (1 mile). The odometer is now calibrated.
[80]	CAL is pressed a third time and normal display resumes.

Table 68-B. Odometer Displays During Correct Operation.

Table 68-C lists odometer displays that are displayed if the odometer is operated incorrectly.

Odometer Displays During Incorrect Operation	
Odometer Display	**Comments**
Unsuccessful Calibration—Case 1	
[80]	Normal display (showing typical 80 psi pressure).
[0000 80]	*DIST is pressed instead of CAL.*
[5160 80]	Train has traveled 5160 feet.
[5160 80]	CAL is pressed. The display does not beep or show 5280 feet. The odometer is not calibrated.
[80]	CAL or DIST is pressed and normal display resumes.
Unsuccessful Calibration—Case 2	
[80]	Normal display.
[CAL ON]	CAL is pressed. Display lasts 1 second.
[5160 80]	Train has traveled 5160 feet.
[5160 80]	*DIST is pressed instead of CAL as the milepost is passed. The display does not beep or show 5280 feet. The odometer is not calibrated.*
[80]	CAL or DIST is pressed and normal display resumes.
Unsuccessful Calibration—Case 3	
[80]	Normal display.
[CAL ON]	CAL is pressed. Display lasts 1 second.
[4000 80]	Train has traveled 4000 feet.
[4000 80]	*CAL is pressed before the train has traveled approximately 1 mile. The display does not beep or show 5280 feet. The odometer is not calibrated.*
[80]	CAL is pressed and normal display resumes.

Table 68-C. Odometer Displays During Incorrect Operation.

68.8.4 Motion Display

The EOT unit automatically reports rear-of-train motion whenever the rear car starts or stops. The EOT unit also reports rear-of-train motion with every normal report.

Table 68-D shows the LCU's normal motion displays and Table 68-E shows the buff/draft displays.

NOTE: The buff/draft displays occur only if the EOT unit is equipped with the appropriate software (such as version A4).

Normal Motion Displays	
Display	**Comments**
[80]	Normal display (showing typical 80 psi pressure). Motion detector is not fitted.
[80]	Normal display. Motion detector is fitted, but the train has not started moving.
[80]	Forward. The train has started moving forward.
[–>80]	Moving. The train has been moving for approximately 10 seconds.
[–80]	Stopped. The train is stopped.
[<–80]	Reverse. The train has started moving backward.
[* 80]	Moving. The train is moving steadily.
[–80]	Stopped. The train is stopped.

Table 68-D. Normal Motion Displays.

Buff/Draft Displays	
Display	**Comments**
[80]	Normal display. The train has not started moving.
[->80]	Forward. The train has started moving.
[* 80]	Moving. The train is moving steadily.
[|| 80]	Buff. The last car is decelerating.
[* 80]	Moving. The train is moving with steady motion.
[|| 80]	Draft. The last car is accelerating.
[* 80]	Moving. Steady motion is resumed.
[|| 80]	Buff. The last car is decelerating.
[–80]	Stopped. The train is stopped.

Table 68-E. Buff/Draft Displays.

68.8.5 Marker Light Display

If the EOT unit is equipped with a marker light, the LCU will show the marker light's ON/OFF condition using the leftmost digit of the display (see Table 68-F).

Marker Light Displays	
Display	**Comments**
[123]	Normal display. (Marker light is off.)
[* 123]	Marker light is on.
[123]	Marker light is off.

Table 68-F. Marker Light Displays.

68.8.6 Checking the Operation of the LCU

The LCU does not have an ON/OFF switch. Instead, the LCU automatically turns on whenever the primary power source is turned on.

When the LCU turns on, it functions as follows:

1. The display beeps and shows [DIGITAIR] for 1 second.
2. The display shows [6622-A1] for 1 second.
   - "6622" is the LCU's model number.
   - "A1" is the LCU's software version number.
3. The LCU turns on all segments of all digits of the display. If any segment is not on, replace the LCU.
   a. The LCU keeps all segments on until it receives a report from the EOT unit.
   b. If the LCU does not receive a report or receives a report with the wrong ID number, the LCU keeps all segments on. In this state, the LCU will not display messages or alarms from the EOT unit (see Rule 68.8.3A).

68.8.7 Reading the LCU Display

During normal operation, the LCU displays its normal pressure display. However, under certain conditions, the LCU will display alarm messages (either steady or flashing) and will sound alarm beeps. The following sections describe the No Communications alarm message and other LCU display messages.

A. No Communications Alarm Message [NO COM]

The [NO COM] alarm message indicates that the LCU and EOT unit are not communicating. The [NO COM] message is displayed as follows:

1. The LCU gives a [NO COM] alarm if it does not receive a report from the selected EOT unit for a period of 196 seconds.

a. The LCU displays a flashing [NO COM] message for 5 seconds and sounds 5 alarm beeps.

b. The LCU displays the EOT unit's ID number for 2 seconds.

c. At the end of the alarm, the LCU displays a steady [NO COM] message.

NOTE: If all segments of all digits of the display are on, the LCU is waiting for its first valid report and the [NO COM] alarm timer is not armed (see Rule 68.8.3A).

2. When the LCU receives a valid report from the EOT unit, the [NO COM] message is replaced by the normal pressure display.

3. Once the LCU has displayed a [NO COM] message, the LCU will display the ID number of the transmitting EOT unit for 2 seconds whenever it receives a report. This feature helps the engineer determine the correct ID number of the train's EOT unit if the LCU's thumbwheels are set incorrectly.

CAUTION: In this situation, the LCU displays the ID number of the *transmitting* EOT unit, whether or not the number matches the LCU's thumbwheel setting. The displayed ID number could possibly be the ID number from a nearby train.

If you are not sure that the displayed ID number is that of your train's EOT unit:

a. Set the thumbwheels to the displayed ID.

b. Wait for the normal pressure display to appear.

c. Make a 5- to 7-psi brake application and see if the air pressure display changes as you expect.

Causes of the [NO COM] Message. The [NO COM] alarm message can be caused by:

- Operating in a long tunnel
- Operating a long train near other trains on adjacent tracks

- Operating a very long train in a long rock cut or operating it slowly over the brow of a hill
- Extra cars coupled *behind* the EOT unit
- Weak or dead battery in the EOT unit
- Faulty EOT unit (for example, damaged antenna)
- Faulty LCU antenna
- Wrong ID number set on the LCU's thumbwheel switches

B. LCU Display Messages

Table 68-G lists normal and alarm messages displayed by the LCU.

LCU Display Messages				
Display Messages	**Duration In Seconds**		**Condition**	**Remarks**
	Beeps	**Flashes**		
[DIGITAIR]	1	—	First power-up message	Lasts 1 second.
[6622-A1]	—	—	Second power-up message	Lasts 1 second. A1 is the software version number.
[********]	—	—	Display after power-up	All segments of all digits are on until the LCU receives a valid report from the EOT unit. Until this happens, no alarms can occur.
[123]	—	—	Normal Display	Pressure is displayed in psi.
[W 123]	1	—	Weak Battery	Battery has about 8 hours left.
[F 123]	5		Failing Battery	Battery has only a few minutes left.

LCU Display Messages				
Display Messages	**Duration In Seconds**		**Condition**	**Remarks**
	Beeps	**Flashes**		
[LO PRESS]	5	5	Low Pressure	Pressure was at least 45 psi, but is now 44 psi or below. After 5 seconds, the display reverts to normal display.
[NO AIR]	5	5	No Air	EOT unit has had no air applied for 5 minutes and has turned itself off.
[NO COM]	5	5	No Communicatio	The LCU has not received a report from the EOT unit for 196 seconds.
[SERVICE]	5	5	LCU is faulty	Have the LCU serviced.
[NO DATA]			No Data	The CDU display is not plugged into the RDU correctly. Possible cable fault or faulty unit, or cable is unplugged.
Normal display but beeps every 5 seconds and flashes briefly			Faulty cable	Either the CDU display is plugged into the wrong connector, or there is a cable or LCU fault.

Table 68-G. LCU Display Messages.

68.9 Digitair Troubleshooting

68.9.1 Troubleshooting the EOT Unit

When an EOT unit leaves the shop or is installed on the rear car, test the unit according to Rule 68.7.3C. Use the results of the test and Table 68-H to diagnose a faulty EOT unit so it can be returned to the shop for repair.

EOT Unit Troubleshooting Chart

Symptom	Probable Causes	Remedies
1. EOT does not turn on when TEST is pressed (see Rule 68.7.3C).	a. Faulty battery	Change battery.
	b. Battery not installed	Install battery.
	c. EOT not jumpered	Consult option numbers on the label and refer to the ordering information.
2. EOT does not turn on when air is applied.	a. Faulty battery	Change battery.
	b. Battery not installed	Install battery.
	c. Air hose clogged	Try to clear the air hose.
	d. Faulty pressure limit switch	Replace the EOT.
	e. Blown fuse	Replace unit.

EOT Unit Troubleshooting Chart		
Symptom	**Probable Causes**	**Remedies**
3. Display shows more than pressure reading when TEST is pressed.	a. [085 W] (Weak Battery)	Replace battery.
	b. [085 F] (Failing Battery)	Replace battery immediately.
	c. [085 A] (Battery Abort)	Replace battery immediately.
	d. [VSWR] (Faulty Antenna)	Replace EOT antenna.
4. Incorrect pressure reading when TEST is pressed.	a. Are you sure? This device is more accurate than most gauges.	—
	b. EOT needs calibrating	Calibrate the EOT.
	c. Air hose clogged	Try to clear the air hose.
	d. Angle cock not open properly	Open angle cock.
5. EOT reports are not received by LCU.	a. EOT is not turned on	Press TEST or apply air, then try again.
	b. Low battery	Press TEST and check display; see symptom 3 above.
	c. Incorrect installation	Make sure the EOT is installed with the handle at the top.
	d. Incorrect thumbwheel setting	Set LCU thumbwheels to the EOT unit's ID number.

EOT Unit Troubleshooting Chart		
Symptom	**Probable Causes**	**Remedies**
5. EOT reports are not received by LCU (continued).	e. Faulty LCU or LCU antenna	Repair or replace.
	f. Interference on radio channel	Try again.
	g. Nearby metal structures or trains are affecting radio path. Possible only on very long trains.	—
	h. Faulty EOT antenna	Check if EOT handle is broken. If it is, replace the EOT.

Table 68-H. EOT Unit Troubleshooting Chart.

68.9.2 Troubleshooting the LCU

Use Table 68-I to diagnose and correct problems with the LCU.

LCU Troubleshooting Chart		
Symptom	**Probable Causes**	**Remedies**
1. LCU does not turn on (see Rule 68.8.6).	a. Power source turned off	Turn the switch on.
	b. Power cable unplugged	Plug in the power cable.
	c. Display cable unplugged	Plug in the display cable.
	d. Incorrect power source (for example, 72 volts DC)	Check if a fuse inside the LCU has blown. If so, replace the fuse.

LCU Troubleshooting Chart		
Symptom	**Probable Causes**	**Remedies**
2. LCU beeps for 5 seconds.	a. Display cable plugged into wrong connector	Plug the display cable into the correct connector.
3. [NO DATA] message	a. Faulty display cable	—
	b. Connectors not plugged in completely	—
4. [SERVICE] message	a. Faulty RDU or LCU (not CDU)	—
5. [NO COM] message	a. Thumbwheel setting is incorrect	Set LCU thumbwheels to the EOT unit's ID number.
	b. Front or rear of train in tunnel	Normal display will resume upon exit from tunnel.
	c. Train has separated; EOT out of range	—
6. [NO AIR] message	a. Possible vandalism	Someone may have closed the air cock ahead of the last car and opened the air cock on the last car.
7. No reports from EOT (display shows all segments of all digits on)	a. Incorrect thumbwheel setting	Set LCU thumbwheels to the EOT unit's ID number.
	b. LCU antenna not plugged in	Plug in LCU antenna cable.
	c. Interference on radio channel	Try again.
	d. Faulty EOT	—

LCU Troubleshooting Chart		
Symptom	**Probable Causes**	**Remedies**
8. Incorrect pressure display	a. Air cock closed	Open air cock.
	b. Pinched air line	Straighten air line.
	c. Incorrect thumbwheel setting. You are monitoring another train's EOT unit!	Set LCU thumbwheels to your EOT unit's ID number.
	d. Marginal radio signal from interference, tunnels, metal structures, etc.	—
9. Pressure display far too high	a. Internal jumper not cut. The display is showing kilopascals, not psi.	Have LCU serviced.
10. Incorrect odometer display	a. Odometer cable not plugged in	Plug in odometer cable.
	b. Odometer not calibrated	Calibrate the odometer over a measured mile (see Rule 68.8.3(C)).
	c. Locomotive is cabled incorrectly.	Make sure the locomotive has the correct cables for the type of axle generator (20 or 60 pulses per wheel revolution).
11. W or F appears on left side of display	a. EOT battery weak or failing	Replace EOT battery.

Table 68-I. LCU Troubleshooting Chart.

GLOSSARY

Accelerometer

An instrument that displays the rate of speed increase or decrease in MPH per minute.

Activate Dynamic Brake

The process of going from power to dynamic braking. After moving the throttle to IDLE, pause 10 seconds before moving the brake handle to SET UP or the selector level to BRAKING.

Actuate

Action required to release locomotive brakes during an automatic brake application.

Adhesion

The coefficient of friction between the wheel and the rail of a car or locomotive. Adhesion indicates the amount of rotating force the wheel can place on the rail before wheel slip occurs during acceleration or deceleration.

Air Flow Indicator

An instrument that measures the air flow through the automatic brake valve to the brake pipe.

Alertness Device

A device that initiates a penalty brake application when the engineer does not maintain the required frequency of movement.

Alignment Control Couplers

Specially equipped couplers that limit lateral movement and reduce lateral forces on the track. These couplers minimize rail turnover, wheel climb, and jackknifing.

Amp Meter

The instrument that indicates how much current is flowing through the locomotive's DC traction motors. Current is measured in amps and decreases as locomotive speed increases.

Angle Cock

A device used to open and close the brake pipe on the ends of locomotives and cars. To open, move the handle in line with the brake pipe. To close, move the handle at a right angle to the brake pipe.

Articulated Car

A car constructed by permanently connecting two or more platforms with an articulated joint (two platforms share a common truck).

Automatic Air Brake System

The piping, reservoirs, and valves that operate the air brake system on locomotives and cars. Reducing brake pipe pressure at a service or emergency rate automatically applies the brakes. Increasing brake pipe pressure above auxiliary reservoir pressure releases the brakes.

Automatic Brake Valve

A device that controls the flow of main reservoir air into the equalizing reservoir and brake pipe to charge and release brakes. The automatic brake valve also reduces equalizing reservoir and brake pipe pressure at a service or emergency rate.

Automatic Brake Valve Cutout Valve

A device used to cut the automatic brake in or out.

Auxiliary Reservoir

A storage volume for compressed air on locomotives and cars. It is charged from the brake pipe and provides air pressure for service and emergency brake applications.

"B" End (of car)

The end where the hand brake is located, unless otherwise identified.

Back-Up Valve or Hose

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

Bleed

Venting air pressure to the atmosphere.

Blended Braking

Using automatically controlled mixed air and dynamic braking at the same time to provide a retarding force on cars and locomotives.

Brake Cylinder Release Valve (bleed valve)

The valve that initially bleeds brake cylinder pressure. If held open, it will bleed auxiliary and emergency reservoir pressures.

Brake Pipe

The pipe, angle cocks, hose, and hose couplings that distribute compressed air throughout the automatic brake system.

Brake Pipe Gradient

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

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

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

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

Branch Pipe Cutout Cock

A device on locomotives and cars that isolates the control valve from the brake pipe.

Break-In-Two

Any unplanned train separation.

Buff Force

Compressive coupler forces that occur during a slack bunched condition.

CDU

Continuous display unit; part of the Glenayre Digitair end-of-train telemetry device.

Check Valve

A valve that allows air flow in one direction only.

Coefficient of Friction

The ratio between the braking force caused by brake cylinder pressure and the resulting retarding force of the brake shoe at the wheel.

Computer Controlled Brake (CCB)

A computer-based electro-pneumatic system that controls air brakes on locomotives and cars.

Control Car

A commuter car equipped with a control compartment to operate a train while being pushed by a locomotive.

Control Valve

The valve on locomotives and cars that charges reservoirs and applies or releases brake cylinder pressure in response to changes in brake pipe pressure.

Cutout Cock or Valve

A device used to cut in or cut out certain air brake functions. To open (cut in), move the handle at a right angle to the pipe. To close (cut out), move the handle in line with the pipe.

Cycle Braking

The process of applying, releasing, and reapplying train brakes to control speed without completely recharging the train brake system.

Dead Engine Device

A device near the locomotive control valve used when a locomotive unit is handled dead-in-train (hauled like a car). When the dead engine cutout cock is opened, the No. 2 main reservoir is charged from the brake pipe to operate the engine brakes.

Dead-In-Train

Hauling locomotive(s) in a train without the MU air hoses coupled and cut in.

Draft Force

Pulling force (tension) on couplers and draft gear during a slack stretched condition.

Draft Gear

A cushioning device that transmits draft or buff forces between coupler and car or locomotive frame.

Drawbar Forces

The longitudinal forces at the couplers between cars or locomotives. The forces may be draft or buff, depending on train operation.

Dynamic Brake

The system that electronically converts energy created by the momentum of a moving locomotive into an effective retarding brake.

Emergency Application

A reduction in brake pipe pressure at a rate sufficient to cause control valves to move to the emergency position.

Emergency Brake Valve

The valve used to initiate an emergency brake application. It is found on locomotives, cabooses, passenger cars, and some work equipment.

Emergency Reservoir

A storage volume on cars for compressed air. This reservoir is charged from the brake pipe and provides air pressure for emergency brake applications and certain recharge features.

End-Of-Train (EOT) Telemetry Device

A system of components that determines the rear car brake pipe pressure and transmits that information to the display on the locomotive cab unit (LCU).

Equalizing Reservoir

A small reference volume on locomotives used to make service brake applications.

Foundation Brake Gear

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

Full Service Application

A service reduction of brake pipe pressure that equalizes the pressure between the brake cylinder and the auxiliary reservoir.

Grade

The slope of railway track measured by the number of feet of rise or fall in 100 feet of horizontal distance. One foot of rise or fall in 100 feet of horizontal distance equals a 1.0 percent grade. Grade designations include the following:

Light Grade: Less than 1.0 percent

Heavy Grade: 1.0 percent to 1.8 percent

Mountain Grade: 1.8 percent or greater

Cresting Grade: A long ascending grade that changes with enough magnitude to require a change in train handling procedures

Gradient

See "Brake Pipe Gradient."

Graduated Release

A feature in locomotive and passenger brake equipment that allows brake cylinder pressure to be reduced in steps proportional to the increase in brake pipe pressure. This feature allows the operator to reduce the braking effort on passenger equipment without releasing and reapplying the automatic brake.

Hand Brake

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

Harmonic Rocking

The excessive lateral rocking of cars and/or locomotives that may result in wheel lift. Harmonic rocking usually occurs at speeds between 13 and 21 MPH on jointed rail.

Hauled-In-Tow

See "Dead-in-Train."

Head End Power (HEP)

The system on a locomotive that supplies electrical power to a train for air conditioning, heat, light, etc. HEP includes the following power sources:

Normal HEP: The head-end power alternator supplies 480 VAC (volts AC) to the train.

Shore Power: Any external (nonlocomotive) source that supplies 480 VAC to the train.

Standby HEP: The main alternator supplies 480 VAC to the train.

Helper

One or more manned locomotives added to a train to assist movement.

In-Train Forces

Any force occurring within a train. Examples include buff, draft, run-in, and run-out. Excessive in-train forces may result in break-in-two, jackknifing, stringlining, damage to lading, etc.

Independent Brake

A device used to operate the air brakes on a locomotive independent of the automatic brakes.

Independent Pressure Switch (IPS)

A device on a locomotive that cancels the extended range portion of dynamic braking or all dynamic braking when enough independent brake cylinder pressure is applied. This switch prevents the locomotive wheels from sliding because of excessive braking.

Integrated Cab Electronics (ICE)

The feature that uses computer-controlled display screens to integrate the control stand functions with the operator-controlled electronics.

Jackknifing

When the center sill between two rail vehicles is excessively misaligned, or the coupler is angled sharply. Usually caused by excessive buff forces.

Load Indicating Meter

The amp meter or tractive effort meter that measures force generated by traction motors.

Locomotive

A unit or combination of units propelled by any form of energy and operated from a single control.

Light Locomotive: A locomotive operating without cars.

Locomotive Consist: One or more units with multiple unit (MU) connectors coupled, cut in, and operated from a single control.

Locomotive Cab Unit (LCU)

A telemetry transmitter/receiver that provides the locomotive engineer with the displays and controls needed to monitor and operate the associated EOT device.

L/V Ratio

The ratio of lateral force (a wheel trying to climb the rail) to the vertical force (weight of a car or locomotive and its load). Excessive L/V can contribute to rail turnover, wheel climb, and derailments.

Main Reservoir

A reservoir on a locomotive that stores, cools, and dries the supply of compressed air.

Minimum Reduction

A 5 to 7 psi service brake pipe reduction. It takes advantage of "quick service" and minimizes in-train forces caused by the serial action of a brake application.

MU-2A Valve

A device used to cut the independent brake valve in or out.

Multiple Unit (MU) Connections

The hoses and cocks at both ends of locomotives that connect air brake equipment in a locomotive consist, allowing operation from a single control. MU connections include:

Actuating (ACT): When charged with main reservoir air, causes a release of an automatic brake application on locomotives.

Independent Application and Release (IAR): Controls independent brakes on locomotives from a single control.

Main Reservoir (MR): Equalizes the main reservoir pressure between locomotives.

Brake Pipe: The pipe, angle cocks, hose, and hose couplings that distribute compressed air throughout the automatic brake system.

Overcharge

When brake equipment on cars or locomotives is charged to a pressure higher than the regulating valve setting.

Over-Reduction

A service brake pipe reduction to a pressure lower than a full service application.

Penalty Brake Application

An automatic brake application at a service rate caused by a safety control device (electronic alertness device [alertor], overspeed, or foot pedal).

Planned Braking

The braking process that occurs when the engineer has enough time and distance to slow, control, or stop the train in the safest and most efficient manner.

Powered Axles

Axles driven by a traction motor.

Pressure Maintaining Braking

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

Pressure Maintaining Feature

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

Propagation

The serial action of a brake application from car to car through a train.

Quick Service

The local venting of brake pipe pressure at each car. This venting occurs every time the control valve on a car moves from the release position to the service position.

Radial Truck

A steerable truck with axles mechanically coupled through steering linkage. Axles deflect a few degrees within the truck.

RDU

Receiver display unit; part of the Glenayre Digitair end-of-train telemetry device.

Reduction (of the brake pipe)

A decrease of brake pipe pressure at a rate and amount sufficient to initiate an automatic brake application or increase it.

Reduction Relay Valve

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

Regulating Valve

At the automatic brake valve, a device that controls the maximum pressure put into the equalizing reservoir and brake pipe. The air controlled is supplied by the locomotive main reservoir and delivered to the automatic brake system.

Run-In

The rapid change of the train's coupler slack to buff (compressed).

Run-Out

The rapid change of a train's coupler slack to draft (stretched).

Running Release

The release of an automatic brake application while the train is moving.

Safety Control Devices

A variety of devices including event recorders, alertors, deadman controls, automatic cab signals, cab signal whistles, automatic train stop equipment, and automatic train control equipment.

Sag

A descending grade followed by a level, nearly level, or ascending grade. These combinations of changes in grade require adjustments in train handling to control slack.

Service Brake Application

A reduction of brake pipe pressure at a controlled rate that causes the control valve to move to a service position and apply the brakes.

Slack Action

Movement of part of a coupled train at a speed different from another part of the same train.

Slug

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

Split Reduction

The preferred method of applying train brakes. An initial 5 to 7 psi brake pipe reduction followed by additional reductions in 2 to 3 psi increments spaced 30 seconds apart. This method reduces in-train forces.

Stretch Braking

Slowing or stopping a train using the automatic air brakes and enough power to maintain a slack-stretched condition.

Stringlining

The result of excessive draft forces in a train negotiating a curve. Causes wheel climb, track damage, or derailment.

Thermal Cracks (in wheels)

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

Throttle Modulation

Adjusting the throttle one notch at a time to control train speed and in-train forces without applying air brakes.

Tons Per Operative Brake

The measurement calculated by dividing the gross trailing tonnage of a train (not including the locomotive) by the total number of cars with operative air brakes. Each platform of multi-platform cars equals one car.

Tractive Effort

The force exerted by a locomotive on the track to move a train. Tractive effort is measured in pounds and decreases as locomotive speed increases.

Tractive Effort Meter

The device that indicates the tractive effort being produced by a locomotive with AC traction motors. It reads as a percentage of rated tractive effort or a display showing pounds of tractive effort.

Two-Compartment Reservoir

A component on cars that contains both the auxiliary and emergency reservoirs.

Undesired Emergency (UDE)

An undesired emergency application of a train's air brake system. (Also known as "dynamiter" or "kicker.")

Yard Test Plant

A supply of compressed air in a train yard used to charge and test trains.

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