

Buff Force: compressive coupler force that occurs during a slack bunched condition. (Buff forces can bump you)

Train crews must have a copy of and be familiar with:

- General Code of Operating Rules (GCOR)
- HAZMAT materials
- Air Brake and Train Handling (ABTH) book
- Timetable and Special Instructions

Must also be familiar with General Orders and Circulars but are not required to have a copy with them

Crews must inform the dispatcher after they've been on duty for 9 hrs, and it looks as though the train will not reach it's destination prior to the expiration of the Hours of Service Law (HSL).

If an employee is called to go to work before HSL off duty time has expired, the employee must notify the person making the call of this.

Must not exceed the HSL without proper authority, however employees must not leave trains, engines, or cars on the main track without protection. Trains must be secured properly (if possible) before exceeding HSL Employees are then relieved of all duties.

It is possible to return to work after only having had 4 hrs off duty time. The crew can then continue working the remainder of the 12 hrs left from their previous time on duty.

During an air brake test, the engineer must not apply or release the air brakes, or move the train without receiving a signal to do so.

A leakage test that allows a 5 psi (or less) loss within 60 seconds is considered *passed*.

During a **class I** air test 100 % of the car air brakes must work. If a car's air brakes fail enroute, no less than 85% of the train's remaining air brakes must work properly.

Class III air test is the setting and releasing of the brakes on the rear car, and this test is required when ever the brake pipe has been broken.

Charge the brake pipe to within 15 psi of the regulating valve setting (75 psi)

Make a 20 psi automatic brake valve reduction

Observe a 5 psi drop, on the rear (use of an EOT is OK)

Observe a 5 psi increase on the rear after the automatic brake valve is moved to the release position

Pressure is restored to the rear

When picking up pre-tested cars a **class III** air test must be performed after the train has been put back together and the brake pipe has been restored.

When picking up not pre-tested cars a **class I** air test is required on the cars that are being picked up, and then a **class III** air test is required after the train is put back together and the brake pipe has been restored.

(If a **class I** air test is performed on the cars picked up after the cars have been added to the train, then a **class III** is not required, as the brakes on the rear car can be seen to apply and release by observing the EOT.

A minimum reduction consists of a 6-8 psi reduction in the brake pipe, resulting in 10-12 psi of brake cylinder pressure. It is the first step in a split reduction and allows for a quick light setting of the brakes on each car (takes advantage of Preliminary Quick Service).

Low dynamic brake settings along with a minimum reduction of the brake pipe can be used to help distribute buff forces and control train speed. Dynamic braking is the primary means of slowing a train.

Pull ½ of the train over a hill, attempting to maintain a constant speed by throttle modulation. At the top of the hills reduce throttle position by at least one position to reduce in train draft forces.

Class **C** couplers and draft gear have a breaking strength of 250,000 lbs.

Class **E** couplers and draft gear have a breaking strength of 390,000 lbs.

A running release of the air brakes should not be attempted unless the brakes can be fully released below:
10 MPH on trains having less than 120 cars.
15 MPH on trains having more than 120 cars.

When an undesired emergency application of the air brakes occurs, a leakage test must be done, even if the air pressure on the rear of the train is restored. This is done by making a 20 psi reduction, and after the air has stopped exhausting, cut out the automatic air brake valve. If the air pressure stabilizes (actually air pressure does not matter) the test is considered *passed*, if the air pressure rapidly drops to zero, the test is considered *failed*, and the train must be inspected.

Tractive Effort is the pulling force extended by a locomotive on a track to move a train.

Slack Action: The movement of a portion of the train at a speed different than another portion of the train.

Running Release: the release of the automatic brake application while the train is still moving.

Stretch/ Power Braking: The slowing, controlling, or stopping of the forward movement of a train by application of the automatic brakes while the locomotive is working in power (run 1 through run 4). This tends to keep the slack in a stretched condition.

Slack: The play between cars

Free slack: mechanical free motion between adjoining couplers which can run in or run out without compressing the draft gear springs, can be as much as 1 inch per car.

Spring Slack: the additional amount of slack that can occur when springs and draft gear are compressed, could be up to 5 inches per car.

Locomotives are not to be left in a run position opposite the direction of movement (to hold on a hill with throttle) to prevent track damage and traction motor stall burns.

Lateral versus vertical force ratios are the relationship between the weight of the locomotives and cars pushing down on the rail (vertical) and the force of the wheel flange pushing out on the rail (lateral)

When the lateral forces exceed the vertical forces, the wheels will climb over the rail, spread the rail, or even roll the rail over.

Throttle Modulation: adjusting the throttle one notch at a time to control train speed, and in train forces without applying the air brakes.

Draft Force: the pulling forces (tension) on couplers and draft gear during a slack stretched condition.

Electric switch locks must not be unlocked without the proper authority.

Authority to enter CTC limits can be given by:

Verbally

Authority to pass signal displaying stop

Track and Time

A correctly addressed track bulletin and a controlled signal displaying a proceed indication.

Clearing through a hand operated switch, not equipped with an electric switch lock.

- 1) speed limit must be less than 20 MPH on the main track, or on a siding equipped with an intermediate signal.
- 2) speed limit must be less than 30 MPH on a siding track that is not equipped with an intermediate signal.
- 3) A signal governs movement to a track where CTC is in effect.
- 4) The hand operated switch is left open.

While working in track and time, restricted speed applies when it is joint, and track speed on signal indication applies when not joint.

Must be given authority to enter track and time limits on either end.

DTC is given from control point sign to control point sign, and it extends from the first named point to the last named point.

If the exact location of the rear of the train is unknown, the second control point to the rear of the train will be used.

If told to use the siding at the last named point, authority will extend to, and include the switch to be used.

Working time is given between two control points, and can be used in either direction.

Restricted speed if joint

Maximum authorized speed if not joint.

Working time remains in effect until voided

DTC remains in effect until the crew reports clear of the limits, or it has been voided.

DTC authority can be given for *The exclusive purpose of exchanging engines*, and if the identifying engine is set out the dispatcher will:

Void current authority

Re-identify

Issue new authority

Approach Signal displays a yellow aspect, and indicates a train must immediately slow to 35 MPH, being prepared to stop at the next signal.

Medium Approach Signal displays a flashing yellow aspect, and indicates a train must slow to 35 MPH before passing the next signal.

Locomotive daily inspection is due each calendar day (0001-2359 hrs). Forms 1055 (green card) and 1277 (locomotive daily inspection report) must be filled out for each engine inspected.

Locomotive daily inspection will include:

A cab inspection

A walkway & start/ stop station inspection

A ground inspection

A standing locomotive air brake test will also be required.

When changing from power (throttle notches 1-8) to dynamic brake, pause 10 seconds before going to dynamic brake set-up to allow traction motor current to stabilize.

All coupling should be made at a speed that does not exceed 4 MPH.

If a train experiences an undesired emergency application of the breaks and/ or severe slack action is experienced while stopping near adjacent tracks the crew will immediately warn other trains of the possibility of their track being fouled by derailed (or otherwise misaligned) cars or engines. They will also provide flag protection (where required), notify the train dispatcher, and inspect their train.

Main track switches may only be left open within CTC limits when track and time is in effect, or if a crew member is left at the switch, or if the dispatcher has given permission to leave the switch in “other than normal” position.

When trailing through a spring switch and stop, be sure to control the slack, and do not back up until the switch is lined for the proper route.

When approaching a switch that is not lined for the intended route, movement must stop clear of the adjacent track, and not continue until the switch is lined for the intended route.

If a switch is run through, continue movement through the switch until clear. Do not change direction until the switch has been either repaired or spiked (protected).

No part of a car or engine may pass a signal requiring stop. If you go by the stop signal you must immediately warn other trains via radio, provide flag protection (where required), and notify the dispatcher.

When operating within CTC limits, a signal may be acted upon when it's aspect can clearly be seen, when not running at restricted speed (normal requirements for restricted speed apply when running on restricted speed).

Delayed in a Block (Rule 9.9) Within CTC limits... proceed prepared to stop at the next signal, maximum authorized speed, provided you're able to stop before passing a signal displaying stop at the next signal. Within ABS limits trains may act upon a proceed signal as soon as the signal's aspect can be clearly seen, and the track ahead is seen to be clear. A train is considered delayed in the block when it's speed drops below 10 MPH.

When approaching an automatic interlocking and speed drops below 25 MPH, a train must proceed prepared to stop short of the interlocking signal until reaching a point approximately 1000 feet from the signal.

When entering the main track between signals within CTC limits or if the aspect of the last signal is not known, movement must be made at restricted speed until the leading wheels reach a point where restricted speed is no longer required, or the end of the block system.

Restricted Speed!

When encountering a stop signal at a manual interlocking the control operator must be contacted.

Be governed by the instructions in the release box at an automatic interlocking.

When entering the main line in ABS, you're not required to wait 5 minutes to establish protection when

Your own train occupies the block on the main line.

A train can be seen moving away from you on the main line

When working time has been established.

If the control operator cannot operate a dual control switch, he must give permission to operate the switch *in hand throw position*.

before passing the fusee. If not running at restricted speed the train must stop if consistent with good train handling. After the fusee burns out, or after 10 minutes if the fusee is not visible, proceed at restricted speed until the head end is 1 mile beyond the fusee. If beyond the first rail of an adjacent track fusee does not apply.

Dim the headlight at stations or yards where switching is being done, when stopped close behind another train, when stopped on the main track waiting for an approaching train, when approaching and passing the head end of a train at night, at other times to permit passing of hand signals or when safety of employees requires, or when left unattended on the main track in non-sigaled territory.

Turn off headlight when stopped clear of the main track, at the radio request of an approaching train within a block system limits, or when the train is left unattended on the main track in block system limits.

Blue Signals: A blue signal (light) signifies that workmen are on, under, or between rolling equipment. A blue signal cannot be passed, cars or equipment protected by a blue signal cannot be coupled to or moved until the blue signal is removed, and the blue signal cannot be removed by anyone except an employee of the class that placed the blue signal.

Dark or improperly displayed signals must be regarded as displaying the most restrictive indication that they are capable of displaying.

You must receive a track bulletin before moving on the main line.

If you must change direction within the limits of a manual interlocking, you must first receive permission from the dispatcher. The outer opposing signals of a siding (within CTC) are considered a manual interlocking.

If at least one car continuously occupies one car length within the limits of an automatic interlocking, you may change direction without permission.

The speed limit within yard limits is restricted speed, unless operating on a signal more favorable than approach.

Must stop 50 feet short of a gated crossing.

A train may back up on any main track where CTC is in effect to pick up a crew member. Restricted Speed does not apply, and signals displaying stop and proceed may be passed without stopping. A *back up pick up move* may be made when the following conditions have been met:

- 1) dispatcher has given permission
- 2) movement is limited to the train's authority
- 3) movement will not foul any crossing
- 4) movement will not be made into or within yard limits, restricted limits, interlocking limits, drawbridges, railroad crossings at grade, or a Form B
- 5) movement does not exceed the train's length.

At meeting points, trains must stop 400 feet short of the clearance point, when train length permits.

At train meeting locations in DTC territory where the train that is being met will travel over the facing points of a switch, a crew member will go and line the switch for the other trains movement, and inspect the switch points.

Public and private road crossings should not be blocked for longer than 10 minutes. When cutting a road crossing allow at least 300 feet on either side of the road crossing.

Electric Switch Lock: An electrically controlled lock that restricts the use of a hand operated switch or derail.

Signal aspect: The appearance of a fixed or cab signal. (what color it is)

Signal indication: The action required by the signal.

Timetable: A publication with instructions on train, engine, or equipment movement. It also contains other essential information.

Yard Limits: A portion of main track designated by yard limit signs and timetable special instructions or a track bulletin.

When using the radio, listen long enough to ensure that the channel is not in use, and ignore any instructions or signals that were not completely understood. If given a signal via the radio to back up, it must specify a distance and direction, and movement must stop within half that distance unless another signal was given. Cannot relay the name, position, aspect, or indication displayed by a fixed signal to anyone who is not on your crew via the radio except when the information is needed to warn of an emergency. All radios must be tested to verify that they are in proper working condition as soon as possible after coming on duty.

Anyone operating the controls of a moving engine may not copy *mandatory directives* (DTC authority, Track and time, work and time, radio speed restrictions, etc).

When a new timetable comes into effect it will replace the old one. A notice stating that a new timetable will be in effect will be placed on the track bulletin 24 hrs before it takes effect, and will remain on the track bulletin for 6 days after it takes effect.

Track Bulletins can replace General Orders which can replace Special instructions which can replace the general code of operating rules (GCOR). Any rules that have a conflict are replaced by the next level of instruction.

Timetable characters indicate special conditions and can be found in the station column.

During shoving movements if a sudden loss of communications occurs, or if the light disappears all movement must stop.

Yellow flags warn of temporary speed restrictions, and are placed 2 miles before the restriction. The specified speed of the restriction must not be exceeded until the rear of the train clears the limits of the restriction. If multiple speed restrictions are in effect, a yellow flag is used for each restriction, and at the end of the last a single green flag is used to indicate the end of the restrictions. Temporary speed restrictions are listed in the Form A section of the track bulletin.

If a yellow flag is encountered that is not listed on the track bulletin (not specified in writing) the train must be at 10 MPH 2 miles from where the yellow flag was encountered. This speed must be

Maintained until the rear of the train has traveled 4 miles from the yellow flag AND the dispatcher has verified that there is not a temporary speed restriction in effect or until the rear of the train has passed a green flag

Flags that are placed less than 2 miles before the restriction will be listed on the Track bulletin Form A in the "flag's at " column.

If an unattended fusee is encountered while traveling at restricted speed the train or engine must stop

A locomotive engineer can become decertified for any of the following offenses:

- 1) Speeding in excess of 10 MPH of the speed limit.
- 2) An improper brake test
- 3) Passing a stop signal
- 4) Tampering with safety devices
- 5) Occupying the main track without authority

Federal Minimum Desertification standards:

- 1st offense one month suspension
- 2nd offense 6 month suspension
- 3rd offense 1 year suspension

Absolute Block: a length of track that no train or engine may enter while occupied by another train.

Absolute Signal: a block or signal without a number plate

Automatic Block System (ABS): A system of signals that react to track conditions. A proceed indication in ABS does not constitute authority to occupy the track. Must have other authority (i.e. yard limits, DTC, etc).

Block: A length of track, between consecutive block signals, or between block signals and the end of the block system limits.

Block Signal: A fixed signal at the entrance of a block that governs trains entering and using that block.

Block System: A block or a series of consecutive blocks within ABS, ACS, CTC, or interlocking limits.

Centralized Traffic Control (CTC): A block system that uses block signal indications to authorize train movements.

Fixed Signal: A signal that is fixed to a location permanently, and that indicates a condition affecting train movement.

Interlocking: Signal appliances that are interconnected so that each of their movements follow the other in a proper sequence. Interlocking may be operated manually or automatically.

Interlocking limits: The tracks between outer opposing absolute signals at an interlocking.

Interlocking signals: The fixed signals of an interlocking that govern trains using interlocking limits.

Main Track: A track extending through yards and between stations that must not be occupied without authority or protection.

Controlled Siding: A siding within CTC or interlocking limits where a signal indication authorizes the siding's use.

Controlled signal: An absolute signal controlled by a control operator.

Proceed indication: Any block signal indication that allows a train to proceed without stopping.

Reverse movement: A movement made opposite the authorized direction. Always made at restricted speed.

the main generator, and the end that has the water pumps and governor on it. The governor serves to regulate the engine RPMs, and as a protection device.

Most of the newer EMD locomotives will need to have all of the circuit breakers in the black area up to function properly.

Excess fuel is used to help cool and lubricate the injector parts.

Fuel in the *return* sight glass is an indication of clogged filter elements.

The pressure must first be relieved from the cooling system before filling.

If a locomotive is overheating, check the water level, water temperature, proper operation of the shutters, and proper operation of the electric cooling fans.

The turbocharger lube oil pump will operate for the first 30 minutes after an engine is started, and continue operating for 30 minutes after the engine is shut down.

Low lube oil button is built into the governor, and is connected to the engine oil system. It will trip if low water, hot oil, low oil, or crankcase over pressure is sensed.

Crankcase over pressure button senses a build up of gases within the crankcase. If this button trips, immediately leave the area, warn others, and do not approach the engine room for 2 hrs. NEVER reset.

When attempting to start an engine, do not crank for longer than 20 seconds. If the engine fails to start, wait 2 minutes to allow the starter motor time to cool before attempting to start the engine again..

The engine over speed is located on the right front side of the engine behind the governor. The 1 o'clock position indicates that it's been tripped. The over speed protects the engine from too high RPMs.

The engine oil should be checked with the engine at normal operating temperature, and at idle.

The engine cooling system is pressurized to 7 psi to increase the boiling temperature of the coolant. The ETS is activated at 215 degrees F.

Normal oil pressure at idle is 15-40 psi and in run 8 normal oil pressure is 50-100 psi.

The federal regulations concerning locomotive engineer certification can be found in 49 CFR part 240.

Student Engineers (SE) may operate locomotives, with or without cars attached, under the supervision of a certified locomotive engineer.

Train Service Engineers (TSE) may operate locomotives with or without cars attached, during all situations. Locomotive engineers must demonstrate knowledge of the operating rules, and skills to operate the locomotive. Engineers are certified for 36 months, and must be evaluated annually on their understanding of the operating rules and train handling skills. Prior to being certified (or being decertified) as a locomotive engineer and evaluation of the driving record for the past 36 months for convictions for drivers' license revocation for DUI/ DWI or refusal to submit to a DUI/ DWI test as well as hearing and vision acuity tests..

A locomotive engineer must upon request produce his certification card to a company official or FRA inspector. The certification card must be kept in his possession whenever operating a locomotive. If the card becomes lost, stolen, or mutilated he must immediately make a report to his immediate supervisor (MOP) and the administrator of engineer certification records.

An emergency brake application causes the brake cylinder, emergency reservoir, and the auxiliary reservoir to all have 77 lbs of pressure.

Accelerated emergency release uses air from both the emergency and auxiliary reservoirs to charge the brake pipe.

#2 main reservoir air is used to charge the brake pipe, and goes to the automatic brake valve, independent brake valve, J-relay, and the regulating valve.

The regulating valve is to adjust the equalizing reservoir pressure. The brake pipe pressure follows the equalizing reservoir pressure. (sets the pressure to which the brake pipe is charged to).

Left gauge on the control stand has the equalizing reservoir and the main reservoir pressures.

Right gauge on the control stand has the brake cylinder and brake pipe pressures.

Automatic brake valve cut- out valve is used to cut in or cut out the automatic brake valve. This does not disable the ability to initiate an emergency application of the brakes.

MU-2A is used to cut in or cut out the independent brake valve.

Automatic brake valve positions:

- Release
- Minimum reduction
- Service zone
- Full service reduction
- Suppression
- Continuous service
- Emergency

Independent brake valve positions

- Release
- Application zone
- Full application
- Actuate

When the penalty whistle sounds, and a penalty is started, a full service brake application is made, the throttle or dynamic brake is disabled, and the sanders are turned on. A penalty is recovered by moving the automatic brake valve to the suppression position. Suppression is also used to recover from an overspeed.

A-1 cut out pilot valve is located on the locomotive, and is activated by an emergency application of the brakes. (break in two protection).

A train is moving at 40 MPH without the automatic or independent brakes set. What are the pressures in the lines from the outside in.

Independent application and release (IAR)	0 psi
Actuating (ACT)	0 psi
Main Reservoir (MR)	130-140 psi
Brake Pipe (BP)	90 psi

The front end of the diesel engine is the end located to the rear of the locomotive. It is the end opposite

Certification Exam Review

What are the three functions of the control valve? What does each portion do?

- 1) Pipe Bracket
 - attaches the car and connects various piping to the components
 - filters the air with an internal strainer
 - connects the service and emergency valve portions
- 2) Service Portion- allows the emergency & auxiliary reservoirs to charge
 - performs all service braking
- 3) Emergency Portion- senses that the brake pipe air is reduced at greater than a service rate
 - It moves to vent brake pipe air directly to the atmosphere and directs Emergency reservoir air pressure to the brake cylinder.

What are the three components of the air brake system?

- 1) the signal sender (automatic brake valve)
- 2) signal relay (brake pipe)
- 3) signal receiver (control valve)

Air brake system is measured in pounds per square inch (psi) and cubic feet (cuft) (volume/ pressure)

The auxiliary reservoir provides compressed air for all braking.

A 1- 1 ½ lbs reduction in brake pipe pressure is needed for the brakes to apply. This sets the preliminary quick service into action.

An increase of the brake pipe pressure of 1-1 ½ lbs will cause the brakes to begin releasing.

Equalization occurs when the pressures in the auxiliary reservoir and the brake cylinder are equal. This occurs at 64 psi, during a full service brake application where a reduction of 26 lbs is made.

During a service brake application the brakes continue to apply until the auxiliary reservoir pressure is slightly lower than the brake pipe.

During a minimum reduction 6-8 lbs is drawn off the brake pipe, and *due to equipment design* it translates into 10-12 lbs of brake cylinder pressure. This takes advantage of the preliminary quick service feature that allows a quick light setting of brakes throughout the train by locally venting air to the atmosphere at each car.

A true gradient on the brake pipe is the difference between the locomotive reading, and the reading on the rear when the brake pipe is fully charged.

Accelerated service release is activated with at least a 10 lbs brake pipe reduction. It helps prevent sticking brakes, and will release faster by using air from the emergency reservoir and the brake cylinder to help recharge the brake pipe.

Retaining Valve settings and what they do:

- 1) EX (exhaust) exhaust brake cylinder pressure to the atmosphere.
- 2) HP (high pressure) retains 20 lbs of brake cylinder pressure
- 3) SD (slow direct) 86 seconds to exhaust, allowing the brake pipe to recharge Before the brakes are fully released.

Control Valve retarding recharge allows the rear of the train to charge faster than the head end (charging choke).

An emergency application of the brakes allows for 20% more brake cylinder pressure than a full service application with a fully charged brake pipe.