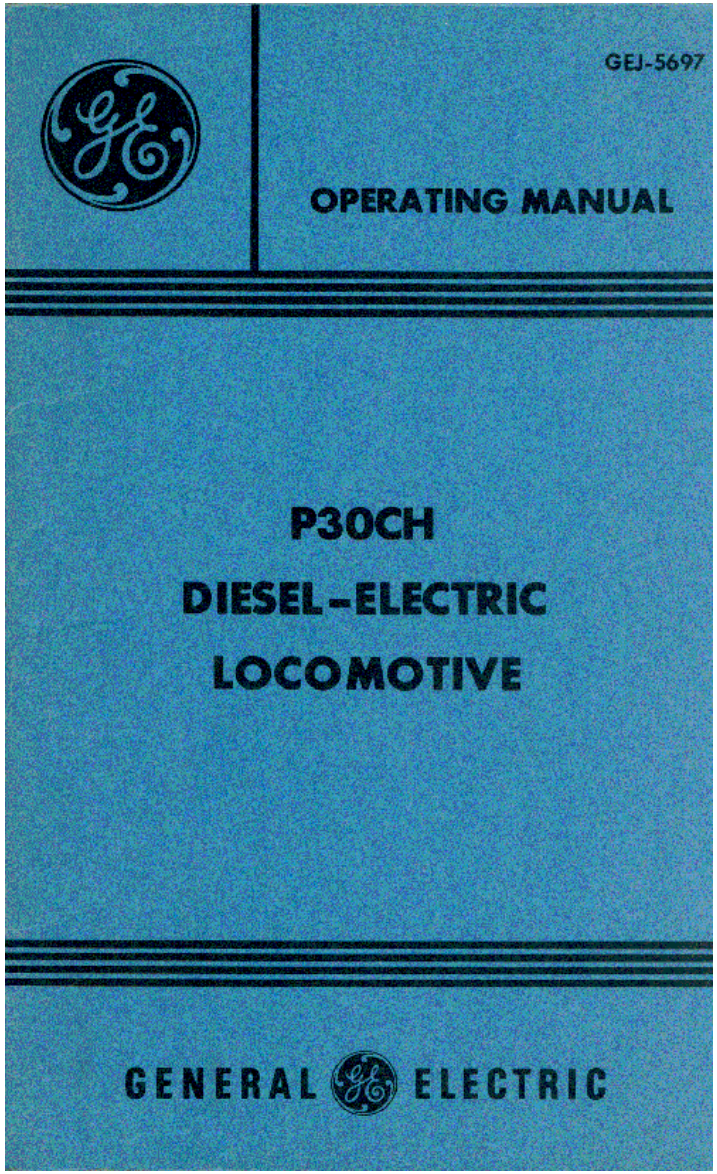


OPERATING MANUAL

●

P30CH

DIESEL-ELECTRIC

LOCOMOTIVE

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

Verify numbers for parts, tools, or material by using the Renewal Parts or Tool Catalogs, or contact your General Electric representative for assistance. Do not order from this publication.

GENERAL ELECTRIC

CONTENTS

Model	P30CH
Horsepower	3000
Type (AAR Symbol)	C-C
Major Dimensions	
Length Inside Knuckles (Over-all)	72 ft. 4 in.
Width (Over-all)	10 ft. 8.8 in.
Height Above Rail (Over-all)	15 ft. 4-1/2 in.
Length Between Center Plates	46 ft. 0 in.
Total Wheel Base	
Truck Wheel Base	13 ft. 7 in.
Drive	
Traction Motors	Six GE-752
Wheel Diameters	40 in.
Weight (Typical) (lbs.)	
Total Weight	386,000
Total on Drivers	386,000
Per Axle	64,333
Supplies	
Fuel (gal.)	3600
Lubricating Oil (gal.)	380
Cooling Water (gal.)	385
Governor Oil (qt.)	2
Sand	56 Cu. Ft.
Air Brakes	26L

INTRODUCTION

All the operating devices, manual or visual, normally used by the operator to operate or set up locomotive for operation, are located near the operator's position.

Most of the operating devices are located either on the operating control console, on the air brake stand or on the EC panel. (See Fig. 19 for location of major equipment.)

MASTER CONTROLLER (See Fig. 1)

The Master Controller is a set-up switch used by the operator to control the locomotive during operation. It is equipped with a Throttle handle, Dynamic Braking handle and Reverse handle. Various switches, instruments and indicating lights are mounted on the housing of the controller.

Reverse Handle

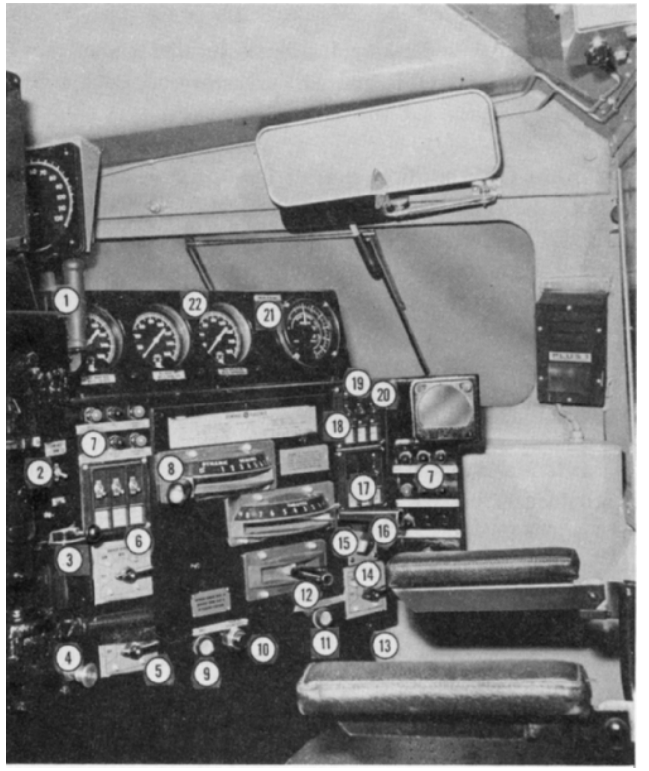
The Reverse handle, the bottom of the three handles, is used to determine the direction of locomotive travel. It has positions REVERSE, OFF, and FORWARD. The handle is removable only when the Throttle handle is in IDLE position and the Braking handle is in OFF.

Throttle Handle

The Throttle handle is located above the Reverse handle. It has a SHUTDOWN, IDLE, and eight major positions, or notches, for power.

The SHUTDOWN position (MU Stop) is located to the right of IDLE. This position is used in an emergency to shut down all engines of a locomotive or all engines on all locomotives of a multiple-unit consist.

To increase motoring power, the handle is moved clockwise toward the operator.



REF.	DESCRIPTION	REF.	DESCRIPTION
1	HORN VALVE	12	REVERSE HANDLE
2	LEAD AXLE SAND SWITCH	13	SIDE HEATER SWITCH
3	SANDING SWITCH	14	FRONT HEADLIGHT
4	BELL BUTTON	15	SPEED CONTROL
5	REAR HEADLIGHT	16	THROTTLE HANDLE
6	BACK-UP HEADLIGHT	17	DYNAMIC BRAKING BREAKER
7	INDICATING LIGHTS	18	ENGINE RUN BREAKER
8	DYNAMIC BRAKING HANDLE	19	GEN. FIELD BREAKER
9	CALL BUTTON	20	CONTROL BREAKER
10	TRAINLINE GROUND RESET BUTTON	21	LOADMETER
11	PARALLEL START OVERRIDE BUTTON	22	AIR BRAKE SYSTEM GAGES

FIG. 1. OPERATORS CONTROL CONSOLE.

Dynamic Braking Handle

The Dynamic Braking handle is located above the Throttle handle and has OFF and SET-UP positions and a BRAKING sector.

In the OFF position, nearest the operator, dynamic braking is shut off. The SET-UP position establishes dynamic braking circuits. Movement beyond this position into the BRAKING sector (counter-clockwise away from the operator) increases braking effort.

Interlocking Between Handles

Interlocking between the handles of the Master Controller is provided as follows:

1. The Reverse handle must be inserted before the Throttle handle can be moved out of IDLE position.

2. The Reverse handle can be moved into FORWARD or REVERSE only when the Throttle handle is in IDLE position and the Braking handle is in OFF position.

3. The Reverse handle cannot be moved out of FORWARD or REVERSE position when either the Throttle handle is advanced beyond IDLE or the Braking handle is advanced beyond OFF.

4. The Braking handle must be in OFF position before the Throttle handle can be moved out of IDLE position.

5. The Throttle handle must be in IDLE and the Reverse handle in FORWARD or REVERSE before the Braking handle can be moved.

6. The Reverse handle can be removed when the braking handle is in OFF and the Throttle handle is in IDLE.

Operation

To manipulate the controller operating handles during locomotive operation, proceed as follows:

Lead or Single-Unit Operation

Operating handles set-up (Reverse handle removed):

1. Braking (top) handle in OFF

2. Throttle (middle) handle in IDLE.

CAUTION: Finding the Braking handle away from OFF or the Throttle handle away from IDLE with the Reverse handle removed indicates that interlocking between handles requires repair or adjustment. Do not attempt to operate.

3. Insert the Reverse (bottom) handle.

4. Set the Reverse handle for desired direction.

Operating in Power Mode

1. Braking handle remains in OFF.

2. Move the Throttle handle to the desired notch.

Operation in Dynamic Brake Mode

1. Throttle handle returned to IDLE.

2. Move the Braking handle to SET-UP, pause for several seconds, then advance as desired.

Operation as Trail Unit

1. Braking handle in OFF.
2. Throttle handle in IDLE.
3. Reverse handle centered and removed.

DEVICES ON MASTER CONTROLLER AND CONTROL CONSOLE

The following devices are located on the Master Controller housing and control console:

Speed Control Switch

This is a two-position switch which is used in conjunction with train control. Operate as prescribed by railroad rules.

Headlight Switches

Three rotary-type 4-position switches are provided to control the headlights of the locomotive.

The Front Headlight switch controls the front headlight in the consist from the controlling locomotive, provided it is not arranged as the No. 2 end of a P30CH locomotive unit. It also sets up the Alerting lights.

The Rear Headlight switch controls the rear headlight in the consist from the controlling locomotive, provided the locomotive units are in MU rear-to-rear.

The Backup Headlight switch controls the rear headlight of a single locomotive unit.

Engine Run Breaker

The Engine Run breaker controls engine speed. It must be ON to control engine speed of the controlling locomotive and other units of the consist.

Generator Field Breaker

The Generator Field breaker is ON whenever the locomotive is powered and operating as a lead unit. The breaker also may be used to keep the main generator (alternator) de-energized when it is necessary to run the engine at speeds higher than idle.

Control Breaker

The Control breaker must be ON to run the fuel pump, start the engine, and provide control voltage power to other circuits, including the auxiliaries. In MU operation this breaker must be ON on the lead unit only.

Dynamic Braking Control Breaker

The Dynamic Braking Control breaker is used to control dynamic and blended braking of a locomotive. It must be ON to provide this braking.

Engineers Heater Breaker

Engineer's Heater breaker is a two-pole breaker located on the right side of the control console and controls heat at the engineer's position.

Parallel Start Override Push-Button

The Parallel Start Override push-button is used in conjunction with the Passenger Start Selector switch on the EC panel. This button is depressed when the selector switch is in PARALLEL START position and it is desired to override such starting. It must be depressed when the Throttle handle is in IDLE. The override feature will permit one series start to all units in consist and then reset back to PARALLEL START when all locomotives have gone through transition.

Trainline Ground Reset Button

The trainline Ground Reset button is used in MU operation, to reset the ground relay of a locomotive in consist not equipped with the automatic ground relay reset feature, and as a manual reset for a local ground. The reset button also may be used for steam boiler separator blowdown, when such an equipped locomotive is in consist.

Call Button

The Call button is used to sound the alarm bell in all units of the consist.

Other Devices

The following other devices are on the controller housing:

1. Horn Valve - for horn warning during normal operation

2. Lead Axle Sand Switch - for sanding the front wheels of the front truck (lead locomotive)

3. Air Gages - for registering air brake system pressure

4. Loadmeter - for registering tractive motor current in motoring (clockwise) and dynamic braking (counterclockwise).

NOTE: *The loadmeter registers current in the No. 4 traction motor.*

HELPER'S HEAD-END-POWER CONTROL PANEL (See Fig. 2)

A Head-End-Power Control Panel is mounted at the Helper's side of the operating cab. Mounted on this panel is a 0-600 a-c voltmeter to register voltage output of the Head-End-Power system and a push-button to shut down the system in an emergency. The push-button also can be used for trainline steam boiler shut-off.

FIG. 2. HELPER'S HEAD END POWER CONTROL PANEL.

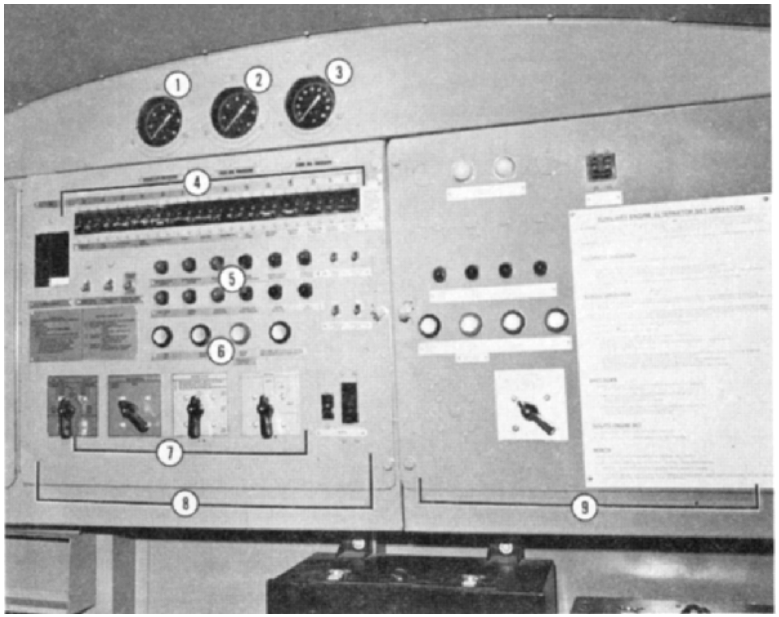
TRACTION ENGINE CONTROL PANEL (See Fig. 3)

The Traction Engine Control Panel (EC) is located on the rear wall of the operator's cab. Mounted on this panel are various other switches, circuit breakers and operating devices used during locomotive operation.

MU Headlight Set-Up Switch

The MU headlight set-up switch has five positions. Positioning of this switch is determined by location of the locomotive unit in the consist and whether the front of the locomotive unit is leading or trailing. Switch positions are as follows:

1. SINGLE OR MIDDLE UNIT - Place switch in this position on any locomotive unit operated singly or on all units, except the leading or trailing unit, when the locomotive consist is made up of more than one unit.



REF	DESCRIPTION	REF.	DESCRIPTION
1	*TURBO AIR PRESSURE*	*6*	RESET AND TRIP BUTTONS
2	FUEL OIL *PRESSURE*	*7*	ROTARY SETUP SWITCHES
3	LUBE OIL PRESSURE	8	TRACTION ENGINE CONTROL PANEL
4	CIRCUIT BREAKER PANEL	9	AUXILIARY ENGINE CONTROL PANEL
5	INDICATING LIGHTS		

FIG. 3. TRACTION ENGINE AND AUXILIARY ENGINE CONTROL PANELS.

2. SHORT HOOD LEAD-LEADING UNIT - Place switch in this position when the leading unit is operated with the short hood forward.

3. LONG HOOD LEAD-LEADING UNIT - Place switch in this position when the leading unit is operated with the long hood forward.

4. SHORT HOOD TRAIL-TRAILING UNIT - Place switch in this position when the final trailing unit is connected so its short hood trails.

5. LONG HOOD TRAIL-TRAILING UNIT - Place switch in this position when the final trailing locomotive is connected so its long hood trails.

Engine Control Switch (EC)

The Engine Control switch has two positions: START-ISOLATE and RUN. The engine start button is effective only when the EC switch is in the START-ISOLATE position.

When the engine is running and the EC switch is in START-ISOLATE position, engine speed is held at idle, and power cannot be applied to the locomotive. The power plant is said to be "off-the-line", or isolated from powering.

When the engine is idling and the locomotive is to be operated, the Engine Control switch must be moved to the RUN position.

Motor Cut-Out Switch

The Motor Cut-out switch is a four-position rotary switch used for cutting out traction motors a pair at a time. When used, power output of the locomotive will be reduced to 2/3 normal power to maintain the same ratio of horsepower per axle with other units in consist. Operation of the switch does not eliminate a ground fault in a power circuit. CMR wheelslip detection is disconnected from the cut-out traction motors.

Cab Heater Blower Switch

The Cab Heater Blower switch is a three-position rotary switch used in conjunction with the helper's heater breaker on the EC panel and the operator's heater breaker on the control console. The switch has HIGH and LOW speed blower control and must be ON for either or both heaters to operate.

NOTE: *A heater over-temperature manual reset is located in the nose cab.*

Helper's Heater Circuit Breakers

The two Helper's Heater Circuit breakers, located on the right side of the Heater Blower switch, must be ON, along with the blower switch, when heat is required at the helper's position.

CMR Test Button

A CMR Test button, located on the right side of the Wheelslip Function Test procedure instruction plate, is used to qualify the CMR wheelslip system for operation.

Engine Start And Stop Buttons

The Engine Start button, when used, must be depressed firmly and held in until the engine starts. It is effective only when the EC switch is in START position.

To stop the engine, depress the Engine Stop button momentarily.

Fuel Pump-Air Filter-Hot Diode - Engine Governor Shutdown Reset Button

A multi-purpose reset button is provided and must be depressed:

1. To set-up fuel pump circuit during engine start-up
2. To reset circuits following Engine Air Filter warning
3. To reset circuits following Hot Diode warning
4. To reset circuits following Engine Governor Shutdown.

Cause of fault must be corrected before normal operation can be restored.

Passenger Start Selector Switch

A Passenger Start Selector switch having two position, PARALLEL START and SERIES START, is provided. The switch is positioned as prescribed by railroad rules. It must be set up identically in all units of a consist before moving a train.

CAUTION: *To avoid serious equipment damage, never operate the Passenger Start Selector switch when the locomotive is under power.*

Locked Wheel Cut-Out Switch

The Locked Wheel Cut-Out switch is used as prescribed by railroad rules to nullify the trainline warning bell. When used, the Locked Wheel light will stay on continuously. During normal operation the switch is sealed IN.

Blended Brake Cut-Out Switch

The Blended Brake Cut-Out switch is used to cut out the blended brake feature. During normal operation the switch is sealed IN.

CAUTION: *Casual use of the switch must be avoided because of its reducing effect on braking deceleration rates.*

Circuit Breakers on EC Panel

The following circuit breakers are located on the EC panel:

1. Battery Charging Circuit
2. Running Lights
3. Fuel Pump
4. Excitation
5. Local Control
6. Headlights
7. Radio
8. Alerter
9. Speedometer
10. Cab Signal
11. Helper's Heater
12. Electric Brake
13. Intercomm and PA
14. Car Batt Neg.
15. Alerting Lights
16. Heater.

Other Toggle Switches on EC Panel

The following other toggle switches are located on the EC panel:

1. Front Class Lights
2. Front Number Lights
3. Crosswalk Lights
4. Engine Room Lights.

AUXILIARY ENGINE CONTROL PANEL (See Figs. 3 and 17)

The Auxiliary Engine Control panel is located on the right rear wall of the operator's cab. Mounted on this panel are various controls used with Head-End 480-vac-Power operation.

NOTE: *For procedures of system operation, refer to Head-End-Power Operation section.*

480 V System Set-Up Switch

The 480 V System Set-Up switch is a seven-position master switch used for setting up the head-end-power system. It sets up the trainline sequential crank and shutdown trainline, provides locomotive unit system isolation, sets up trainline power breakers, selects the master unit in the consist, sets engine run loop, sets up the trainline complete circuit and sets up the cross-circuit-compensation loop. It has seven positions as follows:

1. LAST UNIT, SHORT HOOD TRAIL
2. LAST UNIT, LONG HOOD TRAIL
3. SINGLE UNIT (LONG HOOD TRAIL ONLY)

4. ISOLATE, MIDDLE OR TRAIL UNIT

5. ISOLATE, SHORT HOOD LEAD (ONLY)

6. LEAD, SHORT HOOD LEAD (ONLY)

7. MIDDLE UNIT.

Auxiliary Power Control Breaker

The Auxiliary Power Control breaker connects locomotive battery power to the Head-End-Power system. It must be ON in all units whenever any unit in the consist has its Head-End-Power equipment operating, to insure proper trainline system control, including system shutdown. An isolated unit also must have the breaker ON.

Push-Buttons

Push-buttons on the panel are used to start, stop or reset circuits of the Head-End-Power system. These push-buttons are as follows:

1. 480 V System Start

2. 480V System Stop

3. Reset Trainline Breakers

4. 480 V Ground Reset.

Indicating Lights

The following indicating lights are mounted on the panel:

1. Trainline Phase Lights

2. Local No Crank

3. 480 V Ground Tripped

4. Trainline Complete

5. Trail Breaker Closed.

Functions of indicating lights are described under AUTOMATIC ALARMS AND SAFEGUARDS section.

MISCELLANEOUS CONTROLS

In addition to the previously described operating devices, the following additional controls are used during locomotive operation:

Emergency Brake Valve

A hand-operated Emergency Brake valve is located on the back of the operator's console, and another is located on the right side of the rear exit door in the Head-End-Power engine compartment. Pulling either handle will cause an Emergency brake application and cut off the locomotive power.

Windshield Wiper And Washer Valves

A set of Windshield Wiper and Washer valves is located overhead at the operator's and helper's positions. The valves control operation for the windshield at each position. A handle on each wiper mechanism is provided for manual operation.

Handbrake

A lever-type handbrake is located in the right aisle near the air compressor-radiator compartment.

Emergency Fuel Cut-off System

In an emergency, all engines on a locomotive and in a consist may be shut down by momentarily depressing an electric push-button on either side of the locomotive platform, one near the fuel tank and another near the air brake compartment. Also, the MU shutdown feature on the Throttle handle may be used to perform the same function.

In an emergency, both engines used for Head-End Power on a locomotive may be shut down by depressing either the 480 V System Stop button at the helper's station or on the Auxiliary Engine Control Panel.

> **NOTE**: *The push-button at the helper's station will also shut down the steam generator of any locomotive in the consist.*

> **NOTE:** *When the Throttle handle MU Stop has been used for emergency shutdown, the Throttle handle must be returned to IDLE position before engines can be started.*

Alerting Lights

Alerting strobe lights, two white and one red, are located at the front of the locomotive, above the front cab windows. These lights are controlled by the Alerting Light circuit breaker on the EC panel and the Red Alert Light switch and Front Headlight switch on the operator's console.

One white strobe light is mounted at each of the front corners of the operator's cab roof with non-directional focusing. A red strobe light is mounted between the number lights, with focusing directed in line with the track.

Operation of the air horn also operates the crossing bell and turns on the white strobe lights. Brilliance of strobe lights is dependent on the position of the Front Headlight switch, BRIGHT, MEDIUM, or DIM.

> **NOTE**: *The crossing bell must be turned off manually.*

The red strobe light can be turned on manually by the Red Alerting Light switch on the operator's console. When the switch is operated, the white strobe lights are cancelled and the Red Alert indicating light will come on.

During emergency air brake operation, the red strobe light will come on automatically and will stay on until brake pipe pressure is restored.

When t

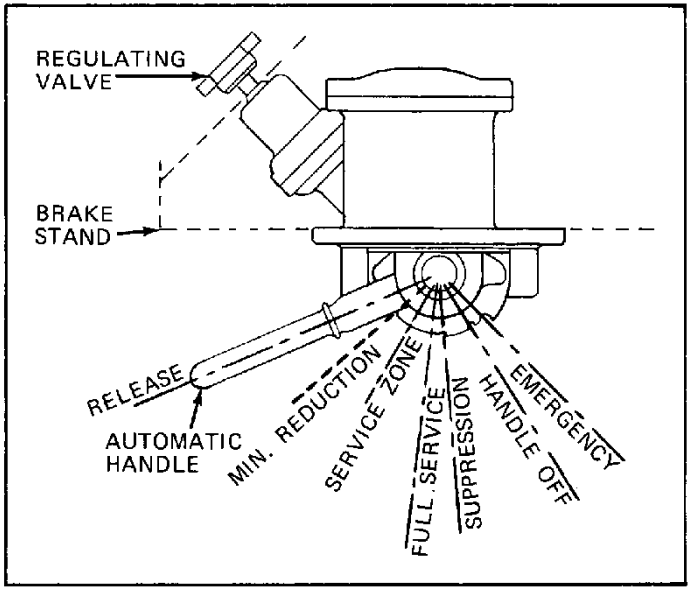


FIG. 4. AUTOMATIC BRAKE VALVE HANDLE POSITIONS.

AIR BRAKE EQUIPMENT

The schedule 26-L equipment, arranged for single-end, multiple-unit operation, is used on this locomotive. Operation is performed in the normal manner and according to railroad rules, even though blending braking has been included on this locomotive to utilize the dynamic braking along with the 26L brake equipment.

26-C Brake Valve (See Fig. 4)

This brake valve consists of two separate valves: the Automatic brake valve and the Independent brake valve. The automatic valve is designed for regulating brake-pipe pressure to control both locomotive and train brakes. The independent valve will apply and release locomotive brakes independently of the train brakes. The independent valve also controls the release of the locomotive brakes (due to an Automatic brake application while in force) without releasing the train brakes.

Automatic Brake Valve Handle (See Fig. 4)

The Automatic Brake Valve handle has six positions:

1. RELEASE (RUNNING) POSITION - This position charges the equipment and releases the locomotive and train brakes after an Automatic application. This is accomplished by controlling air flow to the brake pipe, as set by handle position of regulating valve (on back of brake stand). The RELEASE position is at the extreme left of the quadrant and is the normal position when the Automatic brake is not in use.

2. MINIMUM REDUCTION POSITION - This position is located to the right of the RELEASE position, where the brake valve handle reaches the first raised portion of the quadrant. With the brake valve handle moved to this position, the minimum service application is obtained, which results in a 4-61b. brake pipe reduction.

3. SERVICE POSITION - This sector for brake valve handle movement is to the right of the MINIMUM REDUCTION position. Moving the handle from left to right in this sector increases the degree of brake application. At the extreme right of the sector, a Full Service brake application is obtained.

4. SUPPRESSION POSITION - This position is located with the handle against the second raised position of the quadrant, to the right of the RELEASE position. This position provides a Full Service brake application and, in addition, on locomotives equipped with overspeed control and safety control penalty brakes, these applications will be suppressed.

5. HANDLE-OFF POSITION - This position is located by the quadrant notch to the right of the SUPPRESSION position. The handle is removable in this position. It must be placed in this position and removed on trailing units of a multiple-unit consist or on locomotives being towed "dead-in-train".

6. EMERGENCY POSITION - This position is located to the extreme right of the brake valve quadrant. It is used for making a brake valve Emergency brake application.

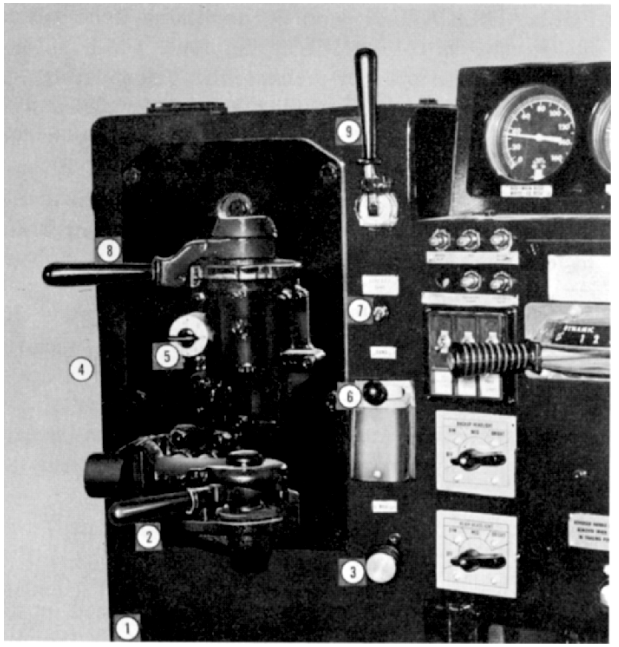
When an Emergency application is received, the Automatic Brake Valve handle must be moved to the EMERGENCY position and left in this position until the equalizing reservoir gage hand indicates zero (0) pressure. The Automatic Brake Valve handle then must be moved to the RELEASE position, to recharge the brake pipe and release the brakes.

NOTE: If *equipped with split reduction for penalty application, the penalty control functions.*

When the penalty control functions, a Service brake application is made about five seconds after a warning whistle sounds. Leave the Automatic Brake Valve handle in RELEASE position during the initial reduction of approximately nine pounds for approximately 20 seconds. At the start of the second reduction (indicated by a further drop in equalizing reservoir pressure), move the Automatic Brake Valve handle to the SUPPRESSION position, and leave it in this position until the application gage hand shows not less than 125 lb. pressure. Then, move the Automatic Brake Valve handle to the RELEASE position.

Independent Brake Valve Handle (See Fig. 5)

The Independent Brake Valve handle applies and releases the brakes on the locomotive consist or releases the brakes on the locomotive unit alone, after an Automatic or Emergency application.



REF.	DESCRIPTION
1	MU-2A VALVE (OR TO POSITION COCK)
2	INDEPENDENT BRAKE VALVE
3	BELL VALVE
4	REGULATING VALVE
5	BRAKE-VALVE CUT-OUT COCK
6	SANDER VALVE
7	LEAD-AXLE SAND SWITCH
8	AUTOMATIC BRAKE VALVE
9	HORN VALVE

FIG. 5. AIR AND AIR BRAKE CONTROLS.

The Independent Brake Valve has two position: RELEASE and FULL APPLICATION, with the application zone between. The brake valve is of the self-lapping type, which automatically maintains brake cylinder pressure when the application pressure reaches a value corresponding to the handle position. An Independent brake application can be released only by movement of the handle toward the RELEASE position. An automatic Service or Emergency application can be released on the locomotive consist by depressing the Independent Brake Valve handle in the RELEASE position.

Pilot Cut-Out Cock (Brake Valve Cut-Out) (See Fig. 5)

This cock, also known as the "double-heading cock", is located on the front of the Automatic brake valve. Push in the handle and turn to position for type of service. The OUT position is used when the locomotive is operated in Trail.

MU-2A Valve

This is a two- or a three-position valve located on the brake stand. It enables a locomotive equipped with 26-L brakes to be operated in multiple with locomotives having similar or other types brake equipment. Push handle in and turn to change positions.

> **NOTE:** *On some railroads, this device is replaced by a two position cut-out cock in same location.*

1. LEAD or DEAD position is used when locomotive unit is operated singly or when it is the lead unit of a multiple-unit consist. Position is also used when locomotive unit is hauled "dead-in-train".

2. TRAIL-6 or -26 position is used to trail a lead locomotive having 6SL or 26L brake equipments.

3. TRAIL-24 position is used to trail a lead locomotive having 24RL brake equipment.

Type 26-F Control Valve

This valve is located in the air brake compartment. When actuated by changes of pressure in the brake pipe, it operates to charge, apply, and release the locomotive brakes. The Release Cap on the control valve is mounted so that letters GRA are over the word RELEASED. This positioning of the release cap provides graduated release of Automatic brakes.

DUPLEX AIR GAGES

The following air gages are located on the gage panel in front of the engineman:

1. Main Reservoir-Equalizing Reservoir - Red hand indicates main reservoir pressure; white hand indicates equalizing reservoir pressure.

2. Brake Cylinder-Brake Pipe - Red hand indicates locomotive brake cylinder pressure; white hand indicates brake pipe pressure.

3. Application-Suppression (if installed) - Red hand indicates overspeed or safety control "penalty" application; white hand indicates suppression (if this feature is used).

> **NOTE:** *Timing Gage is located on right side of operator's control console.*

CUT-OUT COCKS

At specified inspection or maintenance periods, the following manually-operated devices are used:

1. Main Reservoir Cut-Out Cock - Located on right side of locomotive near the rear main reservoir.

2. Main Reservoir Drain Cocks - One located on the end of each main reservoir, usually part of automatic drain valves.

3. Air-Filter Drain Cocks - Normally located at rear of fuel tank on filter and on auxiliary air filter at front of fuel tank.

4. Control-Air Cut-Out Cock - Located in air brake compartment as part of reducing valve.

5. Control-Air Reservoir Drain Cock - Located in air brake compartment on rear wall.

6. Brake Cylinder Cut-Out Cocks - Located on right side beneath locomotive platform level (one for each truck).

7. Air Compressor Governor Cut-Out Cock - Located beside lube oil cooler in engine cab on right side of locomotive.

8. Bell, Horn and Window Wiper Cut-Out Cock - Located in air brake compartment.

9. Sander Control Cut-Out Cocks - Located behind door above top side step on right side of locomotive, both ends.

10. Cut-Out Cocks at Each End of Locomotive (see Fig. 6):

    a. Brake pipe angle cocks or cut-out cock behind end frame with snow plows

    b. Main Reservoir Equalizing

    c. Actuating

    d. Brake Cylinder Equalizing (Independent Application and Release)

    e. Signal pipe.

11. Dead Engine Cock - Located in air brake compartment.

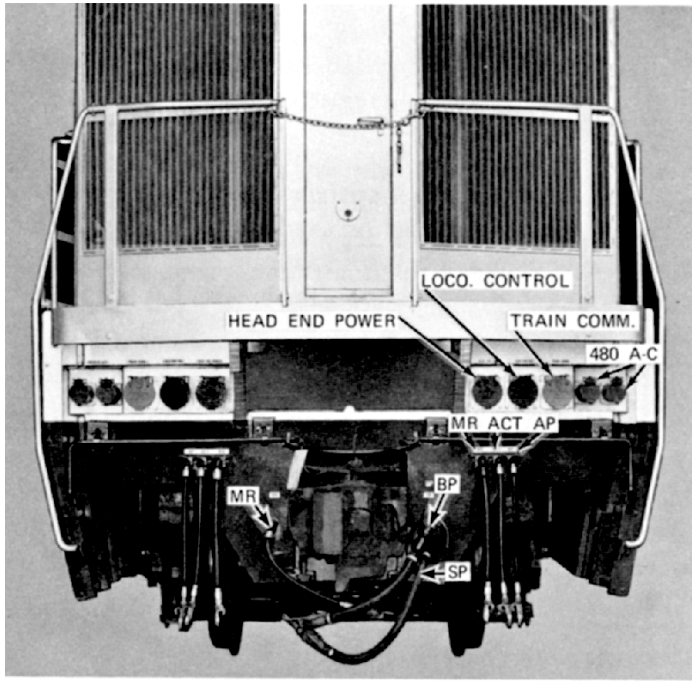


FIG. 6. LOCOMOTIVE END CONNECTIONS.

ADJUSTING VALVES

Air-Regulating Valve (Feed Valve) (See Fig. 4)

The air-regulating valve, located on the control stand, automatically maintains a predetermined air pressure in the brake system. A clockwise movement of the adjusting handle increases the pressure setting. A counter-clockwise movement decreases the pressure setting. Adjust to conform with railroad regulations.

Control-Air Reducing Valve

This valve maintains a predetermined normal air pressure in the air pressure supply for operation of the reverser, braking switch, and pneumatic contactors. Clockwise adjustment of the adjusting screw increases pressure. Normal control air pressure is 70 lb.

The locomotive is equipped with devices which warn of or protect against serious faults or abnormal operating conditions.

CIRCUIT BREAKERS

The circuit breaker is operated like a toggle switch to open or close a circuit manually. An overload in a breaker circuit causes a breaker to open a circuit automatically, and the toggle moves into the center position, indicating the breaker has tripped.

The breaker is reset by moving it to OFF, then to ON, after allowing a few minutes for the thermal element in the breaker to cool. The breaker should be reclosed only if there is no visible reason for the automatic opening of the circuit. If it trips after reclosing, it should be left open, unless instructed otherwise.

COLORED INDICATING LIGHTS AND BELL

Colored indicating lights on various panels are a visual means used to indicate a condition of operation or an existing fault or abnormal situation. When a fault light comes on, a warning bell will sound also. The warning bell will sound in all units, while the fault light will light only on the affected unit. All lights are "push-to-test" for maintenance checks.

NOTE: *If troubles occur on two or more units simultaneously, causing the alarm bell to ring, turn the EC switch on the Engine Control panel of all affected units to START position before attempting to restart any unit. With the Throttle handle on the lead unit beyond IDLE position, it is impossible to start any unit while the alarm bell is ringing.*

INDICATING LIGHTS ON OPERATOR'S CONTROL CONSOLE (See Fig. 1)

The following is a functional description of the indicating lights on the operator's control console:

1. Wheelslip (White) - Indicates wheels are slipping beyond the control of the automatic wheelslip correction system. The warning buzzer will sound and a reduction in excitation will occur, along with automatic sanding.

   NOTE: *If wheelslips are observed, but the wheelslip light does not come on, a report should be made. The wheelslip detection equipment may require maintenance.*

2. PCS Open (Red) - Indicates a Penalty or Emergency air brake application has occurred and power has been removed. The traction diesel engine goes to full engine speed.

3. Brake Warning (White) - Indicates normal safe dynamic braking limit has been exceeded.

4. Red Alert Light (Red) - Indicates the red strobe light is on.

5. Lead Axle Sand (White) - Indicates the Lead Axle Sand switch is on.

6. EP Brake ON (Green) - Indicates the Automatic brakes are set up for LEAD and the breaker is on.

7. Brake Released (Green) - Indicates the car electro-pneumatic brakes are released.

8. Brake Applied (Red) - Indicates the car electro-pneumatic brakes are applied.

9. S.C. Not Operating (White) - Indicates Speed Control is not operating.

10. Overspeed (Red) - Indicates the train block speed is being exceeded.

11. Door Closed (Green) - Advises the engineman when all passenger car doors are closed.

12. Hot Journal (Red) - Indicates a hot journal is present on one or more cars in the train.

INDICATING LIGHTS ON ENGINE CONTROL PANEL (See Fig. 3)

The following is a functional description of indicating lights on the Engine Control Panel:

1. Ground Relay Tripped (White) - Indicates Ground Relay has tripped, removing traction power and operating trainline alarm bell (see Ground Relay description).

2. Overload Relay Tripped (White) - Indicates Alternator Overload Relay has tripped, removing traction power and operating trainline alarm bell.

3. No Battery Charge (White) - If the engine is running and the Engine Control switch (EC) is in RUN position, the light indicates the battery charging equipment has failed. The alarm bell will also sound.

   NOTE: *The light will also come on if the engine is not running, but the battery switch is closed. Under this condition, a fault does not necessarily exist.*

4. Self-Load Box (White) - Indicates the Self-Load Box toggle switch in the control compartment is in the LOAD BOX position.

5. Locked Wheel (White) - Indicates a locked axle is present, or a continuous wheelslip of long duration has occurred, or a mechanical maintenance fault exists. Proceed as directed by railroad rules.

6. Reduced Excitation (White) - Indicates the CHEC excitation system is not functioning properly and the locomotive is operating at reduced power. Proceed as directed by railroad rules.

7. Crankcase Overpressure (Red) - Indicates a serious engine fault exists. The engine shuts down automatically and the alarm bell rings.

   CAUTION: *To prevent serious engine damage, before the engine is restarted, cause of the shutdown must be determined and the fault corrected.*

8. Engine Air Filter (Red) - Indicates the traction engine air filters are plugged and require changing. Power is removed and engine speed automatically returns to idle. Press Air Filter reset button on EC panel to restore normal operation after clearing fault.

9. Hot Diode (Red) - Indicates safe operating temperature of the power rectifier panels has been exceeded. Alarm bell will sound, power will be removed and engine speed will return to idle.

Engine Systems Monitor Lights

Three indicating lights on the Engine Control panel function with the Engine System Monitor. One or more of these lights will come on to warn the operating crew and the maintenance people that an abnormal situation has developed.

Engine Systems Maintenance Light (Yellow)

The Engine Systems Maintenance light comes on whenever:

1. A fault is present, Throttle handle is in IDLE and the EC switch is in ISOLATE

2. A fault is present and the engine shuts down on the road 3. Self-load box is in operation.

Engine Over-Temperature Light (Red)

The Engine Over-Temperature light comes on when the engine temperature has exceeded the safe maximum operating condition. The alarm bell will ring for thirty seconds, after which the engine will return to idle and power is removed.

Governor Shutdown Light (Yellow)

The Governor Shutdown light comes on, alarm bell rings, and the engine shuts down when engine system problems have developed which make it unsafe to continue running the engine. The engine cannot be cranked until the fault is corrected and the appropriate devices have been reset.

INDICATING LIGHTS ON AUXILIARY ENGINE CONTROL PANEL (See Figs. 3 and 17)

The following is a functional description of the indicating lights mounted on the Auxiliary Engine Control panel:

1. Phase Lights - Indicate three-phase output is available from the head-end-power system.

2. Local No Crank - Indicates at least one engine set on the locomotive has failed to start when called for.

3. 400 V Ground Tripped - Indicates a system ground is present, not necessarily on the locomotive. All locomotives in the consist may respond to the ground and a 150-second alarm bell will ring.

4. Trainline Complete - Indicates all power jumpers between units are plugged in.

5. Trail Breaker Closed - Indicates the line breaker on the last locomotive of the consist has closed and power is available for the train circuits.

ALTERNATOR OVERLOAD RELAY

A surge relay (GOLR) is provided to detect power faults which could cause the alternator to overload and go to ground. The fault detection also prevents excessive equipment damage caused by an inoperative ground relay. An indicating light on the Engine Control panel will light when such a fault has occurred.

GROUND RELAY

If a ground occurs in the main power circuits, the ground relay operates to reduce engine speed automatically to idle, removes power from traction motors, and sounds the alarm bell.

An indicating light (Ground Relay Tripped) on the Engine Control panel will light, indicating a fault has occurred.

If a ground occurs in the control circuits, the ground relay may operate during the engine cranking cycle. Report this condition.

Resetting Ground Relay

An automatic reset feature is provided which automatically resets the ground relay after two trips have occurred. When the relay trips a third time, it locks out and must be reset using a manual reset button on the control console. To reset the relay, proceed as follows:

1. Make a visual observation of the locomotive to verify there are no unusual conditions.

2. Take the engine "off-the-line".

3. Press the Trainline Ground Reset button on the control console.

NOTE: *The Trainline Ground Reset button is used to set the local ground relay and the ground relay on locomotives not equipped with the automatic ground relay reset feature.*

4. Advance the Throttle handle. If the ground relay stays in, continue normal operation. Limit reset attempts to two, or as directed by railroad rules.

5. If the ground relay trips repeatedly the unit either must be shut down or, if necessary, the engine can be left running by turning the EC switch to START. This takes the unit "off-the-line".

PCS SWITCH

The pneumatic control switch (PCS) is operated from the air brake system.

During a "penalty" or Emergency air brake application, this switch opens. The engine automatically goes to full engine speed and, shortly thereafter, full dynamic and air braking are applied. The PCS Open light on the operator's control console will light. These events will occur regardless of Throttle handle or Dynamic Braking handle position on the lead locomotive.

NOTE: *When the independent bail ring is depressed in the lead locomotive, such as desired in a break-in-two, the air and blended dynamic brakes are released and will not reapply. Ten seconds after the bail ring is depressed, motoring operation is resumed, unless the Throttle handle has been returned to IDLE.*

To reset the PCS switch automatically, move Throttle handle to IDLE. If the switch has tripped while in dynamic braking, the dynamic braking handle must be returned to OFF to reset the circuit.

EMERGENCY SANDING

Emergency sanding is applied automatically in forward and reverse directions during all Emergency brake applications, for a sufficient time to stop the train. In multiple-unit operation, emergency sanding is applied to all units, regardless of whether they are equipped with pneumatic or electro-pneumatic sanding equipment.

CRANKCASE OVERPRESSURE SWITCH (See Fig. 7)

A Crankcase Overpressure switch is mounted on the left side of the traction diesel engine near the generator. The switch will shut down the engine in case a serious engine fault occurs.

When the switch trips, the engine shuts down automatically, the alarm bell rings, and an indicating light comes on in the operator's cab and on the housing of the switch.

When such a fault occurs, take the locomotive off the line and leave the engine shut down. Proceed as directed by railroad rules.

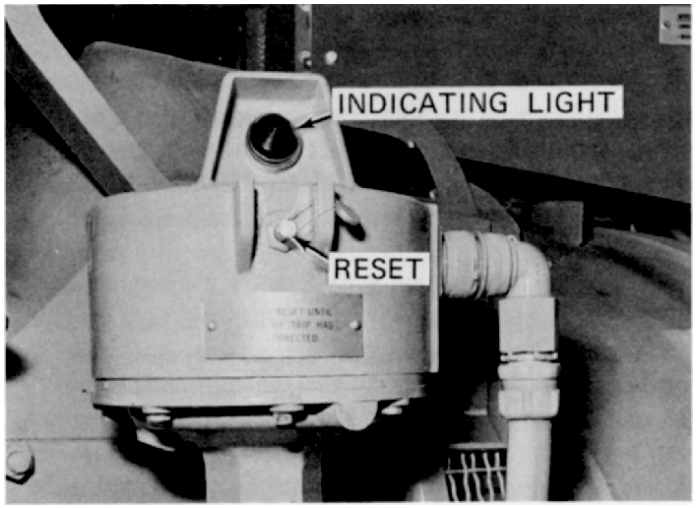


FIG. 7. CRANKCASE OVER-PRESSURE SWITCH.

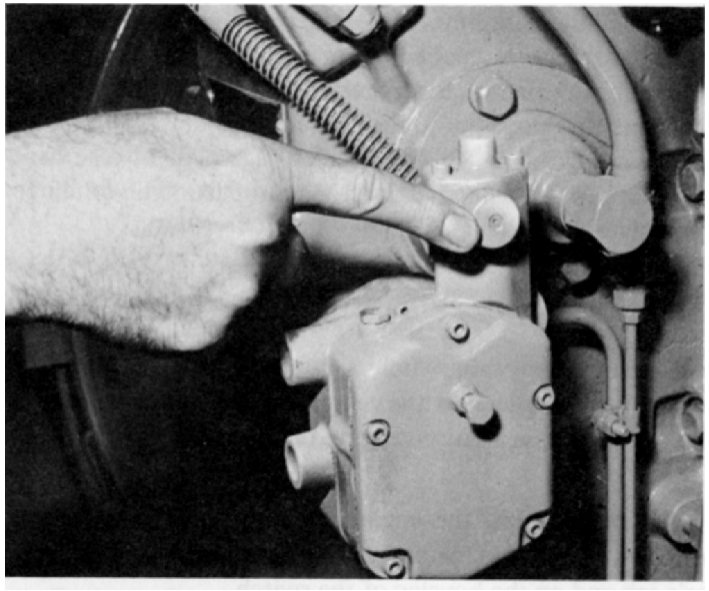


FIG. 8. ENGINE OVERSPEED GOVERNOR AND RESET.

ENGINE OVERSPEED SHUTDOWN (See Fig. 8)

In the event the traction engine overspeeds to 1160 rpm, the engine is shut down automatically. After an overspeed shutdown of the engine, move the EC switch to START. Reset the overspeed mechanism by pushing in on the knob of the Engine Overspeed Governor, located on the left side of the engine under the engine control governor. Proceed to start the engine as described under Starting Engine section. If it overspeeds again, do not restart the engine.

> **NOTE:** *If troubles occur simultaneously on two or more units which cause the alarm bell to ring, turn the EC switch on all affected units to START position before attempting to restart any unit. With the Throttle handle on the lead unit beyond IDLE position, it is impossible to start any unit while the alarm bell is ringing (during freezing weather, protect engine cooling system according to railroad instructions).*

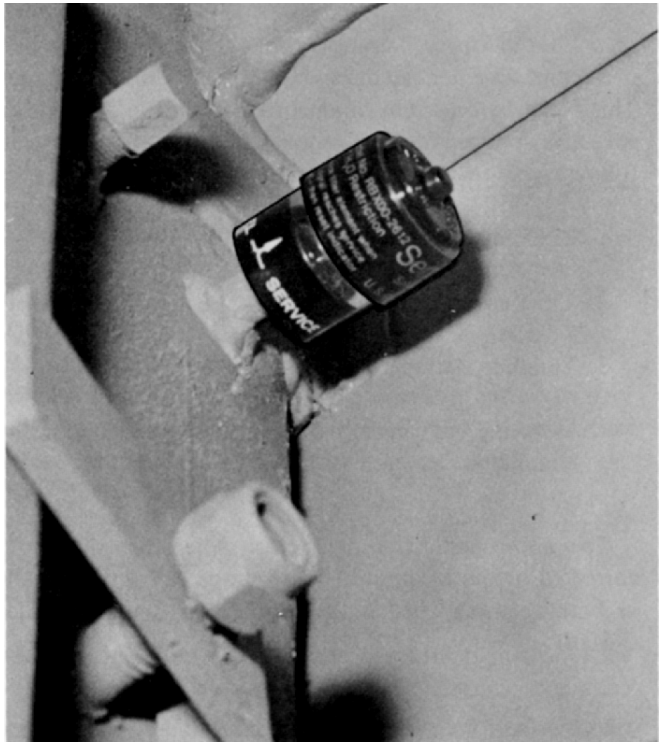


FIG. 9. ENGINE AIR FILTER SERVICE INDICATOR.

ENGINE AIR FILTER SERVICE INDICATOR (See Fig. 9)

An Engine Air Filter Service Indicator is located near the right aisle door of the radiator compartment. This indicator serves as an early warning that the engine air paper filters are becoming clogged. When the engine is running under load at full speed and the red band inside of the indicator becomes visible, this is an indication the engine paper air filters are starting to get dirty. When the red band locks in place at the top of the indicator, the filter service condemning limit has been reached. Proceed as directed by railroad rules.

LOCKED WHEEL WARNING SYSTEM

A Locked Wheel Warning System goes into effect when a slip or slide of an extended duration develops in motoring or braking. This could be caused by an uncorrected slide in dynamic braking, excessive Independent brake application or a locked wheel. The following events take place:

1. Trainline buzzer will sound.
2. The Locked Wheel light will come on at the EC panel.
3. Trainline alarm bell will ring.
4. Motoring, dynamic braking and blended braking will be eliminated during the slip or slide.

The above indication will cease when the slip or slide is corrected or the locomotive speed drops below 5 mph. Motoring or braking is reapplied if the Throttle or Braking handle is not shut off.

If the fault indications do not cease, follow the procedure on the instruction plate located on the lower left side of the Engine Control panel, which states:

1. Stop train.
2. Look for unit with locked wheel indication.
3. Roll train slowly and observe wheels.
   a. If wheel slides, cut unit out of train.
   b. If all wheels roll freely, open locked wheel cut-out switch and have mechanical department notified by the chief dispatcher at time of occurrence, or proceed as directed by other railroad rules.

PRESSURE AND TEMPERATURE GAGES

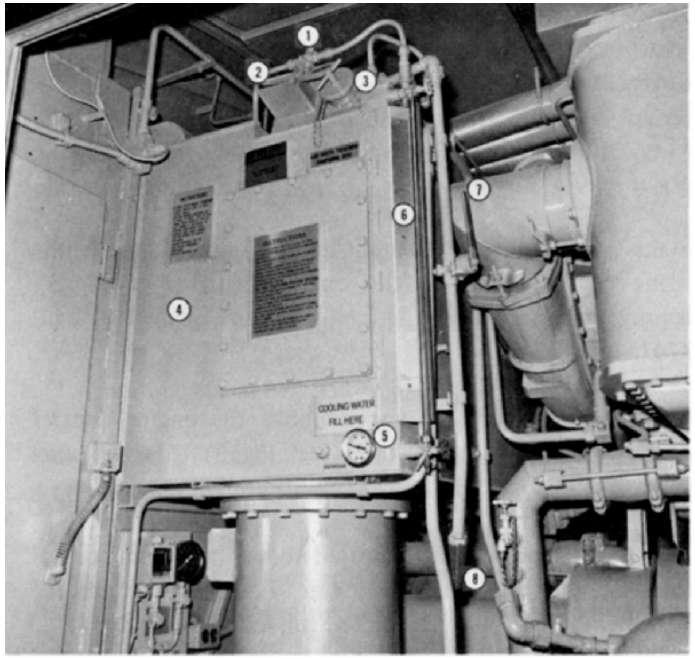
1. Control Air - Located in the air brake compartment. Normal air pressure is 70 psi.

   NOTE: *The following values are nominal, due to the effect of varying conditions.*

2. Intake Manifold Air-Pressure Gage - Located above the engine control panel in the operator's cab (see Fig. 3). Normal reading at FULL ENGINE SPEED and FULL LOAD is 26-32 psi.
3. Fuel Pressure Gage - Located above the engine control panel in the operator's cab (see Fig. 3). Normal fuel pressure at idle is 40 psi and at full load is 33 psi.
4. Lube-Oil Pressure Gage - Located above the engine control panel in the operator's cab (see Fig. 3). Normal lube pressure at idle is 10-25 psi and at full load is 75-100 psi.
5. Water Temperature Gage - Located on the right side of the water storage tank (see Fig. 10). Normal operating temperature is 170-180 F.

OTHER GAGES

1. Engine Lubricating-Oil Dipstick - One located on the side of the engine near the lube-oil fill. The stick is marked FULL and LOW. Proper level with the engine idling is between FULL and LOW.
2. Fuel-Oil Sight Glasses and Dial Gages - Mounted on both sides of the main fuel tank to indicate the level of fuel in the tanks.
3. Cooling Water - A water level sight glass mounted on the side of the cooling water storage tank indicates the level of the cooling water. Markings near the sight glass indicate the proper level for different conditions of the system.



REF.	DESCRIPTION	REF.	DESCRIPTION
1	VENT VALVE	5	WATER TEMPERATURE GAGE
2	VENT-VALVE HANDLE	6	WATER SIGHT GLASS
3	PRESSURE CAP	7	FILL-VALVE HANDLE
4	WATER STORAGE TANK	8	WATER FILL PIPE

FIG. 10. WATER STORAGE TANK DETAILS.

When filling the system, or adding water treatment compound, proceed according to instructions mounted on the water storage. tank and on the inside of the fill cap door panel above (see Fig. 10).

CAUTION: *To avoid personal injury from water burns, never remove the water fill cap when the water level is above FULL AT IDLE mark.*

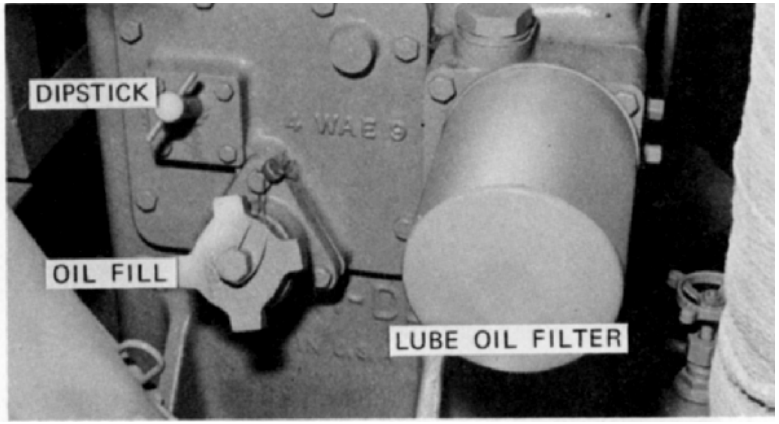


FIG. 11. AIR COMPRESSOR.

4. Compressor Lube Oil (Gardner-Denver Compresser) - A dipstick near the Fill cap indicates when crankcase is full and how much oil is needed to bring oil level to FULL mark (see Fig. 11).

5. Traction Alternator Gear Box - A dipstick marked EMPTY - ADD - FULL indicates oil level. Proper level is between ADD and FULL, with the engine stopped (see Fig. 12).

FIG. 12. TRACTION GENERATOR GEAR UNIT.

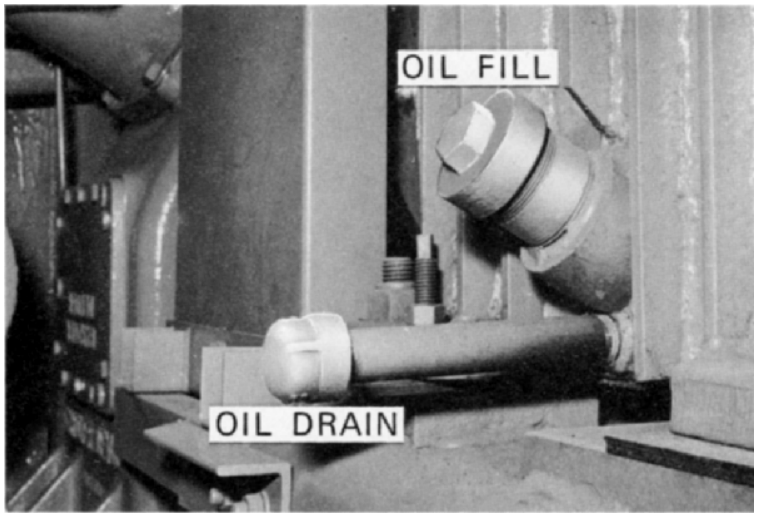


FIG. 13. FAN GEAR UNIT.

6. Fan-Gear-Unit Oil Level - Maintain oil level near the spill-over of the fill pipe (see Fig. 13).

7. Governor Oil-Level Sight Glass - Located on the left side of the engine near the traction generator (see Fig. 14). Oil level must be visible between marks on the sight glass when the engine is running.

> **CAUTION**: *To prevent serious equipment damage, never start an engine until the engine governor has been properly serviced with Tube oil.*

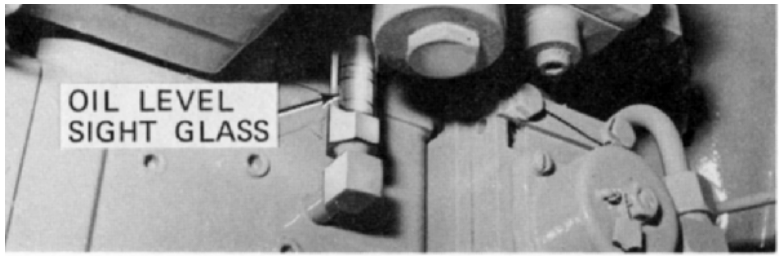


FIG. 14. **ENGINE GOVERNOR LUBRICATION.**

The following checks and inspections should be made in accordance with railroad rules.

BEFORE BOARDING LOCOMOTIVE

1. Inspect for broken, worn, loose, or dragging parts (e.g. brake rigging, brake shoes, wheels, traction motor commutator covers).

2. Check for leaks from outside piping.

3. Properly position all drain and cut-out cocks.

4. Check the proper connection of air hoses and properly secure unused hoses.

5. Connect electrical jumper cable between locomotives and cars as follows (see Fig. 15):

   a. At the non-coupled end of lead locomotive and last train car, jumper each 480 vac receptacle to the adjacent receptacle.

   b. Between locomotives, jumper one set of Head End Power (HEP), Loco. Control (LC) and Train Comm. (TC) receptacles between units and both sets of 480 vac receptacles between units.

   c. Between trail locomotive and lead car, jumper both sets of 480 vac receptacles between locomotive and car.

6. Check the fuel supply on the fuel tank sight glass.

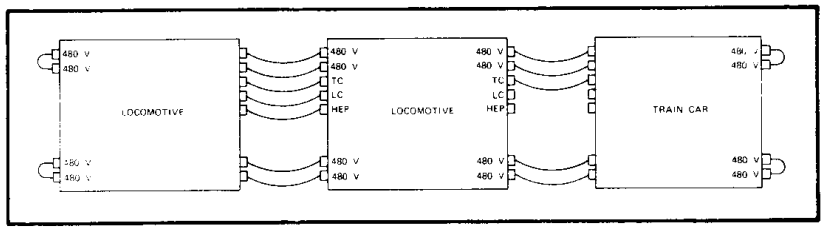


FIG. 15. TYPICAL TRAINLINE JUMPER ARRANGEMENT.

AFTER BOARDING LOCOMOTIVE

1. Remove rags, tools, etc., from moving parts and electrical equipment.

2. Check the diesel engine lubricating-oil supply. Oil level should indicate FULL on the measuring gage, with the engine shut down. A measuring gage (dipstick) is located on the side of the engine near the lube oil fill and is marked LOW-FULL.

3. Check the governor oil supply. The sight glass on the governor should be full of oil. After the engine is started, the oil must be visible between the marks on the sight glass (see Fig. 14).

4. Check the air compressor lubricating-oil supply. On the Gardner-Denver compressor, the proper level is indicated on the dipstick (FULL 16 gal.).

5. Check the cooling water supply. Verify the water drain valves are closed.

6. Assure the fan-gear unit oil level is up to the spill-over of the fill pipe.

7. Check the lubricating oil of the generator gear unit. The dipstick is marked EMPTY - ADD - FULL. The proper level is between the ADD and FULL marks (see Fig. 12).

8. Assure the diesel-engine overspeed device is reset (see Fig. 8).

9. Assure the engine barring-over device is removed from the engine.

10. Assure the following air cut-out cocks are open:

    a. Air compressor governor

    b. Control air

    c. Cab signal

    d. Bell, horn and window wiper.

11. Assure the brake-pipe angle cock is "cut-in" (vertical position).

12. The brake valve pilot cut-out cock (double-heading cock) on the 26L air brake system should be properly positioned.

13. The MU-2A valve or double cut-out cock must be positioned according to the location of the unit in the locomotive consist and the type of brake equipment in the lead locomotive.

14. Check the positions of the Automatic and Independent Brake Valve handles. The Automatic Brake Valve handle should be removed on all trail units, and the Independent handle should be in RELEASE if not removable.

15. Move the engine control switch to START.

16. Properly position the MU headlight selector switch.

17. Assure the Throttle handle is in IDLE and the Selector handle is in OFF.

18. Assure the dead-engine cock is closed.

STARTING ENGINE

1. Perform operation as in Before Boarding Locomotive and After Boarding sections.

   NOTE: If *the engine has been stopped for a considerable period of time, the cylinders should be cleared of fuel or water accumulation before starting the engine.*

   Proceed as follows:

   a. Apply the engine barring-over device and back off the compressor relief plugs on the left side of each cylinder.

   b. Rotate the engine at least two complete revolutions, using the engine barring-over device.

   c. Remove the barring-over device from the engine and tighten all compression relief plugs before cranking.

2. Verify the emergency stop feature is nullified (Throttle handle in IDLE).

3. Close the battery switch located beside the EC panel in the operator's cab.

4. Assure the Ground Relay Overload or Governor Shutdown indicating lights are not on. The cause of the faults must be removed before proceeding.

5. Close the following circuit breakers on the engine control panel:

   a. Control Circuit

   NOTE: *When starting engines of several locomotives in a multiple-unit consist, start engines one-at-a-time. Close the control circuit breaker only on one unit. Push the fuel pump reset button, and allow the fuel pump to run a few seconds until some fuel pressure shows on the EC panel gage, before starting the engine. When all engines are* running, *close the control circuit breaker on the lead unit only.*

   b. Charging Circuit

   c. Running Lights

   d. Fuel Pump

   e. Excitation

   f. Local Control

   g. Headlights.

6. Push the engine start button on the engine control panel, and hold until the engine starts.

   NOTE: *If proper engine lube-oil pressure does not build up within approximately 40 seconds, the governor will shut off fuel and prevent the engine from starting. (Refer to Pressure and Temperature Gages section.)*

CAUTION: *Do not discharge the battery excessively by repeated attempts to start. If the first two or three tries are unsuccessful, recheck the starting procedure.*

BEFORE MOVING LOCOMOTIVE

1. Turn the engine control switch to RUN.

2. Make an air brake test and other checks in accordance with railroad regulations.

3. Check the main reservoir air pressure according to railroad rules.

4. Check the control air pressure. Normal pressure is 70 psi.

5. Make an Independent air brake application. Release the handbrake and remove any blocking of the wheels.

6. Allow time for the engine cooling water to warm up before moving the locomotive in accordance with railroad rules.

FASTER AIR PUMPING

To provide faster air pumping on locomotive, when reservoirs have been drained or after the locomotive has been coupled to a train, proceed as follows:

1. Leave the generator-field circuit breaker in the OFF position.

2. Close the control breaker on the engine control panel.

3. Insert the Reverse handle.

4. Move the Throttle handle to the 4th or 5th notch, as needed.

NOTE: *If the main reservoir air pressure is above 130 psi and is not rising, increasing the engine speed will not raise the pressure.*

MOVING A TRAIN

1. Close the generator field circuit breaker on the control stand.

CAUTION: *To prevent equipment damage when changing from power to dynamic braking or from dynamic braking to power, pause 10 seconds with Throttle handle at IDLE and Dynamic Braking handle OFF.*

2. Move the Reverse handle to the desired direction of movement.

3. Release the brakes completely. Several minutes may be required to release the brakes, depending on the length of the train.

4. Advance the Throttle handle.

5. The Throttle handle has notches (IDLE up to NOTCH 8), with each successive notch representing an increase in power or locomotive tractive effort.

Starting a train depends on type, length, weight, grade condition of rail, and amount of slack in the train. This locomotive is designed to have easily controlled tractive effort build-up characteristics, with the tractive effort in each notch limited to definite values as the Throttle handle is moved from the lowest to the highest notch. No harm will be done by moving the Throttle handle beyond Notch 4 when starting a train. The engineman can easily control the amount of tractive effort required to start and accelerate a particular train. Speed can be controlled as desired by reducing or increasing the Throttle handle position.

STOPPING A TRAIN

Move the Throttle handle to IDLE and apply the air brakes according to railroad regulations. If leaving the operator's position after the train has stopped, move the Reverse handle to OFF.

REVERSING LOCOMOTIVE

1. Bring the locomotive to a full stop.
2. Move the Reverse handle to the opposite direction.
3. Release the brakes.
4. Advance the Throttle handle.

PASSING THROUGH WATER

Do not exceed 2-3 mph if there is water over the rails**.** Do not pass through water that is over 2.5 in. above the top of the rail.

STOPPING ENGINES

1. Move the Throttle handle to IDLE.
2. Open the Generator Field circuit breaker on the control stand.
3. Move the engine control switch to START.
4. Press the Stop button on the engine control panel.
5. To shut down all engines when in multiple-unit operation, move the Throttle handle to the SHUTDOWN position on the Master Controller. The Throttle handle must be in IDLE before attempting to start the engine.

BEFORE LEAVING LOCOMOTIVE

1. Apply the handbrake and release the air brakes after uncoupling from the train.

CAUTION*: On three-axle floating bolster trucks with low-hung brake cylinders, a "QR", or quick-release, valve is provided which removes the air in the one brake cylinder that is in the handbrake system. The handbrake chain must trip the stem of the QR valve, and no trapped air is permitted in this brake cylinder. Otherwise, if the locomotive air pressure leaks* off, *the locomotive can roll down the track unattended.*

2. Leave the Throttle handle in IDLE.
3. Open all switches and circuit breakers.
4. Close the windows and doors.
5. Open the battery switch.
6. In freezing weather, precautions must be taken to assure the cooling water does not freeze. See Draining Cooling System section, and follow railroad rules for this situation.

CAB SIGNAL AND TRAIN SPEED CONTROL

Cab Signal and Train Speed Control are provided. See railroad rules for specific procedures.

Dynamic braking is applied to the locomotive only. A dynamic brake interlock keeps the air brakes on the locomotive from being applied when automatic air braking and dynamic braking are being used.

APPLYING DYNAMIC BRAKING

Dynamic braking is applied in the following manner:

1. Move the Throttle handle to IDLE.

CAUTION: *To prevent equipment damage when changing from power to dynamic braking or from dynamic braking to power, pause 10 seconds with Throttle handle at IDLE and Dynamic Braking handle OFF.*

2. Move the Dynamic Brake handle to SET-UP position. Then move the handle into the BRAKING sector, as required.

3. After the slack is bunched, advance the Braking handle until the desired braking effort is obtained. Observe and correct braking effort during the initial period of dynamic brake application.

The amount of braking effort obtainable varies with the position of the Dynamic braking handle for various speeds. Maximum braking effort is obtained in the 8th Notch at speeds of about 49 mph.

NOTE: *Wheelslip warning may occur while in dynamic braking. This indicates wheels are sliding. Sand is applied automatically to the wheels of the sliding unit. Reduce the Braking handle position until the warning stops.*

USE OF AIR BRAKES DURING DYNAMIC BRAKING

When necessary, the automatic air brake may be used in conjunction with the dynamic brake. Automatic air brakes will apply on the train but not on the locomotive. If the Automatic Air Brake handle is moved to the EMERGENCY position, the dynamic brake is removed and brakes on the locomotive, as well as those on the train, go into Emergency application.

CAUTION: *The independent air brake must not be used during dynamic braking, to avoid flat spots on the locomotive wheels caused by sliding.*

RELEASE OF DYNAMIC BRAKING

Release dynamic braking by moving the Dynamic Braking handle to the OFF position.

OPERATING AS A LEADING UNIT

To operate the locomotive as a lead unit of a consist, proceed as follows:

1. Make the necessary preliminary preparations for operation.
2. Test the air brake in accordance with railroad rules.
3. Close the generator field circuit breaker.
4. Close the control circuit breaker (on lead unit only).
5. Position 480 V System Set-up switch, as required.
6. Move the Reverse handle to the desired direction.
7. Operate the locomotive in accordance with operating procedure.

OPERATING AS A TRAILING UNIT

Air Equipment Set-Up

1. Make a Full Service application with the Automatic Brake Valve handle.
2. Move the brake-valve pilot cut-out (double-heading) cock to the OUT position.
3. Move the Automatic Brake Valve handle to the HANDLE OFF position, and remove the handle.
4. Place the Independent handle in RELEASE position.
5. Move the MU-2A valve to suit brake equipment on the leading unit (either TRAIL-24 or TRAIL-26 or 6 positions).

Electrical Set-Up

1. Move the Reverse handle to OFF and remove the handle.
2. Open the generator field circuit breaker on the control stand. Leave all breakers in the CLOSED position on the engine control panel (EC), except the control circuit breaker and engine run switch, if used. The running lights circuit breaker may be positioned as desired.
3. Place the MU headlight set-up switch in the proper position.
4. Move 480 V System Set-up switch to conform with changed locomotive arrangement.

CHANGING OPERATING ENDS

To change operating control from the cab of one locomotive unit to the cab of another, proceed as follows:

Vacating Unit-Air Equipment Set-Up

1. Make a Full Service brake-pipe reduction.
2. Allow time for all air blowing sounds to stop; then depress the handle of the brake valve pilot cut-out cock and move it to the OUT position.
3. Place the Automatic Brake Valve handle in the HANDLE OFF position and remove; place the Independent Brake Valve handle in the RELEASE position.
4. Depress the handle on the MU-2A valve and move it to TRAIL-24, or TRAIL-6 or TRAIL-26 position, depending on the type of equipment used on the lead locomotive unit.

Vacating Unit - Electrical Set-Up

1. Move the Reverse handle to OFF and remove the handle.

2. Open the generator field circuit breaker on the control stand.

3. Leave all breakers in the CLOSED position on the engine control panel (EC), except the control circuit breaker and engine run switch, if used. The running lights circuit breaker may be positioned as desired.

4. Move the MU headlight set-up switch to the required position.

5. Move the 480 V System Set-Up switch to conform with changed locomotive arrangement.

Operating Unit - Air Equipment Set-Up

1. Insert the Automatic Brake Valve handle in the HANDLE OFF position.

2. Move the Independent Brake Valve handle to the FULL APPLICATION position.

3. Depress the handle of the MU-2A valve, and move it to the LEAD or DEAD position.

4. Depress the handle of the brake-valve pilot cut-out cock, and move it to the IN or FRT. or PASS. position, as designated by the service in which the locomotive is to be operated.

Operating Unit - Electrical Set-Up

1. Insert the Reverse handle into the control stand.

2. Close the generator field circuit breaker on the control stand.

3. Close all circuit breakers on the engine control panel (EC). (The control circuit breaker must be closed on the lead unit only.)

4. Move the MU headlight set-up switch to the required position.

5. Move the 480 V System Set-Up switch to conform with changed locomotive arrangement.

TO OPERATE WITH OTHER TYPES OF UNITS

If the units of the locomotive consist are geared for differing maximum speeds, do not run at speeds in excess of that recommended for the unit having the lowest maximum permissible speed.

Similarly, do not operate at low speeds long enough to exceed the specified traction motor ratings on any of the units in the locomotive consist. A locomotive with high horsepower per axle will develop more tractive effort at any given speed than will units of lower horsepower per axle.

On GE units equipped with automatic power-matching control, power is automatically reduced to a lower level under certain conditions when operating at low locomotive speeds. Special operating instructions will be required for this feature.

Units equipped with braking current-limiting regulators can be operated in multiple with GE locomotives in dynamic braking, regardless of the gear ratio or differences in maximum braking current ratings. If some units do not have current-limiting regulators, the locomotive consist MUST always be operated so as not to exceed the braking current of the unit having the lowest maximum braking current rating. Special operating instructions will be required for this case.

BRAKE-PIPE LEAKAGE TEST

A brake-pipe leakage test can be performed in the following manner:

With the brake system fully charged and with the brake-valve pilot cut-out cock in the IN position, move the Automatic Brake Valve handle promptly toward the SERVICE position until the equalizing reservoir pressure has been reduced 15 psi; then stop and leave the handle in this position.

As soon as the brake-pipe pressure has reduced to the level of the equalizing reservoir pressure (continuous blow from brake-valve exhaust), depress the brake-valve pilot cut-out cock handle and move it to the OUT position. Immediately observe the brake-pipe gage, and time the pressure drop in accordance with railroad rules.

At the completion of the brake-pipe leakage test, move the brake-valve handle further toward the SERVICE position and reduce the equalizing reservoir pressure slightly below the brake-pipe pressure. The brake may later be released by returning the brake-valve handle to the RELEASE position.

DEAD HEADING (DEAD-IN-TRAIN)

1. Place the Independent Brake Valve handle in the RELEASE position and the Automatic Brake Valve handle in the HANDLE OFF position.

2. Depress the brake-valve pilot cut-out handle and move to the OUT position.

3. Depress the handle of the MU-2A valve and move to the LEAD or DEAD position. On units equipped with the optional double-ported cut-out cock, place the cock in the IN or OPEN position.

4. Open the dead-engine cock.

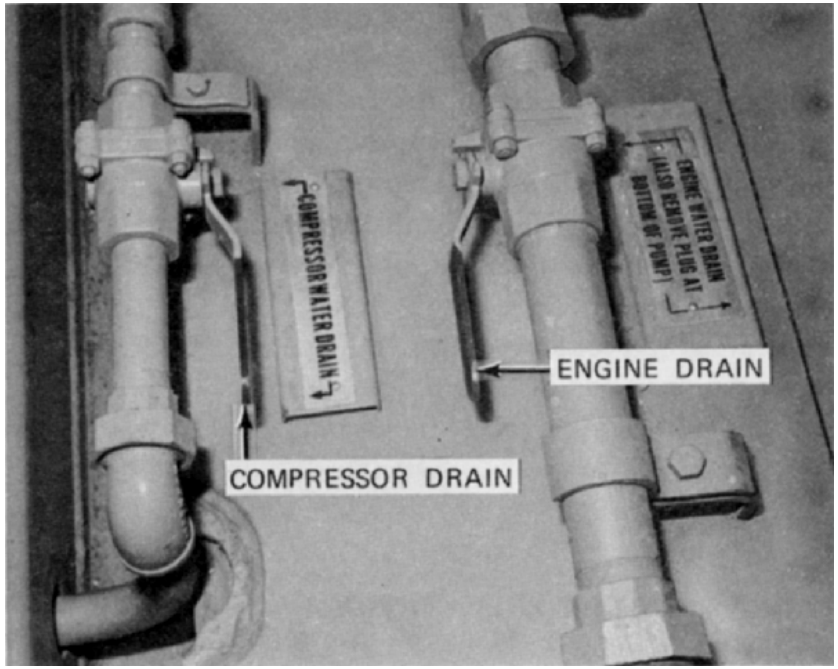


FIG. 16. TRACTION ENGINE WATER DRAIN VALVES.

DRAINING COOLING WATER SYSTEM

For weather above freezing, the cooling water system may be drained by opening the two main water drain valves on the right side of the locomotive near the base of the lube oil cooler (see Fig. 16).

For freezing weather, in addition to opening the two main drain valves, remove the plug at the base of the water pump and be sure that both cab heater valves are open. (One valve is located below the operator's cab floor on most locomotive units. It may be reached from the nose cab.)

INTRODUCTION

The Head-End 480-VAC power system operation is primarily automatic, and functions to control engine set start-up, load cycling of engine sets, trainline energizing and de-energizing. It also provides thermal and overload power plant protection and provision for manual override of startup and shutdown of the entire system remotely controlled from the operator's cab.

The operating procedures which follow are essentially a duplicate of the operating instructions provided in the auxiliary engine cab and the operating cab of the locomotive.

PRELIMINARY SYSTEM PREPARATIONS (See Figs. 17 and 18)

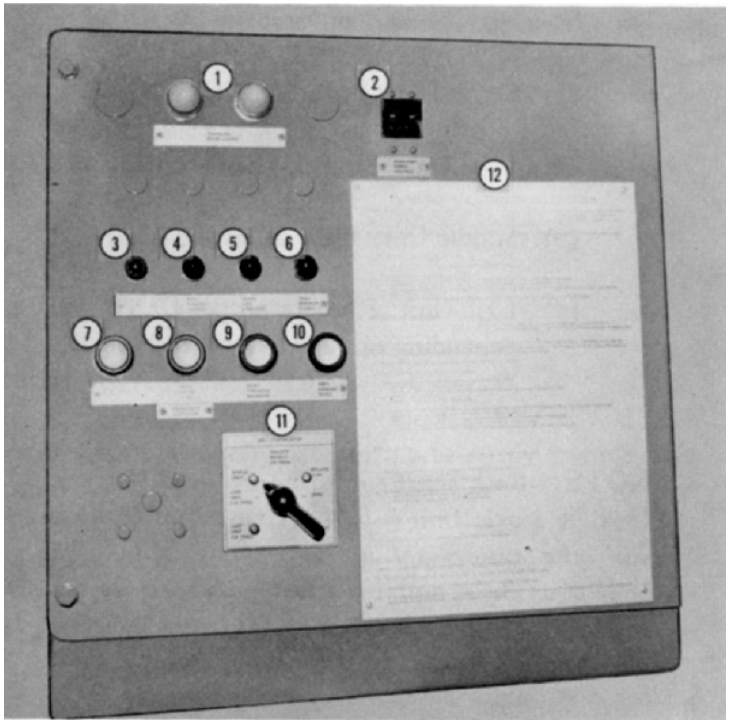
Preliminary preparations for Head-End-Power system operation require:

First - setting up the operating controls on all the Engine Set Control panels which will be used on all locomotives of the consist.

Second - setting up the operating controls on the Auxiliary Engine Control panels on each of the locomotives in consist.

HEAD-END 480-VAC POWER OPERATION (See Fig. 17) Set-Up

1. Set up Auxiliary Engine alternator controls in Auxiliary Engine Cab. See instructions at that location.



REF	DESCRIPTION	REF	DESCRIPTION
1	TRAINLINE PHASE LIGHTS	7	480 V SYSTEM START BUTTON
2	AUXILARY POWER CONTROL SWITCH	8	480 V SYSTEM STOP BUTTON
3	LOCAL NO CRANK LIGHT	9	RESET TRAINLINE BREAKERS
4	480V GROUND TRIPPED LIGHT	10	480 V GROUND RESET
5	TRAINLINE COMPLETE LIGHT	11	480 V SYSTEM SET-UP SWITCH
6	TRAIL BREAKER CLOSED LIGHT	12	480 V SYSTEM OPERATING PROCEDURE

FIG. 17. AUXILIARY ENGINE CONTROL PANEL.

2. Set up Auxiliary Engine Control panel in operator's cab (see Fig. 17).

   a. Auxiliary Power Control switch must be ON in all units, isolated or not, if any unit has the system operating.

b. Set 480 V System Set-Up switch, depending on unit location in consist and status.

(1) Single Unit: Place in SINGLE UNIT.

(2) Lead Unit: Place in LEAD or ISOLATE LEAD.

(3) Middle Unit: Place in MIDDLE.

(4) Last Unit: Place in proper LAST UNIT position, depending on Short Hood or Long Hood Trailing.

NOTE: *Each consist must have a Lead Unit and a Last Unit. A Single unit is both. A Last Unit is the last unit with the system set up to operate. Any other units behind a single unit or a last unit must be set at the ISOLATE, MIDDLE OR TRAIL switch position. Lead units and single units must run Long Hood Trailing.*

3. Connect Control and Power MU Jumpers.

a. Connect Control Jumpers.

(1) Connect a 27-point locomotive and a 16-point Power System Control Jumper, and a 27-point Communication Jumper, between locomotives.

b. Connect Power Jumpers

(1) Connect 4 Power Jumpers between locomotives, between locomotive and car, and between cars. (2) At front of lead locomotive connect a Power Jumper between the two Power Receptacles on the left side. Connect another between the two receptacles on the right side.

(3) At the rear of the last car connect a Power Jumper between the two Power Receptacles on the left side. Connect another between the two receptacles on the right side.

c. Verify Trainline Complete light in operator's cab is on.

System Start

With the system properly set up, momentarily push System Start button.

1. All available engines will start and synchronize.

2. If the Trainline is complete, the Trail breaker will close after a delay (indicated by Train Breaker Closed light.)

3. If the Trainline is not complete, all engines will stay at ready until it is completed. When complete, Trail Breaker will close after a delay.

4. If the Trainline is not complete in 10 minutes, the system will shut down.

System Stop

Momentarily push System Stop button to discontinue system operation for any reason.

Throttle MU Stop position on Master Controller will shut down all Auxiliary System Engines as well as all Locomotive Engines.

Breaker Reset

To reset breakers, momentarily push Trainline Breaker Reset button.

1. All breakers will open, then reclose when the switch is released, except the Trail breaker, which will close after a delay.

2. All available engines will start before the Trail breaker closes.

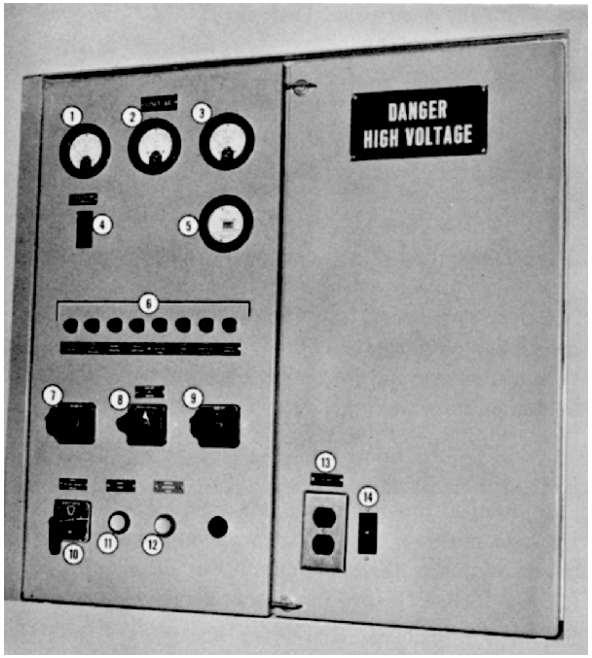
AUXILIARY ENGINE ALTERNATOR SET OPERATION (See Fig. 18)

WARNING: *Before performing any maintenance inside any Auxiliary Engine Set Control compartment, ascertain the Head-End-Power System on a unit and any connected unit is shut down and the set-up switch in each operator's cab set at ISOLATE and tagged. If the system is operating on any locomotives connected to one another, portions of equipment in a compartment may be at dangerous voltages, even if an engine set is isolated. To avoid personal injury, take and observe proper precautions.*

CAUTION: *If any trouble indication is showing, determine nature of problem and correct before resetting for operation.*

Automatic Operation

1. Auxiliary Power Control switch must be ON for the set to run (located on Auxiliary Engine Control panel in operator's cab).



REF	DESCRIPTION	REF	DESCRIPTION
1	AC VOLTAGE	8	ENGINE CONTROL SWITCH (AUX. ENG)
2	HERTZ METER	9	AMMETER SELECTOR SWITCH
3	AC AMMETER	10	600 AMP BREAKER CONTROL
4	HEAD END POWER DC BREAKER	11	MANUAL CRANK BUTTON
5	ENGINE HOUR METER	12	SYSTEM EMERGENCY STOP BUTTON
6	INDICATING LIGHTS	13	74 VDC RECEPTACLE
7	VOLTMETER SELECTOR SWITCH	14	WATER HEATER BREAKER

FIG. 18. **ENGINE SET CONTROL PANEL.**

2. Place Engine Control Switch in AUTO (see Fig. 18).

   a. Engine will start and run when System Start switch in operator's cab is pushed.

   b. Both engine sets on the last unit with system operating should be on AUTO:

c. Enough additional sets through the consist to handle the anticipated load plus at least one spare should be on AUTO.

d. All engine sets may be on AUTO if desired. Excess sets will be shut down automatically.

Manual Operation

Before proceeding, be certain all equipment and electrical lines are clear of personnel and ready to operate. Manual operation is for maintenance and emergency purposes only. Assure the system is isolated from any other voltage source.

In order to provide power to a train load, the Trail Breaker to the load must be closed. This may be done by positioning the Set-up switch in the operator's cab of all units in the ISOLATE (LEAD ISOLATE for Lead and Single Units) position. This should be done before attempting to close the set breaker.

1. Auxiliary Power Control switch must be ON for the set to run (located on Auxiliary Engine Control Panel on operator's cab).

2. Place Engine Control switch in MANUAL.

3. Push and hold Manual Crank switch until engine starts.

   a. Engine Running light will come on.

   b. Local Generator Voltage light will come on. This light is not push-to-test.

   c. Verify 60 Hz frequency.

   d. Verify 480 v line-to-line voltages.

4. To close Engine Set breaker, move Manual Breaker Operate switch momentarily to CLOSE position.

   a. Breaker will not close if Power Trainline is not complete.

   b. Breaker will not close if there is already voltage on the Power Trainline.

   c. Only one engine set at a time may be placed on-line manually.

   d. Connected load (if any) should not be greater than 300 kw or 375 kva initially.

Shutdown

1. Normal Shutdown - Move Engine Control Switch to OFF position.

   a. Shuts down one engine set.

2. Emergency Shutdown - Push set Emergency Stop switch.

   a. Reset Engine Control switch.

   b. Reset Air Cut-Off solenoid at engine.

3. System Emergency Shutdown - Push System Emergency Stop switch.

   a. Shuts down entire system, all locomotives.

   b. May be used for Normal System Shutdown.

Isolate Engine Set

1. Move Engine Control switch to OFF position.

2. Move Auxiliary Power Control switch to OFF position.

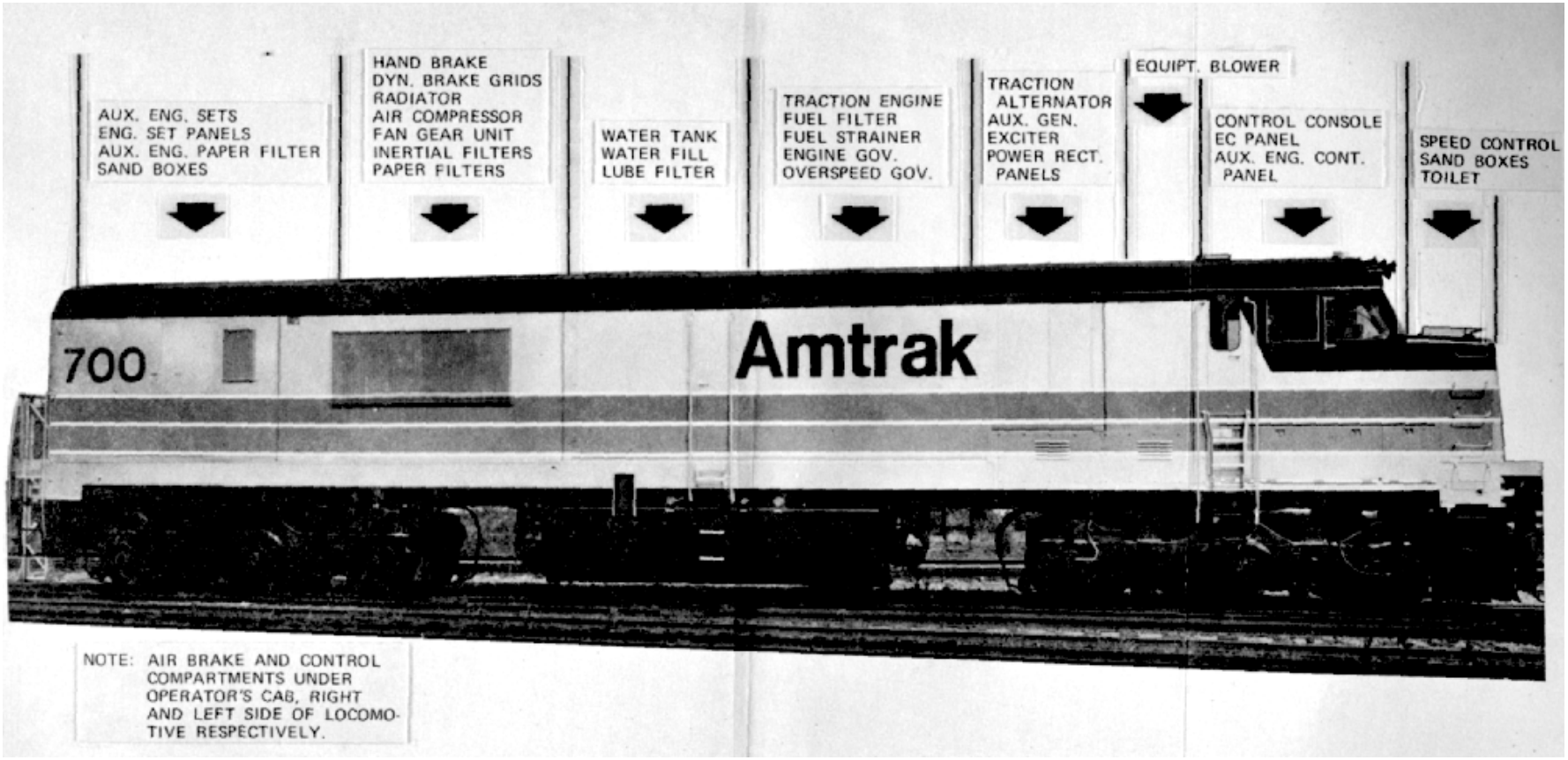
Resets

Before resetting, determine nature of problem and correct.

1. Move Engine Control switch to OFF, then move to desired position.

2. Manually reset Air Cut-Off solenoid on top of engine if tripped.

3. If set does not provide voltage, but otherwise seems normal, check Under-Frequency Protection module inside set control compartment. Reset at module.


AUX. ENG. SETS
ENG. SET PANELS
AUX. ENG. PAPER FILTER
SAND BOXES
HAND BRAKE
DYN. BRAKE GRIDS
RADIATOR
AIR COMPRESSOR
FAN GEAR UNIT
INERTIAL FILTERS
PAPER FILTERS
WATER TANK
WATER FILL
LUBE FILTER
TRACTION ENGINE
FUEL FILTER
FUEL STRAINER
ENGINE GOV.
OVERSPEED GOV.
TRACTION
ALTERNATOR
AUX. GEN.
EXCITER
POWER RECT.
PANELS
EQUIPT. BLOWER
CONTROL CONSOLE
EC PANEL
AUX. ENG. CONT.
PANEL
SPEED CONTROL
SAND BOXES
TOILET
700
Amtrak
NOTE: AIR BRAKE AND CONTROL COMPARTMENTS UNDER OPERATOR'S CAB, RIGHT AND LEFT SIDE OF LOCOMOTIVE RESPECTIVELY.