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.

Introduction

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BNSF

Burlington Northern Santa Fe Railway

Air Brake and Train Handling Rules

No. 2

IN EFFECT AT 0001
Central, Mountain and Pacific
Continental Time

Wednesday, April 1, 1998 (including revisions up to Sunday, April 2, 2000)

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100.0 Locomotive Engineer Responsibilities and Certification

100.1 General Responsibilities

Engineer certification must comply with these federal and company requirements:

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

   State-sponsored diversion programs, guilty pleas, and completed state actions to cancel, revoke, suspend, or deny a driver's license are considered convictions under this rule. An engineer must report any conviction to his or her supervisor responsible for engineer certification no later than five business days following the day the engineer receives notice of the motor vehicle conviction.

100.2 Engineer Certification Requirements for Operating Locomotives

Certified engineers may operate locomotives under the following conditions:

1. A certified locomotive servicing engineer may not operate locomotives coupled to cars.
2. A certified locomotive servicing engineer may operate locomotives within a yard or terminal area for hostling purposes.
3. Only certified train service engineers may operate locomotives coupled to cars.
4. Certified student engineers may operate locomotives within the limits of their class of service under the direct supervision of the engineer instructor. Prior to operating a locomotive in a yard or over a road territory for the first time, a certified student engineer must have made at least one trip observing the territory. Engineer instructors must have a minimum of six months of experience on the road territory over which they are supervising certified student engineers.
5. Certified train service engineers and hostlers, including Engineers/Hostlers that have been cutback to train service, who have not had their evaluation and certificate signed prior to October 1 of each year, must advise their respective Road Foreman of Engines of this fact. Should a new Road Foreman be assigned or a train service engineer/hostler change work locations after October 1, the train service engineer/hostler must again report to the new Road Foreman of Engines that certification evaluation is due.

100.3 Maintaining Locomotive Engineer Proficiency for Skills, Route Familiarization and Special Equipment

A certified train service engineer must maintain proficiency as an engineer as it pertains to:

1. skills.
2. route familiarization.

   and

3. special or unique equipment.

100.3.1 Skills Proficiency

A qualified engineer who has not operated a locomotive in the last six (6) months, including under the provisions of Rule 1.47, Item B, Engineer Responsibilities, of the General Code of Operating Rules, must inform crew management of this fact when called to perform service as an engineer and that he/she may only be used as an engineer if another qualified engineer acts as a pilot (this includes a member of the crew who is qualified as an engineer or a supervisory engineer).

If seniority limitations or any situation results in a qualified locomotive engineer not performing the skills of an engineer for a period of six (6) months, that individual must immediately contact his/her Road Foreman of Engines (or other supervisor if Road Foreman of Engines is unavailable) to determine the number of trips required, if any, and routes, for the purpose of maintaining the engineer's skills proficiency.

100.3.2 Route Familiarization

Route familiarization is required in order to perform service as a certified train service engineer without the assistance of a pilot. Once initially qualified on a specific route by making the required number of familiarization trips as specified by the Road Foreman of Engines, route familiarization is maintained by observing the route when performing service in any capacity (engineer or trainman) every 12 months. Other methods of maintaining route familiarization may also be available as specified by the Road Foreman of Engines.

Exception: Route familiarization as outlined above on the heavy and/or mountain grades of the subdivisions listed below, in any capacity, is required every six (6) months: Cajon, Mojave, Gateway, Scenic, Stampede, Glorieta, Raton, Pikes Peak and Hi Line subdivisions.

Train service engineers assigned to new routes or who become unqualified on current assigned routes due to lack of route familiarization are required to contact their Road Foreman of Engines (or other supervisor) who will advise the number of trips required to qualify or re-qualify on that route. If and when an engineer is qualified at the completion of these trips, the Road Foreman of Engines or other supervisor will then authorize the train service engineer to perform service on that route without a pilot.

Route familiarization (and the use of a pilot) is not required when the movement to be made does NOT include a section of track with an average grade of greater than 1% over 3 continuous miles and;

1. The train is on other than main track; or
2. The maximum distance the locomotive or train will be operated will not exceed one mile; or
3. The maximum authorized speed for any operation on the track does not exceed 20 MPH; or
4. Operations are conducted under operating Rules that require all movements to proceed at a speed that permits stopping within one half the range of vision of the locomotive engineer.

100.3.3 Special Equipment Proficiency

Distributed power and electronically controlled pneumatic brake systems require the engineer to have continued experience in order to maintain an adequate level of proficiency. If after the engineer is initially qualified on this equipment and a period of 12 months occurs without any experience operating this equipment (whether or not as assigned engineer), the Road Foreman of Engines or other supervisor must be contacted and be governed by his/her instructions concerning requirements to become re-qualified on this equipment.

Exception: Rules 100.3.1, 100.3.2 and 100.3.3 do not apply to any individual restricted to yard service as a locomotive engineer unless otherwise instructed.

100.4 Pilots

A person acting as a pilot may not be an assigned member of the crew. In addition,

1. When a pilot is required account engineer has NO previous experience on the route, the pilot must be a certified train service engineer.
2. When a pilot is required account engineer requires re-familiarization on a route where previously qualified, any person with route familiarization may be used as a pilot.

101.0 Air Brake Tests, Car Equipment and Components

101.1 General Responsibilities

101.1.1 Compliance with FRA Regulations

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

101.2 Air Brake Tests

These requirements apply to air brake tests and inspections:

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

Note: Cars with inoperative brakes may be moved to a repair facility with proper documentation.

101.2.1 Person in Charge

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

101.2.2 Engineer Responsibilities During Test

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

- Apply or release train brakes.
- Move the train until the air test is complete.

101.3 Charge Brake System

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

1. Do not charge a train's air brake system with more than one automatic brake valve cut in unless utilzing distributed power locomotives.
2. Do not increase diesel engine RPM to maintain main reservoir pressure unless the pressure fails to stay 10 psi above the regulating valve setting.
   a. If engine RPM must be increased, do not exceed throttle position 4.
3. In yards where trains are made up, unattended locomotives may be used to charge the brake system when ambient temperature requires additional charging time if:
   a. There is a sufficient number of hand brakes applied to hold the cars to be charged.
   b. Locomotive consist must have all hand brakes applied.

Note: Locomotive consists with locomotives equipped with electric air compressors may only require Run 1 for maximum efficiency.

A. Standard Brake Pipe Pressures

a. Yard service—80 psi
b. Freight service—90 psi
c. Mountain grade territory identified by special instructions—100 psi
d. Trains consisting entirely of business car or passenger equipment—100 psi

B. Charging Time Chart

When the brake system is empty, use Table 101A to determine the minimum and maximum charging times:

Table 101A. Charging Time Chart

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

C. Reducing Charging Time

Temperature, train length, leakage, and cars partially charged affect the time required to charge cars in the train. To reduce charging time:

1. Remove snow, ice, dirt, and other obstructions before coupling the air hoses.
2. Repair any brake system leakage.

D. Inspecting for Leakage or Obstructions

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

- The rear car brake pipe pressure stops rising before it reaches the required pressure.
- The air flow indicator holds steady above 60 CFM or above the calibration mark.
- The maximum charging time is reached. (See Table 101A)

E. Reducing Brake Pipe Pressure

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

F. Reducing Pressure in Overcharged Train Brake Systems

Reduce pressure in overcharged train brake systems as follows:

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.

101.3.1 Train Kept Charged

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

Note: A train considered "kept charged" has had air pressure in its brake pipe within the last 2 hours.

101.4 End-of-Train Telemetry Devices

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

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

  or

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

4. Give the release signal when the inspection is complete.
5. After the release, inspect each brake to make sure all are released. The release may be verified during a roll-by inspection.

C. Test: When Train has Been Previously Tested With Yard Test Plant

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

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

D. Before Leaving Test Location

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

101.7 1,000-Mile Air Brake Test

At designated locations, conduct a 1,000-mile train air brake test to test brake pipe leakage and inspect air brake equipment on through freight trains.

To conduct the test:

1. Test brake pipe leakage with the AFM or brake pipe leakage method.
2. With the automatic brake valve, make a 20 psi brake pipe reduction and verify that brakes apply on each car.
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.

101.8 Air Brake Test When Cutting Off and Recoupling

When a train is uncoupled, unchanged and recoupled in 2 hours or less, make sure brake pipe pressure is being restored and the brakes release on the rear car.

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

1. Make a 20-psi brake pipe reduction with the automatic brake valve.
2. Make sure the brakes apply and release on the rear car.

If the cars are recoupled in more than 2 hours, refer to Rule 101.3 (Train Kept Charged).

101.9 Application and Release Test

Conduct the following application and release test when:

- Any locomotive in the locomotive consist is changed.
- A caboose is changed.
- Helper locomotives are added anywhere in the train or removed from other than the rear end of the train.

  or

- One or more consecutive cars are set out from the head or rear of the train at other than the initial terminal.

101.9.1 Procedure for Application and Release Test

To conduct an application and release test:

1. Verify that the brake system is charged to within 15 psi of the regulating valve setting.
2. Make a 20 psi brake pipe reduction with the automatic brake valve.
3. Verify that brakes on the rear car apply.
4. Move automatic brake valve to RELEASE position
5. Verify that brakes release on rear car.

Note: See Rule 104.14 for procedure for application and release test when adding helper locomotives.

101.10 Air Brake Test When Adding Cars

101.10.1 Adding Cars Not Pretested

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

- The train is not at the initial terminal.
- One or more cars have not been pretested by the initial terminal air brake test. (See Rule 101.6)

To conduct the test:

1. Test brake pipe leakage with the AFM or brake pipe leakage method.
2. Make a 20 psi brake pipe reduction with the automatic brake valve.
3. Verify that the brakes apply on the rear car and the cars added.
4. Place the automatic brake valve handle in RELEASE position.
5. Verify that the brakes release on the rear car and the cars added and that brake pipe pressure is being restored at the rear of the train.

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

101.10.2 Adding Pretested Cars

When adding a block of cars pretested by the initial terminal air brake test (see Rule 101.6):

1. Make a 20 psi brake pipe reduction with the automatic brake valve.
2. Verify that the brakes apply on the rear car.
3. Place the automatic brake valve in RELEASE position.
4. Verify that the brakes release on rear car and that brake pipe pressure is being restored at the rear of the train.

101.11 Transfer Train and Yard 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 and involves no intermediate switching. To conduct the test:

1. Couple brake pipe hoses between all cars.
2. Charge the brake system to at least 60 psi. If a rear car gauge is not available, refer to the Charging Time Chart (Table 101A) in Rule 101.3.
3. Make a 20 psi brake pipe reduction.
4. Verify that the brakes apply on each car.

101.12 Inbound Train Inspection

Inspect inbound trains for defects in the air brake system.

A. Train Speed

When an inspector is present, incoming trains must not exceed 10 MPH.

B. Brake Inspection and Test Required

When an immediate brake inspection and test are required, including a 1,000 mile inspection:

1. If the locomotive will remain on the train, make a 20-psi brake pipe reduction. If train will be unattended, secure train as required with hand brakes and make a further brake pipe reduction to 40 psi.

   or

2. If the locomotive will be detached or a cut made:
   a. Place the automatic brake valve handle in CONTINUOUS SERVICE until the exhaust stops.
   b. Signal that the brake valve exhaust has stopped by sounding whistle signal 5.8.2, (2), or using the radio.
   c. Close the angle cock at the rear of the last locomotive or car to be detached.
   d. Detach the locomotive or locomotive and cars and move at least 50 feet from the cars left standing.
   e. When available, use the end-of-train telemetry device to ensure that the brake pipe pressure drops to 0 psi.

Do not bottle air or maintain air pressure in the brake pipe when controlling locomotives are detached or yard air is uncoupled.

Note: 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.

101.13 Running Air Brake Test

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

- The train leaves 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.

101.18.2 Truck-Mounted Air Brake Cylinders

Table 101C. Truck-Mounted Air Brake Cylinders

Piston Travel Limits of Truck-Mounted Air Brake Cylinders		
Truck-Mounted Brake Cylinder Manufacturer	**Initial Terminal Requirements**	**Intermediate and 1,000-Mile Inspection Points**
WABCOPAC/NYCOPAC (One brake cylinder mounted on each brake beam.)	3/4" to 3"	4" max.
WABCOPAC II (Same as above with slack adjusters in each truck.)	1-3/4" to 3"	3-1/4" max.
TRIAX II	1-1/2" to 3"	3-1/4" max.
ELLCON NATIONAL (One brake cylinder mounted to bracket on each truck bolster.)	2-1/4" to 3-3/4"	4" max.
THRALL/DAVIS (Each brake cylinder mounted directly to truck bolster with a cylinder push rod extending through.)	2-3/4" to 4-1/4"	4-1/2" max.
MISNER/TTX (Air bag designed actuator mounted to each truck bolster. Load indication pointer inside truck on slack adjuster.)	7-1/2" to 10"	10-1/4" max.
WABCO TMX (One brake cylinder mounted to one brake beam within each truck. New models have piston travel indicator on brake cylinder.)	1-1/2" to 3"	3-1/4" max.
TTOX/TTFX AIR ACTUATOR (Single wheel truck air brake system.)	With the brakes applied, shoes must be against the wheels and the indicator pointed to the ON position.	With the brakes applied, shoes must be against the wheels and the indicator pointed to the ON position.
KIM ANGIE (Roadrailer Equipment)	1-1/4 to 3-1/2"	3-5/8" max.

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

101.19 Friction Bearing Equipment

Check freight cars with friction bearings to ensure that the cars are operating properly and bearing components are free from defects. To check the cars:

1. When picking up cars on line where mechanical personnel are not on duty, look for these defects before departing:
   a. Open the friction bearing box lids and check for missing or displaced components.
   b. Check the friction bearing box for contamination.
   c. Check for at least 1 inch of visible oil.
2. When a train stops enroute, examine the friction bearing boxes to verify that they are free from defects.
3. If weather conditions cause snow or ice to accumulate in journal boxes, before moving the cars, notify the train dispatcher to send mechanical personnel to service the car(s).

Note: Equipment with friction bearings are not accepted in interchange.

101.19.1 Cooling Friction Bearings

When friction bearings become overheated, cool them as follows:

1. Stop movement.
2. Check the dust guard, decking, and side of the car for fire.
   a. Use hot box compound to put out any fire.
   b. Do not use sand, dirt, or other abrasive material to put out fires in journal boxes.
3. If the pad is intact, place a stick of hot box coolant along the sides of the journal.
4. Do not use water or snow to cool hot journal boxes except in an emergency.

101.20 Roller Bearing Equipment

Check freight cars or locomotives with roller bearings to ensure that the cars are operating properly and that roller bearings do not overheat. To check the equipment:

1. Stop movement.
2. Determine if the roller bearing is hot.
   a. Mark the outside of the bearing cup with a 200 degrees F heat-indicating crayon. Use a 163 degrees F crayon if the ambient temperature is below 32 degrees F.

      Note: If a liquid smear remains, the bearing is overheated.

   b. If a crayon is not available, carefully pass your hand near the bearing without touching it.

      Note: If the bearing is radiating more heat than others, it is overheated.
3. On locomotives, when a detector indicates hot journal bearing(s), check for an overheated journal, support bearing, or armature bearing.

101.21 Setting Out Defective Cars

Set out a defective car whenever it cannot be safely moved to the next repair location. When cars are set out defective, report this fact to the dispatcher and Mechanical Help Desk. When setting out defective cars:

1. Set out mechanically defective cars where maintenance crews can access them.
2. If the journal is overheated, inspect the underside of the car immediately if the maintenance crew is not available.
3. Put out any fires before leaving the car.
4. Promptly report setout cars to the train dispatcher.
5. Include location of overheated journal with marking crayon.
6. When a derailed car with roller bearings is rerailed by other than Mechanical Department employees, move it carefully to the setout point for inspection and maintenance.

101.22 Train Air Brake System

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

101.22.1 End-of-Car Connections

Maintain end-of-car connections to enable the air brake system to function properly throughout the train.

A. Opening or Closing Angle Cocks

When opening or closing angle cocks:

1. Do not leave angle cocks partially open or closed.
2. When cutting air in with the brake pipe charged:
   a. Make a 20-psi brake pipe reduction.
   b. Signal that the brake valve exhaust has stopped by sounding whistle signal 5.8.2, (2), or using the radio.
   c. Open angle cocks slowly to prevent an emergency brake application.

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

Note: Distributed power trains, in some cases, require a different procedure when coupling to rear portion of train with a remote consist. Refer to Rule 107.6.5, Item B.

101.25.1 Bleed Off Cars

Bleed off cars only when:

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

  or

- Switching.

101.26 Scale Test Cars

Scale test cars handled in a train do not need to be equipped with air brakes.

101.27 Securing Equipment Against Undesired Movement

Crew members are responsible for securing standing equipment against undesired movement.

101.27.1 Applying Hand Brakes on Cars

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

1. When applying hand brakes:
   a. Use proper body mechanics to prevent injury.
   b. Do not use additional leverage, such as when utilizing a bar, brake club, or foot.
2. Fully apply hand brakes by operating the mechanism until the slack is out of the chain and the brake shoes are snug against the wheels.
3. Use these hand brake procedures when removing locomotives from a consist or setting out cars:
   a. When removing locomotives from a consist, apply all hand brakes to prevent movement. Refer to Rule 102.13.2.
   b. When setting out cars on a grade with slack bunched, apply the hand brakes on the low end of the cut of cars.
   c. When setting out cars on a grade with slack stretched, apply the hand brakes on the high end of the cut of cars.
4. When necessary, apply all hand brakes on multiple-platform cars.

101.27.2 Releasing Hand Brakes

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

1. If a hand brake is difficult to release, charge the air brake system and apply the brakes in emergency before attempting to release the hand brake again.
2. Check at least an additional three cars beyond the last applied hand brake to ensure that no other hand brakes are applied.

101.27.3 Blocking Wheels

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

To block wheels:

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

101.27.4 Securing Train or Portion of Train With Locomotive Attached

When securing a train or portion of a train with locomotive(s) attached, perform the steps below. In addition, perform Items 1-4 as outlined in Rule 102.13.2 in order to further secure the controlling locomotive:

1. Fully apply the independent brake.
2. Make a 20-psi brake pipe reduction.
3. When required, apply a sufficient number of hand brakes.
4. Increase the brake pipe reduction to 40 psi and leave the automatic brake cut in.

   Exception: Do not increase brake pipe reduction to 40 psi if train is left unattended and will be inspected at designated 1,000 mile inspection location.

101.27.5 Securing Train Before Detaching Locomotives

When securing a train or portion of a train and locomotives will be detached:

1. Make a 20-psi brake pipe reduction.
2. When required, apply a sufficient number of hand brakes.
3. Allow the train or portion of the train left standing to apply in emergency.

101.27.6 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 Table 101D to determine the minimum number of hand brakes to apply or wheels to block to hold equipment on a grade.

Table 101D. Percentage of Cars on Which to Apply Hand Brakes or Blocking Fully

Grade	Percentage of Cars on Which to Apply Hand Brakes or Blocking Fully	
	Empties	Loads
Level	1% of cars	2% of cars
0.1 - 0.5%	7% of cars	14% of cars
0.6 - 1.0%	15% of cars	30% of cars
1.1 - 1.5%	23% of cars	45% of cars
1.6 - 2.0%	30% of cars	60% of cars
2.1 - 2.5%	38% of cars	75% of cars
2.6 - 3.0%	45% of cars	90% of cars
3.1 - 3.5%	53% of cars	100% of cars
3.6% and over	100% of cars	100% of cars

101.28 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
4. If flat spots exceed 1 inch, handle cars or locomotives according to Table 101E.

Table 101E. Speed Permitted for Flat Wheels

Speed Permitted for Flat Wheels		
Length of Single Flat Spot	**Length of Two Adjoining Flat Spots Less Than 1-1/2" Apart**	**Maximum Speed**
Locomotives		
2" or less	1" or less	Normal speed
2" to 2-1/4"	1" to 1-1/2"	40 MPH
2-1/4" to 2-1/2"	1-1/2" to 2"	25 MPH
2-1/2" or more	2" or more	10 MPH; set out at first available point
Cars		
2-1/4" or less	1-1/2" or less	Normal speed
2-1/4" to 2-1/2"	1-1/2" to 2"	50 MPH
2-1/2" or more	2" or more	10 MPH; set out at first available point

Note: "Adjoining" means flat spots less than 1-1/2 inches apart.

101.29 Emergency Application Capability from Rear of Train

All trains must be operated with the ability to initiate an emergency application of the brakes from the rear of the train.

Exceptions:

Locals, road switchers and work trains that do not operate on grades described in Rule 101.29.4 or a continuous grade of 1% or more for a distance of three miles or more are exempt from these requirements. In the application of this rule, locals, road switchers and work trains are defined as a train that can be operated by a single crew in a single tour of duty that do not exceed 4,000 trailing tons. Divisions may individually issue instructions concerning which locals, road switchers and work trains are excepted from the above.

Engine(s) without cars are also excluded from this rule.

101.29.1 Methods of Providing Emergency Application Capability at the Rear of the Train

One of the following methods of providing emergency capability at the rear of the train must be utilized:

1. An operable two-way end of train device (ETD) which must be armed and tested at point of installation per Rule 108.4.1. This device consists of an (ETD) mounted on the coupler of the last car and a head-of-train device (HTD) mounted on a locomotive at the head end of the train.
   An ETD with a calibration date exceeding 365 days must not be used. Brake pipe pressure readings displayed on the HTD must be accurate to within 3 psi of brake pipe pressure displayed at the ETD.
2. Remotely controlled locomotive(s) capable of initiating an emergency application placed in the rear 1/3 of the train.
3. Trains with a helper locomotive(s) in the rear 1/3 of the train or a 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. Train must be stopped if radio communications has failed before train proceeds on grades described below. If already moving on grades described below when radio communications has failed, train may proceed as long as train is under control.

101.29.2 Testing Emergency Function

The functional capability of ETD, caboose or passenger equipment emergency valve must be tested at the installation point as follows:

1. Couple the brake pipe on the train to the ETD, caboose, or passenger equipment.
2. Arm the ETD as outlined in Rule 108.4.1 (all parts).
3. Close the angle cock between the train and ETD, caboose or passenger equipment.
4. Initiate an ETD emergency from the lead locomotive HTD or by using the emergency valve on the caboose or passenger equipment being used.
5. Note the brake pipe pressure on the ETD, caboose or passenger equipment reduces to 0 psi.

6. Open the angle cock between the ETD, caboose or passenger equipment and train. Determine that brake pipe pressure is restored before proceeding.

Note: Allow ETD emergency valve to automatically close before opening angle cock. UP/CNW ETD's require manual reset of emergency valve. 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. Failure to wait a minimum of 15 seconds after testing valve before again opening brake pipe to valve may result in an erroneous "Valve Fail" indication.

101.29.3 Conditions Indicating Enroute Failures

A failure is indicated when:

1. ETD/HTD indicates one of the following:
   a. Loss of front to rear communication. Message = FR NOCOM, EOT COMM or NO CONT depending on HTD type.
   b. Emergency valve not enabled. Message = NOT ARMD and/or "Emergency Enabled" indicator NOT illuminated.
   c. Emergency valve failure. Message = VALVFAIL.
   d. Battery failure. Message = DEAD BAT, REPL BAT or BATTERY LOW.
2. Remotely Controlled Locomotives: Loss of communication as indicated by control console for remotely controlled locomotive on lead, controlling locomotive at head end of train.
3. Manned helper, caboose or passenger equipment: A loss of voice radio communication that occurs between manned helper locomotive(s), caboose or passenger equipment and the lead, controlling locomotive.

101.29.4 Action Required When Enroute Failures Occur

When an enroute failure occurs, train must not exceed 30 MPH until failure is corrected or another method of compliance is secured.

Exception:

On the following grades, train must not proceed until failure is corrected or another method of compliance is secured:

Cajon Subdivision	MP 56.6 to MP 80, both tracks
Raton Subdivision	MP 639 to MP 660
Glorieta Subdivision	MP 775 to MP 810 and MP 818 to MP 842
Pikes Peak Subdivision	MP 52 to MP 66
Hi Line Subdivision	MP 1151 to MP 1166, both tracks
Midway Subdivision	MP 0.5 to MP 5, both tracks
St. Paul Subdivision	MP 430 to MP 5, both tracks
Scenic Subdivision	MP 1694.5 to MP 1731.3
Stampede Subdivision	MP 41.0 to MP 58.5
San Diego Subdivision	MP 250 to MP 255 (SDN RR)
Gateway Subdivision	MP 178.0 to MP 188.0
On UP/SP Railroad:	
Mojave Subdivision,	MP 331.3 to MP 381.3
Moffat Tunnel Subdivision	MP 19 to MP 50 and MP 58.1 to MP 61.7
Provo Subdivision	MP 630.5 to MP 638.1 and MP 652 to MP 682
Roseville Subdivision	MP 115 to MP 170 and MP 195 to MP 210

If stopped or moving on grades described above when loss of ETD or remote controlled locomotive radio communications occurs due to train being in a location of poor communications (tunnel, rock cut, overpass, etc.), train may be moved in an attempt to regain communications. If communications cannot be restored after clearing the poor communications area, train must be stopped. The failure must be corrected or alternative method of compliance secured.

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

Note: Normal HTD to ETD communications is at a much lower strength than the command to initiate an emergency application from the HTD to the ETD. 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.

102.0 Locomotive Daily Inspection, Air Brake Test and Components

102.1 General Requirements

Engineers are responsible for the following:

1. If possible, position yourself so you can conduct a roll-by inspection of an incoming locomotive consist.
2. Keep the side and end doors of the locomotive closed when the doors are not being used.
3. Keep cab windows and doors of unoccupied, trailing locomotives closed.
4. Keep the locomotive's high-voltage cabinets closed during operation.
5. Isolate DC locomotives and discharge AC locomotives before opening any electrical cabinet door marked "Danger."
6. Check for sliding wheels at frequent intervals if:
   - The locomotive is dead.
   - The locomotive is isolated.

     or
   - The locomotive's traction motors are cut out.
7. Verify that brake pipe exhaust ports are not plugged or obstructed.
8. Verify that the independent brake valve handle is not blocked in the actuate position.
9. Verify that the reverser is *centered* to engage the low-idle feature when the locomotive is not moving.
10. Verify that the brake shoes are thick enough to last until the next maintenance or through the shift in yard service.
11. Make sure the head-of-train device (HTD) for the end-of-train telemetry device (ETD) is located in the cab of the controlling locomotive.

102.2 Locomotive Daily Inspection

Each locomotive in service must be inspected daily.

102.2.1 Responsibility for Inspection

To comply with federal requirements, each locomotive engineer is responsible for ensuring that each locomotive in his or her charge is inspected each calendar day.

Note: A calendar day is a 24-hour time period from midnight to midnight.

102.2.2 Obtain Locomotive Inspection Forms

Keep a supply of the following locomotive inspection forms. Complete these forms at the appropriate time to comply with Rule 102.2 (Locomotive Daily Inspection) and Rule 102.3 (Defects/Non-Complying Conditions Found Enroute).

- Locomotive Inspection Report
- Non-Complying Tags
- Out of Service Tags
- Locomotive Daily Inspection Report

102.2.3 Determine If Inspection Is Required

Determine if the locomotive needs to be inspected by checking the FRA Rule 229.21 Daily & Mid-Trip Inspection form (locomotive cab card) in the locomotive cab. The card will indicate the date and time of the last inspection.

A. Previous Inspection Recorded

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:

1. 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
2. If you have time to reach your final terminal before 2359 hours, inspect the locomotive at that terminal, unless the proper authority informs you that one of the following will inspect the locomotive before 2359 hours:
   - The Mechanical Department

     or
   - The relieving engineman

B. Previous Inspection Not Recorded

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

C. Locomotive Picked Up On Line/Assigned to Outlying Points

When picking up a locomotive on line or taking charge of locomotives at an outlying point, the engineer must determine if a daily inspection is needed.

- Inspection is required when the locomotive will be used as a working unit at any time during the current calendar day.

  or

- Inspection is not required when the locomotive is idling or shut down and is not used during the current calendar day.

D. Locomotive Set Out On Line

When setting out a locomotive on line, determine if a daily inspection is needed. If an inspection is needed, inspect the locomotive, unless the proper authority informs you that one of the following will inspect it before 2359 hours:

- The Mechanical Department

  or

- The relieving engineman

102.2.4 Inspect Locomotive for Non-Complying Conditions

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:

A. Control Compartment/Locomotive Cab

Ensure that:

1. Each air gauge registers correctly and is within 3 psi of the required pressure. See Rule 102.5 (Standard Air Pressures).
2. These functions are operational:
   - Headlights (At least one headlight bulb must be operational on each end of the locomotive consist and at least one of two ditch lights must be operational in direction of travel.)

     Note: If one ditch light fails enroute, the train may proceed, but repairs must be made by the next daily inspection. If two ditch lights fail enroute, the train may proceed not exceeding 20 MPH with head end over public crossings, but must not travel beyond the first point where repairs may be made or until the next daily inspection, whichever comes first.

     Oscillating headlights or strobe lights may be displayed to the front of a locomotive consist in lieu of ditch lights. If oscillating headlight or strobe lights become inoperative enroute, handle the same as with loss of both ditch lights, above.
   - Horn
   - Bell
   - Sanders (They deposit sand in front of each locomotive's lead wheels when the reverser position determines the direction.)
   - Gauge lights and engineer's overhead cab light (Report as a defect but not a non-complying condition unless other available lighting is insufficient.)
   - Speed indicator

     Note: After a daily inspection, if the speed indicator failure is identified on the lead locomotive as soon as it begins moving, the failure is a non-complying condition discovered during the daily inspection.
3. Locomotive cab is free of stumbling or slipping hazards.
4. Windows provide a clear view. (Small cracks that do not obscure view must be reported as a defect but not a non-complying condition.)

102.7 Locomotive Safety Devices

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

- Overspeed.
- Alertors.
- Deadman controls.
- Automatic cab signals.
- Automatic train stop equipment.
- Automatic train control equipment.

EXCEPTION: Safety devices do not have to be operating:

- When locomotives are hauled in tow.
- When a safety device becomes defective enroute.

  or

- During drag loading/unloading operations under 5 MPH.

102.7.1 Verify and Report Safety Device Function

Engineers must check to make sure safety devices are operative. If a safety device becomes defective enroute, inform the train dispatcher as soon as possible.

102.7.2 Do Not Tamper With Safety Devices

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

102.8 Electronic Alertness Device

An electronic alertness device stops the train with a service rate brake application if the engineer does not respond properly. The controlling locomotive of a passenger train being operated in territory not equipped with either cab signal, automatic train control (ATC) or automatic train stop (ATS) equipment must be equipped with an operative Electronic Alertness Device. If Electronic Alertness Device should fail enroute on a passenger train, the locomotive cab must be either occupied by a second qualified crew member or constant communication via radio or other means must be maintained between engineer and another qualified crew member. It functions as follows:

- The device begins functioning when locomotive brake cylinder pressure falls below 25 psi.
- At this point, the device monitors the operator's alertness.
- It resets when the operator changes the position of or operates one of these locomotive controls:
  - Throttle
  - Horn
  - Bell
  - Changes the dynamic brake

    or

  - Device reset button
  - Radio transmit (on some alertor types)
- If the device is not reset within the reset cycle (varies relative to speed):
  - A warning light flashes.
  - A warning horn sounds off and on for 10 seconds and then continuously for 10 seconds.
- If the device is not reset within 20 seconds after the warning light and horn begin operating, the train brakes will automatically be applied at a service rate.

102.8.1 Deactivate Device Temporarily

To deactivate the device temporarily for loading/unloading:

1. Cut out the automatic brake valve.

   Note: If train has distributed power remote(s), place remote(s) in Brake Valve Out Mode.
2. Adjust the regulating valve to 114 psi.
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.

Note: When the locomotive is in SLOW SPEED operation, if equipped, the electronic alertness device does not function under 5 MPH.

102.8.2 Restore Electronic Alertness Device Control

To restore the electronic alertness device control:

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

102.9 Safety Control Device—Overspeed Control

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

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

Exception: Some BNSF locomotives allow an Overspeed Penalty Application to be prevented by placing automatic brake valve to MINIMUM position. When warning whistle is heard, move automatic brake valve to MINIMUM position. If speed reduces sufficiently, train brakes may be released, when desired. If Penalty Brake Application occurs as indicated by PCS open and service brake application, move automatic brake valve handle to SUPPRESSION to recover.

102.9.1 Slow Train During Warning Period and Recover Overspeed Control

A. 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.

B. 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.

102.10 Operative Speed Indicators

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

1. Locomotive speed indicators must be accurate within:
   - ±3 MPH at speeds between 10 and 30 MPH
   - ±5 MPH at speeds above 30 MPH
2. If a speed indicator on a controlling locomotive fails enroute, the locomotive may continue as a controlling locomotive at normal track speed only to the next repair facility (see Rule 102.3.2 [Non-Complying Condition Found Enroute]).

102.10.1 Speed Indicator Accuracy

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.

102.14 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 Tables 102A through 102D:

Table 102A. 26 and 30CDW Brake Equipment Positions

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

Table 102B. CCB Brake Equipment Positions

CCB Brake Equipment Positions			
	Lead	**Trail**	**Helper**
Automatic Brake Valve	Release	Continuous Service	Continuous Service
Independent Brake Valve	Applied Full	Release	Release
Air Brake Setup	Lead/Cut-In	Trail	Lead/Cut-Out

Table 102C. 6BLC Brake Equipment Positions

6BLC Brake Equipment Position				
		Lead	**Trail**	**Helper**
Automatic Brake Valve		Release	Lap	Lap
Independent Brake Valve		Applied Full	Release	Release
Automatic Brake Valve Cutout Cock	2 Pos.	Open	Closed	Closed
	3 Pos.	Lead	Trail	Trail
Rotair Valve		Pass or Frt	Frt Lap	Pass or Frt
MU-2A Valve or Double-Ported Cutout Cock		Lead or Dead	Trail	Lead or Dead
		In Horizontal	Out Vertical*	In Horizontal

*On locomotives equipped for dual control, cut out both independent brake valve cutout cocks by placing them in VERTICAL when the locomotive is trailing.

Table 102D. 24RL Brake Equipment Positions

24RL Brake Equipment Positions			
	Lead	**Trail**	**Helper**
Automatic Brake Valve	Release	Release	Lap
Independent Brake Valve	Applied Full	Release	Release
Automatic Brake Valve Cutout Cock	Open	Closed	Closed
Rotair Valve	Pass or Frt	Frt Lap	Pass or Frt
MU-2A Valve	Lead or Dead	Trail	Lead or Dead

102.14.1 Separating Locomotives

When separating locomotives:

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

102.14.2 Coupling Locomotives for Multiple-Unit Operation

Locomotives coupled for multiple-unit operation must not exceed 12 locomotives. When coupling locomotives for multiple-unit operation:

1. Clean out all MU and brake pipe hoses before coupling them to other hoses.
2. Couple corresponding MU and brake pipe hoses beginning with the inside hoses.
3. Open cutout cocks and angle cocks fully between locomotives in the consist.
4. From November through March, connect the main reservoir air hoses on both sides of the locomotives.
5. Connect the electric jumper cable between units to MU receptacle.
6. Connect walkway safety chains and lower walkway platform (if equipped).

Note: Some traction motor booster units (slug) do not MU all functions, including dynamic braking. To enable control of dynamic braking on all dynamic brake-equipped locomotives in consist, these traction motor booster units must be placed at rear of locomotive consist.

102.14.3 Alignment Control Couplers

Locomotives without alignment control couplers must not be used as helper locomotives or placed ahead of more than 5,000 trailing tons when locomotive consist exceeds a rating of 18 power/dynamic brake axles unless:

- Locomotive with alignment control coupler is coupled against train.
- No two locomotives without alignment control are coupled together.

BNSF locomotives without alignment control couplers:

Current Number	When Renumbered
BN 5	BNSF 3310
BN 375-585	BNSF 3500-3546
BN 1000-1004	BNSF 3700-3704
BN 1400-1438	BNSF 1400-1438
BN 6100-6237	BNSF 6100-6199

102.14.4 Powered Axle Limitation

Locomotive consists must not have in excess of 36 rated powered axles. Excess power must be isolated.

102.15 Locomotive Brake Valve Positions and Functions

The following is a 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.)

Automatic Brake Valves

102.15.1 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.

103.0 Special Equipment—Electronically Controlled Pneumatic Brakes and Roadrailer Equipment

103.1 Description of Electronically Controlled Pneumatic Brake System

A train with 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.

When operating in ECP mode, all service and emergency brake applications are performed with the Head End Unit (HEU) brake controller. This controller may be a push/pull button or a separate brake handle, or it may be integrated into the automatic brake valve handle. The braking effort is provided by air pressure that is electronically regulated on each car via commands from the brake controller.

Warning: The automatic brake valve must be cut in, and except for the systems using the integrated brake valve handle, the automatic brake valve handle must be in release position while operating in the ECP mode. Reason: The automatic brake valve is used to continuously charge the brake pipe and the reservoirs on the freight cars. The automatic brake valve handle can be used to initiate a pneumatic emergency brake application when it is moved to the emergency position while operating in either mode.

While operating in ECP mode, a pneumatic emergency brake application can also be initiated via the conductor's emergency valve, two-way ETD emergency valve or from any other sudden drop in brake pipe pressure, i.e. hose separation.

103.2 ECP Operating Practices and Train Handling Methods

ECP provides uniform in-train forces through simultaneous brake applications and releases, which can be graduated on the entire train. ECP brake applications should be made in small increments as with pneumatic brake systems. Although propagation is almost instantaneous throughout the train and in-train forces are greatly reduced due to this fact, heavy ECP brake applications must be avoided, if possible.

ECP brake applications must be made in small increments spaced not less than 5 seconds apart. The throttle must be in idle or in a dynamic brake position while the brakes are applied.

Exceptions:

- Trains operated at a loading or unloading facility may use light brake applications while in power for improved pace setting.
- On trains making a required running air brake test, throttle is not to exceed run 4.

103.3 Air Brake Tests for ECP Trains

Trains operated using ECP brakes are required to make air brake tests as outlined in ABTH Chapter 101 using the pneumatic mode (ECP cut out). At the initial terminal, an ECP brake application and release must also be made to verify that reported brakes operable at the HEU are correct. A running air brake test must be made when returning to an ECP operating mode following any pneumatic operation or test.

103.4 Required Operable Brakes in ECP Mode

At the initial terminal, there must be 100% operable brakes as indicated by the HEU in ECP mode. En route there must not be less than 90% operable brakes as indicated by the HEU in ECP mode. If operable brakes fall below the above listed percentages, ECP brakes must be turned off and the train must be operated with conventional pneumatic brakes. Report any failure of the train braking system to the Mechanical Help Desk at the NOC.

103.5 Detaching and Coupling Locomotives or Cars of an ECP Train

The ECP mode must be changed from RUN to CUT-OUT.

Warning: Train line cables connected between cars and locomotives carry 230 VDC when train line power mode is set to AUTO. Power must be turned off before equipment is detached or coupled.

103.6 ECP Inter-Car Connectors

An ECP train must have the train line air hose and an electrical cable connected between each car. Inter-car cable connectors must be fully engaged. To disconnect cables, press on release buttons (2) on connector and then separate.

Note: It is not necessary to manually separate cables when uncoupling cars; connectors will disengage automatically as the cars part.

103.7 Securing an Unattended ECP Brake Train

An unattended ECP brake train must be secured with the ECP brake system turned off and as outlined in applicable ABTH Rules 101.27.4 or 101.27.5.

103.8 ETD Requirements for ECP Trains

Trains operated with ECP brakes are required to have an operable two-way end-of-train device installed and tested at the rear of the train as outlined in ABTH Rule 101.29.

Note: This is in addition to an auxiliary EOT that may be used by the ECP system to provide a beacon to the HEU, verifying that the train line is complete.

103.9 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.

103.9.1 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. Roadrailer equipment shown as empty is limited to a maximum speed of 55 MPH. (Trains with a block of this equipment or unit trains made up entirely of this equipment may be operated at maximum authorized speed if only one railroad truck/bogie is shown as an empty.)

   Exception: Amtrak roadrailer equipment may operate at maximum authorized passenger speed either loaded or empty.

3. 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.
4. 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.

5. Roadrailer equipment must not be humped.
6. When coupling a locomotive to roadrailer equipment, a safety stop must be made.
7. Roadrailer equipment coupling speed must not exceed 2 MPH.
8. Shoving roadrailer equipment must be avoided whenever possible. If necessary to shove roadrailer equipment, movement must not exceed 10 MPH.
9. 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.

103.9.2 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 CouplerMate 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 Air Brake & Train Handling Rule 101.27.6 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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G. Penalty Brake Application

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.
3. If in power, return throttle to IDLE position.
4. After PCS closes, release brakes if operating conditions allow.

H. Use of Dynamic Brake 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.

I. Running Air 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 during weather conditions are as described above, trains approaching meeting, passing or waiting points or approaching a signal indication which will require a train to stop 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.

J. Delayed Departure

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

1. When a train is stopped and operating conditions allow, do not release the train brakes until you are ready to depart.
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.

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.

104.3.2 Dynamic Braking

Follow these dynamic braking rules:

1. To allow for electrical current decay and to prevent a surge of dynamic braking, pause for 10 seconds before changing from power to dynamic braking.
2. When operating over a railroad crossing at grade (diamond):
   a. Reduce the dynamic braking level before the train reaches the crossing.
   b. Wait until the entire locomotive consist passes over the crossing before increasing the dynamic braking level.
3. If the wheel slip light or brake warning light comes on:
   a. Reduce the brake handle position and dynamic brake retardation until the light goes out.
   b. If the light does not go out, stop the train and inspect the locomotive.
4. 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.
5. 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.

A. Retarding Force

Dynamic braking is most effective between 18 and 23 MPH. Specific characteristics of dynamic brakes include:

- Basic dynamic brakes can develop 10,000 pounds of retarding force per axle.
- Basic range dynamic braking force normally fades below 10 MPH.
- Extended range dynamic brake maintains a high retarding force down to 6 MPH before fading.
- High-capacity dynamic brakes can develop 13,500 pounds of retarding force per axle.
- Development of approximately 15 to 18 psi of independent brake cylinder pressure, dynamic braking will reduce to that of a basic dynamic brake or, depending on locomotive brake cylinder pressure switch design, will eliminate all dynamic braking completely.

  Note: Most former BN locomotives will currently nullify dynamic braking completely when applying locomotive brake cylinder pressure of 15 psi or greater.,
- When an emergency brake application is in effect, the dynamic braking holding feature will maintain retarding force until locomotive brake cylinder pressure exceeds the maximum pressure setting of the independent pressure switch. (20 to 23 psi depending on equipment type.) Once nullified, dynamic braking can be restored if independent brake cylinder pressure is reduced to below 15-18 psi. (Dynamic braking is only to be utilized in emergency application situations on heavy grade when dynamic brake effort of a locomotive consist is thought to be greater than that available with independent brakes and additional braking is desired, and such as when an air brake failure of train brakes is suspected. Refer to Rule 104.13.1, Item G.)

B. 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. During normal operating conditions, limit the total operative dynamic brake to 28 axles unless further restricted by another rule or special instruction.
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.

   The preferred option is to cut out the basic dynamic brake(s) on a trailing locomotive(s).
3. To apply axle limitations for locomotives equipped with high-capacity dynamic brakes, count four-axle units as 6 axles and six-axle units as 8 axles.

   Note: All high horsepower (3,800 HP or more) locomotives built after 1984 are equipped with high-capacity dynamic brakes.

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.

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.

Exception: Trains with remotely controlled (Distributed Power) or manned helper locomotive consists may have the maximum allowable dynamic brake axles for each locomotive consist placed within the train.

104.3.3 Independent Brake (Locomotive Brake)

When using the independent brake, follow these rules:

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 to prevent an automatic application of the locomotive brakes.
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 RELEASE position prior to the automatic brake application and held depressed for four (4) seconds per locomotive in the consist.
3. The independent brake must not be applied while power or the 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 should never be exceeded.

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

104.4 Throttle Handling

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

1. Make throttle changes one notch at a time.
2. 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. When operating over the crest of a grade and handling trains with 8,000 or more horsepower of head-end power at speeds below 20 MPH, gradually reduce throttle on lead locomotive consist before the head of train crests a heavy 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 distributed power or manned helpers.
5. *Do not* apply power to hold a train stationary on a grade.
6. Reverser handle must not be moved to any position other than in the direction of travel while locomotive is moving.
7. The generator field switch must never be closed or moved to "ON" position with the throttle open.

104.4.1 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 for more than the maximum time at the most restrictive consecutive short time rate. Short time ratings are accumulative.

   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.

104.4.2 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.

104.5 Train Handling Conditions

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

104.5.1 Train Status Information

The conductor or another train crew member must inform the engineer of the train's status so the engineer can make appropriate operating decisions. It is the engineer's responsibility to control slack changes, dynamic brake and automatic or independent air brakes while moving in forward or reverse direction. This status information includes:

- 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.

104.5.2 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 104.13.1D concerning minimum brake pipe pressure at rear of train.

  or

- A brake application cannot be transmitted.

B. Increased Air Brake System Leakage Enroute

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

1. Brake pipe air flow or brake pipe gradient increases.
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 and the Mechanical Help Desk immediately of any unusual air brake condition that affects safe train movement.
2. The dispatcher must then notify the trainmaster, road foreman, or the superintendent.
3. The trainmaster, road foreman, or superintendent will determine if the train can be moved safely or if it must be held for inspection.

104.6 Starting Train

Follow these steps to start the train:

1. 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.
2. Allow each locomotive to load up properly before advancing the throttle to the next higher position.
3. Once the train is moving, do not increase the throttle until either the amperage or the tractive effort decreases.
4. To accelerate, advance the throttle slowly, one notch at a time.
5. In curved territory, use only enough power to start the train. Regulate amperage to reduce the possibility of stringlining in curves because of excessive lateral forces.

106.0 Fuel Conservation

106.1 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 used enroute, contact the Mechanical Help Desk for authorization. When utilized, employees must watch these locomotives closely and isolate or shut them down if spark emissions are detected.

106.1.1 Regulating Horsepower per Ton

Train and engine crews are required to isolate 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. Crews working trains with symbols beginning in "Z," "Q," or "P," must isolate excess units to be as close to but not below scheduled HPT. Crews working all other trains must isolate excess units, but not more than 0.5 HPT below scheduled HPT.

EXCEPTIONS:

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. Do not isolate a unit for fuel conservation if it causes your train to exceed 400 tons per operative axle of dynamic brake (TODB).
   - Train and engine crews must have authority from the train dispatcher to place excess locomotives back on line.
   - Newer locomotives are equipped with the option to isolate for power/tractive effort only and allow dynamic brake to remain operative. This feature must be utilized when isolating locomotives for fuel conservation measures. Dynamic brake axle limitations still apply.

106.1.2 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.

106.1.3 Empty Unit Trains—Horsepower Restriction

Empty unit trains, i.e., coal, taconite, grain, potash and sulfur, must not operate with more than 9,000 working horsepower (HP) on line.

Exceptions: Empty unit coal trains may operate with a maximum of 12,000 HP on the following subdivisions: Black Hills, Butte, Canyon, Dalhart, Orin, Red River Valley and Wichita Falls.

106.1.4 Empty Unit Coal Train—Speed Restriction

Empty unit coal trains must not exceed 50 MPH. However, to take advantage of descending grade situations, the 50 MPH restriction only applies while train is in power (for these instructions, power is defined as throttle positions 3 through 8). When operating at a location where power is not required, train may be operated at maximum authorized timetable speed for that location.

Exceptions: Empty unit coal trains may operate at maximum authorized timetable speed on the following subdivisions: Brush, Dalhart, Dickinson, Gallup, Ravenna, Red River Valley and Wichita Falls Subdivisions.

106.1.5 Movement of Light Engines and Engines with 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 online.
2. When operating on sustained grades exceeding 2.0 percent, only one axle of power per each 90 tons of consist may be online.

106.1.6 Isolated Locomotives

When instructions require to isolate a locomotive for fuel conservation, the following will apply:

1. Temperature 40 degrees F or above, locomotive must be shut down; do not drain.
2. Temperature below 40 degrees F, locomotive must be isolated; do not shut down.

3. Temperature below 32 degrees F, locomotives must not be isolated for fuel conservation.

Note: Distributed power remote consists may idle if necessary for fuel conservation by using the DP control screen and placing the remote consist in IDLE. This allows for continued use of the air brake function and for train air brake recharging from the remote consist. Distributed power train checks should continue to be made as required.

Exception: The following locomotives are equipped with alarm protection or automatic water drain and will be isolated below 32 degrees F:

Former Santa Fe	Former BN	BNSF	Make	Type
100-162		100-162	EMD	GP60M
200-250		8200-8250	EMD	SD75M
325-347		325-347	EMD	GP60B
500-582		500-582	GE	B40-8W
600-699		600-699	GE	C44-9W
		700-799	GE	C44-9W
800-951		800-951	GE	C40-8W
		960-1123	GE	C44-9W
3000-3045		2000-2030	EMD	GP20
3047-3066		2032-2047	EMD	GP20
3067-3072		2050-2053	EMD	GP20
2374-2380		2065-2071	EMD	GP38-2
2301-2311		2139-2149	EMD	GP38
2312-2360		2190-2236	EMD	GP38
2700-2779		2400-2477	EMD	GP30
2801-2962		2500-2649	EMD	GP35
3400-3409		2740-2749	EMD	GP39-2
3410-3430		2779-2799	EMD	GP39-2
3431-3683		2835-2869	EMD	GP39-2
3685-3704		2941-2959	EMD	GP39-2
3800-3809		3028-3037	EMD	GP40X
3810-3854		3163-3207	EMD	GP50
6350-6419		4207-4276	GE	B23-7
		4700-4999	GE	C44-9W
8099-8166		5142-5209	GE	C30-7
9508-9568		5218-5278	GE	SF30C
1556-1575		6200-6219	EMD	SD39
5000-5002		6300-6302	EMD	SD40U
5003-5006		6305-6308	EMD	SD40U
5007-5009		6310-6312	EMD	SD40U
5010-5014		6314-6317	EMD	SD40U
5016-5018		6319-6322	EMD	SD40U
5019		6324	EMD	SD40U
5020-5023		6335-6338	EMD	SD40-2
5024-5031		6340-6347	EMD	SD40-2
5032		6367	EMD	SD40-2
5033-5036		6374-6377	EMD	SD40-2
5038-5048		6386-6399	EMD	SD40-2
5325-5437		6406-6457	EMD	SD40-2
5800-5975		6458-6535	EMD	SD45-2
5049-5113		6708-6772	EMD	SD40-2
5114		6790	EMD	SD40-2
5115		6794	EMD	SD40-2
5116		6800	EMD	SD40-2
5117		6812	EMD	SD40-2
5118-5120		6837-6839	EMD	SD40-2
5121 & 5122		6848 & 6849	EMD	SD40-2
5123-5171		6852-6899	EMD	SD40-2
5172		6901	EMD	SD40-2
5173		6905	EMD	SD40-2
5174		6909	EMD	SD40-2
5175		6914	EMD	SD40-2
5176 & 5177		6921 & 6922	EMD	SD40-2
5178-5191		6929-6942	EMD	SD40-2
5192		6958	EMD	SD40-2
5200-5205		6943-6949	EMD	SD40-2
5207-5213		6951-6957	EMD	SD40-2
5250-5267		6959-6976	EMD	SDF40-2
5501-5517		7503-7512	EMD	SD45-2B

Former Santa Fe	Former BN	BNSF	Make	Type
.....	.....	8251-8301	EMD	SD75M
.....	9200-9298	9200-9298	EMD	SD60M
.....	9400-9716	9400-9716	EMD	SD70MAC
.....	.....	9717-9839	EMD	SD70MAC
EMD9000-EMD9099			EMD	SD60

4. Temperature below 0 degrees F, locomotives must be isolated in Winter/Isolate position. Locomotives not equipped with Winter/Isolate position must not be isolated for fuel conservation.

106.1.7 Locomotive Shut Down Policy

At ALL points, when locomotive(s) will not be utilized within one hour, all locomotives 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.

Exceptions:

1. When a locomotive will not be used within one hour and is left attached to a train, the lead locomotive will be left idling, with the engine isolated and the remainder of the consist will be shut down.. This is done in order for the brake pipe to remain charged.
2. Do not shut down locomotives equipped with Smart Start except to perform maintenance or unless Smart Start is defective. These units can be identified by Smart Start labels, instructions and warnings displayed in the cab of the locomotives. Warning labels are also placed on the outside of the locomotive at the start station and at other maintenance points. A green Smart Start enabled light is positioned on the engineers control stand. Small warning horns sound inside the cab and outside the locomotive before an automatic shut down or restart occurs. Smart Start equipped locomotives will automatically shut down when conditions permit. These units will also automatically restart when conditions require a startup. This requires the locomotive to be conditioned as a running locomotive.

106.1.8 Shut Down Procedures

A. Shut down locomotives left standing as follows:

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.
4. Turn off all switches and circuit breakers on the control stand and engine control panel to conserve battery life.

   Exception: The following switches must be left on or closed:

   a. Auto water drain on all engines equipped.
   b. Auxiliary turbo lube oil pump circuit breaker on EMD turbocharged engines.
   c. Computer control circuit breaker if equipped.
   d. Open battery knife switch on the following locomotives:
      1. All GE locomotives
      2. EMD—GP50, GP60, SD60, SD70, and SD75

B. Shut down locomotives in consist (entrained) as follows:

When locomotives are shut down in consist, such as light engines and excess power in a train, in order to maintain event recorder and train lined electrical functions, the following switches and circuits must be on or closed, in addition to those above:

1. Battery knife switch
2. Control circuit breaker
3. Local control circuit breaker

Note: Distributed power remote consists must not be shut down for fuel conservation.

106.1.9 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.

106.2 Winterization of Locomotives

When temperature is below freezing or expected to drop below freezing, the following precautions must be followed to prevent locomotive freezing.

106.2.1 Locomotives Set Out for Service and/or Left Unattended

1. Secure locomotive per existing instructions.
2. 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.

106.2.2 Locomotives Set Out Due to Defects

1. Secure locomotive per existing instructions.
2. 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 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.

106.2.3 Locomotives Developing Enroute 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. Locomotive cannot be placed in Winter/Isolate position or Run 3—No Load.

Note: Contact Mechanical Help Desk and advise of action taken.

106.2.4 Locomotive Fuel Level Reporting

During winter operations, 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.

107.0 Distributed Power Operation

Chapter 107 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.

107.1 Introduction

There are two distinct distributed power remote control operating systems:

- Locotrol III system, which is referred to as DP.
- Locotrol LSI system, which is referred to as 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. BNSF DP and IDP systems are interoperable. Note: BNSF distributed power equipment is not interoperable with other railroad"s distributed power equipment.

Distributed power systems provide synchronous and independent control of one to four remote consists (DP) or six 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 trainlines for multiple unit service to the lead and remote unit(s) are called "trail locomotives."

107.2 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 102.2 (Locomotive Daily Inspection).
- Locomotive brakes—see Rule 102.4 (Locomotive Air Brake Test). Secure consists to prevent movement during conditioning.

Note: Link units after placing them in the train. (Units may be linked on service track to test equipment but must be unlinked before being placed in the train.) Ensure that the brake pipe is connected and open between the consists.

As outlined above, consider remote locomotives to have the same inspection date as the lead locomotive when determining if inspection is required. Any information concerning a change in locomotives en route with a different inspection date than at point where distributed power was initially made up should be left on lead locomotive.

107.2.1 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 DP systems. Complete the applicable procedures for the system equipped on each locomotive.

107.2.2 Conditioning Remote IDP Unit

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

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

A. Switch and Handle Positions

"Data radio" circuit breaker ..... ON **Note:** On GE Locotrol IFC locomotives, the Distributed Power and TIM 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

Reverser ..... Centered (handle removed)

Throttle handle ..... Idle

Automatic brake handle ..... Continuous Service

Independent brake handle ..... Fully applied (at this time)

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. 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.
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.

107.2.3 Conditioning Remote DP Unit

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

Condition the controlling remote DP 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

Independent brake handle ..... Fully applied (at this time)

B. DP Setup Procedure

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

1. Set the thumb wheels to the lead DP (or IDP) unit number.
2. Set the LEAD/REMOTE switch to REMOTE.
3. Set the SAME/OPPOSITE switch to the position that the remote DP unit is facing compared to the lead DP (or IDP) unit.
4. Turn ON the three circuit breakers labeled ELEC, RELAY, and RADIO.

At the engine control panel:

5. Turn the distributed power circuit breaker ON.

At the control stand:

6. Place the independent brake handle in RELEASE.
7. Verify that the air brake message block reads DIST PWR REMOTE.
8. Do not attempt to reset the PCS.

This unit is now set up as a remote unit.

107.6.1 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. Return Consist in Other Mode to NORMAL

Note: See Rule 107.6.5 for instructions to return to NORMAL from the SET OUT mode.

If one of the other remote modes has been selected for a consist, return it to NORMAL as follows:

1. Select NORMAL from the remote display.

Note: Units in the STOP mode should 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.

B. Cut in Automatic Brake Valve

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.

107.6.2 Remote Mode IDLE

Use the IDLE mode under these conditions:

- The remote consist's tractive and dynamic brake functions are not needed.
- Locomotive(s) must be isolated for fuel conservation.
- A unit in the consist may be causing a fault.

The IDLE mode allows the consist to use all air brake functions.

Note: You may change the mode while the train is moving or stopped.

107.6.3 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 107.5.2B. If a consist is operated in the remote BV OUT mode, the consist will not continue to operate in power or dynamic brake in an override condition during a communication interruption of 45 seconds or more (see Rule 107.8.2).

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: You may change the mode while the train is moving or stopped.

107.6.4 Remote Mode ISOLATE

A remote consist changes to ISOLATE when a communication loss idle down has occurred (see Rule 107.8.2A).

Note: You may change the mode while the train is moving or stopped.

107.6.5 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. 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.
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 Recoupling Train

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

1. Recouple and secure the train.
2. Do not open the angle cock to recharge the rear portion of the train at this time.
3. Place automatic brake valve in CONTINUOUS SERVICE position and allow brake pipe pressure to exhaust to near zero psi before cutting in the air. (Change reference cards for DP and IDP accordingly.)
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 recoupled.
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).

107.6.6 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.

A. Return Remote Consist to NORMAL

1. Select the remote consist to be restarted.
2. Select NORMAL and then EXECUTE.
3. Restart each unit in the remote consist. Restarting cannot be done remotely.

107.7 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.

107.7.1 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 ICE 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 relinked, end distributed power operation as follows:

   a. Select the DP MAIN MENU key.

   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.

107.7.2 Unlinking DP Lead Unit from Remote Consist(s)

To unlink a DP 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.

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

107.7.3 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.

107.7.4 Ending Distributed Power on Remote DP Units

End distributed power on each remote DP 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.

107.8 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.

107.8.1 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 DP 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.

107.8.2 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 10-psi brake pipe reduction or 10-psi greater reduction (if brakes were already applied before the communication interruption occurred) is necessary as a signal to the remote(s).

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 be re-established.

Note: The remote brake valve must be cut in and charging at the time of and during the communication interruption to allow the remote consist to operate in override.

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:

1. Try to check with the lead unit via radio.
2. 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.
3. 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.

Note: UP and KCS distributed power remote locomotives will initiate an emergency application of the train brakes if a RELEASE of the brakes is attempted during a communication interruption. To prevent this emergency application, an additional 10 psi or greater brake pipe reduction must be made before releasing the train brakes.

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 107.6.1. This will restore the throttle and dynamic brake functions.
2. Cut in the automatic brake valve as outlined in Rule 107.6.3.

107.8.3 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 101.29.1 is applied (while using a remote DP/IDP unit in the rear one-third of the train without a two-way ETD), a communication interruption that exceeds 5 minutes should be considered an enroute failure.

107.8.4 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 107.7.)
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 102.4.1, Item A, Independent Brakes, steps 1 and 2 and Item B, Automatic Brakes, steps 1 through 5, 14 and 15.

Note: The air brake test can be performed by the engineer 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 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.

107.8.5 Handling Remote Consist(s) by Another Train or Engine

The IDP and 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.

107.8.6 Restarting Diesel Engine of Lead or Remote Unit

Do not attempt to restart or crank a lead or remote 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).

107.8.7 Alarm Warning from a Remote Unit

When an alarm indication is received from a remote unit, train must be stopped and alarm condition investigated. The alarm light is triggered by the trainlined alarm bell from that consist. The defect may be on any unit in that consist.

Note: 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.

107.9 Using Remote DP/IDP Unit as ETD

BNSF remotely controlled equipment may be used as a two-way ETD when a remote unit is placed in the rear one-third of the train.

107.9.1 Providing Alternative Marker

When a remote DP/IDP 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 enroute, comply with GCOR Rule 5.10.2.

107.9.2 Comparing Brake Pipe Pressure Readings

Compare the pressure readings of the brake pipe pressure displayed on the remote DP/IDP unit at the rear of the train and the remote brake pipe pressure displayed on the distributed power console. If the pressure differs by more than 3 psi, do not use the pressure reading at the distributed power console to determine pressure at the rear of a train during air brake testing.

107.10 Train Handling

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). Use the instructions in Rule 107.10.4.

The train handling rules in Rules 107.10.1 through 107.10.6 can be applied to both types of equipment (IDP/DP) 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.

107.10.1 Operating Remote Units in Front Group

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, use independent control for train handling.

107.10.2 Operating Remote Units in Independent Control

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.

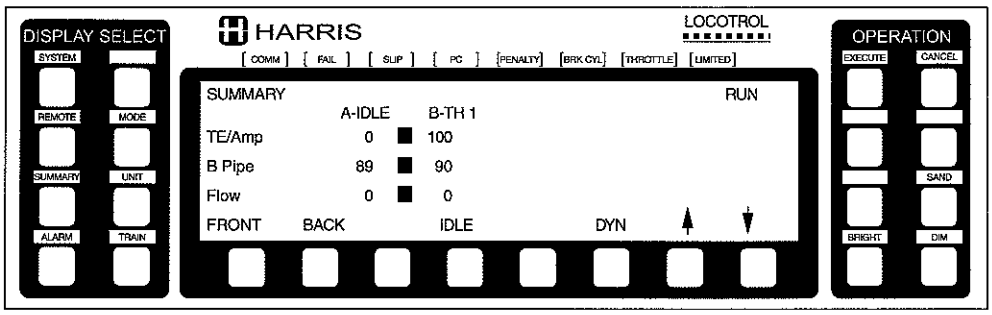
If a train is operating on undulating terrain, improve the train handling or slack action by operating the remote consist(s) at a power setting different from the front portion of the train (called independent control).

Operate in independent control by moving the remote consist(s) into the back group and providing independent control of the throttle or dynamic braking as follows:

1. 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. (See Figure 107A.)

Figure 107A. DP Console (Summary Display) Shown With Remote Consist in Back Group Throttle 1



a. 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.

b. 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.

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108.0 End-of-Train Telemetry Device (ETD)

108.1 Overview of End-of-Train Telemetry Device

An end-of-train telemetry device transmits data concerning train functions to the locomotive cab. This data informs the engineer of any operating problems that require corrections. This chapter is written with references to the most common 2-Way End-of-Train Telemetry equipment found on BNSF locomotives. On BNSF and foreign locomotives with electronic displays for End-of-Train Telemetry Devices, follow the prompts on ETD set up display to perform the steps outlined in this chapter.

108.1.1 Telemetry Components

End-of-train telemetry devices are a second-generation 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.

108.1.2 Telemetry Functions

Two-way end-of-train devices perform all basic functions of one-way end-of-train devices and, in addition, can initiate ETD emergency braking. This emergency braking function requires a front-to-rear radio channel and the usual rear-to-front channel. Radio transmitters at both the locomotive and the last car perform this function.

End-of-Train Device—The ETD transmits last car data approximately every 55 seconds.

Head-of-Train Device—The HTD functions as follows:

- It automatically polls the ETD every 10 minutes by sending a request for status update. This polling verifies that the communications link is working properly.
- It has an internal audio alarm that alerts the engineer of an important change in status.
- In conjunction with the ETD, it provides train crews with status updates and functional capabilities including:
  - Distance measurement referenced to locomotive movement.
  - Last car brake pipe pressure monitoring.
  - Last car low pressure alarm.
  - Last car motion status (moving or stopped).
  - Marker light status (on or off).
  - Battery status.
  - Loss of communications alarms.
  - Automatic and manual communications test.
  - Rear-of-train emergency braking.

108.2 ETD Unit

The ETD is installed on the trailing coupler of the last car. Do not use any ETD that has a calibration sticker that indicates that more than one year has passed since the last calibration. Correct installation, a functioning battery, proper ID coding, and an operational check enable the unit to communicate with the HTD and give status on brake pipe pressure, marker light operation, and emergency braking. Refer to safety rule requiring communication prior to installing or removing marker. ETD units must be calibrated every year. Do not use any ETD that does not have a calibration sticker that indicates that more than one year has passed since last calibration. (Requirement also referenced in Rule 101.29.1, Item 1.)

108.2.1 Mechanical Installation

To install the ETD on the trailing coupler of the last car:

1. On the trailing end of the last car, close the angle cock.
2. Install the ETD onto the coupler as follows:
   a. Unscrew the handle on the ETD until the hook lies flat.
   b. Insert the hook into the top coupler coring hole.
   c. Turn the handle clockwise until the hook is upright and pulls the ETD firmly against the coupler.
   d. Secure the bottom of the V-jaw on the coring hole rib, then hand-tighten the handle.
3. Secure the ETD in place by aligning the handle with the lock hole. Apply locking clip, if equipped.
4. Connect the air hose to the brake pipe and open the angle cock slowly.
5. Press the TEST button to check that the ETD is operational. (See Rule 108.2.3.)

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

108.2.2 Correct ETD ID Code Number

Once the ETD is installed properly, make sure its ID code number matches the ID code thumb wheel switch on the HTD. If you set an incorrect ID code, the HTD will reject all messages from the ETD and the ETD will not receive messages from the HTD. Also see Rule 108.3.3 (HTD Code Selection/Input).

108.2.3 ETD Operational Check

To check the operation of the ETD:

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

        Note: The number will be between 0 and 100 and represents the percent of battery charge used. A "100" means that all battery charge has been used. *A fully charged battery must be used when an ETD is applied to the train. The battery charge must be determined by pushing the battery test button and reading the charge condition in the readout window. A fully charged battery will read C 0 to C 10. ETD batteries must not be placed in charger when the date on the test sticker is more than 60 days old.*
      - Brake pipe air pressure P XXX.

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

   b. Make sure the display on the HTD illuminates and the alarm sounds if the HTD has been armed prior to the ETD being tested.

      Note: If the HTD has not been armed prior to the ETD being tested, the ETD will display the ARM NOW message on the HTD. Some foreign HTD/ETD systems are self-arming when telemetry is established.
2. During the daylight, make sure the marker light functions by:
   a. Ensuring that the marker light comes on for 30 seconds when the ETD TEST button is pressed.

      OR

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

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

108.2.4 Automatic Power Off

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

108.2.5 Battery Replacement

The battery may be replaced with the ETD installed on the coupler on most ETD types.

Replace the battery in the ETD as follows:

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

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

When either of the above situations occur, the HTD will:

1. Sound an alarm for 5 seconds.
2. Display the FR NOCOM alarm message on the message display window. The FR NOCOM message will remain until front-to-rear communications are restored or a higher priority message overrides the alarm message. The FR NOCOM message will be removed if a confirming message is received after:
   - The COMMUNICATIONS TEST/ARM button is operated.
   - A response is received to an automatic communications poll which the HTD initiated.

E. Replace Battery

See Rule 108.3.1D (Battery Status Displays Dead Battery).

F. Pressure Display

See Rule 108.3.1B (Pressure Display).

108.3.3 HTD Code Selection/Input

The ETD operates effectively if the ETD and HTD are communicating. To achieve a communication link, set the correct ID codes.

A. Controlling Locomotive

To make sure the HTD communicates with the correct ETD, set the HTD ID code thumb wheel switches to match the ID code of the selected ETD. As a result:

- The HTD will accept messages only from the selected ETD.
- When the HTD transmits messages to the ETD, only the selected ETD will respond.

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

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

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

B. Trailing Locomotive

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

108.3.4 HTD Operational Check

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

A. Manual Test

To manually test the HTD:

1. Make sure the ETD is installed correctly and connected to the brake pipe. (See Rule 108.2.1 [Mechanical Installation].)
2. Set the HTD ID code thumb wheel switches to match the ID code of the ETD being used for testing. (See Rule 108.3.3A.)
3. Press and release the DISPLAY TEST button on the HTD.

   Note: If all LED indicators and displays light up, the display test is successful.
4. Test the front-to-rear and rear-to-front radio links by pressing the COMMUNICATIONS TEST/ARM button on the HTD. Make sure COM TEST appears in the message display window.

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

B. Automatic Test

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

During the test:

1. If an ETD reply is not received within a designated time period, the HTD sends another request 15 seconds later.
2. If the ETD does not respond to this retry, the HTD sends another request 6 minutes later.
3. If the ETD does not respond to this request, the HTD sends a final transmission 15 seconds later.
4. If the ETD does not respond to this final transmission, an FR NOCOM alarm message appears in the message display window accompanied by an audio warning alarm.

108.4 Rear Car Emergency Braking

Rear car emergency braking is a key feature of the ETD. Arming the HTD activates the emergency braking function for a specific ETD.

108.4.1 Arming the HTD

Two people are needed to arm the HTD:

- One is needed at the HTD on the controlling locomotive of the train.
- One is needed at the ETD on the last car of the train.

To arm the HTD:

1. Set the HTD ID code thumb wheel switches to the ID code of the ETD on the last car.
2. Press the TEST button on the ETD, which will display the ARM NOW message on the message display window of the HTD.
3. 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.

Note: If NOT ARMD appears on the HTD message display, the system did not accept the arming sequence. Repeat steps 1 through 3 above. Some foreign HTD/ETD systems are self-arming when telemetry is established and are so indicated by a "*" displayed on the HTD.

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

A. Making an Emergency Brake Application

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

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

   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.

108.4.2 Disarming the HTD

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

1. Set the HTD ID code thumb wheel switches to 00000.
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 an HTD are to be separated such as when reaching the train's final terminal or when changing either an ETD or HTD enroute, the HTD must be disarmed as outlined above.

Note: 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:

1. 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,
2. If last ETD identifying number is not known, HTD may be disarmed by entering a valid new ETD number and arming as outlined in rule 108.4.1 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.