

BNSF Safety Vision

We believe every accident or injury is preventable. Our vision is that Burlington Northern Santa Fe will operate free of accidents and injuries. Burlington Northern Santa Fe will achieve this vision through:

A culture that makes safety our highest priority and provides continuous self-examination as to the effectiveness of our safety process and performance ...

A work environment, including the resources and tools, that is safe and accident-free where all known hazards will be eliminated or safe-guarded ...

Work practices and training for all employees that make safety essential to the tasks we perform ...

An empowered work force, including all employees, that takes responsibility for personal safety, the safety of fellow employees, and the communities in which we serve.

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Air Brake and Train Handling Rules

No. 4

IN EFFECT AT 0001
Central, Mountain and Pacific
Continental Time

Sunday April 29, 2007
(Including revisions up to
December 15, 2008)

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100.0 Train Air Brake Tests and Inspections

100.1 Compliance with FRA Regulations

Inspect and test brake equipment on locomotives and cars according to Federal Railroad Administration (FRA) regulations contained within these rules.

100.2 Safety Inspection of Freight Cars

Inspect and test brake equipment on locomotives and cars according to Federal Railroad Administration (FRA) regulations contained within these rules. In addition, all cars at the initial terminal or that are added enroute must be given a safety inspection as per rule 1.33 in the General Code of Operating Rules (GCOR).

Inspections and air brake tests may be performed by either a “Qualified Person” or a “Qualified Mechanical Inspector”.

A “Qualified Person” refers to a trainman given fundamental training on freight car inspections and air brake tests and a “Qualified Mechanical Inspector” refers to a person such a carman who has been given more extensive training that provides for a more detailed inspection. All trainmen are “Qualified Persons” in the application of the following rules.

Inspection and air brake tests by Qualified Mechanical Inspectors provide for a greater distance that a train may travel before additional inspections and tests are required. Inspection of equipment, when required, must be performed on both sides at some point during an inspection and air brake test to be able to examine and observe the functioning of all moving parts of the brake system on each car as necessary, as well as to comply with all parts of GCOR Rule 1.33. Roll-by inspections may only be utilized to determine that all brakes have released and may not be used to perform all other inspection requirements for either side of the train.

100.3 Coupling and Securing Air Hoses

Before coupling air hoses between locomotives and/or cars, employees must:

- Shake debris out of the hoses.
- Blow all condensation from the locomotive brake pipe or yard air line.

Whenever possible, secure air hoses on locomotives and cars during all movements to prevent the hoses and glad-hands from dragging and becoming damaged.

100.4 Operative Brakes

These requirements apply to air brake tests and inspections:

- Unless the brakes fail enroute, the air brakes on all cars must be operative unless being moved for repairs and they are properly tagged. As per GCOR Rule 1.33, Qualified Mechanical Inspectors will provide three tags on cars given to train crews to be moved to repair facilities. Cars with defective air brake equipment will be tagged on each side and the third tag will be retained on the locomotive.

EXCEPTION: Scale test cars are not required to be equipped with air brakes, but if they are equipped they must be operable.

- Cars discovered with air brakes that fail enroute and are cut out are tracked utilizing our system database and do not require the application of defect tags on the car. When required to cut out the air brakes on a car en route, contact the NOC Mechanical Desk and be governed by the manager’s instructions regarding where to set the car out making a notation of this on the blank spaces provided on the TRAIN PROFILE. If subsequent crew(s) will be required to move the car with the air brakes cut out to its set out location, this written information must also be provided to any relieving crew(s) or left in the controlling locomotive cab form holder for the relieving crew(s). (Reference ABTH Rules 102.7 and 102.9 on procedures for handling cars with cut out air brakes.)

- Train documentation that is produced for subsequent crews may also reflect information regarding cars with the air brakes cut out moving to a location to be set out for repairs.
- At least 85 percent of the cars in a train must have operative brakes under all circumstances.
- When departing terminals, engineers must allow their trains to be inspected where required.

100.5 Person in Charge of Air Brake Test

The person performing the air brake test is in charge of the train while the test is being conducted. Before permission is given to apply or release the brakes, the person in charge must determine that all employees are safely positioned.

The employee at the controls of the locomotive must not apply or release train brakes without permission from the person performing the air brake test.

100.6 Standard Brake Pipe Pressures

Regulating valve must be set as follows:

- Yard or Freight service - 90 psi
- Trains consisting entirely of business car or passenger equipment - 105 psi. Exception: Amtrak and Commuter Trains will be governed by their own instructions.

100.7 Charging Air Brake System

Charge the air brake system to ensure that the system functions as needed. When charging the system:

- Do not charge a train's air brake system with more than one automatic brake valve cut in unless utilizing distributed power locomotives.
- Do not increase diesel engine RPM to maintain main reservoir pressure unless the pressure fails to stay 10 psi above the regulating valve setting.
- If engine RPM must be increased, do not exceed throttle position 4.

Note: Locomotive consists with a single locomotive equipped with an electric air compressor (GE C40-8 or C44-9, for example) may only require advancing throttle to Run 1 position to increase charging speed. Some EMD locomotives (SD70MAC, for example) automatically increase engine speed as needed to maintain main reservoir pressure.

In yards where trains are made up, unattended locomotives may be used to charge the brake system when ambient temperature requires additional charging time.

100.8 Air Brake Tests Using End-of-Train Telemetry Devices (ETD)

When air brake test requires determining brake pipe pressure is restored or air brake system is to be charged to a specified pressure at the rear end of train this can be determined by any of the following:

- An accurate gauge.
- An ETD.
- A DP locomotive consist.

When an air brake test requires an inspection to determine that the brakes apply and release on the rear car of the train, this requirement is considered fulfilled when either an ETD or a distributed power unit attached to the rear of the train indicates the following:

- A brake pipe pressure decrease of at least 5 psi, the brakes are applied.
- A brake pipe pressure increase of at least 5 psi, the brakes are released.

100.8.1 Air Brake Tests Using Handheld Gauges

Handheld gauges used for air brake test purposes must be determined to be accurate within the last 92 days. A method of checking accuracy of the hand held gauge is outlined below:

1. Utilizing a locomotive brake pipe gauge, have engineer release automatic brake valve and charge brake pipe to 90 psi.
2. Attach handheld gauge to brake pipe of the controlling locomotive.
3. Compare pressure indicated by the handheld gauge to locomotive brake pipe gauge.
3. If pressure indicated by handheld gauge is within 3 psi of locomotive brake pipe gauge reading, the handheld gauge may be used to conduct air brake tests.
4. The date of the most recent pressure comparison must be noted on a sticker applied to the gauge or on a document in the possession of the user.

Note: Gauges that are not within 3 psi of the locomotive reading must not be used to conduct air brake tests and must be turned in to the mechanical department for repair or recalibration.

100.9 Brake Pipe Leakage Test

Brake system leakage can be tested by utilizing either the Air Flow Method (AFM) or the Brake Pipe Leakage Method. The Air Flow Method is the preferred method when required equipment is available.

A. Location of Test

A brake pipe leakage test is required when:

- Conducting a Rule 100.10 (Initial Terminal and Road Air Brake Test),
- Conducting a Rule 100.10.2 (Initial Terminal Air Brake Test From Yard Test Plant),
- Conducting a Rule 100.12 (Intermediate Brake Test),
- Adding cars to a train that have not been pre-tested,
- An AirTurbine ETD is used to replace an existing end-of-train device on a train.

B. Air Flow Method (AFM)

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

- The controlling locomotive has a maintaining-type automatic brake valve.
- The train has a gauge or device at the rear of the train.
- The locomotive has an air flow indicator with a direct reading of air flow in increments no greater than 10 cubic feet per minute (CFM). Note: Some locomotives without digital displays of air flow have air flow meters with a scale that does not correspond to a specific CFM and may not be used for conducting an air flow method brake pipe leakage test. These are identified by their lack of any reference to CFM on the gauge.

Conduct an AFM test as follows:

1. Charge the brake system to within 15 psi of the regulating valve setting as indicated by a gauge or device at the rear of the train.
2. When air flow does not exceed 60 CFM, test is complete. If air flow exceed 60 CFM, train must be inspected for leakage.

C. Brake Pipe Leakage Method

If the train does not meet AFM test conditions conduct a brake pipe leakage test as follows:

1. Charge the brake system to within 15 psi of the regulating valve setting as indicated by a gauge or device at the rear of the train.
2. Wait for the signal to apply the brakes.
3. When you receive the signal, reduce brake pipe pressure by 20 psi.
4. Allow the brake pipe exhaust to stop.
5. Wait 1 minute.
6. Cut out the automatic brake valve.
7. Wait an additional 1 minute for the brake pipe pressure to equalize
8. Time the brake pipe leakage for 1 minute. If the leakage does not exceed 5 psi the test is complete. If the leakage exceeds 5 psi train must be inspected for leakage and re-tested.
9. When you receive the signal to release the brakes, move the automatic brake valve to RELEASE position and cut the automatic brake valve in.

Note: Utilize the Distributed Power systems automated brake pipe leakage mode when checking leakage on DP trains.

Exception: Using the brake pipe leakage method with only a few cars while equipped with an air turbine ETD may result in the brake pipe pressure dropping at a rate greater than 5 psi in one minute. Should this occur, close the angle cock between the last car and the air turbine ETD after step 1, above, until the test is successfully completed. After the test is successfully completed, reopen the angle cock between the last car and the air turbine ETD.

100.10 Initial Terminal and Road Air Brake Test (Class 1 Air Brake Test)

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

A. Requirement For Test

Test must be conducted:

- Where the train is originally assembled (initial terminal).
- Where the train consist is changed, other than by adding and/or removing a car or a solid block of cars, or by removing cars that are determined to be defective.
- Where a unit or cycle train has traveled 3,000 miles since it's last Class I Air Brake Test, or
- Where the train is received in interchange and the train consist is changed. However, an inspection and test is not needed if the train consist is changed by any one or a combination of the following:
 - a. Removing a solid block of cars from train.
 - b. Changing motive power.
 - c. Removing or changing the caboose, if used.

On a portion of the train as specified below:

- On one or more cars added that have not been pre-tested by the initial terminal air brake test.
- On that portion of train that has not been kept charged. (off air for over 4 hours)
- On a solid block of cars being added to train that is comprised of cars from more than one previous train.
- On each solid block of cars that is comprised of cars from only one previous train but the cars of which have not remained continuously and consecutively coupled together with the train line remaining connected, other than for removing defective equipment, since being removed from it's previous train.

Note: Cars are still considered a “solid block” if from only one previous train and divided into smaller segments to accommodate space or trackage constraints as long as placed back in same relative order as when removed from previous train.

Exception: When any combination of set outs and pick ups at one location exceeds what is outlined above or when switching cars for train make up and/or hazardous materials placement reasons, only that portion of the train involved in the rearrangement of such cars must be given a Class 1 inspection and air test. The remaining pre-tested cars in the train that have remained consecutively coupled only require a Class 3 test before departing.

B. Procedure for Initial Terminal and Road Air Brake Test and Inspection

Inspect before or during Air Brake Test for the following:

- Inspect the angle cocks and verify that they are properly positioned.
- Inspect the air hoses and verify that they are in condition for service and properly coupled.
- Inspect the system for leakage.
- Make necessary repairs to reduce leakage to a minimum.
- Inspect the retaining valves and verify that they are in EXHAUST.

Conduct the test as follows:

1. Charge the air brake system to within 15 pounds of the locomotive regulating valve setting as indicated by a gauge or device at the rear of the train.
2. Perform a leakage test as specified in Rule 100.9 (Brake Pipe Leakage Test).
3. When proper notification is received to apply the brakes for the test, make a 20 pound brake pipe reduction.
4. Inspect the entire train or cars added not pre-tested to determine that:
 - Brakes are applied and remain applied until signal is given to release on each car and piston travel meets the requirements of Rule 100.18 (Piston Travel). Make sure 100 percent of the train brakes are operative before departing. Any car whose brakes release prior to signal being given to release the brakes may be re-tested once and a determination must be made that brakes will remain applied until a release is initiated for a period of no less than 3 minutes.
 - Brake rigging does not bind or foul.
 - All parts of the brake equipment are properly secured.
5. When the test and inspection of the air brake application is complete and the proper notification has been received to release the brakes:
 - Place the automatic brake valve handle in the RELEASE position.
 - Notify the inspector that the brakes have been released.
 - Inspect each brake to make sure all brakes have released. This inspection may be made as the train departs at a speed not exceeding 10 MPH.

Note: An ETD pressure drop and rise of 5 psi during the air brake test may be used to determine application and release of cars within the train that have been previously tested.

C. Engineer Notification

Written record of Class 1 inspections performed at the train's origin and at any 1500 mile Extended Haul inspection location (at origin or en route) must be retained on the locomotive to the train's destination. Cars picked up, inspected and air tested en route by train crew do not require written documentation of the Class 1 inspections. Since which trains are designated as “Extended Haul” trains may not be communicated to train crews, unless notified otherwise, assume all carmen inspections are for “Extended Haul” and retain all Form 15287 inspection forms provided by a carman to destination.

When required as outlined above, a qualified person or mechanical inspector who participated in the test and inspection or anyone who knows the test was completed must notify the engineer in writing that the initial terminal air brake test has been completed satisfactorily including name, date, time, location and number of cars inspected. Class 1 inspections and tests may also be communicated to the engineer so that it may be entered on the space provided on train documentation (**TRAIN PROFILE**). Engineers receiving written notification of the air brake test must:

1. Accept the notification as authority that the initial terminal air brake test has been completed satisfactorily.
2. Maintain the written record of all Class 1 inspections and brake test in the cab of the locomotive in the form holder provided until train reaches final destination.

Written notification of the initial terminal inspection and air brake test may be provided the locomotive engineer by any one of the following methods:

- a. On Form 15287 at the initial terminal.
- b. By written record on space provided on TRAIN PROFILE. Note: Any written record is acceptable if profile is unavailable.
- c. By electronic means on the space provided on the TRAIN PROFILE.

Note: Electronic records of Class 1 inspections on TRAIN PROFILE are only to be used in the absence of the originals and should a discrepancy occur, the original will be used as the official record. All other brake tests other than Initial Terminal Tests (Class 1) do not require any written documentation to be maintained on the lead locomotive of the train. The number of cars indicated on your Class 1 test record(s) may not correspond to the number of cars on your train due to pick ups and set outs en route.

When train identification (symbol) is changed en route, this alone does not require another Class 1 inspection and air test on the train. The original Class 1 documentation is acceptable to retain to destination. When this occurs, the train symbol change and location should be noted on your PROFILE and/or the original Form 15287 from origin.

In addition to maintaining written documentation on locomotive as outlined above, conductor must utilize the Voice Train Reporting (VTR) method to report all Class 1 inspections performed by the train crew at the train's origin (where train is initially made up) and at all locations where the train crew performs an Intermediate Brake Test and Inspection (Class 1A Brake Test) en route.

ETD Emergency Test Record

ETD test information is required to be provided the outbound crew only if performed in the absence of all train crew members.

Cycle Trains

Unit bulk commodity trains (coal, grain, taconite, etc.) that remain intact are considered "Cycle Trains" and may be operated up to 3,000 miles before an additional Class 1 inspection and brake test is required. This does not exclude the requirement for intermediate inspections and tests (Class 1A). Loading or unloading locations and/or train symbol changes on cycle trains have no bearing on where inspection and brake tests are required.

Interchange Trains

Crews accepting trains received in interchange from foreign railroads should be provided all Class 1 inspection records for that train, which must be maintained in the cab of the controlling locomotive to destination. Class 1 inspection records must also be provided when trains are delivered in interchange to a foreign railroad. Exception: Unless otherwise instructed, Cycle trains returning to BNSF in interchange require only the Class 1 inspection record described above.

In addition to maintaining written documentation on locomotive as outlined above, conductor must utilize the Voice Train Reporting (VTR) method to report all Class 1 inspections performed by the train crew at the train's origin (where train is initially made up) and at all locations where the train crew performs an Intermediate Brake Test and Inspection (Class 1A Brake Test) en route.

100.10.1 Trains Designated as “Extended Haul”

Trains designated as “Extended Haul” must be given air brake inspection and tests performed by a Qualified Mechanical Inspector and train may be operated greater than 1,000 miles but not to exceed 1,500 miles before an additional Intermediate or Initial Terminal Inspection and Air Brake Test is required. To apply the extended distance for this type of inspection and air brake test:

- The train may not make more than one pick up and more than one set out between Initial Terminal (Class 1) and/or Intermediate (Class 1A) inspection points. This excludes any set out of defective equipment discovered en route.
- Any set out en route must be given an inbound inspection by a Qualified Mechanical Inspector.
- Any cars or solid block of cars added en route must be pretested by a Qualified Mechanical Inspector.
- Train must not move any cars with defective equipment, regardless of whether tagged appropriately.
- Train must be given inbound inspection by a Qualified Mechanical Inspector at 1,500 mile intermediate inspection points.

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100.10.2 Test Required After Attaching Locomotive to Train Previously Tested with Yard Test Plant

When the locomotive is coupled to a train that the initial terminal air brake test has been performed with yard test plant:

- If train has been off air 4 hours or less and yard air pressure setting is the same as locomotive regulating valve, perform air test as outlined in Rule 100.15 (Application and Release Test).
- If train has been off air 4 hours or less and yard air pressure setting is less than locomotive regulating valve.
 1. Charge air to regulating valve setting
 2. Perform a leakage test as specified in Rule 100.9 (Brake Pipe Leakage Test).
 3. Perform a Rule 100.15 (Application and Release Test).
- If train has been off air more than 4 hours perform a Rule 100.10 (Initial Terminal Air Brake Test) on the entire train.

100.11 Transfer Train Movements Test

Test the air brake system on a train making a transfer train and yard movement that does not exceed 20 miles in one direction. Intermediate switching is permitted on Transfer Train movements.

Test the air brake system on a transfer train as follows:

1. Couple brake pipe hoses between all cars.
2. Charge the brake system to at least 60 psi as indicated by a gauge or device at the rear of the train.
3. Make a 15 psi brake pipe reduction.
4. Verify that the brakes apply and remain applied on each car until release signal is given. Any car whose brakes release prior to signal being given to release the brakes may be re-tested once and a determination must be made that brakes will remain applied until a release is initiated for a period of no less than 3 minutes.

Note: Testing the air brake system as outlined above is also required before proceeding after adding cars during a transfer train and yard movement. If cars are set out during a transfer train and yard movement, determine that brake pipe pressure at the rear car has been restored before proceeding.

Note: When making retest, car must be charged to within 15 psi of the regulating valve setting, then make a 20 psi brake pipe reduction instead of 15 psi. Brakes shall remain applied until a release is initiated after a period of no less than three minutes.

100.12 Intermediate Brake Tests (Class 1A Brake Test)

At designated locations, conduct an intermediate train air brake test as follows:

1. Perform a leakage test as specified in Rule 100.9 (Brake Pipe Leakage Test).
2. With the automatic brake valve, make a 20 psi brake pipe reduction and verify that brakes apply and remain applied on each car until release signal is given. Any car whose brakes release prior to signal being given to release the brakes may be re-tested once and a determination must be made that brakes will remain applied until a release is initiated for a period of no less than 3 minutes.
3. Verify that the brake rigging is properly secured and does not bind or foul.
4. Verify that 100 percent of the air brakes are operative before proceeding.

100.13 Running Air Brake Test

Requirements for Test

Conduct a running air brake test of all passenger trains and trains consisting entirely of business cars when:

- The train leave the initial terminal,
- Locomotive, engine crew, train crew, or operating ends have been changed,
- Any angle cocks or cutout cocks have been closed. However, the running test is not required when cars are cut off from the rear end of the train only,
- A standing air brake test has been conducted,
- The train reaches points designated by the timetable or general order, or
- The train has struck debris on the track.

Procedure for Running Air Brake Test

To conduct a running air brake test:

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

Brakes Not Operating Properly

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

1. Inspect the brakes to identify and correct the problem.
2. Before proceeding, conduct an application and release test as specified in Rule 100.15 (Application and Release Test).
3. Once the train is proceeding, immediately repeat the running test.

100.14 Air Brake Test When Cutting Off and Recoupling

When a train is uncoupled, unchanged and then recoupled in 4 hours or less, determine that brake pipe pressure is being restored as indicated by gauge or device at the rear end of the train before proceeding.

If the cars are recoupled in more than 4 hours, conduct a Rule 100.10 Initial Terminal Air Brake Test) on those cars that did not remain charged

100.15 Application and Release Test (Class 3 Air Brake Test)

Requirement For Test

Test must be conducted:

- When any change is made to a locomotive consist.
- When a caboose is changed.
- After picking up a block of previously tested cars.

- When helper locomotives are added anywhere in the train or removed from other than the rear end of the train, or
- When one or more consecutive cars are set out of the train.

Procedure for Conducting An Application and Release Test

To conduct an application and release test:

1. Charge the brake system to within 15 psi of the regulating valve setting as indicated by a gauge or device at the rear of the train.
2. Make a 20 psi brake pipe reduction with the automatic brake valve.

Verify that brakes on the rear car apply and release.

100.16 Air Brake Test When Adding Pretested Cars

When adding a block of cars pre-tested by Rule 100.10 (Initial Terminal Air Brake Test) that have been off air 4 hours or less, conduct a Rule 100.15 (Application And Release Test).

100.17 Inbound Train Inspection

At terminals where facilities are available for immediate air brake inspections and repairs:

1. Secure cars with sufficient hand brakes as required.
2. Place the automatic brake valve handle in the HANDLE OFF/CONT SVC position, to reduce brake pipe to near 0 psi.
3. When the brake pipe reduction is complete and the air has stopped exhausting, close the angle cock on the locomotive or on the cars that will be detached with the locomotive.
4. Make sure the angle cock on the portion of the train or cars left standing is left open.

100.18 Piston Travel Limits

Follow the piston travel requirements as outlined by stenciling or badge plate. If no stenciling or badge plate is available, piston travel must be within the following guidelines:

Truck-Mounted Brake Cylinders

Piston travel must provide brake shoe clearance when brakes are released.

Piston travel must not exceed 4 inches where the piston acts directly on the brake beam.

Body-Mounted Brake Cylinders

At the initial terminal:

- The piston travel must be adjusted to between 6 and 9 inches.

At intermediate inspection points:

- The piston travel must not exceed 10 ½ inches.

100.19 Dynamic Brake Requirements

Locomotives discovered to have inoperative dynamic brakes must be individually tagged and an additional defect tag must be left on the controlling locomotive of the locomotive consist as information to the locomotive engineer. Inoperative dynamic brake information may also be provided to the locomotive engineer by electronic means on the train documentation under locomotive information, which will show for each locomotive whether locomotive dynamic brake is “operative”.

The requirement to identify inoperative dynamic brakes only includes dynamic brakes that are defective or ineffective due to malfunction and does not include tagging dynamic brakes that are simply cut out to comply with dynamic brake axle limitations.

Tags indicating inoperative dynamic brakes should include the following information:

1. Locomotive number.
2. Name of discovering railroad.
3. Location and date condition discovered.
4. Signature of person discovering the condition.

100.20 Inoperative Dynamic Brake on Lead, Controlling Locomotive

On train movements requiring the use of the dynamic brake, the lead, controlling locomotive must be equipped with the ability to control the operative dynamic brakes of trailing locomotives in the consist, as well as be equipped with:

1. An operative dynamic brake, or
2. An operative accelerometer that displays current change in speed or predicted change in speed in miles per hour per minute.

Note: Low speed yard and transfer movements on level or near level grade are examples of movements that would not “require” the use of dynamic braking.

101.0 Locomotive Air Brake Tests and Inspections

101.1 General Requirements

When locomotive inspection forces are not immediately available, an engineer taking charge of a locomotive consist must know that the brakes are in operating condition.

Engineers are responsible for the following:

1. If possible, position yourself so you can conduct a roll-by inspection of an incoming locomotive consist.
2. Keep the side and end doors of the locomotive closed when the doors are not being used.
3. Keep cab windows and doors of unoccupied, trailing locomotives closed.
4. Keep the locomotive's high-voltage cabinets closed during operation.
5. Check for sliding wheels at frequent intervals if:
 - The locomotive is dead,
 - The locomotive is isolated, or
 - Any of the locomotive's traction motors are cut out.
6. Verify that brake pipe exhaust ports are not plugged or obstructed.
7. Verify that the independent brake valve handle is not blocked in the actuate position.
8. Verify that the reverser is centered to engage the low-idle feature when the locomotive is not moving.
9. Verify that the brake shoes are thick enough to last until the next maintenance or through the shift in yard service.

101.2 Locomotive Daily Inspection

A. Inspection Requirements

Engineers are responsible for ensuring that each locomotive in their charge including locomotive(s) picked up en route is inspected each day the locomotive is in service. In service includes locomotives moving in through freight service that are isolated or shut down for fuel conservation or other than non-complying defects. (Locomotives properly tagged as non-complying locomotives moving to repair facilities require no daily inspection enroute.) Determine if locomotive needs to be inspected by checking the FRA Rule 229.21 Daily & Mid-Trip Inspection form (locomotive cab card) in each locomotive cab. The card will indicate the date and time of the last inspection.

Exceptions

- On a multiple locomotive consist engineer may assume that all trailing locomotives in the consist and any distributed power in train were inspected on the same date as the cab card on the controlling locomotive.
- An inspection is not required on a locomotive that is left standing (idling or shutdown) and will not be used as a working locomotive:

Union Pacific locomotives have an entry in the "REMARKS" section at the bottom of the blue card (Form FRA F-6180-49A) which reads "Do Not Use After: mm/dd/yy". Verify that the locomotive has not passed this date.

BNSF locomotive daily inspection reports will be filed electronically, whenever possible. Defects to locomotives, whether discovered during locomotive daily inspection or otherwise, non-complying or not, will be verbally reported to the BNSF mechanical desk, NOC unless local instructions provide otherwise.

Inspected Previous Calendar Day

If the locomotive cab card indicates that the locomotive was inspected the previous calendar day, complete the current daily inspection before 2359 hours.

To allow the locomotive to remain in service:

- If your tour of duty will go beyond 2359 hours, conduct the locomotive daily inspection before 2359 hours. Contact the train dispatcher, yardmaster, or other proper authority to determine where to complete the daily inspection, or
- If you have time to reach your final terminal before 2359 hours, inspect the locomotive at that terminal, unless informed that the Mechanical Department or the relieving engineer will inspect the locomotive before 2359 hours:

Not Inspected Previous Calendar Day

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

Locomotive Picked Up En Route

When picking up a locomotive on line, the engineer must determine which locomotives will require a daily inspection. No locomotive in resulting consist may have a date older than the lead, controlling locomotive.

Locomotive Set Out On Line

When setting out a locomotive on line that was inspected on the previous calendar day, inspect the locomotive, unless notified that the locomotive will be inspected by the Mechanical Department or be picked up by another train before 2359 hours.

B. Conducting a Locomotive Daily Inspection

Not all defects are non-complying conditions. However, the following items are non-complying conditions if they do not function properly during the daily inspection.

Inspect these three general areas of each locomotive:

Control Compartment/Locomotive Cab

Verify that FRA Form F 6180-49A (blue card) is displayed under a transparent cover in the cab of each locomotive.

Operate sanders to deposit sand in front of each locomotive's lead wheels when the reverser position determines the direction.

Ensure that:

1. Each air gauge registers correctly and is within 3 psi of the required pressure. See Rule 101.7
2. At least one headlight bulb must be operational on each end of the locomotive consist.
3. Two ditch lights, if equipped, are operational in direction of travel. If not equipped or when operated as a remote control locomotive, may be used as leading locomotive if 20 MPH is observed over all road crossings. Inspection of ditch lights is not required when performing daily inspection on locomotive being used as remote control locomotive.
4. Horn operates
5. Bell operates
6. Gauge lights and engineer's overhead cab light illuminate. If burned out and other available lighting is sufficient to allow visibility from the crews normal position, report as a defect but not a non-complying condition.
7. Speed indicator functions accurately, if equipped. After a daily inspection, if the speed indicator failure

is identified on the lead locomotive as soon as it begins moving, the failure is a non-complying condition discovered during the daily inspection.

Exception: Locomotives not equipped with speed indicators or when operated as a remote control locomotive, are not considered to have a non-complying defect and may be used as controlling locomotive only if operated at speeds not exceeding 20 MPH. Inspection of speed indicator is not required if locomotive is being used as a remote control locomotive.

8. Locomotive cab is free of stumbling or slipping hazards.
9. Windows provide a clear view. Small cracks that do not obscure view must be reported as a defect but not a non-complying condition.
10. No traction motors have been cut out. However, on GE AC, GE-8 DC, GE-9 DC & EMD AC locomotives, one or more traction motors/trucks may be cut out and not considered a non-complying condition.
11. Cab seats are properly secured.

Note: Locomotives with defect items 3, 4, 5, 6, 7 and 9 above, may be used in power as trailing units. These defects must always be reported but are considered non-complying only when positioned in locomotive consist as the lead, controlling locomotive.

12. A Sanitary Toilet Facility

Note: Toilet facilities are not required on locomotives used in switching or transfer service on which employees have railroad-provided sanitation facilities outside the locomotive that meet sanitation standards at frequent intervals during the course of their work shift. However, toilet facilities on any locomotives must be part of the locomotive daily inspection and defect reporting. In addition, unoccupied locomotives in trail position on through freight trains are not required to have operative or sanitary toilets. However, any locomotive toilet found defective or unsanitary, whether required or not, are to be reported as defective.

Locomotive with defective or unsanitary toilet may not be used as lead unit, unless:

- 1) No other suitable locomotives are available for use
- 2) It is not possible to switch another locomotive into lead position
- 3) Location is not equipped to clean the sanitation compartment, if unsanitary, or repair the toilet facility if defective.

Walkway and Engine Compartment

Inspect both sides of each locomotive to ensure that:

1. Walkways and walk-in compartments (car body-type locomotives) are clear of debris, tools, and accumulated oil or grease that present a hazard to the crew.
2. Handrails, hand holds, steps, ladders, safety chains, and guards are secured and ready for service. Inspect for broken, bent, damaged, or loose equipment. Make sure safety chains are connected high enough for safe passage.
3. All electrical and rotating equipment guards are in place.
4. The diesel engine has no apparent exhaust, oil, water, or fuel leaks.
5. The hand brake is operational.

Ground Level

Inspect the exposed areas for apparent defects, but do not crawl under or between locomotives to make the visual inspection.

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

1. Sand is deposited on the rail in front of the lead wheels of each locomotive in consist.

Exception: All locomotives with inoperative sanders must be reported as defective and must be repaired within 7 or 14 days, depending on class of service, but such locomotives may be operated under power until repaired as follows:

- Road service - Locomotives discovered with inoperative sanders on freight trains may be operated out of their original terminal to destination provided the first powered wheel set in the lead, locomotive consist has operative sanders.
- Yard switching service - Locomotives used in yard switching operations discovered with inoperative sanders may continue to be used under power only if that terminal is not equipped with sander servicing facilities. If sander servicing facilities are available, locomotive may only be used under power until next time the locomotive daily inspection is due.

2. Fuel tank is not leaking.

3. No defects such as cracks and broken or missing parts are on the:

- Locomotive trucks
- Wheels
- Gear cases
- Draft gears

4. Brake cylinder piston travel is:

- Minimum: Sufficient to provide brake shoe clearance when the brakes are released.
- Maximum: 1 1/2 inches less than the travel entered on FRA Form F 6180-49A (blue card) in the locomotive cab.

5. Foundation brake rigging is secured and all components other than wheels and sand hoses are at least 2 1/2 inches above the top of the rail.

6. Snowplow, pilot, or endplate is properly secured and is between 3 inches and 6 inches above the top of the rail.

7. Brake shoes are secured and approximately in line with the tread of the wheel. Make sure the shoe has no obvious lips or overhangs.

8. No part of the electrical cable is lying on the coupler.

9. Unused electrical cables are stowed, or the disconnected ends are placed into a dummy receptacle or a multiple-unit cable holder.

10. 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 clockwise to the automatic position, with the stem extending beyond the valve handle.

C. Complete Required Daily Inspection Forms

Locomotive Inspection Report

Complete a Locomotive Inspection Report for each locomotive inspected.

Locomotive daily inspection form and a FRA Rule 229.21 Daily & Mid-Trip Inspection form (cab card) must be completed with the following inspection information:

- Date
- Location
- Time
- Signature

Write "NC" for Non-Complying in the "time" column if locomotive with a non-complying defect is found during the inspection of that locomotive.

Note: Leave a copy of the locomotive daily inspection at location designated by other local instructions.

101.2.1 Locomotive With Non-complying Condition Safe To Move

If during the locomotive daily inspection you find one or more non-complying conditions, determine if the locomotive is safe to move.

If the locomotive is safe to move, it may be moved only:

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

Exceptions:

- Controlling locomotive found with defective speed indicator during daily inspection may be operated under power attached to cars not exceeding 20 MPH.
- Locomotives found with the following defects during the daily inspection may be operated under power attached to cars as a trailing locomotive:
 - a. Inoperative headlights
 - b. Inoperative horn
 - c. Inoperative bell
 - d. Defective speed indicator
 - e. Window cracks that obscure view
 - f. Cab seats not properly secured
 - g. Both ditch lights inoperative
 - h. Inoperative Safety Devices (see Rule 101.10)

Prior to moving a non-complying locomotive perform the following:

1. Complete a non-complying locomotive tag and attach it to the isolation switch of the non-complying locomotive. The tag must include this information:
 - “Non-complying locomotive” written on the tag.
 - Locomotive initials and number.
 - 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.
2. Secure a copy of the non-complying tag on the control stand of the controlling locomotive.
3. Make sure the engineer in charge of the locomotive movement receives written notification of the non-complying locomotive (a copy of a non-complying locomotive tag meets this requirement). The engineer must inform all other crew members of the non-complying unit and of any restrictions.
4. Notify the train dispatcher/mechanical desk, yardmaster, or other proper authority.

However a locomotive may be moved without complying with Items 1, 2, and 3 above as a single locomotive or dead within a yard solely for repairs and at no more than 10 MPH.

101.2.2 Locomotive With Non-complying Condition Not Safe To Move

If during the locomotive daily inspection you find one or more non-complying conditions and determine the locomotive is not safe to move, do the following:

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

101.3 Defects Other Than Non-Complying Conditions

If a defect or problem is found and is not a non-complying condition do the following:

1. Complete a Locomotive Daily Inspection Report for each locomotive in the consist with a defect or problem.
2. Report any locomotive not producing power to the Mechanical Desk.

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

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

Note: When a locomotive is discovered with a single operative headlight bulb, immediately contact the mechanical desk and be governed by the managers instructions.

101.4 Non-Complying Condition Found En Route

A locomotive that develops a non-complying condition en route may continue operating if the engineer or other qualified employee determines the locomotive is safe to move and completes the Locomotive Daily Inspection Report. The locomotive may then be operated at normal speed until the next daily inspection or until it reaches the nearest point where repairs can be made, whichever occurs first.

The engineer must:

1. Report any non-complying conditions on the Locomotive Daily Inspection.
2. Leave the completed Locomotive Daily Inspection Report with the non-complying locomotive unless otherwise instructed.
3. Report non-complying conditions to the train dispatcher/mechanical desk as soon as possible.
4. Notify the relieving engineer of any non-complying conditions when possible.
5. Apply a Non-Complying Tag to the isolation switch on the non-complying locomotive and the controlling locomotive.

Examples of additional non-complying conditions found en route include:

1. While performing a speed indicator check, an employee determines that the speed is not accurate to within:

- ±3 MPH at speeds up to 30 MPH, or
- ±5 MPH at speeds above 30 MPH

See Rule 101.11 (Operative speed Indicator) when defective speed indicator is found en route

2. While moving and crew members detect flat spots and if inspection determines:

- One or more flat spots are 2 1/2 inches or more in length, or
- Flat spots of 2 inches or more are adjoining.

Note: If a locomotive has flat spots as described above, set it out at the first available point and limit speed to 10 MPH until the setout destination is reached.

101.5 Major Internal Defects Found En Route

If a locomotive en route has a major internal defect do the following:

1. If possible, isolate the locomotive.
2. Shut down the diesel engine immediately if noise indicates an internal mechanical defect in:
 - Diesel engine.
 - Turbocharger, or
 - Components related to the above.
3. If you shut down the engine, do not restart the engine until the equipment has been inspected and can be operated without damaging the locomotive.
4. Report condition to Dispatcher/Mechanical Desk.
5. Fill out an "Out of Service" tag and attach the tag near the engine starting control.

Set out a locomotive with a major defect if the defect requires that the locomotive be set out. Leave the locomotive where maintenance personnel can access it.

101.6 Locomotive Air Brake Test

A. Location of Test

Conduct a locomotive air brake test when:

- Making up a locomotive consist.
- Adding locomotive to a consist
- Other than rear locomotive(s) is removed from consist, or
- Locomotive consist is rearranged

B. Procedure for Conducting Locomotive Air Brake Test

From the ground, observe that the locomotive brakes apply and release from one side of the locomotive consist during these procedures:

Note: If a hand brake has been applied on the locomotive(s) being tested, observe only the pistons at the opposite end of that locomotive(s) with the hand brake applied to determine brake applications and releases.

1. With the independent and automatic brake valve handles in RELEASE, apply the independent brake.
2. After observing that the brakes apply on each locomotive, release the independent brakes.
3. When the brakes are released on all locomotives, apply the automatic brakes by making a 10-psi brake pipe reduction.
4. After the brakes apply on all locomotives, actuate and observe that the brakes release.
5. Reduce brake pipe pressure an additional 10 psi and determine that all brakes reapply.
6. Cut out the automatic brake.
7. Observe gauges and verify that equalizing reservoir indicates no leakage and that brake pipe leakage does not exceed 5 psi per minute.
8. Move automatic brake valve handle to RELEASE position and cut it in.
9. Determine that all brakes release.

Note: Upon successful completion of the test, re-apply the independent brakes.

101.6.1 Single Person Helper Air Brake Test

1. All locomotive hand brakes will be applied to the consist during the test.
2. Fully apply independent brake with automatic brake handle in release position and observe that brakes on each locomotive are applied.
3. Check independent release by placing the automatic brake handle in suppression position, wait for brake pipe exhaust to stop, then release and bail the independent brake. Fully apply, then fully release and bail the independent brake. Observe that brakes are released on each locomotive.
4. Check automatic brake application by moving the automatic brake handle into the over reduction zone until cylinder pressure develops on the gauge, then observe that brakes are applied on each locomotive.
5. Check automatic brake release by releasing the automatic brake, wait for brake cylinder pressure to reduce to zero (0). Cut out the automatic brake and then place the automatic brake handle in suppression position. Observe that brakes are released on all locomotives. Also observe the gauges and verify that equalizing reservoir indicates no leakage and that brake pipe leakage does not exceed 5 PSI per minute. Cut in the automatic brake. After reapplying the brakes, release the hand brake(s).
6. Engineers will make a moving locomotive consist test of the automatic and independent air brakes as prescribed by rule 101.13 as soon as speed and conditions permit.

101.7 Standard Air Pressures

Ensure that air pressures are as follows:

- Main reservoir pressure is 120 to 140 psi.
- Locomotive brake cylinder pressure is:
 - a. Switch locomotives with 10- or 11-inch brake cylinders-35 psi
 - b. Switch locomotives with 9-inch brake cylinders-45 psi
 - c. Locomotives with clasp type brake shoe rigging (2 shoes per wheel)-45 psi
 - d. Locomotives with single shoe per wheel brake rigging-72 psi. Note: Foreign line locomotives may require different main reservoir and independent brake cylinder pressures.
- Brake pipe pressure is:
 - a. Yard or Freight service - 90 psi
 - b. Trains consisting entirely of business cars or passenger equipment-105 psi

101.8 Reducing Locomotive Overcharge

To reduce locomotive overcharge:

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

101.9 Control Switches

Position electrical switches and control equipment in the cab according to instructions on the badge plate or stenciling.

101.10 Locomotive Safety Devices

To the extent possible, make sure these locomotive safety devices are cut in and operating at all times:

- Overspeed
- Alerters (consider defective if device fails to provide visual and audible warnings)
- Automatic cab signals
- Automatic train stop equipment
- Automatic train control equipment

However, safety devices do not have to be operating on non-controlling locomotives, distributed power remote controlling locomotives, or:

- a. When a safety device becomes defective en route, or
- b. During drag loading/unloading operations under 5 MPH.

If a safety device becomes defective en route, inform the train dispatcher and mechanical department as soon as possible. Do not cut out, tamper with, or defeat a safety device without proper authorization. When a locomotive is en route, this authorization may come from the train dispatcher, mechanical supervisor, or other manager.

Rule 101.10.1 Cab Signal Equipment-Foreign Locomotives

Cab signal equipment on foreign locomotives operating on BNSF may inadvertently activate and cause a penalty application if no action is taken by the engineer. These false activations are often related to the additional electrical current in the rails when train is near road crossings equipped with automatic warning devices. When operating a foreign locomotive equipped with cab signal equipment that cannot be cut out, should cab signal equipment inadvertently activate, depressing the button labeled “Cab Signal Acknowledge” during the warning period will prevent a penalty application. If a penalty application has occurred from the Cab Signal System it will be necessary to depress the “Cab Signal Acknowledge” button before moving the automatic brake valve from suppression position to recover from the penalty brake application.

101.11 Operative Speed Indicator

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

1. Locomotive speed indicators must be accurate within:

- ± 3 MPH at speeds between 10 and 30 MPH
- ± 5 MPH at speeds above 30 MPH

Speed indicator that exceeds the above tolerances must be handled as a non-complying condition found en route.

2. If a speed indicator on a controlling locomotive fails en route, the locomotive may continue as a controlling locomotive at normal track speed only to the next facility where repairs can be made or until the locomotive is due a daily inspection, whichever occurs first. Movement beyond a facility where repairs can be made or location where daily inspection was conducted must not exceed 20 MPH.

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

1. Test speed indicator accuracy using identified test miles or mile posts.
2. Conduct the speed check in the 10 to 30 MPH range.
3. Conduct the speed check as near maximum speed as conditions permit.

101.12 Event Recorder

Access to the event recorder is restricted. Only authorized personnel may remove the event recorder data pack or download event recorder data.

101.13 Moving Locomotive**A. Initial Movement of a Locomotive Consist Not Coupled to Other Equipment.**

1. Follow these steps prior to making the initial movement of a locomotive consist outside designated mechanical department limits:
 - a. Ensure locomotive air brakes are applied on each locomotive during visual inspection.
 - b. Determine that sufficient main reservoir pressure is present.
 - c. Verify that hand brakes are released on all locomotives.
 - d. Ensure air hoses are coupled between all locomotives in consist including brake pipe, main reservoir, actuation, and application and release.
 - e. Position cutout cocks and valves for MU operation.
2. Perform these steps as soon as operating conditions permit when changing operating ends of a locomotive consist previously tested as per ABTH 101.6 or 101.6.1 or during the initial movement of a locomotive consist.

- a. At a speed of 1 to 3 MPH, allow the locomotive to drift with the throttle in IDLE.
- b. Check that brakes or other defects do not restrict the locomotive's movement.
- c. Increase speed to approximately 10 MPH, make a service brake pipe application sufficient to develop brake cylinder pressure.
- d. When speed decreases to approximately 5 MPH, actuate to make sure the brakes release.

B. Initial Movement of a Locomotive Consist Coupled to Other Equipment.

When making the initial movement of a locomotive consist that is coupled to a train or other equipment, before speed exceeds 10 MPH, actuate for 5 seconds per locomotive in the consist to determine if brakes apply on trailing locomotive(s) in consist.

If actuating results in brakes applying on trailing locomotives or a sudden change in slack is noted, stop and check MU hose connections. (Lines may be crossed between Act and App/Rel)

If MU hoses are not properly connected, correct the problem and then perform locomotive air brake test 101.6.

Note: Instructions regarding coupling MU air hoses between locomotives in this rule and under Rule 101.17 are intended to mean only one coupling for Main Reservoir, Actuation and Application & Release hoses is required. Duplicating the coupling of any of these hoses on both sides of the locomotive is not required.

C. Hostling Locomotives Utilizing Brake Pipe Only to Control Air Brakes

Multiple locomotive consists may be moved within a terminal area with only the brake pipe connected provided speed does not exceed 10 MPH. When handling locomotive(s) in this manner, main reservoir charging must be maintained on locomotives with brake pipe only connected with either an operative air compressor or with the "dead engine fixture" cut in to provide main reservoir charging from the brake pipe.

Perform the following inspection and test before initial movement of locomotives coupled together and whenever locomotives are added or controlling locomotive is changed:

1. Brake pipe is connected and angle cocks are open between each locomotive.
2. Automatic brake valve must be cut out and independent brake placed in "trail" position with handle RELEASE position on all locomotives coupled together except the controlling locomotive.
3. Allow brake pipe to charge.
4. Perform a standing brake test as follows:
 - a) Make a 10 psi service brake application
 - b) Ensure brakes are applied on each locomotive with brake pipe only applied
 - c) Release the automatic brake application
 - d) Ensure brakes release on each locomotive with brake pipe only applied
5. Release all hand brakes.

D. Moving Locomotives Within Mechanical Department Limits

When moving locomotives within mechanical department limits:

1. Charge and properly position brake equipment before moving the controlling locomotive.
2. Apply and release locomotive brakes to verify on controlling locomotive that brake cylinder pistons are operating and brake cylinder lines to trucks are not cut out.
3. Do not move on or off a turntable unless correctly lined and locked.
4. When hostling locomotives with inoperative brakes, a minimum of one locomotive with operative brakes must be used per six locomotives without operative brakes.

101.14 Moving Light Locomotive Consists

Operate a light locomotive consist from the cab nearest the direction of travel when any one of the following conditions exists:

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

101.15 Locomotive Air Brake Equipment

Place air brake valves in the proper position on freight and helper locomotives. Position brake valves and cutout cocks as indicated in the following tables:

26 and 30 CDW Brake Equipment Positions			
	Lead	Trail	Helper
Automatic Brake Valve	Release	Handle Off/Continuous Service	Release
Independent Brake Valve	Applied Full	Release	Release
Automatic Brake Valve Cutout Valve	Frnt/in	Out	Out
MU-2A Valve or Double-Ported Cutout Cock	Lead or Dead	Trail	Lead or Dead
	In	Out	In
CCB Brake Equipment Positions			
	Lead	Trail	Helper
Automatic Brake Valve	Release	Handle Off/Continuous Service	Release
Independent Brake Valve	Applied Full	Release	Release
Air Brake Setup	Lead/Cut in	Trail	Lead/Cut out
6BLC Brake Equipment Positions			
	Lead	Trail	Helper
Automatic Brake Valve	Release	Handle Off/Continuous Service	Release
Independent Brake Valve	Applied Full	Release	Release
Automatic Brake Valve Cutout Cock	2 Pos. Open Lead	Closed Trail	Closed Trail
MU-2A Valve or Double-Ported Cutout Cock	Lead or Dead	Trail	Lead or Dead
	In	Out	In
24RL Brake Equipment Positions			
	Lead	Trail	Helper
Automatic Brake Valve	Release	Release	Release
Independent Brake Valve	Applied Full	Release	Release
Automatic Brake Valve Cutout Valve	Open	Closed	Closed
Rotair Valve	Frnt	Frnt Lap	Pass or Frnt
MU-2A Valve	Lead or Dead	Trail	Lead or Dead

101.16 Separating Locomotives

When separating locomotives do the following:

1. Apply hand brakes on locomotives to be cut away from.

2. Disconnect electric jumper cables.
3. Plug the jumper cables into a dummy receptacle.
4. Close cutout cocks.
5. Disconnect walkway safety chains and reposition chains to provide safe passage.
6. Disconnect fuel tender hoses (if equipped).
7. Separate locomotives.
8. Attach air hoses to the dummy couplings or place them in the pockets.

101.17 Locomotives Equipped for Multiple-Unit Operation

A. Locomotives With Alignment Control Couplers

When a locomotive equipped with alignment control couplers is being placed in a train with the diesel engine isolated or shutdown, couple the locomotive(s) at any position directly behind the lead locomotive at the head end of the train. Then, do the following:

1. Set up air brake equipment as a trailing unit, couple all hoses, connect MU jumper cables and open all cut out cocks between the operating locomotive consist and the units that will be moved.
2. Perform an air brake test as outlined in Rule 101.6.

Exception: SW and MP model switch engines must be placed second in the locomotive consist, one per train, when handling cars.

If it cannot be determined whether a locomotive is equipped with an alignment control coupler, locomotive must be moved as described in Part (B) below.

B. Locomotives Not Equipped with Alignment Control Couplers

Most SW1200, SW1500, MP15, GP7, GP9, SD7 and SD9 locomotives, waybilled locomotives, some foreign line road and switch engines and some Amtrak and other commuter locomotives are not equipped with alignment control couplers. BNSF locomotives without alignment control couplers may be identified with stencilling. These units may also be identified on the train list. They are to be placed second in the locomotive consist, one per train when handling cars.

Mechanical inspection forces must ensure that coupler swing limiting devices are in place before these units move in freight trains. Coupler swing limiting devices do not make the coupler an alignment control coupler.

101.18 Locomotives Not Equipped for Multiple-Unit Operation

A. Placement in Train

Non-MU Locomotives Equipped with Alignment Control Couplers

Shut down locomotives that are not equipped for multiple-unit operation or have inoperative multiple-unit equipment and couple them directly behind the locomotive consist.

Non-MU Locomotives Not Equipped with Alignment Control Couplers

Locomotives that are not equipped with alignment control couplers may be identified on the train list. BNSF locomotives without alignment control couplers may be identified with stencilling. They must be shut down and placed not less than five cars or greater than ten cars from the rear of the train, with at least one car separating locomotives. No more than two locomotives may be placed in a train.

Mechanical inspection forces must ensure that coupler swing limiting devices or truck bolster movement limiting devices are in place before these units are moved in freight trains. Distributed power consists or manned helpers must be cut in ahead of locomotives not equipped with alignment control couplers.

Place locomotive with bolted or temporary drawbar no more than five cars from rear of train.

B. Set-up Procedure for Handling Locomotives Not Equipped for Multiple-Unit Operation

Complete the following:

1. Make sure the dead-engine feature cutout cock is open or “Dead.”
2. Reduce main reservoir pressure to below 90 psi.
3. Cut out the automatic brake valve and place the handle in the HANDLE OFF/CONTINUOUS SERVICE position.
4. Cut in the independent brake valve and place the handle in the RELEASE position.
5. Close the cut out cocks in the main reservoir equalizing pipe.
6. Make sure the cut out cocks in the actuating pipe and independent application and release pipe are open.

101.19 Changing Operating Ends

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

A. Cut Out Operating Controls

To cut out operating controls, do the following:

1. Place the throttle in IDLE.
2. Place the reverse lever in NEUTRAL and remove the handle.
3. Fully apply the independent brake.
4. Make a 20 psi brake pipe reduction.
5. Cut out the independent brake and move the handle to RELEASE.
6. Cut out the automatic brake and move the handle to HANDLE OFF/CONTINUOUS SERVICE.
7. Place the generator field switch in the OFF position.
8. Disarm 2-way ETD, if equipped.

B. Restore Operating Controls

To restore operating controls, position equipment on the control stand as follows:

1. Replace the reverse lever.
2. Place the independent brake valve handle in FULL APPLICATION.
3. Cut in the independent brake.
4. Place the automatic brake valve handle in RELEASE.
5. Cut in the automatic brake.
6. Place the generator field switch in the ON position.
7. Place the engine run switch in the ON position.
8. Place the control/fuel pump switch in the ON position.
9. Conduct the test as specified in Rule 101.13 (Moving Locomotive).

101.20 Changing to Opposite Controls in the Same Cab on Dual Control Locomotives

Follow this procedure to change to opposite controls in the same cab:

Controlling Brake Valve

1. Move the independent brake handle to FULL APPLICATION.
2. Make a 20-psi brake pipe reduction.
3. Return the automatic brake handle to LAP and remove the brake handle.
4. Move the independent brake handle to RELEASE.
5. Move to the opposite set of air brake controls.

New Controlling Brake Valve (Opposite Side of Locomotive)

1. Remove the automatic brake handle with the stop plate attached and place it on the non-controlling automatic brake valve in LAP.
2. Insert the automatic and independent brake handles.
3. Move the independent brake handle to FULL APPLICATION.
4. Move the automatic brake handle to RELEASE.
5. Check the air gauges and verify that the proper pressures are being maintained.
6. Conduct the test specified in Rule 101.13 (Moving Locomotive).

101.21 Locomotive Camera Systems

When instructed to assemble a locomotive consist for freight service, locomotives with forward-view camera system, when available, that are otherwise lead qualified should be positioned as the lead, controlling locomotive (short hood facing the direction of travel) whenever this can be accomplished without turning the locomotives. Camera-equipped locomotives are identified by the camera unit positioned in the windshield of the locomotive.

102.0 Train Operations

102.1 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.

Use the following steps to determine the hand brakes to be applied when setting out cars on a grade:

- With slack bunched, apply the hand brakes on the low end of the cut of cars.
- With slack stretched, apply the hand brakes on the high end of the cut of cars.

To 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).

Note: Reference Rule 104.14 for hand brake guidelines.

To verify the hand brake(s) applied will prevent movement, release all air brakes. Note: All retainer valves must be in EXHAUST position

102.1.1 Securing an Unattended Train or Portion of Train with Locomotive Attached

To secure a train or a portion of a train with the lead locomotive consist attached, perform the steps below:

1. Secure equipment against undesired movement. When securing an unattended train, in addition to hand brakes required to secure train, all locomotive hand brakes on the lead consist must be applied. When determining the minimum number of hand brakes required to secure a train, the locomotive hand brakes should be counted toward the total hand brakes required. Use the table provided in Rule 104.14 if the minimum number required is not known.

Exception: Distributed power remote consists coupled to unattended trains do not require hand brakes to be applied or other securement steps outlined in Rule 102.3 when the train is otherwise properly secured.

2. Release all air brakes to ensure hand brakes will prevent movement.
3. Secure the locomotive consist as outlined in Rule 102.3, items 1 - 10.

102.1.2 Securing Train Before 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:

1. Secure equipment against undesired movement. Exception: Use the table provided in Rule 104.14 if the minimum number required is not known or if releasing air brakes to test for sufficient hand brakes is not practical (i.e. only rear of train being left unattended).
2. Release all air brakes to ensure hand brakes will prevent movement.
3. Make a 20-psi brake pipe reduction.
4. Close angle cock on rear locomotive or last car to be detached from portion left standing. Leave angle cock open on portion left standing.
5. 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.

6. 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.

Exception: When separating a train in temperatures below 25 degrees F and the train is on a light grade, (see Glossary) follow the steps in Rule 100.17 (Inbound Train Inspection) to prevent vent valves from sticking open.

102.2 Releasing Hand Brakes

Before moving cars or locomotives, fully release all hand brakes to prevent wheel damage.

If a hand brake is difficult to release, charge the air brake system and make a full service application of the car or locomotive brakes before attempting to release the hand brake again. If hand brake is still difficult to release place the car or locomotive brake system into emergency.

If the hand brake cannot be released using the above method do not move the car except to set it out. Car must be watched during entire movement to set out and limit speed to 5 MPH if wheels are not turning freely. Report defect to Mechanical Desk/Dispatcher.

When releasing hand brakes, check at least three additional cars beyond the last applied hand brake to ensure that no other hand brakes are applied.

102.3 Unattended Locomotive(s)

When securing locomotives (excluding DP remote locomotives on secured unattended trains):

1. Place the throttle in IDLE unless you are protecting the engine from freezing (see Rule 106.2, Winterization of Locomotives).
2. Place the transition handle (if equipped) in the OFF position.
3. Place the generator field switch or the circuit breaker on the control stand (if equipped) in the OFF position.
4. Remove the reverser handle from the reverser slot on the control stand and place it in the receptacle, if equipped. Do not remove the reverser handle if you need to increase the throttle position to prevent freezing.
5. Apply all hand brakes.
6. Release the air brakes to determine the hand brakes will prevent movement.
7. Make a 20-psi brake pipe reduction after allowing the brake system to charge.
8. Leave the automatic brake valve cut in.
9. Fully apply the independent brake.
10. Place engine control switch to ISOLATE on all locomotives unless conditions require winter protection as prescribed by Rule 106.2 and Rule 106.6.

Additional securement guidelines for unattended locomotives not coupled to other equipment:

11. Must not be left unattended on a main track.
12. When left unattended on auxiliary tracks must be protected by derail(s) or a facing point switch lined and locked to prevent movement to the main track.
13. If the grade exceeds 1 percent, block the wheels securely.

Exceptions: DP remote locomotives and single person helper consists may be left standing with all hand brakes applied at any location, even on the main track, when building or disassembling a DP train or when single person helper is performing duties that require temporarily leaving the locomotives.

At mechanical facilities, when locomotives are protected by outbound derails on designated servicing tracks, apply a sufficient number of hand brakes to prevent undesired movement, but a minimum of one per locomotive consist.

102.4 Brakes Not Operating Properly

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

1. Inspect the brakes to identify and correct the problem.
2. Before proceeding, conduct an application and release test as specified in Rule 100.15 (Application and Release Test).
3. Once the train is proceeding, conduct a running test as specified in Rule 100.13 (Running Air Brake Test).

102.5 Sticking Brakes

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

1. Stop the train as soon as possible.
2. Determine why the brakes are sticking. Some reasons for sticking brakes include:
 - Overcharged air brake system.
 - Hand brakes applied.
 - Retaining valve not in EXHAUST.
 - Leak in the air brake system.
 - Releasing a brake pipe reduction with brake pipe air still exhausting.
 - An insufficient brake pipe reduction to ensure proper release.
3. Correct the problem.
4. If necessary, cut out the control valve or set out the car.

102.5.1 Minimizing Sticking Brakes

To minimize the possibility of sticking brakes, observe the following:

1. Do not overcharge the train air brake system.
2. When handling cars to be placed on the rear portion of a freight train, regulating valve pressure setting must be 10 psi less than standard pressure for that train.
3. When a running release of train brakes is to be made, if operating conditions permit, increase the brake pipe reduction to at least 10 psi and allow brake pipe exhaust to stop for at least 20 seconds before releasing.
4. When the train air brakes are used to stop a train, when operating conditions permit, increase brake pipe reduction to at least 15 psi after stopping. The brakes must not be released until at least 20 seconds after exhaust stops.

102.6 Reducing Pressure in Overcharged Train Brake Systems

To reduce pressure in an overcharged train brake systems do the following:

1. Adjust the regulating valve to the desired pressure.
2. Make a full service brake pipe reduction with the automatic brake.
3. Wait at least 30 seconds after the brake pipe exhaust stops. Move the automatic brake handle to RELEASE and charge the system to the required pressure.

102.7 Cutting Out Air Brake Equipment

Cut out control valves or other air brake devices only if they are defective or if the brake rigging is being serviced. If air brake devices must be cut out en route, notify the train dispatcher and the Mechanical Help Desk of car number(s) and any other pertinent information.

A. Procedure to Cut Out Control Valve or Automatic Vent Valve

Cut out control valves or automatic vent valve as follows:

1. Close the branch pipe cutout cock.
2. When cutting out a control valve, drain the air reservoirs completely by operating the brake cylinder release valve.

B. Placement of Cars with Cut-Out Air Brake Equipment

Follow these requirements when multiple air brake devices must be cut out:

1. Make sure no more than two air brake devices that have been cut out are together in a train.
2. If necessary to cut out a third consecutive air brake device, separate it from the other two cars with cut-out brakes by at least one car with operative brakes.

C. Rear Car Brakes

The rear car of a train must have operative air brakes. However, the rear car brakes possibly could become inoperative en route. When this happens, follow these steps:

1. Before moving the train, test the hand brake on the disabled car.
2. If the hand brake is inoperative, do not move the car until it is repaired and can be moved safely.
3. Chain, strap or cable the disabled rear car to the rear of the train.
4. Move the car directly to the first auxiliary track and switch it ahead of at least one car with operative brakes, or set it out.
5. If one air brake device/control valve is cut out on a car with multiple control valves, consider the brakes on that car to be operative.

Note: Even though the disabled car has inoperative brakes, the air must be cut in to the brake pipe. If the brake pipe on disabled car is broken, car with a broken brake pipe should be handled with brake pipe pressure in air hoses between car ahead and disabled car. This is accomplished by coupling the air hoses between rear disabled car and car ahead, leaving angle closed on disabled rear car and opening the angle cock on car ahead. (This is in order to ensure an emergency application of the train's air brakes should the disabled car become separated from the train.)

102.7.1 Bleed Off Cars

Bleed off cars only when:

- Repairing the brake system.
- Cutting out the brakes on a defective car, or
- Switching.

102.8 Reporting Flat Spots

While inspecting car and locomotive wheels, measure and report flat wheels to the train dispatcher and Mechanical Help Desk so they can be repaired.

1. Determine the length of the flat area.
2. If the length of the flat area is more than 1 inch, report it.

3. In cases of a flat wheel(s) on a switch locomotive, inform:

- Maintenance facility
- Yardmaster
- Supervisor

Note: See GCOR Rule 1.34 for set out and speed restriction guidelines.

102.9 Setting Out Defective Cars

Set out a defective car whenever it cannot be safely moved to the next repair location. When defective car must be set out, do the following

1. Report this fact to the dispatcher and Mechanical Desk.
2. Set out defective car where maintenance crews can access it.
3. If the journal is overheated, inspect the underside of the car immediately if the maintenance crew is not available.

102.10 Coupling Brake Pipe Connections

Maintain brake pipe connections to enable the air brake system to function properly throughout the train.

Angle cocks must never be left partially closed or partially open.

Before coupling air hoses to charge brake pipe:

1. Make a 20-psi brake pipe reduction. If on grade, in order to prevent an undesired release of the cars being coupled to, make a 40-psi brake pipe reduction.
2. Signal that the brake valve exhaust has stopped by sounding whistle signal 5.8.2, (2), or using the radio.
3. Couple air hoses and open angle cocks slowly to prevent an emergency brake application.

Note: Distributed power trains, in some cases, require a different procedure when coupling to rear portion of train. Refer to instructions for DP.

When adjusting air hose height:

- Couple the air hoses.
- Verify that the brake pipe hose support is adjusted so that the glad hands are at least 4 inches above the top of the rail.

102.11 Powered Axle Limitation

Locomotive consists must not have in excess of 42 equivalent powered axles. Excess axles of power must be isolated. Unless otherwise restricted, trains made up entirely of intermodal equipment may operate with a maximum of 48 equivalent powered axles.

102.12 Helpers

102.12.1 Manned Helper Entrained or Coupled at Rear of Train

A. When a manned helper is cut-in or coupled at the rear of the train, before the angle cocks are opened the engineer on the manned helper must:

1. Make a 20 psi brake pipe reduction.
2. Cut out the automatic brake valve and place the handle in the RELEASE position.
3. Couple the brake pipe hoses. Open the brake pipe angle cock on the locomotive first, then slowly open the brake pipe cock on the car.
4. Place the independent brake valve handle in the RELEASE position and actuate to fully release the helper locomotive consists' brakes.

B. After the manned helper is cut-in the train or coupled at the rear of the train, the engineer of the leading locomotive must:

1. Increase brake pipe reduction by at least 8 psi, but not to exceeding a full service reduction.

Note: If train will be continuing on a descending, heavy/mountain grade, release and recharge brake system before conducting the helper air brake test if helper test cannot be conducted without exceeding a 15-psi brake pipe reduction.

2. Helper crew will visually inspect brakes on helper consist to ensure application.

3. After obtaining the desired reduction, release the train brakes and determine there is at least 5 psi brake pipe increase at the rear of the train as indicated by a gauge or device.

102.12.2 Removing a Cut-In Helper

After a cut-in helper has been removed conduct a brake test as specified in Rule 100.15 (Application and Release Test) Note: This air brake test is not required when removing manned helpers from the rear of the train.

102.12.3 Manned Helper Added to Head End of Train

When a manned helper is coupled on the head end of the train, transfer control of air brakes (and throttle with MU cable) to the manned helper as follows:

1. Before opening angle cocks between the road locomotive and the manned helper, the engineer on the road locomotive will:
 - a. Make at least a 6 psi brake pipe reduction.
 - b. After brake pipe exhaust has ceased, cut out the automatic brake valve and place handle in the RELEASE position.
 - c. Notify the engineer on the manned helper of the amount of brake pipe pressure reduction made.
 - d. Independent brake valve must be left cut in.
2. The engineer on manned helper will:
 - a. Move the automatic brake valve handle into the service zone to reduce the equalizing reservoir pressure at least 2 psi below the brake pipe pressure reduction made by the engineer on the road locomotive.
 - b. After opening the angle cock, increase brake pipe reduction to at least 20 psi and observe at least a 5 psi reduction at the rear of the train as indicated by a gauge or device.
 - c. Release the automatic air brakes and observe that brake pipe pressure is being restored at the rear of the train by observing a 5 psi increase in pressure as indicated by gauge or device.

102.12.4 Manned Helper Removed From Head End of Train

When a manned helper will be detached from the head end of train do the following:

- Engineer on manned helper will:
 - a. Make not less than a 6 psi brake pipe reduction
 - b. Notify the road engineer of the amount of brake pipe reduction made.
- Detach manned helper
- Road engineer will:
 - a. Move the automatic brake valve into the service zone to reduce the equalizing reservoir pressure at least 2 psi below the brake pipe pressure reduction made by the helper locomotive engineer before cutting in the automatic brake valve.

- b. Increase brake pipe reduction to 20 psi and observe at least a 5 psi reduction at the rear of the train as indicated by a gauge or device.
- c. Release the automatic air brakes and observe that brake pipe pressure is being restored at the rear of the train by observing a 5 psi increase in pressure as indicated by gauge or device.

Note: ETD may remain ARMED to original road locomotive during such head end helper movements. However, road engineer must remain on original road locomotive and maintain radio communication with helper locomotive engineer in order to operate ETD emergency valve, if necessary.

102.12.5 Operating Responsibilities with Manned Helper

Comply with these manned helper operating responsibilities:

- When adding helpers to other locomotives on a train, control of all locomotives coupled together must be transferred to the lead engineer by plugging in the MU cable, whenever practicable.
- When more than one locomotive is attached to a train, the engineer in the lead locomotive must control the train's air brakes.
- The engineer in the lead locomotive is in charge of train movement.
- The engineer in charge will communicate with and direct the helper locomotive engineer as follows:
 - a. Identify speed restrictions and locations where a stop is to be made at least 2 miles in advance.
 - b. Communicate clearly the name or aspect of signals affecting the helper locomotive's movement as soon as the signals become visible or audible.
- When dynamic braking is used on both lead and helper locomotives:
 - a. The helper engineer should maintain constant dynamic braking force at the direction of the lead engineer.
 - b. The lead engineer should control variations in train speed.
- Do not cut off helper locomotive while the train is moving. (unless equipped with "Helperlink".)
- Locomotives using "Helperlink" must not plug in MU cable if coupling to other locomotives.

102.12.6 Distributed Power/Helper Limitations and Placement

1. Rated Powered Axle Limitations

Unless individual subdivisions special instructions specify otherwise, the following rated powered axle (RPA) limitations apply to each DP/helper consist:

(Use Locomotive Data Table to determine powered axle ratings)

- All trains (excluding unit bulk commodity trains) - 16 RPA or less on rear and 24 RPA, cut in.
- Solid, empty unit bulk commodity trains - 12 RPA or less on rear or cut in.
- Solid, loaded unit bulk commodity trains - 24 RPA or less on rear or cut in. (bulk commodity trains = coal, grain, potash, taconite, molten sulphur, etc.)

2. Maximum power differential allowed.

On trains operating with a single DP/helper consist, the total operative locomotives of the lead consist must not exceed the remote DP/Helper consist by more than 16 rated powered axles.

3. DP/Helper Train make Up Restrictions

- a. All DP/helpers locomotives must be placed ahead of:
 1. All TTOX (single unit 2 axle equipment) and TTFX (4-unit solid drawbar connected 2-axle per unit equipment), regardless of weight.
 2. 2-axle scale test cars.
 3. Cars designated "Rear end only".

- 4. Occupied caboose.
 - 5. Multiplatform (2 unit), solid drawbar-connected gondola cars with initials AMGX.
- b. DP/Helper locomotives consists rated at 8 powered axles or less are exempt from DP/Helper train make up instructions outlined in Item 3 below.
- c. Except for empty unit bulk commodity trains, which may be operated with 12 rated powered axles, when DP/helper locomotive consist powered axle rating is between 9 and 24 powered axles, the following cars may not be placed:
- Within 10 cars/platforms AHEAD a DP/helper consist if on rear of train, or
 - Within 5 cars/platforms AHEAD a cut in DP/helper consist.
 1. A conventional car (non multi-platform) weighing less than 45 tons.
 2. A multi-platform car having a single empty platform.
 3. A car 45 feet or less in length coupled to a car 80 feet or longer in length.
- Note: Does not apply to multi-platform cars except those with individual platforms exceeding 80 ft. in length. Examples: Twin flat cars and AutoMax cars.
- 4. Any 80 foot or longer flat car with a single trailer/container, regardless of weight.
- Note: This includes twin flat cars (solid-drawbar connected flat cars, TTEX and RTTX series) with a single trailer/container on either platform.

4. Additional heavy grade train make up restrictions

In addition to above make up requirements, on heavy grades listed below, the above cars must not be:

- Within 5 cars/platforms BEHIND a cut in DP/helper consist if trailing tonnage behind helpers exceeds the following tonnages when operating over specified locations.

Location	Training Tonnage Behind DP/Helper
Glorieta Subdivision (MP 775.0 - MP 842.0)	2,500 tons
Raton Subdivision (MP 639.0 - MP 660.0)	2,500 tons
Cajon Subdivision (MT 2, MP 56.6 - MP 62.8)	3,500 tons
Gateway Subdivision (MP 178.0 - MP 188.0)	3,500 tons
Mojave Subdivision (MP 331.3 - MP 381.3)	3,500 tons
Scenic Subdivision (MP 1694.5 - MP 1731.3)	3,500 tons
Stampede Subdivision (MP 41.0 - MP 58.5)	3,500 tons

5. Position Requirements for Cut-In DP/Helper Consists

A single DP/helper consist exceeding 8 RPA that requires cutting in due to lack of proper train make up at the rear of train or due to exceeding the maximum rated powered axles allowed as outlined above must be cut in at 300 tons per axle exceeding 8 RPA, but no closer to the head end than mid-train, by car count. This cut in location may vary by 5 cars either forward or to the rear of the train as long as train make up requirements next to DP/helper consist outlined above is met.

Two DP/helper consists may be used and must be positioned with one DP/helper consist at the rear and the middle DP/helper consist within 20 car lengths of mid-train, by car count.

Limiting Tractive Effort When Using Manned Helpers with Trains Not in Compliance with Train Make-up Guidelines:

Trains may be helped from the rear of train with a manned helper only (no DP) when exceeding axle limitation guidelines above if train is disabled and not in compliance with train make up restrictions for DP/Helper service as outlined above. Tractive effort limit when exceeding 8 rated powered axles and helping trains not in compliance with DP/Helper train make up guidelines as follows:

DC Locomotives:

8 rated powered axles - no restriction

10 rated powered axles - 1,000 amps

12 rated powered axles - 950 amps

14 rated powered axles - 900 amps

16 rated powered axles - 850 amps

AC Locomotives

Limit total tractive effort of AC consist to 100,000 lbs. Total AC locomotive consist tractive effort is determined by multiplying tractive effort indicated on display of controlling locomotive and multiplying by the total number of operative AC locomotives in the consist.

Example: A controlling unit of a two-unit AC locomotive consist should not be allowed to produce more than 50,000 lbs. of tractive effort.

102.13 End of Train Telemetry System

102.13.1 Installation

Only an ETD calibrated within the last 365 days and an ETD battery that has been tested within the last 60 days may be used. Refer to the affixed stickers prior to installation.

1. To determine a battery-operated ETD is charged sufficiently at installation point, depress the test button on the ETD. Several messages will be displayed including the percentage of battery life that has been used, displayed as "C XX". At installation point, do not use an ETD battery if battery life used is indicated as greater than 10. (on locomotive screen electronic display of ETD information, this display may also be labeled as "% Battery Used") Note: All ETD battery requirements do not apply to an air-turbine operated ETD's. See 102.13.2 below.
2. After entering the ETD number on the HTD of the locomotive, push the COMM TEST button to establish one-way communication with the ETD.
3. With brake pipe pressure present, make a comparison of pressure indicated on ETD and displayed at HTD and do not use ETD if pressure readings differ by more than 3 psi.

Air Turbine Driven ETD's

A. Activation Requirements

Some turbine ETD's models do not automatically turn on after uprighting, installing and applying air pressure. For these ETD types, depress the START / ARM button to activate the device before attempting to establish communications.

B. "Charge Used" on Air Turbine ETD's

The "Charge Used" (CU) displayed for air turbine-operated ETD's differ from ETD's operated by battery only and also vary by manufacturer as follows:

Wabtec Air Turbine ETD's (identified with "ATX" on device) = The CU display is a value used to indicate generator voltage only and normally varies between 30 and 39 with brake pipe pressure at approximately 90 psi. This value corresponds to air pressure so the lower the brake pipe pressure being provided, the lower the CU reading. If no pressure is being provided to the ETD, this model will indicate "0" CU, which is normal. If "0" CU is displayed while brake pipe pressure is being provided to the device, this is an indication the generator has failed. In either case, this device is now operating on it's back-up battery and as the back-up battery is then depleted, Low Battery and Dead Battery alarms will be displayed and are the only indicator available as to remaining battery life.

Quantum Air Turbine ETD's = CU displayed when using this ETD type is the voltage of the non-removable backup battery and this reading remains at "0" when battery is fully charged and is being maintained by an operative air turbine generator. When air pressure is removed or generator has failed on this device, the battery charge used value begins to count up from 0 to 99 as battery power is used in the same manner as all battery-powered ETD's. There is no immediate indication of a generator failure as with the Wabtec device above but a CU count that is ascending while brake pipe pressure is being provided to the device is an indication of a failed generator.

Note: Quantum air turbine ETD's that are installed with an uncharged backup battery may indicate "Low Battery" for a short time period (5-15 mins) after air pressure is applied until it's backup battery is charged up to a higher voltage. Charged units on this model will count down when the back-up battery is being charged.

For train crews en route, in order to apply the information on CU readings provided above, the type of air turbine ETD installed on your train is provided on your train list.

102.13.2 Arming HTD/ETD

Two people are needed to arm the HTD.

To arm the HTD:

1. Press the TEST button on the ETD, which will display the ARM NOW message on the message display window of the HTD.
2. Immediately press the COMMUNICATIONS TEST/ARM button on the HTD, which will display the ARMD message on the message display window of the HTD and light the EMERG ENABLED status LED at the same time. If NOT ARMD appears on the HTD message display, the system did not accept the arming sequence repeat steps above.

Note: Some foreign HTD/ETD systems are self-arming when telemetry is established and may be so indicated by a “*” displayed on the HTD. Also, some Canadian National Railroad locomotives are self-arming and provide no indication of “Emerg Enabled” on the locomotive display for this device. These locomotives are identified by decals in the cab of the locomotive and may be used. If no display decal can be found on a CN locomotive and there is no document confirming device has been tested and is functional, test the device’s 2-way capability and leave that information on the locomotive for the next crew(s).

The system is now armed.

102.13.3 Testing HTD/ETD

To test the emergency application capability from the rear of the train, do the following:

1. Close the angle cock between the train and ETD.
2. Initiate an ETD emergency from the lead locomotive HTD. The brake pipe pressure on the ETD must reduce to 0 psi.
3. Open the angle cock between the ETD and train and determine that brake pipe pressure is restored before proceeding.

Exception: When using an air turbine ETD, air pressure trapped in the air hoses while performing the above emergency test is depleted quickly by the air turbine. Therefore, for additional volume, the emergency valve function test must be performed after closing the angle cock ahead of the last car. A successful ETD emergency function test can be determined by listening for the last car’s emergency application.

Note: When performing ETD emergency test, allow ETD emergency valve to automatically close before opening angle cock. ETD emergency valve will require a minimum of 15 seconds to reset after actuated. No attempt to restore brake pipe pressure should be made until emergency brake valve on ETD has reset.

102.13.4 Disarming HTD/ETD

Disarming the HTD disables the emergency command for all ETD ID numbers.

To disarm the HTD:

1. Set the HTD ID code to 00000 (or follow the disarm procedures on electronic display.)
2. Press the COMMUNICATIONS TEST/ARM button.
3. Verify that:
 - a. The HTD displays DISARMD in the message display window.
 - b. The EMERG ENABLED status LED turns off.
 - c. The EMERG DISABLED LED turns on.
4. When a two-way ETD armed to a HTD are to be separated such as when reaching the train’s final terminal or when changing either an ETD or HTD en route, the HTD must be disarmed as outlined above.

GE locomotives with screens displaying “Armed Other” indicate the HTD was not disarmed from the last 2-way ETD utilized. This condition can be corrected by either of two methods:

- Enter the ETD number of the last ETD and disarm as prompted by the ETD screen display before then establishing telemetry with another ETD; or,
- If last ETD identifying number is not known, HTD may be disarmed by entering a valid new ETD number, establishing communication and arming as outlined in rule 102.13 above. When test button is pushed on new ETD, depress button below “Arm Now” prompt that will briefly appear in the lower right corner of the ETD screen.

102.13.5 Emergency Switch

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

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

Note: Immediately following a release of a service brake application, if the two-way end-of-train device is activated, an emergency application MAY NOT occur from the device. However, the brakes will apply on the rear end of the train at a service rate. If this condition occurs, it will only be during initial stages of the release (approximately 4-10 seconds). This will not affect emergency brake capabilities from the head end of the train.

102.14 Emergency Application Capability from Rear of Train

A. Requirements

All trains must be operated with a method of providing emergency application capability of the brakes from the rear of the train. However the following trains are exempt from the requirement of this rule:

- Amtrak and Commuter Trains (covered by other requirements)
- Engines without cars
- Locals, road switchers, work trains and yard assignments (includes transfer jobs) that do not operate on grades listed in system special instructions or on a continuous grade of 1% or more but less than 2% for a distance of three miles or more. In the application of this rule, locals, road switchers and work trains are defined as a train that does not exceed 4,000 trailing tons and travels over a distance which can normally be operated by a single crew in a single tour of duty.

B. Providing Emergency Application Capability from Rear of Train

Any one of the following methods fulfills the requirement to provide emergency application capability from the rear of the train:

- An operable two-way end of train telemetry system (HTD/ETD) which must be armed and tested at point of installation.
- Distributed power placed on the rear of the train.
- Trains with a manned helper, caboose or passenger equipment at the rear of train equipped with an emergency brake valve and manned with an employee equipped with two-way voice radio communication with the engineer at head end of train.

102.14.1 Loss of Emergency Application Capability from Rear of Train

Trains required to be equipped with rear of train emergency capability as outlined in Rule 102.14 (A) are considered to have an en route failure when one of the following conditions occur:

1. ETD or HTD indicates:

- Loss of front to rear communication. Message = FR NOCOM or EOT COMM, depending on HTD type.
- Emergency valve not enabled. Message = NOT ARMD and/or “Emergency Enabled” indicator NOT illuminated, or
- Emergency valve failure. Message = VALVFAIL or EOT VALVE.

2. Loss of communication exceeding 5 minutes as indicated by control console for distributed power locomotive on lead controlling locomotive at head end of train.

3. A loss of voice radio communication between a manned helper, caboose or passenger equipment at the rear of the train and the lead, controlling locomotive.

When an en route failure occurs on trackage other than those listed in system special instructions, train must not exceed 30 MPH until failure is corrected or another method of compliance is secured.

When an en route failure occurs on trackage identified in system special instructions, train must not proceed until failure is corrected or another method of compliance is secured:

Exceptions:

- When en route failure occurs due to train being in a location of poor communication (tunnel, rock cut, overpass, etc.), train may be moved a train length in an attempt to regain communication. If communication cannot be restored after clearing the poor communication area, train must be stopped. The failure must be corrected or alternative method of compliance secured.
- Should a train separation and/or locomotive failure occur while on the ascending grades referenced in the system special instructions which require the train to be moved in segments (doubling the hill), it is permissible to move the head portion of the train without emergency capability at the rear of the head portion being moved.
- If a loss of voice radio communication occurs between a manned helper, caboose or passenger equipment at the rear of the train and the lead, controlling locomotive, while descending grade, train may continue until clearing the grade as long as train is being properly controlled not exceeding 5 MPH above maximum authorized speed.

All train crew members on train operating on grades identified in the system special instructions must take action to stop train, with an emergency application of the brakes should train exceed 5 MPH over maximum authorized speed.

In the event of a need to utilize the emergency feature of the ETD, the command to initiate an emergency must be attempted even if no communications is indicated at the HTD.

102.15 Running Air Brake Test

Required Running Brake Test During Inclement Weather

During inclement weather conditions which may cause snow or ice build up to occur between brake shoes and wheels, periodic running air brake tests must be performed to insure proper braking effort is being provided.

Whenever snow is up to or above the top of the rail or inclement weather where icing conditions may exist and train is approaching:

- a meeting, passing or waiting point, or
- a signal indication which will require the train to stop,

the engineer must make a brake pipe reduction sufficiently in advance of that location to determine that the brakes are working properly.

If brakes do not provide sufficient braking effort, the train must be stopped by a full service brake application and full dynamic braking effort. If braking effort still does not appear to be sufficient, the locomotive engineer must make an emergency brake application without hesitation. After stop is made, train must be inspected to determine if brake rigging and shoes are free of snow and ice before proceeding.

(Refer to Rule 100.13 for procedure for conducting a running air brake test.)

102.16 Dynamic Brake Warning Light

If the Dynamic Brake Warning Light comes on reduce the dynamic brake retardation until the light goes out. If the condition continues, cut out the dynamic brake on the affected unit. Note: Report all dynamic brake defects to train dispatcher or Mechanical Desk.

102.17 Unusual Conditions

Recognize the proper procedures for unusual train handling conditions.

A. Unusual Changes in Brake Pipe Pressure

The engineer must stop and secure the train if:

- An abnormal change in or loss of brake pipe pressure occurs with the train brakes released and a normal gradient established. Refer to Rule 103.7.3 concerning minimum brake pipe pressure at rear of train, or
- A brake application cannot be transmitted.

B. Increased Air Brake System Leakage En Route

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

1. Brake pipe air flow or brake pipe gradient increases.
2. The air flow pointer does not return to a reading below 60 CFM or below the calibration mark within the appropriate time.

Note: If you cannot repair the brake system to reduce leakage within the required limits, proceed with caution. However, proceed only if the brake pipe pressure on the rear car is at least 60 psi.

C. Reporting Unusual Air Brake Conditions

Follow this process when reporting unusual air brake conditions:

1. The person reporting must notify the train dispatcher or the Mechanical Help Desk immediately of any unusual air brake condition that affects safe train movement.
2. The dispatcher must then notify the appropriate supervisor.
3. Supervisor assisting will determine if the train can be moved safely or if it must be held for inspection.

102.18 Train Separation Report

After a train separation occurs, notify the dispatcher or mechanical help desk by radio and complete a written Train Separation Report.

103.0 Train Handling

Locomotive engineers must exercise judgment and plan ahead to operate their train safely and efficiently. The engineer is responsible for properly controlling the slack in the train. Good train handling requires the proper combination of throttle modulation, dynamic braking, and air braking to:

- Protect yourself and others from injury.
- Prevent damage to the track structure and equipment.
- Protect lading.
- Use the most fuel-efficient method consistent with good train handling.
- Controlling and limiting in-train forces is essential for safe train operation. Unless an emergency or other condition requires immediate speed reduction, change throttle positions and dynamic and air brake applications slowly to allow slack to adjust gradually. Many locomotives can produce higher tractive effort than the average train's draft gear and couplers can withstand.

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

103.1 Train Status Information

Train crew member must discuss with the engineer, train status or other conditions affecting train movement. It is the engineer's responsibility to ensure slack changes are controlled, through the use of the throttle, dynamic, automatic and independent air brakes while moving in forward or reverse direction. This would include some or all of the following:

- Train makeup.
- Train length and tonnage.
- Tons per operative brake.
- Speed
- Severity of the grade.
- Block signal spacing.
- Type and axle limitations (if any) of the dynamic brake.
- Temperature and weather conditions.
- Throttle response.
- Amount and type of slack in the train.

103.2 Dynamic Braking

Dynamic Brake Ground rules

- Allow for electrical current decay and prevent a surge of dynamic braking, by pausing for 10 seconds before changing from power to dynamic braking.
- Do not supplement the dynamic brake with the locomotive brakes unless in the process of starting or stopping and speed is below the effective range of the dynamic brakes in your locomotive consist.
- The locomotive brake should never be relied on to control speed in lieu of an effective dynamic brake.
- Extended range dynamic brakes must be utilized to their fullest extent.

103.2.1 Dynamic Brake Limitations

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

1. Limit the total operative dynamic brake to 28 equivalent dynamic brake axles unless further restricted by another rule or special instruction.

Exception: Trains with remote and/or manned helper locomotive consists entrained or at the rear of the train may have the maximum allowable dynamic brake axles for each locomotive consist placed within the train.

2. Limit the dynamic brake retarding force by cutting out the dynamic brake on the trailing locomotive(s) using the dynamic brake cutout switch or the dynamic brake selector switch on the control panel.
3. The preferred option is to cut out the basic dynamic brake(s) on a trailing locomotive(s).
4. When approaching and operating through turnouts or disturbed track areas with train's air brakes released, use the dynamic brake handle position to limit retarding force to 50 percent of maximum (dynamic brake handle position number 4). Continue to limit the braking effort until at least half the train has passed the restricted area. At speeds of 10 MPH or less, this limitation applies only if 12 axles or more of extended range dynamic brakes are being utilized.

103.3 Use of Automatic Brake

A. Applying or Reapplying Automatic Brakes

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

1. Make an initial brake pipe reduction as follows:
 - For a fully charged system, reduce the brake pipe at least 6 psi, or
 - For an uncharged system, reduce the brake pipe 5 psi below the previous reduction.
2. Use split reductions for planned slowdowns and stops. Make an initial reduction of 6 to 8 psi followed by additional reductions in 2 to 3 psi increments spaced 30 seconds apart.
3. Limit brake pipe reduction to 15 psi or less to control speed.
4. Make a final reduction when operating conditions permit as train is nearing a stop to prevent a run out of slack. A final reduction is a brake pipe reduction made in such a way as to result in brake pipe pressure exhausting as the train comes to a stop.

B. Delayed Departure

Observe the following when train is stopped and movement is delayed.

1. When train is stopped and operating conditions allow do not release the train brakes until you are ready to depart. If required to release brakes, such as during a train inspection, brakes must be reapplied and released prior to departing.

Note: An example of an operating condition that may not allow brakes to remain applied until ready to depart or no increase in brake pipe reduction after stopping would be when near a long, descending heavy or mountain grade and brake system requires full charge before proceeding.

2. When operating conditions allow, increase brake pipe reduction to at least 15 psi.
3. Closely observe equalizing reservoir pressure when brakes are applied and if leakage occurs, report to mechanical help desk and make a locomotive defect report of this fact at first opportunity.
4. When a train is ready to depart and grade conditions allow train brakes to be released, it must be known that the brake pipe pressure is being restored to the rear of train after releasing the brakes. If end of train telemetry indicates brake pipe pressure is not being restored:

Movement must not exceed 10 MPH and the train's length unless the reason for the brake pipe blockage indicated by telemetry is determined. (Distance may be extended if public crossings or bridges not equipped with walkways are involved).

If end of train telemetry has failed, visual observation of a set and release of brakes at the rear car is sufficient in determining no blockage exists. Dispatcher must be notified of a failed ETD to avoid additional stops and delays, when possible.

Exception: Locals, road switchers and work trains, working under the provisions of Rule 102.14 (without a 2-way ETD) are exempt from this requirement.

5. A brake pipe pressure reduction at the end of the train with no corresponding brake pipe reduction made at the head end of the train, as indicated by end of train telemetry, may also indicate a possible blockage in the brake pipe. Cause of blockage, if any, must be determined as outlined above before proceeding.

Note: Refer to GCOR Rule 14.7 regarding reporting clear of limits. Refer to Distributed Power instructions for requirements concerning use of "Train Check".

C. Releasing Brakes

To release the brakes at slow speeds, use judgment and evaluate the following conditions before attempting a running release of the automatic brakes:

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

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

When operating conditions allow releasing the brakes:

1. Increase the brake pipe reduction to 10 psi.
2. Allow the exhaust at the automatic brake valve to stop before releasing the train brakes.

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

103.3.1 Use of Automatic Brakes During Cold Weather Conditions

During extreme cold weather (below zero degrees) when operating conditions and outstanding instructions permit, throttle manipulations and dynamic braking must be used in lieu of train air brakes whenever possible in controlling and stopping freight trains.

103.4 Throttle Handling

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

1. Make throttle changes one notch at a time. If making transition from dynamic brake mode to power mode, wait 10 seconds in IDLE before advancing throttle to a power position.
2. When moving at speeds of 25 MPH or more over a railroad crossing at grade (diamond):
 - a. At least 8 seconds before the locomotive reaches the crossing, reduce the throttle to RUN 4 (or lower if the throttle is already positioned in RUN 4 or lower).
 - b. Wait until the entire locomotive consist passes over the crossing before advancing the throttle.
3. Use this procedure if the wheel slip light comes on:
 - a. If the light is on continuously, reduce the throttle on the locomotive until the light goes out.
 - b. If the light does not go out, stop the locomotive immediately and make sure the wheels are rotating freely.

- c. If the wheels rotate freely and the wheel slip light remains on during throttle reduction, isolate the locomotive unit affected.
- d. If the wheels do not rotate freely, notify the dispatcher and set out the locomotive if safe to do so.

WARNING: A wheel slip light continuously illuminated for 6-8 seconds or longer at speeds above 15 MPH may indicate a locked wheel or a slipped pinion gear. Should this occur, stop and determine that all wheels rotate freely. A slipped pinion gear is indicated by traction motor rotation while locomotive is stopped and under load.

4. Do not apply power to hold a train stationary on a grade.
5. Reverser handle must not be moved to any position other than in the direction of travel while locomotive is moving.
6. The generator field switch must never be closed or moved to "ON" position with the throttle open.
7. Reverser must be centered when stopped.

103.4.1 Short Time Ratings

A. Short Time Rating

Short time rating limits on DC locomotives apply to high amperage levels in any throttle position. A rating plate is located near the load meter and gives the time limits for operating locomotives at various amperage levels. Always stay within the time limits indicated by the rating plate on the lead, controlling locomotive. (AC locomotives do not require short time rating protection, and newer DC locomotives without short time rating plates are protected by computer from overheating. Computer-protected locomotives include EMD-type GP/SD60 and above and GE-type C/B40 and above.)

B. More Than One Consecutive Short Time Rating

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

1. Do not operate the locomotive continuously for more than the maximum time of any one short time rating without stopping to cool traction motors.

Example: Do not operate a locomotive at the 1/4 hour rating for 1/4 hour, then at the 1/2 hour rating for 1/2 hour, then at the 1 hour rating for 1 hour, etc.
2. If the locomotive exceeds the short time rating indicated on the rating plate, stop train and double the train over the grade or allow traction motors time to cool before continuing, unless otherwise instructed.
3. Sufficient cooling of traction motors is when allowing the locomotive a minimum of 20 minutes without a short time event.

103.4.2 Minimum Continuous Speed

Minimum continuous speed is the slowest speed at which a DC locomotive can operate continuously in Throttle 8. Locomotive traction motors operating under these conditions develop the highest amperage possible before overheating. The minimum continuous speed varies and is indicated by the rating plate on the locomotive.

103.5 Independent Brake (Locomotive Brake)

When using the independent brake, do the following:

1. The independent brake valve on the controlling unit must be cut in at all times and the handle must not be blocked in ACTUATE position.
2. When operating a locomotive consist and it is desired to prevent the locomotive brakes from applying during an automatic brake application, the independent brake valve handle must be depressed in ACTUATE position a minimum of two seconds per locomotive prior to the automatic brake application and held depressed until exhaust ceases.

3. The independent brake must not be applied while power or dynamic brake is being used, except when starting or stopping while in the dynamic brake mode and speed is below the effective range of the dynamic brakes being used. Light independent brake may be used to control wheel slips at speeds below 10 MPH only.
4. When conditions require the independent brakes to be applied, brake cylinder pressure must be controlled to prevent overheating or sliding of the locomotive wheels, excessive slack action and high in-train forces. The independent brake must not be used when the same results can be obtained with the dynamic brake.
5. When controlling the independent brake during an emergency brake application, place the independent brake handle to the desired position in the APPLICATION ZONE that will develop sufficient pressure, without sliding the locomotive wheels, while at the same time depressing the handle in the ACTUATE position. When emergency brake cylinder pressure is desired, release the handle from the depressed position.
6. Helper locomotive engineers must closely observe brake pipe gauge in order to appropriately react to either a service or emergency brake pipe reduction and control locomotive brakes as necessary.
7. The maximum independent brake cylinder pressure designed for each locomotive type must never be exceeded.

EXCEPTION: When emergency braking is necessary to protect life or property, parts 1 through 7 above do not apply. Use the maximum braking effort.

103.6 Train Handling Scenarios

Use the train handling methods for starting, stopping, slowing, and controlling trains as well as unplanned stopping. These methods are guidelines. Heavy tonnage, heavy grades, or specific locations may require other combinations of throttle modulation, dynamic braking, or air braking.

103.6.1 Starting Train

Locomotives equipped with automatic engine start/stop systems may have shut down if locomotives have been inactive for a sufficient period of time. Before attempting to start a train, throw reverser lever in the direction of travel and momentarily open throttle to Run 1 to trigger their start up. After waiting a minimum of two minutes, start train as follows:

- Use the lowest throttle position possible to start the train moving. It may be necessary to retard starting acceleration by use of the locomotive brake.
- Allow the locomotive load to stabilize before advancing the throttle to the next higher position.
- Once the train is moving, do not increase the throttle until either the amperage or the tractive effort decreases.
- To accelerate, advance the throttle slowly, one notch at a time.
- In curved territory, use only enough power to start the train. Regulate amperage to reduce the possibility of stringlining in curves because of excessive lateral forces.

A. Starting, Level Grade

When starting the train on a level grade:

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

Note: If the train does not move in RUN 4, return the throttle to IDLE, apply the independent brake, and determine the cause.

4. After the train starts to move, check to see if the amperage or tractive effort levels are decreasing. If these levels are decreasing, you may advance the throttle to the next higher position.

B. Starting, Ascending Grade

When starting the train on an ascending grade:

1. Advance the throttle to RUN 1.
2. Reduce the independent brake.
3. Release the automatic brake.
4. As the brakes release toward the rear of the train, advance the throttle to RUN 2 or higher to start the train moving.
5. Slowly reduce the independent brake until it is fully released. If the train will not start, consider doubling or getting helpers. Applying power on a standing locomotive longer than necessary will damage DC traction motors.
6. After the train starts to move, check to see if the amperage or tractive effort levels are decreasing. If these levels are decreasing, you may advance the throttle to the next higher position.
7. Observe the load meter and limit the throttle position if necessary to avoid high draft forces.

C. Starting, Descending Grade

When starting the train on a descending grade:

1. Ensure that the independent brake is fully applied.
2. Activate the dynamic brake to full.
3. Release the automatic brake and wait for all brakes to release and slack to adjust.
4. Reduce the independent brake until the train begins to move gradually.
5. Once the entire train is moving, gradually reduce the independent brake to avoid abrupt changes in slack.
6. Slowly release the independent brake when the dynamic brake becomes effective.

103.6.2 Cresting a Grade

A train cresting a grade:

- When speed is less than 20 MPH and
- Using 16 or more equivalent axles of head-end power must gradually reduce throttle on lead locomotive consist as the head of train crests the grade to a position that will prevent a speed increase until at least one-half of the train has crested the grade.

Note: This reduction in throttle outlined above includes trains being operated with remote or manned helpers.

103.6.3 Slowing or Controlling Speed

When slowing or controlling train speed, the following methods should be utilized and are listed in preferred order when operating conditions allow and for best fuel efficiency:

1. Throttle manipulation. Coast braking when conditions allow.
2. Dynamic braking.
3. Dynamic braking supplemented with train air brakes.

When using dynamic and air brakes and the desired speed has been reached, maintain enough dynamic brake to control slack until the train brakes are fully released.

When using the stretch braking method and the desired speed has been reached, reduce the throttle until train brakes are fully released.

When operating in curved territory, keep the total braking effort at the lowest practical level.

A. Slowing/Controlling Speed, Level or Descending Grade, with Dynamic Brakes, Slack Bunched

When slowing or controlling speed on level or descending grade with dynamic brakes and slack bunched do the following:

1. If in power, gradually reduce the throttle to IDLE.
2. Wait 10 seconds.
3. Activate the dynamic brake and gradually bunch the slack.
4. Increase braking to the desired level. If the dynamic brake alone will slow or control the speed sufficiently, do not use the train brakes.
5. At a sufficient distance from the speed restriction, make a minimum brake pipe reduction and actuate.
6. Make further split reduction(s) as needed and actuate.
7. When the speed is controlled and the automatic brake is released, maintain enough dynamic braking to keep the slack bunched until the brakes release throughout the train.

B. Slowing/Controlling Speed, Level or Descending Grade, without Dynamic Brakes, Slack Bunched

When slowing or controlling speed on level or descending grade without dynamic brakes with slack bunched, do the following:

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

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

C. Slowing/Controlling, Ascending Grade, Slack Stretched, Throttle Reduction

When slowing or controlling speed on ascending grade, do the following:

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

D. Slowing/Controlling While Cresting Grade, Throttle Reduction Method

When slowing or controlling speed approaching a crest:

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

E. Slowing or Controlling Speed, Undulating Grade or Sag, Throttle Modulation Method

Follow these steps when slowing or controlling speed on undulating grade or sag:

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

F. Stretch Braking

Stretch braking is permitted ONLY where more fuel efficient methods will not provide the necessary control of train speed. When necessary, exceeding throttle position four (4) is prohibited (referred to as “power braking”). When it becomes necessary to apply the train brakes while in power, observe the following:

1. Make the desired throttle adjustment sufficiently in advance to allow the slack to adjust.
2. After the slack has adjusted, make a minimum brake pipe reduction and actuate.
3. Reduce the throttle when amperage or tractive effort increases from the effect of the brake pipe reduction. If a portion of the train is on a grade the drawbar force may increase rapidly, requiring further throttle reduction(s).
4. Make additional brake pipe reductions and actuate as necessary.

Note: If the entire train is on a descending grade and the train brakes must remain applied, it is permissible to use LIMITED power to control train speed. Do not exceed throttle position four (4), reducing throttle as necessary to prevent excessive amperage or tractive effort.

103.6.4 Stopping**A. Stopping, Level or Descending Grade with Dynamic Brakes Available, Slack Bunched**

When stopping on level or descending grade with dynamic brakes available with slack bunched:

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

B. Stopping, Level or Descending Grade, No Dynamic Brakes, Slack Bunched

When stopping on level or descending grade with no dynamic brakes:

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

C. Stopping, Ascending Grade, Slack Stretched, Throttle Modulation Method

When stopping on an ascending grade using throttle modulation method:

1. Gradually reduce the throttle one notch at a time.
2. Maintain a slack stretched condition and allow the ascending grade to slow the train.
3. When the train stalls, place the independent brake in FULL APPLICATION.
4. After the independent brake is fully applied, reduce the throttle to IDLE.
5. Apply train brakes as the train stops or just before it stops if immediate movement after stopping is not anticipated.

103.6.5 Unplanned Stop

In order to stop in the shortest possible distance without using an emergency brake application, such as when encountering a sudden block signal change or when being signaled to stop by a flagman or other person, the following procedure must be followed:

1. Make a brake pipe reduction immediately before making a throttle change.
2. After the initial brake pipe reduction and train slack has adjusted, throttle must be gradually reduced to IDLE position.
3. The independent brake must not be allowed to apply while still applying power.

103.6.6 Shoving Movements

During shoving movements to avoid jackknifing, wheel climb, or rail turnover use extreme care when applying tractive effort. When exceeding 12 equivalent axles of power during shoving movements, use only the minimum amount of tractive effort necessary to begin movement.

A. Starting Reverse/Shoving, Level or Ascending Grade

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

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

B. Starting Reverse/Shoving, Descending Grade, Slack Stretched

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

1. Ensure that the independent brake is fully applied.
2. Activate the dynamic brake to full.
3. Release the automatic brake and wait for all brakes to release and slack to adjust.
4. Reduce the independent brake gradually as the train begins to move.
5. Slowly release the independent brake when the dynamic brake becomes effective.

C. Starting Reverse/Shoving, Descending Grade, Slack Bunched or Unknown

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

1. Activate dynamic brake.
2. Reduce the independent brake by 50 percent to allow the locomotive to begin moving as slack adjusts.

3. Release the automatic brake and wait for all brakes to release and slack to adjust.
4. Continue to reduce the independent brake gradually as the train begins to move.
5. Slowly release the independent brake when the dynamic brake becomes effective.

D. Stopping Reverse/Shoving on Ascending Grade, Slack Bunched

When stopping a reverse or shoving movement on an ascending grade with the slack bunched, do the following:

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

E. Stopping Reverse/Shoving, Level or Descending Grade, Slack Stretched

When stopping a reverse or shoving movement on level or descending grade with the slack stretched, do the following:

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

103.7 Grade Operation

103.7.1 Operating on a Grade

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

1. Do not exceed the speed limit.
2. When conditions warrant, use all available braking power. If you are not sure that a service brake application will control the speed of the train, make an emergency brake application without hesitation.
3. Early in the braking process, achieve a balance between the level of dynamic brake and the level of air brake needed to control train speed on a descending grade.
4. At speeds below 10 MPH, use extended range dynamic brakes if available. Extended range dynamic brakes provide more retarding force than locomotive brakes.

103.7.2 Recharging on a Grade

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

1. Apply a sufficient number of hand brakes.
2. Release the automatic brake.
3. Recharge the air brake system.
4. After recharging the system, make a sufficient brake pipe reduction to hold the train while releasing the hand brakes.

Note: Do not apply power to hold a train stationary on a grade.

103.7.3 Cresting a Mountain Grade

Before passing the summit of a mountain grade, observe the following:

1. Ensure that the rear car brake pipe pressure is within 15 pounds of the regulating valve setting.
2. Abnormal brake pipe pressure changes, loss of brake pipe pressure, an abnormal increase in air flow reading, etc.

Note: If minimum brake pipe pressure or unusual conditions are noted, stop and secure the train. Correct the problem before proceeding.

103.7.4 Balance Braking on Grade

When a constant level of braking is required for long distances do the following:

1. Make a minimum brake pipe reduction and make further reductions of 2 psi until the train maintains the desired speed.
2. Limit the effective brake pipe reduction to 15 psi or less. If a greater than 15 psi brake pipe reduction is required to control train speed, stop train and inspect to determine reason before proceeding.
3. If the equalizing reservoir leaks and pressure maintaining is required for long distances, place the automatic brake valve cutout valve in PASSENGER, if equipped. Do not move the automatic brake valve cutout valve from FRT to PASS unless the automatic brake valve is in the RELEASE position. When operating in PASSENGER, use extreme care. A any movement of the automatic brake valve handle toward RELEASE will release the brakes throughout the train.

103.7.5 Regulating Valve Braking

Do not use the regulating valve to brake the train.

103.7.6 Retaining Valves

Use retaining valves when required by the timetable, general order or when requested by the engineer.

Setting Retaining Valves - To set retaining valves:

1. Stop the train.
2. Set the retaining valves as specified by the timetable or general order. If no quantity is specified, set all retaining valves.
3. Use High Pressure Position, except use Low Pressure Position on empty cars if equipped. Slow Direct Position must not be used.
4. Notify the engineer of the number of retainers set before proceeding.

Operating With Retainers - After the retaining valves are set, brake cylinder pressure is not retained until a brake pipe reduction and release has been made.

When retainers are set in HP (High Pressure) a 20 psi brake cylinder pressure will be retained or in LP (Low Pressure) a 10 psi brake cylinder pressure will be retained only after a brake pipe reduction of at least 10 psi has been made and released. Further brake pipe reductions will add to the pressure in the brake cylinder.

Do not exceed 15 MPH when operating with retaining valves set.

When retaining valves are not in use, place them in EX (Exhaust). Ensure that cars picked up en route have retaining valves in EX (Exhaust).

103.7.7 Inclement Weather Running Air Braking Test on Grade

A running air brake test (Rule 100.13) is required when snow has accumulated above the top of the rail or when snow is blowing within 10 miles of descending mountain grades.

If the ascending grade prior to crest of grade and/or train tonnage does not permit running air brake test, brakes must be applied as trains begins to crest grade, utilizing the stretch braking method, in order to determine the effectiveness of the brakes prior to entire train descending the heavy/mountain grade.

103.8 Emergency Brake Applications

When conditions warrant, use an emergency brake application without hesitation if any condition occurs in which there is doubt that service applications can control train speed and anytime maximum authorized speed is exceeded by 5 MPH or more. Make an emergency brake application by moving the automatic brake valve handle quickly to EMERGENCY and leave it there until the train or locomotive stops. In addition, lift the red cover of the EMERGENCY SWITCH and activate the emergency valve on the end-of-train device (ETD) utilizing the head-of-train (HTD) telemetry device, if equipped. Use the following procedure when stopping from an emergency application:

1. Move the independent handle to a position in the application zone that will develop the desired brake cylinder pressure without sliding wheels or developing excessive buff or draft force, then actuate and hold the handle in the actuate position. Extra care must be used to prevent sliding wheels if in dynamic brake mode at the time of emergency application.
2. Adjust brake cylinder pressure by moving the handle in the application zone while actuating.
3. Maintain the current slack condition (bunched or stretched) by avoiding the development of excessive buff or draft force. Extra care must be used to prevent sliding wheels if in dynamic brake mode at the time of emergency application.
4. If in power, return throttle to idle.
5. When maximum locomotive brake cylinder pressure is desired, release the handle from the actuate position.
6. After stopping and once freight car vent valves have closed (approximately 60 seconds), if operating conditions permit, place automatic brake valve in RELEASE position to release brakes.

103.8.1 Lead Unit Not Equipped with DYNAMIC BRAKE HOLDING Feature

This D.B. Holding feature may not be available on some foreign locomotives. When operating with a foreign locomotive, to assure full dynamic braking effort during emergency applications on descending, heavy/mountain grades as described above, observe the following procedures:

1. Place automatic brake valve handle in EMERGENCY position.
2. Control independent brake cylinder pressure to maximum without sliding wheels.
3. Return dynamic brake lever to OFF position. (Required on GE controlling locomotives only)
4. After waiting approx. 30 to 50 seconds, move automatic brake valve handle to CONTINUOUS SERVICE (or HANDLE OFF) position to reset PCS.
5. Return dynamic brake lever to FULL position.

6. Dynamic braking will be restored if independent brake is actuated and locomotive brake cylinder pressure is kept below 15 psi.

103.8.2 Emergency Brake Application by Crew Member

A crew member must initiate an emergency brake application, without hesitation, when:

- Life or property is in danger.
- The engineer cannot be informed to reduce train speed or stop the train, or
- The engineer does not respond to warnings or signals to reduce train speed or stop the train.

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

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

103.8.3 Undesired Emergency Brake Application

When an undesired emergency (UDE) brake application occurs, move the automatic brake valve handle to EMERGENCY and wait until the train stops. After stopping, if operating conditions permit, place the automatic brake valve handle in RELEASE to release the brakes and help locate the air hose separation or other problem.

103.8.4 Emergency Brake Application—Report to Train Dispatcher

When a train is stopped by an emergency brake application, whether it is induced by the engineer or other employee controlling the move, or by an undesired emergency brake application, a crew member will communicate the following information to the train dispatcher.

1. The milepost location where the emergency brake application occurred.
2. Brief report of who/what caused emergency application and factors involved.

103.9 Unintentional Brake Release

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

103.10 Penalty Brake Application

A penalty brake application is initiated by one of the following safety control devices:

- Alertness Device
- Cab Signal
- Overspeed
- Distributed Power failures

When a penalty brake application occurs, observe the following procedures:

1. Move automatic brake valve handle to SUPPRESSION position.
2. Control the amount of independent brake cylinder pressure desired, if any, by moving handle into the application zone and actuating. (If in power, return throttle to IDLE position.)
3. Reset PCS after train stops.
4. After PCS closes, release brakes if operating conditions allow.

103.11 Switching Movements

When switching cars, follow these switching movement requirements:

1. When starting or stopping switching movements, gradually stretch or bunch slack.
2. When using multiple locomotives, limit buff and draft forces.
3. Under normal conditions, make switching movements without using the automatic air brake system.
4. If necessary, cut in sufficient freight car air brakes to control switching movements.
5. Reverser handle must not be moved to any position other than in the direction of travel while locomotive is moving.
6. The generator field switch must never be closed or moved to "ON" position with the throttle open.

103.12 Temporary Speed Restrictions

When moving through an area with a temporary speed restriction, do the following:

1. If possible, release train air brakes and dynamic brakes before entering the restricted area.
2. Use the lowest possible throttle position for running or starting.
3. Avoid or minimize changes in train speed or slack condition.
4. Limit independent brake cylinder pressure as much as possible.
5. Do not exceed the 50 percent limit for dynamic brakes as outlined in Rule 103.2.1 (Dynamic Brake Limitations).

104.0 Freight Car and Locomotive Components and Charts

104.1 Freight Car End and Platform Identification

Identify car ends as follows:

- On cars with one hand brake, the “B” end of the car is the end with the hand brake. The other end is the “A” end.
- On cars with more than one hand brake, the letters “A” and “B” are stenciled on the appropriate ends of the car.
- On cars with more than one platform, each section is stenciled. Example: A five-platform articulated spine car is designated with an “A” platform on one end and the adjacent platform is designated as “E” then “D”, then “C” and then “B” on the opposite end.

104.2 Wheel and Journal Identification on Cars

To determine the correct wheel numbers on cars:

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

104.3 Coupler Assemblies

American railroads use three types of coupler assemblies. Each coupler head and knuckle is marked with a letter indicating its type. E, F and H

104.4 Freight Car A-1 Reduction Relay Valve

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

The relay valve functions as follows:

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

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

The following freight cars are equipped with the relay valve:

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

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

104.5 Freight Car Automatic Vent Valve

Some multi-platform cars are equipped with an automatic vent valve (AVV), which is simply an emergency portion of a control valve which is used only to propagate an emergency brake application through the brake pipe. Should an AVV become defective, the cutout cock is used to cut it out.

104.6 Retaining Valves

The retaining valve on each car controls the brake cylinder pressure exhaust. All freight cars have retaining valves located at the “B” end of the car or at the side near the control valve. The retaining valve can be positioned to function as follows during a brake release:

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

Three-Position Retaining Valve

The three-position retaining valve includes these positions.

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

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

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

Four-Position Retaining Valve

The four-position retaining valve includes the positions listed above and one additional position:

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

104.7 Locomotive Brake Equipment

Description of the various automatic and independent brake valve positions and their function. (Brake valve handle positions are described from left to right, or from front to back if desktop mounted.)

104.7.1 Automatic Brake Valves

H6 Automatic Brake Valve

The H6 automatic brake valve is a non-maintaining, non-self-lapping type automatic brake valve normally found on older locomotives and some switch engines. Handle positions include:

RELEASE—Charges the brake system and releases the brakes.

LAP—Prevents air from leaving or entering the brake pipe at the automatic brake valve. All ports in the brake valve are closed. Brake pipe leakage will continue to reduce brake pipe pressure at the same rate as the leakage. This position is also used for conducting brake pipe leakage tests and recovering from a penalty application.

SERVICE—Reduces equalizing reservoir pressure and brake pipe pressure at a service rate.

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

24RL-MC Automatic Brake Valve

The 24RL-MC automatic brake valve is a maintaining, non-self-lapping automatic brake valve. This brake valve maintains in LAP. Therefore, cut out the maintaining feature during brake pipe leakage tests. Handle positions include:

FULL RELEASE—Releases the train and locomotive brakes and charges the brake pipe through the regulating valve, preventing overcharge. When the handle is in this position, air is heard exhausting at the brake valve.

RELEASE—Releases the train and locomotive brakes and charges the brake pipe through the regulating valve.

FIRST SERVICE—Reduces the equalizing reservoir 6 to 10 psi at a service rate, then continues to reduce brake pipe pressure at a slow rate.

LAP—Maintains brake pipe pressure at the same level as equalizing reservoir pressure.

SERVICE—Reduces equalizing reservoir and brake pipe pressures at a service rate.

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

24RL-MC1 Automatic Brake Valve

The 24RL-MC1 automatic brake valve is a maintaining, non-self-lapping automatic brake valve. This brake valve maintains in MAINTAINING. Use LAP during brake pipe leakage tests. Handle positions include:

FULL RELEASE—Releases the train and locomotive brakes and charges the brake pipe through the regulating valve, preventing overcharge. When the handle is in this position, air is heard exhausting at the brake valve.

RELEASE—Releases the train and locomotive brakes and charges the brake pipe through the regulating valve.

MAINTAINING—Maintains brake pipe pressure at the same level as equalizing reservoir pressure. After making a brake pipe reduction, maintain brake pipe pressure by returning the automatic brake handle to MAINTAINING without pausing in LAP.

Note: Pausing in LAP may allow leakage to reduce brake pipe pressure below equalizing reservoir pressure. The brakes will release when you return the handle to MAINTAINING if equalizing reservoir pressure is above brake pipe pressure.

LAP—Prevents air from leaving or entering the brake pipe at the automatic brake valve. All ports in the brake valve are closed. Brake pipe leakage will continue to reduce brake pipe pressure at the same rate as the leakage. This position is also used for conducting brake pipe leakage tests and recovering from a penalty application.

SERVICE—Reduces the equalizing reservoir and brake pipe pressures at a service rate.

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

26C, 30CDW, Knorr CCB and WABCO EPIC Automatic Brake Valves

These maintaining, self-lapping brake valves regulate brake pipe pressure, controlling both locomotive and train brakes.

Brake Valve Features—These automatic brake valves have these features:

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

Handle Positions—Handle positions include:

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

MINIMUM REDUCTION—Reduces equalizing reservoir and brake pipe pressures 6 to 8 psi.

SERVICE ZONE—Gradually reduces equalizing reservoir and brake pipe pressures in increasing amounts as the brake handle is moved to the right. Moving the brake handle to the left with the brake valve cutout valve in PASS will increase equalizing reservoir and brake pipe pressures. Use extreme care when operating freight trains with the automatic brake valve cutout valve in PASS.

FULL SERVICE POSITION—Reduces equalizing reservoir and brake pipe pressures to near equalization.

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

HANDLE OFF/CONTINUOUS SERVICE—Reduces equalizing reservoir and brake pipe pressures at a service rate. Use this handle position for:

- Trailing locomotives
- Locomotives hauled dead-in-train

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

104.7.2 Automatic Brake Valve Cutout Valve

The automatic brake valve cutout valve determines how and when the automatic brake controls brake pipe pressure. There are two-position and three-position cutout valves. Because the cutout valve handle is spring-loaded, push it in before changing positions. Note: EMERGENCY is always available regardless of the position of the automatic brake valve cutout valve.

Two-position cutout valve

The two-position cutout valve has these positions:

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

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

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

Three-position cutout valve has these positions:

The three-position cutout valve has these positions

FRT—Same as IN position described in two-position cutout valve above.

OUT—Same as OUT position described in two-position cutout valve above.

PASS—Provides control of brake pipe pressure from the automatic brake valve. Equalizing reservoir pressure and brake pipe pressure will increase from any movement of the brake handle toward RELEASE—Use this position when operating passenger or commuter trains to utilize the graduated release feature.

Note: In freight service, if the equalizing reservoir is leaking, PASS may be used only if it is necessary to maintain constant brake pipe pressure during an automatic brake application. Because of the possibility of an undesired release, placing the three-position cutout valve in PASS position must only be done with the automatic brake valve handle in RELEASE position.

104.7.3 Independent Brake Valves

The following describes the positions and functions of all independent brake valves including:

LA6-P (Used with H6 automatic brake valves)

S40 (Used with all 24RL brake equipment)

SA26 (Used with 26C automatic brake valves)

30CDW

Knorr CCB

WABCO EPIC

RELEASE/ACTUATE—Normal position to release the locomotive brakes. To release the locomotive brakes while an automatic brake application is in effect, depress the handle (or lift actuating ring) while it is in the RELEASE position (actuate).

APPLICATION ZONE—All handle movements between RELEASE and FULL APPLICATION increase or decrease locomotive brake cylinder pressure as follows:

1. Increase by moving the brake handle to the right (or forward).
2. Decrease by moving the brake handle to the left (or back towards operator).

FULL APPLICATION—Position for creating maximum locomotive brake cylinder pressure from the independent brake system.

104.7.4 MU-2A/Double-Ported Cutout Cock

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

The MU-2A valve has three positions:

LEAD or DEAD—Engages control of the independent brakes. Use when a locomotive is a single unit, a controlling unit, or is being hauled dead-in-tow.

TRAIL 6 or 26—Disconnects control of the independent brakes from the independent brake valve. Use when a locomotive is a trailing unit in a multiple-unit consist.

TRAIL 24—Disconnects control of the independent brakes from the independent brake valve. Use when a locomotive is a trailing unit in a multiple-unit consist.

The double-ported cutout cock has two positions:

IN—Engages control of the independent brakes on a single locomotive or on the controlling locomotive of a multiple-unit consist.

Use IN also when a locomotive is hauled dead-in-tow.

OUT—Disconnects control of the independent brakes from the independent brake valve.

Use OUT when a locomotive is trailing in a multiple-unit consist.

104.8 Electropneumatic Automatic and Independent Brake Valves

Electropneumatic automatic and independent brake valves (Knorr CCB or WABCO EPIC) are cut in or cut out through electronic display screens. The air brake setup screens options are:

Independent Brake:

1. Lead
2. Trail

Automatic Brake Valve:

1. Pass (passenger-to be used only in passenger service)
2. Freight
3. Cut Out

104.9 Locomotive Electronic Air Brake Computer Resets

Contact NOC Mechanical Desk when encountering Knorr CCB system problems and be governed by the manager's instructions. If unable to contact NOC Mechanical Desk, Knorr CCB or Wabco Epic systems faults may be cleared by either cycling the circuit breaker for the air brake computer, or by the following steps.

1. Secure locomotive.
2. Close end cocks on affected unit, including main reservoir line.
3. Verify that air brake computer (CCB) circuit breaker is closed and remove reverser handle.
4. Set unit air brake setup to TRAIL. Note: If unit will not go to TRAIL, select LEAD, save and confirm. Try Step 4 again.
5. Place automatic brake valve handle in EMERGENCY position.
6. Place independent brake valve handle in RELEASE position.
7. After 60 seconds, place automatic brake valve handle in RELEASE position.
8. Change air brake setup to LEAD-CUT IN, and charge brake pipe to 90 psi.
9. Place automatic brake valve handle in SUPPRESSION position for 10 seconds.
10. Return automatic brake valve handle to RELEASE position. Allow equalizing reservoir and brake pipe to FULLY charge and allow brake cylinder pressure to go to 0 psi.
11. Place independent brake valve handle in FULL APPLICATION position.
12. Place independent brake valve handle in RELEASE position.
13. ACTUATE (BAIL) for 10 seconds.
14. Place automatic brake valve handle in EMERGENCY position.
15. After 60 seconds, place automatic brake valve handle in RELEASE position.
16. Place independent brake valve handle in FULL APPLICATION position.
17. Faults should be cleared. If faults do not clear, follow message instructions on operator's display.

104.10 Air Flow Meter

The air flow meter measures the rate in cubic feet per minute (CFM) that air flows into the brake pipe. The Air Flow Method (see Rule 100.9) uses this meter to determine brake pipe leakage.

Air Flow Meter Readings

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

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

- If the air flow meter shows a reading (less than 60 CFM) that is stabilized, the brake system is charged.

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

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

Engineer Responsibilities

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

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

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

104.11 Charging Time Chart

When the brake system is uncharged and not equipped with an air flow meter, use the following chart to determine the minimum and maximum charging times:

Minimum and Maximum Charging Times When Brake System is Empty		
Brake Pipe Length (in feet)	Minimum Charging Time (in minutes)	Maximum Charging Time (in minutes)
2,500 or less	8	25
3,000	10	30
4,000	15	35
5,000	20	40
6,000	26	55
7,000	35	65
8,000	45	75
9,000	57	100
10,000	71	125
11,000	80	160

104.12 Electronic Alertness Device

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

It functions as follows:

1. The device begins functioning when locomotive brake cylinder pressure falls below 25 psi.
2. At this point, the device monitors the operator’s alertness.

3. It resets when the operator changes the position of or operates one of these locomotive controls:

- Throttle
- Horn
- Bell
- Dynamic brake
- or
- Device reset button
- Radio transmit (on some alerter types)

4. If the device is not reset within the reset cycle (varies relative to speed):

5. A warning light flashes.

6. A warning horn sounds off and on for 10 seconds and then continuously for 10 seconds.

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

104.12.1 Deactivate Device Temporarily

To deactivate the electronic alertness device temporarily for unit train loading/unloading:

1. **WARNING:** If distributed power train, first place remote consist(s) in REMOTE MODE - IDLE to prevent undesired loading of remote consist during loading/unloading operation.
2. Isolate all units in the LEAD consist except the controlling unit. (Controlling unit will be isolated after completing all steps below.)
3. Select slow speed control on operating screen. (Leave speed setting to lowest speed setting available or 0 MPH)
4. Move reverser to the direction of travel.
5. Open throttle as commanded if using Slow Speed to load or Run 1 to simply nullify alerter during automatic car positioner unloading operation.
6. Isolate lead unit. (if only nullifying alerter with Slow Speed feature active.)
7. Release independent brakes when ready for movement.

Note: Alerter is nullified as long as train movement does not exceed 4 MPH.

If the above steps do not nullify alerter, complete the following steps:

On 26C, 30CDW equipped locomotives

1. **WARNING:** If distributed power train, first place DP remote(s), if any, in REMOTE MODE – ISOLATE to prevent undesired loading of remote consist during loading/unloading operation and to allow adjustment to regulating valve setting at lead DP unit)

Cut out the automatic brake valve.

2. Adjust the regulating valve to 114 psi or highest setting available.
3. Move the automatic brake valve handle to SUPPRESSION.
4. Cut in the automatic brake valve to PASS.
5. Make sure the brake pipe pressure is at the required 90 psi.

Restore Electronic Alertness Device Control on 26C and 30CDW

To restore the electronic alertness device control:

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

UPRR Locomotives (this feature only available on some models)

Observe the following steps:

1. Close throttle.
2. Center reverser.
3. Place remote consist(s) in REMOTE MODE IDLE, if DP train.
4. Isolate controlling locomotive.

Note: As long as speed remains below 2 MPH, alerter is nullified.

104.13 Overspeed Control

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

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

Slow Train

To slow the train when the safety control device sounds a warning, comply with the following:

1. On locomotives with 26L, 30CDW, and CCB brake equipment, move the automatic brake handle to SUPPRESSION within the 6- to 12-second warning period.
2. On locomotives with other brake equipment, reduce the brake pipe pressure 6 to 8 psi, or more if necessary.

Recover

To recover when the overspeed control applies the train brakes:

1. On locomotives with 26L, 30CDW, and CCB brake equipment, move the automatic brake handle to SUPPRESSION.
2. On locomotives with other brake equipment, move the automatic brake handle to LAP.
3. Move the throttle to IDLE and wait 60 seconds.
4. After the train stops, move the automatic brake handle to RELEASE and note that:
 - Brake pipe pressure is restored.
 - PC light goes out.
 - Brakes release.

Note: Some locomotive equipment has been modified to slow the train during the warning period with the automatic brake valve in MINIMUM REDUCTION. Unless the engineer knows that the locomotive being operated includes this modification, the SUPPRESSION position should be used.

104.14 Determining Number of Hand Brakes

The number of hand brakes depends on:

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

Use the following to determine the minimum number of hand brakes to apply, when the number required is unknown and/or when testing of the handbrakes by releasing the air brakes is not possible.

Guideline Chart When Unable to Verify Required Hand Brakes by Release of Air Brakes Number of Applied Hand Brakes Required													
	Grade (%)												
Tons	0	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00+
<1000	2	2	2	2	3	3	4	4	5	6	7	7	9
1000+	2	3	3	3	5	6	8	8	10	12	13	14	15
2000+	2	3	5	5	6	8	9	11	12	14	15	17	20
3000+	3	5	5	7	8	10	12	14	16	18	20	23	30
4000+	4	5	5	8	10	13	15	18	20	23	25	28	35
5000+	5	6	7	9	12	15	18	21	24	27	30	33	39
6000+	5	7	8	11	14	18	21	25	28	32	35	39	46
7000+	5	7	9	13	16	21	24	29	32	37	40	45	53
8000+	5	8	10	14	18	23	27	32	36	41	45	50	60
9000+	5	9	12	15	20	25	30	35	40	45	50	55	65
10000+	6	10	13	17	22	28	33	39	44	50	55	60	100%
11000+	6	11	15	18	24	30	36	42	48	54	60	66	100%
12000+	7	14	16	20	26	33	39	46	52	59	65	72	100%
13000+	8	15	17	22	28	35	42	49	56	63	70	100%	100%
14000+	8	15	20	23	30	38	45	53	60	68	75	100%	100%
15000+	9	16	22	24	32	40	48	56	64	72	80	100%	100%
16000+	10	18	24	26	34	43	51	60	68	77	85	100%	100%
17000+	10	20	26	28	36	45	54	63	72	81	90	100%	100%

105.0 Distributed Power (DP)

This Chapter presents rules, general instructions, and requirements for operating and conditioning locomotives equipped with multi-remote control systems. These systems are referred to as distributed power or DP.

105.0.1 Introduction

There are two distinct distributed power remote control operating systems:

- Locotrol III system, which is referred to as LIII (formerly referred to as DP).
- Locotrol IFC, LEB and LSI systems, are referred to as Integrated Distributed Power (IDP).

Each system has a different operator interface, equipment setup steps, and consist limitations. However, both systems provide the same control of air brakes, throttle, and dynamic braking.

Note:

- BNSF LIII and IDP systems are interoperable.
- Union Pacific LIII and IDP systems are interoperable.
- BNSF and Union Pacific LIII or IDP systems are NOT interoperable.
- BNSF and Union Pacific LIII or IDP systems are NOT interoperable with other railroads.

Distributed power systems provide synchronous and independent control of one to four remote consists (LIII) or five remote consists (IDP). These consists within a train provide, in addition to the lead consist, power, dynamic braking, and air braking as follows:

- The system controls the remote units by radio signals transmitted from the lead unit.
- During the initial setup and linking of the equipment and continuously during operation, a series of checks and comparisons detect equipment status, communication errors, or procedure sequence errors.
- For safety, this equipment becomes operational only when it is properly conditioned, a brake pipe continuity test is confirmed, and the radio links the lead controlling unit and the remote controlled unit(s).

Note: An engineer controls each locomotive consist in the distributed power train from the “lead unit.” The term “remote unit” applies to the controlling locomotive unit in a remote consist. Locomotives connected through the train lines for multiple unit service to the lead and remote unit(s) are called “trail locomotives.”

105.1 Preparing for Distributed Power Service

Before setting up and linking locomotives for distributed power operation, ensure that the locomotives in each consist (lead and remote) have passed these inspections:

- Federal locomotive daily inspection-see Rule 101.2 (Locomotive Daily Inspection).
- Locomotive brakes-see Rule 101.6 (Locomotive Air Brake Test). Secure consists to prevent movement during conditioning.

Link units after placing them in the train. The brake pipe must be connected and open between the consists. However, units may be linked on service track to test equipment but distributed power system must be unlinked and relinked to enable performing distributed power train brake pipe test after being placed in the train. (Necessary to check air flow sensitivity.)

Adding Cars to DP Trains En Route

A DP (LIII or IDP) Brake Pipe Continuity and Leakage Test will be required when a DP train is originally made up and, if en route if,

- DP power train increases its total length (including locomotive power) to greater than 7,500 feet, or
- A DP train length was already greater than 7,500 feet and additional cars are added.

This will require unlinking from the remote(s) and re-linking in order to run these DP test modes unless lead, controlling DP unit is equipped with “Brake Pipe Test on Demand” feature as described in Rule 105.4, Brake Pipe Test on demand.

A DP Brake Pipe Continuity and DP Leakage Test may be relied on in lieu of “train check” if departure immediately follows the completion of these tests.

105.1.1 Locomotive Conditioning Sequence

Condition locomotives for distributed power in the following order:

1. Set up the remote units.
2. Set up the lead unit.
3. Link to remote(s) from the lead unit.
4. Perform a brake pipe test.

Follow this sequence for both IDP and LIII systems. Complete the applicable procedures for the system equipped on each locomotive.

105.1.2 Conditioning Remote IDP Unit

Condition the controlling remote IDP unit in each consist as follows:

A. Switch and Handle Positions

“Data radio” circuit breaker—ON

Note: On GE IDP locomotives, the Distributed Power/TIM or MTB breakers must be turned on in lieu of “Data Radio.”

Isolation switch—RUN

Dynamic brake circuit breaker—ON

Control and fuel pump switch—ON

Engine run switch—ON (some EMD units require switch OFF, follow prompts from screen)

Generator field switch—OFF

Reverser—Centered (handle removed)

Throttle handle—Idle

Automatic brake handle—Continuous Service/Handle Off

Independent brake handle—Fully applied (at this time)

Air brake setup—Lead (freight) CUT IN

Note: **Ensure that the PCS and all air brake faults are reset before starting the setup procedure.**

B. IDP Setup Procedure

On the right-hand (No. 1) ICE screen or either screen on GE Locotrol IFC, perform the following:

1. Select the MORE Menu.
2. Select the DIST POWER key from the menu options.
3. From the Distributed Power Main Menu, choose the REMOTE SETUP key.
4. Enter the LEAD IDP (or DP) unit number.

5. Designate the direction of the remote unit as either SAME as or OPPOSITE of the lead unit.
6. Press ACCEPT.
7. Verify LEAD CUT IN and DP ENABLED. (or DP REMOTE)
8. Place the independent brake valve handle in RELEASE.
9. Do not attempt to reset the PCS.

This unit is now set up as a remote unit.

Note: If the locomotive is equipped with outer door locking hasp and lock, lock remote IDP unit(s) and any trailing units in remote consist(s) after conditioning for service.

105.1.3 Conditioning Remote LIII Unit

Condition the controlling remote LIII unit in each consist as follows:

A. Switch and Handle Positions

- Distributed power circuit breaker—OFF (at this time)
- Isolation switch—RUN
- Dynamic brake circuit breaker—ON
- Control and fuel pump switch—ON
- Engine run switch—ON
- Generator field switch—OFF
- Reverser—Centered (handle removed)
- Throttle handle—Idle
- Air brake setup—Lead (freight)
- Automatic brake handle—Continuous Service/Handle Off (UP LIII with air brake button control console, place ABV in RELEASE position)
- Independent brake handle—Fully applied (at this time)

Note: Ensure that the PCS and all air brake faults are reset before starting the setup procedure.

B. LIII Setup Procedure

At the LIII setup module in the nose compartment of the unit:

ALL LIII

1. Set the thumb wheels to the lead LIII unit number.
2. Set the LEAD/REMOTE switch to REMOTE.
3. Set the SAME/OPPOSITE switch to the position that the remote LIII unit is facing compared to the lead DP unit.

UP LIII only

4. Dual port air brake valve set to CUT IN. (on units so equipped)
5. Locotrol/conventional switch set to Locotrol (on units so equipped)

ALL LIII

6. Turn ON the three circuit breakers labeled ELEC, RELAY, and RADIO.

At the engine control panel:

7. Turn the distributed power circuit breaker ON.

At the control stand:

8. Place the independent brake handle in RELEASE.
9. Verify that the air brake message block reads DIST PWR REMOTE (if IFC screen-equipped.)
10. Do not attempt to reset the PCS.

This unit is now set up as a remote unit.

Note: If the incorrect lead DP unit is identified or the SAME/OPPOSITE switch is in the wrong position at the setup module, turn OFF the distributed power breaker on the engine control panel. After making the correct settings, turn ON the distributed power breaker.

Note: If the locomotive is equipped with outer door locking hasp and lock, lock remote IDP unit(s) and any trailing units in remote consist(s) after conditioning for service.

105.1.4 Conditioning Lead IDP Unit

Before starting the setup procedures, ensure that:

- Equalizing reservoir is adjusted to the required pressure.
- PCS and all air brake faults are reset.

Condition the controlling IDP unit as follows:

A. Switch and Handle Positions

“Data radio” circuit breaker—ON

Note: On GE Locotrol IFC locomotives, the Distributed Power/TIM or MTB breakers must be turned on in lieu of “Data Radio.”

Isolation switch—RUN

Dynamic brake circuit breaker—ON

Control and fuel pump switch—ON

Engine run switch—ON

Generator field switch—OFF (until ready to move)

Reverser—Centered (handle removed)

Throttle handle—Idle

Automatic brake handle—Continuous Service/Handle Off

Independent brake handle—Fully applied

Air brake setup—Lead (freight) CUT IN

B. IDP Setup Procedure

On the right-hand (No. 1) ICE screen or either screen on GE Locotrol IFC, perform the following:

1. Select the MORE Menu.
2. Select the DIST POWER key from the menu options.
3. At the Distributed Power Main Menu, select the LEAD SETUP key.

This unit is now conditioned and is ready to begin the linking process (see Rule 105.1.6).

105.1.5 Conditioning a Lead LIII Unit

Before starting the setup procedures, ensure that:

- Equalizing reservoir is adjusted to the required pressure.

- PCS and all air brake faults are reset.

Condition the controlling LIII unit as follows:

A. Switch and Handle Positions

- Distributed power circuit breaker—OFF (at this time)
- Isolation switch—RUN
- Dynamic brake circuit breaker—ON
- Control and fuel pump switch—ON
- Engine run switch—ON
- Generator field switch—OFF (until ready to move)
- Reverser—Centered (handle removed)
- Throttle handle—Idle
- Air brake setup—Lead (freight)
- Automatic brake handle—Continuous Service/Handle Off
- Independent brake handle—Fully applied

B. LIII Setup Procedure

At the LIII setup module in the nose compartment of the unit:

ALL

1. Set the thumb wheels to the lead LIII unit number.
2. Set the LEAD/REMOTE switch to LEAD.
3. Set the SAME/OPPOSITE switch to SAME/LEAD.

UP LIII only

4. Dual port air brake valve set to CUT IN. (on units so equipped)
5. Locotrol/conventional switch set to Locotrol (on units so equipped)

ALL

4. Turn ON the three circuit breakers labeled ELEC, RELAY, and RADIO.

At the engine control panel:

5. Turn ON the distributed power circuit breaker.

At the control stand:

6. On units so equipped, verify that the IFC displays an air brake message block indicating “DPC Penalty, Place handle in Supp.”

Note: The system LIII console should now begin cycling through a self-diagnostic mode. Verify that all lights are working before proceeding to the linking operation. Press any button on the LIII console to stop the diagnostic cycling.

This unit is now conditioned and is ready to begin the linking process (see Rule 105.1.7).

105.1.6 Linking to Remote Consist(s) from Lead IDP Unit

After completing step 3 of the lead IDP conditioning (see Rule 105.1.4B), the linking process is started by entering the controlling unit number of the remote consist(s). If there is more than one remote consist enter the locomotive remote nearest the lead consist first.

Perform the following:

1. Enter the number of the remote DP unit to be linked and select LINK.

The system will perform a short test.

- Check the System display for LINK OK, which means this step was successful.
- If the System display responds with LINK FAIL, check and re-enter the number of the controlling remote unit. If this step fails again, check the setup of the remote unit.

Note: If a “Radio Fail A or B” message is received, unlink and then re-link with remote. If a “Radio Fail A or B” message is again received, continue with linking process. Report the radio defect.

2. Repeat step 1 for each remote consist. Verify that each remote(s) are linked OK and then press the ACCEPT key.

Note: Once the consists are accepted, the Distributed Power Main Menu will appear on the right screen and the Distributed Power Operation will appear on the left screen. (On GE Locotrol IFC locomotives, the DP Main Menu may be displayed on either screen, and the DP Operation can then be displayed on the opposite screen.)

3. Perform the brake pipe continuity test (see Rule 105.1.8).

105.1.7 Linking to Remote Consist(s) from Lead LIII Unit

If the LIII console indicator lights are cycling, press any soft key to reset and to display the prompt to enter the controlling unit number of the remote consist nearest the lead consist. Perform the following:

1. Use the arrow keys to select the number and move the cursor.
2. After the proper unit number is displayed, press the LINK soft key.

Note: The status of the linking process will be displayed to the right of the unit number, i.e., TESTING, LINK OK, RADIO FAIL A or B, LINK FAIL.

Ensure that LINK OK is displayed to the right of the remote before proceeding to the next step. If LINK FAIL is displayed, re-enter the unit number and press the LINK soft key. If LINK FAIL is displayed again, check for the proper setup of the remote unit.

Note: If a “Radio Fail A or B” message is received, unlink and then re-link with remote. If a “Radio Fail A or B” message is again received, continue with linking process. Report the radio defect.

3. If the train has more than one remote consist, repeat steps 1 and 2 for each consist.
4. After entering all controlling remote engine numbers, press the DONE soft key.
5. Ensure that the automatic brake valve is in SUPPRESSION and wait until the penalty clears (about 2 minutes).
6. When the PCS and air brake message clears (on IFC-equipped units), you may move the automatic brake valve handle to RELEASE to charge the brake system.
7. Perform the Brake Pipe Continuity Test. (See Rule 105.1.9.)

Note: The Distributed Power Equipment is equipped with two sets of radios ‘A and B’ as a redundant backup system.

105.1.8 Brake Pipe Continuity Test from IDP Unit

Perform the brake pipe continuity test (BP test) after linking the consists and before moving the locomotive or train. This test is only available during the initial conditioning of the equipment. Ensure that the IDP system mode is IDLE.

After the correct locomotive(s) have been accepted in the linking process (see Rule 105.1.6), perform the following:

1. When the message CHARGE TRAIN BEFORE RUNNING BRAKE PIPE TEST appears, place the automatic brake valve handle in RELEASE.

Note: After linking to remote(s) the left-hand screen on EMD, IDP locomotives will automatically display the DP control screen. GE IDP units must be manually set up at this time on some units to display DP control screen to left.

Upon releasing brakes on lead unit, observe automatic brake valves on remote(s) cut in and a flow indication for all DP units on the DP control screen. Wait until flow values drop to 20 CFM on lead and remote(s) units before proceeding with step 2. This may require several minutes to reach desired rate.

2. Press the BRK PIPE TEST key followed by the EXECUTE key.
3. When prompted (this is an automated test), move the automatic brake valve handle to MINIMUM REDUCTION.

Note: Moving beyond MINIMUM REDUCTION will void the test.

4. Check the System screen for BP TEST OK, which means the test was satisfactorily completed.
5. If the test fails (BP TEST FAIL), release the train brakes and recharge. Return to step 1, wait until the flow has stabilized, and repeat the test.
6. See Rule 105.2.1 for steps to complete a leakage test.
7. See Rule 105.3 for steps to change the system operating mode to RUN.

105.1.9 Brake Pipe Continuity Test from LIII Unit

Perform the brake pipe continuity test to properly condition and enable the LIII equipment. Perform the following:

1. Press the BP TEST soft key.
2. When the BP TEST key begins to flash (this is usually a prompt to press the EXECUTE or CANCEL soft key):
 - a. Do not press EXECUTE or CANCEL at this time.
 - b. Check the flow values for the lead and remote consists displayed on the LIII console screen and wait until these values are below 20 CFM.

Note: The flow may take several minutes to reach the desired rate.

3. Once the air flow indicated on the lead and remote consists is below 20 CFM, press the EXECUTE soft key to initiate the BP test. (some LIII systems automatically reduce to MINIMUM REDUCTION at this time.)
4. When prompted on the LIII control console, move the automatic brake valve handle to MINIMUM REDUCTION. Moving beyond MINIMUM REDUCTION will void the test.

Note: The BP test will continue automatically and may take up to 30 seconds to complete.

5. Check the LIII control console for BP TEST OK, which means the test was satisfactorily completed.
6. If the test fails, release the train brakes and recharge. Wait until the flow has stabilized to a lower flow value than previous attempt, return to step 1, and repeat the test.
7. See Rule 105.2.2 for steps to complete a leakage test.
8. See Rule 105.3.2 for steps to change the system operating mode to RUN.

105.2 Distributed Power Brake Pipe Leakage Test

Follow the instructions for this test whenever a train using distributed power requires a brake pipe leakage test (as outlined in Rule 100.9). This test reduces the steps required to cut out the brake valves on the lead and remote consists.

Note: Distributed power trains must be tested using the Leakage Method instead of the Air Flow Method (AFM).

The leakage test is automated. The required 20-pound brake pipe reduction will be made and the timing will be measured for brake pipe cutout and leakage. The amount of leakage is displayed at the end of the test on the System screen. The test sequence requires at least 3 minutes to complete.

105.2.1 Brake Pipe Leakage Test Performed from IDP Controlling Unit

The LEAKAGE TEST soft key is located on the No.1 or right screen. The leakage test function will be displayed as a soft key on the System screen only when the train is stopped and the automatic brake valve handle is in RELEASE or MINIMUM REDUCTION. If the leakage test function is requested while the system is in the RUN mode, the mode will change to the IDLE mode.

Perform the test as follows:

1. Press the LEAKAGE TEST key.
2. Press the EXECUTE key.

Note: During the leakage test, several messages will be displayed updating the progress of the test, including STABILIZING AIR LINE, BRAKE VALVE OUT, and TIMING.

3. When the test has been completed, follow the message prompts displayed.
4. Move the automatic brake handle to FULL SERVICE.
5. Move the automatic brake handle to RELEASE when the inspection is complete.

Note: The test results will be displayed in the system log as leakage in psi.

6. Change the system mode to RUN to enable remote power and dynamic brake functions. (See Rule 105.3.1)

105.2.2 Brake Pipe Leakage Test Performed from LIII Controlling Unit

The LEAKAGE TEST soft key is accessed from the System display. The option to perform a leakage test is displayed only when the train is not moving and the automatic brake valve handle is in RELEASE or MINIMUM REDUCTION.

Perform the test as follows:

1. Press the LEAKAGE TEST soft key.
2. Press the EXECUTE soft key.
3. When prompted by the system at the end of the test, move the brake valve handle to FULL SERVICE.
4. When the prompt changes to RELEASE BRAKES to COMPLETE TEST, do not release the train brakes until the inspection is complete.

Note: The system will display the amount of brake pipe leakage in psi.

5. Change the system mode to RUN to enable power and dynamic brake functions. (See Rule 105.3.2)

105.3 Distributed Power System Operating Modes

After completing a brake pipe continuity test or a brake pipe leakage test, change the system mode to RUN to enable the remote distributed power traction and dynamic brake functions.

Note: The brake pipe continuity and brake pipe leakage tests are performed in the system IDLE mode.

105.3.1 Changing System Operating Modes on IDP Controlling Unit

To change the operating mode on an IDP controlling unit:

1. Select DP MAIN MENU.
2. Select MODE.
3. Select RUN or IDLE.
4. Press EXECUTE.

The RUN or IDLE status appears in the upper left-hand corner of the No. 2 or the left ICE screen.

105.3.2 Changing System Operating Modes on LIII Controlling Unit

To change the operating mode on a LIII controlling unit:

1. Select the MODE display.
2. Select RUN or IDLE.
3. Press EXECUTE.

The RUN or IDLE status appears in the upper right-hand corner of the DP control console.

105.4 Brake Pipe Test on Demand

Some BNSF DP (and other RR DP units) locomotives have been modified to allow performing the DP Brake Pipe Test even after the train is initially conditioned as outlined above. This enhancement is referred to as “Brake Pipe Test on Demand”. Other DP units without this enhancement require unlinking and reconditioning the DP locomotives to again be able to perform this test. (Refer to 2nd paragraph of ABTH Rule 105.1 regarding when and why this test is required.) Controlling lead DP locomotives with this enhancement can perform additional DP Brake Pipe Tests as required after initial test, such as when picking up additional cars en route or reconfiguring the train consist after test was initially performed.

For DP locomotives without this enhancement, the key for Brake Pipe Test disappears after test is successfully performed and is replaced by “Train Check” when a brake pipe reduction is of 10 psi or greater is made with the automatic brake valve. On DP locomotives with this enhancement, “Brake Pipe Test” is displayed on the DP Main Menu when automatic brake valve is in the RELEASE position. When automatic brake valve is used to reduce brake pipe pressure by 10 psi or greater, this key is changed from “Brake Pipe Test”, to “Train Check”. (See ABTH rule 105.5 for guidance on how “Train Check” is used.) If allowed by local instructions, this feature may be utilized to pre-test the DP locomotive equipment and thereby reduce time required to condition DP trains for service.

105.5 Train Check

The train check operating feature verifies that the brake pipe is open and unrestricted between the lead consist and the remote consist(s).

Perform the train check operation in the following instances:

- To secure a train to be left unattended except during extremely cold temperatures (below 25 degrees F).
- Just before movement anytime the train has been stopped or the train’s brake pipe may have been compromised.

Note: On descending grades where train handling techniques require automatic air brakes to remain applied when initiating movement, train check is not required.

If the check is successful, the display will show TRAIN CHECK-OK and the train may proceed at maximum authorized speed. If the display shows TRAIN CHECK FAIL, follow the instructions in Rule 105.5.2 before proceeding. If the train was started before the fail indication was displayed, stop the train.

105.5.1 Performing Train Check from IDP or LIII Unit

The conditions and procedure for this brake pipe system check are identical for both types of distributed power equipment.

Perform the check as follows:

1. Ensure that the train is standing.
2. Apply the train air brakes (make at least a 10-pound brake pipe reduction).
3. Wait until the brake pipe exhaust has ceased before initiating the train check.

Note: During extremely cold temperatures, do not initiate the train check until just before departure.

4. From the system display, select TRAIN CHECK.
5. Select EXECUTE.
6. Verify that the brake valves cut out on the remote consist(s) by checking the status of the remotes or by seeing the prompt appear to release the brakes.
7. Move the automatic brake handle to RELEASE when ready to depart.

The results of the train check will appear on the display as PASS or FAIL.

The check may take up to 2 minutes. During this time, the Locotrol system is expecting brake pipe pressure to increase on the remote consist(s). If it does not detect this increase, if the increase comes up too slowly, or if communication is interrupted, the result will be a FAIL indication.

Note: Train may be started while waiting for the train check results.

The results of the train check must yield a PASS indication before:

- Train speed exceeds 10 MPH and
- Train movement exceeds the train's length unless the entire train is visually inspected, or the changing brake pipe pressure readings from the remote(s) or ETD indicate that the brake pipe is not obstructed.

105.5.2 Responding to Train Check FAIL

If the train check results in a FAIL indication, three chimes will sound and the System screen will indicate the failure. A brake pipe blockage, excess brake pipe leakage, or an interruption in communications between the lead and remote(s) could cause the failure.

Train check or the alternate method must be successfully completed before allowing the train to proceed at maximum authorized speed.

A. Second Attempt of Train Check

If the train was started and is moving when the train check fail is received. Stop the train and retry the train check. (See Rule 105.5.1)

1. If a TRAIN CHECK PASS or OK indication is given on the second attempt, proceed at maximum authorized speed.
2. If another TRAIN CHECK-FAIL occurs, perform the alternative method for determining brake pipe continuity between the lead unit and rear of the train.

B. Alternative Method for Determining Brake Pipe Continuity

If there are no indications of communication interruptions between the remote(s) and/or the ETD and the lead unit, perform the alternative method as follows:

1. Make a 10-psi brake pipe reduction with the automatic brake valve.
2. Cut out the brake valves on all remote(s) by placing each in BV OUT mode.
3. After determining that all remote brake valves are cut out, return the remotes to NORMAL mode.
4. Move the automatic brake valve handle to RELEASE.
5. Using a remote DP at the rear of the train or an ETD, verify a rise of at least 5 psi of brake pipe pressure at the rear of the train.
6. If any remote brake valves do not cut in with a rise in brake pipe pressure of at least 4 psi at that remote as indicated by the control console, report that the remote DP unit is defective to the mechanical help desk.
7. If the brake pipe is unrestricted between the lead unit and the rear of the train, proceed at maximum authorized speed.

If the brake pipe pressure does not increase or decrease in a normal amount of time, visually inspect the train. Correct and report any defect(s) found.

C. Communication Interruption During Train Check or Alternate Method

During the train check or alternate method, if there are indications of a communication interruption between the remote(s) and/or ETD and the lead unit, perform the following:

1. If needed and if move can be made safely, proceed one train length at no more than 10 MPH to try to improve radio reception.
2. Successfully complete the train check or the alternate method before allowing the train to proceed at maximum authorized speed.

105.5.3 Securing Train Using Train Check

Use train check when securing a distributed power train left unattended, except during extreme cold temperatures. If the temperature is below 25 F, make a 20 psi brake pipe reduction and leave the brake valves cut in on the lead and remote units.

A. Securing an entire Distributed Power Train with Locomotives Attached

To secure a train using train check:

1. Secure train with hand brakes as required in Rule 102.1
2. Fully apply the locomotive brakes.
3. Make a 20-pound brake pipe reduction.
4. After the brake pipe exhaust stops, select TRAIN CHECK from the system display.
5. Select EXECUTE.
6. Wait until the brake valves are cut out on the remote consist(s).

B. Separating a DP Train to be Left Unattended

Securing a DP train that is not kept intact:

1. Secure what will be the detached portion as required by Rule 102.1.2.
2. Use the SET OUT mode (as outlined in Rule 105.6.5) on each remote consist(s) that will not be attached to the head portion of the train (Lead Consist).
3. Leave the rear portion of the train standing in emergency and leave the angle cock open.
4. Use train check to condition the head portion of the train if it contains remote consists.
5. Secure the front portion of the train as required by Rule 102.1.1.

105.6 Remote Operating Modes

The system mode and the individual remote modes determine how each remote unit responds to the commands from the lead unit for throttle, air brake conditions, and other operator inputs.

Use the REMOTE display on the lead locomotive to select limiting modes for the individual remote units. The remote modes are:

NORMAL—All remote traction and dynamic brake functions are enabled for control. All remote air brake functions are enabled, and the brake valve may be cut in.

IDLE—The remote throttle remains in IDLE. All remote air brake functions are enabled, and the brake valve may be cut in.

BV OUT—All remote traction and dynamic brake functions are enabled for control. The emergency and independent air brake functions are enabled for control. The remote automatic air brake functions are restricted by cutting out the brake valve.

ISOLATE—The remote throttle does not respond to commands and remains in Idle. The remote's emergency air brake application function and independent brake functions are enabled for control. All other brake functions are disabled, and the brake valve is cut out.

SET OUT (S/O)—The remote throttle does not respond to commands and remains in IDLE. The remote's emergency brake application is enabled for control. The independent brakes are fully applied (72 psi). All other air brake functions are disabled, and the brake valve is cut out.

STOP—The remote's throttle is set to ENGINE STOP (train-line stop). All other remote functions are in ISOLATE. These modes may be selected from the REMOTE display.

105.6.1 Remote Mode NORMAL

When the distributed power system is linked and the brake pipe leakage test is complete, the remote consists are in NORMAL.

A. Returning a Remote Consist to NORMAL mode.

Exception: See Rule 105.6.5 for instructions to return to NORMAL from the SET OUT mode.

If a remote is in other than SETOUT or NORMAL modes, return it to NORMAL as follows:

1. Select NORMAL from the remote display.

Note: Units in the STOP mode must be placed into the ISOLATE mode to be restarted and then may be returned to the NORMAL mode.

2. After changing the remote consist to NORMAL, you may cut in the automatic brake valve.

Note: A change to this mode can be made while train is moving or stopped

B. To Cut In Automatic Brake Valve on Remote

To cut in an automatic brake valve on a remote unit that has been returned to or is in NORMAL or IDLE:

1. Make at least a 10-psi brake pipe reduction with the automatic brake valve.
2. After the brake pipe exhaust has ceased, move the automatic brake valve handle to RELEASE.

With the lead unit automatic brake valve in RELEASE, the remote brake valve will cut in when the brake pipe pressure increases at least 4 psi at the remote unit.

105.6.2 Remote Mode IDLE

The IDLE mode allows the Remote consist to use all air brake functions, but disables all power or dynamic braking.

Note: A change to this mode can be made while the train is moving or stopped.

If the mode is changed while moving, care must be exercised to assure that slack adjustment is not affected by loss of power or Dynamic Brakes.

105.6.3 Remote Mode BV OUT

The BRAKE VALVE (BV) OUT mode can be used when troubleshooting air brake problems and when making a brake pipe continuity check as outlined in Rule 105.4.2B. If a consist is operated in the remote BV OUT mode, the consist will not continue to operate in power or dynamic brake (no override) following a communication interruption of 45 seconds or more (see Rule 105.7.2)

To cut in an automatic brake valve on a remote unit that has been returned to or is in NORMAL or IDLE:

1. Make at least a 10-psi brake pipe reduction with the automatic brake valve.
2. After the brake pipe exhaust has ceased, move the automatic brake valve handle to RELEASE.

With the lead unit automatic brake valve in RELEASE, the remote brake valve will cut in when the brake pipe pressure increases at least 4 psi at the remote unit.

Note: A change to this mode can be made while the train is moving or stopped.

105.6.4 Remote Mode ISOLATE

The remote mode changes to ISOLATE when a communication loss idle down has occurred (see Rule 105.7.2A).

Note: A change can be made to this mode while the train is moving or stopped.

105.6.5 Remote Mode SET OUT (S/O)

The SET OUT mode is used to condition and help secure a remote consist left standing uncoupled from the front portion of a train operating in distributed power. A change to this mode must only be made when train is stopped.

A. Separating from Remote Consist to be Left Standing

To separate the remote consist from the train:

1. Stop the train.
2. Fully apply the independent brakes.
3. Make a 20-pound brake pipe reduction.

Note: When instructed to prepare train for an inbound inspection, comply with ABTH Rule 100.17 Inbound Train Inspection and place the automatic brake valve handle in the HANDLE OFF/CONT SVE position to reduce brake pipe to near 0 psi.

4. From the REMOTE display:
 - a. Use the cursor to select the remote consist to be left standing.
 - b. Select S/O.
 - c. Select EXECUTE.
 - d. Wait for the status to change to S/O.
 - e. Repeat steps "a" through "d" for each remote consist to be left standing.
5. Close the angle cock on the last car of the head portion of the train to be moved.
6. Separate the train when ready.
 - a. Leave the angle cock OPEN on the detached portion of the train.
 - b. Ensure that the detached portion of the train goes into emergency.

B. Returning Remotes to NORMAL After Re-coupling Train

To return the remotes to NORMAL after using the SET OUT mode to separate the train:

1. Re-couple and secure the train.
2. Do not open the angle cock to recharge the rear portion of the train at this time.
3. Make a 20 psi reduction,
4. From the remote display:
 - a. Select the remote consist to be returned to NORMAL.
 - b. Select NORMAL and then EXECUTE.
 - c. Ensure that the remote consist status changes from S/O to NORMAL before continuing.
 - d. Repeat steps “a” through “c” for each remote consist re-coupled.
5. Open the angle cock.
6. Place the automatic brake valve in RELEASE.

Note: After a PCS open condition has occurred on a remote consist(s), the following conditions are required before tractive effort will be allowed to be produced by the remote consist(s):

1. PCS on remote(s) has reset.
2. Automatic brake valve on remote(s) has cut in.
3. A minimum brake pipe pressure of 25 psi has been restored at the remote consist(s).

105.6.6 Remote Mode STOP

Use the STOP mode to shut down units in a consist only if an emergency condition exists from a heavy impact, fire, hazardous material leak, or a stop in a tunnel. Executing the STOP mode will shut down all units in the selected remote consist.

Execute the STOP mode as follows:

1. Select the remote consist to be shut down from the remote display.
2. Select STOP and then EXECUTE.

To Restart Remote Consist

1. Select the remote consist to be restarted.
2. Select ISOLATE and then EXECUTE.
3. Restart each unit in the remote consist. Restarting cannot be done remotely.
4. When ready for remote consist(s) to cut in automatic brake valve with at least a 4 psi rise in brake pipe pressure and provide tractive effort, select NORMAL and then EXECUTE.

105.7 Unlinking from Remote Consists (Ending Distributed Power Operation)

Before ending DP or IDP on remote consist(s), end distributed power on the lead consist. Stop and secure the train before ending distributed power, and follow one of the procedures below to unlink a DP or IDP lead unit.

105.7.1 Unlinking IDP Lead Unit from Remote Consist(s)

To unlink an IDP lead unit:

1. Stop the train.
2. Fully apply the independent brake.
3. Place the throttle in IDLE.

4. Make a 20-pound automatic brake pipe reduction.
5. From the right screen (or DP Main Menu):
 - a. Select the system display key.
 - b. Press the UNLINK key followed by the EXECUTE key.

Note: A penalty brake application will reduce brake pipe pressure to 15 psi.
6. Wait to proceed until after the brake pipe exhaust ceases and the distributed power backup emergency valve drops the brake pipe pressure rapidly to zero.

Note: Locotrol LEB IDP lead unit does not perform distributed power backup emergency valve test. On these IDP lead units, recover penalty application and end distributed power to return to conventional operation.
7. If the lead unit will not be re-linked, end distributed power operation as follows:
 - a. Select the DP MAIN MENU key. On UP IDP loco's END DIST POWER button should appear after back up emerg valve check without returning to DP menu again
 - b. Press the END DIST POWER key followed by the EXECUTE key.
 - c. Turn the DATA RADIO circuit breaker OFF (or Distributed Power and TIM breakers).

You may now operate the lead consist using normal operating procedures. Be sure to condition remote units for normal operation.

Note: Some foreign locomotives with DP equipment unlink with an immediate emergency application and no penalty application. End distributed power on these units after the emergency application upon unlinking.

105.7.2 Unlinking LIII Lead Unit from Remote Consist(s)

To unlink a LIII lead unit:

1. Stop the train.
2. Fully apply the independent brake.
3. Place the throttle in IDLE.
4. Make a 20-pound automatic brake pipe reduction.
5. From the system display, select UNLK and then EXECUTE.

Note: A penalty brake application will reduce brake pipe pressure to approximately 9 psi. UP LIII systems will initiate an emergency application.
6. Wait to proceed until after the brake pipe exhaust ceases and the distributed power backup emergency valve drops the brake pipe pressure rapidly to zero.
7. Turn OFF the distributed power breaker located on the engine control panel.
8. At the distributed power setup module in the nose of the unit:
 - a. Set thumb wheels to 0000.
 - b. Turn OFF the three circuit breakers on the distributed power switch panel labeled ELEC, RELAY, and RADIO.
9. Follow the instructions in the air brake message block to recover the locomotive brakes.

You may now operate the lead consist using normal operating procedures. Be sure to condition remote units for normal operation.

Note: Some foreign locomotives with LIII equipment unlink with an immediate emergency application and no penalty application. End distributed power on these units after the emergency application upon unlinking.

105.7.3 Ending Distributed Power on Remote IDP Units

End distributed power on each remote IDP controlling unit only after it has been unlinked from the lead unit.

On the controlling remote unit:

1. Select the distributed power key.
2. Select END DISTRIBUTED POWER.
3. Turn the DATA RADIO circuit breaker OFF (or Distributed Power and TIM breakers).

Condition the locomotive brakes for normal operation.

105.7.4 Ending Distributed Power on Remote LIII Units

End distributed power on each remote LIII controlling unit only after it has been unlinked from the lead unit.

On the controlling remote unit:

1. Turn OFF the distributed power breaker located on the engine control panel.
2. At the distributed power setup module located in the nose of the unit, set the thumb wheels to 0000.
3. Turn OFF the three circuit breakers on the distributed power switch panel labeled ELEC, RELAY, and RADIO.

Note: You may need to save and confirm LEAD CUT-OUT before changing the air brake system to the desired operation.

105.8 Special Operating Conditions

This section describes special operating conditions and procedures for:

- Handling a communication loss override.
- Adding or removing units while linked.
- Handling remote consist(s) by another train or engine.
- Restarting the diesel engine of a lead or remote unit.

Every few seconds, the distributed power system checks the radio and onboard computer communication on the lead and remote controlling units. If a communication check fails, the system will:

- Attempt to operate the lead and remote backup radios.
- Declare a communication interruption at the lead and at the remote unit.

105.8.1 Lead Unit Communication Interruption

If a lead unit fails to receive an expected command reply from a remote unit, a yellow COMM light (IDP unit) will come on, or the COMM light will flash (DP unit).

The lead unit will declare a communication interruption:

- If no reply is received from a remote unit in 45 seconds, or
- In 10 seconds if an automatic brake application is made.

The following will occur when a communication interruption is declared:

- On an IDP unit, a red COMM light will come on.
- On a LIII unit, a steady COMM light will come on.
- On both units, a double chime alarm will sound.

Note: The status displayed for the remote consists will not change during the COMM interruption and will continue to indicate the remote status at the time of the failure.

105.8.2 Remote Unit Communication Interruption

When radio communication is interrupted, the last throttle command and brake pipe pressure being maintained by the DP remote(s) remain in effect. A 20-psi brake pipe initial reduction (with no split in the reduction) or 20-psi greater reduction (if brakes were already applied before the communication interruption occurred) is necessary as a signal to the remote(s). **WARNING:** If the brake system is not fully charged at the time of a communication interruption, make a brake pipe reduction (with no split in the reduction) sufficient to reduce brake pipe pressure at least 10 psi below the last brake pipe reduction.

If a radio communication has been interrupted, each remote consist will do the following:

1. Continue to operate on the last throttle and air brake command received via the radio.
2. If no changes in the actual brake pipe pressure are detected at the remote:
 - a. Continue to act on last command received for no longer than 90 minutes.
 - b. At the end of 90-minute override, remote will drop throttle (or dynamic brake) to idle at a rate of 3 seconds per throttle position, and automatic brake valve will cut out, if radio communication has not been re-established.

Note: The remote brake valve must be cut in during the communication interruption to allow the remote consist to operate in override. Operating a DP train without the brake valve cut in on the remote consist(s) should be avoided, if possible, as it may result in an immediate undesired idle down of the remote consist during a radio communications break. Any undesired loss of power on remote consist while under heavy load, such as when operating on ascending grade, may result in a severe run-out of slack and train separation.

A. Remote Unit Senses Brake Application or Release Without Command

If a remote unit senses a brake application or release via the brake pipe without receiving a radio command to reduce brake pipe pressure or to release the brakes, the unit will:

Try to check with the lead unit via radio.

1. If no response is received:
 - a. Step the throttle or dynamic brake to IDLE at 3 seconds per step.
 - b. Cut out the brake valve on the remote.
 - c. Limit to an ISOLATE mode.
2. If a communication interruption (45 seconds) is declared while the brake valve is cut out:
 - a. Step the throttle or dynamic brake to IDLE at 3 seconds per step.
 - b. Limit to an ISOLATE Mode.

Note: The engineer uses the brake pipe as a backup communication tool, as described in steps 1 and 2 above, to eliminate tractive effort or dynamic braking. As a result:

- Ensure that the brake pipe is unobstructed between the lead unit and remote units.
- Always use train check just before moving after being stopped for any length of time or anytime the brake pipe may have been tampered with.

B. Radio Communication Reestablished

When radio communication is reestablished, at the lead unit:

1. Return the remote to the NORMAL mode as outlined in Rule 105.5.1. This will restore the throttle and dynamic brake functions.
2. Cut in the automatic brake valve as outlined in Rule 105.5.3.

105.8.3 Operation During Loss of Communication

During a communications interruption between the lead and remote(s), keep the train moving, if possible, to a location where communications might improve.

When Rule 102.14 is applied (while using a remote DP/IDP unit at the rear of the train without a two-way ETD), a communication interruption that exceeds 5 minutes should be considered an en route failure.

105.8.4 Adding or Removing Unit(s) in Lead or Remote Consist While Linked

Locomotives may be added or removed from the lead or remote consist while linked except the controlling locomotive of each consist. If it is necessary to change out the controlling locomotive of a remote or lead consist:

1. Unlink the distributed power. (See Rule 105.6)
2. Properly condition the new controlling locomotive and link it to the other consists in the train.

A. Adding or Removing Trail Locomotives

Trail locomotives may be added or removed while the train is stopped and linked. When adding or removing locomotives, except when removing the rear locomotive(s) of the consist, perform locomotive air brake test outlined in Rule 101.6.

Note: The air brake test may be performed on the remote consist by the engineer operating from the lead consist. Crew members or mechanical forces must observe from the ground that the locomotive brakes apply and release on the consist that has been changed.

Do not operate (MOVE) a remote consist(s) from the lead consist unless the brake pipe is connected and open between the lead and remote consist to be moved.

105.8.5 Handling Remote Consist(s) with Brake Pipe Only

DP remote consists that have been conditioned for service may thereafter be handled like a freight car (using brake pipe pressure to apply and release the brakes) under two conditions:

Unlinked from Remote Consist

1. Unlink from remote consist to be moved. (must be stopped)
2. Wait a minimum of one minute.
3. Couple brake pipe to remote consist and with either same lead, controlling DP unit or any other locomotive.
4. Perform set and release to verify air brake control using the brake pipe, only.

After a communications loss with the remote consist (to be used when DP is disabled due to the communication loss).

1. Observe that communications loss with remote is continuous.
2. Make an emergency application of the brakes (unless train already has an emergency application in effect)
3. Wait a minimum of one minute.

4. Release train brakes and confirm brakes release on remote consist.

5. Perform a set and release of the train brakes to verify brake control using the brake pipe, only.

Exception: If physical characteristics of the location prevent reaching the remote consist to perform brake test as per Item 5 above, the train may be moved, but may not exceed 5 MPH for the distance necessary to perform the test.

Under all other conditions, the DP systems do not allow another train or engine to move the remote unit(s) while it is linked in distributed power operation. If a remote unit(s) must be moved or switched when not coupled to the same portion of the train the lead unit is attached, the remote unit(s) should be unlinked and conditioned for normal operation.

105.8.6 Restarting Diesel Engine of Lead or Remote Unit

Do not attempt to restart or crank a lead or remote controlling unit operating in distributed power while the train is moving. It may be necessary to re-link the distributed power system after restarting the unit(s).

105.8.7 Alarm Warning from a Remote Unit

The alarm indication is triggered by a trainlined alarm from that remote consist. The defect may be on any unit in that consist.

When lead DP unit display indicates a wheel slip from a DP remote consist that is continuous (active alarms remain highlighted on alarm display screen and audible alarm is continuous), train must be stopped immediately and cause for alarm determined. A rolling inspection of remote consist(s) involved is required before proceeding.

All other alarms must be investigated as first opportunity.

105.9 Using Remote DP Unit as ETD

Remotely controlled equipment may be used as a two-way ETD when a remote consist is placed at the rear of the train.

105.9.1 Providing Alternative Marker

When a remote DP locomotive consist is at the rear of a train and no ETD is being used, provide an alternative marker as follows using one of these methods:

1. Plug an operative locomotive marker into the MU receptacle at the rear of the rear locomotive. (The marker will flash constantly after being plugged in.), or
2. Place the headlight at the rear of the rear locomotive on dim.

Note: If either the headlight or locomotive marker fails en route, comply with GCOR Rule 5.10.2.

105.10 Distributed Power Train Handling

The following train handling rules can be applied to both types of equipment (IDP/LIII) and are intended to be generic. The train handling technique is the same for both types of equipment even though the exact steps and indications may vary.

Before initially moving a distributed power train after linking, ensure that the SAME/OPPOSITE switch is in the proper position by starting the train with power from only a remote consist (if possible).

A. Operating Remote Units in Front Group (synchronous mode)

After a distributed power train has been conditioned and the system has been placed in the RUN mode, the system is configured with all remote units in the front group (“synchronous mode”) and controlled from the lead unit throttle.

If possible, operate all remote units in the front group when the train is operating on:

- Near-level or gentle undulating grades.
- Continuous descending or ascending grades without severe undulation.

When operating on severely undulating grades or when cresting a grade, use independent control for train handling.

B. Operating Remote Units in Independent Control (back group)

Caution: Remote unit(s) always have the generator field circuit energized regardless of the position of the generator field switch of the lead unit. The reverser on the lead unit must be centered while the train is standing, until the train is ready to move.

Use the independent control function only when the train is operating in the RUN mode. Control the independent operation for remote consist(s) using function keys displayed on the Summary screen.

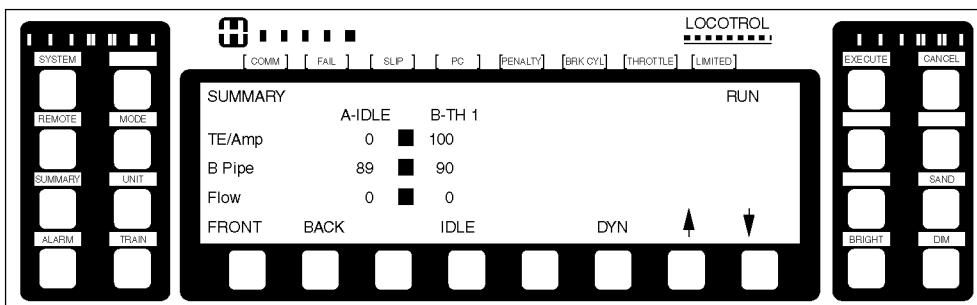
- Only the consist(s) displayed in the back group can respond to throttle and dynamic brake commands initiated from the Summary screen.
- Only the consist(s) operating in the front group can respond to throttle and dynamic brake commands made from the lead unit controller.

If a train is operating on undulating terrain, improve the train handling or slack action by operating the remote consist(s) at a power setting different from the front portion of the train (called independent control).

Operate in independent control by moving the remote consist(s) into the back group and providing independent control of the throttle or dynamic braking by press the BACK soft key on the Summary screen.

Note: A fence (bar) separates the front and back consists. All consists to the right of the fence are in the back group and those on the left are in the front group.

LIII Console (Summary Display) Shown With Remote Consist in Back Group Throttle 1



If the consists were operating in power or dynamic braking (synchronous) when the rear remote consist was moved to the back group, the rear remote will remain at its present power setting until it is changed using the soft keys on the Summary screen.

If the consists were in IDLE when the rear remote consist was moved to the back group, it is necessary to select THROTTLE/TRACTION or DYN/BRAKE and to execute the command to take independent control of the back group. Once executed, the throttle or dynamic brake will move to Position 1.

Control the remote consist(s) in the back group as follows:

- From an IDP lead unit, press more or less TRACTION/BRAKING.
- From a LIII lead unit, press the up or down arrows for more or less THL or DYN.

To control the throttle or braking of the units in the front group, use the lead unit throttle controller.

To reassign a remote consist from the front group to the back group, press the BACK soft key.

To reassign a remote unit from the back group to the front group, press the FRONT soft key.

Note: The Summary screen continues to display both the front and back throttle positions. A remote unit moved to a new group will immediately begin changing throttle or dynamic brake positions to match its new group assignment.

C. Reassigning Remote DP Units to Front Group When in a Different Mode

When reassigning units between the front and back groups while the front group is in the DYNAMIC BRAKE mode, the back group is in the THROTTLE mode, and the reverser is in the forward direction (as when cresting a grade):

1. Press the console's FRONT button to initiate the back-to-front transition. The following sequencing occurs:
 - a. The selected remote steps down in throttle at 3 seconds per step. When it reaches IDLE, it pauses.
 - b. The console's Summary screen indicates that the front group is in DYNAMIC BRAKE mode, the selected remote is in IDLE, and the back group is in the THROTTLE mode.
2. When additional braking in the front group is required as more of the train crests the grade, press the console's FRONT button again. The following sequencing occurs:
 - a. The remote configures for dynamic braking and advances at 3 seconds per step to match the lead unit.
 - b. The control console's SUMMARY screen indicates that the selected remote is operating in the DYNAMIC BRAKING mode.

Note: Having the front group in the THROTTLE mode and the back group in the DYNAMIC BRAKE mode is an invalid condition, unless the front group's reverser switch is in the reverse setting. Then, the sequence in steps 1 and 2 above applies.

105.10.1 Starting

A. Level or Ascending Grade Less Than 1 Percent

To start a train with all DP remote units in the front group ("synchronous mode"), use conventional train handling methods in most cases.

1. To start a train operating in independent control on a level or ascending grade of less than 1 percent:
2. Place the desired number of remote(s) in the back group.
3. Move the automatic brake valve handle to RELEASE and use the independent brake valve to reduce brake cylinder pressure to near zero. The brake cylinder pressure is the same on all distributed power consists and should be reduced according to grade conditions, train makeup, and number of units in each consist.
4. Apply sand if conditions warrant.
5. Press THL or Traction and ensure that TH 1 is displayed on the control console for the remote(s) in the back group.
6. Ensure that the train moves as soon as possible to prevent traction motor stall burns.
7. If THL 1 does not close the slack and start the train, advance the control selector switch slowly, one position at a time.

8. While observing the ground to judge speed and slack control, slowly release brake cylinder pressure using the independent brake valve handle. Be careful to prevent run out of the head portion of the train.
9. Advance the lead throttle and control selector switch one position at a time. During acceleration, limit remote(s) in the back group one or two notches above the front group.

Note: Using the above method to start a train with a single remote DP unit verifies that the SAME/ OPPOSITE switch is properly positioned.

B. Ascending Grade of 1 Percent or More

To start a train in independent control on an ascending grade of 1 percent or more, handle the train as follows:

1. Place all remotes in the back group.
2. Release the independent brake to the desired amount (as determined by the grade condition and locomotive consist).
3. Apply sand as conditions warrant.
4. Press THL and ensure that TH 1 is displayed on the control console for the remote(s).
5. Advance THL on the control console one position at a time until enough power is developed to prevent the rear of the train from rolling back.
6. Release the train's automatic brakes.
7. Advance the lead throttle and the remote(s) throttle one position at a time to start the train as the brakes release. Ensure that the train moves as soon as possible to prevent traction motor stall burns.

C. Undulating Grade

When starting a train on grades that require continued braking, handle the train as follows:

1. Place the desired number of remote(s) on the ascending grade in the back group.
2. Place the lead consist (front group) in full dynamic braking before starting.
3. Reduce the independent brake cylinder pressure to the desired amount and release the automatic-brake. On severely undulating territory, leave the train brakes applied until the remote(s) in the back group develop enough tractive effort to prevent a rollback.
4. Apply sand as conditions warrant.
5. Press THL and ensure that TH 1 is displayed on the control console for the remote(s) in the back group.
6. If Position 1 does not close slack and start the train, advance the remote(s) throttle slowly, one position at a time, to close the slack and start the train.
7. Control brake cylinder pressure with the independent brake valve to prevent the wheels from sliding and the train slack from running out. Do this until the train reaches a speed where the dynamic brake would be effective. Then, move the independent brake to RELEASE. Ensure that the train moves as soon as possible to prevent traction motor stall burns.

D. Cresting Grade

When cresting the grade, handle a DP train as follows:

1. Prior to reach crest of grade, place all remote consists in the back group.
2. As the lead consist crests the grade, reduce the throttle and maintain a constant speed until at least one half the train has crested the grade.
3. If continuing on a descending grade and braking is required, apply dynamic braking to the lead DP consist.

4. As the remote consist(s) reaches the crest of the grade, the throttle on the remote consist(s) must be reduced to no greater than three notches above the THL of the lead consist or if lead consist is in dynamic brake mode.

E. Descending Grade of 1 Percent or More

To start a train on a descending grade of 1 percent or more, handle the train as follows:

1. Place all remote(s) in the front group.
2. Place the lead consist in maximum dynamic brake.
3. Release the automatic brakes and slowly reduce the independent brake cylinder pressure to allow gravity to start the train.
4. Apply sand as conditions warrant.
5. Control brake cylinder pressure with the independent brake valve to prevent the wheels from sliding and the train slack from running out. Do this until the train reaches a speed where the dynamic brake would be effective. Then, move the independent brake to RELEASE.
6. When the dynamic brake is in maximum and the train speed cannot be maintained within the prescribed limits, use the train air brakes to supplement the dynamic brake to maintain a uniform speed.

105.10.2 Slowing or Controlling Speed and Slack

When possible, use the dynamic brake to control or reduce train speed.

To slow or control speed on level or light undulating territory with all DP/IDP remote units in the front group ("synchronous mode"), use conventional train handling methods. However, in severe undulating territories, slow or control speed and slack of a train operating in independent control as follows:

1. Slowly reduce power on the lead consist and remote(s), limit the remote(s) one or two notches above the lead consist, until the lead consist is in IDLE or dynamic brake.
2. Apply the dynamic brake on the lead consist as follows to regulate speed and allow the slack to adjust gently.
 - a. Control the speed by varying the dynamic braking effort on the lead consist.
 - b. Apply power on the remote consist(s) to keep the slack closed between the lead and the remote(s).
 - c. If the maximum dynamic brake on the lead consist cannot control the speed, slowly reduce the remote(s) THL on the control console to IDL and wait 10 seconds.
3. Select DB on the control console and ensure that DB 1 is displayed.
4. Slowly increase dynamic braking on the remote(s) to the desired braking effort.
5. Place the dynamic brake on the lead consist in maximum and control the speed by varying the dynamic braking effort on the remote(s). If grade conditions prevent the lead and remote(s) from controlling speed with the maximum dynamic brake:
 - a. Actuate the independent brake valve to prevent brake cylinder pressure from developing on all consists. Move the automatic brake valve handle to MINIMUM.
 - b. Make additional reductions as necessary to maintain or reduce train speed. Allow enough time between reductions for the slack to adjust.
 - c. Actuate to prevent brake cylinder pressure from developing on all consists from each brake pipe reduction.

6. When releasing the train brakes, ensure that the dynamic brake on the lead consist is in maximum. Then, release the train brakes. After the train brakes are released, you may again manipulate the dynamic brake on the remote(s) to control speed.

Never apply the dynamic brake on the lead consist to a lesser degree than the dynamic brake on the remote(s).

105.10.3 Stopping

A. Level of Descending Grade Less than 1 Percent

To stop on level or light grade with all DP remote units in the front group (“synchronous mode”), use conventional train handling methods.

However, to stop a train operating in independent control on a level or descending grade of less than 1 percent, handle the train as follows:

1. Slowly reduce power on the lead consist and remote(s), limit the remote(s) one or two notches above the lead consist, until lead consist is in IDLE or dynamic brake.
2. Apply the dynamic brake on the lead consist, allow the slack to adjust gently, then slowly increase to maximum dynamic braking effort.
3. Slowly reduce the remote(s) to IDL using the control console and wait 10 seconds.
4. Select DB or BRAKE for the back group and slowly increase to maximum braking effort.
5. Actuate the independent brake and move the automatic brake valve handle to MINIMUM.
6. Make additional brake pipe reductions using the automatic brake valve to complete the stop at the desired point.
7. Allow time between brake pipe reductions for the slack to adjust.
8. Actuate to prevent brake cylinder pressure from developing on all consists from each brake pipe reduction.
9. As dynamic braking becomes ineffective near the stopping point, turn on the sand and develop enough brake cylinder pressure with the independent brake valve to prevent forward surge.
10. Make a final brake pipe reduction to complete the stop with the service exhaust blowing at the stopping point.
11. After stopping, move the dynamic brake controller to OFF and reduce the remote(s) DB to IDLE.
12. Fully apply the independent brake and turn off the sand after the stop is completed.

B. Descending Grade of 1 Percent or More

To stop on a descending grade of 1 percent or more with all DP units in the front group, use conventional train handling methods. However, use independent control if desired.

To stop a train on a descending grade of 1 percent or more when the dynamic brakes on both the lead and remote(s) are controlling speed, with or without the air brakes applied, follow these train handling methods:

Speed Controlled with Dynamic and Automatic Brake

When the dynamic brake is being supplemented by automatic brake applications to control speed:

1. Make additional brake pipe reductions using the automatic brake valve to stop at the desired point.
2. Allow time between reductions for the slack to adjust.
3. Actuate to prevent brake cylinder pressure from developing on all consists from each brake pipe reduction.

4. When the dynamic brake effort required is less than maximum, reduce the dynamic brake on the remote(s) before reducing the dynamic brake effort on the front group.
5. As dynamic braking becomes ineffective near the stopping point, turn on the sand and develop enough brake cylinder pressure with the independent brake valve to prevent forward surge.
6. Move the dynamic brake controller to OFF.
7. Make a final brake pipe reduction to complete the stop with the service exhaust blowing at the stopping point.
8. When the train is stopped, fully apply the independent brake and turn off the sand.

Stopping with Dynamic Brake and Automatic Brake

When the dynamic brake is controlling speed and the train brakes are needed to stop the train at the desired location:

1. Actuate the independent brake valve to prevent brake cylinder pressure from developing on all consists. Move the automatic brake valve handle to MINIMUM.
2. Make additional brake pipe reductions using the automatic brake valve to stop at the desired point.
3. Allow time between reductions for the slack to adjust.
4. Actuate to prevent brake cylinder pressure from developing on all consists from each brake pipe reduction.
5. When the dynamic brake effort required is less than maximum, reduce the dynamic brake on the remote(s) before reducing the dynamic brake effort on the front group. If operating in power on remote, limit throttle to Run 3 while in dynamic brake on front group.
6. As dynamic braking becomes ineffective near the stopping point, turn on the sand and develop enough brake cylinder pressure with the independent brake valve to prevent forward surge.
7. Move the dynamic brake controller to OFF.
8. Make a final brake pipe reduction to complete the stop with the service exhaust blowing at the stopping point.
9. When the train is stopped, fully apply the independent brake and turn off the sand.

105.10.4 Penalty Brake Application

If a penalty brake application occurs during distributed power operation:

1. Control the lead locomotive consist brake cylinder pressure to prevent excessive buff or draft forces.

Note: The remote consist(s) locomotive brake cylinder pressure is automatically regulated to maintain 45 psi of brake cylinder pressure during a penalty brake application and cannot be controlled by the lead unit.

2. Move the automatic brake valve handle to SUPPRESSION.
3. Place the lead and remote(s) throttle in IDLE.
4. After the train has stopped and the PCS has reset on the lead unit (approximately 2 minutes), move the automatic brake valve handle to RELEASE.

Note: The remote brake valve will cut in and begin charging the brake pipe after sensing a brake pipe pressure increase.

105.10.5 Emergency Brake Application

If an emergency exists or an emergency brake application occurs during distributed power operation:

1. Move the automatic brake valve handle to EMERGENCY.
2. Control the lead locomotive consist brake cylinder pressure to prevent excessive buff or draft forces.

Note: The remote consist(s) locomotive brake cylinder pressure is automatically regulated to maintain 45 psi of brake cylinder pressure during an emergency brake application and cannot be controlled by the lead unit.

3. Place the lead and remote(s) throttle in IDLE.
4. After the train has stopped and the PCS has reset on the lead unit (approximately 1 minute), move the automatic brake valve handle to RELEASE.

Note: The remote brake valve will cut in and begin charging the brake pipe after sensing a brake pipe pressure increase.

106.0 Fuel Conservation

To accomplish maximum fuel efficiency, use the most efficient method consistent with good train handling. Unless other local isolate/shut down instructions apply, locomotives of the following type must be the first locomotives isolated or shut down when meeting maximum horsepower per ton guidelines: SW 10, SW 12, SW 15, MP 15 and SD 9.

Note: These locomotives are the least fuel efficient types and may be prone to produce sparks and become a fire hazard. If they must be placed on-line en route, contact the Mechanical Help Desk or dispatcher for authorization. When utilized, employees must watch these locomotives closely and isolate or shut them down if spark emissions are detected.

106.1 Regulating Horsepower per Ton

Train and engine crews are required to isolate or shut down units in a consist that are in excess of the scheduled Horsepower per Ton (HPT) as identified on the train list and train profile. When train list or profile does not indicate scheduled HPT, the train dispatcher may advise crew of train's scheduled HPT. Unless otherwise outlined below, crews must isolate or shut down excess units, but not more than 0.5 HPT below scheduled HPT:

Exception: On trains with symbols beginning in "Z", "Q" or "P", isolate or shut down excess units to as close to but not below scheduled HPT. All intermodal, manifest trains and loaded bulk commodity trains operated with distributed power are exempt from HPT limitations for fuel conservation.

1. Trains operating on steep grades of the subdivisions defined below, may use all available horsepower:
Cajon, Gateway, Glorieta, Hi Line, Mojave, Pike's Peak, Raton, Scenic and Stampede subdivisions.
After train has traversed steep grade, excess units must again be isolated/shut down as soon as safety permits.
2. Locomotive is utilized in dynamic brake mode only by utilizing "Dynamic Brake Only" position on Isolation Switch, if available. Dynamic brake axle limitations still apply.
3. Do not isolate, shut down or utilize Dynamic Brake Only feature on a unit for fuel conservation if it causes your train to exceed 400 tons per operative axle of dynamic brake (TODB).
4. Empty unit trains, i.e., coal, taconite, grain, potash and sulphur must not operate with more than 9,000 working horsepower (HP) on line.
5. Train dispatcher authorizes train and engine crews to place excess locomotives on line.

Note: A crew member at a train's originating terminal must report any locomotive(s) isolated, shut down or placed in Dynamic Brake Only Mode for fuel conservation as outlined above to the NOC Mechanical Desk. In addition, on en route trains, a crew member must report changes in status of any locomotive(s) being utilized in power due to change in train's HPT or en route changes to locomotive consist. Locomotive(s) within your consist equipped with Automatic Engine Start/Stop Systems (AESS) do not relieve you from the responsibility of reducing horsepower as outlined in this rule. When selecting locomotives to shut down or isolated in compliance with this rule, locomotives not equipped with AESS should be shut down or isolated as required first before selecting locomotives equipped with AESS.

106.2 Isolating or Shutting Down Locomotives En Route

Locomotives with Freeze Protection Systems (May be "ISOLATED" if ambient temperature is below 32 degrees F)		
BNSF Number	Make	Type
2000-2030, 2032-2047, 2050-2053	EMD	GP20
4207-4276	GE	B23-7
5142-5209	GE	C30-7
5218-5278	GE	SF30C
2065-2017, 2139-2149, 2190-2236	EMD	GP38
2400-2477	EMD	GP30
2500-2649	EMD	GP35
2740-2749, 2779-2799, 2835-2869, 2941-2959	EMD	GP39-2
6200-6219	EMD	SD39
6300-6302, 6305-6308, 6310-6312, 6314-6317, 6319-6322, 6324	EMD	SD40U
6335-6338, 6340-6347, 6367, 6374-6377, 6386-6399, 6406-6535, 6708-6772, 6790, 6794, 6800, 6812, 6837-6839, 6848, 6849, 6852-6899, 6901, 6905, 6909, 6914, 6921, 6922, 6929-6949, 6951-6976	EMD	SD40-2
3028-3037	EMD	GP40X
500-582	GE	B40-8W
100-162	EMD	GP60M
5600-5717, 5838-5840	GE	AC4400CW
800-951	GE	C40-8W
600-699, 700-799, 960-1123, 4300-5529*, 5300-5499, 5841-5843	GE	C44-9W
5718-5837, 5844-6086	GE	ES44AC
7503-7512	EMD	SD45-2B
3163-3207	EMD	GP50
325-347	EMD	GP60B
9000-9099	EMD	SD60
9200-9298	EMD	SD60M
9400-9900, 8800-8999	EMD	SD70MAC
8200-8301	EMD	SD75M

When isolating or shutting down a locomotive en route for fuel conservation purposes, the following will apply:

1. Temperature 40 degrees F or above - Temperature 40 degrees F or above - locomotive must be shut down; do not drain. (This includes EMD locomotives equipped with automatic engine start/stop systems.)

Exception: Due to modifications made to the automated engine start/stop systems on GE locomotives, GE locomotives equipped with AESS are to be ISOLATED ONLY - DO NOT shut down.

2. Temperature below 40 degrees F - locomotive must be isolated; do not shut down.
3. Temperature below 0 degrees F - locomotives must be isolated in Winter/Isolate position, if equipped.

Exceptions:

- Locomotives not equipped with freeze protection equipment - must not be isolated if temperature is below 32 degrees F. (Locomotives not equipped with freeze protection may be determined by the absence of a "Water Drain" circuit breaker in the circuit breaker panel or by referencing the table above.)

- Distributed power lead, controlling unit, or all locomotives in remote consist(s) must not be manually shut down for fuel conservation purposes. If necessary, DP remotes must be “Isolated” by placing DP remote(s) in remote mode “IDLE”. This prevents all throttle activity by the remote consist but allows for continued air brake function by the remote consist. Distributed power “Train Check” must continue to be performed, as required.

106.3 Shut Down Requirement for Locomotives Not Being Utilized

At ALL points when locomotive(s) will not be utilized for one hour or more, all locomotives except locomotive maintaining a train’s air brake pipe system and occupied locomotives kept running to maintain air conditioning must be shut down when current and expected ambient temperature is 40 degrees F or above. When in doubt as to the temperature or the length of time locomotive(s) will not be used, contact the train dispatcher or local supervisor.

Exception: Automatic Engine Start/Stop Systems - Locomotives equipped with automatic engine start/stop systems are identified by labels and instructions affixed inside the locomotive cab and at the engine start/stop station. The AESS system on a single locomotive within a locomotive consist may be utilized to maintain a train’s air brake system as outlined above since they are designed to automatically shut down and restart as conditions require. These conditions include maintaining necessary main reservoir and brake pipe pressures. All locomotives not equipped with AESS within the consist must be shut down manually.

A green “Enabled” light is positioned on the engineers control stand on some automatic start/stop systems referred to as “Smart Start”. Small warning horns or bells sound inside the cab and outside the locomotive before an automatic shut down or restart occurs. Auto start/stop equipped locomotives will automatically shut down when conditions permit.

106.4 Shut Down Procedures

Fuel conservation shut down procedures:

NOTE: Locomotives with automatic start/stop systems that are manually shut down must be manually restarted.

1. Isolate the engine.
2. Depress the engine stop button.
3. Immediately attempt to restart unit. If unit fails to restart, notify the Mechanical Help Desk or the train dispatcher immediately and place tag or note on the isolation switch. If restart is successful, depress engine stop button again and proceed with Step 4.

Note: Some computer equipped locomotives require a 2-minute wait after shut down, before successful restart can be made. On all locomotives with electronic operator displays, wait for displays to shut down before restarting.

4. Turn OFF or OPEN all switches and circuit breakers on the control stand and engine control panel to conserve battery life except those outlined in items 5 and 6 below.

Note: Battery knife switch may only be opened on the following locomotives after electronic operator display screens have shut down as follows:

- All GE locomotives
- EMD locomotives - GP28, GP38, GP50, GP60, SD60, SD70, and SD75

5. On locomotives unused and left standing, leave the following switches and circuit breakers ON or CLOSED:
 - a. Auto water drain on all engines equipped.
 - b. Auxiliary turbo lube oil pump circuit breaker on EMD turbocharged engines.
 - c. Battery knife switch on all EMD locomotives not listed in Item 4 above.
6. On trailing locomotives shut down within a locomotive consist per ABTH Rule 106.1 Regulating Horsepower Per Ton, leave the following switches/circuit breakers ON or CLOSED in addition to those listed in Item 5 above.

- a. Control circuit breaker
- b. Local control circuit breaker
- c. Computer control circuit breaker, if equipped.

Note: Distributed power lead or remote consist locomotives, whether lead, controlling or trailing position, must not be shut down for fuel conservation.

106.5 Locomotive Starting

The following are basic instructions for all locomotives:

1. Close battery knife switch.
2. Turn on Engine Run, Control and Fuel Pump Switches on control stand.
3. Turn on all necessary switches and circuit breakers on engine control panel.

Note: On EMD locomotives, all circuit breakers in black area must be on for engine to start.

4. If locomotive(s) fail to start, contact the Mechanical Help Desk for assistance.

Note: Computer-equipped GE locomotives experience a 5-10-second delay after the start switch has been placed to start before the diesel engine begins to turn over.

5. Train and engine crews must not attempt to jump start locomotives, unless under the direction of the Mechanical Team.

106.6 Cold Weather Protection for Locomotives

When temperature is below or expected to drop below 32 degrees F, the following precautions must be followed to prevent locomotive freezing.

A. Locomotives Set Out for Service and/or Left Unattended

1. Secure locomotive.
2. If locomotive is not identified in table above, place engine control switch in Winter/Isolate position or Run 3-No Load, if not equipped with winter isolate. (Turn generator field circuit breaker off or pull generator field fuse.)
3. Notify train dispatcher, advising location set out, fuel readings and method used to prevent freeze damage.

B. Locomotives Set Out Due to Defects

1. Secure locomotive per existing instructions.
2. If locomotive is not identified in table above, place engine control switch in Winter/Isolate position or Run 3-No Load, if not equipped with winter isolate. (Turn generator field circuit breaker off or pull generator field fuse.)
3. Notify train dispatcher, advising location set out, fuel readings and method used to prevent freeze damage.
4. If locomotive is not identified in table above or cannot be placed in Winter/Isolate position, Run 3-No Load or defect requires for locomotive to be shut down, drain the cooling water system.
5. In all cases, when defect occurs, contact the Mechanical Help Desk.

Note: Do not set out locomotive(s) for defect(s) unless a safety issue exists or under direction of the Mechanical Help Desk.

C. Locomotives Developing En route Failures

Drain locomotive cooling system when any of the following conditions exist:

1. Locomotive has shut down and cannot be restarted.
2. Locomotive has defect(s) that prevent loading or throttle speeds from developing.

3. If locomotive is not listed in table above or cannot be placed in Winter/Isolate position or Run 3-No Load.

Note: Care should be taken to spot the locomotive so that if the cooling water system must be drained it will not go into a waterway or public roadway. In addition, contact Mechanical Desk and advise of action taken and if the cooling water system has been drained or if it drained automatically, advise if a waterway was impacted.

D. Locomotive Fuel Level Reporting

During cold weather, when trains are left between terminals, crew must contact train dispatcher, advising fuel readings of all locomotives in consist.

Note: Fuel gauges on both sides of locomotives must be compared.

106.7 Speed Reduction for Fuel Conservation

The train dispatcher may issue instructions for train speed to be reduced to less than maximum authorized timetable speed for fuel conservation. To take advantage of descending grade situations, this restriction only applies when your train is in power (for these instructions, power is defined as throttle positions 3 through 8).

When operating at locations where power is not required, train may be operated at maximum authorized timetable speed for that location.

106.8 Movement of Light Engines and Caboose Only Moves

To conserve fuel, isolate excess units in a consist to handle movement as follows:

1. Only one axle of power per each 120 tons of consist may be on line.
2. When operating on sustained grades exceeding 2.0 percent, only one axle of power per each 90 tons of consist may be on line.
3. Do not isolate excess units if doing so will drop the locomotive consist below the minimum dynamic brake requirements for that mountain grade subdivision.

Note: This rule is intended to limit excess tractive effort only. Employees are encouraged to use the "Dynamic Brake Only" feature on locomotives so equipped when complying with this rule.

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107.0 Roadrailer Equipment

107.1 Roadrailer Equipment (Roadrailer Triple Crown, Autorailer, and Allrailer) Description

Trailer/container units that can be assembled and interconnected with shared railroad trucks (also referred to as bogies) and operate over the railroad are known as “roadrailer” equipment. This equipment is identified by the railroad truck/bogie and has car kind codes QZW or M2E. This equipment is assembled similarly to articulated freight equipment and blocks of this equipment should reflect an additional railroad truck/bogie that will be indicated as an empty on train documentation. Roadrailer truck/bogies equipped with conventional couplers and tool storage are referred to as “coupler mates.” This equipment comes in three different types:

1. Roadrailer Triple Crown (car kind code QZW)—highway/railroad capable trailers that can move all types of conventional dry freight.
2. Roadrailer/Autorailer (car kind code QZW)—highway/railroad capable trailers that can move both conventional dry freight and automobiles.
3. Roadrailer/Allrailer (car kind code M2E)—lightweight container segments that are capable of operating only on the railroad and are capable of carrying automobiles only.

107.1.1 Special Handling Requirements and Operating Practice Guidelines for Roadrailer Equipment

1. Roadrailer equipment must be operated as a unit train consisting of all roadrailer equipment or at the rear of other freight equipment as instructed by dispatcher.

Note: Notify the Train Dispatcher and the Mechanical Help Desk if an enroute equipment failure or other problem occurs that requires Roadrailer equipment to be:

- setout
- bypassed with a runaround hose, and/or the spring parking brake is “caged”
- secured on a grade (by use of the parking brake isolation valve) to recharge the brake system.

2. Total number of roadrailer units that can be operated as a block on the rear of other freight equipment or as a unit train is 125 with total trailing tonnage beginning at the lead roadrailer unit not to exceed 4,800 tons.

3. Roadrailer equipment must be entrained “nose first” for main track operation.

Exception: Amtrak passenger trains may be handled “nose trailing” due to equipment differences and as per Amtrak guidelines.

4. Roadrailer equipment must not be humped.
5. When coupling a locomotive to roadrailer equipment, a safety stop must be made.
6. Roadrailer equipment coupling speed must not exceed 2 MPH.
7. Shoving roadrailer equipment must be avoided whenever possible. If necessary to shove roadrailer equipment, movement must not exceed 10 MPH.
8. If necessary to couple to rear “coupler mate” to move this equipment other than “nose first”, limit the locomotive consist’s rated powered axles to eight (8) or less. Limit tonnage being moved in this manner by excluding other than roadrailer equipment.

Other Special Handling Requirements

1. Roadrailer equipment must not be left standing as a single unit within block system or interlocking limits without notifying train dispatcher who must provide protection.
2. Roadrailer equipment is not equipped with the following safety appliances: ladders, hand holds, platforms, sill steps, uncoupling levers or hand brakes. **DO NOT ATTEMPT TO MOUNT THIS EQUIPMENT.**
3. Roadrailers must be set out if highway wheels are on the rail and the condition cannot be corrected.
4. Any unit bypassed with a run-around hose must be set out as instructed by dispatcher.
5. Do not bypass a railroad truck/bogie unless absolutely necessary; if railroad truck/bogie must be bypassed, the following will apply:
 - If equipment personnel are not available to cage or otherwise disable bogie spring brake, trailer must be set out.
 - Caging bolt and instructions for its use are supplied in coupler mate.

107.1.2 Securing Roadrailer Equipment

Roadrailer equipment is not equipped with hand brakes. In most cases, this equipment is light enough that the locomotive(s) being utilized in this service has sufficient locomotive braking force to hold the equipment at rest.

However, this equipment is equipped with what is referred to as a parking brake. The parking brake is a spring mechanism that secures each individual bogie automatically after brake pipe pressure has been absent for approximately four minutes.

Releasing the Parking Brake Without Charging the Brake System

If there is a need to release the parking brake to move this equipment, other than by simply releasing and charging the air brake system, isolate or “cage” the parking brake by using the “caging” tool and instructions in the coupler mate toolbox. This method would be used when an air brake control valve failure has occurred.

Recharging on Grade

If operating on heavy grade, it may be necessary to recharge the air brake system before proceeding while using roadrailer parking brakes to help hold the train at rest. First, exhaust the brake pipe to zero psi with the automatic brake valve and wait a minimum of 4 minutes for the parking brake to apply automatically. Next, locate and close a sufficient number of parking brake isolation valves on the Roadrailer equipment as follows:

On 1% grade or greater, close all available parking brake isolation valves. On less than 1% grade, close half of the available parking brake isolation valves.

Release the train air brakes and recharge. After sufficient recharge has occurred, make a sufficient air brake application to hold the train and open the parking brake isolation valves to release the parking brakes.

If train also consists of equipment other than Roadrailer equipment, first utilize hand brakes on the other equipment per Rule 102.1 in addition to Roadrailer parking brake isolation valves, as required.

Leaving Roadrailer Equipment Unattended

If it is necessary to leave roadrailer equipment unattended, use the following procedure:

With Locomotives Attached

1. Exhaust brake pipe pressure to zero psi with the automatic brake valve by placing the handle in Continuous Service. (Note: It may be necessary to use an emergency application on CCB systems to completely drop brake pipe pressure to zero psi.)
2. Wait a minimum of 4 minutes with brake pipe pressure at zero psi for the “parking brake” to automatically apply.
3. Close the angle cock between the locomotive and the roadrailer equipment and detach the brake pipe hose from the locomotive.
4. Secure the locomotive consist as prescribed in ABTH Rule 102.13.

Without Locomotives Attached

1. Make a 20-psi brake pipe reduction.
2. Detach locomotives and allow emergency brake application to apply on roadrailer equipment.
3. Leave angle cock open on roadrailer equipment left standing.

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108.0 Electronically Controlled Pneumatic Brakes (ECP)

Rules 108.0 through 108.8 are deleted in their entirety.

(Remove Current Pages 105 - 120.)

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Glossary

Accelerometer

An indicator that displays in MPH per minute the rate of increase/decrease of speed.

AC Locomotive

AC locomotives are equipped with AC traction motors and are not affected by maximum continuous current ratings or short time operating ratings.

Actuating

Using of feature of the independent brake valve to charge the actuating pipe from the main reservoir and prevent or release a locomotive brake application from a brake pipe reduction.

Air Brake

A system of compressed air devices, controlled manually, electronically or pneumatically, that make the car or locomotive slow down or stop.

Air Brake Equipment

The equipment that supplies and exhausts air to and from the brake cylinders, but does not include foundation brake gear and hand brakes.

Air Brake Hose

A reinforced tubing. On each car or engine, the tubing is attached to a nipple that screws into the angle cock at the end of the brake pipe. The other end of the hose includes a coupling (glad hand) that fits into an identical coupling on the adjoining car. The complete arrangement connects air between the brake pipes of the cars and the locomotives throughout the train.

Air Brake System

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 engine or an electric motor, that compresses air for operating the air brakes and all other air-operated devices on locomotives and cars.

Air Compressor Control Switch

A device that controls the loading and unloading of the compressor at the proper main reservoir pressures.

Air Flow Indicator (AFI)

An instrument that indicates the volume of the air flowing through the automatic brake valve into the brake pipe.

Air Gauge

An instrument that indicates air pressure in pounds per square inch (psi).

Alignment Control Coupler

Specially equipped couplers, installed on most locomotives that only allow the coupler in buff to move laterally within certain limits. This equipment minimizes rail turn-over, wheel climb and jackknifing.

Ampere (Amperage, Amps)

The standard unit for measuring electric current.

Angle Cock

A manually operated device located at each end of the brake pipe on locomotives and cars to permit or prevent air flow.

Articulated Multi-platform Car

A car with multiple units (segments) that have articulated couplings and which the units share a common truck.

Automatic Brake Valve

A manually operated electronic controller or pneumatic valve on the locomotive that controls the train and engine brakes.

Auxiliary Reservoir

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

“B” End (of car)

The end where the hand brake is located unless otherwise identified.

Back-up Valve or Hose

A device, either portable or permanently connected to the brake pipe, that controls brakes from the car that it is attached to. The device can apply the brakes with a service or emergency application.

Balanced Braking

Controlling train speed by making enough of a brake pipe reduction to stabilize speed on a grade, then allowing the automatic brake valve pressure maintaining feature to hold the brake application constant regardless of brake pipe leakage. This ordinarily is accomplished in combination with dynamic braking.

Bleed (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.

Blended Brake (Amtrak)

The combination of air and dynamic braking by making an automatic service brake application with the throttle in IDLE.

Brake Application

A brake pipe pressure reduction (no matter how made) that causes the control or distributing valve to move to the service or emergency position.

Brake Cylinder

A metallic 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 that supplies the reservoirs. It also connects the piping to allow the locomotive engineer to control the car brakes. The pipe is 1-1/4 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.

or

- **False Gradient.** The temporary gradient that exists when the system is less than fully charged (for example, the exaggerated difference between the head end and rear end after a release).

or

- **Inverse Gradient.** The temporary condition when the brake pipe pressure is higher at the rear of the train than at the head end of the train (for example, during a service brake application).

Brake Pipe Pressure

The amount of pressure in pounds per square inch (psi) in the brake pipe (commonly expressed in pounds).

Brake Valve Cutoff Valve

A device on locomotives that can cut out the charging and service functions of the automatic brake valve. This valve also properly positions the brake valve for passenger or freight operation.

Branch Pipe Cutout Cock

A device on locomotives and cars that isolates the control valve from the brake pipe.

Control Valve

A device on locomotives or cars that charges the reservoirs and applies or releases brake cylinder pressure when brake pipe pressure reduces or increases.

DC Locomotive

DC locomotives are equipped with DC traction motors and are affected by maximum continuous current ratings or short time operating ratings.

Dead Engine Feature

A device near the locomotive control valve that is used when the unit is handled dead-in-train. When the dead engine cutout cock is opened, the main reservoirs are charged from the brake pipe to operate the engine brakes.

Distributed Power

One or more locomotive consists that are remotely controlled from the lead, locomotive.

Disturbed Track

A section of passable track that has a temporary speed restriction imposed because various defects or track maintenance has affected the integrity of the track.

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)

Forces at the couplers between cars and/or locomotives that may be either draft (stretched) or buff (compressed), depending on train operation.

Dynamic Brake

An electrical device that converts some of the energy developed by a moving locomotive into an effective retarding force.

· Dynamic Brake Holding Feature

A feature of the lead, controlling locomotive that allows dynamic braking effort when a PCS open condition exists.

· Dynamic Brake Interlock (DBI)

A device that will automatically keep the locomotive brakes from applying when automatic brakes are applied during dynamic braking.

- **High Capacity Dynamic Brakes** – provide approximately 13,500 lbs. of effort per axle instead of 10,000 lbs. per axle as other dynamic brake systems.

- **Flat (Grid Control) Dynamic Brake System** – a dynamic brake system that provides retardation that is controlled solely by the position of the dynamic brake lever. Maximum retardation occurs at Position 8.

· **Taper (Speed Control) Dynamic Brakes** – a dynamic brake system that provides retardation relative to both speed and dynamic brake handle position. The higher the speed, the greater the retarding force developed for a given handle position. At higher speeds, full dynamic brake effort is reached at Position 4.

Electronic Alertness Control

A safety control system that senses the activity of the 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 activity is detected, an audible and/or visual alarm occurs. If activity still doesn't occur for another period, approximately 6 seconds, a penalty brake application is initiated.

Electronic Controlled Brakes

An air brake system that can be controlled electronically is referred to as electronically controlled pneumatic brakes or ECP. The ECP systems that are being utilized are overlay brake systems. Overlay means the freight car brake system can be operated in either ECP or conventional pneumatic mode. All cars in the train must be equipped with ECP to operate in the electric mode.

Emergency Application

A rapid reduction of brake pipe pressure that causes the control valves to move to the emergency position and the vent valves to open. This equalizes auxiliary reservoir, emergency reservoir, and brake cylinder pressures.

Emergency Brake Valve

A manually operated device on equipment that initiates an emergency brake application.

Emergency Reservoir

A storage volume, charged from the brake pipe, to receive and store air used during emergency brake applications and certain recharge features.

Empty Bulk Commodity Unit Train

A train made up entirely of empty cars used to transport coal, grain, ore, potash, molten sulfur, soda ash, phosphate rock, oil, taconite or other bulk commodities.

End of Train Telemetry System

Telemetry Components

End-of-train telemetry devices is a radio end-of-train telemetry system that consists of:

- End-of-train device (ETD) mounted on the trailing coupler of the last car.
- Head-of-train device (HTD) mounted in the locomotive.

An ETD that has not been armed to, provides:

- Last car brake pipe pressure monitoring.
- Last car motion status (moving or stopped).
- Marker light status (on or off).
- ETD battery status.

An ETD that has been armed to (emergency enabled), provides capability to initiate an emergency brake application at the rear of the train. Both the HTD and ETD must be equipped for two-way communication and the HTD must be armed to the ETD (emergency enabled). An Emergency toggle switch associated with the HTD cab display is used to activate the ETD emergency valve.

A system of components that determines the rear car brake pipe pressure and transmits that information to the display on the controlling unit.

A 2-way ETD transmits and receives information between the head-end and rear-end units. The additional purpose of a 2-way ETD is to provide a way to initiate from the locomotive an emergency brake application at the rear of the train. For this to happen, both the head-end and the rear-end units must be equipped for two-way communication and armed (emergency enabled). An Emergency toggle switch associated with the ETD cab display is used to activate the ETD emergency valve located on the rear-end unit.

Equalizing Reservoir

A small reservoir connected to a piston or diaphragm chamber and used in automatic air brake operations. It is only cut in on the controlling unit. The reservoir's purpose is to add a volume of air to one side of the chamber, which can be accurately controlled.

When a brake pipe reduction occurs, air is drawn from the equalizing reservoir. The reservoir then automatically draws the proper amount of air from the brake pipe. For this reason, the brake pipe pressure and the equalizing reservoir pressure are always the same, except when they are equalizing after a brake pipe reduction or a brake pipe charging operation.

Foundation Brake Gear

The levers, rods, brake beams, etc. that connect the brake cylinder piston rod to the brake shoes so that when air pressure forces the piston out, the brake shoes are forced against the wheels.

Full Service Application

A brake pipe reduction made only to the point at which the auxiliary reservoir and brake cylinder pressures equalize. Any further reduction in the brake pipe pressure, except an emergency application, will not affect the amount of pressure in the brake cylinder. Therefore, air is being wasted from the brake pipe (over reduction).

The chart below shows the reduction needed for a full-service application for various initial brake pipe pressures. Also listed is the brake cylinder pressure at full service for various initial brake pipe pressures:

Initial Brake Pipe Pressure	Service Equalization Pressure	Brake Pipe Reduction to Obtain Equalization
90 psi	64 psi	26 psi
105 psi	75 psi	30 psi
110 psi	78 psi	32 psi

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 distance of 100 feet. For example, a 1-percent ascending grade means that the track rises 1 foot in elevation for every 100 feet the equipment travels on the track. Unsecured rail equipment may roll on a grade.

Grade designations include the following:

- Light Grade: Less than 1.0 percent.
- Heavy Grade: At least 1.0 percent for a distance of 3 miles or more.
- Mountain Grade: 2.0 percent or greater for a distance of 2 miles or more.

Hand Brake

A mechanical arrangement of levers, chains, rods, gears, and fulcrum. When applied manually by wheel or lever, the hand brake forces the brake shoes against the braking surfaces (wheel tread or disc) to control car or locomotive movement.

Head of Train Device (HTD)

A radio device located in the locomotive cab that communicates with an End of Train Device (ETD). The HTD displays:

- Last car brake pipe pressure.
- Last car motion status (moving or stopped).
- Marker light status (on or off).
- ETD battery status.
- Communication Status with ETD
- 2-Way Armed Status
- Distance measurement referenced to locomotive movement.

And provides:

- Audible alarms pertaining to status changes
- Arming capability to a selected 2-way ETD.
- Interface for Manual and Automatic initiated ETD emergencies

Helper

Distributed power or manned helper added to a train to assist movement.

Horsepower Per Trailing Ton (HPT)

The total horsepower of all working locomotives divided by the total trailing weight of the train and isolated locomotives in tons. For example, a train powered by 15,000 horsepower and a train weight of 4,285 tons with two isolated Locomotives weighing 400 tons has a 3.2 horsepower per trailing ton ratio (15,000 HP divided by 4,685 tons).

Independent Brake Valve

A brake valve that controls the locomotive brakes independent of the automatic brake valve handle position.

Independent Pressure Switch (IPS)

A device on a locomotive that cancels the extended range portion of dynamic braking or all dynamic braking when a sufficient independent brake application occurs. This switch prevents the locomotive wheels from sliding because of excessive braking.

Interchange

A location where railroads exchange rolling equipment.

Intermodal Equipment

Equipment designed to carry trailers, containers, automobiles.

Intermodal Trains

Trains made up of entirely of intermodal equipment.

Isolation Switch

A switch on diesel electric locomotives that has two or three positions. In the RUN position, the unit is “on the line,” responds to control, and develops power. In the ISOLATION (or Stop-Start) position, the unit is isolated from the consist and does not develop power or respond to control.

Linking

The process of electronically connecting the controlling lead unit to the controlling distributed power unit on a distributed power train.

Light Locomotive

One or more units, with or without a caboose, not coupled to cars.

Loaded Bulk Commodity Unit Train

A train made up entirely of loads of coal, grain, ore, potash, molten sulfur, soda ash, phosphate rock, oil, taconite or other bulk commodities.

Main Reservoir

An air reservoir on the locomotive for storing and cooling compressed air.

Minimum Continuous Speed

Minimum continuous speed is the slowest speed at which a DC locomotive can operate continuously in Throttle 8. Locomotive traction motors operating under these conditions develop the highest amperage possible before overheating. The minimum continuous speed varies and is indicated by the rating plate on the locomotive.

Minimum Reduction

The first position of the automatic brake valve that initiates a service application of 6 to 8 psi.

Manned Helper

A helper controlled by an engineer in the controlling unit of the locomotive helper consist.

MU Cutout Cock (MU-2-A, Dual-Ported Cutout Cock)

A device for cutting in or out the independent brake valve.

Non-articulated Multi-platform Cars

A car with multiple units (segments) that are connected with solid drawbars. Each unit is a stand-alone unit and does not share a common truck with another unit.

Off Air

Off air means when it is known that a brake system has not been connected to a continuous source of compressed air of at least 60 pounds per square inch (psi) for a period of 4 hours or more. The “source” of compressed air is brake pipe pressure being supplied at the locomotive(s) or yard air connection to the brake system. If brake pipe gradient is observed, no minimum brake pipe pressure at the opposite end of a brake system is required as long as 60 psi or more is being maintained at the charging end of the brake system.

Overcharge

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

Penalty Brake Application

An automatic full service brake application caused by various safety devices.

Pneumatic Control Switch (PCS)

An air-operated switch, activated by an emergency or penalty brake application, that drops the engine speed to idle on EMD locomotives or throttle notch 1 on GE locomotives.

Pressure Maintaining Braking

Controlling train speed by making enough of a brake pipe reduction to stabilize speed on a grade, then allowing the automatic brake valve pressure maintaining feature to hold the brake application constant regardless of brake pipe leakage.

Pressure Maintaining Feature

A system designed to overcome brake pipe leakage both in the RELEASE and SERVICE positions of the automatic brake valve. This allows a constant brake application to be held as long as needed.

Reduction (of the brake pipe)

A decrease in brake pipe pressure at a rate and of an amount sufficient to cause a train brake application to be initiated or increased.

Reduction Relay Valve

A device on long cars that helps brake pipe pressure reduce during service and emergency brake applications. The valve compensates for the added length of brake pipe on long cars.

Regulating Valve

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

Retaining Valve

A manually operated valve used on cars to exhaust brake cylinder pressure completely or to maintain a predetermined pressure.

Service Application

When brake pipe pressure exhausts at a service rate to apply the train brakes.

Slack Action

Movement of part of a coupled train at a different speed than another part of the same train.

Slug

A unit with traction motors but no diesel engine and incapable of propelling itself. The unit receives electrical power through a power cable from an adjacent, specially equipped locomotive. Slugs are used where low speeds and high tractive effort are needed.

Solid Block (of cars)

Two or more freight cars coupled together and added to, or removed from a train as a single unit.

Thermal Cracks (in wheels)

Cracks in a railroad wheel, normally caused by heat generated on the tread and flange of the wheel from excessive braking.

Throttle Modulation

The action of adjusting the throttle one notch at a time between idle and position 8 to control train speed without the application of air brakes.

Tons per Dynamic Brake Axle

The total gross trailing tonnage of the train divided by the number of axles of locomotives, including helper locomotives, operating in dynamic brake. Refer to locomotive data tables in system special instructions for dynamic brake axle ratings.

When making this calculation, include in the gross trailing tonnage the weight of any locomotive, including a helper locomotive, not operating in dynamic brake or with dynamic brake cut out.

Tons per Operative Brake

The gross trailing tonnage of the train divided by the total number of cars having operative brakes. For example, a 100-car train with all brakes operating, having a total train weight of 6,000 tons, has 60 tons per operative brake (6,000 tons divided by 100 cars).

Train lists showing average tons per car or platform will equal tons per operative brake when:

- The train list is current (no additional pickups or setouts have been made).
- No brakes have been cut out.
- There is one brake per car or platform (Note: This is not the condition for some equipment, such as articulated intermodal cars).

Transfer Train Movement

A train that travels between a point of origin and a point of final destination not exceeding 20 miles. Such trains may pick up or deliver freight equipment while en route to destination.

Unattended

Means cars and/or locomotives left standing and unattended in such a manner that the brake system of the cars and/or locomotives cannot be readily controlled.

Vent Valve

A valve attached to the brake system of a car or locomotive. The valve responds to an emergency brake pipe pressure rate of reduction by venting the brake pipe at each vehicle to the atmosphere. As a result, the emergency application spreads throughout the train.

Wheel Sliding

When the wheel rotates slower than lengthwise movement dictates.

Wheel Slipping

When the wheel rotates faster than lengthwise movement dictates.

Yard Test Plant

A system of piping and fittings that supplies air at convenient locations to charge and to test cars without a locomotive.