



RAIL DIESEL CAR

**OPERATOR'S
MANUAL**

READING COMPANY

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FOREWORD

This manual is compiled for the qualified operating personnel of the Budd Rail Diesel Car. It should be used as a guide to locate operating equipment, for normal operating methods and for trouble-shooting.

Items I to IX inclusive explain the normal operating methods, including check lists. Road trouble-shooting is explained in Item X. One engine operation appears as Item XI. Multiple car operation is explained in Item XII. Engine cooling water draining instructions appear as Item XIII. The truck braking equipment is described in Item XIV.

This manual explains those service and preventive maintenance operations that logically fall within the scope of the operator of the Budd Rail Diesel Car.

See Air Brake companies' pamphlets covering air brake equipment.

FIGURE 1
CONTROL CAB

The car is provided with duplicate controls at each end.

1. Defroster Switch.
2. Classification or Marker Light Switch.
3. Number Sign Light Switch.
4. Windshield Wiper Motor.
5. Access Door - Classification Lights, Gauge Light Resistors.
6. Horn Signal Valve.
7. Generator Pilot Light - No. 1 Engine.
8. Generator Pilot Light - No. 2 Engine.
9. Horn Emergency Cut-out Cock.
10. Cab Signal.
11. 26-B-1 Brake Valve.
12. Windshield Wiper Control Valve.
13. Bell Signal Air Valve.
14. Whistle Cab Signal.
15. Cut-out Cock - Whistle - Cab Signal.
16. Foot Valve Cut-out-cock - Sealed open.
17. D-1 Foot Valve.
18. Access Door - Number Lights, Windshield Wiper Motor.
19. Air Reservoir Gauge, Main & Equalizing Reservoirs.
20. Horn Cord.
21. Air Brake Gauge, Brake Pipe and Brake Cylinder.
22. Headlight and Instrument Light Switch.
23. Helper's Cab Heat Switch.
24. Operator's Cab Heat Switch.
25. Cab Ceiling Light Switch.
26. Master Plug Switch.
27. Forward and Reverse Lever.
28. Speedometer.
29. Manual Sanding Button.
30. Throttle Lever.
31. Cab Heat Blower.
32. Controller - Engine Direction and Speed.
33. Control Handle Stowage Box.
34. Operator's Seat.
35. Cab Signal Acknowledging Switch.
36. Cab Heater.
37. Emergency Fuel Cut-off Ring.
38. Reset Sand Direction Button.
39. Brake Valve Cutout Key.

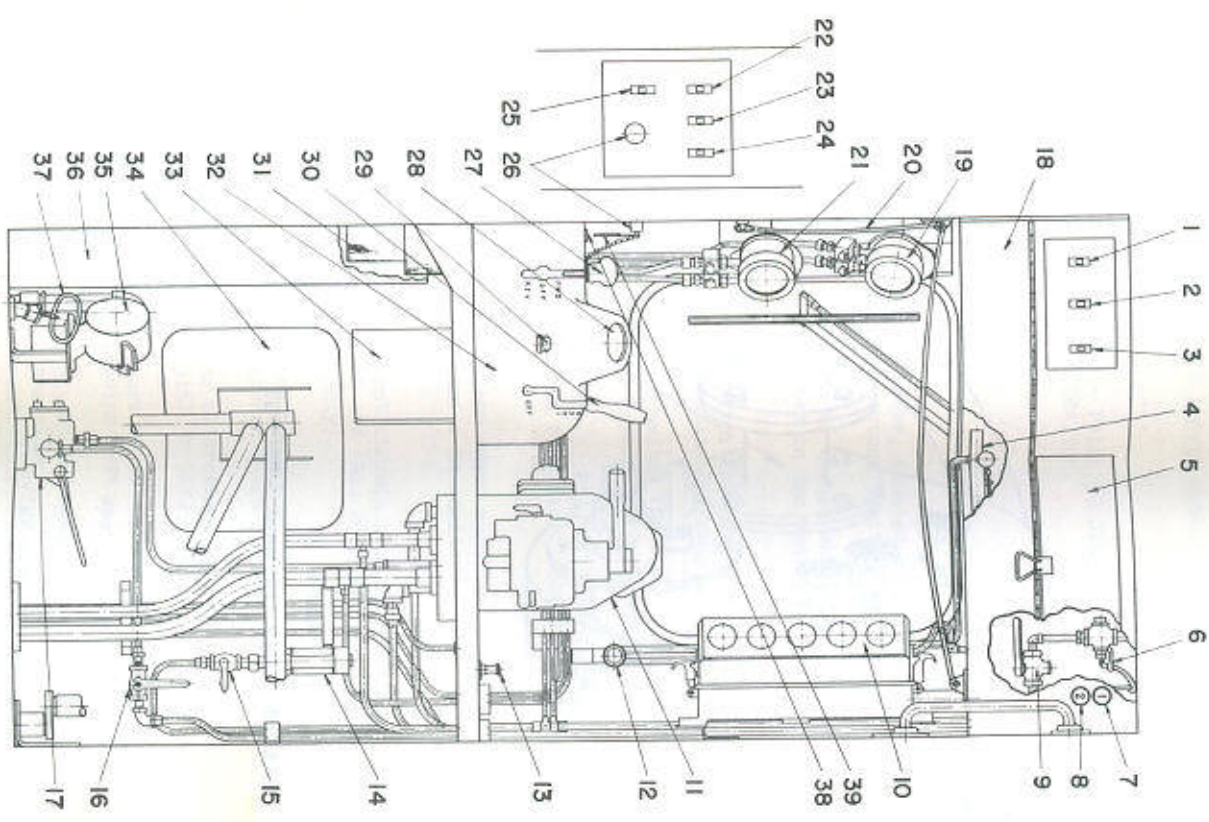


FIGURE 1
CONTROL CAB

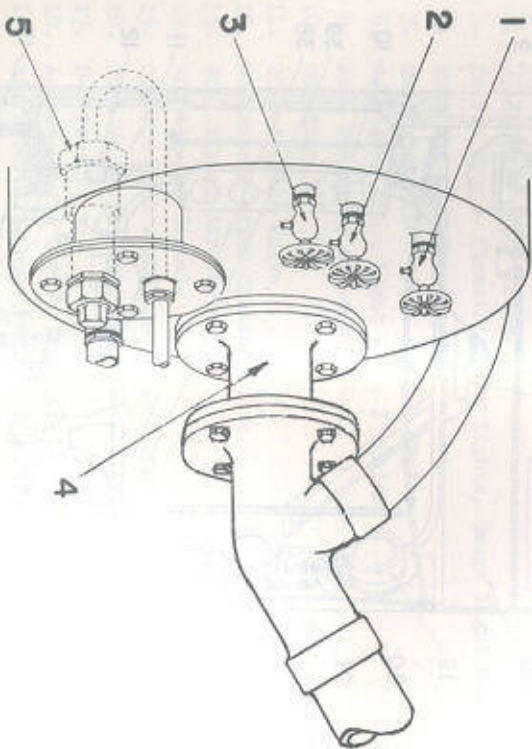


Figure 2
WATER TANK (Engine Cooling)

1. Top Cock
2. Middle Cock
3. Bottom Cock
4. By-pass Valve
5. Temperature Regulator

TOP COCK - If inhibitor is used, water should not be above this level (FULL).

MIDDLE COCK - water should flow from this cock (NORMAL).

BOTTOM COCK - water flowing from this cock ONLY is signal to add water (LOW).

Normal operating level between top and middle cocks with engine stopped.

OPERATOR'S POCKET MANUAL

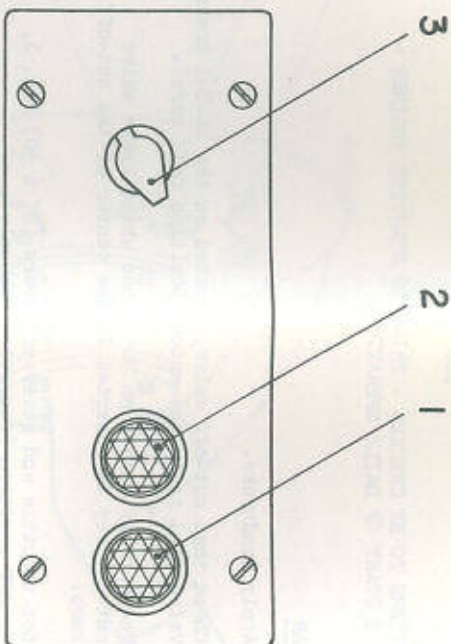
ITEM I - ITEMS TO BE CHECKED - PRIOR TO STARTING ENGINES -
AT START OF DAILY OPERATION.

IN CAR

- A. Apply Handbrake.
- B. Check that cut-off valve, located on the 26-B-1 Brake Valve (11), is in the cutout position (all cars).
The cut-off valve can be turned while brake valve cut-out key is inserted in the center of the cut-off knob.
- C. Set throttle and reverser levers (27 & 30) FIG. 1, in OFF position (Operating Cab only).
- D. Insert master plug in switch (26) FIG. 1 (connects battery to circuits) (Operating Cab only).
- E. Set isolation switches (5) FIG. 6, and (7) FIG. 7 in NORMAL position in all regulator lockers at both ends of each car.

NOTE: ISOLATE position opens negative circuit to control solenoids on engine.

- F. Set cab signal control circuit breaker (34) FIG. 7 to ON position - 'B' end (No. 2) regulator locker (lead car of train only).
- G. Set excitation switch to ON position 'A' end (No. 1) regulator locker (cars 9151 or 9152 only).
- H. Set excitation motor alternator circuit breaker to ON position (cars 9151 or 9152 only).
- I. Check circuit breakers on switch panels of all cars, FIG. 8. The following must be ON:-
Signal and Sanding (4)
Trainline Supply (5)
Controller, Cab 1 & 2 (6)
Car Sanding (12)
Air Compressor (13)
Engine Solenoids (14 & 15)



1. PILOT LIGHT-GREEN-ON.
2. PILOT LIGHT-RED-OFF.
3. CONTROL SWITCH.

FIGURE 3

**EXCITATION PILOT LIGHT BOX
(CAB CEILING AT OPERATOR'S POSITION)**

- J. Set excitation control switch - (3) FIG. 3 to ON position (cars 9151 or 9152 only).

UNDER CAR

- A. Close battery switch (all cars).
- B. Check fuel emergency valve (29) FIG. 5; valve must be open when leg of T-shaped toggle is in line with stem of valve (all cars).
- C. Check engine cooling water level - try cocks on end of tank, both sides of car. See FIG. 2. Water level should be between upper two cocks with engine stopped (all cars).
- E. With engines stopped, check engine crankcase lubrication oil level on all cars. Car should be level. If the car is not level, the oil level will be low on the high side of the car and high on the low side, thereby giving a false reading. This should be taken into consideration. Oil filler cap and dip stick (2) FIG. 4.
- F. With engines stopped, check transmission oil level on all cars. Car should be level. Oil filler cap and dip stick (13) FIG. 4.
- G. Before re-entering car, see that:-
 1. Air brake hose cocks are closed on the front end of the lead car, rear end of the trailing car, and dummy couplings are in place.
 2. Air hoses are secure.

ITEM 11 - STARTING ENGINES

A. REGULATOR LOCKER STARTING.

1. Press START ENGINE NO. 1 push button (2) FIG. 6 and hold until green generator pilot light No. 1 (7) FIG 1, lights, indicating that engine is running.

CAUTION: Do not crank more than 30 seconds continuous without a pause of several minutes to allow the cranking motor to cool. Failure to observe the above may result in complete failure of cranking motor.

2. Press START NO. 2 ENGINE push button (15) FIG. 6 and hold until Green Generator pilot light No. 2 (8) FIG. 1, lights, indicating that engine is running.

CAUTION: Do not crank more than 30 seconds continuous without a pause of several minutes to allow the cranking motor to cool. Failure to observe the above may result in complete failure of cranking motor.

NOTE: No. 1 and No. 2 engines can be started from the 'A' end or 'B' end regulator locker. This starting circuit is not trained and engines must be started from either one of the two regulator lockers on each car in the train.

B. ENGINE PANEL STARTING.

1. Open engine casing doors.
2. Press START button (5) FIG. 4, until engine fires and hold reset lever (3) FIG. 4, until lever latches open automatically.

NOTE: Engine starting at the engine panel is not remote and each engine on each car must be started independently at this location.

CAUTION: Do not press START button more than 30 seconds continuous without a pause of several minutes, to allow the starter motor to cool. Failure to observe the above may result in complete failure of cranking motor.

3. Make visual check for leaks.
4. Close engine casing doors.

ITEM III - AIR BRAKE TEST PREPARATION - AT START OF DAILY OPERATION AND AFTER EACH LAYOVER.

- A. Enter control cab and watch main reservoir air gauge - top Gauge - red hand (19) FIG. 1 - air compressor running.

NOTE: 10 to 12 minutes are required to build up main reservoir pressure from 0 to 140 pounds.

- B. Depress foot valve pedal (17) FIG. 1.

NOTE: Brake valve handle in SUPPRESSION position will nullify foot valve.

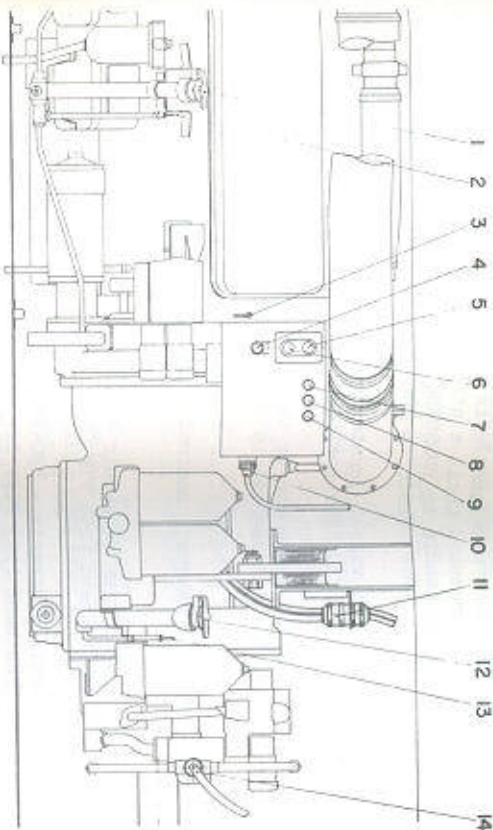


FIGURE 4
ENGINE CONTROL PANEL

1. Engine Crankcase Lubrication Oil Fill Tube.
2. Engine Crankcase Lubrication Oil Dip Stick.
3. Air Shutdown Valve Reset Lever.
4. Reset Button - Telltale Lights.
5. START Button.
6. STOP Button.
7. Engine Oil Pressure - Telltale Light.
8. Engine Water Temperature - Telltale Light.
9. Transmission Oil Temperature - Telltale Light.
10. Engine Control Cable Quick Disconnect.
11. Starter Cable Quick Disconnect.
12. Transmission Oil Fill Tube.
13. Transmission Oil Dip Stick.
14. Transmission Control Cable Quick Disconnect.

C. Insert brake valve handle in the HANDLE OFF position, pressing downward until a stop is reached. At this point move handle to EMERGENCY position and press downward. Move handle to RELEASE position.

D. Turn cut-off valve, located on the 26-B-1 brake valve (11) FIG. 1, to "I" position.

The cut-off valve can be turned while brake valve cutout key is inserted in the center of the cut-off knob.

E. Check air gauges; nominal readings with brakes released.

1. Equalizing reservoir - 90 pounds - top gauge - white hand (19) FIG. 1.
2. Main reservoir - 130-140 pounds - top gauge - red hand (19) FIG. 1.
3. Brake pipe - 90 pounds - bottom gauge - white hand (21) FIG. 1.
4. Brake cylinder - 0 pounds - bottom gauge - red hand (21) FIG. 1.

ITEM IV - PERFORM BRAKE TEST

NOTE: There are four brake cylinders on each truck, one cylinder per wheel, easily visible from outside of truck. Each cylinder is equipped with a collapsible rubber boot with corrugations or rings. When boot is collapsed, brakes are released. Foot valve must be depressed while brakes are released to avoid an emergency application.

Precaution should be taken to prevent car from moving when the brake test is performed.

A brake cylinder cut-off cock for each truck is located in the supply line to the Rolokron control box (22) FIG. 5, at side of car.

ITEM V - SETTING CAR IN MOTION

A. After completing procedures Item I - IV inclusive:-

1. Check to see that EXCITATION ON (green) (1) FIG. 3 pilot light is on (Cars 9151 or 9152 only).

Excitation must be in service on single car operated as a train.

Green pilot light (1) FIG. 3 will glow when excitation is established.

Red pilot light (2) FIG. 3 will glow when excitation has failed.

2. Make brake application to hold car.

NOTE: Check that handbrake is released.

3. Move reverse lever (27) FIG. 1, to direction required.

4. Move throttle lever (30) FIG. 1, from OFF to #1 position. After approximately 5 seconds a lurch will be felt in the car body, indicating that the transmission clutches are engaged.

5. Press RESET SAND DIRECTION push button.

NOTE: Operation of directional sanding reset button is required whenever direction of operation is reversed.

Pressing the RESET SAND DIRECTION push button (38) FIG. 1 will set up the directional sand relay (26) FIG. 6 on all cars for the direction the train is traveling, by means of the trainline circuits, and thereafter will hold the desired sanding direction regardless of reverser lever and throttle lever setting.

When it is desired to reverse the sanding direction, it is only necessary to press the RESET SAND DIRECTION push button after resetting the reverser lever and throttle lever.

6. Release brakes. Car will accelerate slowly, depending on grade.

7. For greater speeds, move throttle lever to #2, then #3, and finally to #4 as required, pausing in each position before advancing.

NOTE: Never advance throttle lever above #1 position until after the clutches engage. To do so would cause engagement of clutches at high engine speed, resulting in possible damage to equipment.

Operation in #4 throttle position when car is stationary must not exceed 30 seconds duration. Failure to observe this precaution will result in engine shutdown and possible damage to equipment.

Do not allow car to stand on sand. Roll car off the sand to insure signal shunting.

ITEM VI - BRAKING

A. Speed Control

1. Under normal running conditions, this can be accomplished by positioning of the throttle lever at #1, 2, 3, or 4. A combination of braking and throttle lever positioning provides intermediate speed control. NEVER bring throttle lever into OFF position to retard speed. If throttle lever is accidentally returned to OFF position during high speed operation, reduce car speed to 40 m.p.h. or under before return to first power position and clutch engagement.

B. STATION OR MOMENTARY STOP

1. Bring throttle lever (30) Fig. 1 back to #1 position, not OFF. See NOTE below.
2. Make service application as required.
3. Graduate to between 15 and 20 pounds brake cylinder pressure for final stop.

NOTE: Disc brake allows full service application for rapid initial deceleration, followed by gradual reduction of brake cylinder pressure for final stop.

NOTE: Do not return throttle lever to OFF position unless an extended layover is anticipated.

C. EMERGENCY BRAKING.

Emergency brake applications can be manually initiated from three sources:-

1. By placing the brake valve (11) Fig. 1 in emergency position (75 p.s.i. B.C. pressure).
2. By releasing pressure from foot valve pedal (17) Fig. 1 in absence of brake cylinder pressure.

NOTE: Brake cylinder pressure will not nullify emergency unless brake valve handle is in SUPPRESSION position.

3. By opening conductor's or helper's valve.

CAUTION: Return throttle controller lever to OFF position IMMEDIATELY if an emergency brake application occurs.

D. RESTORATION TO SERVICE FOLLOWING EMERGENCY BRAKE APPLICATION.

The following procedure covers release of an emergency brake application and restoration to service braking.

- a. Bring throttle lever to OFF position.
- b. Clear cause of emergency application. (Conductor's or helper's valve must be closed manually).
- c. Depress foot valve pedal and move the brake valve handle to SUPPRESSION position. After brake pipe pressure has increased, as indicated by brake pipe gauge (21) Fig. 1., the brake valve handle can then be moved to release position for continued operation.
- d. Place brake valve handle in full service position.

E. TOWING CAR - AS PART OF A TRAIN OR IN YARD MOVEMENT.

Make sure that 26-B-1 brake valve cut-off valves at both ends of all cars are in the cutout position. It is necessary to connect only the brake pipe to the train for proper control of air brakes.

It is essential in any movement of the cars that the main battery switches on all cars be in the ON position to insure functioning of the Rolokron anti-wheel slide device.

ITEM VII - CHANGING OPERATING ENDS

- A. Make a full service application.
- B. Turn cut-off valve located on the 26-B-1 brake valve (11) Fig. 1, to CUT-OFF position.
The cut-off valve can be turned while brake valve cut-out key is inserted in the center of the cut-off knob.
- C. Remove brake valve handle (11), Fig. 1. To remove, the handle must be moved to EMERGENCY position and then raised until a stop is reached. After reaching the stop, move handle to HANDLE-OFF position and remove.
- D. Set throttle and reverser lever (27 & 30) Fig. 1, in OFF position and remove.
- E. Remove master plug (26) Fig. 1 from switch
- F. Remove operator's seat back rest and stow seat pedestal.
- G. Turn off windshield wiper (12) Fig. 1.
- H. Turn off Headlight (22) and cab lights (25) Fig. 1.
- I. Turn on classification or marker lights (2) Fig. 1.
- J. Turn off excitation control switch (3) Fig. 3. (cars 9151 or 9152 only).
- K. Turn off the following, ONLY if car will NOT be leading car in train.
 1. Cab signal circuit breaker 'B' end (No. 2) regulator locker (34) Fig. 7.
 2. Excitation switch (30) Fig. 6 - 'A' end No. 1) - regulator locker (cars 9151 or 9152 only).

- L. Proceed to opposite end of car and insert master plug in switch (26), Fig. 1.
- M. Depress foot valve pedal (17) Fig. 1.

NOTE: Brake valve handle in SUPPRESSION position will nullify foot valve.

- N. Insert brake valve handle in the HANDLE-OFF position, pressing downward until a stop is reached. At this point move handle to EMERGENCY position and lower until the handle is in full engagement in EMERGENCY position. Move handle to FULL SERVICE position.
 - O. Turn cut-off valve, located on the 26-B-1 brake valve (11) Fig. 1, to "IN" position.
The cut-off valve can be turned while brake valve cut-out key is inserted in the center of the cut-off knob.
 - P. Lower operator's seat pedestal and install seat back rest.
 - Q. Proceed as in ITEM V, 1 to 7 inclusive - SETTING CAR IN MOTION.
- ITEM VIII - ITEMS TO BE CHECKED - AT END OF RUN, See Fig. 1.
- A. Make a full air brake service application.
 - B. Turn cut-off valve, located on the 26-B-1 brake valve (11) to CUT-OFF position.
The cut-off valve can be turned while brake valve cut-out key is inserted in the center of the cut-off knob.
 - C. Remove brake valve handle (11). To remove, the handle must be moved to EMERGENCY position and then raised until a stop is reached. After reaching the stop, move handle to HANDLE-OFF position and remove.

- D. Move throttle lever and reverser lever to OFF position and remove.
- E. Remove master plug (26) from switch.
- F. Remove operator's seat backrest and stow seat pedestal.
- G. Turn off windshield wiper (12).
- H. Turn off headlight and instrument lights (22).
- I. Turn off classification or marker lights (2).
- J. Turn off excitation control switch - cab ceiling (3) Fig. 3.
- K. Turn off cab signal circuit breaker (34) Fig. 7 'B' end (No. 2) regulator locker.
- L. Turn off excitation switch (30) Fig. 6 'A' end (No. 1) regulator locker (cars 9151 or 9152 only).

ITEM IX - ENGINE SHUTDOWN

- A. Engine can be shut down in the following manner:
 - 1. ENGINE CONTROL PANEL of each engine. See Fig. 4. By pressing STOP button (6) until engine shuts down and oil pressure switch trips air shutdown damper.
 - 2. AIR REGULATOR LOCKER - By using isolation switch.
 - a. To stop #1 engine, move the isolation switch in regulator locker #1 (A) end, (5) Fig. 6, to ISOLATE, then to STOP position. Hold in stop position until generator pilot light (7) Fig. 1, goes out. This will indicate that #1 engine has stopped. After engine has stopped, move switch back to normal position.
 - b. #2 engine may be stopped in a similar manner by the isolation switch in #2 (B) end regulator locker (7) Fig. 7. Match generator pilot light for #2 engine (8) Fig. 1.

- 3. At #1 (A) regulator locker, by using STOP ENGINE #1 (3) or STOP ENGINE #2 (16) stop buttons Fig. 6.
 - a. To stop #1 engine, press button and hold in depressed position until #1 generator pilot light (7) Fig. 1, goes out.
 - b. To stop #2 engine, press button and hold in depressed position until #2 generator pilot light (8) Fig. 1, goes out.
- 4. At #2 (B) regulator locker, by using STOP ENGINE #1 (3) or STOP ENGINE #2 (17) stop buttons Fig. 7.
 - a. To stop #1 engine, press button and hold in depressed position until #1 generator pilot light (7) Fig. 1, goes out.
 - b. To stop #2 engine, press button and hold in depressed position until #2 generator pilot light (8) Fig. 1, goes out.
- 5. At #1 (A) or #2 (B) regulator locker, by using STOP ALL ENGINES - ALL CARS stop button (1) Fig. 6 or (1) Fig. 7.
 - a. To stop all engines on all cars, press button and hold in depressed position until both the #1 and #2 generator pilot lights (7) and (8) Fig. 1 go out.
 - b. In case of fire - fuel may be shut off at the tank by pulling the red fuel emergency cut-off ring, located in each cab (37) Fig. 1.

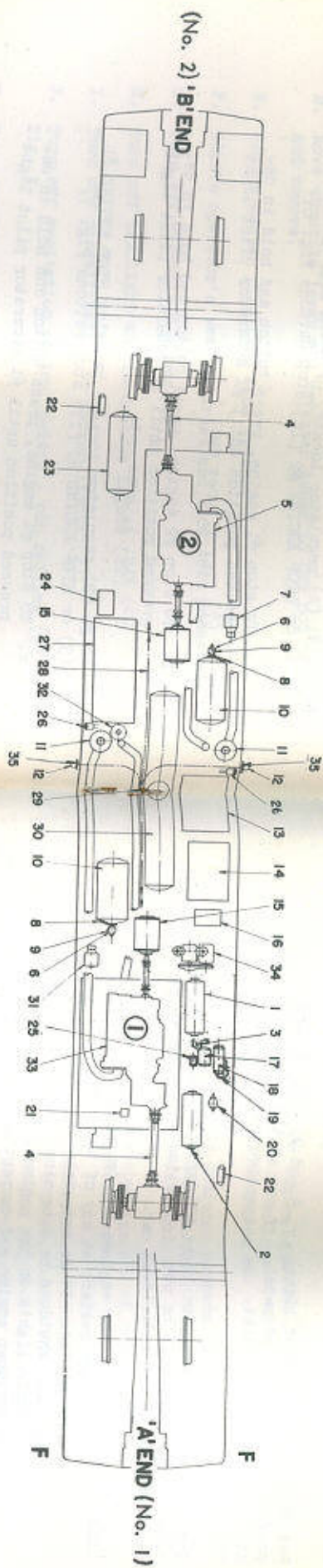
CAUTION: This method of shutdown can ruin the injectors and should not be used except in emergency.

ITEM X - TROUBLE SHOOTING

Note #1 - Protective shutdown is provided for low engine oil pressure, high transmission oil temperature, high engine cooling water temperature, and engine overspeed. If any of these conditions exist, the respective switch will close to trip the air shutdown valve and limit switch, which de-energizes the engine control.

Note #2 - The overspeed governor is interconnected with the low engine oil pressure switch to shut down the engine in the event of overspeed.

1. No. 2 Main Reservoir.
2. Service Reservoir.
3. J-1 Relay Valve.
4. Main Drive Shaft.
5. No. 2 Engine.
6. Steam Admission Valve.
7. Water Pump - Floor Heat.
8. Water Level Cocks - Engine Cooling.
9. By-Pass Valve - Engine Cooling.
10. Water Tank - Engine Cooling.
11. Engine Air Cleanser.
12. Fuel Emergency Valve Ring. Pull In Case of Fire ONLY.
13. Air Conditioning Condenser.
14. Air Conditioning Compressor.
15. Generator.
16. Pull Box and D.C. Charging Receptacle.
17. Auxiliary Reservoir



18. Combined Control & Selector Volume Reservoir.
19. 26-C Control Valve.
20. Type "J" Filter.
21. Emergency Sanding Pressure Switch.
22. Rolokron Control Box.
23. No. 1 Main Reservoir.
24. Battery Cut-Out Switch and D.C. Charging Receptacle.
25. Volume Reservoir
26. Fuel Fill and Sight Gauge.
27. Battery Box.
28. Fuel Valve Cable to Cab.
29. Fuel Emergency Valve Toggle - See Fig. 3.
30. Fuel Oil Tank.
31. Water Pump - Overhead Heat.
32. Bell.
33. No. 1 Engine.
34. Air Compressor and Motor.
35. Emergency Valve Reset Handle.

Figure 5
PLAN OF EQUIPMENT UNDER CAR

Red tell-tale indicator lights (7, 8 and 9) Fig. 4, are provided on each engine panel. If any of the above conditions of shutdown exist, the respective red indicator will light.

Individual Generator pilot light (7) or (8) Fig. 1, located in each cab will be out, indicating which engine is shut down on the individual car.

WARNING: When any of the engines are found to have shut down DO NOT restart at any of the regulator locker start buttons. It is extremely important that the cause for shutdown be determined by observing the tell-tale lights on the engine control panel of the shutdown engine and correcting the cause if possible. Failure to observe this warning could result in destruction of the engine.

To resume normal operation, the air shutdown valve must be restored to OPEN position manually, which closes the limit switch to complete negative circuit.

When an engine is shut down, loss of oil pressure will cause the air shutdown valve to trip (close). To start, the reset lever (3) Fig. 4 must be held out manually until a rise in oil pressure opens the protective switch.

If engine shutdown is caused by excessive water temperature, as indicated by tell-tale light (8) Fig. 4, the engine may be re-started in the following manner:

- a. Check water level - between upper two try cocks. (See Fig. 2).
- b. Press tell-tale reset button (4) Fig. 4. Red pilot light will go out.
- c. Crank engine and hold air shutdown lever until engine pump operation and cooling fan operation reduces water temperature and latches up air shutdown reset lever. If engine water temperature does not drop, and reset lever does not lock up within two minutes, shut down engine and proceed as per item XI.

NOTE 3. See Fig. 2. Engine water temperature is maintained by diverting the engine outlet water through the roof radiators. The water flow to the radiators is controlled by a by-pass valve (4). The by-pass valve is bolted to the inlet opening of the sump tank.

As the water leaving the engine rises to 170° F, the by-pass valve will close, and the water cannot enter the tank and is diverted to the roof radiators.

If the water leaving the radiator exceeds 165° F, the fan operates at low speed. When the water exceeds 176° F, the fan operates at high speed.

The water returns to the opposite end of the tank from which the by-pass valve is located.

NOTE 4. Throttle and transmission solenoids are fed battery positive from the traction relays in the #1 (A) end regulator locker. A common negative solenoid feed for #1 or #2 engines is routed through the Isolation Switch (5) Fig. 6 or (7) Fig. 7, in the respective locker. ISOLATION switches must be in NORMAL for tractive power to wheels. The isolation switch is used to de-energize the traction solenoids only and does not remove safety protection if engine is operated in ISOLATE.

Circuit breaker protection for positive and negative feed to the engine solenoids (14 & 15) Fig. 8 is located on the switch panel and must be ON for power operation.

Circuit breaker protection for positive feed to traction relay coils and controller is located on the switch panel (6) Fig. 8 and must be ON for relay operation.

Plug switch at controller (26) Fig. 1 must be IN and air compressor control circuit breaker (13) Fig. 8 must be ON for compressor operation.

Cooling fan motor and control circuit breakers (6, 19, 23, & 29) Fig. 7, and air compressor motor circuit breaker (12) Fig. 7 are located in the (B) end regulator locker.

Inter-connection between car and engine wiring is accomplished by two quick disconnect eight contact plug and cable assemblies, one for the engine and one for the transmission. These plugs must be IN for normal operation of controls.

A. WHEN ENGINE WILL NOT CRANK

1. Check that the air shutdown valve reset lever is being pulled out to its limit of travel.

2. Check battery switch - must be closed (24) Fig. 5.
 3. Check starter cable disconnect (11) Fig. 4. Must be in.
- B. WHEN ENGINE WILL CRANK BUT WILL NOT FIRE.

1. Check fuel in tank - gauge (26) Fig. 5.
2. Check emergency fuel shutoff valve reset lever (35) Fig. 5 - at fuel tank - Valve must be open.

C. WHEN ENGINE WILL FIRE BUT STOPS WHEN RESET LEVER IS RELEASED.

1. Engine air shutdown valve manual reset lever (3), Fig. 4, must be held for approximately 30 seconds to allow engine lubrication oil pressure to rise and open low engine oil pressure switch. If the reset lever is released prior to build-up in oil pressure, the low engine oil pressure switch will remain closed and air shutdown valve will close, thus shutting down the engine.

- a. Check oil level. If oil level is above FULL - may be an indication of fuel dilution.

CAUTION: If fuel dilution is present, fuel leak must be corrected, crankcase drained and oil replaced. Do not attempt to run engine with excessive oil dilution.

2. Check for high engine water temperature - Engine panel tell-tale light (8) Fig. 4 will be lit. High water temperature protective switch is set to close air shutdown valve when water temperature exceeds 200°F. If temperature is above 200° the engine cooling system is faulty and should be checked as follows:

- a. Check water level - petcocks on end of tanks.
- b. Check cooling fan circuit breakers - Motor (6 or 19) Fig. 7, and Control (23 or 29) Fig. 7.
- c. Check radiator cooling fan operation. Jumper #5 and #9 terminals on the fan control panel terminal block (4) No. 2 engine (18) No. 1 engine Fig. 7, in 'B' end regulator locker. This shorts the low speed thermostat and

fans should operate at low speed. Jumper between #4 and #9 terminals should operate fans at high speed.

For fan operation with jumper in place and water temperature above 200°F air shutdown valve reset lever must be pulled and held to complete negative circuit.

CAUTION: If engine water temperature is not lowered immediately after fan starts to run, SHUT DOWN ENGINE and allow to cool.

If engine water temperature is lowered and protective switch restored to OPEN position by application of jumper, leave jumper attached and proceed. DO NOT use this procedure during freezing weather due to the possibility of freezing the roof radiators.

If engine water temperature is not lowered by application of jumpers and subsequent operation of fans, shut down engine and proceed on one engine. See ITEM XI.

3. If transmission oil temperature was above 255° - Engine tell-tale light (9) Fig. 4, will be lit.

A temperature cutoff switch is provided in the Engine Control Panel to protect the transmission from excessive oil temperature. This switch is set to close the air shutdown valve and shut down the engine when the oil temperature exceeds 255°.

If this occurs, to start engine the reset lever must be pulled and held for approximately one minute to reduce transmission oil temperature and OPEN the protective switch. This procedure may be repeated to accomplish oil cooling.

4. Protective Switches are faulty.

If Items 1, 2 and 3 above indicate that oil and water conditions of engine are normal but engine still stops when reset lever is released, it may be assumed that one of these switches is faulty, thus falsely shutting down the engine. Failure of Direct Drive Clutch Governor to disengage clutches will stall engine. Failure of Overspeed Governor valve to close will cause low oil pressure shutdown.

These conditions should be reported and switches checked at end of run.

Proceed on one engine. See ITEM XI.

D. WHEN ENGINES RUN BUT CAR WILL NOT MOVE - with throttle lever in #1 position.

1. If engine speeds increase when the throttle is advanced. -
 - a. Handbrake may be applied - CHECK
 - b. Check for sand on rails - an emergency application may have been made while car was standing, filling sand on rails in front of wheels. Move throttle lever to #2, 3 or 4 position to ride over sand.
 - c. Check TRANSMISSION CONTROL CABLE (14) Fig. 4. Plug must be IN.
 - d. Listen for clutch engagement, one engine at a time.
 - e. One of the axle gear units may have seized.
- DO NOT ATTEMPT TO MOVE THE CAR - If gear unit is suspected to be faulty, until proper authority is obtained.
2. If the engine speeds do not increase when throttle is advanced but remain at idle speed -
 - a. Check both ISOLATION SWITCHES (5) Fig. 6, and (7) Fig. 7; Must be in NORMAL position.
 - b. Check CONTROLLER CIRCUIT BREAKERS (6) Fig. 8 in switch locker - must be ON.
 - c. Check MASTER PLUG SWITCH (26) Fig. 1 - must be IN.
 - d. Check ENGINE SOLENOID CIRCUIT BREAKERS (14) & (15) Fig. 8 - must be ON.
 - e. Check TRAINLINE SUPPLY CIRCUIT BREAKER (5) Fig. 8 must be ON.

E. INSUFFICIENT POWER

If the car does not have the proper acceleration when throttle is advanced it may be an indication that only one engine is propelling the car.

f. Check ENGINE CONTROL CABLE (10) Fig. 4, at right end of engine control panel box - must be IN.

1. Check transmission oil level on each power unit.
 - a. If oil level is below "ADD" level on dip stick, shut engine down and proceed on one engine. See ITEM XI.
 2. With brakes set, individually check each power unit for transmission clutch engagement. This can be accomplished by using the ISOLATION switches located in the lockers at each end of the car.
 3. Isolate engine closest to controller from which test is being made. With reverser positioned, advance throttle to #1 position. After approximately 8 seconds, a light lurch will be felt in the car body indicating that the transmission clutch is engaged on the engine furthest from the controller.
 4. Return the isolation switch to normal for the engine closest to the controller, and note a heavier clutch engagement.
 5. Failure of either power unit to engage clutches indicates a faulty unit - ISOLATE engine and proceed on one engine. See ITEM XI.
- F. ENGINE RUNS BUT STALLS - when throttle is moved from OFF to #1 position.
1. This is caused by the transmission going into direct drive. ISOLATE engine and proceed on one engine.
- G. WHEN MAIN RESERVOIR PRESSURE DOES NOT BUILD UP OR HOLD.
- NOTE: The air compressor will not operate unless one or both engines are running. Master plug switch must be IN.
1. Check air compressor control circuit breaker (13) Fig. 8 - must be ON.
 2. Check air compressor circuit breaker (12) Fig. 7.

3. Check compressor governor - remove cover and observe that contacts are CLOSED. Compressor governor is located in switch panel locker.
4. Check reverse current relay auxiliary contacts - of engine that is running (27) FIG. 6, or (32) FIG. 7. Contacts must be CLOSED.
5. Check air compressor motor for operation.
6. Check for leaks in air brake system or open angle cocks.

H. WHEN GENERATOR WILL NOT CHARGE - with engine running.

If generator pilot light (7 or 8) FIG. 1 is not lit, it is an indication that generator is not charging. Check whether the lamp is burned out by observing the pilot light at opposite end of car.

If the same light on both ends of the car is not lit:-

1. Shut down engine.
2. Remove and replace field fuse with known good fuse (23) FIG. 6, or (28) FIG. 7.
3. Restart engine.

If the pilot lights fail to operate - report failure to maintenance forces.

ITEM XI - OPERATING CAR ON ONE ENGINE.

Should on-the-road trouble-shooting fail to restore an engine to normal service, it is possible to operate the car on one engine providing grades are not excessive. However, acceleration and cruising speed should be reduced.

When car heating is required, and it is possible to IDLE a troublesome engine, it is advisable to do so. The ISOLATION SWITCH must be set to ISOLATE under these conditions.

When the outside temperature is above freezing, it is not necessary to drain the shutdown engine. If a troublesome engine prohibits operation and there is a danger of freezing, refer to Draining Instructions. Proceed on remaining engine.

To prevent unnecessary draining of cooling system, table giving outside temperature and approximate time required to lower temperature of cooling water, with pump shut down, from normal to freezing follows.

<u>Outside temperature</u>	<u>Time required</u>
32°F.	7 hours
15°F.	5 hours
0°F.	3 hours
-15°F.	1 hour

ITEM XII - MULTIPLE CAR OPERATION

Each car is equipped with four receptacles - one at each corner of the car. A jumper cable equipped with a plug at each end is provided to connect the trainline circuits from car to car. It is necessary to have only one jumper between each two cars.

The trainline jumper is stored in the utility locker of each car. When the cars are separated, the jumper should be returned to the locker in the car from which it was removed. Failure to remove the jumper cable may result in severe damage to the equipment.

An occasional check of the condition of the receptacles is recommended. Any collection of dirt should be blown out.

When cars are coupled together, and control is not obtained from lead car to car, or cars following - check condition of plugs and receptacles. Clean units if necessary. Check that plugs are completely entered in receptacles and that cover latch engages lug on the plug.

ITEM XIII - DRAINING INSTRUCTIONS - ENGINE COOLING WATER

TO DRAIN SYSTEM remove drain plug, located in the engine cooling water tank bottom fitting. Strike the crossbar on the plug sharply with a hammer to rotate in a clockwise direction (looking down on plug). Removal of this plug will drain all water from system except that in oil coolers, engine water pump and feed line to car heat.

CAUTION: When drain plug is removed do not lose the gasket. The drain plug and gasket should be wired to the engine control panel (FIG. 4) and panel tagged "COOLING SYSTEM DRAINED - DO NOT CRANK ENGINE".

TO DRAIN ENGINE WATER PUMP open petcock located in bottom of pump.

TO DRAIN ENGINE AND TRANSMISSION OIL COOLERS open the oil cooler drain valve. The drain valve extension rod handle is located to the right of the engine water pump. Turn handle counterclockwise to drain.

TO DRAIN CAR HEAT PUMP AND FEED TO RADIATORS - open petcock in car heat radiator feed line (at pump outlet check valve). Open petcock in car heat pump housing.

NOTE: When #1 Engine is Drained - Move BLOWER SWITCH, on air conditioning panel (9) Fig. 8, in switch locker, to OFF position to prevent blowing cold air into car and remove OVERHEAD HEAT PUMP FUSE on air conditioning panel to prevent operation when dry.

When #2 ENGINE IS DRAINED - remove FLOOR HEAT PUMP FUSE to prevent operation when dry.

ITEM XIV - TRUCK BRAKING EQUIPMENT

The car is equipped with Budd Disc Brake Model CP in conjunction with the Budd Rolokron Anti-Wheel Slide Equipment. This combination affords a safe and positive braking action without damage to the wheels.

On each axle are two brake discs securely attached, one to each wheel. A braking assembly, consisting of a "C" frame which supports the shoes, brake heads, tongs and cylinders, is mounted in proper relation to the brake disc. As air, under pressure, is admitted to the brake cylinder, it forces the piston out, which in turn actuates the linkage, squeezing the composition lined shoes against both sides of the disc. The friction developed between the shoe linings and the disc stops the revolving disc and, in turn, the wheel to which the disc is attached.

In this manner, all heat generated by the brake application is confined to the disc. The disc is designed with cooling fins and openings that rapidly dissipate the heat into the surrounding air and thus saving the wheel from wear and heat.

The Budd Rolokron is a device mounted on the journal boxes, one per axle, to prevent wheel slide by:

- (1) Detecting the instant of excessive wheel deceleration (which occurs at the beginning of wheel slip).

- (2) Following detection, it immediately reduces brake cylinder pressure (before the wheel has become locked), thereby allowing the wheel to resume normal rotation.

- (3) At the same time initiates rail sanding to restore normal adhesion.

- (4) It immediately restores brake cylinder pressure as the wheel resumes normal rotation.

NOTE: In the event of repeated Rolokron action during service stops, check sand delivery.

REGULATOR LOCKER ('A' END)

1. Push Button - Stop - All Engines - All Cars.
2. Push Button - Start - Engine No. 1.
3. Push Button - Stop - Engine No. 1.
4. Throttle #1 Relay.
5. #1 Engine Stop and Isolation Switch.
6. Reverse Relay.
7. Fuse - Cab Heater - Left Side.
8. Fuse - Cab Heater - Right Side.
9. Fuse - Heater Blower - Left Side Cab.
10. Fuse - Heater Blower - Right Side Cab.
11. Rolokron Sanding Relay.
12. Plug Switch Relay.
13. Reset Sand Direction Relay.
14. Electro Pneumatic Sanding Valves.
15. Push Button - Start - Engine No. 2.
16. Push Button - Stop - Engine No. 2.
17. Lamp Regulator.
18. Throttle #2 Relay.
19. Forward Relay.
20. Manual Sand Relay.
21. Generator Regulator
22. Main Fuse - Generator.
23. Field Fuse - Generator.
24. Sanding Timer Relay.
25. Hi-Rate Sand Relay.
26. Sanding Directional Relay.
27. Auxiliary Contacts - Reverse Current Relay.
28. Battery Contacts - Reverse Current Relay.
29. Air Conditioning Control Panel.
30. Excitation switch.

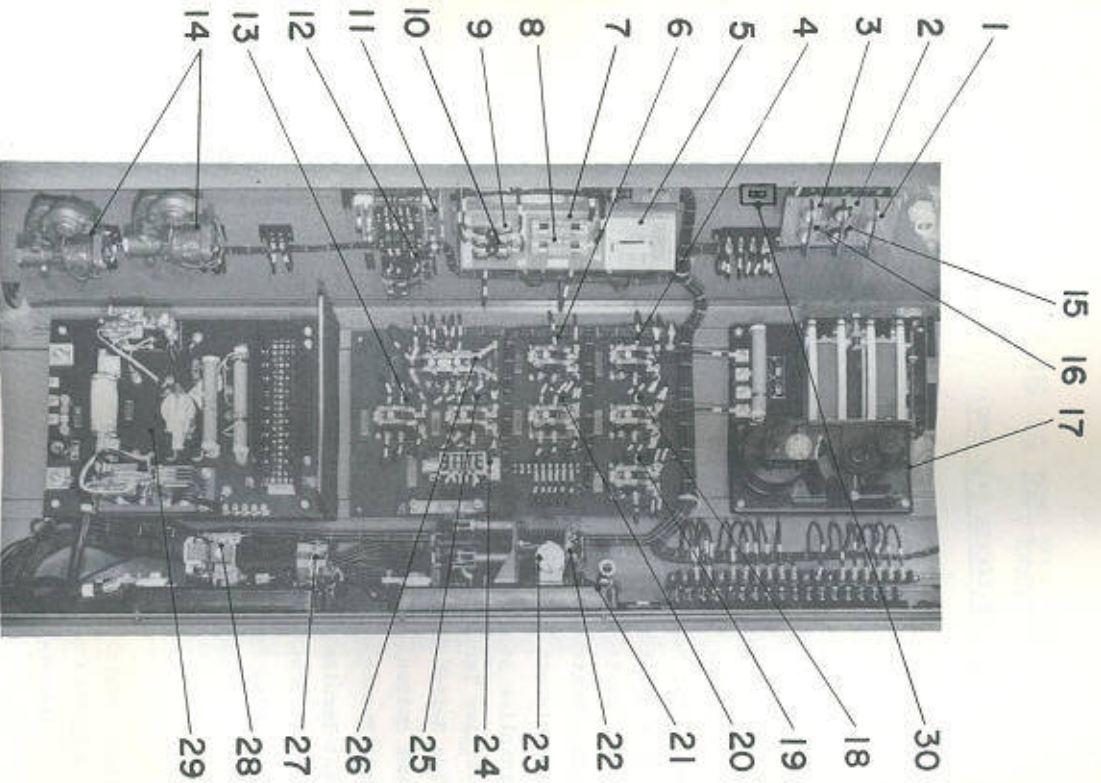


Figure 6
EQUIPMENT ARRANGEMENT
REGULATOR LOCKER ('A' End)

FIGURE 7
REGULATOR LOCKER ('B' END)

1. Push Button - Stop - All Engines - All Cars.
2. Push Button - Start - Engine No. 1.
3. Push Button - Stop - Engine No. 1.
4. Test Terminal Block - Cooling Fan - No. 2 Engine.
5. Time Delay Relay - No. 2 Engine Cooling Fan Motor.
6. Circuit Breaker - No. 2 Engine Cooling Fan Motor.
7. No. 2 Engine Stop and Isolation Switch.
8. Fuse - Cab Heater - Left Side.
9. Fuse - Cab Heater - Right Side.
10. Fuse - Heater Blower - Left Side Cab.
11. Fuse - Heater Blower - Right Side Cab.
12. Main Circuit Breaker - Air Compressor.
13. Trainline Stop Relay.
14. Positive Terminal Block.
15. Plug Switch Relay.
16. Push Button - Start - Engine No. 2.
17. Push Button - Stop - Engine No. 2.
18. Test Terminal Block - Cooling Fan - No. 1 Engine.
19. Circuit Breaker - No. 1 Engine Cooling Fan Motor.
20. Time Delay Relay - No. 1 Engine Cooling Fan Motor.
21. Low Speed Contactor - No. 1 Engine Cooling Fan Motor.
22. High Speed Contactor - No. 1 Engine Cooling Fan Motor.
23. Control Circuit Breaker - No. 1 Fan Thermostat & Contactor Coils.
24. High Speed Contactor - No. 2 Engine Cooling Fan Motor.
25. Low Speed Contactor - No. 2 Engine Cooling Fan Motor.
26. Generator Regulator.
27. Main Fuse - Generator.
28. Field Fuse - Generator.
29. Control Circuit Breaker - No. 2 Fan Thermostats & Contactor Coils.
30. Line Contactor - Air Compressor.
31. Time Delay Relay - Air Compressor.
32. Auxiliary Contacts - Reverse Current Relay.
33. Battery Contacts Reverse Current Relay.
34. Circuit Breaker - Cab Signal.

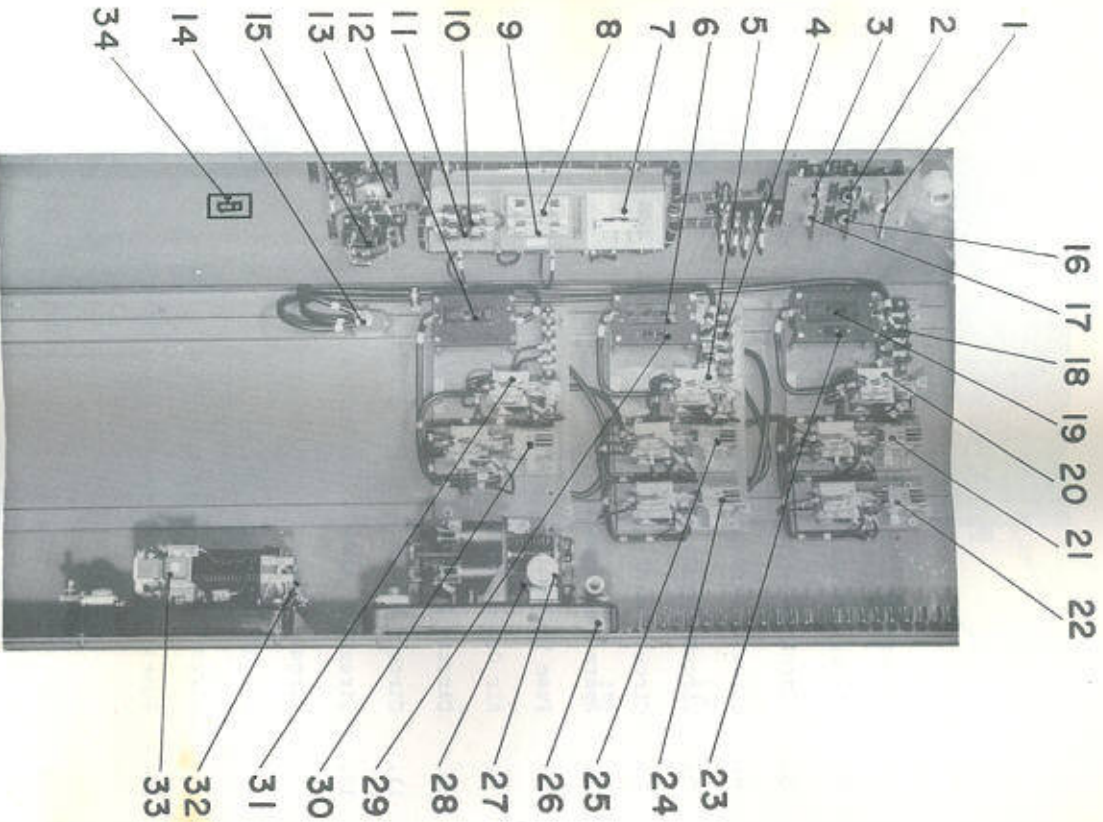


Figure 7
EQUIPMENT ARRANGEMENT
REGULATOR LOCKER ('B' End)

FIGURE 8
SWITCH PANEL

1. Circuit Breaker - Headlights, Cab Lights.
2. Circuit Breaker - Coach Ceiling and Cove Lights.
3. Circuit Breaker - Coach Ceiling Lights.
4. Circuit Breaker - Signal and Sanding.
5. Circuit Breaker - Trainline Supply.
6. Circuit Breaker - Controller - Cab No. 1 and No. 2.
7. Spare Fuse Panel.
8. Fuse Tester.
9. Air Conditioning Control Panel.
10. Circuit Breaker - Main Lighting.
11. Circuit Breaker - Plenum Lights and Defroster.
12. Circuit Breaker - Car Sanding.
13. Circuit Breaker - Air Compressor.
14. Circuit Breaker - No. 1 Engine Solenoid.
15. Circuit Breaker - No. 2 Engine Solenoid.
16. Fusetrons - Overhead and Floor Heat Pumps.

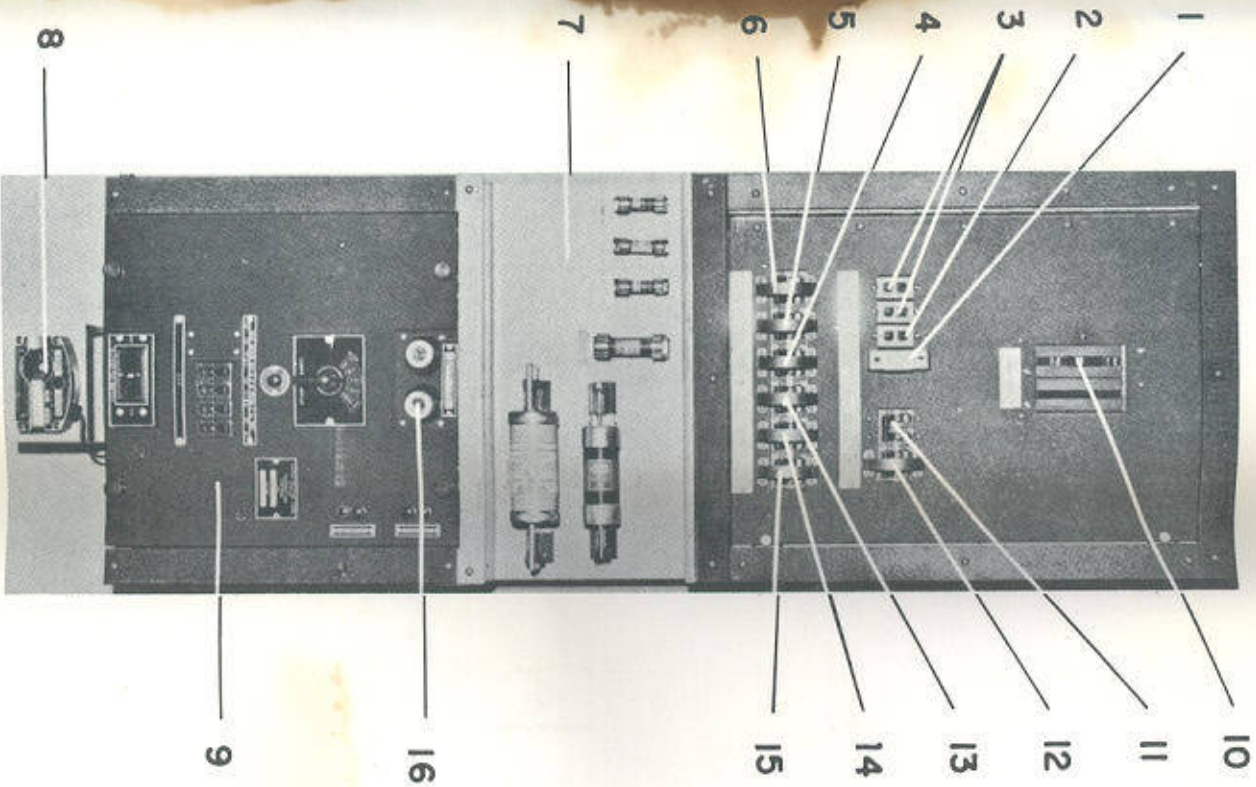


Figure 8
SWITCH PANEL