Chicago, Rock Island and Pacific Railroad Company

RULES AND INSTRUCTIONS FOR TRAIN HANDLING AND OPERATION OF AIR BRAKES

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General Manager

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The rules herein govern the operation of air brakes and appliances and must be complied with by all employees whose duties are in any way affected by these rules.

Employees whose duties are governed by any of these rules are subject to examination on those rules pertaining to their duties.

These rules supersede all previous rules and instructions. When properly authorized, these rules may be cancelled, superseded or changed by:

1. General Order.
2. Special instructions in the time table.
3. By inserting additional or revised pages.

Employees must have a copy of these rules in their possession while on duty.

BOOK 1

GENERAL

BOOK 1

GENERAL

AIR BRAKE—Equipment consisting of several components so interconnected as to provide the means of controlling the speed of an engine or train by the use of compressed air.

AB AND ABD VALVES—The operating device used on freight cars for charging, applying and releasing the air brakes according to the varying pressures in the brake pipe.

ALTERNATOR—The alternator supplies electrical power to all the radiator or traction motor cooling fan motors driven by alternating current. (AC) On high horsepower locomotives, the alternator supplies AC power that is rectified to direct current and used for main generator field excitation. The transductor type wheel slip system also uses AC current, supplied by the alternator, for its operation.

ANGLE COCK—A hand operated valve that differs from a cut-out cock in that the valve has an angular shape, and the valve is normally closed when the handle is at right angles to the pipe. This cock usually is employed on brake pipes at each end of the engines and cars. (See diagram book 5.)

AUTOMATIC BRAKE VALVE—A manually operated valve used by the engineer to control the pressure in the equalizing reservoir, which in turn automatically controls the pressure in the brake pipe to an equal amount, for the application and release of engine and train air brakes.

AUTOMATIC DRAIN VALVE—A device which automatically drains condensation from the air reservoirs.

AUTOMATIC SLACK ADJUSTER—The automatic slack adjuster is an optional feature which

may be incorporated in the brake rigging to automatically maintain a constant predetermined brake cylinder piston travel.

AUXILIARY GENERATOR—The auxiliary generator is used for charging for operation of locomotive engine storage batteries and to supply all the low voltage current power when the locomotive is operating.

AIR FLOW INDICATOR—A separate gauge located so as to inform the Engineer that the train brakes are being applied from the caboose or that excessive leakage has developed in the brake pipe.

AUXILIARY RESERVOIR—A storage volume to receive and store air for use in applying a brake on a car or locomotive. In freight car equipment, the auxiliary reservoir and emergency reservoir are combined in one structure.

BRAKE CYLINDER—That portion of the air brake in which the pressure of compressed air is converted into mechanical force for the purpose of applying the brakes.

BRAKE CYLINDER RELEASE VALVE—An appliance interconnected with freight brake equipment permitting manual depletion of brake cylinder pressure on a single car while retaining air pressure in the remainder of the brake system.

BRAKE PIPE—The pipe that runs the length of every engine and car which carries compressed air for the operation of the air brakes.

BRAKE PIPE LEAKAGE—The loss of compressed air from the brake pipe, through all of the brake pipe connections or other causes, measured in terms of pounds per minute reductions.

BRAKE PIPE GRADIENT—A term used to ex-

press the difference between brake pipe pressure indicated on the engine or supply and on the caboose or rear of a train.

BRAKE PIPE PRESSURE—The amount of air pressure expressed in pounds per square inch in the brake pipe.

BRAKE PIPE REDUCTION—A term used to describe a reduction in brake pipe pressure or a loss of pressure which cannot be overcome by the supply.

BRAKE RIGGING—The system of rods, levers, links and pins, by which the mechanical force produced by the brake cylinder is multiplied and converted to braking force at the wheels of an engine or car.

BRAKE VALVE—Any hand-operated valve that is provided for the control of compressed air for the application or release of air brakes.

BRAKE VALVE CUTOUT COCK (DOUBLE HEADING COCK)—The cutout cock provided to "cut in" or "cut out" the functions of the automatic brake valve on each engine.

CHARGING—The term applied to the act of directing compressed air into a pipe or reservoir for the purpose of raising the pressure therein.

CHECK VALVE—A self-closing device so arranged that it permits a free flow of air in one direction while preventing a similar flow in the opposite direction.

COMPRESSOR GOVERNOR—A device to automatically control the air compressor operation.

CONTROLLER OR CONTROL STAND—Contains the operating levers for the locomotive. The throttle lever controls engine speed and/or power

output of the engine. The reverser lever sets up electrical connections to control the direction of locomotive movement.

CONTROL VALVE—The component of a car or locomotive brake that causes the brake to apply and release in response to changes in the pressure of the compressed air in the brake pipe.

CRANKCASE EXHAUSTER—Is a small electric motor and fan mounted on the engine for removing fumes from the crankcase of the engine.

CUTOUT COCK—A hand operated valve provided on a pipe or piece of equipment for the purpose of directing, or preventing, the flow of compressed air. When handle of cock is parallel to pipe, cock is normally closed, but when at right angles to pipe, it is normally open. (See diagram book 5.)

DEAD ENGINE FIXTURE—A device on the locomotive for charging main reservoirs from the brake pipe when the locomotive is dead or the compressor inoperative.

DISTRIBUTING OR CONTROL VALVE—A device on the locomotive which applies and releases the brakes on the locomotive directly or through relay valves, and maintains automatically the pressure in brake cylinders against leakage after brake application.

DUPLEX RELEASE VALVE—An appliance permitting manual reduction or depletion of auxiliary reservoir pressure alone, or auxiliary and emergency reservoir pressure together.

EMERGENCY APPLICATION—A quick heavy reduction in brake pipe pressure which causes the control valves to move to emergency position. Emergency application may be obtained by use of

the automatic brake valve, or will result from the development of any large opening in the brake pipe from any cause.

EMERGENCY BRAKE VALVE—A device placed near the exits or doorways and on the left side of every locomotive and in all cabooses to provide an emergency means of applying the air brakes.

EMERGENCY RESERVOIR—In freight car equipment, a storage volume combined with the auxiliary reservoir to provide air pressure for use in emergency applications and certain recharge features.

EQUALIZING RESERVOIR—The small reservoir connected to an equalizing piston chamber to add volume to the piston chamber for use in making service applications.

FEED VALVE AND/OR PRESSURE REGULATING VALVES. Valves that reduce main reservoir pressure to the pressure desired in the brake pipe, maintaining that pressure automatically while the brake valve handle is in running position.

FINAL REDUCTION—An additional service reduction that is required to set the engine and head train brakes harder at a time too late for this reduction to be effective on the rear portion of the train, thus avoiding a run-out of slack as the stop is completed.

FUEL PUMP MOTOR—The fuel pump motor is a DC motor that drives the fuel pump supplying fuel to the injector pumps or unit injectors, whichever are used.

INDEPENDENT BRAKE VALVE—The brake valve provided for the control of engine air brakes only.

General

INTERCOOLER—A radiating means of cooling compressed air between stages of compression.

LAP—The position of the brake valve, control valves and distributing valves in which all operative parts in these valves are closed to the passage of air.

LOCOMOTIVE—A unit propelled by any form of energy or a combination of such units operated from a single control used in train or yard service.

MAIN GENERATOR—The main generator is directly connected to the diesel engine through a flexible coupling and produces electric power for operation of the traction motors. It is air cooled.

MINIMUM REDUCTION—The first application position on 26-L brake equipment, which provides a small reduction (usually 6 to 8 pounds) in brake pipe pressure, used primarily to condition the train for subsequent brake pipe reductions.

MU-2-A—Conditions 26-L brake equipped locomotives to be used in MU operation.

When two position only, is referred to as a 'double ported cut-out cock.'

QUICK ACTION—The feature whereby the emergency brake pipe reduction is passed rapidly from car to car throughout the train.

QUICK RELEASE PORTION—A portion of the brake equipment which allows the release of the engine brakes when the automatic air brake is being used.

QUICK SERVICE VALVE—A device auxiliary to the control valve that will assist in reducing brake pipe pressure, providing continuous quick service regardless of brake cylinder or displace-

ment reservoir pressure. Each brake pipe reduction will cause the quick service valve to respond.

OVER-CHARGE—A condition in which the brake pipe pressure becomes higher than the setting of the feed valve or pressure regulating valve. Over-charging can lead to sticking brakes.

OVER-REDUCTION—A reduction of brake pipe pressure in excess of a full service reduction. EXCESSIVE OVER REDUCTION CAN RESULT IN LOSS OF ABILITY TO OBTAIN EMERGENCY BRAKE APPLICATION.

PRESSURE MAINTAINING—A feature of the automatic brake valve, on units so equipped, that will automatically maintain the desired brake pipe pressure during service application of the brakes.

RATE OF RETARDATION—Rate of speed reduction over a period of time. If the speed is reduced from 60 MPH to 57 MPH in 1 second, the rate of retardation is 3 MPH per second.

REDUCTION RELAY VALVE—A device consisting of a brake pipe vent valve and a quick service valve mounted on a common pipe bracket and used on freight cars 65 feet or longer.

RELAY VALVES—Valves used on engines or cars which are equipped with a large number of brake cylinders. They relay the application and release operation of the control valve and provide direct flow of main reservoir or supplementary reservoir air to the brake cylinders under control of the control valve.

RESERVOIR—A tank, of various shapes and sizes, used for the storage of compressed air on the engines and cars.

RETAINING VALVE—A hand operated valve

used on cars only, through which the brake cylinder pressure is exhausted. Positioning of the handle determines the amount of brake cylinder pressure that is retained, which in turn, allows for recharge of the braking train system with brakes remaining applied.

ROTAIR VALVE—A registered trademark name for a rotary type valve, used primarily with 24 RL type brake equipment, for the control of engine air brakes.

RUNNING RELEASE—A term applied to the act of releasing an automatic brake service application while the train is in motion.

SAFETY CONTROL—A device which will cause the air brakes to apply whenever the engineer becomes incapacitated.

SAFETY VALVE—A valve set to open at a predetermined pressure. It is used to limit maximum pressure in intercoolers, mechanically operated air compressors, main reservoirs, distributing valves, control valves, triple valves or the brake cyclinders.

SERVICE APPLICATION—A controlled reduction in brake pipe pressure which will automatically apply the air brakes of a train and engine. The application may consist of one or more reductions, with brakes remaining applied, and will constitute full service when the brake cylinder pressure, the brake pipe pressure and the auxiliary reservoir pressure are equal and a further reduction in brake pipe pressure will not result in an increase in brake cylinder pressure.

SLACK—There are two kinds of slack; One is termed "Free Slack" and is the accumulation of clearances and wear in the associated parts of the coupler. The other type of slack is often called

"Spring Slack" and results from the cushioning action of the draft gear.

SPLIT REDUCTION—A service application of the brakes that consists of a small initial reduction followed by subsequent further reductions equaling the total amount desired.

TRACTION MOTOR BLOWER—The traction motor blower is either a mechanically or electrically driven centrifugal blower. Air from the blower is directed to the traction motor or motors through flexible couplings.

TONS PER OPERATIVE BRAKE—The gross tonnage of the train divided by the total number of cars having operative brakes; for example, if the total tonnage of the train equals 6,000 ton, consist equals 100 cars (all with operating brakes) —divide the tons by the number of cars and there is 60 tons per operative brake.

TRACTION MOTOR—The traction motor is used to propel the locomotive. The motors are driven by direct current and are connected to the drive wheels thru a gearing arrangement. These motors are air cooled by a mechanical or electrical driven fan arrangement.

TRACTIVE EFFORT—The amount of force necessary, between the drive wheels and the rail, to move the engine and cars. This force is expressed in pounds and is directly proportional to the traction motor amperage and inversely proportional to the locomotive speed.

VENT VALVE—The name applied to a portion of an air brake valve which responds to emergency reduction of brake pipe pressure and vents the air locally, thereby propagating serially the emergency application throughout the train.

General

YARD AIR—A system of piping and fittings installed between the tracks in such a manner that an air supply can be furnished at convenient locations for charging and making tests on cars previous to the engine becoming available.

PRINCIPLES OF OPERATION

The various air brake systems in use on all cars operate on one basic principle. Each and every car has a volume of compressed air stored in reservoirs, which is used for the release and application of the brakes. These reservoirs are charged with compressed air supplied by the engine. Control valves, operating on a pressure differential arrangement, provide a safe and efficient means for controlling the speed of a train and also provide emergency break-in-two protection to stop the train.

The basic operation is an equalizing compressed air system (with the exception of independent or straight air braking systems) operated by pressure differentials. These differentials can be controlled in part by the operation of the automatic brake valve or by any loss of brake pipe air pressure.

The principle described, as it applies to engines, is outlined as follows: a mechanically driven air compressor provides the compressed air necessary for the operation of the brake system of the entire train. This volume of compressed air is cooled and stored in main reservoirs and is controlled, to a certain extent, by the operation of the compressor governor, which maintains the pressure within specified limits.

Manual operation of the automatic brake valve directs use of this compressed air in such a way as to control the application and release of the brakes of the entire train and also to provide inde-

pendently controlled operation of the engine brakes. The main reservoirs also provide additional air for the operation of other air operated devices and appliances. The specific types of air brake equipment in use at the present time on this railroad will be discussed individually in succeeding chapters.

BRAKE PIPE LEAKAGE

The leakage condition existing in a train affects its performance. The effect of leakage on brake pipe pressure is dependent on the train length and the distribution of leakage within any given train length. When the leakage is evenly distributed through the train, the gradient in brake pipe pressure on a 50 car train is 1 psi, with a 5 psi/min leakage. Doubling the length of the train to 100 cars results in 3 psi gradient, with the same 5 psi/min leakage. A train of 150 cars results in a 7 psi gradient, with the same 5 psi/min leakage. (These figures based on a 70 pound brake pipe.) When the leakage is concentrated in the rear third of the train, the same 5 psi/min leakage results in larger gradients on the given train lengths. Thus, the amount of brake pipe gradient will be greater for a given degree of brake pipe leakage the longer the train. The amount of brake pipe gradient for any specific degree of brake pipe leakage depends upon the location of that leakage. Therefore, when checking trains for leakage, correction of leakage at the rear of the train will produce greater improvement in brake pipe gradient than correction of comparable leakage at the head end of the train.

SERVICE APPLICATIONS

Locomotive brake valves provide the means for the engineman to obtain any desired brake cylin-

der pressure on the train from a minimum pressure of 10 psi to equalization.

It is important to understand that, taken independently, each car will produce a given amount of brake pipe reduction, depending upon the length of brake pipe and the cylinder volume. Hence, a car with short piston travel will produce less brake pipe drop due to quick service activity. Conversely, long piston travel will cause a larger brake pipe reduction for a given length of brake pipe on the car. Also, a car of shorter length brake pipe will produce a larger brake pipe reduction than will one of a longer length for any given piston travel. To apply this knowledge to train operation, using brake equipment with pressure maintaining feature, assume that the engineer made a "Super light" minimum reduction of about 4 psi and quick service was transmitted through the train. Those cars of shorter length will reduce brake pipe pressure locally 5 to 6 psi; the longer cars will reduce brake pipe pressure locally 4 to 5 psi. The brake pipe will ultimately equalize at a pressure throughout its length depending upon the proportion of long and short cars. Again assume the equalized value was 5 psi below initial brake pipe pressure. The brake valve will maintain brake pipe pressure at 4 psi below its initial value. We now have a condition of the brake valve feeding air to brake pipe to bring its level from the 5 psi below initial pressure up to 4 psi below the initial brake pipe pressure. The increase in brake pipe pressure will cause those valves which made the heavier local quick service brake pipe reduction to go to release. When a brake valve release is attempted, the brake pipe pressure at the rear of the train will rise very slowly. If AB control valves on cars toward the rear of the train have service piston ring leakage of 3 psi/min., it is very possible that the valves,

if they have not already released because of maintaining, will not release at all, resulting in "stuck brakes." This occurs because the auxiliary reservoir pressure behind the piston is charging, by way of piston ring leakage, at about the same rate as brake pipe is charging, and no differental is obtained to cause the piston to go to release.

"Super light" initial reductions should be avoided to prevent "kickoff" of brakes and to prevent "stuck brakes." Initial reductions should be not less than 6 to 8 pounds, followed by an additional reduction, so that the release is initiated from not less than 9 to 10 psi brake pipe reduction to minimize the "stuck brake" occurrence.

The use of a split service reduction is recommended for applying train brakes. This type of application is made by making a 6 to 8 psi initial reduction, waiting for approximately 20 seconds, then continuing the reduction to the desired brake pipe pressure. This results in having quick service run through the train and assures a minimum brake cylinder pressure on all cars of 10 psi. The 20 second delay allows the brake shoes to go against the wheels, providing light retarding force to the train and snubbing slack action. Additional braking effort is then started, after the train slack has been controlled, to the degree required to control the train. When using a split reduction as compared to a straightaway reduction, from 80 psi brake pipe pressure, there is only a very slight difference in average train brake cylinder pressure at any instant of time until full pressure is obtained, even though a delay of 20 seconds occurred from the time the initial reduction was made and the second application was started on the split reduction. (See Graph on page 24.)

FIG. C-15. AVERAGE TRAIN B.C. PRESSURE DEVELOPMENT STRAIGHT-AWAY AND SPLIT SERVICE APPLICATIONS

The amount of reduction required to produce service equalization and the brake cylinder equalization pressure for various brake pipe pressures is as follows:

Brake Pipe Pressure psi	Brake Pipe Reduction for Equalization	Brake Cylinder Equalization Pressure
110 psi	32	78
100 psi	29	71
90 psi	26	64
80 psi	23	57
70 psi	20	50

Service Release

The release of service application is initiated by movement of the brake valve handle to release position or "running". This causes the brake valve to restore air pressure to the brake pipe. The increasing brake pipe pressure then causes the car equipments to move to release, exhausting brake cylinder pressure through the retainer, and charging the auxiliary reservoir.

The time to initiate the release of the last car in a train is dependent upon several factors.

1. Train Length
2. Brake Pipe Leakage
3. Amount of Brake Pipe Pressure Being Restored
4. Type of Car Equipment—AB or ABD
5. Lower temp may increase times shown

Release times increase as train length increases

as indicated below in Table 1 for the release of a 20 psi reduction from an initial brake pipe pressure of 80 psi, minimum brake pipe leakage, and AB or ABD Car Equipment.

Table 1

Train Length	Time to Initiate Release on Last Car: ABD Equipment	Time to Initiate Release on Last Car: AB Equip. ment	Train Gradient
50 cars - 2500 ft.	4.5 sec.	6.9 sec.	¼psi
100 cars - 5000 ft.	8.4 sec.	13.3 sec.	½ psi
150 cars - 7500 ft.	13.5 sec.	31.0 sec.	½ psi

The effect of brake pipe leakage can be seen from the following tabulation (Table 2) where the brake pipe leakage has been increased to 5 psi/min. evenly distributed through the train.

Table 2

Train Length	Time to Initiate Release on Last Car: ABD Equipment	Time to Initiate Release on Last Car: AB Equipment	Train Gradient
50 cars - 2500 ft.	5.0 sec.	6 sec.	¾ psi
100 cars - 5000 ft.	8.6 sec.	20 sec.	2 psi
150 cars - 7500 ft.	14.5 sec.	46 sec.	6 psi

The effect of the amount of reduction on the release time can be seen by comparing the following figures (Table 3) for the release of a 7 psi brake pipe reduction to those in Table 2 for 5 psi/min. leakage condition.

Table 3

Train Length	Time to Initiate Release on Last Car: ABD Equipment	Time to Initiate Release on Last Car: AB Equipment	Train Gradient
50 cars - 2500 ft.	7 sec.	7 sec.	¾ psi
100 cars - 5000 ft.	22 sec.	22 sec.	2 psi
150 cars - 7500 ft.	63 sec.	63 sec.	6 psi

The additional time required to obtain a release when an overreduction has been made can be noted by comparing the following tabulation (Table 4) for a 25 psi reduction (a 2 psi over-reduction) with those shown in Table 1 for the release of a 20 psi reduction from 80 psi brake pipe and minimum brake pipe leakage.

Table 4

Train Length	Time to Initiate Release on Last Car: ABD Equipment	Time to Initiate Release on Last Car: AB Equipment	Train Gradient
50 cars - 2500 ft.	8 sec.	10 sec.	¼ psi
100 cars - 5000 ft.	16 sec.	35 sec.	½ psi
150 cars - 7500 ft.	26 sec.	50 sec.	½ psi

For brake applications of equalization or less, it is necessary that brake pipe pressure increase only about 1½ psi at each car location to cause the valve on that car to move to release. If an over-reduction has been made, that is, brake pipe pressure reduced below that required to produce

equalization, a release of the brakes on any car cannot be accomplished until brake pipe pressure has been increased to the equalization pressure plus the 1½ psi. This is of importance particularly with long trains where the time to obtain release is materially lengthened by an overreduction.

Wherever possible, the release of light brake pipe reductions should be avoided by increasing the amount of reduction before initiating the release. This procedure will avoid stuck brakes and is particularly useful on trains of 150 cars and longer or trains which have maximum permissible brake pipe gradients.

When making running releases of service applications, it is important to allow sufficient time for the release of the brakes through the train before applying power. The times tabulated previously should provide a guide. Each train with its own characteristics of brake pipe leakage, length, and degree of reduction will govern the situation. Applying too much power too soon after initiating the release can result in a break-in-two if slack conditions are not right.

INDEPENDENT BRAKE

The independent brake permits applying braking force to the locomotive or locomotive consist independent of the train brakes. Probably no element of braking can create train shock conditions more severe than improper use of the independent brake.

The independent brake valve on the lead or controlling unit of consist must always be left in the application position when there is no attendant in the cab.

In switching operation where the independent

brake only is used, the engineer will release the independent brake just prior to stopping and then reset if necessary, to avoid sliding the wheels at the moment of stop, and also to avoid the resulting lurching action of the locomotive.

EMERGENCY APPLICATION

The emergency application of freight brake equipment provides an extremely rapid transmission of the application throughout the train, as well as developing higher brake cylinder pressure than is obtained during service braking.

By movement of the brake valve on the locomotive to emergency position, the brake pipe is vented unrestricted to atmosphere. This rapid drop in brake pipe pressure acts on the emergency portion of each succeeding valve to cause it to go to emergency and vent brake pipe pressure to atmosphere at that location. This serial action of transmission results in an ability to transmit an emergency at the rate of 930 feet per second or 635 miles per hour. The action of emergency is such that the AB or ABD Control Valves will apply rapidly causing approximately 15 psi brake cylinder pressure to occur on each car within 1 - 1½ seconds after that car has gone to emergency position. This action applies the brake shoes to the wheel quickly and aids in arresting any severe slack changes. Each car operates to increase pressure at a controlled rate until full emergency pressure is obtained.

The following shows the emergency brake cylinder pressure obtained from various brake pipe pressures where equipment is fully charged:

Brake Pipe Presure	Emergency Brake Cylinder Pressure
110 psi	93 psi
100 psi	85 psi
90 psi	77 psi
80 psi	69 psi
70 psi	60 psi

Rule 1

Emergency applications when made on a train must never be released until the train has come to a stop. The car brake equipment will not permit a release until 2 minutes have elapsed, and any attempt to do so results only in wasting air.

An emergency application which occurs from the caboose or within the train will be recognized at the locomotive. The engineman must immediately place the automatic brake valve in emergency position to cut-off brake pipe charging then reduce throttle to idle.

The release of an emergency application requires time. Even though car equipments can be released in 3½ to 4 minutes on a 150-car train, 20 to 30 minutes may be required to recharge the car reservoirs on the rear of the train to within 5 psi of their initial condition.

Increasing or Decreasing Train Brake Pipe Pressure

When changing train brake pipe pressure, certain precautions should be observed to avoid stuck brakes or unintentional release of brakes.

General

Increasing brake pipe pressure from a lower pressure to a higher pressure is readily accomplished by resetting the feed valve to the higher desired pressure. This should be done only when a release of brakes is to be made or when brakes are released. No attempt at increasing brake pipe pressure should be made while a brake application is desired since the increasing pressure will cause release of the brakes. It should also be noted that, should the desired new brake pipe pressure result in being somewhat higher than that required, no attempt at reducing the pressure should be attempted unless a service application is first made. To do otherwise will result in stuck brakes. Also sufficient time should be permitted for equipments to recharge to the new pressure.

Where it is required to reduce the train brake pipe pressure to a lower value than that which was in effect or to reduce cuts of cars which have not been drained and are placed in a train having a lower brake pipe, the following procedure is recommended for trains having AB or AB and ABD Brake Equipment mixed in the train makeup.

To reduce brake pipe pressure level from 90 psi to 70 psi:

> Reduce FV or PR and then make an emergency from 90 psi; release with feed valve set at 80 psi. When the brake cylinder on the last car has fully released, make a second emergency. Set feed valve to 70 psi and release brakes.

In general, it may be said that an emergency from a given brake pipe pressure will safely reduce reservoir pressure so that a release can be accomplished from a brake pipe pressure 10 psi below the initial pressure. Although other manipulations

may accomplish the same purpose, the procedure outlined will assure that all reservoirs are adequately reduced to avoid any subsequent "creep on's" or stuck brakes.

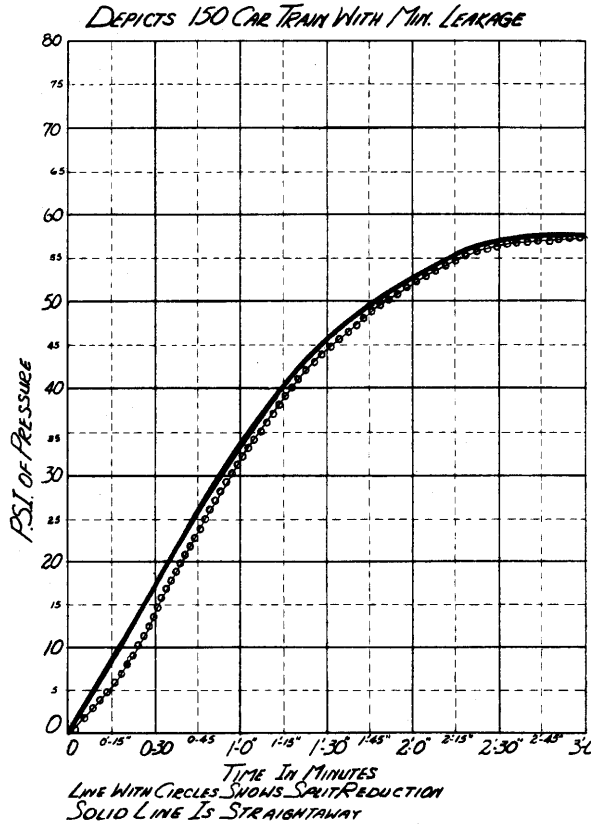
TRAIN AIR BRAKE SYSTEM OPERATION

The automatic brake system on cars and engines responds to pressure changes in the brake pipe. A volume of reservoirs, cylinders and control valves are so proportioned that a 20 psi brake pipe reduction from any initial brake pipe pressure, 70 psi or higher, will produce approximately 50 psi in the brake cylinder.

In service brake applications, the auxiliary reservoir supplies the brake cylinder. When auxiliary reservoir and brake cylinder pressures have equalized the maximum service pressure has been reached. This is based on a 10″ diameter cylinder having an 8″ piston travel or the equivalent.

Initial Brake Pipe Pressure	Service Equalization Pressure	Brake Pipe Reduction to Obtain Equalization
70 psi	50 psi	20 psi
80 psi	57 psi	23 psi
90 psi	64 psi	26 psi
100 psi	71 psi	29 psi
110 psi	78 psi	32 psi

Freight car equipment can obtain the above pressures. Engines and passenger equipment usually have a limiting or safety valve to limit the maximum service brake cylinder pressure to some intermediate value . . . 60 psi being the most common.


DEPICTS 150 CAR TRAIN WITH MIN. LEAKAGE
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
P.S.I. OF PRESSURE
0
0-15"
0-30
0-45
1-0"
1-15"
1-30"
1-45"
2-0"
2-15"
2-30"
2-45"
3-0"
TIME IN MINUTES
LINE WITH CIRCLES SHOWS SPLIT REDUCTION
SOLID LINE IS STRAIGHTAWAY

BOOK 2

TRAIN AIR TESTS

BOOK 2

TRAIN AIR TESTS

TRAIN AIR TEST

Rule 1

NOTE TO INITIAL TERMINAL:

Where the term initial terminal is used in these Train Air Test rules, it refers to that terminal where the train is originally made up. It may or may not be the initial terminal on a sub-division, as defined in the UNIFORM CODE OF OPERATING RULES.

Rule 2

CAUTION: During brake pipe leakage test, with 26 L equipment, after determining the amount of leakage, the engineer must make a reduction of equalizing pressure that will equal brake pipe pressure before cutting in the double heading cock. Then cut-in the double heading cock and immediately complete a full service brake pipe reduction.

Rule 3

§ Train air-brake system tests.

(a) Supervisors are jointly responsible with inspectors, enginemen and trainmen for condition of air brake and air signal equipment on motive power and cars to the extent that it is possible to detect defective equipment by required air tests.

(b) Communicating signal system on passenger equipment trains must be tested and known to be in a suitable condition for service before leaving terminal.

Train Air Tests

(c) Each train must have the air brakes in effective operating condition, and at no time shall the number and location of operative air brakes be less than permitted by Federal requirements. When piston travel is in excess of 10 inches, the air brakes cannot be considered in effective operating condition.

(d) Condensation must be blown from the pipe from which air is taken before connecting yard line or motive power to train.

INITIAL TERMINAL ROAD TRAIN AIR BRAKE TESTS

Rule 4

(a) Except for run-through and unit run-through trains covered under Rule 10, each train must be inspected and tested as specified in this section at points—

1. Where the train is originally made up (initial terminal);
2. Where train consist is changed, other than by adding or removing a solid block of cars, and the train brake system remains charged; and
3. Where a train is received in interchange.

(b) Each carrier shall designate additional inspection points not more than 500 miles apart where intermediate inspection will be made to determine that—

1. Brake pipe pressure leakage does not exceed 5 pounds per minute;
2. Brakes apply on each car in response to a 20 pound service brake pipe pressure reduction; and

3. Brake rigging is properly secured and does not bind or foul.

(c) Train airbrake system must be charged to required air pressure, angle cocks and cutout cocks must be properly positioned, air hose must be properly coupled and must be in condition for service. An examination must be made for leaks and necessary repairs made to reduce leakage to a minimum. Retaining valves and retaining valve pipes must be inspected and known to be in condition for service.

(d) (1) After the airbrake system on a freight train is charged to within 15 pounds of the setting of the feed valve on the locomotive, but to not less than 60 pounds, as indicated by an accurate gauge at rear end of train, and on a passenger train when charged to not less than 70 pounds, and upon receiving the signal to apply brakes for test, a 15 pound brake pipe service reduction must be made in automatic brake operations, the brake valve lapped, and the number of pounds of brake pipe leakage per minute noted as indicated by the brake pipe gauge, after which brake pipe reduction must be increased to full service. Inspection of the train brakes must be made to determine that angle cocks are properly positioned, that the brakes are applied on each car, that piston travel is correct, and that all parts of the brake equipment are properly secured. When this inspection has been completed, the release signal must be given and brakes released and each brake inspected to see that all have released.

(2) Omitted intentionally.

(3) When a locomotive used to haul the train is provided with a means for maintaining brake pipe pressure at a constant level during service application of the train brakes, this feature must be cut out during train air brake tests.

(e) Brake pipe leakage must not exceed 5 pounds per minute.

(f) (1) At initial terminal piston travel of body-mounted brake cylinders which is less than 7 inches or more than 9 inches must be adjusted to nominally 7 inches.

(2) Minimum brake cylinder piston travel of truck-mounted brake cylinders must be sufficient to provide proper brake shoe clearance when brakes are released. Maximum piston travel must not exceed 6 inches.

(3) Piston travel of brake cylinders on freight cars equipped with other than standard single capacity brake, must be adjusted as indicated on badge plate or stenciling on car located in a conspicuous place near brake cylinder.

(g) When test of airbrakes has been completed the engineman and conductor must be advised that train is in proper condition to proceed.

(h) During standing test, brakes must not be applied or released until proper signal is given.

(i) (1) When train airbrake system is tested from a yard test plant, an engineer's brake valve or a suitable test device must be used to provide increase and reduction of brake pipe air pressure at the same or a slower rate as with engineer's brake valve and

yard test plant must be connected to the end which will be nearest to the hauling road locomotive.

(2) When yard test plant is used, the train airbrakes system must be charged and tested as prescribed by paragraphs (c) to (g) of this section inclusive, and when practicable should be kept charged until road motive power is coupled to train, after which, an automatic brake application and release test of airbrakes on rear car must be made.

(3) If after testing the brakes as prescribed in subparagraph (2) of this paragraph the train is not kept charged until road motive power is attached, the brakes must be tested as prescribed by paragraph (d) (1) of this section.

(j) Before adjusting piston travel or working on brake rigging, cutout cock in brake pipe branch must be closed and air reservoirs must be drained. When cutout cocks are provided in brake cylinder pipes, these cutout cocks only may be closed and air reservoirs need not be drained.

ROAD TRAIN AND INTERMEDIATE TERMINAL TRAIN AIR BRAKE TESTS

Rule 5

(a) Passenger trains: Before motive power is detached or angle cocks are closed on a passenger train operated in either automatic or electro-pneumatic brake operation, except when closing angle cocks for cutting off one or more cars from the rear end of

train, automatic air brake must be applied. After recoupling, brake system must be recharged to required air pressure and before proceeding and upon receipt of proper request or signal, application and release tests of brakes on rear car must be made from locomotive in automatic brake operation. Inspector or trainmen must determine if brakes on rear car of train properly apply and release.

(b) Freight trains: Before motive power is detached or angle cocks are closed on a freight train, brakes must be applied with not less than a 20 pound brake pipe reduction. After recoupling and angle cocks are opened, it must be known that brake pipe air pressure is being properly restored as indicated by the caboose gauge and that brakes on rear car are released. In the absence of a caboose gauge, air brake test must be made as prescribed by that portion of paragraph (a) of this section pertaining to automatic brake operation.

(c) (1) At a point other than initial terminal where locomotive or caboose is changed, or where one or more consecutive cars are cut off from rear end or head end of train with consist otherwise remaining intact, after train brake system is charged to within 15 pounds of feed valve setting on locomotive but not less than 60 pounds as indicated at rear of freight train, and on a passenger train to at least 70 pounds, a 20-pound brake pipe reduction must be made and it must be determined that brakes on rear car apply and release properly.

(2) Before proceeding it must be known that brake pipe pressure as indicated at rear of freight train is being restored.

(d) (1) At a point other than a terminal where one or more cars are added to a train, and after the train brake system is charged to not less than 60 pounds as indicated by a gauge at the rear of freight train and on a passenger train to not less than 70 pounds, tests of air brakes must be made to determine that brake pipe leakage does not exceed five (5) pounds per minute as indicated in the brake pipe gauge after a 15 pound brake pipe reduction. After the leakage test is completed, brake pipe reduction must be increased to full service, and it must be known that the brakes on each of these cars and on the rear car of train apply and release. Cars added to train which have not been inspected in accordance with § Rule 4 (c) to (j) must be so inspected and tested at next terminal where facilities are available for such attention.

(2) (i) at a terminal where a solid block of cars which has been previously charged and tested as prescribed by § Rule 4 (c) to (j) is added to a train, test must be made to determine that brakes on the rear car of train apply and release.

(ii) When cars which have not been previously charged and tested as prescribed by § Rule 4 (c) to (j) are added to a train, such cars

may either be given inspection and tests in accordance with § Rule 4 (c) to (j), or tested as prescribed by subparagraph (1) of this paragraph prior to departure in which case these cars must be inspected and tested in accordance with § Rule 4 (c) to (j) at next terminal.

(3) Before proceeding it must be known that the brake pipe pressure at the rear of freight train is being restored.

(e) (1) Transfer train and yard train movements not exceeding 20 miles, must have the air brake hose coupled between all cars, and after the brake system is charged to not less than 60 pounds, a 15 pound service brake pipe reduction must be made to determine that the brakes are applied on each car before releasing and proceeding.

(2) Transfer train and yard train movement exceeding 20 miles must have brake inspection in accordance with § Rule 4 (c) to (j).

(f) The automatic air brake must not be depended upon to hold a locomotive, cars or train, when standing on a grade, whether locomotive is attached or detached from cars or train. When required, a sufficient number of hand brakes must be applied to hold train, before air brakes are released. When ready to start, hand brakes must not be released until it is known that the air brake system is properly charged.

TESTS REQUIRED WHEN CREWS ARE CHANGED ENROUTE

Rule 6

I At points, other than initial terminals, where locomotive crew, train crew, or both, are changed on a passenger train and the consist, including engine, remains intact:

A. Engineman of arriving train, after making stop, must apply the brakes with a full service brake pipe reduction, remove reverse lever handle, and place generator field switch in "Off" position. Independent brake must be applied.

B. Engineman of departing train must note, as soon as he boards locomotive, that locomotive brakes are fully applied, as indicated by brake cylinder gauge, and that main reservoir pressure is within required limits.

C. The rear trainman of the departing train must note, before boarding train, that the brakes are applied on the rear car and must then signal the engineman with four blasts of the communicating signal.

D. Upon receipt of this signal, engineman must then release the brakes.

E. The trainman must then note that the brakes release on the rear car.

II At points other than initial terminals where locomotive crew, train crew, or both, are changed on a freight train and consist including engine remains intact; and the outbound or relieving crew is in position to take charge of the train.

Train Air Tests

A. Engineer of arriving train, after making stop, must complete a full service "Brake Pipe" reduction, if not already in effect.

B. Engineer of departing train must note, as soon as he boards the locomotive, that locomotive brakes are applied, as indicated by gauge, and that main reservoir pressure is within required limits.

NOTE: When engine crew is changed without stopping train, the outbound engineer must have the assurance from the inbound engineer that the train's air brakes are working properly.

III At points other than initial terminals where locomotive crew, train crew, or both are changed on a freight train and consist including engine remains intact and the outbound or relieving crew is NOT in position to take charge of the train:

A. Engineer of arriving train, after making stop, must complete a full service pipe reduction, if not already in effect, must remove reverse lever handle, place generator field switch in OFF position, and apply the independent brake.

IV ENGINEMEN AND TRAINMEN, WHEN BOARDING A TRAIN, MUST IMMEDIATELY ACQUAINT THEMSELVES WITH THE LOCATIONS OF THE BRAKE PIPE EMERGENCY VALVES.

DOUBLEHEADING

Rule 7

When more than one locomotive is attached to

a train, the engineman of the leading locomotive shall operate the brakes.

I On all other motive power units in the train, the brake pipe cut-out cock to the brake valve must be closed, the maximum main reservoir pressure maintained and brake valve handles kept in the prescribed positions.

II In case it becomes necessary for the leading locomotive to give up control of the train, short of the destination, a test of the brakes must be made to see that the brakes are operative from the automatic brake valve of the locomotive taking control of the train.

PASSENGER TRAIN RUNNING TEST

Rule 8

I Required when motive power, engine crew, or train crew has been changed, when train departs from initial terminal, or when angle cocks have been closed except for cutting off one or more cars from rear end of train.

II Running test must be made when speed of 30 miles per hour is attained. Where this speed cannot be attained in a relatively short distance, test must be made as soon as speed of train permits, to insure safe operation.

A. Power must not be shut off unless required.

B. Brakes must be applied with sufficient force to ascertain whether or not brakes are operating properly.

III If air brakes do not operate properly, train must be stopped, cause ascertained, necessary remedies made, and running test repeated.

Train Air Tests

IV Trainman will locate himself at retaining valve, if possible, and by its exhaust determine that brakes on rear car have applied and released. Proper signal will then be transmitted to engineman. In absence of this signal train must be stopped and cause ascertained.

V If running test is not made, trainman must stop train and know brakes are operating normally before proceeding.

BACK UP MOVEMENTS UNDER CONTROL OF BACK-UP VALVE OR BACK-UP HOSE

Rule 9

I When ready to make a back up movement, in which a back-up valve or back-up hose is to be depended on for control of train, the employee who is to operate the valve must first give the signal to back up and must then make a sufficient discharge from the back-up hose or valve to insure a substantial application of the brakes.

II Engineman must not begin back up move until this standing application has been made, as indicated by brake pipe gauge, and must allow sufficient time for the brakes to release before starting to move train.

III If train undergoing back up move consists of passenger equipment, a running test of brakes must be made by use of the back-up hose or valve after the train has begun the back up move but before it has moved 500 feet. If this running application and release is not made, engineman must stop the train and determine cause for test failure.

IV When making such backing movement, the automatic brake valve must be in running position except when necessary to apply brakes to insure safety.

V When stopped enroute for any reason, and before completion of back-up move, engineman must apply independent brake.

VI As soon as back-up move is completed, and train is stopped under control of back-up hose or valve, engineman must make a full service application to avoid the possibility of stuck brakes on a subsequent move.

AIRBRAKE-TESTS ON RUN-THROUGH AND UNIT RUN-THROUGH TRAINS

Rule 10

(a) For the purpose of this section—

1. "Run-through train" means a train which passes from one carrier to another carrier with no change in consist (including locomotive) other than the addition or removal of a block of one or more cars; and
2. "Unit run-through train" means a run-through train operated by more than one carrier on a continuous round trip cycle and consisting of assigned equipment.

(b) The carriers involved shall jointly notify the Federal Railroad Administrator in writing of run-through trains operating over their tracks. The notice must identify points of interchange and all other points where equipment and air brake inspections are made.

(c) Each run-through train shall be inspected and tested as prescribed by Rule 4(c)-(j)—

(1) Where the train is originally made up (initial terminal);

(2) Where train consist is changed other than by adding or removing a solid block of cars and train brake sytem remains charged; and

(3) At intermediate inspection points not more than 500 miles apart, subject to the requirements of paragraph (f) of this section.

(d) Each unit run-through train shall be inspected and tested as prescribed by rule 4 (c) - (j)—

(1) Where the train is originally made up and where it is reassembled after being broken up;

(2) Once during each round trip cycle of less than 500 miles at an inspection point designated in writing by the carrier involved; and

(3) At intermediate inspection points not more than 500 miles apart, subject to the requirements of paragraph (f) of this section.

(e) Each carrier that adds a block of one or more cars to a run-through train or unit run-through train after the train is originally made up, shall inspect and test the block as follows:

(1) In accordance with rule 4 (c) to (j) at the point where the block is added; or

(2) In accordance with rule (d) (1) at the point where the block is added, and rule 4 (c) to (j) at the next point on its line where the inspections and tests can be performed, but not beyond a designated 500 mile inspection point.

(f) For the purpose of the intermediate inspection and tests required by paragraphs (c) (3) and (d) (3) of this section—

(1) Piston travel of a body-mounted 10 inch brake must not exceed 10 inches; and

(2) Piston travel on all other brakes—

(i) Must not exceed the nominal travel specified by more than 2 inches; and

(ii) Must not exceed the maximum travel specified by the badge plate or stencil on the car.

(g) The inspections and tests made under rule 4 (c) to (j) as required by this section shall be performed by qualified carrier personnel at locations where adequate repair facilities are available to maintain power brake systems in effective operating condition in conformity with this part. Defective cars shall be repaired or removed from service at the point of inspection and testing.

(h) Each carrier shall record the inspections and tests made under rule 4 (c) - (j) as required by this section at the time they are performed by completing Form FRA-F-6180-48, in duplicate. This form shall be signed by the supervisor or other carrier employee responsible for the inspections and tests. One copy of the form shall be kept in the cab of the locomotive until the train arrives at its final terminal, and one copy shall be retained for 3 months at the terminal where the inspections and tests were made.

(i) At locations where the crew of one carrier takes over control and operation of a run-through train or unit-run-through train from

the crew of another carrier, the receiving carrier shall inspect and test the train to determine that—

(1) The cab of the locomotive contains a Form FRA-F-6180-48 completed as required by paragraph (h) of this section;

(2) Brake pipe leakage does not exceed 5 pounds per minute; and

(3) Brakes apply and release on the rear car from a 20-pound service brake pipe pressure reduction. If the cab of the locomotive does not contain a completed Form FRA-F-6180-48, the train must be inspected and tested as prescribed by rule 4 (c) - (j) before it proceeds.

BOOK 3

ENGINES

BOOK 3

ENGINES

Rule 1

MULTIPLE UNIT AIR CONNECTIONS

The diagrams on page 19 will depict the various units hooked up in multiple operation complete with the correct positioning of the hand operated valves. There may, on occasion, be other combinations of units that are not shown here. When necessary to hook up combinations that are not shown here, follow these basic rules:

1. RI units with 26 L equipment must have MU-2-A valve in "Trail 24", when trailing foreign line 26 L units having a two position MU-2-a valve.
2. RI units with 6 BL brakes equipment must not lead 24 RL equipped units, or any 26 L units having a two-position MU-2-A valve.
3. RI units with 6 BL equipment must not trail foreign line units equipped with 26 L equipment having a two position MU-2-A valve, unless separated by a RI unit with 24 RL or 26 L equipment brake equipment.

It is the responsibility of the engineer to know that the units are coupled properly, when such units are picked up enroute.

ENGINES

A-1 CHARGING CUT OFF PILOT VALVE. Most engines arranged for multiple unit operation are equipped with an A-1 charging cut off pilot valve, or its equivalent. When an emergency application occurs from any source, the cut off valve responds by going to application position where it:

1. Delivers air pressure to the brake valve through a port which immediately cuts off air flow to the brake pipe.

2. Delivers air pressure to the PC switch which causes the power of the engine to be cut off.

3. Delivers air pressure to initiate automatic sanding.

The A-1 charging cut off pilot valve operates when an emergency application occurs regardless of whether it was initiated from the automatic brake valve or from an undesired separation of the engine units or cars; or whether the emergency was initiated from the caboose or any other source. An emergency application which occurs from the caboose or within the train will be recognized at the engine. The engineman should immediately place the automatic brake valve in an emergency position and reduce throttle to idle. Engine speed will have already returned to idle account action of the cut off pilot valve.

BRAKE PIPE FLOW INDICATOR. The Brake Pipe Flow Indicator is an instrument which indicates the rate of flow of air through the automatic brake valve to the brake pipe. It may be used with any of the brake equipment presently in use.

This instrument is actually a differential pressure gage which indicates on its dial a difference between two pressures. It also actuates a switch which lights a lamp as an added indication. The lamp switch may be set to light the indicating lamp at any desired reading.

The Brake Pipe Flow Indicator is the only indication which the engineer has which will inform him as to what is taking place in the brake pipe in regard to air flow.

BRAKE PIPE FLOW INDICATORS are of two types:

A. A separate gauge located on or near the control stand, equipped with a black hand and a red hand (manually operated) and an amber -"bull's eye" light. The black hand on the instrument measures the flow of air from the feed valve (or regulating valve) through the automatic brake valve. The red hand should be used as a fully charged brake system marker by moving it to coincide with the black hand once the train has been fully charged.

B. EMD Air Flow Indicator. The gauge indicates changes in the rate of air flow into the brake pipe. The orange colored, single pointer gauge hand shows equalizing reservoir pressure. The half disc sector or dial part of the gauge moves the air volume changes within the brake pipe. With no leakage and a fully charged train, the gauge hand should register with the zero mark on the dial. When a brake pipe reduction is made from the rear of the train or when there is unusual leakage that may result in undesired brake action, the sector hand turns to the right and the gauge hand remains stationary. The change in the rate of brake pipe charging will be indicated by the change in position of the sector, or dial, to the gauge hand. When the brake pipe flow gauge indicates unusual leakage, or brakes are being applied from other than the engineers brake valve, comply with the applicable air brake rule.

AIR GAUGES

Air gauges to be used by the engineman for normal control of air brakes must be so located and illuminated that they may be easily read by the engineman. Air gauge dials and glass covers must be kept clean.

Engines

Rule 2

Equalizing reservoir and brake pipe pressure gauges must not show any differential, at normal pressure. Gauges showing any irregularity must be reported on the work report.

Rule 3

ENGINE BRAKE CYLINDER PISTON TRAVEL

Minimum brake cylinder piston travel must be sufficient to provide proper brake shoe clearance when brakes are released.

Maximum brake cylinder piston travel must not exceed six (6) inches.

Rule 4

No part or appliance of an engine, except the wheels and flexible non-metallic sand pipe extension tips, shall be less than 2½ inches above the top of rail.

Rule 5

RULE: Any engines equipped with 26 C brake equipment that has a 24 RL brake valve handle must be considered as a defective engine. Engineers must make a report to the superintendent, mechanical officer and road foreman of engines, whenever above condition is encountered.

Rule 6

CRANKCASE PRESSURE

To minimize the possibility of crankcase explosions in diesel engines, the following instructions must be observed:

1. NEVER hold a governor low oil button in to attempt starting an engine which has shut down due to operation of any safety device.

2. After an engine has shut down due to operation of the governor low oil button, no attempt should be made to start the unit if there is an unusual amount of smoke coming from around the top deck covers and other engine locations.

3. After an engine has shut down due to operation of the governor low oil button, no attempt should be made to start the unit until the engine has been shut down for a minimum of 15 minutes.

4. After an engine has shut down due to any malfunction, the lubricating oil level should be checked. This should be done immediately after starting the engine and in the case of a low oil shutdown after the 15 minute waiting period. If the lubricating oil level is found to be one inch or more above the FULL level, the engine should not be put on the line until an inspection has been made by qualified mechanical personnel.

5. Enginemen should, at every opportunity, check the lubrication oil level, oil temperature, oil pressure and general condition of the engine with special attention to unusual amounts of smoke coming from overhead covers and other engine components.

6. On locomotives which are equipped with crankcase pressure protection devices, if this device operates to shut the engine down after it has been on the line and operating, no attempt should be made to start the engine until qualified mechanical personnel have inspected the engine and determined that it is safe to operate.

This pertains only to the crankcase pressure portion which is marked "crankcase." During extreme cold weather, it may at times be necessary to drain the engine cooling system in order to comply with these instructions.

7. On locomotives units on which the starting button is located in the engine room, when starting the engine the engineman should turn his face away from the engine until it has started and is running normal.

8. The preceding instructions, with the exception of #7, do not pertain to other malfunctions such as an overspeed trip, ground relay action, emergency fuel trip, etc. The engine may be started without the waiting period after the operation of one of these devices.

Rule 7

TRACTION MOTOR CUT OUT SWITCH

GP-40 locomotives numbered 382 thru 396 and 4700 thru 4719 are equipped with traction motor cut out switches. In the event of repeated ground relay action due to defective traction motor, engineer may cut out the traction motor involved and proceed to destination. Maintenance point and Chief Mechanical Officer at Kansas City must be notified by wire, of traction motor being cut out. Engineman must attach isolation tag to the isolation switch whenever traction motors are cut out.

Rule 8

GROUND RELAY ACTION

All high horse power units are equipped with a Remote Control Ground Relay Reset. In multiple unit operation, the engineman may reset the

ground relay on trailing units when required, except as outlined below.

CAUTION: Engineman must not reset ground relay remote control more than three (3) times. If engine again trips the ground relay, inspection must be made to determine unit causing the action, unit must be isolated and tagged. Engineman must know that all wheels are turning freely, by observation or roll by inspection.

On engines not equipped with remote control ground relay reset the same precautions must be taken.

Rule 9

PCS SWITCH

In multiple unit operation, where an emergency application of the air brakes is initiated from the train, re-setting the PC switch automatically will not always reset one or more of the trailing units. Indications in the controlling unit leads the engineer to believe that all units are reset, however, it will soon be noticed that the main reservoir pressure as indicated by the gauge in the leading unit will soon start to fall and engineer will be unable to maintain sufficient pressure for safe operation of the brakes. Engineers experiencing such, must stop the train, close the angle cocks at both ends of the unit showing PC tripped, cut in brakes on that unit and proceed with normal recovery of the PC. After resetting, cut out brakes on that unit, open angle cocks at both ends of unit, make automatic brake application to check and see if brakes apply and release on rear car of train and then proceed.

Rule 10

THE REVERSER

Under circumstances where an engine is to be

moved "Dead in Train," it is necessary to 'center' the reverser. On EMD units, equipped with electrical controlled reversers, it is only necessary to 'open' the main battery switch, in order to accomplish this.

On EMD units equipped with pneumatic controlled reversers, the reverser must be centered (by depressing the air magnet valves) and inserting the locking pin thru the centering hole. The locking pin is located at the top left side of the reverser drum, the centering hole is located at the top right side of the reverser drum.

On GE units, this must be done manually. On the left side of the locomotive, there are a series of access doors to the electrical controls located under the cab. Starting at the front end these access doors will be referred to by number. Door #5 houses the reverser control. This reverser is equipped with a short handle that will move the control to a centered position. After moving this control manually, close the 'control air cut-out cock' located under the cab on the right side of the locomotive. See diagram located on page 25 for the exact location of this valve. The picture shows the reverser in forward movement.

Rule 11

SAFETY CONTROL

On engines assigned or used in yard service, the safety control is provided to stop the engine or train whenever the engineer becomes incapacitated. The safety control works in such a way that the foot pedal must be depressed at all times, when the equipment is cut in, or a penalty application of the brakes will occur. To nullify the resulting action

or prevent this occurrence, the engine brakes must be applied to not less than 25 pounds, as indicated by the brake cylinder gauge.

NOTE: PIPE BRACKET PORT #8 AND THE MAIN RESERVOIR SUPPLY CUT-OUT COCK MUST BE OPEN AT ALL TIMES.

Whenever the safety control becomes defective during a tour of duty or service, the following precautions must be taken:

1. Depress the top of the magnet valve plunger and lock in the "OPEN" position. The safety control will then be inoperative.
2. Proper report must be made and repair noted on MP 164.

Preparing the safety control for movement of the engine "dead in train."

1. Main battery switch must be "IN" until items 2 and 3 are completed.
2. Depress the top of the magnet valve plunger and lock in the "OPEN" position.
3. Plug the bottom of the K-4 application brake pipe exhaust port only.

ELECTRICAL AND AIR PIPING DIAGRAM OF SAFETY CONTROL

Rule 12

PASSENGER ENGINES

Passenger units, numbered 610 through 665,

will not make backward transition automatically. On ascending grades, or whenever the speed drops below 23 MPH, the throttle must be shut off to effect backward transition. The throttle may then be opened gradually, as needed, to pick up the load.

Passenger units must be operated as lead units of a mixed consist, or in freight service, when practicable.

Rule 13

SW 1200

EMD, Model SW-1200, switch engines numbered 920 thru 936, are equipped for multiple unit operation. Due to the inability of this type power to make backward transition automatically, the following instructions must be adhered to, in order to avoid damage to these units. Regardless of their position in the engine consist, lead or trail, when operating in road or similar service, the throttle must be closed and then re-opened to make backward transition whenever the speed drops below 20 MPH.

Located on the left side of the control stand is a two position selector switch, labeled as follows:

UP—NORMAL
DOWN—TRAIL ROAD POWER

There are various operating conditions under which the above mentioned switch is involved and they are outlined in the following paragraphs. At the same time, the position of the selector handle switch, located above the throttle, will also be discussed.

A. Single unit or leading unit of consist of SW-1200 units.

1. Switch to be in "NORMAL" position for both conditions.

2. Selector handle in:

   a. SW-Fast start, for kicking cars, etc. Unit will not make "Forward" transition.

   b. SER-Slow Start, for road operation. Unit will not make "Forward" transition.

   c. AUTO-Slow Start, forward transition is made automatically as speed warrants.

UNIT WILL NOT MAKE BACKWARD TRANSITION AUTOMATICALLY

The necessity for making backward transition will occur at approximately 20 MPH, indicated by a steady wheel slip light. At this time, it is necessary to close the throttle to "idle" position, in order to effect or make "backward transition." After this is done, the throttle may again be reopened if necessary or as circumstances may require. Any undesired subsequent "forward transition" may be forestalled by moving the selector handle to "SER" or "SW" position.

B. As trailing unit and coupled to a leading SW-1200

   1. Switch to be in "NORMAL" position.

   2. Selector handle, throttle and reverse levers to be in usual position for a trailing unit. All functions and operations will be same as outlined in "A".

C. As lead unit of consist of different class units.

   1. Switch to be in "NORMAL" position.

   2. Selector handle to be in "SER" or "AUTO"

only. (Do not use "SW" position when leading any other class of road power.) All functions and operations will be as outlined under "A" above.

D. As trailing unit of different class of road power.
   1. Switch to be in "TRAIL ROAD POWER" position.
   2. Selector handle, throttle and reverse lever to be in usual position for a trailing unit.
   3. When operated under these conditions, this unit will then make "forward transition" automatically. This unit will NOT make "backward transition" automatically. There will be no wheel slip indication in the cab of the lead unit. Because of this, whenever an engineer has a trailing unit SW-1200 in his engine consist, and the speed drops below 20 MPH, it will be necessary to close the throttle to idle and reopen it to the desired position in order to allow the trailing SW 1200 to make backward transition.

Rule 14

FOREIGN LINE LOCOMOTIVES

Foreign line locomotives, unless they are equipped with a three (3) position MU-2-A valve, must not be used in multiple unit operation with Rock Island GP-7 or GP-9 units that are equipped with #6 brake.

SP-MU-2-A valves must be in TRAIL 24, when trailing RI 26 equipped engines.

FUEL CONSUMPTION RI ENGINES

(Gallons per Hour)

	IDLE	FULL LOAD
GP 7	2.2	98
GP 35	3.7	143
GP 40	5.6	170
U 25 B	5-6	135
U 28 B	5-6	150
U 33 B	5-6	165

Rule 15

CHANGING CONTROL STATIONS

When changing a controlling unit to a trailing unit in the same consist, enginemen must perform the following:

1. Place throttle in "idle" position.
2. Place transition lever in "off" position, on engines so equipped.
3. Place reverser handle in "neutral" position, and remove handle.
4. Make a full service application with automatic brake valve.
5. Position air brake system in accordance with program instructions shown on page 19.
6. At engineman's control stand, open the following switches.
   A. Control.
   B. Generator Field.
   C. Fuel Pump . . . GE and Alco units must have the fuel pump switch closed on unit to lead, before opening.

D. Control of brakes should be assumed at control station on unit to lead as soon as possible.

Changing a trailing unit to a lead or controlling unit.

1. Close following switches:
   A. Control
   B. Fuel Pump
   C. Generator Field
2. Place the independent brake valve in Full Application position. Open the double heading cock, or brake pipe cut out cock.
3. Position the MU-2-A valve or Rotair valve in line with instructions shown on page 19.
4. Operate independent and automatic brake valves and check that brakes apply and release properly.
5. Check gauges to insure system is fully charged before operating locomotive from new control station.

Rule 16

AIR TESTS FOR MULTIPLE UNITS

Whenever units are assembled for multiple unit operation, the following tests must be made to insure that proper connections are made and that brakes apply and release properly.

NOTE: The hand brake should be applied, during the below tests, to prevent the possibility of engines moving.

1. Note that all engine brakes apply and release

from an automatic brake application. Leave independent brake in release or running position during this portion of test.

2. Note that all engine brakes apply and release from an independent brake application and release. Do not place independent brake in quick release position during this test.

3. Re-apply brakes with the automatic brake valve and depress independent brake valve handle to the quick release position and note that all engine brakes release.

4. After completing the above tests, make a standard brake pipe leakage test, by noting the loss of brake pipe pressure for period of one minute.

5. With reverser on controlling unit in neutral position, open throttle sufficient to ascertain continuity of electrical train line.

The following diagrams, pages 20 and 21 of the various multiple unit hook-ups, do not include the BRAKE PIPE hose, which must always be coupled. The sander hose connections are also omitted: Sand hoses connections (when required) must always take into consideration the direction in which the individual units are headed. EXAMPLE: The FOREWARD sand hose of the leading unit would be hooked to the REVERSE sand hose of the trailing unit, when it faces in the opposite direction, etc. The FOREWARD sand hose of the leading unit would be hooked to the FOREWARD sand hose of the trailing unit when it is headed in the same direction as the leading unit.

Rule 17

MULTIPLE UNIT HOOK UP

It must always be remembered that we do not

have a standard identification of hoses used in making the multiple unit hook up. In order to simplify the hookup diagrams, the following will govern:

Line #1—MAIN RESERVOIR LINE

Line #2—ACTUATING LINE

Line #3—APPlication & RELease LINE OR INDenpendent EQUALizing LINE OR EQUALizing LINE

Line #4—MU LINE (24 RL only)

Units with 26L brake equipment must have the ACTUATING pipe cutout cock OPEN at both ends when attached to, but trailing units with 6SL or 6BL brake equipment. (This is required to eliminate an undesired brake action occurring on the locomotive).

PRACTICAL TEST TO DETERMINE CORRECT CONNECTION OF AIR HOSES IN MULTIPLE UNIT OPERATION

When it becomes necessary to provide multiple unit operation and the unit to be coupled does not have any name plates or numbers than can be used to identify the proper air hoses, the below test should be performed to determine the correct air hose connection.

Line #1 Program the unit for LEAD operation and set the HAND brake. Place the AUTOMATIC and INDEPENDENT brake valves in RUNNING POSITION. Open the cut-out cocks on the end to be coupled and a strong flow of air will emit from the MAIN RESER-

VOIR line. Close the cut-out cock and mark that as Line #1.

Line #2 To determine which line is the ACTUATING LINE, depress the INDEPENDENT brake valve handle and a strong flow of air, main reservoir pressure, will flow from this line. Mark this as line #2.

Line #3 Set the INDEPENDENT brake and a flow of air will be evident from the APPLICATION & RELEASE LINE. (This line is also called the INDEPENDENT EQUALIZING and EQUALIZING).

Line #4 On 24 RL equipped engines only, the MU line will also emit air, under test #3. To determine which line is the MU line, set the AUTOMATIC brake in full service with the INDEPENDENT brake in running position. Air will flow from the MU line but will not flow from the APPLICATION & RELEASE line.

Rule 18

Rock Island units with 26-L type brake equipment must have the MU 2-A valve positioned in "Trail 24" when such units are trailing foreign line 26-L equipment having a two position MU-2-A valve. (double ported cut-out cock.)

CAUTION: A Dead Engine Fixture, when cut in with engine working normally, may cause a build up of brake pipe pressure over and above the feed valve or pressure regulating setting. The build up will eventually cause a flow of air to emit from the brake valve of the controlling unit.

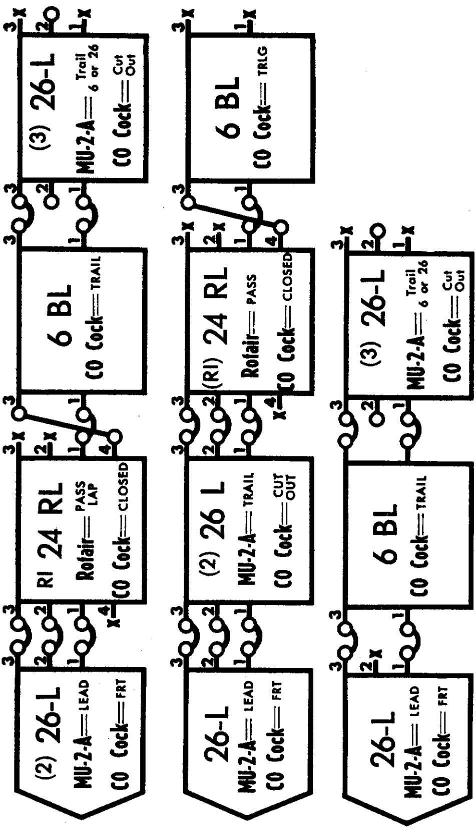
Engines

Engineers experiencing such, should check all units of the consist to determine that trailing units are properly programmed and also check the dead engine fixture, to see if properly cut out.

PROPER POSITIONING OF HAND OPERATED VALVES IN MULTIPLE UNIT OPERATION

TYPE OF BRAKE	TYPE OF SERVICE	AUTO BRAKE VALVE	IND BRAKE VALVE	CUT-OFF VALVE (double heading cock)	MU-2-A VALVE	DEAD ENGINE FEATURE
	Lead	Running	Release	FRT (Psgr)	Lead	Closed
26 L	Trail	Handle Off	Release	Cut-Out	Trail (6-26) (24)	Closed
	Dead	Handle Off	Release	Cut-Out	Lead	Open
	Lead	Running	Release	Cut-In	(Rotair) Pass	Closed
24 RL	Trail	Running	Release	Cut-Out	P Lap	Closed
	Dead	Running	Release	Cut-Out	Pass	Open
	Lead	Running	Release	Lead		Closed
6 BL	Trail	LAP	Release	Trail		Closed
	Dead	Running	Release	Dead		Open

Engines


(2) 26-L
MU-2-A LEAD
CO Cock FRT
RI 24 RL
Rotair PASS LAP
CO Cock CLOSED
6 BL
CO Cock TRAIL
(3) 26-L
MU-2-A Trail 6 or 26
CO Cock Cut Out
26-L
MU-2-A LEAD
CO Cock FRT
(2) 26 L
MU-2-A TRAIL
CO Cock CUT OUT
(RI) 24 RL
Rotair PASS
CO Cock CLOSED
6 BL
CO Cock TRLG
26-L
MU-2-A LEAD
CO Cock FRT
6 BL
CO Cock TRAIL
(3) 26-L
MU-2-A Trail 6 or 26
CO Cock Cut Out

X = Closed
O = Open
(2) = MU - 2
(3) = MU 2 - A
RI = 24 RL
F = Foreign 24 RL

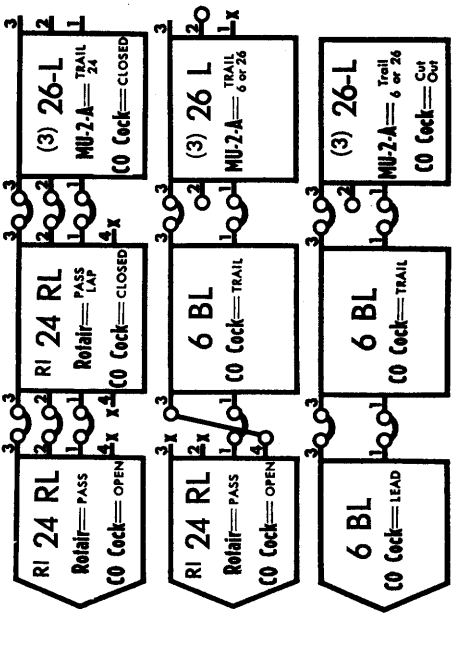
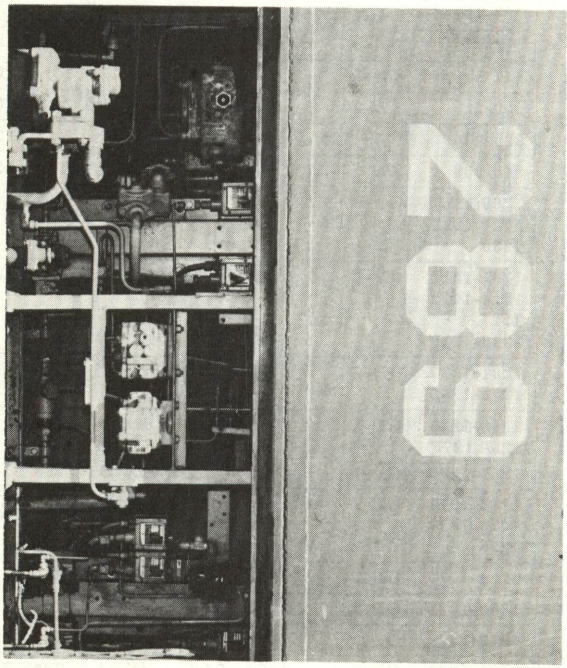


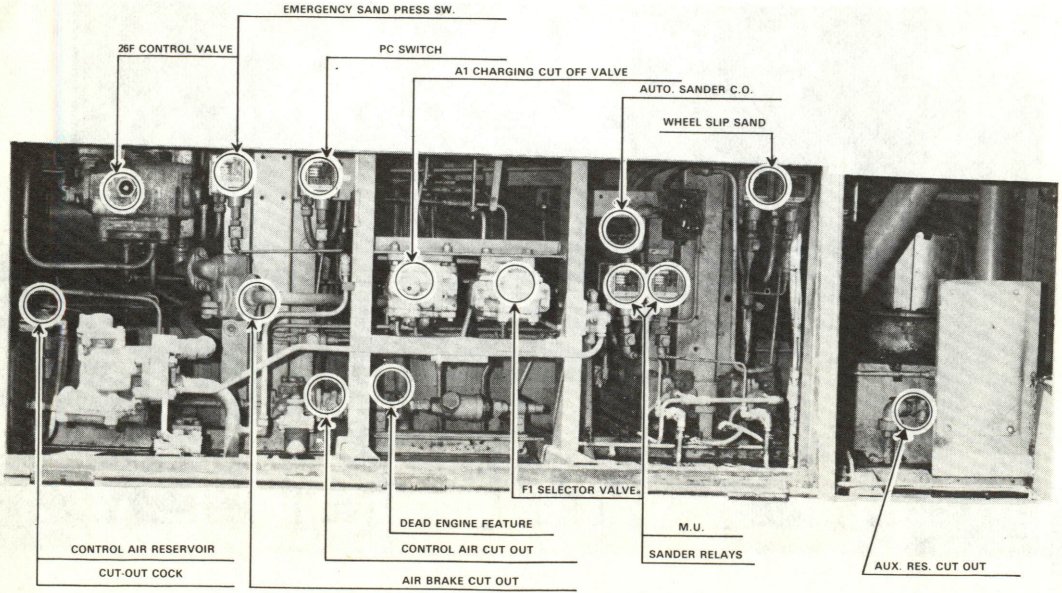
TABLE I
DIESEL ENGINE DATA

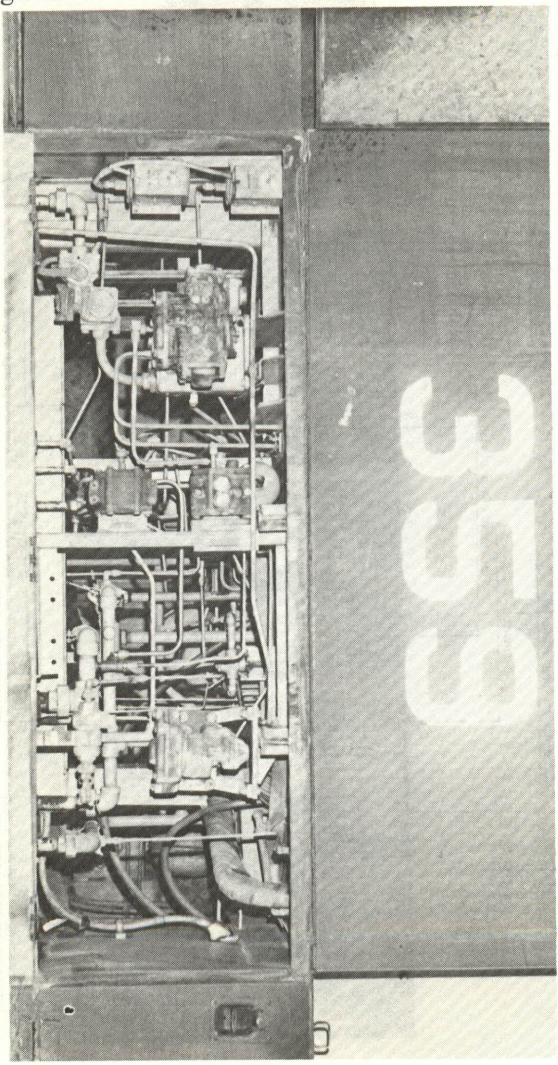
Series	Type	Fuel Oil Gals.	Type Air Brake	Builder	MU Control	H.P. Rating
10-27	F7-B	1200	24-RL	EMD	Yes	1500
100-127	F7	1200	24-RL	EMD	Yes	1500
190-199	U33B	3250	26-L	GE	Yes	3300
200-238	U25B	2900	26-L	GE	Yes	2500
240-253	U28B	2900	26-L	GE	Yes	2800
254-281	U28B	3250	26-L	GE	Yes	2800
285-299	U33B	3250	26-L	GE	Yes	3300
300-333	GP35	3000	26-L	EMD	Yes	2500
340-396	GP40	3200	26-L	EMD	Yes	3000
402-411	FP-7	1200	24-RL	EMD	Yes	1500
415-424	C415	1500	26L	ALCO	Yes	1500
430-432 435-438 440-441	GP-7	1700	6-BL	EMD	Yes	1500
433-444 439	GP-7	1200	6-BL	EMD	Yes	1500
451-456	RS-2	1700	6-BL	ALCO	Yes	1500
470-475	RS-3	1700	6-BL	ALCO	Yes	1600
485-499	RS-3	800	6-BL	ALCO	Yes	1600
529-536	SW-1	600	14-EL	EMD	No	600
537-546	SW-1	600	6-BL	EMD	No	600
550-563	SW900	660	6-BL	EMD	No	600
610	E7-B	1200	24-RL	EMD	Yes	2000
613-620	E8-B EA-6	1200 1200	24-RL 24-RL	EMD EMD	Yes Yes	2250 2000
638-642	E-7	1200	24-RL	EMD	Yes	2000
643-661	E-8	1200	24-RL	EMD	Yes	2250
662-665	E-9	2200	24-RL	EMD	Yes	2400

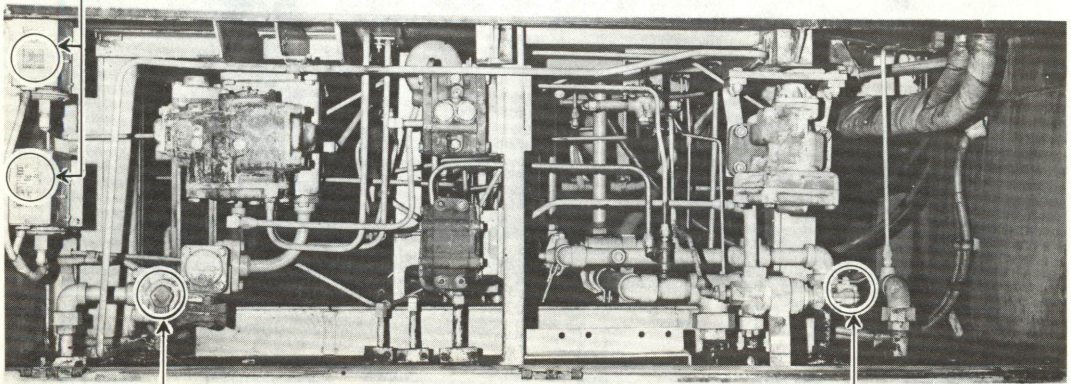
TABLE I
DIESEL ENGINE DATA (Continued)

Series	Type	Fuel Oil Gals.	Type Air Brake	Builder	MU Control	H.P. Rating
675-677	F-7	1200	24-RL	EMD	Yes	1750
	AB-6	1200	24-RI	EMD	Yes	2000
765-774 795-797	NW-2	600	6-BL	EMD	No	1000
775-779	SW-9	600	6-BL	EMD	No	1200
811-840	SW-8	600	6-BL	EMD	No	800
900-915	SW-900	600	26-L	EMD	No	900
920-936	SW-1200	930	26-L	EMD	Yes	1200
940-949	SW-1500	1100	26-L	EMD	Yes	1500
1200,1213 1220,1222 1230	GP-7	1200	6-BL	EMD	Yes	1500
1201-1212 1214-1219 1221, 1223-1229	GP-7	1700	6-BL	EMD	Yes	1500
1231-1237 1250-1255	GP-7	1700	6-BL	EMD	Yes	1500
1238-1239 1256,1275	GP-7	2350	26-L	EMD	Yes	1500
1257-1262	GP-7	1700	6-BL	EMD	Yes	1500
1263-1274 1276-1287 1293	GP-7	1600	6-BL	EMD	Yes	1500
1294-1299	GP-7	1100	6-BL	EMD	Yes	1500
1300-1311	GP-7	1700	6-BL	EMD	Yes	1500
1312-1320	GP-9	1700	6-BL	EMD	Yes	1750
1321-1332 P6BL-1322	GP-9	1700	26-L	EMD	Yes	1750
1333-1353	GP-18	1700	26-L	EMD	Yes	1800
4700-4719	GP-40	3200	26-L	EMD	Yes	3000
4800-4804	SW-1	600	LT	EMD	No	600
1287-1287	SL-12398	1287	34-RL	ALCO	Yes	1287

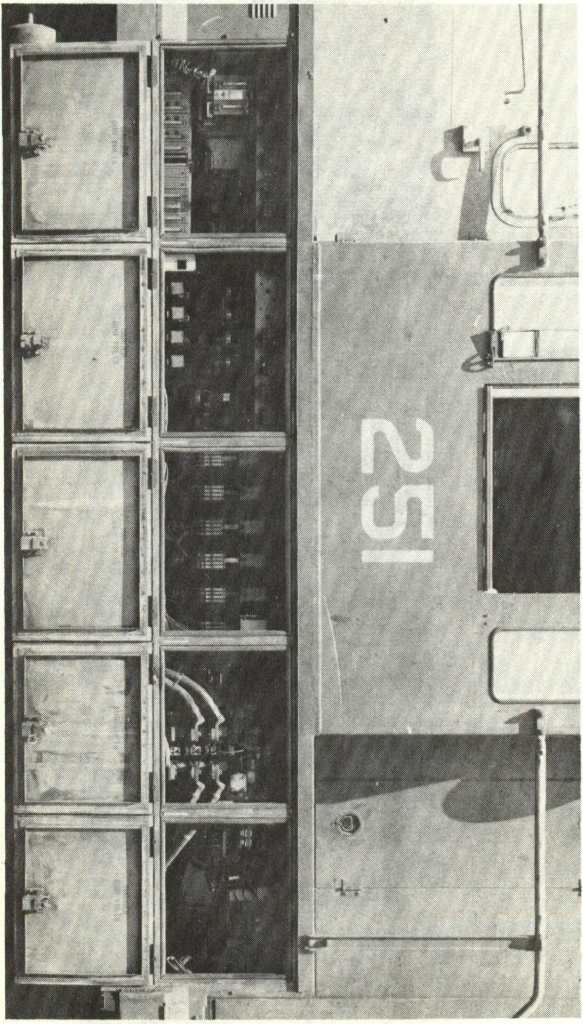

283

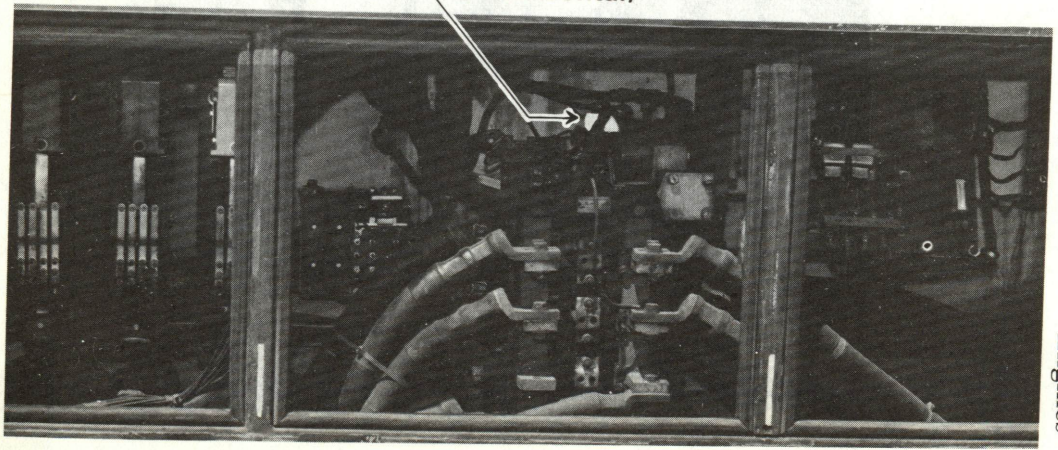

EMERGENCY SAND PRESS SW.
26F CONTROL VALVE
PC SWITCH
A1 CHARGING CUT OFF VALVE
AUTO. SANDER C.O.
WHEEL SLIP SAND
F1 SELECTOR VALVE
DEAD ENGINE FEATURE
CONTROL AIR CUT OUT
AIR BRAKE CUT OUT
M.U.
SANDER RELAYS
AUX. RES. CUT OUT
CONTROL AIR RESERVOIR
CUT-OUT COCK

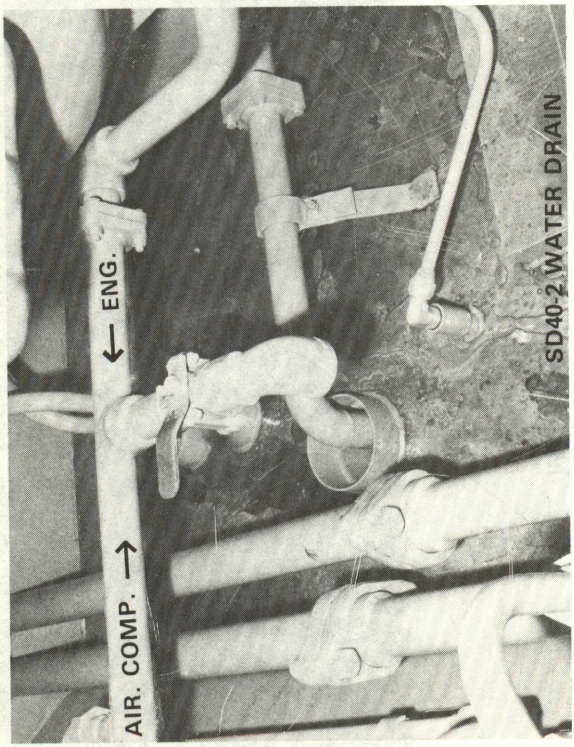

SSG

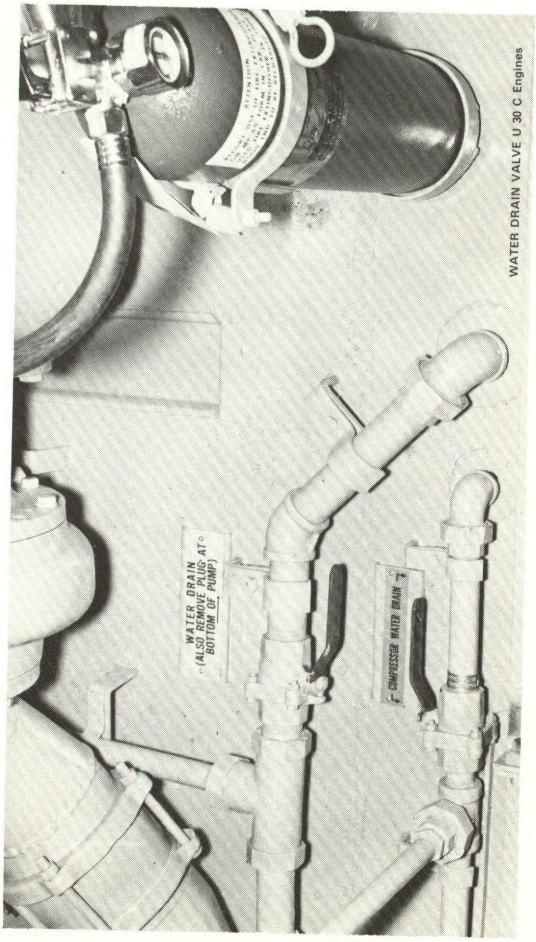

P.C. #1
P.C. #2
BRAKE SYSTEM CUT OUT
DEAD ENGINE
CUT-OUT COCK

Engines




Manual Reverse Lever
General Electric
Engines
(may be vertical
or Horizontal)


AIR. COMP. →
← ENG.
SD40-2 WATER DRAIN



WATER DRAIN VALVE U 30 C Engines

BOOK 4

ENGINEMEN

BOOK 4

ENGINEMEN

Rule 1

OPERATIONAL PRACTICE

The mark of a good engineman is:

1. Plan the trip in advance, so as to control train speed and slack action.
2. Control the train, never allow the train to control you.
3. Remember, drawbar forces are the result of:

Pulling force of throttle

+

Retarding force of cars

Rule 2

GENERAL RULES

Enginemen must be on the alert to observe reduction in train speed caused other than by a reduction of power or ascending grades, and note the need for power in excess of normal requirements as shown on the loadmeter. The cause of this speed reduction may or may not be indicated on air gauges in engine cab. When necessary, power must be reduced to avoid break-in-two.

Rule 3

Enginemen must check for brake pipe leakage before starting train stopped by application of train brakes other than by engineers brake valve. After air gauges in engine cab indicate brake pipe pressure has been restored, check must be made to assure there is no break or opening in the brake-pipe.

Graduated release of AB or ABD type freight

brake control valves is not possible. With pressure maintaining, do not attempt to release the brakes in just a portion of the train by means of a short time in release or running position and then returning to zone of application. This will set up false brake pipe gradient conditions. With a sizable number of ABD type valves in the train a complete release may occur anyway.

HANDLING OF LONG TRAINS

When handling long trains, avoid as much as possible the use of the train brakes to make a slow down. Instead, reduce the throttle far enough in advance to meet speed requirements. By studying the train makeup and the physical condition of the road, the throttle can be reduced and advanced at proper locations to reduce slack changes and keep the speed within required limits. The engineer must always take into consideration the following factors:

1. Number of units in engine consist.
2. Speed of train.
3. Length of train.
4. Grade conditions.
5. Rate of retardation.
6. Brake pipe leakage.

Rule 4

STARTING A TRAIN

When starting a train, use only enough power to assure continued movement and avoid harsh slack action. Do not repeatedly open and close the throttle, to accomplish a slow and uniform start. If excessive power is generated in #1 throt-

tle position, apply the engine brake a sufficient amount to control the speed for a smooth start.

When necessary to take slack to start a train, take only enough slack to accomplish the smooth start and avoid the possibility of the rear of train moving in reverse direction.

On ascending grades, when necessary to take slack to start a train, the automatic brake must be used to accomplish a smooth and uniform start. Using a very light application of the train brakes, move engine in reverse a sufficient distance to take slack necessary. Avoid excessive use of power to accomplish this. Care must be taken in order to prevent the rear of the train from moving in the reverse direction. Complete a service application of the brakes and then release the brakes. Make a normal start of the train. Timing is very essential in making starts on ascending grades and requires skill and attention to details, on the part of the engineer.

Knowing the capabilities of the engines, the grade conditions, and the train consist and make up, are all factors that must be considered, when starting a train under these circumstances.

On descending grades, extreme caution must be used to avoid the head end of train attaining appreciable speed before the rear of the train starts to move. The force generated by gravity alone is sufficient to cause severe slack action and possible train separation. The engineer should know if slack is bunched or stretched so he can plan his start accordingly.

Rule 5

SERVICE BRAKING OF FREIGHT TRAINS

Train slack must be kept stretched while stop

is being made by using power with train brakes applied. Gradually reduce power as speed reduces to avoid excessive drawbar pull. Keep engine brakes released. Initial reduction should equal 6 to 8 pounds. Use first service or minimum reduction if engine is so equipped, to allow slack to adjust. After slack adjusts, usually requiring about 20 seconds, make subsequent reductions of 2 or 3 pounds, as needed, to complete stop at the desired point. The braking should begin at a sufficient distance from the stopping point so that not more than 15 pounds total reduction will be required to make the stop. A final reduction MUST be made, when train is about to stop, to avoid a run out of slack. Make the final reduction so as to have air exhausting from the brake valve as the stop is made. Close the throttle before stop is made, and allow independent brake to set up with the final reduction.

When the make up of trains or grade conditions are such that slack cannot be stretched during service braking, gradually reduce throttle to the idle position and then proceed as outlined above. Allow independent brake to apply lightly to prevent weight of engines from causing run-out of slack.

Experience and attention to length of time that exhaust port is open, after lapping brake valve, will tend to inform the engineer the approximate length of the train.

When making a normal slow-down or a running release of the train brakes, engineers must know that sufficient time is available to recharge auxiliary reservoirs before a reapplication of brakes becomes necessary.

Rule 6

RETAINERS

It is the responsibility of the engineer to decide when and how many retainers will be set on a train. When braking with the slack bunched, set retainers on the head portion of train. When braking with the slack stretched, set retainers on the rear portion of the train. Retainers must be turned down when no longer needed.

Rule 7

HANDLING THE LIGHT ENGINE

In addition to required air brake tests, when leaving engine terminal or service track or after changing controls from one unit of a consist to another, a running test of the locomotive air brakes must be made as soon as possible. Locomotive operating practice requires that the throttle be in "idle" before coming to a complete stop. DO NOT make any attempt to change the reverser position before the wheels have stopped rotating and the locomotive has come to rest. (This also applies to engines with or without cars.)

Rule 8

RUNNING RELEASE

A number of factors determine at how low a speed brakes can be released without likelihood of damage. These factors include:

1. How heavily brakes are applied.
2. Time interval since last reduction.
3. Amount of main reservoir pressure.
4. Length of train.
5. Grade and curvature of track.

Enginemen

Engineers must exercise good judgment in this, but if in doubt, bring train to a stop.

Rule 9

BACK UP MOVEMENTS

Care is required in handling throttle and air brakes in order to avoid harsh slack action, or damaging equipment and lading, when making back up moves. The following precautions must be observed when backing a train:

A. Allow sufficient time for train brakes to release before applying power.

B. DO NOT USE ANY MORE POWER than is actually required to smoothly start the train in motion.

When stopping the train from a back up movement, make light brake pipe reductions while working power with the engine brakes released. Make additional reductions in 2-3 psi steps, as needed. Avoid making a heavy reduction. Use only sufficient power, as speed reduces, to prevent slack from running out. As train comes to rest, close throttle and apply independent brake promptly.

Rule 10

BACK UP OR REVERSE MOVEMENTS
(light engines)

Whenever the engine consist is cut-off from a train and it becomes necessary to make a back up movement for one mile or more, the controls must be changed to the lead unit, in the direction of travel, when possible to do so. Engineers must change operating ends for shorter distances, if local conditions or instructions require.

Rule 11

BACK-UP MOVEMENTS

Whenever the back up hose or valve is used to stop a train, the engineman must make a full service application of the automatic brake to avoid the possibility of stuck brakes on a subsequent move.

Rule 12

HELPER ENGINE

Whenever necessary for a following train to assist a preceding train up a grade or to the next siding the engine must be detached from the following train and the engine only used for assistance under these circumstances. The brake pipe must be connected to the helper engine the double heading or automatic brake valve cut out cock closed and the amperage controlled to the extent necessary to prevent jack knifing.

Rule 13

EMERGENCY BRAKE STOPS

Engineers initiating emergency brake stops from the engine must leave the automatic brake valve in emergency position until the train stops. Close throttle, and turn on sanders if engine is not equipped for automatic sanding. Control independent brake to extent necessary to prevent the wheels from sliding. A sliding wheel will not produce as short a stop as a rolling wheel which is braked as hard as rail adhesion will permit.

When an emergency brake application originates from the train, close the throttle and move the automatic brake valve to emergency position.

Enginemen

Control independent brake and sanders as outlined above. After train stops, place automatic brake in release or running position, to assist trainmen in locating trouble.

Following any emergency stop, determine if any flat spots have developed on the locomotive. This may be done by inspection or slowly rolling train, when permissible. Engineers must make a brake pipe leakage test following an emergency brake application originating in the train, to determine amount of leakage that may have developed due to stop.

Rule 14

BRAKE PIPE PRESSURE

Feed valves or pressure regulating valves must be set to deliver pressure for the brake in accordance with the type of service in which the locomotive is to operate.

Passenger	110	pounds
Suburban	90	"
Freight	80	"
Yard	65	"

NOTE: 1. The standard brake pipe pressure for freight trains is 80 pounds. There may be occasions, such as picking up cars at an intermediate point, when it might become necessary to make slight increases in brake pipe pressure in order to effect a release at the rear of the train. This is not to be construed so as to permit an engineer to leave his initial terminal with excessive brake pipe pressure.

Rule 15

REDUCTION OF POWER WHEN SHOVING OR PUSHING FREIGHT TRAINS

Whenever there are more than three road-switcher type units on a train and it becomes necessary to back up or shove a train, no more than the three units immediately next to the train may be used for traction. The remaining units must be taken off the line until all shoving or pushing moves have been completed. If more than three units are used in such moves, there is a possibility that the units will jack-knife or that train will buckle.

Rule 16

INDEPENDENT BRAKE

The locomotive brake cylinder pressure must be controlled by the independent brake valve to avoid wheels sliding.

The blocking down of the independent brake valve handle or bail, is strictly prohibited.

Enginemen must not adjust self-lapping independent brake valves or reducing valves for pressures higher than are specified herein:

Passenger and Freight locomotives with 24 RL or HSC equipment	35 lbs.
Road Switcher and Switchers with 6 and 26 equipment	45 lbs.
All others	35 lbs.

SLACK

Damage to lading and equipment may result

from improper methods of handling the locomotive. Consider a locomotive coupled to some 50 or 60 cars, with the slack stretched; a signal is given which necessitates pushing the cars. There may be 50 or 60 feet of slack in such a train. If the throttle is opened suddenly and heavily, the locomotive may attain a speed of 3 or 4 miles per hour before the other end of the train begins to move. The last few cars to move are suddenly thrust forward, while those cars in the middle of the train are being crushed through the energy being produced by the locomotive and cars close to it, and the cars at the extreme end of the train being required to suddenly assume a speed of from 3 to 4 miles per hour.

If, under these conditions, the movement is reversed, the slack is suddenly pulled out of the train, which results in the cars at the extreme end assuming an instantaneous speed of 3 or 4 mph. Shocks of such magnitude are produced under such methods that the equipment is unable to stand it. This results in damaging the entire structure of the car, its lading, or complete failure of the draft gear. No loss of time would result from moderately bunching or stretching the slack under these conditions before opening the throttle heavily.

Many train and yardmen practice advising the engineman in advance, the direction of the next move, by giving signals for a reverse movement following a stop signal. Do not confuse such signals as indicating impatience on his part. The stop signal permits bunching or stretching the slack until the stop is completed, while the next signal permits quick and careful handling.

Knowing the movement which is being made, the engineman can and should open the throttle lightly to moderately bunch or stretch the slack, or at least a greater part of it; after which the

throttle may be opened as wide as desired. In operating the locomotive brake, the brake should be applied quickly, but not heavily, (10 or 15 pounds brake cylinder pressure is sufficient) in order to bunch or stretch the slack moderately; after which the brake may be applied as heavily and quickly as desired. The slack should be taken as promptly as possible in order to facilitate the work. Prolonging the time of taking the slack leads to the practice of giving violent signals. Do Not Contribute to This.

It is possible in ordinary switching to adjust the slack moderately without loss of time by handling the throttle and brakes as previously outlined above. The use of the automatic brake valve in short switching is slower than necessary, while the proper use of the independent brake will produce the desired results.

When handling a large number of cars with the air coupled, and working through such cars, follow the suggestions contained in the next paragraph with reference to road switching.

So far as road work is concerned, everything that has been said with regard to switching in yards will apply, with the following exception. Ordinarily, in road work when switching is being done, any number of cars may be handled with the air coupled and working through such cars. Trainmen must understand that the time required for applying brakes in slowing down or stopping is slightly prolonged, if the use of emergency is to be avoided. When handling a large number of cars, car length signals must be given in advance. When switching passenger equipment where the slack is bunched or stretched and the locomotive has stalled, such as stretching the train after making a coupling, or reversing the movement, etc., the locomotive brake should be applied

as the throttle is closed to prevent the locomotive moving back into, or away from, the train with such force as to cause slack action.

Rule 17

SWITCHING PASSENGER EQUIPMENT

When switching passenger equipment, air hoses must be coupled, brake system charged, and only the automatic brake will be used during the switching moves. When coupling to cars not charged a full service brake pipe reduction must be made before air is cut in to the uncharged car. No attempt to move may be made until all brakes are released.

NOTE: Yard engines working with passenger equipment may increase brake pipe pressure to 110 pounds, when required. Yard engines may increase brake pipe pressure to 80 pounds, when required to handle previously charged cars out of a train.

Rule 18

ENGINEMEN TRAIN SEPARATIONS

Engineers will be held responsible for any train separations caused by improper handling of the train.

Rule 19

Rock Island crews are prohibited from operating the dynamic brake on units so equipped unless directed to do so by the road foreman or instructor in charge.

Rule 20

When charging or re-charging the brake pipe of a train or portion of a train, do not increase the engine speed of the locomotive unless the main reservoir pressure drops below 130 psi, as indicated by the gauge.

Rule 21

Nullifying the intended operation of any safety control or safety brake application is prohibited. In cases where normal recovery is not possible due to malfunction, close the cut-out cock controlling such feature and report same on regular work report.

Rule 22

Engines must not be operated with the brake cylinder cut-out cock closed. In case of emergency, when it is necessary to close the cut-out cock, engine is to be operated to the next terminal only, where repairs can be made.

Rule 23

A locomotive unit or units picked up enroute must be properly positioned and prepared for the movement to be made. See programming instructions on page 19, Book III.

Rule 24

USE OF SAND

When necessary to use sand to stop a locomotive moving light, (4 cars or less), use only sufficient sand to insure safe operation. After stopping, locomotive must be moved immediately a sufficient distance to clear sanded portion of rail

to insure proper operation of block or interlocking signals. Sand must not be used over the movable parts of interlocking, spring or power switches.

Rule 25

Enginemen when taking charge of locomotives must know that the brakes are in operative condition.

Rule 26

Enginemen must understand that normal brake pipe exhaust takes time. The longer the train, the longer the exhaust time. Brake pipe exhaust time also depends on the relative amount of brake pipe leakage and the number of cars in the train equipped with quick service and/or A-1 reduction relay valves. Weather conditions may also play an important part in exhaust times. Enginemen paying strict attention to the variations of the exhaust time can readily detect possible restrictions in the brake pipe, on any given train.

Rule 27

The engineer is responsible for the proper care of equipment and supplies in his charge. He must not permit any practice that will jeopardize the safe and efficient operation of the equipment.

Rule 28

ENGINEMEN

Enginemen when taking charge of engines must know that **All** brake cylinders are cut in and that all hand brakes are released. Pressure indicated on the brake cylinder gauge does not necessarily mean that brake cylinders are cut in.

Rule 29

When taking charge of a locomotive not coupled to a train, engineman must be sure that the brakes are operative and that brake valves function properly in all positions, before he operates the locomotive.

Rule 30

While in charge of a locomotive, engineman must drain all reservoirs equipped with manual or automatic drain cocks at every opportunity.

Rule 31

Unless relieved by proper authority, the engineman setting out a locomotive unit or units of a consist must know that such unit or units is properly secured. When such unit is equipped with 26 L brake equipment, the MU 2 A valve must be positioned in "Lead or Dead".

Rule 32

When coupling a locomotive to a train or to other locomotives, engineman must stop the locomotive a sufficient distance before coupling is made to insure safety to personnel, to prevent jackknifing, avoid impact damage to equipment and permit the air hoses to be blown out. It is the joint responsibility of enginemen and all employees involved in coupling a locomotive to a train or to other locomotives, to see that his required stop is made not farther than 10 feet from the point of the coupling.

Rule 33

Engineers must use extreme care when handling trains through turnouts, crossovers, and around

sharp curves, to avoid excessive acceleration or braking.

Rule 34

When operating engines at speeds exceeding 20 MPH, reduce the throttle to a Run 4 position before the engine reaches a railroad crossing at grade. If the engine is already operating in Run 4 position or lower, allow the same interval and place the throttle in the next lower position. Advance the throttle after all units of the engine consist have passed over the crossing.

Rule 35

Enginemen experiencing diesel trouble enroute or train delays due to knuckle or drawbar failure must send written message to Superintendent, Road Foreman, Division Mechanical Officer and Chief Dispatcher, giving all information possible to avoid unnecessary delays and/or misunderstandings.

Rule 36

Enginemen must not make manual transition by use of Air Magnet valves or Parallel Relays. It is imperative that Enginemen do not make any adjustments on transition relays or resistors.

Rule 37

MOVEMENTS DIT.

Enginemen required to pick up an additional unit or units enroute, either for use or to move dead in train, must know that such unit or units are programmed to move safely.

For movement "Dead in Train."

1. Reverser centered and blocked (On units so equipped)
2. All electrical switches in "off" position.
3. "Dead engine feature" open. (handle 90° to pipe)
4. Brake equipment as per instructions on page 19, Book III.
5. Hand brake released, after coupling is made, and know that all wheels are turning freely.
6. Cab doors and windows closed.

For movements of engines as part of working consist, be governed by instructions for trailing or leading units, shown on pages 20 and 21, Book III.

Rule 38

RADIOS

Engineers will be held responsible for the proper use of radios on the engine, in compliance with all radio rules. When radio is not operating properly it must be reported as soon as possible by wire or phone to the train dispatcher. In addition, it must be included on the work report, form MP 164, at the end of the tour of duty.

Engineers must keep radios turned "on" and volume controlled to allow proper understanding of communications. In multiple unit operation, the radio on the leading unit only will be used, when so equipped.

Rule 39

FLAT SPOTS

Engineers are responsible, to the extent of their

ability to control it, for the development of flat spots on the engine. Engines with flat spots in excess of 2½ inches must not be operated, unless authorized by proper officer.

Engines with flat spots less than 2½ inches may be operated to the final terminal. Whenever flat spots are developed in route, wire report must be sent from first open station giving all particulars.

Engineers receiving engines with flat spots at terminals must immediately notify Mechanical supervisor and/or dispatcher.

Rule 40

WHEEL SLIPS OR SLIDES

Enginemen must make every effort to control wheel slips on engines by proper handling of the throttle and use of sand. Wheel slip relays must not be prevented from performing their intended function. When stopping trains, unless otherwise prohibited, sand must be used for at least two car lengths short of stop to be made regardless of condition of the rail. When starting trains, sand should be used until sufficient speed is attained to prevent slippage. Manual sanding valve must be left open not less than five seconds each time sand is required. When slipping occurs, sand should not be applied until throttle has been reduced and wheels have stopped spinning. The engineer will be held responsible for unnecessary slipping of engine wheels.

When wheels slip or slide in starting a train, the wheel slip light will flash on and off intermittently. If the light stays on more or less constantly as the train speed increases, it is an indication that one or more pair of wheels are sliding and the

train should be promptly stopped and an inspection made.

IT SHOULD BE UNDERSTOOD THAT THE WHEEL SLIP LIGHT WILL NOT GIVE AN INDICATION IF THE ENGINE IS ISOLATED OR WHEN THE THROTTLE IS CLOSED TO IDLE POSITION.

Rule 41

In the event train or engine crew observe fire or smoke on or around the traction motor, the train should be stopped and the cause of the fire or smoke ascertained. The following inspection should be made:

1. With a flashlight, look through the screen and observe if any loose wire insulation can be seen in the motor. If the banding wire is broken, the armature coils may be thrown into the air gap, which could seize the motor.
2. Feel the end of the traction motor, as close as possible to the center where the armature bearings are located, for heat, which might indicate a bad order bearing.
3. Feel each traction motor support bearing to determine if hot.
4. When the locomotive is moved after this inspection, a member of crew must be on the ground, and a complete pull-by made slowly to see if all wheels are turning.

If anything is found wrong, and the wheels are turning, the train should be operated at slow speed to the first available point where the unit can be set out and the dispatcher notified. Should any of the wheels be sliding, contact will be made with the dispatcher before further movement is made with the unit.

Enginemen

In cases of repeated wheel slip indication or repeated ground relay action, under no circumstances should a locomotive unit or power plant be isolated and continued in service without first making the above inspection.

When necessary to isolate any GP-7, GP-9, GP-18, F-7, FP-7, E-7, E-8 or E-9 class engine, account KGR or similar malfunction and the engine remains idling in the consist, disconnect the governor cable and put the isolation switch in "Run" position, in order to insure train line wheel slip continuity.

Rule 42

REPAIRS TO LOCOMOTIVES

Shutdown — Start

In case of a diesel traction motor seizure or pinion gear failure, the unit must be set out at the first available point. While the unit is being set out, the conductor or some other member of the crew will contact the train dispatcher, advising him of the circumstances and will be governed by the instructions of the train dispatcher at that time.

In the event there is no means of communication with the train dispatcher at the point where the seizure or pinion gear failure occurs, the dispatcher is to be contacted from the first point where such means of communication is available, advising him where the unit was set out.

Repeated ground relay tripping may indicate traction motor failure, which might result in a locked axle. A check must be made to insure that all wheels are turning freely.

The ground relay will often trip when starting

a diesel engine, making it necessary to check the ground safety relay before engine is put on line.

The ground relay knife switch, when open, eliminates the protection of the ground relay. This switch must not be opened unless definite instructions are issued by the proper mechanical officer, road foreman or supervisor.

Repairs or adjustments are not to be attempted on locomotives while the unit is under load or being towed in a locomotive consist with the engine shut down or off the line. The traction motors on a dead locomotive which is being towed will generate enough voltage and current to be very dangerous even though all control equipment is shut off.

The following instructions must be complied with when a diesel locomotive's engine is shut down: The engine will have a tag applied to the isolation switch showing the diesel number, unit position, why the engine was taken off the line or shut down, the name of the employee, date, time and place. The engine must not be started again until inspection by a qualified mechanic or mechanical department supervisor. Instructions governing traction motor trouble are located in the cab of locomotives. To insure safety and to prevent damage to diesel engines and electrical equipment, it is imperative that all engine room doors be kept closed.

Rule 43

START

CAUTION: Before starting a diesel engine that has been shut down for more than one hour, the compression relief valves must be opened and

the engine barred over by hand before attempting to start the diesel engine.

Rule 44

STEAM GENERATORS

Enginemen, when in charge of units and having steam generators operating, will arrange to operate all steam generators in consist. The regulating valve must be set for 160 lbs., or higher if necessary.

CAUTION: Steam generators that have been shut down must have coils refilled before starting. Locomotive steam generators that have been shut down must be properly cared for and precaution taken to prevent any damage to steam generators through freezing. Steam separators on steam generators must be blown down at least twice over each subdivision.

Rule 45

WORK REPORTS MP-164

Engineers must see that a proper work report, MP-164, is made out for each and every unit in the engine consist. When "step on-step off" changes are made, the Engineer will be relieved of making ground inspection of the running gear, trucks, traction motors, etc., unless he has received advice from the in-bound engineer on this matter or he has good reason to suspect that a defect exists.

1. Under the heading "Repairs needed," the engineman will insert thereon any defects that have come to his attention during the normal course of operating such locomotive unit.
2. Under the headings "Main Reservoir Pressure"

and "Brake Pipe Pressure" the engineman will insert the pertinent information which covers his leading or controlling unit only.

3. Under "Condition of Brakes" and "Condition of Brake Rigging" the engineman will report "Good", unless he has noted a defect.

4. Engineman will be expected to fill in the data concerning; outside, lube oil, cooling water, temperatures and the various pressures, in-so-far as is practicable. Such information MUST be included whenever it could be relative to a defect noted.

5. All pertinent information relative to any defective condition, such as; amperage, throttle position, speed, etc. must be included when practicable.

6. Condition of the radio, on the lead or controlling unit, must be included. (Show; Good, BO, Weak, Scratchy, etc.)

7. Speedometers on road engines must be checked by observing time between mile posts twice each trip. The location, speed and any variation must be shown on the work report.

Rule 46

SPECIAL RULES FOR ALL EMPLOYEES WHOSE DUTIES INCLUDE THE MOVING OF ENGINES AT TERMINALS AND MAINTENANCE POINTS

A. Before boarding engine, employee must know:

(1) Brakes are applied by observing brake cylinder piston.

(2) Engine is free from wheel blocks, chains and other track or wheel obstructions.

(3) Engine is free from all hose or electrical connections that would interfere with movement.

(4) There are no other employees engaged in making repairs to engine, that are not aware of the movement to be made.

(5) There is sufficient clearance from all obstructions that would interfere with safe movement.

B. After boarding engine and before movement is made, employee operating engine must know:

(1) That brakes are cut in and in working order.

(2) There is sufficient Main Reservoir and Brake Cylinder Pressure to assure safe operation.

(3) That controls on all units are properly positioned for the movement to be made.

(4) That employee operating unit or units is fully aware of the movement or movements to be made.

(5) Proper whistle signal is given for the movement to be made.

(6) That engine bell is ringing before movement is started in either direction.

C. After movement is started, employee operating engine must know:

(1) That engine brakes are working by trying the brakes to insure safe operation.

(2) That all switches connected with the movement are properly lined.

(3) That employees giving signals concerning movements are in view.

(4) That engine is stopped short of the fouling point of all switches that are not properly lined.

(5) When movement requires coupling to other units, that it can be done safely and without damage to unit or other equipment and without danger to or injury to other employees.

D. That in case of doubt or uncertainty, the safe course must be taken.

E. After movement is completed and before leaving engine or engines unattended, employee must know:

(1) That brakes are applied.

(2) That all switches are in proper position in control unit.

(3) That engine is properly secured to prevent movement.

Rule 47

SPECIAL RULES FOR ALL EMPLOYEES WHOSE DUTIES REQUIRE THEM TO ASSIST HOSTLERS AND OTHER EMPLOYEES IN THE MOVEMENT OF ENGINES AT TERMINALS

1. Employees whose duties may require them to give signals must provide themselves with the proper appliances, keep them in good order and ready for immediate use.

2. Signals of prescribed color and type must be

used by day, and lights of prescribed color and type by night. Night signals must be used from sunset to sunrise, and when day signals cannot be plainly seen.

3. Employee must be fully qualified on the requirements of Rule 12, Uniform Code of Operating Rules.

4. When engines or diesel units are shoved and conditions require, a helper must take a conspicuous position on the leading unit in direction of travel.

5. See that engines or units left on tracks are properly secured, clear other tracks and, when practicable, clear public crossings at least 100 feet.

6. When coupling or shoving engines or units, take proper precaution to prevent damage or fouling of other tracks by stretching coupling, and setting sufficient hand brakes.

7. Both switches of a crossover must be lined before movement is started. Movement must be completed and cleared of other track involved before either switch is returned to normal position.

8. Engines or units must not foul any track until switches connected with the movement are properly lined.

9. Employees handling switches must see that they are properly lined for route to be used and that both switch points have moved and fit in proper position, and that lever is properly secured.

10. Where engines are being serviced, helpers will not give a signal to move engine or unit until

it is known that connections are removed and all employees clear.

11. Units of engines must not be uncoupled until it is known that all cables, air hoses, steam connections, etc., have been separated.

12. In case of doubt or uncertainty, the safe course must be taken.

13. Enginemen and trainmen, when boarding a train, must immediately acquaint themselves with the locations of the brake pipe emergency valves (conductor's emergency valves).

BOOK 5

TRAINMEN AND CARS

BOOK 5

TRAINMEN AND CARS

CABOOSE GAUGE

All cabooses are fitted with an air gauge that indicates brake pipe pressure. In normal operation the caboose is the rear unit of the train, therefore, this gauge indicates the minimum amount of brake pipe pressure of that train. The difference in pressure as indicated by the brake pipe gauge on the locomotive when compared with the gauge pressure indicated on the caboose is called "GRADIENT".

Rule 1

Trainmen must observe the caboose gauge frequently, especially when operating on descending grades and when approaching speed restrictions and in addition are required to observe this gauge frequently to insure that the brake pipe has not become blocked or that excessive leakage is not developing.

Rule 2

In order that caboose gauges can be maintained in good condition, trainmen will report any irregularity of same or differential between gauges on same caboose.

Rule 3

CONDUCTORS BRAKE VALVE

Any attempt to control train slack by opening and then closing the conductors valve can result in releasing any brake application made by the engineer, on engines equipped with pressure maintaining. This practice is strictly prohibited, with any type of motive power.

When running forward, brakes must not be

applied from the rear of the train except in cases of actual emergency, or when conditions require that the train be stopped and signal cannot be transmitted to engine crew by any means.

After the caboose valve handle has been moved to any position to apply the train brakes, it MUST NOT be moved toward the closed position until the train has stopped.

Applying the brakes by the use of the emergency valve, except in actual cases of emergency, is prohibited.

Rule 4

USE OF RADIOS

When radio communication is available between the caboose and engine, the conductor or rear brakeman will inform the engineer when the entire train is moving and other pertinent information necessary to accomplish smooth and efficient starting of the train.

Rule 5

The conductor will be responsible for the proper use of the radio, on the caboose, in accordance with all radio rules, and must report any radio not operating properly. Radios must be turned "on" and volume controlled to allow receiving of communications. When not relieved by connecting crew, radios must be turned "off" at completion of tour of duty.

Rule 6

CABOOSE STOVES

When necessary to shut caboose stoves off, it

must be turned off at both the supply line shut off and the control valve on the stove.

No attempt should be made to ignite caboose stoves when fuel is visible in the fire pan, before turning on the control valve.

Rule 7

COUPLING ENGINES TO TRAINS OR OTHER ENGINES

Before coupling engines to train or to other engines, stop must be made not more than 10 feet from point of coupling, to permit trainman to blow condensate from air hose.

Rule 8

YARD AND ROAD SWITCHING

Cars must not be kicked or dropped at such speed as will cause danger to employees, damage to equipment, or displacement of lading. The following table indicates the relative coupling shocks encountered at different coupling speeds:

2 MPH	.....	4 times that of 1 MPH
3 "	.....	9 " " " " "
4 "	.....	16 " " " " "
10 "	.....	100 " " " " "

Impacts of 4 MPH are generally absorbed by the draft gear. Impacts above 4 MPH result in damage to lading, equipment or both.

Rule 9

Not more than two consecutive brakes in a train may be cut out.

Trainmen and Cars

Rule 10

Before leaving terminals or at points where cars are added to a train, trainmen must report to engineer, advising number of loads, empties, tonnage and tons per operative brake, where practicable.

Rule 11

Short movements with long or heavy trains must be avoided, whenever possible. It shall remain the decision of the engineer if short movement can be made safely.

Rule 12

When coupling engines to cars of a train, or adding cars to a previously charged train, care must be used in opening angle cocks to prevent emergency application of the brakes.

Rule 13

SWITCHING PRACTICES

Violent signals must not be given, except in cases of emergency or to avoid an accident. Give proper signals sufficiently in advance so that violent signals will not be necessary. Use "easy" or car length signals, when it is desired to reduce speed when shoving to a coupling or to end of tracks, spotting cars, etc.

Switching with long heavy cuts of cars should be avoided when practicable.

Rule 14

HAND BRAKES

Hand brakes must be released, brake chains free

on cars before leaving terminals, and on cars added to train enroute. When cars are left on sidings, industry, house, or any track with the hand brake applied, air brakes must be released and retaining valves turned down to insure cars being securely held by hand brakes.

If the hand brake cannot be released by hand, the brake pipe should be charged and air brakes set which should allow brakes to be released by hand.

Rule 15

STICKING BRAKES

Trainmen experiencing sticking brakes or stuck brakes on a car, will check to insure that the RETAINER valve is in release position, will close the branch pipe cut-out cock and drain the brake system on that car. See page 15 for location of cut-out cock. If after complying with the above instructions, the brakes again creep on or set up on this car, proceed as outlined below. Using a piece of wire or string, tie the bleeder rod open to prevent a build up of air pressure. See diagram on page 15 for the identification and location of the reservoir bleed rod.

CAUTION: Trainmen experiencing stuck or sticking brakes or any condition necessitating cutting-out the brakes, MUST notify the mechanical department specifying train, location, car number, lading, etc.

RETAINING VALVE: When used, as required by instructions, it functions to hold air pressure in car brake cylinders while brake pipe is being recharged. There are two types:

A. Old standard Pressure Retaining Valve, which has three positions:

Trainmen and Cars

A. 1. Direct Exhaust—"EX"

(a) Handle turned down.

(b) Brake cylinder pressure vents directly to atmosphere during brake release.

2. High pressure retaining—"HP"

(a) Handle turned to position 45 degrees below horizontal.

(b) During brake release, 20 pounds of brake cylinder pressure is retained.

3. Low pressure retaining—"LP"

(a) Handle turned to horizontal position.

(b) During brake release, 10 pounds of brake cylinder pressure is retained.

B. New standard Four-Position Release Control Retainers; In addition to the three positions found on the standard retaining valve, (Part A, above), this valve has a fourth position: Slow direct exhaust—"SD"

1. Handle is turned to position 45 degrees above horizontal.

2. During brake release, brake cylinder pressure blows down from 50 to 10 pounds in the first 90 seconds and then continues to blow down to zero pressure.

OPERATIONAL CHARACTERISTICS COMMON TO ALL AB BRAKE EQUIPMENT

1. Quick Service. Control valve exhausts a fixed volume of air to the atmosphere. (It must be understood that a minimum of 10 psi of brake cylinder pressure is developed).

2. Insured release. An automatic release of the air brakes is instituted whenever the brake pipe pressure is increased 1½ or more psi above auxiliary reservoir pressure.
3. Rapid recharge. Whenever the brakes are released, a portion of the emergency reservoir air is used to assist the recharge of the auxiliary reservoir.
4. Speed of emergency. An emergency brake application will serially transmit through a train at the rate of 930 feet per second.
5. Development of emergency. Full emergency cylinder pressure is developed within 8 to 10 seconds, with 80 psi brake pipe pressure.

COUPLERS & KNUCKLES

Because of the many different types of couplers in use in freight trains, it is of advantage to the trainman and engineer to be able to distinguish between the various knuckles used with these couplers. The AAR Standard "E" Coupler, with either a rigid or swivel shank, is used on most freight cars at the present time. These couplers can be identified by the letter "E" immediately preceding the two numbers, which appear in the catalog number cast into the top of the coupler on the guard arm side. Typical type "E" coupler designations are B-E60-HT, B-E67-HT, B-E61-HT, etc. dependent upon the type and size of the shank or type of draft gear arrangement it is used with. The catalog designation of the knuckle used with the Type "E" Coupler, which is cast into the top of the knuckle, is E50 or E50-HT. The letters "HT" designate that the knuckle was cast in high tensile steel. The E50 or E50-HT knuckle is also used with the AAR Type "D" coupler which is now a superseded design but many "D" couplers are still in use.

Trainmen and Cars

There is a tendency toward greater use of the AAR Alternate Standard Type "F" Interlocking Coupler especially on TTX equipment and also on integral unit trains where the Type F rotary coupler permits car dumping without uncoupling or disconnecting air hoses. These couplers can be identified by the letter "F" immediately preceding the two numbers which appear in the catalog number. On Type "F" Coupler bodies, the catalog number is cast into the top of the coupler on the knuckle side. Typical Type "F" coupler designations are C-F79-HT, C-F70-HT, C-F71-HT and C-F72-HT. The catalog designations of the knuckle used with the Type "F" Coupler is F51-HT. Thus any coupler knuckle with the letter "F" can be used with any coupler body that includes the letter "F" as part of its catalog number as shown in the examples above.

Also, with the greater use of mixed trains, that is trains carrying freight cars and head end express cars, or a combination of freight and passenger cars, it is important for the trainman to be able to also identify the knuckle used with the AAR Standard "H" Tightlock Coupler. The Type "H" Couplers can be identified by the letter "H" immediately preceding the two numbers which form a part of its catalog number. The catalog number of the knuckle used is H50-HT-5.

It can be seen from the above discussion that any coupler knuckle with the letter E, F, or H can be used with coupler bodies that include the same letters in their catalog numbers. The letter designating the coupler type will be that letter immediately preceding the two numbers forming part of the catalog number. For reference, the sketch shows the location of the catalog numbers which are cast into the coupler bodies

and knuckles by the various manufacturers. In the case of the coupler body, its catalog number will appear on the top of the coupler on either the guard arm or knuckle side as shown in the sketch. In the case of the knuckle, its catalog number will appear on the top side as shown. In those cases where the catalog number of the knckle is not discernible due to weathering or other reasons, the proper knuckle replacement can be determined by noting the letter designation on the coupler body as discussed previously.

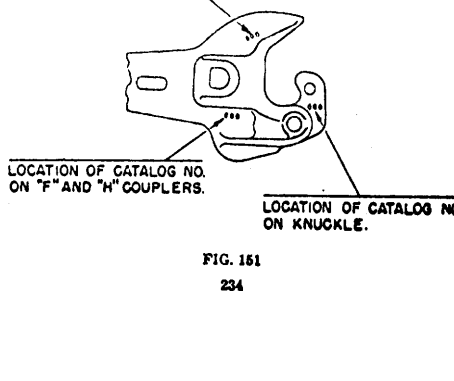


FIG. 151

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ANGLE COCKS & CUT OUT COCKS

Regardless of the type of handle or position of handles, it is always possible to determine the difference between an Angle Cock and a Cut-Out Cock by noting the slot or raised line which will indicate the flow of air through the pipe.

NOMENCLATURE OF BOXCAR SCHEMATIC

CARS

1. End roof sheet
2. Latitudinal runnning board
3. Hand brake ratchet operating lever
4. Roof handhold
5. Hand brake gear-housing support
6. Running board end support
7. Longitudinal running board bracket
8. Running board end saddle
9. Roof sheet
10. Longitudinal running board
11. Running board intermediate saddle
12. Roof seam cap
13. Running board splice saddle
14. Corner cap
15. Grain strip at floor
16. Side lining
17. Door post and side sill gusset
18. Door post and side plate gusset
19. Door bottom backing plate
20. Door lifting device operating cam
21. Door lifting lever shaft
22. Door lifting device connecting bar
23. Door lifting device roller support
24. Door roller
25. Flooring
26. Side lining nailer or furring strip
27. Intermediate side post
28. Door post filler
29. Door post grain strip
30. Door post
31. Door header angle
32. Side plate
33. Door top retaining Z-bar
34. Door post protection strip
35. Grain spout hook
36. Latitudinal running board bracket
37. Side ladder stile bracket
38. Door back stop (upper)
39. Door top edge
40. Door top sheet
41. Door rear weather strip
42. Door spark seal
43. Door rear edge backing plate

44. Door post sealing strip
45. Door front edge backing plate
46. Side placard board
47. Side placard board protection strip
48. Side sheet
49. Side ladder tread
50. Side ladder stile
51. Door rear edge
52. Push pole pocket
53. Sill step
54. Sill step bracket
55. Body bolster and side sill connection
56. Door center sheet
57. Door bottom sheet
58. Crosstie and side still connection
59. Door handle
60. Door back stop (lower)
61. Routing card board
62. Door bottom edge
63. Door lifting lever retainer
64. Door lifting lever
65. Door hasp holder
66. Door hasp
67. Door bottom retainer
68. Door front edge
69. Door track
70. Side sill reinforcement
71. Door threshold plate
72. Door threshold reinforcing angle
73. Door threshold support angle
74. Door track bracket
75. Side sill
76. Door hasp seal pin
77. Door operating lever
78. Door front stop
79. Door lock
80. Filler strip
81. Crossbearer top cover plate
82. Defect card receptacle
83. Crossbearer diaphragm
84. Crossbearer bottom cover plate
85. Floor stringer support bracket
86. Floor stringer
87. Floor clip
88. Center sill
89. Crosstie
90. Center still stiffener
91. Body bolster stop cover plate
92. Body bolster bottom cover plate

93. Body bolster diaphragm
94. Side bearing brace or body bolster stiffener
95. Body side bearing
96. Combined body bolster center filler and rear draft gear stop
97. Body center plate
98. Corner post
99. End sill
100. Diagonal brace
101. Rear draft gear stop, cast integral with body bolster center filler
102. Draft gear carrier
103. Coupler yoke
104. Draft gear
105. Draft gear follower or follower plate
106. Front draft gear stop, cast integral with striking casting
107. Draft key retainer
108. Draft key
109. Coupler carrier
110. Coupler carrier wear plate
111. Coupler knuckle
112. Coupler head
113. Combined striking casting and front draft gear stop
114. Coupler knuckle pin
115. Hand brake bell crank
116. Bell crank pin
117. Bell crank bracket
118. Air brake retaining pipe union ell
119. Uncoupling lever
120. Uncoupling lever bracket
121. End handhold bracket
122. End handhold
123. End ladder stile bracket
124. Steel end bottom sheet
125. Steel end filler block or end furring
126. End lining
127. Vertical hand brake rod
128. Steel end filler clip
129. Steel end filler clip collar bolt
130. Release control retainer pipe (Retainer pipe)
131. End placard board
132. End placard board protection strip
133. Release control pipe clamp
134. End ladder tread
135. End ladder stile
136. Brake step bracket
137. Brake step
138. Hand brake winding chain clevis

139. Hand brake winding chain
140. Hand brake gear housing
141. Release control retainer (Retainer valve)
142. Steel end top sheet
143. Hand brake wheel
144. Brake shoe key
145. Truck side frame
146. Brake hanger wear plate
147. Brake hanger key
148. Brake hanger bracket, cast integral with side frame
149. Brake pin and cotter
150. Truck bolster
151. Truck center plate, cast integral with truck bolster
152. Center pin
153. Dead lever guide bracket
154. Dead lever guide
155. Truck dead lever
156. Bottom rod safety support
157. Axle
158. Truck side bearing roller
159. Truck side bearing and roller guide
160. Wheel
161. Journal box lid pin
162. Journal box, cast integral with truck side frame
163. Top spring plate
164. Truck spring
165. Bottom spring plate
166. Journal box lid hood
167. Journal box lid spring
168. Journal box lid
169. Journal bearing wedge
170. Journal lubricator
171. Journal bearing or journal brass
172. Dust guard cap
173. Dust guard
174. Dust guard wedge or plug
175. Brake beam truss rod
176. Bottom brake rod
177. Brake beam safety support
178. Brake beam strut
179. Truck live lever
180. Brake beam compression member
181. Brake hanger or brake beam hanger
182. Brake shoe
183. Brake head
184. Hand brake bell crank chain
185. Hand brake rod guide
186. Hand brake connecting rod
187. Brake lever badge plate
188. Hand brake connecting chain

189. Air brake cylinder push rod
190. Air brake cylinder
191. Brake cylinder support
192. Brake cyclinder pipe
193. Floating lever
194. Combined dirt collector and branch pipe cutout cock
195. "AB" valve support
196. "AB" valve
197. Branch pipe tee
198. Branch pipe tee support
199. Floating and truck lever connecting rod
200. Brake pipe anchor
201. Brake pipe coupling
202. Brake pipe nipple
203. Angle cock
204. Air brake hose
205. Air brake hose coupling
206. Air brake hose coupling gasket
207. Air brake hose clamp
208. Air brake hose nipple
209. Emergency reservoir pipe
210. Reservoir support, emergency end
211. Two-compartment reservoir
212. Air brake release rod
213. Reservoir support, auxiliary end
214. Auxiliary reservoir pipe
215. Floating lever fulcrum
216. Floating lever guide
217. Cylinder and floating lever connecting rod
218. Cylinder lever
219. Cylinder lever guide
220. Cylinder and truck lever connecting rod
221. Brake pipe or train pipe
222. Angle cock holder support
223. Angle cock holder