TC 55-88-1

Rail Handbook for Air Brake and Train Handling Rules

MARCH 2008

HEADQUARTERS
DEPARTMENT OF THE ARMY

Training Circular
No. 55-88-1

HEADQUARTERS
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Washington, D.C., 26 March 2008

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PREFACE

This handbook provides rules on air brake and train handling (ABTH) for train crew members conducting rail operations on continental United States (CONUS) Department of Defense (DOD) installations.

The proponent of this publication is Headquarters (HQ), United States Army Training and Doctrine Command (TRADOC). Submit comments and recommendations on DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to: Department of the Army, Training Directorate, Move Division, ATTN: ATCL-TDM, 401 First Street, Fort Lee, VA 23801-1511.

CHAPTER 1

RULES FOR INSPECTION, TESTING, AND MOVEMENT OF LOCOMOTIVES

Rule 1-1. TAKING CHARGE OF LOCOMOTIVE. Inspectors are jointly responsible with engineers for the condition of air brake equipment on the locomotive to the extent that it is possible to detect defective equipment by required inspections and tests. When an engineer takes charge of a locomotive someplace other than a crew change location, the below must be known before each trip or day's work and before the locomotive is moved:

- Brakes are in safe and suitable condition of service.
- Air hoses are properly connected.
- Jumper cables are properly positioned.
- Safety chains and walkway platforms are properly placed.
- Doors and windows on trailing locomotive units are closed.
- Brake valves and electrical switches on all locomotive units are properly positioned for multiple unit operation (see Chart 1-A and Chart 1-B, page 1-4 and page 1-5).

- Air gauges are registering correctly and the main reservoir pressure gauges indicates a minimum pressure for each of the following:

  - 120 psi for freight.
  - 125 psi for passenger service.

- The cooling system and the engine governor sight glasses indicate proper fluid levels.
- Speed indicator and alerter (if equipped) are working and sealed.
- Headlights, bell, and horn are in working order.
- Condensation has been drained from the air brake system and automatic drain valves are functioning properly.
- A Standing Locomotive Air Test (see Rule 1-2) must be performed when mechanical forces are not on duty, an engineer takes charge of a locomotive at the beginning of a workday, or when a locomotive has been shut down.

- Hand brakes are released on all locomotive units in the consist.
- If a locomotive is dispatched with a non-functioning dynamic brake, a written notice must be placed on the engineer's control stand in the controlling cab stating the dynamic brake is cut out on the unit(s) involved. Dynamic brake cutout switches must be properly tagged.

Locomotive units which are required to be shut down at outside locations where there are no mechanical employees available will be started by the engineer. An engine that has been shut down for more than eight hours must be pre-lubed before turnover. If the engine is equipped with flash cock "T" handles, the flash cocks must be opened. The engine must also be turned over at least one revolution and the flash cock closed prior to starting. In cases of rain, severe snow conditions, or when ambient temperature is below 32 degrees Fahrenheit and the engine has been shut down for at least 4 hours, the engineer will conduct the same operation as described above.

Chart 1-A. Multiple Unit Operation

Location of Unit in Service	Control Levers			Switches and Breakers					
	Throttle Position	Selector or Dynamic Brake Lever Position	Reverser Position	Engine Run Switch	Generator Field Switch	Control and Fuel Pump	Dynamic Brake Cutout (if equipped)	Dynamic Brake Control Circuit Breaker (if equipped)	Warning Device Circuit Breaker
Controlling Unit	Idle	Off	Center until ready	On	Off	On	On	On	On
Manned Controlling Unit	Idle	Off	Center until ready	On	Off	On	On	On	On
Trailing Unit	Idle	Off	Center until ready	On/Off	Off	On/Off	On/Off	On/Off	Off

Chart 1-B. Multiple Units

Location of Unit in Service	Automatic Brake Valve		Independent Brake Valve	
	Brake Valve Handle Position	Brake Valve Cutout Cock Position	Brake Valve Handle Position	Brake Valve Cutout Cock Position
Controlling Unit	24RL Running 26C Release 30A - CDW	Cut In	Applied or Released	Cut In
Manned Controlling Unit if locomotive located in position other than head end	24RL Running 26C Release 30A - CDW	Cut Out	Applied or Released	Cut In
Trailing Unit	Removed (if removable)	Cut Out	Released	Cut Out

Rule 1-2. STANDING LOCOMOTIVE AIR TEST. It must be known that this air test has been performed when:

- Locomotive is started.
- Taking charge of a locomotive.
- Units other than the rear locomotive unit are set out.
- The locomotive unit is picked up.
- The locomotive is to be operated beyond the terminal.
- Work has been performed on the locomotive air brake equipment.
- The locomotive consist is rearranged.
- Locomotives are placed in multiple-unit (MU) operation.

a. **Standing Locomotive Air Test.** When a test is required, perform the following tasks:

(1) Sufficient hand brakes must be applied if necessary to prevent movement with the air brakes released.

(2) An employee must be positioned on the ground near the locomotive to signal the employee performing the test when the brakes apply and release on each locomotive unit.

(3) Brakes apply and release using the independent brake.

(4) Brakes apply from an automatic brake pipe reduction.

(5) Depress the independent brake valve handle and see that brakes release.

(6) Cut out the automatic brake valve and check the brake pipe leakage for 1 minute. Leakage must not exceed 5 psi.

(7) With Generator Field switch in OFF position and reverser in NEUTRAL, advance throttle to 3. Initiate EMERGENCY application and observe the following:

- Pneumatic Control Switch (PCS) light illuminates.
- Brake cylinder pressure rises.
- Brake pipe pressure falls to 0 psi.

- Engine reduces to idle.
- After 45 to 60 seconds, place automatic brake handle in release and recover.

b. **Locomotive Apply and Release Test.** When a locomotive consist is made up, locomotives are added or removed from an existing consist, or when changing ends, an application and release test of the locomotive brakes must be made in the following order.

(1) Ensure brake pipe is set to the prescribed pressure.

(2) Apply independent brake fully and observe brakes apply on each locomotive.

(3) Release independent brake and observe brakes release on each locomotive.

(4) With equipment fully charged, make a 10 psi brake pipe reduction and observe brakes apply on each locomotive.

(5) Actuate and observe brakes release on each locomotive.

(6) Reduce brake pipe pressure an additional 10 psi and observe brakes apply on each locomotive.

(7) Release automatic brake and observe brakes release on each locomotive.

c. **Hybrid Locomotive Air Brake Test (GG20B – Green Goat).** The GG20B (Green Goat) does not employ a standard engine that rotates a generator as its standard power for the traction motors and does not have an engine to idle and unload. Therefore the following operation will be undertaken to test the air brake system.

(1) Sufficient hand brakes must be applied if necessary to prevent movement with the air brakes released.

(2) An employee must be positioned on the ground near the locomotive to signal the employee performing the test when the brakes apply and release on each locomotive unit.

(3) Independent is fully released.

(4) Isolation switch is RUN.

(5) Reverser in forward.

(6) Throttle in Position 1.

(7) Automatic to EMERGENCY.

(8) Observe the following:

- Computer screen shows PENALTY and PCS. Wait 60 seconds.
- Place automatic brake valve in CONTINUOUS. Bell should stop.
- Computer screen should read DRIVE INACTIVATED.
- Press and hold EMERGENCY STOP RESET.
- Move reverser to center and throttle to IDLE.
- Observe computer to read CENTER.

Rule 1-3. LIGHT LOCOMOTIVE RUNNING AIR TEST. The engineer must perform this air test when the following takes place:

- Taking charge of the locomotive consist originally made up and tested by anyone other than the assigned engineer.
- The controlling ends have been changed.

EXCEPTION: A Standing Locomotive Air Test (see Rule 1-2), if performed by the assigned engineer, may be made instead of a running air test.

Perform the following tasks when a test is required:

- Release the independent brake and open the throttle sufficiently to cause the locomotive to move.
- Close the throttle. The locomotive should roll freely. If it does not, check for the cause and correct it.
- Apply and release the independent brake while the speed is slow. A speed reduction indicates that the brakes have been applied.

- With the independent brake released, make a light automatic brake pipe pressure reduction. A speed reduction indicates that brakes have been applied.
- Depress and hold the independent brake valve in RELEASE position. Ensure the brake cylinder pressure reduces to zero. The locomotive should roll freely. If it does not, check for crossed or open actuating hose.

When defects or malfunctions are noted or when the consist has been improperly made up, the engineer must report the condition to the following:

- The mechanical personnel.
- The supervisor.
- On FRA Form 6180-49A (Locomotive Inspection and Repair Record).

Rule 1-4. LOCOMOTIVE DAILY INSPECTION REQUIREMENTS.

a. **Supply of Forms.** Engineers must keep on hand a supply of DD Form 862 (Daily Inspection Worksheet for Diesel-Electric Locomotives and Locomotive Cranes).

b. **When Inspection is Required.** Each locomotive in service must be inspected daily. Determine whether the locomotive needs to be inspected by checking FRA Form 6180-49A located in the cab of the locomotive unit.

c. **Record of Previous Inspection.** If the DD Form 862 indicates that the locomotive unit was inspected the previous day, complete the current day inspection prior to 11:59 PM to allow the unit to remain in service, using the following criteria:

- If your tour of duty will go beyond 11:59 PM, you must perform the inspection prior to 11:59 PM.
- Contact the train dispatcher, yardmaster, or other proper authority to determine the location for completing the daily inspection.

d. **No Record of Previous Inspection.** If the record card indicates that the locomotive was not inspected the previous calendar day or there is no record on a locomotive unit, inspect the locomotive unit(s) before placing it in service on the current day.

e. **Locomotive Unit Picked Up On Line.** When picking up a locomotive unit on line, the engineer must determine if a daily inspection is needed. After making the pick up, if working trailing units have an earlier date than the lead unit, tag the lead unit "Trailing units due inspection by 11:59 PM (current date)."

f. **Inspection Requirements – Control Compartment.** The following conditions must exist on the controlling locomotive unit:

- Each air gauge registers correctly and within 3 psi of required pressure.
- The main reservoir pressure is between 130 to 140 psi.
- The brake pipe pressure is: Freight – 90 psi.
- The independent brake cylinder pressure is that specified on the badge plate; or, if there is no badge plate, it is 30 psi or greater when the independent brake is fully applied.
- Headlight functions properly. A minimum of one headlight beam must be on each end of the locomotive unit.
- Horn functions properly.
- Bell functions properly.
- Gauge lights and overhead cab lights function properly.
- Speed indicator functions properly.
- Alerter, if equipped, functions properly.
- Windows provide a clear view.

g. **Inspection Requirements – Cab, Walkway, and Engine Compartment.** The following conditions must exist on all locomotive units:

- The cab is free of stumbling, slipping, or tripping hazards.
- No traction motors are cut out.
- Sanders are functioning properly.
- Walkways and walk-in compartments are clear of debris, tools, and accumulated oil or grease.
- Handrails, handholds, steps, ladders, safety chains, and guards are secured and ready for service. Inspect for broken, bent, damaged, or loose equipment. Safety chains should be connected high enough for safe passage.
- All electrical and rotating equipment guards are in place.
- The hand brake is operational.
- Walkway and engine compartment lights are working.

h. **Inspection Requirements – Ground Level.** Set the hand brake, if necessary, inspect the exposed areas for apparent defects (but do not crawl under or between locomotives to make the visual inspection) and walk around both sides of the locomotive to ensure the following:

- Sand has been deposited on the rail in the proper location.
- No fuel leak exists.
- No defects (such as cracks and broken or missing parts) exist on locomotive trucks, wheels, gear cases, or draft gears.
- The brake cylinder piston travel is adjusted as follows:
  - Minimum – Sufficient to provide brake shoe clearance when the brakes are released.
  - Maximum – 1 ½ inches less than the travel entered on FRA Form 6180-49A.

- The foundation brake rigging is secured.
- The brake shoes are secured and approximately in line with the tread of the wheel. Make sure there are no obvious lips or overhangs on the shoe.
- No part of the electrical cable is lying on the coupler.
- Electrical cables that are not being used are stowed or the disconnected ends are placed into a dummy receptacle or a multi-unit cable holder.
- The air hoses are usable.
- Manually drain oil and water from main reservoirs that are not equipped with automatic drains. If equipped with automatic drains, ensure the valve handles are then turned fully "counter-clockwise" to the AUTOMATIC position, with the stem extending beyond the valve handle.

i. **Completing DD Form 862.** If the defect or problem is not a non-complying condition, the engineer must report the defects or problems of all locomotive units on a single DD Form 862. Leave the completed form with the locomotive unless otherwise instructed. A DD Form 862 must be completed with the following inspections information (as a minimum):

- Date.
- Location.
- Time.
- Complying or non-complying (check appropriate box).
- Inspector's legible signature.

The engineer must verbally report any of the following conditions to the train dispatcher, yardmaster, or other proper authority:

- Defects or problems.
- Any non-complying condition(s).

Complete the Inspection Report Card on each locomotive unit.

j. **Non-Complying Conditions.** During the locomotive daily inspection, if the employee finds one or more non-complying conditions, the employee must determine if the locomotive is safe to move. If safe to move, the non-functioning alerter or the speed indicator may remain in trailing unit. If other conditions exist and the locomotive is safe to move, it may be moved only under one of the following conditions:

- As a single unit under power, not attached to cars.
- In a consist, not attached to cars.
- Isolated or shut down when attached to cars.

A non-complying locomotive unit required to be isolated or shut down in consist may not continue as the controlling or lead unit of a locomotive consist.

Rule 1-5. NON-COMPLYING TAGGING REQUIREMENTS.

a. **If Safe to Move.** A non-complying locomotive tag must be completed and attached to the Isolation switch of the non-complying locomotive unit. The tag must include the following information:

- The words “Non-Complying Locomotive” on the tag.
- Locomotive unit initials and numbers.
- Name of the inspecting railroad.
- Inspection location and date.
- Nature of the defect.
- Movement restrictions, if any.
- Destination.
- Signature of the employee making the inspection.

Secure a copy of the tag on the control console of the controlling locomotive unit. The engineer in charge of the locomotive unit must receive written notification of the non-complying locomotive unit. A copy of a non-complying locomotive tag meets this requirement. The engineer must inform all other crew members of the non-complying locomotive unit and of any restrictions.

b. **If Not Safe to Move.** If the employee determines the locomotive unit is not safe to move, notify the train dispatcher, yardmaster, or other proper authority. Also complete a non-complying tag and attach it to the Isolation switch of the non-complying locomotive unit. The tag must include:

- The words "Non-Complying Locomotive" on the tag.
- Locomotive unit initials and number.
- Name of the inspecting railroad.
- Nature of the defect.
- Signature of the employee making the inspection.

Rule 1-6. NON-COMPLYING CONDITION EN ROUTE. A locomotive unit that develops a non-complying condition en route may continue operating if the engineer or other qualified employee determines it is safe to move and completes the requirements outlined in Rule 1-5. The locomotive unit may then be operated until the next daily inspection is required or until it reaches the nearest point where repairs can be made, whichever occurs first. The engineer must do the following:

- Report any non-complying conditions on FRA Form 6180-49A.
- Leave the completed FRA Form 6180-49A with the non-complying locomotive unit unless otherwise instructed.
- Report non-complying conditions to the train dispatcher, yardmaster, or supervisor as soon as possible.
- Notify, when possible, the relieving engineer of any non-complying conditions.

Rule 1-7. MOVEMENT OF LOCOMOTIVE WITHIN LOCOMOTIVE SERVICING TRACK AREA. Before moving locomotive units on servicing tracks, inspection must be made to determine that all personnel are in a safe position and clear for movement. It must be known that all service hoses, cables, and other devices are disconnected from the locomotive units and clear of the track before moving.

a. **Air Brakes Operate.** The employee in charge of the locomotive consist must know that air brakes operate properly before moving the locomotive. The following must be known:

- Brakes on each locomotive unit of a multiple unit consist can be applied and released with both the independent and automatic brake valves in the control cab.
- Brake cylinder pistons and shoes move properly. The brake cylinder air gauge may indicate air pressure changes even though the brake is disabled by the cutout cock located at the truck.

b. **Coupling.** When coupling locomotive units, check to see that brakes are applied and/or hand brake is applied before coupling is made. After coupling, stretch to test the coupling on each locomotive unit as it is added to see that the knuckle is in the LOCKED position.

c. **Uncoupling.** When uncoupling from other locomotive units, sufficient hand brakes must be applied on units left standing.

d. **Wheel Blocking.** Where chocks, chains, or skates are used, see that they are removed before moving.

e. **Dead Engine.** Within the shop area, dead locomotive units may be moved under the direction of the mechanical foreman without cutting in the dead engine feature. However, there must be an employee at the hand brake and the brake is applied until the coupling is made and tested. The hand brake must be applied before the dead locomotive unit is uncoupled.

f. **Safety Stop Within the Shop.** When moving locomotive units into the diesel shop, a stop must be made before entering and shop doors must be opened and properly secured. An engineer must sound a proper whistle/bell signal before entering the diesel shop. Movement may proceed if the shop track is clear and personnel are in a safe position. A safety stop must be made approximately 15 feet before reaching the end of the stall. Complete the move to the end of the stall at a speed of not more than 1 MPH. The locomotive unit must be secured by the hand brake.

g. **Operation Beyond the Terminal.** Locomotive units that will operate beyond the terminal must have a brake pipe and MU air hoses properly connected between all units of the consist and cutout cocks. Angle cocks must be opened as required. A Standing Locomotive Air Test (see Rule 1-2) must be performed.

h. **Operation Within the Terminal.** Locomotive units that will operate within a terminal, but beyond the service tracks or shop area, must have a brake pipe properly connected between all units of the locomotive consist. Cab controls must be properly positioned for movement. An application and release of the air brakes must be made using the automatic brake valve on the controlling locomotive unit. An inspection must be made to see that brakes on all locomotive units apply and release properly.

Rule 1-8. LEAVING LOCOMOTIVE UNATTENDED. Before a locomotive is left unattended, the engineer must know all of the following tasks have been performed.

a. **Leaving the Controlling Locomotive Unit.** Before leaving the controlling unit, the controls must be positioned to ensure securement as follows:

- Center the reverse level and remove the handle and place it in the proper holder, if any.
- The Control and Fuel Pump switch and the Engine Run switch should be turned ON if the unit will remain running.

- The Generator Field switch should be OFF.
- Fully apply the independent brake.
- The Isolation switch should be in the START/STOP/ISOLATE position.

b. S**ecurement – When Locomotive is Running or Shut Down.**

- After the hand brakes are applied, the independent brake and the automatic brake must be released to ensure locomotive unit(s) will not move. The independent brake must then be fully applied and the automatic brake must be released if the locomotive is not coupled to cars. When the locomotive is coupled to cars with the air brake system charged, a sufficient automatic brake pipe pressure reduction must be made.
- The lead truck of the lead locomotive unit in descending direction must be chocked with suitable blocking material.
- Cab doors and windows must be locked on the controlling locomotive unit.

c. **Mechanical Employees Not On Duty.** When a locomotive is to be left at a location where the mechanical personnel service employees are not on duty, in addition to tasks listed in Rule 1-8 a and b, the following tasks must be performed:

- Apply hand brake on each locomotive unit.
- Cab doors and windows must be locked, if possible, on each locomotive unit.
- It must be protected from an uncontrolled movement entering the main track in a descending direction by one of the following:
  - Placed on a track with derail protection and as near as possible to the derail in the descending direction.
  - Placed on a track with a Facing Point switch lined and locked to prevent movement to the main track.
  - Placed on a track which has an ascending grade sufficient to prevent entry to the main track.

If unable to place a locomotive on a protected track, it must not be left unattended unless specifically authorized by a supervisor. When so authorized, or when hand brakes will not hold the locomotive, one of the following must be done:

- The locomotive must be coupled to a sufficient number of cars on which sufficient hand brakes are applied to prevent an uncontrolled movement.
- A wheel of the lead locomotive unit in descending direction must be placed on a rail skate.
- Any electrical cable is properly stowed or the disconnected end is placed into a dummy receptacle or multi-unit cable holder.

Rule 1-9. LOCOMOTIVE SHUTDOWN PROCEDURE. When a locomotive is to be left unattended for over 1 hour, all locomotive units are to be shut down except under the following conditions:

- When ambient temperature is below or expected to drop below 32 degrees Fahrenheit.
- During rain or snow conditions.
- When tagged for bad batteries

- When a locomotive is left coupled to a train or is left on a grade of over one percent, the controlling locomotive unit must be left idling to maintain main reservoir and train line pressure.
- When local instructions specify otherwise.

When required to shut down the engine, the controlling locomotive unit is not to be shut down until it is known that the locomotive will not move with only the hand brake applied.

a. At a locomotive service facility, the inbound engineer is to contact a mechanical personnel service track employee to determine if the locomotive is to be inspected within 1 hour. If the inspection is not to be made within 1 hour or the engineer is unable to contact the mechanical employee, the locomotive is to be shut down.

b. To conserve battery life when the locomotive is shut down, turn off all lights, heaters, and the air conditioner. On an electro-motive diesel (EMD) locomotive, units equipped with a turbocharger, do not open the Battery switch, turn off the turbo lubrication oil pump circuit breaker, or turn off the computer control circuit breaker (if equipped). Locomotives not equipped with turbocharger should have the Battery Knife switch opened.

c. If the lead locomotive of the consist has less than 200 gallons of fuel remaining, notify the train dispatcher or yardmaster of this fact before leaving the locomotive unattended. If the lead locomotive is not running, leave one trailing locomotive running when necessary to maintain an air supply on the train.

Rule 1-10. PICKING UP LOCOMOTIVE UNITS. Before picking up locomotive unit(s), ensure that they are properly secured before coupling to them. After coupling, perform the following tasks:

- Stretch the coupling.
- Install control cable(s).
- Couple brake pipe and MU hoses.
- Properly position cutout and angle cocks.
- Position end platforms and connect safety chains.
- Position cab controls and air brakes for intended service.
- Perform a Standing Locomotive Air Test (see Rule 1-2).
- Remove any wheel blocking material and release the hand brakes.

Rule 1-11. REARRANGING LOCOMOTIVE CONSIST. Before cutting away from a locomotive unit that is being switched or rearranged in the consist, perform the following tasks shown in Table 1-1.

Table 1-1. Separating Locomotive Engines in Consist

Task	Engine Running	Engine Dead
1 Cut in Control Switches	✓	
2 Fully apply independent brake	✓	
3 Close end and angle cocks	✓	✓
4 Secure safety chains and end platforms	✓	✓
5 Secure control cable or remove, if removable	✓	✓
6 Apply sufficient hand brakes before cutting away		✓

If the locomotive is to be set out and left unattended, comply with Rule 1-9.

NOTE: Before proceeding, comply with the applicable locomotive air test (see Rule 1-2 and Rule 1-3).

Rule 1-12. OPERATING FROM OTHER THAN LEADING LOCOMOTIVE UNIT. A light locomotive consist must be operated from the leading controls in the direction of movement, unless movement is less than one mile.

NOTE: A locomotive being controlled from other than the lead locomotive unit in the direction of movement must not exceed 20 MPH.

Rule 1-13. CHANGING CONTROLLING ENDS. When changing ends on a locomotive consist, the following steps must be performed, in proper sequence, without delay:

a. **Cutting Out.**

- Move independent brake handle to FULL APPLICATION position.
- Make a 20 psi brake pipe reduction.
- Cut out automatic brake valve cutout valve.
- Move automatic brake valve to continuous service.
- Move MU2A valve or double ported cutout cock to “TRAIL” or “OUT” position.
- Move the independent brake valve to the RELEASE position.
- Center the reverser lever and remove the handle, placing it in the proper holder.

- Position the Control and Fuel Pump switch, the Generator Field switch, and the Engine Run switch to their proper position (see Chart 1-A).
- Position the Headlight Control switch to the proper trailing position.

NOTE: Proceed without delay to the other end of the locomotive consist.

b. **Cutting In.**

- Position the Control and Fuel Pump switch, the Generator Field switch, and the Engine Run switch to their proper position (see Chart 1-A).
- Place the independent brake valve handle in the FULL APPLICATION position.
- Position the MU-2A valve or double ported cutout cock to “LEAD” or “IN” position.
- Move the automatic brake valve handle to the RELEASE position.

- After the equalizing reservoir pressure is above brake pipe pressure, position the automatic brake valve cutout valve in the “FREIGHT” position.
- Insert the reverse lever.
- Position the Headlight Control switch to the proper position for controlling the unit operation.
- Comply with the applicable locomotive air tests (see Rule 1-2).

Rule 1-14. LOCOMOTIVE UNIT REPLACEMENT. Locomotive units equipped with alignment control couplers being handled dead-in-train (DIT) must be coupled behind the road locomotive. Locomotive units without alignment control couplers being handled DIT must be placed not less than five cars, nor more than 15 cars, from the rear of the train. If two such units are handled in the same train, they must be separated by placing them not less than five cars between each unit. All locomotive units being handled DIT must be set up as prescribed in Rule 1-16.

Rule 1-15. ISOLATING LOCOMOTIVES. The Isolation switch must be in the RUN position on all locomotive units in the consist, except when it is necessary to isolate unit(s) due to mechanical failure. When a locomotive unit has been isolated for any reason, it must be watched closely and not permitted to remain in the locomotive consist unless it has been determined that all of its wheels rotate freely.

Rule 1-16. DEAD ENGINE SET UP REQUIREMENTS. When the dead locomotive units cannot be handled in the working locomotive consist, they must be handled DIT and controls must be positioned as follows:

- Automatic brake valve cut out.
- Independent brake valve cut out and the handle in the RELEASE position.
- Main reservoir drained.
- Dead engine feature cut in.
- End cocks of the actuating pipe and the application and release pipe must be open.
- Transition lever (if equipped) in OFF position.
- Reverse lever centered and handle removed.
- Generator Field switch in OFF position.
- Isolation switch in START/STOP/ISOLATE position.

- All other switches must be turned OFF and the main Battery Knife switch must be opened.
- Locomotive units without alignment control couplers being handled DIT must be placed not less than five cars, nor more than 15 cars, from the rear of the train. If two such locomotive units are handled in the same train, they must be separated by placing not less than five cars between each locomotive unit.
- Locomotive units with alignment control couplers being handled DIT must be coupled behind the road locomotive.

Rule 1-17. LOCOMOTIVE FLAT SPOTS.
Locomotive units having one or more flats spots that are 2 ½ inches in length or adjoining flat spots or more than 2 inches, must be set out at the first available point. Speed must not exceed 10 MPH to the set out point.

Rule 1-18. LOCOMOTIVE AMPERAGE. The loadmeter on the control console gives the following two indications.

- Traction motor current in the No. 2 traction motor, or an average of the current in all traction motors in a single unit (depending on the model year), when in power.
- Dynamic brake grid current when in the dynamic brake (if so equipped).

In the event the loadmeter becomes inoperative, the minimum continuous speed rating of the locomotive that should be maintained is approximately 10 MPH for all units when operating at full throttle. Short time rating is a term used to describe the length of time a locomotive may be operated at various high amperage levels before traction motor damage occurs. The locomotive is designed to withstand overload operation if the condition does not exceed the limits indicated on the loadmeter dial or on the load limit plate adjacent to the loadmeter. The greater the overload, the further the pointer swings over into the overload area, and the less time the locomotive can operate without the traction motors overheating. Overheating will damage the insulation and even though no failure may occur at the time, the resulting deterioration will cause subsequent failure. A plate near the loadmeter, called the short time rating plate, gives the time limits for operating locomotives at various levels of current. Do not operate a locomotive at a level of current longer than the plate indicates. Do not run the locomotive at more than

one consecutive short time rate for the maximum time at each rate.

- For example, do not run the locomotive at the ¼ hour rating for ¼ hour then the ½ hour rating for ½ hour, then the 1 hour rating for 1 hour.
- If the loadmeter reading exceeds the short time ratings indicated on the plate, then reduce the tonnage or double the train.

Short time ratings are not cumulative. When you add operations of less than 20 minutes in short time ratings together, their sum must not exceed the limit of the most restrictive zone reached by the loadmeter pointer. Operations in short time ratings 20 minutes or more apart are considered separate operations. Otherwise, the tonnage must be reduced, the train doubled or help must be obtained.

Rule 1-19. REVERSE LEVER. During normal operations, locomotive must be brought to a complete stop before moving the reverse lever.

Rule 1-20. GROUND RELAY. A protective device that functions to prevent operation of a locomotive in the event of a short circuit or ground in the electrical equipment. This is done to ensure the safety of the crew on the locomotive and to prevent damaging the locomotive itself.

a. **Manual Ground Relay Reset.** Locomotive units equipped with manual ground relay reset may be reset by pressing the reset button on the lead unit. A ground relay trip results in the following:

- Ground Relay Light will illuminate on the affected unit.
- Diesel engine will reduce to idle on the affected unit.
- Alarm bell will ring throughout the locomotive consist.

b. **Maximum Resets Allowed.** Locomotive units equipped with a Traction Motor Cutout switch may be reset three times after which the Traction Motor Cutout switch must be used to attempt to isolate the problem traction motor. One additional reset may be attempted for each traction motor cutout position. After which, contact mechanical personnel.

c. **Automatic Ground Relay Reset.** Locomotive units equipped with an automatic ground relay reset will attempt an automatic reset after a six to ten second delay following a ground relay trip. If the ground relay trips four times within a 12-minute interval, the reset will not operate the fourth time and the unit must be isolated. If the

ground relay does not trip within the 12-minute interval, the device will start a new cycle. Repeated ground relay tripping, accompanied by unusual noises such as thumping or squealing, may indicate serious traction motor trouble and must be investigated at once.

d. **Railroad Crossings.** Reducing the throttle when passing over rail crossings at a grade allows traction motor amperage to decay to a safe level before the mechanical shock that occurs at rail crossings is transmitted to the motor brushes.

NOTE: To prevent traction motor flashover or ground relay action when operating over a rail crossing at a grade, reduce the throttle to the No. 4 position or lower it until all locomotive units have passed over the crossing.

e. **Reporting Ground Relay Action.** All ground relay action must be reported on FRA Form 6180-49A. In addition, any unit isolated because of ground relay action must be reported to the train dispatcher, yardmaster or supervisor.

Rule 1-21. OVERHEATED TRACTION MOTORS. Serious damage to electrical equipment will occur if the locomotive is allowed to stand with the throttle open. This practice is prohibited. Overheating or seizing of traction motor armature or support bearing may result in sliding wheels. Any indication of overheated bearings should be investigated at once to determine whether the heating is the

result of electrical difficulty in the traction motor or mechanical trouble in the bearings (see Figure 1-1).

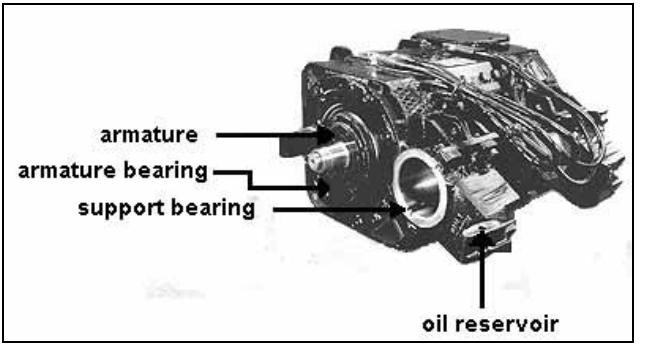

Figure 1-1. Traction Motor

Examination must include inspection of:

- Wheel hubs.
- Journals.
- Support bearings.
- Armature bearings.
- Pinion bearings.
- Gear case.
- Discoloration of gear case or area around the bearings. These are indications of excessive heat.

Wheels may overheat or slide due to brakes sticking, brake rigging binding, damaged traction motor bearings, or broken pinion or bull gear teeth. A unit with an overheated traction motor or a support bearing must be set out.

Rule 1-22. WHEEL SLIP/PINION SLIP LIGHT. When the wheel slip light flashes on and off or stays on continuously, it indicates difficulty or sliding wheels. Reduce throttle or add sand to locomotive to reduce wheel slip.

Rule 1-23. DIESEL ENGINE OVERSPEED. Diesel engine overspeed protection is provided on all locomotive units. Protection is provided by sounding an alarm bell and shutting down the diesel engine, should the diesel engine speed becomes excessive. To reset the diesel engine overspeed:

- ON the EMD unit, move the reset lever (located near the engine governor) counter clockwise until it latches.
- On the General Electric (GE) unit, push the reset button near the governor or pull and hold the lay shaft for 3 seconds.

Rule 1-24. EMD GOVERNOR LOW/HOT OIL RESET PLUNGER. The governor low/hot oil reset plunger will trip under either the following conditions:

- When the lubrication oil pressure drops to a dangerously low level.
- When the lubrication oil becomes excessively hot.

The diesel engine will shut down and the governor shutdown alarm light will come on at the engine control panel when the governor reset plunger trips. When the fault occurs:

- Isolate the unit.
- Check the air compressor lubrication oil level if the air compressor alarm light is on.
- Reset the governor reset plunger.
- Start the diesel engine and inspect the lubrication oil level and pressure (which should be between 15 and 40 psi idle).

The governor plunger also trips in conjunction with the tripping of any one of the following protective devices:

- Low water pressure.
- Crankcase overpressure detector.
- Compressor low oil pressure detector.

NOTE: The engine governor reset plunger may be reset a maximum of three times. One additional reset may be attempted for each trip that results from the action of other protective devices.

Rule 1-25. LOW WATER RESET BUTTON. The low water protective device shuts down the diesel engine when cooling water pressure is severely low. When it trips, it also causes the engine governor reset plunger to trip. When fault occurs:

- Isolate the locomotive unit.
- Check the cooling water level and for any obvious leaks.
- Reset the low water protective device.
- Reset the engine governor reset plunger.
- Start the diesel engine.

While the engine is at idle, examine the cooling system for the proper water level, obvious leaks, and proper cooling fan and/or shutter operation.

NOTE: The low water reset button may be reset a maximum of three times. The low water reset button is located on the engineer's side in the engine compartment near the layshaft.

Rule 1-26. CRANKCASE OVERPRESSURE DETECTOR. The crankcase overpressure detector device shuts down the diesel engine when gases produce a positive pressure in the crankcase, thus avoiding a possible crankcase explosion. The mechanical personnel must inspect the diesel engine and release it for service if it has shut down due to crankcase overpressure detector action.

NOTE: Do not attempt to restart a diesel engine that has been shut down due to crankcase overpressure detector action.

Rule 1-27. SAFETY CONTROL DEVICES. Safety control devices must be operative and cutout cocks or switches related to such devices must be cut in and sealed during operation of a locomotive. If one of these devices listed in this rule malfunctions, the device must be repaired or cutout by a mechanical personnel employee only, or the locomotive unit must be switched to a TRAILING position in the consist. Report malfunctions to the train dispatcher/yardmaster/ supervisor and complete a FRA Form 6180-49A.

NOTE: The use of any method to alter, lessen or defeat the purpose of a properly functioning safety control device is prohibited.

a. **Locomotive Overspeed.** The purpose of the locomotive overspeed control is to prevent serious damage to traction motor armature due to centrifugal force of the rotating armature resulting from high speeds. The gear ratio between the traction motor and the wheel governs the maximum speed at which various classes of locomotives may be operated. If the locomotive overspeed trips, a penalty brake application will occur and the PCS will open.

b. **Safety Alerter.** The alerter light and horn assembly is sealed. If the seal is found broken, a report must be made to the mechanical personnel before leaving the terminal. If the engineer is not actively engaged in controlling the locomotive after an elapsed time between 30 and 120 seconds, a horn and warning lights will come on with increasing intensity for 10 seconds. If the engineer does not take action during this time, a penalty brake application will occur and the PCS will open. To prevent a penalty brake application, one of the following actions must be taken before the warning period expires:

- Change the throttle position above No. 2.
- Depress the independent brake valve handle.
- Change the level of dynamic braking.
- Sound the locomotive whistle.
- Vary the power reduction rheostat more than 50 amperes.

- If standing, apply the locomotive brake with at least 25 psi.
- Press the alerter manual reset button.

The alerter will not function if the automatic brake valve is cut out. If the alerter is tripped, it can be reset by recovering from a penalty brake application.

Rule 1-28. DYNAMIC BRAKE WARNING LIGHT. A brake warning light is located on the control console. This light will come on whenever a dynamic brake overload condition exists on any unit in the locomotive consist. When lit, the engineer must reduce the dynamic brake current immediately to prevent possible damage to the motors and the resistor grid assembly to stay on. If the desired speed cannot be maintained with the dynamic brake alone, the automatic air brakes must be applied in conjunction with the dynamic brake. The independent air brake must be kept released to avoid sliding of the wheels. Unless otherwise provided, the locomotive must not be operated with the dynamic brake warning light lit.

Rule 1-29. DIESEL ENGINE COOLING.

WARNING: YOU MAY BE SERIOUSLY BURNED WHILE ADDING COOLING WATER TO A DIESEL ENGINE IF YOU ARE NOT CAREFUL OR IF YOU FAIL TO READ THE WATER SIGHT GLASS CORRECTLY.

a. **EMD Locomotive Units.** The cooling water is constantly circulated through the radiators. Therefore, the holding tank and radiators are always full of water. Cooling is controlled by the cooling fans running, or not running. Air conditioning contactors are controlled by engine temperature switches which turn on cooling fans and control air-actuated shutters on unit so equipped.

(1) The water level sight glass usually has two scales. The top scale measures the water level on a dead engine. The lower scale measures the water level on a running engine.

(2) Water is pumped to the air compressor for cooling and through the temperature switch manifold. Temperature sensors in the manifold respond to water temperature changes to operate the cooling fans and shutters. These fans blow fresh air through the radiators to cool the water from the diesel engine.

(3) If normal operating temperature is exceeded, a high engine temperature sensor (ETS) causes a relay to be energized which reduces the engine load and revolutions per minute, and the hot engine light will come on in the affected unit and an alarm bell will ring throughout the locomotive consist. When the engine temperature is reduced to a safe level, full power is automatically restored. On units without ETS, the hot engine light will come on in the affected unit and alarm bell will ring throughout the locomotive consist. If the engine temperature becomes high enough to

turn the water to steam, water pump cavitations can occur and the engine will shut down by the low water button.

(4) Engine temperature is indicated by a dial gauge located on the suction line near the water pumps. Most gauges are color coded and indicate cold (blue), normal (green), and hot (red).

b. **GE Locomotive Units.** GE radiators are divided into segments. As engine temperature changes, these radiator segments are filled, or emptied, to increase or decrease cooling. As the water temperature decreases, the hot water in some of the radiator segments flushes back into the water holding tank.

WARNING: IF YOU REMOVE THE WATER PRESSURE CAP ON A UNIT THAT IS HOT, YOU EXPOSE YOURSELF TO THE POSSIBILITY THAT WHEN YOU ADD COLD WATER, THE RADIATORS WILL FLUSH VERY HOT WATER BACK INTO THE HOLDING TANK AND OUT THROUGH THE FILL SPOUT. THIS ACTION IS EXTREMELY DANGEROUS TO ANYONE STANDING NEAR THE OPEN FILL SPOUT.

(1) There are two water level sight glasses: one for the deep side of the tank and one for the shallow side. The FULL AT IDLE and the LOW AT IDLE marks are on the sign glass located on the shallow tank. When the engine is hot, look at the deep tank sight glass. The badge

plate will indicate whether additional cooling water is required.

(2) Because of the filling and purging of many radiators segments, if the engine is running hot, all the radiator segments will be full of cooling water, leaving the tank at a lower level. This is normal.

CAUTION: If you need to add water to the system, use CAUTION. Allow the engine to remain at IDLE for 10 minutes before adding water. When you add cold water, the hot water in the radiator segments will rush back down into the holding tank. PROTECT YOURSELF FROM BURNS.

c. **All Locomotives.**

- Make accurate sight glass readings.
- When so equipped, use the water fill hose nozzle.
- If you remove the pressure cap on the cooling water tank, USE EXTREME CAUTION. Pressure relief valve must be used prior to removal of the cap.
- If you need to add cooling water, KNOW YOUR SYSTEM.
- When filling a GE locomotive, let the engine idle for 10 minutes before adding water. When using the water fill spout on the engineer's side of the

locomotive, be particularly careful and stand well clear of the filling spout.

CAUTION: Do not add water to a hot engine when water is not visible in the water sight glass.

Rule 1-30. EVENT RECORDERS. The use of any method to alter, lessen or defeat the purpose of an event recorder is prohibited.

CHAPTER 2

RULES FOR AIR BRAKE TESTS AND INSPECTIONS

Rule 2-1. RESPONSIBILITY FOR TRAIN INSPECTION AND TEST. Operations supervisors are jointly responsible with inspectors, enginemen and trainmen for the condition of air brake equipment on locomotives and cars to the extent that it is possible to detect defective equipment by the required inspections and tests. While air brake tests are being made, trains are under the jurisdiction of employees making such tests. Trains must not be moved until authorized to do so. It must be determined all employees are safely positioned before authority to move is granted. During air brake tests, brakes must not be applied or released until proper signal is given. Employee in charge of the air test is responsible for giving the signal to apply brakes. When necessary to work under cars in trains where accidental movement of the car being worked on could occur, sufficient hand brakes must be applied adjacent tot eh car to prevent such movement.

Rule 2-2. INSPECTION OF FREIGHT CARS. Each car placed in a train must receive the following safety inspection. Any car found with a defect that makes it unsafe for movement must be corrected or set out of train. Cars must be checked for:

- Leaning of listing to side.
- Sagging downward.
- Positioned improperly on truck.

- Object dragging below.
- Object extending from side.
- Door insecurely attached.
- Broken or missing safety appliance (handrail, ladder, or stirrup).
- Lading leaking from a placarded hazardous material car.
- Insecure coupling device.
- Overheated wheel or journal.
- Broken or extensively cracked wheel.
- Brake that fails to release.
- Any other apparent safety hazard likely to cause an accident or casualty before the train arrives at its destination.
- Retaining valve set to the (EX) EXHAUST position.

a. Open top loads, including trailers and containers on flat cars must be safely loaded.

b. Where width or height appear close to clearance lines, check that the movement has been cleared with proper authority.

c. Freight cars carrying bad order tags that are "safe for movement" may be taken in train to the nearest point where repairs can be made.

d. Inspection of placarded cars must include a visual inspection to see that trucks and journal boxes are in proper condition for service. Friction journal boxes must have a minimum level of one inch visible oil.

e. Before loaded placarded cars are accepted for movement in a train beyond a required inspection point, which includes interchanges with other railroads, an inspection must be made to ensure the cars are in a safe condition for movement. Unsafe shipments must be rejected.

Rule 2-3. COUPLING TO TRAIN AND CHARGING. After the locomotive has been coupled to the train, the couplers between the locomotive and the train (and where possible the entire train) must be stretched to see that all couplings are made. When this is known, the engineer must fully apply the locomotive brake. Before air hoses between the locomotive and the train are couple, condensation should be blown from them by slightly opening each angle cock. After coupling the brake pipe hose, the angle cock on the locomotive must be opened slowly. The angle cock handles must be locked in the OPEN position. When charging the train, if the main reservoir pressure drops below 105 psi, turn off the Generator Field switch, center the reverser handle, and advance the throttle as needed, but not higher than the No. 4 position. The main reservoir pressure must be closely observed and when the gauge indicates 120 psi, the throttle must be reduced to idle. Fuel conservation must be a consideration during this procedure. When the main reservoir air is used to charge the auxiliary or work train equipment such as derricks, plows, spreaders, pneumatic side dump or

bottom dump cars, sound judgment should be exercised in maintaining the main reservoir pressure. When standing, the dynamic braking position of the engine controls must not be used to increase the engine speed for the purpose of charging the air brake system. Over charged air brake equipment on locomotives can be corrected by one of the following methods:

- Make two or more 20 psi brake pipe pressure reductions and releases.
- Make one emergency brake application and release.

For Train Line Over-Charge, use the following procedures:

- Adjust regulating valve to desired pressure.
- Place automatic brake in Emergency for 1 minute.
- Place automatic brake valve in RELEASE position until brake pipe pressure reaches 20 psi.
- Place automatic brake valve in continuous service for 1 minute.
- Place automatic brake valve in RELEASE position.

Rule 2-4. CALIBRATED TELEMETRY SYSTEM. A calibrated telemetry system may be used to assist in the making of an air test. At a location where the telemetry system is initially installed, a calibration check must be performed. To perform a calibration check, the pressure indicated on the end of train telemetry device must be compared with the pressure displayed on the head end device. If the difference between the two readings does not exceed 3 psi, the telemetry system maybe used to make an air brake test. When making an air brake test, a calibrated telemetry system may be used to determine the following:

- Air pressure at the rear of the train.
- Brakes on the rear car of the train have been applied and released after the telemetry system has indicated a brake pipe pressure reduction of at least 5 psi followed by a pressure increase of at least 5 psi.

Rule 2-5. LEAKAGE TEST PROCEDURE. During a brake pipe leakage test, when the controlling locomotive or yard air brake testing device is equipped with a maintaining feature, this feature must be cut out during train air brake leakage tests after required brake pipe reduction has been made. When a leakage test is required, performing the following tasks in the sequence shown:

- Make a 20 psi brake pip pressure reduction.
- Wait at least 60 seconds after the brake pipe air has stopped exhausting at the automatic brake valve.
- Cut out the pressure maintaining feature by moving the automatic brake valve to the OUT position.
- Wait at least 60 seconds for the brake pipe pressure to stabilize.
- Determine the brake pipe leakage for 1 minute, making sure it does not exceed 5 psi per minute. If leakage exceeds 5 psi per minute, notify those who are inspecting the train that excessive leakage exists. Train must be inspected for leaks and leakage corrected. After leakage is corrected, leakage tests must be repeated.
- If leakage is within the allowable limits, and after receiving a proper release signal, place the automatic brake valve handle in the RELEASE or RUNNING position.

- Cut in the pressure maintaining feature by placing the brake valve cutoff valve in the FRT and PASS position, as appropriate for the service to be performed.
- Notify those who are inspecting the train that the brakes have been released.

Rule 2-6. INITIAL TERMINAL AIR TEST. This test must be performed under any one of the following conditions (see also Table 2-1):

- When the train is originally made up.
- When the train consist is changed other than by adding or removing solid blocks of cars and car air brake reservoirs remain charged.
- When the train is received in the interchange and the train consist is changed (other than by one or a combination of the following) and the car air brake reservoirs remain charged:
  - Removing or adding solid blocks of cars.
  - Changing locomotive.
  - Changing or removing caboose.

When the test is required, perform the following tests:

INSPECTION AND TEST FOR REQUIRED AIR PRESSURE. Charge the air brake system to within 15 pounds of the locomotive regulating valve setting, as indicated by a gauge or device connected to the brake pipe at the rear of the train. During the test, do not apply or release the brakes unless proper notification is received.

NOTE: Do not Actuate.

TEST LEAKAGE. When proper notification is received, perform a Leakage Test (see Rule 2-5).

INSPECTION OF BRAKE APPLICATION. Inspect the brake application to determine that:

- The angle cocks are positioned properly as should retaining valves. Check for leakage.
- Brakes are applied on each car. Any car found with inoperative brakes must have the condition corrected or the car must be set out before the train departs the initial terminal.
- The piston travel is correct. The freight car air brake piston travel must be adjusted to nominally 7 inches if the travel is less than 7 inches or more than 9 inches on body-mounted brake cylinders. Minimum brake cylinder

piston travel of truck mounted brake cylinders must be sufficient to provide proper brake shoe clearance when the brakes are released. Maximum piston travel must not exceed 9 inches on this type of equipment.

- The piston travel of the brake cylinders on the freight cars equipped with an other than standard single capacity brake, must be adjusted as indicated on the badge plate or the stenciling on the car.

    - The brake rigging does not bind or foul.
    - All parts of the brake equipment are properly secured.

- When 1) the piston travel of the body mounted brake cylinders exceeds 10 ½ inches, 2) the piston travel of the truck mounted brake cylinder exceeds 6 inches, or 3) the piston travel of the brake cylinder (of other than a standard single capacity brake) exceeds the specification on the badge plate or specification stenciled on the car, then the air brakes must be considered as being inoperative.

- Any car found with inoperative air brakes must have the condition corrected or the car must not be moved in the train.
- Inspection and test completion. When the test and inspection of the air brake application is complete and the proper notification has been received, release the brakes and:

    - Notify those inspecting the train that the brakes have been released.
    - Inspect each brake to make sure that the brakes have all been released. This inspection may be made by a roll by.

NOTIFICATION OF ENGINEER. A qualified person who participated in the test and inspection or who knows that the test was completed must notify the engineer that the Initial Terminal Air Test (see Rule 2-6) was performed satisfactorily.

Rule 2-7. TRANSFER TRAIN AND YARD TRAIN MOVEMENT AIR TEST. Transfer train and yard train movements that exceed 20 miles must have an Initial Terminal Air Test (see Rule 2-6). On transfer train and yard train movements which exceed one mile but not more than 20 miles, perform the following tasks:

- Charge the air brake system to at least 60 psi. The engineer can determine the brake pipe pressure by cutting out the automatic brake valve and noting what pressure the brake pipe pressure stabilizes (as indicated by the brake pipe pressure gauge).
- Make a 20 psi brake pipe pressure reduction.
- Visually see that the brakes apply on each car.

Rule 2-8. APPLICATION AND RELEASE AIR TEST. This test must be performed under any one of the following instructions:

- Cars are set out.
- When required by Rule 2-11 (Picking Up Cars En Route).
- Locomotive and/or caboose are changed.

- Controlling locomotive unit is changed.
- Locomotive units are picked up or set out.

When this test is required, perform the following tasks:

- Charge the air brake system to within 15 psi of the locomotive regulating valve setting, as indicated by a gauge at the rear of the train or calibrated telemetry system.
- Receive proper notification to apply the brakes.
- Make a 20 psi brake pipe pressure reduction.
- Determine that the brakes apply and release on the rear car by one of the following methods;
- Observe on a calibrated telemetry system a brake pipe reduction of at least 5 psi followed by a pressure increase of at least 5 psi.
- Visually observe the brakes on the rear car.
- Observing that the brake pipe pressure is being restored at the rear of the train.

Rule 2-9. DETACHING LOCOMOTIVE OR SEPARATING TRAIN. Complete the following tasks when detaching a locomotive or separating a train or cars that are being handled with air brakes:

- Make at least 20 psi brake pipe pressure reduction.
- The engineer must notify a crew member when the air has stopped exhausting at the automatic brake valve.
- Close the angle cock on the locomotive unit or on the rear car that will remain with the locomotive.
- Make sure that the angle cock on the detached portion of the train of cars left standing is open to allow an emergency brake application on the detached portion.

Rule 2-10. RECOUPLING LOCOMOTIVE OR CARS.

a. **Separated More Than Two Hours.** If recoupling to cars that have been separated from the locomotive for more than 2 hours, conduct an Initial Terminal Air Test (see Rule 2-6).

b. **Separated for Two Hours or Less.** After recoupling a locomotive to cars that are being handled with air brakes and have not been separated from the locomotive for more than 2 hours, perform the following tasks:

- Open the angle cocks.
- Determine that the brake pipe pressure is being restored at the rear of the train by a gauge or a calibrated telemetry system.

In the absence of a gauge or calibrated telemetry system, visually observe that the brakes apply and release on the rear car.

Rule 2-11. PICKING UP CARS EN ROUTE.

a. **Not Previously Tested.** When picking up cars that have not been previously air tested or cars, in which the air in the brake pipe has been depleted for over 2 hours, perform the following tasks:

- Charge the air brake system to 75 psi, as indicated by a gauge at the rear of the train or a calibrated telemetry system.
- Receive the proper notification to apply the brakes.
- Perform a Leakage Test (see Rule 2-5).

- Determine that the brakes apply and release on all cars picked up.
- Determine that the brakes apply and release on the rear car by one of the following methods:
  - Observe (on a calibrated telemetry system) a brake pipe reduction of at least 5 psi followed by a pressure increase of at least 5 psi.
  - Visually observe the brakes on the rear car.
- Observing that the brake pipe pressure is being restored at the rear of the train.

b. **Previously Tested.** When picking up cars that have been previously air tested and the air in the brake pipe on these cars has not been depleted over 2 hours, perform an Application and Release Air Test (see Rule 2-8). Car added to a train must be given an Initial Terminal Air Test (see Rule 2-6) at the next terminal where facilities are available for such inspection.

Rule 2-12. RUNNING AIR TEST. Before cresting a grade in anticipation of an extended descent where the air brakes may be necessary to control the speed of the train, the engineer must determine that the brake pipe pressure is being maintained at the rear of the train. If the pressure cannot be determined, the engineer must apply the train brakes with sufficient force to determine that the brakes are operating properly, the train must be stopped, and the cause of the failure must be determined and corrected.

Rule 2-13. AIR FLOW METHOD (AFM) BRAKE TEST. When testing the train air brake system using the AFM, the AFM may be performed only if the controlling locomotive of the train is equipped with the following operating equipment:

- 26L brake equipment.
- Calibrated air flow meter.
- End of train device.

When this test is required, perform the following tasks:

- Charge the brake pipe system to within 15 pounds of the regulating valve setting as indicated by an accurate gauge at the rear of the train.
- Observe the brake pipe flow indicator and note that the indicator pointer is at or to the left of the 60 CFM calibration mark.

- After receiving the proper signal, make a 20 psi brake pipe reduction. However, do not cut out brake valve cutout cock. Employees assisting in the test will observe the car(s) of the train for the application of brakes as required by the type of test being performed. After the proper signal, the engineer will release the brakes and the release will be observed as shown in Rule 2-5. The train may proceed upon indication that the brakes on the rear car have released and that the AFM indicator pointer is returning toward the left.

If at any time the AFM indicator becomes inoperative, engineer will revert to a brake pipe leakage test as prescribed by the Air Brake and Train Handling Rules and Instructions (see Rule 2-5). During train operation, if the AFM indicator's movable pointer does not return to the limits established in the Initial Terminal Air Test (60 CFM or less) within a reasonable time or the 15 pound brake pipe gradient cannot be maintained, the train crew must notify the train dispatcher/ yardmaster. The train dispatcher/yardmaster will arrange to have the train inspected and repaired if any leaks are found.

Table 2-1. Air Test Quick Reference

NOTE: This chart is meant as a **quick reference only** and is based on freight trains using a 90 psi regulating valve setting on the controlling locomotive unit. You are advised to refer to the appropriate Rules for detailed information and requirements of each test.

Air Test	ABTH Rule	Required Pressure	Required Brake Pipe Pressure Reduction	Leakage Test Required
Initial Terminal	2-6	75 psi	20 psi	YES
Transfer Train and Yard	2-7	60 psi	20 psi	NO
Application and Release	2-8	75 psi	20 psi	NO
Intermediate Inspection	2-10	Non-Specified	20 psi	YES
Picking Up Cars En Route	2-11	75 psi	20 psi	YES
In-Bound Brake Inspection	2-12	N/A	60 psi	NO
Recouple Locomotive or Cars	2-13	Non-Specified	20 psi	NO

CHAPTER 3

RULES FOR TRAIN EQUIPMENT AND SECUREMENT

Rule 3-1. ANGLE COCKS. Angle cocks must NEVER be left in a PARTIALLY OPEN/CLOSED position. When coupling or recoupling cars and/or locomotive:

- Make a 20 psi brake pipe reduction.
- Signal with one sound of the horn or communicate by radio that the brake valve exhaust has ceased.
- Gradually open the angle cock to the FULL OPEN position.

When cutting in the air with the brake pipe charged, open the angle cock slowly to prevent an emergency brake application.

Rule 3-2. AIR HOSE HEIGHT. When air hoses are coupled, ensure the brake pipe hose support is adjusted so the glad hands are 4 to 5 inches above the top of the rail.

Rule 3-3. SECURING EQUIPMENT AGAINST UNDESIRED MOVEMENT. Crew members are responsible for securing standing equipment with hand brakes to prevent undesired movement. The air brake system must not be depended upon to prevent an undesired movement. Determining the number of hand brakes to be applied depends on:

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

When setting out cars on a grade with slack bunched, apply the hand brakes on the low end of the cut of cars. When setting out cars on a grade with slack stretched, apply the hand brakes on the high end of the cut of cars.

NOTE: All retainer valves must be in EXHAUST position.

a. **Steps to Secure Equipment.**

- Stop the cars and stretch or bunch slack as applies.
- Ensure all movement has stopped.
- Request 3 step protection.
- Set hand brakes in accordance with Rule 3-3b.

- Test brakes by releasing the independent and automatic air brakes.
- If movement occurs, repeat all steps.

(1) *Securing Equipment When Detaching Locomotives.* When any part of a train is left standing and train brake inspection is not required, do not depend on the air brake system to secure the cars. When detaching locomotives or locomotives and cars:

- Secure equipment against undesired movement as outlined above.
- Release air brakes to ensure hand brakes will prevent movement.
- Make a 20 psi brake pipe reduction.
- Close angle cock on rear locomotive or last car to be detached from portion left standing. Leave angle cock open on portion left standing.
- Allow brakes on any standing portion to apply in emergency. When available, use the end-of-train telemetry device to make sure that brake pipe pressure drops to 0 psi.

- Do not bottle air or maintain air pressure in the brake pipe when locomotives are detached or yard air is uncoupled. However, after the brake pipe pressure has completely exhausted, the angle cock on the standing portion of the train may be closed to allow a locomotive to switch the cars from the opposite end.

(2) *Securing an Unattended Train or Portion of Train with Locomotive Attached.* To secure a train or a portion of a train with the locomotive consist attached, perform the steps below:

- Make a 20 psi brake pipe reduction.
- Secure equipment against undesired movement as outlined above.
- Release air brakes to ensure hand brakes prevent movement.
- Secure the locomotives as outlined above.

b. **Hand Brake Matrix.**

(1) *Cars.* The following is the minimum number of fully applied hand brakes or blocking to apply to hold cars on the grades indicated.

Grade	Empties	Loads
Level	1% of cars	2% of cars
.5%	7% of cars	14% of cars
1.0%	15% of cars	29% of cars
1.5%	23% of cars	45% of cars
2.0%	30% of cars	60% of cars
2.5%	38% of cars	75% of cars
3.0%	45% of cars	90% of cars
3.5%	53% of cars	100% of cars
4.0% and over	100% of cars	100% of cars

(2) *Locomotives.* When the grade is over 1.5 percent, you must apply all locomotive hand brakes in addition the wheels must be securely blocked.

Grade	Minimum Number of Applied Hand Brakes
Level to .2%	One of every 5 locomotives
Over .2% to .5%	One of every 4 locomotives
Over .5% to 1%	One of every 3 locomotives
Over 1% to 1.5%	One of every 2 locomotives
Over 1.5%	All Locomotives

CHAPTER 4

RULES FOR TRAIN OPERATION

Rule 4-1. TRAINS OPERATING ON GRADES. Great care must be exercised by engineers and conductors when handling the train or cars on grades. Before proceeding, they must know that full protection against uncontrolled movement is provided by setting sufficient hand brakes on cars until the air brake system is fully charged and tested, and until required adjustments are made and retainers set (if required).

a. **Starting from Summit of Grade.** A train must not be allowed to start from the summit of a grade or following a stop on a descending grade until the train brake system is sufficiently charged to a safe level.

CAUTION: When approaching a descending grade of 1.8 percent or greater, the speed must be at least 5 MPH below the maximum authorized speed as the train crests the summit of the grade.

b. **Maximum Brake Pipe Reduction.** Table 4-1 shows maximum brake pipe reductions that must not be exceeded (to balance the grade).

Table 4-1. Maximum Brake Pipe Reductions

Maximum Brake Pipe Reduction	Maximum Speed Allowed
13 psi	Above 25 MPH
18 psi	25 MPH or less

If the train speed cannot be controlled with an 18 psi brake pipe pressure reduction, the train must be stopped and secured by setting the hand brakes. The train must not proceed until a complete inspection of the train has been performed to determine the cause. The supervisor must be notified before proceeding.

c. **Restoring Air Pressure.** If necessary to restore the air brake pressure to a safe level before proceeding and if the independent brake may not hold the train, sufficient hand brakes must be set before the air brakes are released and before the system is recharged. After the brake pipe pressure is properly charged to a safe level, a sufficient brake pipe pressure reduction must be made to hold the train while the hand brakes are being released.

d. **Use of Retainers.** When retainer valves are used, the following will govern:

- Cars with an actual weight of 50 tons or less must have a retainer valve set to the LOW PRESSURE position (if equipped), or SLOW DIRECT position (if not equipped).
- Cars with an actual weight over 50 tons must have the retainer valve set to HIGH PRESSURE position.

(1) The short cycle method of braking must be used. This method consists of making frequent automatic brake applications and short holds of the application. If the brake pipe pressure is gradually reducing and cannot be restored at a slower train speed, and the brake pipe reduction reaches 18 psi, the TRAIN MUST BE STOPPED and the air brake system recharged.

(2) Trains which experience dynamic brake failure, and trains which cannot be controlled at the allowed speed with the use of a full dynamic brake and an 18 psi brake pipe pressure reduction 1) must STOP and 2) must have sufficient hand brakes applied to prevent movement. The train must not proceed until additional dynamic braking is obtained, tonnage is reduced, or the retainer valves on all cars are placed in the operative position. The train must not proceed until instructed by the supervisor.

NOTE: Trains using retainers must not exceed 15 MPH.

3 Position Retainer Valve (see also Figure 4-1)

EX Position – EX is the DIRECT-EXHAUST position. When a retainer is in the EX position, the flow of brake cylinder pressure exhaust to the atmosphere is unrestricted. When the retainer is not being used, the retainer valve handle must be in the EX position (pointing downward, parallel to the pipe).

HP Position – HP is the HIGH-PRESSURE position. When a retainer is in the HP position, the flow of brake cylinder pressure exhaust to the atmosphere is controlled. When in the HP position, the handle points downward at a 45 degree angle.

SD Position – SD is the SLOW DIRECT-EXHAUST position. When a retainer is in the SD position, the flow of brake cylinder pressure exhaust to the atmosphere is completely vented. When in the SD position, the handle points upward at a 45 degree angle.

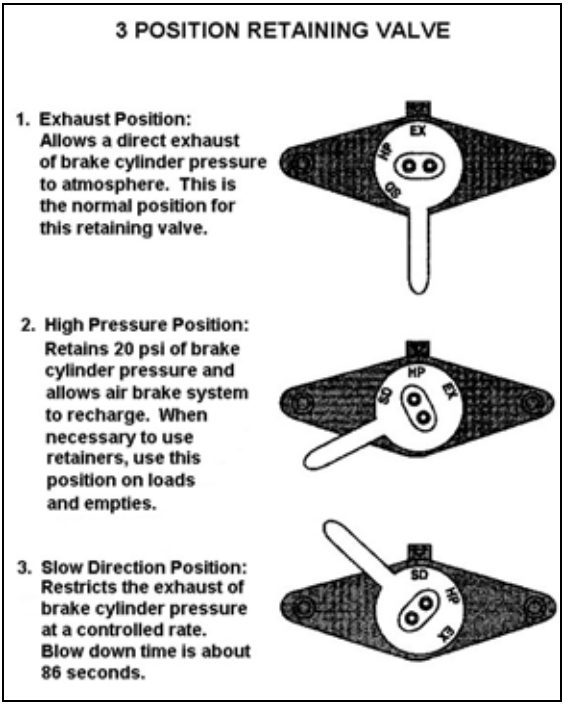

Figure 4-1. 3 Position Retaining Valve

4 Position Retainer Valve (see also Figure 4-2)

EX Position – Same as 3 Position Retainer System.

HP Position – Same as 3 Position Retainer System

LP Position – LP is the LOW-PRESSURE position. When a retainer is in the LP position, the flow of brake cylinder pressure exhaust to the atmosphere is controlled.

SD Position – Same as 3 Position Retainer System.

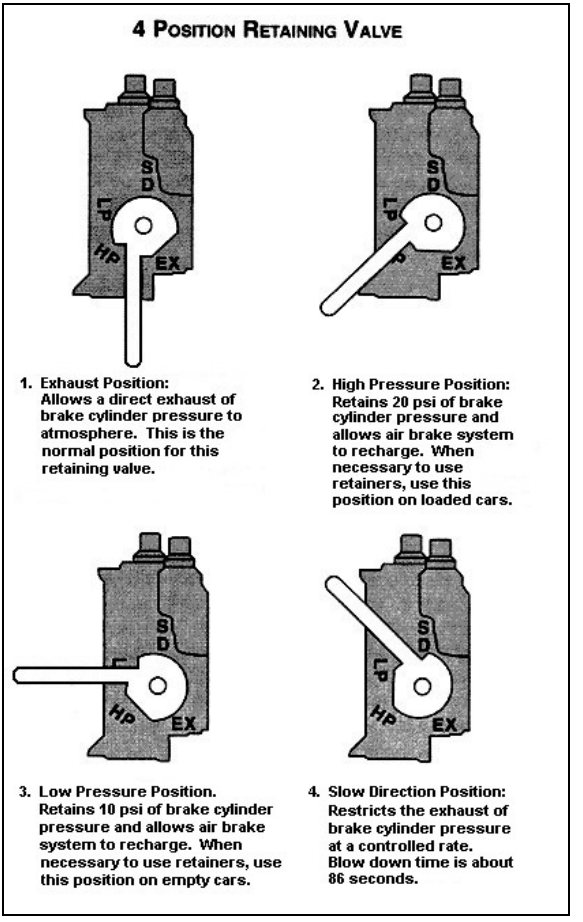

Figure 4-2. 4 Position Retaining Valve

Rule 4-2. SNOW AND ICE CONSIDERATIONS. When weather conditions are such that the depth of snow is near or above the top of the rail, or such that icing conditions may exist, the train and engine crews must be on the alert for the possibility of snow or ice building up on the brake shoes. Where conditions are favorable, a running application of the train brakes may be made to determine that the proper brake power is available. When approaching descending grades, precautions must be taken to ensure that the brake shoes are free of ice and snow.

Rule 4-3. PENALTY BRAKE APPLICATION (PBA).

a. **Pending PBA.** A warning whistle will sound for approximately 4 to 6 seconds to alert the engineer to a pending penalty brake application. To prevent a PBA occurrence, the engineer must depress the alerter button, actuate, change the throttle position, blow the whistle, ring the bell or move either of the brake valve handles.

b. **PBA Occurrence.** When a penalty brake application occurs, a full service automatic brake application will occur and the PCS will open. To recover from a penalty brake application, perform the following tasks:

- Place the automatic brake valve handle in the following position and leave it there until the train stops:
  - SUPPRESSION position (26-C or 30A-CDW).
  - LAP position (24-RL).
- Place the throttle in the IDLE position or place the dynamic brake lever in the OFF position.
- After the train is stopped and the PCS is reset, the automatic brake valve handle may be placed in the RELEASE position when it is safe to do so.

Rule 4-4. BRAKE PIPE PRESSURE REDUCTION FROM UNKNOWN SOURCE.

a. **Brakes Apply on Train.** If the train brakes are applied at a service rate from an unknown source, the engineer must stop the train:

- Leave the automatic brake valve handle in the RELEASE position.
- Keep the locomotive brakes released.
- Reduce the throttle gradually as the train slows down.
- Sand the rails, if necessary.
- As the train comes to a stop, fully apply the independent brake.

b. **Brakes Do Not Apply on Train.** Whenever a brake pipe pressure reduction of 5 psi or more is observed on the head end telemetry device due to an unknown cause and the brakes do not apply, the engineer must ascertain the brake pipe continuity by making a brake pipe pressure reduction, observing a reduction in pressure on the head end telemetry device. If the head end telemetry device does not indicate a brake pipe pressure reduction, the train must be stopped and an inspection must be made to determine that the train is intact and that the brakes apply and release on the rear car.

Rule 4-5. MAXIMUM DYNAMIC BRAKE AXLES. Maximum operative dynamic brake for any locomotive consist is 24 axles. When computing the number of axles of the operative dynamic brake, locomotive units identified as having high-capacity dynamic brake (electronic front hitch [EFH] or electronic transfer hitch [ETH]) must be considered as having the following equivalent:

- 4 axle unit = 6 axles
- 6 axle unit = 8 axles

Rule 4-6. USE OF DYNAMIC BRAKE TO CONTROL TRAIN. Consistent with good train handling techniques, the dynamic brake must be used as the primary means of reducing and controlling speed movements at speeds above 18 MPH. Low speed yard and transfer movements on level or near level grades are examples of movements that would not "require" the use of dynamic braking.

Rule 4-7. DYNAMIC BRAKE CUTOUT SWITCH AND CONTROL CIRCUIT BREAKER. Locomotive units are equipped with a dynamic brake control circuit on the control console. On the controlling unit, this breaker must be turned ON for dynamic brakes to operate properly. The position of this breaker in trailing units has no effect on the dynamic brake. If it is necessary to cut out the dynamic brake, it must be known that all wheels of the unit continue to rotate freely and the engine is tagged and a defect tag is placed on the lead locomotive. A locomotive unit with traction motors cut out will not have an operative dynamic brake. If the dynamic break fails, immediate action must be taken to

control speed and prevent harsh slack action (stopping the rain, if required).

Rule 4-8. USE OF ISOLATION SWITCH DURING DYNAMIC BRAKING. Locomotive units MUST NOT be isolated while the dynamic brake is in operation. Isolating the unit, while using the dynamic brake, causes the electrical load to be removed suddenly. This will result in serious damage to the electrical equipment.

Rule 4-9. SHOVING CARS. During backup or shoving movements with cars, do not use more power than needed to start the movement smoothly. Always use the lowest possible throttle position when shoving through sharp curves and turnouts or across bridges. During backup or shoving movements, the following maximum throttle position applies:

Number of Powered Axles	Maximum Throttle Position
12 or less	8
14	6
16	5
18	4
20 maximum axles	3

When a backup movement is necessary and a locomotive is coupled at the rear, transfer control of the air brakes to the rear locomotive before starting the movement.

Rule 4-10. CREW CHANGE PROCEDURES.
When crews are changed, the inbound and outbound crew members must confer on the condition of the following:

- Locomotive units.
- Train.
- Air brakes.
- Telemetry system (where equipped).
- Equipment discrepancies.
- Dynamic brake. Dynamic brake cutout switches properly positioned to provide maximum allowable dynamic brake, not to exceed 24 operative axles.
- Previous block signal indication, when applicable.
- Status of daily inspection on locomotive units.

The engineer and conductor must leave written notification if they are unable to confer with the outbound crew members. The outbound conductor and engineer must review this information and discuss any discrepancies. The inbound engineer must notify the outbound engineer when the train has experienced an undesired emergency brake application.

Rule 4-11. INITIATING TRAIN MOVEMENT. At points where a train is originally made up, or where consist is changed, as soon as it is practicable and before entering trackage controlled by the train dispatcher/yardmaster, a crew member must communicate the following information to the train dispatcher/yardmaster:

- Loads, empties, tons and total train length, including locomotive.
- Total locomotive units.
- Maximum permissible speed.
- Any locomotive unit defects.
- Whether the train does or does not contain high/wide loads.

Any change to the above information which occurs en route must be communicated to the train dispatcher/yardmaster at once.

Rule 4-12. HIGH WINDS AND SEVERE WEATHER. When a train (other than a unit train handling bulk commodities) experiences severe weather and/or high winds that suddenly reduces the train speed by 5 MPH or more, the train must stop and not proceed until the severe wind conditions have subsided. When the train dispatcher/yardmaster/manager receives notification of high wind conditions, he/she will contact all effected trains, advising maximum speed permitted within the affected area.

Rule 4-13. APPLYING BRAKES FROM REAR END OF TRAIN. When moving forward, brakes must not be applied from the rear of the train, except in the case of an emergency or when a stop signal cannot be given to the engineer by radio, hand or lamp signal.

Rule 4-14. OVERHEATING OF SLIDING WHEELS. Crewmembers must watch trains closely for signs of overheating or sliding wheels while the train is in motion, particularly for wheels sliding at a low speed and while retainers are in use. Should excessive overheating of wheels occur while retainers are in use, the trainman must turn the retainer valve handler on such car(s) to the RELEASE position until the wheels have had sufficient time to cool. The trainman must closely inspect the wheels (that experience excessive heat) for flat spots, tread build up, cracked flanges, and plates. If defective wheels are found, the brake on such car must be cut out and the car must be set out at the first opportunity.

Rule 4-15. STICKING AIR BRAKES. Brakes can remain applied from any of the following causes:

- Automatic brake application.
- Hand brake.
- Retainer valve.
- Excessive brake pipe leakage.
- Overcharge brake system.
- Brake rigging that binds or fouls.
- Defective control valve.

Improper handling by the engineer of the automatic brake valve (such as attempting to release a train brake application before the brake pipe exhaust closes) is a common cause of sticking brakes. If the cause for the sticking brakes is from improper handling of the automatic brake valve, usually an additional set and release (properly made) will correct the condition. When it is found that brakes are sticking on a car(s), the engineer must be notified at once. If the air brake on any car cannot be released normally from the locomotive, the train must be stopped and the brake on that car must be cut out (unless an inspection reveals that the brake was applied due to a retainer valve being in another position other than exhaust or that the hand brake was applied).

Rule 4-16. CUTTING OUT CAR AIR BRAKES. To cut out the brake, close the branch pip cutout cock and drain all the air pressure from the reservoirs and cylinders by use of the release valve. When the condition will permit, and it is safe to do so, the car may be handled to the next available

repair point. If the brakes are cut out, the following must be notified:

- Engineer.
- Train dispatcher/controller/yardmaster.
- Relieving crew.
- Mechanical personnel (must be informed of the car number(s) involved on arrival at the terminal).

Control valves on articulated cars are located on platforms having air reservoirs and auxiliary air reduction valves (located on platforms not having air reservoirs).

NOTE: The proportion of air brakes in operation must never be less than 85 percent of all the brakes in the train. Not more than two consecutive freight car brakes may be cut out in a train. The cutting out of more than two consecutive brakes may result in loss of emergency application reliability and result in high in-train forces. The rear car of the train must have an operating air brake. Articulated cars will be considered to have operating brakes when all control valves are cut in. When a control valve is cut out, the number of operative brakes is reduced by one for each control valve that is cut out. If more than one control valve and one auxiliary air reduction valve (in series) must be cut out, the articulated car must be set out. If necessary to cut out the brakes on a locomotive unit, the brake on any truck can be cut out by closing the cutout cock in the brake cylinder pipe leading to that truck. This will permit the brake on the other truck to continue to operate.

Rule 4-17. SETOUT OF BAD ORDER CAR. When it is necessary to set out a bad order car, a prompt report must be made to the train dispatcher/yardmaster/manager stating the nature of the defect. Providing the following applicable information:

- Car initial and number.
- If loaded, give contents and destination.
- If coupler is damaged, specify whether "A" or "B" end is involved.
- If wheel or journal is involved, specify journal number, size, and location by numeric system.

Rule 4-18. REGULATING VALVE. The regulating valve is used to reduce main reservoir pressure to the pressure desired in the brake pipe. The pressure shall be determined by the reading of the equalizing reservoir gauge with the automatic brake valve handle in the RELEASE position.

NOTE: Use of the regulating valve to apply and release the train brakes is prohibited.

Rule 4-19. EQUALIZING RESERVOIR LEAKAGE. In the event a freight train has an equalizing reservoir leak in the territory where pressure maintaining braking is being used, stop train, notify the supervisor and await instructions.

Rule 4-20. DEFECTIVE PRESSURE MAINTAINING FEATURE. A locomotive unit having a defective pressure maintaining feature must not be used as the controlling unit of a train, but may remain in the locomotive consist.

Rule 4-21. EMERGENCY APPLICATION OF AIR BRAKES.

a. **Crew Initiated.** An emergency brake application must not be used to stop a train except when life or property is in danger. When such an emergency demands the shortest possible stop, move the automatic brake valve handle to the EMERGENCY position, or pull the emergency brake handle, and leave it there until the train has stopped. No attempt should be made to release an emergency brake application until the train has stopped.

b. **Response to Any Emergency Brake Application.** When the train brakes apply at an emergency rate from any cause, the locomotive brake cylinder pressure must be exhausted by actuating the independent brake valve to prevent harsh slack action, excessive buff forces, and/or sliding of the wheels. No attempt should be made to release an emergency brake application until the train stops.

(1) When the train stops on a grade and the independent brake MIGHT NOT hold the train, the train must be secured with sufficient hand brakes before the air brakes are released and recharged. To assist trainmen in finding a break in the train line, and after properly securing the

train with sufficient hand brakes, the engineer may recover the PCS and place the automatic brake valve in the RELEASE position to allow air into the brake pipe.

(2) After an emergency brake application, do not attempt to start a train until it is known that the brake pipe pressure has been restored to a safe level. When the brakes apply at an emergency rate on a train with a helper locomotive cut in train or on rear, the helper engineer must immediately close the throttle and control the locomotive brake cylinder pressure to prevent harsh slack action and sliding of the wheels.

(3) If the speed of the locomotive increases considerably immediately following an emergency brake application, it may be due to the train parting near the head end. The locomotive brakes should be held released by depressing the independent brake valve handles as long as there is danger of the rear portion of the train colliding with the front portion.

(4) When the train is stopped by an emergency brake application, the engineer must not move the train until the proper proceed signal is received. When necessary to replace a knuckle or to perform any work under or between separated portions of the train, angle cocks on BOTH portions must be left open until the work is completed and the train is ready to be recoupled. The hand brakes must be applied on both portions to the extent necessary to prevent movement or run out of the slack when standing on a grade.

Rule 4-22. BRAKE MALFUNCTION. If the air brakes do not respond properly when the automatic brake valve, or emergency valve, is used on the head end of the train, place the train brakes in emergency by use of the end of train telemetry device (if equipped). When operating a locomotive in an extreme case of emergency (such as loss of main reservoir air pressure, brake equipment failure, loss of dynamic brake, or any other failure which prevents controlling the locomotive and/or train in the usual manner), any means of stopping must be used.

Rule 4-23. BRAKE APPLIED WHILE STOPPED. When safety permits, trains stopped on the main track or siding must have automatic brakes applied and the automatic brakes must remain applied until the train departs.

Rule 4-24. BRAKE PIPE CONTINUITY CHECK. After stopping, and when ready to proceed, trains equipped with a functioning telemetry system must check the brake pipe continuity by observing a change in the pressure on the head end device.

NOTE: If a functioning telemetry system does not indicate a pressure change, the train must be inspected to ensure that the angle cocks are open, and it must be known that the brakes apply and release on the rear car. If the brakes do not apply and release on the rear car, the cause must be determined and the condition corrected before proceeding. When conditions do not permit or require a release of brake pipe reduction, a brake pipe pressure change (with a functioning telemetry system) is not required.

Rule 4-25. INDEPENDENT BRAKE APPLICATION. The independent brake must be cut in at all times and operated to avoid sliding of the wheels, overheating of the wheels and brake shoes, or harsh slack action. When stopped, the independent brake must be fully applied. When moving, the independent application must be controlled to prevent sliding of the wheels. Blocking the independent brake valve handle in the BAIL position is prohibited. When the dynamic brake is not effective at very low speeds, the independent brake may be used to control slack and train speed. At no time may the independent brake be used to supplement the dynamic brake. The independent brake must not be used to control speed over 10 MPH on a moving train.

Rule 4-26. SPEED CONTROL DURING SWITCHING MOVEMENTS. When relying entirely on the locomotive brakes to control speed during switching movements, consideration must be given to:

- Rail condition.
- Weight of cars.
- Distance required for stopping.
- Number and type of locomotive units.

Cars must not be handled without the air brake system being charged unless it is known that they can be handled safely and can be stopped within the required distance. When the locomotive brake may not be sufficient to control the movement, the crew must couple the brake pipe hoses, open the angle cocks and ascertain that the brakes are operative on a sufficient number of cars to allow the engineer to safely control the movement at all times.

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CHAPTER 5

RULES AND INSTRUCTION FOR PROPER TRAIN HANDLING

NOTE: Before reading the following section covering recommended methods of operating freight trains, it is essential that one understand the limitations of these instruction. It must be remembered that an instruction is not meant to be a statement of the only method by which a train is to be operated. A train is a very complex system of machinery that can react in many different ways to a given situation. The type of reactions are dependent on many factors including the arrangement of cars within a train, the train make-up, the length of the train, the curvature of the track, grades, weather conditions, whether or not a car is loaded or empty, the speed of the train, and characteristics of the locomotive consist. It is safe to say that for one reason or another, no two trains are the same. While rules must be adhered to, instructions must be adjusted to fit each situation consistent with good train handling instructions.

Rule 5-1. STARTING TRAINS. The method used to start a train requires the engineer to take into consideration many important factors such as:

- The throttle response characteristics of the locomotive.
- The amount and condition of the slack in the train (stretched or bunched).
- Rail conditions.
- Tractive effort of the locomotive consist.
- Tonnage.
- Train length.
- Terrain.

a. **Level Track (see Figure 5-1).**

- After the brakes have released on the entire train, release the independent brake and move throttle to RUN 1.
- If train does not start, move throttle to RUN 2 or higher (but not above RUN 4) until the train is moving.
- After train is moving, when amperage begins to decrease, the throttle may be moved to the next higher position.

- If throttle position 1 starts the head end moving too rapidly, the independent brake may be used to control the surge in throttle position 1.
- If the train does not move in RUN 4, return the throttle to IDLE and determine the cause of the train not moving.

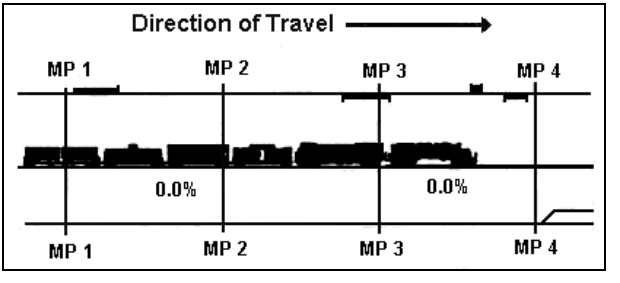

Figure 5-1. Direction of Train Travel on a Level Track

b. **Ascending Grade (see Figure 5-2).**

- Advance the throttle to RUN 1 and reduce the independent brake.
- Place the automatic brake valve in the RELEASE position.

- Advance the throttle to RUN 2 or higher attempting to start the train moving as the brakes release toward the rear of the train.

    - It is important to keep the slack stretched, therefore heavier trains will require higher throttle positions before reducing the independent brake in step 1, to prevent the locomotive from rolling back into the train.
    - Do not allow the throttle to remain in an OPEN position any longer than necessary attempting to start the train as it will cause stall burns in the traction motors.
    - If the train does not start in RUN 5, apply the independent brake, reduce the throttle to IDLE (apply automatic brakes if necessary to hold the train on the grade) and determine the reason for the train not starting.
    - Consideration must be given to doubling, getting helpers or taking slack to prevent possible train separation due to the high tractive effort developed by the locomotive when starting.

CAUTION: Due to short brake release times, taking slack can easily result in break-in-two because the brakes will release on the entire train and the rear portion will begin rolling backward before the entire train started. Taking slack is not a recommended method for heavy tonnage or heavy grade starting.

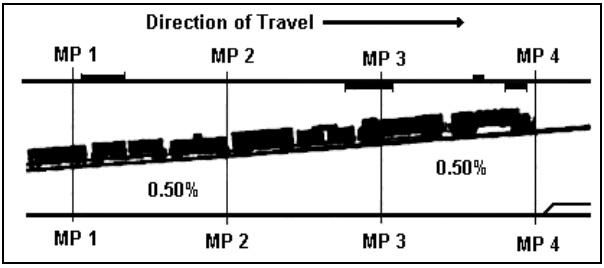

Figure 5-2. Direction of Train Travel on an Ascending Grade Track

c. **Descending Grade (see Figure 5-3).**

- With the independent brake fully applied, place the automatic brake valve in the RELEASE position.
- Reduce the independent brake only to the point that will allow the train to gradually begin moving.
- Once the entire train is moving the independent brake must be gradually reduced to avoid a run-out of slack.

NOTE: The dynamic brake may be used at any point and independent brake reduced when dynamic becomes effective.

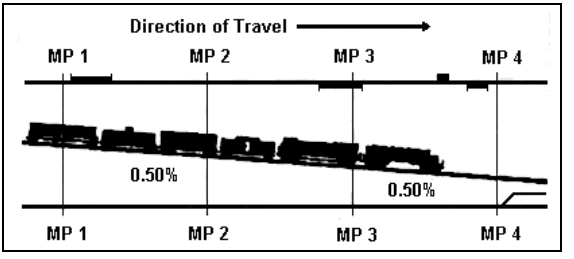

Figure 5-3. Direction of Train Travel on a Descending Grade Track

d. **Back-Up Movement (Level or Ascending Grade) (see Figure 5-4).**

- Place the automatic brake valve in the RELEASE position. Allow sufficient time for the train brakes to release and slack to adjust before applying power.
- Apply only enough power to start the locomotive and train moving and reduce the independent brake.
- Observe loadmeter for any unusual changes in amperage indicating possible train buckling.

NOTE: Consideration must be given to the high buff forces concentrated at the head end of the train, resulting in train jackknifing.

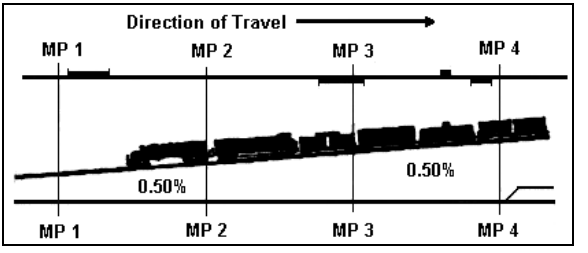

Figure 5-4. Direction of Train Travel in a Back-Up Movement on a Level or Ascending Grade Track

e. **Back-Up Movement (Descending Grade) (see Figure 5-5).**

- Place the automatic brake valve in the RELEASE position, allow sufficient time for the train brakes to release and slack to adjust.
- Gradually reduce independent brake and allow the train to start moving. If the train will not roll on its own, use only enough power to start the locomotive moving.
- If available, use dynamic brake to maintain slack stretched condition and control train speed.

NOTE: Maintain a slack stretched condition.

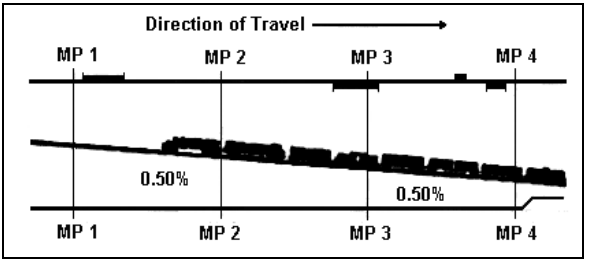

Figure 5-5. Direction of Train Travel in a Back-Up Movement on a Descending Grade Track

Rule 5-2. STOPPING TRAINS. The method used to stop a train requires the engineer to take into consideration many important factors such as:

- Throttle response characteristics of the locomotive.
- Type of dynamic brake.
- Weight, length and load/empty distribution of the train.
- Block signal spacing.
- Tons per operative brake.
- Amount of slack in the train.
- Weather and rail conditions.
- Knowledge of the territory.
- Choosing the train handling method which minimizes in-train forces and slack action.

a. **Slack Bunched Method – Dynamic Brake Available (Preferred Method for Level, Light, Heavy, and Mountain Descending Grades) (see Figure 5-6).**

- If in power, gradually reduce the throttle to IDLE.
- Pause 10 seconds, activate dynamic brake, gradually bunch the slack and increase to the desired braking level.
- At a sufficient distance from the stop, make a minimum brake pipe reduction and actuate.
- If needed, make further split reduction(s) and actuate.
- Below 10 MPH, supplement the fading dynamic brake with independent brake.
- Approximately 200 feet from the stop, make a final brake pipe reduction with brake pipe air exhausting on stop keeping the slack bunched with the independent brake.

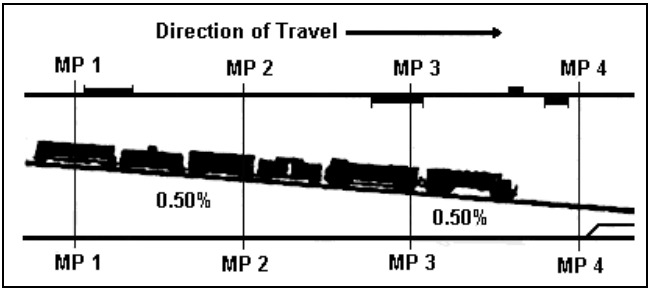

Figure 5-6. Direction of Train Travel in a Slack Bunched Method (Dynamic Brake Available)

b. **Slack Bunched Method – Dynamic Brake Not Available (Preferred Method for Level, Light, Heavy, and Mountain Descending Grades) (see Figure 5-7).**

- Gradually reduce throttle to IDLE and allow the slack to adjust.
- At a sufficient distance from stop, make a minimum brake pipe reduction and actuate.
- If needed, make further split reduction(s) and actuate.
- Approximately 200 feet from stop, make a final brake pipe reduction with air brake pipe exhausting on stop and allow the locomotive brakes to apply.

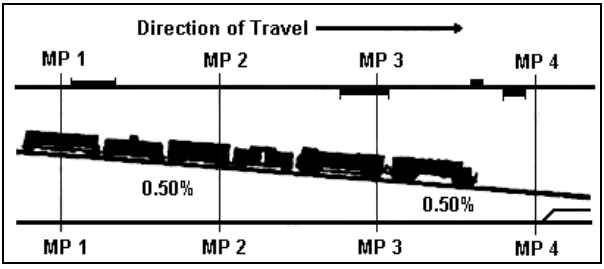

Figure 5-7. Direction of Train Travel in a Slack Bunched Method (Dynamic Brake Not Available)

c. **Modified Slack Bunched Method – Below 15 MPH (Preferred Method for Level, Light, Heavy, and Mountain Descending Grades) (see Figure 5-8).**

- Gradually reduce throttle to IDLE and allow slack to adjust.
- Further bunch slack with the independent brake.
- At a sufficient distance from the stop, make a minimum brake pipe reduction and deep the slack bunched with the locomotive brake.
- Approximately 200 feet from the stop, make a minimum brake pipe reduction and keep the slack bunched with the locomotive brake.

NOTE: The dynamic brake may be used if available, to bunch slack, but must be supplemented below 10 MPH with the locomotive brake.

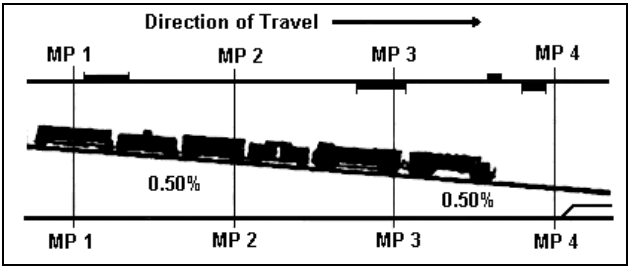

Figure 5-8. Direction of Train Travel in a Modified Slack Bunched Method (Below 15 MPH)

d. **Throttle Reduction Method (Preferred Method for Light, Heavy, and Mountain Ascending Grades) (see Figure 5-9).**

- Gradually reduce the throttle one notch at a time maintaining a slack stretched condition, allowing the grade to slow the train
- After the grade stalls the train, place the independent brake in FULL APPLICATION position and allow the independent application to become effective before reducing the throttle to IDLE, to prevent the locomotives from rolling back into the train.

NOTE: The automatic brakes may be required to hold the train on the grade. Therefore, brake application must be made in advance of stall to prevent rolling back after stop.

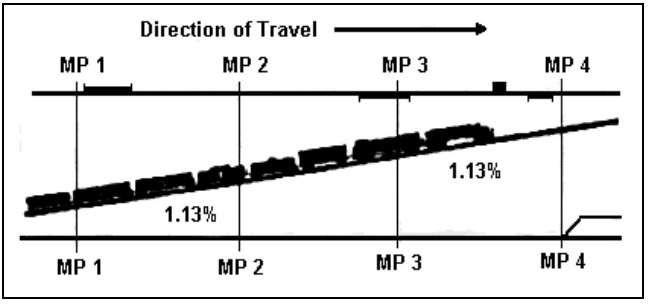

Figure 5-9. Direction of Train Travel in a Throttle Reduction Method

e. **Back-Up Movement Ascending Grade (Bunched) (see Figure 5-10).**

- Use only enough power to maintain a slack bunched condition.
- At a sufficient distance from stop make a minimum brake pipe reduction and actuate.
- If needed, make further split reduction(s) and actuate.

NOTE: Avoid high buff forces by frequently observing amperage and reducing throttle as necessary.

- As the train comes to a stop, apply the independent brake fully and allow sufficient time for the brakes to become effective to prevent the locomotives from running out, and move the throttle to IDLE.

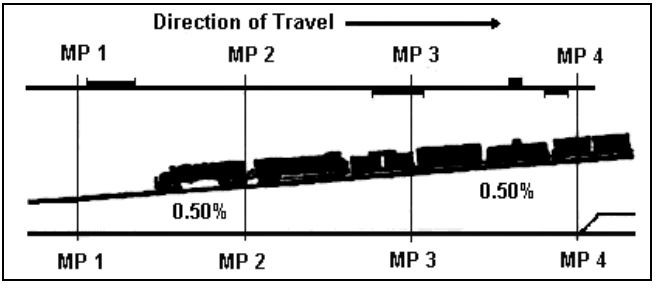

Figure 5-10. Direction of Train Travel in a Back-Up Movement Ascending Grade (Bunched)

f. **Back-Up Movement Level or Descending Grade (Stretched) (see Figure 5-11).**

- Gradually reduce throttle to IDLE and allow slack to adjust.
- Pause 10 seconds and activate dynamic brake to stretch the slack.
- At a sufficient distance, make a minimum brake pipe reduction and actuate.
- If needed, make further split reduction(s) and actuate.
- Below 10 MPH, supplement the fading dynamic brake with independent brake until train stops.

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

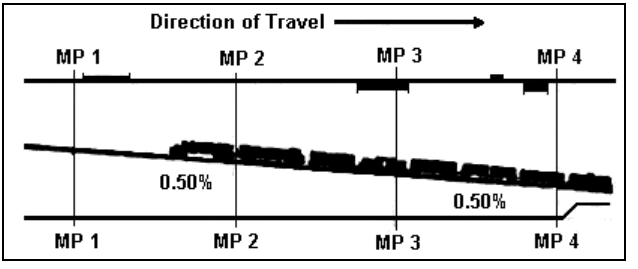

Figure 5-11. Direction of Train Travel in a Back-Up Movement Level or Descending Grade (Stretched)

Rule 5-3. SLOWING OR CONTROLLING SPEED. The method used to slow or control train speed requires the engineer to take into consideration many important factors such as:

- Throttle response characteristics of the locomotive.
- Type of dynamic brake.
- Weight, length and load/empty distribution of the train.
- Block signal spacing.
- Tons per operative brake.
- Amount of slack in the train.
- Weather and rail conditions.
- Knowledge of the territory.
- Choosing the train handling method which minimizes in-train forces and slack action.

a. **Slack Bunched Method – Dynamic Brake Available (Preferred Method for Level, Light, Heavy, and Mountain Descending Grades) (see Figure 5-12).**

- If in power, gradually reduce the throttle to IDLE.
- Pause 10 seconds, activate dynamic brake, gradually bunch the slack and increase to the desired level of retardation.

- At a sufficient distance from the restriction, make a minimum brake pipe reduction and actuate.
- If needed, make further split reduction(s) and actuate.
- When speed control has been achieved and brake valve handle moved to RELEASE position, maintain sufficient dynamic braking to keep slack bunched until brakes release throughout the train.

NOTE: If the dynamic brake alone will provide sufficient retardation to slow or control speed, use of the train brake is unnecessary.

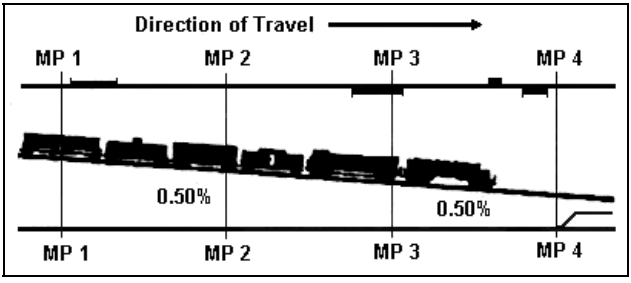

Figure 5-12. Direction of Train Travel in a Slack Bunched Method (Dynamic Brake Available)

b. **Slack Bunched Method – Dynamic Brake Not Available (Preferred Method for Level, Light, Heavy, and Mountain Descending Grades) (see Figure 5-13).**

- Gradually reduce throttle to IDLE and allow the slack to adjust.
- At a sufficient distance from the restriction, make a minimum brake pipe reduction and actuate.
- If needed, make further split reduction(s) and actuate.
- When speed control has been achieved and brake valve handle moved to RELEASE position, keep the locomotive brakes released unless required to avoid severe slack changes.

NOTE: Keep locomotive brakes released unless needed to avoid severe slack changes as the brakes release.

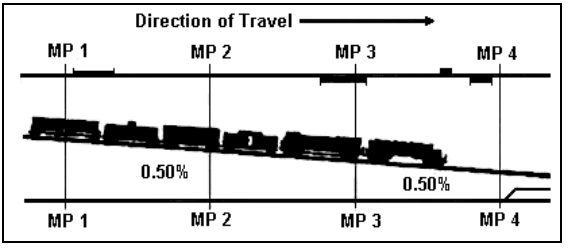

Figure 5-13. Direction of Train Travel in a Slack Bunched Method (Dynamic Brake Not Available)

c. **Throttle Reduction Method (Preferred Method for Light, Heavy, and Mountain Ascending Grades) (see Figure 5-14).**

NOTE: Gradually reduce the throttle one notch at a time maintaining a slack stretched condition, allowing the grade to slow the train

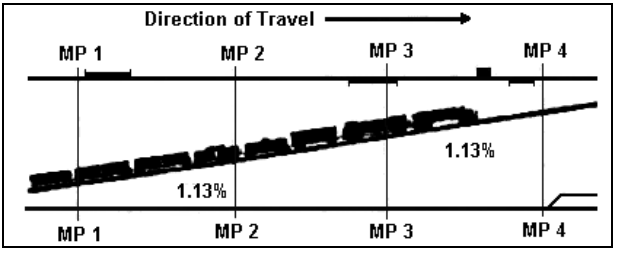

Figure 5-14. Direction of Train Travel in a Throttle Reduction Method

d. **Throttle Modulation Method (Sag) (Preferred Method for Controlling Speed) (see Figure 5-15).**

- Reduce throttle approaching sag to reduce train speed as necessary.
- Reduce throttle further as head portion of the train begins descending.

- Just before the head portion of the train reaches ascending grade, increase throttle.
- Continue to increase throttle until the rear portion of the train approaches the ascending grade.
- Reduce throttle as the rear portion of the train reaches the ascending grade.

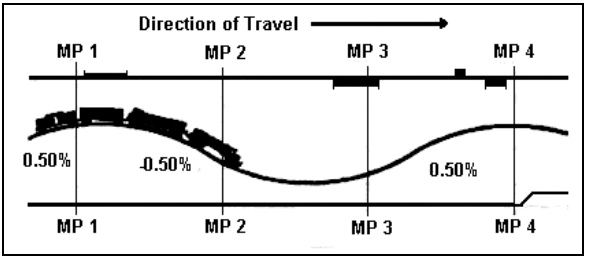

Figure 5-15. Direction of Train Travel in a Throttle Modulation Method (Sag)

e. **Slack Stretched Method (Preferred Method for Slowing Trains With a Concentration of Empty Cars at the Rear) (see Figure 5-16).**

- Adjust throttle using only enough power to maintain a slack stretched condition.
- At a sufficient distance from the restriction, make a minimum brake pipe reduction and actuate.

- Reduce throttle, maintaining a slack stretched condition.
- If needed, make further split reduction(s) and actuate.
- When speed control has been achieved and the automatic brake valve handle moved to RELEASE position, reduce the throttle to a lower position until the brakes have released throughout the train.

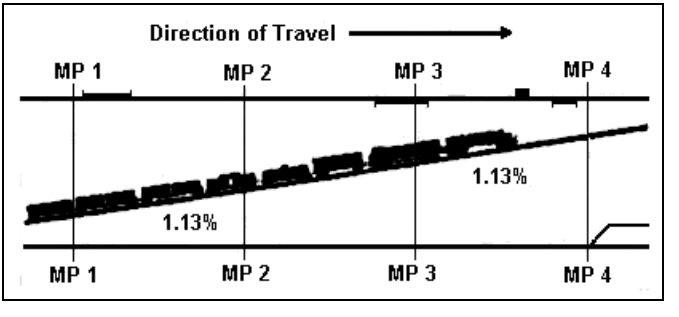

Figure 5-16. Direction of Train Travel in a Slack Stretched Method

f. **Cresting Grade.** When handling heavy trains with 15,000 horsepower or more at speeds below 15 MPH, gradually reduce throttle before the locomotive crests the grade to a position that will prevent speed increase until at least one-half the train has crested the grade (see Figure 5-17).

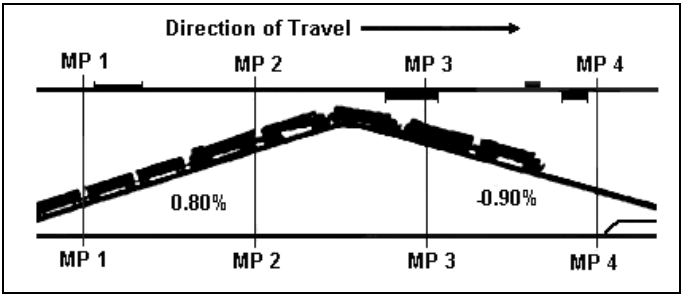

Figure 5-17. Direction of Train Travel on a Cresting Grade

NOTE: Using this method will reduce the additional draft force created by the weight of the locomotive and cars as they crest the grade.

Rule 5-4. CURVATURE CONSIDERATIONS. Special care must be observed in negotiating curves in excess of two degrees, especially curves of four degrees or more in order to avoid generating excessive lateral forces since these excessive forces can cause wheel climb or rail turnover. The lateral forces which can cause this situation come from the dynamic forces produced by the following:

- Run-ins of slack.
- Having long cars coupled to short cars under certain conditions.
- Having long, light cars preceding blocks of heavily loaded cars.

- Having the slack run-in against the locomotive.
- Coupler or truck characteristics; or 6) high steady state buff or draft forces.

a. **Starting.** Extreme care must be taken whenever a train is started in curve territory. When power must be used to start a train, use the minimum throttle position required in order to start the train. Any advances of the throttle must be made one notch at a time since abrupt increases of draft forces in a curve may generate excessive inward lateral forces which can result in string-lining of the curve. This effect can be severe enough to shift the track, turn a rail over, or otherwise result in a derailment.

b. **Negotiating.** Whenever possible, the throttle, the dynamic or the air brake changes should not be made near the beginning, within, or near the end of any curve in excess of two degrees. Changes in the power output or changes in retardation effort in curve should be made cautiously to avoid undesirable forces.

c. **Slowing and Stopping.** Particular care must be taken in curve territory because various combinations of curvature, dynamic or air brakes, and train make-up will always generate lateral forces during deceleration. In order to keep in-train forces at an acceptable level whenever the dynamic brake is in use, it is recommended that the dynamic brake be supplemented with an automatic brake application. The dynamic brake should be reduced proportionately to the degree of curvature and the number of operative axles in the

locomotive consist. Total braking effort from the dynamic brake and the air brakes should be kept at the lowest practical level in curve territory. Heavy braking should be avoided when trains are being slowed in curves since the track must absorb forces created by braking action as well as the forces of moving the train around the curve. When handling heavy trains at speeds below 15 MPH, gradually reduce the throttle before the locomotive crests the grade to a position that will prevent speed increase until at least one-half of the train has crested the grade. This will reduce the tractive effort sufficiently to compensate for the additional draft force created by the weight of the locomotive and the head end cars as they crest the grade. Do not advance the throttle until the train speed increases in the reduced throttle position.

Rule 5-5. RUNNING RELEASE OF AIR BRAKES. When the brakes are set with a light application, before releasing, make an additional reduction sufficient to ensure a release throughout the train. The total brake pipe reduction should be at least 10 psi.

EXCEPTIONS:

- Grade territories where grade braking conditions prevail.
- Locations where the brakes have to be reapplied or a stop made.

Do not attempt a running release if the speed is not high enough to maintain enough momentum to ensure all the brakes will release before the train comes to a stop.

Rule 5-6. PROPER USE OF DYNAMIC BRAKE. The effect of the dynamic brake on the train is similar to the locomotive independent air brake in that the braking effort is applied to only the locomotive. The engineer must exercise good judgment in applying and regulating the dynamic brake. This is particularly true when slowing in order to avoid excessive buff forces that could result in damage to track or cars in the train. Care must be exercised to prevent harsh slack action.

Rule 5-7. SURPRISE STOPS. For the shortest stop without using the emergency:

a. **Slack Stretched.**

- Make a 6 to 8 psi automatic brake pipe pressure reduction. While brake pipe is exhausting, gradually reduce throttle to IDLE.
- When the exhaust becomes weak, make an additional 10 psi reduction and increase the reduction to full service.

(1) If the dynamic brake is operative and the throttle has been in IDLE for 10 seconds, set up for dynamic braking and gradually increase to full braking effort.

(2) If the dynamic brake is not operative, allow the locomotive brakes to apply with the final automatic brake application. At a low speed, apply sand and sufficient independent brake to complete the stop without sliding the wheels.

b. **Slack Bunched.** With the dynamic brake in operation, gradually increase the full braking effort.

- Make a 6 to 8 psi automatic brake pipe reduction.
- When the exhaust becomes weak, make an additional 20 psi reduction.
- As the exhaust becomes weak, increase the reduction to full service.

CHAPTER 6

RULES FOR FUNCTION AND OPERATION OF AIR BRAKE AND LOCOMOTIVE EQUIPMENT

Rule 6-1. STANDARD AIR PRESSURES. Air pressure regulating devices on locomotives and cars must be adjusted for the following standard pressures:

a. **Main Reservoir –** Freight and Switch.

- Minimum - 130 psi
- Maximum - 140 psi

b. **Main Reservoir –** Passenger.

- Minimum - 130 psi
- Maximum - 140 psi

c. **Brake Pipe.**

- Yard Service - 80 psi
- Standard - 90 psi
- Mountain Grade 100 ton or more per operative brake - 100 psi

Helper service in train or on rear of train and locomotive switching trains from the rear, must adjust regulating valve to 10 psi less than the brake pipe setting for the train being handled.

d. **Independent Brake Cylinder Pressure.**

(1) *Freight Locomotives.*

- With Cast Iron Brake Shoes - 45 psi
- With Composition Brake Shoes - 72 psi

(2) *Switch Locomotives.*

- With 9” Brake Cylinders - 45 psi
- With 10” or 11” Brake Cylinders - 35 psi

e. Foreign line locomotives may carry different main reservoir and independent brake cylinder pressures. Those different pressures are permissible, however, crews must be aware of their presence and limit locomotive brake cylinder pressure accordingly.

Rule 6-2. AIR COMPRESSOR. A three-cylinder, two stage, oil lubricated, water or air cooled compressor is used to compress air for the brake system and air operated devices on the locomotive units and trains. An unloading

valve regulates the pressure in the main reservoir. There are two main reservoirs used to cool and store compressed air and to trap moisture and dirt. Compressed air from the main reservoir is piped to the automatic brake valve and to other air operated devices.

Rule 6-3. INDEPENDENT BRAKE VALVE.

a. **Operation of Independent Brake Valve.** The independent brake valve operates the locomotive brakes by directing main reservoir through a reducing valve and to a J-relay valve to control the main reservoir air to and from the brake cylinders on the locomotive. The independent brake valve has two positions:

- RELEASE position.
- APPLICATION ZONE position.

The further the independent brake valve handle is moved toward the APPLICATION ZONE position, the greater the application pressure. To release the locomotive brakes and to allow the train brakes to remain applied after an automatic brake application, depress the independent brake valve handle in the RELEASE position. This is known as actuating and must be done 4 seconds per locomotive. If the independent brake valve handle is depressed while in the application one, the brake cylinder pressure will correspond to the position of the handle.

b. **Independent Brake Cutout Valve.** The independent brake cutout valve is used to cut in or cutout out the independent brake. It has two positions:

- IN position. This position is used to cut in the independent brake.
- OUT position. This position is used to cut out the independent brake (refer to Chart 1-B).

Rule 6-4. 26-C AUTOMATIC BRAKE VALVE. The automatic brake valve quadrant (see Figure 6-1) has six positions. The name and function for each position is:

- **RELEASE** position. It is located to the extreme left of the quadrant and is used for charging the air brake system and to release an automatic brake application.
- **MINIMUM REDUCTION** position. It is located against the first raised portion to the right of the RELEASE position and is used to obtain a service brake pipe reduction to 6 to 8 psi.

- **SERVICE** position. It extends to the right of the MINIMUM REDUCTION position on the quadrant to just short of the second raised portion. The farther the handle is moved into the service zone, the greater will be the brake pipe pressure reduction (which is controlled by the equalizing reservoir).
- **SUPPRESSION** position. It is located against the second raised portion and is used to recover a penalty brake application.
- **CONTINUOUS SERVICE** position. It is located under the opening which permits removal of the handle. In this position, the brake pipe pressure will be reduced to zero at a service rate.
- **EMERGENCY** position. It is located at the extreme right of the quadrant and is used for making an emergency brake application whether the brake valve is cut in or cut out.

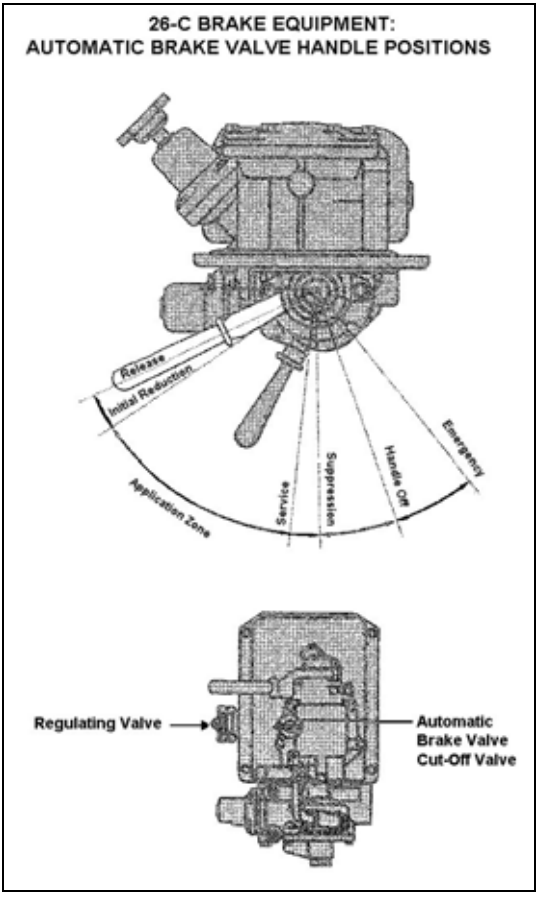

Figure 6-1. 26-C Automatic Brake Valve Quadrant

Rule 6-5. 30A-CDW BRAKE VALVE. This brake valve assembly (see Figure 6-2) is found on locomotive units having the *North American Cab* desk top control console. The automatic brake valve is located on the left side of the assembly. The independent brake valve is located on the right side of the assembly.

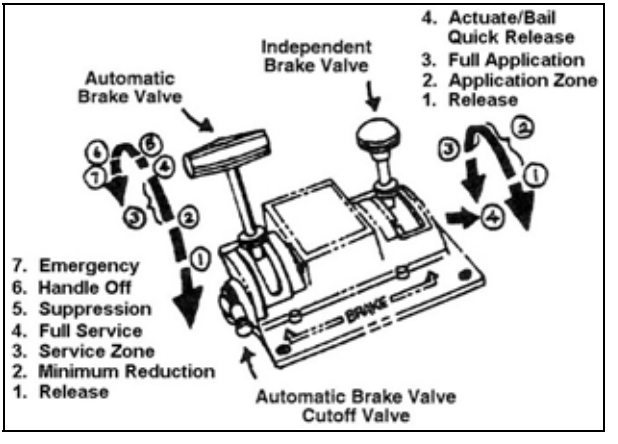

Figure 6-2. 30A-CDW Brake Valve Assembly

The automatic brake valve quadrant has six positions. The name and function for each position is:

- **RELEASE** position. It is located at the extreme back of the quadrant and is used for charging the air brake system and to release an automatic brake application.
- **MINIMUM REDUCTION** position. It is located at the first notch position forward of the **RELEASE** position and is used to obtain a service brake pipe reduction to 6 to 8 psi.
- **SERVICE** position. It extends forward of the MINIMUM REDUCTION position on the quadrant just short of the second notch position. The farther the handle is moved into the service zone (away from the engineer), the greater will be the brake pipe pressure reduction (which is controlled by the equalizing reservoir). FULL SERVICE (FS) position is indicated by the second notched position on the quadrant.

- **SUPPRESSION** position. It is located at the NOTCH position and is used to suppress, or recover from, a penalty brake application.
- **CONTINUOUS SERVICE** position. It is located at the opening and it permits the removal of the handle at the fourth notch position. In this position, the brake pipe pressure will be reduced to zero at a service rate.
- **EMERGENCY** position. It is located at the extreme forward position on the quadrant and is used for making an emergency brake application whether the brake valve is cut in or cut out.

Rule 6-6. AUTOMATIC BRAKE VALVE CUTOFF VALVE. The cutoff valve has three positions. The handle of this valve must be depressed before changing to one of the three positions. The name and function for each position is:

- OUT position. In this position, communication between the brake valve and the brake pipe is cut. This position is used to check brake pipe leakage.
- FRT position. This position is used when the locomotive is assigned to freight service.

- PASS position. This position is used when the locomotive is assigned to passenger service or when an equalizing reservoir leak develops when operating in freight service (see Rule 2-5).

WARNING: THE AUTOMATIC BRAKE VALVE CUTOFF VALVE MUST NOT BE CHANGED UNLESS THE BRAKE VALVE HANDLE IS IN THE RELEASE POSITION. WHEN AN AUTOMATIC BRAKE APPLICATION HAS BEEN MADE, AND IF THE CUTOFF VALVE IS IN THE PASS POSITION, ANY MOVEMENT OF THE BRAKE VALVE HANDLE TOWARD THE RELEASE POSITION WILL RESULT IN AN UNDESIRED RELEASE OF THE BRAKES ON A FREIGHT TRAIN.

Rule 6-7. SELF-LAPPING FEATURE. The self-lapping feature automatically maintains equalizing reservoir pressure with the automatic brake valve cutoff valve in the FRT positioned and the brake valve handle in the RELEASE position. With the automatic brake valve cutoff valve in the PASS position, the equalizing reservoir pressure is maintained (corresponding to the position of the automatic brake valve handle) whether it is in the RELEASE position or in the service zone.

Rule 6-8. EQUALIZING RESERVOIR. The equalizing reservoir is a small reservoir which acts as a reference volume between the position of the automatic brake valve handle and the brake pipe pressure. This relationship is established through a relay valve diaphragm. The reservoir and the diaphragm are part of the automatic brake valve and are cut in on the controlling locomotive unit of a multiple-unit locomotive consist. During brake pipe charging (with the automatic brake valve handle in the RELEASE position), the higher pressure in the equalizing reservoir forces the diaphragm piston assembly to the right and open a supply valve which allows the main reservoir air to flow into the brake pipe. The brake pipe pressure is then raised to the level of the equalizing reservoir at which time the relay valve diaphragm and the piston assembly are moved to the left, closing off the supply of the main reservoir air to the brake pipe. An application of the automatic brake is made by moving the automatic brake valve handle away from the RELEASE position. Equalizing reservoir pressure is reduced a corresponding amount. As equalizing reservoir pressure is reducing, the relay valve allows the brake pipe air to exhaust to the level of the equalizing reservoir.

Rule 6-9. RELAY VALVE. The relay valve is an integral part of the 26-C and the 30A-CDW automatic brake valve and operates whenever the brake pipe pressure falls below the pressure in the equalizing reservoir. When the automatic brake valve cutoff valve is in the FRT or PASS position, brake pipe pressure is maintained against leakage. This action by the relay valve is known as the maintaining feature.

Rule 6-10. 24-RL AIR BRAKE EQUIPMENT. The automatic brake valve quadrant has six handle positions (see Figure 6-3). The name and function for each position is:

- **RELEASE** position. In this position feed valve air is supplied to brake pipe and will charge the brake pipe to the setting of the feed valve. The RELEASE position charges the brake pipe at the same rate as the RUNNING position.
- **RUNNING** position. In this position, the feed valve air is supplied to the brake pipe and will charge the brake pipe to the setting of the feed valve. The RUNNING position charges the brake pipe and is used for releasing the engine and train brakes. When the automatic brake is not being used, place the brake valve handle in this position.
- **PRESSURE MAINTAINING** position. The position is for pressure maintaining only. The service brake reduction is made in the SERVICE position and then the brake valve handle must be moved to the PRESSURE MAINTAINING position while the air is exhausting from the service exhaust port. Do not pause in the LAP position. The brake valve handle must not be

moved from the PRESSURE MAINTAINING position to the RUNNING position or the LAP position then back to the PRESSURE MAINTAINING position. More than one service application can be made by moving the brake valve handle from the PRESSURE MAINTAINING position to the SERVICE position and then returned directly to the PRESSURE MAINTAINING position.

- **LAP** position. Brake pipe pressure will not be maintained against leakage when the brake valve handle is in this position. All operating ports are closed when in this position and the resulting brake pipe leakage will cause the engine and the train brakes to apply. This position is used primarily for:

  - Recovery from penalty brake application.
  - Testing the amount of leakage in the brake pipe.

- **SERVICE** position. This position allows the feed valve air supply to the brake pipe to be cut off. The equalizing reservoirs is exhausted to the atmosphere through the preliminary exhaust port, actuating the equalizing

discharge valve to the exhaust brake pipe air with a corresponding amount (through the discharge valve and the rotary valve exhaust), at a service rate.

- **EMERGENCY** position. This position allows passages to be connected to provide a large, direct exhaust passage from the brake pipe to the atmosphere which produces an emergency rate of brake pipe reduction.

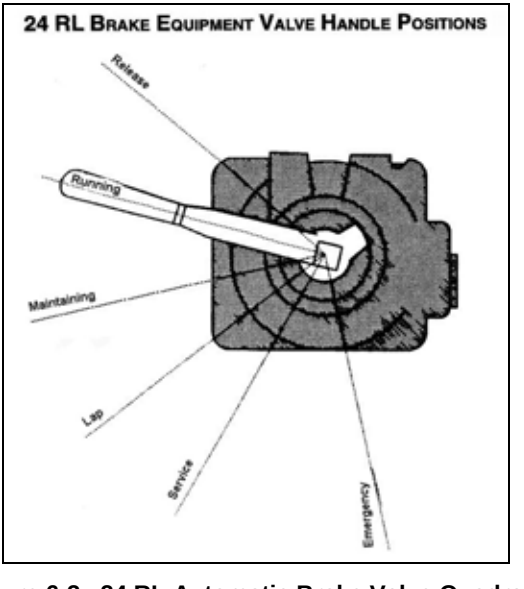

Figure 6-3. 24 RL Automatic Brake Valve Quadrant

Rule 6-11. MULTIPLE-UNIT (MU) HOSES.
Locomotive units designed for multiple-unit operation are equipped with MU hoses at each end. Identification, function, and normal pressure for these hoses are shown in Figure 6-4.

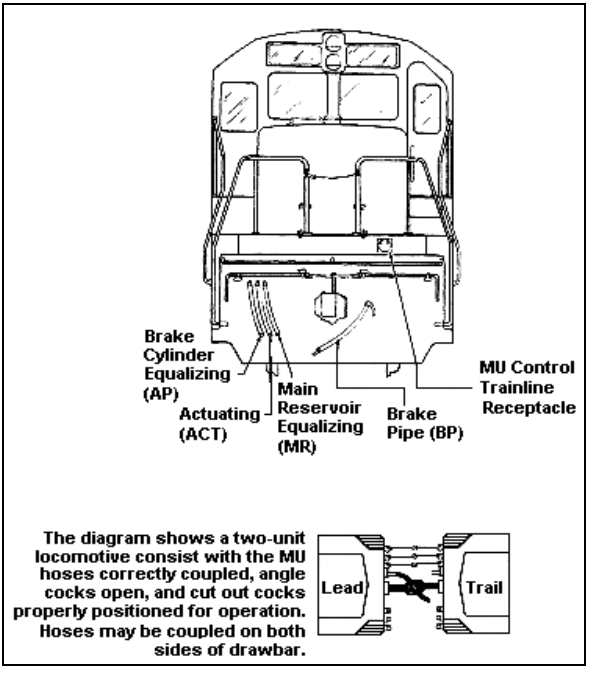

Figure 6-4. Two-Unit Locomotive Consist (with MU Hoses)

- **MU HOSE No. 1. Main Reservoir**. This hose connects all main reservoirs in the locomotive consist. Normally it contains air pressure of 130 to 140 psi.
- **MU HOSE No.2. Actuating**. Directs air from the controlling locomotive unit's independent brake valve to the Quick Release portion of each unit's respective control valve causing a release of the locomotive brakes that are applied as a result of an automatic brake application. Normally it contains 0 psi when the independent brake valve handle is not depressed. When the handle is depressed, the pipe is charged to the main reservoir pressure (130 to 140 psi).
- **MU HOSE No. 3. Application and Release Brake Cylinder Equalizing**. Direct air from the controlling locomotive unit's independent brake valve to the J-Relay valve on each unit to control the locomotive brake cylinder pressure. Normally it contains 0 (zero) psi when the independent brake valve handle is in the FULL APPLICATION position, the pipe is normally charged to 45 psi.

- **MU HOSE No. 4. Turn on Sanders**. Older model locomotive units are equipped for this hose connection. If equipped, this hose contains 0 (zero) psi when the sanders are not turned on. With sanders on, this hose is charged to the main reservoir pressure (130 to 140 psi).

Rule 6-12. DYNAMIC BRAKE. Dynamic braking is an electrical arrangement used to change energy developed by the momentum of a moving train into effective retarding force.

Rule 6-13. A-1 REDUCTION RELAY VALVE. Certain long freight cars are equipped with an A-1 Reduction relay valve (see Figure 6-5) to assist in the propagation of a service or an emergency brake pipe reduction to compensate for the added brake pipe length. The A-1 Reduction Relay is a completely separate function of the control valve. If the vent valve should fail to reset after an emergency brake application causing a continuous blow at the exhaust port, the valve may be plugged by removing the vent protector and screwing in the threaded plug.

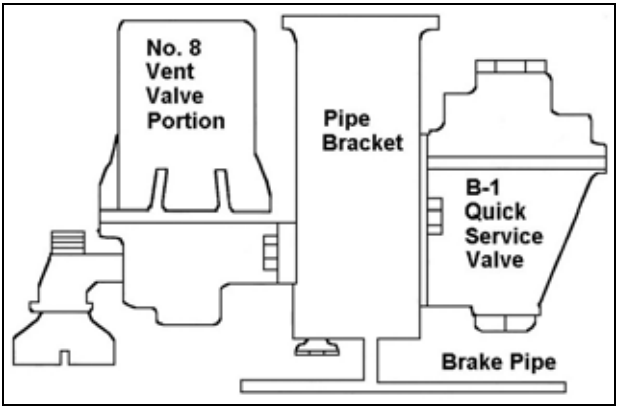

Figure 6-5. A-1 Reduction Relay Valve

CHAPTER 7

RULES FOR AIR FLOW METHOD (AFM) INDICATOR DEVICE

Rule 7-1. PRIMARY PURPOSE OF THE AFM INDICATOR DEVICE. The primary purpose of the AFM indicator device (see Figure 7-1) is to indicate the rate at which air is flowing into the train brake system. The AFM indicator provides the following information:

- During initial charging of the train brake system, the air flow pointer will move to the higher numbers, indicating a high flow into the brake pipe.
- As the brake system becomes charged, the air flow pointer will then move slowly back to the lower numbers, indicating a lesser flow of air into the brake pipe.
- Once the brake system becomes charged, the pointer will stabilize, indicating the normal flow of air into the brake pipe to maintain leakage. At this point, the reference pointer can be adjusted to the same as the flow pointer and the engineer will have a reference mark to indicate fluctuations in the brake pipe.

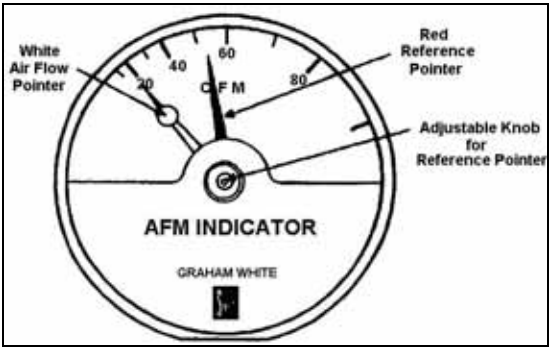

Figure 7-1. AFM Indicator Device

Rule 7-2. SECONDARY PURPOSE OF THE AFM INDICATOR DEVICE. The AFM indicator also provides useful information about conditions affecting the train brake system:

- After a brake application and release has been made, an indication of high flow will be observed, as the brake system becomes recharged the brake pipe slow will decrease until the air flow pointer reaches the reference pointer, indicating the brake system is charged.
- A brake pipe flow less than the reference pointer may be an indication of a closed angle cock.

- A brake pipe flow greater than the reference pointer may be an indication of increased leakage to the brake system.
- With a brake application in effect, a decrease in flow may be an indication of an unintentional brake release occurring.

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CHAPTER 8

RULES FOR CAR AND LOCOMOTIVE LOCATION DESIGNATION

Rule 8-1. A AND B END OF CARS. On cars with one hand brake, the end of the car with the hand brake is the "B" end. The other end is the "A" end. On cars with two hand brakes, the letters "A" and "B" are stenciled on the appropriate ends (see Figure 8-1).

Rule 8-2. NUMBERING OF WHEELS. To number the wheels, face the "B" end of the car. The wheels on the left side are designated with the letter "L". The wheels on the right side are designated with the letter "R". Wheels are numbered up from "1" on either side, with "1" closest to you: "R1", "R2", "R3", "R4" and "L1", "L2", "L3", and "L4".

Rule 8-3. FRONT OF LOCOMOTIVE AND WHEEL NUMBERING. 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 as shown in Figure 8-2.

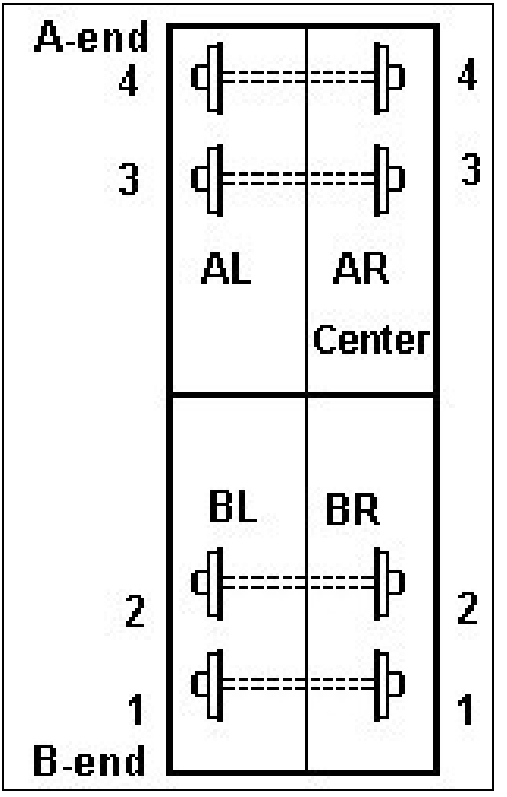

Figure 8-1. A and B End of Cars

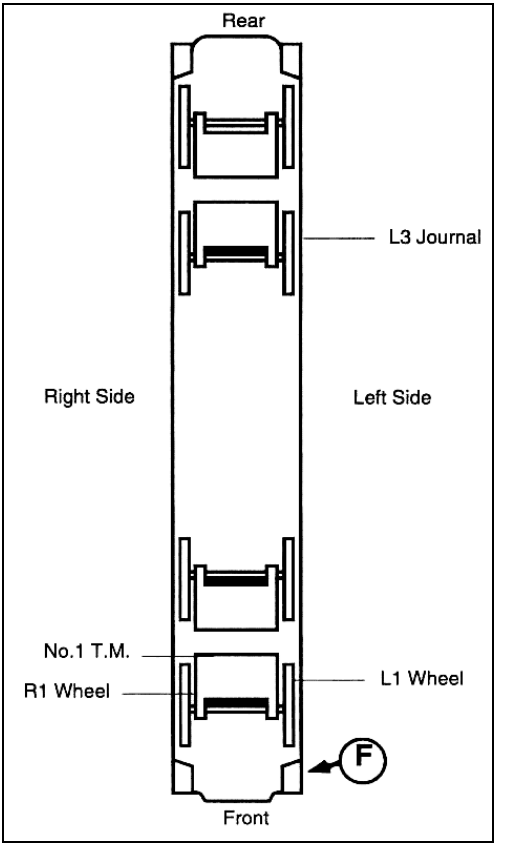

Figure 8-2. Front of Locomotive and Wheel Numbering

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GLOSSARY

Section I. Abbreviations and Acronyms

ABTH	Air Brake and Train Handling
AFM	Air Flow Method
ATTN	attention
CFM	cubic feet per minute
D.C.	District of Columbia
DA	Department of the Army
DBI	Dynamic Brake Interlock
DD	Department of Defense
DIT	dead-in-train
EFH	electronic front hitch
EMD	electro-motive diesel

ETH	electronic transfer hitch
ETS	engine temperature sensor
FRA	Federal Railroad Administration
FS	Full Service
GE	General Electric
HQ	Headquarters
IPS	Independent Pressure Switch
MPH	miles per hour
MU	multiple-unit
No.	number
PBA	Penalty Brake Application
PCS	Pneumatic Control Switch
PM	post méridien (after noon)
psi	pounds per square inch

TC	training circular
UDE	Undesired Emergency
USATRADOC	United States Army Training and Doctrine Command
VA	Virginia

Section II. Terms

Accelerated Emergency Release – A release feature for the control valve that allows brake cylinder and auxiliary reservoir air to flow into brake pipe during releases after an emergency brake application.

Accelerated Service Release – A feature of freight car control valves (except type AB) that allows emergency reservoir air to flow into the brake pipe for a faster service release.

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

Actuating – Depressing the independent brake valve handle charges the actuating pipe from the main reservoir and releases the automatic brakes on each locomotive unit in the consist. Sometimes referred to as bailing off.

Adhesion – The coefficient of friction between the wheel and rail during acceleration and retardation. It is a direct indicator for the amount of traction achieved.

Adverse Dynamic Behavior – Any motion which is unfavorable to the movement of trains or individual cars, including rock-and-roll, truck hunting and vertical bounce. Extreme cases of these dynamics can cause derailment.

Aftercooler – A radiator unit for cooling compressed air after it has been heated by compression.

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

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

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

Air Compressor Control Switch – A device that loads and unloads the air compressor at the proper main reservoir pressures and includes a latch or cutout cock to manually unload the air compressor.

Air Flow Method (AFM) Indicator – An instrument that indicates the speed of the air flowing through the automatic brake valve into the brake pipe. An AFM indicator is commonly called a flow meter.

Air Gauge – A duplex or single-pointer gauge which indicates air pressure in pounds per square inch.

Alerter – A safety control system that senses the movements of an engineer. As the engineer goes about normal activities, any such changes will reset the control and start a timing circuit. If, during the timing period, no additional motion is detected, an audible and/or visual signal calls attention to this lack of motion. If motion still does not occur for another period, nominally 6 seconds, a relay contact opens, applies the penalty brake and cuts off power and dynamic brake.

Alignment Control Couplers – Couplers on most locomotives which allow only limited lateral movement when in buff, reducing the possibility of rail turnover or jack knifing of the equipment.

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

Angle Cock – A hand operated valve that has an angular shape and is closed when the handle is at right angles to the pipe and usually employed on brake pipe at each end of locomotive units and cars.

Articulated Car – A car created by the uniting of two or more railcar segments or units to form a single unit whose joints are created by a permanent connection included between the segments or units. Articulated cars share a common truck under the articulated connection.

Automatic Air Brake – An arrangement of air brakes whereby air is stored in reservoirs on cars and locomotive units. An operating valve such as a control valve that causes the brakes to apply and release by changes in the brake pipe pressure, whatever the cause. A reduction in brake pipe pressure results in a brake application; an increase in brake pipe pressure results in a brake release.

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

Automatic Brake Valve – A manually operated device used by the engineer to control the flow of compressed air into and out of the brake pipe.

Automatic Drain Valve – A device which automatically drains condensation from main reservoirs.

Automatic Slack Adjuster – A device that automatically maintains brake cylinder piston travel at predetermined length.

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

"B" End (of Car) – The end of the car where the hand brake is located.

Back-Up Valve – A device, either portable or permanently connected to the brake pipe, for the purpose of controlling air brakes from the car that it is attached to.

Balanced Speed – The speed at which the drawbar force exerted by the locomotive is equal to the train resistance, resulting in a constant speed.

Bleed or Bleed Off – Venting air pressure to the atmosphere, such as venting air pressure from the brake cylinder of individual cars by using the release valve.

Brake Application – A reduction of brake pipe pressure, no matter how made, sufficient to cause the control valve to move to SERVICE or EMERGENCY position.

Brake Cylinder – A cylinder containing a piston. Compressed air forces the piston outward to apply the brakes. When the air pressure is released, the piston returns to its

normal position by a release spring coiled around the piston rod inside the cylinder.

Brake Pipe – The section of air brake piping of a car or locomotive unit that supplies the reservoirs. It also connects the piping to allow the locomotive engineer to control the brakes. The pipe is 1 ¼ inches in diameter and extends from one end of the car to the other. At the ends, flexible hoses connect the cars. When a train is made up and all brake pipes on the cars are joined together, the entire pipe line is called the brake pipe.

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

- **Normal Gradient –** The gradient that exists when the system is fully charged.
- **False Gradient –** The temporary gradient that exists when the system is less that 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 end of the train than at the head end of the train (for example, during a service brake application).

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

Brake Pipe Vent Valve – An appliance to ensure propagation of an emergency application of air brakes.

Branch Pipe – The connecting pipe between the brake pipe and the control valve.

Branch Pipe Cutout Cock – A device used to cut out the control valve on a car.

Buff – A term to describe compressive coupler forces.

Center Plate – One of a pair of plates, male and female, which fit into each other and which support the car body on the trucks, while allowing the trucks to turn freely. On a freight car, the male center plate is attached to, or cast in, the car body and the female center plate is attached to, or cast as, part of the truck.

Center Sill – The central longitudinal member of the underframe of a freight car which forms the "backbone" of the underframe.

Check Valve – A valve that permits a free flow of air in one direction while preventing the air from flowing in the opposite direction.

Clasp Brake – A braking arrangement in which two brake shoes are used on each wheel, opposite to each other.

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

Cutout Cock – A hand operated valve provided in a pipe for the purpose of direction for preventing the flow of compressed air. Generally, when handle of cock is parallel to the pipe, cock is closed; when handle is at right angles to the pipe, cock is open.

Cycle Braking – A method of applying and releasing the train brakes to control speed without a complete recharge of the train brake system.

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

Draft – A term to describe tension coupler forces.

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

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

Dummy Coupling – A device used to secure and protect unused air hoses and jumper cables.

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

Dynamic Brake Interlock (DBI) – A device installed on some locomotive units that will automatically keep the locomotive brakes from applying when automatic brakes are applied during periods of dynamic brake use.

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

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

Emergency Reservoir – A storage volume for compressed air on each car, charged by the brake pipe, to provide air pressure for use in emergency applications and certain recharge features.

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

Empty-Load Feature – A system installed on various cars which will adjust the braking force to a lower level to prevent wheels from sliding when the car is empty or lightly loaded.

Equalization – A term used to describe the condition that exists when brake cylinder pressure and auxiliary reservoir pressure become equal.

Equalizing Reservoir – A small reservoir which acts as a reference volume between the position of the automatic brake valve handle and the brake pipe pressure.

Foundation Brake Gear – The levers, rods, brake beams, and so forth, that connects the brake cylinder piston rod to the brake shoes so that air pressure forces the piston out and brake shoes are forced against the wheels.

Full Service Application – An automatic air brake that is applied until the auxiliary reservoir and brake cylinder pressures equalize. Any further reduction in the brake pipe pressure, except an emergency application, will not effect the amount of pressure in the brake cylinder. Therefore air is being wasted from the brake pipe (over reduction).

Gear Ratio – The relation between the number of teeth on the axle ring (bull) gear to those of a pinion gear with which it meshes.

Glad Hand – The metal fitting attached to the free end of an air hose used for connection of the hose.

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

Hand Brake – A brake operated manually to force brake shoes against the wheel to prevent of slow the movement of cars or locomotive units.

Harmonic Rocking – Excessive lateral rocking of cars and/or locomotives, usually at speeds between 13 and 21 MPH.

Helper Locomotive(s) – One or more locomotives added to a train to assist movement.

Independent Brake Valve – A device used to apply and release the independent (locomotive) brake.

Independent Brake Valve Cutout Cock – A device to cut in or cut out the independent brake.

Independent Pressure Switch (IPS) – A device on a locomotive unit that cancels the extended range portion of dynamic braking when sufficient brake cylinder pressure occurs.

Interchange – A location where railroads exchange rolling equipment.

Intercooler – An arrangement of pipes used for cooling compressed air between stages of compression.

Isolation Switch – In the RUN position, the locomotive unit responds to control and develops power. In the ISOLATE/STOP/START position, the locomotive unit will not respond to control or develop power.

Jack Knife – A term used to describe an extremely adverse condition existing between two cars whereby excessive sharp angularity occurs at the couplers or drawbars between the two cars, resulting in severe center sill misalignment of the connection and derailment. Jackknifing is caused by excessively high buff forces in a train.

L/V Ratio – The ratio of the lateral force to the vertical force of a wheel on a rail.

Loadmeter – A meter that indicates the rate of flow of amperes through one or more traction motors on a single locomotive unit.

Locomotive – A unit propelled by any form of energy or more than one of these units operated from a single control. Locomotives are used in train or yard service. Rules that apply to locomotives also apply to cab control cars.

Locomotive Servicing Track Area – One or more tracks within an area in which testing, servicing, repair, inspection, or rebuilding of locomotive unit and is under the exclusive control of mechanical personnel.

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

Minimum Continuous Speed – The minimum speed at which a locomotive unit can operate continuously without damage to traction motors. This speed is based on the maximum amperage the traction motor can accept without overheating.

Minimum Reduction – An initial brake pipe reduction of 6 to 8 psi which causes a minimum brake application.

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

Over Reduction – A reduction of brake pipe pressure in excess of full service.

WARNING: EXCESSIVE OVER REDUCTION CAN RESULT IN LOSS OF ABILITY TO OBTAIN AN EMERGENCY BRAKE APPLICATION.

Penalty Brake Application – An automatic brake application, at a service rate, caused by actuating various devices.

Planned Braking – Having prior knowledge of a condition affecting movement which allows sufficient time and distance to slow, control, or stop a train in the safest and most efficient manner for the conditions.

Pneumatic Control Switch (PCS) – An electrical device that will automatically reduce the locomotive to idle. Pneumatic control can be initiated by an emergency, safety control or locomotive OVERSPEED (MPH). Automatic sanding will occur when the PCS is actuated.

Power Braking – The application of the automatic brakes while the locomotive is working in throttle position 5 or higher.

Pressure Maintaining – A feature of the automatic brake valve which maintains brake pipe pressure against brake pipe leakage.

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.

Propagation of Air – The serial action of transmitting a brake application from car to car through a train.

Quick Service – The local venting of brake pipe air at each car which occurs any time the control valve moves from a release to applied position.

Reduction Relay Valve (A-1) – A quick service valve and an emergency vent valve mounted on a common bracket designed for application on long freight cars. The purpose is to offset the effect of increased volume and brake pipe length by promoting quick service activity and ensuring propagation of an emergency brake application through long cars in a train.

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

Relay Valve – A valve that receives a controlling pressure from a source and operated to deliver and maintain a corresponding pressure. Through differential diaphragms of different sizes a lesser or greater pressure may be delivered.

Release Valve – A device on the control valve that permits air on an individual car to bleed to atmosphere from the brake cylinder, auxiliary and emergency reservoirs, individually or together.

Retainer – A valve through which brake cylinder air can be completely exhausted, or the rate of exhaust can be reduced to a slower rate, or predetermined brake cylinder pressure can be retained.

Service Application – A reduction of brake pipe pressure at a controlled rate to cause an application of brakes. It may consist of one or more service reductions.

Service Lap Position – The condition obtained when two different volumes of air become equalized and a connection between them is closed.

Service Rate Reduction – A rate of reduction that will cause the brakes to apply with a service application.

Slack – The free movement of the coupling devices before a car or locomotive begins to move. There are two kinds of slack:

- Free slack is the accumulation of clearances and wear in the associated parts of the couplers.
- Spring slack results from the cushioning action of the draft gears.

Solid Block (of Cars) – One or more charged cars coupled together and tested. The air brake system on a solid block remains charged if it is disconnected from its air supply for less than 2 hours.

Split Service Reduction – The preferred method of applying train brakes gradually thus reducing in-train forces. A split reduction is accomplished by making an initial 5 to 7 psi brake pipe reduction, followed by subsequent reductions in 2 to 3 psi increments spaced at intervals 30 seconds apart.

Stringlining – The result of excessive draft forces in a train while negotiating a curve which causes wheel climb, track damage, and derailment..

Surprise Stop – The shortest stop possible without using an emergency application.

Telemetry System –

- *Head End Device:* A radio device on the controlling locomotive unit capable of receiving and displaying data from an End of Train Device. Some devices are equipped with a switch to initiate an emergency brake application from the rear of the train.
- *End of Train Device:* A radio device at the rear of a train that transmits brake pipe pressure and other information to the Head End Device. Some devices are capable of initiating an emergency brake application. A highly visible marking device is incorporated into this device.

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

Throttle Modulation – Minor adjustments of the throttle for the purpose of controlling train speed.

Tons Per Axle Dynamic Brake – The total actual trailing tonnage of the train divided by the total equivalent axles of operative dynamic brake.

Tons Per Operative Brake – The actual trailing tonnage of the train divided by the total number of operative brakes.

Track-Train Dynamics – A general term used to describe the interaction of locomotive and cars with the track structure during the movement of a train. Track-Train Dynamics are affected by variables such as weather, speed, train make-up, train handling, condition of track and equipment, grade, curvature, and operating policies.

Tractive Effort – The force exerted by a locomotive unit, measured in pounds.

Undesired Emergency (UDE) – A service application that results in an unintentional emergency application. Also referred to as a dynamiter.

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REFERENCES

Department of the Army Forms

DA forms are available from the APD website at https://myforms.us.army.mil/wps/myportal

DA Form 2028 *Recommended Changes to Publications and Blank Forms*

Department of Defense Forms

DD forms are available from the OSD website at http://www.dtic.mil/whs/directives/infomgt/forms/formsprogram.htm

DD Form 862 *Daily Inspection Worksheet for Diesel-Electric Locomotives and Locomotive Cranes*

Federal Railroad Administration Forms

FRA forms are available from the FRA website at http://safetydata.fra.dot.gov/OfficeofSafety/Forms/Default.asp

FRA Form 6180-49A *Locomotive Inspection and Repair Record*

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TC 55-88-1
26 March 2008

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General, United States Army
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Official:

JOYCE E. MORROW
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