OPERATORS MANUAL

DIESEL ELECTRIC TRANSFER LOCOMOTIVE

LIMA-HAMILTON CORPORATION
LIMA, OHIO, U.S.A.
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Form D.T.L.

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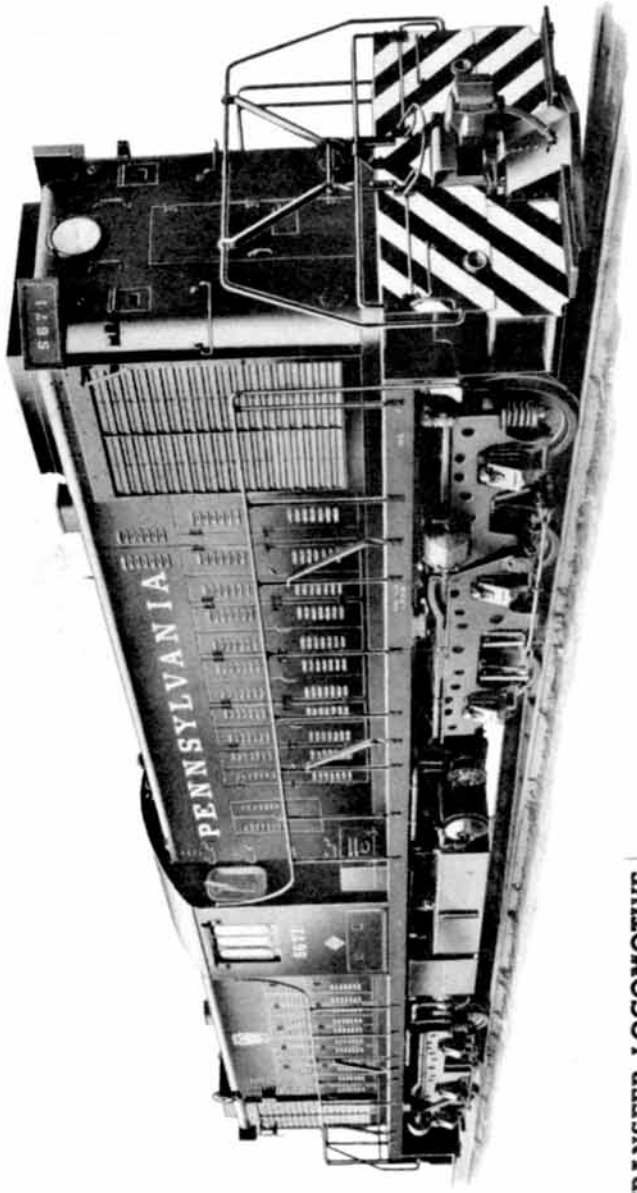


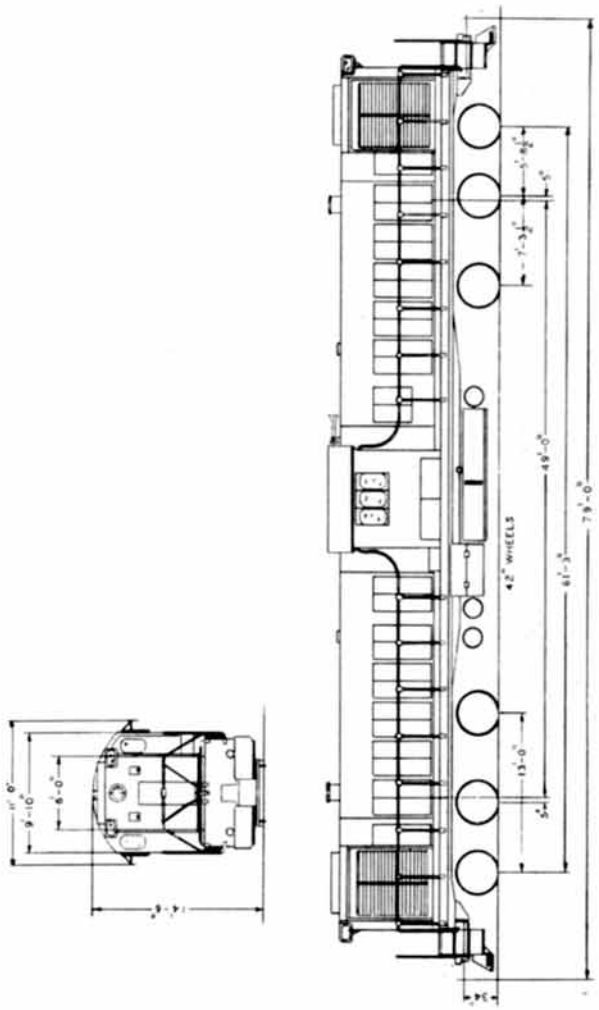
TRANSFER LOCOMOTIVE

INDEX

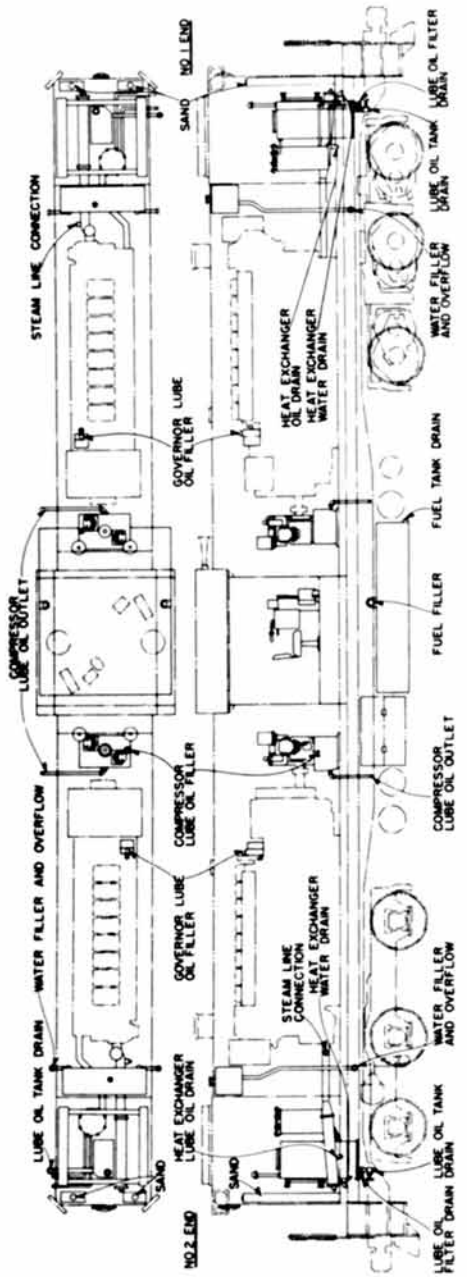
LIST OF ILLUSTRATIONS

2500 H.P. TRANSFER LOCOMOTIVE SPECIFICATIONS

Class	(0-6-6-0) C-C
Number of Drivers	6 Pairs
Wheel Diameter	42"
Gear Ratio	15:63
Maximum Speed Restriction	65 M.P.H.
Weight, Working Order	360,000 lbs.
Starting T. E. @ 30% Adhesion	108,000 lbs.
Starting T. E. @ 25% Adhesion	90,000 lbs.
Minimum Curve Radius	191 Ft. (30°)
Two 8 Cylinder Diesel Engines, Type T-89-SA	
Fuel Oil Capacity	1,250 Gals.
Lubricating Oil Capacity	290 Gals.
Water Capacity	450 Gals.
Sand Capacity	30 Cu. Ft.



2500 H.P. TRANSFER LOCOMOTIVE
Fig. 18



DRAINS AND FILLERS Fig. 19

DESCRIPTION

The Diesel-electric transfer locomotive is a self-contained power unit consisting of two Diesel engines, being the prime movers, and a generator-traction motor electrical circuit, for each engine, which is the transmission. The cab is mounted in the center of the locomotive, between each engine generator unit, and the locomotive can be operated from either side of the cab.

The functions of each are described further in this manual.

In referring to the locomotive, we use the term No. 1 End or Power Unit No. 1 and No. 2 End or Power Unit No. 2 throughout this manual.

ENGINE

The Hamilton Diesel Engine, Model T-89-SA, is a four cycle vertical 8 cylinder in line engine, pressure-charged. Separate fuel injection pumps and injectors are provided for each cylinder. Lubricating oil pressure and scavenging pumps, and cooling water pump are engine driven. Fig. 3 illustrates the cylinder locations, sides and ends. Lubricating oil pressure and scavenging oil pump, pressure-charger and water pump are located at the pump end of the engine. Main generator exciter and auxiliary generator are located at the generator end.

The engine is started by motorizing the main generator with current supplied by the locomotive batteries.

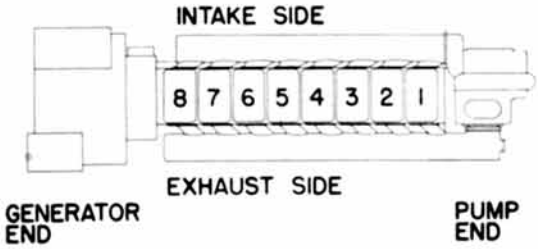
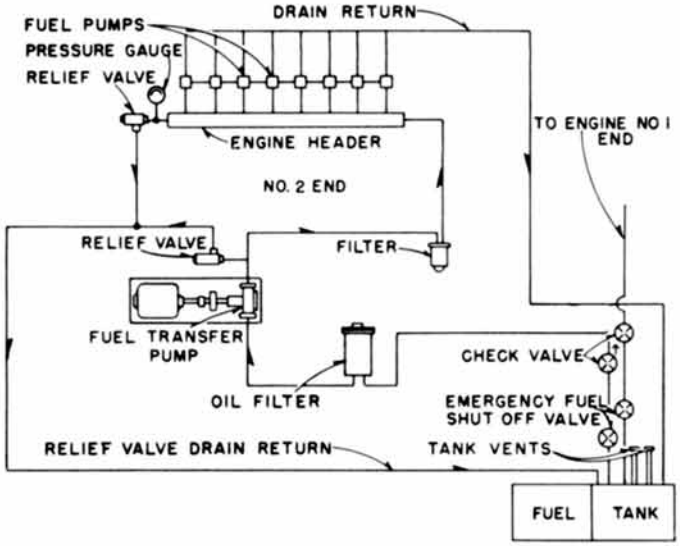


Fig. 3

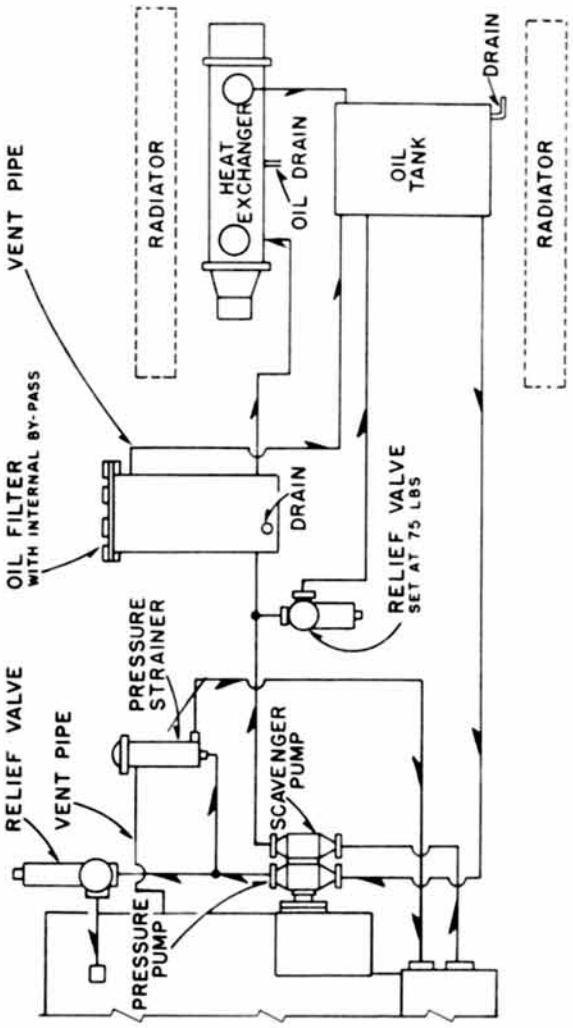
FUEL OIL SYSTEM

See Fig. 4-3 for the schematic illustrations of the fuel oil system. A single tank mounted to the underframe beneath the cab supplies fuel oil to both engines. The fuel oil transfer pump draws fuel oil from the supply tank through the emergency fuel shut-off valve and suction filter and discharges it through the pressure filter to the fuel oil header. From the fuel oil header the fuel oil flows to the individual fuel injection pumps which deliver the fuel oil to the injection nozzles in the proper quantity. A pressure gauge on the gauge panels in the cab indicates the pressure at the end of the fuel oil header.

There is a pressure relief valve between the transfer pump and the pressure filter; the opening of this valve is usually caused by a clogged filter. When the valve is open, the fuel oil is bypassed back to the fuel oil tank.



FUEL OIL PIPING SCHEMATIC
Fig. 4-3



LUBRICATING OIL PIPING SCHEMATIC
Fig. 5-1

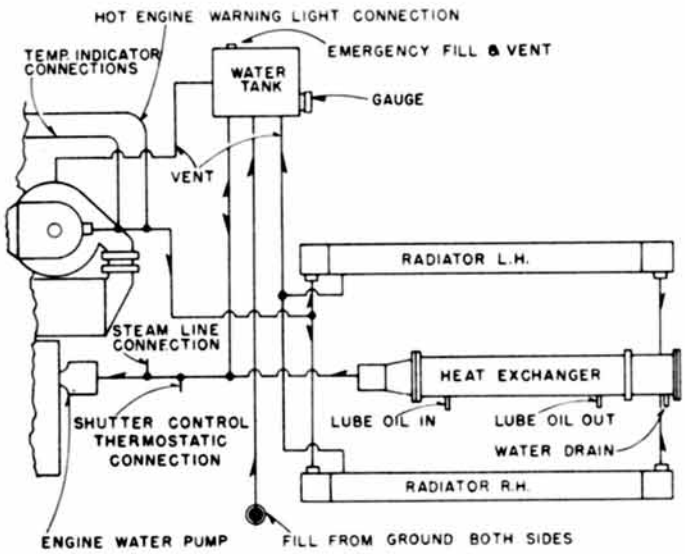
A pressure relief valve is mounted at the end of the fuel oil header to maintain a constant head of fuel.

If trouble is encountered, see "Engine turns but will not start" in Operational Difficulties Section.

LUBRICATING OIL SYSTEM

See Fig. 5-1 for the schematic illustration of the lubricating oil system. The engine at No. 1 End and No. 2 End each has its own self contained lubricating oil system. Fig. 5-1 is applicable to both engines. The lubricating oil system is a pressure system of the dry sump type using two positive displacement gear type pumps combined in a single unit. The inner pump delivers oil to the engine from the supply tank to the main bearing lube oil header from which it is distributed to the main bearings, crank pin bearings, connecting rods, wrist pins, piston crowns for cooling, cylinder head valve rockers and pressurecharger. The outside pump takes oil from the engine pan thru a suction screen to the lube oil filter, lube oil cooler and back to the supply tank.

If trouble is encountered, see "Low Lubricating Oil Pressure Shutdown" in Operational Difficulties Section.



WATER PIPING SCHEMATIC
Fig. 6-1

COOLING SYSTEM

See Fig. 6-1 for the schematic illustration of the cooling system. The engine at No. 1 End and No. 2 End each has its own self-contained water system. Fig. 6-1 is applicable to both engines. The water cooling system is of the closed type with the water flowing thru the engine, radiator, intercooler and inside the lubricating oil cooler tubes. A centrifugal pump, engine driven, circulates the water thru the system. A sight gauge mounted on the water tank registers the water level. A temperature gauge on the gauge panels in the cab indicates the temperature of the water at the discharge end of the exhaust manifold.

There is a shutter control thermostat in the water inlet line to the engine. The thermostat is set to open the shutters at about 170° F. The radiator fan starts when the shutters are about one quarter open.

The system can be filled from the ground on either side of the locomotive. Water riser pipes are located at both the No. 1 End and No. 2 End directly beneath the water tanks and are accessible from the ground level. In emergency water can be added thru the vent on top of the water tank. Treated water of the approved type should be used. Provisions are made to protect the system in freezing weather by allowing steam to circulate thru the system. See "To Shut Down the Locomotive" in the Locomotive

Operation System.

If trouble is encountered see "Hot Engine" in Operation Difficulties Section.

ELECTRICAL SYSTEM

The Diesel engine drives the main generator which supplies current for the operation of the traction motors. The auxiliary-exciter and fan generators are belt driven from the main generator. The auxiliary generator supplies current for charging the battery, control, cab heater motor, lighting, excitation of fan generator and exciter. The exciter unit excites the main generator. The fan generator supplies current for operating the traction motor blower motor and radiator fan motor.

These circuits are operated and protected by various switches, contactors, relays and fuses located in the electrical control cabinets and in the cab. There are two electrical control cabinets, one for each power unit, which open into the cab of the locomotive. The contents of each cabinet are similar in construction except for certain items which are used for both units.

The equipment is the cabinet for Power Unit No. 1 and Power Unit No. 2 consists of:

STARTING CONTACTORS

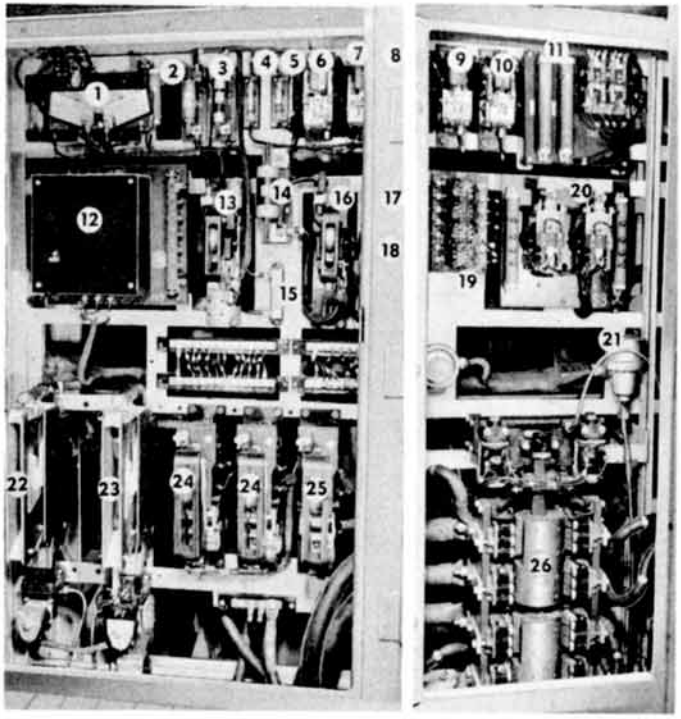
These magnetic contactors G1 and G3 in cabinet No. 1 and G2 and G4 in cabinet No. 2 connect the main generator, in the respective unit, to the battery thru its starting winding to operate the generator as a series motor for starting the engine.

ELECTRICAL SYSTEM
ELECTRICAL CONTROL CABINET
NO. 1 END

Fig. 20

1. Reverse Current Relay, 1RC.
2. Auxiliary Generator Fuse, 100A, (106).
3. Auxiliary Generator, Fan Generator, Exciter Field Fuse, 70A, (132).
4. Fuel Transfer Pump Fuse, 30A, (127).
5. Radiator Fan Contactor Fuse, 15A, (137).
6. Power Knockout Contactor, PK.
7. Fuel Pump Contactor, 1FPC.
8.* Exciter Field Contactor, 1EF.
9. Auxiliary Generator & Fan Generator Field Contactor, 1AF.
10. Ground Relay Contactor, 1GRC.
11. Ground Relay Panel, 1GR.
12. Voltage Regulator, 1VR.
13. Battery Contactor, 1BC.
14. Fan Generator Fuse 400A, (111).
15. Ammeter Shunt, (155).
16. Radiator Fan Motor Contactor, 1RF.
17.* Wheel Slip Relay, 1WSR.
18.* Blower Fuse Signal Light Relay, 1BF.
19. Sequence Converter (139).
20. Field Shunt Relay Panel, FS1, FS3.
21. Automatic Control Switch, FW1.
22. Traction Motor Field Shunt Contactor M-1.
23. Traction Motor Unit Switch P-1.
24. Starting Contactor G1, G3.
25. Traction Motor Field Shunt Contactor M-3.
26. Traction Motor Reverser, REV.

* NOT ILLUSTRATED.



ELECTRICAL CONTROL CABINET
NO. 1 END

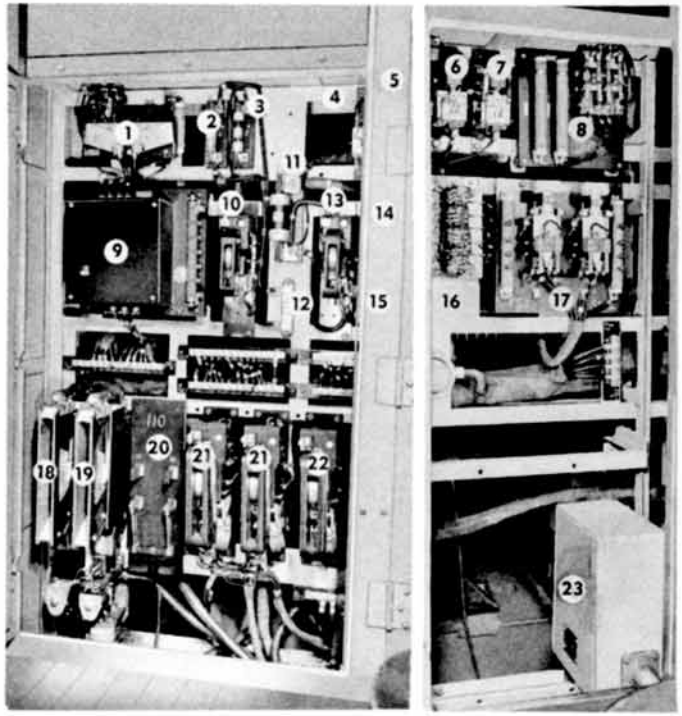
Fig. 20

ELECTRICAL SYSTEM
ELECTRICAL CONTROL CABINET
NO. 2 END

Fig. 21

1. Reverse Current Relay, 2RC.
2. Auxiliary Generator Fuse, 100A, (206).
3. Exciter Field Fuse, 70A, (232).
4. Stop Relay SR.
5.* Exciter Field Contactor, 2EF.
6. Auxiliary Generator & Fan Generator Field Contactor, 2AF.
7. Ground Relay Contactor, 2GRC.
8. Ground Relay Panel, 2GR.
9. Voltage Regulator, 2VR.
10. Battery Contactor, 2BC.
11. Fan Generator Fuse, 400A, (211).
12. Ammeter Shunt, (255).
13. Radiator Fan Motor Contactor, 2RF.
14.* Wheel Slip Relay, 2WSR.
15.* Blower Fuse Signal Light Relay, 2BF.
16. Sequence Converter, (239).
17. Field Shunt Relay Panel, FS2, FS4.
18. Traction Motor Field Shunt Contactor, M-2.
19. Traction Motor Unit Switch, P-2.
20. Battery Switch, (110).
21. Starting Contactors, G2, G4.
22. Traction Motor Field Shunt Contactor, M-4.
23. Starting Panel For Motor Generator Set (When inductive train communication is provided).

* NOT ILLUSTRATED.



ELECTRICAL CONTROL CABINET
NO. 2 END

Fig. 21

Power Unit No. 1

The air operated switch P1 serves to disconnect the traction motors 1, 3, and 5 from the main generator when the locomotive is not under power.

Power Unit No. 2

The air operated switch P2 serves to disconnect the traction motors 2, 4, and 6 from the main generator when the locomotive is not under power.

FIELD SHUNT RELAYS AND CONTACTORS

Power Unit No. 1

The field shunt relays FS1 and FS3 close when the main generator voltage rises to a predetermined value as a result of locomotive speed. FS1 closes first and operates field shunting contactor, M1. This connects a resistance across the traction motor field coils to decrease the voltage and increase the current in the generator motor circuit. FS3 operates at a higher voltage than FS1 as a result of a further increase in locomotive speed and reduces the shunting resistance across the traction motor field coils by operating M3 to repeat a similar effect to the one originated by FS1.

Power Unit No. 2

The field shunt relays FS2 and FS4 close when the main generator voltage rises to a predetermined value as a result of locomotive speed. FS2 closes

first and operates field shunting contactor, M2. This connects a resistance across the traction motor field coils to decrease the voltage and increase the current in the generator motor circuit. FS4 operates at a higher voltage than FS2 as a result of a further increase in locomotive speed and reduces the shunting resistance across the traction motor field coils by operating M4 to repeat a similar effect to the one originated by FS2.

TRACTION MOTOR REVERSER

The reverser REV, mounted in the cabinet for Power Unit No. 1, serves both Power Unit No. 1 and Power Unit No. 2, is an air operated switch whose function is to change the direction of current flow through the traction motor fields and this changes the direction of rotation of the traction motors. It is remote operated from the master controller in the cab, either from the (A) station or the (B) station depending upon the position of the transfer switch.

WHEEL SLIP RELAYS

The wheel slip relay, 1WSR Power Unit No. 1 and 2 WSR Power Unit No. 2 operate when the voltage drop through the traction motors are not equal. This voltage difference occurs only when one pair of wheels is slipping. The relay lights the wheel slip lamp mounted on the gauge panel to signal the operator.

GROUND RELAY

This relay, 1GR Power Unit No. 1, 2 GR Power Unit No. 2, operates when either the positive or negative side of the main generator or traction motors is accidentally grounded to the metal frame work of the locomotive. Operation of this relay removes excitation from the main generator, brings the engine to idle and lights the ground indicating lamp in the gauge panels. In case of a ground condition, a holding coil holds this relay in the tripped position until it is reset.

GROUND RELAY CONTACTOR

These contactors, 1GRC Power Unit No. 1, 2 GRC Power Unit No. 2 are under control of the ground relay push button. This button should be normally pushed in to allow the ground relays to record any ground condition.

To reset the Ground Relay, after a ground relay operation, the following procedure should be followed at the control station from which the locomotive is being operated—

1. Throttle must be set in "Idle" position and reverser in "Off" position.
2. Pull out button marked "Ground Relay" located alongside controller.
   Gound indicating lamp is still on.
3. Push in button marked "Ground Relay".
   Ground indicating lamp goes out.

Power cannot be restored to the locomotive unless the above three operations are performed.

In an emergency, the ground relay can be made inoperative by pulling the ground relay button out. When the ground relay push button is pulled, the ground relay contactor is opened and the ground indicating lamp remains lighted. In these conditions the traction equipment is not protected from ground, and locomotive should be operated under great caution.

BLOWER FUSE RELAY

The coil of the blower fuse relay, 1BF Power Unit No. 1, 2BF Power Unit No. 2, is connected across the fan generator fuse in each unit. If this fuse is blown, the relay will operate to remove excitation from the main generator of the power plant involved, and light the blower fuse signal lamp on the gauge panels. The circuit cannot be restored until the fuse is replaced.

FIELD CONTACTOR

The contactor 1AF, Power Unit No. 1, 2AF, Power Unit No. 2, close the circuit to the fields of the fan generator, auxiliary generator and exciter in each power plant. The contactors are both under control of one push button marked "Excitation". One of these buttons is mounted at each control station along side of the master controller. When this button is pulled, both 1AF and 2AF open and this prevents the battery from being drained into the auxiliary machine fields. The coils of the contactor are both connected through the isolating switches 147 and 247.

EXCITER FIELD CONTACTOR

This contactor, 1EF Power Unit No. 1, 2EF Power Unit No. 2, closes to excite the main generator when the locomotive is put under power.

VOLTAGE REGULATOR

The voltage regulator, 1VR Power Unit No. 1 and 2 VR Power Unit No. 2, controls the auxiliary generator voltage for each power unit by varying the value of the auxiliary generator shunt field current.

REVERSE CURRENT RELAY

This relay, 1RC Power Unit No. 1 and 2RC Power Unit No. 2, and the battery contactor 1BC Power Unit No. 1 and 2BC Power Unit No. 2, operate to disconnect the auxiliary generator from the battery when its voltage falls below that of the battery for each power unit. This relay and contactor also connects the auxiliary generator to the battery when the voltage is proper.

SEQUENCE CONVERTER

This is a relay panel, (139) Power Unit No. 1 and (239) Power Unit No. 2, used to provide the proper synchronization between the throttle lever and the engine governor for each power unit.

FUEL TRANSFER PUMP CONTACTOR

The fuel transfer pump contactor, FPC, serves both No. 1 and No. 2 Power Units. This contactor closes

to start the fuel transfer pump motors, which operate the pumps which transfer the fuel oil from the fuel tank to the fuel injection pumps on the engines. The pump circuits are connected to 147 and 247.

POWER KNOCKOUT CONTACTOR

The power knockout contactor PK serves both No. 1 and No. 2 Power Units. In an emergency brake application control switch FW1 opens and PK contactor opens. The engines at No. 1 End and No. 2 End return to idle.

To reset FW1 after an emergency brake application:

1. Brake valve must be put in lap position.
2. Throttle must be set in "Idle" position and Reverser in "Off" at the controller from which the locomotive is being operated.

AIR SYSTEM

See Fig. 9-4 for a schematic diagram of the air system.

AIR COMPRESSOR

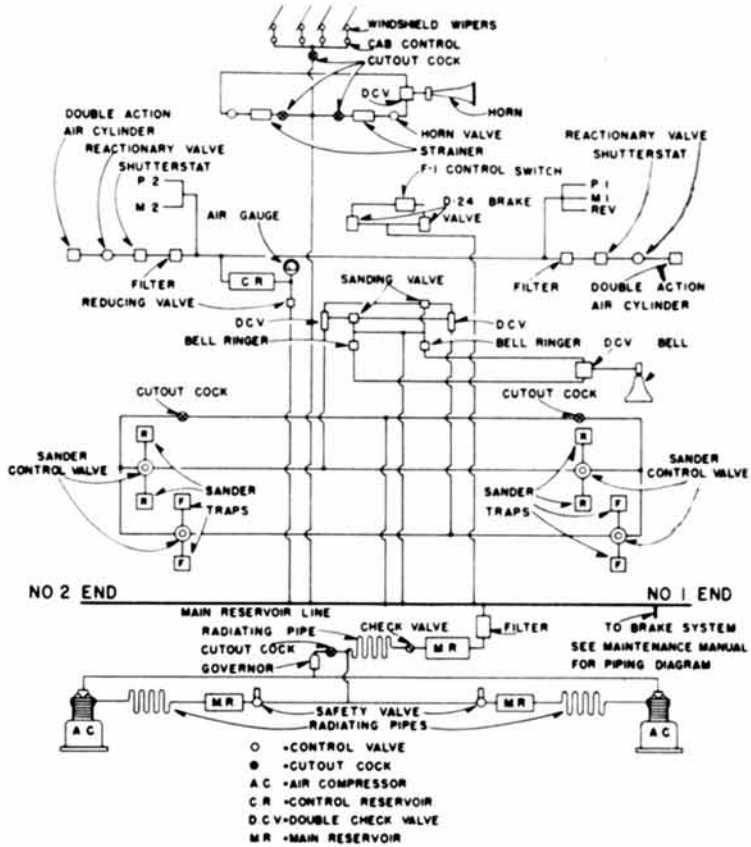
Each power unit has its own air compressor. The air is supplied by a three-cylinder, two-stage Westinghouse Air Compressor, Type 3CDC. See Fig. 12-3.

This is driven by the Diesel engine thru a flexible coupling. The compressor has its own oil system. The oil level is checked by a bayonet gauge in the crank case. This is done when the engine is stopped. Oil pressure, warm, should be approximately 20 pounds.

The compressor is equipped with unloading valves operated by a governor connected to the main reservoir. When the main reservoir pressure reaches 140 pounds, the unloader pilot actuates the unloader, holding the valves open in the compressor. When the main reservoir pressure falls to 130 pounds, the unloader pilot allows the unloading valves to close and the compressor resumes pumping.

CONTROL AIR

The control air is used to actuate various pneumatic contactors and switches, and should be maintained at 70 pounds. The gauge for this is directly under the window in front of the operator's position at "B" control station. The reducing valve which regulates the pressure is located below the gauge. See Fig. 9-4.



AIR PIPING SCHEMATIC
Fig. 9-4

CAB

CAB INSTRUMENTS (See Figs. 22 and 23)

There are two gauge panels mounted in the cab, one at control station A and another at control station B. The instruments are identical on each panel.

On the gauge panels are located:
Air gauges indicating main reservoir, equalizing reservoir, brake cylinder and brake pipe pressures. No. 4 and 19.

Load Ammeter: No. 10 and 11.

These ammeters indicate the current flowing from Power Plant No. 1 and Power Plant No. 2.

Lube Oil Pressure Gauges: No. 3 and 5.

These gauges indicate the pressure of the lubricating oil in the engine at No. 1 End and No. 2 End. The pressure in the 8th notch should be 40-65 pounds.

Engine Temperature Gauges: No. 17 and 21.

These gauges indicate the temperature of the water going out of the engine at No. 1 End and No. 2 End. The temperature should not exceed 180°F. or be less than 140°F.

Intake Manifold Pressure Gauges: No. 2 and 6.

These gauges indicate the air pressure from the turbocharger to the engine at No. 1 End and No. 2 End.

Fuel Oil Pressure Gauges: No. 18 and 20.

These gauges indicate the pressure at the end of the fuel oil header on the engine at No. 1 End and No. 2 End. Under normal operation this gauge will register approximately 50 pounds.

Battery Ammeter: No. 9.

This indicates the rate of battery charging. A charge should always be indicated.

Wheel Slip Light: No. 14.

This is an amber light indicating that a pair of wheels is slipping.

Blower Fuse Lights: No. 7 and 16.

These are blue lights indicating the blower fuse (400A) has blown. There is a light for No. 1 End and No. 2 End.

Ground Indicating Lights: No. 8 and 15.

These are white lights indicating a current leak to the locomotive frame. There is a light for No. 1 End and No. 2 End.

Hot Engine Light: No. 12.

This is a red light indicating that the maximum operating temperature of the engines cooling system has been exceeded.

Low Lubricating Oil Pressure Light: No. 13.

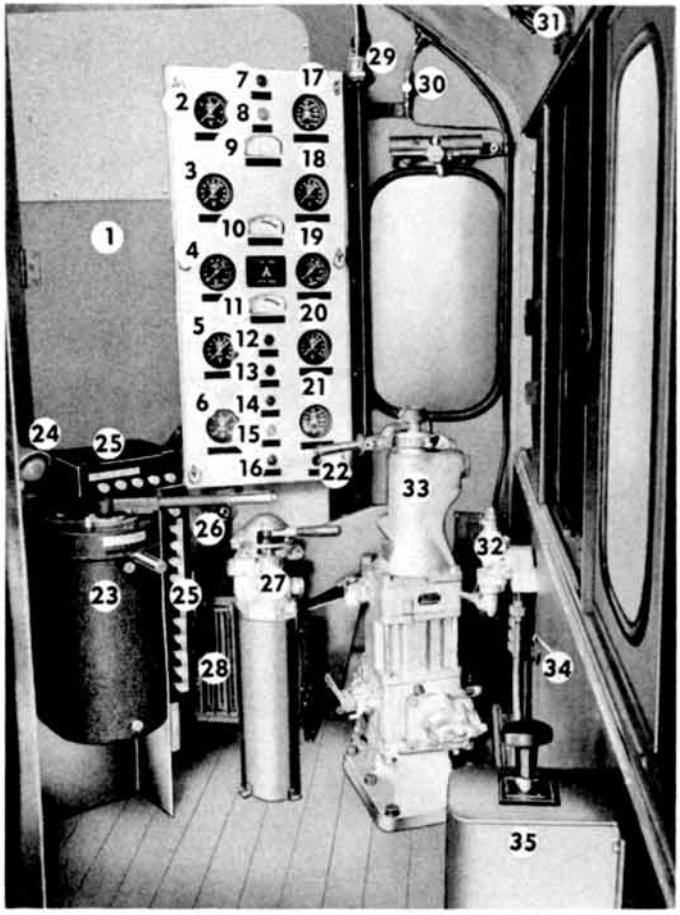
This is a green light indicating insufficient oil pressure in the engine. If the oil pressure drops below safe operating conditions, the light will go on and the engine will stop. The reset button on

LOCOMOTIVE CAB "A" CONTROL STATION

No. 1 End

Fig. 22

1. Electric Control Cabinet Door
2. Intake Manifold Pressure Gauge No. 1 Engine
3. Lubricating Oil Pressure Gauge No. 1 Engine
4. Air Gauge
5. Lubricating Oil Pressure Gauge No. 2 Engine
6. Intake Manifold Pressure Gauge No. 2 Engine
7. Blower Fuse Light No. 1 End
8. Ground Relay Light No. 1 End
9. Battery Ammeter
10. Load Ammeter No. 1 End
11. Load Ammeter No. 2 End
12. Hot Engine Light
13. Low Lube Oil Pressure Light
14. Wheel Slip Light
15. Ground Relay Light No. 2 End
16. Blower Fuse Light No. 2 End
17. Engine Temperature Gauge No. 1 End
18. Fuel Oil Pressure Gauge No. 1 Engine
19. Air Gauge
20. Fuel Oil Pressure Gauge No. 2 Engine
21. Engine Temperature Gauge No. 2 End
22. Engine Start Button
23. Master Controller
24. Order Light
25. Light Switches, Control Switches and Fuses
26. Cab Heater Switch
27. Independent Brake Valve
28. Cab Heater
29. Horn Valve
30. Windshield Wiper Control Valve
31. Headlight Switch
32. Sander and Bell Ringer Valve
33. Automatic Brake Valve
34. Emergency Fuel Cut-Off Pull Ring
35. Transfer Switch



LOCOMOTIVE CAB "A" CONTROL STATION

No. 1 End

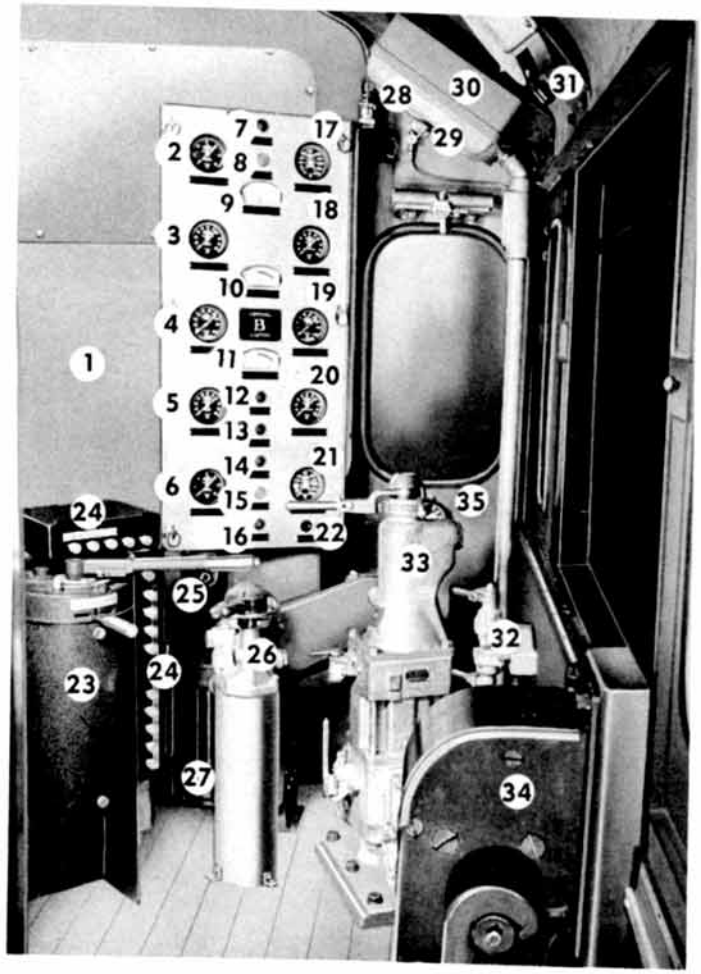
Fig. 22

LOCOMOTIVE CAB "B" CONTROL STATION

No. 2 End

Fig. 23

1. Electrical Control Cabinet Door
2. Intake Manifold Pressure Gauge No. 1 Engine
3. Lubricating Oil Pressure Gauge No. 1 Engine
4. Air Gauge
5. Lubricating Oil Pressure Gauge No. 2 Engine
6. Intake Manifold Pressure Gauge No. 2 Engine
7. Blower Fuse Light No. 1 End
8. Ground Relay Light No. 1 End
9. Battery Ammeter
10. Load Ammeter No. 1 End
11. Load Ammeter No. 2 End
12. Hot Engine Light
13. Low Lube Oil Pressure Light
14. Wheel Slip Light
15. Ground Relay Light No. 2 End
16. Blower Fuse Light No. 2 End
17. Engine Temperature Gauge No. 1 End
18. Fuel Oil Pressure Gauge No. 1 Engine
19. Air Gauge
20. Fuel Oil Pressure Gauge No. 2 Engine
21. Engine Temperature Gauge No. 2 End
22. Engine Start Button
23. Master Controller
24. Light Switches, Control Switches and Fuses
25. Cab Heater Switch
26. Independent Brake Valve
27. Cab Heater
28. Horn Valve
29. Windshield Wiper Control Valve
30. Train Phone Power Switch When Inductive Train Communication is Provided.
31. Headlight Switch
32. Sander and Bell Ringer Valve
33. Automatic Brake Valve
34. Hand Brake
35. Control Air Pressure Gauge



LOCOMOTIVE CAB "B" CONTROL STATION

No. 2 End

Fig. 23

the governor must be set before the engine can be started.

Isolating Switches:

The isolating switches 147 and 247 are mounted beneath the gauge panel at control stations A and B respectively. The switches have three positions; namely, idle, run and stop. These switches enable the operator to run the locomotive with both power units in operation.

Transfer Switch:

The transfer switch TW mounted on the cab wall has two positions (A) and (B). When in A position, the A control station is energized and the locomotive is operated at this station. When the switch is in B position, the B control station is energized and the locomotive is operated at this station.

Push Button Switch Boxes:

The push button boxes are identical at the No. 1 End and No. 2 End. These boxes contain switches and fuses for the order light, engine room lights, front headlight, rear headlight, number lights, class lights, dome lights, control, fuel pump, ground relay, exciter field, and gauge lights; also, low lubricating oil pressure, hot engine light fuses, and a fuse for the drop light receptacle circuits.

Engine Start Button:

The engine start button at A control station starts the engine in the No. 1 End and the button at B control station starts the engine in the No. 2 End of the locomotive. These buttons are used to motorize the main generator with the batteries for each power unit.

CAB CONTROLS

Master Controller:

Both power plants are controlled by the master controlled at A or B control station depending on the position of the transfer switch. These controllers are equipped with cam switches which perform the following functions:

a. Set the governors to the desired engine speeds.

b. Operate the traction motor switches and excite the main generators to put the locomotive under power.

c. Stop the Diesel engines.

d. Operate the traction motor reverser.

e. Prevent the engine from cranking if the reverse lever is not in the OFF position.

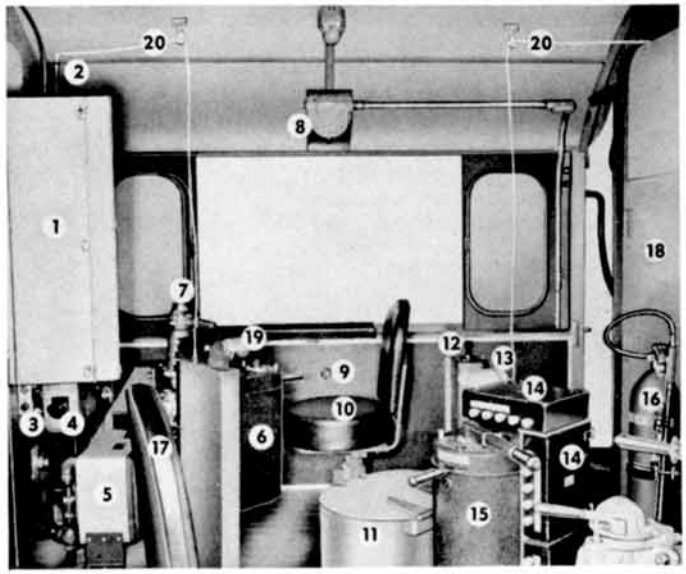
f. Prevent power from being restored after a ground relay operation until the throttle is moved to IDLE and the reverse handle in off.

g. Prevent power from being restored after an emergency brake application until the throttle is moved to IDLE and the reverse handle in off.

LOCOMOTIVE CAB FACING "A" CONTROL STATION

Fig. 24

1. Gauge Panel "A" Control Station
2. Horn Valve
3. Isolating Switch Idle Light and Test Push Button
4. Isolating Switch
5. Cab Heater
6. Master Controller "A" Control Station
7. Automatic Brake Valve
8. Headlight Switch
9. Emergency Fuel Cut-Off Pull Ring
10. Operator's Seat "A" Control Station
11. Water Cooler
12. Transfer Switch
13. Order Light "B" Control Station
14. Light Switches, Control Switches and Fuses
15. Master Controller "B" Control Station
16. Fire Extinguisher
17. Operator's Seat "B" Control Station
18. Electrical Control Cabinet Door No. 2 End
19. Order Light "A" Control Station
20. Horn Cord



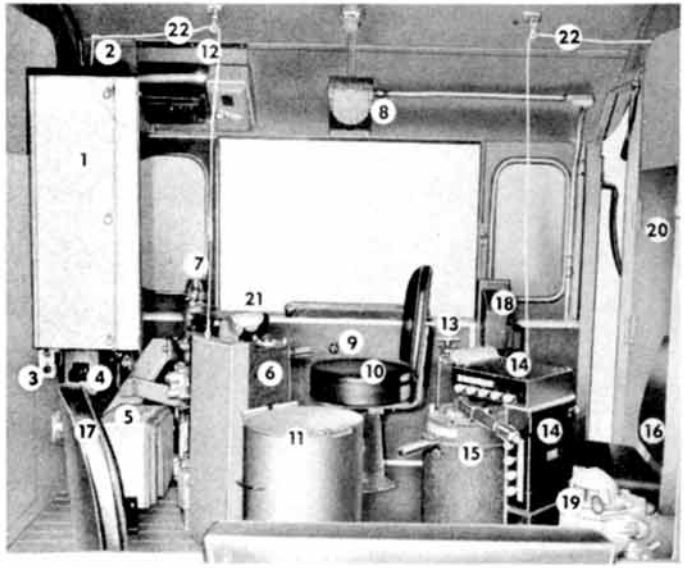
LOCOMOTIVE CAB FACING "A" CONTROL STATION

Fig. 24

LOCOMOTIVE CAB FACING "B" CONTROL STATION

Fig. 25

1. Gauge Panel "B" Control Station
2. Horn Valve
3. Isolating Switch Idle Light and Test Push Button
4. Isolating Switch
5. Cab Heater
6. Master Controller "B" Control Station
7. Automatic Brake Valve
8. Headlight Switch
9. Emergency Fuel Cut-Off Pull Ring
10. Operator's Seat "B" Control Station
11. Water Cooler
12. Train Phone Power Switch and Control Station when inductive train communication is provided
13. Rotair Valve
14. Light Switches, Control Switches and Fuses
15. Master Controller "A" Control Station
16. Brakeman's Seat
17. Operator's Seat "A" Control Station
18. Hand Brake
19. Independent Brake Valve
20. Electrical Control Cabinet Door No. 1 End
21. Order Light "B" Control Station
22. Horn Cord



LOCOMOTIVE CAB FACING "B" CONTROL STATION

Fig. 25

Air Brake Pedestal:

The air brake pedestal at control stations (A) and (B) carries the automatic brake valve. A bracket mounted to the stand carries the independent brake valve.

Sander Valve:

A sander valve is mounted to the cab wall adjacent to the operator's position at control stations (A) and (B). The valve incorporates forward and reverse sanding.

Bell Ringer:

The bell ringer valve is incorporated in the same housing as the sander valve, and this valve operates the bell.

Windshield Wiper Valves:

The windshield wiper speeds are controlled by needle valves located near the windshield wiper motors. A cut-out valve is mounted on the wall directly in front of the operator's position at control station (A).

Headlight Switch:

This switch is mounted to the roof directly above the operator's position at control stations (A) and (B). It controls the intensity of either the front or rear headlight. The headlight switches on the master controller stand must be closed first.

Cab Heater:

Hot water heaters are mounted to the floor beneath the gauge panels at (A) and (B) control stations. A switch for the heater at (A) control station is mounted below the gauge panel at (A) control station, and the switch for the heater at (B) control station is mounted below the gauge panel at (B) control station. There is a rheostat incorporated in each switch for adjusting the fan speed of the heaters. The heat output is adjusted by check valves in water line.

Horn Valve:

These valves are attached to the cab wall directly ahead of the operator's position at control stations (A) and (B). A cable hangs from each valve and is attached to the control stand, convenient to the operator. A cutout cock in the line must be opened before the horn can be operated.

Hand Brake:

The hand brake is located in the cab directly behind the (B) control station operator's position. The hand brake acts only on one side of the truck at the No. 1 End of the locomotive. To apply, pump hand lever and to release, lift release handle approximately 40°.

Fire Extinguisher:

A fire extinguisher, for use on electrical equip-

ment fires, is mounted to the No. 2 End electrical control cabinet door. An additional fire extinguisher is located in each engine compartment on the intake side.

K-2 Rotair Valve:

The K-2 Rotair valve handle is mounted in the cab directly behind the (B) control station operator's position.

Cab Signals and Trainphone:

1. Certain locomotives are equipped with Union Switch & Signal Company's Four Indication Code Cab Signal System with Whistle and Acknowledger. This equipment is to be operated in accordance with P.R.R. instructions.

2. Certain locomotives are equipped with Union Switch & signal Company's "FM" Yard Inductive Train Communication system. This equipment is to be operated in accordance with P.R.R. instructions.

LOCOMOTIVE OPERATION
INTRODUCTION

PRELIMINARY

1. Check the supplies of—
   a. Lubricating oil
      1. Engine
      2. Governor
      3. Air Compressor
   b. Water
   c. Fuel
   d. Sand

2. Inspect the electrical control cabinets and engine compartment for tools, rags, etc., that may interfere with the proper operation of the equipment.

STARTING THE DIESEL ENGINES

Operating the Locomotive at (A) Control Station—

1. Close the battery switch 110 in the No. 2 End electrical control cabinet.

2. Place transfer switch TW in position "A".

3. Put isolation switches 147 and 247 in "IDLE" position.

4. Close the "Control" switch.

5. Close the fuel pump switch.

6. Place the throttle in the "IDLE" position at the (A) and (B) control stations. The reverser handle should be removed from (B) control station.

7. Insert the reversing handle in the controller and leave it in the "OFF" position.

8. Press engine start button on the gauge panel at (A) control station. If the engine fails to turn over, check the control fuse in the push button switch box mounted on the control stand. If the engine turns but does not fire, check the engine overspeed stop and reset if tripped. See Fig. 15. Check governor low lube oil switch.

9. Repeat operation 8 at (B) control station.

10. Allow the engine to idle until the water reaches 120°F.

Operating the Locomotive at (B) control station. If starting the Diesel engines at (B) control station is desired proceed exactly as outlined for (A) control station except for item 2 which would be as follows: Place transfer switch TW in position "B".

PUMPING AIR

1. As the engine runs, the air compressor will pump air into the main reservoir. Make sure the red hand on the main reservoir gauge rises to

the correct value and then stops, indicating the compressor has unloaded.

2. See that the control air pressure gauge indicates approximately 70 pounds.

3. Observe that the compressor resumes pumping when the main reservoir pressure drops to the unloader pilot cut-in pressure.

4. To pump air at a higher rate than idling rate, place reversing controller handle in "OFF" and speed up engine by advancing throttle to no higher than the 3rd notch.

MOVING THE LOCOMOTIVE

1. Push in button A53 which is located beneath the gauge panel at (A) control station. Provided the white light A54 goes "ON" and shows the word "IDLE" turn switch 147 to "RUN" position.

2. Push in button B53 which is located beneath the gauge panel at (B) control station. Provided the white light B54 goes "ON" and shows the "IDLE" turn switch 247 to "RUN" position.

3. Test air brakes. Do not attempt to move the locomotive until the brake pipe gauge hand indicates full brake pipe pressure.

4. Put K-2 Rotair valve handle in the desired position.

5. Release hand brake.

6. Close exciter field push button at the operation control station. This must be in whenever engines are running.

7. Move the reverser lever to the forward or reverse position according to the direction the locomotive is to be moved.

8. Move the throttle handle to the No. 1 position. A flow of current will be indicated on the load ammeter. If no current is indicated, return the throttle to idle and check isolating switches 147 and 247.

9. The wheels will slip when too much power is applied. It has nothing to do with how fast the throttle is opened.

OPERATION WITH TRACTION MOTOR FIELDS SHUNTED

With a light train, the locomotive will operate at higher speeds with resistors in parallel with the motor field. The shunting control is automatic and requires no attention by the engineman.

LOAD LIMIT AND SHORT TIME RATINGS

Overloading the electrical apparatus may cause serious damage. This damage may not be apparent immediately, but could cause a failure later. The load the electrical equipment can carry is limited by the heat generated by the current. The continuous

current rating of the motors is 930 amperes and the traction equipment may be run continuously at this current or below.

Amperes	**Time Limit - Minutes**
930	Continuous
1040	30
1100	20
1200	10

These short time setups are not cumulative. Any one short time rating may be used following continuous operation but a short time rating may not be repeated unless 30 minutes or more of operation at continuous or less intervenes between the use of the short time ratings.

SANDING

When there is a possibility of slipping the wheels while starting, sand may be applied by operation of the sander valve located on the cab wall adjacent to the operator's position. Do not apply sand while wheels are slipping. Stop the slipping by reducing the throttle and then apply sand.

STOPPING THE LOCOMOTIVE

Move the throttle lever to the idle position. This stops the flow of current to the traction motors. The locomotive can be brought to a stop by a brake application.

If an emergency brake application is made with power on, then before putting the locomotive in motion see Power Knockout Contactor Page 26.

TO REVERSE THE LOCOMOTIVE

With the throttle in the idle position at the operating control station and the locomotive completely stopped, move the reverse lever to the desired direction and advance the throttle.

CAUTION: Power should never be applied in the opposite direction while the locomotive is in motion, as serious damage is likely to occur.

INSPECTION DURING OPERATION

1. Check height of engine lubricating oil in sight glass in lube oil tank.
2. Governor oil level.
3. Water level in the sight glass on the water tank.
4. Water temperature should not exceed 180°F. or be less than 140°F.
5. Battery charging ammeter should always show charge.

6. Drain condensation from the main reservoir—
   a. Control air reservoir
   b. Air compressor intercooler
7. Lube oil pressure should be 40-65 lbs. in the 8th notch and a minimum of 17 lbs. at idle.
8. Usual inspection of running gear for loose or dragging parts.
9. Check for unusual noises and odors.

TO SHUT DOWN THE LOCOMOTIVE

1. Allow the engine to idle a sufficient time for the engine temperature to drop to 165°F. with manual shutter control.
2. Place the reverse lever at control station in the off position.
3. If one power plant only is to be shut down, move the corresponding isolating switch 147 and 247 to stop position. If both power plants are to be stopped, see item 5.
4. Open the exciter field switches.
5. Press the button in the end of the throttle lever and push the throttle lever into the stop position.

6. Open all switches in the push button boxes mounted on both control stands.

7. Open the main battery switch 110.

8. Set the hand brake.

9. Water system must be protected in cold weather. See Fig. 14-1.

   a. Admit steam to system through connection # 2 at front of engine water pump intake pipe. Do this for each unit.

   b. Drain at end of heat exchanger located in the radiator compartment. Do this for each unit.

TO SHUT OFF FUEL IN AN EMERGENCY

Pull the emergency fuel cable ring. These rings painted red are mounted to the cab wall at the operator's position at (A) and (B) control stations in the cab of the locomotive. An additional red ring is mounted above the fuel tank on the side opposite the emergency fuel cut off valves. At the emergency fuel cut off valves is a hand lever which closes the valves. See Fig. 13-1.

TO ISOLATE A UNIT

While operating the locomotive from either the (A) or (B) control station put isolating switch 147 and 247 in stop position. Isolating switch 147 controls power unit No. 1 and 247 controls power unit No. 2.

TO CHANGE OPERATING POSITION

To operate the locomotive from the control station proceed as follows:

1. Bring the locomotive to a complete stop.

2. Put throttle handle in idle position.

3. Remove brake handles and reverser handle.

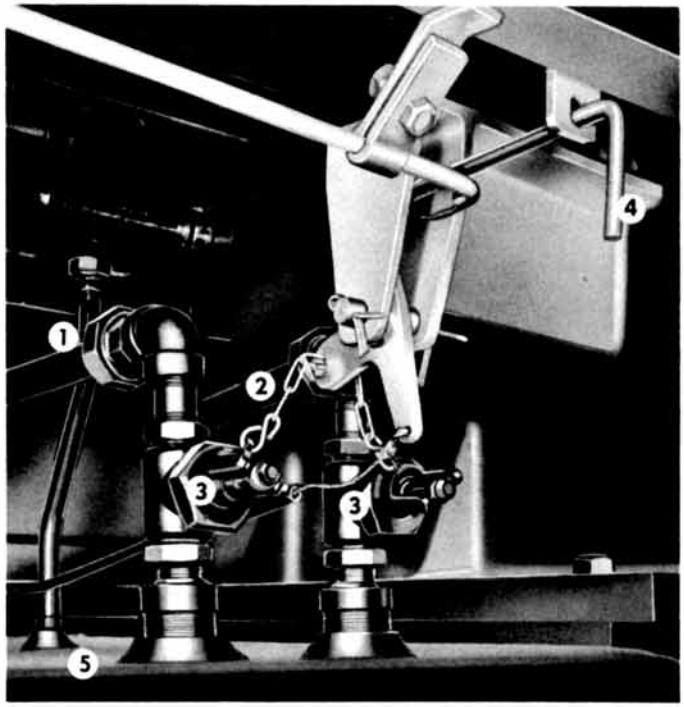
4. Close the corresponding push buttons at the station the locomotive is to be operated.

5. Open the double heading cock at the new station and close it at the station the operator is leaving.

6. Put transfer switch TW in the position corresponding to the control station the locomotive is to be operated.

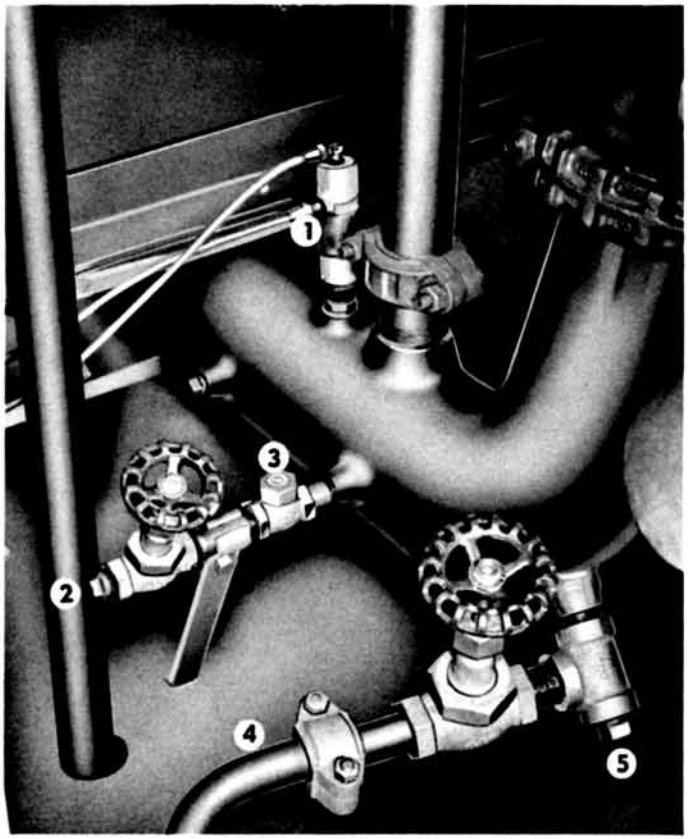
7. Put the brake handles and the reverser handle in position at the new control station.

8. Put the locomotive into operation.



EMERGENCY FUEL SHUT-OFF VALVE
Fig. 13-1

1. Fuel Pipe to No. 2 End Engine
2. Fuel Pipe to No. 1 End Engine
3. Fuel Shut-Off Valve
4. Operating Handle
5. Fuel Tank



STEAM ADMISSION
Fig. 14-1

1. Shutterstat
2. Steam Admission
3. Check Valve
4. Cab Heater Water Line
5. Drain Plug

OPERATIONAL DIFFICULTIES

FAILURE IN LIGHTING CIRCUITS

1. Check the fuses in the push button switch boxes.

FUEL PUMP WILL NOT OPERATE

1. Check 30 amp. fuel pump fuse (127).
2. Check 15 amp. fuse in push button switch box.
3. See that fuel pump contactor, FPC, is operating and that contacts are clean.

ENGINE WILL NOT TURN WHEN START BUTTON IS PRESSED

1. Check 15 amp. "control" fuse in push button switch box.
2. Check for run down battery by observing cab lights while pressing start button. If lights go out, battery is run down.
3. Reverser not in "OFF" position.
4. Throttle not in "IDLE" position.
5. Check interlock on exciter field contactor, "EF". Interlock should be closed.
6. Isolation switches (147) (247) not in "IDLE" position.

ENGINE TURNS BUT WILL NOT START

1. Empty fuel tanks.
2. Overspeed governor tripped. See Fig. 15.
3. Emergency fuel shut-off valve tripped.
4. Fuel pump not operating.
5. Clogged filters.

6. Low lube oil pressure shut-down button on governor out.

AUXILIARY GENERATOR WILL NOT CHARGE BATTERY

1. Check 100 amp. auxiliary generator fuse (106) (206).
2. Check Battery Contactor, 1BC, and 2BC, to see if the contacts are clean and making good contact.
3. Check reverse current relay.

ENGINE OPERATES BUT LOCOMOTIVE DOES NOT MOVE

1. Check reverser to see if its position corresponds with reverse lever.
   a. Be sure control air pressure is 70 pounds.
   b. Check interlock fingers.
2. Check the interlocks of the starting contactors, G1, G2, Motor Switches, P1, P2, and the contacts of the blower fuse relays BF.
3. Ground Relay tripped.
   a. Place throttle in idle and reverse lever in off to reset.
4. "Exciter" switch open.
5. Hand brake on.
6. Isolation switches 147 or 247 not in run position.

ENGINE STOPS

1. Overspeed governor trips. See Fig. 15.

2. Emergency fuel shut-off valve trips.
3. Low lube oil pressure shut down.
4. Fuel pump motor fuse blown.

BLOWER MOTORS WILL NOT OPERATE

1. Check (400A) blower fuse. (111) (211).
2. Check auxiliary generator field contactor, AF. It should close whenever the engine is running.

RADIATOR FAN WILL NOT OPERATE

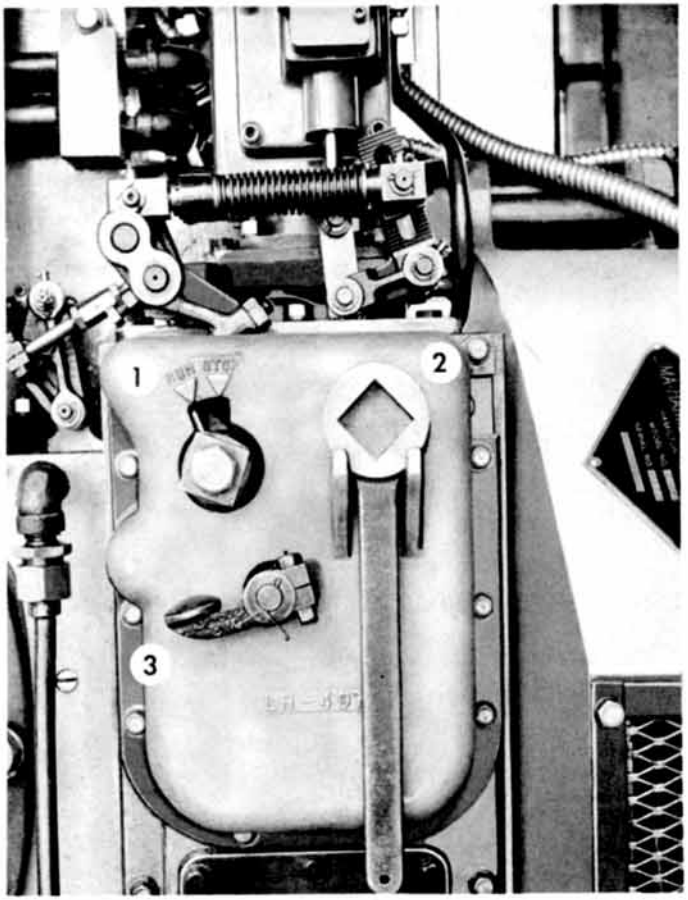
1. See "Blower Motor will not Operate".
2. Check the radiator shutter switch and radiator fan contactor.

LOW LUBRICATING OIL PRESSURE SHUT-DOWN

1. Insufficient oil supply.
2. Lube oil dilution.
3. Clogged filters.
4. Stuck relief valve.
5. Oil leak.
6. Clogged strainer screens.
7. Hot Engine.

HOT ENGINE

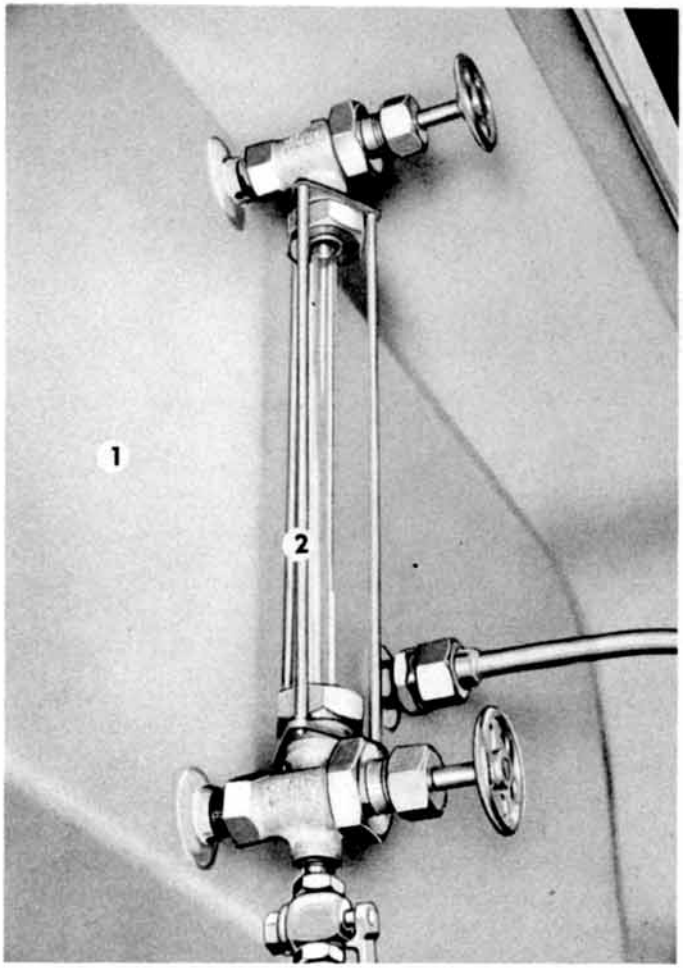
1. Insufficient water.
2. Shutters closed, check:
   a. Air pressure to shutter air cylinder.
3. Fan inoperative.



OVERSPEED TRIP

Fig. 15

1. Indicating Pin
2. Reset Wrench
3. Manual Trip Lever



WATER GLASS

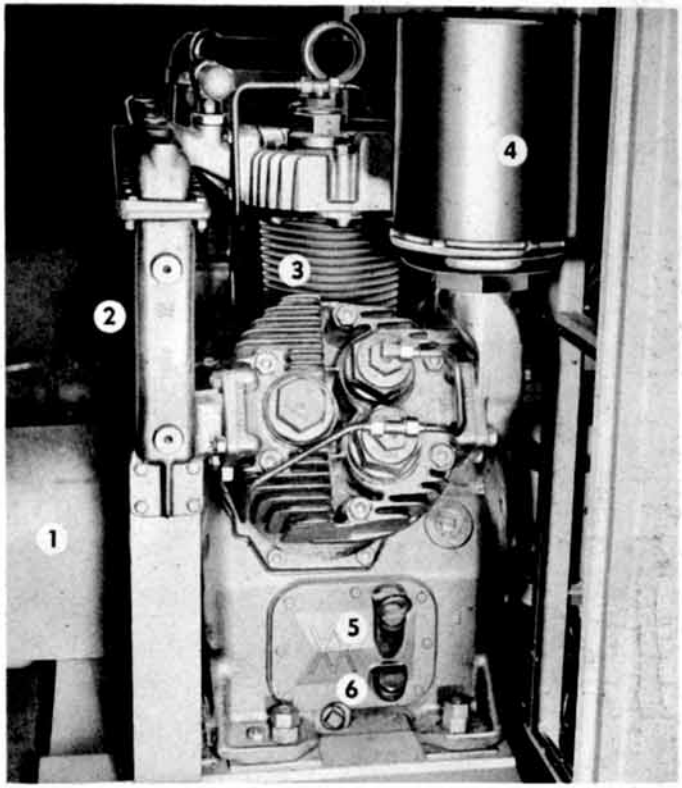
Fig. 16-3

1. Water Tank
2. Water Level Glass

SHUTTER CONTROL

Fig. 17-4

1. Shutter Control Handle
2. Radiator Shutter
3. Numeral Light



AIR COMPRESSOR

Fig. 12-3

1. Main Generator and Air Compressor Flexible Coupling
2. Air Intercooler
3. Air Compressor
4. Air Strainer
5. Lube Oil Bayonet Gauge
6. Lube Oil Filler Plug