DEPARTMENT OF THE ARMY TECHNICAL MANUAL **TM 55-2210-204-10**

DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER **TO 45A2-2-19-1**

OPERATOR'S MANUAL

LOCOMOTIVE, DIESEL ELECTRIC
56½ INCH GAGE, 44 TON, 0-4-4-0 WHEEL,
380 HP, CATERPILLAR ENGINE MODEL D17000
GENERAL ELECTRIC COMPANY
FSN 2210-112-8504

LOCOMOTIVE, DIESEL ELECTRIC
56½ INCH GAGE, 45 TON, 0-4-4-0 WHEEL,
380 HP, CATERPILLAR ENGINE MODEL D17000
GENERAL ELECTRIC COMPANY
FSN 2210-529-9038

DEPARTMENTS OF THE ARMY AND THE AIR FORCE

APRIL 1963

AGO 8777A

SAFETY PRECAUTIONS

When operating the locomotive, be guided by the fundamental rules of safety. Safety rules pertinent to diesel-electric locomotives are contained in DA Pam 55-1. Take all necessary precautions to insure the safety of others as well as yourself. Avoid careless operating habits which cause accidents to personnel and equipment.

Do not work on electrical equipment without first isolating the equipment from the power source by stopping the engine. Open the control and battery switches and remove fuses where applicable.

Do not perform work while wearing rings or wrist watches.

Do not use metallic-cased flashlights around electrical equipment.

When traction motor or under-locomotive equipment must be inspected while the engine running, remove excitation from the main generator and set air brakes. Move reverser to "off" position and remove from the controller. This will prevent accidental movement of the locomotive.

When working on diesel engine, pull the starting fuse and block open the engine starting contactors.

Never use volatile cleaning solvents in enclosed, spaces, and never use them anywhere without adequate fire extinguisher apparatus

Should a fire develop on the locomotive and carbon dioxide is used to extinguish the flame, do not breathe the fumes. These fumes are toxic.

Never fill the fuel tank near an open flame.

TECHNICAL MANUAL
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WASHINGTON 25, D. C., *15 April 1968*

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CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope

a. These instructions are published for the use of the personnel who operate the locomotive. They provide information on the operation, lubrication and preventive maintenance services of the equipment, accessories, components and attachments as prescribed by the maintenance allocation chart.

b. Appendix I is a standard list of publications applicable to this manual and available to the operator.

c. Appendix II is the basic issue items list authorized for use by the operator of this equipment. It is composed of accessories, attachments, component assemblies and the quantities thereof, which constitute the major end item of equipment and the first echelon maintenance accessories, tools, supplies, spare assemblies, and repair parts accompanying the equipment. These items are commonly known as "on board spares."

d. The maintenance allocation chart will be found in the manual containing the organizational maintenance instructions. It assigns maintenance functions and repair operations to be performed by the lowest appropriate echelon.

e. Recommendations for changes, additions, deletions, or other corrections will be forwarded through appropriate channels on DA Form 2028 to the Commanding General, U. S. Army Transportation Materiel Command, ATTN: SMOSM-MESR, P. O. Box 209, Main Office, St. Louis 66, Mo.

2. Forms, Records and Reports

a. Daily Inspection Worksheet. DD Form 862 (Daily Inspection Worksheet for Diesel Electric Locomotives) ; the operator will record any deficiencies encountered during operation, in the "A" Operator's Report portion of the form.

b. Equipment Improvement Recommendation, DA Form 2407 (Maintenance Request). Any suggestions pertinent to the improvement, safety or unsatisfactory performance of equipment, materiels or publications are to be reported to the supporting unit so that necessary action can be initiated.

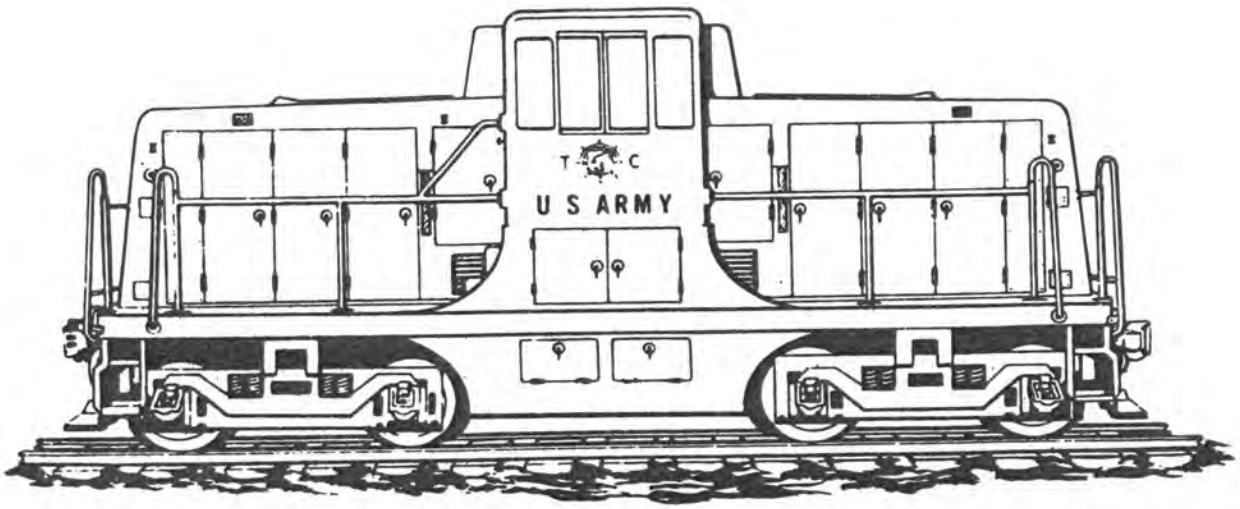
c. Field Report of Accidents. Injury to personnel or damage to equipment must be reported to the supporting unit so that reports as required by Army regulations can be prepared.

Section II. DESCRIPTION AND DATA

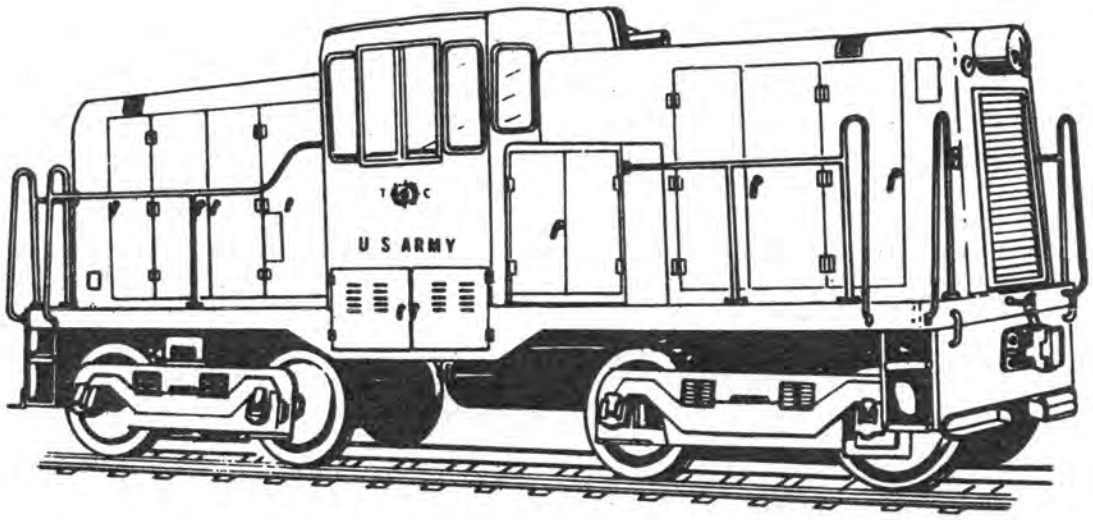
3. Description

a. General. These locomotives are powered by two diesel engines, which are rated at 190 horsepower at 1000 rpm. All wheels are driven by individual traction motors geared to each axle. They are classified in two tonnages, 44 and 45 ton. Two sand boxes are located on the front and rear of the locomotive. Manually controlled shutters are provided to aid in water temperature control. The locomotives are equipped with either a single station, single unit control or a single station multiple unit control. Grouped at this station are all the controls, gages and instruments necessary to operate the locomotive. The locomotives are suitable for yard switching or light road service.

b. Diesel Engine. Each engine drives a direct-current, self excited, main generator, ra-



44 TON



45 TON

Figure 1. View of locomotive.

diator fan, auxiliary generator, traction motor blower and air compressor. The engine crankshaft is directly connected to the main generator through a flexible disc-type coupling. Starting power for the engine is supplied to the generator starting field by a 32 cell lead-acid type battery.

c. Main Generators. The main generators furnish electrical current for the operation of the traction motors. Each generator is equipped with windings which permit cranking of the diesel engine by storage battery power.

d. Traction Motors. There are four direct current, series wound, self-ventilated traction motors, two of which are connected electrically in parallel to the main generators. The traction motors actuate the four axles individually through double reduction spur gearing with a ratio of 11.25 to 1. The gearing is totally inclosed in a sealed gear housing, which holds the gear lubricant.

e. Auxiliary—Exciter Generator. The auxiliary—exciter generator is essentially two separate electrical machines, mechanically built into the same frame assembly with two armatures mounted on the same shaft. The auxiliary generator charges the battery and supplies power for the control and light circuits. The exciter is designed and adjusted to furnish excitation for the main generator. This unit is belt driven through a pulley mounted on the main generator.

f. Traction Motor Blowers. A belt-driven blower is provided for each pair of traction motors. The blowers are mounted on the locomotive floor and supply cooling air through ducts to the traction motors.

g. Air Compressors. There is a belt-driven, air-cooled, two-stage air compressor mounted at the rear of each engine. The compressors supply air pressure for operating the air brakes, sanders, horn, bell ringer and windshield wipers. A pneumatically operated governor controls the reservoir pressure between 105 and 115 pounds.

h. Air Brakes. The air-brake equipment is combined independent and automatic schedule 14–EL, with one brake valve type K–14. Two brake cylinders are mounted on each truck and operate fully-equalized brake rigging which applies one brake shoe to each wheel.

4. Identification

The builder's identification plates (figs. 2 and 3) are normally located on both sides of the locomotive cab. In some instances the identification plates on the 44 ton locomotives are located on the left front corner and right rear corner of the running board.

5. Difference in Models

a. Locomotives bearing U.S.A. road numbers 1214, 7064, 7069, 7095, 7253, 7310 thru 7312, 7410, 7411, 7439, 7491 thru 7494, 7508, 7513, 7516 and 7930 thru 7932 are equipped with single station, single unit control.

b. Locomotives bearing U.S.A. road numbers 1236 thru 1246, 7087, 7924 thru 7929, 8499, 8500, 8502 thru 8507, 8509 thru 8523, 8525 thru 8528, 8560 thru 8578 and 8580 thru 8583 are equipped with single station, multiple unit control.

6. Component Data

a. Diesel Engine.

Manufacturer	Caterpillar Tractor Company.
Model	D17000
Number of cylinders	8
Bore	5¾ inches
Stroke	8 inches
Displacement	1,662 cubic inches
Maximum governed speed	1,000 r.p.m.
Horsepower rating	190 hp
Type fuel	Diesel oil
Fuel system	Solid injection
Cooling system	Circulating water
Weight	8,000 pounds

b. Main Generator.

Manufacturer	General Electric Company.
Type	GT–555
Voltage	250 volts
Amperage	450
Speed	1,000 r.p.m.
Weight	3,575 pounds

c. Auxiliary and Exciter Generator.

Manufacturer	General Electric Company.
Type	G.M.G.–140
Auxiliary Generator Capacity.	
Volts	76 @ 1,000 r.p.m.

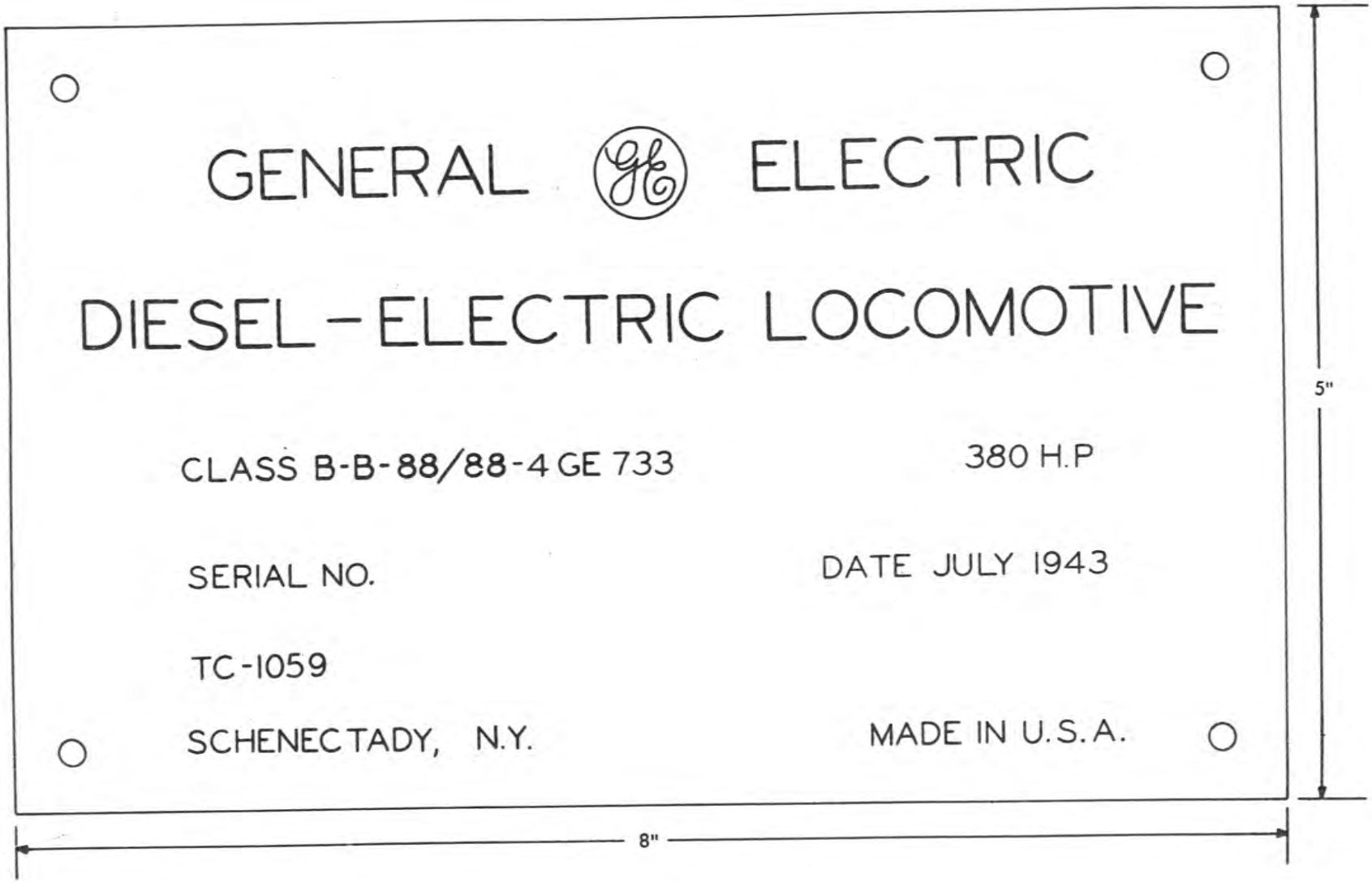


Figure 2. 44-ton builder's identification plate.

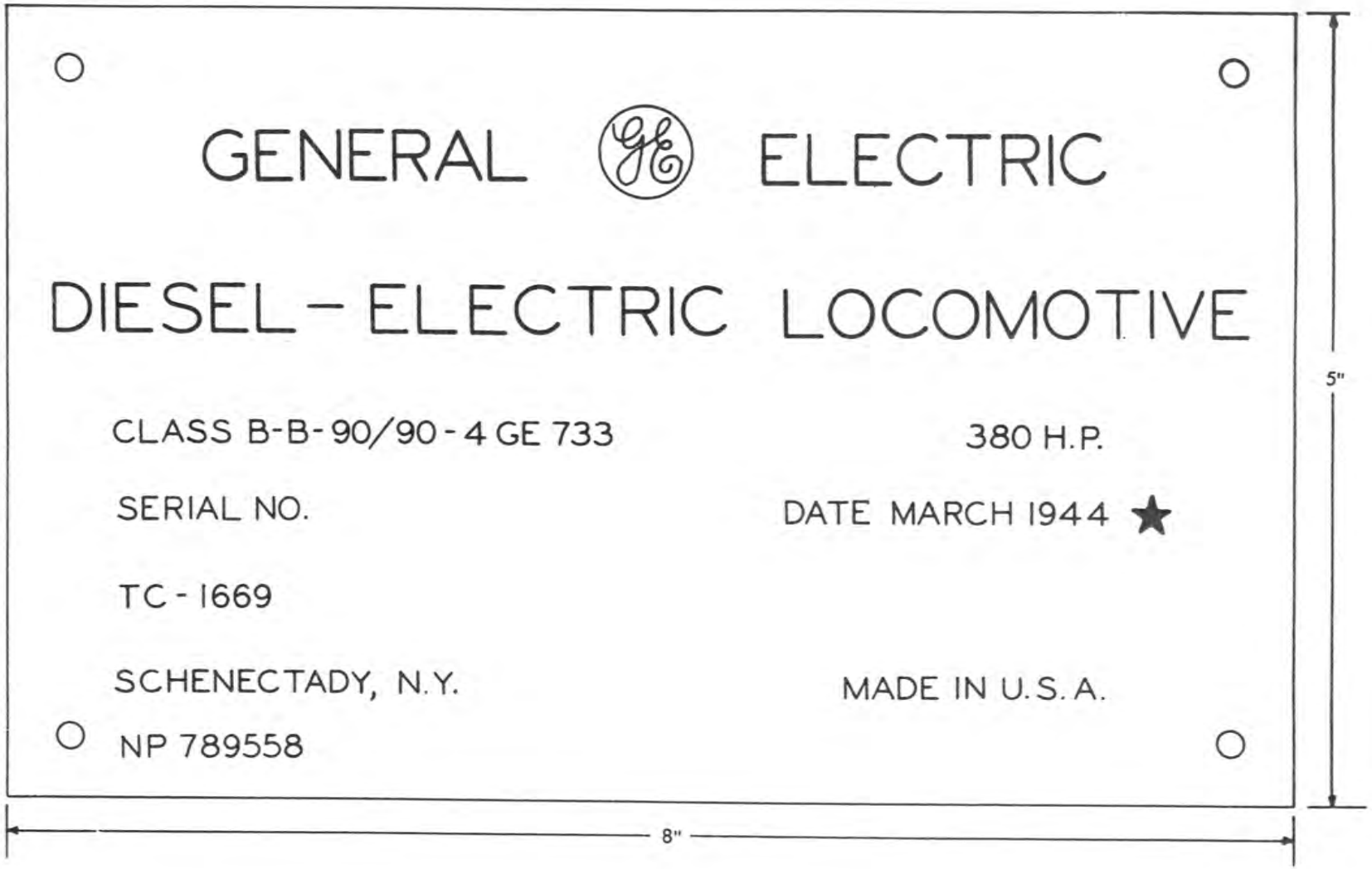


Figure 3. 45-ton builder's identification plate.

Amperes	23 @ 1,000 r.p.m.
Exciter Capacity	
Volts	130 to 265 @ 1,000 r.p.m.
Amperes	840 to 240 @ 1,000 r.p.m.
Weight of set	675 pounds

d. Traction Motors.

Manufacturer	General Electric Company.
Type	GE–733
Volts	250
Amperes	375
Rating	82.5 hp
Weight	2,500 pounds

e. Brake Equipment.

Manufacturer	Westinghouse Air Brake Company.
Schedule	14—EL

f. Trucks.

Manufacturer	General Electric Company.
Gage	56½ inches
Wheel arrangement	0–4–4–0
Journal size	5 x 9 inches
Journal bearing	Friction type
Wheel diameter (44 ton)	33 inches
Wheel diameter (45 ton)	38 inches
Weight (approximate)	26,000 pounds

g. Air Compressors.

Manufacturer	Westinghouse Air Brake Company.
Model	4YC
Cylinders	2
Bore, high pressure	3½ inches
Bore, low pressure	6½ inches
Displacement	57 c.f.m. at 700 r.p.m.
Weight	450 pounds

h. Air Compressors.

Manufacturer	Gardner Denver Company.
Model	ADS 9008
Cylinders	2
Bore, 1st stage	5½ inches
Bore, 2d stage	3 inches
Stroke	4 inches
Displacement	50 c.f.m at 700 r.p.m.
Weight (approximate)	500 pounds

7. Tabulated Data

a. 44-ton Locomotive.

(1) *General.*

Manufacturer	General Electric Company.
Classification	B–B–88/88–4GE733.
Weight of locomotive (light).	86,000 pounds
Weight of locomotive (fully loaded).	89,000 pounds
Tractive effort at 30% adhesion.	26,400 pounds
Continuous tractive effort.	13,000 pounds at 7.1 m.p.h.
Minimum curve radius (light locomotive).	50 feet
Minimum curve radius (coupled to train).	125 feet
Coopers rating	E–23
Maximum permissible operating speed.	35 m.p.h.
Maximum permissible speed (shipped over commercial railroads).	35 m.p.h.

(2) *Clearance Dimensions.*

Length over couplers	33 feet 5 inches
Width overall	10 feet 1 inch
Height overall	13 feet 3 inches
Height center of coupler (above rail).	34½ inches
Length between truck centers.	18 feet 9 inches
Truck wheelbase	6 feet 10 inches

(3) *Supplies.*

Fuel oil	250 gallons
Lubricating oil	50 gallons per engine
Cooling water	40 gallons per engine
Sand	8 cubic feet

b. 45-ton Locomotive.

(1) *General.*

Manufacturer	General Electric Company.
Classification	B–B–90/90–4GE733.
Weight of locomotive (light).	88,500 pounds
Weight of locomotive (fully loaded).	91,000 pounds
Tractive effort at 30% adhesion.	27,000 pounds
Continuous tractive effort.	13,500 pounds at 7.1 m.p.h.
Minimum curve radius (light locomotive).	75 feet
Minimum curve radius (coupled to train).	130 feet
Coopers rating	E–23
Maximum permissible operating speed.	35 m.p.h.
Maximum permissible speed (shipped over commercial railroad).	35 m.p.h.

(2) *Clearance Dimensions.*

Length over couplers	33 feet, 5½ inches
Width overall	9 feet, 7 inches
Height overall	12 feet, ½ inch
Height center of coupler (above rail).	34½ inches
Length between truck centers.	18 feet, 6 inches
Truck wheelbase	6 feet, 10 inches

(3) *Supplies.*

Fuel oil	250 gallons
Lubricating oil	50 gallons per engine
Cooling water	40 gallons per engine
Sand	8 cubic feet

CHAPTER 2
OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATERIEL

8. General

It is the responsibility of the organizational maintenance personnel to determine whether the equipment has been properly prepared for service by the supplying unit, and to be sure it is in condition to perform its function. However, it is the duty of the operator to assist the organizational maintenance personnel to detect any malfunction that may arise during the break-in-period.

9. Break-In Service

After the preliminary service has been performed by the organizational maintenance personnel the break-in service will be accomplished in normal operation. The preliminary inspection to be performed is designated in paragraph 49. The operator will record any deficiencies encountered during operation on the daily inspection worksheet (par. 2).

Section II. CONTROLS AND INSTRUMENTS

10. General

a. This section describes, locates, illustrates and furnishes information pertaining to the various controls and instruments provided for the proper operation of the locomotives.

Note. Because of minor variations in the location of the various controls and instruments made during manufacture, it would be impractical to illustrate all models. Representative arrangements are used to illustrate the location of such devices. Locomotives having other arrangements, are similar to those depicted within this section.

b. Controls and instruments necessary for routine operation of the locomotive are located in the cab in front of the operator. These include the throttle, controlling power and speed; the reverse lever, controlling the direction of travel; the brake valves; indicating instruments; and many manually operated lighting and control switches. The throttle, reverse lever and brake valves control all locomotive movement.

11. Throttle Lever
(4, figs. 4 and 5)

a. The throttle lever controls the engine speeds and subsequently the generator output and power to the traction motors. When the throttle is in idle position, no power will flow to the traction motors. A slight advancement of the lever does not affect the engine speeds but makes up the necessary electrical connections to cause power to flow to the traction motors and move the locomotive. Each successive movement will increase the engine speeds.

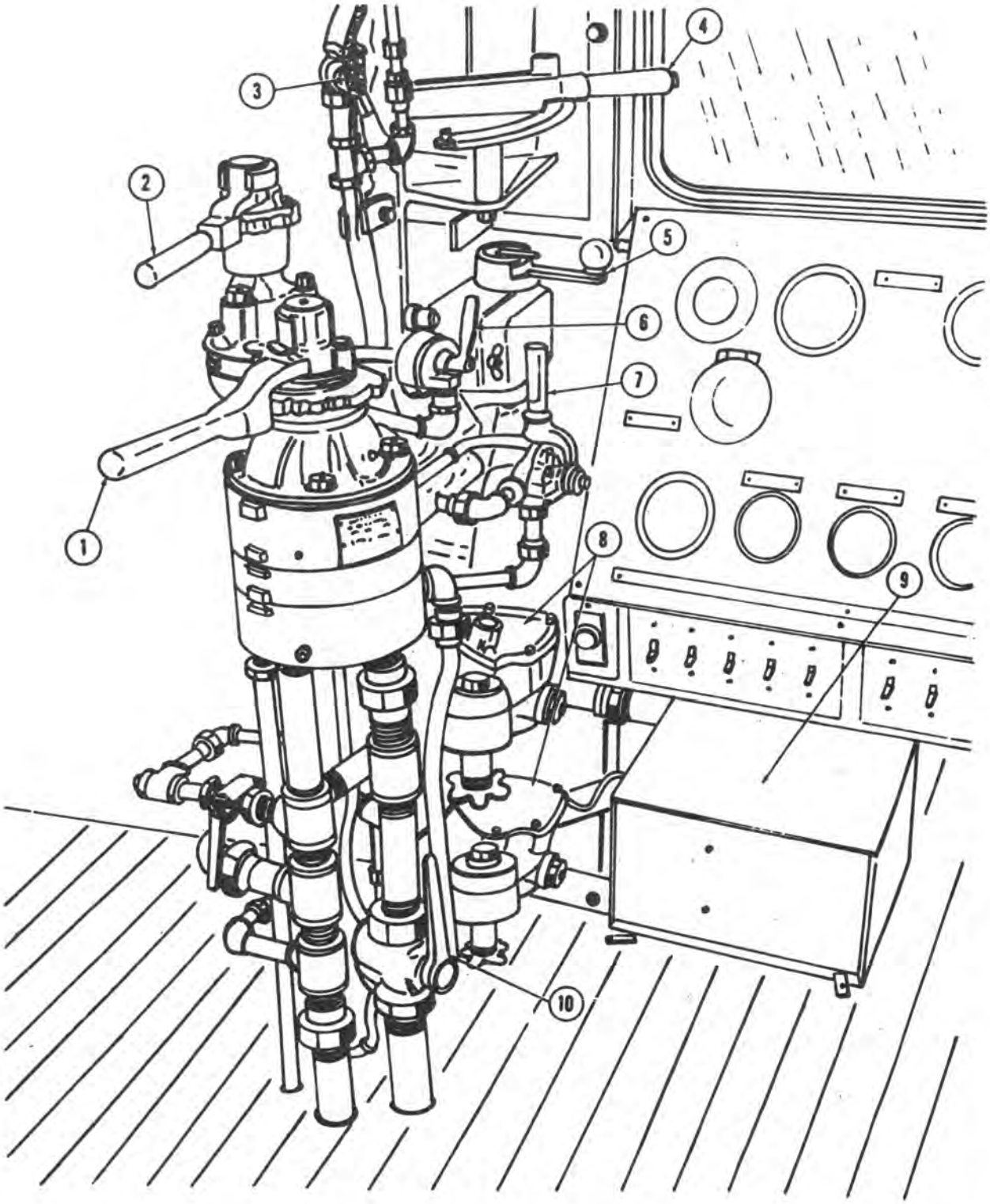
b. The throttle can be advanced through its entire operating range in one movement. Under normal conditions it should be opened gradually until the desired engine speed is obtained.

c. USA road numbers 1236 thru 1246 are equipped with a deadman lever attached to the throttle (fig. 6). This deadman lever must be depressed at all times when operating the locomotive.

12. Reverse Lever
(5, figs. 4 and 5)

a. The reverse lever controls the direction of the locomotive, by reversing the current to the traction motors. It has four positions: "forward," "off," "neutral," and "reverse."

b. The reverse lever must not be moved except when the locomotive is standing still. It is



1 Automatic brake valve handle
2 Independent brake valve handle
3 Horn pull cord
4 Throttle lever
5 Reverse lever
6 Bell ringer valve
7 Sander valve
8 Feed valves
9 Cab heater
10 Double heading cock

Figure 4. 44-ton operating controls.

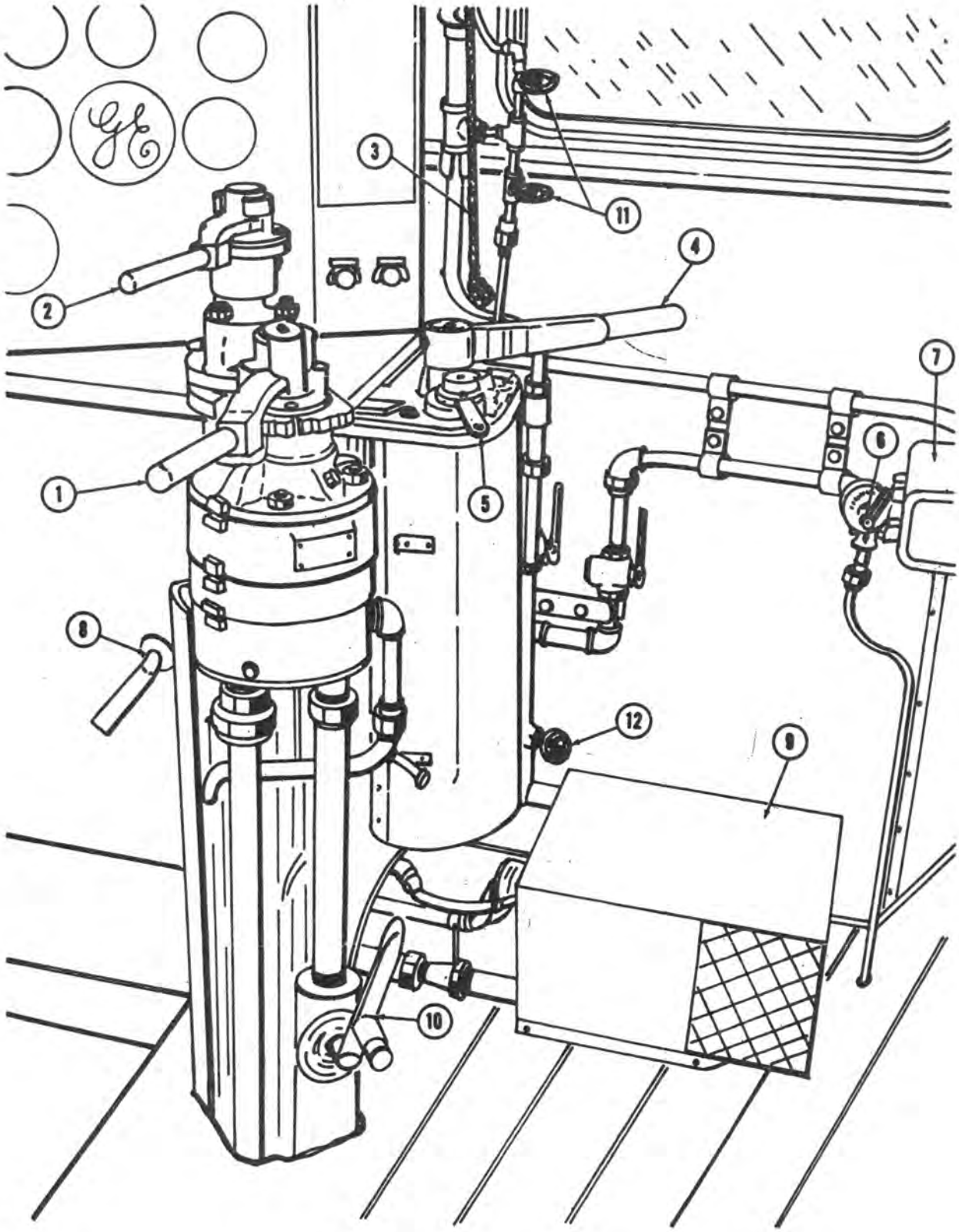


Figure 5. 45-ton operating controls.

1 Automatic brake valve handle
2 Independent brake valve handle
3 Horn pull cord
4 Throttle lever
5 Reverse lever
6 Bell ringer valve
7 Sander valve
8 Feed valve cabinet
9 Cab heater
10 Double heading cock
11 Windshield wiper valves
12 Cab heater valve

Figure 5—Continued.

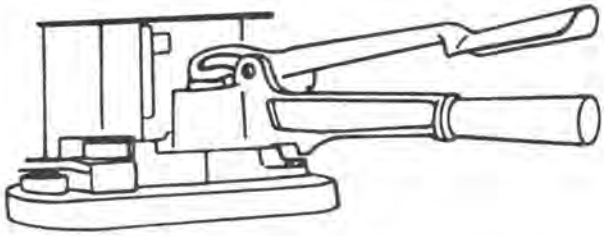


Figure 6. Throttle with deadman lever.

mechanically interlocked with the throttle lever so that it cannot be moved, except when the throttle is in the, "idle" position.

c. Placing the reverse lever in the "neutral" position will allow the engine to run at idle speed, or permit the throttle lever to be advanced, increasing the speed of the engine without moving the locomotive. Placing the lever in "forward" or "reverse" will result in a corresponding movement of the locomotive when the throttle is advanced. The "off" position locks the operating controls and enables the operator to remove the handle in order to prevent the accidental movement of the locomotive.

13. Automatic and Independent Brake Valves

a. Automatic Brake Valve. The automatic brake valve controls the operation of the locomotive and train brakes. By proper movement of the automatic brake handle (1, figs. 4 and 5), the operator is able to charge the entire brakes system on the locomotive and train, or hold the locomotive brakes applied while releasing the train brakes and recharging the entire air system. The six position (fig. 7) beginning at the extreme left are: "release," "running," "holding," "lap," "service," and "emergency."

(1) *Release.* The release position provides a large and direct passage from the main reservoir to the brake pipe. This permits a rapid flow of air into the brake pipe to charge the train brake system and quickly release the train brakes. This position will not release the locomotive brakes, if applied.

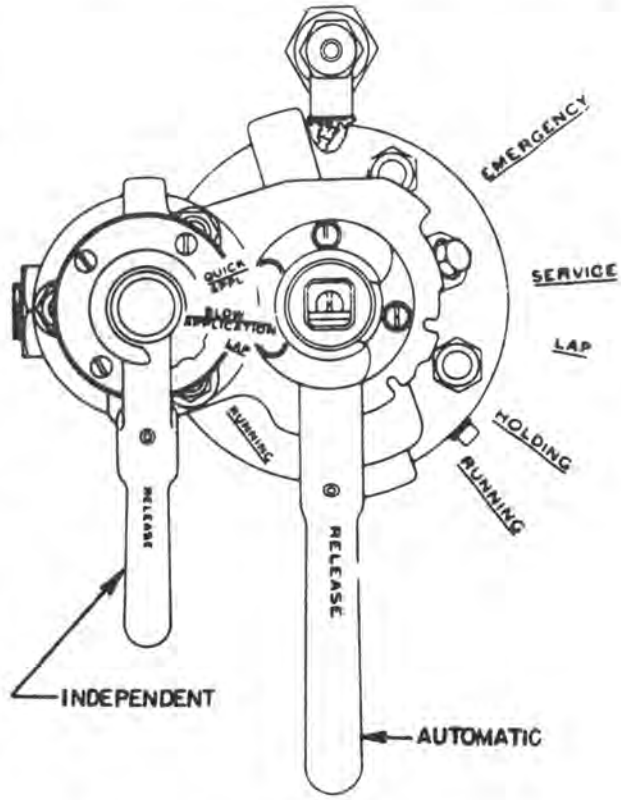


Figure 7. Automatic and independent brake valve positions.

***Caution:* Do not leave the automatic brake handle in "release" position as it will cause the train line to become overcharged with main reservoir pressure.**

(2) *Running.* The running position releases the train brakes, keeps them released, and charges the train brake system.

(3) *Holding.* The holding position keeps the locomotive brake applied, but re-

leases the train brakes, while the train brake system is being charged.

(4) *Lap.* The lap position keeps the brakes applied after a service application, until a further brake pipe reduction is made, or the brakes are released. The train brake system is not being charged in this position.

(5) *Service.* The service position gives a gradual reduction of brake pipe pressure to cause a service application of the train brakes.

(6) *Emergency.* The emergency position gives a prompt and full application of the brakes and gives the maximum braking force in the shortest possible time.

Caution: **This position is to be used only in case of extreme emergency.**

b. Independent Brake Valve. The independent brake valve controls the operation of the locomotive brakes only. By proper movement of the independent brake valve handle (2, figs. 4 and 5), the locomotive brakes can be operated independently of the train brakes at any and all times. The five positions (fig. 7) beginning at the extreme left are—

(1) *Release.* The release position is used to release the locomotive brakes when the automatic brake valve is not in running position. The handle must be held in the position to release brakes. The valve is equipped with a return spring which automatically moves the handle from release to running position.

(2) *Running.* The running position releases the locomotive brakes at a normal rate after an independent application. This is the normal position the handle should be in when the brakes are not in use.

(3) *Lap.* The lap position holds the locomotive brakes applied after the desired brake cylinder pressure is obtained.

(4) *Slow application.* The slow application position applies the locomotive brakes at a gradual rate. The resulting brake cylinder pressure depends on the length of time the handle is kept in this position.

(5) *Quick application.* The quick application position will apply to locomotive brakes very quickly. The handle must be held in this position to obtain quick application. The return spring will automatically return the valve to slow application position when pressure is released from the handle.

14. Sander Valve

(7, figs. 4 and 5)

The sanding valve controls the flow of air to the forward or reverse sand traps. Locomotives may be equipped with either of the following three types of sander valves:

a. Foot Operated Type. A foot operated switch is located on the floor of the cab within easy reach of the operator. It electrically controls the flow of air to the forward or reverse sand traps. The switch operates either the forward or reverse magnet valve depending on the position of the reverser.

b. Lever Type. A lever type sander valve (7, fig. 4) is located near the automatic brake valve handle. This valve is designed for single-unit operation and has three positions, forward, neutral and reverse. It is operated by moving the lever forward or backward depending on the direction of travel.

c. Push Button Type. A push button type electrical switch (7, fig. 5) is located on the wall of the cab on the right side below the window frame. This switch has two positions; forward and reverse, and is operated by depressing the button depending on the direction of travel. Releasing the button automatically shuts the sanders off.

15. Bell Ringer Valve

(6, figs. 4 and 5)

The bell ringer valve has two positions "off" and "on." Movement of the handle to the "on" position rings the signal warning bell.

16. Double Heading Cock

a. Single Unit Locomotives. The double heading cock (10, fig. 4) is located directly below the automatic brake valve near the floor

of the cab. The valve has two positions; open and closed. The cock must be set in "open" position for normal operation and in "closed" position when double heading or towing the locomotive.

b. Multiple Unit Locomotives. The double heading cock (10, fig. 5) is located directly below the automatic brake valve near the floor of the cab. It has three positions: lead (horizontal position), trailing (vertical or intermediate position), and dead (extreme clockwise position). The setting must correspond to the position of the locomotive. "Dead" is used when towing. It is necessary to pull out on the spring-loaded stop pin until the handle can be moved over the stop plug when moving to "dead" position.

17. Windshield Wiper Valves

The windshield wiper valves are located in the air lines leading to the wiper motors. The valves are of the gradual opening type. The speed of the wipers is controlled by the amount of air admitted to the motors.

18. Horn Pull Cord
(8, figs. 4 and 5)

The horn pull cord is located above the control stand within easy reach of the operator. It is connected to an air valve which operates the horn. The cutout cock located in the air line must be open for normal operation.

19. Feed Valves

a. Two feed valves are located below the brake stand (8, fig. 4), in a cabinet next to the brake stand (8, fig. 5) or in a compartment under a trap door in the center of the cab floor. They regulate the brake pipe pressure and brake cylinder pressure.

b. The valve that regulates the brake pipe pressure must be adjusted for the type of service the locomotive is used (70 pounds for freight service), 90 pounds for passenger service).

c. The valve (reducing valve) that regulates the brake cylinder pressure must be adjusted for 45 pounds.

d. Turning the adjusting handle clockwise increases the pressure and counterclockwise reduces the pressure.

20. Cab Heater Rheostats

a. The cab heater rheostat controls the speed of the cab heater fan motor. They are located on the right side of the front electrical equipment cabinet near the horn pull cord.

b. Turning the rheostat clockwise increases the speed of the fan, whereas turning the rheostat counterclockwise decreases the speed of the fan.

21. Shutter Control Levers

a. The shutter control levers (2, 3, and 5, figs. 8 and 9) are located above the front and rear electrical cabinets. They manually control the admission of outside air to the engine compartment, according to the position of the levers.

b. The longer lever (5) operates the radiator shutters on the front and rear of the locomotive. The shorter levers (2) and (3) operate the shutters above the engine compartment.

c. If the engine temperature registers above 170°, fully open the shutters to insure proper cooling. During cold weather it may be necessary to close the shutters partially or entirely to maintain the proper temperature.

22. Engine Start and Stop Buttons

a. The engine start buttons (1 and 11, fig. 10) and (17 and 18, fig. 12) are clearly marked for identification. Depressing the buttons closes the electrical circuits necessary to start the diesel engines.

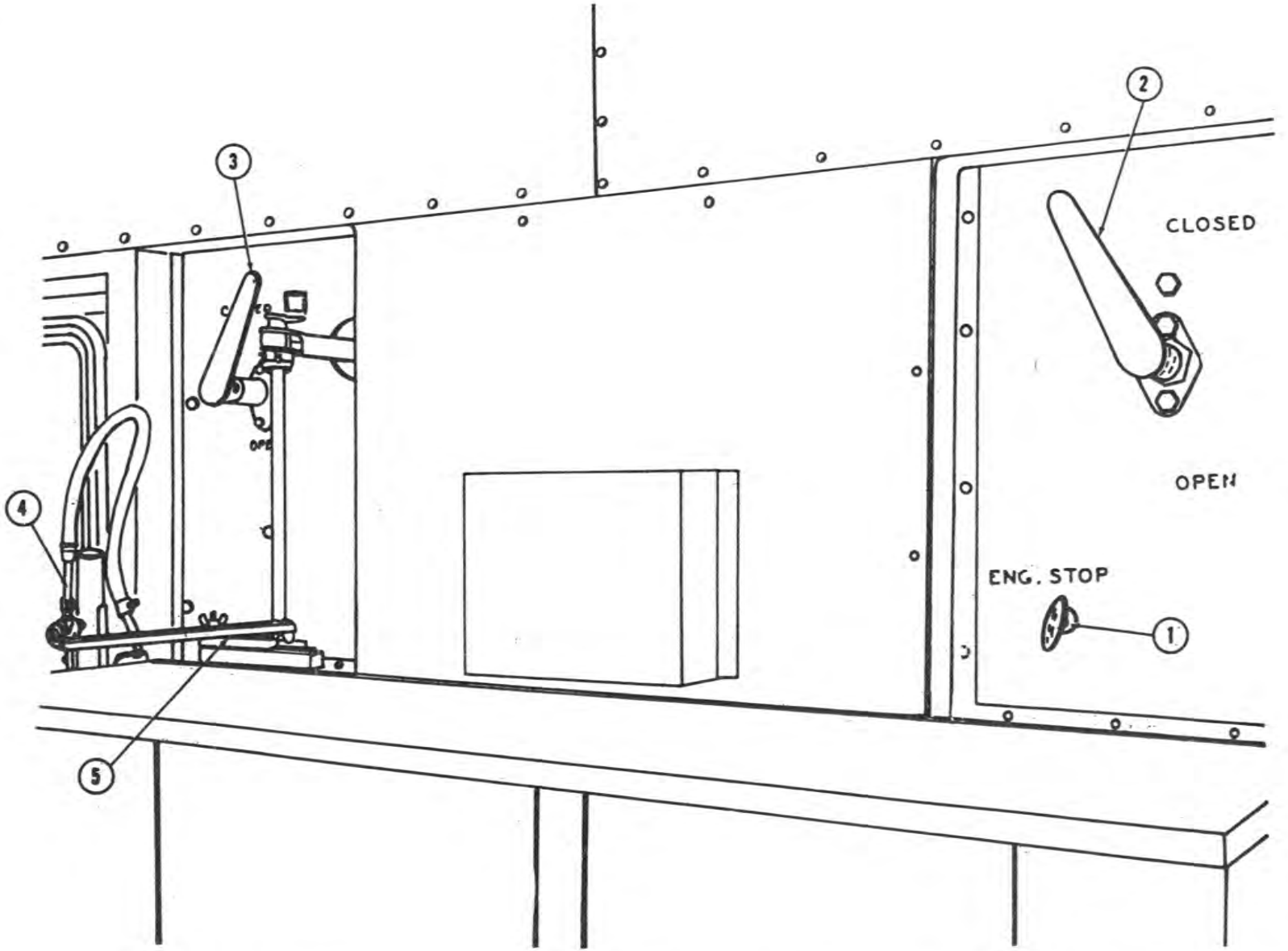
b. The locomotives are equipped with either a multiple stop button (19, fig. 12) or stop levers (1, fig. 8) and are operated as follows:

(1) Depressing the multiple stop button stops both diesel engines. The button must be held firmly in place until the engines stop.

(2) Pulling the stop lever above the front electrical cabinet stops No. 1 engine. Pulling the stop lever above the rear electrical cabinet stops No. 2 engine.

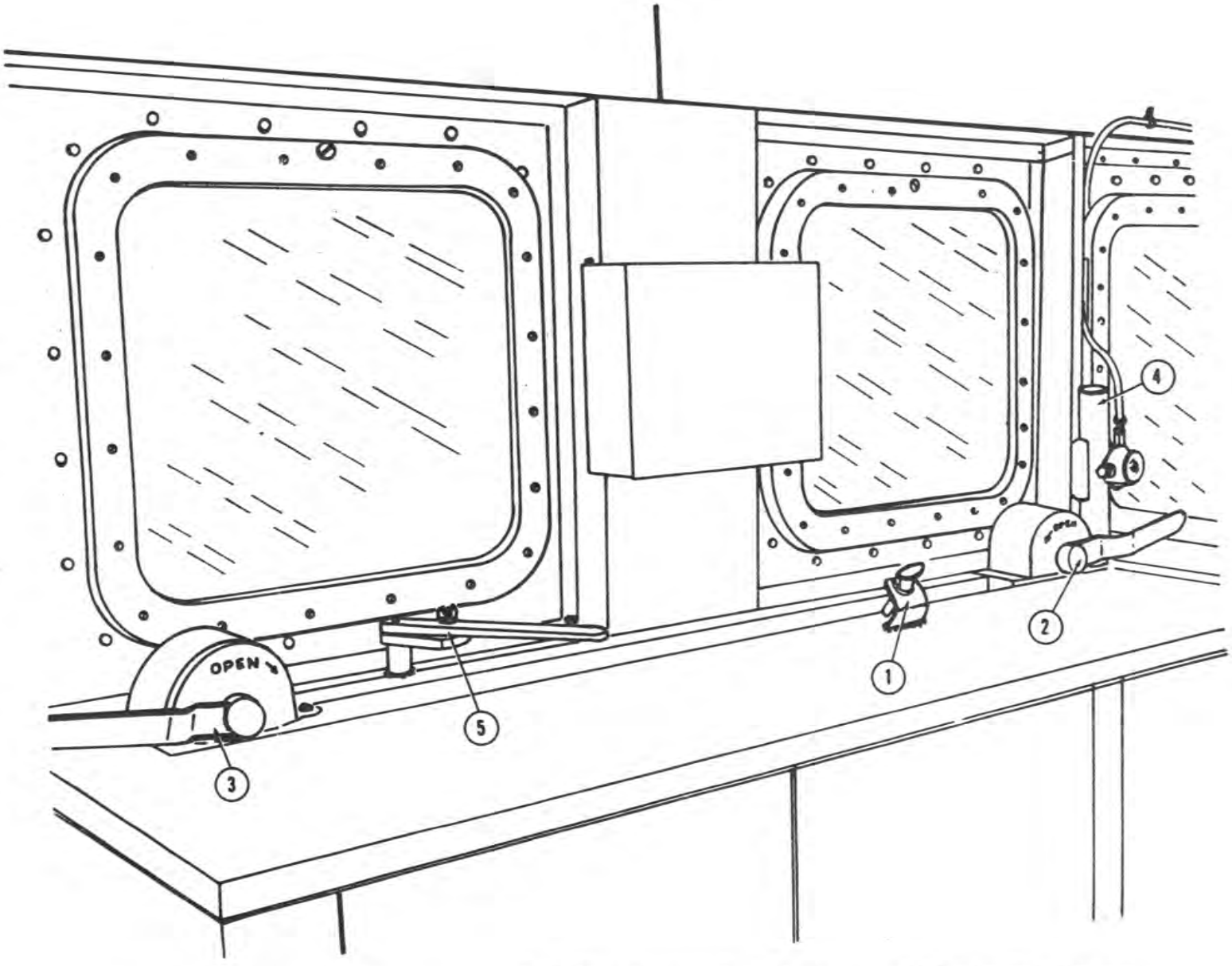
23. Engine Temperature Gages

The engine temperature gages (5 and 8 fig. 10), (4 and 6, fig. 11) and (6 and 20, fig. 12) register the temperature of the engine coolant.



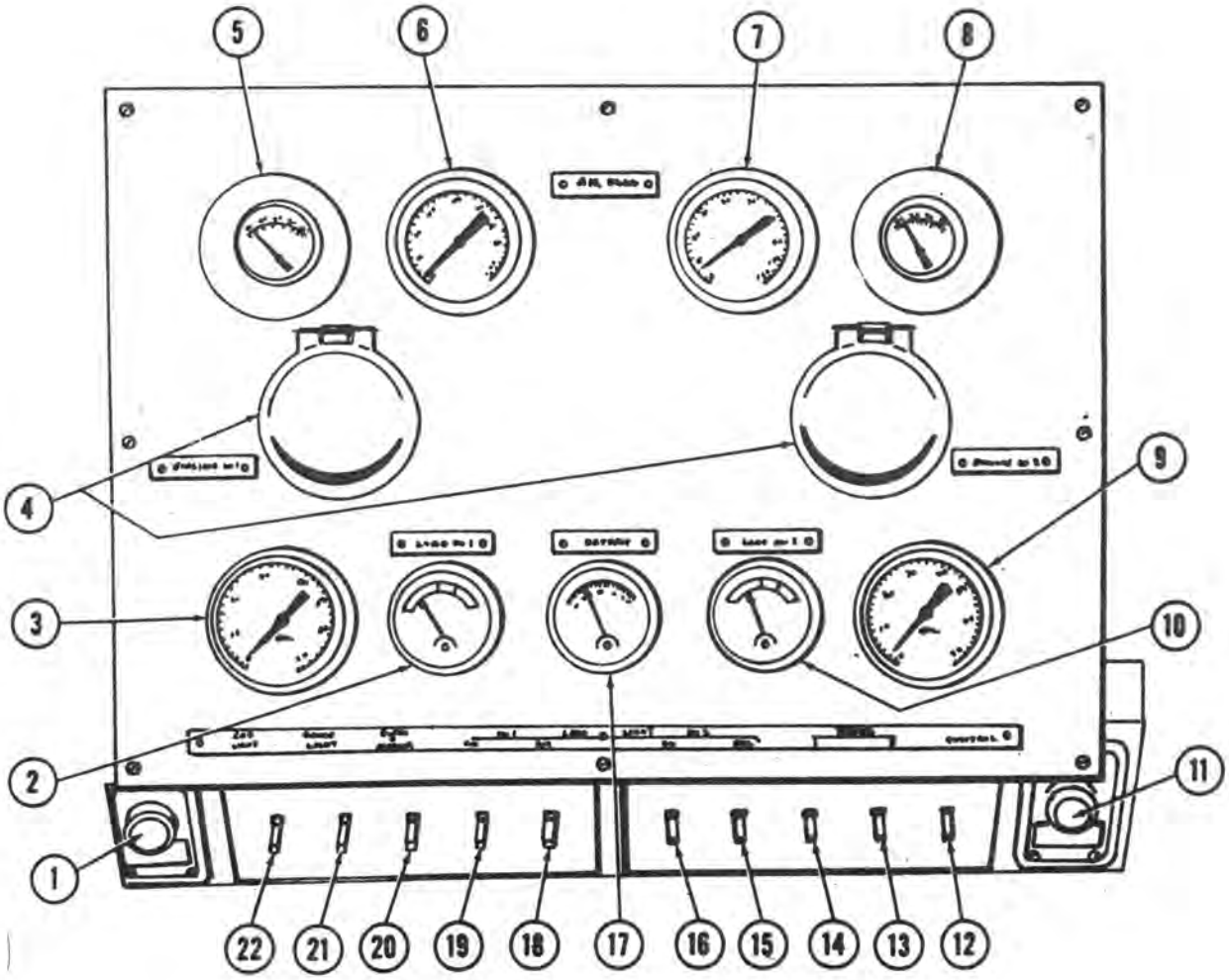
1 Engine stop lever
2 Left engine room shutter lever
3 Right engine room shutter lever
4 Rear windshield wiper motor
5 Radiator shutter lever

Figure 8. Upper rear view of cab (45-ton).



1 Engine quick start lever
2 Left engine room shutter lever
3 Right engine room shutter lever
4 Rear windshield wiper motor
5 Radiator shutter lever

Figure 9. Upper rear view of cab (44-ton).



1 Engine No. 1 start button
2 Engine No. 1 load meter
3 Engine No. 1 oil pressure gage
4 Gage lights
5 Engine No. 1 water temperature gage
6 Main reservoir and equalizing reservoir gage
7 Brake cylinder and brake pipe gage
8 Engine No. 2 water temperature gage
9 Engine No. 2 oil pressure gage
10 Engine No. 2 load meter
11 Engine No. 2 start button
12 Control switch
13 Heater switch right side of cab
14 Heater switch left side of cab
15 Rear headlight, dim switch
16 Rear headlight, bright switch
17 Battery voltmeter
18 Front headlight, dim switch
19 Front headlight, bright switch
20 Classification and marker light switch
21 Gage light switch
22 Cab light switch

Figure 10. 44-ton gage and instrument panel (except USA road numbers 1236 through 1246).

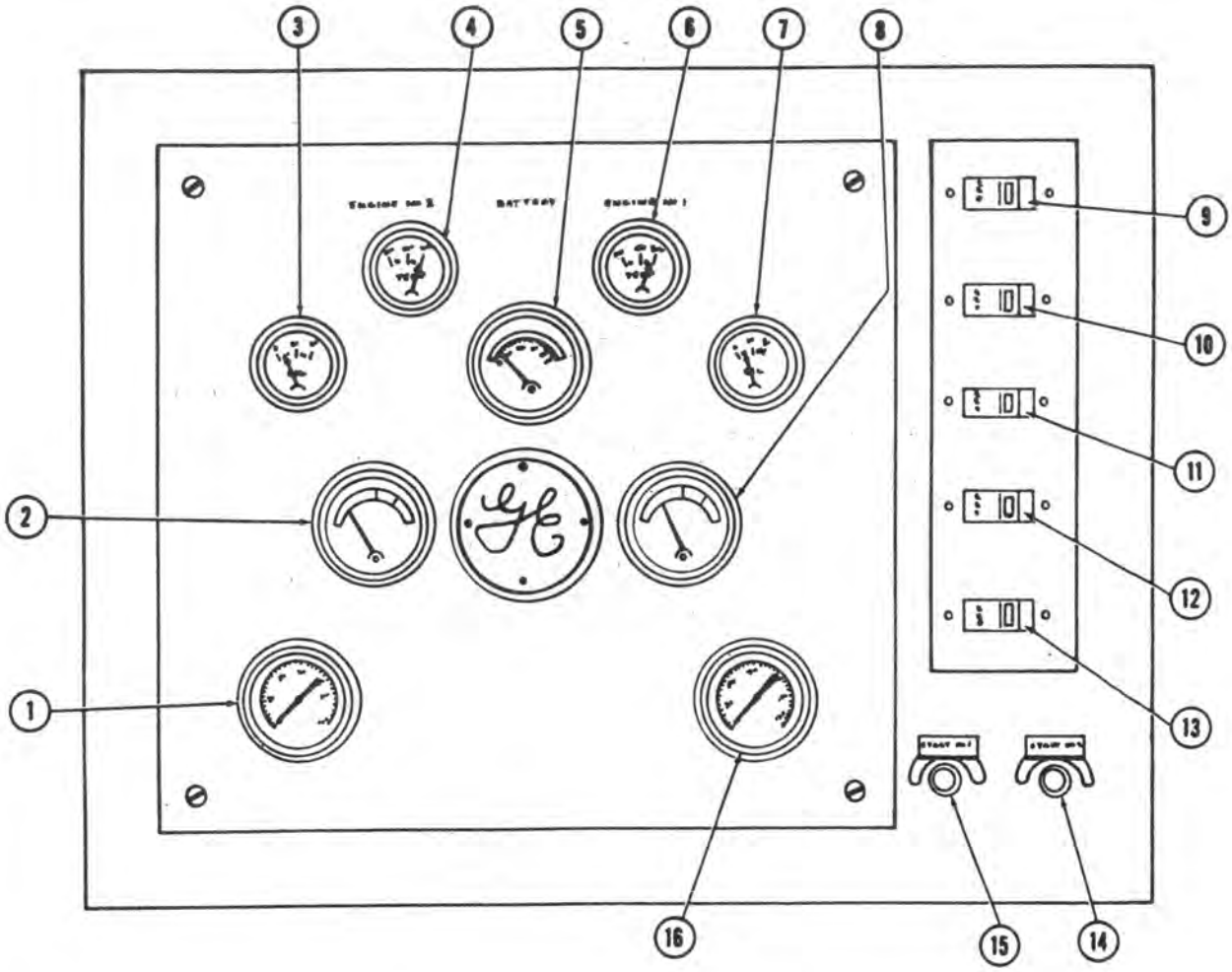
Normal operating temperature should be between 160° and 180°.

24. Lube Oil Pressure Gages

The lube oil pressure gages (3 and 9, fig. 10), (3 and 7, fig. 11) and (3 and 22 fig. 12) indicate the lubricating oil pressure of each engine. At idle speed (400 rpm) the pressure should be approximately 15 p.s.i. At maximum speed (1,000 r.p.m.) the pressure should be approximately 38 p.s.i.

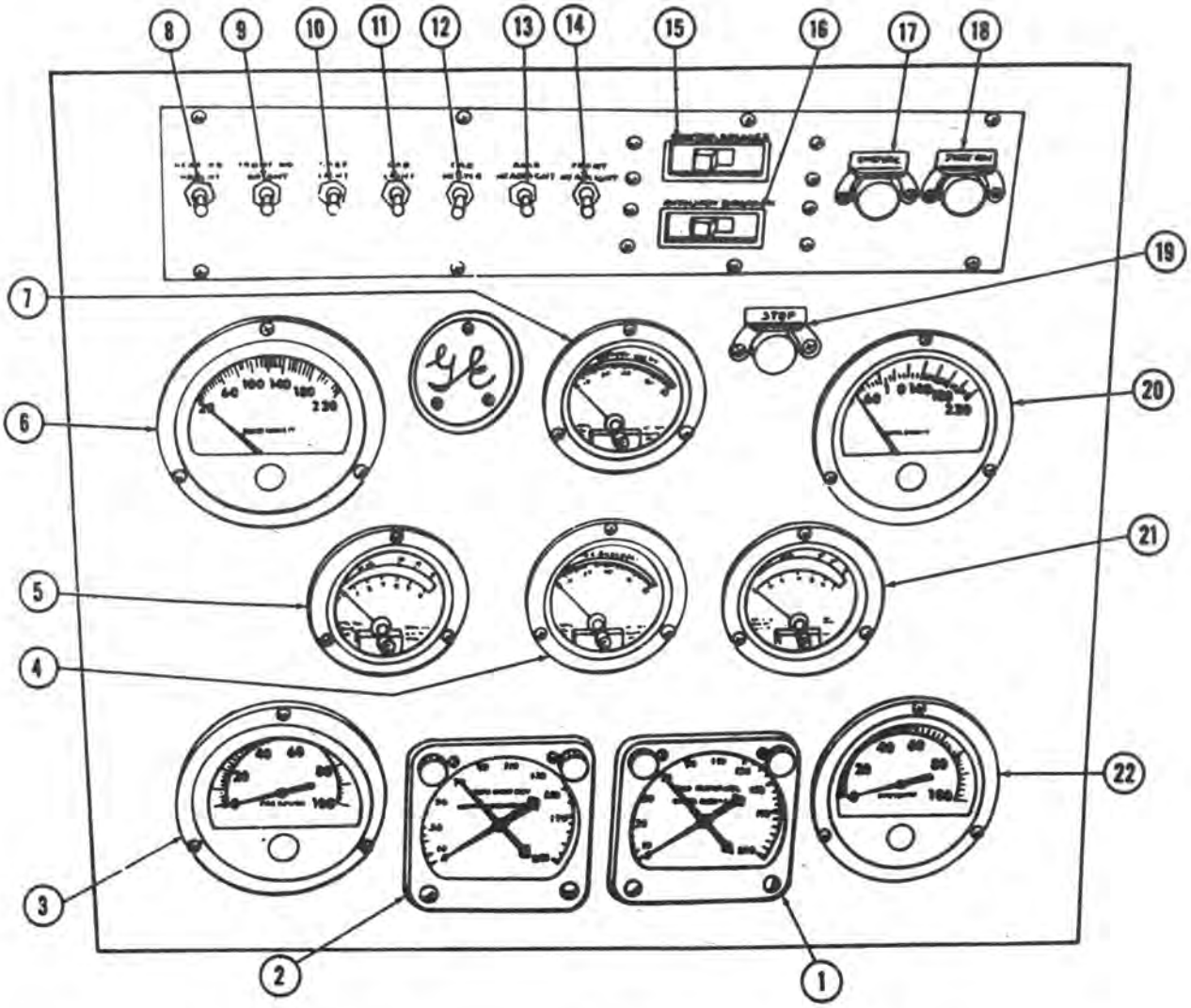
25. Air Pressure Gages

These standard air gages are labeled to show their functions. They indicate the main and equalizing reservoir air pressure and the brake



1 Main reservoir and equalizing reservoir gage
2 Engine No. 2 load meter
3 Engine No. 2 oil pressure gage
4 Engine No. 2 water temperature gage
5 Battery voltmeter
6 Engine No. 1 water temperature gage
7 Engine No. 1 oil pressure gage
8 Engine No. 1 load meter
9 Control switch
10 Cab heater switch
11 Cab light switch
12 Front headlight switch
13 Rear headlight switch
14 Engine No. 1 start button
15 Engine No. 2 start button
16 Brake cylinder and brake pipe gage

Figure 11. 45-ton gage and instrument panel.



1 Brake cylinder and brake pipe gage
2 Main reservoir and equalizing reservoir gage
3 Engine No. 2 lube oil pressure gage
4 Battery ammeter
5 Engine No. 2 load meter
6 Engine No. 2 temperature gage
7 Battery voltmeter
8 Rear headlight bright switch
9 Front headlight bright switch
10 Gage lights switch
11 Cab lights switch
12 Cab heater switch right side
13 Rear headlight dim switch
14 Front headlight dim switch
15 Control circuit breaker
16 Auxiliary circuit breaker
17 Engine No. 2 start button
18 Engine No. 1 start button
19 Engine multiple stop button
20 Engine No. 1 temperature gage
21 Engine No. 1 load meter
22 Engine No. 1 oil pressure gage

Figure 12. 44-ton gage and instrument panel (USA road numbers 1236 through 1246).

cylinder and brake pipe air pressures. For satisfactory operation they should register as follows:

a. Main Reservoir Pressure. With the system fully charged the main reservoir pressure gage (6, fig. 10), (1, fig. 11) and (2, fig. 12) should register between 105 and 115 p.s.i.

b. Brake Pipe and Equalizing Reservoir Pressure. With the automatic brake valve handle in running position the brake pipe pressure gage (7, fig. 10), (16, fig. 11) and (1, fig. 12) and equalizing reservoir pressure gage (6, fig. 10), (1, fig. 11) and (2, fig. 12) should register 70 p.s.i.

c. Brake Cylinder Pressure.

(1) With the automatic brake valve handle in service position, the brake cylinder pressure gage (7, fig. 10), (16, fig. 11) and (1, fig. 12) will vary according to the amount of brake pipe reduction.

(2) With the independent brake valve handle in service position, the brake cylinder pressure should register from 5 to 45 p.s.i. depending on the amount of application. The brake cylinder pressure should not exceed 45 p.s.i. with the independent brake valve in slow or quick application position.

26. Load Indicating Meters

Two load indicating meters are located on the instrument panel in the cab. They are a guide to the load and pulling force of the locomotive. Three different types of meters are used. The difference in types are in the indicating graduation. Their descriptions and functions are as follows:

a. 44-ton locomotives. The 44-ton locomotives are equipped with two different types of loadmeters as follows:

(1) *Colored band type* (2 and 10, fig. 10). The dial of the meter is marked in "green," "green yellow" and "solid yellow" segments. The permissible time of operation in any one of the overload areas is as follows:

(*a*) Operation within the "green" band is unrestricted as long as the locomotive is used for the service for which it was designed.

(*b*) Operation with the pointer in the "green yellow" must not exceed 1 hour in any 8-hour period.

(*c*) Operation with the pointer in the "solid yellow" must be confined to starting or short movements, that are never over 4 minutes at a time. When the time in the "solid yellow" band is 2 minutes or more, the operation must not be repeated frequently.

(*d*) The total time in the "green yellow" and "solid yellow" added together must not exceed 1 hour in any 8-hour period.

(*e*) When starting a train, advance the throttle as far as possible without slipping the wheels, even if this action brings the pointer in the "solid yellow" momentarily. In this way the time in "solid yellow" will be minimized.

(2) *Colored band type with amperes graduations.* The dial of the meter is graduated in amperes of 100 through 600 as well as a colored band of "green," "yellow" and "red." The permissible time of operation in any one of the overload ranges is as follows:

(*a*) Operation within the "green" band is safe for continuous service.

(*b*) Operation within the "yellow" band is safe for switching or short runs in transfer or haulage services and must not exceed 30 minutes.

(*c*) Operation within the "red" band is limited from 30 seconds to 3 minutes depending on the position of the pointer as marked on the face of the loadmeter.

b. 45-Ton Locomotives. The 45-ton locomotives are equipped with colored band ammeters marked in "green," "yellow" and "red" segments (2 and 8, fig. 11). Operation in any one of the overload ranges is the same as specified for the 44-ton locomotives (*a*(1)above).

27. Battery Voltmeter

a. The battery voltmeter (17, fig. 10), (5, fig. 11) and (7, fig. 12) indicates the rate of charge or discharge of the battery and must be observed frequently.

b. It has a graduated scale of 0 to 100 volts and a color band above the scale to indicate proper circuit range, as well as abnormal conditions.

c. Continuous low voltage or high voltage may be due to poor condition of the battery, auxiliary generator, or incorrect voltage regulator adjustment, and must be reported on the daily inspection worksheet (par. 2). Normal

battery voltage with the engines shut down is approximately 64 volts.

28. Battery Ammeter

The battery ammeter (4, fig. 12) indicates the rate of charge or discharge of the battery and must be observed frequently. With the engines running, it should indicate zero, or varying charge readings, depending on the condition of the battery. Excessive continuous charge or discharge may be due to poor condition of the battery, generator, or incorrect voltage regulator adjustment, and must be reported on the daily inspection worksheet (par. 2).

29. Circuit Breakers

The locomotives are equipped with a control and auxiliary circuit breaker. They are located either on the gage and instrument panel or inside the front electrical equipment cabinet. In case of an overload the affected circuit breaker will "kick out" moving the breaker lever midway between the "off" and "on" positions. Service to the circuit is restored by moving the lever 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.

a. Control Breaker. The control circuit breaker (15, fig. 12) and (8, fig. 15) connects the electrical current from the battery to all of the control circuits. It must be in the "on" position for normal operation.

b. Auxiliary Breaker. The auxiliary circuit breaker (16, fig. 12) and (9, fig. 15) protects all of the light circuits from an electrical overload. If any of the circuits are overloaded the circuit breaker will trip putting out all of the lights on the locomotive.

30. Headlight Switches

a. The 44-ton locomotives are equipped with four headlight switches, "front bright," "front dim," "rear bright" and "rear dim." They are located on the gage and instrument panel (figs. 10 and 12). The switches have two positions "on" and "off."

b. The 45-ton locomotives also are equipped with four headlight switches as in *a* above. Two are located on the gage and instrument panel (12 and 13, fig. 11) and two are located on the side of the front electrical equipment cabinet.

31. Headlight Transfer Switch

The 44-ton locomotives USA Road Numbers 1236 through 1246 are equipped with a headlight transfer switch (10, fig. 13). It has two positions, "normal" and "emergency." In normal position one sealed beam headlight bulb will illuminate on the front and rear of the locomotive. In emergency position two sealed beam headlight bulbs will illuminate on the front and rear end.

32. Cab and Gage Lights

a. The cab light switches (22, fig. 10) and (11, figs. 11 and 12) control the operation of the dome light in the roof of the cab.

b. The gage light switches on the 44-ton locomotives (21, fig. 10) and (10, fig. 12) control the operation of the gage and instrument panel light. The gage and instrument panel light on the 45-ton locomotives is controlled by the headlight switches.

33. Control and Heater Switches

a. The control switch (12, fig. 10) and (9, fig. 11), when in the "on" position completes the electrical circuits necessary for starting the diesel engines.

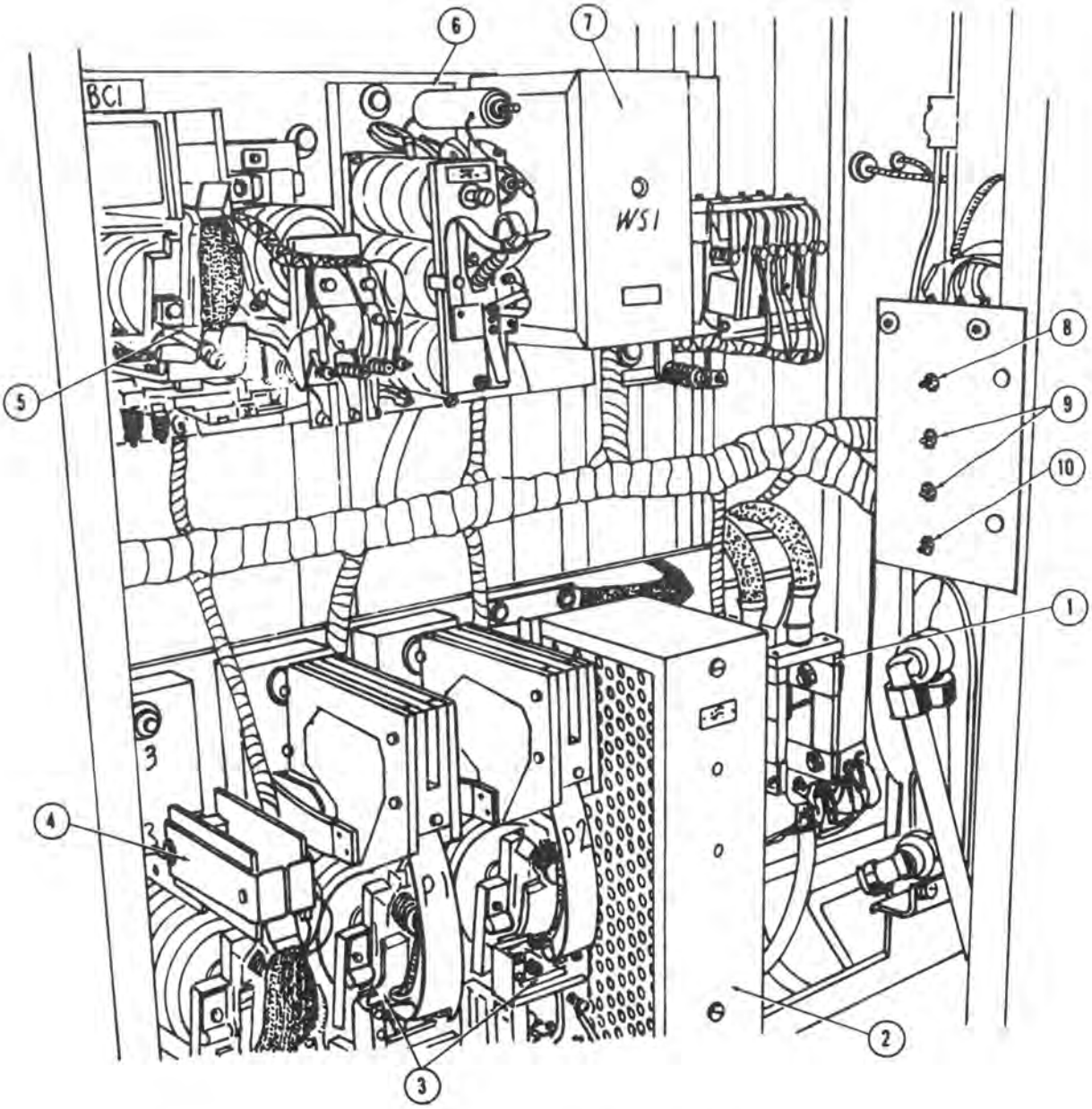
b. The cab heater switch (13 and 14, fig. 10), (10, fig. 11) and (12, fig. 12) connects the supply of current from the battery to the cab heater motor which in turn drives the cab heater fan.

34. Classification and Marker Light Switches

The classification and marker light switches, when in the "on" position, energize the circuits to the marker light receptacles located on front of each engine hood. Desired classification is obtained by plugging the portable marker lights into the receptacles and turning the line to "red" or "green" depending on the type of service in which the locomotive is to be operated.

35. Electrical Equipment Cabinets
(figs. 13, 14, 15 and 16)

The main electrical equipment is located in the front and rear electrical cabinets located

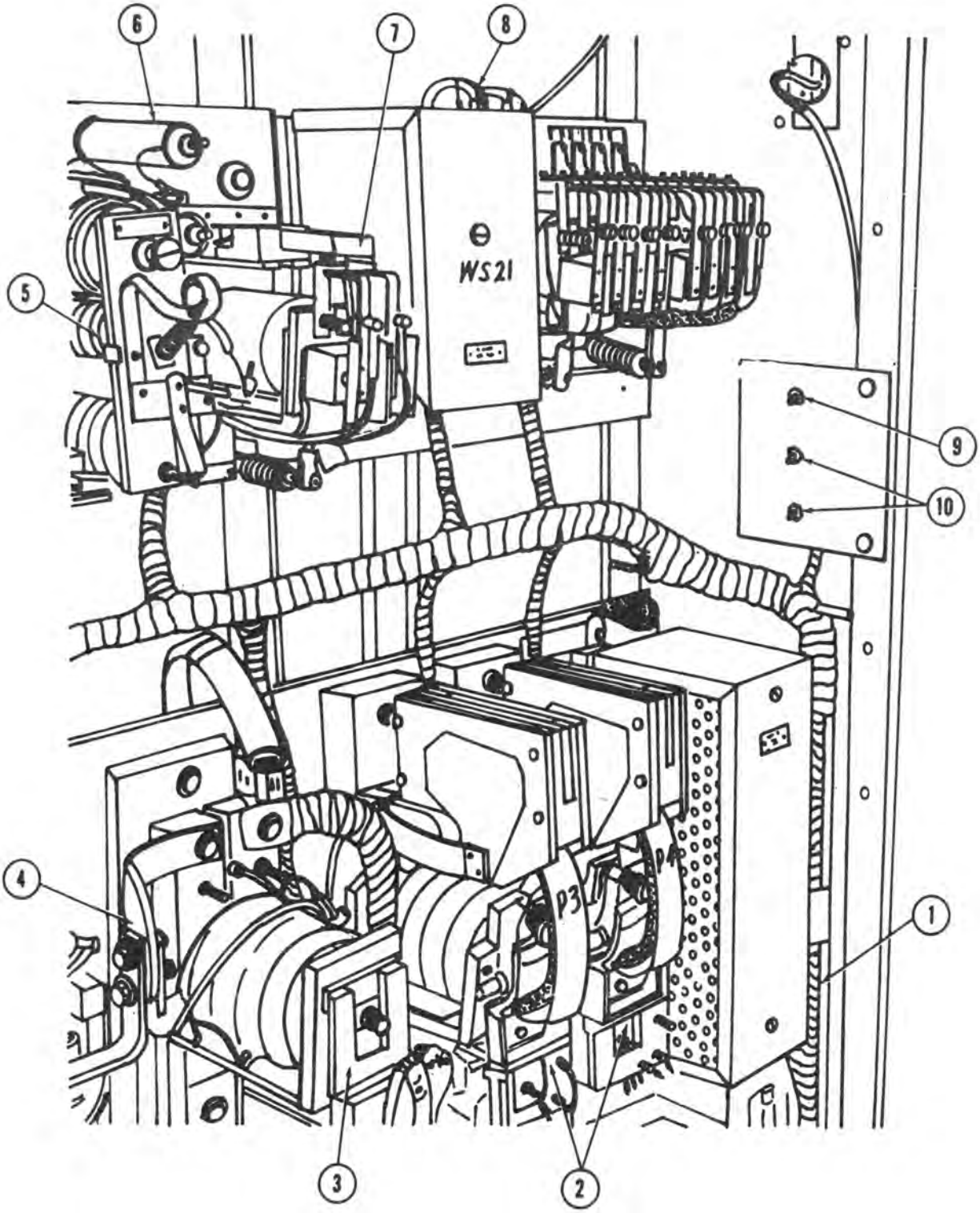


1 Main battery switch
2 Voltage regulator No. 1
3 Power contactors (P1 and P2)
4 Engine starting contactor
5 Battery charging contactor
6 Reverse current relay
7 Wheel slip relay
8 Exciter field swtch No. 1
9 Motor cut out switch No. 1 and 2
10 Headlight transfer switch

Figure 13. Front electrical cabinet (44-ton).

in the cab. Most of the equipment in the cabinets functions automatically, and should not be adjusted or repaired unless adequate maintenance facilities are available. However, the operator must be familiar with the use of the manually controlled items in the low voltage circuit described in paragraphs 36 through 40 below.

Warning: **The main power circuits operate at high voltage. Cabinet doors must not be**



1 Voltage regulator No. 2
2 Power contactors (P3 and P4)
3 Field shunting relay
4 Field shunting drop out relay
5 Battery charging contactor
6 Reverse current relay
7 Ground relay
8 Wheel slip relay
9 Exciter field switch No. 2
10 Motor cut out switches No. 3 and 4

Figure 14. Rear electrical cabinet (44-ton).

opened except by authorized and qualified personnel. When doors are open, it is important that adequate safety rules be observed.

36. Main Battery Switch
(1, figs. 13 and 15)

The main battery switch is located in the lower right hand corner of the front electrical cabinet. It is a two pole single throw switch and is used to open or close the low voltage battery circuits. During normal operation this switch must be in closed position.

37. Fuse Panels
(7, fig. 15 and 6, fig. 16)

The fuse panels hold the protective fuses for the charging generators and voltage regulators. When replacing any of these fuses, use the fuse puller provided for this purpose and replace with a fuse of correct amperage.

38. Traction Motor Cutout Switches

The traction motor cutout switches (9, fig. 13), (10, fig. 14), (11, fig. 15) and (8, fig. 16) are located in the front and rear electrical cabinets. They are used to isolate motors from the power circuits in case of damage or trouble. The switches are numbered CO1, CO2, CO3 and CO4 and correspond to the traction motors starting at the front end of the locomotive. If motors No. 1 and No. 3 are cut out, the load indicator will be inoperative. If any one of the motors are cut out, the wheel slip buzzer (if applied) will be inoperative.

Caution: **Operate the locomotive with traction motors cut out only in an emergency.**

39. Ground Relay

The ground relay is located in the rear electrical cabinet. The relay operates to reduce generator field current, if a ground occurs in a high voltage circuit. If the locomotive suddenly loses power, inspect the relay to see if it has tripped and latched. To reset the relay, close the throttle to idle, raise the holding latch and pull the contact back. If a ground persists, open the ground disconnect switch, reset the relay and move the locomotive no more than absolutely necessary to get in the clear until trouble is corrected by maintenance personnel.

40. Engine Starting Contactors

The starting contactors (4, figs. 13 and 15) completes the starting circuit for starting the diesel engines. The contactors sometimes weld closed when an engine is started, especially if the start button is not held in firmly. If they weld together the locomotive will not move even though the engine speed can be increased. To separate the contacts, pry apart with a piece of wood or other nonconductive material.

41. Miscellaneous Items

The other items in the cabinets function automatically and seldom need the operator's attention. Each item is clearly marked for easy identification. If any of the automatic controls fail to perform, an annotation will be made on the daily inspection worksheet (par. 2).

42. Deadman Safety Control
(fig. 17)

A deadman safety control pedal is mounted on the cab floor, directly below the operator's seat on USA road numbers 1236 through 1246. It is a safety device which must be depressed at all times, unless a service brake application is already in force. It also safeguards against the incapacities or negligence of the operator. A release of the deadman pedal causes a warning whistle to sound for approximately 2 to 4 seconds, after which the brakes automatically apply, and the engines are brought to idling speed. If the deadman pedal is depressed within the warning period, no braking action takes place. To resume operation, after a penalty brake application, the following steps must be taken:

a. Move the automatic brake valve handle to "lap" position.

b. Move the throttle lever to "idle" position.

c. Place foot on deadman's safety control pedal.

43. Emergency Fuel Shutoff Valve
(fig. 18)

a. An emergency fuel shutoff valve is located in the fuel suction line to shut off the supply of fuel in case of fire or other emergency.

b. Three triangular shaped pull rings are provided for tripping this cutoff valve, one in

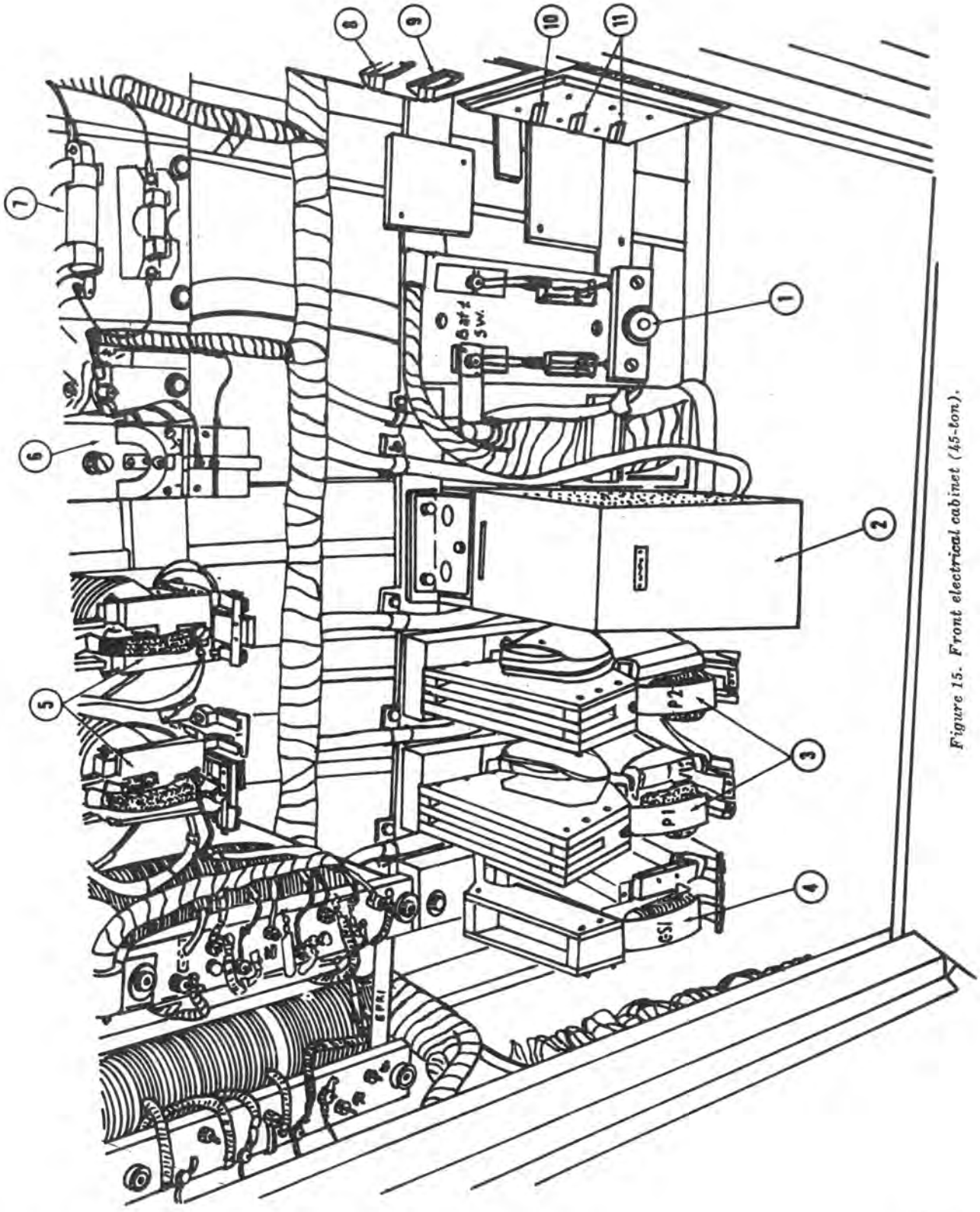
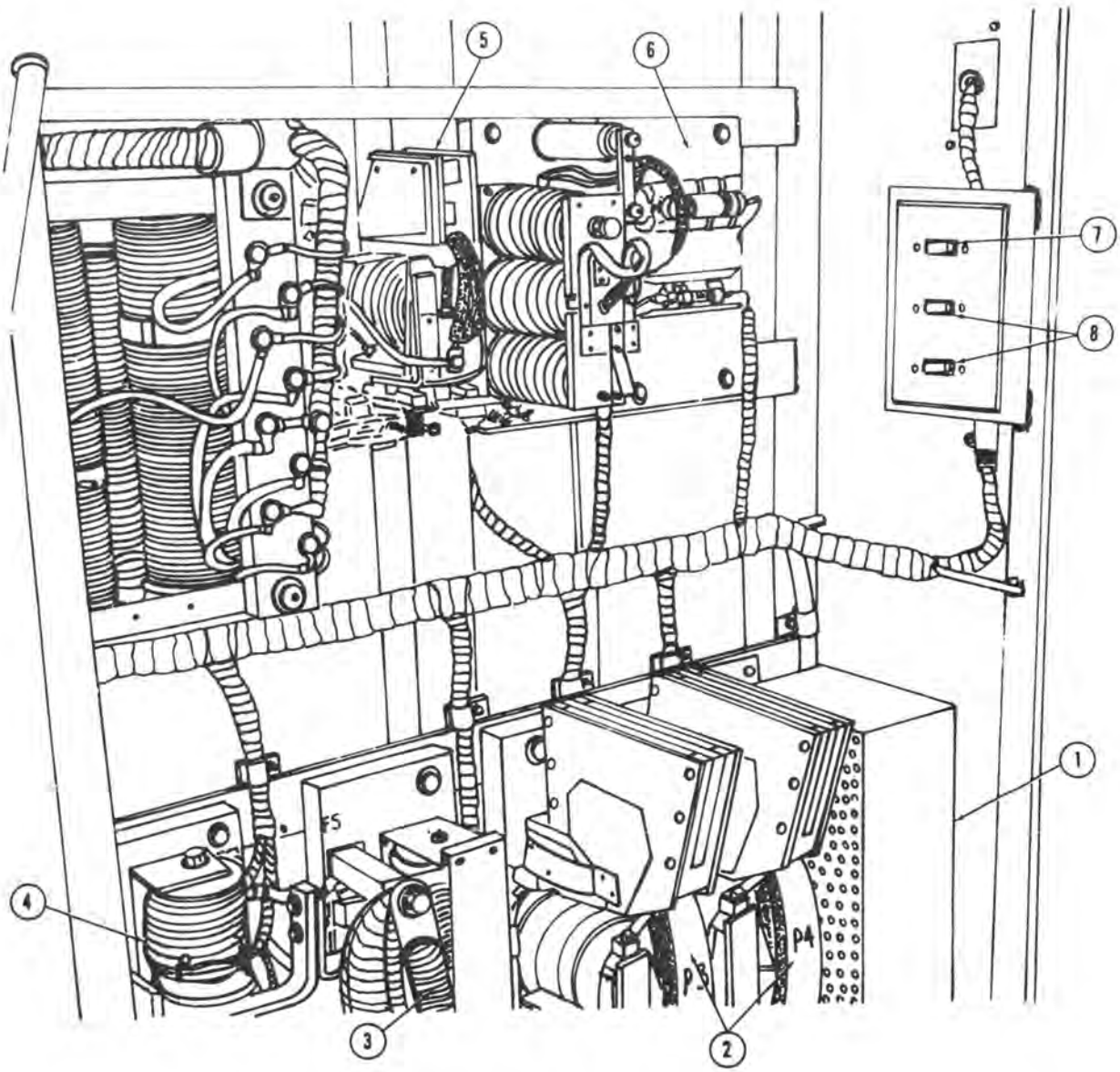


Figure 15. Front electrical cabinet (45-ton).

1 Main battery switch
2 Voltage regulator
3 Power contactors (P1 and P2)
4 Engine starting contactor
5 Field shunting relays
6 Reverse current relay
7 Fuse panel
8 Control circuit breaker
9 Auxiliary circuit breaker
10 Exciter field switch No. 1
11 Motor cut out switches No. 1 and 2

Figure 15—Continued.



1 Voltage regulator
2 Power contactors (P3 and P4)
3 Field shunting relay
4 Field shunting drop out relay
5 Battery charging contactors
6 Fuse panel
7 Exciter field switch No. 2
8 Motor cut out switches No. 3 and 4

Figure 16. Rear electrical cabinet (45-ton).

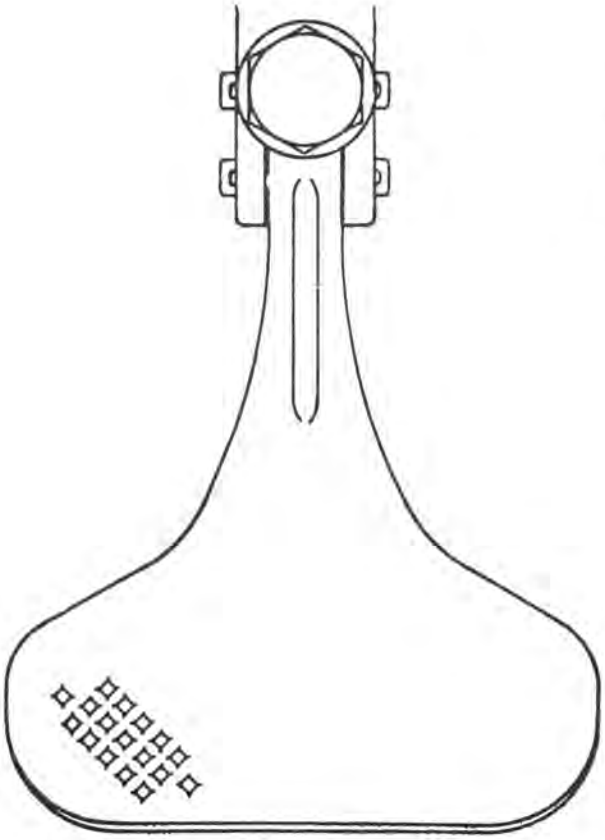


Figure 17. Deadman safety control.

the cab to the right of the operator's seat and one on either side of the locomotive below the cab (1, figs 20 and 21). If the valve is tripped accidently or by pulling any one of these pull rings, it will have to be reset before operation can be resumed.

c. To reset, pull valve stem "up" so that yoke which normally holds valve stem open (valve stems up) may be slid into place.

44. Handbrake

a. The handbrake is provided to hold the locomotive at a standstill during nonoperating periods.

b. The locomotives may be equipped with either a lever type handbrake or a wheel type handbrake. Operation of either type of brake is not difficult and are listed as follows:

(1) *Lever type* (fig. 19).

(*a*) To apply the brake, raise the operating lever (4) to a horizontal position and ratchet the lever until the brake shoes are applied tight against the wheels.

(*b*) To release the brake, pull the release handle (1) forward as shown on figure 19. The release handle bolt (2) and the fulcrum bolt (5) must be kept tight for the brake to function properly.

(2) *Wheel type.*

(*a*) To set, turn the wheel clockwise until the brakeshoes apply tight against the wheels.

(*b*) To release, disengage lower ratchet wheel by pressing in with foot.

45. Distributing Valve (3, figs. 20 and 21)

a. Description.

(1) The distributing valve is located in the air brake compartment below the cab floor. The valve works in conjunction with the automatic and independent brake valves to control braking operation.

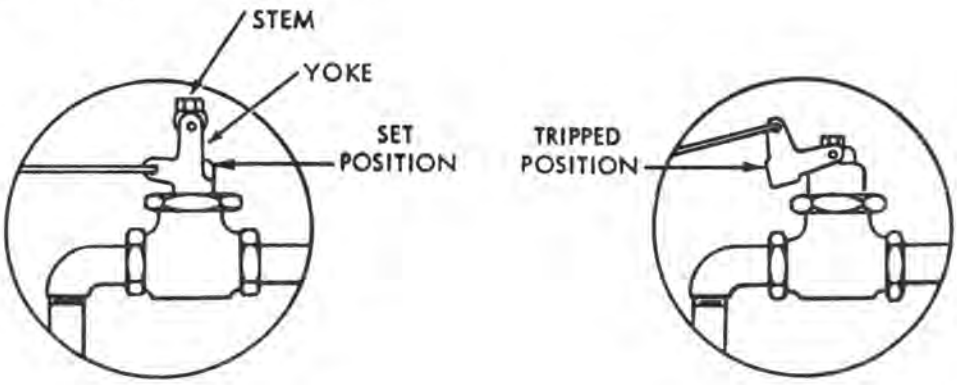
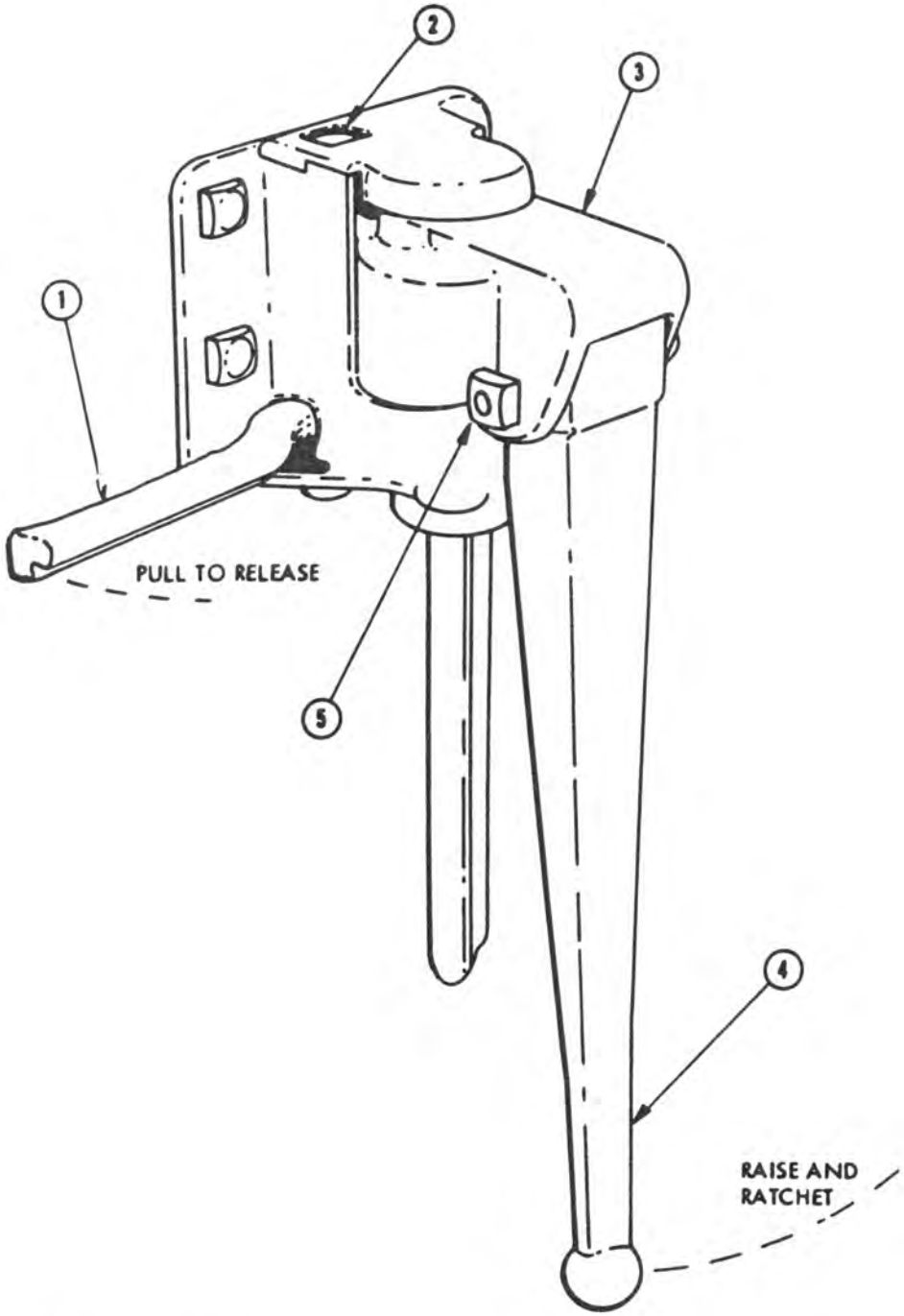
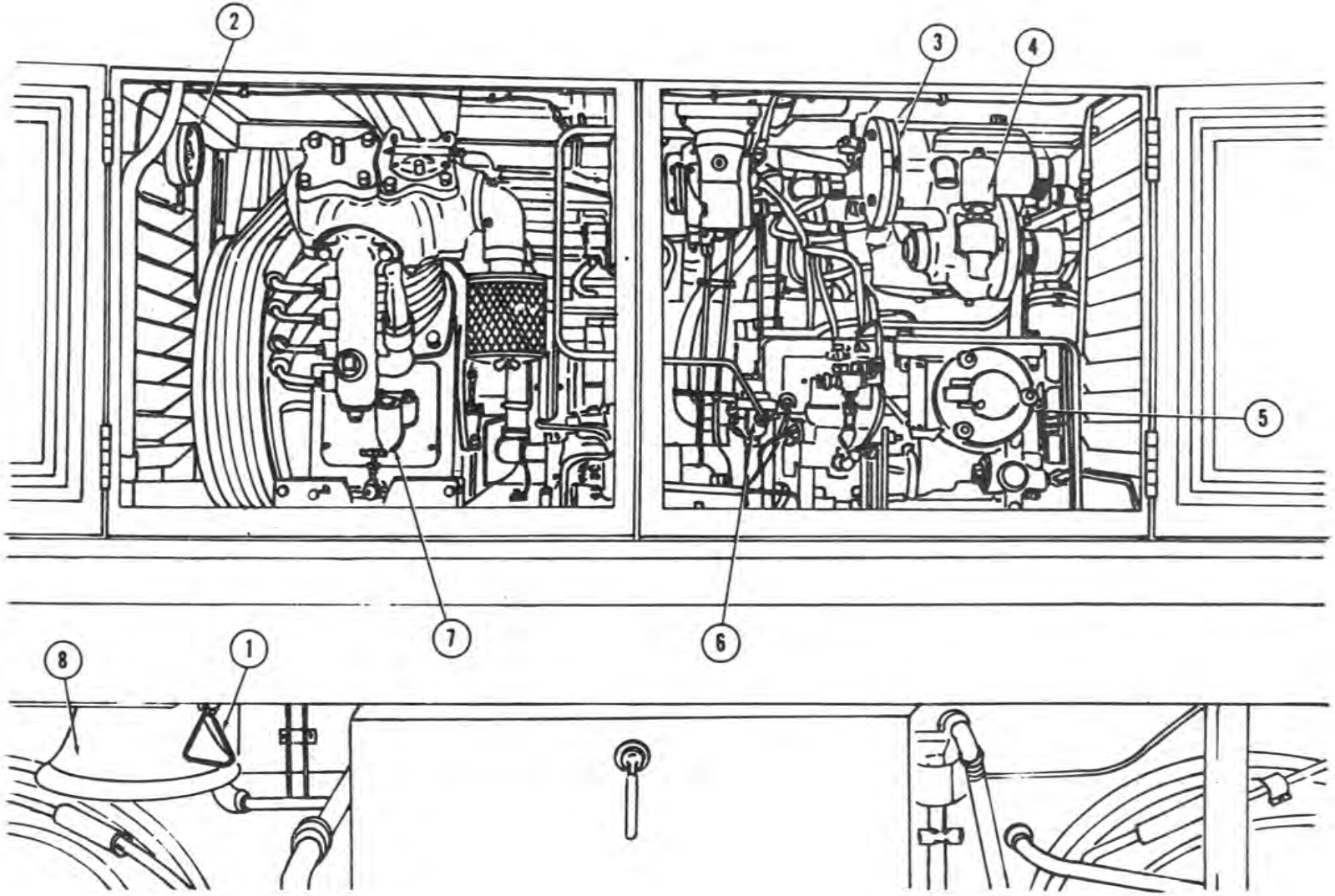


Figure 18. Emergency fuel shutoff valve.



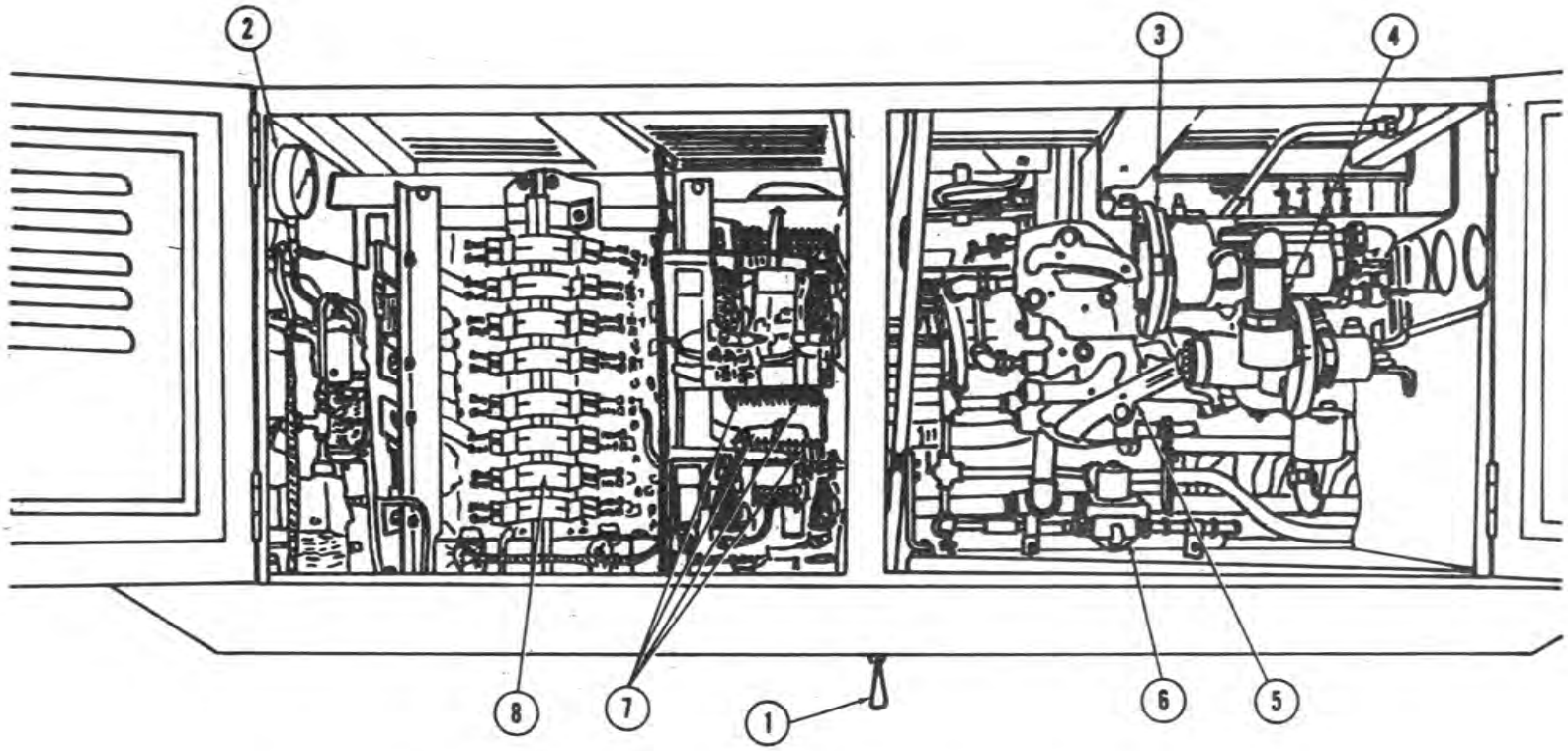
1 Release handle
2 Release handle bolt
3 Fulcrum housing
4 Operating lever
5 Fulcrum bolt

Figure 19. Handbrake controls.



1 Emergency fuel trip pull ring
2 Control air pressure gage
3 Distributing valve
4 Safety valve
5 Application valve
6 Control air reducing valve
7 Air compressor
8 Bell

Figure 20. Airbrake compartment (44-ton).



1 Emergency fuel trip pull ring
2 Control air pressure gage
3 Distributing valve
4 Safety valve
5 Application valve
6 Control air reducing valve
7 Shunt field contactors
8 Air reverser

Figure 21. Airbrake compartment (45-ton).

(2) The safety valve (4, figs. 20 and 21) is set at 68 p.s.i. It releases the excess air pressure to atmosphere when an emergency brake application is made.

b. Adjustment of Safety Valve.

(1) With the brake system fully charged, move the automatic brake valve handle to the emergency position.

(2) Remove safety valve cap or locknut and cotter key as required.

(3) Turn regulating nut down (clockwise) to increase pressure setting; and up (counterclockwise) to decrease pressure setting.

(4) After the proper adjustment (68 p.s.i.) has been made, replace and tighten safety valve cap or nut and cotter key as required.

46. Main Reservoir Safety Valve

a. The main reservoir safety valve is located below the cab floor in the air line between the air compressors and the main reservoir.

b. It releases the main reservoir pressure in case of air compressor governor or unloader failure.

c. Pressure is set at 125 pounds. Adjustment is the same as the distributing valve safety valve (par. 45*b*).

47. Control Air Reducing Valve and Gage

a. Description. The control air reducing valve (6, figs. 20 and 21) and gage (2, figs. 20 and 21) are located in the air brake compartment below the cab floor. The pressure of the control air system is regulated by this valve and is indicated on the control air gage. For proper operation of the electrical apparatus, the control air must be adjusted to approximately 80 p.s.i.

b. Adjustment. With the brake system fully charged, turn the reducing valve regulating nut "clockwise" to increase pressure and "counterclockwise" to decrease pressure.

Section III. OPERATION UNDER USUAL CONDITIONS

48. General

a. This section gives instructions on starting and stopping the locomotive and the basic capabilities of the equipment, as well as coordinating these capabilities to perform the specific tasks for which the equipment is designed.

b. It is essential that the operator know how to perform every operation of which the locomotive is capable. Since nearly every job presents a different problem, it may be necessary that the operator vary the given procedures to fit the individual job.

49. Preliminary Inspection

Inspect the locomotive for the conditions listed below. Report any discrepancies to the organizational maintenance personnel so corrective action can be taken before the locomotive is put in service.

a. Liquids leaking from the locomotive.

b. Loose or dragging parts.

c. Visually inspect wheels for defects.

d. Proper positioning of angle cocks and shutoff valves.

e. Worn or missing brake shoes.

f. Observe brake cylinder piston travel, with the brakes applied (should be approximately 3 to 4 in.).

g. Check fuel indicating gage on fuel tanks (par. 88*c*).

h. Check water supply in radiator (par. 86*b*).

i. Check lubricating oil supply in engine crankcase and air compressor.

j. Check that all fuses are in place and in proper condition (par. 37).

k. Drain condensate from main and auxiliary reservoirs.

l. Check emergency fuel cutoff valve to see that it is open (par. 43).

m. Check position of double heading cock (par. 16).

50. Preparation Before Starting Engines

Before starting the engine, perform the preliminary inspections prescribed in paragraph 49 and complete the following:

a. Controls.

(1) Apply the handbrake.

(2) Move the throttle lever to the "idle" position.

(3) Move the reverse lever to the "neutral" position.

(4) "Close" the main battery switch.

(5) Move the control and auxiliary generator circuit breakers to the "on" position.

(6) Inspect engines, generators, and control compartment for rags or tools inadvertently left near moving parts or electrical equipment.

b. *Priming Engines* (fig. 22). Before attempting to start the engines after an undetermined shutdown period, it may be necessary to prime the fuel systems by bleeding out any existing air pockets. This procedure will also be necessary anytime the fuel supply tank is entirely depleted.

(1) Check the fuel tank supply.

(2) Make sure the emergency fuel shut off lever on the fuel pump is in the "open" position.

(3) Open the fuel filter vent valves on the filter housing (a, fig. 22).

(4) Turn the hand priming pump handle up (counterclockwise) and operate with a pumping action using full steady strokes (c, fig. 22). When the flow of fuel through the fuel filter vent valves becomes a continuous stream without air bubbles, close the vents.

(5) Open each bleeder vent in turn, on each injector (b, fig. 22) and continue to operate the hand priming pump until each vent discharges solid fuel.

(6) Open and close the vents several times in succession to be sure that all the air is bled from the system.

(7) After the system is primed, the hand priming pump plunger must be forced to the bottom of the pump cylinder and screwed (clockwise) into place. This closes the valve seat located in the bottom of the cylinder and prevents air from leaking into the fuel system.

51. Starting Engines

a. Normal Starting.

(1) Press the number 1 engine start button and hold it firmly until engine fires.

(2) After number 1 engine has started, press the number 2 engine start button and hold it firmly until the engine fires.

Caution: **Do not run the battery down by excessive cranking. If the engines do not turn over or fail to fire promptly, release the start button and determine the cause. Never push start buttons while engines are running; also never push both start buttons at the same time.**

(3) After the engines start, check the engine lube oil pressure gages (par. 24) to see that pressure builds up.

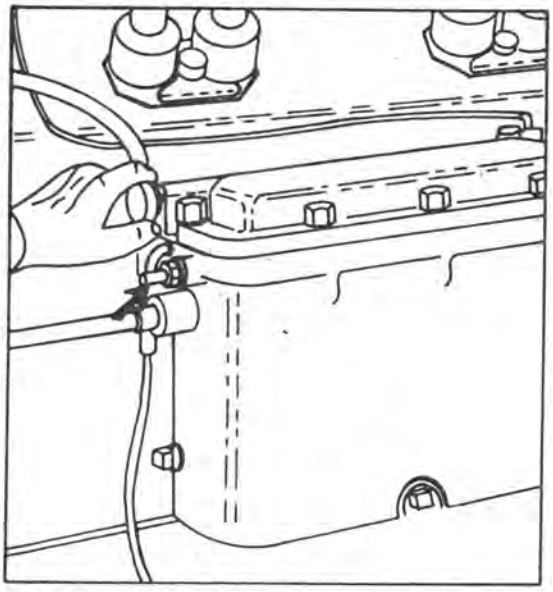
(4) Observe that the battery is being charged as indicated on the battery ammeter (par. 28).

(5) Check the starting contactors (par. 40) to see if they are stuck closed. If they should weld together, pry apart with a piece of wood or other nonconductive material.

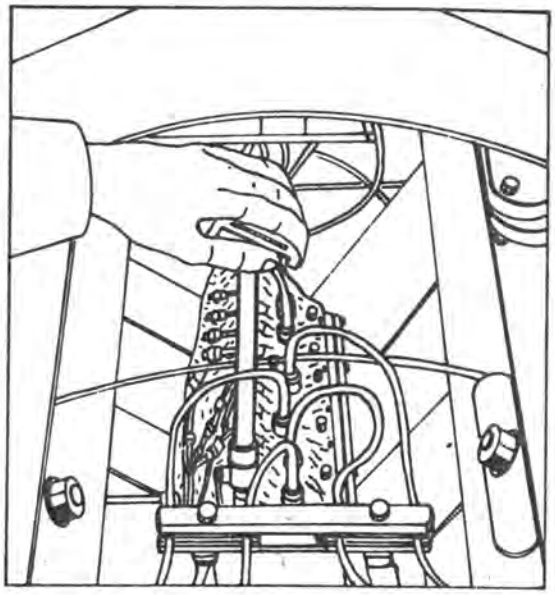
(6) Idle the engines until the water temperature reaches 120° F., and main reservoir air pressure reaches 105 to 115 pounds.

b. Starting With Compression Released (fig. 23).

(1) *General.* Each engine is equipped with a compression release lever located on the right side near the flywheel housing. It can be used as an aid to start the engines when the battery is low, or the lube oil congeals in cold weather. Assistance from operating personnel will be required as no means of operating the release lever from the cab is provided.



A



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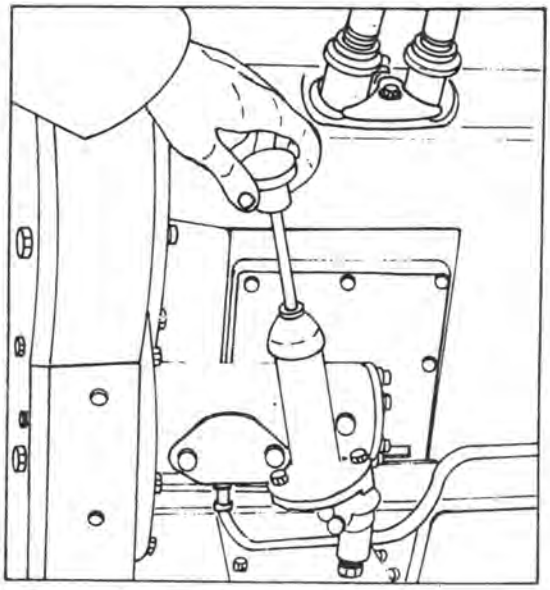


C

Figure 22. Method for priming fuel system.

(2) *Operation.*

(*a*) Open the compression release by moving the lever to "start" position.

(*b*) Press the engine start button. Hold in this position until the engine has acquired the highest possible momentum and then move the compression release to the "run" position. Continue to press the engine start button until engine fires.

Caution: **If the engine does not start after approximately 30 seconds, release the start button. This indicates fuel is not being delivered to the injectors. Determine the cause (par. 111) before further attempts at starting are made.**

c. Extreme Cold Weather Starting. Refer to paragraph 93 for starting the engines under extreme cold weather conditions.

52. Stopping Engines

a. Normal Stop.

(1) Place the throttle in "idle" position and reverse lever in "neutral" position. Idle the engines for five minutes to allow even cooling.

(2) Push engine stop button or pull engine stop lever and hold firmly until engine stops (par. 22*b*).

(3) Move the control and auxiliary generator circuit breakers to "off" position.

(4) Open the main battery switch and ap-

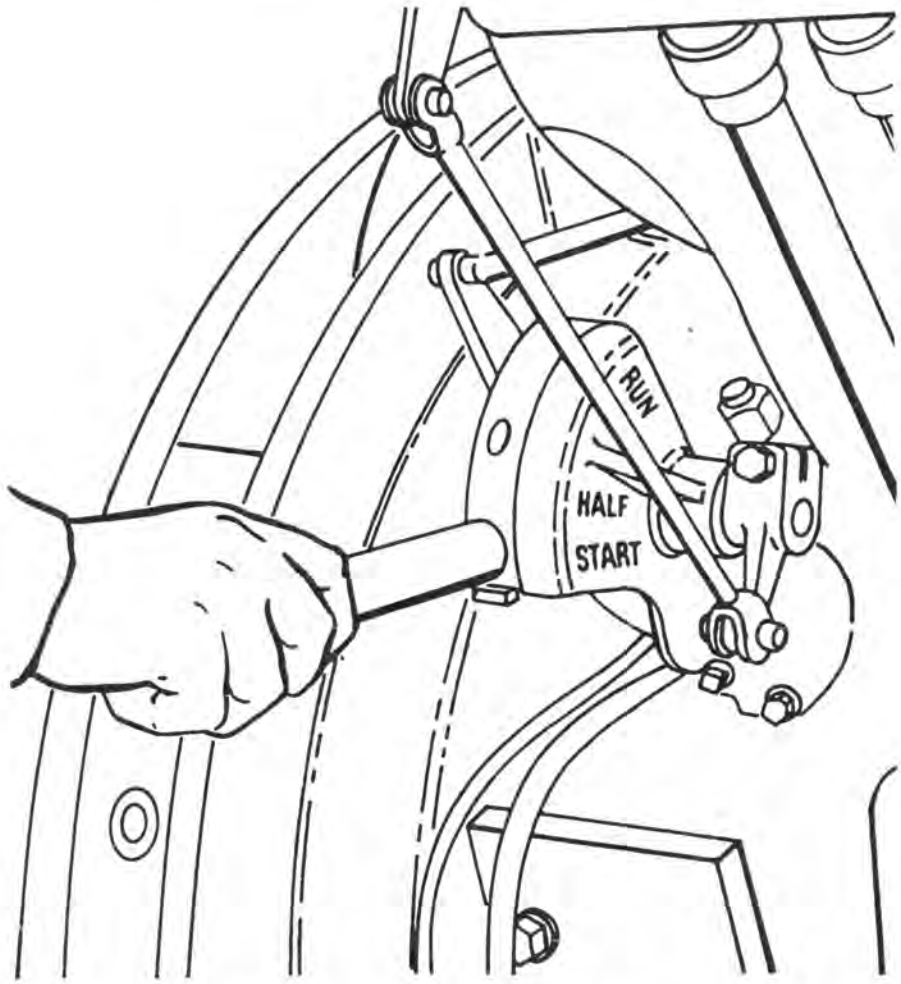


Figure 23. Compression release lever in start position.

ply the handbrake if the locomotive is to be taken out of service.

b. Emergency Stop. To stop the engines in an emergency, pull the emergency fuels trip rings (1, figs. 20 and 21). This will trip the emergency fuel shutoff valve and starve the engine of fuel. The fuel shutoff valve will have to be reset manually (par. 43c) before the engine can be restarted.

53. Precautions Before Moving Locomotive

a. Check the automatic and independent brake valves for proper operation in the application and release positions (par. 13). Visually observe if the brake shoes are being applied and released.

b. Check that the pressure in the main reservoir is between 105 and 115 p.s.i. Check that the control air pressure is 80 p.s.i.

c. Check that brake pipe and equalizing reservoir pressures register 70 p.s.i.

d. The engine water temperature gage should register 120° or more.

e. Be sure the horn, sanders, bell ringer, headlights and windshield wipers are functioning properly.

f. See that the traction motor blower is operating properly, as a locomotive must not be operated unless the traction motors are adequately cooled.

54. Pre-operational Air Brake Test

To insure that the air brake system is functioning properly, perform the following tests before any attempt is made to move the locomotive:

a. Test Number One. With the air system fully charged, note whether a leak occurs at the service exhaust port of the automatic brake valve. This leak can be noted when the automatic brake valve handle is in the "running," "holding," or "lap" positions. Leakage at this point indicates that the equalizing discharge valve is leaking. If this leakage is due to foreign matter on the valve seat, it can usually be displaced by closing the cutout cock, then making a heavy service application and returning the handle to "running" position. This heavy blow of air caused at the exhaust fitting usually removes the obstacle and allows the equalizing piston to seat.

b. Test Number Two. Open the cutout cock and move the automatic brake valve handle to "service application" position and allow it to remain there until brake pipe pressure is entirely exhausted as indicated by the air gage. Return handle to "lap" and note if there is leakage at the rotary valve. This leakage, will be indicated as follows:

(1) Increase of brake pipe pressure will cause a blow at service exhaust fitting.

(2) Increase of equalizing reservoir pressure will cause equalizing reservoir gage hand to so register.

(3) Increase of pressure in the application chamber of the distributing valve will cause an increase in brake cylinder pressure or an intermittent blow at safety valve.

c. Test Number Three. Make a partial "service" application with the independent brake valve then "lap" the valve. If the brake cylinder pressure increases up to the amount for which the reducing valve is adjusted, it indicates leakage of the independent rotary valve. If brake cylinder pressure increases to brake pipe pressure, it indicates leakage of the distributing valve equalizing slide valve.

d. Test Number Four. Make an automatic brake "service" application and note if locomotive brakes release. If brakes release, air is leaking from the application cylinder or application cylinder pipe. Leakage at the brake cylinder exhaust port of the distributing valve when the locomotive brakes are applied, indicates a leaky exhaust valve. An increase of pressure above that put into the brake cylinder at the time of the application or blowing of a safety valve, indicates that the application valve is leaking. A blow at the exhaust port of the automatic portion of the brake valve when the handle is in the "running" position indicates leakage past the equalizing slide valve.

e. Test Number Five. To test for a leaky graduating valve, make a "service" application of twenty pounds and return the automatic brake valve handle to "lap" position. Leakage

can be detected by an increase of brake cylinder pressure as indicated by the air gage.

Note. If the locomotive fails to pass any of the above tests, notify maintenance personnel and report on daily inspection worksheet (par. 2).

55. Moving Light Locomotive

a. Start the engines as prescribed in paragraph 51.

b. Release the handbrake.

c. Move the reverse lever to "forward" or "reverse" position depending on the direction of travel (the reverse lever must not be moved unless the locomotive is standing still).

d. Depress the deadman safety control pedal (if equipped) and release the brakes.

e. Be sure track ahead is clear and open the bell ringer valve.

f. Open the throttle lever and hold until the load indicating meter registers power. It requires about 4 seconds for circuits to close.

g. When the load indicating meter registers power, slowly advance the throttle lever until the desired speed is obtained.

h. Note that the locomotive rolls freely, and use care in judging speed (maximum speed limit of 35 m.p.h. must be observed).

56. Stopping Light Locomotive

a. Normal Stop.

(1) Reduce the throttle until the load ammeter indicates that the current has dropped.

(2) Then move the throttle to the "idle" position, and apply the independent brake valve by moving the handle to the right, away from release position. The amount of application depends on the length of time the handle remains in "slow" or "quick" application.

(3) Release the deadman safety control pedal (if equipped) after the brakes have been applied and the locomotive has come to a stop.

b. Emergency Stop. Move the throttle lever to the "idle" position and the independent brake valve to the "quick application" position.

57. Reversing Light Locomotive

a. Stop the locomotive (par. 56).

b. Move the reverse lever to the opposite direction.

c. Release the brakes and advance the throttle lever in the normal manner.

Caution: **Do not move the reverse lever while the locomotive is in motion. Do not drift in one direction with the reverse lever set in the opposite direction. Serious damage to the electrical equipment may result if this rule is disregarded.**

58. Makeup of Trains

Before departing from any terminal, the operator will know the makeup of the train he is operating. Operators will acquaint themselves with the number of cars in the train and the location of loads and empties.

59. Coupling to Train and Pumping Up Air

a. Stop a safe distance from the head car or other unit, until it is determined that knuckles are open, and couplers are properly aligned.

b. After coupling to train, stretch coupling to insure that couplers are locked.

c. If the train has been coupled to a yard line, the train's air system has already been charged.

d. Couple air hose, and open angle cocks slowly.

e. When the train's air system has not been charged by a yard line, and the main reservoir pressure falls below the feed valve setting when the brakes are cut in, proceed as follows:

(1) Move throttle lever to the "idle" position.

(2) Move reverse lever to the "neutral" position.

(3) Advance the throttle lever slowly until the required pumping rate is reached (as main reservoir pressure builds up, reduce the throttle).

60. Starting Train

a. General. Starting a train depends largely on the grade and weather condition, as well as the type, length, weight, and amount of slack. A brake test will be made to determine if all

brakes are functioning properly in the "application" and "running" positions, and that no handbrakes are set prior to starting.

b. Releasing Brakes and Starting.

(1) Move the reverse lever to the desired direction of travel.

(2) Open the bell ringer valve.

(3) Depress the deadman safety control pedal (if equipped).

(4) Place the independent brake valve in "running" position and the automatic brake valve in "running" position.

(5) Do not attempt to start the train until ample time has been allowed for the brakes to release. After moving the automatic brake valve handle to "running" position, wait until the time shown below has elapsed:

With train of—	*Wait—*
20 to 60 cars	One minute
60 to 80 cars	Two minutes
80 to 100 cars	Three minutes
100 to 120 cars	Four minutes
120 to 140 cars	Five minutes
140 to 160 cars	Six minutes

(6) After brakes have been released, advance the throttle lever one notch at a time, every one or two seconds. On a level track, the locomotive may start the train in the first or second notch. It is generally unnecessary to go above the fourth notch, but experience and percent of grade will govern this situation. When pulling a train, leave the throttle in each notch for a few seconds to allow gradual acceleration.

(7) A smooth acceleration is obtained by opening the throttle lever one notch each time the pointer on the loadmeter begins moving to the left; this tends to keep a steady pull on the train during its acceleration.

61. Wheel Slipping

a. If wheel slipping occurs, reduce the throttle lever until wheel slipping stops, then apply sand and slowly open the throttle lever.

b. Under extreme rail conditions (excessive grades, rain, ice, or snow) repeated and consecutive slipping may occur. In these instances, reduce the throttle lever to a position which will apply the maximum power permissible without causing slipping.

c. Sand is a preventive, not a corrective measure. Use sand sparingly, and never apply sand while the wheels are slipping as this could cause a broken traction motor gear.

62. Wheel Sliding

If wheel sliding occurs, the engine crew must make an immediate investigation to determine the cause. The wheels may be sliding due to a locked brake, a broken gear tooth wedged between the reduction gear, and the like.

63. Load Limits

a. Keep within proper load limits as shown on the dial of the load ammeter, which has both a colored band scale and an ampere scale. The ammeter is connected to measure the output of the main generator. Any reading of the load ammeter in excess of the continuous rating constitutes an overload.

b. Each segment of the band shows the allowable load time limits which may be carried by the generator and motors connected in parallel with it. As shown on the dial, operation in any ONE of the overload ranges for the time specified is permitted. When the time limit for that range is reached, the generator and motors have reached their maximum allowable temperature, and to avoid severe damage by overheating, must be allowed to dissipate the excess heat by one of the following methods:

(1) Allowed to cool with load cutoff and engine idling for a period of 15 to 30 minutes, (after which, operation in any one of the overload ranges as specified on the dial, is again permitted with cooling period to follow).

(2) Load may be reduced to "continous range" on the dial, and operation continued in this range.

64. Ground Relay Action

a. If a ground occurs in the electrical equipment, the ground relay will trip and the engine will be returned to "idle."

b. When the ground relay is tripped, the trouble may be remedied as follows:

(1) The ground relay may be energized by

some temporary condition in which case it may be reset (par. 39) and normal operation may then be resumed.

(2) If the ground persists, move the locomotive into the clear. Report this condition on the daily inspection worksheet.

(3) Repeated tripping of the ground relay, accompanied by unusual noises, such as continuous thumping or squealing, may also be an indication of serious traction motor trouble that must be investigated at once.

65. Running Over Railroad Crossing

When running over railroad crossings, reduce the throttle lever to avoid excessive jarring of gears and electrical pitting of commutators.

66. Overcharge of Brake Pipe Pressure

If the automatic brake valve is allowed to remain in "release" position, an overcharge of brake pipe pressure may occur. If this happens enroute, adjust the feed valve to the overcharged pressure to insure proper release of the brakes. Maintain this pressure to the next terminal where the auxiliary reservoir pressure on the cars will be reduced. The feed valve must then be adjusted to the type of service in which the locomotive is operating.

67. Handling Independent Brake Valve

a. The independent brake must be applied to prevent the locomotive from moving while taking fuel and water, and always left in "slow application" position when leaving the locomotive.

b. In "release" position, if brake does not release promptly, this indicates equalizing piston of distributing valve is in "lap" position. To release, make a "kick off" with the automatic brake valve by moving the handle quickly from "running" position to "release" and return to "running."

68. Service or Emergency Application of Brakes From Train

a. When the brakes apply automatically from the train at a service or emergency rate of reduction, as shown by the brake pipe pressure falling gradually or rapidly to "zero," place the automatic brake valve handle in "lap" position to prevent the escape of main reservoir pressure, and leave it in that position until train stops. Move throttle to idle position. Use sand until train stops.

b. Place the independent brake valve in "release" position to prevent brakes from applying on the locomotive and possibly sliding and flattening the wheels. Approximately 100 feet before stopping apply the independent brake to avoid runout of slack as the train stops.

c. After stopping, wait two minutes, then place automatic brake valve in "release" position for 30 seconds up to 75 cars; 45 seconds with 75 to 100 cars, and one minute with 100 cars or more, then move to "lap" position.

d. If the brake pressure falls to "zero" this indicates an air hose is leaking or parted or brake pipe is broken in which case, move the brake valve to "running" position to provide pressure for trainmen to locate defect. If brake pipe is not broken or hose parted, place brake valve in running position to release brakes.

69. Handling Throttle After Brake Application

With a "service" application of the brakes, gradually reduce the throttle as the speed decreases. After an "emergency" application of the brakes, immediately move the throttle to "idle."

70. Reducing Speed on Curves and Downgrades

a. General. The operator must acquaint himself with the speed restrictions on downgrades and curves in the territory in which he is operating.

b. Curves. To obtain the smoothest operation on curves, reduce speed to the limit permitted by speed restrictions, and release brakes just before entering the curve. As brakes are released, regulate throttle to maintain the permissible speed and to keep train stretched while rounding the curve.

c. Downgrades.

(1) Before entering downgrades, reduce

speed to that permitted for safe operation, and follow the rules listed below:

(a) When braking train for slow down, use power to hold slack stretched. Make a five pound braked piped reduction with automatic brake, keeping the independent brake fully released.

(b) After slack is adjusted, further brake pipe reductions may be necessary.

(c) Reduce power to ⅓ throttle position.

(d) If brake pipe reduction indicates excessive leakage and slack action is severe, do not make a running release. Close throttle and come to a stop before releasing.

(e) If necessary to stop, make a final reduction of six to eight pounds approximately 40 feet from stopping point, allowing locomotive brake to apply with final reduction.

Caution: **Under no condition, either after a stop or slow down has been made, will the brakes be released on less than 100 cars with less than a 15 pound total brake pipe reduction or 100 cars or more with less than a 20 pound full service reduction.**

(2) Where tonnage of the train and distance and percent of down grade will not permit the operation of the train at a safe speed, take the following steps:

(a) Bring train to a complete stop before entering the downgrade.

(b) Release brakes on train, and apply independent brake on locomotive.

(c) Notify trainmen to place retainer valve handles on several cars in "holding" position. (This will hold the brakes applied on these cars, and will not slide the wheels.)

(d) This operation will premit the operator to move automatic brake valve handle to "running" position after "service" application, thus giving ample time to recharge train brake system, without losing control of train speed.

71. Running Release

When releasing brakes while running, it is imperative to know that ample time is available to recharge auxiliary reservoirs on the cars in the train before reapplying brakes.

72. Service Braking

a. In making stops from 15 or more miles per hours, apply the train brakes with an initial brake pipe reduction of eight pounds, keep locomotive brakes released.

b. After train slack has become adjusted, reduce throttle just enough to keep slack stretched as speed decreases.

c. Begin braking a sufficient distance from the actual stopping point, so that not more than fifteen pounds total brake pipe reduction will make the stop. In order to avoid slack "runout" at the stop, when 100 feet from stopping point, move throttle lever to "idle." When approximately forty feet from stopping point, make an additional six to eight pound reduction. Use sand for the last few car lengths and allow locomotive brake to set with the final reduction.

d. The final reduction will not be made earlier that specified in *c* above. If this rule is disregarded, slack will move in and out, thus defeating the purpose of the final reduction and inviting break-in-two's.

73. Braking With Power

When braking with power for any given throttle lever position, the draw bar pull rapidly increases as the speed decreases. This pull might become great enough to part the train, unless the throttle lever is reduced as the train loses speed. Since the loadmeter indicates the pull of the locomotive, a constant pull can be maintained on the train during a slow down, by keeping a steady amperage on the loadmeter. This is accomplished by consecutively reducing the throttle lever a notch, whenever the amperage starts to increase. The independent brake must be fully released during power braking. The throttle lever must be in "idle" position before the locomotive comes to a stop.

74. Emergency Stop

Should it become imperative to stop the train in the shortest possible time (to save life, or avoid an accident), move the automatic brake valve handle quickly to the emergency position. Sand the rails, and move the throttle lever to "idle" position.

Caution: **Before resuming operation after an emergency brake application, make an inspection of the equipment for possible damage. Make sure all brakes apply and release properly.**

75. Stopping Train, Loads Ahead

Trains composed of loads ahead and empties behind can be properly handled as described in paragraph 72, provided sufficient power is used to keep the slack well stretched during brake action with the locomotive brake released. The object is to have the train stretched at the time brakes shoes start to adjust slack action.

76. Stopping Train, Loads Behind Empties

Trains made up in this manner are the most difficult to handle smoothly. Utmost care must be taken while adjusting the slack prior to, and during the stop. Stop must be made by graduating "off" on the throttle allowing slack to bunch and permitting locomotive brake to apply. Close throttle when 100 feet from stop. Make final brake pipe reduction when 40 feet from stop as described in paragraph 72.

77. Stopping Train From Slow Speed

When stopping train from speed (below fifteen miles per hour) with slack stretched, make an initial brake pipe reduction of eight pounds with automatic brake valve. Keep locomotive brakes released with independent brake valve. This action may be followed with a further reduction of two pounds, if needed. At 100 feet from stopping point, move throttle to "off." At 40 feet from stopping point, make a final reduction allowing locomotive brakes to apply. After stopping, complete a "full" service reduction of twenty pounds.

78. Making Stop in Back-up Movement

a. Apply brakes lightly, using necessary power until stop is made, keeping locomotive brakes released.

b. If grade conditions are such that there is a possibility of slack running out and breaking train "in two," a sufficient number of handbrakes should be applied at rear of train to prevent damage.

79. Slack Action and Rough Handling

a. The manner in which an operator starts, drifts, and stops his train, and how he keeps the train's slack bunched or stretched under varying conditions of load and empty makeup of the train, how he handles his air on downgrade reductions, all have a tremendous bearing on the efficient life of the locomotive, its traction motors, drivers, drawgear and braking equipment. These same factors also have a direct bearing on defects occurring in the draft and running gear of the rolling stock being handled by the locomotive.

b. Couplers are either jerked out or driven in by sudden and violent slack changes. There are two kinds of slack, loose slack and spring slack, which work together.

(1) Loose slack is that which can be run in or out without compressing draft gear springs.

(2) Spring slack is the additional amount that can occur when the springs are compressed, and helps drive all slack in the opposite direction.

c. When slack runs in or out rapidly, one part of the train attains a lower speed than the other and damaging shocks result from the draft gear having to suddenly make the speed of the entire train uniform the instant the slack is all "in" or all "out."

d. How heavy the shock will be, depends mainly on the difference in speed that must instantly be made uniform, and on the weight that must suddenly be altered in speed. Weight is important, but a change in speed is more so. A sudden change in speed of two miles per hour will cause a shock four times that of one mile per hour, a change of three miles, nine times, four miles, 16 times and so on.

e. Trains often part by a runout of slack in which the air hose is not parted when the stop is made, but as soon as the train is started, the air hose parts and the brakes set in emergency. The majority of trains parting occurs by a

runout of slack as speed is reduced, usually at speeds ranging from ten miles per hours to a stop. Therefore, the greatest care in train handling is necessary within this speed range, particularly with long trains.

f. Slack action is a normal condition, and changes in slack must necessarily occur in handling. However, in service braking, by proper use of power, train and locomotive brakes, damaging shocks can be avoided. The operator must know the makeup of the train, the grade condition, anticipate the slack action, and handle the brakes and throttle in such a manner as to reduce, if not entirely eliminate harsh slack action.

g. The brake is less effective at high speed that at low speed. If speed is low, brake application must be light to avoid slack action. If speed is high, the slack action is less in applying and releasing brakes.

80. Cutting Off Locoomtive With or Without Cars

a. When the locomotive is to be cut off or the train is to be separated, leave the brakes applied with a "full service" application.

b. On completion of the "full service" reduction, give one short blast of the whistle to inform the trainman they may close the angle cocks and cut off the locomotive or cars. This is very important to prevent brakes sticking at the rear of train, and to prevent cars moving on grades.

81. Yard Switching To Prevent Damage To Lading and Equipment

a. Kicking Cars.

(1) The impact produced by coupling can be controlled to such a degree that there will not be a perceptible shock.

(2) Do not "kick" cars with a speed too high to control the coupling impact, so as to avoid displacement or damage to the lading and equipment.

b. Shocks in Switching.

(1) When a standing car is struck at a speed of two miles per hour, the shock or destructive effects is four times the shock of destructive effect of a speed of one mile per hour. The following outline gives the destructive force when coupling to a standing car at speeds from three to ten miles per hour:

At a speed of—	*Shock or destructive effect is—*
3 miles per hour	9 times that of one mile per hour
4 miles per hour	16 times that of one mile per hour
5 miles per hour	25 times that of one mile per hour
6 miles per hour	36 times that of one mile per hour
10 miles per hour	100 times that of one mile per hour

(2) Impacts at four miles per hour (average walking speed) are generally absorbed by the draft gear. At above four miles per hour, the draft gear goes solid.

(3) Impacts above four miles per hour must be avoided as the shock is absorbed by the car and the lading, resulting in damage to the cars, lading, or both.

c. Handling Throttle.

(1) Considerable damage results from improper handling of the locomotive when coupled to a "cut" of cars with the slack stretched.

(2) Open the throttle gradually when pushing the "cut" as a sudden opening of the throttle results in the locomotive reaching a speed of four to six miles per hour before the free end of the "cut" starts to move.

(3) Likewise, with the slack bunched, the throttle must never be opened suddenly when pulling the "cut." To do so results in the cars at or near the end of the "cut" being severely jerked, producing shocks of such magnitude that there is a complete draft gear failure with resultant damage to car structure and lading.

(4) When "shoving in" on a track with a "cut" of cars, never open the throttle suddenly just before coupling is made with other cars on that particular track, as damaging shocks between the point of coupling and the locomotives are the result.

(5) The previous movement determines whether the slack is bunched or

stretched. Jerking the throttle open or applying the locomotive brake suddenly are unnecessary when making subsequent movements.

d. Making Reverse Movement. After making a stop the slack is bunched or stretched. In making a reverse movement do not practice coming to a stop and then losing time reversing the engine and releasing the brake. While this is being done, the slack is again settling in the "cut" and more time is lost and damaging shocks produced to readjust slack for subsequent movement. The brake should be released and the locomotive reversed at the moment of stopping.

e. Operating Independent Brake.

(1) In operating the locomotive brake, apply quickly, but not heavily in order to bunch or stretch the slack moderately, after which apply the brake as heavily as required.

(2) If the brake is applied gradually, it greatly delays the time in which the slack is taken when cuts are made.

(3) As speed reduces, reduce brake cylinder pressure to avoid sliding wheels as the stop is made.

82. Inspection Checks During Operation

a. Check the engine lube oil pressure. The gage should read between 15 and 20 p.s.i. with engine idling and between 30 and 35 p.s.i. with engine running at maximum speed.

b. Check the engine temperature gage. It should read between 160° and 180° F.

c. Check the air pressures they should be maintained as follows:

(1) Main reservoir pressure 105 to 115 p.s.i.

(2) Control air pressure 80 p.s.i.

(3) Equalizing reservoir and brake pipe pressure 70 p.s.i. with brake released.

(4) Brake cylinder pressure zero with brakes released.

d. Observe that the battery is being charged as indicated by the battery ammeter (par. 28).

e. Check the reading of the load ammeter (par. 26).

83. Multiple Unit Operation

a. Description. Two or more locomotives equipped for multiple unit operation may be handled by a single operator if connections are properly made. In addition to the conventional coupling of locomotive drawgear and air lines, the electrical control circuits of the locomotives must be connected. A jumper for this purpose must be firmly plugged into the receptacles at the end of the locomotives. The controls are then set so that the power and the brakes on all locomotives are controlled from only one cab. The locomotive from which the operation is controlled is called the leading unit, and any coupled locomotives are called trailing units. Certain alarm and protective devices, and certain auxiliary controls such as sanding, are connected through the jumper, but the power plants and heavy duty circuits of the coupled units remain entirely independent of each other.

b. Coupling.

(1) Couple the units together mechanically in the usual manner.

(2) Connect the air lines and couple the locomotive electrically by means of the train line jumpers, making sure that each plug is pushed all the way into the receptacle and locked in place.

(3) If the locomotives have been coupled under their own power, open the control switch on all trailing units as soon as the electrical jumpers have been connected (if shut down locomotives are coupled by a pusher, engines are started as indicated in *c* below, after other connections are completed).

(4) Open the cocks at the ends of air lines between the units.

(5) Set other controls on trailing units as follows:

(*a*) Double-heading cock in "trailing" position.

(*b*) Automatic brake valve in "lap" and independent brake valve in "running" position. Remove the handles.

(*c*) Reverse lever in "off" and remove handle.

(*d*) Electrical switches are set as directed in *c* below, for trailing units.

c. Operation. In multiple-unit operation, all connected locomotives are controlled from one cab, *a* above. The controlling locomotive is handled in the same manner as operating a single unit. On all trailing or noncontrolling units, the throttle is kept in "idle" position, and the reverse lever removed. The engines on each unit must be started by pressing the start button on that unit, with the throttle in the "idle" position.

d. Changing Operating Cab.

(1) In the cab which has been controlling:
  (*a*) Make a 20 pound reduction with automatic brake valve.
  (*b*) Place double-heading cock in trailing position.
  (*c*) Remove handles (*b* (5) above).

(2) In the cab which will be controlling:
  (*a*) Insert brake valve handles. Independent valve must be in "application" position, and automatic valve in "running" position.
  (*b*) Insert reverse lever.
  (*c*) Place double-heading cock in "lead" position.
  (*d*) Close control switch.

(3) Return to former controlling cab and open control switch.

84. Double Heading

a. In double-heading, power is controlled by the throttle on each locomotive independently, jumpers are not connected as in multiple unit operation.

b. On the trailing locomotive place the double-heading cock in "closed" position. Place the automatic brake valve in "running" position, and the independent brake valve in "running" position. Brakes on the trailing locomotive then function the same as those in the train.

85. Securing Locomotive for Layover

a. Stop the Diesel engines in the usual manner (par. 52).

b. Open the control switch and battery switch.

c. Take precautions against coolant freezing in cold weather (par. 93).

d. Set handbrake.

e. If the locomotive is to be left standing outside, cover the exhaust stacks when there is danger of a severe rain or snow.

f. Plug in the coolant preheater (par. 92).

Section IV. OPERATION OF AUXILIARY EQUIPMENT

86. Cooling System

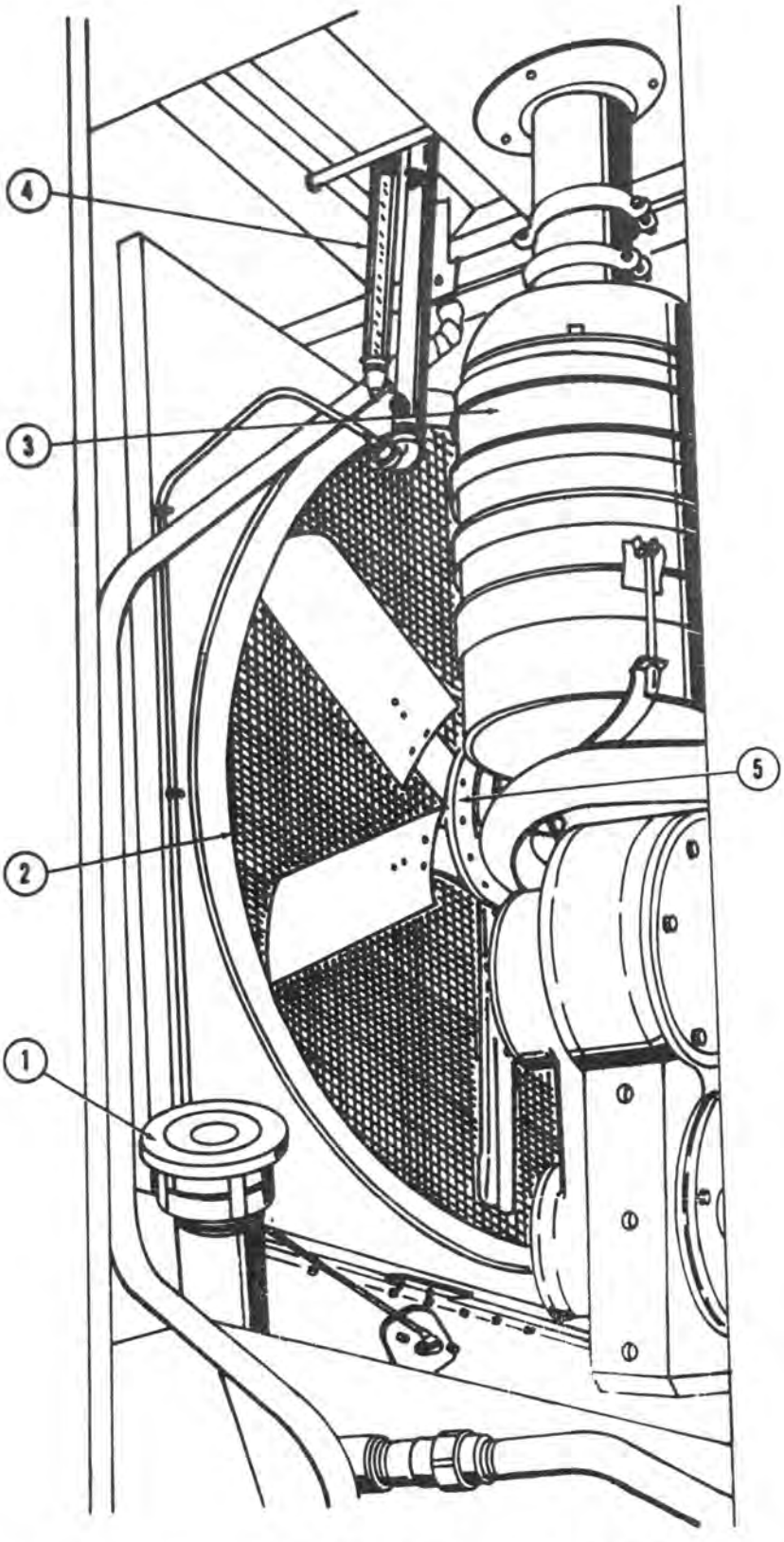
a. Description.

(1) The gear driven centrifugal-type pumps draw the coolant from the radiator bottom tanks into the block of the diesel engines. The coolant is then circulated around the cylinder walls, and passes up into the cylinder heads. It then passes through the water manifolds connected to the radiator top tanks. After the coolant passes through the radiators it returns to the water pumps.

(2) Water circulating through the radiator tubes is cooled by the air which the fan forces through the radiator cores. The volume of air for cooling purposes is dependent on the position of the shutters. When the system is below operating temperature the coolant bypasses the radiators, by action of the thermostats which remain closed until proper operating temperature is reached (170° F.). The thermostats then start to open and allow the coolant to circulate through the radiators.

b. Operating Water Level. It is important that the cooling system always be kept full. Check the coolant before and after each operating period by observing the height of the water in the water glass (4, fig. 24). On locomotives not equipped with a water glass, water can be checked by opening two petcocks located in approximately the same location.

Caution: **Never operate the engines if the coolant can not be seen in the water glass or will not flow from the two petcocks. Progres-**



1 Oil filler pipe 2 Radiator 3 Engine air cleaner 4 Water glass 5 Cooling fan

Figure 24. Front view of engine room compartment.

sive lowering of water indicates a leak in the system, and must be reported on the daily inspection worksheet (par. 2).

c. Filling System. Fill the system through the filler cones located under the platform on each side of the locomotive (fig. 25) as follows:

(1) Place a hose in the cone and use pressure to force the coolant into the system. Use clean naturally soft or treated water. When the system is full, excess water will run out of the cone on the opposite side of locomotive. A filler pipe is located on top of the engine, over the radiator, for filling with a bucket or when adding antifreeze solution.

(2) If the cooling system of a hot engine has been drained, do not refill until engine cools. The sudden change in temperature might crack or warp the cylinder liners and heads. After a sufficient cooling period has elapsed, fill the system and start the engine. Run several minutes, this will eliminate any air pockets. Shut down engine and add more coolant as necessary.

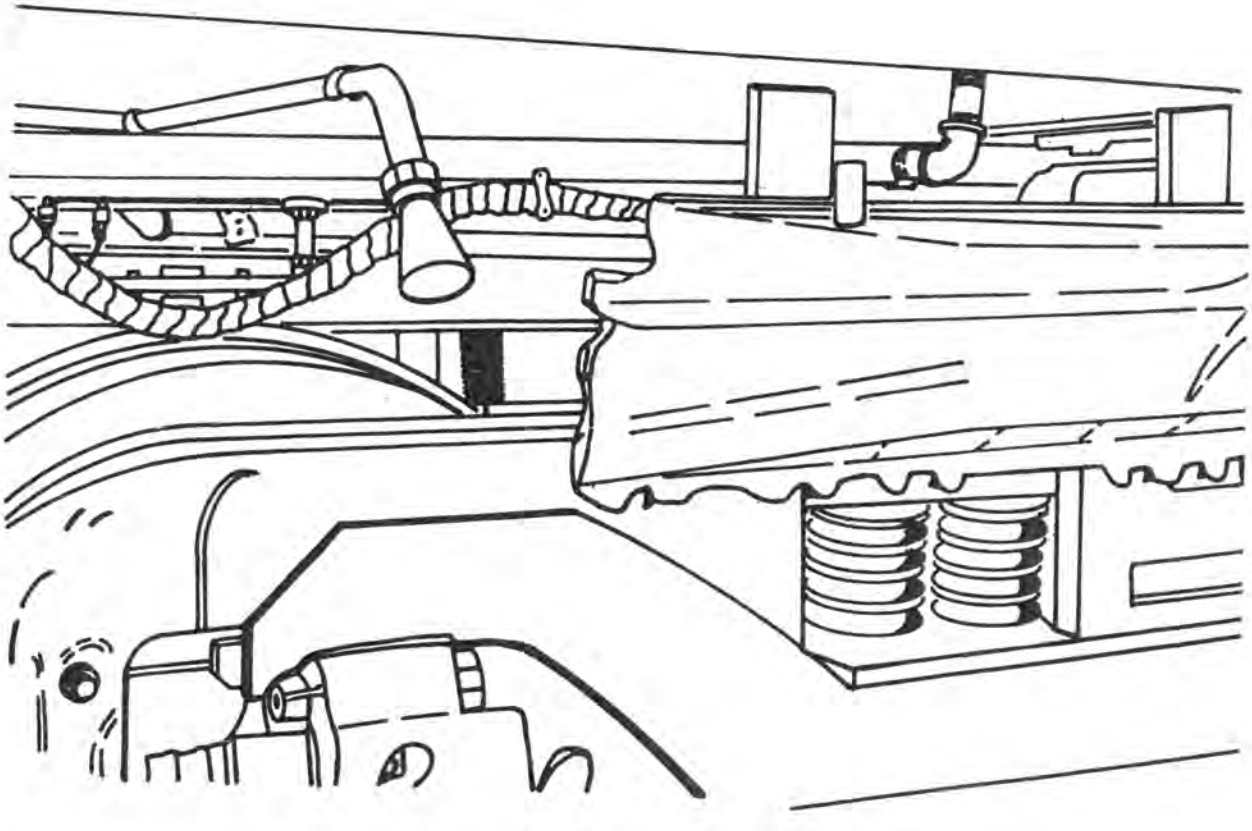


Figure 25. Radiator filler cone.

d. Draining the System (fig. 26).

(1) Remove drain plugs from the radiator bottom tank and radiator outlet pipe.

(2) Remove drain plug (1) from compression release lever bracket.

(3) Remove drain plug (2) from the right lower water manifold.

(4) Remove drain plug (3) from front of fuel filter housing.

(5) Remove drain plug (4) from the water pump.

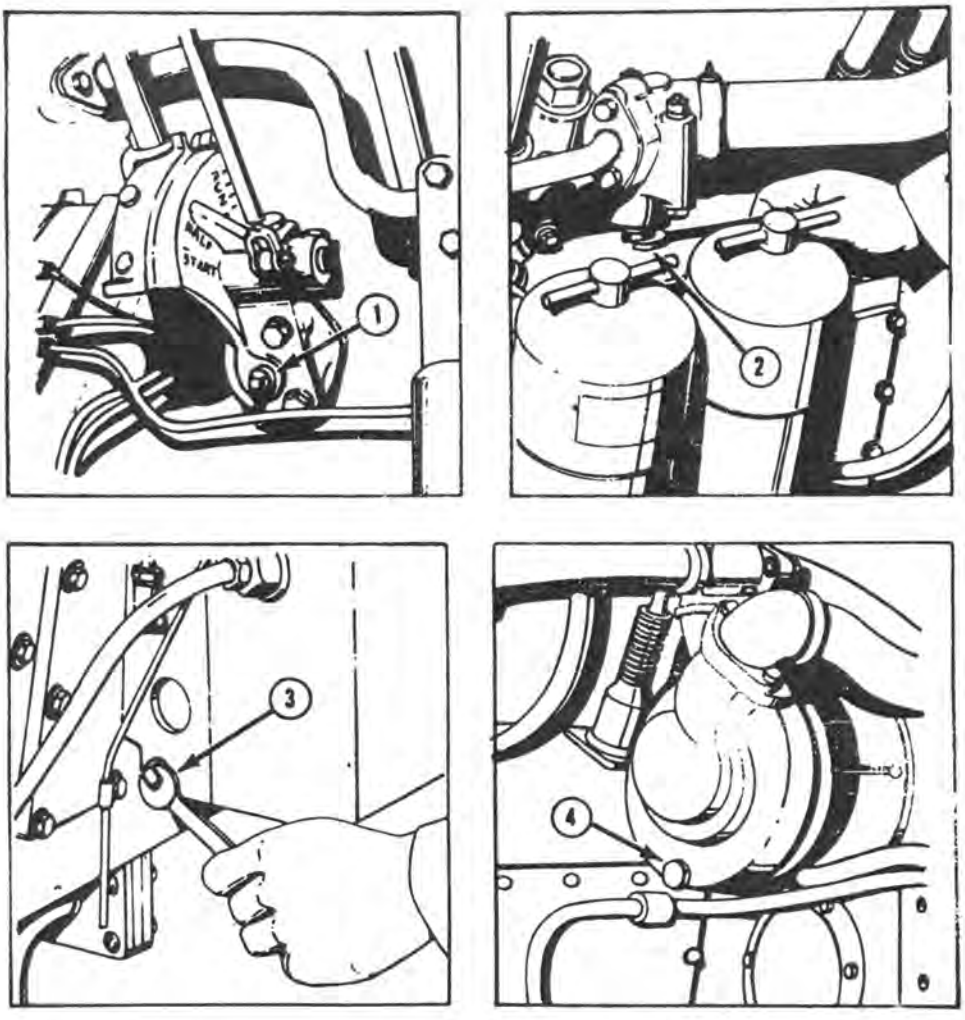
(6) Open main engine drain valve (2, fig. 27) located near the floor on the left side of the engine.

87. Lubricating System

a. Description.

(1) An, externally mounted oil pump assembly consisting of a scavenger pump and a pressure pump is mounted on the right rear side of the timing gear housing. The pump is driven by the right camshaft gear.

(2) The pressure pump draws oil from the supply tank and delivers the oil into the pan. An oil pressure control bypass valve mounted in the oil pan controls the amount of oil to be bypassed into the lower sump. Oil is



1 Drain plug in compression release bracket
2 Engine water manifold drain plug
3 Fuel filter housing water drain plug
4 Water pump drain plug

Figure 26. Cooling system drain plugs.

then delivered to the working parts of the engine from the oil pan by forced feed. Filters and oil cooler are provided to filter and cool the oil prior to entering the engine working parts.

(3) After the oil has been delivered throughout the engine for lubrication, it drains into the oil pan and settles in the upper sump. The oil then drains down an overflow pipe and into the lower sump. The scavenger pump picks up the oil from the lower sump and delivers it to the supply tank, thus completing the oil circuit.

b. Oil Pressure. When the engine is warn and running at rated engine speed, the lube oil pressure gage should register aproximately 38 p.s.i. A lower pressure reading (approximately 15 p.s.i.) is normal at low idling speeds. If for any reason the oil fails to register, the engine must be stopped immediately and the condition reported to the maintenance personnel.

c. Oil Level. A bayonet type gage (5, fig. 27) is provided for making daily lube oil checks. The oil level will be maintained at the "full mark" graduation on the gage with the engine running at idle speed and the locomotive on a level track. Add oil through the oil filler pipe (1, fig. 24) located just below the radiator at each end of the locomotive.

88. Fuel Oil System

a. General.

(1) Fuel is drawn from the fuel tank by the fuel transfer pump (3, fig. 27) and is delivered under pressure into the lower chamber of the fuel filter housing. The fuel is filtered as it passes through the filter elements into the upper chamber of the filter housing.

(2) From the upper chamber the fuel is transmitted to the fuel supply manifold in the fuel injection pump housing. From this manifold the fuel is supplied by separate passages to the individual fuel injection pumps.

(3) The fuel injection pumps meter and force the fuel through the individual fuel injection valves at the proper time. The fuel is then discharged into the precombustion chambers where it is ignited and admitted into each individual cylinder. Overflow from the fuel injection valves is returned to the fuel tank by the fuel return lines.

b. Draining Fuel Filter Housing. Periodically drain the sediment and water that settles in the bottom of the housing as follows:

(1) Remove the filter housing drain plug (3, fig. 28).

(2) Open the upper and lower vents (1) and (2).

(3) After the accumulation of sediment and water have been drained; replace the drain plug and prime fuel system (par. 50*b*).

c. Filling Fuel Tank (fig. 29). The fuel tanks are filled through the filler openings, located in front of the cab, above the running board on each side of the locomotive. To prevent overfilling, observe the fuel indicating gage frequently.

Caution: **Never fill the fuel tank near an open flame.**

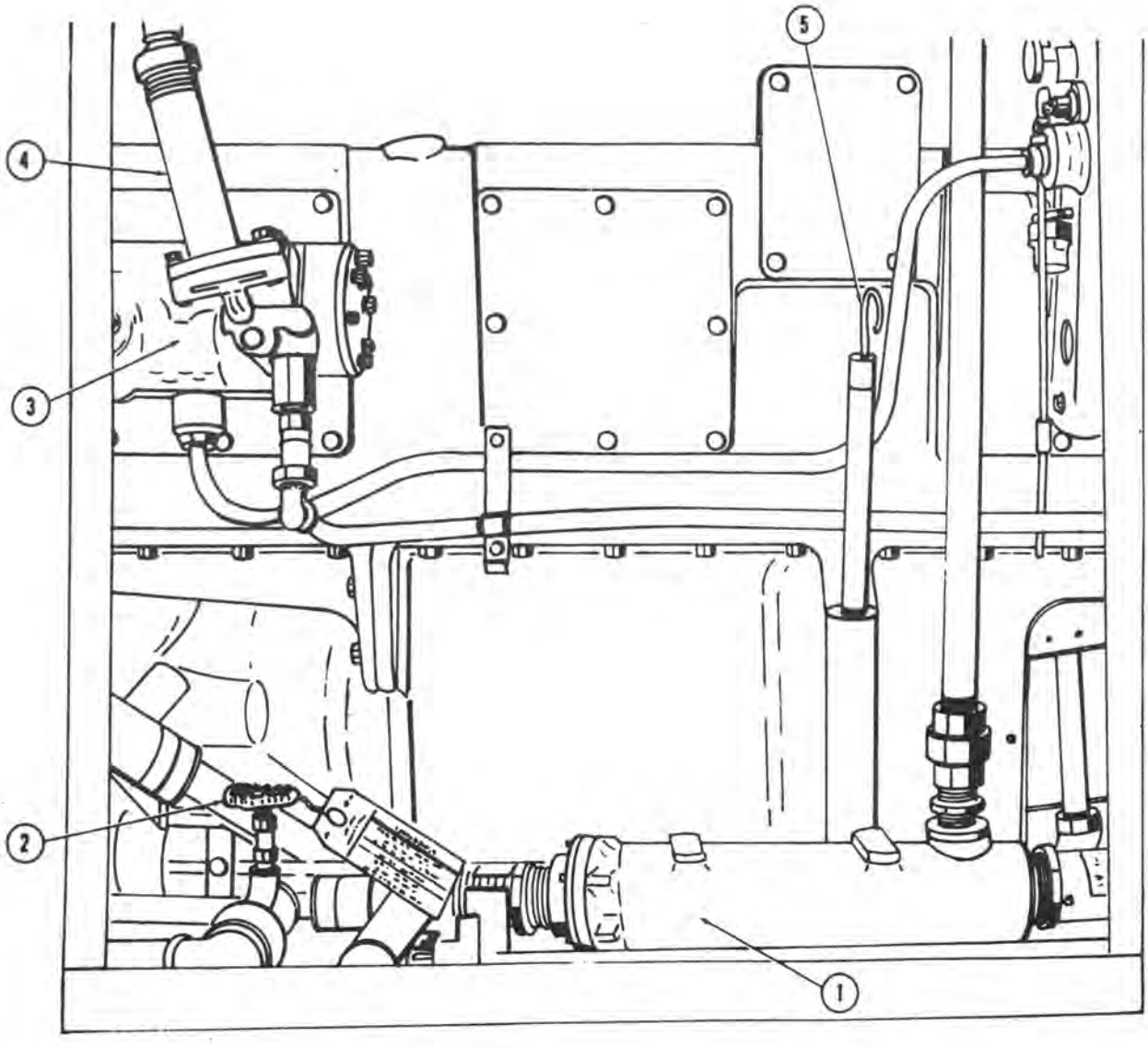
d. Emergency Fuel Shutoff Valves.

(1) An emergency fuel shutoff valve (fig. 18) is located near the fuel tank in the suction line leading to each engine. These valves are spring loaded and are normally latched in the open position. The valves can be closed by pulling any of the three triangular shaped pull rings (par. 43*b*). Closing the valves stops any further flow of fuel oil from the storage tank to the diesel engines. The valves will be tripped only in case of emergency.

(2) To reset, the valve must be forced upward until the tripping handle is allowed to rest on the valve body (par. 43*b*).

89. Air Compressor

a. General. The two air compressors operate against a reservoir pressure of 105 to 115 pounds per square inch. Since the air compressors run continuously when the engines are running, a load and unload type control is pro-



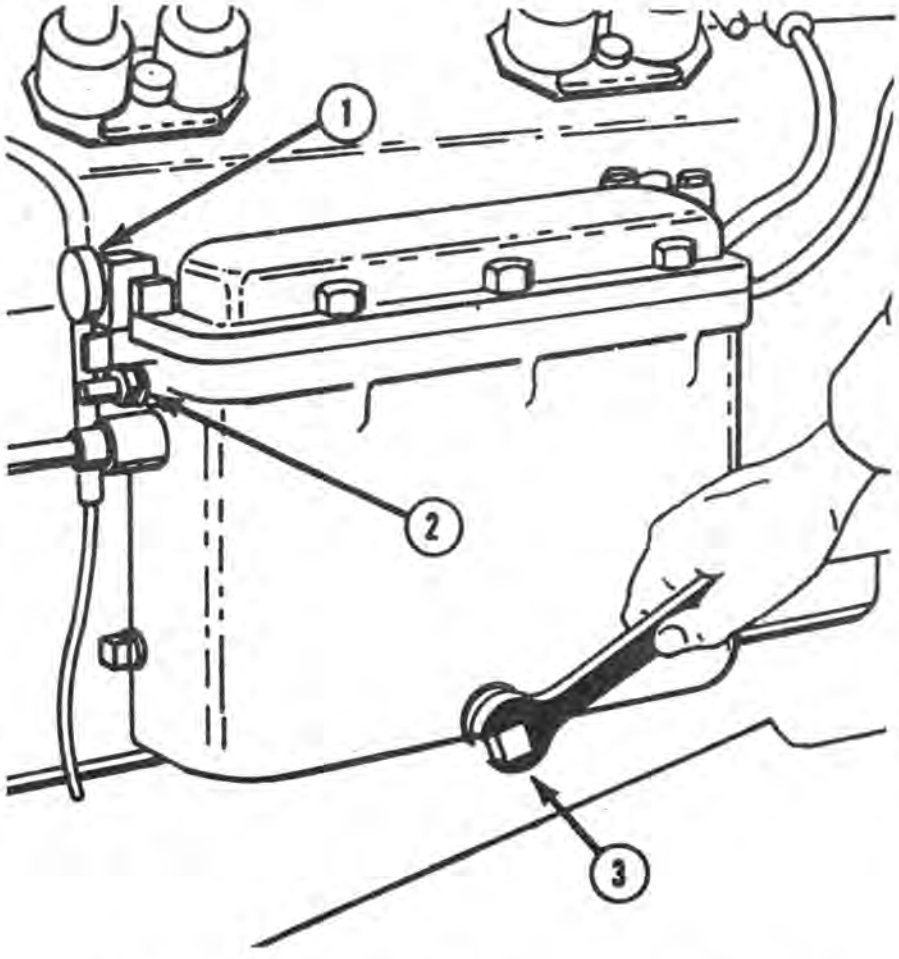
1 Kim hot start
2 Main water drain valve
3 Fuel transfer pump
4 Priming pump
5 Oil dip stick

Figure 27. Side view of engine room compartment.

vided to maintain the main reservoir pressure between the desired limits.

b. Intercooler. Air from the low pressure cylinder discharges to the radial type intercooler, where it is cooled before entering the high pressure cylinder. A safety valve is used to protect the intercooler against excessive pressure. The safety valve is set to open at 60 pounds pressure, and blows off excess pressure to the atmosphere. This valve ordinarily requires no attention. If the valve fails to seat tightly after blowing off, rotate the valve on its seat. This action usually cleans the valve seat and restores the proper seal. A draincock is located in the bottom of the intercooler for draining the oil and sediment which accumulates in the intercooler.

c. Compressor Governor. A pneumatically operated governor controls the compressor operating cycle, maintaining main reservoir pres-



1 Upper vent 2 Lower vent 3 Drain plug

Figure 28. Fuel filter housing.

sure at 105 to 115 pounds. The governor is adjusted to allow the compressor to "cut in" at 105 pounds and "cut out" at 115 pounds. When the governor is "cut in," the air compressor is pumping air into the main reservoirs. When the governor is "cut out," air pressure produced by the compressor is exhausted to atmosphere.

90. Fire Extinguisher

a. A fire extinguisher is located beside the brake stand in the locomotive cab. The extinguisher is the hand operated type and is charged with a carbon dioxide solution.

b. The fire extinguisher is operated by turning the operating valve to the left. Direct the discharge at the base of the flame, with the nozzle as close to the flame as can be held with safety. Allow the discharge to continue for several seconds after the flames are extinguished in order to prevent recurrences. Turn operating valve to the right to stop stream from discharging.

c. Use of the extinguisher must be reported on the daily inspection worksheet (par. 2) so that it may be refilled or replaced with a full unit.

Warning: **The extinguisher contains gas under pressure and must never be dropped, handled roughly, or exposed to extreme heat. The gas is nonpoisonous, but can cause suffocation. Spaces in which this gas has been discharged must be ventilated thoroughly before they are reentered by the operating personnel.**

91. Cab Heater

a. The cab heater (9, figs. 4 and 5) is used to warm the operating cab during cold weather.

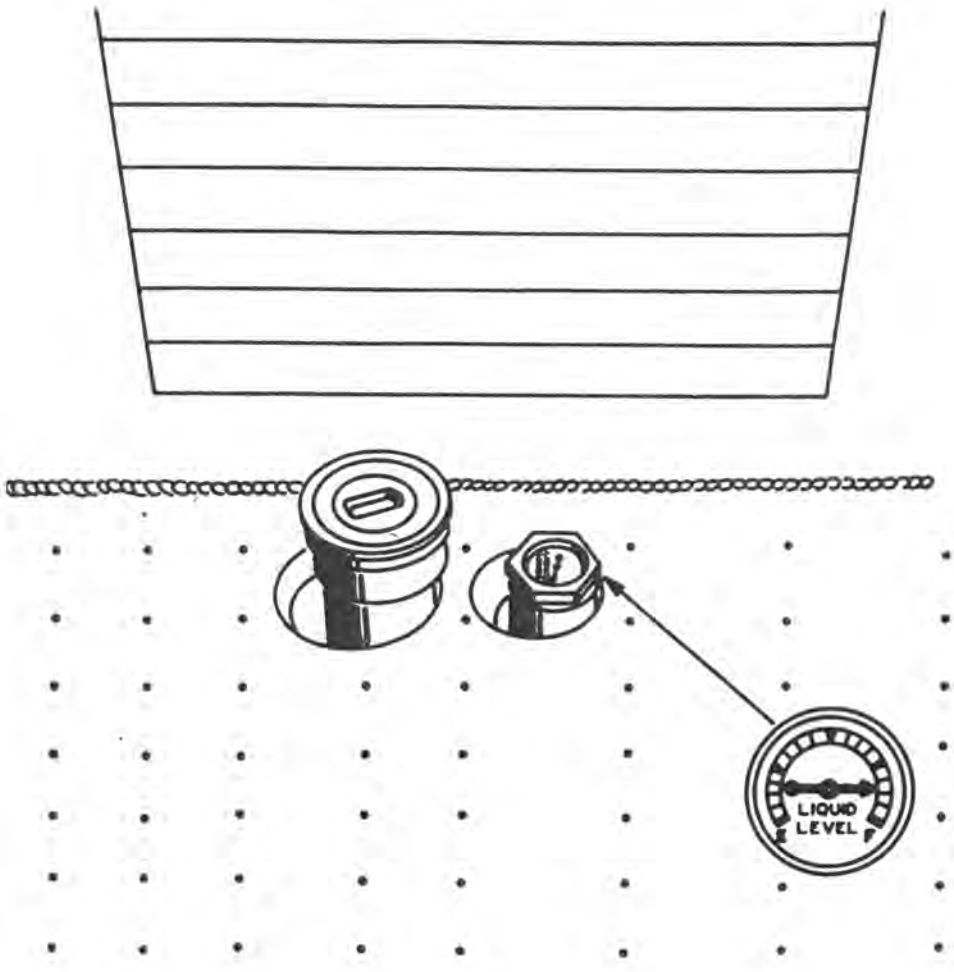


Figure 29. Fuel tank filler and gage.

Hot water from the engine cooling system circulates through the heater elements. The flow of water is controlled by a manually operated valve.

b. The cab heater switch located on the control panel controls the operation of the electrical blower motor.

92. Cooling System Preheater

Each diesel engine is equipped with a cooling system preheater (1, fig. 27). The purpose of the preheater is to keep the engine warm when it is not in use. The preheater becomes a bypass to the regular water circulation system. By controlled percolator-flow action, it draws cold water from the diesel engine into the head of the preheater where it is heated and then forced back into the engine block at another point. The preheater in no way interferes with the regular circulation of coolant fluids. Use of the preheater does not remove the necessity of using antifreeze in the cooling system. Operation of the preheater is very simple, you merely plug the heater cord into 220 volt standby power and it begins to operate immediately, warming the engine coolant. The preheater can be used continuously without danger of overheating the engine, because the engine thermostat will open and allow the hot water from the engine block to circulate through the radiator.

Caution: **Drain the preheater when the cooling sytem of the diesel engine is drained. A drain plug is located in the bottom of the preheater for this purpose.**

Section V. OPERATION UNDER UNUSUAL CONDITIONS

93. Operation in Extreme Cold Weather

a. Cooling System Protection. It is the responsibility of the organizational maintenance personnel to prepare the cooling system for operation in extreme cold weather. However, it is the duty of the operator to check the antifreeze solution to see that the proper protection is afforded for the lowest possible temperature anticipated.

b. Radiator Inspection. Inspect the radiator hose for signs of deterioration. Make sure there are no leaks around hose clamps or drain plugs. Carefully check the radiator for leaks. Report any deficiencies on the daily inspection worksheet (par. 2).

c. Engine Shutdown.

(1) If the engine is to be shut down and the cooling system is not adequately protected with antifreeze solution, the entire system will have to be drained (par. 86).

(2) When the locomotive is to be shut down for an extended layover in freezing weather, check the specific gravity of the battery. Fully charged batteries can withstand temperatures as low as —35° F. before freezing. Frequent hydrometer readings must be taken to check the battery charge.

d. Cold Weather Starting. When starting the engines during cold weather operations, the sequence of steps outlined below must be accomplished prior to starting the engines:

(1) Plug in the cooling system preheaters as outlined in paragraph 92.

(2) Do not attempt to start the engines until the temperature gage registers at least 60° or 70° F.

(3) After the correct water temperature has been reached, start the engines as prescribed in paragraph 51.

(4) During extremely cold weather, it may be necessary to prime the engine fuel system (par. 50).

Caution: **Be sure the cooling system preheater cord is disconnected from the standby power before moving locomotive.**

94. Sandy or Dusty Conditions

a. Sand and dust have a tendency to penetrate into bearings, brakes, traction motors, air cleaners and other moving parts. Protect the locomotive as much as possible from sand and dust particles. Blow or wipe dust and sand from the equipment at every opportunity.

b. At the first indication of overheating, adjust the shutters to give the maximum amount of ventilation. If the operating temperature does not return to normal, examine the radiator cores to determine if they are plugged with dust, sand or other foreign material.

c. Inspect oil filters, air cleaners and breather caps for cleanliness. Take all precautions to prevent sand and dust from entering the fuel system. If it becomes necessary to refuel during operations, use a fine wire mesh or a piece of lint free cloth to screen out impurities.

d. Report any unsatisfactory conditions on the daily inspection worksheet (par. 2), so that action can be taken by the maintenance personnel to correct the deficiency.

95. Operation in Extreme Heat

a. When operating under extremely hot conditions, check the coolant level more frequently than under usual conditions. Make sure the fan and radiator shutters are open to their fullest extent to provide maximum amount of air for cooling.

b. Inspect the radiator hose for signs of deterioration. Make sure there are no leaks around the hose clamps or drain plugs. Carefully check the radiator for leaks. Report any deficiencies on the daily inspection worksheet (par. 2).

96. Operation With One Engine

a. If trouble develops during operation to either of the diesel engines, main generators or traction motors, the locomotive can be operated with the affected engine shutdown. While operating with one engine shutdown,

avoid pulling heavy drags that put undue load on the remaining power plant and traction motors.

b. Take proper precautions to prevent the coolant water in the shutdown engine from freezing.

97. Running Through Water

Do not exceed two or three miles per hour if there is water over the rails. Never operate the locomotive through water more than four inches above the railhead.

98. Rerailing

Caution: **Do not try to rerail the locomotive under its own power, as serious damage may result to the traction motors from spinning the wheels. An unloaded traction motor attains dangerously high speeds.**

a. Move the derailed locomotive with another pusher. However, if one set of wheels is derailed, power may be removed from that particular set by shutting down the diesel engine for the applicable truck and reapplying power to the truck remaining in service.

b. When a derailment occurs, maintenance personnel must be notified immediately. Serious damage may occur to the wheels, axles, journals, and traction motors during a derailment. A thorough inspection of these components must be performed before the locomotive is put back in service.

99. Towing Locomotive Dead

When it is necessary to tow a locomotive any appreciable distance, the controls must be set as follows:

a. Place all switches and circuit breakers in the "off" position.

b. Move throttle to "idle" position.

c. "Open" main battery switch.

d. Move reverse lever to "off" position and remove handle.

e. Place the automatic and the independent brake valve in "running" position.

f. Move double-heading cock to "dead" position (par. 16).

g. Open dead engine fixture.

h. Set distributing valve safety-valve between 20 and 25 pounds.

i. Close doors, ventilators and windows of locomotive.

Note. If locomotive is to be towed a long distance notify maintenance personnel to remove traction motor pinion gears.

CHAPTER 3
MAINTENANCE INSTRUCTIONS

Section I. OPERATOR'S TOOLS AND EQUIPMENT

100. Special Tools and Equipment

No special tools or equipment are needed by the operator for maintaining the locomotive.

101. Basic Issue Tools and Equipment

Tools and repair parts issued with, and authorized for the locomotive are listed in the basic issue item list, appendix III.

Section II. LUBRICATION

102. General

Lubrication of the locomotive is the responsibility of organizational maintenance. Whenever necessary the operator will assist the maintenance personnel in lubrication of the materiel.

103. Lubrication Order

The lubrication order must be carried on the equipment at all times. If during operation the operator hears any unusual noises of the mechanical components which may be traced to lack of lubricant he will attempt to remedy the situation by lubricating at the appropriate points. This deficiency must be reported on the daily inspection worksheet so that corrective action can be taken by organizational maintenance personnel.

Caution: **Keep oil and grease away from electrical apparatus such as contactors, relays, resistors, switches and the like. Add grease or oil to generator and/or electrical motor bearings as sparingly as possible and only when it is determined that lack of lubricant is the originating point of the noise.**

Section III. PREVENTIVE MAINTENANCE

104. General

a. It is the responsibility of the organizational maintenance personnel to perform the maintenance inspections in accordance with the applicable inspection worksheets. However, it is the duty of the operator to assist the organizational maintenance mechanics to detect first signs of electrical and mechanical failures in the materiel.

b. To assure mechanical efficiency, it is necessary that the operator report any defects discovered during operation on the daily inspection worksheet (par. 2) so they may be corrected before they result in serious damage or failure to the equipment.

105. Replacement of Air Hose and Gaskets

a. Should the air pressure fail to build up properly, the failure may be due to a leaking air hose or air hose gasket.

b. To replace a defective hose—

(1) Close the angle cocks to the hoses to be uncoupled. Break the connections gradually to avoid injury by escaping air.

(2) Remove the defective hose and replace with a serviceable item.

(3) Recouple hoses, open angle cocks and check for air leaks.

c. To replace a defective gasket—

(1) Close the angle cocks to both air hoses

to be uncoupled. Break the connections gradually to avoid injury by the escaping air.

(2) Insert a screwdriver between the gasket and body of coupling and pry gasket from groove.

(3) To install a new gasket, start the gasket into the groove and continue to work the gasket into place by hand, forcing the outside edge of the gasket away from the coupling body so that it can be pressed or allowed to snap completely into the grove.

(4) Recouple the air hoses, open angle cocks and check for air leaks.

106. Replacement of Windshield Wiper Blades

a. The windshield wiper arm has a spring tension, hold it away from window when replacing blade.

b. To replace a blade, straighten cotter pin and remove pin and blade.

c. Reverse the above procedure for installing the blade, make sure the ears of the cotter pin are sufficiently spread to prevent cotter from falling out of the blade retaining pin.

107. Replacement of Headlamp

a. The sealed beam headlights are designed to permit easy removal of the door and lamp assembly from the front with one hand while maintaining a handhold with the other. The procedure is as follows:

(1) Loosen door latch.

(2) Swing door open and disconnect attachment plug.

(3) Lift door off headlight hinge.

(4) Apply new lamp.

(5) Replace door and lamp assembly in reverse order.

b. Beam alignment is made from the outside by means of three screws securing the spring loaded lamp holder ring, which slides through a rubber gasket in the door.

108. Replacement of Fuses

To replace a defective fuse, open the affected circuit. Remove the fuse from the clips with a fuse puller, and install a new fuse, be sure it is a fuse of the correct amperage.

Section IV. TROUBLESHOOTING

109. General

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the locomotive and its components. Each trouble symptom stated is followed by a list of probable causes of the trouble. The possible remedy recommended is described opposite the probable cause. Any operational trouble that is beyond the scope of the operator or crew must be reported to higher echelon of maintenance.

110. Engine Does Not Rotate When Start Button Is Pressed

Probable cause	*Possible remedy*
Main battery switch "open"	Close (par. 36)
Control breaker in "off" position	Move to "on" (par. 33*a*)
Starting contactors not closing	Notify maintenance personnel
Low battery voltage	Notify maintenance personnel
Reverse lever not in "neutral" position	Move to "off" (par. 12)
Battery fuse blown	Replace (par. 37)

111. Engine Rotates, But Does Not Fire

Probable cause	*Possible remedy*
Fuel tank empty	Refill (par. 88*c*)
Emergency fuel cutoff valve tripped	Reset (par. 43*c*)
Fuel system airbound	Prime fuel system (par. 50*b*)
Emergency shutoff on fuel pump "closed"	"Open"

Probable cause	*Possible remedy*
Engine not warm enough for starting	Plug in preheater (par. 92)
Insufficient cranking speed due to low battery	Notify maintenance personnel

112. Locomotive Does Not Move When Throttle Is Opened

Probable cause	*Possible remedy*
Reverse lever in "neutral"	Move to "reverse" or "forward" (par. 12)
Brakes not released	Release (hand and air)
Starting contactors welded together	Pry apart (par. 40)
Insufficient control air pressure	Adjust to 80 pounds (par. 47)
Ground relay tripped	Reset (par. 39)

113. Engine Stops

Probable cause	*Possible remedy*
Emergency fuel shutoff valve tripped	Reset (par. 43c)
Fuel tank empty	Refill (par. 88c)
Control breaker in "off" position	Move to "on" (par. 33a)
Fuel transfer pump defective	Notify maintenance personnel

114. Engine Overheats

Probable cause	*Possible remedy*
Loose or broken fan belts	Notify maintenance personnel
Thermostat stuck closed	Notify maintenance personnel
Radiator shutters closed	Open (par. 21)
Insufficient coolant	Fill cooling systems
Radiator plugged	Notify maintenance personnel

115. Battery Ammeter Shows Continual Discharge

Probable cause	*Possible remedy*
Loose or broken generator drive belts	Notify maintenance personnel
Voltage regulator fuse blown	Replace (par. 37)
Voltage regulator not operating	Notify maintenance personnel
Auxiliary generator circuit breaker "open"	Move to "on"
Defective battery	Notify maintenance personnel
Charging generator circuit fuse blown	Replace (par. 37)

116. Compressor Fails To Pump Up Air

Probable cause	*Possible remedy*
Loose or broken compressor belts	Notify maintenance personnel
Drain valve on main reservoir "open"	Close valve
Brake pipe angle cock "open"	Close angle cock
Unloader valve stuck "open"	Notify maintenance personnel
Faulty compressor	Notify maintenance personnel
Broken air pipe	Notify maintenance personnel
Leaking air hose or gaskets	Replace (par. 105)

CHAPTER 4

DEMOLITION OF LOCOMOTIVE TO PREVENT ENEMY USE

117. General

a. Destruction of the locomotive, when subject to capture or abandonment in the combat zone, will be taken by the operator, only when in the judgment of the unit commander concerned, such action is necessary in accordance with orders of, or policy established by, the Army Commander.

b. In general, destruction of vital parts followed by burning will usually be sufficient to render the locomotive useless. However, selection of the particular method of destruction depends on the facilities at hand under the existing conditions. Time is usually a critical factor to be considered.

c. If destruction is directed, due consideration must be given to—

(1) Selection of a point of destruction that will cause greatest obstruction to enemy movement and also prevent hazard to friendly troops from fragments or ricochetting projectiles which may occur incidental to the destruction by gun fire.

(2) Observance of appropriate safety precautions.

d. Where time does not permit the firing or complete hand destruction, the same key part or assembly, on each locomotive abandoned, will be destroyed to prevent possible cannibalization by the enemy.

118. Destruction by Mechanical Means

Using an ax, pick, mattock, sledge, or any other heavy implement, smash all vital elements such as controls, water and fuel pumps, air compressor, generators, switches and traction motors. If time permits and a sufficiently heavy implement is available, smash the engine block and cylinder heads.

119. Destruction by Burning

a. Remove the drain plug from the fuel tank, or puncture the tank as near the bottom as possible, collecting diesel fuel for use as outlined in *c* below.

b. Pack explosive ammunition, if available, on or about the locomotive, so it will be fully exposed to the fire and in such locations that the greatest damage will result from its detonation.

c. Pour fuel oil, or preferably gasoline, over the entire locomotive. Ignite by any appropriate means. If available, use an incendiary grenade, fired from a safe distance, a burst from a flamethrower, or a combustible train of suitable length.

120. Destruction by Gun Fire

Fire on the locomotive with the heaviest weapons available, aiming at the engine traction motors, generators and controls. Although one well-placed direct hit may make the equipment inoperative, several hits may be required for complete distruction of all components.

APPENDIX I
REFERENCES

1. Dictionaries of Terms and Abbreviations

AR 320–5	Dictionary of United States Army Terms.
AR 320–50	Authorized Abbreviations and Brevity Codes.

2. Lubrication

LO 55–2210–204–20	Locomotive, Diesel-Electric (56½-inch gage, 44 ton, General Electric, class BB 88/88–4GE733) (56½-inch gage, 45 ton, General Electric, class BB 90/90–4GE733) 0–4–4–0, 380 hp., dual engine Caterpillar model D–17000.

3. Publication Indexes

DA Pam 108–1	Index of Army Motion Pictures, Film Strips, Slides and Phono-Recordings.
DA Pam 310–2	Index of Blank Forms.
DA Pam 310–3	Index of Training Publications.
DA Pam 310–4	Index of Technical Manuals, Technical Bulletins, Lubrication Orders and Modification Work Orders.

4. Training Aids

FM 5–25	Explosives and Demolitions.
FM 21–5	Military Training.
FM 21–30	Techniques of Military Instructions.
FM 21–30	Military Symbols.
TM 55–202	Fundamentals of Operation and Maintenance of Diesel-Electric Locomotives.

5. Forms Records and Reports

DA Form 862	Daily Inspection Worksheet for Diesel-Electric Locomotives.

APPENDIX II

BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

1. General

This appendix lists the components and accessories initially issued with the equipment and the repair parts and assemblies which comprise the basic issue list of items. It is used for identification, storage, issue, requisitioning, and as an aid to procurement.

2. Arrangement

The items shown in this basic issue list are arranged alphabetically, and when applicable, are arranged in accordance with the assembly, subassembly, and parts relationship.

3. Index

Cross-references are included to facilitate the identification of the items listed by part number or Federal stock number.

a. Part number to Federal stock number cross-reference lists the manufacturer's part or drawing number, and Federal supply code cross-referenced to Federal stock number.

b. Federal stock number to part number cross-referenced lists the Federal stock number cross-referenced to manufacturer's Federal supply code and part or drawing numbers.

4. Explanation of Columns

a. Source, Maintenance, and Recoverability Code. This column indicates assignment of logistical responsibility, repair parts, source, maintenance level, and recoverability codes, which are assigned to each item. These codes are in accordance with AR 700–18.

(1) *Technical service basic number.* Items which are the logistical responsibility of a technical service, other than Transportation Corps, are indicated by the basic number assigned to the technical service. The basic numbers are:

3—Chemical Corps
5—Corps of Engineers
8—Army Medical Corps
9—Ordnance Corps
10—Quartermaster Corps
11—Signal Corps

(2) *Source code.* The following code symbols are used to provide guidance for replacement and source of supply of repair parts and special tools:

(*a*) *Code P*—applies to high mortality repair parts which are stocked in or supplied from the technical service depot system, and authorized for use at indicated maintenance echelons.

(*b*) *Code C*—applies to repair parts authorized for local procurement. If not obtainable from local procurements, such repair parts will be requisitioned through normal supply channels with a supporting statement of nonavailability from local procurement.

(3) *Maintenance level code.* The following code symbol is used to indicate the lowest maintenance echelon authorized to install the repair parts. Capabilities of higher maintenance echelons are considered equal or better. Parts which require manufacture, or assembly at an echelon higher than that authorized for installation will indicate in the source column the higher echelon (i.e., AO, MO). Code O—Organizational.

(4) *Recoverability codes.* The following code symbols are used to indicate re-

pair parts to be returned for recovery or salvage:

(a) *Code R*—applies to repair parts and assemblies which are economically repairable at field maintenance activities (3d and 4th echelon) and are normally furnished by supply on an exchange basis.

(b) *Code T*—applies to high dollar value recoverable repair parts which are subject to special handling and are issued on an exchange basis. Such repair parts are normally repaired or overhauled at depot maintenance activities.

(c) Repair parts and assemblies not assigned a recoverability code shall be considered "throwaway" items.

(5) *Arrangement in column.* The following is the arrangement of the above codes in column (1):

Technical service Basic No.	*Source*	*Maintenance level*	*Recoverability*
5	P	O	R

b. Federal Stock Number. The Federal stock number consists of the applicable 4-digit FSC Code Number plus the 7-digit Federal item identification number. Items that are source coded A or M to be assembled or fabricated at the same level of maintenance at which they are installed are not assigned a Federal stock number, unless the item(s) previously has (have) been identified to a Federal Stock Number.

c. Description. The description of an item consists of the Federal item name followed by such additional information as is necessary for identification. As an additional reference, the applicable specification or typical manufacturer's reference number is indicated following the description. Items listed to clarify assembly relationship and/or for informational purposes are shown with the unit of issue and quantity per unit included in this column.

d. Unit of Issue. This column lists the standard or basic quantity in which the item is issued (EA, LB, SE, etc.).

e. Expendability. This column lists the expendability of each item. All items are expendable unless otherwise indicated. NX in this column indicates that the item is nonexpendable.

f. Quantity Authorized. This column lists the quantity authorized for 1st echelon.

5. Abbreviations

The following abbreviations are used—

ac	alternating current
amp	ampere(s)
Co.	Company (name of firm)
dc	direct current
deg	degree(s)
dia	diameter(s)
EA	EACH (unit of issue)
ft	foot (feet)
h	height, high
hp	horsepower
id	inside diameter(s)
in.	inch(es)
Inc	Incorporated
ips	iron pipe size
lb	pound(s)
lg	length (long)
max	maximum
min	minimum
mtd	mounted
No.	number(s)
nom	nominal
NPT	American Standard Taper Pipe Thread.
o/a	overall
od	outside diameter(s)
oz	ounce(s)
P/N	part number
qtr	quart(s)
SE	SET (unit of issue)
u/o	used on
v	volt(s)
w	watt(s)
w	wide, width
w/	with
wt	weight
&	and

6. Manufacturer's Code Number

The manufacturer's code number is a 5-digit Federal Supply Code identifying a particular manufacturer.

Code	*Manufacturer*
08108	Lamp Industry.
24446	General Electric Co.
71400	Bussman Fuse Division of McGraw-Edison Co.
81349	Military Specifications.
82484	Sprague Devices, Inc.
82722	Westinghouse Air Brake Co.

7. Road Numbers

This manual is applicable to Locomotive Diesel Electric 44 and 45 ton. The repair parts listed are used on all road numbers unless otherwise noted.

USA road No.	*Serial No.*	*USA road No.*	*Serial No.*
1214	17924	7494	17937
1236	31874	7508	15118
1237	31875	7513	15112
1238	31876	7516	15759
1239	31877	7924	27631
1240	31878	7925	27632
1241	31879	7926	27633
1242	31880	7927	27634
1243	31881	7928	27635
1244	31882	7929	27636
1245	31869	7930	17940
1246	31870	7931	18147
7064	15113	7932	18148
7069	15757	8499	27577
7087	15773	8500	27578
7095	15126	8502	27580
7253	15758	8503	27581
7310	13098	8504	27582
7311	13099	8505	27583
7312	15119	8506	27584
7410	12912	8507	27585
7411	12913	8509	27581
7439	15764	8510	27588
7491	17931	8511	27589
7492	18149	8512	27590
7493	18150	8513	27591
8514	27592	8565	27703
8515	27593	8566	27704
8516	27594	8567	27705
8517	27595	8568	27706
8518	27596	8569	27707
8519	27597	8570	27708
8520	27598	8571	27709
8521	27599	8572	27710
8522	27600	8573	27711
8523	27601	8574	27751
8525	27603	8575	27752
8526	27604	8576	27753
8527	27605	8577	27754
8528	27606	8578	27755
8560	27698	8580	27756
8561	27699	8581	27758
8562	27700	8582	27759
8563	27701	8583	27760
8564	27702		

8. Recommendations

Recommendations for changes, additions, deletions or other corrections will be forwarded on DA Form 2028 (Recommended Changes to DA Technical Manual Parts Lists or Supply Manual 7, 8 or 9) through appropriate channels to the Commanding General, U. S. Army Transportation Materiel Command, ATTN: SMOSM–MTS, P. O. Box 209, Main Office, St. Louis 66, Mo.

Section II. BASIC ISSUE ITEM LIST

Code				Federal stock No.	Description	Unit of issue	Expendability	Quantity authorized	Illustration	
Technical service	Source	Maintenance level	Recoverability						Fig. No.	Item No.
a	b	c	d	e	f	g	h	i	j	k
				2210–112–8504	LOCOMOTIVE, DIESEL ELECTRIC: 56½ in. gage 44 ton, 0–4–4–0, Catepillar engine model D17000, 380 hp, General Electric Co.	EA	NX			
				2210–529–9038	45 ton, 0–4–4–0, Caterpillar engine model D17000, 380 hp, General Electric Co.					
					REPAIR PARTS					
					BLADE, WINDSHIELD WIPER: heavy duty, self-locking, w/nonreplaceable rubber insert, rigid insert retainer, mtd w/saddle hook.					
	P	O	----	2540–222–3699	12 in. lg (P/N C1100–12)	EA	----	1		
	P	O	----	2540–222–3700	14 in. lg (P/N C1100–14)	EA	----	1		
	C	O	----	2240–652–3362	GASKET: coupling, trainline (P/N 538976).	EA	----	4		

Code				Federal stock No.	Description	Unit of issue	Expendability	Quantity authorized	Illustration	
Technical service	Source	Maintenance level	Recoverability						Fig. No.	Item No.
a	b	c	d	e	f	g	h	i	j	k
					REPAIR PARTS—Continued					
	P	O	----	2240-178-8207	HOSE, AIR BRAKE, RAILWAY: trainline, w/FP-5 coupling and gasket, 1⅜ in. id, 2 1/16 in. od, 22 in. lg (P/N 87101). *Note.* The following item is u/o USA road No. 7064, 7065, 7312, 7508, 7513.	EA	----	1		
5	P	O	----	5920-050-0544	FUSE, CARTRIDGE: auxiliary generator field, 3 amp, 250 v, ferrule contact, nonrenewable, 9/16 in. dia, 2 in. lg (P/N NON3). *Note.* The following 3 items are u/o USA road No. 1236 thru 1246, 7069, 7087, 7253, 7310, 7311, 7410, 7411, 7439, 7491 thru 7494, 7516, 7924 thru 7931, 8499, 8500, 8502 thru 8507, 8509 thru 8528, 8560 thru 8578, 8580 thru 8583.	EA	----	1		
5	P	O	----	5920-280-8605	FUSE, CARTRIDGE: auxiliary generator, 35 amp, 250 v, ferrule contact, nonrenewable, 13/16 in. dia, 3 in. lg (P/N GE1467).	EA	----	1		
	C	O	----	5920-636-4713	auxiliary generator field, 4 amp, 250 v, dc, 500 v, ac, ferrule contact, nonrenewable, 9/16 in. dia, 2 in. lg (P/N G4R00A).	EA	----	2		
11	P	O	----	5920-050-4972	battery, 60 amp, 250 v, dc, 500 v, ac, ferrule contact, nonrenewable, 13/16 in. dia, 3 in. lg (P/N G60R0A). *Note.* The following item is u/o USA road No. 7064, 7069, 7087, 7095, 7153, 7310 thru 7312, 7410, 7411, 7439, 7491, 7494, 7508, 7513, 7516, 7930.	EA	----	1		
5	P	O	----	5920-548-3125	FUSE, CARTRIDGE: control and lights, 10 amp, 250 v, ferrule contact, nonrenewable, 9/16 in. dia, 2 in. lg (P/N GF4A10). *Note.* The following item is u/o USA road No. 1214 and No. 7087.	EA	----	4		
11	P	O	----	5920-543-0673	FUSE, CARTRIDGE: control circuit, 15 amp, 250 v, ferrule contact, nonrenewable, 9/16 in. dia, 2 in. lg (P/N GE1463). *Note.* The following 2 items are u/o USA road No. 7924 thru 7929, 8499 thru 8528, 8560 thru 8583.	EA	----	1		
					HOSE, AIR BRAKE, RAILWAY:					
5	P	O	----	4720-365-4722	equalizing pipe (P/N 521604)	EA	----	1		
	P	O	----	2240-178-8214	main reservoir (P/N 526162) *Note.* The following item is u/o USA road No. 1236 thru 1246, 7924 thru 7929, 8499, 8500, 8502 thru 8528, 8560 thru 8583.	EA	----	1		
	P	O	R	2240-417-2963	JUMPER, TRAINLINE (P/N 332B255G35). *Note.* The following 3 items are u/o USA road No. 1236 thru 1246.	EA	----	1		
					LAMP, INCANDESCENT:					
10	P	O	----	6240-269-9472	cab and gage light, 75 v, 25 w, medium screw base, frosted (P/N 25A17RS75V).	EA	----	2		
5	P	O	----	6240-272-8594	headlight, 30 v, 200 w, screw terminal base, sealed beam (P/N 200PAR30V).	EA	----	2		
5	P	O	----	6240-057-2887	indicator light, 6-8 v, 0.25 amp miniature bayonet base, type T-3-¼ bulb (P/N 44).	EA	----	1		

Section II. BASIC ISSUE ITEM LIST—Continued

Code				Federal stock No.	Description	Unit of issue	Expendability	Quantity authorized	Illustration	
Technical service	Source	Maintenance level	Recoverability						Fig. No.	Item No.
a	b	c	d	e	f	g	h	i	j	k
					REPAIR PARTS—Continued					
					Note. The following item is u/o USA road No. 7064, 7069, 7087, 7095, 7253, 7310 thru 7312, 7410, 7411, 7439, 7491, 7494, 7508, 7513, 7516, 7930.					
5	P	O		6240-681-2795	LAMP, INCANDESCENT: cab and gage light, 60 v, 15 w, medium screw base, frosted (P/N 15A17-60).	EA		2		
					Note. The following item is u/o USA road No. 7492, 7493, 7924 thru 7929, 7931, 7932, 8499, 8500, 8502 thru 8507, 8509 thru 8528, 8560 thru 8583.					
5	P	O		6240-681-2796	LAMP, INCANDESCENT: cab and gage light, 70 v, 25 w, medium screw base, frosted (P/N 25A19-70).	EA		2		
					Note. The following item is u/o USA road No. 7064, 7069, 7087, 7095, 7253, 7310 thru 7312, 7410, 7411, 7439, 7491 thru 7494, 7508, 7513, 7516, 7924 thru 7932, 8499, 8500, 8502 thru 8507, 8509 thru 8528, 8560 thru 8583.					
5	P	O		6240-269-9473	LAMP, INCANDESCENT: headlight, 60 v, 250 w, medium screw base, clear (P/N 250P25-60V).	EA		2		
					TOOLS AND ACCESSORIES					
10	P	O		4930-379-1072	ADAPTER, GREASE GUN	EA		1		
5	P	O		2815-423-9100	BAR: engine turning	EA		1		
10	P	O		5120-224-1372	BAR, PINCH: ¾ in. stock, 26 in. lg	EA		1		
9	P	O		5140-357-5483	BOX, TOOL, STEEL: w/loose tray, 7½ in. w, 8½ in. lg.	EA		1		
	P1	O		4010-270-8668	CHAIN ASSEMBLY, SINGLE LEG: ⅞ in. steel chain, welded, straight link, w/1$\frac{1}{32}$ in. material size, 2 in. w, 8 in. lg, enlarged common link one end, semi-pointed grab hook other end, 14 ft, 2 in. lg, 15,400 lb safe work load capacity.	EA		1		
9	P	O		5110-236-3272	CHISEL, COLD, HAND: ¾ in. w cut, 7 in. lg.	EA		1		
5	P	O		4210-270-4404	EXTINGUISHER, FIRE, CARBON DIOXIDE: hand type, shatterable cylinder, permanent shutoff valve, button or squeeze grip control, 20 lb capacity.	EA		1		
10	P	O		5120-223-9565	EXTRACTOR, STUFFING BOX: hook and rigid shaft, 20 in. o/a lg, ½ in. lg hook.	EA		1		
10	P	O		4930-837-5516	GREASE GUN, HAND: lever operated, spring primed, 15 oz, 7 in. extension, hydraulic coupler, w/loading fitting.	EA		1		
10	P	O		5120-224-4047	HAMMER, HAND: machinist, ball peen, 2 lb nom head wt.	EA		1		
10	P	O		4930-287-6969	HOSE ASSEMBLY, GREASE GUN: coupling pin type, w/swivel straight type, $\frac{3}{16}$ in. id, 19⅝ in. lg, connecting 18 NPT.	EA		1		
10	P	O		4930-266-9159	OILER, HAND: 32 oz, force feed by pressure cheated by an internal pump, copper plated, 18 in. lg spout.	EA		1		

Section II. BASIC ISSUE ITEM LIST—Continued

Code				Federal stock No.	Description	Unit of issue	Expendability	Quantity authorized	Illustration	
Technical service	Source	Maintenance level	Recoverability						Fig. No.	Item No.
a	b	c	d	e	f	g	h	i	j	k
					TOOLS AND ACCESSORIES—Continued					
10	P	O		5120-596-1128	PACKING TOOL, JOURNAL BOX, RAILWAY: w/v shaped knife end, ⅝ in. dia shank, 1¼ in. w at end, 26 in. lg.	EA		1		
	C	O		5340-682-1509	PADLOCK	EA		1		
10	P	O		5120-223-7397	PLIERS, SLIP JOINT: straight hose, w/ cutter 8 in. lg.	EA		1		
10	P	O		5120-243-2776	PULLER, FUSE: plier type, 61 to 400 amp for 600 v fuse, 101 to 600 amp for 25 v fuse.	EA		1		
10	P	O		5120-240-6083	PUNCH, DRIVE PIN: ¼ in. point dia, 5⅜ in. o/a lg.	EA		1		
					RERAILER, RAILWAY: 6 in. max high rail, 200 ton capacity, double end type, rib type flange guide—					
	P	O		2240-191-0021	inside	EA	NX	1		
	P	O		2240-191-0020	outside	EA	NX	1		
					SCREWDRIVER, FLAT TIP:					
9	P	O		5120-293-3177	close qtr, plastic handle, 7/16 in. w tip, 1¾ in. lg blade.	EA		1		
10	P	O		5120-227-7362	w/wrench grip, plastic handle, ⅜ in. w tip, 12 in. lg.	EA		1		
10	P	O		5120-362-7686	WRENCH: fuel valve vent (P/N 9F22)	EA		1		
10	P	O		5120-240-5334	WRENCH, MONKEY: 0 to 3 in. min jaw opening, 18 in. nom lg.	EA		1		
10	P	O		5120-240-5328	WRENCH, OPEN END, ADJUSTABLE: 0 to 0.947 in. jaw opening, single head, 8 in. lg.	EA		1		
					WRENCH, OPEN END FIXED: 15 deg angle double head—					
10	P	O		5120-277-2342	⅜ in. and 7/16 in. opening 5 in. lg	EA		1		
10	P	O		5120-187-7124	½ in. and 9/16 in. opening 5½ in. lg	EA		1		
10	P	O		5120-224-3102	⅝ in. and ¾ in. opening, 6¾ in. lg	EA		1		
	P	O		5120-277-8300	11/16 in. and 13/16 in. opening, 8¾ in. lg	EA		1		
10	P	O		5120-187-7131	⅞ in. and 15/16 in. opening, 9½ in. lg	EA		1		
10	P	O		5120-187-7133	1 in. and 1⅛ in. opening, 10½ in. lg	EA		1		
					WRENCH, PIPE: adjustable jaw type, Stillson pattern—					
10	P	O		5120-277-1485	¼ in. to 1 in. ips, 10 in. nom lg	EA		1		
10	P	O		5120-277-1461	1 in. to 2 in. ips, 18 in. nom lg	EA		1		
					PUBLICATIONS					
					LUBRICATION ORDER: LO 55-2210-204-20, Locomotive, Diesel Electric, 56½ in. gage, 44 and 45 ton, 0-4-4-0, Caterpillar engine model D17000, 380 hp, General Electric Co.	EA		2		
					TECHNICAL MANUAL: TM 55-2210-204-10, operators manual for Locomotive, Diesel Electric, 56½ in. gage, 44 and 45 ton, 0-4-4-0, Caterpillar engine model D17000, 380 hp, General Electric Co.	EA		2		

Section III. INDEX

PART I

PART II

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By Order of the Secretaries of the Army and the Air Force:

EARLE G. WHEELER,
General, United States Army,
Chief of Staff.

Official:
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Major General, United States Army,
The Adjutant General.

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R. J. PUGH,
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Director of Administrative Services.

Distribution:
To be distributed in accordance with DA Form 12-33 requirements for operation and maintenance literature applicable to operator—rail.

*U.S. GOVERNMENT PRINTING OFFICE: 1980--314-243/1305

TM 55–2210–204–10/TO 45A2–2–19–1 LOCOMOTIVES, DIESEL ELECTRIC FSN 2210–112–8504; FSN 2210–529–9038—1963