GENERAL: This group contains information on the wiring system from the domestic panel through all lights, switches, lamps, etc. used for domestic equipment.

SPECIFICS: As applicable

...AC-DC Converter

...Circuit Breakers

...Domestic Batteries

...Domestic Panel and Gauges

...Fuses

...Reading Lights

...Relays

...Service Line and Contactor Box

...Sockets

...Switches

...12 Volt Wiring

...110 Volt Wiring

GROUP 39

110 AND 12V ELECTRICAL SYSTEMS

TABLE OF CONTENTS

TABLE OF CONTENTS - Continued

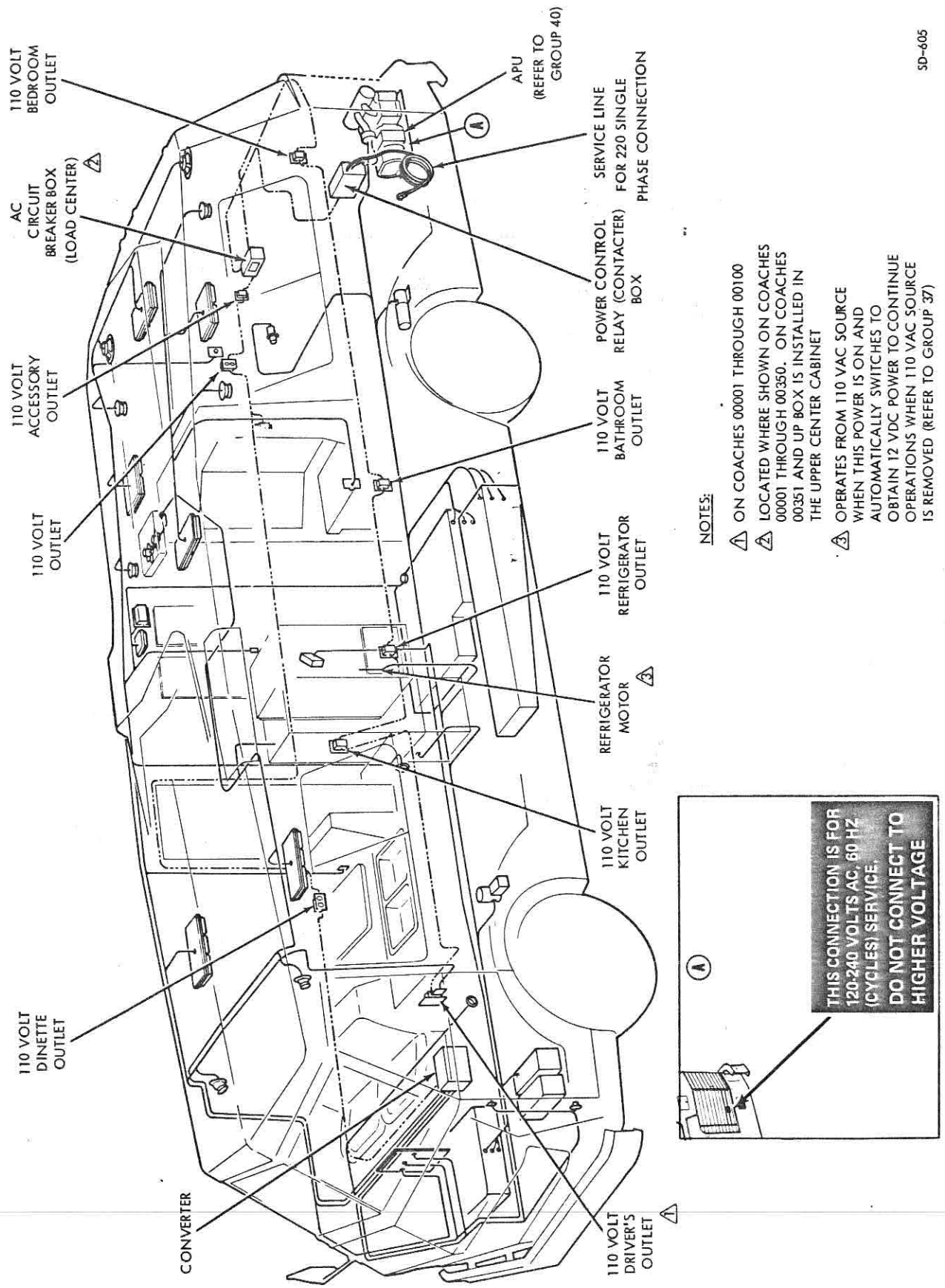


Figure 39-1. AC Operated Domestic Components and Outlets

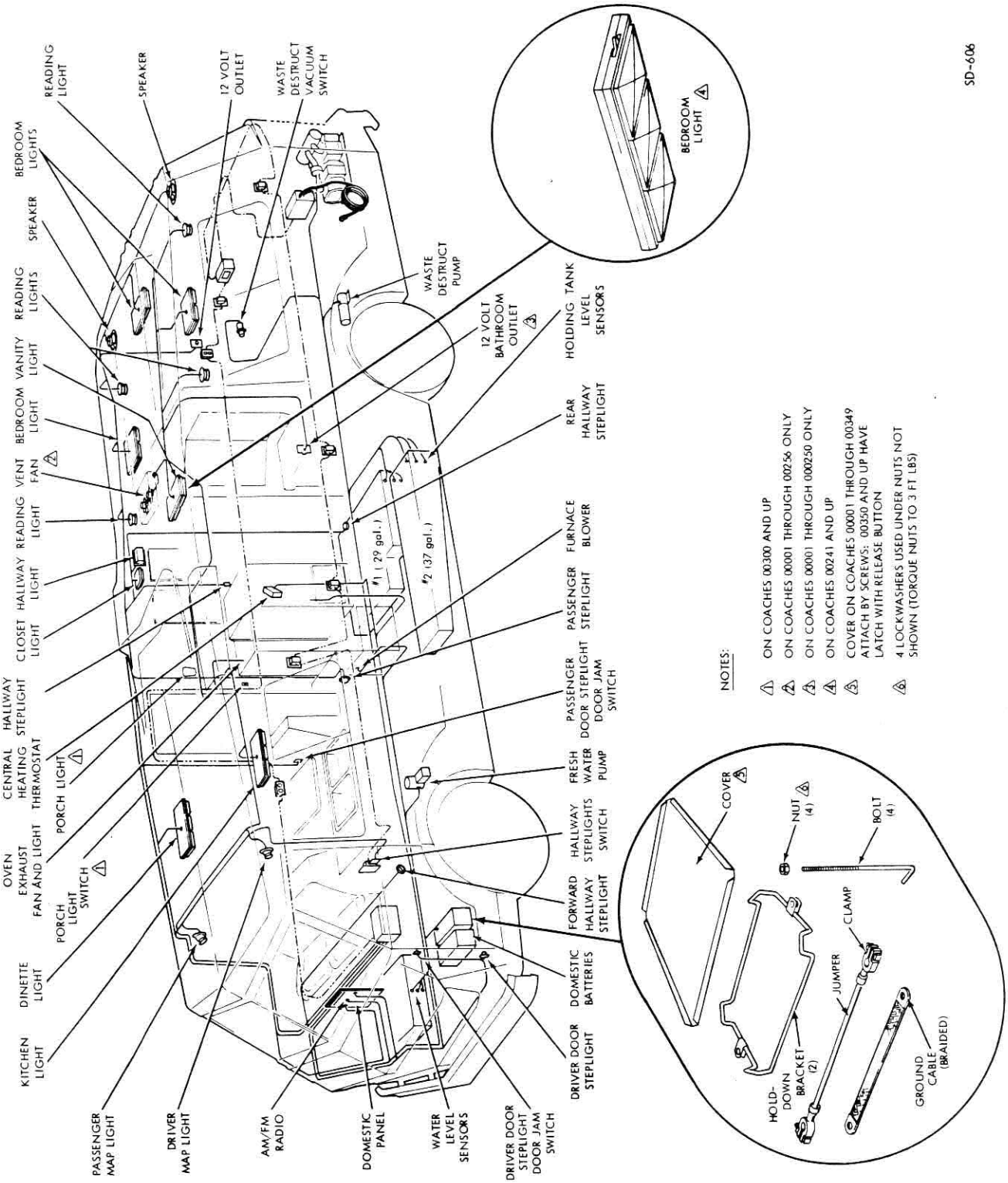


Figure 39-2. DC Operated Domestic Components

GROUP 39

110 AND 12V ELECTRICAL SYSTEMS

39-1. DESCRIPTION

a. General (Figures 39-1 and 39-2). The coach incorporates AC and DC electrical systems supplying power for operation of the domestic components and to power outlets at various locations in the coach. Major components of the domestic electrical power system are the Auxiliary Power Unit (APU), service line, AC-to-DC converter, and two six-volt batteries connected in series to provide 12 VDC.

NOTE

Decals on the coach and some illustrations and text in this group specify voltage figures with tolerances ranging as much as 15 VAC for the AC system and 3 to 6 VDC for the DC system. To explain these variations, the following is provided to assist you in better understanding system operation. AC is listed, in some instances, as 110 VAC, in other cases 115, 120/240 or 125/250 VAC. All references to AC voltages within the coach (after passing through the power control relay "contactor" box) should be interpreted as meaning 110 VAC. This is the normal reference for house electrical AC power for other than 240 VAC. The 240 VAC (or 250 VAC) mentioned herein and listed on coach decals does not mean that 240 VAC is available for the coach at the power outlets or appliances. Although the service line must be plugged into a 120/240 VAC external power source receptacle for operation, the 240 VAC is divided (branched) into two individual (dual) circuits. The two "hot" circuits are routed into the coach, thus providing only the standard 110 VAC for each of the dual circuits of the coach AC system. The same is also true for the Auxiliary Power Unit (APU). The APU is rated as 240 VAC but as explained for the service line, it is connected to deliver only 110 VAC to each of the dual circuits of the coach AC system. The domestic batteries are 6-volt batteries, but 6-volts DC is not used as an operating voltage in this coach. The two 6-volt batteries are always connected in series to provide 12 VDC for the domestic DC system. The 110 VAC to 12 VDC converters rated output is 14.1 VDC (no load) and 12 VDC (full load) when operating. The DC voltage, regarding the converter and domestic batteries, should be interpreted as being a 12 VDC domestic power system.

b. AC Power Operations (Domestic). AC power operations are made possible by connecting the coach service line to an external AC power source (camp-site or city receptacle) or by operating the APU. When AC voltage is applied from either the service line or the APU, the refrigerator, the AC outlet receptacles, domestic air conditioners (when switch is on) and the AC-to-DC converter are energized. When the converter is energized it produces DC voltage for operation of the DC powered domestic components and for maintaining the charge of the domestic batteries.

Both the APU and service line connect into the coach AC electrical system through the power control relay (contactor) box. The AC voltage received from either the service line or the APU, is distributed by two "hot" leads (black and red) each supplying AC through individual contacts (poles) of the power relays (contactors) K2 or K3 when they are closed. The white APU or service line lead is "neutral" and the green lead is "ground". The AC power is routed through two (one left-side and one right-side) AC circuits. Each AC circuit is protected by a 30-ampere circuit breaker and a 20-ampere fusible unit, located in the AC circuit breaker box (load center).

These circuits provide power to the AC outlets and the AC operated domestic components shown in figure 39-3.

(1) AC Power Control Relay (Contactor) Box. The components of the AC power control relay (contactor) box are shown in figure 39-4. Electrical circuitry for the power control relay (contactor) box is shown in the "relay enclosure" portion of figure 39-3. The contactor assembly is classified as "type EBR definite purpose reversing contactor mechanically interlocked" and consists of one three-power-pole (contacts) set mechanically

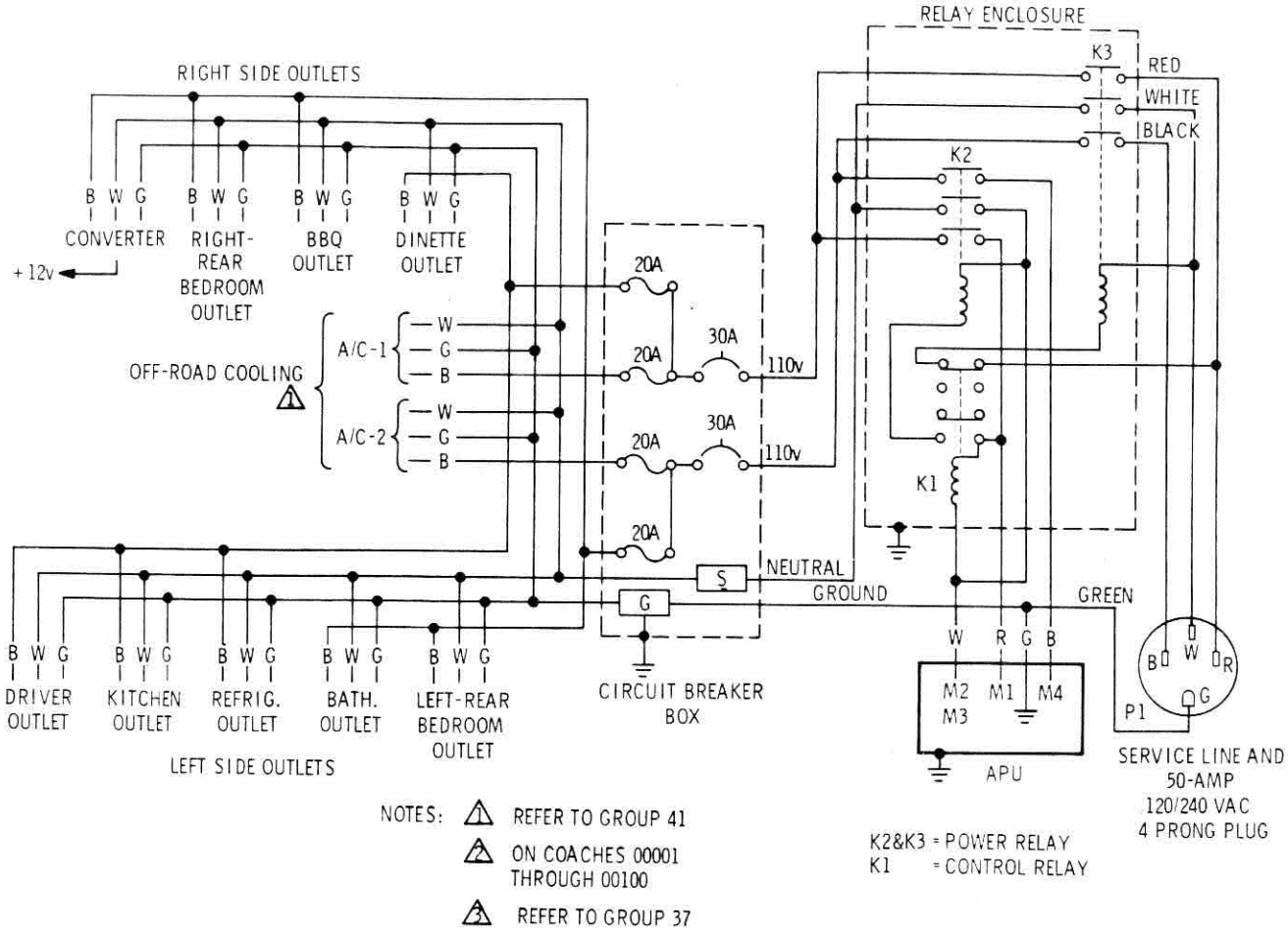
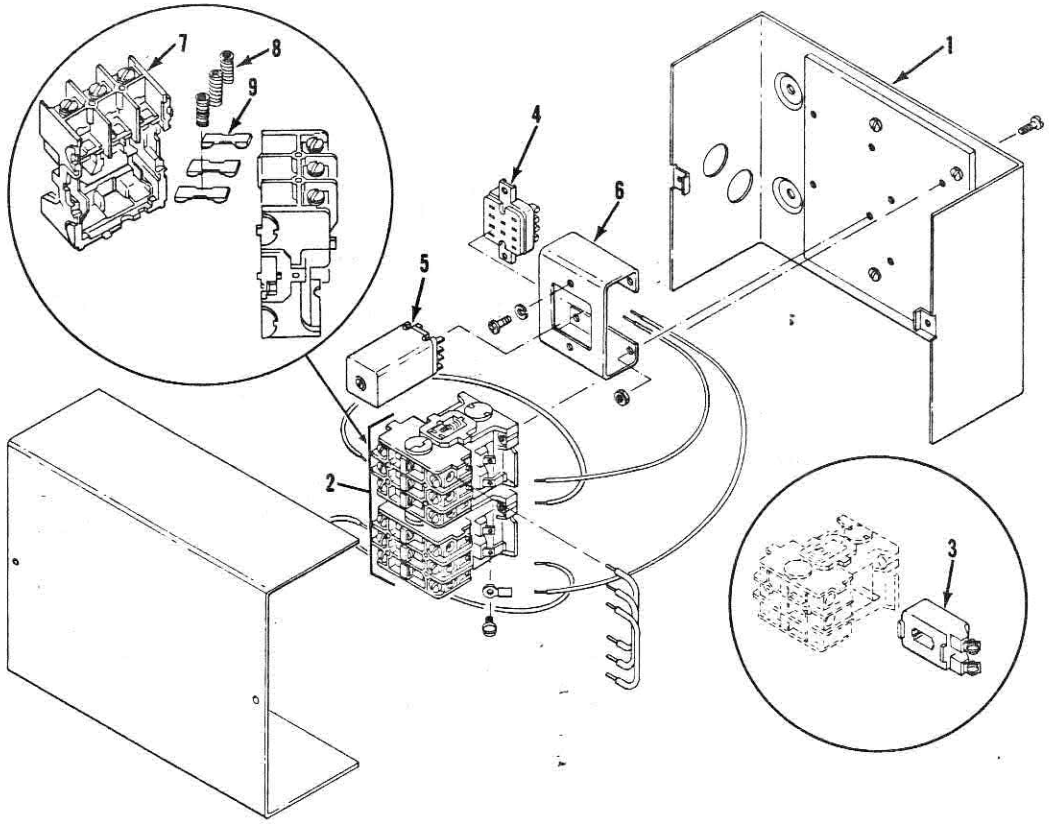


Figure 39-3. AC Power Distribution Schematic

interlocked with an adjacent three-power-pole (contacts) set in a manner that prevents only one of the three-power-pole sets to be closed at a time. All six power-poles (contacts) are normally held open (when no power is on the system) by coil springs. An electro-magnet (coil) is incorporated in each three pole set and when energized, magnetically overcomes the spring tension to close the set of three silver cadmium contacts to complete the circuit through each of the three-power-poles (contacts) of the set that is energized. The circuits that are completed when contacts of relay (contactor) K2 or K3 are closed are shown on the schematic diagram. A power control relay K1 (fig. 39-4, item 8) functions to open or close the circuit to provide the activating voltage to the coils of relays K3 and K2. The power control relay in de-energized condition (APU inoperative), completes the circuit from the service line to contactor (relay K3) to hold it closed, thus providing service line AC power (when plugged into an AC power source) to each branch of the AC domestic power supply system (fig. 39-3). When the APU is turned on, voltage is applied to activate the power control relay K1, which opens the circuit to the coil of relay K3. This de-energizes the coil of the electro-magnet and spring tension opens the three-power-pole contacts to shut off service line power while simultaneously energizing the coil of relay K2 to close its contacts, thus providing APU AC voltage to each branch of the AC power supply system (fig. 39-3).

NOTE

If the APU is started while the service line is plugged in (energized) the mechanical interlock feature between the contactors ensures that the circuit of the service line voltage source is opened slightly before the circuit from the APU source is closed, thus preventing application of AC power to the AC system from both sources at the same time.



LEGEND

1. POWER CONTROL RELAY (CONTACTOR) BOX AND COVER
2. CONTACTOR ASSEMBLY (SIX CONTACTS IN SETS OF THREE)
3. COIL*
4. SOCKET
5. POWER CONTROL RELAY
6. MOUNT BRACKET
7. MOULDING*
8. SPRINGS*
9. CONTACTS*

SD-608

*REPAIR KIT COMPONENTS

Figure 39-4. AC Power Control Relay (Contactor) Box

(2) AC Circuit Breaker Box (Load Center). The components of the AC circuit breaker box (load center) are shown in figure 39-5. Electrical circuitry is shown in figure 39-3. The AC circuit breaker box (load center) houses two 30 amp circuit breakers (switch-type) and two fusible plug-in units, each containing two 20 amp fuses. The fusible units are equipped with two indicator lights (Q-lite), located on the forward end of the case, which illuminate when the adjacent fuse blows, if power is on the AC system. The circuit breakers trip if amperage exceeds 30 and the switch handle moves (flips) to the "OFF" position. Reset is accomplished by repositioning the switch handle to "ON". The reason for circuit breaker tripping should always be determined and corrected before resetting to "ON". In addition to the circuit breakers and fusible units, the box also contains two bus bars; "SN" (solid neutral) and "GB" (ground bus). Each 30 amp breaker line branches into two 20 amp fusible unit lines to deliver AC power to outlets and components shown in figure 39-1.

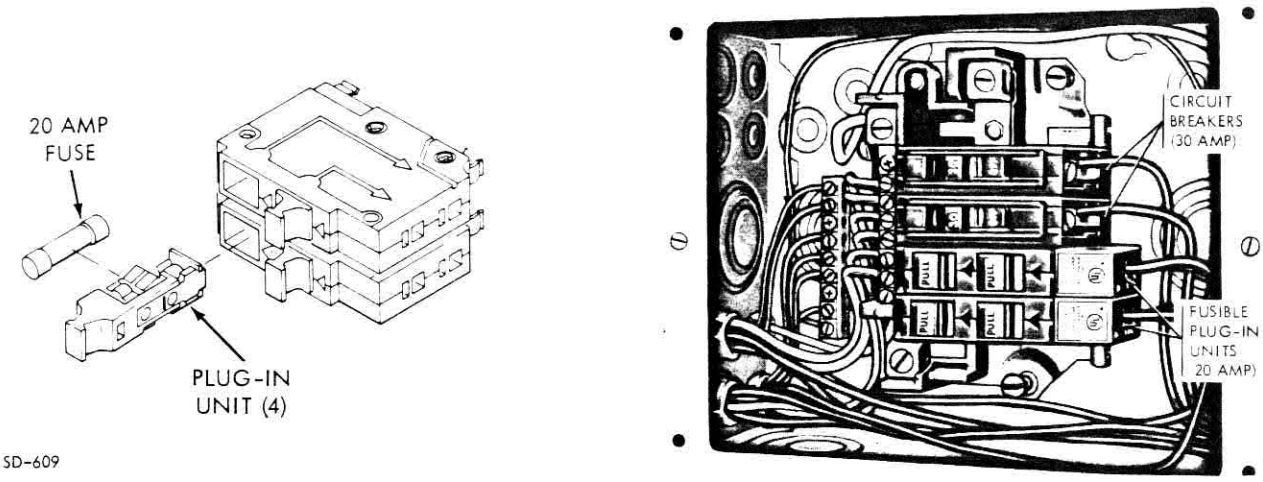


Figure 39-5. AC Circuit Breaker Box (Load Center)

(3) AC Service Line. A 25-foot, flexible, insulated service line (sometimes referred to as "land line" or "power cord") is incorporated in the coach and is coiled around a holding bracket as shown in figure 39-1. The 50 ampere rated service line connects into the coach AC electrical system through the power control relay (contactor) located in the 110 VAC power control box. The opposite end of the service line incorporates a 3-pole, 4-wire grounding-type plug (three current-carrying blades and a ground pin) rated at 50 amperes, 125/250 VAC, for attachment to an external 50 amperes, 125/250 VAC power supply receptacle to permit hook-up and operation of the domestic electrical system from an external city or campsite power source. When using, uncoil only enough of the service line required to reach the supply receptacle.

> ***Caution***
>
> Make certain that the external power source is 120/240 VAC, 60 HZ (cycles). Do not connect to higher voltage.

The service line is routed into the power control box through a split-clamp bushing-type device inserted through a hole in the left side of the box. The clamp protects the line insulation from the hole edges and secures the line firmly to the box wall to prevent strain on the four leads, coming out of the end of the line and attaching to terminals within the box, when line is being uncoiled or coiled during use.

(4) Auxiliary Power Unit (APU). The auxiliary power unit (APU) is mounted at the rear left of the coach to the left of the automotive power plant (fig. 39-1). This group includes coverage of the APU electrical functions related to the domestic electrical system and some operating, trouble-shooting, and adjustment information. Refer to Group 40 and to the Onan Operators and/or Service Manual, or contact an Onan Service/Dealer, for further information regarding servicing the APU. Leading particulars of the APU are contained in table 39-1 and figure 39-6 contains the APU sequence of operations.

The electrical/electronic functioning of the APU and controls is schematically depicted in figure 39-7. The functioning of the various components shown on the schematic is explained in subsequent paragraphs.

(a) Starting The APU. The APU may be started using either the start switch (S4) on the domestic panel or the rocker switch (A1S2) on top of the APU. The start switch (S4) or (A1S2) when held in start position, supplies 12 VDC battery current through the hand-crank, electric-start switch A1S1, through diode CR1, through switch A1S1 to the primary of the ignition coil T1, and to the breaker points to ground and back to the battery. (The ignition coil requires about 4 volts minimum to operate.) The fuel pump is energized at the same time as the ignition circuit. From a connection point at the coil primary, currents flow to the fuel pump (E1) to ground and back to the battery. (The fuel pump requires 5.5 volts minimum to operate.) When A1S2 is closed, current is also supplied from the battery, through the switch, through transistor A102 to the coil of Relay K1 (start relay) to ground and back to the battery. (Relay K1 requires 4.5 volts minimum to operate.) Relay K1 energizes and its contacts close connecting the battery to the generator. (Generator requires 7.0 volts minimum to crank). The gen-

Table 39-1. APU Leading Particulars

APU ITEM	PARTICULARS
Engine (Series Identification) .	6.5 NH
Horsepower	14.0 BHP @ 1800 RPM
Number of Cylinders	2
Cubic Inch Displacement	60
Cylinder Bore (Inches).....	3-9/16
Piston Stroke (Inches)	3
Compression Ratio	7.0 to 1
RPM (60 Hertz)	1800
Ignition Type	Battery
Battery Voltage (Automotive)	12 Volt
Battery Charge Rate (Automotive)	Two-Step
Maximum (High)	5.26 amperes
Minimum (Low)	1.56 amperes
Starting System	Exciter Cranking
Fuel	Same as Main Engine
Oil Capacity (Quarts)	4.0 (4.5 with Filter Change)
Oil Filter.....	1/2 Quart, Spin-On
Generator	
AC Voltage Regulation	± 4%
AC Frequency Regulation (No Load to Rated Load)..	5% (3 Hertz)
60 Hertz Rating (watts).....	6500
Current Rating	27.1 amperes
Phase	Single
Power Factor	1.0
Dimensions (Approximate)	
Length	33 inches
Width	20-13/16 inches
Height.....	21-1/2 inches
Weight	350 pounds
NOTE	
Hertz means a unit of frequency equal to one cycle per second, formerly abbreviated as cps.	

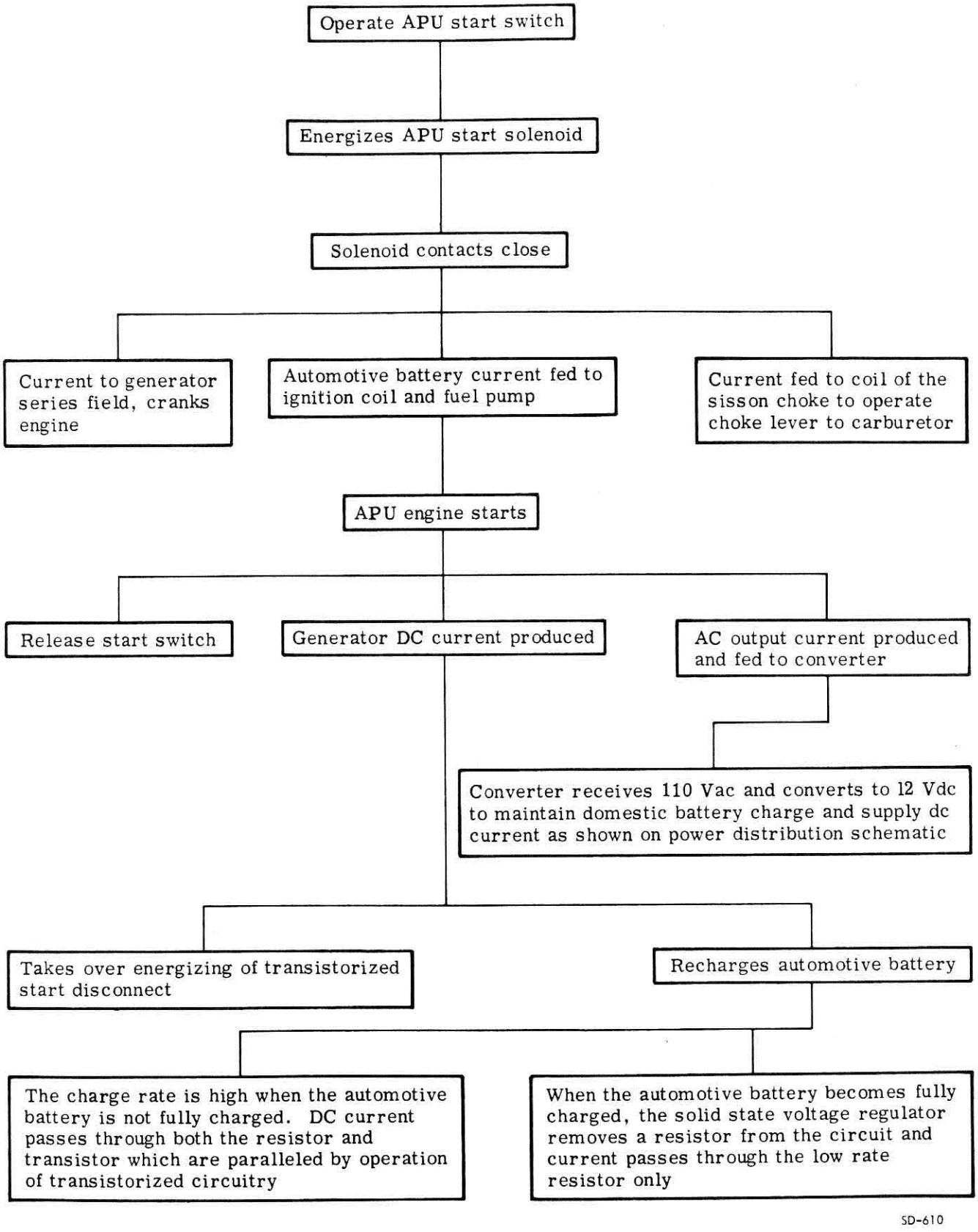


Figure 39-6. APU Sequence of Operations

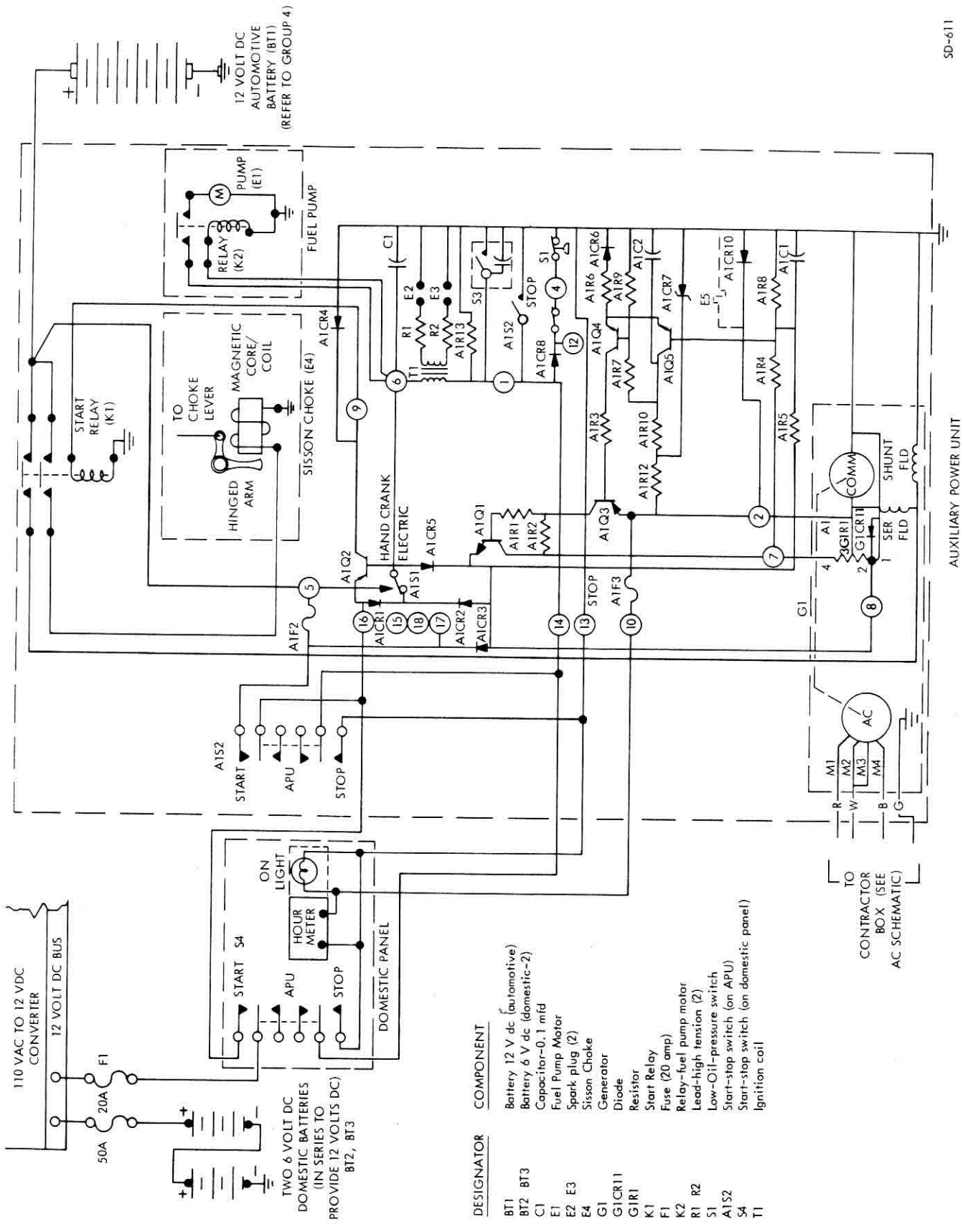
erator acts as a motor as it cranks the APU engine until it starts and accelerates to governed speed. Relay K1 also energizes the sisson choke coil to operate the choke lever to the carburetor.

(b) APU Automatic Starter Disconnect. When the engine starts and comes up to speed, generator voltage starts to build up. Generator DC voltage is supplied to charge resistor G1R1 through both the 3.8 ohm and the 8.3 ohm sections. When this voltage reaches the same value as battery voltage both sides of A1CR5 are at the same potential. This causes A1CR5 to stop conducting and it shuts off and also shuts off transistor A1Q2. This de-energizes the start relay (K1) and opens the starting circuit between battery and APU generator (starter) and sisson choke. At the same time ignition current is supplied from the generator, through the charge resistor (G1R1) to CR2 diode, to the ignition coil and fuel pump.

(c) 12 VDC Automotive Battery Charging By APU. The APU generator provides charging current to the 12 VDC automotive battery in two steps, a high and a low rate. The high rate is transistor controlled and the low is a fixed, steady rate. The low charge circuit is from A1 of the generator to G1R1 charge resistor, through the 8.3 ohm side, through CR3 and to the battery. Low charge rate is about 1.56 amps. This also supplies current to the APU ignition system and fuel pump. The high charge rate is through the 3.8 ohm side of the R1 charge resistor, through Q1 transistor, through CR3 diode and to the battery. This circuit supplies about 3.7 amperes charge current. The high and low charge rate combined is about 5.26 amperes. Each time the APU is cranked for starting, the current used reduces the state of charge of the automotive battery to below normal full charge, triggering the transistor to supply high-charge current until full charge is again restored.

Q4 and Q5 form a trigger circuit to control Q3 and then Q1. R5 and R8 form a voltage divider and control the trigger point of Q5. Q5 turns off at about 13 volts and on at about 15 volts. Because of drop in battery voltage, when cranking, the high charge circuit is always initially turned on. When near normal charge is reached the high charge circuit is shut off. Whenever battery voltage drops below the trip point (13 volts) the high rate circuit is turned back on. When battery voltage drops to about 12.5 volts Q5 turns off. This turns Q4 on and it turns Q3 on. Q3 then turns Q1 on and the high charge circuit is re-energized and the battery receives higher charge current. When the battery voltage comes up to about 15 volts Q5 turns on. It then causes Q4 to turn off which turns off Q3. Q3 shuts Q1 off and opens the high charge circuit. Because of the low power or small size of the transistors Q4 and Q5, transistor Q3 is required to control Q1. Q1 is a high current transistor. Q1 carries the high charge current. When Q3 is triggered on, Q1 is turned off and the battery charge drops to the low rate. When the APU is stopped, by positioning either switch S2 or S4 to "STOP", reverse current flow from the battery is prevented from discharging (flowing) through the generator by CR3 diode. CR8 is a blocking diode in the low oil pressure switch (S1) circuit. C1 and C2 capacitors filter out the interference caused by commutation. This is necessary to prevent the high battery circuit energizing when the battery is at or near full charge. R12 and CR7 form a stabilizing circuit for Q5 and Q4 due to generator voltage variations. A current limiting resistor R7 speeds up the switching time of Q4. CR6 diode compensates the trigger circuit to change the trigger voltage point to follow battery temperature/voltage requirements. G1CR11 diode is to assure that adequate current exists to blow fuse F1 to prevent burning out the control board, in the event battery connections are inadvertently reversed. Terminal 12 is for the low oil pressure (LOP) indicating light. Terminal 10 is for APU on indicating light and hour meter.

(d) AC Power Output of APU. The APU, when operating at governed speed (normally 1830 to 1770 rpm), produces AC power, which is routed from the APU AC power output box through four leads enclosed in a flexible conduit, to the AC power control relay (contactor) box. The output leads are marked M1, M2, M3 and M4. The markings also appear on the wiring schematic, figure 39-3. Refer to paragraph 39-1b (1), for a description of the functioning of the AC power control relays. The speed of the APU engine is a factor in governing AC generator output. The speed at which the engine operates is established by the tension applied to the governor spring. Increasing spring tension increases engine speed. Decreasing tension decreases engine speed. The no-load speed of the engine is slightly higher than the speed requirements of the connected load. If the connected load is to turn at 1800 rpm, the no-load speed of the engine is set at 1875 rpm, approximately; refer to Group 40. The engine speed drop from no-load to full-load should be not less than 60 rpm. The engine speed is checked with no-load connected and again after connecting full-load. The sensitivity of the governor depends upon the position of the arm end of the governor spring. A series of holes in the governor



DESIGNATOR	COMPONENT
BT1	Battery 12 V dc (automotive)
BT2 BT3	Battery 6 V dc (domestic-2)
C1	Capacitor-0.1 mfd
E1	Fuel Pump Motor
E2 E3	Spark plug (2)
E4	Sisson Choke
G1	Generator
G1CR11	Diode
G1R1	Resistor
K1	Start Relay
F1	Fuse (20 amp)
K2	Relay-fuel pump motor
R1 R2	Lead-high tension (2)
S1	Low-Oil-pressure switch
A1S2	Start-stop switch (on APU)
S4	Start-stop switch (on domestic panel)
T1	Ignition coil

Figure 39-7. APU and Controls Schematic

ENGINE TROUBLESHOOTING

GASOLINE ENGINE TROUBLESHOOTING GUIDE

CAUSE

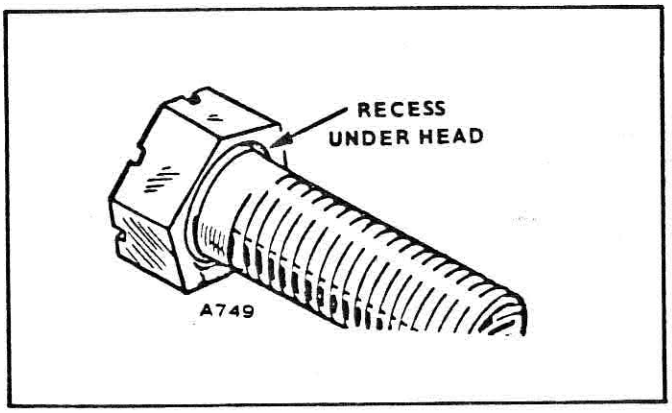
	Backfire at Carburetor	Bearing Wear	Black Exhaust	Blue Exhaust	Burned Valves	Connecting Rod Wear	Cranks Slowly	Cylinder Wear	Engine Stops	Failure to Start	Governor Hunting	High Oil Pressure	Low Oil Pressure	Loss of Coolant (Water Cooled)	Mechanical Knocks	Misfiring	Overheating (Air Cooled)	Overheating (Water Cooled)	Piston Wear	Poor Compression	Ring Wear	Sticking Valves
STARTING SYSTEM																						
Loose or Corroded Battery Connection							●		●													
Low or Discharged Battery							●		●													
Faulty Starter							●		●													
Faulty Start Solenoid							●		●													
IGNITION SYSTEM																						
Ignition Timing Wrong	●			●					●				●	●		●	●					
Wrong Spark Plug Gap									●				●	●								
Worn Points or Improper Gap Setting									●					●								
Bad Ignition Coil or Condenser									●					●								
Faulty Spark Plug Wires									●					●								
FUEL SYSTEM																						
Out of Fuel - Check								●	●								●	●				
Lean Fuel Mixture - Readjust								●	●	●				●								
Rich Fuel Mixture or Choke Stuck									●					●								
Engine Flooded	●		●					●	●													
Poor Quality Fuel	●		●						●					●								
Dirty Carburetor	●							●	●	●												
Dirty Air Cleaner	●	●	●				●		●					●					●			
Dirty Fuel Filter									●	●				●								
Defective Fuel Pump									●	●				●								
INTERNAL ENGINE																						
Wrong Valve Clearance				●				●					●	●					●			●
Broken Valve Spring				●				●					●						●			
Valve or Valve Seal Leaking				●						●				●					●			
Piston Rings Worn or Broken				●									●						●			
Wrong Bearing Clearance	●				●		●				●		●									
COOLING SYSTEM (AIR COOLED)																						
Poor Air Circulation														●	●							
Dirty or Oily Cooling Fins														●	●							
Blown Head Gasket									●	●				●					●			
COOLING SYSTEM (WATER COOLED)																						
Insufficient Coolant															●							
Faulty Thermostat															●							
Worn Water Pump or Pump Seal															●							
Water Passages Restricted															●							
Defective Gaskets															●							
Blown Head Gasket									●	●					●				●			
LUBRICATION SYSTEM																						
Defective Oil Gauge												●	●									
Relief Valve Stuck												●	●									
Faulty Oil Pump												●	●						●		●	
Dirty Oil or Filter	●			●		●	●					●	●						●		●	●
Oil Too Light or Diluted	●			●		●	●					●	●			●	●	●	●		●	
Oil Level Low	●			●		●	●					●	●			●	●	●	●		●	
Oil Too Heavy	●			●		●	●					●	●									
Dirty Crankcase Breather Valve	●			●		●	●					●	●									
THROTTLE AND GOVERNOR																						
Linkage Out of Adjustment											●	●										
Linkage Worn or Disconnected											●	●										
Governor Spring Sensitivity Too Great											●	●										
Linkage Binding											●	●										

ASSEMBLY TORQUES AND SPECIAL TOOLS

TORQUE

Assembly torques as given here require the use of a torque wrench. These assembly torques will assure proper tightness without danger of stripping the threads. If a torque wrench is not available, you will have to estimate the degree of tightness necessary for the stud, nut or screw being installed and tighten accordingly. Be careful not to strip the threads. Check all studs, nuts and screws often with the engine cold. Tighten as needed to prevent them from working loose.

Special Place Bolts do not require lockwashers or gaskets. Never attempt to use a lockwasher with these bolts, it will defeat their purpose. Check all studs, nuts and screws often. Tighten as needed.



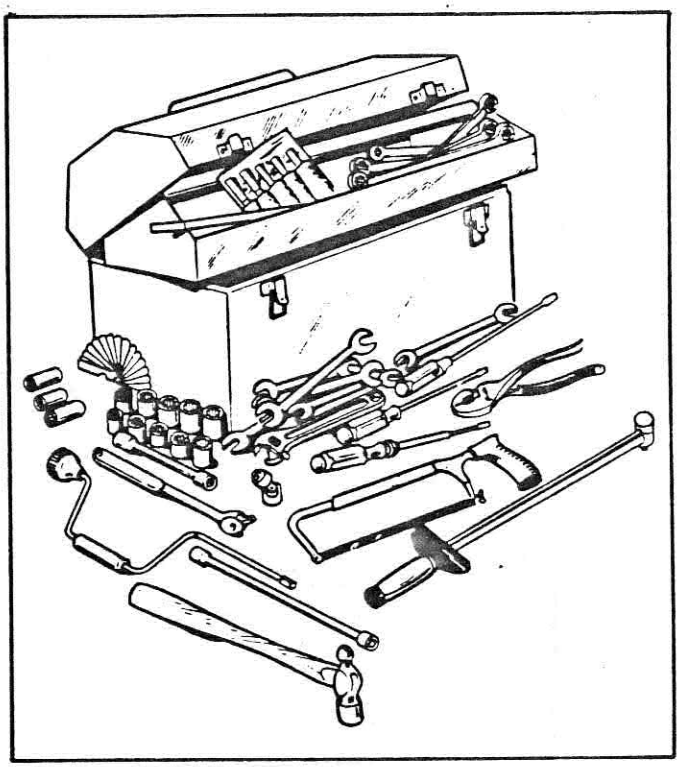
TORQUE SPECIFICATIONS IN LB-FT

	Min.	Max.
Connecting Rod Bolt	27	29
Flywheel Mounting Screw	35	40
Fuel Pump Mounting Screws	5	6
Oil Pump	7	9
Gearcase Cover	8	10
Rear Bearing Plate	20	23
Oil Base Mounting Screws	18	23
Cylinder Head Bolt	17	19
Spark Plugs	15	20
Valve Cover Nut	4	8
Manifold Screws - Intake and Exhaust	16	23
Magneto Stator Screws	8	10
Carburetor Mounting Stud Nuts	8	12
Armature Through Stud Nut	35	40
Generator Through Stud Nut	14	16
Blower Housing Screws	10	15
Generator Adapter - To Cylinder Block	15	18
Starter Bracket - To Oil Base	43	48

SPECIAL TOOLS

These tools are available from Onan to aid service and repair work.

Crankshaft Gear Pulling Ring	420-0248
Main Crankshaft Bearing Driver	
Front and Rear	420-0067
Camshaft Bearing Driver	
Front	420-0066
Rear	420-0307
Valve Seat Driver	420-0308
Valve Seat Staker	
Intake	420-0309
Exhaust	420-0310
Valve Seat Cutter	420-0311
Oil Seal Guide and Driver	420-0181
Camshaft Bearing Remover	420-0314
Crankshaft Bearing Remover	420-0315



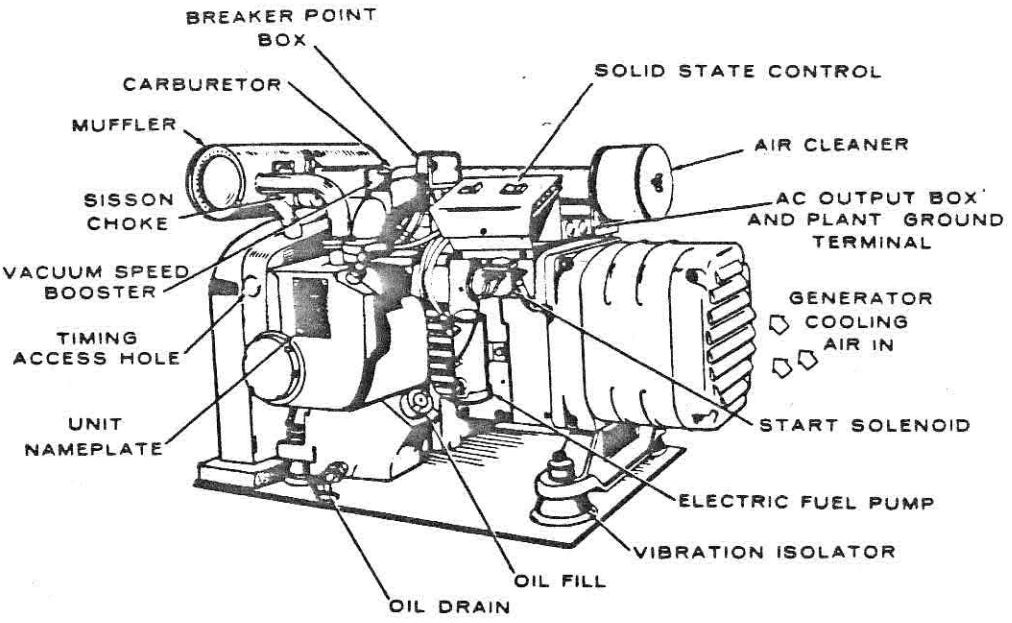
DIMENSIONS AND CLEARANCES

ALL CLEARANCES GIVEN AT ROOM TEMPERATURE OF 70°F
All dimensions in inches unless otherwise specified.

	Minimum		Maximum
Valve Tappet Clearance - Intake		0.003 *	
Exhaust (Gasoline)		0.010 *	
Exhaust (Gaseous Fuel)		0.012 *	
Valve Stem in Guide – Intake	0.0010		0.0025
Valve Stem in Guide – Exhaust	0.0025		0.0040
Valve Spring Length			
Free Length		1.662	
Compressed Length		1.375	
Valve Spring Tension (lb.)			
Open	71		79
Closed	38		42
Valve Seat Bore Diameter			
Intake	1.5645		1.5655
Exhaust	1.2510		1.2520
Valve Seat Diameter			
Intake	1.569		1.570
Exhaust	1.255		1.256
Valve Stem Diameter			
Intake	0.3425		0.3430
Exhaust	0.3410		0.3415
Valve Guide Diameter (I.D.)	0.344		0.346
Valve Lifter Diameter	0.7475		0.7480
Valve Lifter Bore	0.7505		0.7515
Valve Seat Interference Width	1/32		3/64
Valve Face Angle		44°	
Valve Seat Angle		45°	
Valve Interference Angle		1°	
Crankshaft Main Bearing	0.0025		0.0038
Crankshaft End Play	0.005		0.009
Camshaft Bearing	0.0015		0.0030
Camshaft End Play	0.003		–
Camshaft Lift		0.033	
Camshaft Bearing Diameter	1.3760		1.3770
Camshaft Journal Diameter	1.3740		1.3745
Rod Bearing (Forged Rod)	0.0005		0.0023
Connecting Rod End Play (Ductile Iron)	0.002		0.016
Timing Gear Backlash	0.002		0.003
Oil Pump Gear Backlash	0.002		0.005
Piston to Cylinder, Strut Type (Measured below oil-controlling ring – 90° from pin) Clearance	0.0015		0.0035
Piston Pin Diameter	0.7500		0.7502
Piston Pin in Piston	Thumb Push Fit		
Piston Pin in Rod	0.0001		0.0005
Piston Ring Groove Width			
Top 1	0.0955		0.0965
Top 2	0.0955		0.0965
Top 3	0.1880		0.1890
Piston Ring Gap in Cylinder	0.010		0.020
Piston Ring Side Clearance (Top compression ring only)		0.006	
Breaker Point Gap (Full Separation)		0.020	
Spark Plug Gap – For Gasoline Fuel		0.025	
Spark Plug Gap – For Gaseous Fuel		0.018	

Crankshaft Main Bearing Journal – Standard Size	1.9992	2.0000
Main Bearing Diameter	2.0015	2.0040
Main Bearing Clearance	0.0015	0.0043
Crankshaft Rod Bearing Journal – Standard Size	1.6252	1.6260
Cylinder Bore – Standard Size	3.5625	3.5635
Ignition Timing	22°BTC	

* ± .001 "



TYPICAL NH FOR RECREATIONAL VEHICLES

SPECIFICATIONS

	6.5 NH
ENGINE	
Horsepower	14.0 bhp @ 1800 RPM
Number of Cylinders	2
Cubic Inch Displacement	60
Cylinder Bore (inches)	3-9/16
Piston Stroke (inches)	3
Compression Ratio	7.0 to 1
RPM (60 Hertz)	1800
Ignition Type	Battery
Battery Voltage	12 Volt
Battery Size	
SAE Group 60	One
SAE Rating - 20 Hour (nominal)	74 amp/hr.
Battery Charge Rate	Two-Step
Maximum	6 amp.
Minimum	1.5 amp.
Starting System	Exciter Cranking
Fuel	Regular Grade
Oil Capacity (Quarts)	4.0 (4.5 with Filter Change)

GENERATOR	
AC Voltage Regulation	±4%
AC Frequency Regulation (No Load to Rated Load)	5% (3 Hertz)
60 Hertz Recreational Vehicle Rating (watts)	6500
Current Rating (amperes)	27.1 *
Phase	Single
Power Factor	1.0
SET DIMENSIONS (Approximate)	
Length	33 "
Width	20-13/16 "
Height	21-1/2 "
Weight	350 lbs.

NOTE: Hertz is a unit of frequency equal to one cycle per second.

* Reconnectible to deliver rated output at 120 volt, 2 wire (54.2 amp); 240 volt, 2 wire (27.1 amp).

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

GENERAL INFORMATION

INTRODUCTION

This manual includes instructions for the installation, operation, and maintenance of the NH electric generating plants used in recreational vehicles. Identify your model by referring to the MODEL AND SPECIFICATION NUMBER as shown on the Onan nameplate. Electrical characteristics are shown on the lower portion of the nameplate.

How to interpret the MODEL and SPEC NO.

6.5	NH	- 3CR	/	12000	D
1	2	3		4	5

1. Indicates KW rating.
2. Factory code for Series identification.
3. Combines with 1 and 2 to indicate model.
   3 - 120/240 voltage.
   C - Indicates reconnectible feature.
   R - REMOTE. Electric starting at the set or from a remote location.
4. Factory code for optional equipment added to unit.
5. Specification (Spec) letter. Advances when factory makes production modifications.

Onan electric plants are given a complete running test under various load conditions and are thoroughly checked before leaving the factory. Upon receipt of your unit check it thoroughly for any damage that may have occurred during shipping. Tighten loose parts, replace missing parts, and repair any damage before putting the unit into operation.

CAUTION *Onan uses this symbol throughout the text to warn of possible equipment damage.*

WARNING *This symbol is used to warn of any possible personal injury.*

Onan

MANUFACTURER'S WARRANTY

Onan warrants, to the original user, that each product of its manufacture is free from defects in material and factory workmanship if properly installed, serviced and operated under normal conditions according to Onan's instructions.

Onan will, under this warranty, repair or replace, as Onan may elect, any part which on examination shall disclose to Onan's satisfaction to have been defective in material and workmanship, provided that such part shall be returned to Onan's factory or one of its Authorized Service Stations, transportation charges prepaid, not later than one (1) year after the product is first placed in service. Such defective part will be repaired or replaced free of charge, including labor, in accordance with rates approved by Onan, during the stated one (1) year coverage under this warranty.

THIS WARRANTY AND ONAN'S OBLIGATION THEREUNDER IS IN LIEU OF ALL WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND ALL OTHER OBLIGATIONS OR LIABILITIES, INCLUDING LIABILITY FOR INCIDENTAL AND CONSEQUENTIAL DAMAGE.

No person is authorized to give any other warranty or to assume any other liability on Onan's behalf unless made or assumed in writing by an Officer of Onan, and no person is authorized to give any warranty or to assume any liability on the Seller's behalf unless made or assumed in writing by such Seller.

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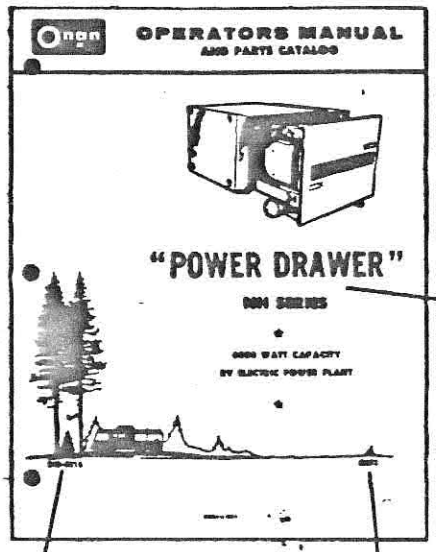
A DIVISION OF ONAN CORPORATION

Please . . . . . fill out the postage paid card and drop in the mail. Your comments help us produce even better publications.

Thank You!

Sample Cover



Title

Manual Number
(e.g. 940-0315)

Publication Date
(e.g. 6A73)

RECEIVED
MAR 13 1974
EMC-RVD
SERVICE DEPT.

TEAR ALONG PERFORATION AND DETACH

COMMENTS ON MANUAL

MANUAL NUMBER _____ **TITLE** _____ **PUBLICATION DATE** _____

CONTENTS: ☐ Excellent ☐ Adequate ☐ Inadequate (please explain) _____

_____

_____

_____

_____

SUGGESTIONS (additions, deletions, changes . . . . . please refer pages) _____

_____

_____

_____

_____

_____

UNIT HISTORY: Model Number _____

Type of Application _____

Unit Purchased From _____

Optional Information

Name _____ Street (or R.Rt.) _____

City _____ State _____ Zip _____

900-0183

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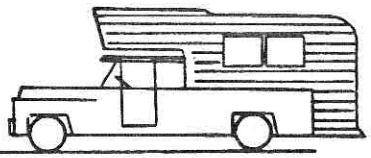
MINNEAPOLIS, MINN. 55432

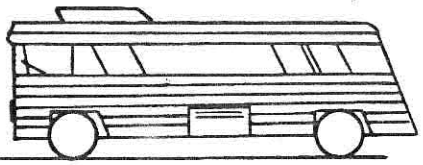
A DIVISION OF ONAN CORPORATION

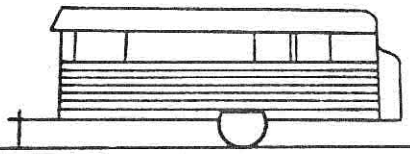
ATTN: TECHNICAL PUBLICATIONS

OPERATOR'S MANUAL AND PARTS CATALOG

ELECTRIC GENERATING PLANTS







FOR RECREATIONAL VEHICLES

SERIES NH

ONAN 1400 73RD AVENUE N.E. • MINNEAPOLIS, MINNESOTA 55432
A DIVISION OF ONAN CORPORATION

940-0310 12AD73

INTRODUCTION

THIS OPERATOR'S MANUAL CONTAINS INFORMATION PERTAINING TO THE INSTALLATION, OPERATION, AND MAINTENANCE OF YOUR ONAN UNIT. A PARTS CATALOG IS ALSO INCLUDED IN THIS MANUAL.

WE SUGGEST THAT THIS MANUAL AND THE WIRING DIAGRAM WHICH ACCOMPANIES EVERY ONAN UNIT BE RETAINED AND REFERRED TO WHEN MAKING EQUIPMENT ADJUSTMENTS OR ORDERING PARTS. ADDITIONAL COPIES ARE AVAILABLE FOR A NOMINAL CHARGE FROM YOUR ONAN DISTRIBUTOR.

WHEN ORDERING PARTS REMEMBER TO INCLUDE THE ONAN MODEL, SPECIFICATION LETTER, AND SERIAL NUMBER LOCATED ON THE NAMEPLATE OF YOUR ONAN UNIT. THIS IS ESSENTIAL TO ENSURE THE CORRECT PART IS SHIPPED TO YOU.

FOR MAJOR REPAIR SERVICE, CONTACT YOUR ONAN AUTHORIZED DISTRIBUTOR.

WARNING

ONAN RECOMMENDS THAT ALL SERVICE INCLUDING INSTALLATION OF REPLACEMENT PARTS BE DONE BY QUALIFIED ELECTRICAL AND/OR MECHANICAL SERVICEMEN. FROM THE STANDPOINT OF POSSIBLE INJURY AND/OR EQUIPMENT DAMAGE IT IS IMPERATIVE THAT THE SERVICEMAN IS QUALIFIED.

GENERAL: This group contains information on the auxiliary generator set or any auxiliary power generating equipment that produces a domestic current supply.

SPECIFICS: As applicable

...Auxiliary Power Unit

...Carburetor - APU

...Choke - APU

...Exhaust Pipe - APU

...Fuel Pump - APU

...Gasoline Engine and Components

...Generator - APU

...Ignition Coil - APU

...Mounting Hardware For Unit

...Muffler - APU

...Solenoid - APU

...Voltage Regulator - APU

...Wiring - APU

Motor Coach Division
333 Brokaw Road Box 664 Santa Clara California 95052

☐ MANDATORY ☒ INFORMATIONAL

Service Bulletin

DATE December 17, 1974 NUMBER 2939-40003

ATTENTION: SERVICE MANAGERS AND OWNERS

GROUP 39

SUBJECT

ACCOMPLISHMENT INSTRUCTIONS

1. Remove AC power from coach (APU inoperative and service line disconnected). Turn off all DC operated domestic components (water pump, lights, etc.) and position the refrigerator thermostat knob to the "OFF" position.

2. Modify the domestic battery refrigerator 12 VDC supply lead as follows:

   a. Remove access cover from domestic battery compartment.

   b. See figure 1. Loosen and remove cable clamp nut at the rear battery positive terminal and disconnect existing lead and terminal and cut off lead about 7 inches back from end.

   c. Assemble butt connector (item 3) and terminal (item 2) by crimping onto in-line fuse connector leads (item 1) so that total length equals amount cut off in previous step.

   d. Crimp butt connector onto the end of the refrigerator black lead (strip off about 1/8 in. insulation) protruding into inboard wall of battery compartment.

   e. Install ring-style lead terminal on rear battery positive terminal cable clamp bolt end, then install and tighten nut removed in step 2. b.

   f. Install cover over battery compartment.

3. Turn on refrigerator and check that it operates.

MODEL(S) AFFECTED

(Factory Use Only) Information added to:

OWNER MANUAL(S)

SERVICE MANUAL(S)

PARTS MANUAL(S)

WARRANTY MANUAL

OTHER

F.M.C., AS OF 12/31/75, DO NOT HAVE [illegible]
AS COVERED IN THIS BULLETIN.

May L Snavely
MAY SNAVELY
Service Manager

RVD-84 (6-73)

FMC Corporation
Motor Coach Division
333 Brokaw Road Box 664 Santa Clara California 95052

☐ URGENT ☐ ROUTINE
☐ MANDATORY ☒ INFORMATIONAL

Service Bulletin

DATE 18 November 1974 NUMBER 2939 40002

ATTENTION: SERVICE MANAGER

GROUP

SUBJECT

MODEL (S) AFFECTED

(Factory Use Only)
Information added to:

OWNER MANUAL (S)

SERVICE MANUAL (S)

PARTS MANUAL (S)

WARRANTY MANUAL (S)

OTHER

CAUTION (CONT.)

to "3" and driving the coach for approximately two hours immediately following reconnection of the domestic batteries will also prevent excessive battery drain, as the automotive alternator will then be providing the refrigerator operating voltage.

Max L Snavely

MAX L. SNAVELY
Service Manager

FMC Corporation
Motor Coach Division
333 Brokaw Road Box 664 Santa Clara California 95052

☐ URGENT ☐ ROUTINE
☐ MANDATORY ☒ INFORMATIONAL

Service Bulletin

DATE 18 November 1974 NUMBER 2939 40002

ATTENTION: SERVICE MANAGER AND OWNERS

GROUP

SUBJECT

MODEL (S) AFFECTED

(Factory Use Only)
Information added to:

OWNER MANUAL (S)

SERVICE MANUAL (S)

PARTS MANUAL (S)

WARRANTY MANUAL (S)

OTHER

d. Drill 1/4 inch diameter hole in forward wall of battery compartment about 4 inches to the inboard and slightly lower than circuit breaker. Grind or sand off area around hole to insure good ground connection for next step.

e. Attach the 1/4 inch ID ring end of cable assembly (item 12) to mount hole drilled in previous step, with screw (item 8), lockwasher (item 10) and nut (item 9).

f. Attach opposite end of cable (item 12) to inboard terminal stud of circuit breaker with lockwasher (item 4) and nut (item 3).

g. Attach the ring end of cable assembly (item 11) to the outboard (copper) terminal stud of the circuit breaker with lockwasher (item 4) and nut (item 3).

h. Install cable (item 11) terminal clamp on negative post of the forward battery and tighten clamp nut.

i. Coat cable clamp with light mineral grease.

j. Install cover over battery compartment.

k. Start APU to energize the system and check that components in the affected circuit operate.

CAUTION

If domestic batteries have been left disconnected for an extensive period and AC power has not been applied during the interval, the refrigerator warms up to a point where it will draw excessive DC current when initially energized by the reconnected batteries. To prevent excessive battery drain due to the above reason, after modification is completed, apply AC power to the coach then position refrigerator thermostat to the number "3" setting and operate until the unit cycles off. Setting the refrigerator thermostat

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Motor Coach Division
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☐ URGENT ☐ ROUTINE
☐ MANDATORY ☒ INFORMATIONAL

Service Bulletin

DATE 18 November 1974 NUMBER 2939 40002

ATTENTION: SERVICE MANAGER AND OWNERS

GROUP
39

SUBJECT

MODEL (S) AFFECTED

(Factory Use Only)
Information added to:

OWNER MANUAL (S)

SERVICE MANUAL (S)

PARTS MANUAL (S)

WARRANTY MANUAL (S)

OTHER

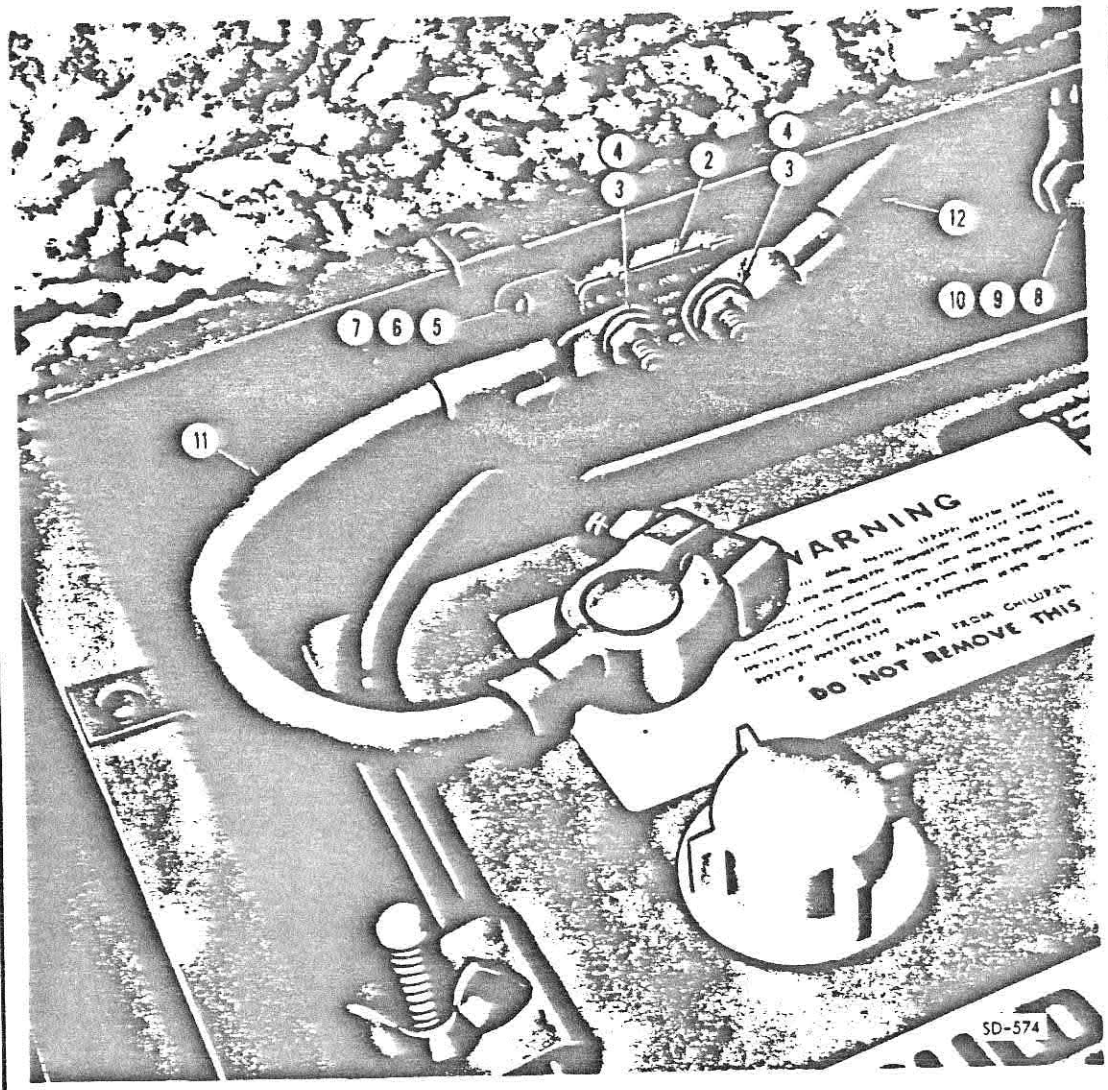

FIGURE 1. MODIFICATION OF DOMESTIC BATTERY GROUND LEAD

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Motor Coach Division
333 Brokaw Road Box 664 Santa Clara California 95052

☐ URGENT ☐ ROUTINE
☐ MANDATORY ☒ INFORMATIONAL

Service Bulletin

DATE 18 November 1974 NUMBER 2939 40002

ATTENTION: SERVICE MANAGER AND OWNERS

GROUP 39

SUBJECT

MODEL (S) AFFECTED

(Factory Use Only)
Information added to:

OWNER MANUAL (S)

SERVICE MANUAL (S)

PARTS MANUAL (S)

WARRANTY MANUAL (S)

OTHER

ACCOMPLISHMENT INSTRUCTIONS

1. Remove AC power from coach (APU inoperative and service line disconnected). Turn off all DC operated domestic components and position the refrigerator thermostat knob to the "OFF" position.

2. Replace converter 50 ampere fuse with conducting link (item 1) as follows:

   a. Gain access to converter bus fuse clips by opening the hinged access door on the front of the converter.

   b. Locate and remove 50 amp fuse (largest fuse in converter).

   c. Insert conducting link (Item 1) in fuseholder clips then solder in place at both upper and lower clip.

   d. Close converter access door.

3. Modify the forward domestic battery ground lead as follows:

   a. Remove access cover from domestic battery compartment.

   b. Loosen cable clamp nut and using a screw type cable puller, disconnect existing ground lead from forward battery negative terminal and cut off at opposite end at the ground screw on the inboard wall of the battery compartment; discard lead.

      NOTE
      Do not remove the smaller white lead (refrigator ground) from the ground screw; retighten ground screw/nut with white lead remaining connected.

   c. See Figure 1. Install circuit breaker as shown with the copper terminal stud outboard, on forward wall of compartment by attaching through existing vent slot with two screws (item 5), two lockwashers (item 7) and two nuts (item 6).

FMC Corporation
Recreational Vehicle Division
333 Brokaw Road Box 664 Santa Clara, California 95052

☐ URGENT ☐ ROUTINE
☒ MANDATORY ☐ INFORMATIONAL

Service Bulletin

DATE 21 August 1973 NUMBER 2939 20001

ATTENTION: SERVICE MANAGER AND OWNERS

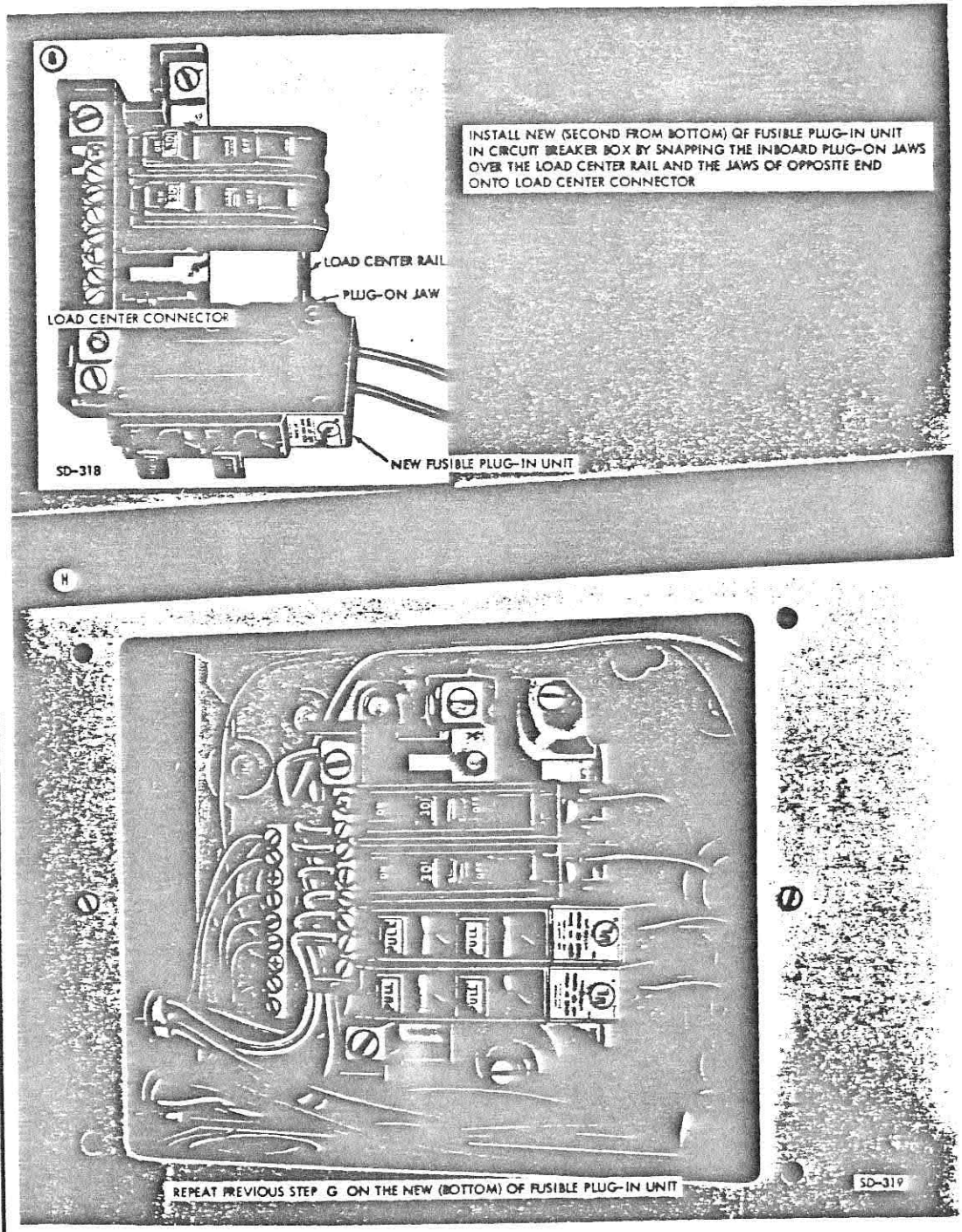


FIGURE 1. REPLACEMENT OF CIRCUIT BREAKERS WITH FUSIBLE UNITS (SHEET 2 OF 2)

GROUP
39

SUBJECT
REPLACEMENT OF CIRCUIT BREAKERS (20-AMP) WITH FUSIBLE UNITS

MODEL (S) AFFECTED
2900R

(Factory Use Only)
Information added to:

OWNER MANUAL (S)

SERVICE MANUAL (S)

PARTS MANUAL (S)

WARRANTY MANUAL (S)

OTHER

RVD-84 (6-73)

FMC Corporation
Recreational Vehicle Division
333 Brokaw Road Box 664 Santa Clara, California 95052

☐ URGENT ☐ ROUTINE
☒ MANDATORY ☐ INFORMATIONAL

Service Bulletin

DATE 21 August 1973 NUMBER 2939 20001

ATTENTION: SERVICE MANAGER AND OWNERS

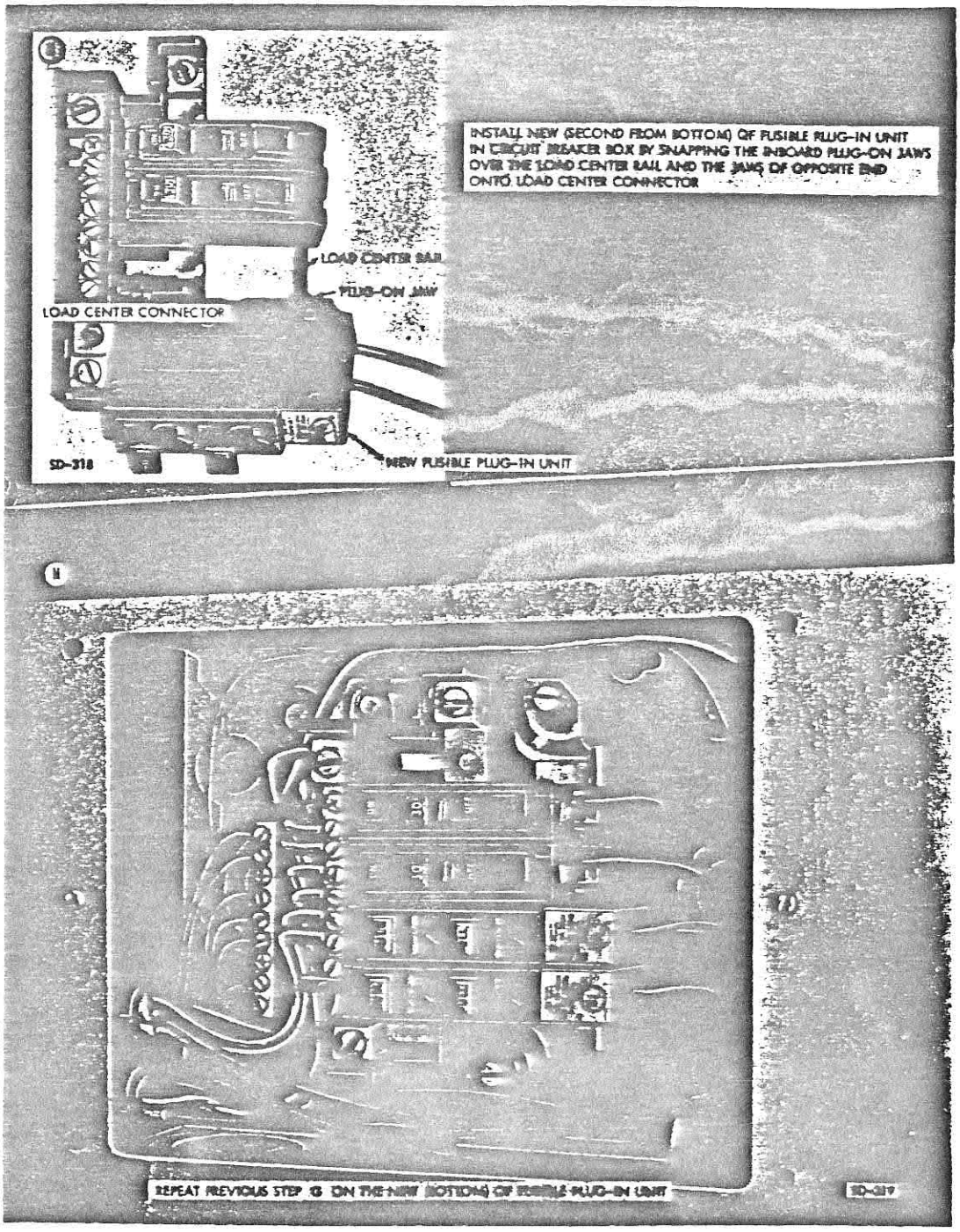


FIGURE 1. REPLACEMENT OF CIRCUIT BREAKERS WITH FUSIBLE UNITS (SHEET 2 OF 2)

GROUP
39

SUBJECT
REPLACEMENT OF CIRCUIT BREAKERS (20-AMP) WITH FUSIBLE UNITS

MODEL (S) AFFECTED
2900R

(Factory Use Only)
Information added to:

OWNER MANUAL (S)

SERVICE MANUAL (S)

PARTS MANUAL (S)

WARRANTY MANUAL (S)

OTHER

FMC Corporation
Recreational Vehicle Division
333 Brokaw Road Box 964 Santa Clara, California 95052

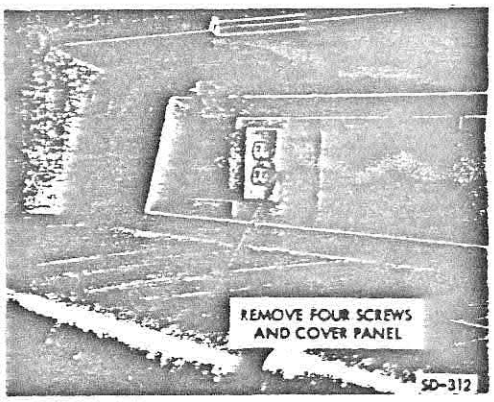
☐ URGENT ☐ ROUTINE
☒ MANDATORY ☐ INFORMATIONAL

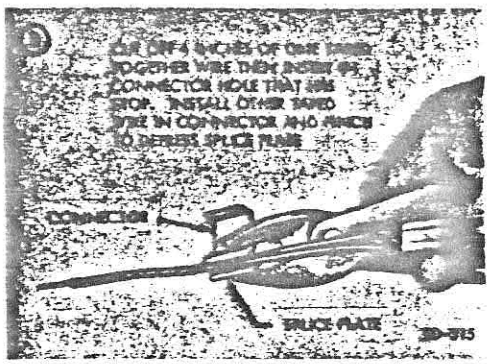
Service Bulletin

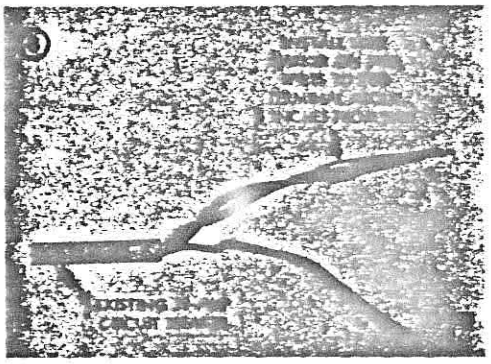
DATE 21 August 1973 NUMBER 2939 20001

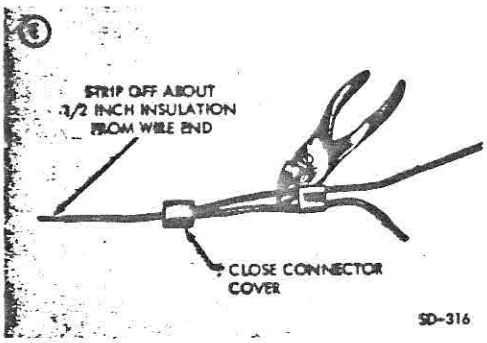
ATTENTION: SERVICE MANAGER AND OWNERS

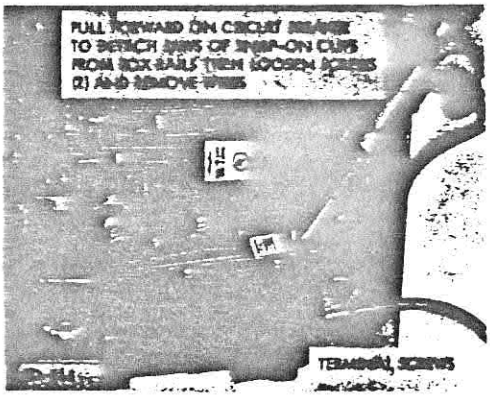
When installation is completed, start APU and operate central air conditioners. The indicator light on the forward end of the new fusible units should remain extinguished. (Light glows when a fuse is blown). Shut down APU and reinstall circuit breaker box cover.

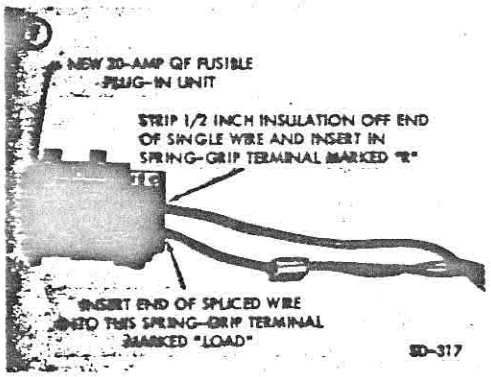












NOTE: REPEAT STEPS (B) THRU (F) FOR OTHER CIRCUIT BREAKER AND FUSIBLE UNIT THEN SEE NEXT PAGE

FIGURE 1. REPLACEMENT OF CIRCUIT BREAKERS WITH FUSIBLE UNITS (SHEET 1 OF 2)

John L. Strever
Service Manager

GROUP
39

SUBJECT
REPLACEMENT OF CIRCUIT BREAKERS (20-AMP) WITH FUSIBLE UNITS

MODEL (S) AFFECTED
2900R

(Factory Use Only)
Information added to:

OWNER MANUAL (S)

SERVICE MANUAL (S)

PARTS MANUAL (S)

WARRANTY MANUAL (S)

OTHER

FMC Corporation
Recreational Vehicle Division
333 Brokaw Road Box 864 Santa Clara, California 95052

☐ URGENT ☐ ROUTINE
☒ MANDATORY ☐ INFORMATIONAL

Service Bulletin

DATE 21 August 1973 NUMBER 2939 20001

ATTENTION: SERVICE MANAGER AND OWNER

GROUP 39

SUBJECT: REPLACEMENT OF CIRCUIT BREAKERS (20-AMP) WITH FUSIBLE UNITS

MODEL (S) AFFECTED: 2900R

(Factory Use Only) Information added to:

OWNER MANUAL (S)

SERVICE MANUAL (S)

PARTS MANUAL (S)

WARRANTY MANUAL (S)

OTHER

DESCRIPTION This bulletin replaces the 20-amp circuit breakers (2) with 20-amp fusible plug-in units to eliminate possible "nuisance tripping" which could occur at high ambient temperatures.

COMPLIANCE Dealers should comply with this bulletin prior to delivery of coach to owner. Present owners should return coach to dealer for this modification as soon as practicable.

MANPOWER Estimated accomplishment time for one mechanic is one-half hour.

MATERIAL Parts required are as follows:

TITLE	MANUFACTURER P/N	RVD P/N	QTY PER COACH
QF fusible plug-in unit	QF 2020 (Square D Company)	5101910	2
Fuse, 20-amp	Type SC 20 Class G (Buss)	5101911	4 (plus 2 spares)
Connector (insulated)	562 (Elec Products Division of 3M)	5101039	2

ACCOMPLISHMENT INSTRUCTIONS

F.M.C., AS OF THIS DATE, NO LONGER
WORK PARTS OR LABOR REIMBURSEMENT
AS OUTLINED IN THIS BULLETIN

WARNING

BEFORE STARTING THESE PROCEDURES, ENSURE THAT THE SERVICE (LAND) LINE IS DISCONNECTED FROM THE POWER SOURCE AND THAT THE APU IS INOPERATIVE.

Observe the preceding warning and accomplish the step-by-step instruction in the following Figure 1.

Either before or after installation, pull the fuse carriers out of the fusible units (using PULL handles), install SC 20 fuses in clips then reinsert with "White Corner" mark next to "ON".

Table 39-7. Cleaning Domestic Electrical Components

TYPE OF CONTAMINATION	CLEANING TECHNIQUE
Rust or other oxidation	Sand (use nonmetal abrasive). Aluminum wool may be used on aluminum surfaces of items such as: mountings, cases, covers, stripped chassis, etc.
Loose solder, metal chips	Brush or vacuum
Excess oil and grease	Wipe with disposable paper towelling
Dust and dirt	Blow with compressed air of suitable pressure
Grime and fingerprints	Wipe with clean detergent moistened cloth

(8) Other cleaning methods which may be used to clean and treat specific parts when removal from the equipment is not feasible or necessary are as follows:

(a) Connectors—where small amounts of rust, corrosion or oxide deposits are present on connectors, either internally or externally, clean the connectors with a brush. Care must be exercised to ensure that no metal fillings or residue remain inside the connector and that the connector is thoroughly dry before the male and female portions are joined. Where rust, corrosion or oxide deposits are present in large quantities, replace the connector.

(b) Components—remove small amounts of rust, corrosion or oxide deposits on components to the bare metal and touch up or refinish with a suitable paint or protective coating unless the portion of the metal involved is used as a ground connection. In these instances the metal must remain free of any type of protective coating. In general, use the least abrasive method possible to remove the contaminant from the affected surface and follow with a non-corrosive solvent and thorough drying prior to applying a protective coating. When using an abrasive to remove the rust, corrosion or oxide deposit, exercise care to ensure that residue does not enter any parts or components such as relays, gears, sockets or switches which may result in malfunction of the equipment. Clean aluminum surfaces with a cloth, brush, aluminum wool or fine sand paper. Steel surfaces may require the use of a wire brush or emery cloth, however, wire brushes should be used only if there is no danger of fire hazard due to sparks generated from the friction of the metals.

d. Corrosion Preventive Treatments. Equipment, parts and accessories used in the coach domestic electrical/electronic equipment possesses protective finishes resistant to corrosion. Retouch or spot-paint equipment exteriors whenever a scratch, mark or scar penetrates to the bare metal or basic structural material of the unit. After cleaning connectors apply minimum amount of Dow Corning 4X spray, or equivalent, on mechanical mating surfaces to prevent corrosion and extend connector life by easing mating and demating pressures.

39-5. GENERAL INFORMATION

a. General. This section contains general information on the domestic electrical system related to data contained in the previous paragraphs.

b. Converter Voltage Output Test. After a converter has been installed and all wiring properly connected, the automatically regulated DC voltage output should be tested. To perform this test, use an accurate DC voltmeter and a plug-in type AC voltage tester. The APU must be operated

or service line connected and normal AC power applied to conduct this test. Check AC power at the dinette outlet with the AC voltage tester plugged into the receptacle. AC voltage should be between 110 to 126 VAC. See figure 39-3. All electrical loads should be removed from the domestic DC system such as lights, water pump, radio, furnace, etc., and position refrigerator thermostat to OFF. Allow a few minutes for the converter to warm up, then gain access to the 12 VDC bus by opening the hinged door on the end of converter. Check with the DC voltmeter between the 12 VDC bus and ground for a reading of 13.8 to 14.2 VDC (no-load). Remove AC power and recheck bus for battery voltage (approximately 12 VDC). Close converter hinged access door, reinstall cover panel underneath passenger seat and reposition refrigerator thermostat to a number "3" setting when complete.

c. Battery Servicing. There are two important things that must be done periodically in order to obtain long life from the domestic batteries. First, the electrolyte must at all times be kept above the plates and separators. The liquid level should be brought up to the bottom of the vent cap tubes. Never add acid except when it is definitely known that acid has been lost by spillage, then only by an experienced battery man. Second, be sure that the battery is kept nearly charged at all times. The state of charge should be checked at frequent intervals by making specific gravity readings with a battery hydrometer. Should the gravity fail more than 0.040 below that specified for fully charged gravity, remove the battery and have it charged. Batteries in a low state of charge should be recharged, preferably at a low rate. A sulphated battery may require a further reduction of the charge rate. This can be determined by making periodic temperature tests of the electrolyte. The temperature should never be permitted to rise above 125 degrees F and preferably maintained at approximately 110 degrees F. A battery is considered fully charged when specific gravity readings do not increase for three hourly intervals. If the gravity of a battery is taken and found to be 1.300 or higher, it is an indication that too much acid has been added.

NOTE

The hydrometer is used for determining the specific gravity. The following gives an indication of specific gravity value (based on an ambient temperature of 80 degrees F) related to battery charge condition:

Specific Gravity Reading	Battery Charged Condition
1.260-1.280	Fully charged
1.230-1.250	Three-quarter charged
1.200-1.220	One-half charged
1.170-1.190	One-quarter charged
1.140-1.160	Just about flat
1.110-1.130	All the way down

Hydrometer readings will vary with temperature variations of the electrolyte. Most hydrometers have a built in thermometer. A hydrometer reading of a cell with electrolyte temperature above 80 degrees F will indicate less than the reading with the electrolyte at 80 degrees F. The opposite holds true where the electrolyte temperature is below 80 degrees F. Hydrometer floats are calibrated to indicate a correct reading only at one temperature, 80 degrees F. Temperature correction of the specific gravity of the electrolyte amounts to 0.004 specific gravity (4 points of gravity) for each 10 degrees F change in temperature. Add four points of gravity for each 10 degrees F change in temperature above 80 degrees F. Subtract four points of gravity for each 10 degrees F change in temperature below 80 degrees F. Excessive water evaporation (decomposition) from all cells of a battery indicates overcharging or excessive heat. The converter output should be checked if this condition exists; refer to paragraph 39-5b.

(4) Disconnect three white leads from ground bar by loosening one screw.

(5) Disconnect two black leads from each other by removing wire nut; retain wire nut.

(6) Disconnect two white leads from each other by removing wire nut; retain wire nut.

(7) Disconnect ground lead from terminal post by removing nut; retain nut.

(8) Using needle nose pliers, compress the locking flanges of the protective grommet type bushing attaching harness to entrance hole of converter box and simultaneously pull harness clear of converter box. Repeat this step for three harnesses.

(9) Remove ground lead from frame stud by removing one nut and washer; retain ground lead, nut, and washer.

(10) Remove converter from mounting studs by removing remaining three nuts and washers; retain nuts and washers.

j. Converter Installation.

(1) Using old converter box, determine location of "knock out plugs" to be removed from new converter box. Remove the three "knock out plugs".

(2) Position converter over four mount studs and using the two forward and one aft inboard stud secure with three nuts and washers.

(3) Connect ground lead to the aft outboard stud and secure, using one nut and washer.

(4) Pull 110 VAC line through bottom hole of the converter housing.

(5) Push plastic protective grommet into hole, and connect leads as previously marked.

(6) Pull three white and one black ground wire through center hole, then repeat step (5) above.

(7) Pull red battery cable and four black fuse wires through top hole, then repeat step (5) above.

(8) Tighten all lead terminal connections.

(9) Perform converter voltage output test in accordance with paragraph 39-5b.

39-4. INSPECTION/CLEANING

a. General. This section contains information necessary for inspection and cleaning of the domestic electrical system components.

b. Inspection. The following contains procedures for inspection of the domestic electrical system components. Inspect the domestic electrical system according to table 39-6.

Table 39-6. Domestic Electrical System Component Inspection

COMPONENT	INSPECT	CORRECTIVE ACTION
Converter	Leads and terminals for evidence of overheating or looseness	Replace leads and/or tighten terminal nuts
	Mount brackets for security	Tighten attaching nut
	Interior for cleanness	Clean if required
	Fuse holder clips for security	Tighten if required

Table 39-6. Domestic Electrical System Component Inspection - Continued

COMPONENT	INSPECT	CORRECTIVE ACTION
Batteries	Terminals for corrosion	Clean
	Compartment cover for damage	Replace if cover does not seat in mount to provide good seal
	Mount tray and hold down brackets for acid damage, excessive dirt or corrosion	Clean; replace hold-down brackets if damage is excessive
	Vent caps for damage and proper operation	Replace
	Low electrolyte level	Replenish, refer to paragraph 39-5c
	Loose cable clamp at terminal posts	Tighten
Wiring Harnesses	Damaged insulation or wrapping loose at terminal connections	Tighten
	Improper routing	Reroute and tie in place
	Connector plugs for secure mating	Fully insert plug prongs into receptacle of mating plug

c. Cleaning. The coach domestic electrical components and equipment require general cleaning prior to final ascertainment of serviceability. This type equipment must be kept free of the following contamination:

(1) Metal chips and other foreign matter.

(2) Loose, spattered, or excess solder.

(3) Excess oils and greases.

(4) Fingerprints, grime, dust, dirt, etc.

(5) Corrosion due to alkalies or acids.

(6) Oxidation such as rust.

(7) Clean moderately contaminated components as indicated by table 39-7.

(3) Remove APU contactor as follows:

(a) Detach electrical leads from APU contactor by loosening six terminal lug screws, then pulling leads out until clear of lug.

(b) Detach electrical leads from APU contactor coil by removing two screws; retain screws.

(c) Detach ground lead from contactor mounting plate by removing one screw and washer; retain screw and washer.

(d) Remove contactor mounting plate from power control relay box by removing three screws and washers; retain plate, screws and washers.

NOTE

Make certain that mechanical interlocks are in the horizontal position before separating contactors. After separating contactors note relative position of mechanical interlocks for reinstallation.

(e) Remove APU contactor from mounting plate by removing two screws and barrel nuts; retain contactor, screws and nuts.

(4) Disassemble APU contactor as follows:

(a) Separate APU contactor side moldings by removing four snap rings; retain snap rings.

(b) Remove two springs, molding with magnet, and contactor coil.

NOTE

The preceding steps (3) and (4) are also applicable for the service line contactor.

e. Power Control Relay (Contactor) Assembly and Installation (fig. 39-4).

(1) Assemble the APU contactor as follows:

(a) Center contactor coil between magnet halves with terminals pointing downward.

(b) Place molding with magnet, and contactor coil into side molding.

(c) Insert rubber strip in bottom slot of side molding.

(d) Assemble mating halves of side moldings and install four snap rings.

(e) Install spring on spring retainer between two side moldings. Repeat on opposite side.

(2) Install APU contactor as follows:

NOTE

Ensure that the mechanical interlock components are in place in the service line contactor, then position the APU contactor to engage the interlock.

(a) Assemble APU contactor to mounting plate with two screws and barrel nuts. Place barrel nuts with barrel down in slots provided on side moldings.

(b) Assemble contactor mounting plate to power control relay box using three screws and washers.

(c) Attach ground lead to contactor mounting plate using one screw and washer.

(d) Attach electrical leads to APU contactor coil using two screws.

(e) Insert electrical leads into APU contactor terminal lugs and secure using six screws.

(f) Assembly cover to power control box using two screws and washers.

NOTE

The preceding steps (1) through (2) (f) are also applicable for the service line contactor.

f. Installation of Repair Kit in Power Control Relay (Contactor) (fig. 39-4).

(1) Remove and disassemble contactor in accordance with paragraph d.

(2) Remove three contact springs and contacts from molding with magnet.

(3) Install new contacts and contact springs supplied in repair kit.

(4) Reassemble and reinstall the contactor in accordance with paragraph e. When accomplishing steps e (1) (a), (b) and (d) use new coil and new molding from repair kit.

g. Service Line Removal. To remove service line proceed as follows:

(1) Remove AC power from coach and open APU access door to gain access to the power control relay (contactor) box.

(2) Remove cover from contactor box (fig. 39-4) by removing screws and washers; retain cover and attaching parts.

NOTE

In order to make correct connections during installation, note the color of each service line lead to contactor lug connection:

BLACK lead to upper
WHITE lead to center
RED lead to lower
GREEN lead connects to screw in mounting plate (ground)

Also check and determine the small control relay lead colors that connect to lugs along with the above leads.

(3) Remove leads or service line from contactor by loosening three terminal lug screws and pulling leads out until clear of lugs.

(4) Disconnect ground lead from contactor mounting plate by removing attaching screw; retain screw.

(5) Remove two screws holding the two halves of the split clamp, located around the service line in the entrance hole of the box outboard side, then pull service line out until clear of box; retain screws and split clamp halves.

(6) Uncoil service line from holding bracket and remove from coach.

h. Service Line Installation. To install a service line proceed as follows:

(1) Insert the end of the service line with the four leads into the entrance hole in the outboard side of the contactor box, until a minimum of one inch of the line insulation is protruding through the hole into the box.

(2) Install the two halves of the split clamp around the outside of the line insulation where it enters the hole in the contactor box, with the flanged end of the clamp halves on the inside of the box wall and the threaded hole ends on the outside. Secure outside ends of clamp halves together with two screws.

(3) Cut leads to proper lengths as required to connect to appropriate terminal lug and ground lead attaching screw; strip insulation back sufficiently to provide good contact when lug screw is tightened. Install insulated crimp terminal (same as on removed lead) on green ground lead after stripping end area.

(4) Connect and secure leads in contactor lugs in same positions noted prior to removal; refer to preceding step g (2). Connect green lead terminal with attaching screw to mount plate.

(5) Plug service line into external AC power source and check that no arcing occurs at connections made above. Check for proper operation of coach AC circuits. Remove power and install cover on power control relay (contactor) box.

(6) Stow service line by coiling around holding bracket adjacent to APU; close access door.

i. Converter Removal.

NOTE

Before disconnecting leads remove AC power from coach and note or mark lead connections for proper hook-up during reinstallation.

(1) Gain access through converter hinged door and disconnect four black leads from fuse bus terminal lugs by loosening four screws.

(2) Disconnect red lead from terminal lug by loosening one screw.

(3) Disconnect black lead from ground bar by loosening one screw.

(1) Remove AC power from coach (APU inoperative and service line disconnected). Turn off all DC operated domestic components and position the refrigerator thermostat knob to the "OFF" position.

(2) Remove domestic battery cover.

(3) Note location of the battery positive and negative posts relative to the battery compartment positioning (both batteries).

Warning

Always disconnect the ground strap "negative" (-) terminal clamps from the forward outboard (-) battery post first, as specified in these steps. If a "positive" (+) hot terminal clamp is disconnected first, arcing can occur if a wrench is accidentally dropped and shorts the hot terminal post of either battery to the battery compartment structure and ground strap remains connected. By disconnecting the ground strap terminal clamp from the battery post first, the chances of such an occurrence are limited to the work done while disconnecting the ground strap only. This minimizes the possibility of a hot short occurring which could burn personnel holding the hot wrench or possibly causing battery explosion if an excess of hydrogen gas has escaped from the vent cap holes.

(4) Loosen cable clamp nuts and disconnect cables in the following order, using a screw type cable puller, or a battery terminal spreader with offset serrated jaws which spread and clean terminal clamps in one operation (Snap-On Tool Corporation Model GA-118B, Kenosha, Wisconsin, or equivalent).

(a) Remove ground strap from negative post of forward battery.

(b) Remove jumper cable from positive post of forward battery and from the negative post of the aft battery.

(c) Remove the dual-cable terminal (with refrigerator lead attached) from the positive terminal post of the aft battery.

Warning

Prior to accomplishment of next step, inspect battery containers for evidence of cracks or leaks. If containers are found cracked or leaking take the following precaution as sulfuric acid contained in the battery is very corrosive and will destroy most things with which it comes in contact. It will cause painful and serious burns if it gets on the skin. The acid should be flushed away with a large quantity of water, which dilutes while washing away the acid. Also, a water and baking soda solution may be used to neutralize the acid. A quantity of baking soda may be kept at hand to sprinkle on anything on which the acid may be spilled. Water should then be used to flush off the acid and soda. Keep the cleaning solution out of the battery to prevent damage to cells. Protect hands from electrolyte by wearing a suitable pair of rubber gloves (not the household type). Also cover exposed coach areas to prevent damage from electrolyte dripping.

(5) Remove nuts/lockwashers from the battery hold-down bolts, then remove hold-down brackets. Use a battery carrying strap (Snap-On Tool Corporation, GA-154, Kenosha, Wisconsin, or equivalent) and lift each domestic battery individually out of the compartment.

(6) Inspect and clean floor and walls of battery compartment, as required. Clean the inside surfaces of the cable terminal clamps, if necessary, using terminal cleaner (Snap-On Model BTC-6 terminal cleaner, or equivalent). Check that the insulator grommet in the cable entrance hole of the compartment is in place and in serviceable condition. Check cable insulation for deterioration and damage. Replace cable assemblies, if required. Clean and tighten grounding strap terminal connection at end that bolts to compartment structure.

NOTE

Prior to installation, make sure replacement batteries are fully charged, clean and serviced.

(7) Install two 6 VDC replacement batteries in the battery compartment. Position replacement batteries with positive and negative posts as shown in figure 39-10.

(8) Install hold-down brackets over batteries and secure with lockwashers and nuts on hold-down bolts; torque nuts to approximately 3 foot-pounds.

> **Caution**
>
> Do not overtighten hold-down nuts as battery container could crack if excessive pressure is applied.

(9) With AC power removed from coach, connect the dual-cable positive lead terminal clamp (with the refrigerator lead terminal attached) to the positive post of the aft battery; secure to post by tightening clamp bolt nut.

> **Warning**
>
> Always connect the ground strap "negative" (-) terminal clamps to the forward outboard (-) battery post last, as specified in these steps. If the negative ground terminal clamp is connected first, arcing can occur if a wrench is accidentally dropped and shorts either battery (+) hot terminal post to the battery compartment structure. By connecting the ground strap terminal clamp to the negative battery post last, the chances of such an occurrence are limited to the work done while connecting the ground strap only. This minimizes the possibility of a hot short occurring which could burn personnel holding the hot wrench or possibly causing battery explosion, if an excess of hydrogen gas has escaped from the vent cap holes.

(10) Install remaining cables and tighten cable clamp nuts in the following order:

(a) Install jumper cable terminal clamp on positive post of forward battery and on the negative post of the aft battery.

(b) Install ground strap terminal clamp on negative post of the forward battery.

(c) Coat all cable clamps with light mineral grease.

(11) Install cover over battery compartment.

> **Caution**
>
> If domestic batteries have been removed from coach for an extensive period and AC power has not been applied during the interval, the refrigerator warms up to a point where it will draw excessive DC current when initially energized by replacement batteries. To prevent excessive battery drain due to the above reason, after battery installation is completed, apply AC power to the coach then position refrigerator thermostat to the number "3" setting and operate until the unit cycles off. Setting the refrigerator thermostat to "3" and driving the coach for approximately two hours immediately following installation of replacement domestic batteries will also prevent excessive battery drain, as the automotive alternator will then be providing the refrigerator operating voltage. Refer to Group 37 for further information regarding operation of the refrigerator.

d. Power Control Relay (Contactor) Removal and Disassembly (fig. 39-4).

(1) Disconnect AC power and gain access to the power control box through the left-hand engine-transmission-APU service door.

(2) Remove cover from power control box by removing two screws and washers; retain cover, screws, and washers.

NOTE

Before detaching electrical leads from terminals note or mark which color lead is connected to each lug for proper hook-up during reinstallation.

Table 39-5. Troubleshooting the 110 VAC Domestic Power Supply System

Malfunction (symptoms)	Probable causes	Corrective action (remedies)
APU engine operating at normal speed but no AC power available in coach	See fig. 39-3. Control relay K1 in power control relay (contactor) box defective	Replace relay K1
	Contactor (power relay) K2 coil defective	Replace; refer to 2900R Parts Catalog for coil kit part number data and paragraph 39-3f for installation procedure
	APU generator defective	Troubleshoot and repair or replace; refer to Group 40
Service line connected to external AC power but no AC power available in coach	Control relay K1 defective	Replace relay K1
	Contactor (power relay) K3 coil defective	(Same as for above relay K2)
	Plug prongs not fully inserted in receptacle	Fully insert prongs in receptacle
	Open circuit in line	Disconnect and inspect line insulation for cuts or breaks; replace
APU will not crank with switch on domestic panel in START position	Automotive battery weak or terminals corroded/loose	Recharge or replace if defective; clean and tighten terminals
APU will not crank with switch on domestic panel in START position (continued)	20 ampere fuse on converter 12 VDC bus blown	Check and repair circuitry; replace fuse
	See figure 39-7. Domestic batteries weak or terminals corroded or loose	Attempt start with switch on APU; if APU starts OK then accomplish recharge or replace domestic batteries
	APU start relay leads not properly connected to terminals	Tighten terminal nuts
APU cranks with switch in START position but engine fails to start	Faulty ignition system	Troubleshoot and repair in accordance with Group 40
	Faulty fuel system	(Same as previous)
	Low oil pressure switch preventing start due to lack of oil	Check oil level; service as specified in Group 40

such as fuses, lamps (bulbs), relays, indicators, resistors, and sending units are replaced rather than repaired. Some parts, such as controls switches, relays, and contactors, with slight damage are repairable. In either case, the replaced or repaired part must be equivalent to the original part to maintain performance, reliability and safety.

b. Replacement of Fuses, Fuse Posts and Fuseholders. Use fuses, fuse posts, and fuseholders of the type in the 2900R parts lists. Replace corroded or oxidized fuses regardless of other conditions. If prescribed fuses are not available use substitute fuses in non-critical circuits, providing the physical size of the fuse satisfies requirements, the current rating of the substitute does not exceed the rating of the original fuse, and that the voltage rating, under no circumstances, is lower than the voltage rating of the original fuse.

(1) Replacement of Fuses in 12 VDC System Converter.

(a) Remove electrical power from the system.

(b) Gain access to converter bus fuse clips by opening the hinged access door on the front of the converter.

(c) Locate and remove blown fuse.

> ***Caution***
>
> Always determine and correct the defect causing the fuse to blow, prior to installation of replacement fuse; refer to paragraph 39-2b.

(d) Insert new fuse in fuseholder clips then energize the system and check that components in the affected circuit operate; close converted access door.

(2) Replacement of Fuses in 110 VAC System Fusible Units in Circuit Breaker Box (fig. 39-5).

NOTE

The QF fusible plug-in units are equipped with two indicator lights (Q-lite), located on the forward end of the case, which illuminate when the adjacent fuse blows, if power is on the AC system.

(a) Gain access to the fusible unit by opening the hinged access door on the front cover of the AC circuit breaker box (load center). Press aft on the catch located at the top of the cover to open access door. Check which light is illuminated to determine which fuse is blown.

(b) Remove electrical power source (APU inoperative and service line disconnected).

(c) Pull the fusible carrier forward out of the unit using the handle marked PULL.

> ***Caution***
>
> Always determine and correct the defect causing the fuse to blow, prior to installation of a replacement fuse; refer to paragraph 39-2c.

(d) Remove the blown fuse from carrier by prying out of the clips through the pry slot provided in the side of carrier.

(e) Install a new SC 20 fuse in the clips of the carrier.

(f) Reinstall carrier in the unit with the white corner marker adjacent to the ON lettering. Press carrier in until fully seated in the unit.

(g) Energize the AC system and check that the components in the affected circuit operate; close circuit breaker box access door.

c. Replacement of Domestic Batteries (figs. 39-2 and 39-10). Replace the domestic batteries as follows:

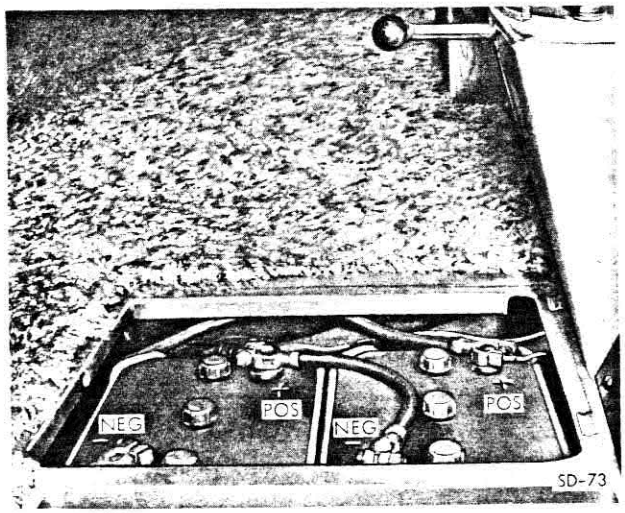


Figure 39-10. Domestic Batteries

b. Domestic 12 Volt DC Open Or Short Circuit Checks (fig. 39-8). Circuit checks may be readily accomplished with a volt/ohmmeter, continuity tester, or by substitution of a known serviceable item. Failure of an electrical unit to operate when its control switch is turned on, requires that a check be made of the power lead to the unit to determine that it is neither shorted to ground nor open. To locate a circuit malfunction, proceed as follows:

(1) A lead that is shorted to ground, to another electrical lead, or that has become overloaded due to fault within the operative electrical unit will cause the protective fuse, located inside the converter behind the hinged access door, to blow. When this condition is encountered, inspect the wire from the fuse throughout its visible length to the electrical unit to which it is connected. Inspect for chafing against another lead or structural member. If wire is not defective, check the item of domestic electrical equipment (see figure 39-2) for visible mechanical defects which would cause electrical overload.

(2) An open circuit between an electrical unit and the power source will not cause the fuse to blow. To locate an open circuit, make a continuity check of the wire. Make sure that the wire under check is electrically isolated from the other wires so that a false continuity indication is not obtained through an inter-connecting circuit. Utilizing a continuity tester, connect one tester lead to one end of the wire under test, and touch opposite test lead to next wire segment connection point. Progressively check each wire segment until an open or disconnected area is found.

> ***Caution***
>
> Continuity tester lead probes should be inserted at segment connection points only. A probe or other sharp instrument should not be used to pierce the insulation at intermediate points in the wire, as permanent damage to the insulation will result.

If continuity check reveals that a particular section of wire is open, but a visual check of the wire does not disclose the broken wire, locate the break by feeling the insulation until a soft spot is found.

(3) Instructions for troubleshooting the 12 VDC domestic electrical power supply system are contained in the following table 39-4.

c. Domestic 110 VAC Open Or Short Circuit Checks (fig. 39-3). Failure of an AC electrically operated component to operate when its control switch is turned on requires that a check of the circuit be accomplished to determine if an "open" in the circuit exists. If the AC circuit is shorted or overloaded, the 20-ampere protective fuse, located in the AC circuit breaker box, will blow. These fuses are in the fusible units in the circuit breaker box, and if they blow, the Q-light located adjacent to each unit illuminates. In instances where the fuse is not blown, but the circuit is open to a particular component or outlet due to other reasons, further checks must be made to locate the defect. To isolate the general area of an open circuit, first attempt operation of the forward most AC component for both the right-hand and left-hand AC circuits. The converter is the forward most AC operated component on the right side and the drivers AC outlet, into which an AC voltage tester can be plugged (inserted), for the left side AC circuit. See figure 39-3.

If both the left and right hand circuits are "hot", the main branches of the AC circuitry are functioning and any open circuit must be between the main branch leads and the take-off lead to the affected AC component or outlet. If the converter does not operate, or if the voltage tester plugged into the left side driver outlet indicates zero, then proceed aft and check at each outlet or component (refrigerator or domestic air conditioners) one-by-one until an operational ("hot") circuit is found. The open will be somewhere forward of this point, and power will have to be removed from the coach and continuity checks performed to determine the exact location of the open. Instructions for troubleshooting the 110 VAC domestic power supply system are contained in table 39-5.

39-3. REMOVAL/INSTALLATION

a. General. Step-by-step instructions (including how to gain access) for replacement of the domestic electrical system components, where procedures are not obvious, are provided in this section. Replacement parts should be procured from those listed in Group 39 of the 2900R Parts Catalog. Substitution parts are used only when necessary. Defective electrical or electronic parts

Table 39-4. Troubleshooting the 12 VDC Domestic Electrical Power Supply System

Malfunction (symptoms)	Probable causes	Corrective action (remedies)
Battery condition meter on domestic panel indicates low charge on domestic batteries	Excessive use of batteries in lieu of APU service line operation of converter	Slow charge batteries and instruct owner to better utilize APU and/ or service line power to provide DC power from converter
Same as above except no reading obtained	Blown 20 or 50 ampere fuse at converter bus (fig. 39-8)	Check causes, repair and replace blown fuse; refer to paragraph 39-2b (1)
	Cable clamps at terminal posts loose or corroded	Clean and tighten
Battery electrolyte level consistently found low during periodic checks	Excessive alternator output (automotive)	Replenish battery; refer to Group 4 and adjust regulator
	Cracked or leaking battery case (container)	Visually inspect battery; if cracked, replace
	NOTE Excessive converter output could also cause this malfunction. If trouble is isolated to converter, replace converter	***Warning*** Care should be taken, in the event battery case is cracked or leaking, to protect hands from the electrolyte. A suitable pair of rubber gloves (not the household type) should be worn when removing the battery by hand. It is recommended that a battery carrying strap be used whenever the battery is to be removed from the coach.
Converter inoperative with AC power applied	20 ampere fusibles unit in circuit breaker box fuse blown (Q-light adjacent to fuse holder illuminated)	See fig. 39-3. Check converter right side AC power supply circuit for short or overload; repair and replace fuse. Refer to paragraph 39-2c. Replace converter; refer to paragraphs 39-3i and j

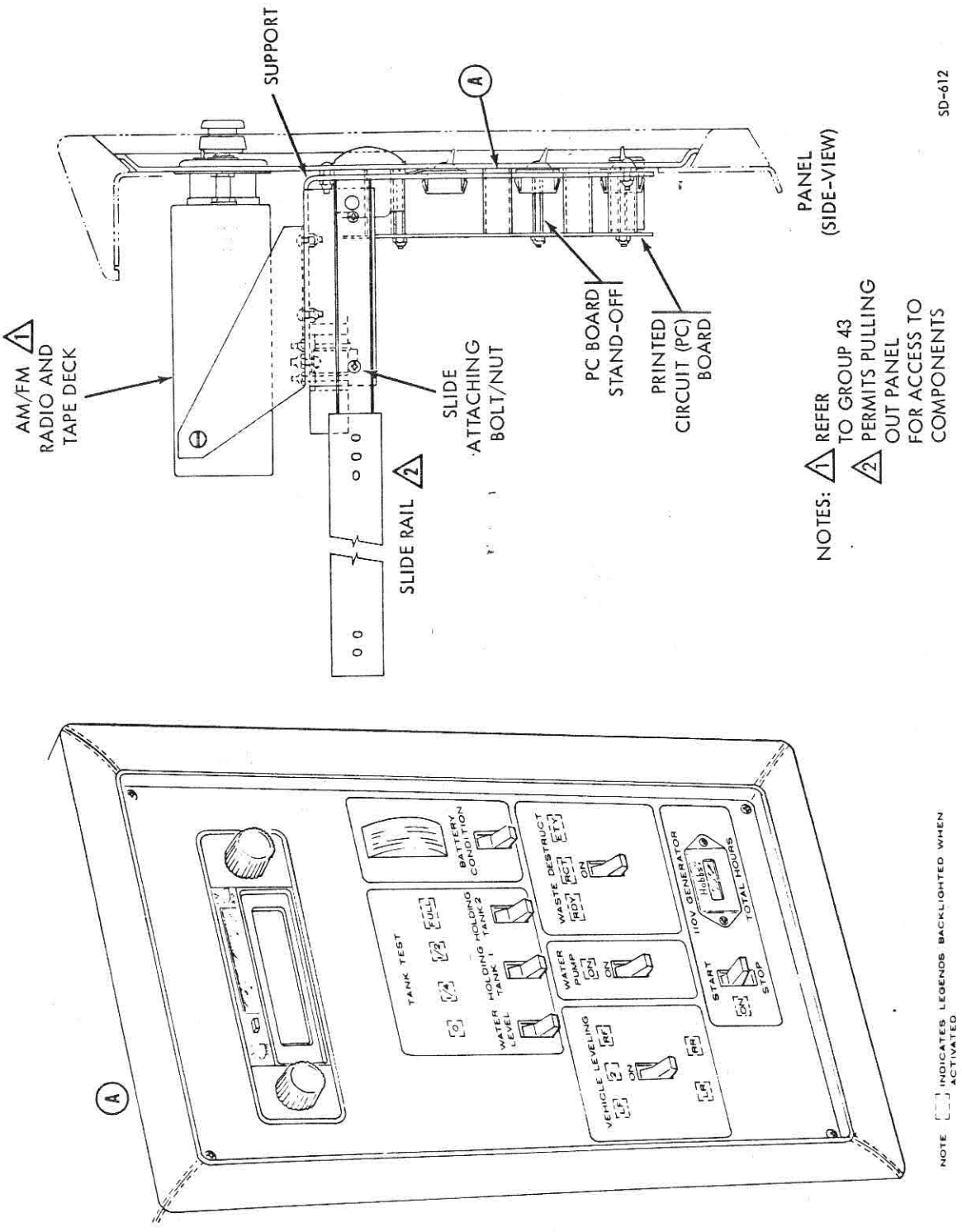


Figure 39-9. Domestic Panel Controls and Indicators

Only the following indicators are used with the "WATER LEVEL" switch: "1/2" for less than half full, and "0" for empty. When holding tank No. 1 spring-loaded switch is pressed upward, the indicator most closely related to the quantity of the liquid waste in holding tank No. 1 (37-gallon) will light. Only the following indicators are used with "HOLDING TANK NO. 1": "1/2" for more than half full and "FULL" for warning that the tank is more than 3/4 full and should be emptied before any extended use. When holding tank No. 2 spring-loaded switch is pressed upward, the same type of indications will be displayed for the holding tank No. 2 (29-gallon) as described for tank No. 1.

(c) Battery Condition. When the spring-loaded battery condition switch is pressed upward (ignition off and/or AC voltage is not applied), the meter will indicate level of charge on the domestic battery system. With ignition on and coach engine operating or AC voltage applied to the converter, the meter will indicate output level of the automotive alternator or the converter respectively.

(d) Vehicle Leveling. The vehicle leveling switch starts the leveling detection system when placed in the ON position. The appropriate indicators light for the lowest corner of the coach: "LF" (left front), "RF" (right front), "LR" (left rear), and "RR" (right rear). When the coach is within 2 degrees of a level plane, the 2-degree indicator will light. When the coach levels within 1 degree, all lamps go off.

(e) Water Pump. Placing this switch in the ON (upper) position illuminates the "ON" indicator and presets the water pump to automatically respond to demand-type requirements. Thus, when the water system pressure drops (water faucet open), the pump operates. With no demands (water system closed), the pump remains inactive but the "ON" indicator light remains illuminated, indicating the water pump is ready for operation.

(f) Waste Destruct. When placed in the "ON" position, this switch will set the waste destruct system in the "RDY" (ready) mode. When the coach is moving at the prescribed speed and the exhaust system reaches the proper temperature, the "RCT" (react) indicator will light and the system is fully operational. When waste holding tanks No. 1 and No. 2 have been emptied of liquid waste, the "ETY" (empty) indicator will light.

(g) 110 V Generator (APU). When this spring-loaded switch is pressed upward to START position the APU start circuit is energized. When the APU is operating, the "ON" indicator light will stay illuminated. Pressing the switch downward momentarily will stop the APU and the "ON" indicator will go out.

NOTE

Another APU start switch is located on top of the unit on the printed circuit board module. The APU ON indicator light will illuminate when the APU is operating regardless of which switch is used for starting.

Operating hours for the generator are shown on the hour meter numerical display to 1/10 of an hour.

d. AC Wiring Harnesses. AC harness routing and construction details are contained in the 2900R Parts Catalog, Group 39. The following is a list of harnesses contained in the referenced catalog:

- Converter to Kitchen Furnace Harness
- Converter to Upper Lights and Fixtures Harness (left side of coach)
- Converter to Upper Lights and Fixtures Harness (right side of coach)
- Domestic Panel to Rear of Coach Harness
- Domestic Panel Harness

39-2. TROUBLESHOOTING

a. General. The following includes instructions for the determination and isolation of the domestic electrical system component or circuit malfunctions. The troubleshooting instructions are presented in sequential steps in tabular form. Troubles are listed in a descending order, from those most likely to occur to those occurring infrequently and troubles caused by the interaction of integrated components. Troubles for which remedies are obvious are not included. Repair procedures for correction of specific malfunctions are appropriately referenced in the troubleshooting table REMEDY column.

The converter incorporates a voltage-sensing device which functions to supply the proper voltage for the domestic DC operated components and for charging the domestic batteries. The amount of current allocated to operating or charging depends on the demand. If the system load is high the overall current output increases. With a low system load and with the batteries fully charged, the converter current output automatically decreases. When a load is placed on the domestic 12 VDC system and the converter is not operating (coach engine and APU inoperative; service line not connected) the domestic batteries are the sole power source for the domestic DC operated components. When the converter again takes over the load after batteries have been used, the batteries (now below full state of charge) are automatically allotted approximately 11 amperes of current on coaches with converters dated prior to 73-10 (as indicated on inside of access cover) and up to 37 amperes on subsequent, until they become fully charged, then the charge rate is automatically lowered by the converter to a constant "trickle" charge of about 1/4 ampere.

NOTE

When coach engine is operating, the 12 VDC automotive power supply system supplies current to the domestic batteries through an equalizer device; refer to Group 4 for detailed description and circuitry.

(2) Batteries (Domestic). Two, 6 volt, 220 ampere hour batteries, connected in series to provide 12 VDC electrical power, are installed in the domestic battery compartment as shown in figure 39-2. Table 39-3 provides leading particulars of each domestic battery.

Table 39-3. Battery Leading Particulars

BATTERY ITEM	PARTICULARS
Voltage.....	6 Volt
Capacity* (mins)	100
Discharge Rate.....	75 Amperes
20 Hour Rate*.....	220 Ampere Hours
Calculated One Hour Rate	110 Ampere Hours
Plates (per battery)	63
Electrolyte.....	6.5 Quarts
Weight	63 Pounds
Length	10-3/8 Inches
Width	7-1/8 Inches
Height.....	10-7/8 Inches
Container-Material.....	Polypropylene
Vent Cap-Type	Baffled to reduce acid spray; quarter-turn spray lock
Terminal Posts	Standard Automotive
*SAE Reserve Capacity Rating	

The battery is a lead-acid, electrochemical device assembled in a heat sealed cover and container. It is divided into three cells. Each fully charged cell, on open circuit, has a voltage of slightly over two volts (total six-plus volts).

NOTE

The battery does not actually store electricity but it does convert electricity into chemical energy which is stored until the battery is connected to an external circuit, at which time the chemical energy is transformed back into electrical energy and current flows through the circuit.

The characteristic of the battery which makes it so adaptable for its purpose is its reversibility. When discharged, it is reactivated by passing an electrical current through it in the opposite direction. Doing so reverses the foregoing chemical action. The lead sulphate is changed to lead peroxide in the positive plates and sponge lead in the negative plates. The sulphate leaves the plates, combines with the water, and changes the electrolyte to sulphuric acid. Water must be added, as required, to replace that which is decomposed into hydrogen and oxygen gases during charge. The efficiency of a fully charged battery is in direct relation to atmospheric temperatures which raise and lower the temperature of the electrolyte. A fully charged battery with an electrolyte temperature of 80 degrees F is considered to be capable of 100 percent performance. An electrolyte temperature of 32 degrees F renders the battery 65 percent effective and an electrolyte temperature of 0 degrees F leaves the battery only 40 percent effective. The grid framework of the battery plates is cast from an alloy of antimony and lead containing from 6 percent to 12 percent antimony. During charging, a small amount of antimony dissolves from the positive plate grids and deposits on the sponge lead of the negative plates, where it sets up a local electrochemical action with the sponge lead. This discharges the negative plates slowly. Small quantities of other impurities may affect to a lesser extent, either the positive or negative plates or both. The batteries will therefore slowly discharge on standing and will discharge much faster when warm than when cold. They will discharge faster when fully charged than when only partially charged.

NOTE

The domestic battery charge should be maintained by frequent running of either the coach engine, the APU, or connecting to an external facility with the service line. When the coach engine is running, the domestic batteries are charged by the automotive alternator through the equalizer. With service line or APU operation, the converter charges the batteries. The charge rate control of the automotive voltage regulator or the voltage sensing circuit of the converter prevent the batteries from being overcharged.

(3) Domestic Panel Controls and Indicators (fig. 39-9). The domestic panel contains a combination of indicators and controls to monitor and initiate performance checks of the coach's domestic facilities. These include functions for the radio, holding tanks, water storage, battery, vehicle leveling, water system pump, waste destruct, APU (110 V generator) and hour meter. The panel is located at the front of the coach between the driver and passenger seats, all controls are within reach of driver and passenger. The panel assembly is mounted on slide-rails permitting it to be pulled out for servicing. Back-lighted indicators are used for domestic functions that require only a quick glance to check status. Meters are used where critical check is required. The domestic functions controlled or monitored at the domestic panel are as follows:

(a) 8 Track Stereo Tape Player and AM/FM Radio. The controls on the 12-volt transistor-powered tape player/radio operate similar to standard car radios. The radio system incorporates an antenna and four speakers. The two forward speakers are mounted on the left-hand and right-hand side walls, one near the driver and the other near the passenger. The two rear speakers are mounted in the upper rear left and right-hand corners of the bedroom. Refer to Group 43 for service information covering the tape player/radio.

(b) Tank Test. This panel area contains four quantity indications: "0", "1/4", "1/2" and "FULL". Three two-position, momentary-on switches labelled "WATER LEVEL", "HOLDING TANK 1", and "HOLDING TANK 2" are located below the indicators. By holding a switch in up position, the indicator circuit for the tank selected is energized and indicators display quantity level.

arm provides for adjustment. To increase sensitivity, the spring is moved toward the governor shaft. To decrease sensitivity, the spring is moved toward the linkage end of the governor arm. If the setting is too sensitive, a hunting condition (alternate increase and decrease in engine speed) will result. If the setting is not sensitive enough, the speed variation between no-load and full-load conditions will be too great. Therefore, the correct sensitivity will result in the most stable speed regulation without causing a surge condition. With a full rated electrical load applied to the APU generator, the output voltage should stabilize at nearly the same reading at full-load as for no-load operation. The speed may remain about the same or increase when the load is applied, resulting in 1 or 2 hertz higher than the no-load frequency (1 hertz is equal to 60 rpm). If the rise in frequency is more than 2 hertz, the internal spring tension in the vacuum booster should be reduced. If there is a drop in frequency, the internal booster spring tension should be increased. To increase the tension, pull out the spring bracket and move the pin to a different hole. A drop of 1 hertz at 1/4 load is normal, giving an overall spread of 3 hertz maximum. Refer to table 39-2 for APU speed relationship to output voltages.

c. DC Power Operations (Domestic). The systems and components operated by 12 VDC power from the domestic DC power supply system are shown in figure 39-2. The electrical 12 VDC power distribution schematic diagram, figure 39-8, shows current routing from the domestic batteries and the 12 VDC power bus (located on the converter). Circuit protective fuses, control switches and operational components are also shown.

(1) 110 Volt AC-to-12 Volt DC Converter (fig. 39-1). 110 VAC-to-12 VDC converter is mounted under the passenger seat. The converter components are housed in a metal case incorporating mount rails which bolt to the coach frame and a hinged door for access to the fuses and 12 VDC bus. On coaches 00001 through 00250 and 00351 and up, access to the converter is from front of passenger seat. On coaches 00251 through 00350 access is from rear of passenger seat. The converter is 7-1/2 inches high, 6-1/4 inches wide, 14 inches long and weighs about 41 pounds. See figure 39-3. The converter receives 110 VAC from either the APU or the 110 VAC service line and functions to provide automatically regulated 12 VDC output power for maintaining the domestic battery charge and to operate the 12 VDC domestic components (fig. 39-8). The converter current output is rated at 45 amperes continuous (70 amperes maximum). The DC voltage output is 14.3 VDC maximum with no load and 12.5 VDC minimum at full load.

Table 39-2. APU Speed Relationship to AC Output

CONDITION	RPM	HERTZ	VOLTAGES
Maximum "no-load" speed	1920	64	Maximum no-load is 126 VAC
Minimum "full-load" speed	1710	57	Minimum full-load is 110 VAC (with booster deactivated)
Maximum speed drop from no-load to full-load	90	3	Maximum drop from no-load to full-load is 16 VAC
Preferred speed regulation, no-load to full-load	1830 to 1770	61 to 59	Preferred regulation is 122 to 118 VAC
Preferred speed spread	60	2	Preferred spread is 5 VAC

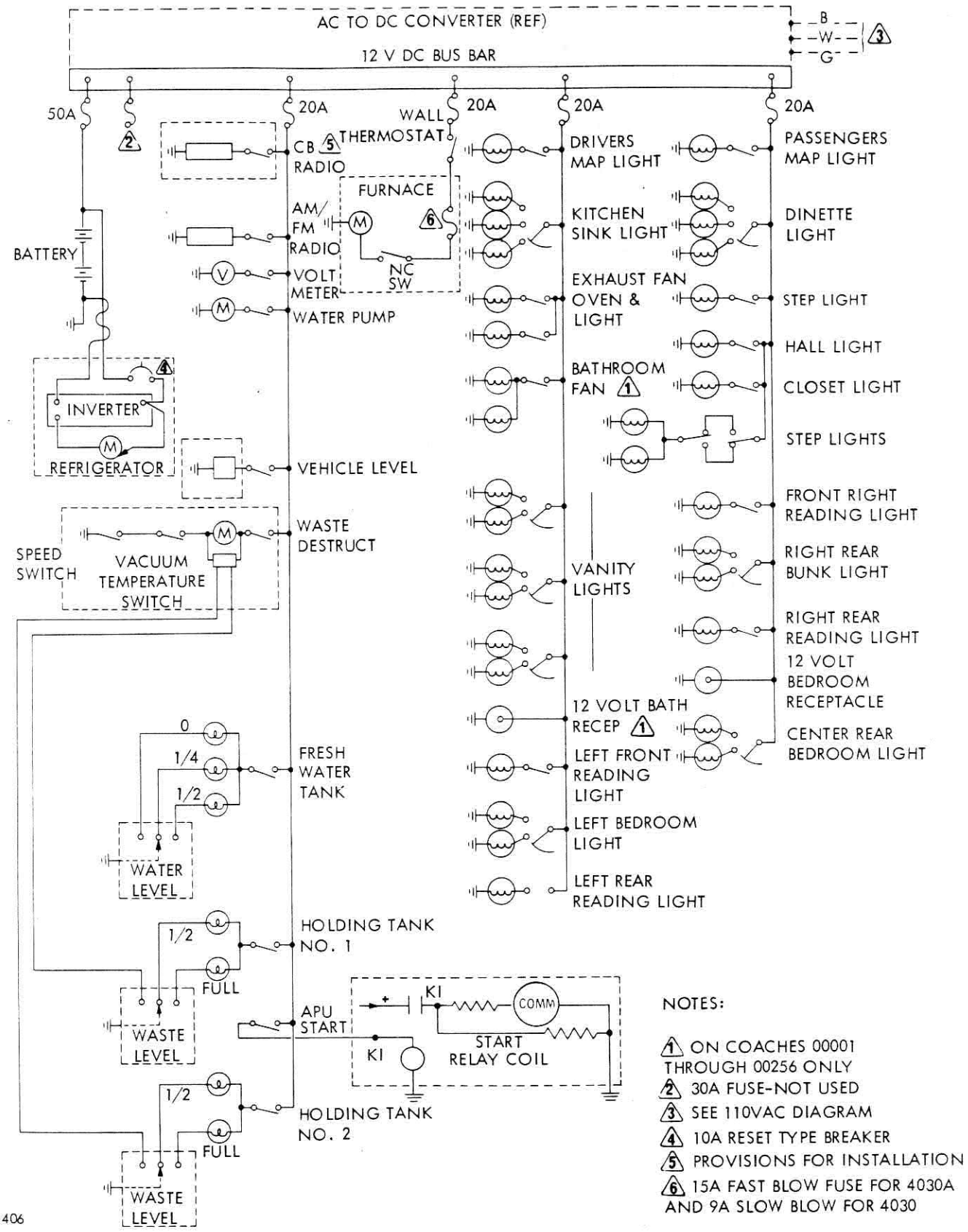


Figure 39-8. 12 Volt DC Power Distribution Schematic