ALCO

TP-454

OPERATING MANUAL

630 Loco

CENTURY SERIES

ROAD LOCOMOTIVES

AC-DC TRANSMISSION

R. Paul

ALCO ALCO PRODUCTS, INC.

NOTE

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MISSING

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Pages

OPERATING MANUAL

CENTURY

430 630

This manual covers the basic instructions to assist operating personnel in the efficient servicing and handling of "Century Series" road locomotives with AC-DC transmission.

Descriptive information pertaining to the most commonly used "specialties" is contained herein and defined with the phrase (if used). The manual is written so as to be complete for locomotives with or without the specialty equipment.

The information furnished is based on construction as of date material was compiled.

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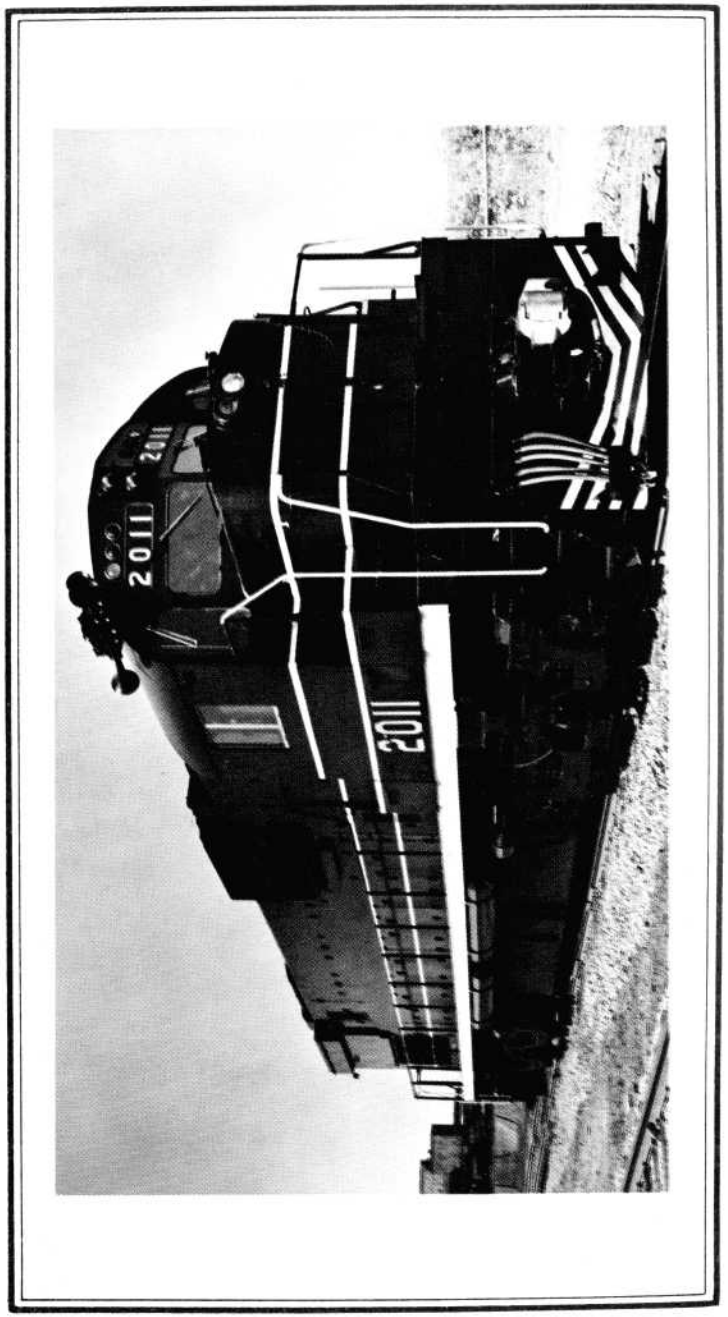

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CENTURY 430

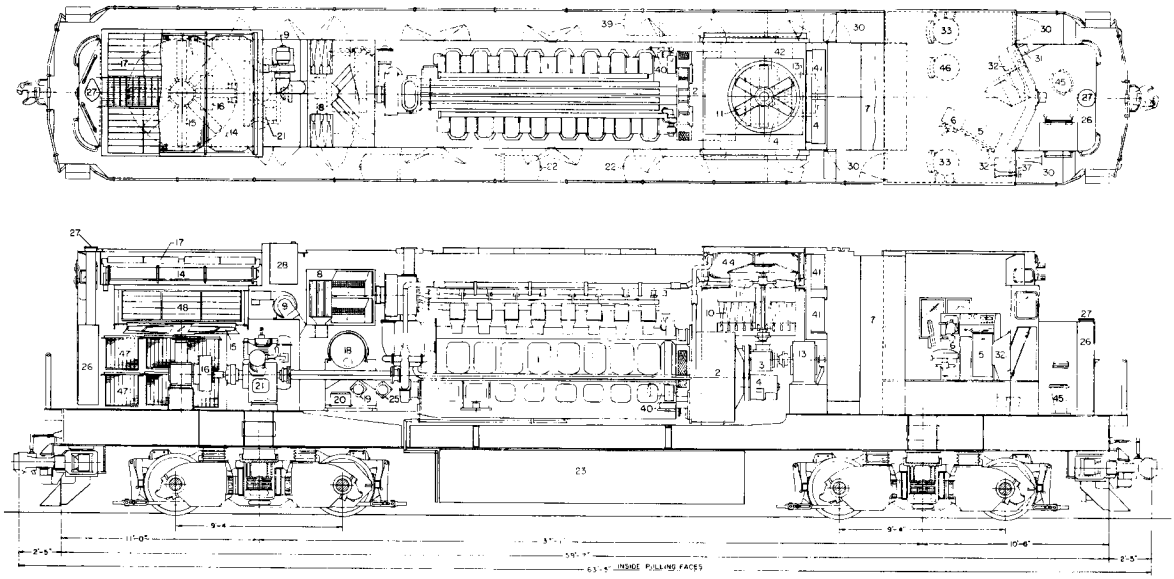
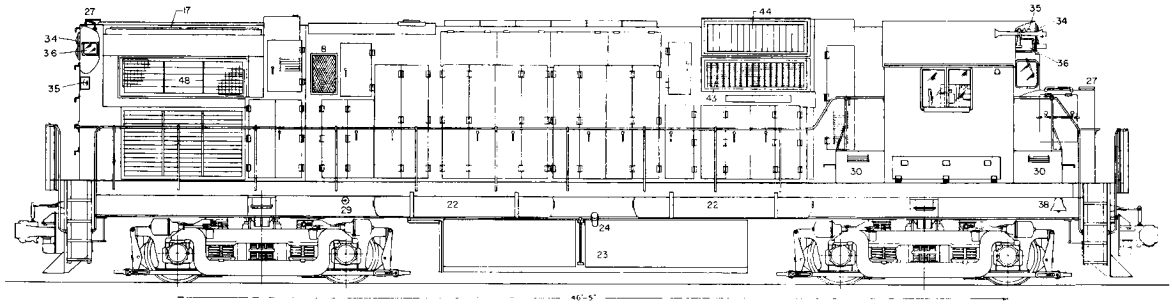


FIG. 1 - PART 2
LOCATION OF APPARATUS
CENTURY 430



1. Engine
2. Alternator
3. Gear Box - Fan Drive
4. Auxiliary Generator
5. Control Stand
6. Brake Valves
7. Control Compartment
8. Mechanical Air Cleaner (Engine Air)
9. Air Cleaner Exhauster
10. Mechanical Air Cleaner - Alternator, Rectifier and T.M. Air
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28. Engine Water Expansion Tank
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FIG. 2 - PART 1
LOCATION OF APPARATUS
CENTURY 630

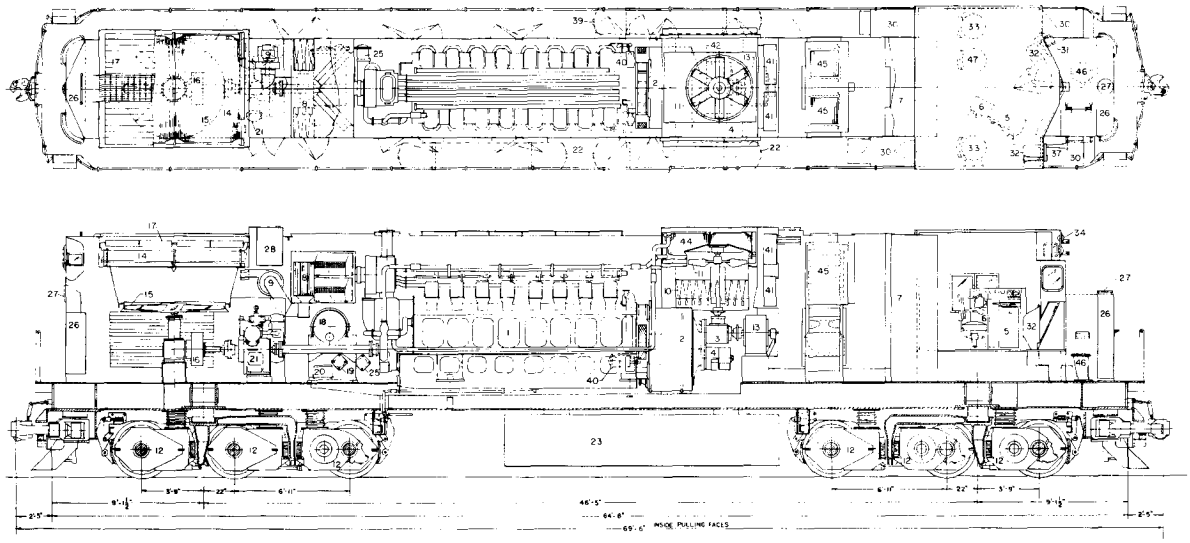
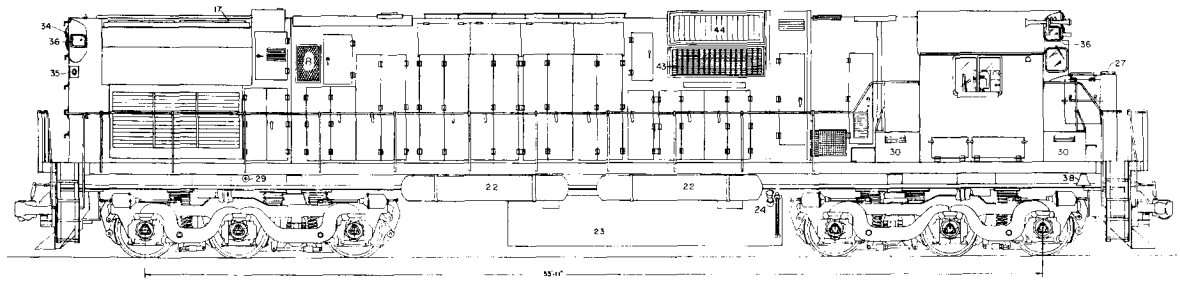


FIG. 2 - PART 2
LOCATION OF APPARATUS
CENTURY 630



1. Engine
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41. Rectifier
42. Exciter
43. Shutters
44. Radiator and Shutters (Engine Aftercooler)
45. Dynamic Brake Resistors)
46. Toilet) Modifications
47. Cab Seat)

BASIC DATA

Century Series	430	630
Specifications	DL-430	DL-630
Class - AAR	B-B	C-C
Wheel Diameter (In.)	40	40
Journal Size (In.)	6-1/2	6-1/2
Track Gauge (Ft. -In.)	4-8-1/2	4-8-1/2
Engine Data		
Speed (RPM)	1100	1100
Horsepower, Traction (HP)	3000	3000
Bore (In.)	9	9
Stroke (In.)	10-1/2	10-1/2
Cylinders	16	16
Capacities		
Fuel Oil (Gal.)	3000	2000
Lubricating Oil (Gal.)	250	250
Cooling Water (Gal.)	340	340
Sand (Cu. Ft.)	28	48
Traction Motors	4	6
Air Brake Equipment	26-L	26-L
Principal Dimensions and Location of Apparatus	Fig. 1	Fig. 2
Track Curvature (Maximum)		
MU Operation	30°	21°
Without Train	39°	25°
Weight		
On Drivers (Lbs.)	272,000	350,000
Total Loco. (Lbs.)	272,000	350,000

INTRODUCTION

These versatile diesel electric road locomotives are adaptable to all classes of railroad operations. They consist of one unit complete with diesel engine, generator, trucks and necessary accessories, with an operating cab between the long and short hoods. Controls may be applied for multiple unit operation with all units controlled from one cab.

DIESEL ENGINE

Each locomotive unit is powered by a V type 9" x 10-1/2", single acting, turbosupercharged, Model 251, diesel engine of four stroke cycle having an open combustion chamber with solid fuel injection. The engine speed is governed by an electro-hydraulic governor.

The diesel engine has an all welded steel frame. Full pressure lubrication of all parts is provided. A pressurized cooling system is used; the cooling water flows successively through the engine, the radiators and the lubricating oil cooler and is circulated by an engine driven centrifugal pump. Lubricating oil is cooled by the water in the heat exchanger and the water by fan cooled radiators.

Thermostatically controlled radiator shutters and fan maintain desired engine temperature automatically.

TRACTION AND AUXILIARY GENERATORS

The traction generator (alternator) is an alternating current, 3-phase machine direct-connected to the diesel engine crankshaft. Solid state rectifiers convert A-C current to D-C for application to the traction motors.

The exciter and auxiliary D-C generators are gear driven from the main generator shaft. The auxiliary generator supplies power for battery charging and low voltage circuits for lighting, control and auxiliary

motors. The exciter supplies power to the excitation system.

TRACTION MOTORS

Each D-C motor is supported by axle suspension bearings and a resilient support mounted on the truck transoms.

Shrunk onto the motor armature shaft is a pinion gear which meshes with a drive gear pressed onto the wheel axle. The gear ratio between the pinion and drive gear is expressed by two figures "81/22". The first number indicates the number of teeth on the driven gear and the second number indicates the number of teeth on the pinion.

The forward and reverse movement of the locomotive is controlled by the positioning of the reverser which, when moved from forward to reverse position, by the reverse handle at the engineman's position, changes the direction of the current through the traction motor fields.

"Transition" is the changing of traction motor connections and is controlled automatically. The motor connections take place in reverse order when locomotive is decelerating with power on.

AUTOMATIC TRANSITION

These units are equipped with automatic transition. Placing the selector handle in position No. 1 permits automatic transition to take place at predetermined locomotive speeds during acceleration and deceleration.

Transition events are as follows:

Starting: Motors connected in series parallel.
1st Event: Motors connected in parallel.

AUXILIARY EQUIPMENT

Engine Air System

Air is drawn through a mechanical type air filter and further filtered by oil-panel type air filters. Dirt removed by the mechanical filter is exhausted through a motor-driven aspirator.

Electrical Rotating Equipment Ventilation

Air is forced through a mechanical type air filter by a mechanically driven fan. A portion of this filtered air is used for cooling the generators and is then used to purge the engine compartment. The remaining portion of the filtered air is blown by a gear-driven multivane type blower into a duct through the underframe for cooling the traction motors and through a separate duct for cooling the main generator rectifiers.

Engine Aftercooler Radiators

The engine air aftercooler is separately water cooled by radiators located in top portion of generator compartment. The system is filled from the main engine cooling system.

Auxiliary Drives

The diesel engine drives the radiator fan through an eddy current clutch. Connections between the engine, air compressor and eddy current clutch are through flexible couplings.

DYNAMIC BRAKING (If Used)

The dynamic brake is a means by which the traction motors are used to produce braking instead of pulling effort. The motors are reconnected as generators and the power produced by them is dissipated as heat by fan blown resistors. This brake is used principally on grades, though it may be used to very good advantage for slow-downs. The resistor assembly is mounted

between the engine compartment and operating cab or in the radiator compartment.

OPERATING CONTROLS

CONTROL STAND

The control stand and engineman's position are shown in Fig. 3. The callouts and legends show the various controls conveniently located to the engineman.

CONTROLLER OPERATING HANDLES

Throttle Handle

Has an "Idle" or "0" position and eight running notches. Its position is shown by an indicator above the handle.

1. Advance throttle handle completely into each succeeding notch. Do not leave it halfway between notches.
2. The throttle handle can be returned to "Idle" as rapidly as desired.

Selector Handle

Has an "Off" or "0" position with four motoring positions to the left and a braking range to the right. Its position is shown by an indicator at top of the controller.

1. Handle in "Off" position disconnects traction motors, power and braking circuits.
2. Handle in motoring position No. 1 sets up motoring circuits. Transition will take place automatically both accelerating and decelerating.
3. When in MU with units equipped for non-supervisory* automatic transition the selector handle in the lead unit should remain in the No. 1 transiton position.

* No manual control of transition with selector handle.

4. When in MU with units equipped for supervisory** automatic transition, the selector handle on lead unit should be placed in selector position No. 4.
5. When in MU with units equipped for manual transition, selector handle should be moved from position No. 1 up through position No. 2, 3 and 4 according to operating instructions on the locomotive equipped with manual transition.
6. Handle in braking range provides control of dynamic braking. If locomotive is not equipped with dynamic braking, a stop on the controller prevents movement of the handle into the braking range.

Reverse Handle

Has three positions, "Forward, " "Off" and "Reverse" for selecting the desired direction of locomotive movement. Move handle in same direction as desired for locomotive movement. Center position is "Off."

Hump Control Handle (If Used)

Has on "Off" position and a hump control range when moved downward.

MECHANICAL INTERLOCKING BETWEEN HANDLES

Throttle Handle

Can be moved from "Idle" position only with selector handle in 1, 2, 3, or 4 and reverse handle installed.

Selector Handle

1. Can be moved from "Off" to the No. 1 position regardless of reverse handle position.
2. Can be moved to position No. 2, 3, or 4 only when reverse handle is "Forward" or "Reverse."

** Manual control of transition with selector handle.

3. On units equipped with dynamic braking the selector handle can be moved into the braking range only when reverse handle is "Forward" or "Reverse" and throttle handle is in "Idle."

Reverse Handle

1. Can be moved only when throttle handle is in "Idle," and with selector handle in "Off" or in No. 1 position.
2. Can be installed or removed only when in "Off" position.

Hump Control Handle (If Used)

Can be moved regardless of position of the above handles.

CONTROLS AT ENGINEMAN'S POSITION (Fig. 3)

MU Emergency Stop-Run Switch

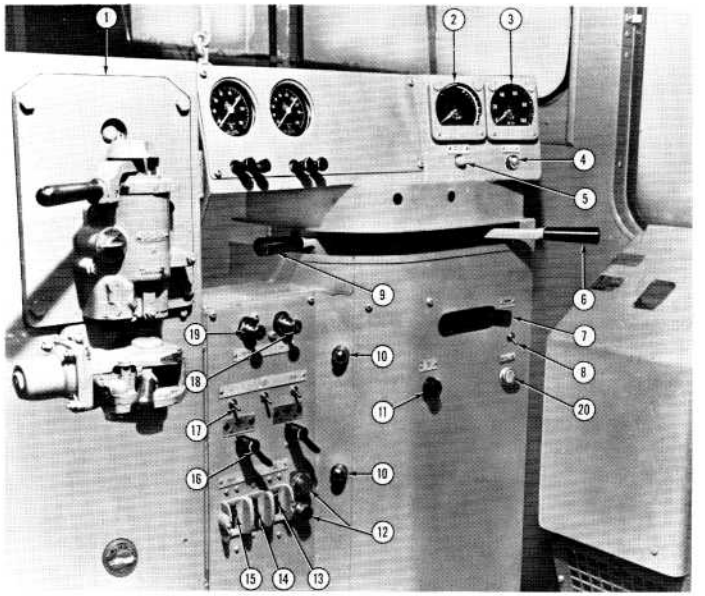
When the red "Stop" button (12) is pushed, it will shut down the engine and simultaneously all other engines of a multiple unit locomotive. It is provided for emergency use only. Reset by pushing in black "Run" button.

Power Reduction Switch (If Used)

If the first unit in a consist slips excessively, operate the power reduction switch (not shown). This reduces power while trailing units operate at full power. Return switch to "Off" for normal full power operation.

Emergency Sanding Switch (If Used)

Switch (8) in "On" position provides for operation of all sanders in case of an emergency such as a "plugging" operation.



1. Air Brake Controls (See Fig. 5)
2. Loadmeter
3. Speedometer (If Used)
4. Lead Axle Sanding Switch (If Used)
5. Wheel Slip and Dynamic Brake Light
6. Throttle Handle
7. Reverse Handle
8. Emergency Sanding Switch (If Used)
9. Selector Handle
10. Name Plate Lights
11. Gauge Light Dimming Control
12. MU Emergency Stop-Run Switch
13. Engine Control Circuit Breaker
14. Generator Field Switch
15. Control Circuit Breaker
16. Headlight Control Switches-Off, Dim, Bright
17. Light Switches - Gauge, Dime, Ground
18. Pneumatic Sanding Control Valve(s) (If Used) or Electric Sanding Control Switch (If Used)
19. Locomotive Bell Control Valve
20. GR Reset and/or Gen. Field Relay Reset

FIG. 3 - CONTROL STAND (COMPOSITE)

Lead Axle Sanding Switch (If Used)

Depress pushbutton switch (4) to sand in front of lead axle. Releasing switch stops sanding.

Sanding Control Valve

On some units sanding is controlled by pneumatic valve(s) (18) while on other units sanding is controlled by an electric switch.

Operate control to sand in front of both trucks. Refer to "Sanding Control" section.

Gauge Light Dimming Control

Adjust control (11) to obtain the desired illumination of gauges.

Remote Ground Relay Reset (If Used)

Depress button (20) to electrically reset ground relay. See "Ground Relay" instructions.

Generator Field Overload Reset (If Used)

Depress button (20) to electrically reset generator field overload relay. See "Overload Relay" instructions.

COMPARTMENT CONTROL PANELS (Fig. 4)

Control panels are located on the rear wall of the operating cab. Refer to Fig. 4. They contain the necessary controls for the engine and auxiliary power distribution.

Engine Control Switch

The engine control switch (15) has two positions, "Idle" and "Run." With the switch in "Idle" position the power plant is "off the line," the engine speed is held at idle and load cannot be applied to the power

plant. Also the switch must be in "Idle" to start an engine.

The switch is moved to "Run" position in order to load the power plant and operate above idle speed.

Engine Start Switch and Stop Button

The start switch (17) is a three position ("Reset-Fuel Pump Start," "Off," "Engine Start"), spring return, rotary switch. The "Reset" position is used to reset after an emergency fuel cutoff switch has been operated and to start the fuel pump. The "Engine Start" position is used to crank the engine.

The stop button (16) is depressed and held until engine stops regardless of position of other controls.

Mechanical Reset Ground Relay (If Used)

The ground relay has an indication lever that points to a red dot when relay is tripped. Reset button located adjacent to indicator must be pushed to reset. See "Ground Relay" instructions.

MU Headlight Setup Switch

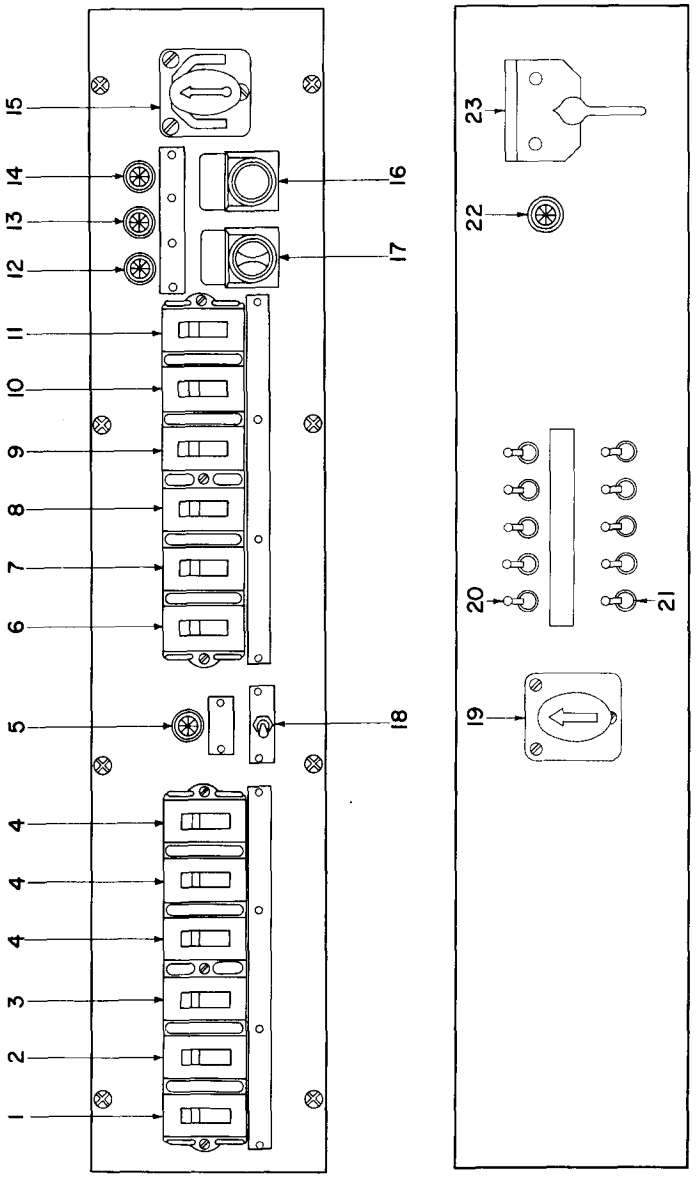
This switch (23) has five positions. Place switch in proper position according to unit's location and direction in an MU consist.

Power Matching Switch (If Used)

Switch (21) in "On" position automatically reduces power on these units to match lower powered units in an MU consist.

Motor Cutout Switch (If Used)

Switch (19) has several positions to isolate individual motors (4 motor units) or either truck (4 and 6 motor units).



11. Check oil level in generator gear boxes.
12. Check oil level in fan drive gear box.

STARTING DIESEL ENGINE

1. Close battery circuit breaker.
2. Close all circuit breakers on the engine control and power distribution panels.
3. Toggle switches on engineman's control stand and control panels will operate lights.
4. The ground relay cutout switch must be closed and the ground relay must not be tripped. If tripped, see "Ground Relay" for resetting instructions.
5. The traction motor cutout switch (if used) should indicate "All In." If in any other position, see "Traction Motor Cutout Switch" instructions.
6. Turn engine control switch to "Idle."
7. Move throttle to "Idle."
8. Move reverse and selector handles to "Off."
9. Close the control and engine control breakers. Reset MU stop-run button. These controls are at engineman's control stand.
10. Turn start switch to "Reset-Fuel Pump Start" momentarily to start fuel pump motor. Allow fuel pressure to build up.
11. Turn start switch to "Engine Start" to crank engine. Hold until engine starts.
    WARNING: Do not exhaust supply of starting air by repeated attempts to crank. If the first two or three attempts are not successful, recheck complete starting preparation.
12. After starting engine, check that engine air filter exhauster motor, generator compartment ventilating fan and engine crankcase exhauster are operating properly.
13. Move engine control switch to "Run" position.

BEFORE MOVING A TRAIN

1. Install brake valve handles and reverse lever.
2. Check main reservoir air pressure.
3. Check control air pressure - normal 70 psi.

4. Move the brake valve cutoff valve to "In" position depending upon the intended use of the locomotive. ("Frt." or "Pass." if 3-position type.)
5. Place MU-2 valve (if used) in "Lead" position or double cutout cock (if used) in "Open" position.
6. Make brake application, release hand brake.
7. The dead engine cock must be in "Live" position.
8. Test sanders.
9. Make air brake test.
10. Have at least 120°F water temperature, if possible, before notching up.

COUPLING UNITS EQUIPPED WITH 26-L BRAKE EQUIPMENT

On Leading Unit

1. Position all switches, breakers and cutout cocks the same as for single unit operation.
2. Place MU-2 valve (if used) in "Lead" position or double cutout cock (if used) in "Open" position.

On Trailing Units

1. See that all circuit breakers on control compartment panel are closed.
2. Make sure that the control, engine control and generator field circuit breakers located on the engineman's control panel are "Off."
3. Throttle handle must be in "Idle."
4. Selector handle must be in "Off."
5. Reverse handle must be in "Off" and removed.
6. Place MU-2 valve (if used) in "Trail-26" position or double cutout cock (if used) in "Closed" position.
7. Place automatic brake valve handle in "Handle-Off" position and independent brake valve handle in "Release" position and remove both handles.
8. Position brake valve cutoff valve in "Out" position.

On All Units

1. Engage couplers.
2. Connect air hoses and multiple-unit jumpers between units.
3. Open air line cocks.
4. See also "Power Matching Feature."
5. Place MU headlight setup switch in proper position. Do this before turning on the headlights.

OPERATING PROCEDURES

MOVING A TRAIN

1. Close generator field switch on engineman's control stand.
2. Move reverse handle to "Forward" or "Reverse" position depending on direction desired.
3. Move selector handle to Position 1. See "Selector Handle."
4. For positioning hump control handle, see "Hump Control."
5. Depress safety control pedal (if used).
6. Release brakes.
7. Open throttle.

STOPPING A TRAIN

Move throttle handle to "Idle" and apply air brakes. If leaving engineman's position, move selector and reverse handles to "Off."

REVERSING LOCOMOTIVE

1. Bring locomotive to full stop.
2. Move selector handle to No. 1 position.
3. Move reverse handle to opposite direction.
4. Release brakes.
5. Open throttle.

SHUTTING DOWN DIESEL ENGINE

1. Open generator field switch located at engineman's control stand.
2. Move engine control switch to "Idle" position.
3. Press and hold stop button located near start switch on the control compartment until engine stops.
4. Apply hand brake and release air brakes.
5. Open all other switches and circuit breakers at engineman's control stand.
6. Open battery switch.
   NOTE: Engine stop button on engineman's control stand to be used for emergency stop only.

MU OPERATION

Whether operating a single unit, or a consist of these units in MU, loss of rail adhesion at lower speeds normally tends to protect the traction equipment against overload and no minimum speed need be observed.

In the event that track conditions are such that unusually high adhesion can be maintained, the loadmeter will move into the "short time" range at approximately the following speeds:

Gearing & Max. Speed (MPH)	Century 430	Century 630
74/18 (66)	-	10.2
81/22 (74)	19.0	11.6
80/23 (78)	20.5	12.3
79/24 (83)	21.6	13.0

When operating units with different minimum continuous speeds, the engineman must not operate the units below the highest minimum continuous speed of any one unit in multiple.

POWER MATCHING FEATURE (If Used)

When operating in multiple with units of different minimum continuous speeds (lower horsepower), the power matching switch should be in "On" position. An automatically controlled reduction of power of these units is thus obtained; therefore, their continuous tractive effort per motor will match that of lower powered units. Under these conditions, the minimum continuous speed of the lower powered unit in the consist may be observed.

NOTE: The power matching switch must be placed in the "On" position in all of these units in a consist with lower powered units prior to operation.

LEAD UNIT POWER REDUCTION (If Used)

When operating under conditions where the adhesion available to the lead unit is less than that available to trailing units, the lead unit power may be reduced the equivalent of one throttle notch (without affecting trailing units). This is accomplished by turning the power reduction switch to "On" position. Wheel slip equipment will operate less frequently, promoting smoother train handling and reducing sand consumption.

After adhesion conditions improve, the power reduction switch should be returned to the "Off" position for normal, full power operation.

THROTTLE HANDLING

An inherent feature of these locomotives provides throttle control of tractive effort. This offers two advantages. First, it affords the engineman the ability to control, by throttle notch position, the amount of tractive effort to be developed. Second, it provides a positive protection against excessive load current on the traction motors and generator.

The proper use of this feature offers much in improved train handling as well as protection to the elec-

trical equipment. It is important therefore that the engineman thoroughly understands its proper use, since it does require slightly different throttle handling than for other types of locomotives not so equipped.

How It Works

For each throttle position a definite maximum load current and corresponding tractive effort may be developed. The increase, as the throttle is advanced from one position to the next, is made immediately but smoothly. Since, however, the total tractive effort of the locomotive is divided into eight steps available on the eight throttle notches, it is necessary to advance all the way into the 8th notch in order to develop full tractive effort. Further, since maximum current is controlled, it is perfectly safe so far as electrical or mechanical equipment is concerned to advance the throttle rapidly into the 8th notch; in fact this is not only desirable but necessary under certain starting conditions.

How It Is Used

It is well understood that the worst treatment that can be given a traction motor is to allow it to stand at "Stall" condition for any appreciable length of time with load current applied to it. It is therefore most important, having given due care to insure that the brakes are released and that train slack is out, to:

1. Start the locomotive to move as quickly as possible; and
2. Accelerate to a speed which will bring the loadmeter pointer down into the green zone in a minimum time. Therefore, in making a start, it is good practice to advance the throttle promptly to a notch that will start locomotive movement. If after starting, acceleration is too fast or until it is certain that all slack is out, the throttle may be backed off as required to maintain desired locomotive speed. As soon as the slack is out, the throttle may be advanced as fast as desired to suit operating conditions.

Starting Passenger or Light Trains

For normal starting of passenger and light trains, no appreciable difference in throttle handling will be noted from other types of equipment except the immediate response obtained for each throttle notch advance.

Normal Starting of Heavy Trains

Normally it is not necessary to "bunch" the slack. If the train is known to be stretched, as soon as the brakes are fully released, throttle should be advanced immediately to whatever notch is required to start movement. Then adjust up or down to suit desired operating conditions bearing in mind desirability of accelerating the train to where the loadmeter registers in the green zone in minimum time. For normal level grade starting, if no movement is obtained when the throttle has reached its 5th or 6th notch, shut off throttle and recheck to insure that the brakes are fully released.

Starting Heavy Trains on Severe Grades

It is occasionally necessary to take as much as the 7th or 8th notch to make a start. The engineman must, of course, use due care in handling the train slack and to time his power application to insure that brakes are released. Having assured himself of slack and brake conditions, he should have no hesitancy in advancing the throttle quickly into even the 8th notch to get the train moving. While the load current will be high, the control limits it to a value corresponding to approximately the maximum short time rating as shown on the loadmeter. The important thing is to get the locomotive moving and thus keep to a minimum the length of

time during which heavy load current is applied to the motors before they start to turn.

WHEEL SLIP

Adhesion Loss Detection System

1. In the event of a wheel slip while locomotive is in motoring, power is automatically reduced in proportion to the severity of the slip. Power is reapplied as the slip is arrested. This action will be evidenced by oscillation of the loadmeter.
2. When wheel slip control functions for any reason, sand is automatically applied until the slip is arrested.
3. In event of repetitive slips, manual sanding may be used.
4. In the event steps 1 and 2 and 3 fail to automatically correct the slip within a predetermined time (approximately 10 seconds), an audible and visible alarm is given in all cabs. Throttle should be reduced until warning stops.
5. When using locomotive air brakes (with throttle in "Idle") loss of adhesion (sliding) of locomotive wheels results in an immediate audible and visible alarm in all cabs.
6. A continuous wheel slip warning may indicate a locked axle. Check should be made to insure free rotation of all wheels. Locked axle protection is provided on all units coupled in multiple, including isolated units, provided battery switch and main control positive and negative breakers are closed in the isolated units.
7. In dynamic braking (if used), loss of wheel adhesion causes dynamic braking effort to be automatically reduced in the unit affected. Also, an audible and visible alarm occurs immediately in all cabs and persists until proper wheel speed is recovered. In the event of repetitive slip indications in dynamic braking, braking effort should be manually reduced until rail condition (adhesion) improves.
8. See also "Lead Unit Power Reduction."

AIR EQUIPMENT

26-L BRAKE EQUIPMENT

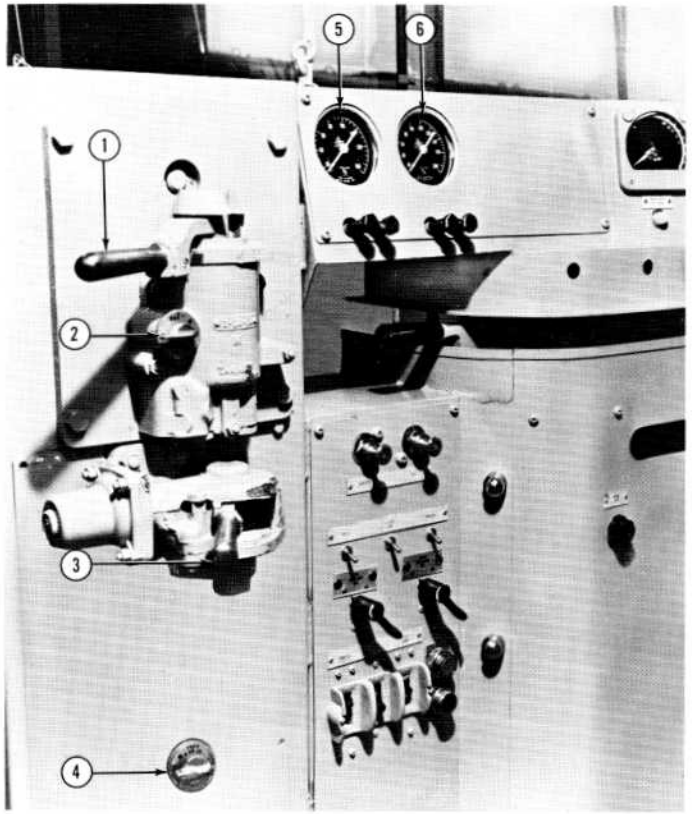
The 26-L brake equipment consists primarily of the automatic brake valve, independent brake valve, control valve, relay valve and double cutout cock or MU-2 valve. Details of this equipment may vary on different railroads to meet specific operating requirements. Refer to Fig. 5.

1. The automatic brake valve is a self-lapping valve with six positions, namely; "Release," "Minimum Reduction," "Service," "Suppression," "Handle-Off" and "Emergency."
   a. "Release" position (extreme left position of brake valve handle) is for charging the brake system and for releasing an automatic brake application.
   b. "Minimum Reduction" position provides a reduction of approximately 6 to 8 psi pressure in the equalizing reservoir which in turn reduces the brake pipe pressure similarly.
   c. "Service" position consists of that sector of the handle movement which regulates brake pipe pressure to a pressure lower than "Minimum Reduction." Intensity of the service brake application is increased as the handle is moved to the right.
   d. "Suppression" position is used for the purpose of nullifying any safety control, overspeed or train control brake application within the allowable penalty time. If the brake valve handle is placed in "Suppression" position just prior to a penalty application, a penalty brake application may be avoided. However, the brake valve is so designed that whenever the handle is placed in "Suppression" position, a full service brake application will be obtained.
   e. "Handle Off" position is that sector of the handle movement which reduces the brake pipe pressure within the brake valve to zero

and the various valves are positioned to make inoperative the normal operating functions of the brake valve. The brake valve handle can be removed in this position.

f. "Emergency" position is the extreme right position of the brake valve handle in which the brake pipe is vented at the fastest possible rate to produce an emergency brake application.

2. The independent brake valve is a self-lapping type with two positions, "Release" and "Application." Leakage is automatically controlled which insures that the brake will not release due to leakage. When the brake valve handle is set in any position of the application zone, the valve will automatically lap when the applied pressure reaches the value corresponding to the position of the handle. Depression of the handle in "Release" position will cause release of any automatic brake application existing on the locomotive.
3. The brake valve cutoff valve has two or three positions, ("In" and "Out" or "Cutout," "Frt" and "Pass"). The valve interrupts air flow from the relay valve to the brake pipe in event of emergency brake applications, when in "Out" position or in operation of auxiliary braking devices connected to the brake valve. For all normal operations of the locomotive, the cutoff valve must be placed in either "In" or "Frt" or "Pass" position, depending upon intended use of the locomotive.
4. The regulating valve portion automatically maintains equalizing reservoir pressure against overcharges and against leakage. Adjustment of the equalizing reservoir pressure in "Release" position is made by adjusting knob on rear of the regulating valve.
5. The control valve is an automatic valve capable of responding to the service rate or emergency rate of change of the brake pipe pressure and thus develop brake cylinder pressure from brake pipe reductions with reference to a control reservoir pressure. The 26-F contains the graduated release cap with two positions; graduated, "GRA," and direct, "DIR." This applies to the automatic



1. Automatic Brake Valve Handle
2. Brake Pipe Cut Off Valve
3. Independent Brake Valve Handle
4. MU-2 Valve (If Used)
5. Brake Cylinder and Brake Pipe Gauge
6. Main Res. and Equal. Res. Gauge
7. Regulating Valve (Behind Panel)

FIG. 5 - AIR BRAKE OPERATING CONTROLS

release of the locomotive brakes which will be graduated in passenger and light service and direct in heavy freight service.

6. The relay valve is a self-lapping valve that functions to supply and exhaust air from the brake cylinders during brake operations.
7. The MU-2 valve (if used) is a three position valve applied to a 26-L equipped locomotive permitting it to operate with 6, 24 and 26 equipped locomotives. The three positions are marked "Lead or Dead," "Trail-6 or 26" and "Trail-24." When the locomotive is operating single, as a "Lead" unit or hauled "Dead" in a train, the valve must be positioned at "Lead or Dead." When operating as a trailing unit behind 6 or 26 equipment, the valve must be positioned at "Trail-6 or 26." When behind 24 type equipment, the valve is positioned at "Trail 24."
8. The double cutout cock (if used) is a two position device applied to a 26-L equipped locomotive permitting it to operate with 24 and 26 equipped locomotives. The two positions are marked "Closed" and "Open." The "Closed" position serves to isolate the independent brake valve in a trailing unit.
9. Safety control pedal (if used) is located on the floor in front of the engineman's seat. The pedal must be depressed at all times except when the locomotive is stopped and 30 pounds or more brake cylinder pressure exists. If the pedal is released during operation, the safety control whistle will sound for two to four seconds during which time the pedal can be depressed preventing brake action. Otherwise a full service application of brakes will be made.
10. Reduction selector valve (if used) with associated devices, provides an automatic split reduction during a penalty application, from overspeed (if used), deadman safety control (if used), or train control (if used), when the freight-passenger cutout cock is in "Freight" position.
11. Dynamic brake interlock is furnished with dynamic brake equipment and is used to release

locomotive if the dynamic brake is on. Independent application and release of the locomotive brake is available at all times irrespective of dynamic brake operation.
NOTE: Railroads specify conditions that operate the interlock.

12. Pneumatic control switch (if used) is an air operated electric switch. Penalty applications of air brakes such as emergency, safety control, etc., will trip this switch returning the diesel engine to "Idle." The switch is reset automatically as soon as the brake pipe is recharged or main reservoir air pressure drops below 40 psi.
NOTE: Railroads specify conditions that operate the switch.

CHANGING OPERATING ENDS 26-L BRAKE EQUIPMENT

On Unit Being Cut Out

1. Make a 20 lb. brake pipe reduction by moving the automatic brake valve handle to "Service" position.
2. Move independent brake valve handle to "Release" position and observe that the brakes are still applied.
3. Move brake valve cutoff valve to "Out" position.
4. Move the MU-2 valve (if used) to "Trail-6 or 26" when trailing 6 or 26 equipment or to "Trail-24" when trailing 24 equipment or double cutout cock (if used) to "Closed" position.
5. Move automatic brake valve handle to "Handle-Off" position and remove both handles.
6. Place reverser handle in "Off" position and remove. To do this it is necessary that the selector handle be in "Off" position and the throttle in "Idle."
7. At the engineman's control station, open control breaker and generator field switch leaving the engine control breaker closed.
NOTE: On some units equipped to MU with units of other manufacture, the control breaker must

be left closed until control and engine control breakers are closed on unit being cut in.

On Unit Being Cut In

1. Insert reverse handle in controller and leave in "Off" position.
2. Insert automatic and independent brake valve handles.
3. Move the MU-2 valve (if used) to "Lead or Dead" position or double cutout cock (if used) to "Open" position.
4. Move the brake valve cut off valve to "In" or "Frt" or "Pass" position depending upon the service intended.
5. Move the independent brake valve handle to "Full Application" position.
6. Move automatic brake valve handle to "Release" position.
7. Close control and engine control breakers on engineman's control panel.
8. Open engine control breaker on end being cut out. NOTE: Open control breaker - see note above.
9. Close the generator field switch on engineman's control panel.
10. Place foot on safety control pedal (if used) and release independent brake.

OPERATING 26-L WITH 6-SL OR 24-RL EQUIPMENT IN MU

When operating locomotives in multiple, those units having 24-RL brake equipment must be ahead of those having 6-SL equipment and the brake piping of the 24-RL equipped unit must be appropriately modified. When operating any one of these brake systems in multiple with 26-L, provisions (if used) are available on the 26-L equipped unit so that it may lead or trail with the other mentioned brake systems.

If the unit is trailing behind a locomotive using 6-SL, place the MU-2 valve in "Trail-6" or if trailing a unit

using 24-RL, place the MU-2 valve in "Trail-24" position.

NOTE: When 26-L, 24-RL or 6-SL equipped locomotives are operated in MU, the following hose connections must be made:

HOSE CONNECTIONS

26-L	24-RL	6-SL
Brake Pipe	Brake Pipe	Brake Pipe
Actuating Pipe	Actuating Pipe	-
MR Equalizing Pipe	MR Equalizing Pipe	MR Equalizing Pipe
BC Equalizing Pipe	Ind. Application & Release Pipe	BC Equalizing Pipe

BRAKING WITH POWER

1. Gradually apply automatic brake for a light brake pipe reduction.
2. Release locomotive brakes by depressing independent valve handle in the "Release" position.
3. Reduce throttle to maintain loadmeter pointer in green band of motoring scale as train speed decreases. Move throttle to "Idle" before a train comes to a dead stop.
4. On locomotive in MU with manual transition locomotives, move the selector handle into the position corresponding to the speed of the locomotive.

RECOVERY OF BRAKE AFTER PENALTY APPLICATION

1. Place brake valve in "Suppression" position.
2. Close throttle to "Idle."
3. Depress safety control pedal (if used).
4. Allow application pipe to build up to main reservoir pressure. (About 12-14 secs.)
5. Release brakes.

FASTER AIR PUMPING

1. Generator field switch located on engineman's control stand must be "Off."
2. Reverse handle must be in "Off" position.
3. Selector handle must be in position 1.
4. Open throttle as desired up to Notch 5. If the compressor governor cuts out after a short interval of pumping it is indicative that a higher engine rpm is being used than is necessary for the air being consumed.

EMERGENCY BRAKE VALVE

The valve is located in the operating cab. When the handle is operated the brake pipe is opened to atmosphere to produce an emergency brake application.

AUXILIARY AIR EQUIPMENT

Locomotive Bell

The bell ringer operating valve is located near the brake valves and controls the air from the main reservoir for operating the pneumatic bell ringer. (See Fig. 3 - Item 19).

Locomotive Horn

1. The control valve for the horn is located in the ceiling of the cab and controls main reservoir air pressure to the horn. A pull rope for its operation is conveniently located at the engineman's position.
2. In some applications a hand operated valve is located on top of control stand.
3. The shutoff cock for the horn is located below the cab floor and is accessible through a hinged door on side of cab.

Windshield Wipers

1. A needle valve located at each of the windshield wipers provides independent control of speed.
2. The shutoff globe valve for air supply to wipers is located under the cab floor and is accessible through a hinged door on side of cab.
3. Some wipers are equipped with manual operating levers.

Control Air Reducing Valve

Air from the No. 1 main reservoir is reduced to 70 psi through a reducing valve with a control air pressure gauge. This is then piped to operate the reverser, series and parallel contactors, and dynamic braking switch (if used).

SANDING CONTROL

Several types of sanding control may be used. In all systems a sander cutout cock for each truck is located under the frame.

Push Pull Pneumatic Control Valves

This type valve has "On" and "Off" positions (see Item 18, Fig. 3) and either a one valve or a two valve application may be used.

One Valve Application

Direction of sand flow is controlled by the position of a reverser interlock. However, in conjunction with the one valve application, a toggle switch, located on the control stand, provides for operation of all sanders in cases of an emergency such as a "plugging operation" (see Item 8, Fig. 3).

Electric Control Switches

Two types of electric control switches are used; a push button switch or a three position switch.

Push Button Switch

Direction of sand flow is controlled by the position of a reverser interlock (see Item 18, Fig. 3). However, in conjunction with the push button switch application a toggle switch, located on the control stand, provides for the operation of all sanders in the case of an emergency such as a "plugging operation" (see Item 8, Fig. 3).

Three Position Switch

A three position switch with "Forward," "Neutral" and "Reverse" positions operates the sanders directly.

Lead Axle Sanding

A push button switch located on the control stand provides sanding for the leading axle only (see Item 4, Fig. 3). In some applications an indicating light is also provided.

NOTE: In some applications the locations of the lead axle sanding switch and the standard sanding control switch, (as shown in Fig. 3) are reversed.

MISCELLANEOUS OPERATING INSTRUCTIONS

DYNAMIC BRAKING OPERATION (If Used)

When All Units are Equipped With Automatically Controlled Dynamic Brake

The engineman controls the application of the dynamic brake with the selector handle. After full braking position has been reached, the brake is automatically regulated to develop maximum available braking effort at any speed without manual attention. The selector handle must be advanced slowly through the braking range. If braking current builds up too rapidly, hesitate advance (do not back off) until current is steady. Any effort to manually reduce the braking current would probably cause a "hunting" condition. When advancing the selector into the braking range, the engine speed will increase to 4th throttle notch thereby providing additional cooling for the traction motors. The operation and effect of the dynamic brake on the train is similar to that of the locomotive independent air brake; braking effort is applied to the locomotive only. The same precautions for bunching the slack and preventing slack "run out" are required.

To Apply Dynamic Braking

1. Move throttle to "Idle."
2. Have reverse handle in "Forward" or "Reverse" depending on direction of motion.
3. Move selector handle to "Off" and then to big "D" in the braking range. Loadmeter pointer will show slight movement.
4. Bunch train slack by advancing selector handle cautiously into the braking range. Do not allow loadmeter pointer to exceed the first white mark on the green scale until all slack is bunched.
5. After slack is bunched advance selector handle slowly into braking range until the desired braking effort is reached. If maximum braking effort is desired move handle to its full "On" position. Make handle movements slowly.
6. The amount of braking effort obtainable varies with the train speed. To obtain maximum braking performance, the selector handle must be moved to its full "On" position.
   With the selector handle in its full "On" position, the braking effort will increase as the speed decreases until it reaches maximum value. It will maintain this maximum value for a few mph after which it will gradually fall off to reach 0 at 0 mph.

The speed range of maximum braking effort for all gearings are as follows:

	66 MPH	74 MPH	78 MPH	83 MPH
Four Motor	-	24	26	27
Six Motor	20	22	24	25

NOTE: Some units have "Extended Range Braking" which increases low speed braking range.

7. It is permissible to start from a standstill on a downgrade with dynamic brake applied.
8. When braking a heavy train on a severe grade, the maximum dynamic braking may not be sufficient to hold the desired train speed. An application of the automatic air brake may be used in addition to the dynamic to maintain desired train speed. The dynamic braking interlock will hold the locomotive brakes released for any position of the automatic brake valve other than emergency. See "Dynamic Brake Interlock and Pneumatic Control Switch" under "26-L Brake Equipment."

Release of Dynamic Brakes When Not Using Air Brakes

1. Reduce braking slowly; pause when the load-meter pointer indicates at the first white mark on the motoring scale to prevent slack run out.
2. Handle can now be moved to "Off" or into "Motoring."

Release of Dynamic Brakes During Automatic Brake Application

To maintain desired speed on severe grades, an application of the automatic air brake may be used to supplement the dynamic brake. However, no automatic air brake application is possible on the locomotive while using dynamic brakes. Flat wheels may result on the locomotive if independent air brakes are

applied while using dynamic brakes. See "Dynamic Brake Interlock and Pneumatic Control Switch" under "26-L Brake Equipment."

When releasing the dynamic brake after an automatic air brake application has been made, depress the independent brake valve handle in "Release" position and then move the selector handle to "Off" position. The independent brake valve handle may now be released. After this operation, the independent brake on the locomotive may be applied if desired.

CAUTION: If the dynamic brake is released before depressing the independent brake valve handle, a rapid locomotive brake cylinder pressure build-up will occur possibly resulting in locked axles and flat wheels.

Release of Dynamic Brakes With An Emergency Air Brake Application

If specified by railroad, in an emergency air brake application, whether initiated by the brake valve handle or from the train, the dynamic brake will automatically be cut out and an emergency air brake application will be made on the locomotive as well as the train. Under these conditions the engineman should return the selector handle to "Off" position as promptly as is consistent with operating instructions.

Cutout of Dynamic Brakes With Engine Control Switch

Cut out dynamic brake only when lead unit selector handle is "Off;" this avoids surges on the equipment or on the train. For the same reasons, dynamic brake must not be cut in except with lead unit selector handle in "Off."

Turning engine control switch to "Idle" causes dynamic braking on that unit to be inoperative.

Dynamic Braking With Lead Unit Idling or Shut Down

Operate dynamic brake in the usual manner; however, the loadmeter will be inoperative.

For other conditions in lead unit see "Operating With Lead Unit Idling or Shut Down."

Operating in MU With Locomotives Having Manually Controlled Dynamic Braking

Operate in usual manner. If brake warning light operates, it indicates that the braking limit has been exceeded on a trailing unit. The engineman must reduce braking to a point where the light will not operate.

Dynamic Brake Unit Selector Switch (If Used)

1. When operating all ALCO units in multiple:
   a. Place unit selector switch on all units in No. 1 position.
   b. Do not install field loop dynamic braking jumpers between units.
2. When operating ALCO units in multiple with units of other manufacture:
   a. Place unit selector switch on all trailing units in No. 1 position.
   b. Place unit selector switch on lead unit to correspond with number of units in consist.
   c. Install field loop dynamic braking jumpers between all units.

DUAL CONTROL (If Used)

When two operating control stations are applied in the same cab, the engine control (fuel pump) breaker, control breaker and generator field switch are wired in series. Therefore, where these breakers and switches are referred to in the operating instructions,

they must be operated at both control stations in order to obtain the desired function.

To change operating stations:

1. Make full service brake application and place brake valve cutout valve in "Out" position.
2. Move automatic brake valve handle to "Handle-Off" position and remove.
3. Move independent brake valve handle to "Release" position and remove.
4. Replace handles in station to be operated and set cutout valve in "In" position ("Frt" or "Pass," if used.)

HUMP CONTROL (If Used)

This device is a means by which the engineman can obtain precise control of tractive effort. Its use permits close control of low train speeds as in humping service. In general service its use will be very helpful in starting trains under difficult conditions.

A small controller mounted on the control stand is the means by which hump control is obtained. The handle of this controller can be moved from an "Off" or maximum tractive effort position through a decreasing range to the full "On" or "Minimum" tractive effort position. By moving the handle down from the "Off" position, the tractive effort will be reduced below the tractive effort setting of the throttle. The farther the handle is moved downward the greater the tractive effort reduction.

For Humping Service

1. Have handle of hump controller in "Off" position.
2. Start train in the normal manner.
3. Advance throttle only to the notch required to move train at proper humping speed and leave in this position.
4. As train becomes lighter, gradually move hump controller downward to hold proper speed.

5. When hump controller reaches full "On" position, reduce throttle one notch and move hump controller toward "Off" to hold proper speed.
6. Observe loadmeter for short time overloads.

For Heavy Duty Service

Following are two methods of using hump control in heavy duty service. Because of the variations in this type of service, it is difficult to predict the best method to use. Therefore, it is suggested that the engineman select the one best suited for his particular case.

First Method:

1. With throttle handle in notch 1, move the hump controller handle to full "On."
2. Advance throttle handle fairly rapidly until 8th notch is reached unless experience indicates that a lower notch is sufficient.
3. Move hump controller handle toward the "Off" position until the train begins to move. Train speed can be further increased or controlled by handle movements.
4. When train is started, the hump controller handle should be moved to "Off" position unless control of tractive effort is necessary to get traction without wheel slip.

Second Method:

1. Start train by advancing throttle in normal manner.
2. If wheel slip occurs in any notch, leave throttle in that notch and reduce tractive effort by moving hump controller down from the "Off" position.
3. After wheel slip stops, move hump controller toward "Off" position to obtain the tractive effort that can be applied without slip.
4. As train picks up speed, move hump controller to "Off" position and operate normally.

PASSING OVER RAILROAD CROSSINGS

The severe mechanical shocks received by traction motors when passing over railroad crossings at high speed may cause the brushes to bounce and flashover the traction motors. At high speeds, reduce throttle to 5th notch or below while all units pass over the crossing. This is not necessary at low speeds. It is also desirable to reduce dynamic braking at high speeds over crossings for the same reason.

ENGINE WATER SYSTEMS

Cooling Water Temperature Control

The engine water temperature is controlled by a single radiator fan and radiator shutters located at the engine-hood end of the locomotive.

The speed of the fan and the positioning of the shutters are automatically controlled by the temperature of the water leaving the diesel engine.

Aftercooler Temperature Control

The aftercooler water temperature is controlled by a fan and a pair of radiator shutters located at the generator compartment.

The fan speed is governed by engine speed and positioning of the shutters is automatically controlled by the temperature of the water leaving the aftercooler.

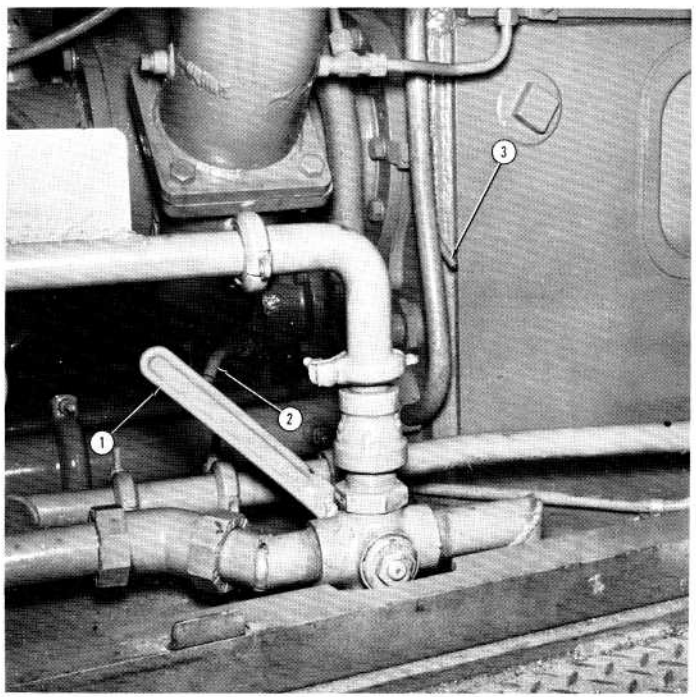
Manual Shutter Positioning

In the event that the shutters fail to operate automatically, they can be operated manually by first closing the cutout cock to the shutter magnet valve. The air is automatically bled from the system allowing free positioning of the shutter vanes. They may be blocked in any desired position but under no condition should the fan be operated with the shutters closed.

Fill and Drain

The system is equipped with a 4-way, 2-position valve (Fig. 6) for filling and draining. To fill or drain system, turn valve to opposite position.

Also shown in Fig. 6 are "tell-tale" pipes from aftercooler and water pump seal. Water dripping from these pipes indicate leaks in the device.



1. Fill-Drain Valve
2. Water Pump "Tell-Tale" Pipe
3. Aftercooler "Tell-Tale" Pipe

(Valve shown in normal position)

FIG. 6 - FILL-DRAIN VALVE AND "TELL-TALE" PIPES

HAND BRAKE OPERATION

To apply the brake, operate the hand lever upward (pumping action) until the brake is set. It is not necessary to manipulate the trip lever in any way while the brake is being applied.

To release the brake, push the hand lever as far back as it will go and leave it there. Do not push against the handle as this retards the releasing action. Pull the trip lever upward and outward holding it only until the chain weight and its rubber snubber comes up against the bottom of the brake housing. If the chain weight and its rubber snubber does return to the bottom of the housing, reset the brake and repeat the releasing procedure.

CAB HEATERS AND DEFROSTERS

Cab heaters are located at right and left side of cab. Defroster dampers and rheostat switches are located on heaters.

CLASSIFICATION LIGHTS

Classification lights are permanently installed in each of the four corners, front and rear, of the locomotive body. Because of the angle the lenses are visible both from the front and side of the locomotive.

At the front, individual lenses and lights for each of three colors are provided. Control switches for each aspect are mounted on the access door in the front wall of the cab.

At the rear, two colored lenses, red and green, are arranged so that each in turn may be swung between the light and the clear glass lens to give the desired color indication. The colored lenses, accessible through small doors in hood, are moved by pushing upward on the knob at the bottom of the light assembly

and rotating it in increments of 90 degrees to the color indication desired. A switch at the compartment control panel will turn on both classification lights.

NUMBER LIGHTS

Angled, illuminated number boxes are provided at the corners of the locomotive. A control switch for the front lights is located in panel above windshield and for rear lights is located on compartment control panel.

HEADLIGHTS

Units are equipped with a headlight at front and rear.

Three position ("Off," "Dim," "Bright") switches located on control stand control each light. The MU setup switch must be properly positioned according to locomotive's direction and position in a consist.

ABNORMAL OPERATIONS

EMERGENCY ENGINE SHUT DOWN

A stop-run switch is located on the engineman's control stand. When the red "Stop" button is pushed, it will shut down the engine of the unit and simultaneously all other engines of a multiple unit locomotive. It is provided for "emergency" use only. Normal shut downs should be made with the engine stop button located on the control compartment near the engine control switch.

To restart engines of a single or multiple unit locomotive after shut down by emergency stop-run switch.

1. Reset switch by pushing in black "Run" button.
2. Start engine on any unit in the normal manner after first turning the engine control switch to the "Idle" position.

OPERATING WITH DEAD BATTERY ON LEAD UNIT

On Lead Unit:

1. Turn engine control switch to "Idle."
2. Open battery breaker.
3. Open electric cab heater circuit breaker (if used).
4. Open all circuit breakers on control compartment panel except headlight, cab lights and engine room light breakers.
5. Open engine control breaker and close generator field switch and control breaker on engineman's control stand.

On Any One Trailing Unit:

1. Close engine control and control breakers on engineman's control stand.
2. Make sure all circuit breakers on control compartment are closed.
   CAUTION: Do not use more than one headlight, control breaker may trip.

TOWING DEAD LOCOMOTIVE

In freezing weather, drain engine water system. Brake equipment on one or more "dead" units which are in multiple with a "live" leading unit should be set up the same as "live" trailing units. It is recommended that brake equipment on each unit of a "dead" multiple unit locomotive which is not in multiple with a "live" unit should be set up as a single "dead" unit as follows:

1. Drain all air from main reservoirs and air brake system.
2. Move brake valve cut off valve to "Out" position and MU-2 valve (if used) to "Dead" position or double cutout cock (if used) to "Open" position.
3. Place automatic brake valve handle in "Handle-Off" position and independent brake valve handle in "Release" position.
4. Place throttle in "Idle," selector and reverse

handles in "Off" position. Remove reverse handle.
5. Place dead engine cock in "Dead" (Open) position.
6. Release cap on control valve should be in "Direct Release" position.
7. Connect brake pipe hose only.

OPERATING THROUGH WATER

Do not exceed 2 or 3 mph if there is water above the railhead. Do not pass through water over 4 inches above railhead.

GAUGES AND INSTRUMENTS

LOADMETER

The loadmeter is a color band device to be used as a guide in correct locomotive operation.

Motoring Band

This pointer position on the color band indicates the relative amount of tractive effort being developed by the locomotive, also the load current on the traction motors. The green zone represents normal operation. In this zone, operating time is unrestricted.

The yellow zone indicates short time capacity of the traction motors. The point at which the color band changes from green to yellow indicates the end of the continuous rating.

Short Time Load Operation

The overload range has been graduated to show the time in minutes that various loads may be carried. The greater the load, the shorter the time allowed. The maximum time allowed in the yellow zone is as indicated. The other marks in the yellow zone indicate

the maximum time allowed when the pointer is at these points. If the pointer remains between any two numbers, the maximum time allowed must be estimated by the operator.

If the load changes, the operator must judge when he has used up the full allowable time in the yellow zone. For example: If only half the time were used at one load before it changed, the allowable time at the new load would be one half of its indicated time.

When the short time load has been used for the full allowable time the load must be reduced until the pointer is at or below the yellow triangle which appears near the upper end of the green band. The load must be held at or below the yellow line for at least 20 minutes before another overload in the yellow zone may be repeated. If this practice is not followed, the traction motors may be seriously damaged.

SPEED INDICATOR

The speed indicator, located at engineman's position, has a speed scale which indicates locomotive speed in miles per hour.

AIR GAUGES

Duplex air brake gauges are located at engineman's position (see Fig. 5). One gauge indicates brake pipe and brake cylinder pressure. The second gauge indicates main reservoir and equalizing air pressure.

CONTROL AIR PRESSURE GAUGE

The control air pressure gage and system reducing valve are located behind contactor compartment. The gauge should indicate 70 psi at all times. A loss of control air pressure will prevent operation of the electro-pneumatic contactors and further locomotive movement.

ENGINE SYSTEM GAUGES

Lubricating Oil Dip Stick

The bayonet gauge (Fig. 7) is located on the left side of the engine and should show oil between high and low marks while the engine is idling. If oil level is checked with engine shut down, the level may be above the high mark.

Water Temperature Gauge

A dial indicator, located in a manifold along with the temperature control switches, is provided. The normal operating temperature of the cooling water is 150°F to 180°F (Fig. 8).

Water Level Gauge

A gauge is located in cooling water system expansion tank. The gauge must show water at all times (Fig. 8).

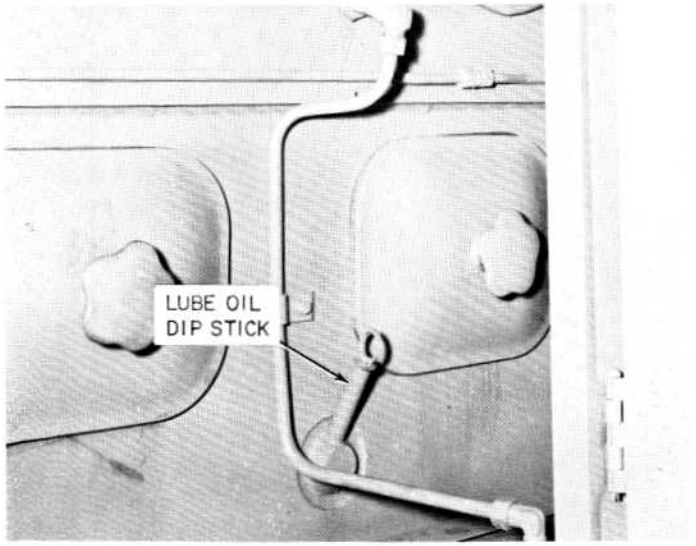


FIG. 7 - ENGINE DIP STICK

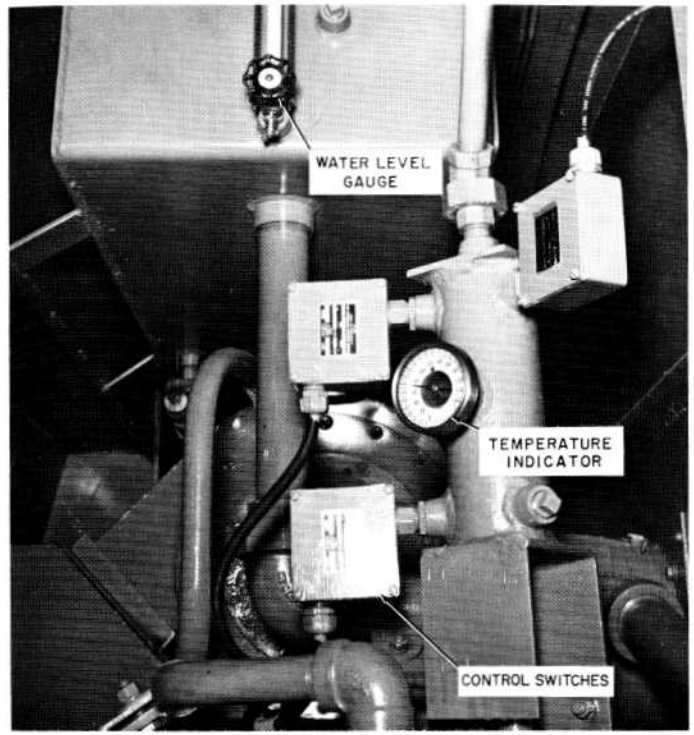


FIG. 8 - WATER LEVEL GAUGE, TEMPERATURE INDICATOR AND CONTROL SWITCHES

A low water level switch is also provided, see Fig. 9. To test switch, open test valve and drain water from switch float chamber. Low water alarm indicator should light.

Lubricating Oil Pressure Gauge

Should indicate a minimum of 35 psi at idling speed and 50 psi at top engine speed.

Fuel Oil Pressure Gauge

Should indicate 35-45 psi at all engine speeds.

Booster Air Pressure Gauge

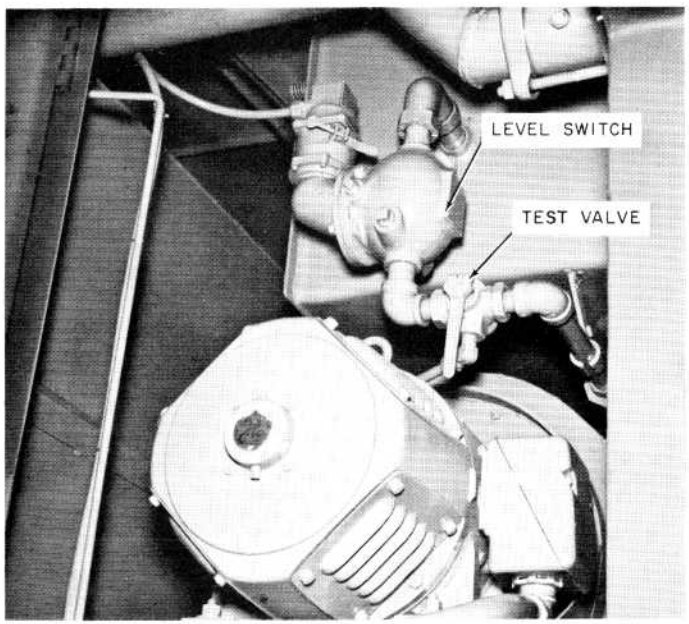
Should indicate 15-18 psi with full throttle and engine fully loaded and lower pressures in lower throttle notches.

NOTE: In some applications the lubricating oil pressure, fuel oil pressure and booster air pressure gauges are mounted on a panel in the operating cab or engine compartment. In other applications quick disconnect test connections are provided in the engine compartment.

OTHER SYSTEM GAUGES

Air Compressor

Maintain oil level at "Full" mark on bayonet gauge



(Valve shown in operating position)
FIG. 9 - LOW WATER LEVEL SWITCH AND TEST VALVE

or at "Run" on dial gauge with engine shut down (Fig. 10.)

Fan Drive Gear Box

Maintain oil level between "Full" and "Add" marks on dipstick (Fig. 11).

Engine Governor

Maintain oil level for PGR governor between lines on sight glass while engine is running (Fig. 12). The MG8 governor has two sight glasses. The oil level should not be below line on lower glass and not above line on top glass.

Generator Gear Boxes

Maintain oil level between "Full" and "Add" marks on dip stick (Fig. 13) with engine running.

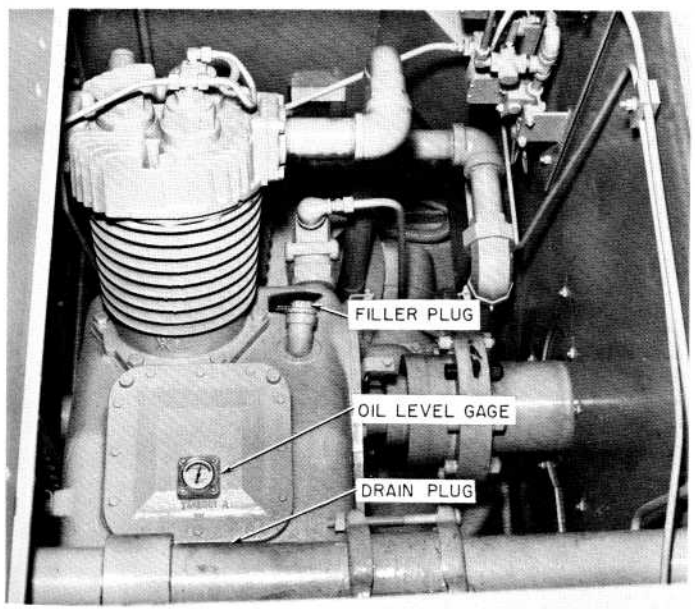


FIG. 10 - AIR COMPRESSOR - 3 CDCL

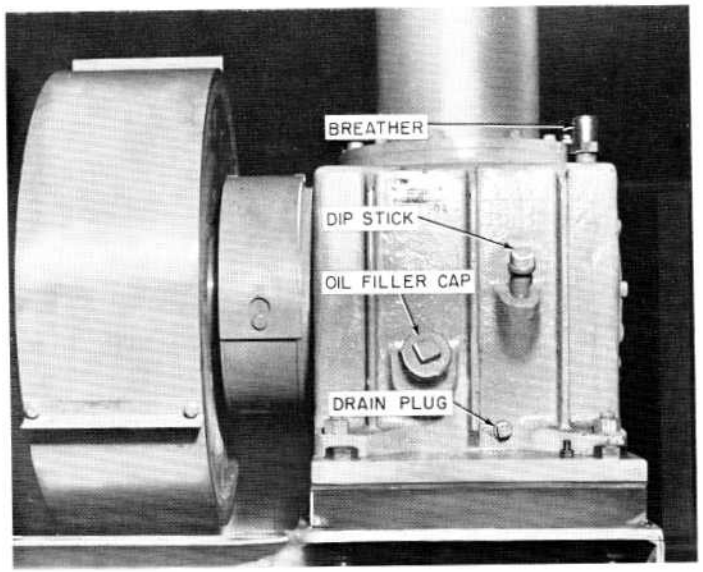


FIG. 11 - FAN DRIVE GEAR BOX - GDY45

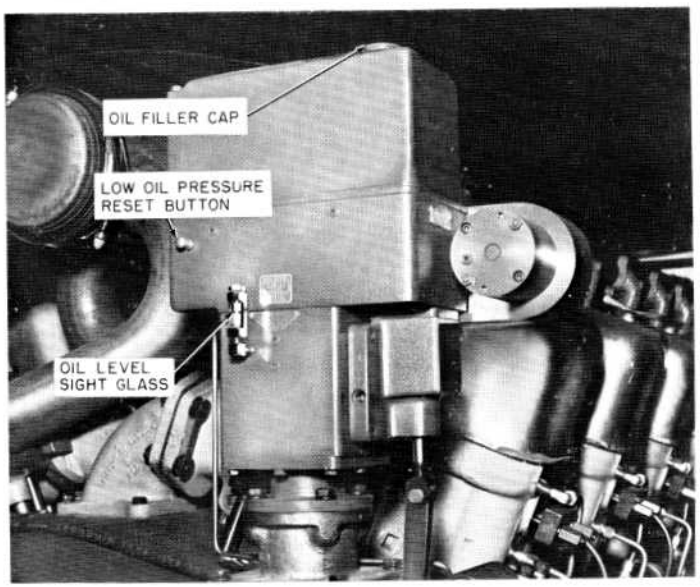


FIG. 12 - ENGINE GOVERNOR - PGR

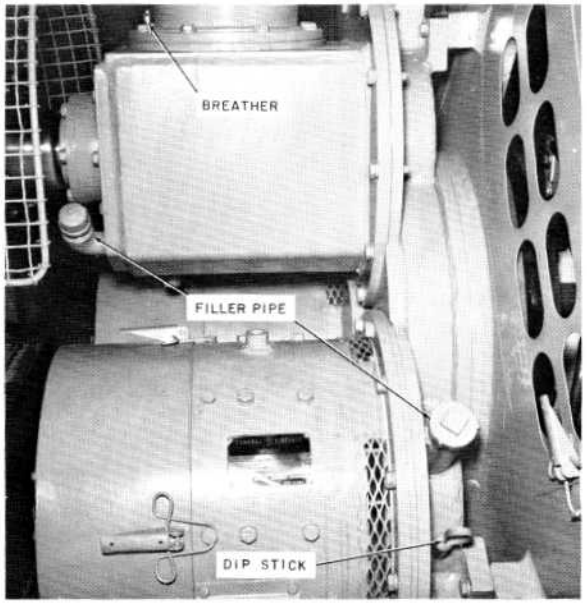


FIG. 13 - GENERATOR GEAR BOX - GTA9

AUTOMATIC ALARMS AND SAFEGUARDS

In single or multiple unit operation, an alarm system is provided for the following:

1. Low lube oil pressure.
2. Hot engine or low water.
3. Ground relay tripped or generator field overload.
4. No battery charge.
5. Wheel slip.
6. Dynamic brake warning.

An alarm bell for Items 1, 2, 3 and 4 will sound in all cabs and a warning light will operate on the affected unit.

NOTE: The alarm bell may be silenced for Item 4 if the engine control switch is returned to "Idle."

A warning light and buzzer for Items 5 and 6 will indicate in the lead cab as well as the unit affected.

LOW LUBRICATING OIL PRESSURE

1. If oil pressure drops to 30 psi or below the engine will shutdown, the alarm bell sound and the green low lubricating oil pressure lamp light on the engine control panel.
2. After engine shuts down, turn engine control switch to "Idle." Check diesel engine lubricating oil supply. Check for broken or leaking oil lines.
3. Reset shutdown plunger on PGR engine governor. Alarm bell will be silenced (see Fig. 12).
4. Restart engine in normal manner.

HOT ENGINE

When the engine cooling water temperature reaches 195°F:

1. The hot engine (red) indicating light, located on the control compartment, will light.
2. The alarm bell will sound.

When the engine cooling water temperature reaches 203°F the engine speed will return to "Idle."

LOW WATER

If the engine cooling water level in the expansion tank drops to a predetermined level:

1. The engine will shut down.
2. The hot engine (red) indicating light will light.
3. The alarm bell will sound.

To test low water switch, open test cock and drain water from switch float chamber (see Fig. 9).

GROUND RELAY

A ground in the power circuit operates the ground relay to return engine to "Idle," remove excitation, sound the alarm bell and light white ground indicating light on control compartment.

Ground Relay Reset (Mechanical)

The indicator pointer on ground relay of affected unit will point to red dot. The pointer can be seen through window on plate covering relay and is located on engine control panel.

1. Turn engine control switch to "Idle."
2. Push in ground relay mechanical reset button.
3. Turn engine control switch to "Run."
4. If relay stays in, continue normal operation.

Ground Relay Reset (Remote Electrical)

The white indicating light will light on affected unit and alarm gong will ring.

1. Return throttle to "Idle."
2. Push in ground relay electrical reset (yellow) button (Fig. 3 - Item 20).
3. Open throttle.
4. If relay stays in, continue normal operation.

Ground Relay Cutout

If ground relay continues to trip:

1. The motor cutout switch (if used) may be used to isolate a faulty truck of motors (individual motors on 4 - motor units). For example: reset ground relay as outlined above; turn motor cutout switch to cut out a truck set of motors and start locomotive. Follow same procedure for motors on remaining truck.
2. Under extreme emergency conditions; reset ground relays as outlined above, open ground re-

lay cutout switch in control compartment and move locomotive no farther than is necessary observing for smoke or overheating of electrical equipment.
A three position cutout switch is used on newer locomotives:

Position 1. Normal operating position.
Position 2. Ground relay and generator field contactor cutout position. Locomotive cannot operate.
Position 3. Emergency position. Locomotive will operate but without ground relay protection. Seal must be broken to use this position.

3. Repeated ground relay tripping may indicate a traction motor failure. This might result in a locked axle. A check should be made to be sure all wheels turn freely.
NOTE: All ground indications should be reported even if the ground appears to have been corrected.

GENERATOR FIELD OVERLOAD RELAY

An overload of the main generator field operates a relay to return engine to "Idle," sound alarm bell and light indicating light on affected unit.

To reset overload relay:

1. Return throttle to "Idle."
2. Push in overload relay electrical reset button (Fig. 3, Item 20) on control stand.
3. Open throttle.

DYNAMIC BRAKE WARNING (If Used)

When the dynamic braking limit is exceeded on any unit, the brake warning light and buzzer will operate. The throttle handle must be moved to a point where the light will not operate.

WHEEL SLIP WARNING

When the wheel slip relay operates, the wheel slip light and buzzer will operate, and power will be automatically reduced and reapplied. For further information see "Wheel Slip."

CIRCUIT BREAKERS

Circuit breakers are used in all control circuits and will trip and open whenever an overload occurs. Breakers, suitably identified, are located at the engineman's position and on the control compartment panel.

If a circuit breaker should trip, the handle will be approximately midway between "On" and "Off." To reset, move handle to "Off" position and then to "On." In some cases it may be necessary to wait a few minutes before the breaker can be reset.

CRANKCASE EXHAUSTER

1. The yellow crankcase exhauster light, located on the engine control panel, should be "Off" continuously indicating that the exhauster is running.
2. If light is "On," see that crankcase exhauster breaker is closed. If breaker is closed, report condition.
3. If exhauster is not running, the engine should be shut down and the trouble corrected.

JOURNAL BOX HEAT INDICATOR (If Used)

Heat indicators installed in the housing of roller bearing journal boxes emit a pungent odor when journal box temperature reaches 250°F.

DIESEL ENGINE OVERSPEED

If the diesel engine overspeeds, the overspeed mechanism located at the free end of the engine, right side will operate to shut down the engine. Refer to Fig. 14. A trip lever releases a spring loaded shaft

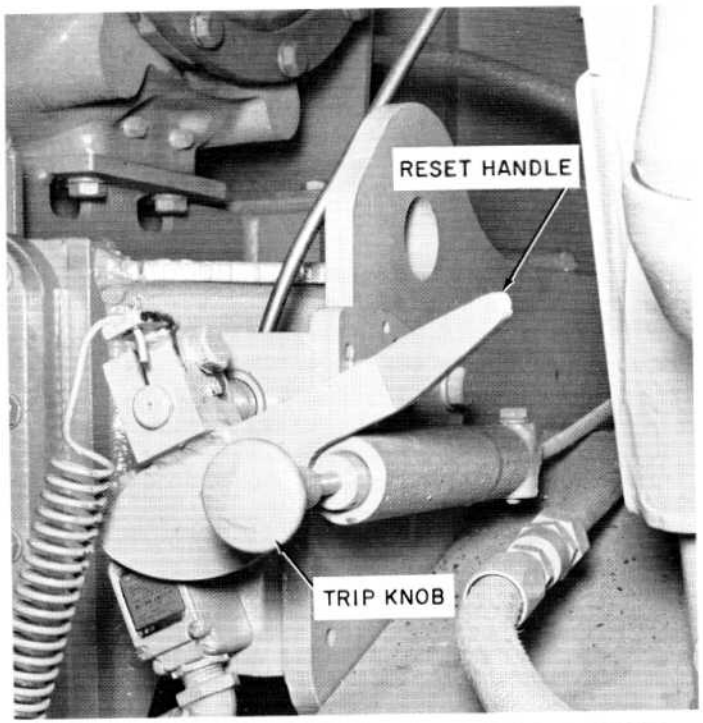


FIG. 14 - ENGINE OVERSPEED TRIP AND RESET

which in turn rotates the fuel pump control shafts to shut off the fuel supply.

To trip manually: Push in on shut down knob.

To reset: Push in on shut down knob and pull down on reset handle until latching portion of reset handle allows shut down knob to be released. The reset handle will then position itself as shown in Fig. 14.

NO BATTERY CHARGE

A no charge indicating light for auxiliary generator is located at the engine control panel. If an engine is running and engine control switch is in "Run" position

and battery charging equipment fails, then the lamp will light and alarm bell will sound.

LOCOMOTIVE OVERSPEED (If Used)

Three types of locomotive overspeed devices may be used:

1. An overspeed signal from an axle generator will automatically initiate a service brake application if the speed limit setting is exceeded. An engineman's warning light will light at 3 mph below maximum locomotive speed.
2. An overspeed signal from a microswitch in the speed recorder will initiate a service brake application if speed limit setting is exceeded.
3. An overspeed signal from the speed governor in the train control system will initiate a service brake application if the locomotive exceeds the maximum speed for the block conditions.

All three systems operate through the pneumatic control switch causing the diesel engine to return to "Idle." To recover brake: see "Recovery of Brake After Penalty Application."