

SECTION INDEX

1975 AND 1976 MAINTENANCE MANUAL MOTOR HOME

ZEO 6581**AND**

TRANS MODES

ZEO 6083**ZEO 6583****TRUCK & COACH DIVISION****GENERAL MOTORS CORPORATION****PONTIAC, MICHIGAN 48053**

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**ALPHABETICAL INDEX
WIRING DIAGRAMS**

SECTION 24

MISCELLANEOUS LIVING AREA FACILITIES

The information in this section pertains to components and/or systems found in the GMC MotorHome (ZEO 6581) ONLY.

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SECTION 24A

PERIODIC MAINTENANCE AND LUBRICATION

PERIODIC MAINTENANCE

SERVICE THESE ITEMS	AFTER EACH CYCLE OF INDICATED HOURS					
	8	100	200	400	500	1000
General Inspection	4000/6000 Watt					
Check Oil Level	4000/6000 Watt					
Change Crankcase Oil (1)		4000/6000 Watt				
Clean Air Cleaner (1)		4000/6000 Watt				
Check Spark Plugs		4000/6000 Watt				
Fuel Filter—Check (1)				4000/6000 Watt		
Check Breaker Points (2)		4000/6000 Watt				
Check Governor Linkage			4000/6000 Watt			
Clean Cooling Fins (1)			4000/6000 Watt			
Change Oil Filter (1)			4000/6000 Watt			
Replace Breaker Points			4000/6000 Watt			
Replace Air Cleaner (1)			4000 Watt		6000 Watt	
Remove Carbon From Heads				4000/6000 Watt		
Adjust Tappets				4000/6000 Watt		
Check Generator Brushes						4000/6000 Watt
Complete Reconditioning (If Required)						4000/6000 Watt

(1) Perform more often in extremely dusty conditions.

(2) Replace if necessary.

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Figure 1—Onan Motor Generator Maintenance Schedule

MOTOR GENERATOR MAINTENANCE INTERVALS

Regularly scheduled maintenance is the key to lower operating costs and longer service life for the unit. The following schedule (figure 1) can be used as a guide. However, actual operating conditions under which a unit is run should be the determining factor in establishing a maintenance schedule. When operating in very dusty or dirty conditions, some of the service periods may have to be reduced. Check the crankcase oil, the filters, etc., frequently until the proper service time periods can be established.

Additional information about the items on this schedule may be found later in this section.

LIVING AREA WATER PUMP BELT

Check the living area water pump belt for wear and adjust tension as necessary every 3 months or 3,000 vehicle miles, whichever occurs first. See "Living Area Water System" Section 24J for adjusting information.

VEHICLE STORAGE

The MotorHome may be stored for considerable lengths of time provided the following steps are performed:

1. SHORT TERM STORAGE — UP TO 60 DAYS AND ABOVE 32° F. (0°C.)

- a. Fill fuel tanks to reduce excessive build-up of moisture in the fuel tanks.
- b. Park MotorHome as level as possible, end for end and side to side.
- c. Wash MotorHome. If exposed to road salts the exterior and underside should be thoroughly washed and flushed.
- d. Remove all perishables, leave refrigerator door open. Be sure controls are turned off.
- e. Ventilate the living area, drawers, cabinets, closets, etc.
- f. Drain the holding tank, toilet and living area water system as described earlier in this section. Be sure the water pump and water heater are turned off.

WATER TANK FILTER

The water tank filter, which is located in the water compartment, is transparent and should be checked periodically and cleaned annually. A helpful sign that filter is dirty is when the transparent filter has become discolored. See "Living Area Water System" Section 24J for filter replacement procedure.

WINTERIZATION

When traveling in winter it is recommended that the water tank not be filled until the destination is reached. This will ensure that the vehicle has thoroughly warmed up. The water and holding tank systems should be drained before leaving for home. Also, an approved plastic pipe non-toxic, non-flammable antifreeze should be put in the sink and shower traps. If equipped with a recirculating toilet the standard winterization is to replace one-half of the charge water with an approved plastic pipe non-toxic, non-flammable antifreeze. This antifreeze added to the holding tank will help keep the tank contents from freezing.

See "Vehicle Storage" for additional information.

- g. Turn off LP gas at tank valve.
- h. Make sure range/oven and furnace manual valve and thermostat are set at "OFF," range/oven burners at "OFF," oven at "PILOT OFF" and gas/electric refrigerator control at "GAS OFF."
- i. Plug or tape all drains to retard evaporation of residual moisture in drain traps.
- j. Tape over vents to prevent insects from entering. Be sure to remove tape before operating LP gas appliances to help avoid poisoning by carbon monoxide.
- k. Check MotorHome weekly to ensure that undesirable conditions are not forming (water seepage, mold, odors, etc.). Household air deodorizers or disinfectants in aerosol cans may be used as required, however, do not spray directly on any surface.
- l. Maintain tire pressure of 60 psi.
- m. Crack one window for ventilation, close all others as well as roof vents.
- n. Check batteries (main, auxiliary and motor

generator, if equipped) for charge. Specific Gravity reading of 1.255 is required to prevent deterioration. Add colorless, odorless drinking water, if necessary.

o. Turn off radio, exterior lights, and interior lights.

p. If MotorHome is to be moved, run engine at least two minutes with the transmission selector in "PARK."

q. Start and run engine for approximately 15 minutes weekly. Check engine, transmission and motor generator oil levels. Dipsticks should always be properly seated on tubes to prevent moisture from entering.

2. LONG TERM STORAGE — 60 DAYS OR MORE AND ABOVE 32°F. (0°C.)

a. Perform all the above steps except for Step q.

b. MotorHomes without automotive air conditioning; remove spark plugs and squirt each cylinder with "Super Engine Oil Supplement" available at your GMC MotorHome service outlet. Replace spark plugs.

c. MotorHomes with automotive air conditioning; run engine approximately 15 minutes with automotive air conditioning controls turned to "ON" position. Perform this operation every 30 days.

d. Treat all bright metal and rubber surfaces with a wax emulsion applied with a brush. A good liquid floor wax or equivalent is satisfactory.

e. Disconnect batteries, and check Specific Gravity every 30 days. See additional instructions for batteries given in SECTION 6Y, ENGINE ELECTRICAL.

3. WINTER STORAGE — BELOW 32°F. (0°C.)

a. While many of the steps in preparing your MotorHome for storage when temperatures go below 32° F. are the same as preparing for storage above 32° F., freezing temperatures present an additional hazard.

b. Fill fuel tanks to reduce excessive build-up of moisture in the fuel tanks.

c. Check coolant level and add antifreeze if required, to protect to the lowest expected temperature during storage (at least — 20°F.) (-29°C.) (-37°C. in Canada).

d. Change engine oil as shown on the recommended S.A.E. Viscosity Chart to aid cold weather starting.

e. Park MotorHome as level as possible, end for end and side to side.

f. Wash MotorHome. If exposed to road salts, the exterior and underside should be thoroughly washed and flushed.

g. Drain moisture from suspension air reservoir. For additional instructions, refer to SECTION 4, REAR SUSPENSION.

h. Remove all perishables and anything which may freeze (canned goods, medicine, etc.). Leave the refrigerator door open. Be sure controls are turned off.

i. Ventilate the living area, drawers, cabinets, closets, etc.

j. Drain the holding tank, toilet and living area water system as described earlier in this section. Add antifreeze solution (5 gallons non-toxic, non-flammable antifreeze and 5 gallons water) to living area water tank. Open all faucets and turn on water pump. When colored water comes out of the faucets, close faucets. Flush toilet. If equipped with recirculating toilet, charge with antifreeze solution (1-1/2 gallons non-toxic, non-flammable antifreeze and 1-1/2 gallons water). Be sure the water pump and water heater are turned off.

NOTE: Remove water purifier cartridge assembly from the vehicle during winter storage as low temperatures could cause the assembly to crack. After winter storage, do not install water purifier cartridge assembly until non-toxic antifreeze has been flushed from the water system.

k. Turn off LP gas at tank valve.

l. Make sure range/oven and furnace manual valve and thermostat are set at "OFF," range/oven burners at "OFF," oven at "PILOT OFF," and gas/electric refrigerator control at "GAS OFF."

m. Add recreational non-toxic, non-flammable antifreeze (1/2 cup) to the kitchen, bathroom, and shower drains.

n. Tape over drain openings (except toilet) to prevent evaporation if storage is lengthy (6 months or more).

o. Crack one window for ventilation, close all other as well as roof vents.

p. Start and run engine weekly for approximately 20 minutes. If very low temperatures are expected the batteries should be removed and stored in a warmer area.

q. Check engine transmission and motor generator (if equipped) for evidence of oil leaks.

r. Maintain tire pressure of 60 psi.

s. Remove accumulations of snow as often as possible.

t. Turn off radio, exterior lights, and interior lights.

u. Tape over vents to prevent possible entry of snow. Be sure to remove tape before operating LP gas appliances, to help avoid poisoning by carbon monoxide.

v. Before moving, run engine at least two minutes with the transmission selector in "PARK" position.

ONAN MOTOR GENERATOR STORAGE

If the motor generator will be out of service for

more than 30 days, the following steps should be taken to protect the unit.

1. Run the unit until thoroughly warm.
2. Disconnect fuel supply and run until unit stops.
3. Drain oil from crankcase while still warm. Refill and attach a warning tag stating oil viscosity used.
4. Remove each spark plug. Pour one ounce of rust inhibitor (or S.A.E. 50 oil) into each cylinder. Crank engine several times. Install spark plugs.
5. Service air cleaner.
6. Clean governor linkage and protect by wrapping with a clean cloth.
7. Plug exhaust outlet to prevent entrance of moisture, dirt, bugs, etc.
8. Wipe entire unit with a clean cloth. Coat rustable parts with a light film of grease or oil.

LUBRICATION

ONAN MOTOR GENERATOR

SERVICE INTERVALS

For service intervals refer to the Maintenance Chart provided earlier in this section.

CHECKING OIL LEVEL

Check the oil level daily, or at least every eight hours of operating time. Check more often on a new unit as oil consumption is generally higher until piston rings seat properly. Do not check oil level while unit is operating.

CHANGING OIL

Initial oil change should be made after the first 25 hours of operation; change every 50 to 100 hours after that. If operating in extremely dusty or cold weather conditions, change oil more frequently.

The 4KW Model has an oil capacity of 3 quarts, 3 1/2 quarts if replacing oil filter.

The 6KW Model has an oil capacity of 4 quarts; 4 1/2 quarts if replacing oil filter.

Do not mix brands or grades of motor oil. Use a

good quality oil with the designation SE/CC. If necessary to add oil between changes, use the same brand and grade of oil.

Use the following chart as a guide for the proper oil according to temperature ranges:

Temperature	Recommended Oil
Above 30°F. (-1.1°C.)	SAE 30
(-17.8°C.) 0°F. to 30°F. (-1.1°C.)	SAE 5W30 or 10W40
Below 0°F. (-17.8°C.)	SAE 5W30

NOTE: Fill engine with oil through dipstick tube.

The oil drain plug is located on the bottom side of the engine oil pan. Unit must be pulled out on its slide rail to gain access.

OIL FILTER (FIGURE 2)

Change the crankcase oil filter at least every 200 hours. The filter is located on the right side of the unit (facing the compartment). Remove filter by

turning counterclockwise with the filter wrench. Before installing new filter, coat the gasket on the filter's base with a light film of new oil. Install by turning clockwise until a light friction is noted, then turn an additional 1/4 to 1/2 turn.

CAUTION: *Do not over-tighten filter as damage may occur to rubber gasket which will cause filter to leak. Be sure to install sealing ring around filter; this ring is an air seal to prevent cooling air loss.*

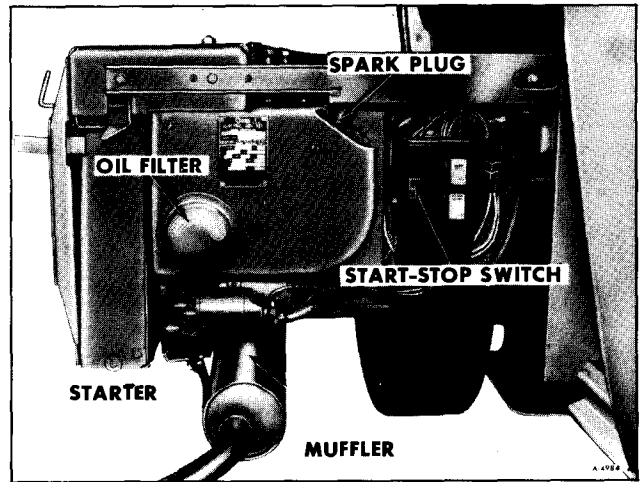


Figure 2—Onan Motor Generator

VEHICLE TRIP PREPARATION

The trip preparation is designed to prepare the Motor Home for an extended trip or vacation. Following the preparation list will aid in providing convenience and proper operation of the vehicle.

SPRING AND/OR SUMMER TRIP PREPARATION

EXTERIOR

- a. Fill LP gas tank.
- b. Sanitize and fill water tank.
- c. Empty and deodorize holding tank.
- d. Check that all exterior vents are unobstructed.
- e. Drain moisture from suspension air reservoir.
- f. Check operation of the following lights:
 - Headlights
 - Parking and turn signals
 - Tail and stop
 - Emergency flashers
 - Back-up lights

Marker and clearance

License

g. Check the following fluid levels:

Engine oil

Batteries (If maintenance free battery, check charge indicator)

Engine coolant

Windshield washer reservoir

Motor generator oil

h. Check tires for pressure and wear.

i. Wash MotorHome.

j. Check windshield wipers for wear.

INTERIOR

a. Check the operation of the following:

Power level system

Wipers and washers

All interior lights

Range/Oven

FALL AND/OR WINTER TRIP PREPARATION

Refrigerator

Air Conditioner

Automotive

Roof-mounted

Vent fans

Water pump

Water heater

Faucets (Includes shower)

Toilet-Charge recirculating toilet

Motor generator

Interior electrical system

12-volt

120-volt

Water purifier

Monitor panel

b. Check the following fluid levels:

Transmission

Power steering

c. Clean the following:

Upholstery

Counter tops

Cabinetry

Range/Oven

Sinks

Toilet

Screens

Windows

Vacuum carpeting

EXTERIOR

a. Fill LP gas tank (Add methyl alcohol).

b. Fill water tank.

c. Empty and deodorize holding tank.

d. Check that all exterior vents are unobstructed.

e. Drain moisture from suspension air reservoir.

f. Check operation of the following lights:

Headlights

Parking and turn signals

Tail and stop

Emergency flashers

Back-up lights

Marker and clearance

License

g. Check the following fluid levels:

Engine oil

Batteries (If maintenance-free battery, check charge indicator)

Engine coolant (test freeze protection level)

Windshield washer reservoir

Motor generator oil

h. Mount snow tires

i. Check tire pressure and wear

j. Wash MotorHome

INTERIOR

a. Check operation of the following:

Power level system

Wipers and washers

IMPORTANT: In addition to the above items, be sure all scheduled vehicle maintenance has been performed. See Maintenance Schedule folder for details. The folder includes information on required fluids and lubricants for your vehicle.

All interior lights

Range/Oven

Refrigerator

Air Conditioner

Automotive

Roof-mounted

Vent fans

Motor generator

Interior electrical system

12-Volt

120-Volt

b. Check operation of following (if water system is filled):

Water pump

Water heater

Faucets

Toilet—Recirculating toilet charged with recreational vehicle anti-freeze solution.

c. Add recreational vehicle anti-freeze *(approx. 1/2 cup) to the following P-traps:

Kitchen sink

Bathroom sink

Shower drain

d. Check the following fluid levels:

Transmission

Power steering

*Recreational vehicle anti-freeze means a non-toxic, non-flammable anti-freeze.

e. Clean the following:

Upholstery

Counter tops

Cabinetry

Range/Oven

Sinks

Toilet

Screens

Windows

Vacuum carpets

SECTION 24B

LIVING AREA ELECTRICAL SYSTEM

Contents of this section are listed below:

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External Power	24B-4
Living Area Lighting System	24B-4
120-Volt Electrical System	24B-5
Monitor Panel	24B-7
Specifications	24B-9

GENERAL INFORMATION

The MotorHome living area electrical system is designed for utmost convenience. It is capable of supplying the vehicle with power from at least two sources (three, if equipped with a motor generator), these are the batteries or external power.

All electrical components except the water heater, the roof mounted air conditioner (if equipped), and the plug receptacles, are powered by the 12 volt living area battery which is automatically charged each time the vehicle's engine is running.

In addition, the vehicle may be plugged into a 120-volt external power source which will supply 120-volt power throughout the living area., power all

12-volt components through a power converter, and charge the living area battery.

If the MotorHome is equipped with a motor generator, the vehicle will be supplied with 120-volt and 12-volt power throughout the living area, and the living area battery will be recharged any time the power converter and motor generator are running.

Both the 12-volt DC and 120-volt AC circuits in the Motor Home living area are designed to be protected by a series of fuses and circuit breakers. The 12-volt living area circuits are protected by automotive-type fuses, and the 120-volt circuits are protected by circuit breakers like those found in modern homes.

ELECTRICAL COMPARTMENT (FIGURE 1)

12-VOLT LIVING AREA FUSE BLOCK

The 12-volt living area fuse block is located in the electrical compartment, next to the hall closet, along with power converter and main circuit breaker panel. (figure 1) In the event of an overloaded circuit, the cause should be corrected and a new fuse of the same capacity installed. For explanation of 12-volt fuse block number code, refer to Figure 2 or the Specifications at the end of this section.

120-VOLT CIRCUIT BREAKER PANEL

The main circuit breaker panel, also located in the living area electrical compartment, contains circuit breakers to protect the 120-volt MotorHome circuits from overloads. These circuit breakers are designed to snap to the center position in the event of an overloaded 120-volt circuit. Once the cause of the overload is corrected the circuit breaker switch may be moved back to the "ON" position.

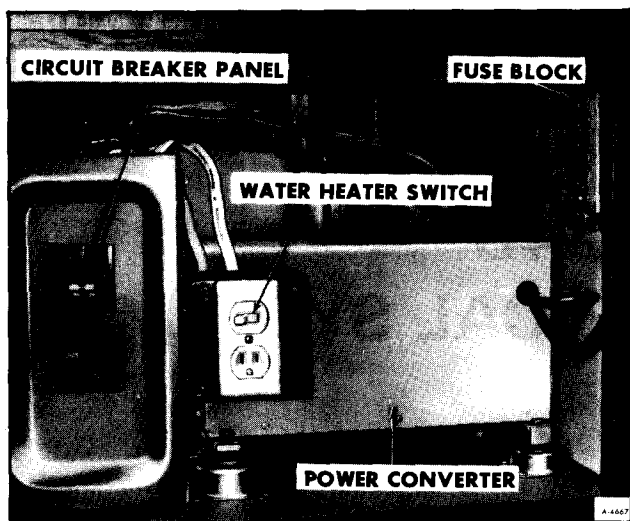


Figure 1—Living Area Electrical Compartment

120-VOLT to 12-VOLT CONVERTER AND BATTERY CHARGER

The MotorHome is equipped with a 120-volt to 12-volt power converter rated at 45 amperes. Its function is to take a portion of the 120-volt current, that is received when the vehicle is plugged into an external power source, or when the motor generator is running and change it to 12-volts which powers much of the MotorHome. It will also charge the auxiliary (living area) battery any time 120-volt current is being received. The unit is located in the living area electrical compartment, next to the hall closet. It should remain plugged at all times.

CAUTION: *Do not use living area electrical compartment as a storage area. The converter must have a force flow of air through and around the unit. If air flow is restricted, the converter could overheat which could result in malfunction and permanent damage. Do not let the unit get wet, but do keep it as clean as possible to help assure its long life. The converter can be cleaned with low pressure air (30 PSI maximum) if necessary.*

The power converter has no moving parts, but should you suspect that the unit is not functioning properly, test it in the following manner.

1. Check the motor generator frequency setting. It should be 63 cycles at 120 volts no load. The converter is sensitive to frequency and will not function properly below 60 cycles. If you plan to bench test the unit, make sure the wall socket is producing 60 cycles. This can also be checked with your frequency meter.

2. Disconnect the converter leads from the MotorHome. This assures that only the converter is being checked.

3. Connect the leads to a good, fully charged, battery and plug in the converter.

4. Using a good calibrated voltmeter, read output voltage across the battery. It should be between 13 to 15 volts.

Converter humming is not considered to be a failure. Humming should be corrected by installing mounting pads.

WATER HEATER SWITCH

An "ON OFF" switch for the water heater is located in the living area electrical compartment. The switch is located in this compartment to prevent the possible hazard of operating the switch with wet hands; i.e., trying to operate the switch after starting to wash or shower.

CAUTION: *Do not operate water heater unless there is water in the living area water system. If unit is operated without water this will result in damage to the heating element.*

NOTE: For details on the water heater, refer to Living Area Water System, Section 24J.

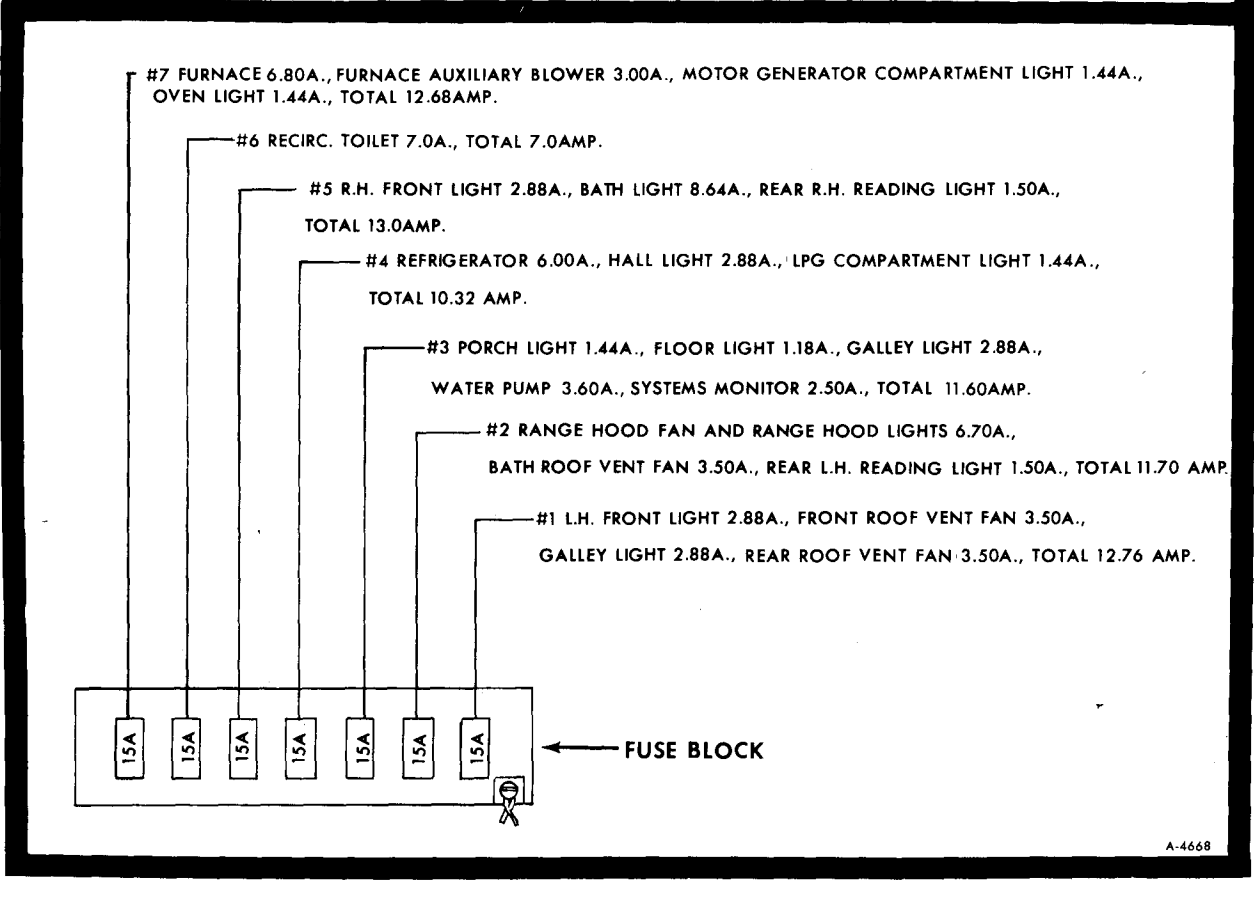
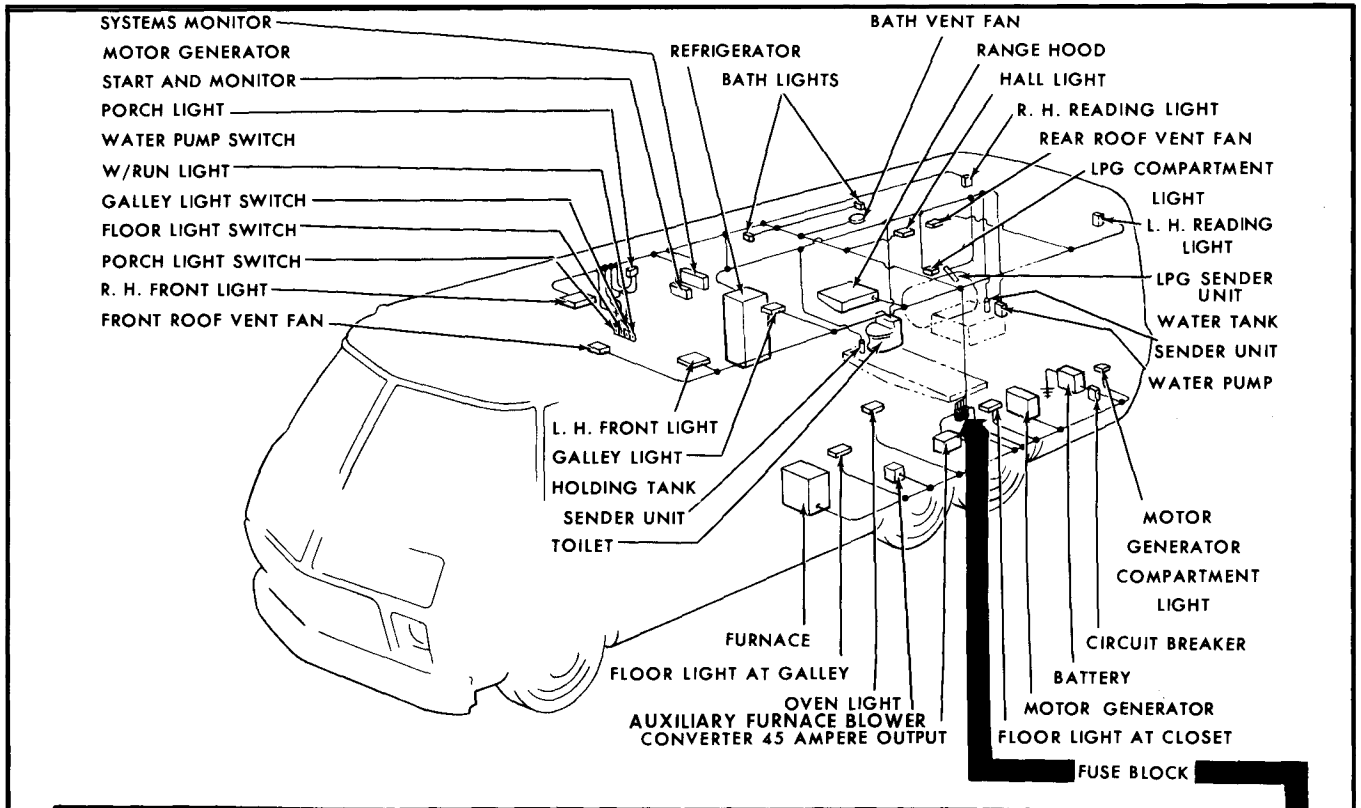


Figure 2—Living Area 12-Volt DC Electrical System (Typical)

EXTERNAL POWER

GENERAL INFORMATION

The external utilities compartment located in the left side of the MotorHome contains the 21 foot power cord used for external power connections (See figure 3).

To make an external power connection, remove the cord from the compartment and plug it into a suitable power receptacle. No internal switching is required. When disconnecting from an external power source the power cord should be plugged into the motor generator receptacle within the external utilities compartment. This connects the motor generator to the MotorHome electrical system. If the vehicle is not equipped with a motor generator simply coil the power cord neatly within the external utilities compartment.

The MotorHome's external power cord contains two 120-volt circuits, each rated to carry 40 amperes total. The electrical connection to be used must be suitable for these requirements. If the receptacle is designed to mate with the prongs on the power cord plug, the electrical connection can be expected to CARRY RATED LOAD. It is recommended that the power cord not be plugged in if the receptacle is not designed for the plug. In this event use the optional motor generator.

CAUTION: *If the available power supply is other than 120/240 volt, 60 cycle rating, or*

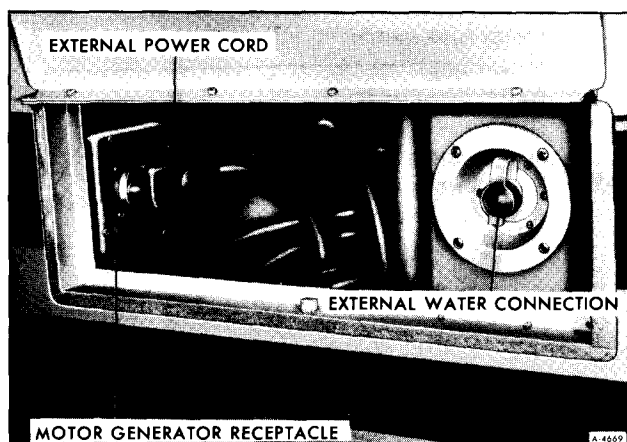


Figure 3—External Utilities Compartment

is not properly grounded, it is essential that no attempt be made to plug in. The MotorHome's electrical system is not designed for such electrical systems and connection could result in serious personal injury or property damage.

CORD REPLACEMENT

Should it ever become necessary to replace the external power cord for any reason, refer to the 120-volt wiring diagram later in this manual. Care should be taken that the new cord is properly wired to panel.

LIVING AREA LIGHTING SYSTEM

All the lighting throughout the MotorHome is on the 12-volt system and is powered by either the living area battery, the power converter when the vehicle is connected to an external power source, or when the motor generator is running (if the vehicle is so equipped). Some of these lights contain a three-way switch which allows a choice in the amount of light given off. The switches to these lights are located on the light fixture itself.

A panel of light switches is located near the entrance door. These switches operate the porch light, the kitchen sink light, the aisle lights, and the water pump (figure 4). The water pump switch is illuminated when the pump is turned on.

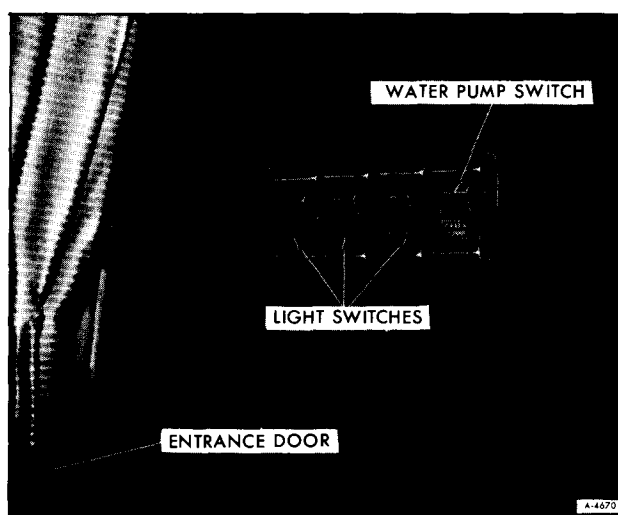


Figure 4—Light Switch Panel

Should any of these lights fail to operate first make sure that the electrical source is sufficient, then check the fuse, next replace the bulb itself, and finally if there is still no operation check the wiring and fixture.

For light bulb specifications or for current draw ratings refer to Specifications at the end of this section.

120-VOLT AC ELECTRICAL SYSTEM

The MotorHome living area is equipped with 120-volt wiring and duplex receptacles (including optional exterior receptacle), like those found in modern homes. These receptacles (including optional exterior receptacle), the power converter and the water heater are operational whenever the MotorHome is connected to an external power source or the motor generator is operating. If the MotorHome is equipped with a roof mounted air conditioner or a vacuum cleaner these will also be run by the 120-volt system. Circuit breakers and the circuits they protect are shown in Figure 6.

For wiring information, location, and specifications refer to Figure 5 and Specifications at the end of this section.

EXTERIOR RECEPTACLE

The optional exterior receptacle includes a ground fault interrupted circuit breaker designed to protect the user from the hazards of line to ground electric shock. The exterior receptacle is located on the right side of the vehicle, beside the refrigerator grille, as shown in Figure 7.

The exterior ground fault circuit interrupting receptacle is designed to protect people using appliances that are plugged into this receptacle.

This receptacle does not protect against overloads, which must be done by circuit breakers located in the living area electrical compartment. If an appliance continuously trips the receptacle, the appliance is defective and should be repaired or replaced.

TESTING THE EXTERIOR RECEPTACLE

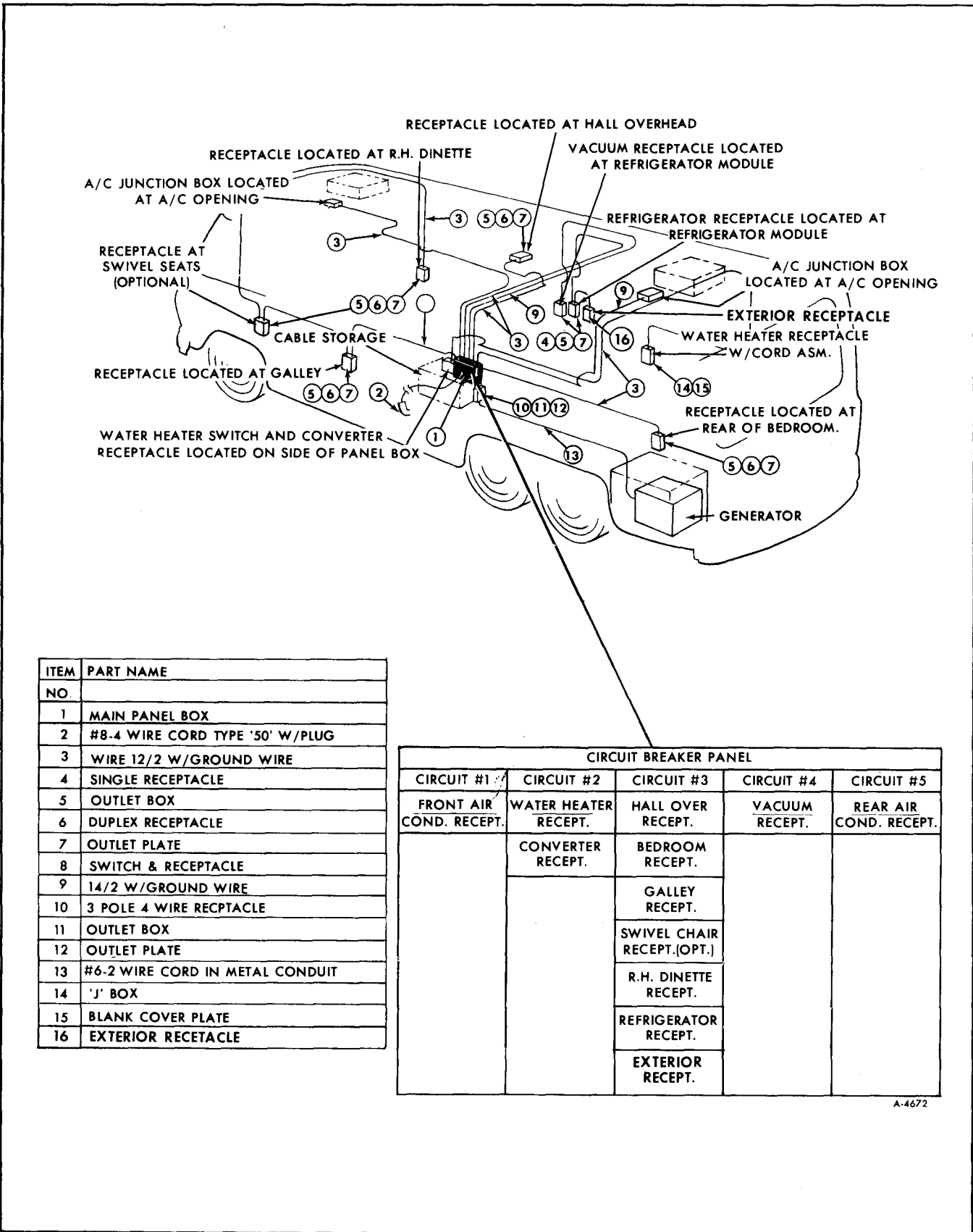
For maximum protection against electrical shock hazard, the exterior receptacle should be tested at least once a month and the test date recorded.

TEST PROCEDURE

1. Push "test" button. The "reset" button should pop up, showing a red line which indicates that power to the protected circuit is discontinued.

CAUTION: *If the "RESET" button does not pop up when test button is pushed, a loss of ground fault protection is indicated. Do not use. Have receptacle serviced by a qualified electrician.*

2. To restore power, push the "reset" button.



ITEM NO.	PART NAME
1	MAIN PANEL BOX
2	#8-4 WIRE CORD TYPE '50' W/PLUG
3	WIRE 12/2 W/GROUND WIRE
4	SINGLE RECEPTACLE
5	OUTLET BOX
6	DUPLEX RECEPTACLE
7	OUTLET PLATE
8	SWITCH & RECEPTACLE
9	14/2 W/GROUND WIRE
10	3 POLE 4 WIRE RECEPTACLE
11	OUTLET BOX
12	OUTLET PLATE
13	#6-2 WIRE CORD IN METAL CONDUIT
14	'J' BOX
15	BLANK COVER PLATE
16	EXTERIOR RECEPTACLE

CIRCUIT BREAKER PANEL				
CIRCUIT #1	CIRCUIT #2	CIRCUIT #3	CIRCUIT #4	CIRCUIT #5
FRONT AIR COND. RECEPT.	WATER HEATER RECEPT.	HALL OVER RECEPT.	VACUUM RECEPT.	REAR AIR COND. RECEPT.
	CONVERTER RECEPT.	BEDROOM RECEPT.		
		GALLEY RECEPT.		
		SWIVEL CHAIR RECEPT.(OPT.)		
		R.H. DINETTE RECEPT.		
		REFRIGERATOR RECEPT.		
		EXTERIOR RECEPT.		

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Figure 5—120-Volt AC Electrical System (Typical)

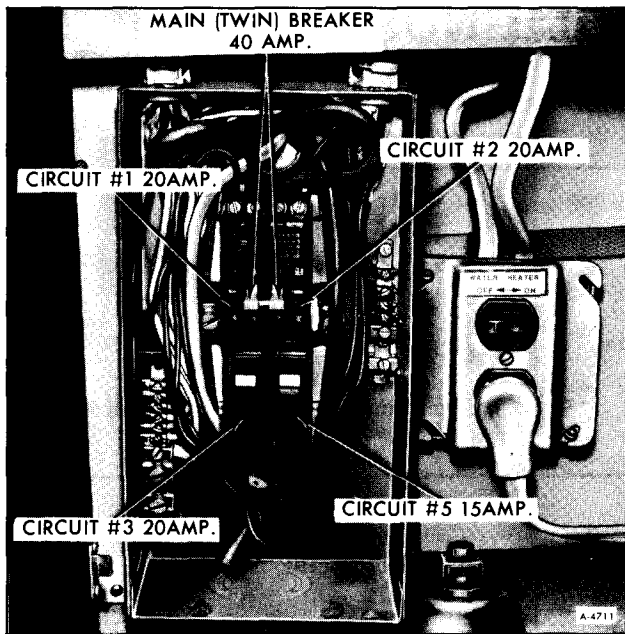


Figure 6—Circuit Breaker Panel, Cover Removed

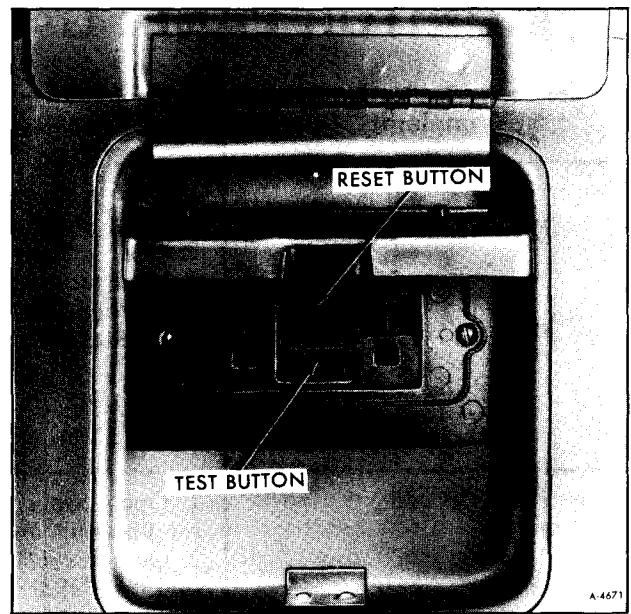


Figure 7—Exterior Receptacle

MONITOR PANEL (FIGURE 8)

DESCRIPTION

The MotorHome Monitor Panel is a series of four gauges located at eye level in the living area. Included are:

- **LP GAS** — This gauge is designed to indicate the amount of liquid petroleum gas remaining in the tank.

- **BATTERY VOLTS** — Indicates living area battery voltage. During operation, the indicator should remain in the center segment of the dial to indicate normal battery condition. If the indicator shows less than 11-volts, an under-charge condition exists in the living area battery and a recharge is required.

For information regarding batteries and charging procedures, refer to **ENGINE ELECTRICAL**, Section 6Y.

- **WATER TANK** — This gauge is designed to indicate the amount of water remaining in the living area water tank.

- **HOLDING TANK** — This is designed to indicate content level in the holding tank. Never allow this gauge to reach the "FULL" mark. If the holding tank is overfilled the overflow will back up through the bathroom shower drain.

These gauges are activated by a "ROCKER" switch located on the face of the panel. This switch has three positions; "ON," "OFF," and "MOMENTARY ON." An indicator light glows when gauges are operating.

TROUBLE DIAGNOSIS

TANK GAUGES

Since the L.P. Gas, the Water Tank, and the Holding Tank gauges all operate on the same principle the following trouble diagnosis will pertain to any of the three gauges.

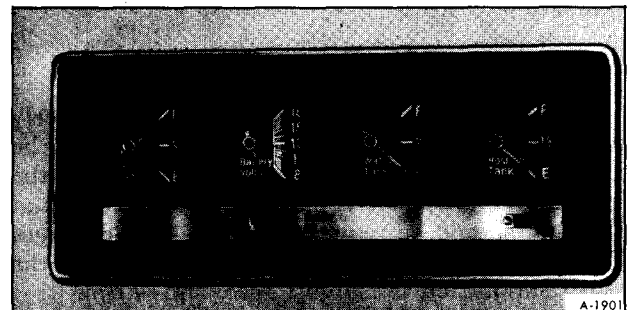


Figure 8—Monitor Panel

MONITOR PANEL GAUGE DIAGNOSIS CHART

Complaint	Possible Cause	Correction
Gauge reads "E" all the time.	<ol style="list-style-type: none"> 1. Circuit grounded between sending unit and tank. 2. Open circuit between ground terminal on gauge and ground. 3. Needle rubbing on face of gauge. 4. Tank float hang-up. 	<ol style="list-style-type: none"> 1. Insulate grounded circuit. 2. Clean contact between gauge and ground. 3. Reposition needle. 4. Free binding float or install new tank unit.*
Gauge reads "F" all the time.	<ol style="list-style-type: none"> 1. Open circuit between sending unit and tank. 2. Open circuit between tank unit slider resistor and ground. 3. Needle rubbing on face of gauge. 4. Tank float hang-up. 	<ol style="list-style-type: none"> 1. Clean terminals or repair wires. 2. Install new tank unit.* 3. Reposition needle. 4. Free binding float or install new tank unit.*
Erratic reading	<ol style="list-style-type: none"> 1. Loose connection anywhere in circuit. 	<ol style="list-style-type: none"> 1. Inspect and if necessary, clean and tighten all connections in circuit.
Needle does not move	<ol style="list-style-type: none"> 1. Lack of 12-volt supply to gauge. 2. Needle rubbing on face of gauge. 3. Tank float hang-up. 	<ol style="list-style-type: none"> 1. Check power supply, fuse, and wiring. 2. Reposition needle. 3. Free binding float or install new tank unit.*
Gauge gives other than correct reading.	<ol style="list-style-type: none"> 1. Tank float hang-up or malfunction in sending unit. 2. Malfunction in gauge. 	<ol style="list-style-type: none"> 1. Free binding float or install new tank unit.* 2. Replace gauge.

* Electrical power must be off before removing tank sending unit, otherwise full voltage may destroy unit or possibly ignite L.P.G. vapor. Disconnect battery ground cables and remove monitor panel fuse.

"BATTERY VOLTS" GAUGE

If "Battery Volts" gauge fails to operate properly the trouble can usually be quickly isolated. If the other gauges of the monitor panel operate but the "Battery Volts" gauge is inoperative the gauge is at fault and should be replaced. If none of the gauges of the monitor panel operate the trouble is in the power supply...check supply, fuse, and wiring.

GAUGE REPLACEMENT (FIGURE 9)

REMOVAL

To remove any of the four gauges in the monitor panel:

1. Remove monitor panel fuse and disconnect battery ground cables.

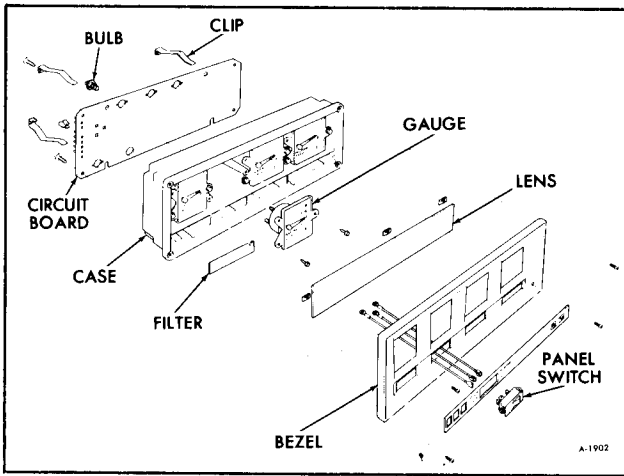


Figure 9—Monitor Panel Components

2. Remove the four screws holding bezel on panel.
3. Remove the two screws holding defective gauge in case and carefully remove gauge.

INSTALLATION

1. Carefully press gauge into position and secure with two screws.
2. Replace monitor panel bezel and secure with four screws.
3. Reconnect electrical power and check gauge operation.

SPECIFICATIONS

LIVING AREA 12-VOLT SYSTEM FUSES

The following are located in the fuse block in the living area electrical compartment, near the hall closet. Do not use fuses of higher amperage rating than those specified below, or damage may result.

Usage	Number on Fuse Block	Fuse Type
L.H. Front Light Front Roof Vent Fan Galley Light Rear Roof Vent Fan	No. 1	AGC-15
Range Hood Vent Fan and Lights Bath Vent Fan Rear L.H. Reading Light	No. 2	AGC-15
Porch Light Aisle Lights Galley Light Water Pump Systems Monitor	No. 3	AGC-15
Refrigerator Hall Light LPG Compartment Light	No. 4	AGC-15
R.H. Front Light Bath Light Rear R.H. Reading Light	No. 5	AGC-15
Toiler (Recirc.)	No. 6	AGC-15

Usage	Number on Fuse Block	Fuse Type
Furnace Furnace Auxiliary Blower Oven Light Motor Generator Compartment Light	No. 7	AGC-15

LIGHT BULB SPECIFICATIONS (LIVING AREA)

Usage	Quantity	Bulb. No.
R.H. Front Light	2	1141
L.H. Front Light	2	1141
Kitchen Light	2	1141
Hall Light	2	1141
Porch Light	1	1141
Compartment Lights	2	1141
Range Hood Lights	2	1156
Rear Compartment Reading Lights	2	1383
Bathroom Lights	6	1141
Aisle Lights	2	67

120-VOLT SYSTEM CURRENT RATING

Water Heater	8.7 Amp.
Power Converter	6.8 Amp.
Roof Mount Air Conditioner	15.0 Amp.
Vacuum Cleaner	7.0 Amp.
Refrigerator	0.8 Amp.

12-VOLT LIVING AREA COMPONENTS CURRENT RATING

R.H. Dinette Light	2.88 Amp.
L.H. Dinette Light	2.88 Amp.
Hall Light	2.88 Amp.
R.H. Reading Light	1.50 Amp.
L.H. Reading Light	1.50 Amp.
Kitchen Light	2.88 Amp.
Aisle Lights (Per Light)	0.59 Amp.
Porch Light	1.44 Amp.
Bath Room Lights	8.64 Amps.
Range Hood Vent Fan and Lights	6.70 Amps.
Furnace Blower	6.8 Amp.
Water Pump	3.6 Amp.
Recirculating Toilet	7.0 Amp.
Monitor Panel	2.5 Amp.
Front Vent Fan	3.50 Amp.
Rear Vent Fan	3.50 Amp.
Bath Vent Fan	3.50 Amp.
Refrigerator	6.0 Amp.

SECTION 24C

MOTOR GENERATOR

This section includes the following:

SUBJECT	PAGE NO.
General Information	24C-1
Onan Motor Generator Trouble Diagnosis	24C-2
Motor Generator Replacement	24C-8
Engine	24C-9
Oil System	24C-21
Fuel System	24C-22
Ignition and Battery Charging System	24C-27
Starting System	24C-28
AC Generator	24C-41
Controls	24C-47
Specifications	24C-49

GENERAL INFORMATION

The Onan Motor Generator is powered by a two cylinder horizontally opposed gasoline engine. An automotive type starter is used on the unit. It is powered by the living area battery of the Motor-Home (located in the compartment with the generator); or motor generator cranking battery (located in the compartment with the generator) of the Trans-Mode. A permanent magnet flywheel alternator and solid state voltage regulator-rectifier (See figure 1) are used to charge the battery.

Lubrication is provided by a pressure oil system. A spin-on type oil filter (See figure 2) is utilized.

The motor generator does not have a separate fuel supply. Fuel is drawn from the vehicle's main fuel tank. An electric fuel pump (See figure 3) is used to supply the unit with gasoline.

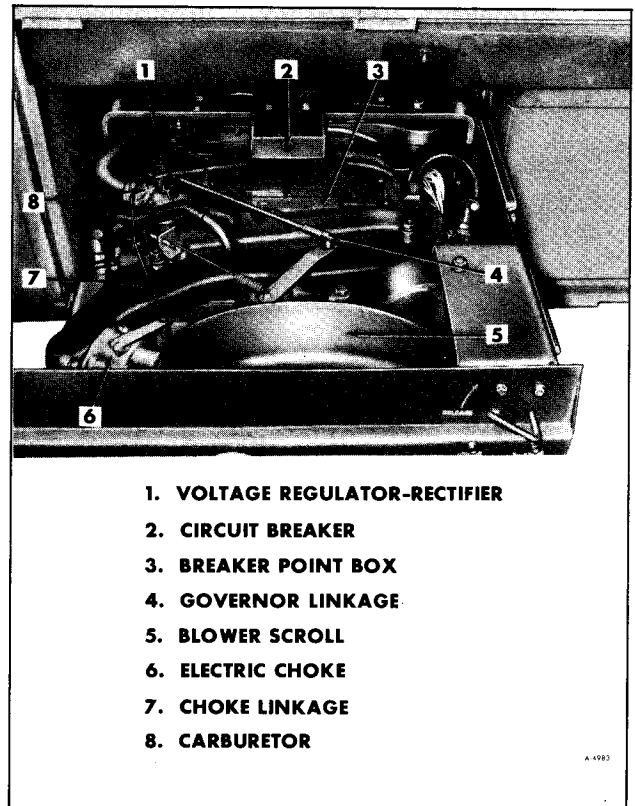


Figure 1—Onan Motor Generator (Top View)

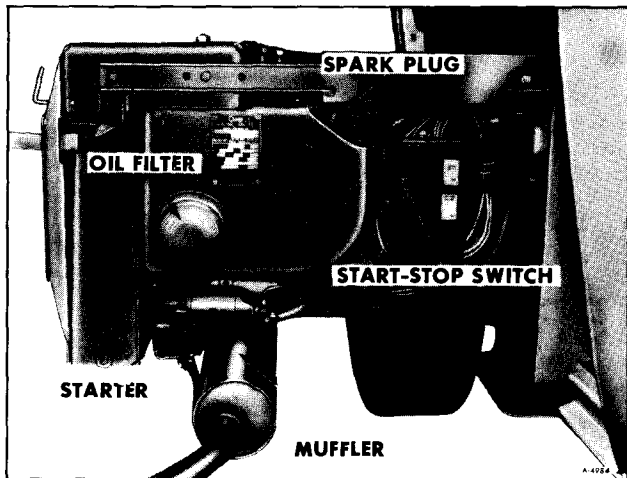


Figure 2—Onan Motor Generator (Right Side View)

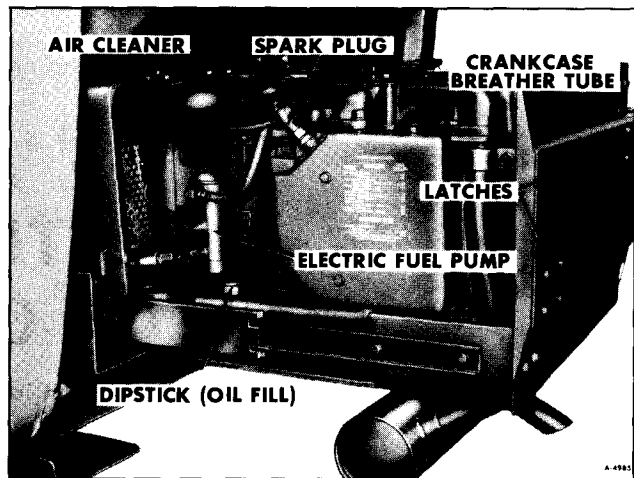


Figure 3—Onan Motor Generator (Left Side View)

ONAN MOTOR GENERATOR TROUBLE DIAGNOSIS

CONTROL SYSTEM TROUBLESHOOTING GUIDE

This troubleshooting section is divided into four parts, A, B, C and D as follows:

- A. Engine does not crank.
- B. Engine cranks but does not start.
- C. Engine runs for 3 or 4 seconds, then stops.
- D. Low battery — low charge rate.

IMPORTANT: Always stop the power plant and disconnect the battery leads before removing the cover or printed circuit board. After removing control cover, use a long nose pliers to remove flag connectors from terminals on board. Pull flag connectors straight out to avoid breaking control board terminals. Although dust covers on two relays (K2 and K3) are removable. **DO NOT** attempt to adjust the contacts on these relays; they are precision set at the factory. The only maintenance required on these relays is blowing out sand and dirt with a low pressure, compressed air source.

To correct a problem, answer the question of the step either YES or NO. Then refer to the number in whichever column question was answered, and proceed to that step next.

A.	ENGINE DOES NOT CRANK	YES	NO
1A.	Check battery. Are battery terminals clean and are cables tight?	2A	—
2A.	Check battery cables for correct polarity. Is 12 volts present across battery terminals with engine stopped and is 8 volts or higher present with engine cranking?	3A	10A
3A.	Remove cover on printed circuit board. Jumper terminal 7 to 3. Press start switch. Does engine crank?	4A	5A

4A.	K2 contact is defective. Replace printed circuit board.	—	—
5A.	Jumper terminal 7 to 1. Does engine crank?	6A	7A
6A.	Start switch S3 is defective. Replace printed circuit board.	—	—
7A.	Jumper from S terminal of B1 starter motor to positive (+). Does engine crank?	8A	9A
8A.	Replace K1 start solenoid.	—	—
9A.	Starter is defective. Remove and perform tests listed in STARTING SYSTEM section and/or replace starter.	—	—
10A.	Replace battery.	—	—
B.	ENGINE CRANKS BUT DOES NOT START	YES	NO
1B.	Is F1 fuse on control board OK?	3B	2B
2B.	Replace with an identical 5 amp fuse. Correct problem which caused fuse to burn. (NOTE: Remote control leads may be shorted or grounded).	—	—
3B.	While engine cranks, check K1-I start solenoid voltage. Is 12 volts present between terminals 10 and 1?	5B	4B
4B.	Replace K1 start solenoid.	—	—
5B.	Jumper terminals 9 to 11. Does engine start when start switch is pushed?	6B	7B
6B.	K2 contacts are defective. Replace printed circuit board.	—	—
7B.	Fuel solenoid K4 must be open during starting and running. Remove fuel line from carburetor. Does fuel pulsate from line when start switch is pushed? WARNING: Use extreme care for tests 7B and 8B. Direct the fuel flow into a suitable container and make sure area is well ventilated to prevent accumulation of gasoline fumes.	11B	8B
8B.	Disconnect fuel solenoid from line and check fuel pump E2. Pump will click when operating properly. Does fuel pulsate from pump (solenoid disconnected) when start switch is pushed?	10B	9B
9B.	Fuel pump (or wiring) is defective and must be replaced.	—	—
10B.	Fuel solenoid is defective and must be replaced.	—	—
11B.	Is electric choke closed when engine is cranking?	13B	12B
12B.	Voltage at choke terminal when engine is cranking should be 12 volts. If choke does not move (at room temperature) with 12 volts applied, replace it. Also check wire from choke to control for shorts to ground.	—	—
13B.	The fault is in the ignition system. Check points, plugs, wires and coil. Refer to IGNITION section.	—	—

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C.	ENGINE RUNS 3 OR 4 SECONDS - THEN STOPS*	YES	NO
1C.	Check oil level. Refill to FULL mark on dipstick. Does engine now continue to run?	—	2C
2C.	Check voltage from terminal 11 to 12. Is it 12 volts with engine stopped and does voltage drop to zero when engine runs?	—	3C
3C.	Check oil pressure sensor wire for shorts to ground by visually tracing wire from S2 low oil pressure switch to control. Is wire grounded?	4C	5C
4C.	Replace or repair wire making sure it isn't rubbing against anything that may again cause a grounding problem.	—	—
5C.	Replace low oil pressure switch S2.	—	—
	NOTE: Remote control leads may be shorted or grounded.		
D.	LOW BATTERY - LOW CHARGE RATE	YES	NO
1D.	With engine cranking, measure voltage at terminal 8 to BAT terminal of K1 start solenoid. Is 6 volts present?	2D	3D
2D.	Check battery connections. They must be clean and tight.	—	—
3D.	Check flywheel alternator G1 output. Disconnect AC lead that connects to voltage regulator VR1 and connect voltmeter to this lead and BAT terminal of K1 start solenoid. This checks AC open circuit voltage. Start engine. Is AC output voltage approximately 28 volts with unit running at 1800 rpm?	5D	4D
4D.	Replace alternator stator G1.	—	—
5D.	Connect a voltmeter across battery terminals. Start engine. Does DC voltage increase to 13 to 14-1/2 volts after engine is running for a few minutes?	—	6D
6D.	Remove and replace voltage regulator VR1.	—	—

ENGINE TROUBLE DIAGNOSIS

TROUBLE															GASOLINE ENGINE TROUBLESHOOTING GUIDE														
Backfire at Carburetor	Bearing Wear	Black Exhaust	Blue Exhaust	Burned Valves	Connecting Rod Wear	Cylinder Slowly	Engine Wear	Engine Stops	Failure to Start	Governor Hurting	High Oil Pressure	Loss of Coolant	Mechanical Knocks	Misfiring	Overheating (Water Cooled)	Overheating (Air Cooled)	Piston Wear	Ring Compression	Ring Wear	Sticking Valves	CAUSE								
																				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								
																				LUBRICATION SYSTEM									
																					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								

Motor Generator Engine Troubleshooting Guide

FUEL SYSTEM TROUBLE DIAGNOSIS

Problem	Possible Cause	Correction
Fuel leaks from carburetor when fuel shut-off is open.	1. Float level set too high.	1. With fuel bowl removed and carburetor inverted, set float parallel to bowl flange. (3/32" clearance)
	2. Dirt under inlet valve.	2. Remove inlet valve, clean seat by rinsing in clean fuel and blow off with compressed air.
	3. Bowl vent plugged.	3. Remove bowl and blow clean with compressed air.
	4. Collapsed float caused by blowing assembled carburetor with compressed air.	4. Replace float.
	5. Carburetor gummed from storage. Float stuck to screen.	5. Remove fuel bowl and clean.
Engine smokes and runs rich.	1. Dirty air filter.	1. Clean or replace.
	2. Improper adjustment.	2. Set idle & power needles at 1 turn open. After engine starts and runs, set for optimum performance.
	3. Nozzle boss gasket leaks. Engine runs with power needle seated.	3. Remove fuel bowl and replace gasket. Tighten bowl retainer securely.
	4. Air bleeds in carburetor plugged.	4. Remove fuel bowl, idle & power needles. Clean thoroughly with compressed air.
Engine runs lean.	1. Improper adjustment.	1. Set idle & power needles at 1 turn open. After engine starts and runs, set for optimum performance.
	2. Idle holes plugged. Dirt in fuel delivery channels.	2. Remove fuel bowl, idle & power needles. Clean thoroughly with compressed air.
	3. Float level set too low. Low level in fuel bowl.	3. With fuel bowl removed and carburetor inverted, set float parallel to bowl flange (3/32" clearance).
	4. Fuel filter in electric fuel pump dirty.	4. Remove filter and replace.
	5. Fuel filter screen in fuel bowl plugged.	5. Remove fuel bowl. Invert bowl and tap on flat surface. Clean thoroughly and replace.

Engine starts hard.	1. Improper adjustment.	1. Set idle & power needles at 1 turn open. After engine starts and runs, set for optimum performance.
	2. No fuel in carburetor.	2. Check carburetor drain valve. If no fuel in bowl clean tank filter and carburetor. Check electric fuel pump operation, check electric solenoid valve.
	3. Choke valve not closing.	3. Check controls for proper travel.
Governor Surge	1. Throttle shaft and valve binding.	1. Remove and replace shaft if worn. Clean carburetor body. Reassemble throttle shaft assembly into carburetor body as far as possible. Hold firmly in place in this position while assembling throttle valve. Make certain valve does not bind in throttle bore when opening and closing throttle.
	Lean carburetion.	2. Adjust carburetor.

GENERATOR TROUBLE DIAGNOSIS

Problem	Possible Cause	Correction
No AC output voltage.	1. Blown fuse or circuit breaker.	1. Replace fuse or reset breaker and look for cause.
	2. Disconnected wire or lead on brushes, bridge rectifier or reactor assembly.	2. Reconnect wire or wires.
	3. Brushes not making contact with collector rings.	3. Check brush springs for free movement or brushes which may be excessively worn.
	4. Open, grounded or short circuit in field or armature winding.	4. Test with series test lamp and repair or replace as necessary.
	5. Defective bridge rectifier assembly.	5. Test with ohmmeter and replace if defective.
	6. Bridge rectifier assembly installed wrong in its case.	6. Reinstall making sure marks on case and rectifier match.

Lights flicker intermittently.	1. Loose or broken lead/ leads in generator.	1. Repair broken lead or reconnect loose lead.
	2. Brushes stuck in holder.	2. Loosen brush and clean or turn rings in lathe.
Low AC output voltage.	1. External short circuit on line.	1. Locate and eliminate short circuit problem.
	2. Generator Overloaded.	2. Remove part of load.
	3. Shorted or grounded circuit in field or armature winding.	3. Test with series test lamp or ohmmeter and replace if defective.
	4. Engine not running properly causing generator to slow down.	4. Refer to Engine Troubleshooting guide.
Noisy generator.	1. Defective bearing in end bell.	1. Replace bearing.
Generator overheats	1. Generator overloaded.	1. Remove part of load.
	2. Windings and parts covered with oil or dirt.	2. Clean generator.
	3. Air intake restricted or incoming air too hot.	3. Take necessary steps to allow for proper cooling.
	4. Shorted, open or grounded circuit in armature or field windings.	4. Test with ohmmeter or series test lamp and replace if defective
	5. Air seals are damaged or missing.	5. Replace air seals or tape over the air leak.
AC output voltage high with no load connected and generator running at 1800 rpm.	1. Compounding reactor defective.	1. Remove, test and replace.

MOTOR GENERATOR REPLACEMENT

REMOVAL

1. Open access door and support in this position.
2. Slide unit out of compartment.
3. Disconnect ground cable (-) at battery.
4. Install lifting eye in manifold on top of unit. A 3/8-16 threaded hole is provided in the manifold for this purpose.
5. Attach a suitable lifting device into lifting eye, and remove slack.

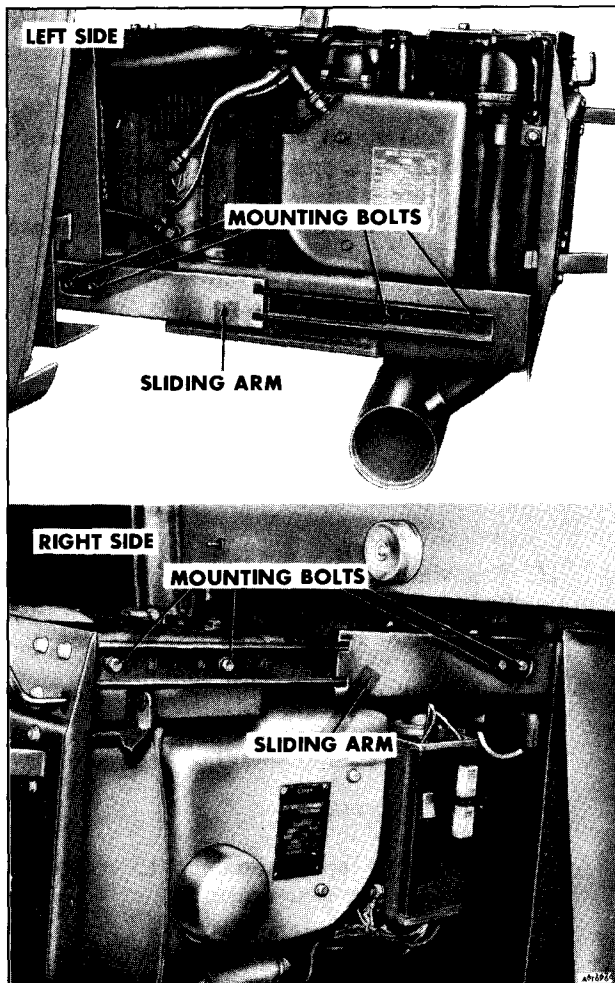


Figure 4—Disconnecting Sliding Arms (Typical)

6. Remove bolts from both sliding arms (figure 4).
7. Disconnect fuel line and all electrical leads.
8. Remove unit from its slide rail and place on a suitable bench or stand.

INSTALLATION

1. Extend slide rails to their full extended position.
2. Supporting the unit with a suitable hoist, position it in the slide rails.
3. Connect fuel line and all electrical wiring.
4. Install mounting bolts in slide rails as shown in Figure 4.
5. Remove hoist and lifting eye.

ENGINE

ENGINE OVERHAUL

The following steps serve only as a guide, when overhauling the engine.

Specific details on individual engine components are covered later in this section.

DISASSEMBLY

1. Drain crankcase oil.
2. Disconnect all exhaust lines, fuel lines and electrical wires (tag all electrical wires).
3. Remove engine from its slide rails and mountings and place on a suitable bench or work stand.
4. Remove all housings, shrouds, mounts, air cleaner, control box, etc.

NOTE: When removing generator and control box, tag all wires according to their respective locations.

5. Remove flywheel, using a puller or pry-bar method.
6. Remove flywheel alternator stator.
7. Remove the gear cover, being careful to protect the oil seal from keyway damage.
8. Remove the crank gear, using a gear puller and ring.
9. Remove fuel pump, oil filter, starter, carburetor, fuel lines, spark plugs, etc.
10. Remove breaker box.

11. Remove oil base, oil pump and cylinder heads.
12. Remove valves, springs, rocker arm, lifters, etc.
13. Remove camshaft and gear assembly.
14. Remove connecting rods, pistons and bearings.
15. Remove rear bearing plate.
16. Remove crankshaft.
17. Remove front main bearing.

NOTE: Keep all parts in their respective orders. Keep valve assemblies together. Return rod caps to their respective pistons. Analyze the reasons for parts failure.

ASSEMBLY

Observe proper clearances throughout the engine. Use a torque wrench to assure proper tightness. Coat the internal engine parts with SAE 30 oil as they are assembled. After the internal engine parts are assembled, the engine should turn over by hand freely.

1. Use the proper bearing driver to install front main bearing after coating it with a light film of oil.
2. Insert rear main bearing in rear bearing plate.
3. Install crankshaft and rear bearing plate.
4. Install connecting rods, pistons and bearings.
5. Install camshaft and gear.
6. Install valve assemblies.

7. Install oil pump, oil base and cylinder heads.
8. Install breaker box.
9. Install fuel pump, oil filter, starter, generator, carburetor, fuel lines, spark plugs, etc.
10. Install crank gear, aligning crank gear mark with camshaft.
11. Install gear cover and oil seal.
12. Install flywheel alternator stator.
13. Install flywheel.
14. Install all housings, air cleaner, control box, etc.
15. Reinstall power plant in vehicle, making proper fuel, battery, electrical and exhaust connections.
16. Fill crankcase with oil.
17. Start engine.
18. Check oil pressure.
19. Run engine approximately 15 minutes to bring up to operating temperature.
20. Check for oil leaks, electrical connections, fuel lines and exhaust connections.

VALVE SYSTEM (FIGURE 5)

Properly seated valves are essential to good engine performance. The aluminum cylinder heads are removable for valve servicing. Do not use a pry bar to loosen the cylinder head; rap sharply on the edge with a soft faced hammer, taking care not to break

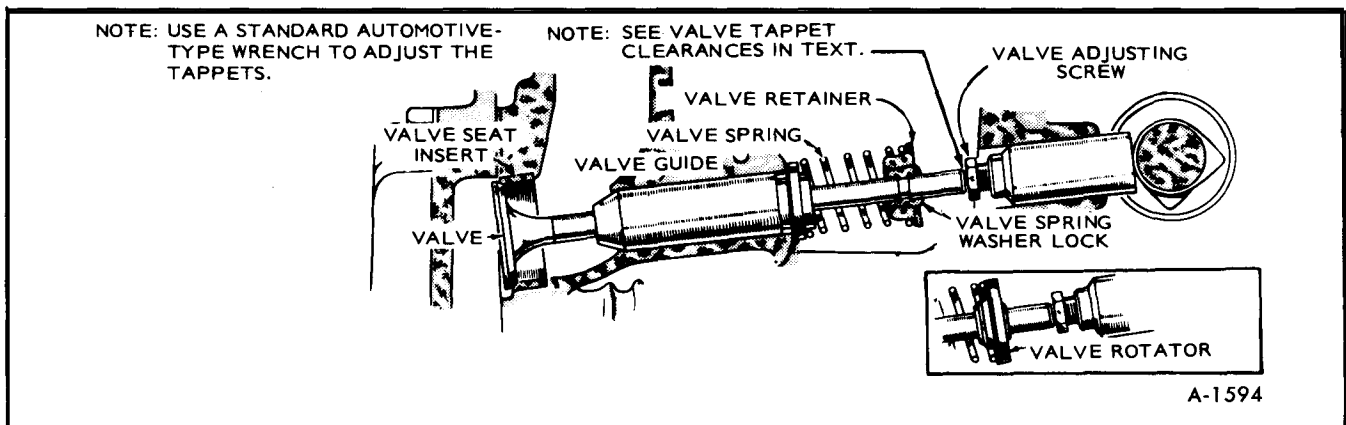


Figure 5—Valve System

any cooling fins. A conventional type valve spring lifter may be used when removing the valve spring locks, which are of the split type. Clean all carbon deposits from the cylinder heads, piston tops, valves, guides, etc. If a valve face is burned or warped, or the stem worn, install a new valve.

Valve locks are split, tapered typed, the smaller diameter of which must face toward the valve head. Tappets are also replaceable from the valve chamber, after first removing the valve assemblies.

The valve *face* angle is 44°. The valve *seat* angle is 45° as shown in Figure 6. This 1° interference angle results in a sharp seating surface between the valve and the top of the valve seat. The interference angle method of grinding valves minimizes face deposits and lengthens valve life.

CAUTION: *The valves should not be hand lapped, because the sharp contact may be destroyed. This is especially important where stellite faced valves and seats are used.*

Valve faces should be finished to 44°. Valve seats should be ground with a 45° stone and the width of the seat band should be 1/32" to 3/64" wide. Grind only enough to assure proper seating.

Remove all grinding compound from engine

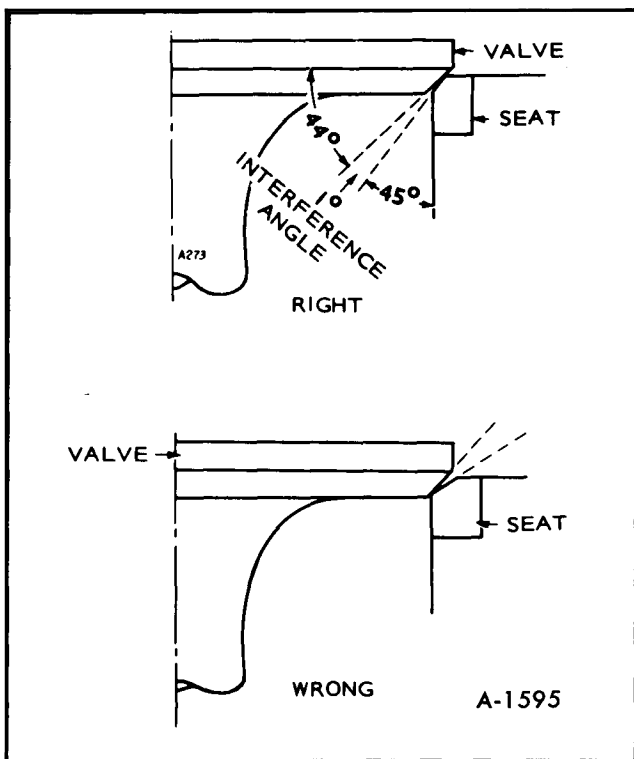


Figure 6—Valve Interference Angle

parts and place each valve in its proper location. Make pencil marks at intervals across the valve face and observe if the marks rub off uniformly when the valve is rotated part of a turn against the seat.

TAPPET ADJUSTMENT (FIGURE 7)

The engine is equipped with adjustable valve tappets. The valve tappet clearance should be checked and adjusted, when necessary. Adjust the valve clearance only when engine is at ambient temperature.

Proceed as follows:

1. Remove all parts necessary to gain access to valve tappets.
2. Remove spark plugs to ease the task of turning the engine over by hand.
3. Use the engine flywheel to turn the engine over slowly by hand until the left hand intake valve opens and closes. Continue turning the flywheel until the TC mark is on the top and lined up with the TC mark on the gear cover. Both valves should be closed. This should place the left hand piston at the top of its compression stroke, the position it must be in to get proper valve adjustment for the left cylinder.
4. For the intake valve, a .003" thickness gauge should just pass between valve stem and tappet.
5. For the exhaust valve, a .010" thickness gauge (.012" on the 6KW) should just pass between valve stem and tappet.
6. To correct the valve clearance, use a 7/16" open end wrench to turn the adjusting screw to ob-

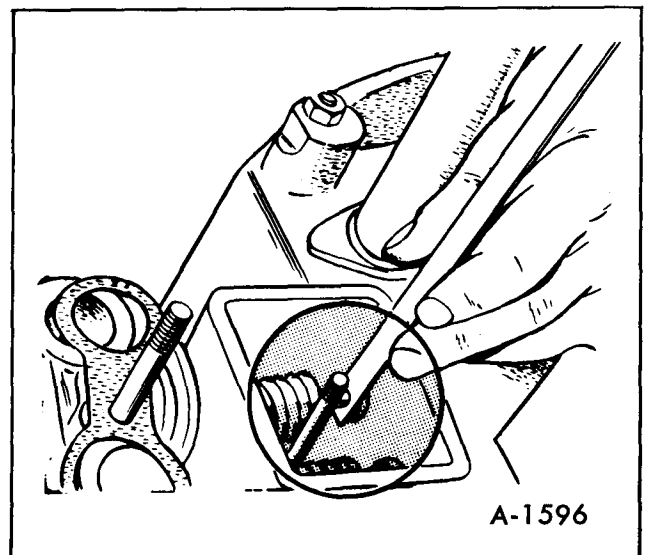


Figure 7—Adjusting Valves

tain the correct clearance. The screw is self-locking and will stay where it is set. A 9/16" open end wrench is required to hold the tappet while turning the adjusting screw.

7. To adjust valves on the right hand cylinder-turn engine one complete revolution and again line up mark on the flywheel and the TC mark on the gear cover. Then follow adjustment procedure given for left hand cylinder.

8. Install all parts removed in Step 1. Tighten all screws securely. Torque manifold bolts to specified torque.

FLYWHEEL

Removing the flywheel is a relatively simple process, but the following procedure must be followed to avoid damage to the gear case and possible personal injury.

1. Turn the flywheel mounting screw outward about two turns.

WARNING: DO NOT REMOVE THE SCREW COMPLETELY SINCE IT ACTS AS A RESTRAINER WHEN THE FLYWHEEL SNAPS LOOSE. IF THE FLYWHEEL IS NOT HELD BY THE SCREW, THE SPRING ACTION IN THE WHEEL WILL CAUSE IT TO FLY OFF WITH GREAT FORCE WHICH CAN CAUSE PERSONAL INJURY.

2. Install a puller bar on the flywheel as shown in Figure 8.

3. Turn the puller bar bolts in, alternately, until the wheel snaps loose on the shaft.

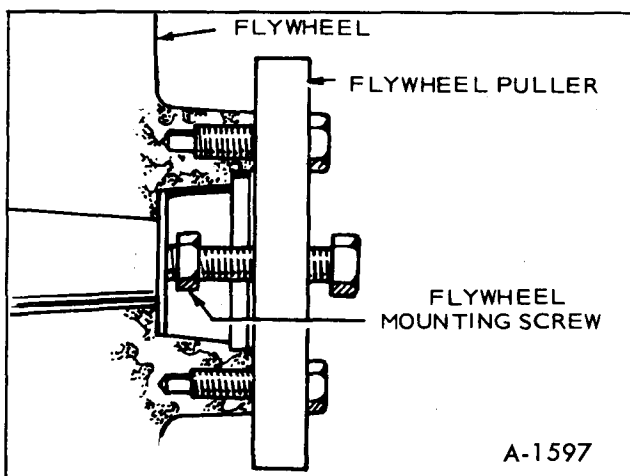


Figure 8—Flywheel Removal

CAUTION: Do not use a screwdriver or similar tool or pry behind the flywheel against the gear case. The gear case cover is die-cast material and will break if undue pressure is applied in this manner.

4. Unscrew the puller from the flywheel, remove the flywheel mounting screw and washer and pull the flywheel off the shaft. Take care not to drop the wheel. A bent or broken fin will destroy the balance. Always use a steel key for mounting the flywheel.

FLYWHEEL ALTERNATOR STATOR

After disconnecting stator terminal wires, remove the three screws securing stator to gear cover and pull off.

GEAR COVER (FIGURE 9)

After removing the mounting screws, tap the gear cover gently with a soft faced hammer to loosen it.

When installing the gear cover, make sure that the pin in the gear cover engages the metal lined (smooth) hole in the governor cup. Turn the governor cup so that the metal lined hole is at the three o'clock position. The smooth side of the governor yoke must ride against the governor cup. Turn the governor arm and shaft clockwise as far as possible and hold in this position until the gear cover is installed flush against the crankcase. Be careful not to damage the gear cover oil seal. Adjust the roll (stop) pin to protrude to a point 3/4" from the cover's mounting surface.

GOVERNOR CUP

With the gear cover removed, the governor cup can be taken off after removing the snap ring from the camshaft center pin. Catch the flyballs while sliding the cup off.

Replace with a new part, any flyball which is grooved or has a flat spot; the ball spacer if its arms are worn or otherwise damaged; and the governor cup if the race surface is grooved or rough. The governor cup must be a free spinning fit on the camshaft center pin, but without any excessive play.

When installing the governor cup, tilt the engine so the gear is up, then put the flyballs in place. Install the cup and snap ring on the center pin.

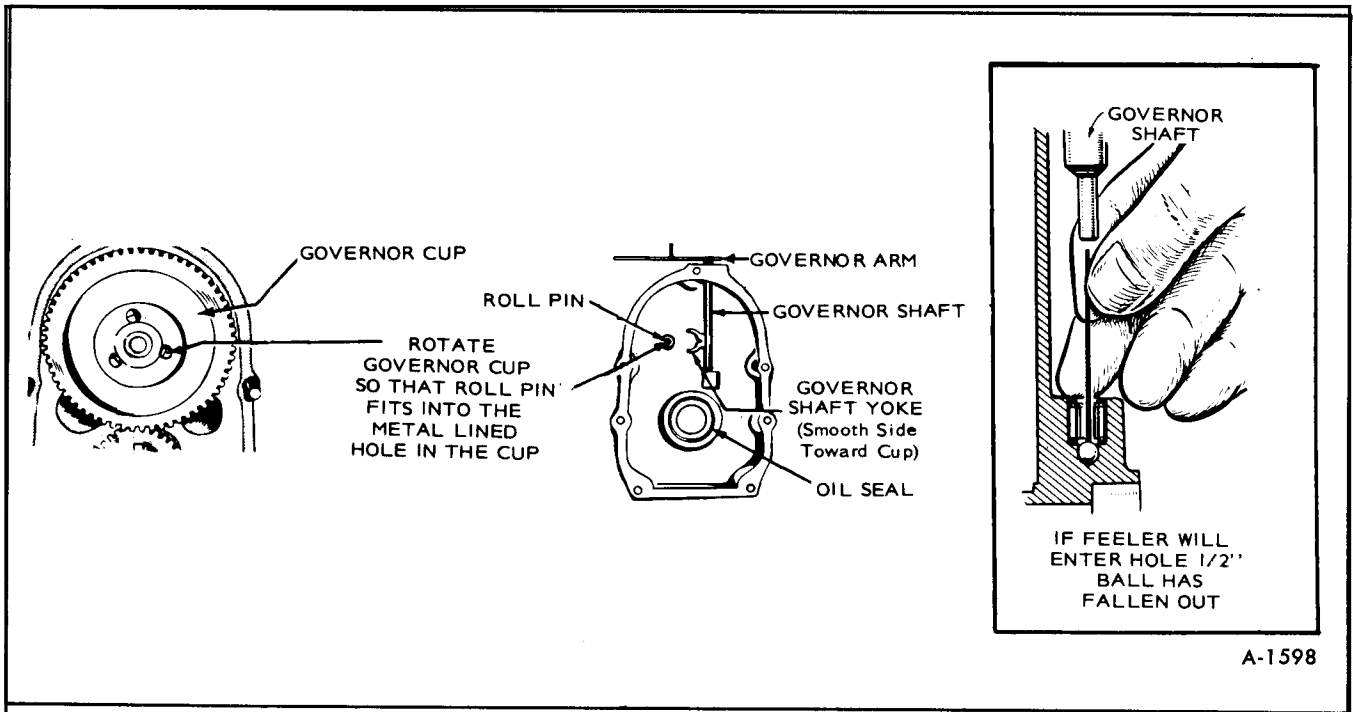


Figure 9—Gear Cover Assembly

The camshaft center pin extends out 3/4" from the end of the camshaft. This distance provides an in and out travel distance of 7/32" for the governor cup, as illustrated in Figure 10. Hold the cup against the flyballs when measuring. If the distance is less (the engine will race especially at no load), replace camshaft. The camshaft center pin cannot be pulled outward or removed without damage. If the center pin extends out too far, the cup will not hold the flyballs properly.

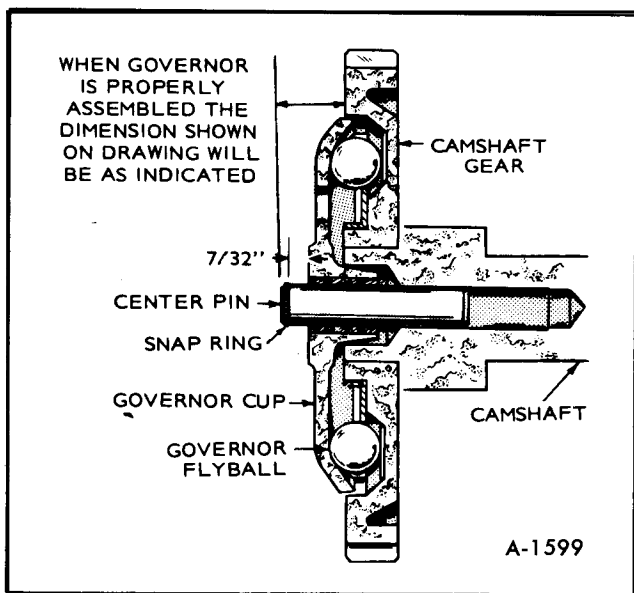


Figure 10—Governor Cup (Cross-Section)

TIMING GEARS

If replacement of either the crankshaft gear or the camshaft gear becomes necessary, always install both gears new.

To remove the crankshaft gear, first remove the snap ring and retainer washer, then attach the gear pulling ring using two No. 10-32 screws (figure 11). Tighten the screws alternately until both are tight. Attach a gear puller to the puller ring and proceed to remove the gear.

The camshaft and gear must be replaced as an assembly. Before removing the camshaft and gear assembly, remove the cylinder head and valve assemblies. Then remove the operating plunger for the breaker points and tappets.

Each timing gear is stamped with 0 near the edge. The gear teeth must mesh so that these marks exactly coincide when the gears are installed in the engine.

When installing the camshaft gear and shaft assembly, be sure that the thrust washer is properly in place behind the camshaft gear. Then install the crankshaft retaining washer and lock ring.

PISTONS AND CONNECTING RODS

REMOVAL

Observe the following procedure when removing pistons and connecting rods from the engine.

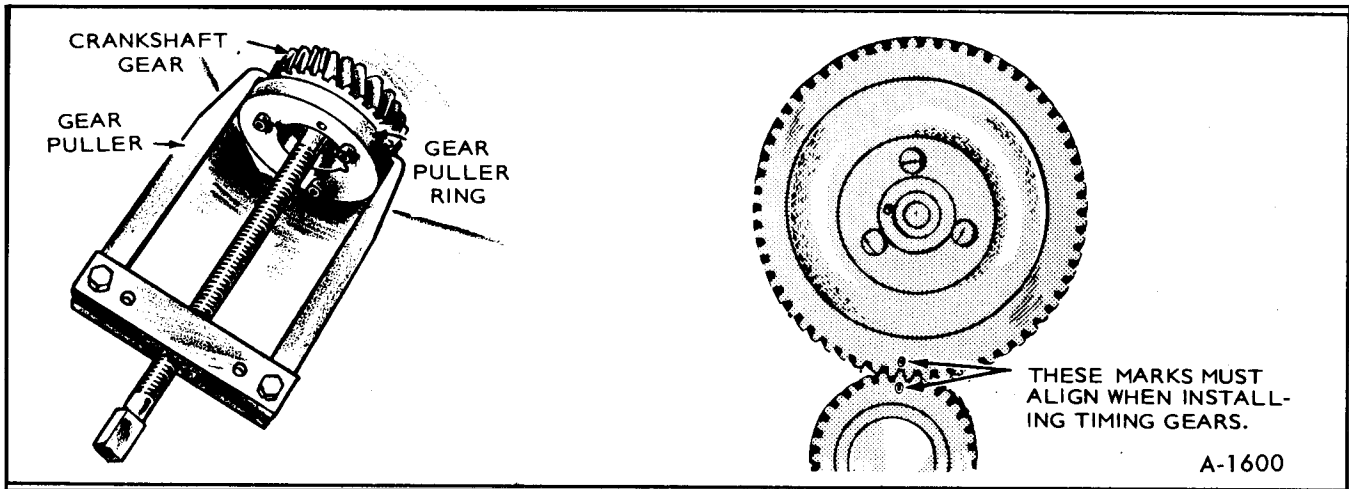


Figure 11—Timing Gear Removal and Installation

1. Drain oil.
2. Remove the cylinder heads and oil base pan from the engine.
3. Remove the ridge from the top of each cylinder with a ridge reamer before attempting piston removal (figure 12). Forcing the piston from the cylinder before reaming may cause damage to the piston lands.
4. Turn the crankshaft until the piston is at the bottom of its stroke and remove the connecting rod bolts. Lift the rod bearing cap from the rod and push the rod and piston assembly out through the top of the cylinder using a hammer handle. Avoid scratching the crankpin and cylinder wall when removing the piston and rod.

NOTE: Mark each piston and rod assembly so they can be returned to their respective cylinders after overhaul. Keep connecting rod bearing caps with their respective rods.

5. Remove the piston rings from the piston with a piston ring spreader as shown in Figure 13. Remove the piston retainer and push the piston pin out.

CLEANING

Remove dirt and deposits from the piston surfaces with an approved cleaning solvent. Clean the piston ring grooves with a groove cleaner or the end of a piston ring filed to a sharp point (figure 14). Care must be taken not to remove metal from the groove sides.

NOTE: Do not use a caustic cleaning solvent or wire brush for cleaning pistons.

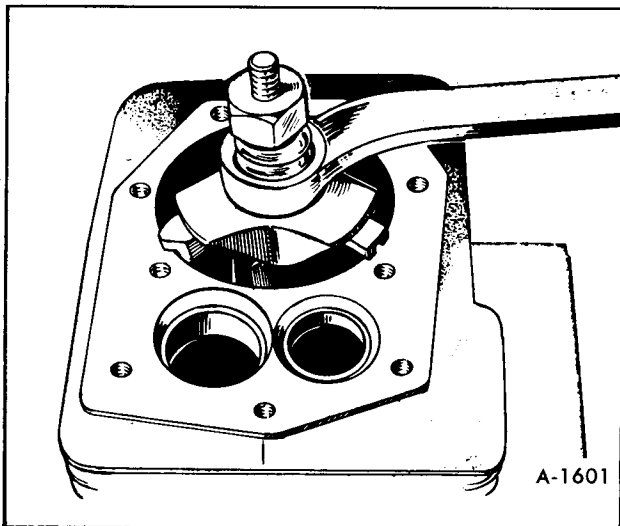


Figure 12—Removing Ridge From The Cylinder

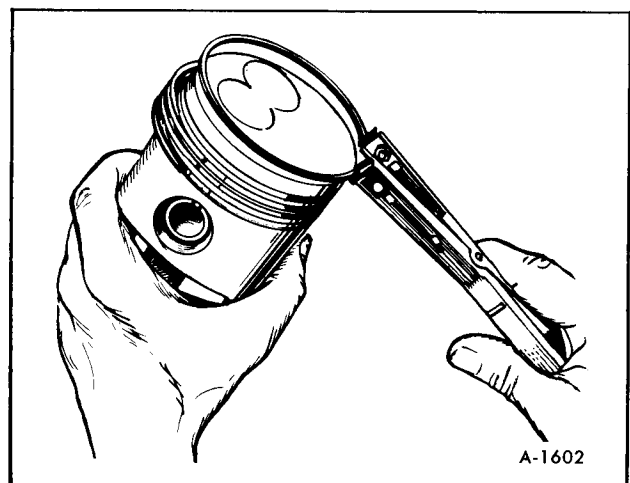


Figure 13—Removing Piston Rings

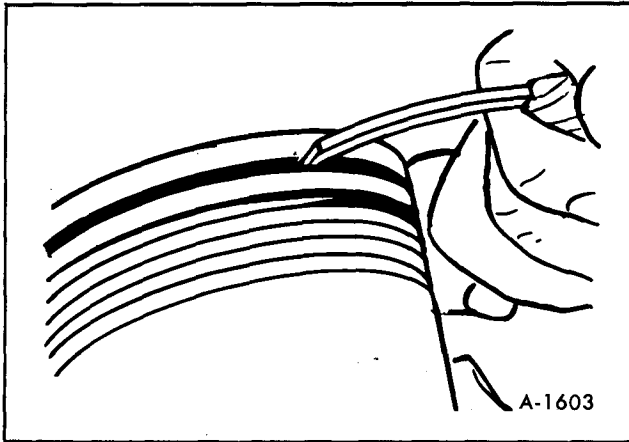


Figure 14—Piston Groove Cleaning

When cleaning the connecting rods in solvent, include the rod bore. Blow out all passages with compressed air.

INSPECTION

The following text contains inspection procedures concerning pistons and connecting rods.

1. Piston Inspection:

a. Inspect the pistons for fractures at the ring lands, skirts and pin bosses. Check for wear at the ring lands using a new ring and feeler gauge as shown in Figure 15. Replace the piston when the side clearance of the top compression ring reaches 0.008".

b. Replace pistons showing signs of scuffing, scoring, worn ring lands, fractures or damage from preignition. Excessive piston wear near the edge of the top ring land indicates preignition.

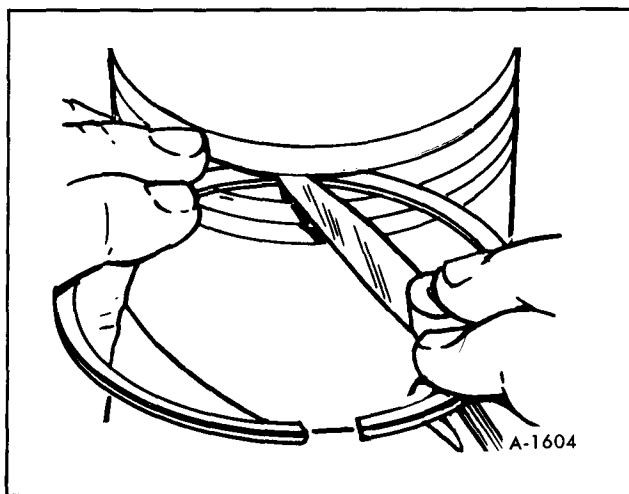


Figure 15—Checking Ring Side Clearance

2. Connecting Rod Inspection

a. Replace connecting rod bolts or nuts with damaged threads. Replace connecting rods with deep nicks, signs of fractures, scored bores or bores out of round more than 0.002".

b. Use a new piston pin to check connecting rod for wear. A push fit clearance is required and varies from engine to engine. If a new piston pin falls through a dry rod pin bore as a result of its own weight, replace the rod.

REPAIR

1. Fitting Pistons:

a. Proper piston tolerances must be maintained for satisfactory operation.

b. Measure the piston as shown in Figure 16 to be sure the total piston-to-cylinder clearance follows specifications.

2. Fitting Piston Rings:

a. Install the piston ring in the cylinder bore. Invert the piston and push the ring to the end of ring travel, about halfway into the bore, which trues the ring end gap. Check the gap with a feeler gauge as shown in Figure 17.

b. The practice of filing ring ends to increase the end gap is not recommended. If the ring end gap does not meet specifications, check for the correct set of rings and correct bore size. A cylinder bore that is 0.001" undersize will reduce the end gap 0.003".

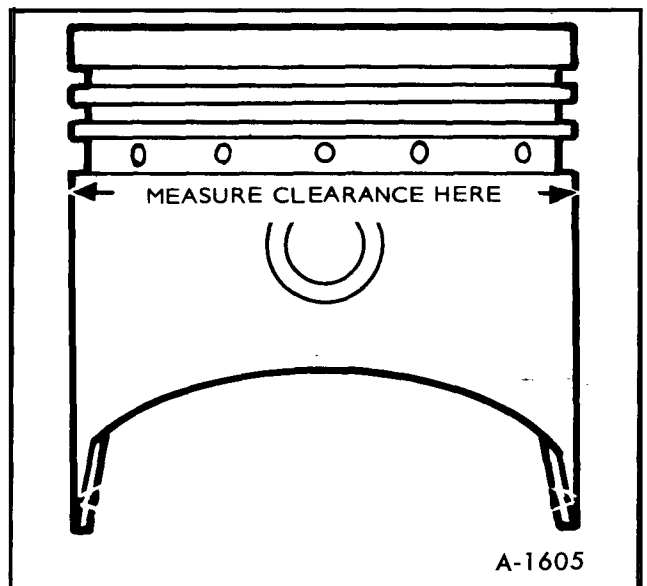


Figure 16—Measuring Diameter of Piston

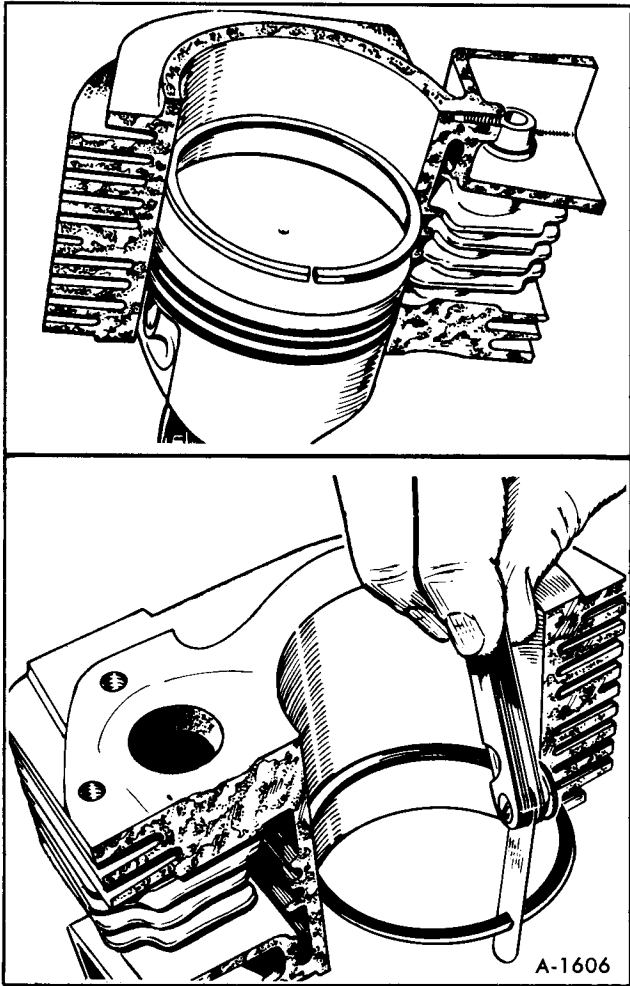


Figure 17—Checking Ring End Gap

CYLINDER BLOCK

INSPECTION:

1. Make a thorough check for cracks. Small cracks may be detected by coating the suspected area with a mixture of 25% kerosene and 75% light motor oil. Wipe the part dry and immediately apply a coating of zinc oxide (white lead) dissolved in wood alcohol. If cracks are present, the white coating will become discolored at the defective area.

2. Inspect the cylinder bore for scoring. Check the Welsh plugs for a tight, even fit and fins for breakage.

3. Check the cylinder bore for taper, out of round and wear, with a cylinder bore gauge, telescope gauge or inside micrometer (figure 18). These measurements should be taken at four places — the top and bottom of piston ring travel.

4. Record measurements taken lengthwise at the top and bottom of the piston travel as follows:

a. Lengthwise of the block, measure and record as "A" the diameter of the cylinder at the top of the cylinder where greatest ring wear occurs.

b. Also, lengthwise of the block, measure and record as "B" the cylinder diameter at the piston skirt travel.

c. Crosswise of the block, measure and record as "C" the diameter of the top of the cylinder at the greatest point of wear.

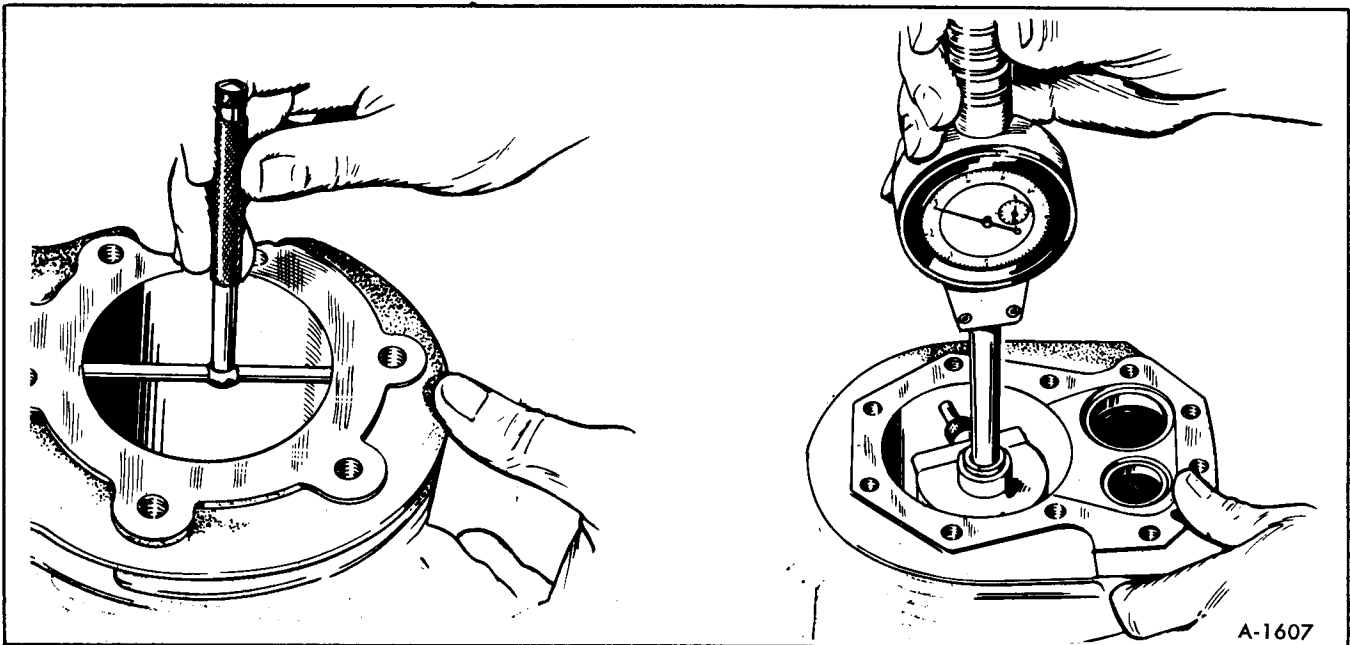


Figure 18—Methods of Measuring The Diameter of a Cylinder

d. Measure and record as "D" the diameter at the bottom of the cylinder bore and crosswise of the block.

e. Reading "A" compared to reading "B" and reading "C" compared to reading "D" indicates cylinder taper.

f. If cylinder taper exceeds 0.005", rebores and hone to accommodate the next oversize piston. Reading "A" compared to reading "C" and reading "B" compared to reading "D" indicates whether or not the cylinder is out of round. If the out of round exceeds 0.002", the cylinders must be rebored and honed for the next oversize piston. A reboring machine is used when going to oversize pistons. The following repair data covers honing to oversize by use of a hone.

REPAIR:

1. A hone can be used to refinish a cylinder.
2. Anchor the block solidly for either vertical or horizontal honing. Use either a drill press or heavy-duty drill which operates at approximately 250 to 450 rpm.
3. Connect drill to hone and start drill. Move the hone up and down in the cylinder approximately 40 cycles per minute. Usually the bottom of the cylinder must be worked out first because it is smaller. Then when the cylinder takes a uniform diameter, move the hone up and down all the way through the bore. Follow the hone manufacturer's recommendations for wet or dry honing and oiling the hone.
4. Check the diameter of the cylinder regularly during honing. A dial bore gauge is the easiest method but a telescoping gauge can be used. Check the size at six places in the bore: measure twice at the top, middle and bottom at 90° angles.
5. The cross hatch formed by the scratching of the stones should form an angle of 23° as shown in Figure 19. This can be achieved by moving the hone up and down in the cylinder about 40 cycles per minute.
6. Clean the cylinder block thoroughly with soap, water and clean rags. A clean white rag should not be soiled on the wall after cleaning is complete. Do not use a solvent or gasoline since they wash the oil from the walls but leave the metal particles.
7. Dry the crankcase and coat it with oil.

CRANKSHAFT

Inspect the bearing journals. If they are scored and cannot be smoothed out by dressing down, replace the crankshaft.

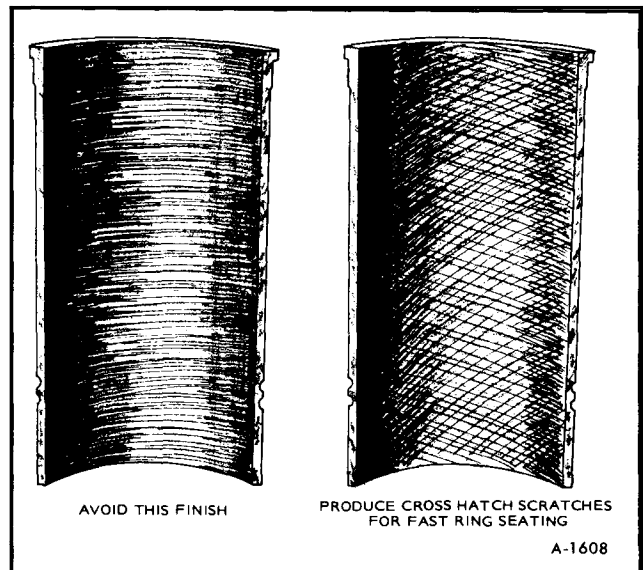


Figure 19—Crosshatching Cylinder Block

Whenever making major repairs on the engine, always inspect the drilled passages of the crankshaft. Clean them to remove any foreign material and to assure proper lubrication of the connecting rods.

BEARINGS

Removal

Removing camshaft or crankshaft bearings requires complete disassembly of the engine. Use a press or a suitable drive plug to remove the bearings. Support the casting to avoid distortion and avoid damaging the bearing bore during removal and installation. Use oil on the bearings to reduce friction when installing and again lubricate with oil after installing.

Installation

Crankshaft main bearings are precision type which do not require line reaming or line boring after installation. They are available in standard size and .002" undersize. Expand the bearing bore by placing the casting in hot water or in an oven heated to 200°F. *If a torch is used, apply only a slight amount of heat.*

To ease assembly, cool the precision bearing to shrink it. Align the oil hole(s) in the bearing with the oil hole(s) in the bearing bore Figure 20. The oil passage must be at least 1/2 open. Lubricate bearings with SAE20 oil before installing. The cold oiled precision bearing should require only light taps to position it with a driving tool. If head of lock pin is damaged, use side cutters or Easy Out tool to remove and install new pin. Apply oil to thrust washer (one used with each bearing) to hold it in place while

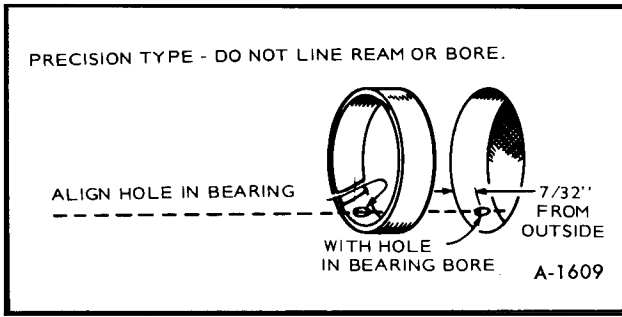


Figure 20—Crankshaft Bearing

installing the crankshaft. Oil grooves in thrust washers must face the crankshaft and washers must be flat (not bent). The two notches on each washer must fit over the two lock pins to prevent riding on the crankshaft.

NOTE: Original front bearing uses a separate thrust washer. Replacement front bearing is a one piece assembly with thrust washer part of the bearing. Do not use a separate thrust washer when installing this replacement part. See Figures 21 and 22.

New camshaft bearings are precision type which *do not* require line reaming or line boring after installation. Coat the bearing with SAE20 to reduce friction. Place the bearing on the crankcase over the bearing bore with the elongated hole in proper position and narrow section facing out (except bores without oil holes install with bearing groove at the top). Be sure to start the bearing straight. Press the front bearing in flush with the outside end of the bearing bore. Press the rear bearing in flush with the bottom of counterbore which received the expansion plug.

CRANKSHAFT ENDPLAY

After the rear bearing end plate has been tightened using the torque recommended in Torque

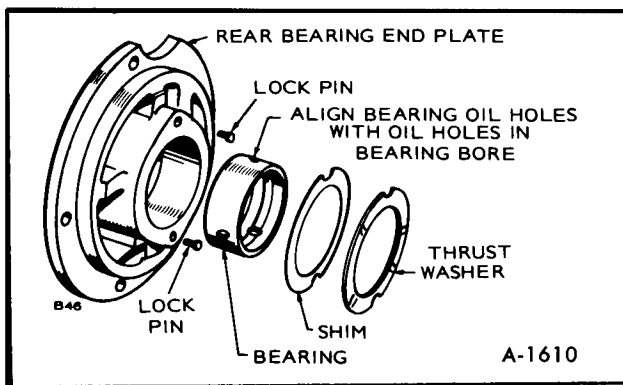


Figure 21—Bearing For Rear Bearing Plate

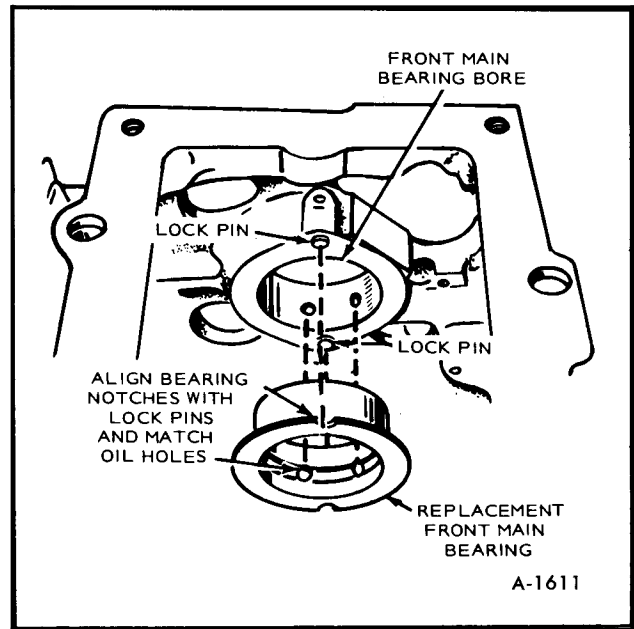


Figure 22—Front Bearing Installation

Specifications check the crankshaft endplay as shown in Figure 23. If there is too much endplay (see Specifications), remove the rear bearing end plate and add a shim between the thrust washer and plate. Reinstall the end plate making sure the thrust washer and shim notches line up with the lock pins. Torque and recheck endplay of the crankshaft.

CHECKING BEARING CLEARANCE WITH PLASTIGAUGE

1. Make certain that all parts are marked or identified so that they are reinstalled in their original positions.

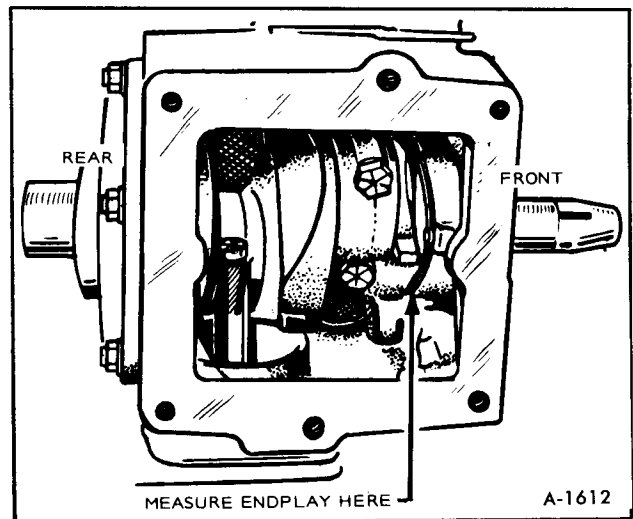


Figure 23—Crankshaft Endplay

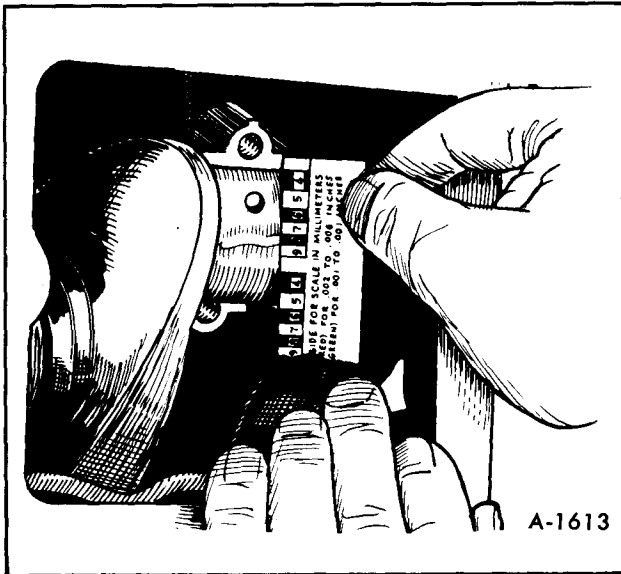


Figure 24—Measuring Bearing Clearance

2. Place a piece of correct size Plastigauge in the bearing cap the full width of the crankshaft rod surface about 1/4 inch off center (figure 24).
3. Rotate the crank about 30° from bottom dead center and reinstall the bearing cap; Tighten the bolts to the torque specified at the end of this section. Do not turn the crankshaft.
4. Remove the bearing cap. Leave the flattened Plastigauge on the part to which it has adhered and

compare the widest point with the graduations on the Plastigauge envelope to determine bearing clearance.

OIL SEALS (FIGURE 25)

The bearing plate must be removed to replace the oil seal. Drive the oil seal out from the inside.

Before installing the seals, fill the space between lips with a multi-purpose grease. This will improve sealing.

When installing the gear cover oil seal, tap the seal inward until it is 31/32" from the mounting face of the cover.

When installing the bearing plate oil seal, tap the seal into the bearing plate bore to bottom against the shoulder in the plate bore. Use a seal expander or place a piece of shim stock around the end of the crankshaft, when replacing the bearing plate to avoid damaging the seal. Remove the shim stock as soon as the plate is in place.

PISTON ASSEMBLY

1. Lubricate all parts with engine oil.
2. Position piston on its respective rod and install the pin.
3. Install the rings on the pistons starting with the oil control ring (figure 26). Use a piston ring spreader

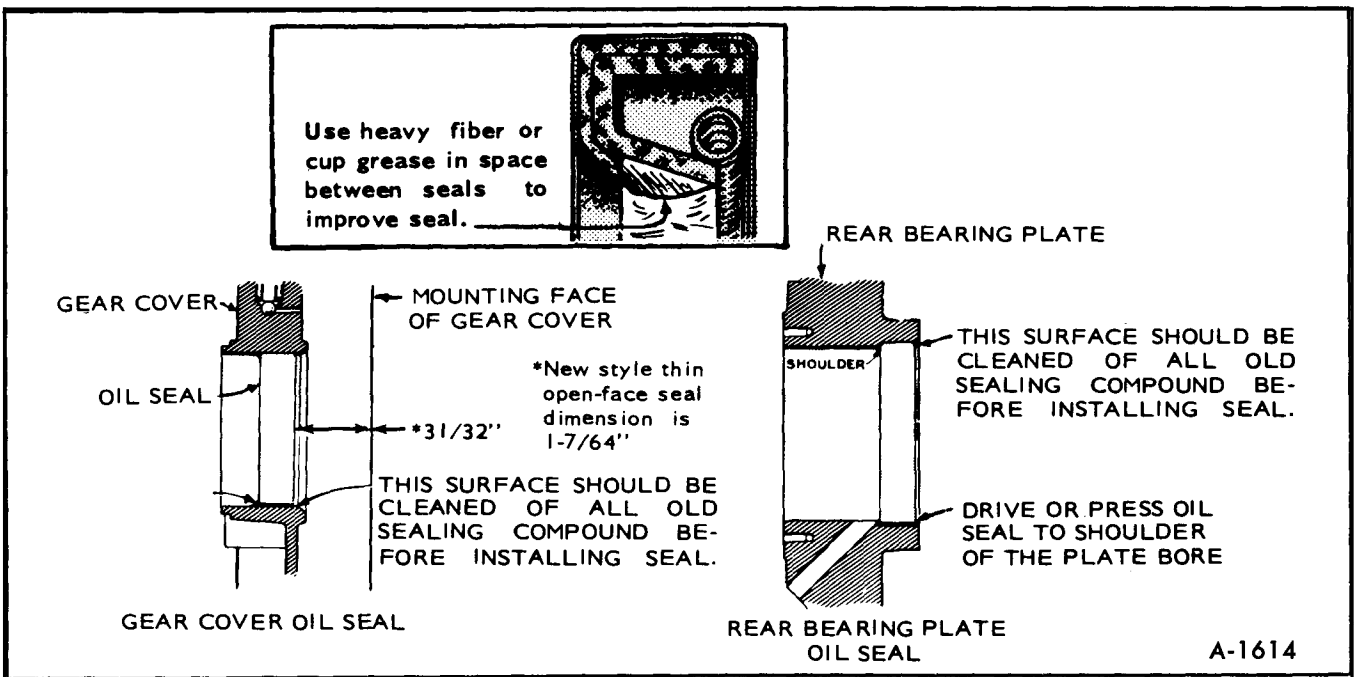


Figure 25—Gear Cover and Rear Bearing Plate Oil Seals

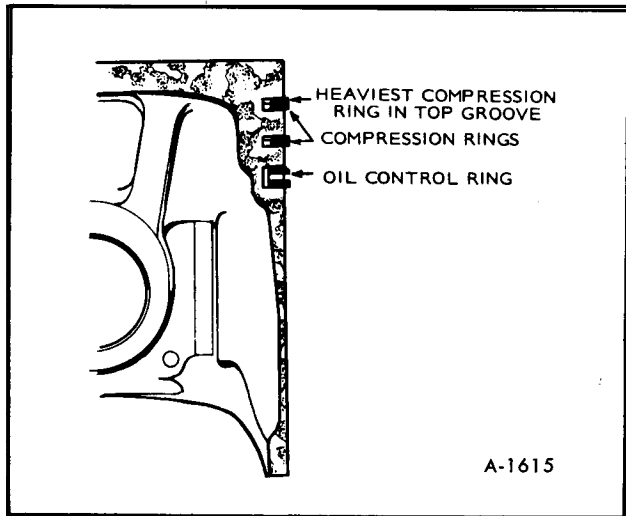


Figure 26—Piston Rings

to prevent twisting or excessive expansion of the ring. Some oil control rings and all compression rings have a dot or the word "top" on one side of the ring to indicate which side faces the top of the piston. Unmarked piston rings can be installed either way. If the oil control ring has a coil expander, install the expander first and then close until the coil ends butt. The joint should be 180° from the gap of that ring.

INSTALLATION OF PISTON IN CYLINDER:

1. Turn the crankshaft to position the number one rod bearing journal at the bottom of its stroke.
2. Lubricate the number one piston assembly and inside of the cylinder. Compress the rings with a ring compressor as shown in Figure 27.
3. Position the piston and rod assembly in the cylinder block.

NOTE: The connecting rod numbers should always face away from the camshaft or bottom side of engine. See Figure 28.

4. Tap the piston down into the bore with the handle end of a hammer until the connecting rod is seated on the journal (figure 27). Install the bearing cap on the rod with the witness marks and stamped reference numbers matching the marks on the rod. Install and tighten the bolts to the specified torques.

The bearing cap must be tapped several times to properly align it with the rest of the connecting rod. Clearance varies on the journal if this is not done.

Install the remaining pistons and rods in the same manner. Crank the engine over by hand to see that all bearings are free.

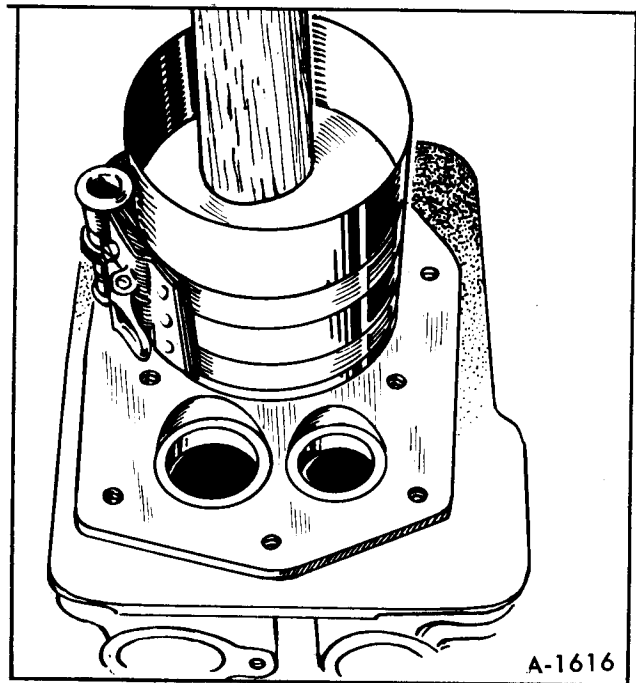


Figure 27—Installing Piston

5. Install the oil base with a new gasket. Torque oil base thru-bolts to 18-23 ft.-lb. Install oil pan.
6. Install the cylinder heads and torque 14-16 ft. lb. (17-19 ft. lb. on 6KW).
7. Replace oil and break-in engine.

CYLINDER HEADS

Remove the cylinder heads for cleaning when poor engine performance is noticed.

1. Use a 1/2 inch socket wrench to remove cylinder head nuts. Lift heads off.

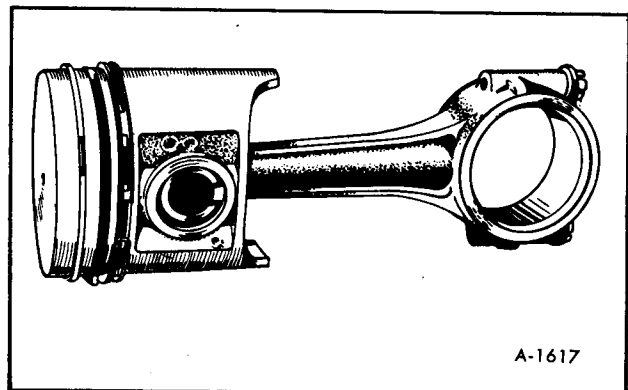


Figure 28—Piston Assembly

CAUTION: Do not remove heads when they are hot. Warpage may occur.

2. After removing heads, clean out all carbon deposits. Be careful not to damage the outer sealing edges where gaskets fit. The heads are made of aluminum and can be damaged by careless handling.

3. Use new head gaskets and clean both the heads and the cylinder block thoroughly where the head gaskets rest.

4. Place heads in position and follow head torque tightening sequence shown in Figure 29. Start out tightening all Nuts to 5 ft.-lb, then 10 ft.-lb, etc., until all Nuts are torqued 14-16 ft - lb. (17-19 ft.-lb. on 6KW).

5. Recheck torque before engine has run a total of 50 hours.

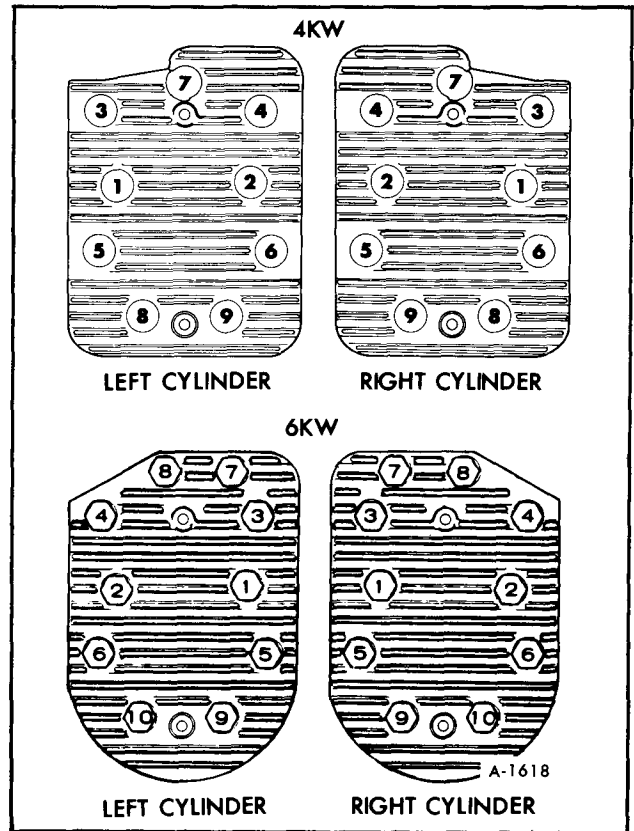


Figure 29—Cylinder Head Tightening Sequence

OIL SYSTEM

CRANKCASE OIL

Change crankcase oil every 100 operating hours and only when engine is warm.

(EXCEPTION: Drain initial oil fill at 25 operating hours.)

To drain, remove the 1/2 inch cap screw (requiring 3/4" socket) on oil pan. After oil drains, replace the cap screw and refill crankcase with a good quality detergent oil. Refer to Section 24A for specific details on oil for the Onan Motor Generator.

OIL FILTER

Change the crankcase oil filter every 200 hours. Filter is located above starter on right side of engine. Remove by turning filter counterclockwise with a filter wrench. Before installing new filter, coat gasket on base of filter with a light film of oil. Install by

turning clockwise until friction is noted, then turn an additional 1/4 to 1/2 turn. See Figure 30.

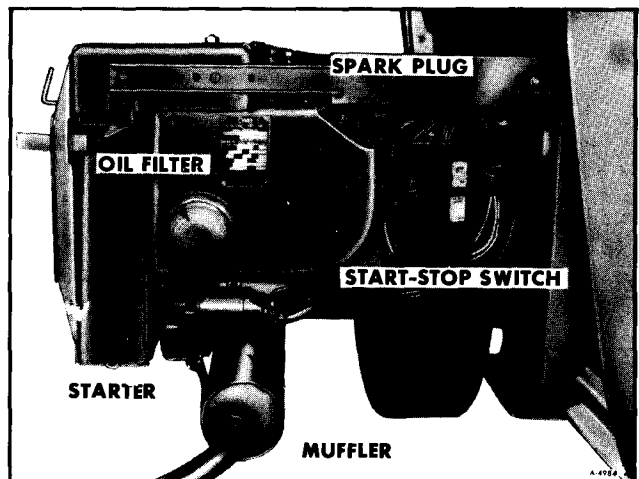


Figure 30—Onan Motor Generator (Right Side View)

CAUTION: Do not over-torque oil filter. Be sure ring is installed around oil filter. This ring acts as an air seal and prevents loss of cooling air.

CRANKCASE BREATHER

This engine uses a crankcase breather valve for maintaining crankcase vacuum. No maintenance is generally required. If the crankcase becomes pressurized as evidenced by oil leaks at the seals, clean baffle and valve in a suitable solvent. Crankcase breather disassembly requires removal of exhaust manifold. See Figure 31.

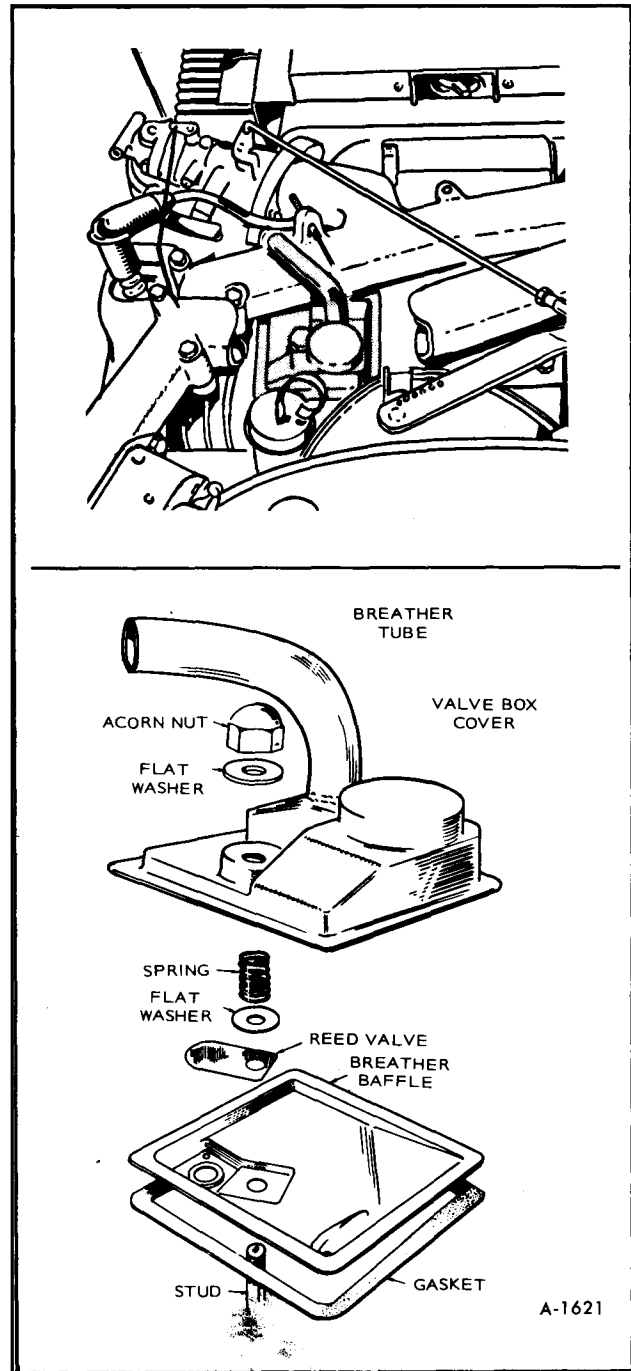


Figure 31—Crankcase Breather

FUEL SYSTEM

CARBURETOR REPAIR (FIGURE 32)

REMOVAL

1. Disconnect fuel inlet hose and crankcase breather hose.

2. Remove air cleaner assembly.
3. Disconnect governor, throttle linkage, and choke control.
4. Remove two hold down screws and lift carburetor from intake manifold.

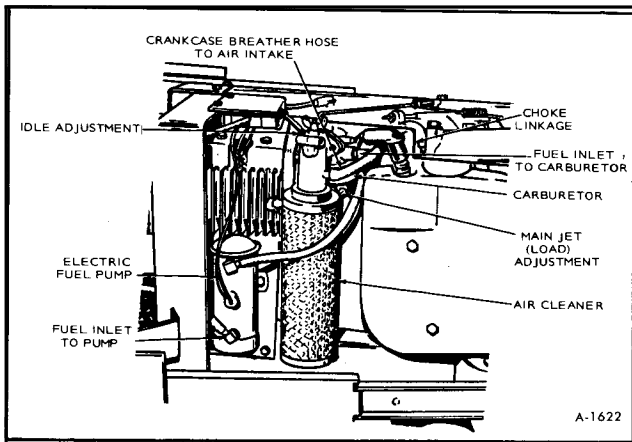


Figure 32—Fuel System (Typical)

REPLACING NEEDLE AND VALVE SEAT (FIGURE 33)

1. Remove $7/16$ " retainer at base of fuel bowl and lift bowl from carburetor.
2. Push out pin that holds float to carburetor body. Disconnect spring holding needle to float.
3. Remove float and set aside in a clean place. Pull out needle and using a large screwdriver remove needle valve seat.
4. Install new valve seat and needle and replace float.
5. Adjust float.

CARBURETOR CLEANING AND INSPECTION

To clean the carburetor, soak all components thoroughly in a good carburetor cleaner, following the manufacturer's instructions. Be sure to remove all carbon from carburetor bore, especially in the area of the throttle valve. After soaking, clean out all passages with filtered, compressed air.

Check the adjusting needles and nozzle for damage. If float is loaded with fuel or damaged, replace it. The float should fit freely on its pin without binding.

Check the choke and throttle shafts for excessive side play and replace if necessary.

CARBURETOR FLOAT ADJUSTMENT

1. Invert float and casting.
2. With the float resting lightly against the needle and seat, there should be $3/32$ -inch clearance between base of float and carburetor casting.

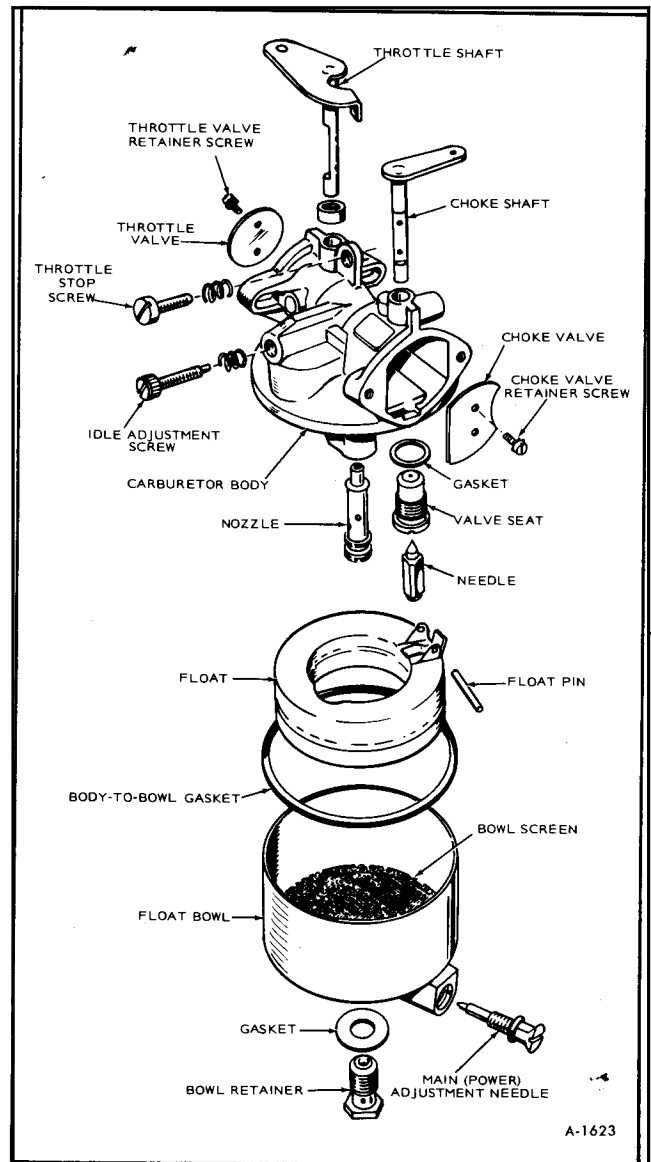


Figure 33—Carburetor Components

NOTE: A drill bit can be used for this measurement as shown in Figure 34. Use a $3/32$ -inch drill bit.

3. If it is necessary to reset float level, remove the float from carburetor and bend the float tang, near the pin, to obtain correct float level.

CAUTION: Do not bend the float when installed; doing so may cause deformation of needle or seat.

4. Check the float closely for signs of leakage. Replace float if damaged or filled with gasoline.
5. Before assembling carburetor, remove filter screen from float bowl and clean both screen and base of float bowl.

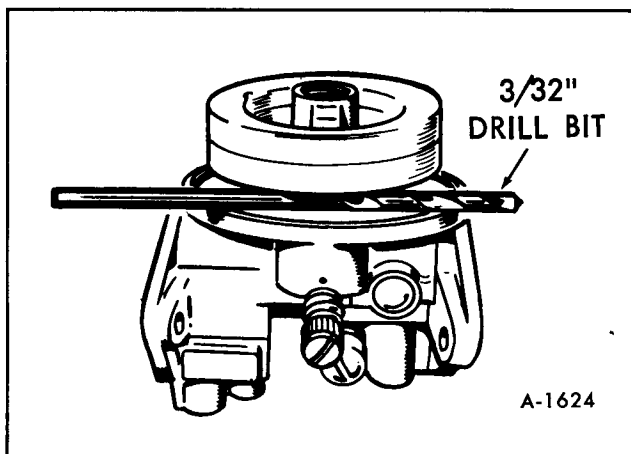


Figure 34—Carburetor Float Adjustment

6. Install new gaskets when reassembling.

FUEL PUMP FILTER ELEMENT (FIGURE 35)

Every 400 hours or sooner, drain fuel pump and check filter element. Remove fuel pump mounting screws and turn off hex nut on base of pump. If element appears dirty, replace with a new one. Be sure to replace gaskets when reassembling.

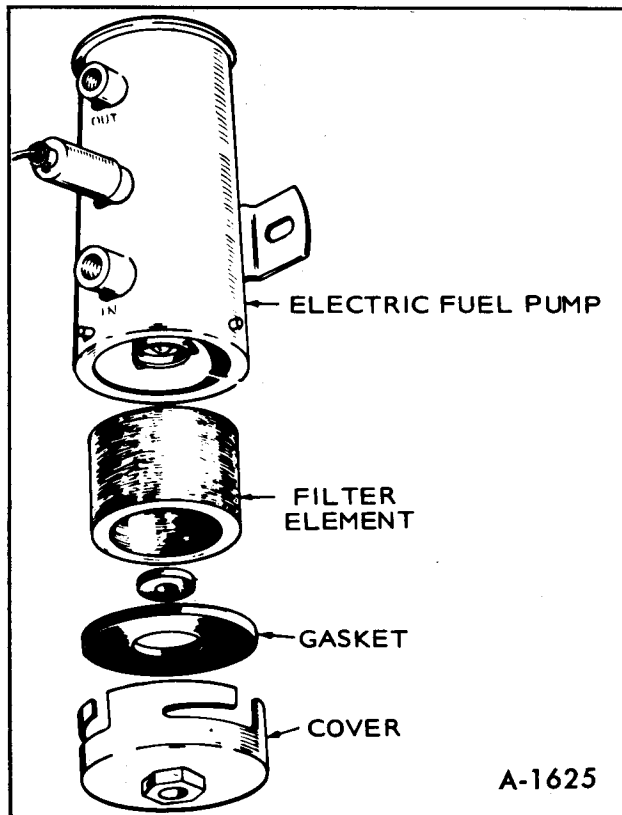


Figure 35—Fuel Pump Filter Element

FUEL SOLENOID

An electric fuel solenoid is mounted on the inlet side of the fuel pump. The solenoid valve is closed when the motor generator is not running, preventing fuel from siphoning out of the pump and back to the tank. The solenoid valve opens during cranking and running. A defective solenoid will not allow the motor generator to start.

AIR CLEANER ELEMENT (FIGURE 36)

Check and clean element at least every 100 hours. Loosen wing nut to remove. Clean by tapping base lightly on a flat surface. Replace element at least every 200 operating hours on the 4KW and every 500 hours on the 6KW; clean or replace more often in dusty conditions.

CARBURETOR ADJUSTMENTS (FIGURE 37)

The carburetor has a main fuel (power) adjustment and an idle fuel adjustment. The main adjustment affects operation under heavy load conditions. The idle adjustment affects operation under light or no-load conditions. Under normal circumstances, adjustments should not be disturbed. If adjustments have been disturbed turn main fuel jet 1-1/4 turn off its seat and idle fuel jet one turn off its seat to permit starting. Then readjust them for smooth operation.

CAUTION: *Forcing the needle against its seat will damage it. The needle does not completely shut off fuel when turned fully in.*

Set the throttle stop screw (located on the carburetor throttle lever), with no load connected to the plant. Turn stop so it just touches adjustment screw; then turn adjustment screw (with stop still touching it) until unit is running at 1500 rpm. When stop is released, governor will then control no-load speed at 1850 to 1890 rpm.

Before final adjustment, allow the engine to warm up. Adjust the idle fuel jet with no load connected. Open the main jet until the engine runs smooth under acceleration with no load. Slightly more fuel may be needed (open about 1/4 turn further) when sudden load is applied or if operating in extremely cold weather.

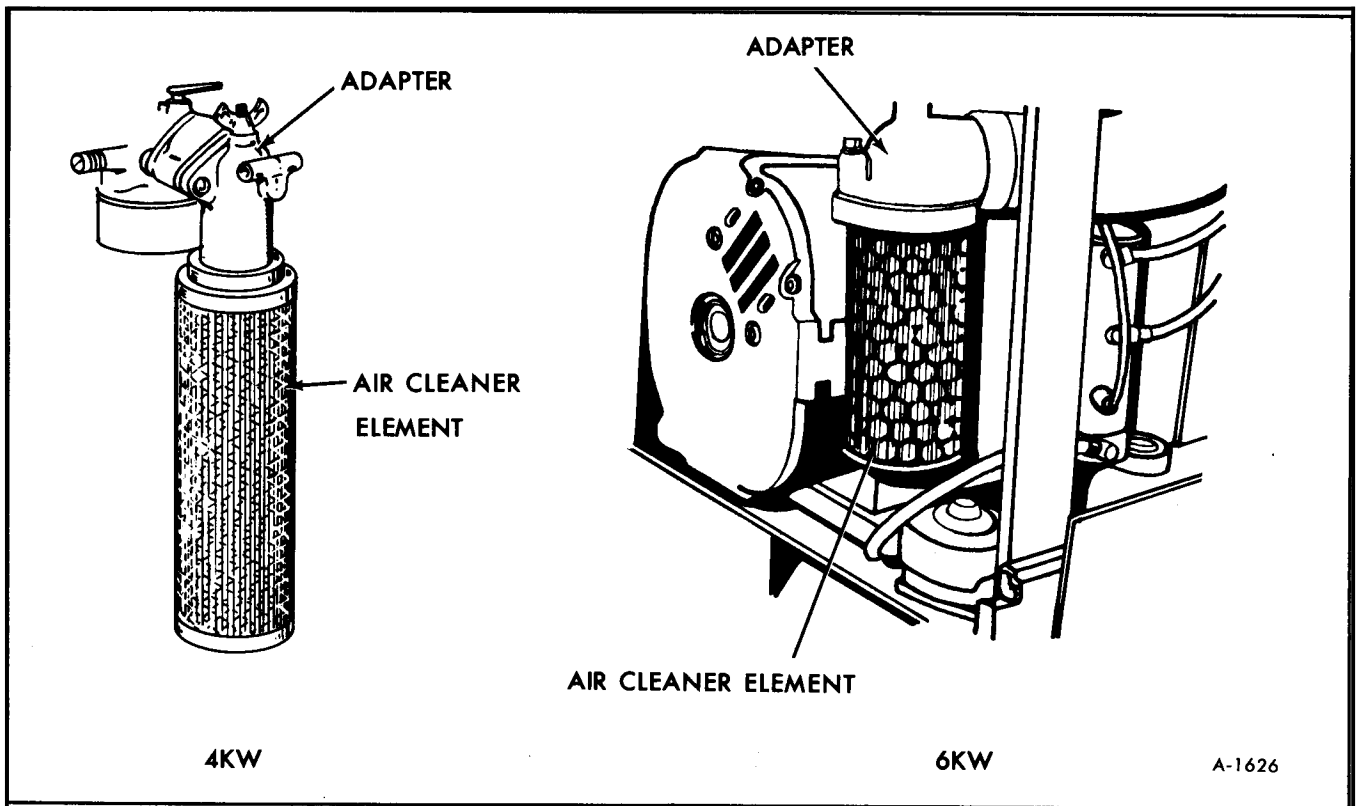


Figure 36—Air Cleaner Element

If the engine develops a “hunting” condition (alternate increase and decrease of engine speed), try correcting by opening the main adjusting needle a little more.

CAUTION: Do not open main fuel jet more than 1/2 turn beyond the maximum power point.

GOVERNOR

Before making governor adjustments, run the unit about 15 minutes under light load to reach normal operating temperature. (If governor is completely out of adjustment, make a preliminary adjustment at no load to first attain a safe voltage operating range).

Engine speed determines the output voltage and current frequency of the generator. By increasing the engine speed, generator voltage and frequency are increased, and by decreasing the engine speed, generator voltage and frequency are decreased. An accurate voltmeter or frequency meter (preferably both) should be connected to the generator output in order to correctly adjust the governor. A small speed drop not noticeable without instruments will result in an objectionable voltage drop. The engine speed can be checked with a tachometer.

A binding in the bearings of the governor shaft, in the ball joint, or in the carburetor throttle assembly will cause erratic governor action or alternate

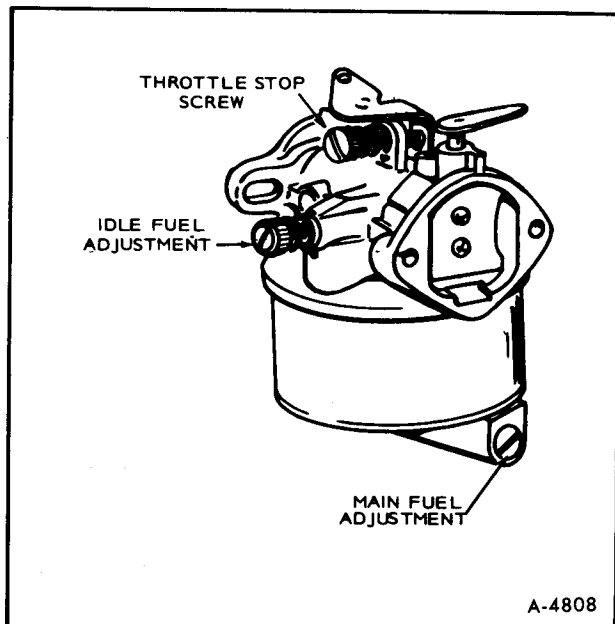


Figure 37—Carburetor Adjustment Screws

increase and decrease in speed (hunting). A lean carburetor adjustment may also cause hunting. Springs of all kinds have a tendency to lose their calibrated tension through fatigue after long usage. If all governor and carburetor adjustments are properly made, and the governor action is still erratic, replacing the spring with a new one and resetting the adjustments will usually correct the trouble.

1. Adjust the carburetor idle needle with no load connected.
2. Adjust the carburetor main jet for the best fuel mixture while operating the set with a full rated load connected.
3. Adjust the length of the governor linkage and check linkage and throttle shaft for binding or excessive looseness.
4. Adjust the governor spring tension for rated speed at no load operation.
5. Adjust the governor sensitivity.
6. Recheck the speed adjustment.
7. Set the carburetor throttle stop screw.

LINKAGE

The engine starts at wide open throttle. The length of the linkage connecting the governor arm to the throttle shaft and lever is adjusted by rotating the

ball joint. Adjust this length so that with the engine stopped and tension on the governor spring, the stop on the carburetor throttle lever just contacts the stop. This setting allows immediate control by the governor after starting. It also synchronizes travel of the governor arm and the throttle shaft.

SPEED ADJUSTMENT

With the warmed-up unit operating at no load, adjust the tension of the governor spring (See figure 38). Turn the speed adjusting nut to obtain a voltage and speed reading within the limits shown.

SENSITIVITY ADJUSTMENT

Referring to Figure 38 check the voltage and speed, first with no load connected and again with a full load. Adjust the sensitivity to give the closest regulation (least speed and voltage difference between no load and full load) without causing a hunting condition.

To increase sensitivity (closer regulation), shift the spring toward the governor shaft.

An adjustment for too much sensitivity will cause alternate increase and decrease of engine speed (hunting).

To decrease sensitivity, shift the spring toward the outer end of the governor arm. Too little sensitivity will result in too much difference in speed between no load and full load conditions.

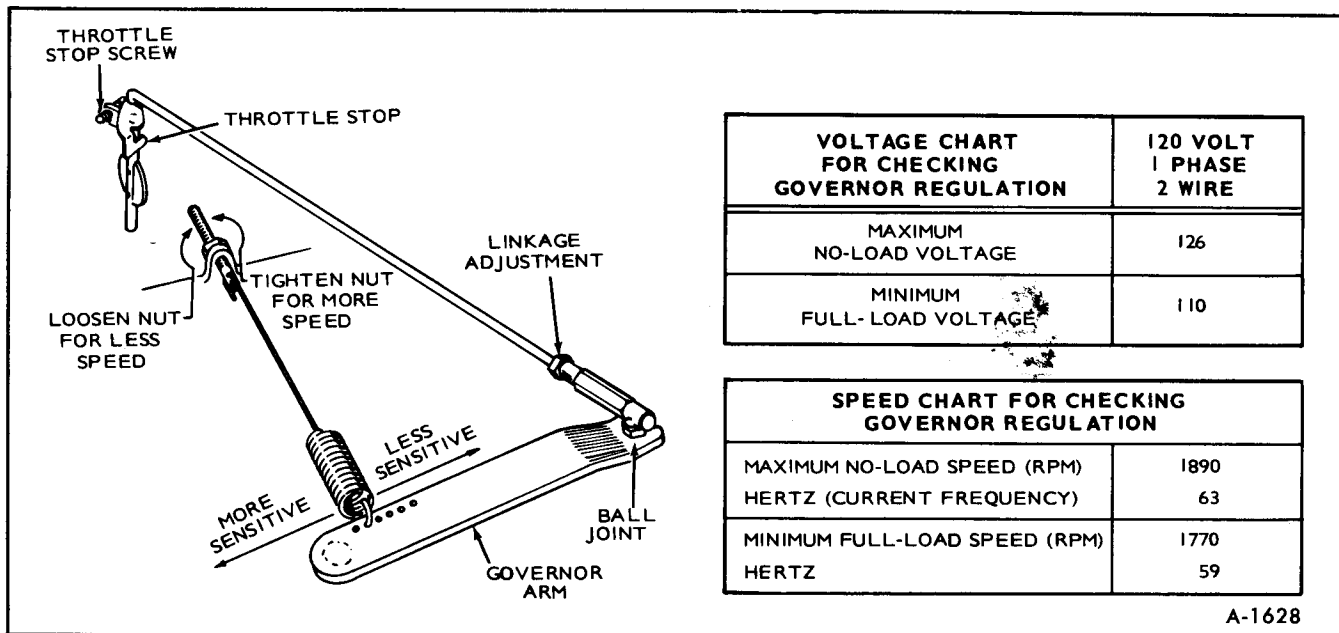


Figure 38—Governor Adjustments

Any change in the sensitivity adjustment usually requires a compensating speed (spring tension) adjustment.

GOVERNOR BALL JOINT

Every 200 hours or sooner, check the governor linkage for freedom of movement through its travel. Clean and lubricate ball joint with lubricating graphite.

ELECTRIC CHOKE

Manually check movement of choke travel to be

sure it is not stuck open or closed. Voltage at choke should be 12 volts during start and drop to zero during run. If choke does not move at room temperature with 12 volts applied, replace it.

This choke should not require any seasonal readjustment. If adjustment becomes necessary proceed as follows:

1. Loosen choke lever clamp screw.
2. With lever fully forward (away from carburetor), adjust so choke valve is completely closed or not more than 1/4 inch open.
3. Tighten clamp screw.

IGNITION AND BATTERY CHARGING SYSTEM

BREAKER POINTS

To maintain maximum efficiency from the engine, change the breaker points every 200 hours of operation. Proceed as follows:

1. Remove the two screws and the cover on the breaker box.
2. Remove the two spark plugs so engine can be easily rotated by hand. Check condition of spark plugs at this time.
3. Refer to Figure 39, remove mounting nut (A) and pull the points out of the box just far enough so screw (B) can be removed and leads disconnected.
4. Remove screw (C) and replace condenser with a new one.
5. Replace points with a new set but do not completely tighten mounting nut (A).
6. Remove the dot button on blower housing. This provides an access to view timing mark.
7. ON 4KW, rotate the engine clockwise (facing flywheel) by hand until the 26° BTC mark on gear cover aligns with mark on flywheel. Turn another 1/4 turn (90°) to ensure points are fully open.
- On 6KW, rotate engine clockwise (facing flywheel) By Hand Until the 20° BTC mark aligns with hole. Turn another 1/4 turn (90°) to ensure points are fully open.
8. Using a screwdriver inserted in notch (D) on the right side of points, turn points until gap measures .025" (.016" on 6KW) with a flat thickness gauge. (Be sure feeler is clean.) Tighten mounting screw and recheck gap. Timing is automatically set.

IGNITION TIMING

The timing on the engine is preset at the factory. A non-movable breaker point box is used, however a slight timing change could be made by adjusting points.

The engine is equipped with an automotive type battery ignition system. Both spark plugs fire simultaneously, thus the need for a distributor is eliminated. Spark advance is set to specifications and should be maintained for best engine performance. Always check timing after replacing ignition points or if noticing poor engine performance. Proceed as follows:

TIMING PROCEDURE (ENGINE RUNNING — HOT SETTING) (4KW)

1. To check the ignition timing with unit running use a timing light. Connect the timing light accord-

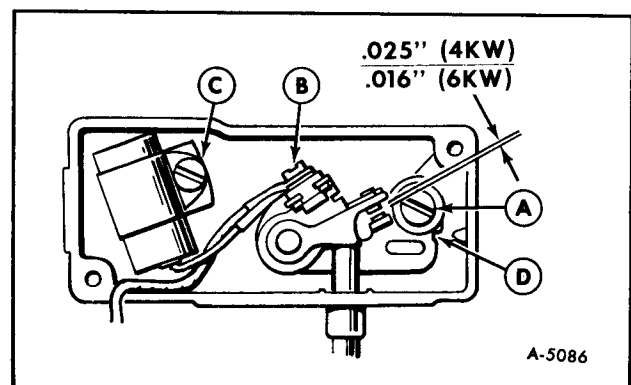


Figure 39—Breaker Point Adjustments

ing to its manufacturer's instructions. Either spark plug can be used as they fire simultaneously.

2. Remove the dot button on blower housing to provide an access to view timing marks (See figure 40).

3. Start the engine and check the timing. The mark on the flywheel should line up with the 21° mark on the cover.

4. Install dot button, breaker box cover and any other hardware removed from engine.

TIMING PROCEDURE (ENGINE RUNNING — HOT SETTING) (6KW)

1. To check the ignition timing with unit running, use a timing light. Connect the timing light according to its manufacturer's instructions. Either spark plug can be used as they fire simultaneously.

2. A small hole on the rear portion of blower housing provides an access to view timing marks (See figure 40). Two marks are provided; one for T/C (top center) and one for 2/0 (20° BTC).

3. Start the engine and check the timing. The 2/0 mark on the flywheel should line up in the middle of the hole.

4. Replace breaker box cover and any other hardware removed from engine.

TIMING PROCEDURE — ENGINE NOT RUNNING — COLD SETTING (4 AND 6 KW)

1. Connect a continuity test lamp set across the ignition breaker points. Touch one test prod to the breaker box terminal to which the coil lead is connected and touch the other test prod to a good ground on the engine.

2. Turn crankshaft against rotation (counterclockwise) until the points close. Then slowly turn the crankshaft with rotation (clockwise).

3. The lamp should go out just as the points break which is the time at which ignition occurs (26° BTC — 4KW and 20° BTC — 6KW).

SPARK PLUGS

Remove both spark plugs and install new ones every 100 hours. Use AC No. R46S or equivalent. Check to be sure spark plug gap is set at .020" as shown in Figure 41.

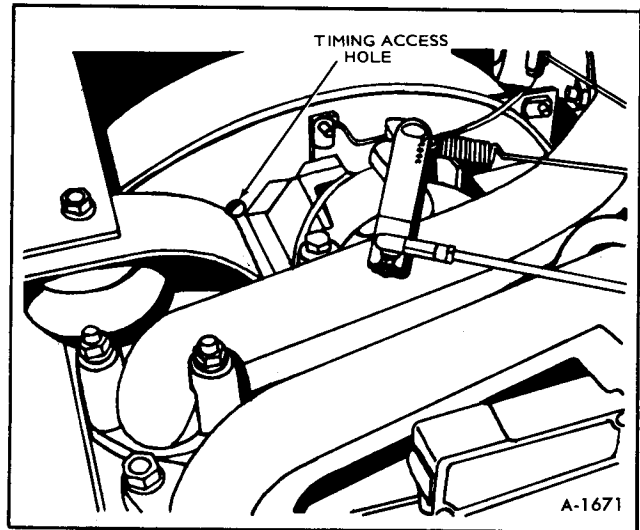


Figure 40—Timing Access Hole Location

IGNITION COIL

To test primary and secondary windings within the ignition coil proceed as follows:

1. Use a Simpson 260 VOM or equivalent.

2. Place black lead on ground (-) terminal of coil and red lead to positive (+) terminal. Primary resistance should read 4.30 ($\pm 10\%$) ohms.

3. Change resistance setting on ohmmeter. Place ohmmeter leads inside spark plug cable holes. Secondary resistance should read 14,000 ($\pm 10\%$) ohms (figure 42).

4. If any of the above conditions are not met, replace coil.

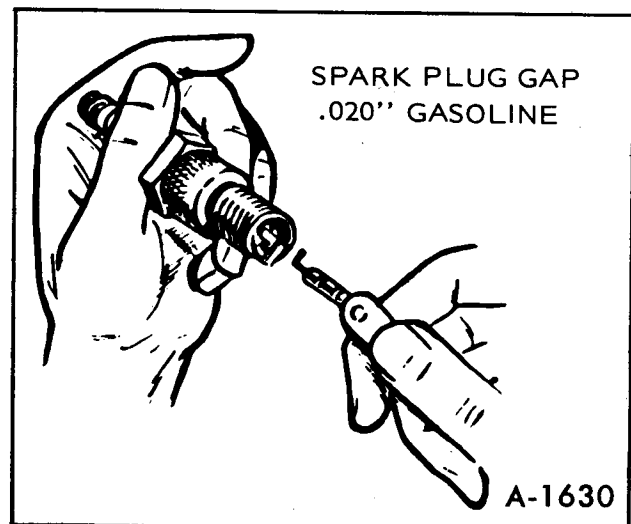


Figure 41—Checking Spark Plug Gap

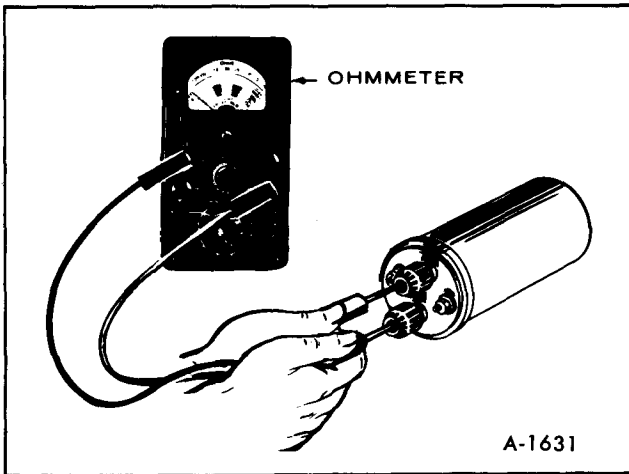


Figure 42—Coil Test

CAUTION: This engine uses a 12-volt, negative ground system. Alternator must be connected to battery at all times when engine is running. Do not reverse battery cables.

BATTERY INSPECTION

Check battery cells with a hydrometer. The specific gravity reading should be approximately 1.280 at 80°F. (figure 43).

If one or more cells are low on water, add distilled water and recharge. Follow charging proce-

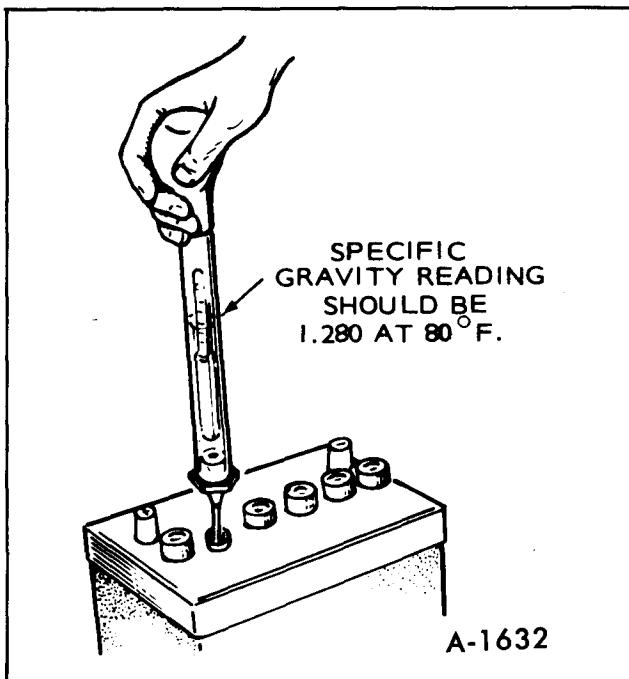


Figure 43—Specific Gravity Test

dures given in "Batteries," SECTION 6Y, ENGINE ELECTRICAL.

Keep the battery case clean and dry. An accumulation of moisture will lead to a very rapid discharge and battery failure.

Keep the battery terminals clean and tight. After making connections, coat the terminals with a light application of petroleum jelly or grease to retard corrosion.

NOTE: For complete discussion of battery service and maintenance, refer to SECTION 6Y, ENGINE ELECTRICAL.

FLYWHEEL ALTERNATOR

(FIGURE 44)

This unit is equipped with a permanent magnet flywheel alternator and solid-state voltage regulator-rectifier (output control). As with all solid-state electrical units, precautions are necessary when servicing. Observe the following:

PRECAUTIONS:

1. Do not connect battery cables in the wrong polarity.
2. Do not short together alternator stator leads.
3. Do not run without a battery. Damage will occur to regulator and battery ignition coil.

PRESERVICE CHECKS:

1. Check for a good ground between equipment and regulator-rectifier case.

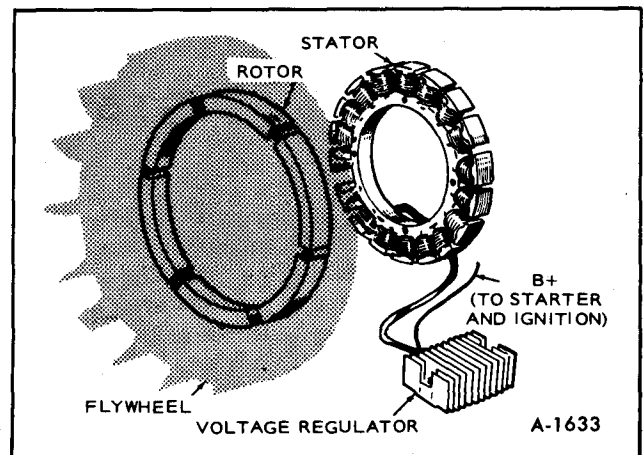


Figure 44—Flywheel Alternator System

2. Be sure output control plug (connector) is properly inserted into stator receptacle to eliminate any resistance due to a poor connection. Keep it clean and tight.

3. Check condition of battery. Be sure cable connections are clean and tight.

NOTE: Charging system tests require a fully charged battery.

TESTING MOTOR GENERATOR BATTERY CHARGING SYSTEM

Basic Test	Procedure	Test Values
1. Battery	Battery Voltage - unit not running.	12 to 12.8 VDC
2. Regulator	Battery Voltage after unit is running 3 to 5 minutes.	13.6 to 14.7 VDC
3. Alternator Stator and Wiring with Fully Charged battery.	Ohmmeter reading from stator output - unit not running. Disconnect wire terminating at AC terminal of voltage regulator and wire terminating at BAT terminal of start solenoid. Insert ohmmeter between these wires.	.2 to .6 Ohms
4. Alternator Stator and Wiring.	Measure AC stator output voltage with unit running. Disconnect wire terminating at AC terminal of voltage regulator. Measure AC voltage (unit running) between this wire and BAT terminal of start solenoid.	25.2 to 30.8 VAC

STARTING SYSTEM

The starter consists of two parts: a low voltage compound DC motor and a means of transmitting motor power to the flywheel ring gear. The constructional difference between this type of starter and others is that the lever spring (figure 45) is located in the central portion of the front bracket. The shift lever, which is operated by solenoid, causes the overrunning clutch assembly to move along the armature shaft toward the flywheel. As the pinion and flywheel teeth make contact, the shift lever continues to move and make electrical contact to spin the arma-

ture. The lever spring compresses, holding the pinion gear against the flywheel gear. As soon as the armature rotates and the gear teeth line up, the gears will mesh.

STARTER REMOVAL

1. Disconnect the ground cables at (-) terminals of both automotive and living area batteries.

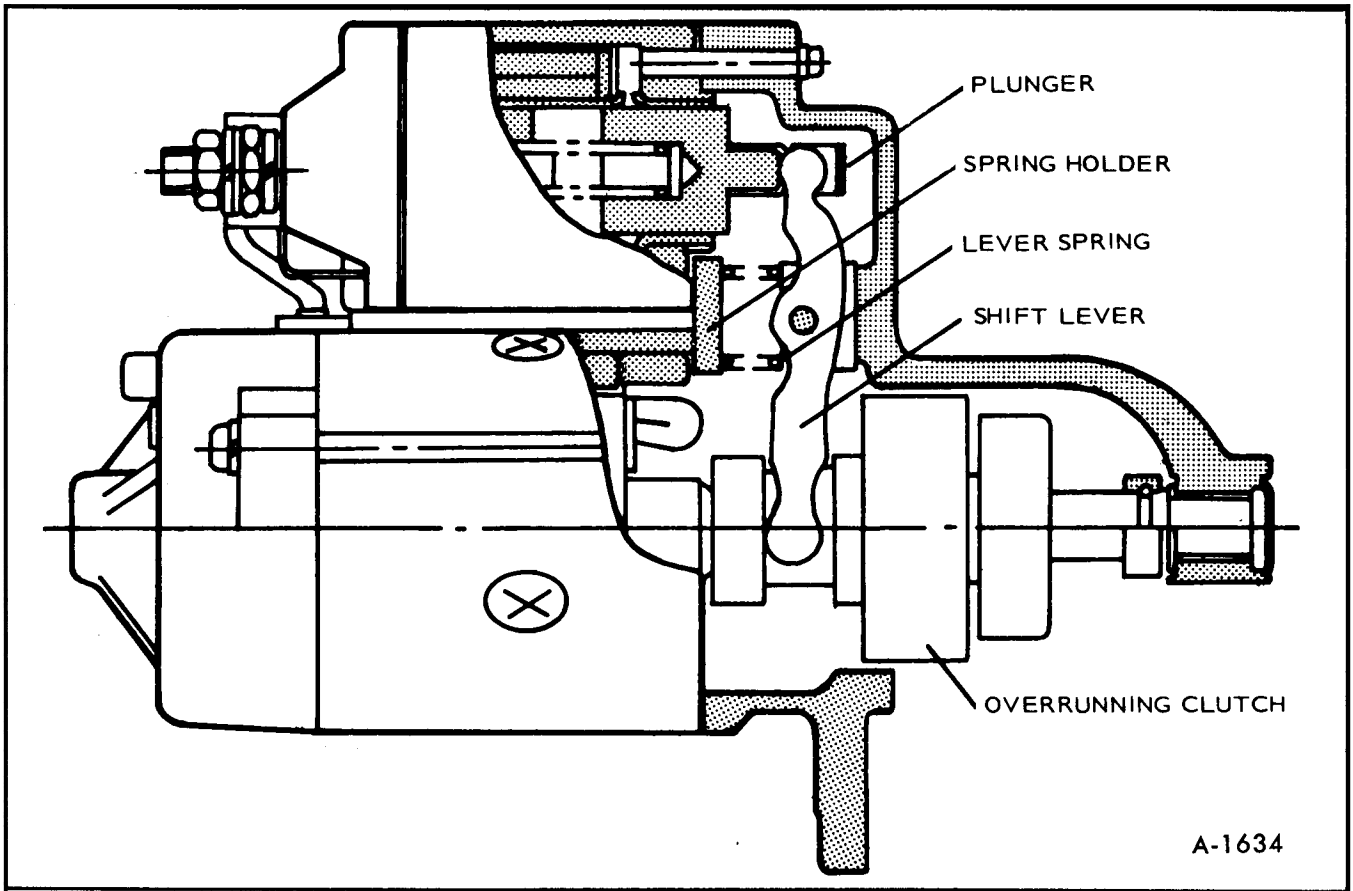


Figure 45—Starter

2. Disconnect the wires from the motor generator starter motor solenoid (See figure 46).

3. Remove the slide out door by removing the six attaching bolts (See figure 47).

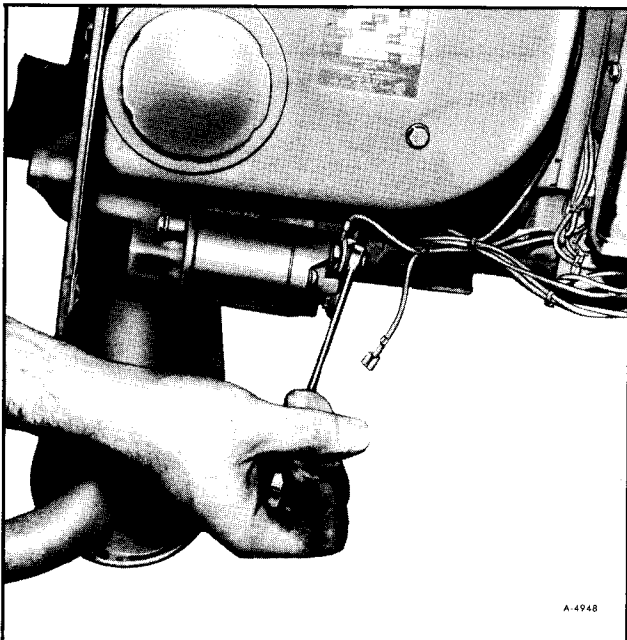


Figure 46—Disconnecting Wires from Starter Motor Solenoid

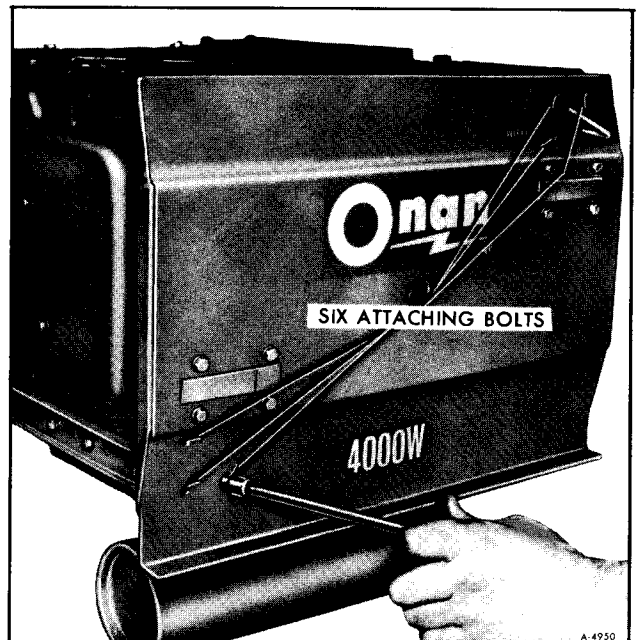


Figure 47—Removing Attaching Bolts from Slide Out Door

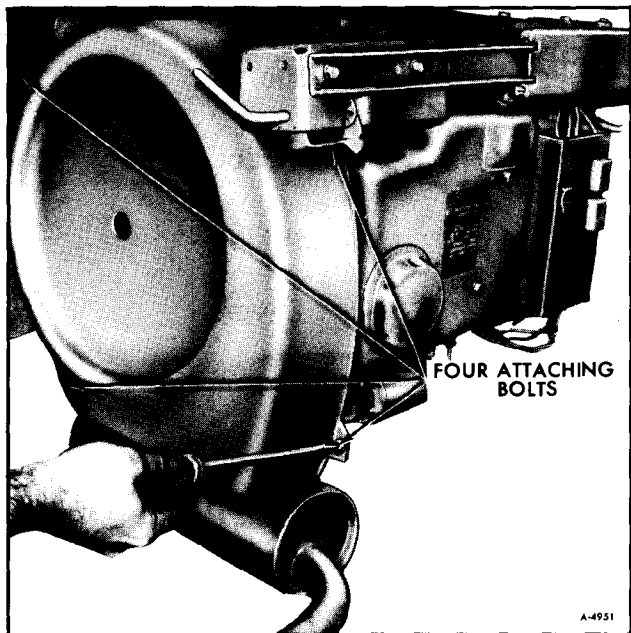


Figure 48—Removing Blower Housing Scroll

4. Remove the blower housing scroll by removing the four attaching bolts (See figure 48).

5. Remove the flywheel center bolt, washer, and lockwasher (See figure 49).

6. Reinstall only the flywheel center bolt.

7. Pull the flywheel with a straight bar puller utilizing the centering hole in the center bolt (See figure 50).

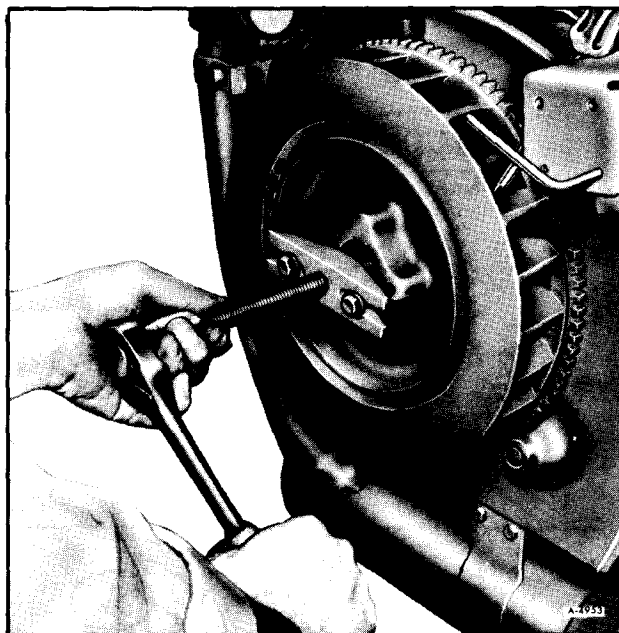


Figure 50—Pulling Flywheel with Straight Bar Puller

8. Pull the flywheel straight off being careful not to contact the alternator stator (See figure 51).

9. Remove the rear muffler mounting bracket by removing the four attaching bolts (See figure 52).

10. Remove the right hand air shroud to expose the starter motor by removing the two attaching bolts (See figure 53).

11. Remove the two starter motor attaching bolts (See figure 54).

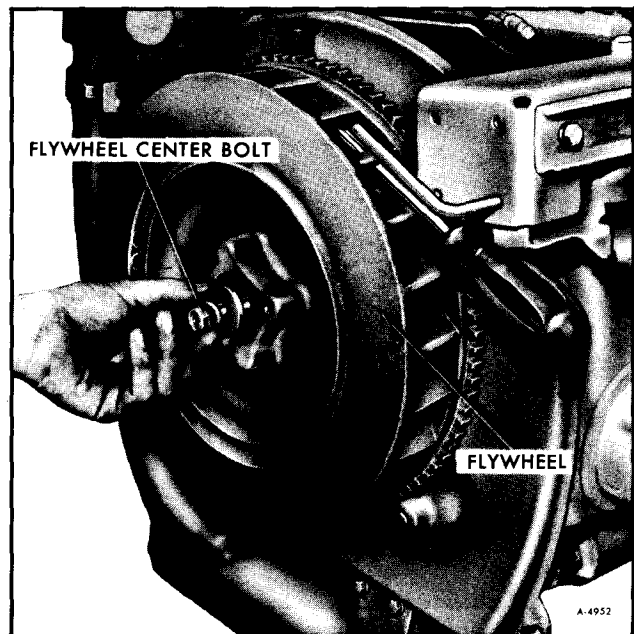


Figure 49—Removing Flywheel Center Bolt



Figure 51—Removing Flywheel

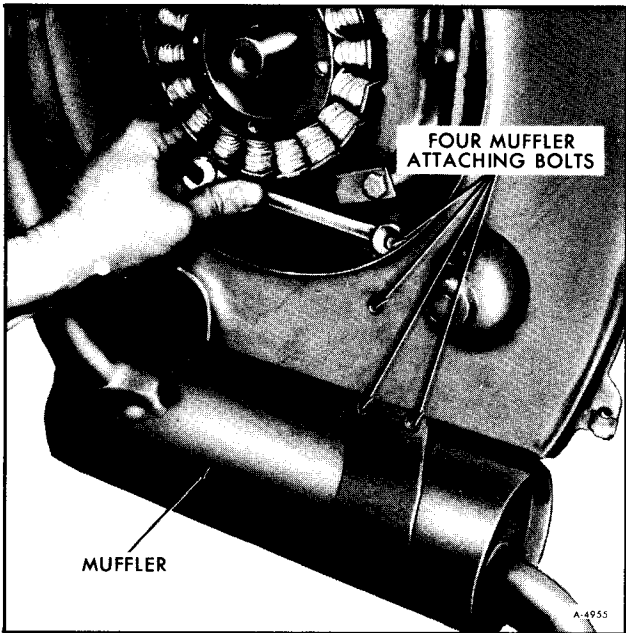


Figure 52—Removing Rear Muffler Mounting Bracket

12. Remove the starter motor assembly.

Reassembly is done in the reverse order of disassembly. When reinstalling the flywheel, be sure to align the starter pinion gear with the ring gear (See figure 55) and torque the flywheel center bolt to 45 ft. lbs. (See figure 56).

STARTER DISASSEMBLY—4KW (FIGURE 57)

1. Loosen the nut that attaches the solenoid mo-

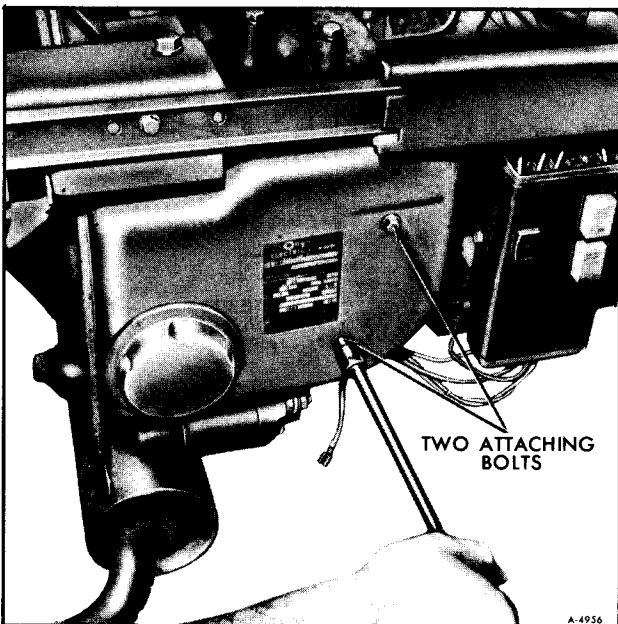


Figure 53—Removing Right Hand Air Shroud

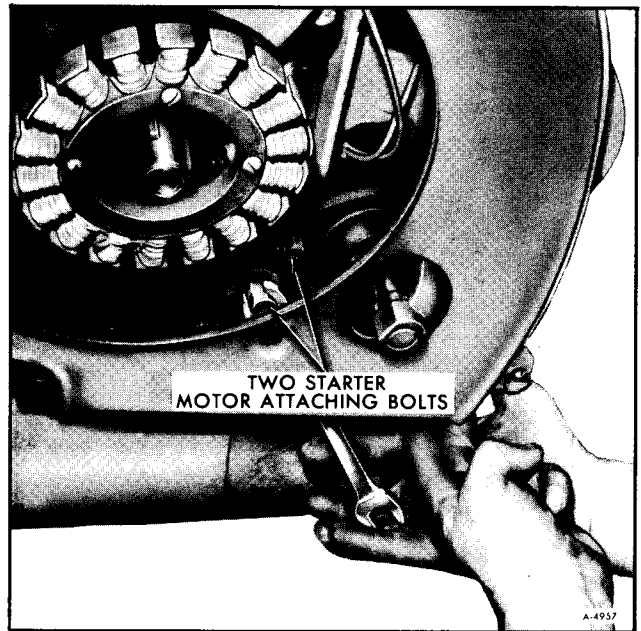


Figure 54—Removing Starter Motor Attaching Bolts

tor terminal to the field coil connector lead and take off the connector lead (figure 58).

2. Loosen the retaining screws and remove the solenoid from the front bracket. Simultaneously, the fiber washers, the return spring and the solenoid plunger will be removed (figure 56).

3. Unscrew the through bolts and separate the yoke with the rear bracket from the front bracket (figure 60).

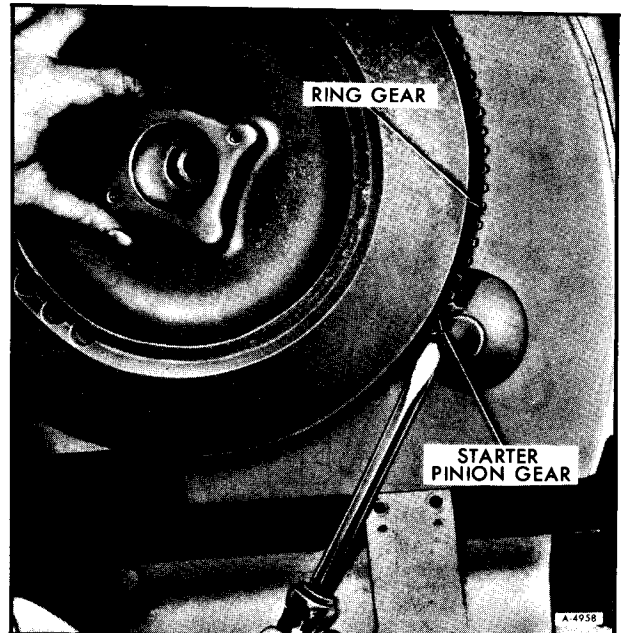


Figure 55—Aligning Starter Pinion Gear with Ring Gear

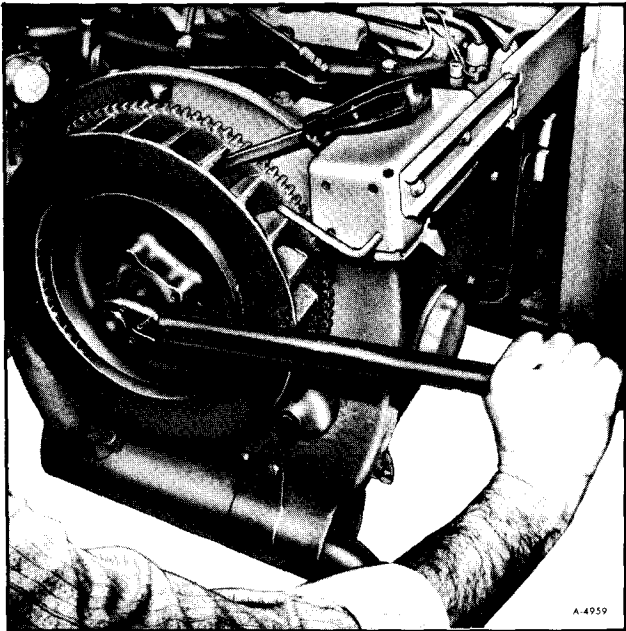


Figure 56—Torquing Flywheel Center Bolt

4. Remove the armature from the front bracket. Simultaneously, the shift lever the lever spring and the spring holder will be removed (figure 61).

5. Removing the insulated brush from the brush holder permits separation of the rear bracket from the yoke (figure 62).

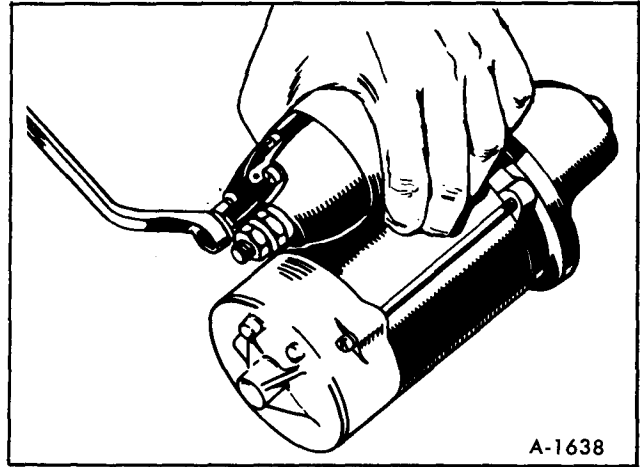


Figure 58—Removing Connector Lead

6. If it is necessary to remove overrunning clutch, first, put a metal cylinder of suitable size over the end of armature shaft so it rests on the stop ring. Then tap the cylinder lightly with a hammer, the stop ring towards armature and lock ring. Remove ring from groove in shaft so the overrunning clutch and the stop ring will be removed from the armature shaft.

STARTER DISASSEMBLY — 6KW (FIGURE 63)

After removing the starter from the engine, disassemble as follows:

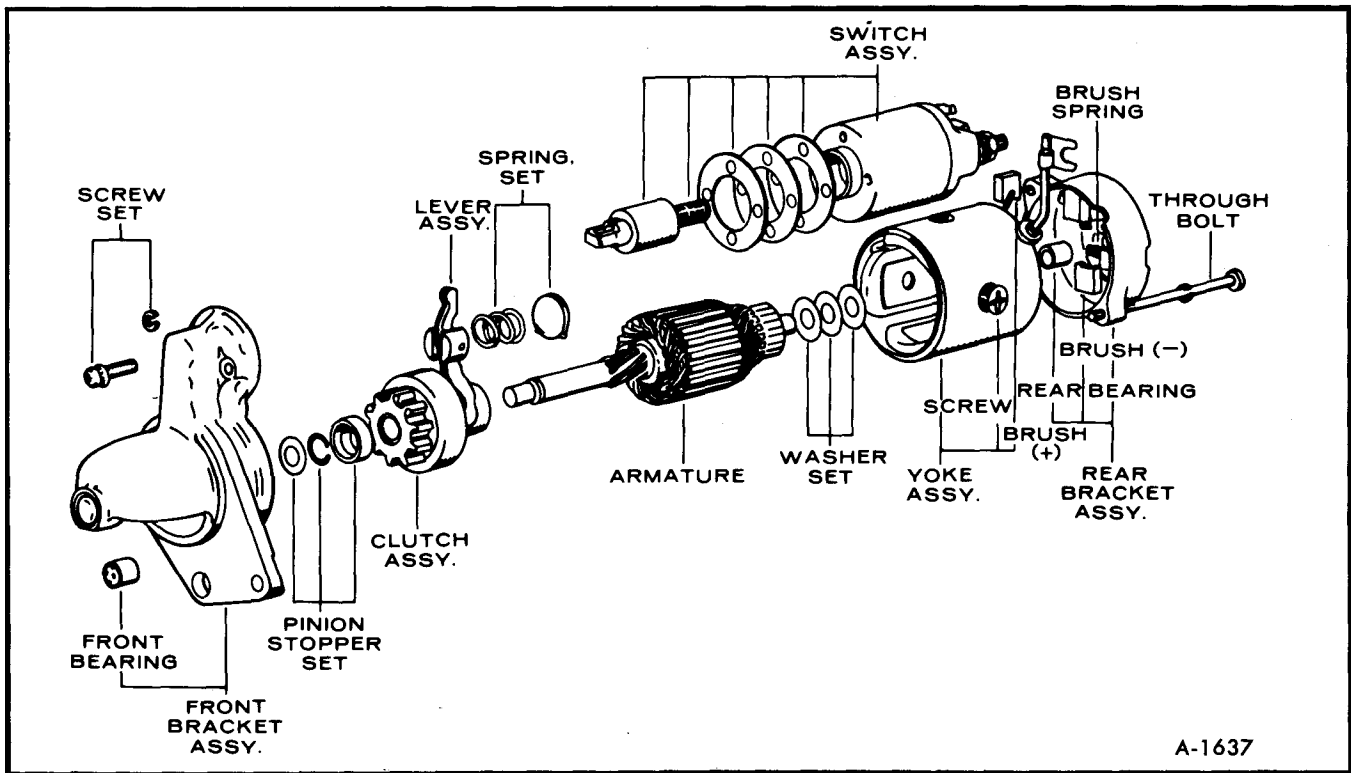


Figure 57—Starter (4 KW)

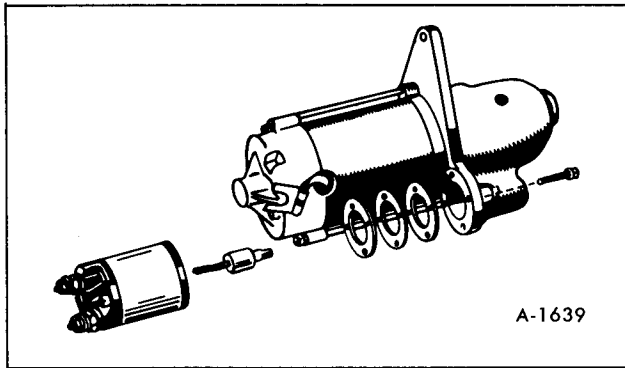


Figure 59—Removing Solenoid

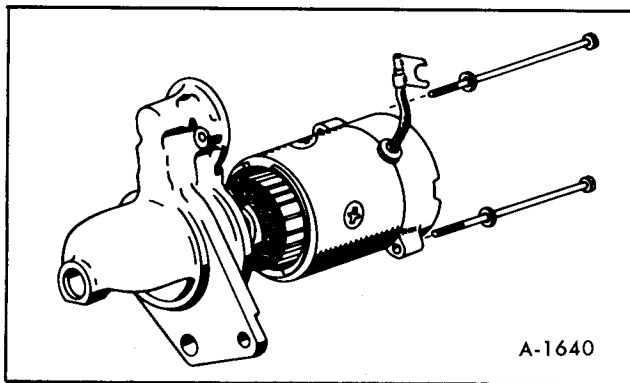


Figure 60—Removing Yoke

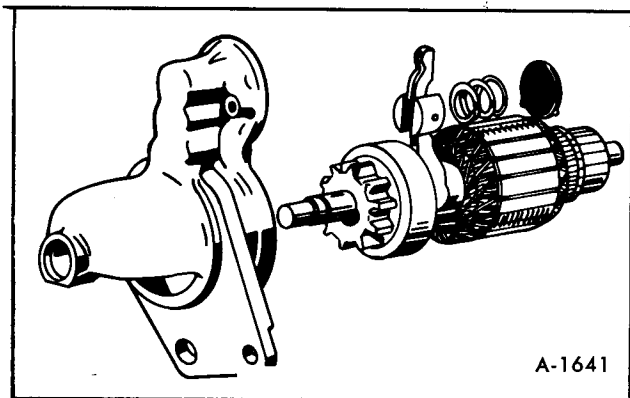


Figure 61—Removing Armature

1. Loosen the nut that attaches the solenoid motor terminal to the field coil connector lead and take off the connector lead (figure 58).

2. Loosen the retaining screws and remove the solenoid from the front bracket. Simultaneously, the fiber washers, the return spring and the solenoid plunger will be removed (figure 59).

3. Unscrew the through bolts and the screws attaching the brush holder assembly to the rear

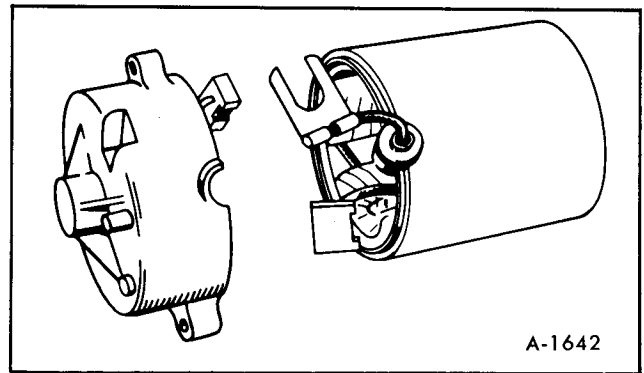


Figure 62—Separating Yoke and Rear Bracket

bracket, so the rear bracket will be removed from the yoke.

4. Remove the yoke with the brush holder assembly.

5. Removing the brushes from the brush holders permit separation of brush holder assembly from the field coil.

6. Remove the armature from the front bracket. Simultaneously, the shift lever, the lever spring and the spring holder will be removed.

7. To remove the overrunning clutch, put a metal cylinder of suitable size over the end of armature shaft so it rests on the stop ring. Tap cylinder lightly with hammer, the stop ring sliding toward armature and off ring. Remove the ring from groove in shaft and then slide the overrunning clutch and the stop ring from the armature shaft.

CAUTION: Do not immerse parts in cleaning solvent. Immersing the field coil, yoke assembly, armature and solenoid will damage the insulation. Wipe these parts with a cloth only. Do not immerse the overrunning clutch in cleaning solvent. The clutch is prelubricated at the factory, and solvent will wash lube from clutch. Wash all other parts in solvent and dry the parts.

INSPECTION OF PARTS

GROUNDING ARMATURE: Use a 120 volt test lamp set for testing armature for grounds as shown in Figure 64. If lamp lights when one probe of test lamp is touched to commutator with other probe to the core, the armature is grounded and must be replaced.

SHORTED ARMATURE: (figure 65) Use a growler tester for testing armature for a short circuit.

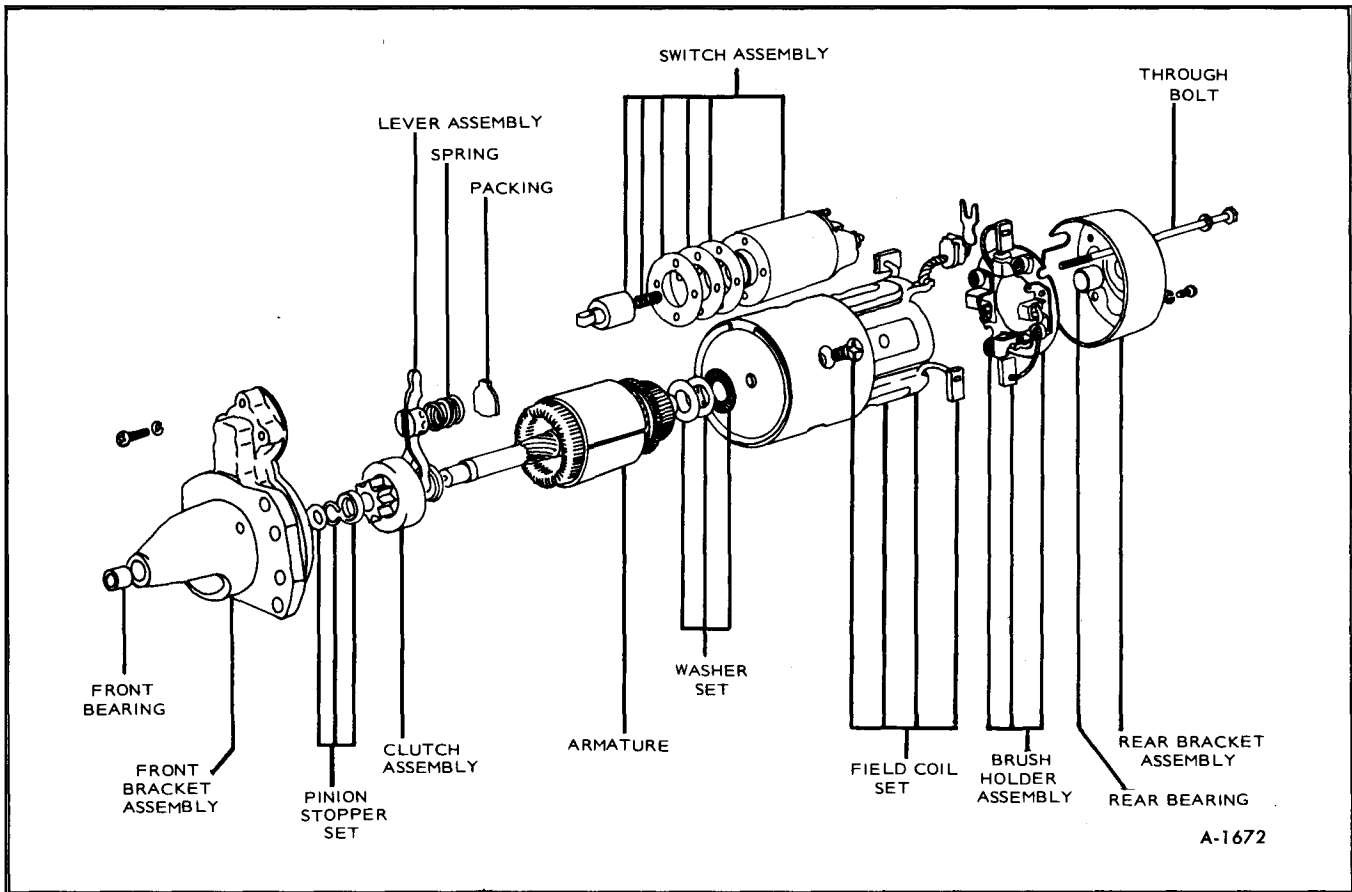


Figure 63—Starter (6KW)

Place armature in growler and hold a thin, steel blade (hacksaw blade) parallel to the core and just above it while slowly rotating armature in growler.

A shorted armature will cause blade to vibrate and be attracted to the core.

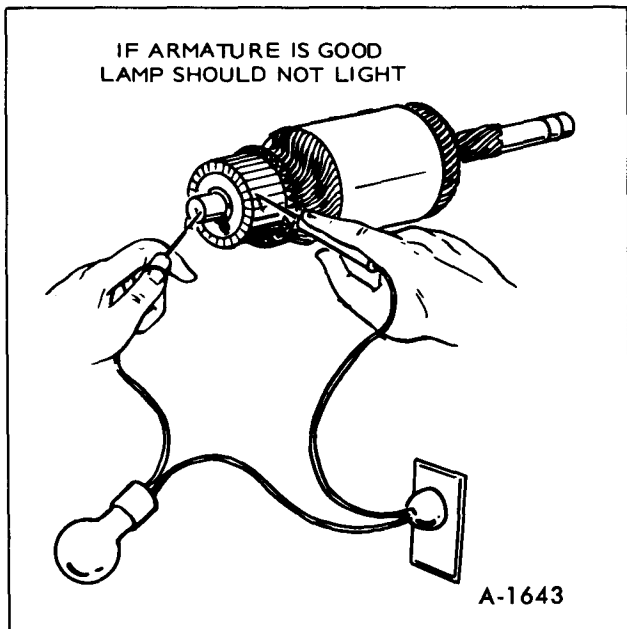


Figure 64—Testing for Grounded Armature

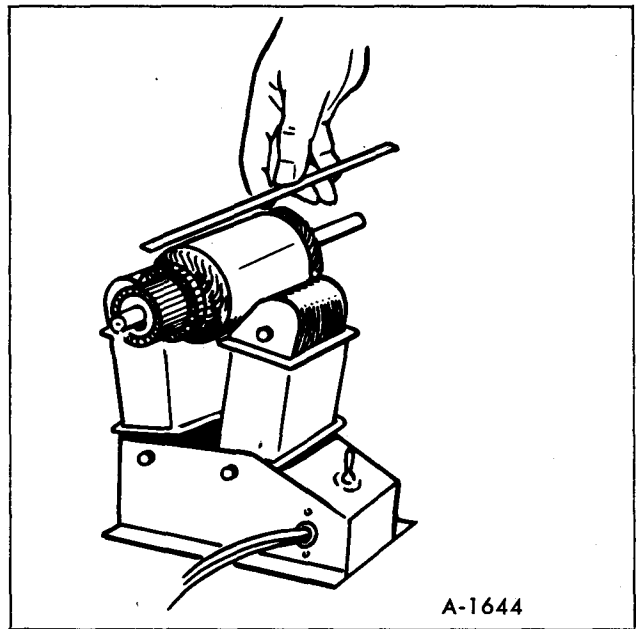


Figure 65—Testing for a Short Circuit

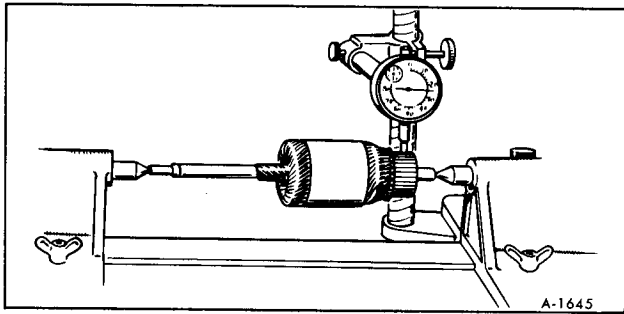


Figure 66—Testing Commutator Runout

OPEN ARMATURE: The most likely place to check for an open circuit is at the commutator riser bars. Inspect for loose connections on points where the conductors are joined to the commutator bars.

COMMUTATOR RUNOUT: Place armature in a pair of v-blocks and measure runout with a dial indicator refer to Figure 66. Measure both shaft and commutator. A bent shaft requires replacement of armature. When runout exceeds a .004 inch, commutator should be refaced. Remove only enough metal to provide a smooth, even surface.

OPEN FIELD COIL: Use a 120 volt test lamp set for this test. Connect one probe of test lamp to the yoke and the other probe to insulated brush. If lamp does not light, the field coil is open.

NOTE: This starter is compound wound, having a series coil and a shunt coil. The grounded end of the shunt coil is soldered inside of the yoke.

GROUNDING FIELD COIL: Use a 120 volt test lamp set for testing for a grounded field coil. First

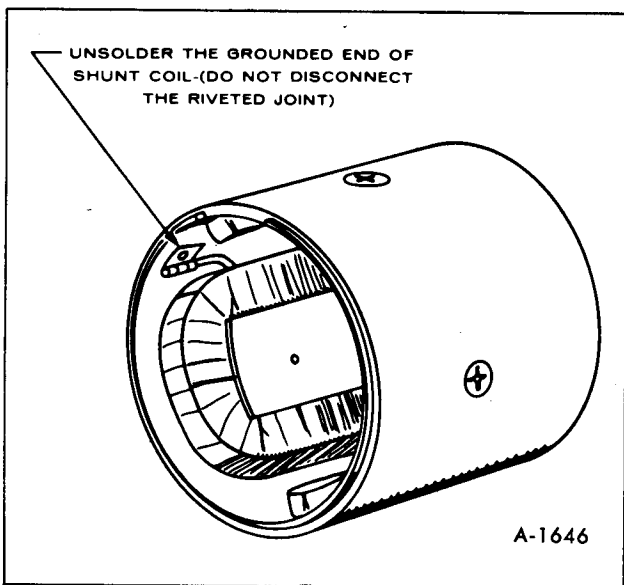


Figure 67—Testing Field Coil

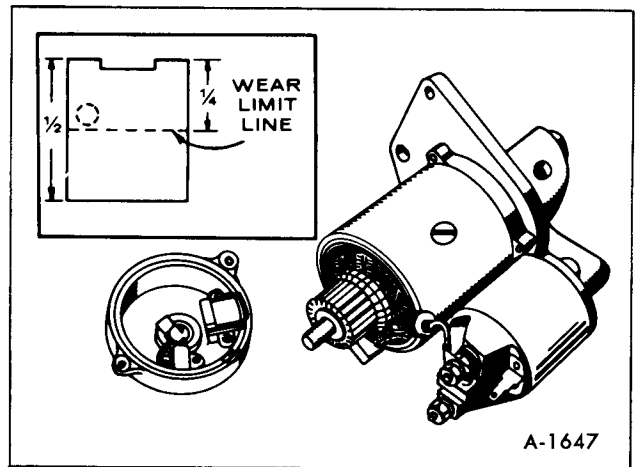


Figure 68—Brush Replacement

disconnect the grounded end of shunt coil as shown in Figure 67. Then connect one probe of test lamp to yoke and the other probe to field coil connector lead. If lamp lights, field coil is grounded.

BRUSH REPLACEMENT: Brushes that are worn out to the wear limit line should be replaced as shown in Figure 68. Brushes can be replaced after removing the rear bracket.

When resoldering the brushes, make a low resistance connection, using a high temperature solder and resin flux.

BRUSH SPRINGS: The spring tension should be taken using a push-type spring scale until the top of a new brush protrudes 1/16 inch from the brush holder. Spring tension should be 36 to 48 ounces on the 4KW and 49 to 59 ounces on the 6KW (See figure 69).

OVERRUNNING CLUTCH: The pinion gear should rotate smoothly in one direction (not necessarily easily), but should not rotate in opposite direction. If pinion gear does not function properly, or if pinion gear is worn or burred, replace the overrunning clutch.

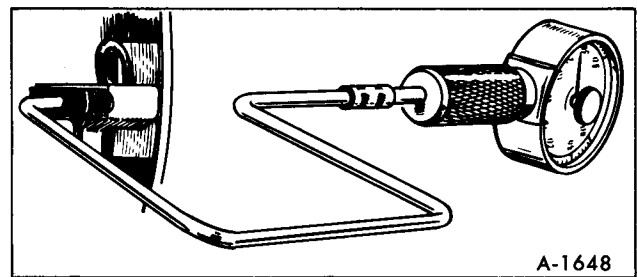


Figure 69—Testing Brush Spring Tension

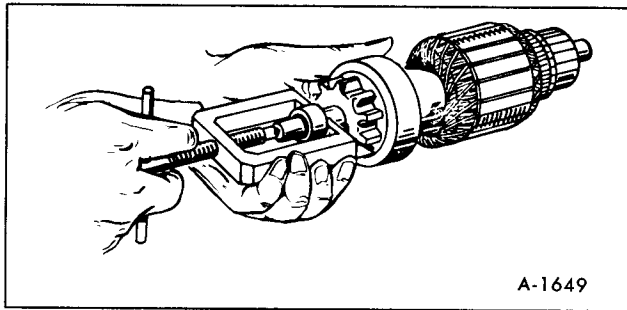


Figure 70—Installing Stop Ring

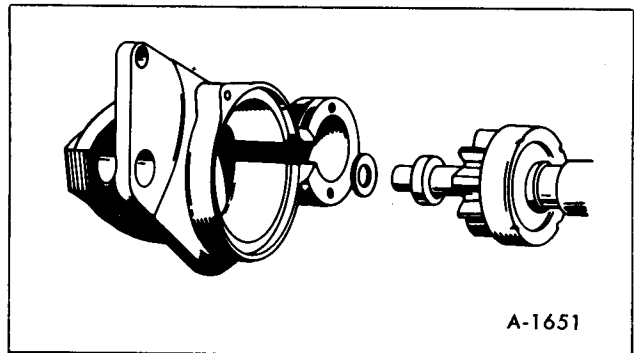


Figure 72—Installing Front Bracket

ASSEMBLY-4KW

1. Lubricate armature shaft and splines with a very light grade oil. A medium or heavy oil and grease may cause the overrunning clutch assembly faulty operation in cold weather.

2. Install the overrunning clutch assembly, the ring and the stop ring on the armature shaft. Drive pinion stopper far enough on shaft to install stop ring. Then using a puller (figure 70) pull stopper against ring.

3. Apply a small amount of lubriplate on the shift lever pivot pin and lever holders.

Install the shift lever over the clutch assembly with position indicated in Figure 71. This is important, if the shift lever is not properly positioned the pinion gear travel will be restricted causing a locking in the clutch mechanism.

4. Place the thrust washer on the drive end of the shaft. Slide the armature with the lever into the front bracket (figure 72).

5. Place the lever spring and the spring holder into the front bracket with the direction shown in Figure 73.

6. Position the Yoke to the front bracket. Be sure that the yoke is properly indexed to the front bracket (figure 74).

7. Place the thrust washer (steel) and washer (fiber) on the commutator end of shaft, and apply a small amount of lubriplate on the shaft (figure 75).

NOTE: In case three washers are used, the fiber washer is placed between the steel washers.

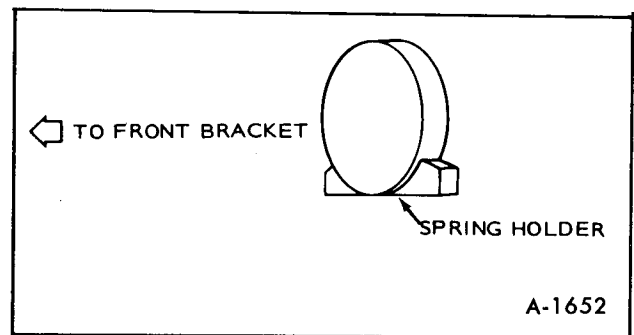


Figure 73—Spring Holder Placement

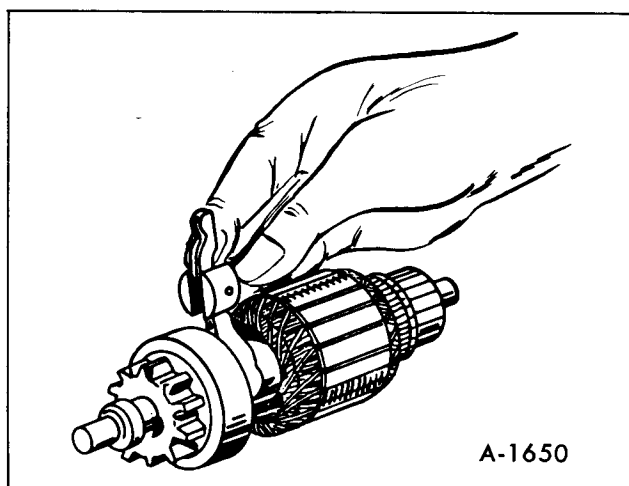


Figure 71—Installing Shift Lever

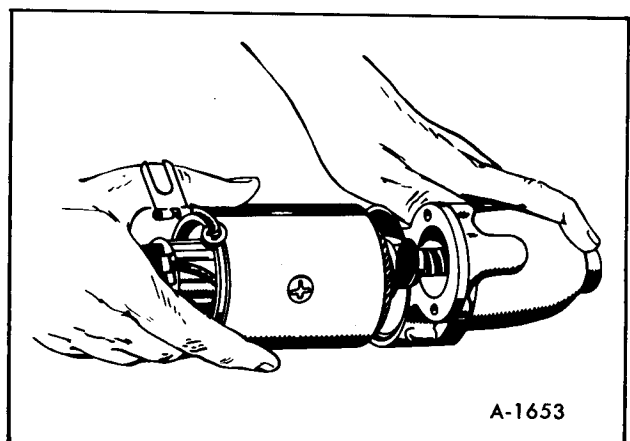


Figure 74—Yoke to Front Bracket Installation

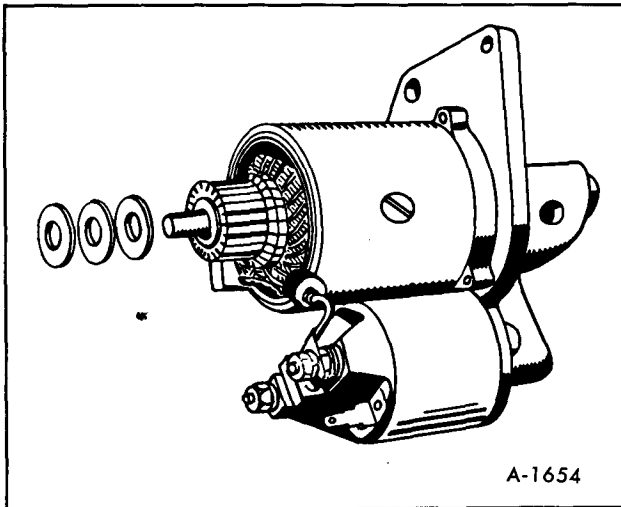


Figure 75—Installing Thrust Washers

8. Insert two brushes and springs in their brush holders and push them against spring tension.

Secure the brushes by iron wires as shown in Figure 76.

9. When securing the brushes, position the rear bracket to the yoke, inserting the rubber gasket to the slot of the rear bracket. After the rear bracket is installed to the yoke, withdraw iron wires so the brushes and the commutator come in contact. Then, insert the bushings into the holes to keep out dirt.

10. Fasten through bolts securely.

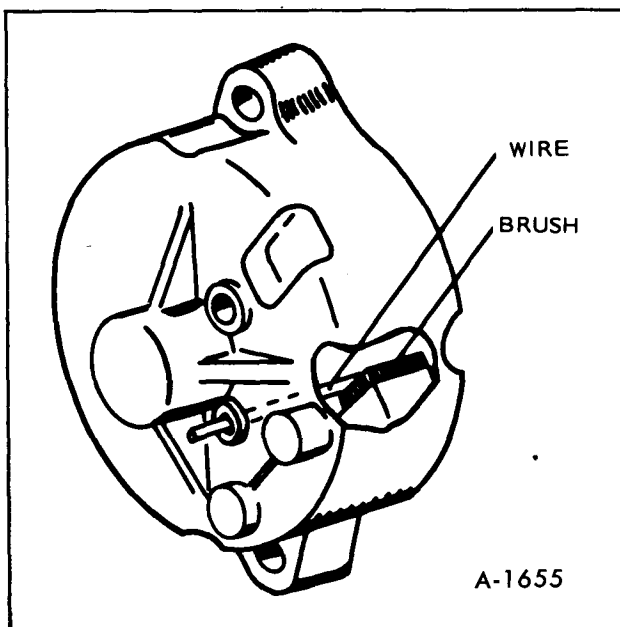


Figure 76—Brush Installation

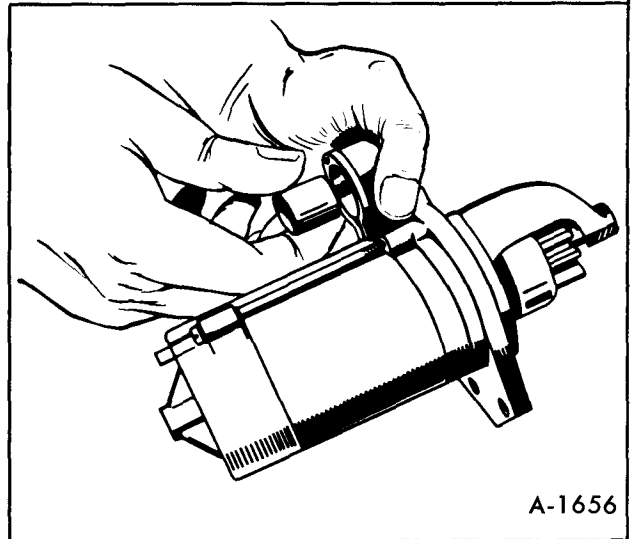


Figure 77—Installing Solenoid Plunger

11. Install the solenoid plunger over the top of the shift lever in the front bracket as shown in Figure 77. Be sure that the pinion gear is moved when the plunger is pulled manually.

12. Install the solenoid.

IMPORTANT: The return spring, in this case, should be straight in the proper position between the bore of the solenoid and the bore of the plunger.

ASSEMBLY — 6KW

1. Lubricate armature shaft splines with a very light grade oil. A medium or heavy oil and grease may cause the overrunning clutch assembly faulty operation in cold weather.

2. Install the overrunning clutch assembly, the ring and the stop ring on the armature shaft.

3. Apply a small amount of lubriplate on the shift lever pivot pin and the lever holders.

Install the shift lever over the clutch assembly with position as indicated in Figure 78. This is important, if the shift lever is not properly positioned the pinion gear travel will be restricted causing a locking in the clutch mechanism.

4. Apply a film of medium engine oil to the drive end of the armature shaft.

Place the thrust washer on the drive end of the shaft. Slide the armature with the lever into the front bracket.

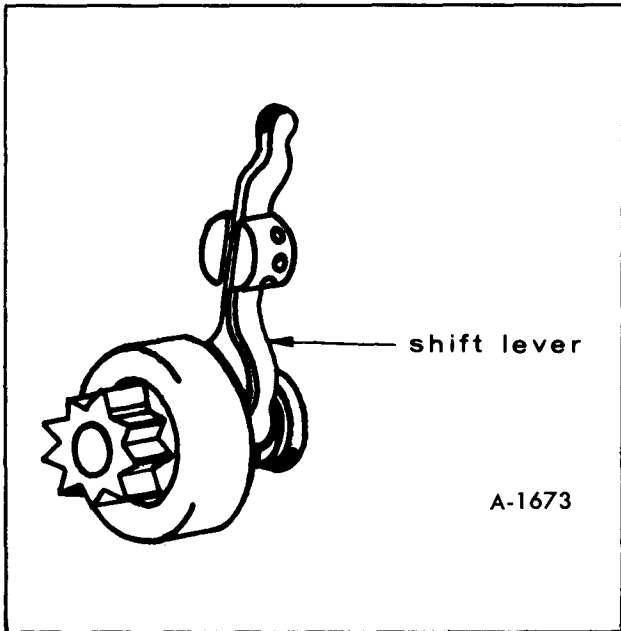


Figure 78—Shift Lever

5. Place the lever spring and the spring holder into the front bracket in the direction shown in Figure 79.

6. Before installing the yoke, note the position of the holes of front bracket in which the through bolts are fastened. Position the yoke to the front bracket. Be sure that the yoke is properly indexed to the front bracket.

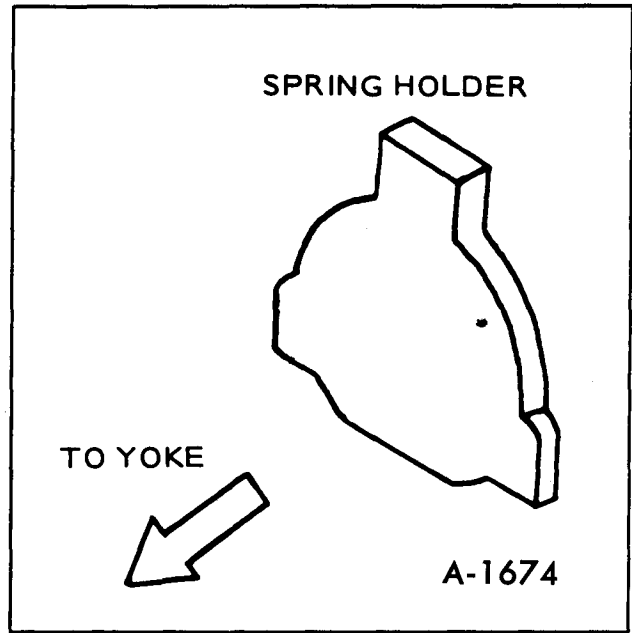


Figure 79—Spring Holder

7. Position the brush holder assembly indexing the cuts of the brush plate to the holes of the front bracket.

8. Install the brushes in their brush holders. Be sure to center the brush springs on the brushes.

9. Place the thrust washers on the commutator end of the armature shaft and apply a small amount of lubriplate on the shaft.

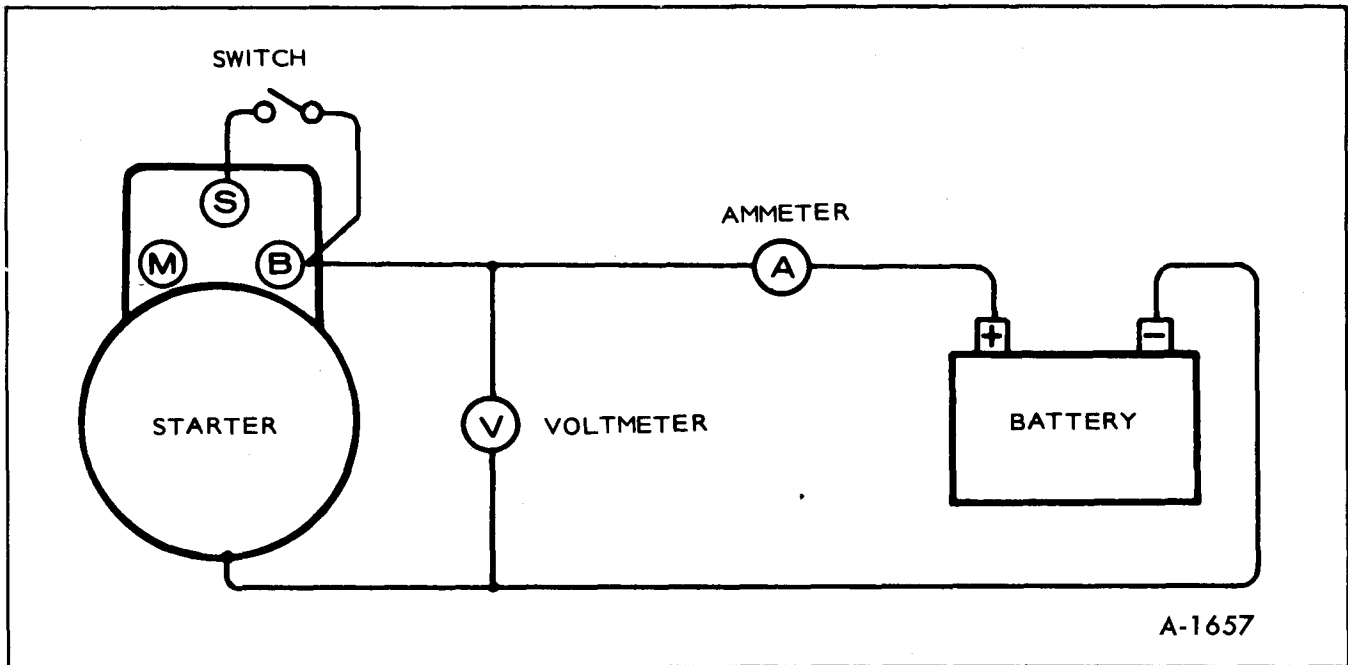


Figure 80—No Load Test

NOTE: The fiber washer is placed between the steel washers.

10. Position the rear bracket to the yoke, inserting the rubber gasket to the slot of the rear bracket.

11. Align the holes in brush plate with holes in the rear bracket and install two screws attaching the brush holder assembly to the rear bracket.

12. Fasten through bolts securely.

13. Install the solenoid plunger over the top of the shift lever in the front bracket. Be sure that the pinion gear is moved when the plunger is pulled manually.

14. Install the solenoid.

NOTE: The return spring, in this case, should be straight in the proper position between the bore of the solenoid and the bore of the plunger.

TESTING AND ADJUSTING STARTER

ADJUSTING PINION CLEARANCE: After

4KW:	
BATTERY VOLTAGE	11.5 Volts
MINIMUM RPM	6000 RPM
MAXIMUM CURRENT DRAW	55 Amps
6KW:	
BATTERY VOLTAGE	10.5 Volts
MINIMUM RPM	5000 RPM
MAXIMUM CURRENT DRAW	53 Amps

CAUTION: Before installing the starter, be sure starter and engine mounting surfaces are free of dirt and oil. These surfaces must be clean to make a good electrical contact. Don't operate the starter more than 30 seconds, or serious damage may result. Starters are not designed for continuous operation.

the starter is reassembled the pinion clearance must be adjusted to give sufficient clearance between the end of the pinion and the stop ring when the pinion is in mesh with the ring gear of the engine.

1. Connect a battery of the proper voltage between the "Switch" terminal of the solenoid and the bracket of the starter (ground), so the pinion will travel.

2. Then, push the pinion back until play is taken out of the lever and the clutch mechanism.

3. Measure the pinion clearance.

4. The clearance should be 0.02 to 0.08 inch. Adjust by removing the solenoid and increasing or decreasing the number of the fiber washers.

NOTE: Increasing the number of the washers decreases clearance, and decreasing the number of the washers increases clearance.

NO LOAD TEST: For this test connect starter as shown in Figure 80. The values of this test should be as follows:

When the engine does not rotate, don't hold the starter in a stall condition more than 10 seconds. The wires between the battery and the starter should be of sufficient size to carry the electric load without excessive voltage drop.

AC GENERATOR

The generator uses a revolving armature and normally needs little care other than a periodic check of the brushes and collector rings.

NOTE: All accessories must be taken off and power plant must be removed from its slide rails for disassembly and repair of the generator.

BRUSH REPLACEMENT

To gain access to brushes, remove plastic end bell screens. Measure brush wear as shown in Figure 81.

Using a small, narrow scale inserted into top of brush block. If brushes need replacing remove and tag wires connecting to brush blocks. Then remove brush blocks and lift out of end bell. Pull out the brushes and springs from bottom of brush block. Clean out any dirt or oil from brush block at this time.

New brushes are shaped to fit and seldom need sanding to seat properly. Always replace brushes as a set. Never use a substitute brush which may appear to be the same but may have entirely different electrical characteristics.

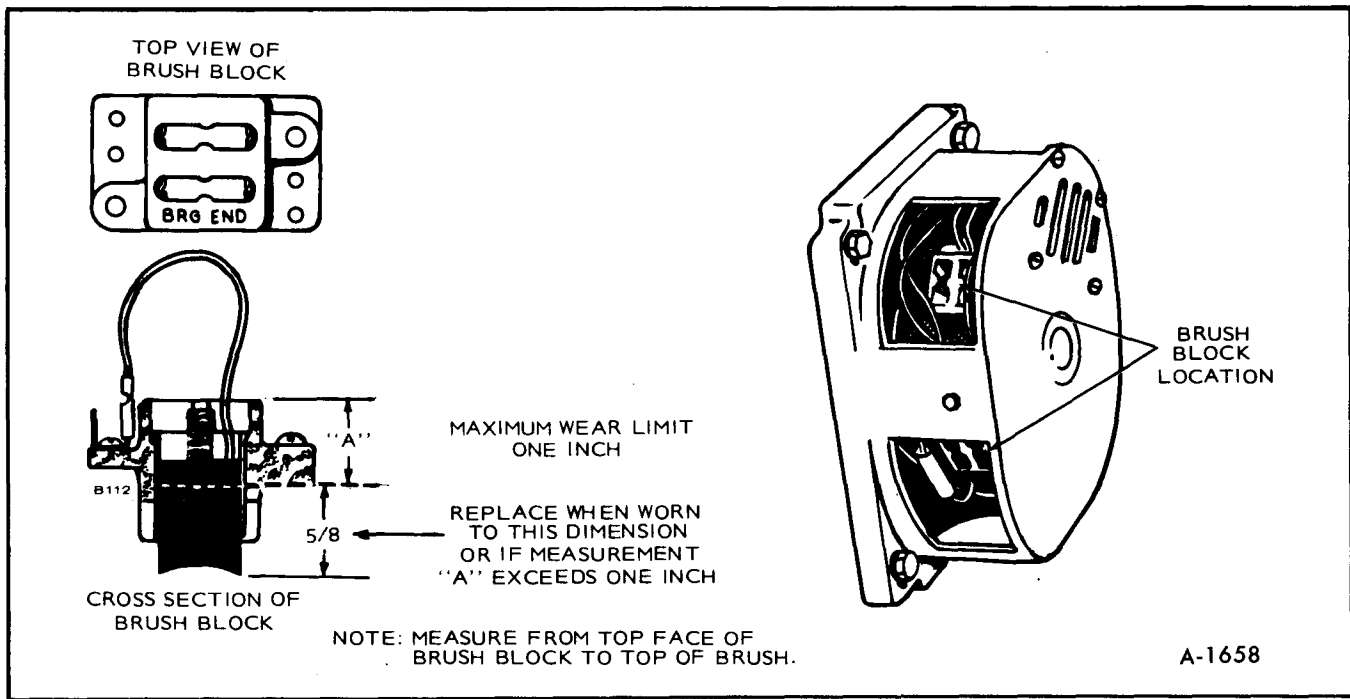


Figure 81—Brush Wear Limits

Note that brush blocks are stamped “BRG END” on one side. Be sure this stamped side faces bearing end of generator for correct brush alignment. Tighten the brush block screws to 40 — 70 in-lb. (4-6 ft-lb.) If some sparking occurs after replacing brushes, run the plant with a light load until brushes seat properly. Check brush springs for freedom of movement.

GENERATOR DISASSEMBLY (FIGURE 82)

1. Remove power plant from its slide rails.
2. Remove all accessories attached to the generator.
3. Tag and remove all leads.
4. Loosen and lift out both brush rigs.
5. Remove four generator through-stud nuts.
6. Lift or pull end bell from frame assembly. Do not pry loose with a screwdriver, use a plastic hammer and tap around edges of end bell to loosen.
7. Remove frame (field) assembly, being careful not to let it rest or drag on the armature.

CAUTION: *Four seals are used between frame (field) assembly and engine-to-gener-*

ator adapter. These seals must be installed when reassembling generator or the generator will overheat.

8. Using a square 3/8-inch drive, insert into 12-point (internal wrenching) armature hold-down nut and remove.

9. While pulling outward with one hand under the armature, strike a sharp end-wise blow on armature shaft to loosen armature. The armature has an internal taper which fits onto the external taper of engine adapter. If the armature does not come loose, place a heavy brass rod on the armature shaft near the ball bearing and strike a sharp downward blow on the rod with a hammer. Rotate the armature 1/2 turn before repeating.

CAUTION: *Do not strike the collector rings or bearing.*

GENERATOR TESTING AND REPAIR

ARMATURE GROUND TEST

Use a 120-volt series test lamp set for this test. Armature must be removed from generator for this test.

Place one test prod on one of the collector rings and the other test prod on the armature shaft. Test lamp should not light. If the test lamp lights, the AC

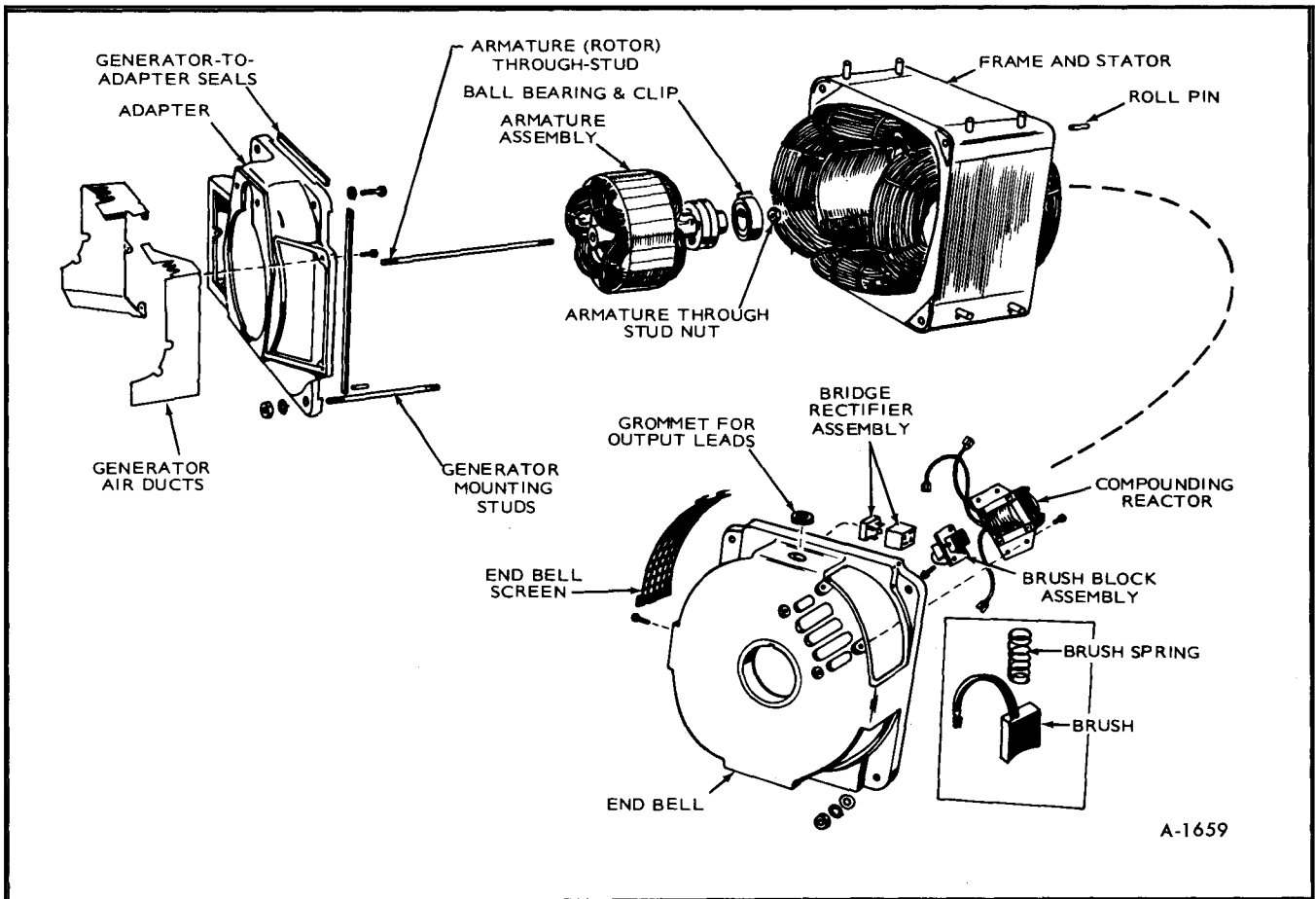


Figure 82—Generator Components

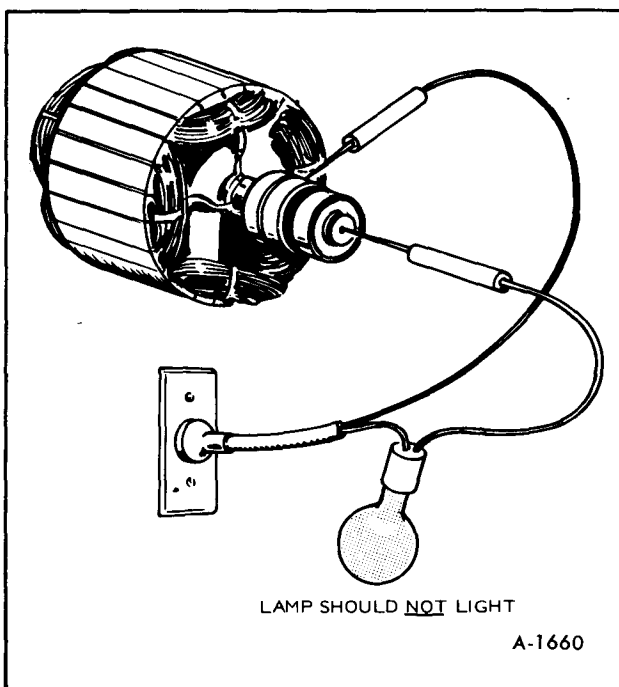


Figure 83—Armature Ground Test

winding or a collector ring is grounded to the shaft. Test both collector rings in this manner, refer to Figure 83.

ARMATURE OPEN TEST (FIGURE 84)

Use a 120-volt series test lamp set for this test. Place one prod on each collector ring. The test lamp should light. If lamp does not light, armature is open and must be replaced.

TESTING FIELD WINDINGS FOR GROUNDS (FIGURE 85)

To test the field assembly for grounds, disconnect all field leads and use a 120-volt series test lamp set. Touch one prod to F1 (+) and the other prod to the frame. Lamp should not light. If lamp lights, field is grounded and must be replaced. (Test F2 lead in the same manner.)

TESTING FIELD WINDINGS FOR AN OPEN CIRCUIT (FIGURE 85)

For this test use either an ohmmeter or a 120-volt series test lamp set.

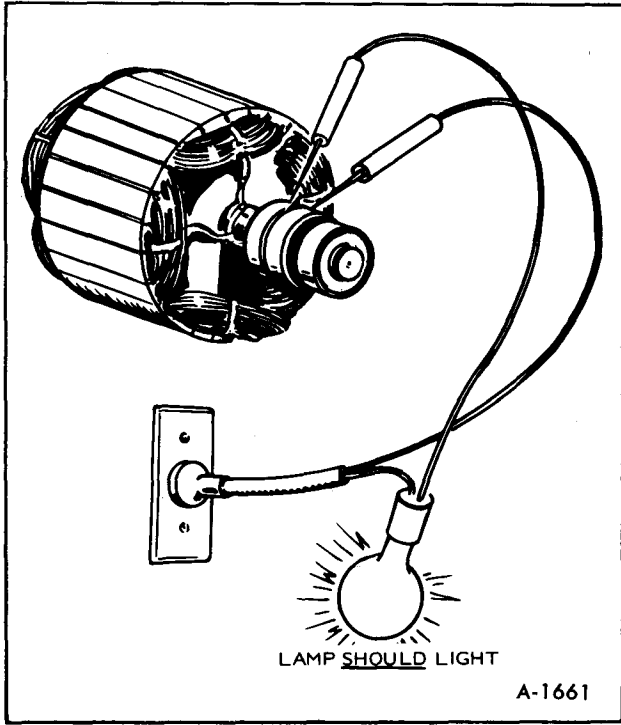


Figure 84—Armature Open Test

Using on Ohmmeter: Disconnect external leads and connect ohmmeter leads to F1 (+) and F2 (-). Resistance in the windings should read 28.8 ohms ($\pm 3\%$) for the 4KW and 38 ohms ($\pm 3\%$) for the 6KW.

Using a Test Lamp Set: Disconnect external leads and touch test prods to F1 and F2. The lamp should light. If not, field winding is open and must be replaced.

Check terminal ends closely for loose connections. These can be fixed easily without replacing the whole assembly.

TESTING BRIDGE RECTIFIER

To accurately test bridge rectifier proceed as follows:

1. Loosen No. 8-32 screw to remove bridge rectifier assembly (See figure 86 for location).
2. Disconnect the nylon connector from bridge rectifier assembly, noting the polarity marking of bridge rectifier assembly and connector.
3. Pull out from end bell and remove bridge rectifier from its case.

CAUTION: Note that connector can only be mounted in one direction.

4. Use an ohmmeter to test bridge rectifier. Set the ohmmeter dial to R x 1 scale.

5. Now place meter leads on points shown in Figure 87 and note readings from following table:

BLACK LEAD	RED LEAD	RE-SISTANCE
A	B	*8 ohms
A	D	*8 ohms
B	C	*8 ohms
D	C	*8 ohms
B	A	Infinity
D	A	Infinity
C	B	Infinity
C	D	Infinity

* $\pm 10\%$ — Readings taken at 70 F.

6. If any tests do not agree with the above readings, install a new bridge rectifier.

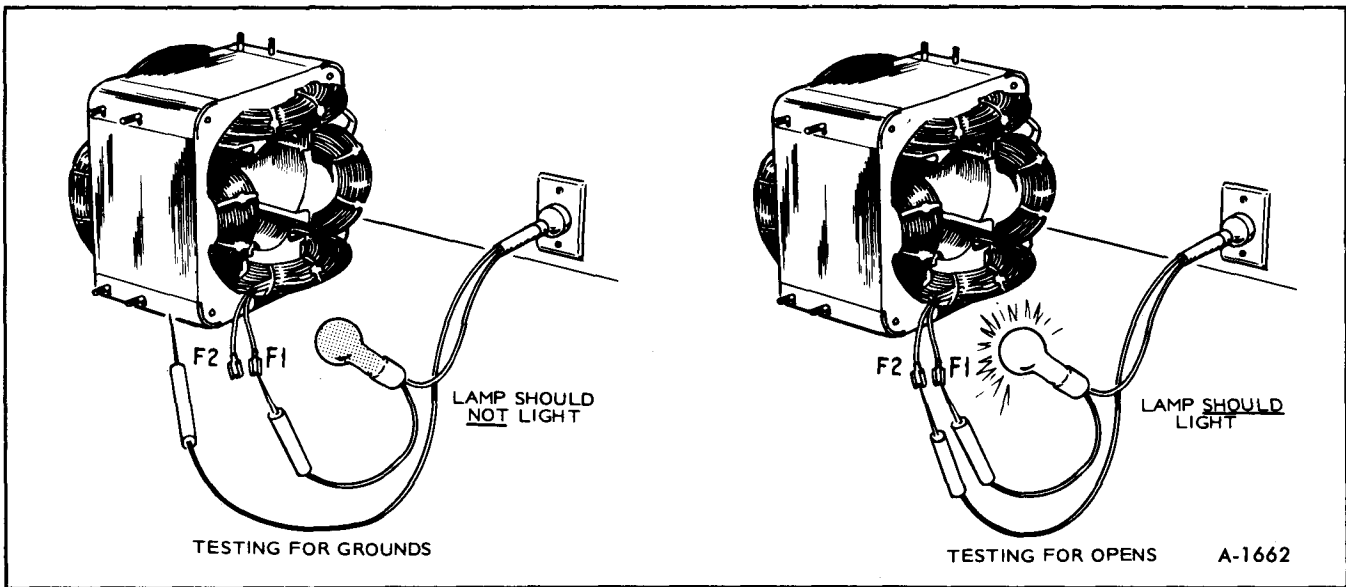


Figure 85—Testing Field Windings

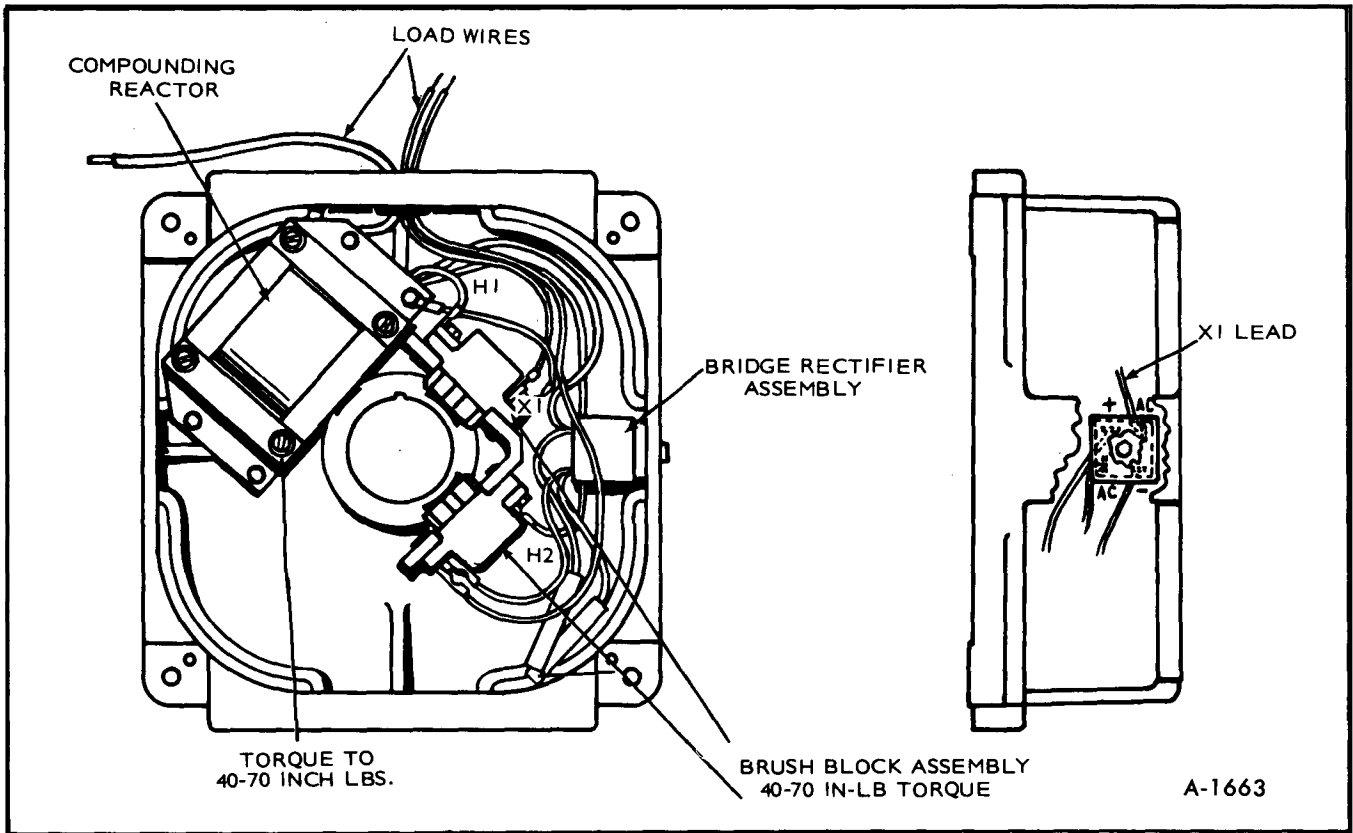


Figure 86—End Bell Assembly

CAUTION: All terminals are marked on both bridge rectifier and nylon case. Observe proper polarity when installing. If installed wrong, generator voltage will not build up.

normal operation. Do not attempt to maintain a bright, newly machined appearing surface. Ordinary cleaning with a dry, lint-free cloth is usually sufficient. Very fine sandpaper (#240) may be used to remove slight roughness. Use only light pressure on the sandpaper, while the plant is running. Do not use emery or carborundum paper or cloth. Clean out all carbon dust from the generator.

COLLECTOR RINGS

Collector rings acquire a glossy brown finish in

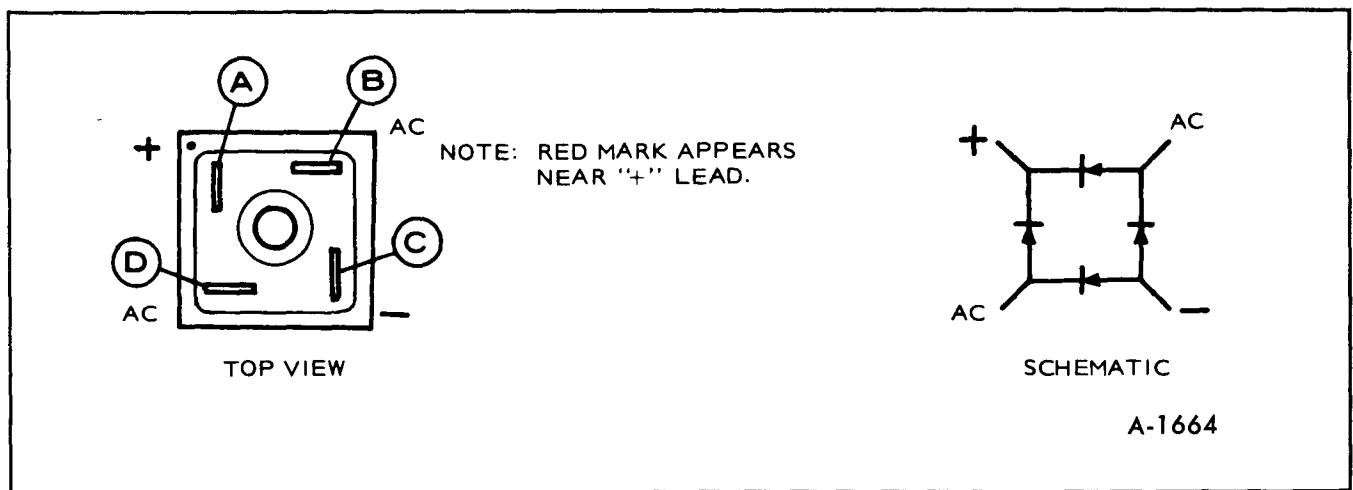


Figure 87—Testing Bridge Rectifier

GENERATOR BEARING

The generator is prelubricated and double-sealed. Replace bearing approximately every 5 years or at each engine overhaul.

COMPOUNDING REACTOR

If output voltage is high with no electrical load connected to the generator, with generator running at 1800 rpm, then the compounding reactor is probably defective. Test as shown in Figure 88, using a Variac.

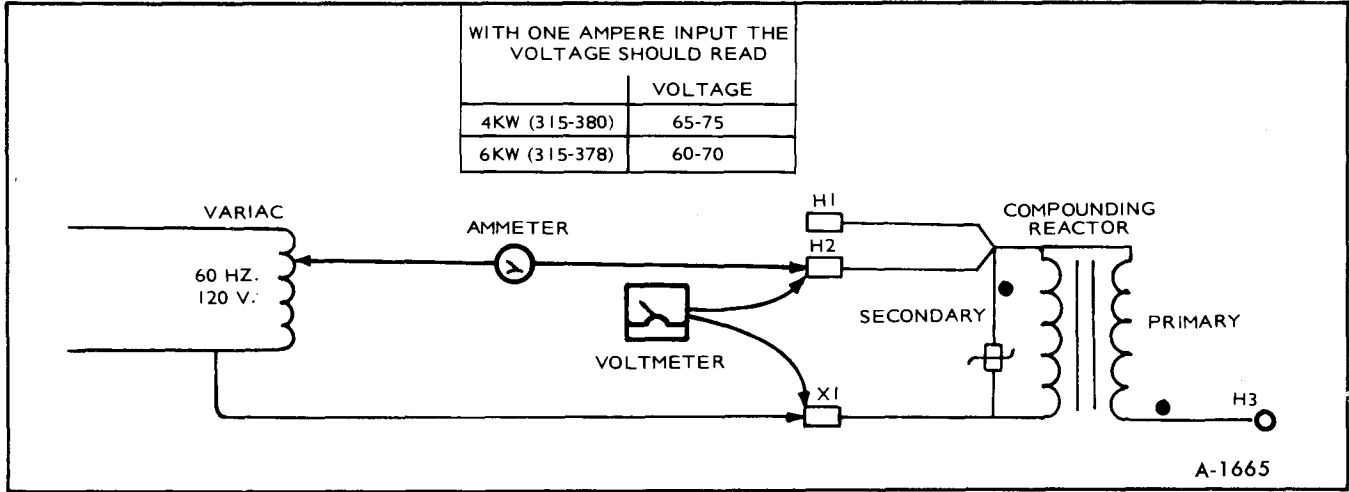


Figure 88—Testing Compounding Reactor

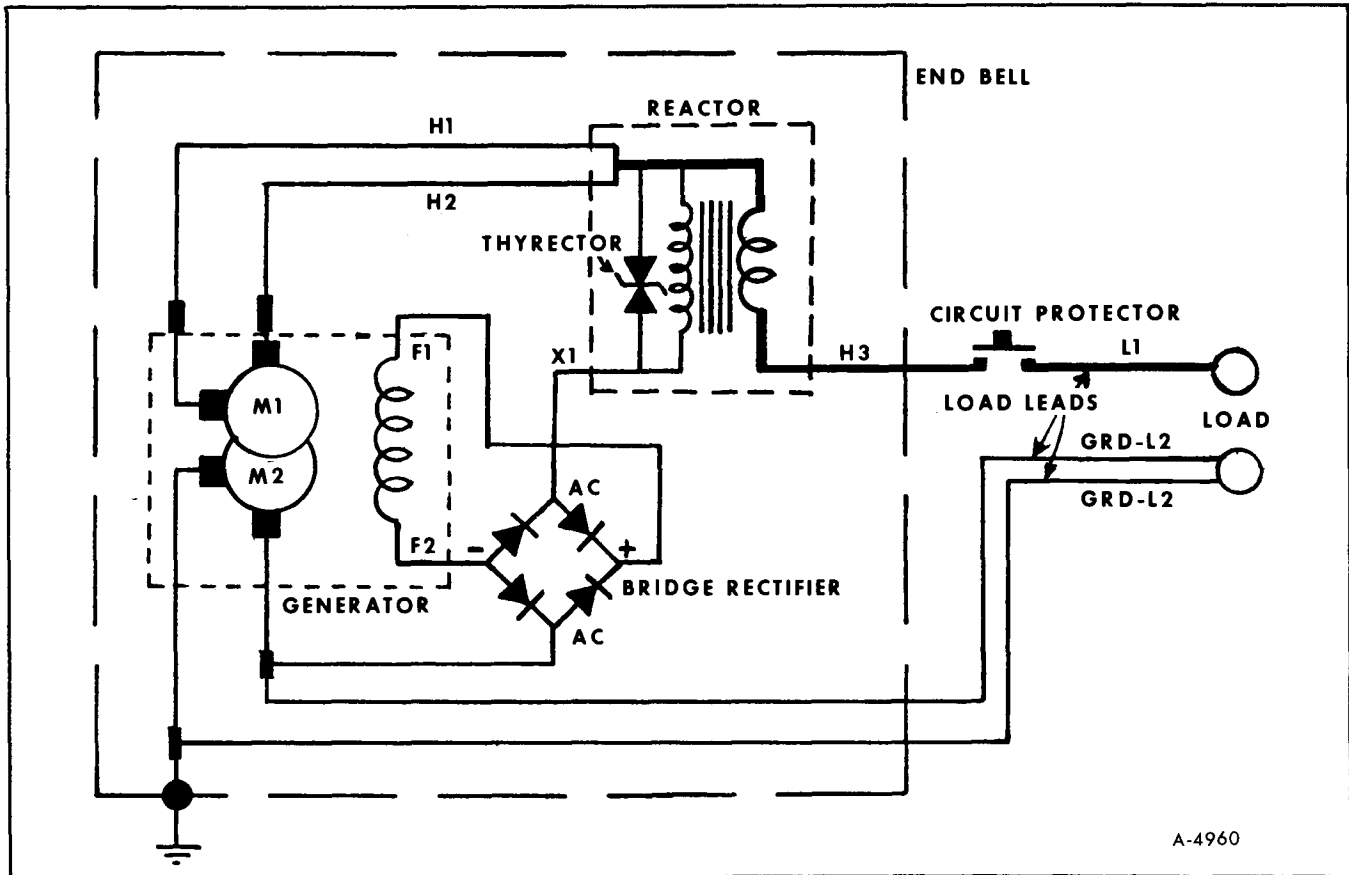


Figure 89—AC Generator Schematic

GENERATOR VALUES FOR 4KW

MODEL	TYPICAL N.L. VOLTS	TYPICAL F.L. VOLTS	N.L. VOLTS X1 to H1	N.L. VOLTS F1 to F2	RESISTANCE F1 to F2	RESISTANCE H1 to X1	CURRENT FULL LOAD
4KW	125	112	100 VAC	40V DC	28 Ohms	0.83 Ohms	33 Amps

GENERATOR VALUES FOR 6KW

MODEL	TYPICAL N.L. VOLTS	TYPICAL F.L. VOLTS	N.L. VOLTS X1 to H1	N.L. VOLTS F1 to F2	RESISTANCE F1 to F2	RESISTANCE H1 to X1	CURRENT FULL LOAD
6KW	123	113	80 VAC	50V DC	38 Ohms	0.85 Ohms	50 Amps

*N.L. — No Load
F.L. — Full Load

CONTROLS

OPERATION (FIGURE 90)

STARTING:

Push start switch S3. Battery current flows thru K1 solenoid, K2 contacts and start switch S3 to battery negative (GND). K1 solenoid closes contacts, feeding current to starter motor and to choke E1 plus K3 relay. K3 relay contacts close the circuit to the ignition coil T1 and fuel pump E2 plus fuel solenoid K4. The engine cranks and the fuel pump, fuel solenoid, and ignition operate to start the engine. The remote start switch is connected as shown in Figure 91.

NOTE: For details on control panel, refer to figures 92 and 93.

ENGINE STARTS:

When the starting rpm increases, the alternator develops a voltage great enough to be rectified and energize relay K2. Relay K2 contacts close to hold relay K3 energized, and K2 normally closed contacts open to drop K1 start solenoid. K3 contacts maintain current to ignition coil, fuel pump, and fuel solenoid. The engine continues running and K2 remains energized.

STOP ENGINE:

Relay K3, energized by K2, maintains ignition. To stop engine, push the stop switch which shorts out K3. Relay K3 drops out to remove power from the fuel pump, fuel solenoid and ignition coil. Resistor R2 absorbs the power that was supplied to K3 during the period the stop switch is held close as the engine slows to a stop.

LOW OIL PRESSURE SHUTDOWN:

The control has a built-in time delay of 2 to 4

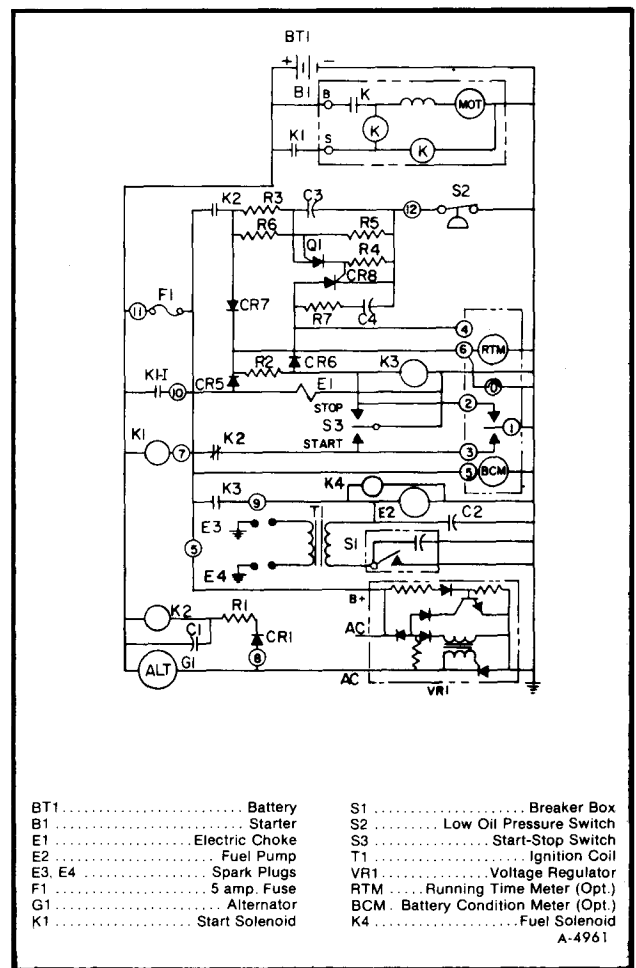


Figure 90—Control System Schematic

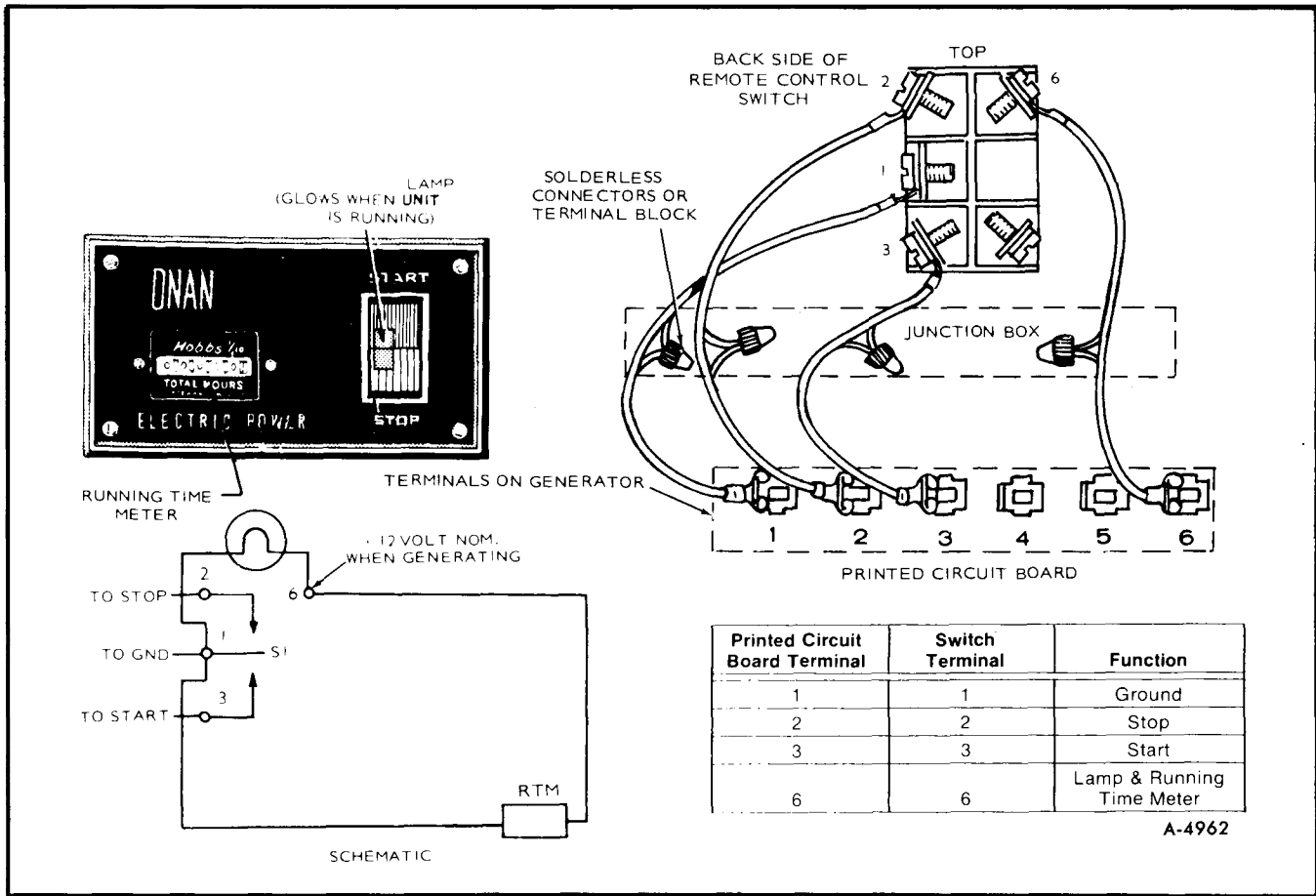


Figure 91—Remote Control Switch

seconds for a low oil pressure shutdown. If a low oil pressure condition occurs, the low oil pressure

switch S2 closes to charge capacitor C3 through resistor R3. When the voltage on capacitor C3 matches the voltage of the divider R5-R6, the programmable unijunction transistor Q1 "fires" to trigger CR8. CR8 turns on to de-energize K3 relay. K2 contacts open as the engine stops and CR8 turns off.

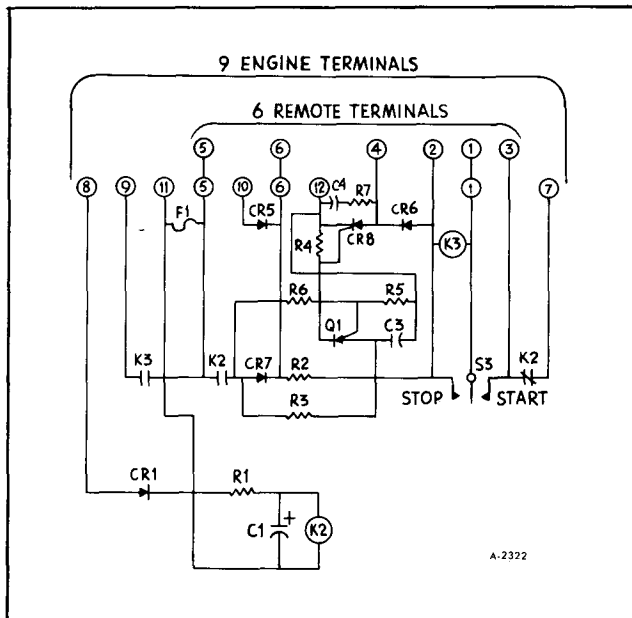


Figure 92—Control Panel Wiring

EMERGENCY START-STOP OPERATION

In an emergency situation the control board, either normal or defective, can be bypassed to start or stop the unit. To completely bypass all control board functions connect a jumper from terminals 9 to 11. This energizes the ignition and fuel pump. Then temporarily jumper terminals 1 and 7 to energize starter. Remove this jumper as soon as the engine starts and runs. **DO NOT** reconnect this jumper while the engine is running. To stop, remove the jumper from terminals 9 and 11.

CAUTION: This emergency operation *DOES NOT* provide fuse protection, start disconnect or low oil pressure shutdown and should not be used without monitoring the motor generator.

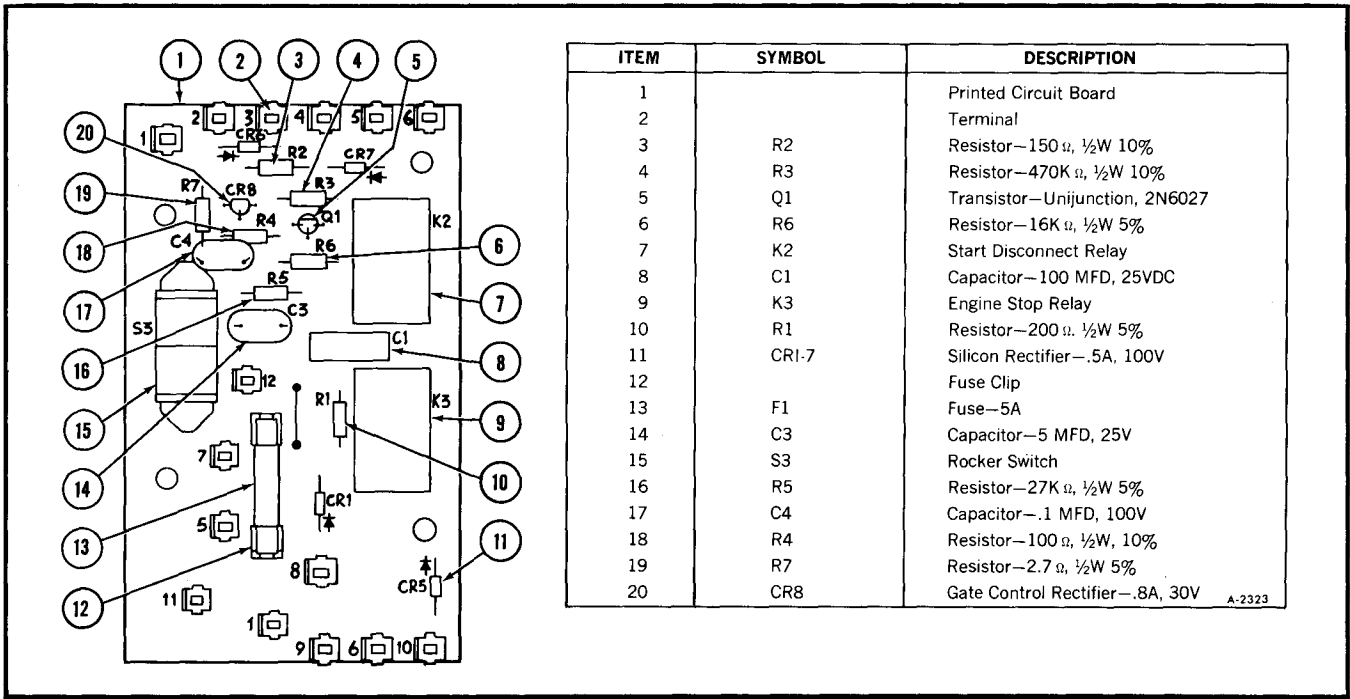


Figure 93—Control Panel

SPECIFICATIONS

4KW MODEL

ENGINE

Engine Manufacturer.....	Onan
Engine Design	Four Cycle, Air Cooled, L Head
Fuel Used	Unleaded or Low-Lead Regular Grade Gasoline
Number of Cylinders.....	Two
Bore	3-1/8 inch
Stroke	2-5/8 inch
Oil Capacity	3 quarts
(With Filter Change)	3-1/2 quarts
Battery Voltage	12 volt
Starting System	Solenoid Shift
Battery Charging System.....	9 amp Flywheel Alternator

GENERATOR

60 Hertz Recreational Vehicle Rating	4KW (4000 watts)
Voltage	120
Current Rating (Amperes)	33
Phase	Single
Wire	Two

TUNE-UP SPECIFICATIONS

Spark Plug Gap .....	.020"
Breaker Point Gap (Full Separation — Engine Cold) .....	.025"
Ignition Timing (Engine Not Running — Cold Setting)	26° BTC
Ignition Timing (Engine Running — Hot)	21° BTC
Tappet Adjustment (Engine Cold)	
Intake .....	.003"
Exhaust.....	.010"

STARTER

Engaging System Solenoid-operated Overrunning Clutch
 Nominal Output..... 0.68 Hp
 Rated Voltage D.C. 12 V.
 Field Connection Compound
 Direction of Rotation Counterclockwise (Viewing from pinion end)
 Weight 6.76 lbs.

6KW MODEL

ENGINE

Manufacturer Onan
 Design..... Four Cycle, Air Cooled, L Head
 Fuel Unleaded or Low-Lead Regular Grade Gasoline
 Fuel Pump 12V, Electric
 Cylinders Two
 Bore 3-9/16 inch
 Stroke 3 inch
 Oil Capacity 4 quarts
 (With Filter Change) 4-1/2 quarts
 Battery Voltage 12 Volt
 Battery Charging System..... 10 Ampere, Flywheel Alternator
 Starting System Solenoid Shift

GENERATOR

Manufacturer Onan
 Design..... Revolving Armature, Four Pole, 1800 rpm
 60 Hertz Recreational Vehicle Rating 6000 Watts (6KW)
 Voltage 120 Volts
 Current Rating..... 50 Amperes
 Phase Single
 Wire Two

TUNE-UP SPECIFICATIONS

Spark Plug Gap020 inch
 Breaker Point Gap (Full Separation)016 inch
 Ignition Timing (Engine Running or Static) 20° BTC
 Tappet Adjustment (Engine Cold)
 Intake003 inch
 Exhaust..... .012 inch

STARTER

Engaging System Solenoid-operated Overrunning Clutch
 Nominal Output..... 1.0 HP
 Rated Voltage D.C. 12 V.
 Field Connection Series
 Direction of Rotation Counterclockwise (Viewing from pinion end)
 Weight 3.7 lbs.

DIMENSIONS AND CLEARANCES

ALL DIMENSIONS & CLEARANCES GIVEN IN INCHES UNLESS OTHERWISE SPECIFIED.

Readings taken at 70° F.

4KW MODEL

	MINIMUM	INCHES	MAXIMUM
CYLINDER AND PISTON			
Piston to Pin (70°) .....	.0002	—	.0004
Pin to Connecting Rod Clearances .....	.0002	—	.0007
Piston Ring Gap in Cylinder .....	.010	—	.020

	MINIMUM	INCHES	MAXIMUM
Piston Clearance in Cylinder			
Solid Type-Measured			
.10 Below Oil Controlling			
Ring — 90° From			
Pin .....	.001	—	.003
Cylinder Bore-Honed Std.	3.1245	—	3.1255
CRANKSHAFT AND CAMSHAFT			
Crankshaft Main Bearing			
Journal to Bearing			
Clearance Steel Backed			
Aluminum .....	.0025	—	.0038
Crankshaft End Play .....	.006	—	.012
Camshaft End Play.....		.003"	
Crankshaft Rod Journal to			
Rod Bearing Clearance.			
Aluminum Rod .....	.0020	—	.0033
Connecting Rod End Play .....	.002	—	.016
Timing Gear Backlash.....	.002	—	.003
Oil Pump Gear Backlash .....	.002	—	.005
TAPPET AND VALVES			
Tappet to Cylinder Block			
Clearance .....	.0015	—	.0030
Valve Seat Width.....	1/32	—	1/8
Valve Stem to Guide —			
Intake.....	.0010	—	.0025
Valve Stem to Guide —			
Exhaust .....		.0025	
Valve Face Angle		44°	
Valve Seat Angle		45°	
Valve Tappet Clearance			
— Intake 70° F .....		.003"	
Valve Tappet Clearance			
— Exhaust 70° F .....		.010"	

6KW MODEL

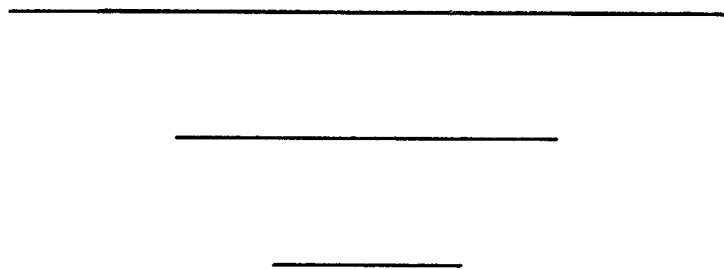
Valve Tappet Clearance			
Intake		0.003"	
Exhaust		0.012"	
Valve Stem in Guide — Intake.....	0.001"	—	0.0025"
Valve Stem in Guide — Exhaust	0.0025"	—	0.004"
Valve Spring Length			
Free Length		1.662"	
Compressed Length		1.375"	
Valve Spring Tension (lb)			
Open	71	—	79
Closed	38	—	42
Valve Seat Bore 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	0.7500"	—	0.7515"
Valve Seat Interference Width.....	1/32"	—	3/64"

	MINIMUM	INCHES	MAXIMUM
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 .....		.003"	
Camshaft Lift.....		.300"	
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-control- ling 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"
Crankshaft Main Bearing Journal — Standard Size.....	1.9992"	—	2.000"
Main Bearing Diameter	2.0015"	—	2.0040"
Main Bearing Clearance	0.0025"	—	0.0038"
Crankshaft Rod Bearing Journal — Standard Size.....	1.6252"	—	1.6260"
Cylinder Bore — Standard Size.....	3.5625"	—	3.5635"

TORQUE SPECIFICATIONS

4KW MODEL	FT.-LBS.
Connecting Rod Bolt — Aluminum Rod	14-16
Flywheel Mounting Screw.....	35-40
Oil Pump	7-9
Gearcase Cover	8-10
Rear Bearing Plate	25-27
Oil Base Mounting Screws	18-23
Cylinder Head Nuts	14-16
Manifolds — Intake and Exhaust	8-10
Starter Mounting Bolts	18-20
Spark Plugs	15-20
6KW MODEL	FT.-LBS.
Connecting Rod Bolts	27-29
Flywheel Mounting Screw.....	35-40
Oil Pump	7-9
Gearcase Cover	8-10
Rear Bearing Plate	19-21
Oil Base Mounting Screws	18-23
Cylinder Head Nuts	17-19
Intake Manifold.....	18-20
Exhaust Manifold	10-12

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SECTION 24D

REFRIGERATOR

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GENERAL INFORMATION

The Norcold seven and one-half cubic foot refrigerator will operate either on 12-volts D.C. or 120-volts A.C. This dual voltage refrigerator automatically switches from A.C. to D.C. or D.C. to A.C. When a power supply of at least 90 volts. A.C. is present at the refrigerator supply cord, the voltage selection relay is energized and disconnects the unit from D.C. operation. When the A.C. power supply is disconnected, the refrigerator automatically reverts to D.C. operation.

There is a circuit breaker incorporated in the 12-volt circuit of the refrigerator. It is located behind the kick plate below the refrigerator door. When the circuit breaker opens a small light will come on beside the breaker. The circuit breaker is reset by pushing IN on the red button next to the light.

The swing motor type compressor, operates on A.C. voltage only. An inverter-transformer assembly inverts 12-volts D.C. to 11 volts A.C., and then transforms this voltage to 23 volts A.C. This is then supplied to the swing motor compressor.

NORCOLD REFRIGERATOR TROUBLE DIAGNOSIS

Problem	Possible Cause	Correction
Compressor does not run.	<ol style="list-style-type: none"> 1. Fuse "blown" in living area fuse block. 2. Circuit breaker in refrigerator has "tripped." 3. Faulty electrical source. 4. Defective thermostat 5. Defective inverter assembly. 6. Open or short circuit in swing motor compressor. 	<ol style="list-style-type: none"> 1. Correct electrical problem that caused fuse to "blow" and replace fuse. 2. Correct electrical problem that caused circuit breaker to trip and reset circuit breaker. 3. Check A.C. and D.C. voltage source at the point where it enters the inverter assembly. The problem may lie in the source and not in the refrigerator. 4. Replace thermostat. 5. Replace inverter assembly. 6. Replace swing motor compressor.

Problem	Possible Cause	Correction
Insufficient cooling, compressor runs.	<ol style="list-style-type: none"> 1. Improper thermostat setting. 2. Overpacking of cabinet. 3. Insufficient heat radiation at condenser. 4. Excess frost build up in freezer compartment. 5. Freon overcharge or undercharge. 6. Insufficient voltage source. 7. System "Freeze-up" or clogging. Clogging is indicated by a warm evaporator plate, a condenser at room temperature, and a low amp draw by the compressor. 	<ol style="list-style-type: none"> 1. Turn thermostat to higher setting. A setting of "3" should be adequate at ambient temperatures of 70° — 90°. When storing frozen food in freezing compartment a setting of "5" is recommended for the above temperature conditions. 2. Space must be left in between food to allow for proper convective heat transfer. 3a. At ambient temperatures above 110°F. the condenser will not be able to radiate enough heat to maintain sufficient cooling, even with a setting of "5". <ol style="list-style-type: none"> b. Dust may have collected on condenser restricting air flow and must be removed. 4. A frost build up of over one quarter inch should be avoided. Defrost refrigerator. 5. Can be determined by testing compressor amperage. In either case the entire cooling system must be replaced. 6. Check A.C. and D.C. voltage supply. 7. Shut-off system and let it cool down, start-up system let it run for 5 minutes, shut-off system for 5 minutes. Restart system. If system does not function repeat cycling. If this does not relieve the clog replace entire system.
Refrigerator too cold, compressor runs constantly.	<ol style="list-style-type: none"> 1. Thermostat "sticking". 2. Thermostat sensing bulb loose on evaporator plate mounting. 	<ol style="list-style-type: none"> 1. Replace thermostat 2. Tighten mounting screws to make sure bulb has good contact with evaporator plate.

COMPONENT TESTING

COMPRESSOR VOLTAGE

The voltage is checked at the compressor terminals with an A.C. voltmeter (figure 1).

NOTE: A standard A.C. voltmeter will read a high A.C. compressor voltage on D.C. operation. The reason being the inverter does not produce a true sine wave on D.C. operation. The

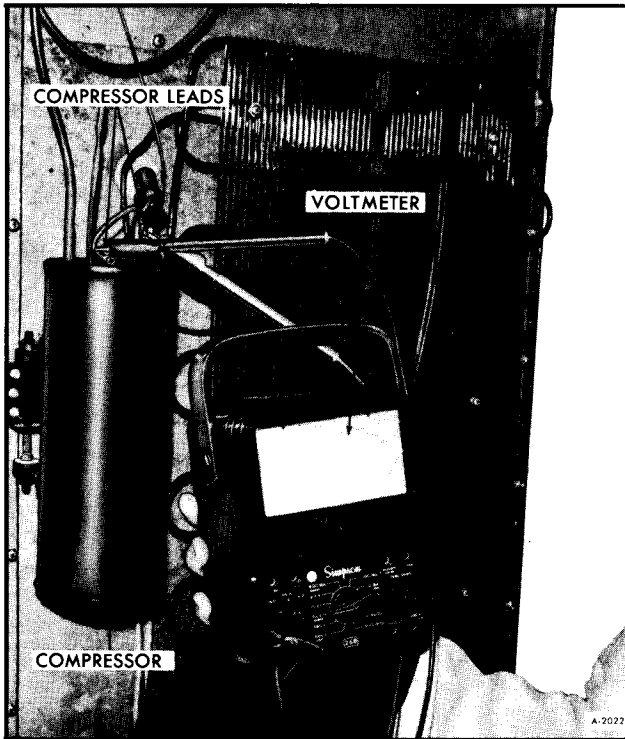


Figure 1—Checking Compressor Voltage

120-volt A.C., 60 cycles/sec., will produce a true sine which an A.C. voltmeter is designed to read.

A.C. OPERATION

Using a standard A.C. voltmeter the voltmeter reading should be 22 to 24 volts.

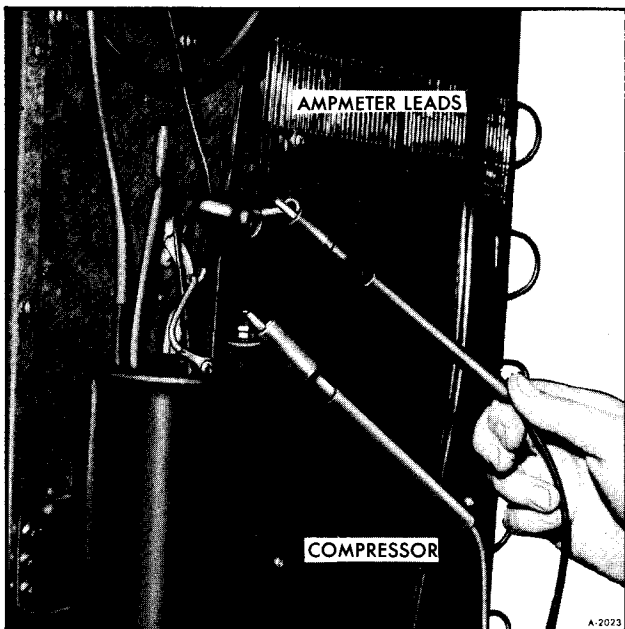


Figure 2—Checking Compressor Amperage

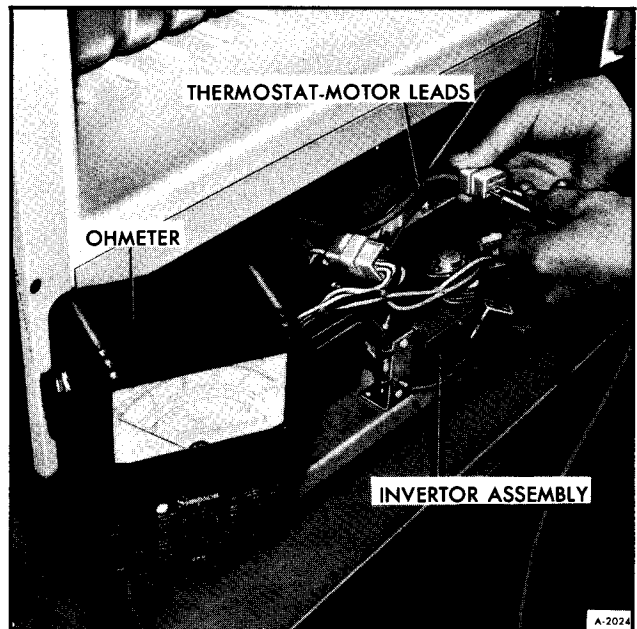


Figure 3—Checking Thermostat at Inverter

If the voltage at the compressor is not adequate the voltage source should be checked.

D.C. OPERATION

Using a standard A.C. voltmeter the voltmeter reading should be 31.5 to 33.5 volts.

COMPRESSOR AMPERAGE

One method of determining whether or not the

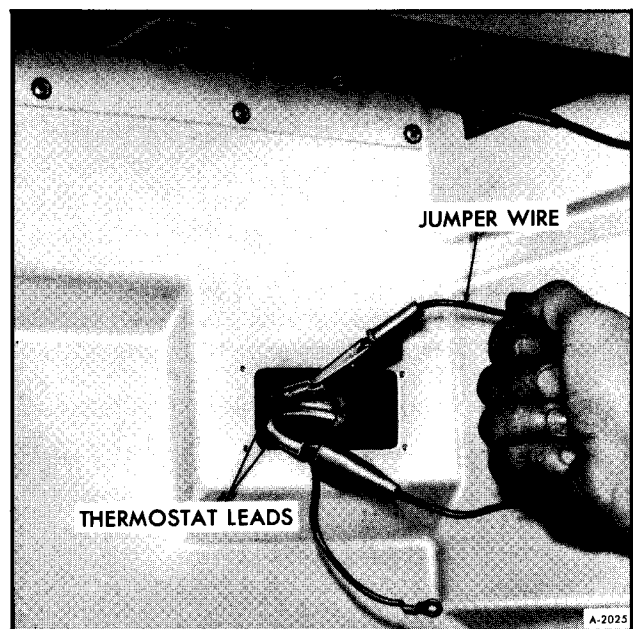


Figure 4—Jumper Wire at Thermostat

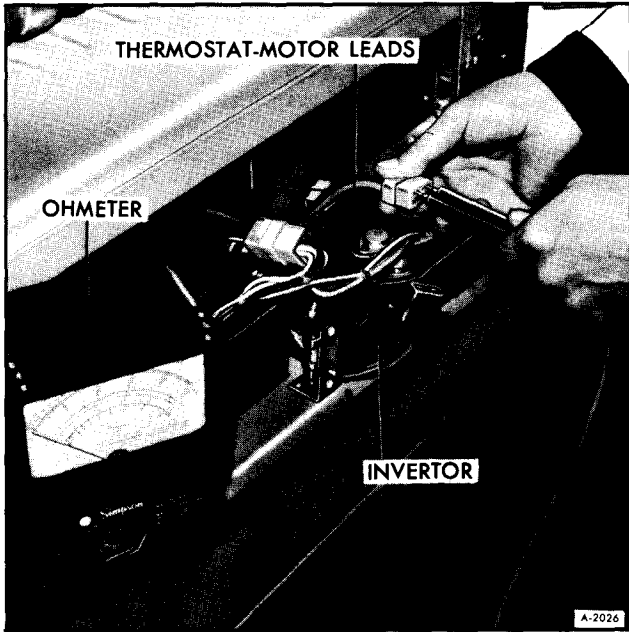


Figure 5—Testing Compressor Resistance

proper amount of freon is in the cooling unit is to measure the number of amps drawn by the compressor when connected to a 120-volt source.

This is done by removing one of the compressor leads and connecting a 0-5 ammeter in series with the compressor (figure 2), a reading of approximately 2.6 amps should be read.

If the amperage reading is high, this is an indication the system is undercharged. If a low reading is obtained the system is overcharged. If it is determined that the system is under or overcharged the entire cooling system must be replaced.

REFRIGERATOR REPLACEMENT

REMOVAL

1. Remove door(s).
2. Remove kick plate from front of refrigerator.
3. Disconnect 12-volt source at electrical connector, which is located behind kick plate. Also unplug 120-volt plug from from receptacle.
4. Remove four screws from sides of refrigerator as shown in Figure 6.
5. Slide unit out, and remove from vehicle.

INSTALLATION

1. Position unit in opening.
2. Install four retaining screws (figure 6).

TESTING THERMOSTAT

The thermostat may be tested by two different methods.

The first method is, gain access to the inverter assembly. Pull this assembly from the bottom of the refrigerator and disconnect the gray thermostat motor leads. Connect an ohmmeter to the thermostat leads (figure 3) and turn the thermostat to "5". There should be continuity. If not replace thermostat.

Another method is, to remove thermostat assembly from inside cabinet and connect a jumper wire between the two lead wires as shown in Figure 4. If the compressor begins to run replace the thermostat.

INVERTER ASSEMBLY

Remove the inverter assembly from the bottom of the refrigerator. Unplug wiring harness from inverter assembly. Install new inverter assembly, and turn on refrigerator. If refrigerator now functions properly the old inverter assembly was faulty and the new inverter assembly should remain installed in the refrigerator.

SWING MOTOR COMPRESSOR RESISTANCE

At inverter assembly disconnect thermostat-motor leads. Connect a suitable ohmmeter across motor leads as shown in Figure 5. A reading of 2-3 ohms should be obtained. If the reading does not fall within this range the motor contains an open or a short. Then, entire cooling unit must be replaced.

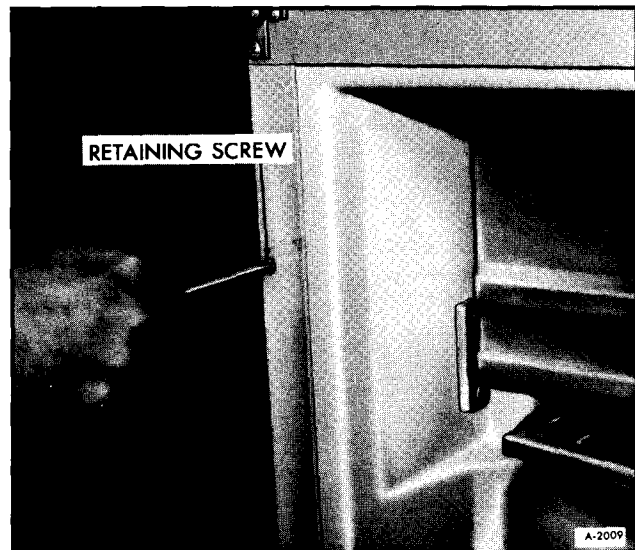


Figure 6—Removing Refrigerator Retaining Screws

3. Reconnect 12-volt electrical connector behind kick plate. Plug 120-volt plug into receptacle.

4. Install kick plate.

5. Install door(s).

COMPONENT REMOVAL

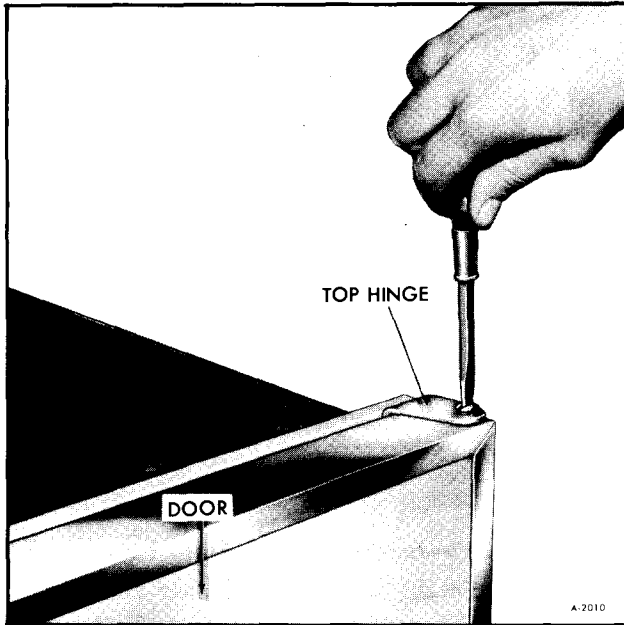


Figure 7—Removing Top Door Hinge

DOOR REMOVAL

1. Remove screw top of freezer door hinge, release travel lock (figure 7).

2. Tilt top of freezer door out and lift door off hinge (figure 8).

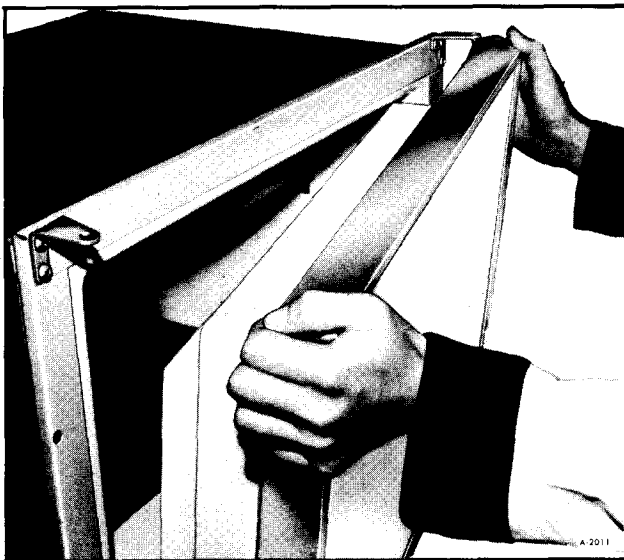


Figure 8—Removing Door

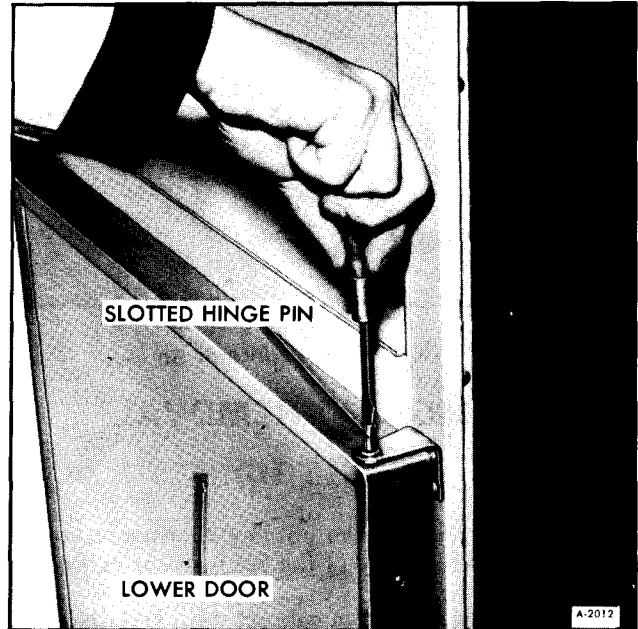


Figure 9—Removing Center Hinge Pin

3. Top of hinge pin is slotted to accept a screw driver. Remove this hinge pin (figure 9).

4. Tilt lower door out at its top and lift off bottom hinge pin.

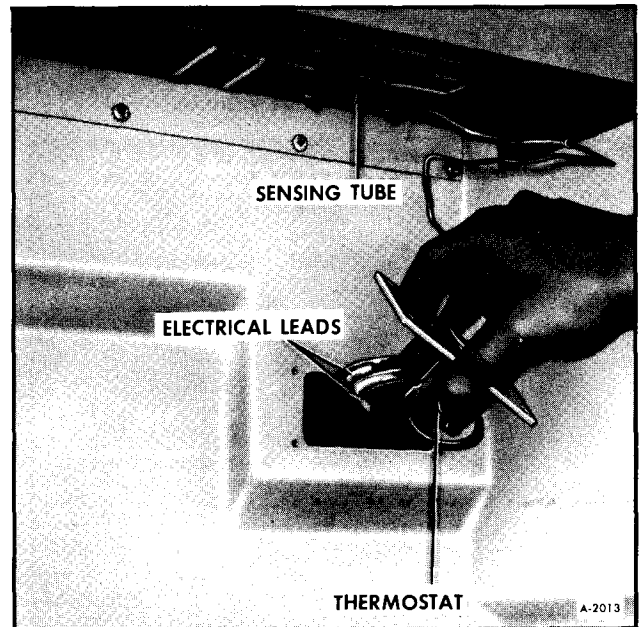


Figure 10—Removing Thermostat

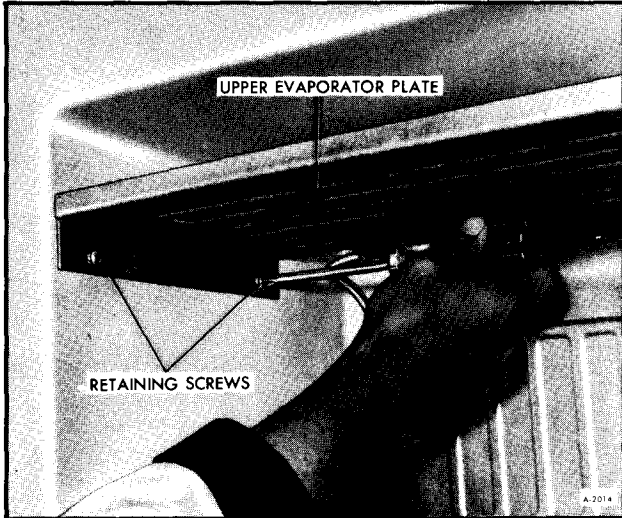


Figure 11—Removing Evaporator Screws

THERMOSTAT REMOVAL (FIGURE 10)

1. Remove four screws holding thermostat and its face plate to the back of the refrigerator cabinet.
2. Pull thermostat from cabinet wall, and disconnect three electrical leads from back of thermostat. Remove sensing tube from freezer tray.
3. Pull control knob off, and remove face plate from thermostat by removing retaining nuts and bolts.

COOLING UNIT REMOVAL

1. Remove refrigerator from vehicle.

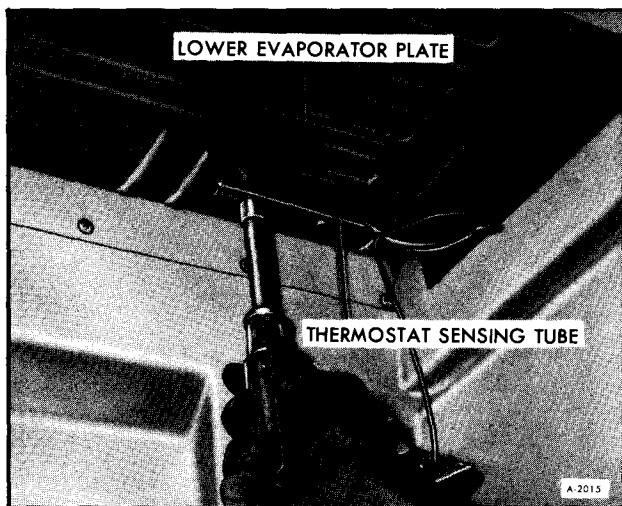


Figure 12—Removing Thermostat Sensing Tube

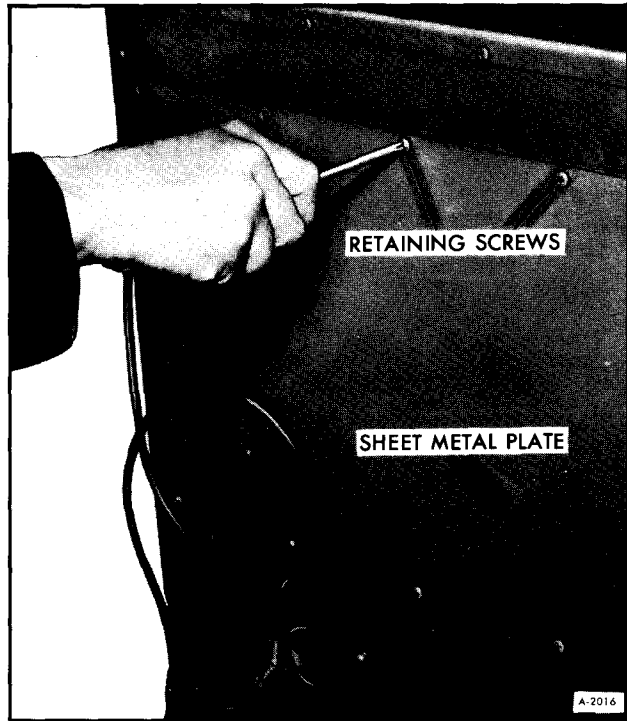


Figure 13—Removing Sheet Metal Plate

2. Remove eight screws from upper and lower evaporator plates, four screws in each (figure 11).
3. Remove thermostat sensing element from lower evaporator plate by removing two screws (figure 12).
4. Disconnect electrical leads to the compressor.

CAUTION: Care must be taken when removing or installing electrical leads to the compressor. The bottom nuts must not be loosened or tightened as the seals at these points may be damaged.

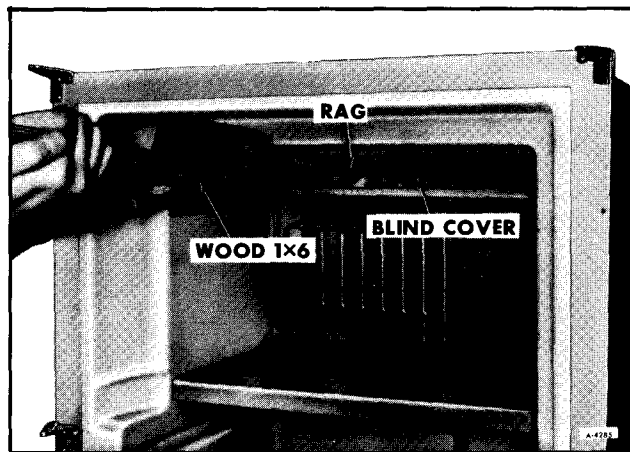


Figure 14—Loosening Cauling Seal on Blind Cover



Figure 15—Removing Blind Cover

5. Remove putty from opening where capillary tube and discharge tube pass through back of cabinet.

6. Remove sheet metal plate from back of refrigerator as shown in Figure 13.

7. Remove eight retaining screws from condenser.

8. Remove mounting screws from compressor.

9. Remove blind cover by performing the following:

a. Wrap the end of a 3-foot, wood 1 x 6 with a rag. Then firmly tap on blind cover as shown in Figure 14, to loosen caulking type seal.

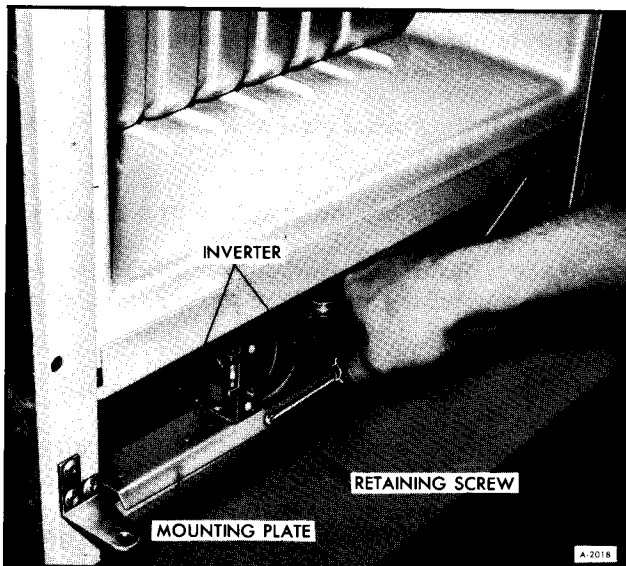


Figure 16—Removing Inverter Assembly



Figure 17—Disconnecting Wiring

b. Then carefully remove blind cover (See figure 15).

10. Pull evaporator plates through opening and remove cooling unit as an assembly.

INVERTER ASSEMBLY REMOVAL

1. Remove kick plate.

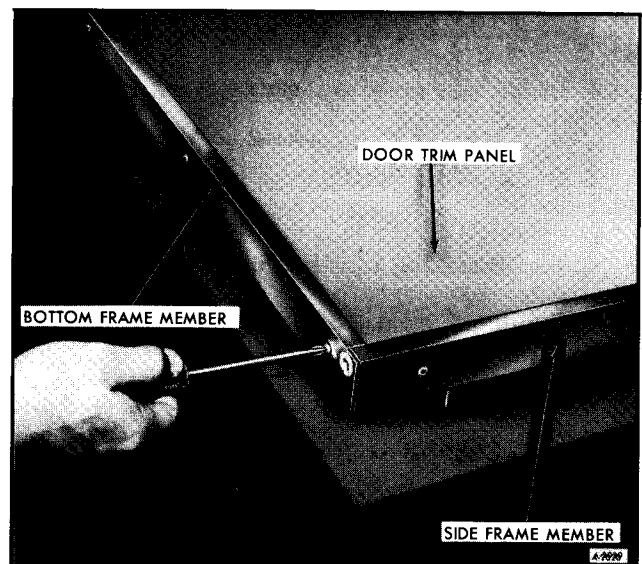


Figure 18—Removing Bottom Frame

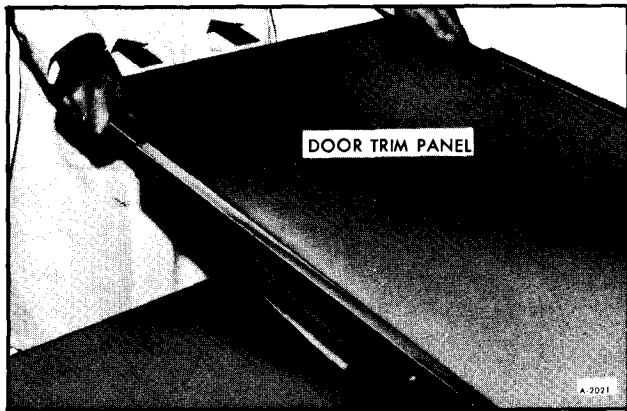


Figure 19—Removing Trim Panel

2. Remove screw at front of inverter assembly mounting plate (figure 16). Lift assembly out of refrigerator.

3. Disconnect wiring from back of assembly (figure 17).

DOOR PANEL REMOVAL

1. Remove door(s) and place door on flat surface liner side down.

2. Remove bottom frame member by removing three screws, as shown in Figure 18.

3. Loosen three screws on both side frame members.

4. Trim panel can now be removed by sliding it out the bottom (figure 19).

COMPONENT INSTALLATION

DOOR INSTALLATION

1. Place lower door on bottom hinge pin and push door to its normal position.

2. Install center hinge pin (figure 9).

3. Place freezer door on its lower hinge pin and push door to its normal position.

4. Install top hinge pin and secure travel lock.

2. Place inverter assembly in position and secure with screw at mounting plate, as shown in Figure 16.

3. Install kick plate.

THERMOSTAT INSTALLATION

1. Install face plate to thermostat with two nuts and bolts.

2. Install three electrical leads shown in Figure 10.

3. Install sensing tube to freezer tray.

4. Position thermostat on cabinet wall and secure with four screws.

5. Install control knob.

INVERTER ASSEMBLY INSTALLATION

1. Connect wiring as shown in Figure 17.

COOLING UNIT INSTALLATION

1. Through opening in back of refrigerator position evaporator plates in cabinet.

2. Install mounting screws in compressor.

3. Install blind cover in rear opening (See figure 15). Tape in place.

4. Install sheet metal plate over rear opening (figure 13).

5. Install eight mounting screws in condenser.

6. Apply sealer (non-hardening caulking) to seal hole where capillary and return tubes pass through.

7. Connect electrical leads to compressor.

8. Install thermostat sensing tube to bottom of lower evaporator plate.

9. Secure evaporators with eight screws (figure 11).

10. Install refrigerator in MotorHome.

DOOR PANEL INSTALLATION

1. Slide panel up into position through the bottom.

2. Tighten screws on side frame member.

3. Install bottom frame member and secure with three screws (figure 18).

4. Mount door(s) back on refrigerator.

NORCOLD SPECIFICATIONS

Model	7.5 Cubic Ft.
Power Compressor Amps Required Compressor Volts Required (A.C. Operation) Compressor Volts Required (D.C. Operation) Compressor Motor Resistance Compressor Motor Speed Inverter Output Transformer Output Input Voltage Refrigerant Refrigerant Charge	60 Watts 2.6 Amps 22 to 24 Volts A.C. 31.5 to 33.5 Volts A.C. 2-3 Ohms 60 Strokes/Sec. 11 Volts A.C. 23 Volts A.C. 12 Volts D.C. or 120 Volts A.C. R12 3.17 Ounces

SECTION 24E ROOF MOUNTED AIR CONDITIONER

Contents of this section are listed below:

SUBJECT	PAGE NO.
General Information	24E-1
Safety Warnings.....	24E-5
Electrical Diagnosis	24E-6
Refrigeration System Diagnosis	24E-10
Cleaning Air Conditioner	24E-13
Air Conditioner Replacement	24E-13
Refrigeration System Service.....	24E-13
Special Tools	24E-15
Specifications	24E-15

GENERAL INFORMATION

DESCRIPTION

There are three configurations of roof mounted air conditioners. Two of these are single unit, and the other is a two unit system.

The single units are 1) a Mark IV unit (figure 1) with a 13,500 BTU rating 2) a Duo-Therm (figure 2) with a 13,500 BTU rating.

The two unit system has a Duo-Therm with a 13,500 BTU rating, forward mounted, and another

Duo-Therm unit with a 11,000 BTU rating, rear mounted.

The refrigerant system consists of four major components: The compressor, the condenser, the capillary tube, and the evaporator. The components are connected by copper tubing and refrigerant circulates within this closed system.

COMPRESSOR (FIGURE 3)

The compressor pumps the refrigerant through the discharge line toward the condenser, and pulls

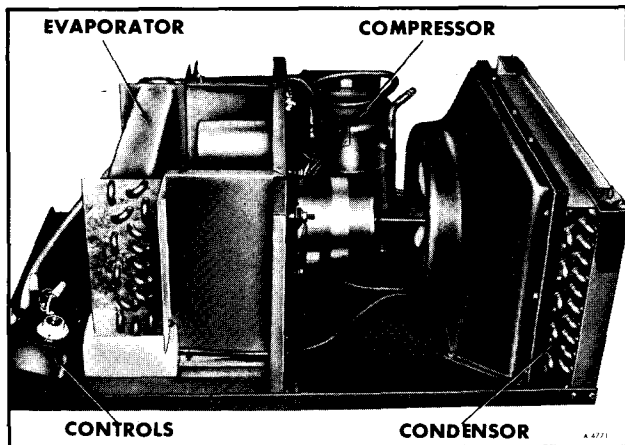


Figure 1—Mark IV Air Conditioner (Shroud Removed)

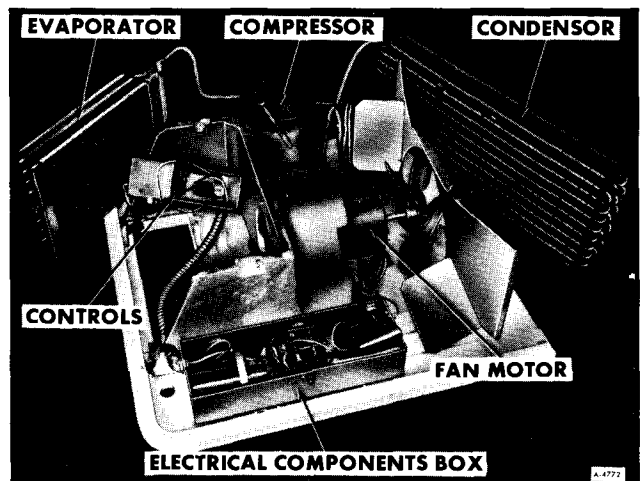


Figure 2—Duo-Therm Air Conditioner (Shroud Removed)

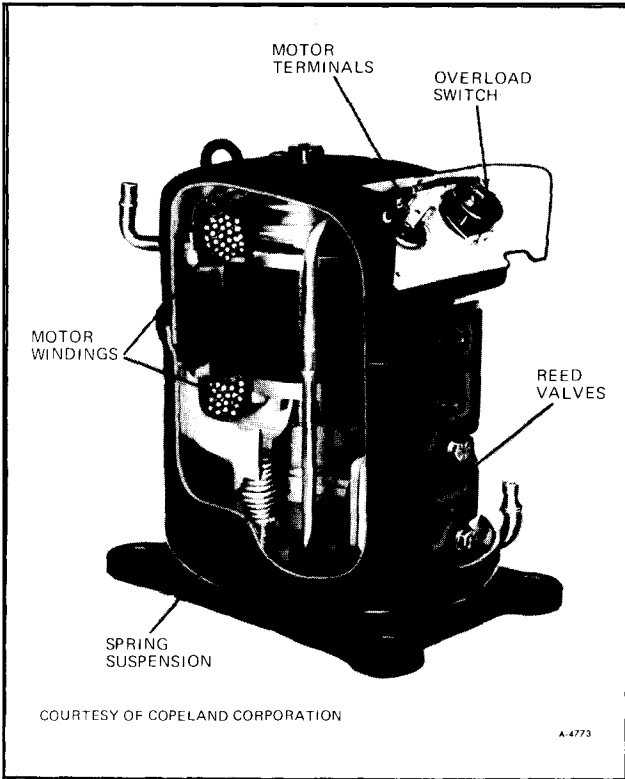


Figure 3—Compressor (Typical)

the refrigerant through the suction line from the evaporator.

It has a piston connected to the motor shaft by a connecting rod. The valves are reed type like those used in two cycle gasoline engines. The oil has been refined for a very low moisture and wax content to make it suitable for use in compressors. The compressor has motor, start, and run windings plus an overload switch.

CONDENSER (FIGURE 2)

The condenser transfers heat from the high pressure, high temperature, refrigerant gas inside the tubes to the outside air flowing across the fins. As the refrigerant gives up heat, its temperature decreases until, at this pressure, it reaches the point at which the gas condenses into a liquid. The liquid refrigerant then leaves the condenser and is forced through the capillary tube into the evaporator coil.

CAPILLARY TUBE (FIGURE 4)

The capillary tube is a metering device for converting high pressure liquid refrigerant into low pressure liquid refrigerant. It is a long thin copper tube from the evaporator to the condenser. The refrigerant charge is critical. Precise charging of an exact amount is required. Excess refrigerant will cause unit

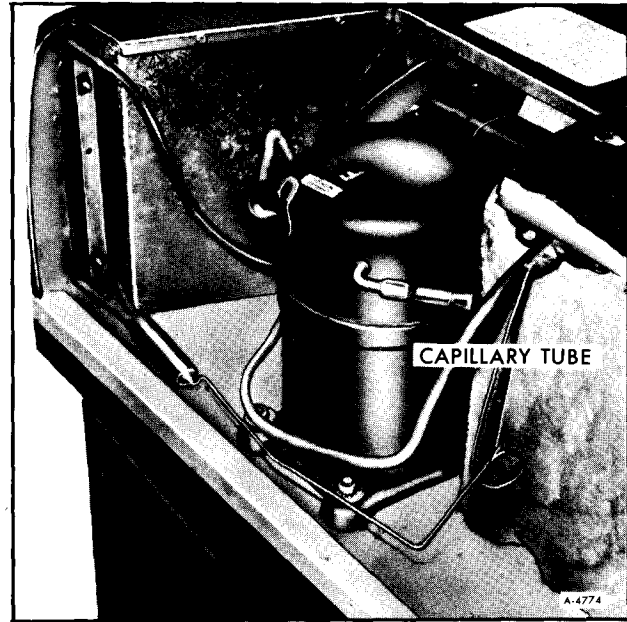


Figure 4—Capillary Tube (Typical)

to frost back on the low or suction side during off cycle.

EVAPORATOR (FIGURE 2)

Refrigerant-22 will boil at low temperature when it is under low pressure. In the evaporator at 70 psi gauge pressure, it will boil or vaporize at about 40°F. (4.4°C.) The vehicle interior air being blown across the fins of the evaporator by a fan or blower will lose its heat to the cold liquid refrigerant as the latter rapidly changes to a gas.

A typical air conditioning system is shown in Figure 5.

ELECTRICAL COMPONENTS (FIGURES 6 and 7)

BLOWER SWITCH (MARK IV)—Rotary type with high fan, low fan, high cool, low cool, and off positions.

BLOWER SWITCH (DUO-THERM)—Rotary type with high fan, medium fan, low fan, high cool, medium cool, low cool, and off positions.

THERMOSTAT—Return air sensing type to control inside vehicle temperature and prevent evaporator freeze up.

POTENTIAL (OR START) RELAY—After starting unit, closed points will open, breaking electrical current

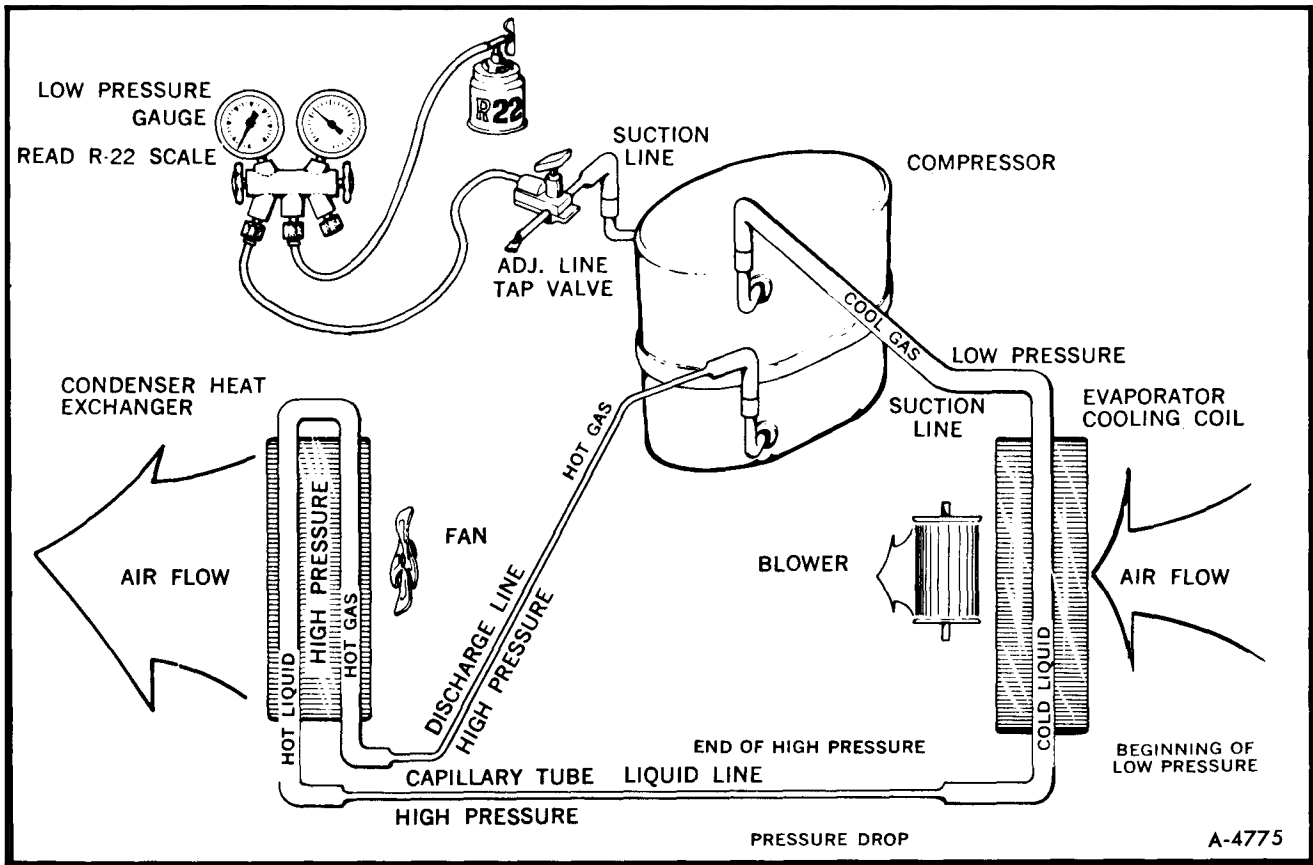


Figure 5—Typical Air Conditioning System

through compressor start capacitor thus causing current to flow only through compressor run capacitor.

COMPRESSOR START CAPACITOR—Is used to throw the start and run windings current out of phase to create the torque required to start the motor. It is designed for intermittent usage and is disconnected when the motor comes up to speed.

COMPRESSOR RUN CAPACITOR—Is designed for continuous duty. It increases motor efficiency while improving power factor and reducing amperage.

OVERLOAD PROTECTOR—External protector is connected in series with compressor and all power to the compressor passes through the protector. The protector is designed to carry normal starting and operating currents. The bi-metal disc is affected by both current and shell temperatures and will disconnect the compressor if either becomes excessive.

FAN MOTOR RUN CAPACITOR—Is designed for continuous duty. It increases motor efficiency while improving power factor and reducing amperage.

TIME DELAY RELAY—(DUO-THERM)—Is designed to energize after an approximately two minute delay, to

allow the refrigeration system to equalize before compressor starts.

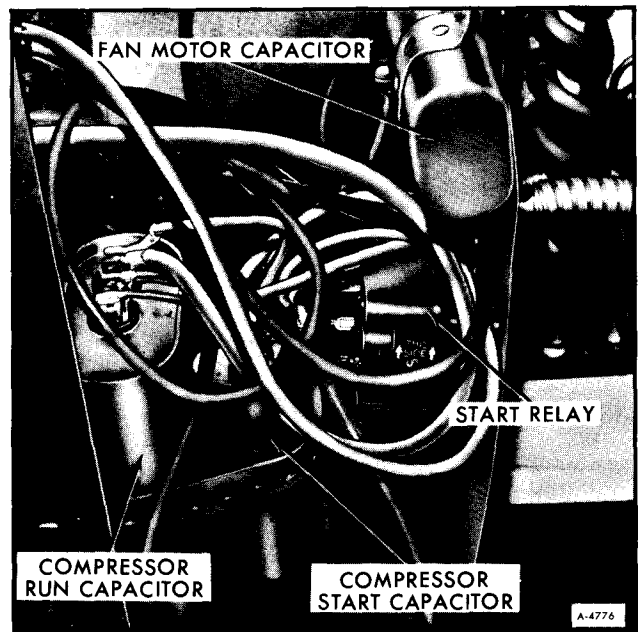


Figure 6—Electrical Components (Mark IV)

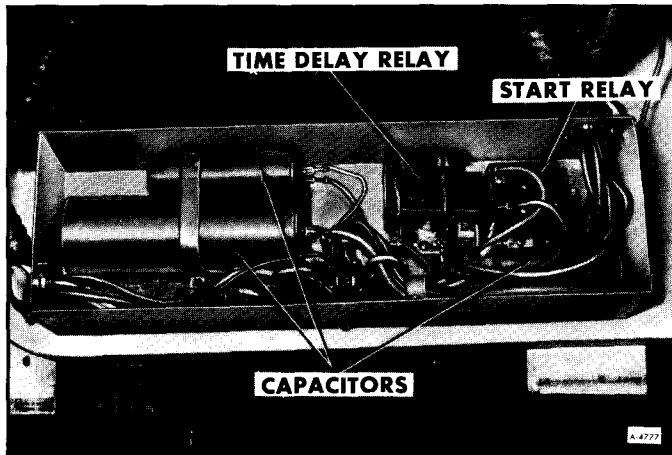


Figure 7—Electrical Components (Duo-Therm)

REFRIGERANT

Refrigerant 22; clean, dry and free from contamination, is the only fluid to be used. It is non-toxic, non-corrosive, non-flammable, non explosive, and odorless under ordinary usage.

TEMPERATURE—PRESSURE CHART

Temp. Deg.		Pressure	Temp. Deg.		Pressure	Temp. Deg.		Pressure	Temp. Deg.		Pressure
C.	F.	PSIG R-22	C.	F.	PSIG R-22	C.	F.	PSIG R-22	C.	F.	PSIG R-22
-6.7	20	43.0	13.9	57	96.1	34.4	94	179.1	55.0	131	300.7
-6.1	21	44.1	14.4	58	97.9	35.0	95	181.8	55.6	132	304.6
-5.5	22	45.3	15.0	59	99.8	35.6	96	184.6	56.1	133	308.6
-5.0	23	46.4	15.6	60	101.6	36.1	97	187.4	56.7	134	312.6
-4.4	24	47.6	16.1	61	103.5	36.7	98	190.2	57.2	135	316.6
-3.9	25	48.8	16.7	62	105.4	37.2	99	193.0	57.8	136	320.7
-3.3	26	50.0	17.2	63	107.3	37.8	100	195.9	58.3	137	324.8
-2.8	27	51.2	17.8	64	109.3	38.3	101	198.8	58.9	138	328.9
-2.2	28	52.4	18.3	65	111.2	38.9	102	201.8	59.4	139	333.1
-1.7	29	53.6	18.9	66	113.2	39.4	103	204.7	60.0	140	337.3
-1.1	30	54.9	19.4	67	115.2	40.0	104	207.7	60.6	141	341.5
-0.6	31	56.2	20.0	68	117.3	40.6	105	210.8	61.1	142	345.8
0	32	57.5	20.6	69	119.4	41.1	106	213.8	61.7	143	350.1
0.6	33	58.8	21.1	70	121.4	41.7	107	216.9	62.2	144	354.5
1.1	34	60.1	21.7	71	122.5	42.2	108	220.0	62.8	145	358.9
1.7	35	61.5	22.2	72	125.7	42.8	109	223.2	63.3	146	363.4
2.2	36	62.8	22.8	73	127.8	43.3	110	226.4	63.9	147	367.8
2.8	37	64.2	23.3	74	130.0	43.9	111	229.6	64.4	148	372.4
3.3	38	65.6	23.9	75	132.2	44.4	112	232.8	65.0	149	376.9
3.9	39	67.1	24.4	76	134.5	45.0	113	236.1	65.6	150	381.5
4.4	40	68.5	25.0	77	136.7	45.6	114	239.4	66.1	151	386.2
5.0	41	70.0	25.6	78	139.0	46.1	115	242.7	66.7	152	390.9
5.5	42	71.5	26.1	79	141.3	46.7	116	246.1	67.2	153	395.6
6.1	43	73.0	26.7	80	143.6	47.2	117	249.5	67.8	154	400.4
6.7	44	74.5	27.2	81	146.0	47.8	118	253.0	68.3	155	405.2
7.2	45	76.0	27.8	82	148.4	48.3	119	256.4	68.9	156	410.0
7.8	46	77.6	28.3	83	150.8	48.9	120	259.9	69.4	157	414.9
8.3	47	79.2	28.9	84	153.2	49.4	121	263.5	70.0	158	419.9
8.9	48	80.8	29.4	85	155.7	50.0	122	267.0	70.6	159	424.8
9.4	49	82.4	30.0	86	158.2	50.6	123	270.6	71.1	160	429.9
10.0	50	84.0	30.6	87	160.7	51.1	124	274.3	71.7	161	434.9
10.6	51	85.7	31.1	88	163.2	51.7	125	278.0	72.2	162	440.1
11.1	52	87.4	31.7	89	165.8	52.2	126	281.7	72.8	163	445.2
11.7	53	89.1	32.2	90	168.4	52.8	127	285.4	73.3	164	450.4
12.2	54	90.8	32.8	91	171.0	53.3	128	289.2	73.9	165	455.7
12.8	55	92.6	33.3	92	173.7	53.9	129	293.0			
13.3	56	94.3	33.9	93	176.4	54.4	130	296.8			

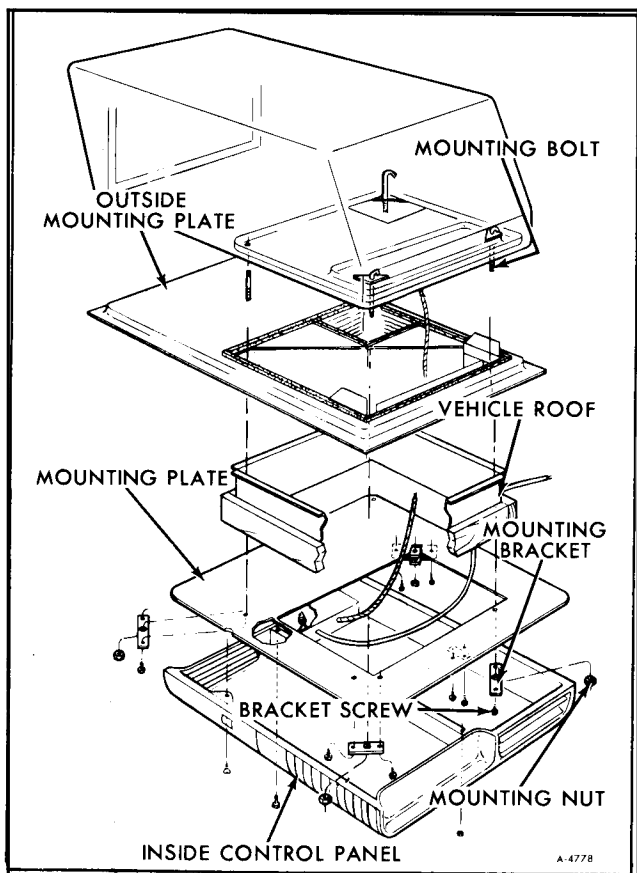


Figure 8—Duo-Therm Air Conditioner Exploded View

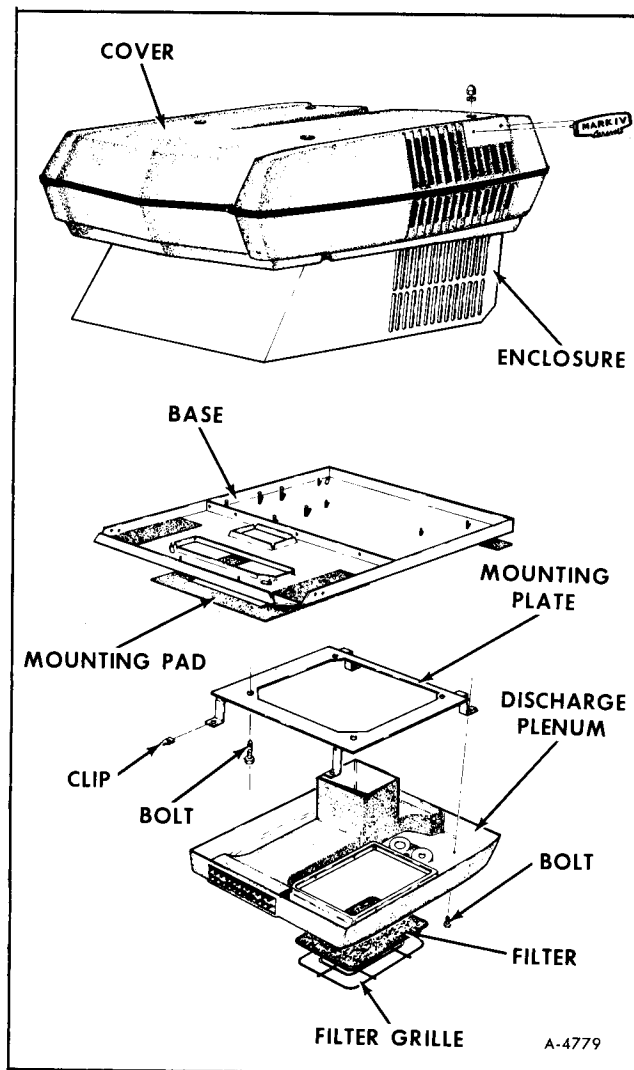


Figure 9—Mark IV Air Conditioner Exploded View

SAFETY WARNINGS

Under some circumstances R-22 can be dangerous. The following warnings describe those circumstances. Careful attention must be paid to these WARNINGS during servicing and testing.

WARNING: ALWAYS WEAR GOGGLES WHEN OPENING THE REFRIGERATION SYSTEM. REFRIGERANT LIQUID OR GAS CAN PERMANENTLY DAMAGE THE EYES.

WARNING: NEVER APPLY HEAT FROM A TORCH TO A SEALED REFRIGERATION SYSTEM. REFRIGERANT WILL EXPAND RAPIDLY WITH HEAT AND COULD CAUSE AN EXPLOSION. (THE PROCESS TUBE MAY BE SILVER SOLDERED AFTER BEING CRIMPED NEAR THE END).

WARNING: REFRIGERANT 22 IN THE PRESENCE OF AN OPEN FLAME PRODUCES PHOSGENE GAS—A TOXIC LUNG IRRITANT—DO NOT BREATHE IT. VENTILATE SERVICE AREA IMMEDIATELY WHEN R-22 IS DISCHARGED.

WARNING: DO NOT USE REFRIGERANTS OTHER THAN R-22, NEVER USE METHYL CHLORIDE REFRIGERANTS, WHICH CAUSE A CHEMICAL REACTION WITH ANY ALUMINUM PART OF THE SYSTEM, RESULTING IN THE FORMATION OF PRODUCTS WHICH BURN SPONTANEOUSLY ON EXPOSURE TO AIR OR DECOMPOSE WITH VIOLENCE IN THE PRESENCE OF MOISTURE.

WARNING: HANDS CAN BE PAINFULLY INJURED IN EVAPORATOR FAN, BLOWER WHEELS, AND ON EVAPORATOR COIL FINS.

WARNING: WHEN FLUSHING OR PURGING A CONTAMINATED SYSTEM, CAUSED BY A COMPRESSOR MOTOR BURNOUT, PROTECT EYES AND SKIN FROM CONTACT WITH ACID SATURATED REFRIGERANT OR OIL MIST.

WARNING: IF REFRIGERANT SHOULD COME IN CONTACT WITH THE EYES:

WARNING: 1. DO NOT RUB THE EYES. SPLASH THE EYES WITH COLD WATER GRADUALLY TO GET THE TEMPERATURE ABOVE THE FREEZING POINT.

WARNING: 2. APPLY A PROTECTIVE FILM OF AN ANTISEPTIC OIL OVER THE EYEBALL TO REDUCE THE POSSIBILITY OF INFECTION.

WARNING: 3. CONSULT A DOCTOR OR AN EYE SPECIALIST IMMEDIATELY.

WARNING: SHOULD LIQUID REFRIGERANT COME IN CONTACT WITH THE SKIN, THE INJURY SHOULD BE TREATED THE SAME AS THOUGH THE SKIN HAD BEEN FROSTBITTEN OR FROZEN.

WARNING: KEEP OUT OF REACH OF CHILDREN. INTENTIONALLY INHALING VAPORS TO PRODUCE INTOXICATION IS HARMFUL AND MAY BE FATAL.

ELECTRICAL DIAGNOSIS

WARNING: THIS IS A 120-VOLT SYSTEM. WHERE POSSIBLE, TURN POWER OFF AND USE CONTINUITY CHECKS IN PLACE OF POWER CHECKS. DON'T TOUCH THE TERMI-

NALS OF A CAPACITOR WITHOUT DISCHARGING IT FIRST TO AVOID POSSIBLE PERSONAL INJURY.

COMPRESSOR FAILS TO START

Problem	Remedy
1. Compressor siezed up. 2. Voltage to compressor (figure 10).	1. Add an extra start capacitor to the compressor start capacitor for a temporary charge boost at start. Compressor may break loose. Remove at once if it starts. If allowed to run with extra capacitor attached, it will burn up. 2. Check for voltage at compressor with controls on. Connect negative test probe to the M or R common wire terminal, and positive lead to overload or O terminal. There should be a reading of 110 to 120 volts to the overload, and through the overload to the compressor O terminal.

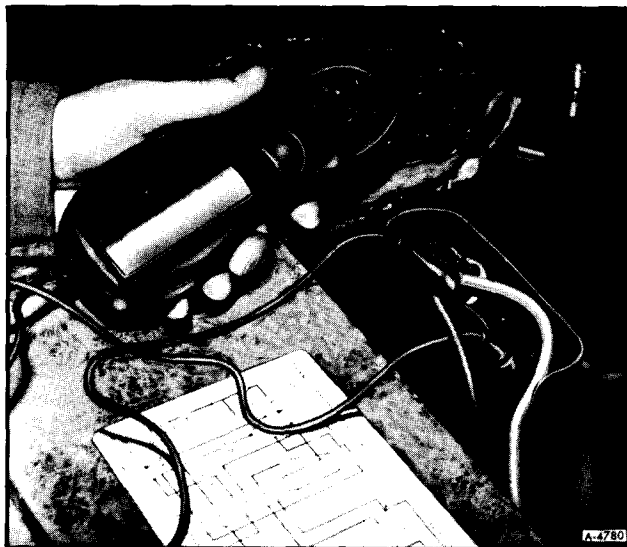


Figure 10—Voltage to Compressor Check

Problem	Remedy
<p>3. Circuit breaker box.</p> <p>a. Overload switch or circuit breaker</p> <p>b. Time delay relay (figure 11).</p>	<p>3. If there is no voltage to the compressor, check the circuit breaker box. Be sure there is power to the circuit, then check the circuit back to the power source to find out where it's open. Make these checks with a voltmeter negative (black) probe at any common (white) wire terminal, and the positive (red) probe at the terminal being tested.</p> <p>a. Check for power to and from the overload. If there is no power from the overload, but power is okay to the overload, the overload is open. Wait 15 minutes for the overload to cool. If it doesn't reset, replace it.</p> <p>b. If the time delay relay has power in, there should be power out within three minutes. Close the contacts with a stick of wood or insulated handle screwdriver. Hold them closed long enough for the compressor to start. If the compressor starts and stays running after you release the contacts, replace the relay.</p>

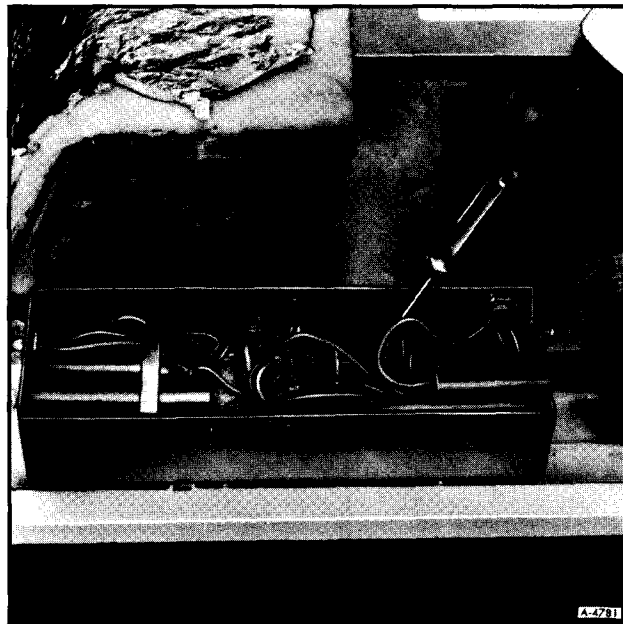


Figure 11—Time Delay Relay Check (Duo-Therm Only)

Problem	Remedy
c. Thermostat (figure 12).	<p>c. The thermostat will open around 70°F. (21.1°C.) so be sure the temperature is warmer than 70°F. (21.1°C.) before checking the power out. If power is available at the black wire terminal, there should be power out of the terminals for each switch position. Power should be received in all cooling positions. With the power off and the leads disconnected, check the switch for continuity with an ohmmeter or self-powered test light. For a positive continuity check of the thermostat, put the sensing probe in warm water (100°F.) (37.8°C.) and check for a closed circuit. Then check for an open circuit at all dial settings with the tube in cold water (50°F.) (10°C.).</p>

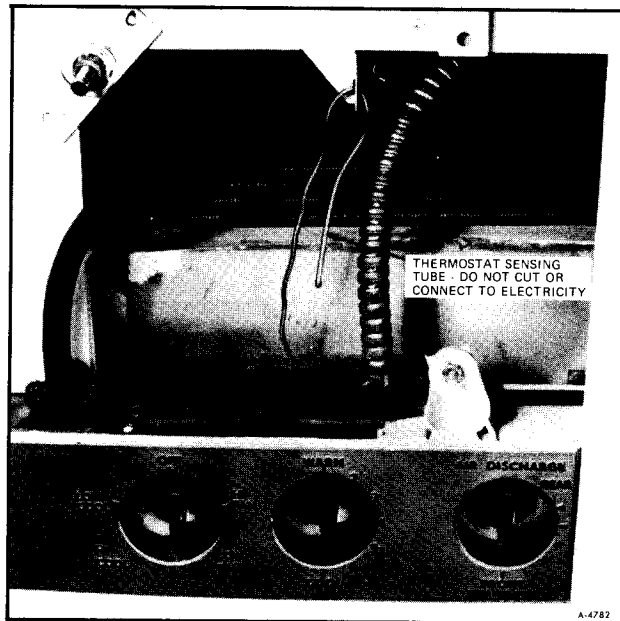


Figure 12—Thermostat Sensing Tube (Typical)

Problem	Remedy
4. Fan Motor (figures 1 and 2).	<p>4. Disconnect the leads to the fan motor at the box and check for continuity from the white wire through each of the other leads. If there is an open circuit through any winding, replace the motor. Check for shorts to the case by connecting the ohmmeter between the case and each power lead. If there is continuity, replace the motor. If the fan runs but not at full speed, check the motor capacitor as described later.</p>

COMPRESSOR STARTS, THEN CUTS OUT

Problem	Remedy
1. Campsite power.	1. One frequent cause is not enough power at the campsite due to inadequate wiring or power availability. The air conditioner is designed to use No. 12 gauge A/C wire cord. The campsite power supply should be 120-volt AC.
2. Vehicle overloading.	2. The air conditioner may cut out when other appliances are operated on the 120-volt vehicle system due to overloading.
3. Compressor winding continuity.	3. Turn power off and disconnect the compressor leads. Use ohmmeter to check start winding continuity between the O and S terminals; run winding continuity between the O and the M or R terminal; then check for continuity between the two winding terminals. If there is an open circuit in any of the checks, replace the compressor.
4. Grounded compressor windings.	4. Connect the ohmmeter between one of the copper tubes and each of the winding terminals. There should be an open circuit in each case. If not the winding is grounded, replace the compressor.
5. Shorted compressor windings.	5. Use a precision ohmmeter with a 0-to-5 and 0-to-25 ohm scale. Check each winding resistance and combined resistance against specifications. Low resistance indicates a shorted winding and the compressor should be replaced.
6. Motor generator.	6. If the unit works when connected to an external power source but not from the generator the problem may be poor motor generator maintenance. Check the generator voltage. The motor generator must be set to 60 cycles plus or minus one. Check with a cycle meter (J-24673). The generator may cut out due to an excess current draw caused by high head pressure. This condition can be created by a high heat load when the vehicle has been in the hot sun all day. The return air to the evaporator may be as high as 150°F (65.6°C.) and the compressor will cut out until it cools.
7. Compressor draw.	7. Put a snap-around amprobe around the power wire. It should read about 16 amps with the compressor running. Too much draw steadily, can indicate an overcharge of refrigerant or a shorted winding. A low draw can indicate an undercharge.

COMPRESSOR IS OKAY, CHECK CAPACITORS AND RELAY

Problem	Remedy
1. Capacitors.	1. With the power off connect the self-powered test light (J-21008) to the capacitor terminals. If the capacitor has an identified terminal, the

	lead with the black tip goes to it. The start capacitor is checked with the tester switch in position "A"; a run or fan motor capacitor in "B". Plug the tester into any 120 volt source. Push the button down and look at the light on top of the tester. If the capacitor is good the light will flash off and on. If the light stays on it indicates a short; if it flickers it indicates a leak; replace the capacitor.
2. Start Relay	2. Remove leads and check with ohmmeter for continuity between start winding terminal and start capacitor terminal. If the contacts are open, replace the relay. Clip amprobe around lead to the start capacitor. Start the compressor. It should show two or three amps for only a couple of seconds, then zero current when the relay cuts out. If current continues after the compressor starts, replace relay.

REFRIGERATION SYSTEM DIAGNOSIS

AIR CONDITIONER FAILS TO COOL

Problem	Remedy
1. Compressor starts and runs. 2. Temperature check. 3. Clean components, fan motor rotation. 4. Leaks or kinks 5. Capillary tube obstruction (figure 13).	1. If the compressor starts and runs then the problem is in the refrigeration system and more checks can be made. If the compressor fails to start and/or run steadily, check the electrical system. 2. Place a good refrigeration thermometer close to the center on both the return and blower sides of the evaporator. If the temperature difference is from 18 to 23°F. (9 to 13°C.), the system is okay. It is cooling the air as much as it can. If the temperature difference is less than 18°F. (9°C.), check further before opening the refrigeration system. 3. Clean any dirt or obstructions that may effect the operation of the air filter, blower wheel, and evaporator fins. Check fan motor rotation. Blower should pull air through evaporator without obstruction. 4. Inspect coils, lines, and connections for pinch, kink, or obvious leak indicated by compressor oil. 5. Feel along the capillary tube for a temperature change. It should be the same temperature at both ends. If not, it is restricted, and must be replaced.

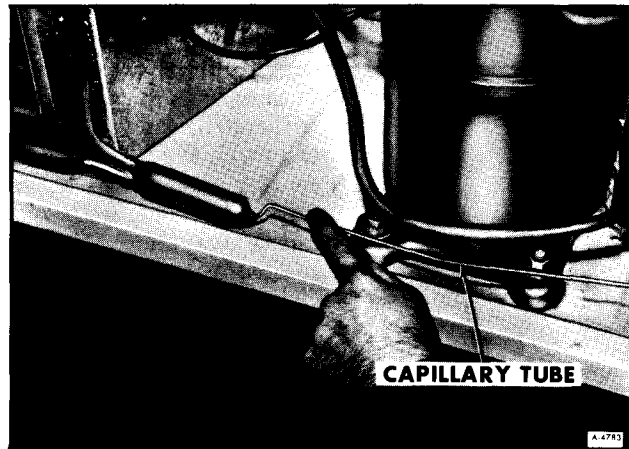


Figure 13—Capillary Tube Obstruction Check

Problem	Remedy
<p>6. Superheat charge test (figure 14).</p>	<p>6. Install manifold gauge set. Tape an accurate thermometer to the suction line about six inches from the compressor. Insulate the thermometer tube and tip so that it will measure the line temperature. Let the system run 10 to 15 minutes with the shroud in place, then read the temperature and pressure. Compare with the temperature pressure chart for R-22 found earlier in this section. Superheat is the difference between actual and chart temperature. It should be from 15 to 25°F. (8 to 14°C.). High superheat indicates an under-charge-charge the system, or it may indicate a restriction. See checks 4 and 5. Low superheat indicates an overcharge-bleed the system.</p>

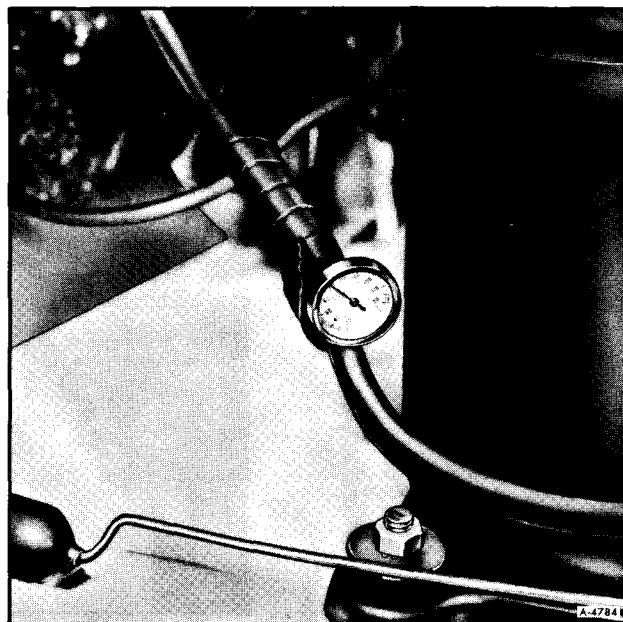


Figure 14—Superheat Charge Test Thermometer

Problem	Remedy
7. Leak test.	<p>7. Shut off the compressor and charge the system with refrigerant to about 150 pounds. If you use the torch type detector J-6084 (figure 15), the reactor plate in the detector must be red hot during use and needs replacement when the copper burns away, about every two weeks under normal use. Move the tester probe slowly around all possible leakage points and watch the flame for a color change. With an electronic detector J-23400-01 (figure 16), listen for the signal. Refrigerant is heavier than air, so it may not be detectable directly above a leak, but only beneath it.</p>
8. Burnout check.	<p>8. During a compressor replacement, check the oil for evidence of an electrical burnout.</p> <p>WARNING: DO NOT GET OIL ON YOUR HANDS. IF ACID HAS FORMED SEVERE BURNS CAN RESULT.</p> <p>A dark oil with burnt odor means the system is contaminated. Remove the capillary tube and dryer as well as the compressor. Backflush the evaporator and condenser with a pound of refrigerant or commercial flushing agent such as "purge". Replace any plugged tubes. Then thoroughly evacuate the system before charging it.</p>



Figure 15—Torch Type Leak Detector



Figure 16—Electronic Leak Detector

CLEANING AIR CONDITIONER

For proper operation the unit should be clean. Before any tests or repair work is started, check the filter. The filter should be checked and cleaned regularly as use requires. If filter is dirty, wash in soapy water and allow to dry. Do not use compressed air to dry filter.

Next, open the shroud that covers the air condi-

tioner outside of the vehicle. If dirt, leaves, or other material is lodged inside it will effect the operation of the unit. Clean such debris away. Make sure nothing is blocking the moving parts of the fan or blower.

If the air conditioner still does not operate properly, proceed with further tests.

AIR CONDITIONER REPLACEMENT

The Mark IV and Duo-Therm units (figures 1 and 2) are mounted in similar manner. The inside panel which includes the controls, the filter access, and air directing vents, is bolted through the mounting hole in the roof to the air conditioning unit mounted outside to the roof of the vehicle.

For convenience and safety, it is best to remove the unit from the roof of the vehicle to a shop bench for tests or repair.

WARNING: USE CARE WHEN REMOVING AIR CONDITIONING UNIT FROM ROOF OF VEHICLE, TO AVOID FALL BY SERVICE PERSONNEL, OR DROPPING UNIT.

REMOVAL

1. Turn air conditioner off. Make sure that motor generator and external power source are discon-

nected. Circuit breaker for air conditioner, located in living area electrical compartment should be turned off.

2. Remove bolts or nuts from inside panel. Remove inside panel.

3. Disconnect vehicle air conditioning electrical harness from air conditioner.

4. Disconnect bolts and nuts that secure unit to roof of vehicle. Remove unit.

INSTALLATION

Reverse the removal procedure.

REFRIGERATION SYSTEM SERVICE

BREAKING INTO THE REFRIGERATION SYSTEM (FIGURE 17)

1. Clamp the tap valve on the process tube as close as possible to the pinched end. Turn the valve handle to puncture the line.

2. Attach the gauge set suction valve to the tap valve.

REPAIRING OR REPLACING REFRIGERATION COMPONENTS

1. When you locate a leak, shut off the refrigerant and attach a discharge hose to the center manifold. Route the hose into an exhaust hose or shop exhaust system.

2. Discharge the refrigerant slowly and watch that the compressor oil doesn't come out with refrigerant. If you see oil, slow down the discharge rate.

3. When the pressure is five pounds or less you can open the system to repair it.

SOLDERING AND BRAZING

All connections are made by brazing. The parts to be brazed, must be clean. Polish with a wire brush or emery cloth until they shine.

The recommended material for connections is Sil-Flos or equivalent. Use just enough heat so it will melt and flow when touched to the metal.

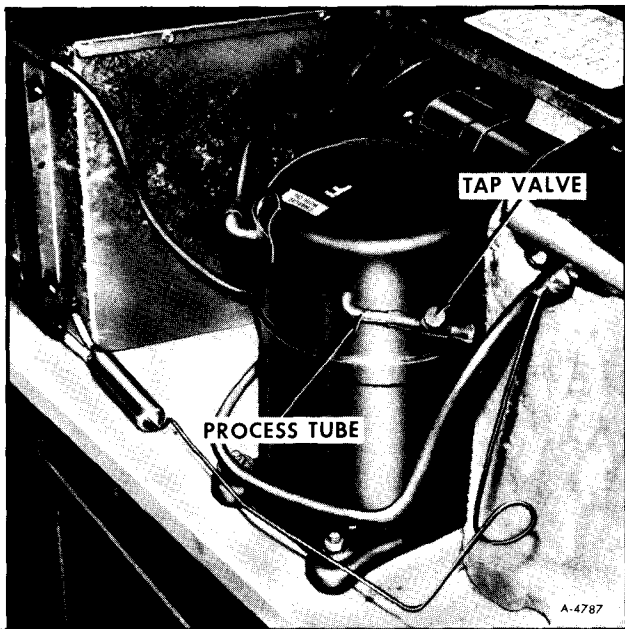


Figure 17—Breaking into the Refrigeration System (Typical)

CAPILLARY TUBE

Never try to repair the capillary tube. It is a metering device and the length and diameter are critical. Install a new tube that exactly duplicates the original. Avoid using too much solder since the open end could be easily plugged.

SAFETY VALVE—DUO THERM

The rectangular piece soldered on the suction line as it comes out of the evaporator is not a patch to cover up an accident.

The patch was soldered in place with a soft solder that will melt in case of fire allowing the refrigerant to escape before the system pressure becomes dangerously high.

COMPRESSOR

The replacement of a compressor because of mechanical failure or very mild electrical burnout is a simple operation.

A severe electrical burnout however usually creates an acid condition throughout the system. If all the acid and other contaminants are not removed the new compressor will be short lived.

A severe burnout will usually be indicated by a characteristic odor of burned insulation when the system is opened. If there is any doubt about the burnout, pour some oil out of the compressor into a shallow pan for observation and testing.

WARNING: DO NOT TOUCH THE OIL WITH YOUR HANDS IF THERE IS A BURNT SMELL, IT MAY HAVE FORMED ACID.

If the oil is clear and free of odor the system is probably free of contamination. If the oil is dark and has an odor, acid has probably formed in the system.

The use of an acid test kit will give you a positive indication of the system condition.

If the system is contaminated discharge all refrigerant from the system. Remove burned compressor, capillary tube and drier. While the system is open flush it, in reverse of normal flow pattern, with either a pound of refrigerant 22 or use "Purge" or equivalent followed by a brief flush of 22.

If the system has been contaminated to the extent that solids have been formed it is a good idea to tie a cloth over one of the open ends to catch the material blown out. This will give you a visual indication if further flushing is necessary.

If the original cap tubes are open they can be reinstalled. If plugged they should be replaced. Install replacement compressor, the filter at the outlet of the condenser and the filter-dryer in the suction line between the compressor and evaporator. Install process tube with charging port at the compressor.

Install the charging port in tubing of sufficient length so it can be removed after evacuation, recharging and leak testing. This will give the customer a hermetically sealed system and one you can be confident will be performing as originally designed.

If the compressor failure was caused by a mechanical failure or if no acid was found when you tested the original oil the flushing operation can be omitted. Most failures are of this nature.

Systems that are contaminated to the point solids have been formed are usually caused by poor prior service where air and/or acids have been left in the system from incomplete evacuation and cleanup.

EVACUATING AND CHARGING SYSTEM (FIGURE 18)

1. Connect a vacuum pump to the manifold. Purge the vacuum hose of charging station (J-24410) before starting the pump. If you have a micron type vacuum pump, run it until the gauge reads 200 to 500 microns. This may take some time, since all the moisture has to boil before the gauge will read. With an automotive pump, pull the system down to about 29-1/2 inches or as close to it as the system will go.

NOTE: Gauge readings at higher altitudes will be less than the sea level rating of 29-1/2 inches Hg. Warming the unit in high altitudes and/or low temperatures will make the air or water in the system vaporize more readily. To warm, place the unit directly in front of a shop heater, or paint drying lights. Do not use any direct flame for warming.

The pump can be tested by connecting it to a clear soft-drink bottle, 3/4 full of water. If the water in the bottle begins to bubble, the pump is functioning.

2. If an automotive pump is used, "break" the evacuation vacuum twice with a charge of R-22 to about 100 psi and repeat the evacuation to be sure to get all air and moisture out. This is not necessary with charging station J-24410.

3. Leak test the system. Stop the vacuum pump and watch the gauge. If the vacuum holds, the system is tight and can be charged.

4. Connect the dial-a-charge or charging station in place of the pump. Purge the line briefly at the gauge port, then admit the specified charge.

CAUTION: *Be sure to measure the charge accurately. The specification is critical with the capillary tube metering system. Each air conditioning unit has an identification tag that specifies the exact charge for that unit.*

5. If necessary during charging, start the compressor and run it until the charge enters. When the charge is in, shut off the refrigerant.

CLOSING THE REFRIGERATION SYSTEM

1. Pinch off the process tube next to the tap valve. Remove the tap valve.

2. Cut off the tube and braze the end to hermetically seal the system before you remove the pinching

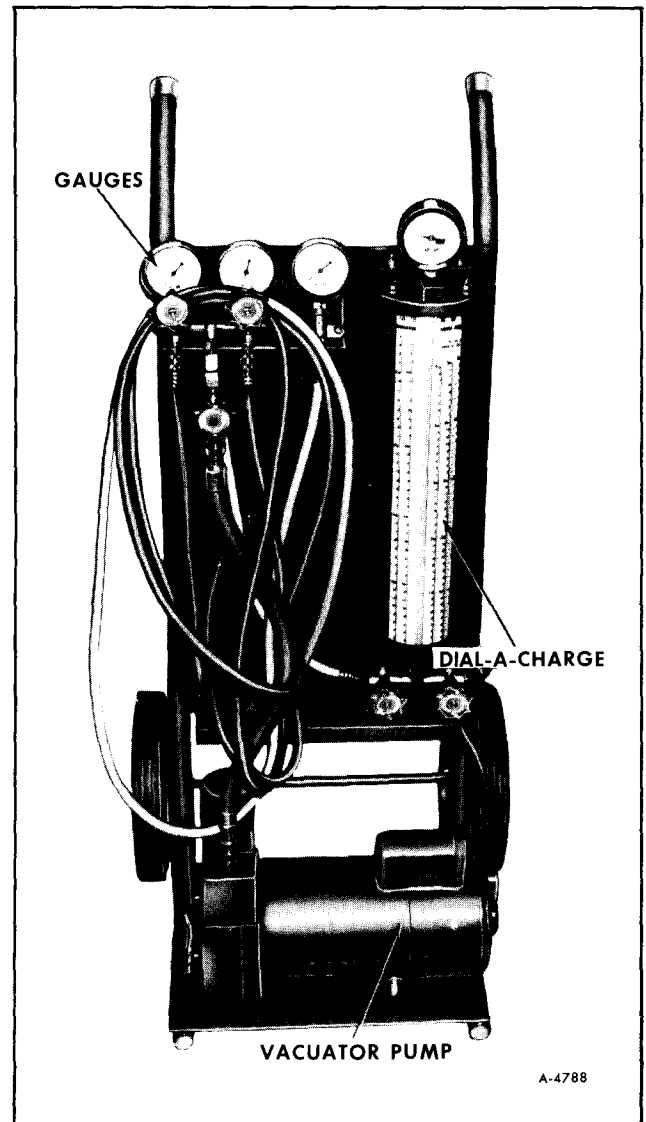


Figure 18—Charging Station J-24410

tool. The pinch off tool acts as a heat sink during the brazing, preventing decomposition of the refrigerant.

SPECIAL TOOLS

- | | |
|------------|---------------------------|
| J-24673 | Cycle Tester |
| J-21008 | Self-Powered Test Light |
| J-6084 | Leak Detector, Flame Type |
| J-23400-01 | Leak Detector, Electronic |
| J-24410 | Charging Station |

SPECIFICATIONS

COMPRESSOR MOTOR RESISTANCE VALUES

Model 54615	Windings Resistance in Ohms + 10%	
	Start	Run
	4.83	.378

SECTION 24F

LP GAS SYSTEM

The contents of this section are listed below:

SUBJECT	PAGE NO.
Description	24F-1
Trouble Diagnosis	24F-2
On-Vehicle Adjustment	24F-3
Regulator	24F-5
Component Replacement	24F-5
Fill Valve	24F-5
Liquid Level Outage Valve	24F-6
Vapor POL Valve	24F-6
Regulator	24F-6
Gas Tank Sight Valve Dial	24F-6
Gas Tank Float Assembly	24F-7
LP Gas Tank	24F-7
LP Gas Lines and Fittings	24F-8
LP Gas Tank Purge	24F-8

WARNING: EMPTYING THE LP GAS TANK SHOULD BE DONE BY AN AUTHORIZED LP GAS DEALER.

IMPORTANT: The LP Gas System will not operate correctly if the tank is overfilled. An overfilled tank will not allow proper vapor pressure to develop and the entire system will cycle between near normal pressure (11 inches of water pressure) and a much lower pressure which will not allow the appliances to operate.

DESCRIPTION

The LP (liquid petroleum) gas system supplies fuel for the range/oven and furnace as shown in Figure 1. The LP gas tank, which stores the fuel, is located in the compartment at the right rear of the vehicle. The LP gas tank is 42" long and holds 62 lbs. of LP gas. The tank is equipped with a fill valve, liquid level outage valve, vapor POL valve, tank float gauge assembly and a regulator.

The gas lines on the MotorHome are laid out so that most connections are outside the vehicle. The lines go inside the vehicle only to reach an appliance.

NOTE: Always leak test the entire LP gas system after performing any service or maintenance on the LP gas system. See "Leak Test" later in this section.

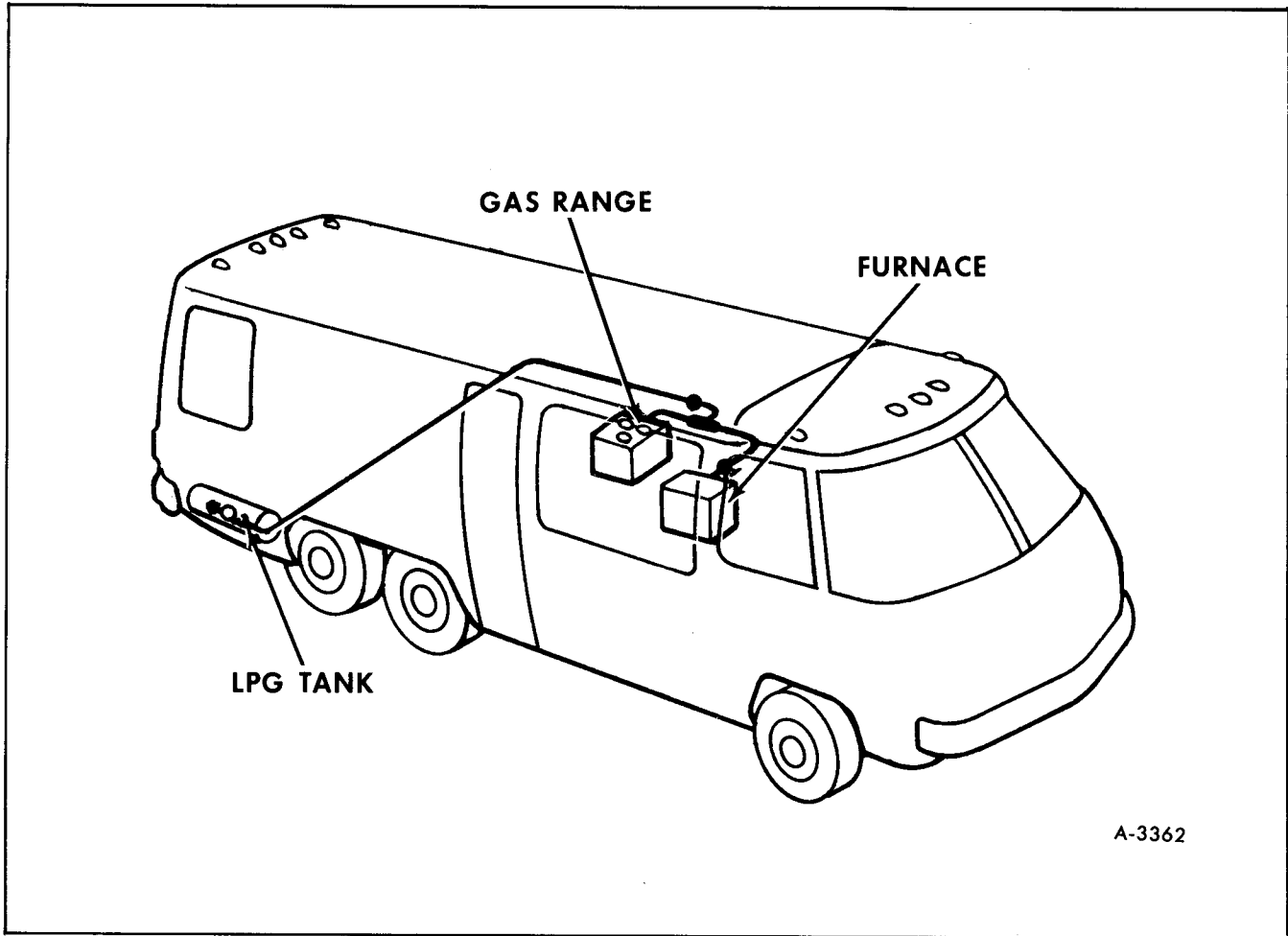


Figure 1—L.P. Gas System

TROUBLE DIAGNOSIS

Problem	Possible Cause	Correction
Gas appliances won't operate.	Appliance faulty	Refer to "TROUBLE DIAGNOSIS" in the particular section for correction.
Insufficient gas supply	Vapor POL valve not open completely. Regulator out of adjustment	Open valve completely. Refer to "ON VEHICLE ADJUSTMENTS" for regulator pressure specifications.
	Leak in LP gas system.	Make up a soap solution. Apply to all fittings. If bubbles occur a leak is present. Inspect fitting for damage or cracks. Replace fitting if necessary. Use only A.G.A. (American Gas Approved) fittings. Otherwise tighten fitting.

Condition	Possible Cause	Correction
	LP gas tank has been over-filled and regulator has frozen up.	Empty LP gas tank. Refer to "LP GAS TANK-REMOVAL" later in this section for proper procedure of emptying tank. Refill tank correctly, see "WARNING" at beginning of this section.
	In freezing weather, water in the system may freeze and block regulator or lines.	In freezing weather add 1 pint of suitable tank and gas line anti-freeze. Then using a monometer check regulator. Refer to "ON-VEHICLE ADJUSTMENTS" later in this section. Empty LP gas tank. Refer to "LP GAS TANK-REMOVAL" later in this section for proper emptying and removal of the tank. Flush out tank with a suitable gas system anti-freeze. Add 1 pint of same anti-freeze to tank and fill with LP gas.
Leaking fill valve assembly or liquid level outage valve.	Damaged or dirt in mechanism.	Replace valve or valve seat. Refer to specific subjects later in this section.
Gas tank is known to be full, however, the tank sight valve does not indicate full.	Damaged float or sight valve.	Replace float and/or sight valve as described later in this section.

ON-VEHICLE ADJUSTMENT

REGULATOR

The regulator shown in Figure 2 is adjustable and is set at the factory to deliver LP gas at a rate of 11 ± 1 inches of water pressure as measured on a manometer.

ADJUSTMENT

WARNING: FAILURE TO PERFORM REGULATOR ADJUSTMENT ACCURATELY COULD RESULT IN IMPROPER OPERATION OF LP GAS APPLIANCES WITHIN MOTOR HOME AND BE A HEALTH AND SAFETY HAZARD TO OCCUPANTS OF VEHICLE.

WARNING: NEVER INCREASE REGULATOR PRESSURE WITHOUT A MANOMETER CHECK. EXCESSIVE LINE PRESSURE COULD RESULT IN AN LP GAS LEAK WHICH IS FLAMABLE AND POTENTIALLY DANGEROUS TO VEHICLE AND PERSONNEL.

Manometer Check

1. Pull range cover up to expose burners.
2. Hang manometer (J-8639) from closet top by

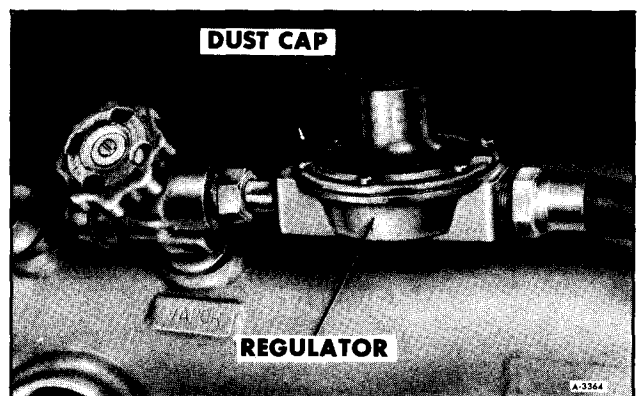


Figure 2—Regulator

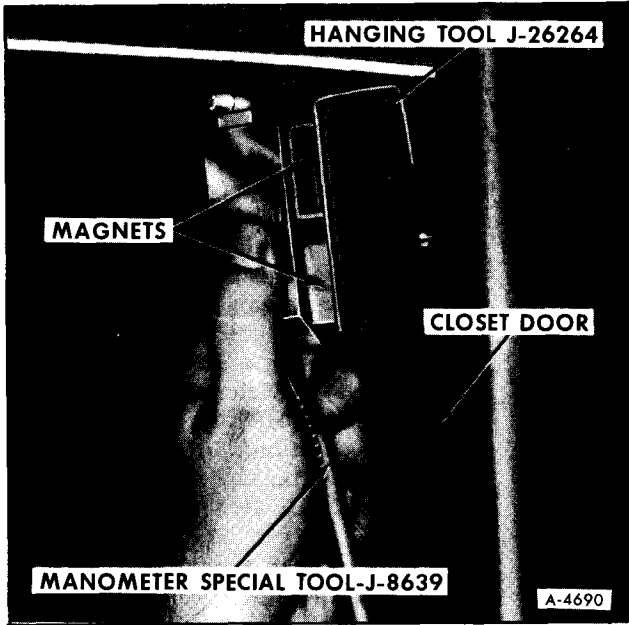


Figure 3—Hanging Manometer

bracket (J-26264) (figure 3). Open the two elbows at top of manometer two turns each so that the fluid levels are equal, then move scale so that "O" matches this level (figure 4).

3. Remove screw holding right hand burner in place and remove burner (figure 5). Connect hose from one manometer elbow to right hand burner speed (figure 6). Position hose away from other burners. Turn one range top burner all the way on, with gas burning.

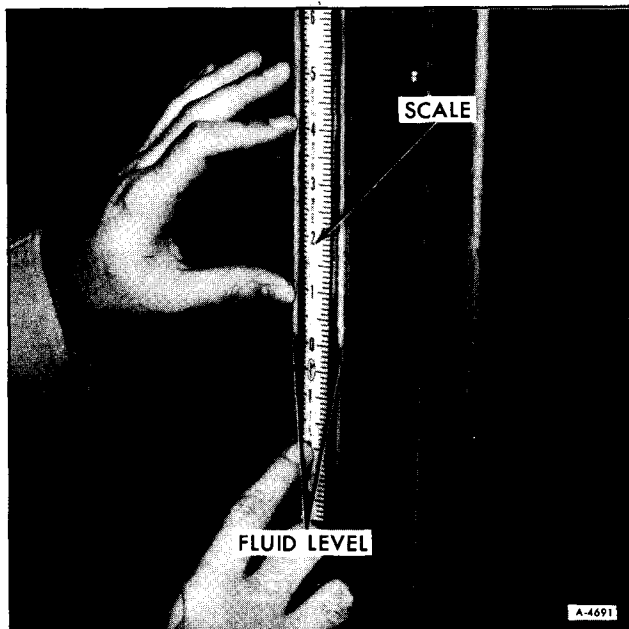


Figure 4—Setting Manometer Scale



Figure 5—Removing Burner From Stove

WARNING: MAKE SURE THAT RUBBER HOSE IS PLACED CAREFULLY AWAY FROM OPERATING RANGE TOP BURNER.

4. Turn on burner control connected to manometer. Read the high to low difference on the manometer. If the difference is not 11 inches the regulator needs adjusting. Adjust the regulator until a reading of 11.0 inches is obtained. Refer to "Regulator Adjustment". If the reading is outside of an 11 ± 2 inch range (9 inches to 13 inches), with range/oven and

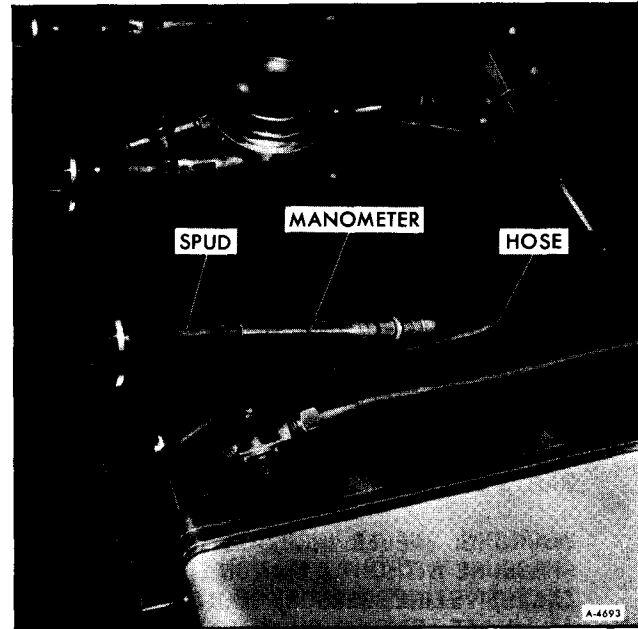


Figure 6—Manometer Connection to Spud

furnace all ON to all OFF, then replace the regulator.

NOTE: If L.P. gas pressure is very high, the fluid in the manometer could be forced out when the gas is turned ON.

Regulator Adjustment

1. Remove the dust cap from the top of the regulator (See figure 2).

2. Turn the adjusting slot clockwise to increase the pressure and counter-clockwise to decrease the pressure (See figure 7).

3. If the correct adjustment can't be made or if the monometer level fluctuates the regulator is defective and needs to be replaced. See "REMOVAL" later in this section.

LEAK TEST

Any fitting or valve suspected of leaking may be tested by applying a soap solution. Bubbles will appear wherever a leak occurs. Tighten fittings or replace components, as necessary. If any fittings require replacement use AGA (American Gas Association) approved components. It is recommended that pipe sealant not be used unless necessary to seal a leaking connection; if necessary use pipe sealant GM Part No. 704133 or equivalent.

WARNING: NEVER CHECK FOR AN LP GAS LEAK WITH A MATCH. AN LP GAS LEAK COULD IGNITE CAUSING INJURY TO VEHICLE AND PERSONNEL.

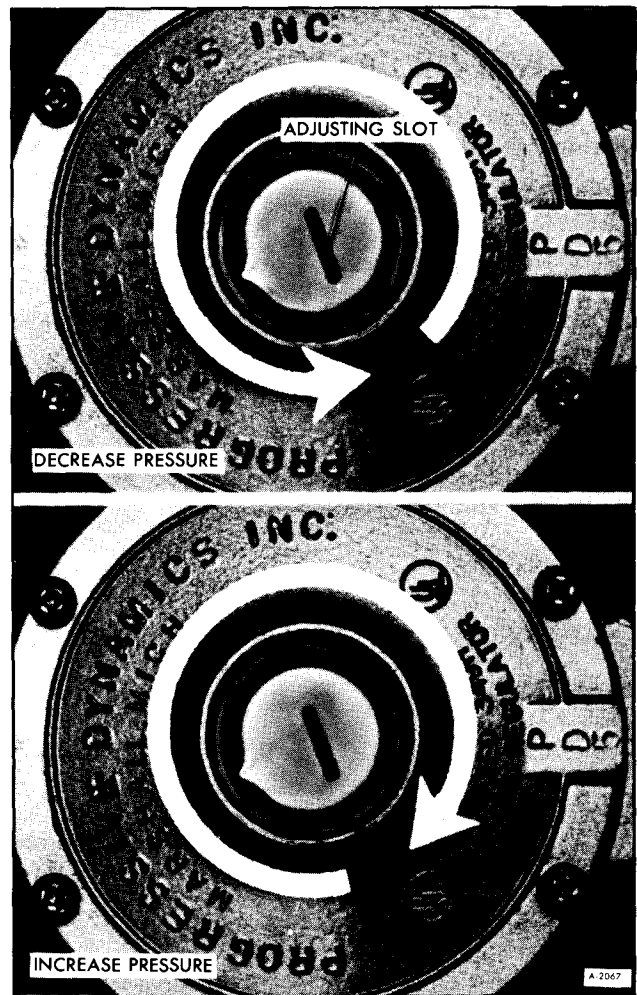


Figure 7—Regulator Adjustment

COMPONENT REPLACEMENT

FILL VALVE (FIGURE 8)

REMOVAL

1. Empty tank. Refer to WARNING at the beginning of this section.
2. Remove the fill valve cap.
3. Remove the fill valve.

INSTALLATION

1. Install fill valve on tank.
2. Tighten all fittings securely and install fill valve cap.
3. Fill tank.

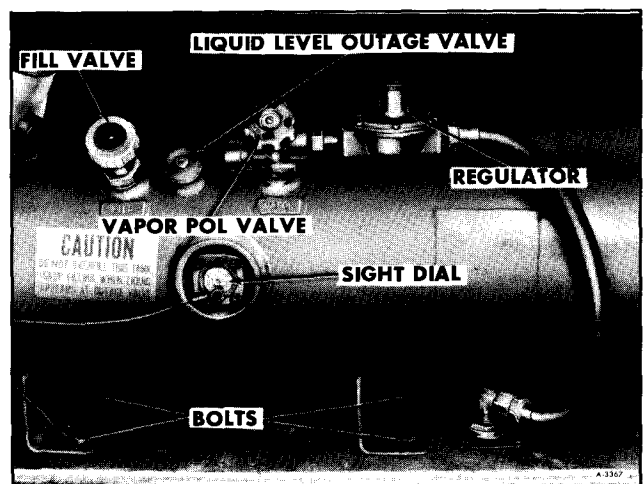


Figure 8—L.P. Gas Tank Valves

LIQUID LEVEL OUTAGE VALVE

REMOVAL (FIGURE 8)

1. Empty tank. Refer to **WARNING** at the beginning of this section.
2. Remove outage valve.
3. Inspect valve seat.
4. If valve seat is defective replace with a new valve.

INSTALLATION

1. Position stop fill dial over adapter and thread valve into adapter. Tighten with fingers.
2. Fill tank.

VAPOR POL VALVE (FIGURE 8)

REMOVAL

1. Empty tank. Refer to **WARNING** at beginning of this section.
2. Remove valve handle securing screw. Remove handle (See figure 10).
3. Remove valve stem (See figure 10).
4. Inspect seals. Replace stem if necessary.

INSTALLATION

1. Install valve stem. Tighten securely.
2. Replace handle and securing screw.
3. Fill tank.

REGULATOR

The regulator is adjustable. Refer to "On-Vehicle Adjustment-Regulator" earlier in this section.

REMOVAL

1. Turn off gas at the tank (See figure 9).
2. Remove hose assembly from regulator.
3. Remove regulator from POL valve.

IMPORTANT: The connector attaching the regulator to the vapor POL valve is left-hand threaded (See figure 9).

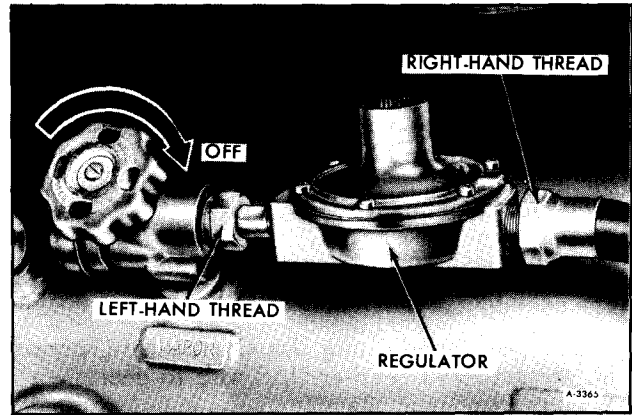


Figure 9—Regulator Attachment

INSTALLATION

1. Install regulator to POL valve.

IMPORTANT: The connector attaching the regulator to the vapor POL valve is left-hand threaded.

2. Connect hose assembly to regulator.
3. Tighten all fittings securely and turn on gas at tank.

L.P. GAS TANK SIGHT VALVE DIAL

REMOVAL

1. Remove wire retaining screw and wire.
2. Remove two retaining screws (See figure 10).
3. Remove sight dial.

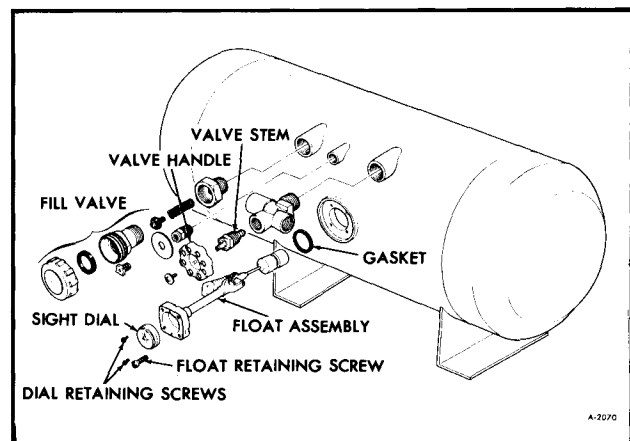


Figure 10—L.P. Gas Tank Components

INSTALLATION

1. Install sight dial.
2. Install two dial retaining screws.
3. Install wire and retainer screw.

GAS TANK FLOAT ASSEMBLY

REMOVAL

1. Empty tank. Refer to **WARNING** at beginning of this section.
2. Disconnect wire at sight dial.
3. Remove four float retaining screws (See figure 10).
4. Remove float assembly.

NOTE: Position float as shown in Figure 10 while removing from tank.

INSTALLATION

1. Install float assembly.
2. Install and tighten four retaining screws.

3. Connect wire to sight dial.
4. Fill tank.

LP GAS TANK

When filling the tank refer to **IMPORTANT** at beginning of this section.

REMOVAL

1. Empty tank. Refer to **WARNING** at beginning of this section.
2. Disconnect hose assembly from regulator and position out of the way.
3. Disconnect wire from sight dial.
4. Remove four nuts and bolts securing tank to vehicle (See figure 8). Ground wire is under one of these bolts.
5. Remove tank.

INSTALLATION

1. Install tank and four bolt and nut assemblies. Secure ground wire under same bolt.

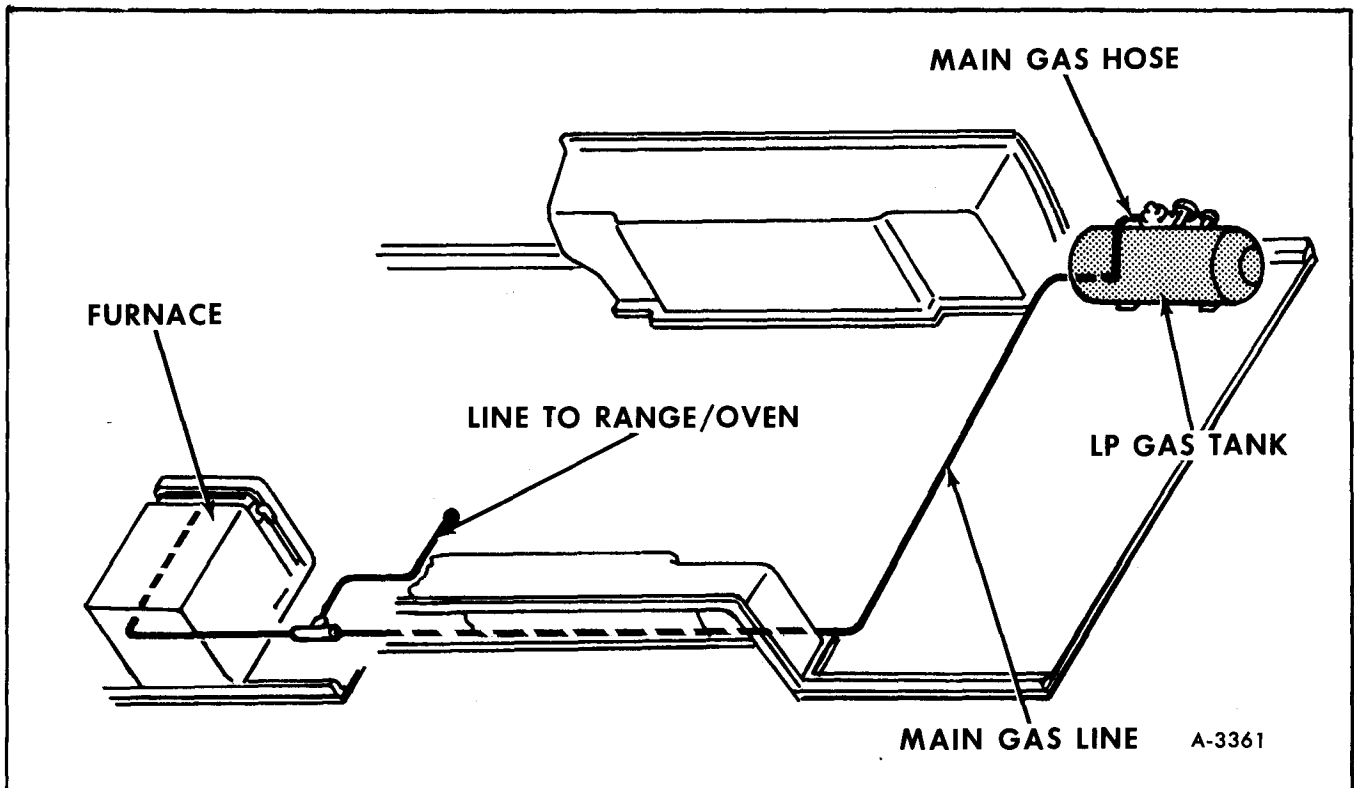


Figure 11—L.P. Gas Lines

Torque nuts to 15-20 ft. lbs.

2. Connect wire to sight dial.
3. Connect hose assembly to regulator.
4. Fill tank.

LP GAS LINES AND FITTINGS (FIGURE 11)

LP gas lines are copper tubing and rubber hose connected with AGA (American Gas Association)

fittings. There are three straight and two elbow connections under the vehicle. The lines are replaceable or repairable. A damaged portion of the copper tubing line may be cut out and a brass approved union used to connect a new section of tube to the line. Be sure that the gas is turned off at the tank. Remember there may always be some residual gas in the system that will escape when a fitting is loosened, therefore work in a well ventilated area.

WARNING: NEVER USE ANY RUBBER HOSE FOR LP GAS LINE UNLESS IT HAS BEEN APPROVED FOR LP GAS. NON-APPROVED HOSES COULD LEAK RESULTING IN DANGER TO VEHICLE AND PERSONNEL.

L.P. GAS TANK PURGE

New LP gas tanks that have not yet been filled, have air and moisture inside which can cause problems in the system once it is in use. The LP gas tank should be purged before it is filled for use.

An LP Gas tank that has been allowed to run dry while appliances are in use can have air and moisture enter through the appliances. If an LP gas tank runs dry in such a manner it should be purged before it is refilled.

NOTE: The LP gas tank should not be allowed to run dry. The regulator can not meter a correct LP gas and air mixture when pressure in the tank has dropped too low.

PURGING

The LP gas tank is purged with vaporized LP gas, not liquid gas used to fill the tank for operation.

Gas used to purge the system must be taken from a filled bottle that has a vapor withdrawal system. Purging should be done by an authorized LP gas dealer.

WARNING: PURGING MUST BE DONE WELL AWAY FROM ANY FLAMES OR SOURCE OF SPARKS THAT MIGHT IGNITE LP VAPORS CAUSING DAMAGE TO COMPONENTS AND/OR INJURY TO PERSONNEL.

1. Bleed off all the air that will escape from tank.
2. Put LP gas in vapor form in the tank to raise the internal tank pressure to about 15 psi. Then open the valve and allow LP gas to escape slowly.
3. Repeat 8-10 times. Allow enough time between each filling and releasing for the gas to dissipate. Properly fill LP tank with LP liquid.

SECTION 24G

FURNACE

Contents of this section are listed below:

SUBJECT	PAGE NO.
General Information	24G-1
Furnace Trouble Diagnosis	24G-5
Operational Checkout	24G-7
Furnace Replacement	24G-8
Component Replacement	24G-9
On Vehicle Adjustment	24G-16
Auxiliary Furnace Blower	24G-17

GENERAL INFORMATION

The furnace in the GMC MotorHome is a 30,000 B.T.U. Sol-Aire furnace. The furnace is located in the compartment under the kitchen sink. The iden-

tification plate is located at the right side of the casing as shown in Figure 1. The furnace has no pilot light, but is ignited by a direct spark ignition system.

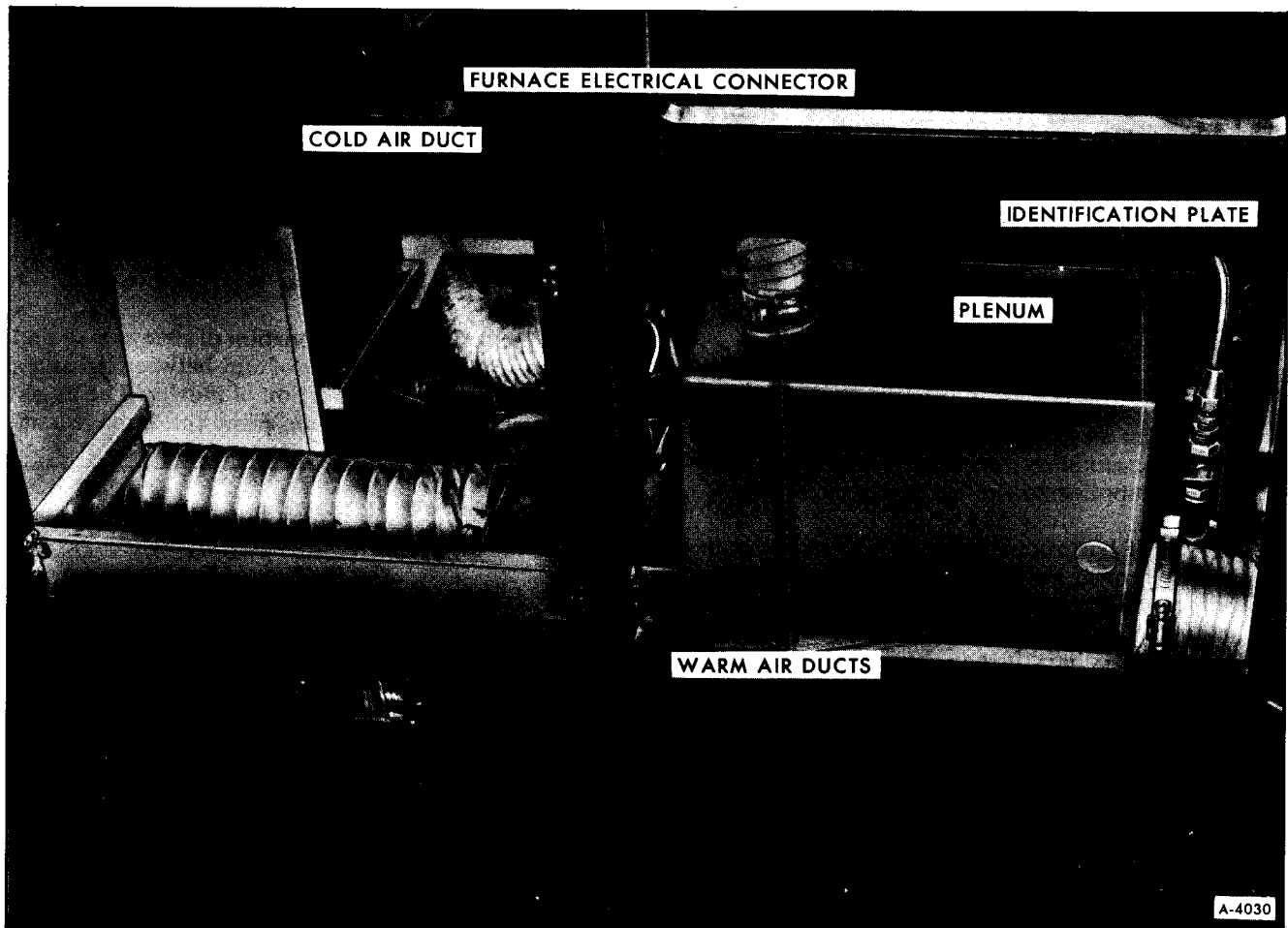


Figure 1—Furnace Installed

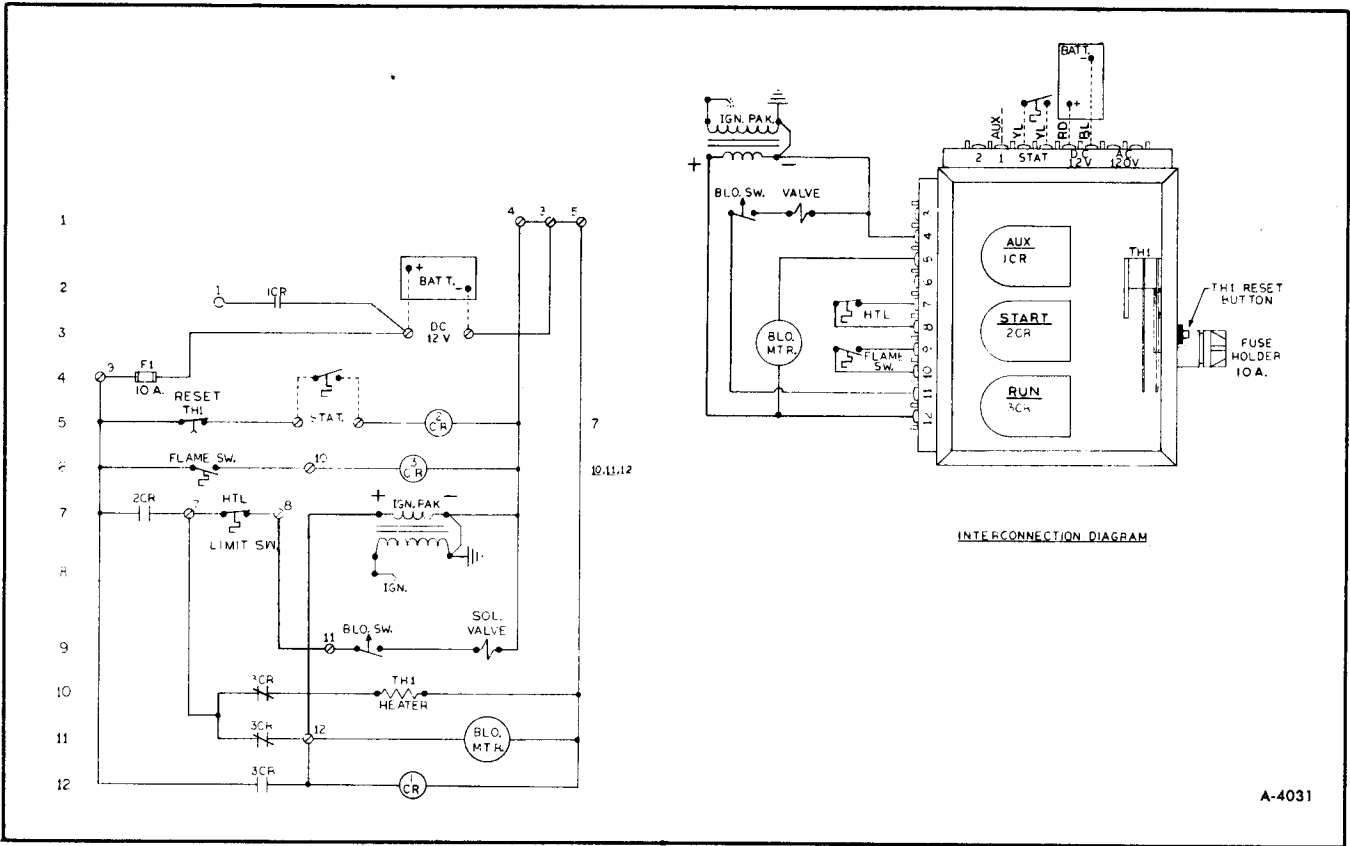


Figure 2—Furnace Wiring

The furnace utilizes a sealed combustion system with an axial blower assembly. Combustion air is drawn in from outside the vehicle, passes through the combustion chamber and returned to the outside. Warm air inside the vehicle is ducted from the plenum on front of furnace to registers located at floor level. Cold air ducts return air to the rear portion of the furnace.

The warm air duct on top of the plenum is connected to an auxiliary furnace blower. This heated air is then supplied to the bathroom module.

NOTE: If bathroom warm air outlet is located beside shower head the auxiliary furnace blower is located in the closet module (See figure 32). If warm air duct is located on wall below bathroom sink the auxiliary furnace blower is installed behind the kitchen range/oven (See figure 33).

The furnace operates on 12-volts D.C. and its wiring diagram is shown in Figure 2.

FURNACE COMPONENTS

CONTROL BOX

The control box contains three control relays, thermal relay with manual reset, and fuse and

holder. The unit is located on the left side of the furnace (refer to figures 2 and 3). If a malfunction occurs, the control box is replaced as an assembly.

BLOWER ASSEMBLY (FIGURE 3)

The combustion-air portion of blower is sealed so as to allow no passage of air between it and the circulating room-air portion of blower. The combustion-air blower draws air from the outside atmos-

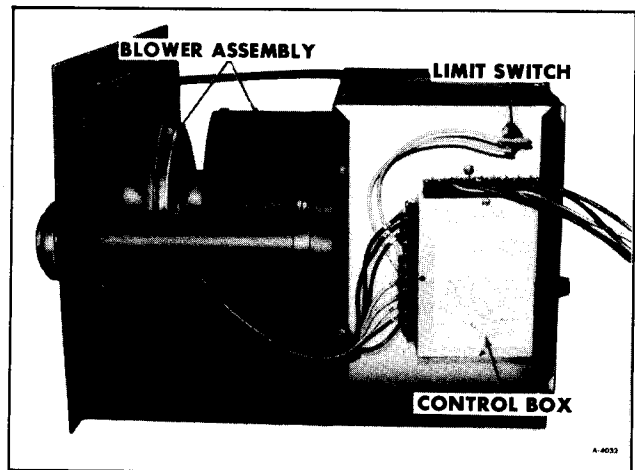


Figure 3—Furnace Components (Left-Side)

phere, discharges it into the combustion chamber, and forces the combustion products out the exhaust tube. The circulating room-air blower pulls return air in and forces it across the heat chamber, discharging into the area to be heated.

LIMIT SWITCH (FIGURE 3)

The limit switch will open if the combustion chamber temperature gets hotter than normal operating temperature. Referring to Figure 2, if HTL (high temperature limit) limit switch opens, this shuts off current flow to the blower switch and results in closing of the gas valve.

A centrifugally operated switch is located inside blower and controls the opening and closing of the gas (solenoid) valve.

GAS VALVE (FIGURE 4)

The gas (solenoid) valve controls the flow of LP gas to the burner assembly.

IGNITION PAK (FIGURE 4)

The ignition pak is basically a step-up transformer that builds up the 12-volt input to approximately 20,000 volts. This voltage is supplied through a high-tension lead to the spark electrode whenever the thermostat contacts are closed (calling for heat).

BURNER ASSEMBLY (FIGURE 4)

The burner assembly contains LP gas spray nozzle, the spark electrode, and a air adjustment feature (See "Primary Air Adjustment" later in this section). The spark electrode will supply a constant wiring to ground through the burner assembly whenever voltage is supplied from the ignition pak.

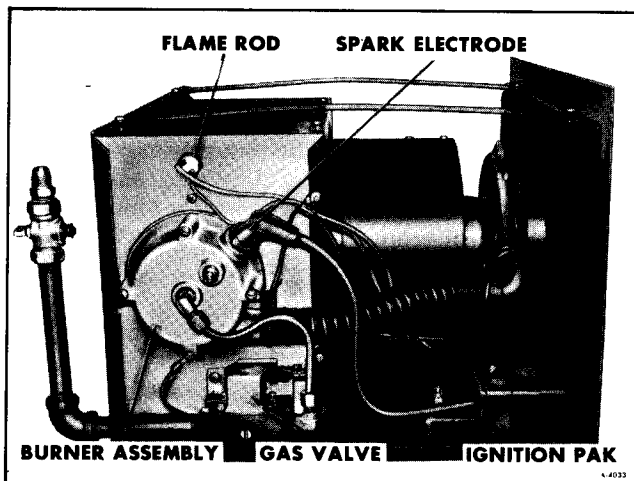


Figure 4—Furnace Components (Right-Side)

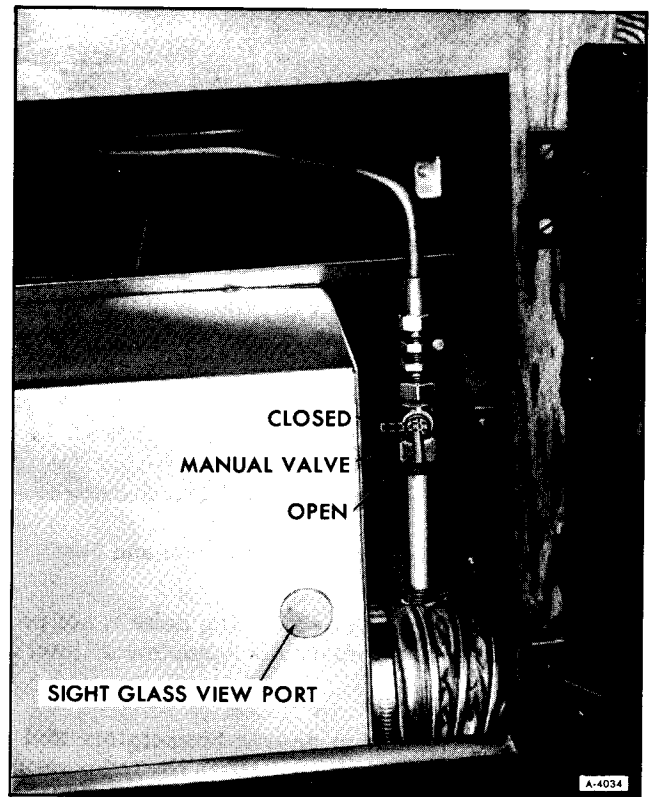


Figure 5—Manual Valve and View Port

FLAME ROD (FIGURE 4)

The flame rod is a switch which closes when the combustion chamber reaches a specified temperature. When the switch closes current is supplied to the coil of control relay 3CR and thereby shuts off current flow to the thermal relay heater TH1 (See figure 2) as the normally closed contacts 3CR are opened.

OPERATION

STARTING FURNACE

1. Turn thermostat to "OFF" position.
2. Open LP gas tank valve.
3. Open manual furnace valve (figure 5).
4. Press manual reset button on furnace (figure 6).
5. Turn thermostat (figure 7) to a temperature above room temperature. Furnace should start.

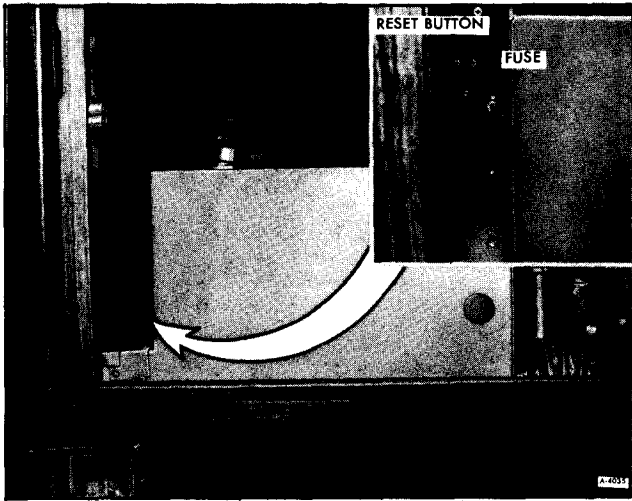


Figure 6—Location of Reset Button and Fuse

NOTE: A rumbling or growling noise is not normal. Refer to "Primary Air Adjustment" later in this section.

6. Set thermostat to desired temperature and it will cycle the furnace on and off as the temperature inside the MotorHome satisfies the thermostat.

SHUTTING OFF FURNACE

1. To shut off furnace set thermostat to "OFF" (See figure 7).
2. Close furnace manual valve (See figure 5).

SEQUENCE OF OPERATION

THERMOSTAT CONTACTS CLOSE, CALLING FOR HEAT (START CYCLE)

1. Control relay 2CR is energized providing power to the ignition pak, thermal relay heater, blower motor, and control relay 1CR. When control relay 1CR is energized power is supplied to the auxiliary furnace blower, through terminal 1 on the control box.

2. When the blower reaches minimum operating speed (approximately 2-3 seconds), the blower

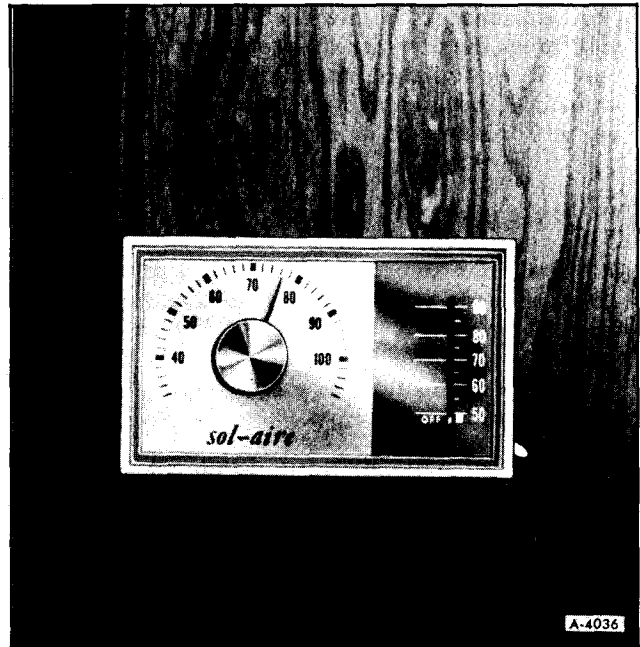


Figure 7 —Furnace Thermostat

switch contacts close providing power to the gas (solenoid) valve.

BURNER IGNITES (START CYCLE)

1. Approximately 10-15 seconds after ignition the flame rod (switch) contacts close, de-energizing the thermal relay heater TH1 through control relay 3CR. The furnace will continue running until the thermostat is satisfied and its contacts open.

THERMOSTAT CONTACTS OPEN (PURGE CYCLE)

1. The coil of control relay 2CR is de-energized, stopping the flow of power to the ignition pak and the gas valve. Power is maintained to the blower motor through the still closed 3CR contacts.

2. After approximately two minutes the flame switch cools, opening the circuit to control relay 3CR and de-energizing the blower motor. This also opens control relay 1CR contacts and de-energizes the auxiliary furnace blower.

FURNACE TROUBLE DIAGNOSIS

IMPORTANT NOTE: Before any diagnosis is attempted on the furnace, there are two necessary and sufficient external conditions that must be met.

1. With the thermostat calling for heat, there must be 12 volts (absolute minimum of 10.5 volts) present at the furnace.
2. With the thermostat calling for heat, there must be a gas pressure of 11" of water present to the furnace measured at the range/oven.

BURNER WILL NOT LIGHT

No.	Check to Make	Results	Go To	Problem
1.	a. Turn off gas. b. Make sure ignition wire is secure on the spark electrode. c. Remove locking nut from the spark electrode. d. Turn on thermostat. e. Hold spark electrode approx. 1/2" from the burner and check for sparking.	Spark Present	#2	
		No Spark	#3	
2.	a. Replace the spark electrode. (Turn the locking nut on finger tight.) b. Turn on L.P.G. c. Turn on the thermostat. d. Sniff for L.P. fumes at the right hand exterior furnace vent.	Gas Present		Primary air adjustment too lean.
		No Gas Present	#7	
3.	a. Check to make sure the ignition pak ground is connected to ground at the burner housing and at the ignition pak.	Ground wire not connected.		Loose ground to the ignition pak.
		Ground wire securely connected.	#4	
4.	a. Check for correct polarity at the ignition pak ground (black wire) on right; hot (red wire) on left.	Polarity not correct.		Polarity wrong, switch wires.
		Polarity is correct.	#5	
5.	a. Check the voltage at the hot wire (red wire) at the ignition pak with the thermostat on.	12 volts.		Defective ignition pak.
		0 volts.	#6	

No.	Check to Make	Results	Go To	Problem
6.	a. Remove the furnace from the Motor Home.	0 volts.		Defective control box.
	b. Connect the furnace to a 12V power supply.			
	c. Short across the thermostat wires.	12 volts.		Broken wire between the control box and the ignition pak.
	d. Check the #12 terminal of the control box.			
7.	a. With the furnace on, check the voltage at the gas valve.	12 volts.		Defective gas valve.
		0 volts.		
8.	a. Remove the furnace from the vehicle.	12 volts.		Defective centrifugal blower switch.
	b. Connect the furnace to a 12V power supply.			
	c. Short across the thermostat wires.	0 volts.		Defective control box.
	d. Check the voltage at the #11 terminal on the control box.			

FURNACE LIGHTS BUT RESET POPS IN LESS THAN ONE MINUTE

No.	Check to Make	Results	Go To	Problem
1.	a. All thermal relay to completely cool, 3 - 5 minutes.	Less than 35 seconds.		Defective thermal relay in control box. Replace control box.
	b. Press the reset button.			
	c. Turn the thermostat on.	35 - 45 seconds.	#2	
	d. Check the length of time before the furnace shuts off.			
2.	a. Disconnect both wires from the flame rod.	Resistance does not drop to 0 ohms.		Defective flame rod.
	b. Connect an ohm meter across the on the flame rod.			
	c. Allow the thermal relay to cool for 3 - 5 minutes.	Resistance does drop to 0 ohms.		Defective control box.
	d. Push the reset.			
	e. Turn on the thermostat.			
	f. Check to see if the resistance of the flame rod goes to approx. 0 ohms before the furnace shuts off.			

BLOWER DOES NOT COME ON WHEN THERMOSTAT IS CALLING FOR HEAT

No.	Check to Make	Results	Go To	Problem
1.	a. With thermostat calling for heat press in reset button.	Furnace turns on.		Reset was not set.
		Furnace does not turn on.	#2	
2.	a. Check the 10 amp fuse in the furnace.	Fuse OK.	#3	
		Fuse blown.	#5	
3.	a. Short across the two thermostat leads at the control box on furnace.	Furnace starts.		Defective thermostat or broken wire.
		Furnace does not start.	#4	
4.	a. Remove Furnace from vehicle.	Blower runs.		Defective control circuit.
	b. Connect a 12V source across the #11 and #5 terminals on the control box.	Blower does not run.		Defective blower asm.
5.	a. Install a new fuse in the furnace. Turn the thermostat on.	Furnace starts and runs.		Surge current blew fuse, furnace OK.
		Fuse immediately blows again.	#6	
6.	a. Remove furnace from vehicle.			
	b. Disconnect the wires from terminals #11 and #12 on the control box.	Fuse blows immediately.		Defective control box.
	c. Install a new fuse in the furnace.			
7.	d. Connect the furnace to a 12V source.	Fuse does not blow.	#7	
	e. Short across the thermostat wires.			
7.	a. Reconnect the wire to the #12 terminal on the control box.	Fuse blows.		Defective ignition pak.
	b. Short across the thermostat leads with the furnace connected to a 12V source.	Fuse does not blow.		Defective blower asm.

OPERATIONAL CHECKOUT

The following checkout is given to aid in checking the furnace if it has not been operated for a long period of time or if a suspected problem is encountered.

1. Check LP gas pressure at range/oven using a water manometer with burners turned on. Details for checking and adjusting LP gas pressure is given in Section 24F "LP Gas System." Pressure should be 11 inches of water.

2. Sol-Aire furnace is designed to operate on a minimum of 10.2 Volts D.C. If voltage is less than 10.2 volts, then reset button will trip and shut off furnace. Check voltage at furnace and recharge living area battery, if necessary.

3. Shut off gas manual valve at furnace. Depress reset button.

4. Turn up thermostat and check the number of seconds it takes to pop reset button. This time should be between 35 and 60 seconds.

5. Open manual to furnace and hold in reset button until burner lights. Observe flame through sight glass view port in plenum. It may take several minutes for air to purge from gas line.

NOTE: A rumbling or growling noise is not normal. Refer to "Primary Air Adjustment" later in this section.

6. Allow furnace to set (not heating) for at least 5 minutes to cool reset (thermal heating element TH1).

7. After cooling, depress reset button, and check the number of seconds it takes for the flame rod (switch) to close, which can be heard by listening for control relay 3CR to "click" in the control box. The time must be between 10 to 15 seconds.

8. Set thermostat to a temperature 5° to 10° above outside temperature.

9. After thermostat is satisfied, burner will shut off and blower will continue to run for several minutes.

10. When flame rod (switch) cools to proper temperature, blower will stop.

11. Open door and windows to cool vehicle.

12. When vehicle has cooled, thermostat contact closing will automatically re-light furnace. Allow 2 or 3 cycles of this type.

NOTE: If a problem occurs while proceeding through the furnace checkout, refer to "Furnace Trouble Diagnosis" earlier in this section.

FURNACE REPLACEMENT

WARNING: BEFORE ANY REMOVAL OR DISASSEMBLY PROCEDURES ARE PERFORMED ON THE FURNACE, BE SURE L.P. GAS IS COMPLETELY TURNED OFF AT THE L.P. GAS TANK AND REMOVE FURNACE FUSE FROM FUSE BLOCK IN LIVING AREA ELECTRICAL COMPARTMENT.

WARNING: DUE TO THE POSSIBILITY OF INJURY ON SHARP SHEET METAL, CARE SHOULD BE TAKEN ANY TIME SERVICE IS PERFORMED ON THE FURNACE.

REMOVAL

1. Be sure LP gas is turned off at LP tank and furnace fuse is removed from fuse block in living area electrical compartment.

2. Disconnect furnace electrical connector (See figure 1).

3. Disconnect LP gas supply line from furnace manual valve (See figure 5).

4. Disconnect furnace ducts from right side of furnace.

a. If vehicle is equipped with davo, raise seat and then disconnect ducts from right side of furnace. Then remove two mounting bolts (See figure 8).

b. If vehicle is equipped with swivel chairs, remove screws retaining duct panel assembly to floor and sink module. Carefully raise panels and disconnect ducts from right-side of furnace. Remove panel assembly and also two mounting bolts (See figure 8). Remove swivel chair.

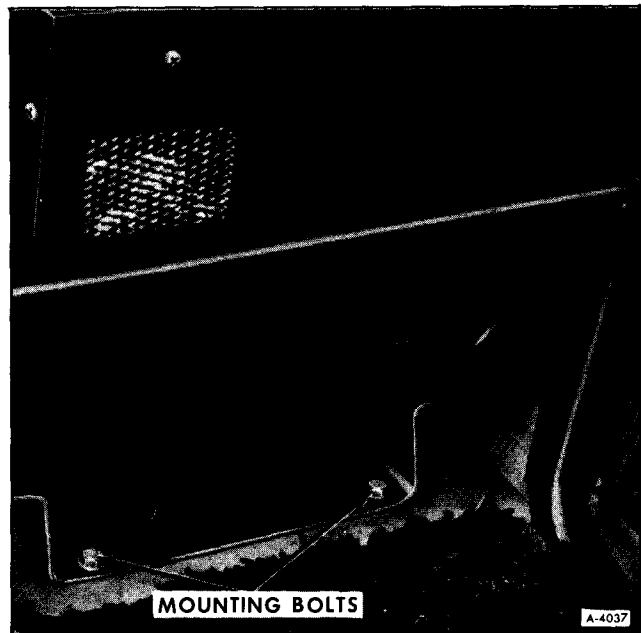


Figure 8—Location Furnace Mounting Bolts (Right-Side)

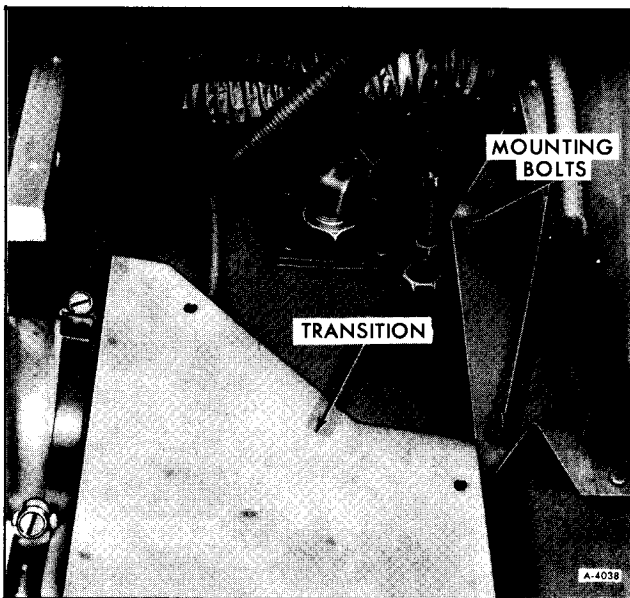


Figure 9—Location Furnace Mounting Bolts (Left-Side)

5. Remove lower shelf from cabinet to left of furnace (as shown in figure 1).

6. Disconnect furnace ducts from left-side of furnace.

7. Remove two mounting bolts from left-side of furnace (figure 9).

NOTE: Figure 9 shows transition removed from plenum to make mounting bolts visible.

8. Disconnect bathroom heat duct located on top of furnace plenum (See figure 10).

9. Remove four upper furnace mounting screws (See figure 10).

10. Carefully slide furnace and plenum towards center-aisle of MotorHome, then remove from end of sink module.

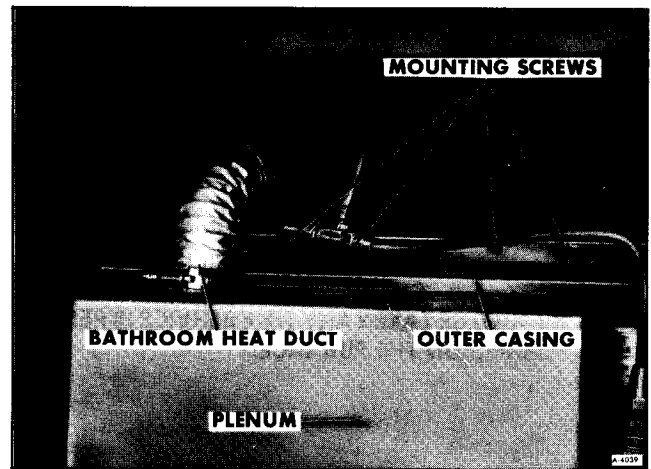


Figure 10—Location of Upper Furnace Mounting Screws

INSTALLATION

1. Slide furnace into sink module.
2. Install two mounting bolts at right-side of furnace (See figure 8).
3. Install two mounting bolts at left-side of furnace (See figure 9). Connect ducts at left-side of furnace. Install lower shelf in cabinet to left of furnace.
4. Install four upper furnace mounting screws (See figure 10). Connect bathroom heat duct to furnace plenum (See figure 10).
5. Connect LP gas supply to furnace manual valve (See figure 5).
6. Connect furnace electrical connector (See figure 1).
7. Connect furnace ducts to right-side of furnace.
8. Install any remaining furniture components, such as: Davo, swivel chair, and trim panels.

COMPONENT REPLACEMENT

The following four components can be inspected or replaced without removing the furnace from the vehicle:

1. Flame Switch
2. Limit Switch.

3. Burner Assembly
4. Spark Electrode

Removal of the furnace from the vehicle is required for replacement of other components.

WARNING: BEFORE ANY REMOVAL OR DISASSEMBLY PROCEDURES ARE PERFORMED ON THE FURNACE, BE SURE L.P. GAS IS COMPLETELY TURNED OFF AT THE L.P. GAS TANK AND REMOVE FURNACE FUSE FROM FUSE BLOCK IN LIVING AREA ELECTRICAL COMPARTMENT.

WARNING: DUE TO THE POSSIBILITY OF INJURY ON SHARP SHEET METAL, CARE SHOULD BE TAKEN ANY TIME SERVICE IS PERFORMED ON THE FURNACE.

FLAME SWITCH REPLACEMENT

REMOVAL

1. Gain access to right-side of furnace. Remove access cover (figure 11).
2. Disconnect two wires from flame rod (See figure 12).
3. Using 11/16-inch wrench, unscrew flame rod from heat exchanger.

INSTALLATION

1. Install flame rod in combustion chamber opening. Tighten securely.
2. Connect two wires to flame rod (figure 12).
3. Install access cover (figure 12).



Figure 11—Removing Furnace Access Cover

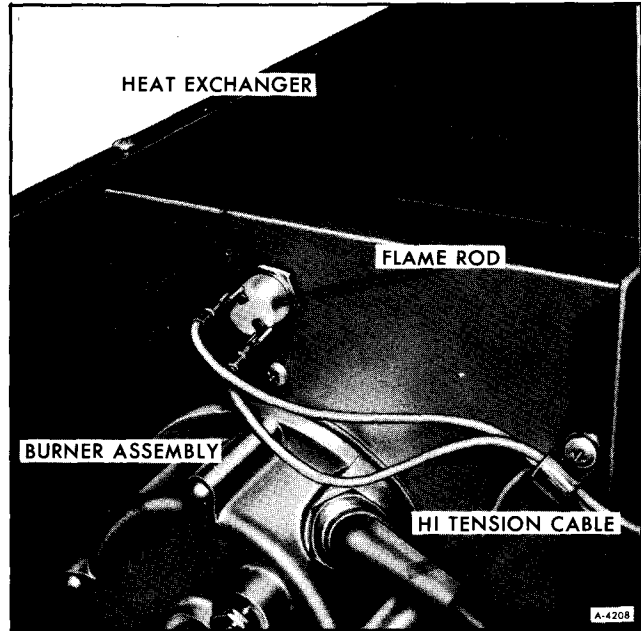


Figure 12—Location of Furnace Flame Rod

SPARK ELECTRODE REPLACEMENT

REMOVAL

1. Gain access to right-side of furnace. Remove access cover (figure 11).
2. Remove hi tension cable (See figure 13) from spark electrode.

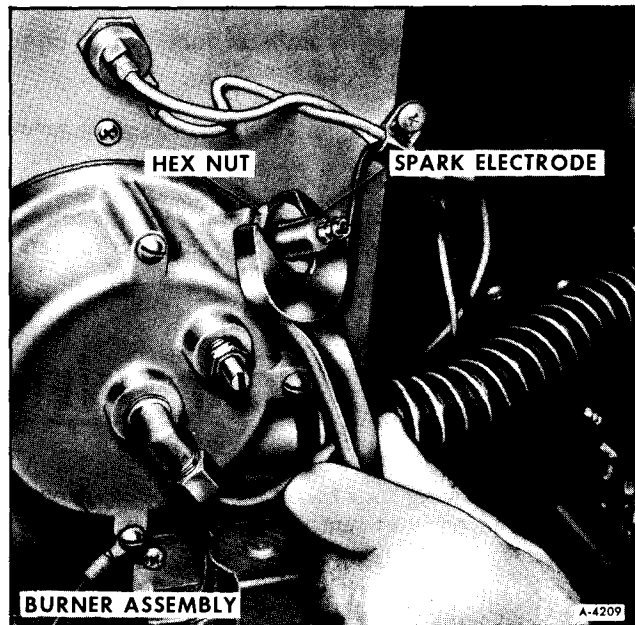


Figure 13—Removing Spark Electrode

3. Loosen hex nut at base of spark electrode.
4. Remove spark electrode from burner assembly.

INSTALLATION

1. Carefully install spark electrode into burner assembly.

IMPORTANT: The hex nut retaining spark electrode in the burner assembly, should be tightened hand-tight. Do not use wrenches to tighten this nut.

2. Install hi tension cable (See figure 13) on spark electrode.
3. Install access cover on furnace (figure 11).

BURNER ASSEMBLY REPLACEMENT

REMOVAL

1. Remove spark electrode. See "Spark Electrode Removal" earlier in this section.
2. Disconnect gas line at burner assembly (See figure 14).
3. Remove four screws retaining burner assembly to heat exchanger (See figure 15).

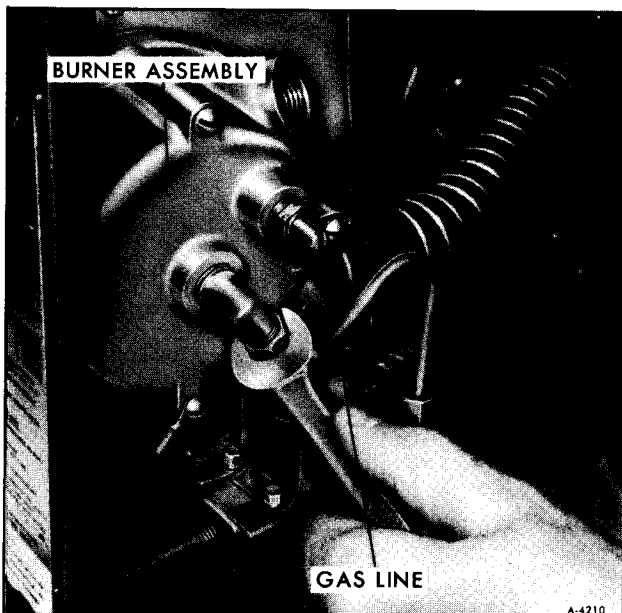


Figure 14—Disconnecting Gas Line from Burner Assembly

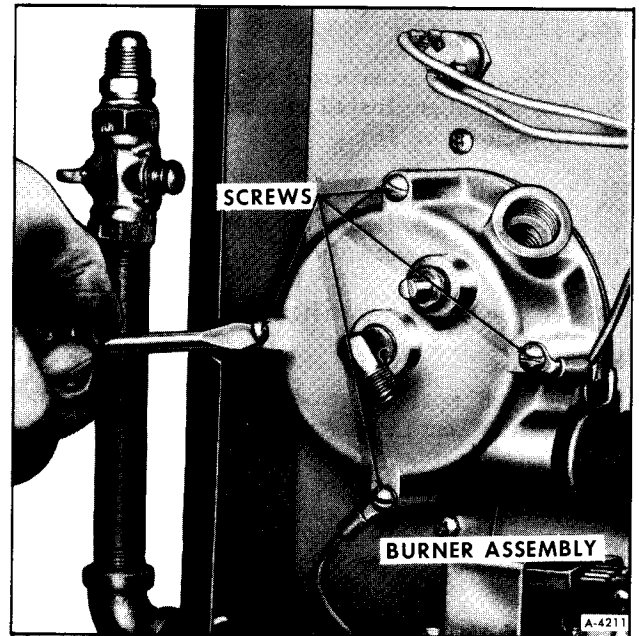


Figure 15—Removing Screws from Burner Assembly

NOTE: Referring to Figure 15, check which screws have ground connections attached so they will be replaced on proper screws.

4. Lift burner assembly away from combustion chamber. Then using hose clamp pliers, slide clamp about 1" away from burner along tube (See figure 16).
5. Remove burner assembly.

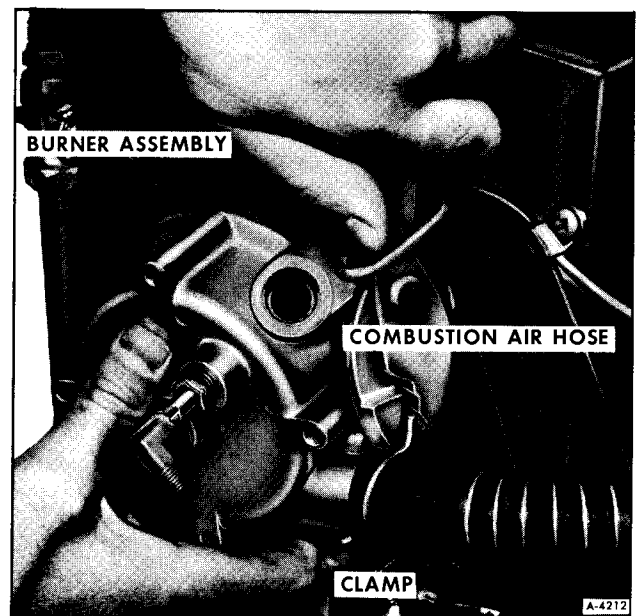


Figure 16—Removing Hose Clamp from Burner Assembly

INSTALLATION

1. Position burner assembly at opening in combustion chamber. Install combustion air hose and clamp (See figure 16).
2. Install four screws retaining burner assembly to heat exchanger. Be sure ground wires are installed under screws as shown in Figure 15.
3. Connect gas line to burner assembly (See figure 14).
4. Install spark electrode. See "Spark Electrode-Installation" earlier in this section.

LIMIT SWITCH REPLACEMENT

REMOVAL

1. Disconnect furnace electrical connector (figure 1) at left-side of furnace.
2. Remove wiring access cover and move rearward, taking care not to damage wires going to control box.
3. Use a magnitized short screwdriver to remove two screws holding limit switch to combustion chamber. Use care to avoid losing screws.
4. Remove limit switch.

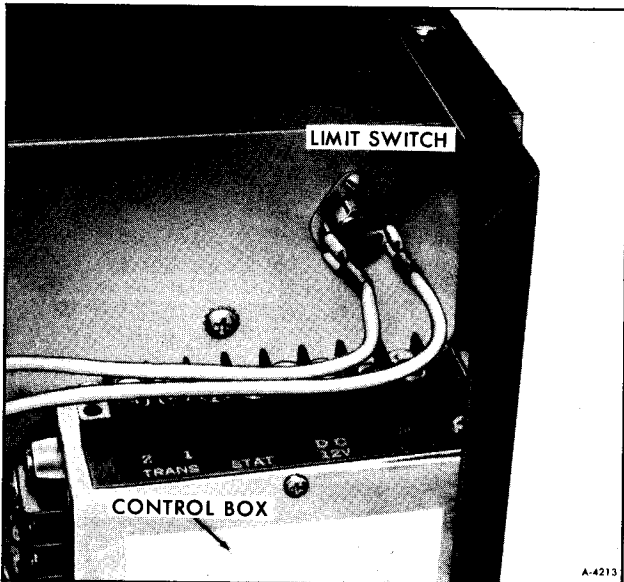


Figure 17—Location of Limit Switch

INSTALLATION

1. Carefully position limit switch in combustion chamber opening.
2. Install two screws retaining limit switch to combustion chamber (See figure 17).
3. Connect two wires to limit switch.
4. Install wiring access cover.
5. Connect furnace electrical connector at left-side of furnace.

GAS VALVE REPLACEMENT

REMOVAL

1. Remove furnace from vehicle. See "Furnace Replacement" earlier in this section.
2. Remove furnace plenum (See figure 18). Remove wiring access cover.
3. Remove furnace from outer casing (See figure 19).
4. Remove gas line between gas valve and main burner (See figure 20). Disconnect two electrical wires from valve. Be sure to note which terminal each wire is removed from, to aid in proper installation.
5. Disconnect gas supply line from gas valve.
6. Remove four gas valve mounting screws.
7. Remove gas valve from furnace.

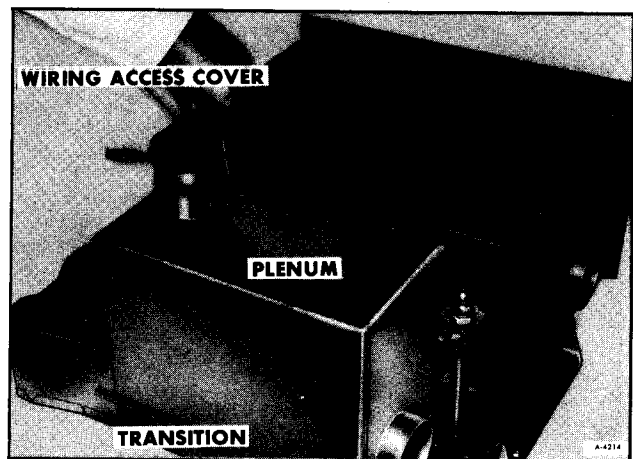


Figure 18—Removing Furnace Plenum

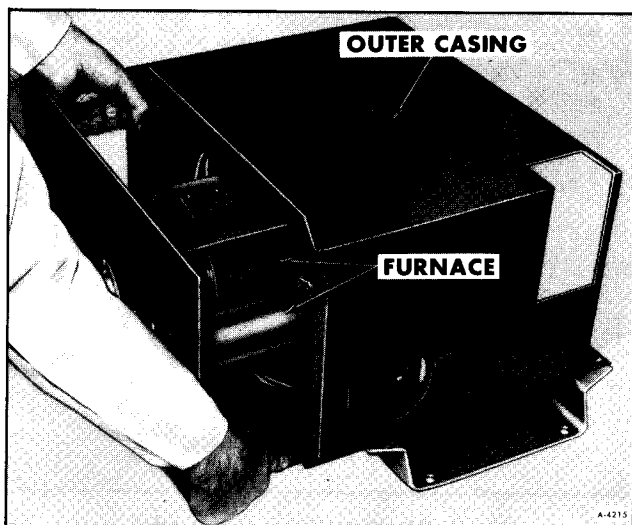


Figure 19—Removing Furnace from Outer Casing

INSTALLATION

1. Referring to Figure 20, connect gas supply line to gas valve.
2. Install four gas valve mounting screws.
3. Install gas line from gas valve to burner assembly.
4. Connect two electrical wires to terminals on gas valve.
5. Install furnace in outer casing (See figure 19).

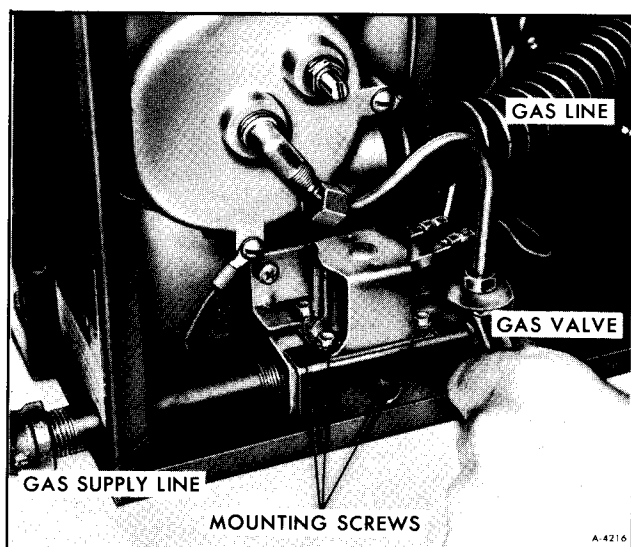


Figure 20—Removing Gas Line from Gas Valve

6. Install furnace plenum (See figure 18). Install wiring access cover.

7. Install furnace in vehicle. See "Furnace Replacement" earlier in this section.

IGNITION PAK REPLACEMENT

REMOVAL

1. Remove furnace from vehicle. Refer to "Furnace Replacement" earlier in this section.
2. Remove wiring access cover (See figure 18).
3. Remove furnace from outer casing (See figure 19).
4. Disconnect hi tension cable from spark electrode.
5. Disconnect two electrical wires from ignition pak (See figure 21). Be sure to note which terminal each wire is removed from, to aid in proper installation.
6. Loosen mounting screw and remove ignition pak.

INSTALLATION

1. Position ignition pak under mounting strap as shown in Figure 21. Tighten mounting screw.
2. Connect two electrical wires to terminals on ignition pak.

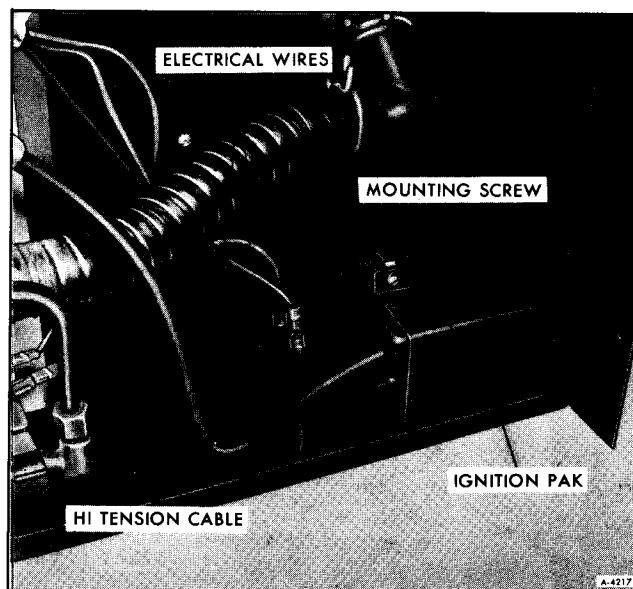


Figure 21—Ignition Pak Installed

3. Connect hi tension cable to spark electrode.
4. Install furnace in outer casing (See figure 19).
5. Install wiring access cover (figure 18).
6. Install furnace in vehicle. See "Furnace Replacement" earlier in this section.

CONTROL BOX REPLACEMENT

REMOVAL

NOTE: If a malfunction occurs in one or more of the relays in the control box (See figure 22) it is to be replaced as an assembly.

1. Remove furnace from vehicle. See "Furnace Replacement" earlier in this section.
2. Remove wiring access cover (figure 18).
3. Remove furnace from outer casing (See figure 19).
4. Disconnect all external electrical wires from control box. Note the number identification on wires, to aid in correct installation, later.
5. Remove two control box mounting screws (See figure 23).
6. Remove control box.

INSTALLATION

1. Position control box as shown in Figure 23. Install two control box mounting screws.

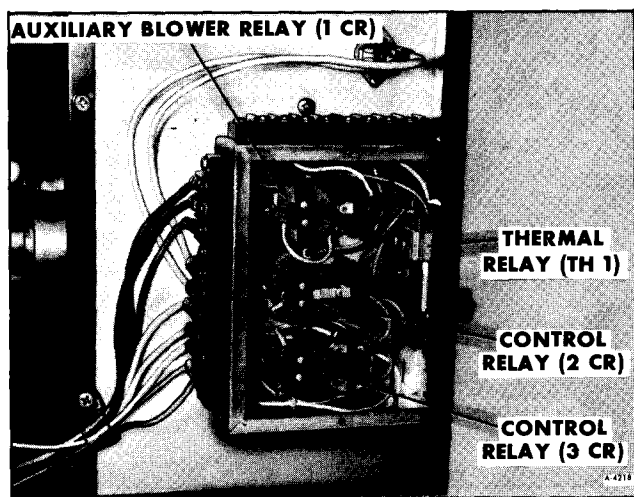


Figure 22—Control Box (Cover Removed)

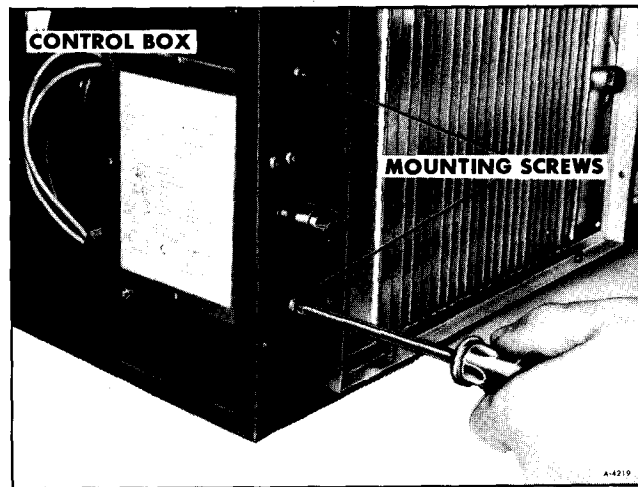


Figure 23—Removing Control Box

2. Connect electrical wires to control box.
3. Install furnace in outer casing (See figure 19).
4. Install wiring access cover (See figure 19).
5. Install furnace in vehicle. See "Furnace Replacement" earlier in this section.

BLOWER REPLACEMENT

REMOVAL

1. Remove furnace from vehicle. See "Furnace Replacement" earlier in this section.
2. Remove wiring access cover (figure 18).

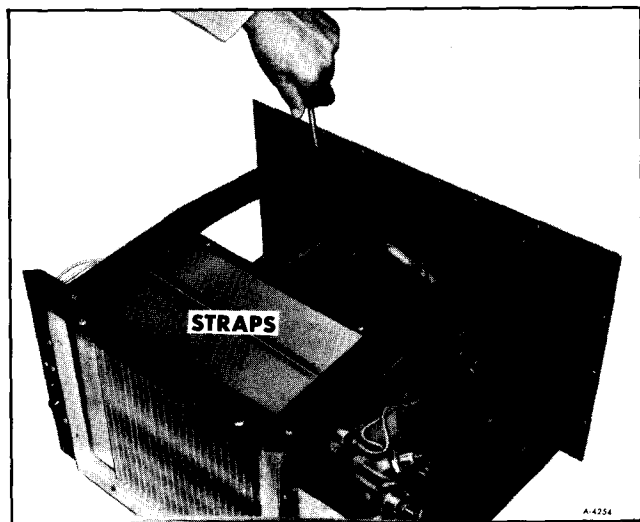


Figure 24—Removing Straps from Furnace

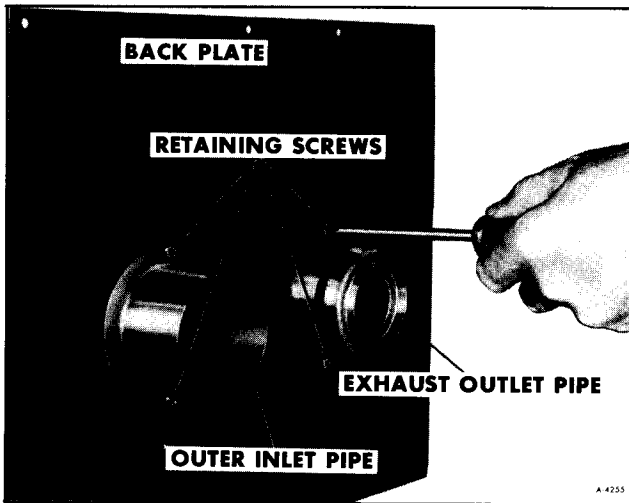


Figure 25—Removing Back Plate Retaining Screws

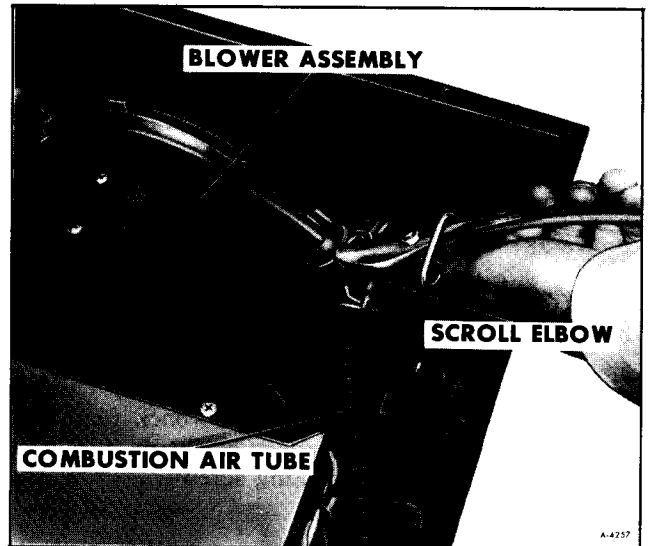


Figure 27—Disconnecting Combustion Air Tube from Blower Assembly

3. Remove furnace from outer casing (See figure 19).

4. Remove straps from furnace (See figure 24).

5. Remove back plate retaining screws (See figure 25). Then remove outer inlet pipe and back plate.

6. Remove exhaust outlet pipe and inner inlet pipe (See figure 26).

7. Disconnect combustion air tube from blower assembly (See figure 27).

8. Disconnect flue tube from combustion chamber (See figure 28). Remove flue tube.

9. Remove six retaining screws holding blower assembly to combustion chamber (See figure 29).

10. Remove blower assembly (figure 30).

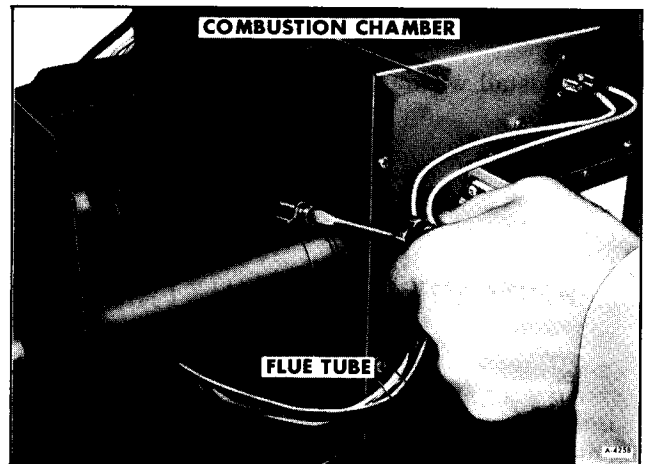


Figure 28—Disconnecting Flue Tube from Combustion Chamber

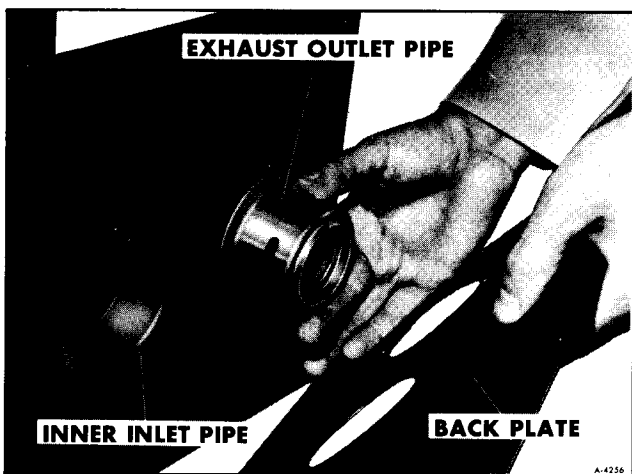


Figure 26—Removing Exhaust Outlet Pipe

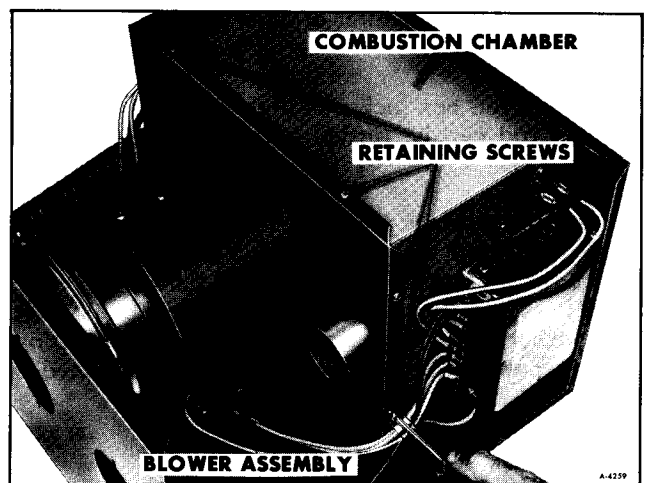


Figure 29—Removing Blower Motor Retaining Screws

INSTALLATION

1. Position blower assembly against combustion chamber. Install six retaining screws (See figure 29).
2. Connect flue tube to combustion chamber (See figure 28).
3. Connect combustion air tube to blower assembly.
4. Position inner inlet pipe and exhaust outlet pipe as shown in Figure 26. Place back plate and outer inlet pipe against furnace as shown in Figure 25. Install back plate retaining screws.
5. Install straps to furnace (See figure 24).
6. Install outer casing on furnace (See figure 19).
7. Install wiring access cover (figure 18).

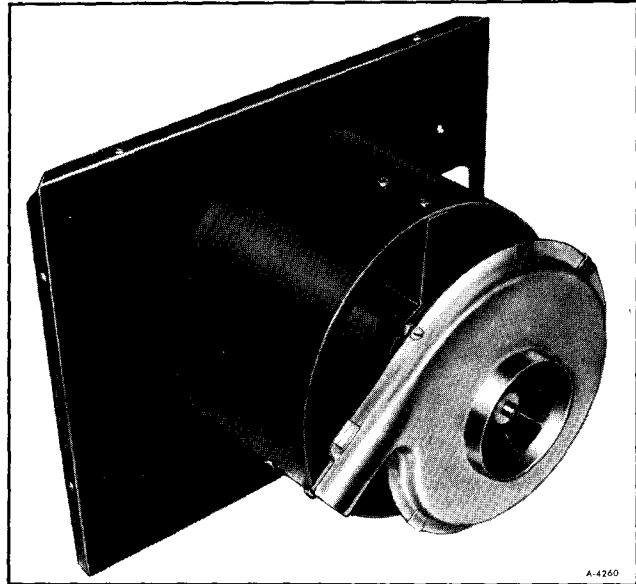


Figure 30—Blower Assembly

8. Install furnace in vehicle. See "Furnace Replacement" earlier in this section.

ON VEHICLE ADJUSTMENT

PRIMARY AIR ADJUSTMENT

Access to the burner assembly to adjust primary air is located at the bottom, right side of the furnace compartment by removing access cover (figure 11).

NOTE: To gain access to right side of furnace, if vehicle is equipped with a davo, squeeze levers located under center of davo seat and raise seat.

1. Loosen hex lock nut slightly until burner adjusting rod can be turned with a screwdriver (See figure 31).
2. Start furnace and watch burner through sight glass view port in plenum (See figure 5). Decrease primary air to give a slightly yellow flame with green cones. The cones are formed at each of the ports in the burner. Then increase air slowly until the yellow disappears and the cones become sharply defined as blue.

NOTE: The total adjustment available, from one extreme to the other, is only about 1/4 turn. Do not force adjusting rod past the stops.

4. Recheck flame to see that it is still properly adjusted.

Hold the adjusting rod in place and tighten the hex nut.



Figure 31—Furnace Primary Air Adjustment

AUXILIARY FURNACE BLOWER

BLOWER LOCATION

The auxiliary furnace blower supplies warm air to the bathroom whenever the furnace is operating.

NOTE: If bathroom warm air outlet is located beside shower head the auxiliary furnace blower is located in the closet module (See figure 32) if warm air duct is located on wall below bathroom sink the auxiliary furnace blower is installed behind the range/oven (figure 33).

AUXILIARY FURNACE BLOWER REPLACEMENT

1. Remove furnace fuse from fuse block in living area electrical compartment.
2. Gain access to auxiliary furnace blower.
 - a. If blower is located in closet module, open upper door beside closet. Remove rear panel in compartment (See figure 32).

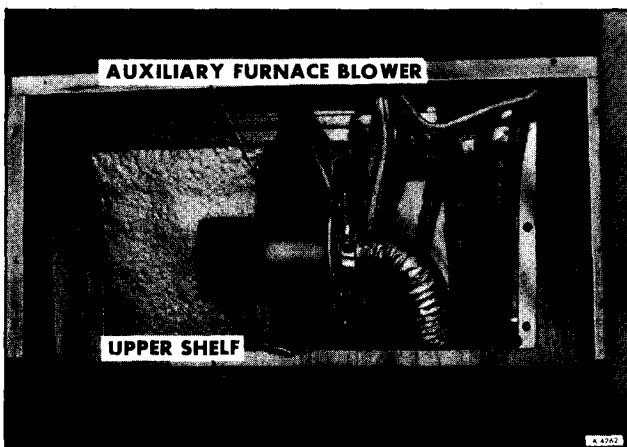


Figure 32—Auxiliary Furnace Blower (Located in Closet Module)

b. If blower is located behind range/oven (See figure 33), remove range/oven. To remove range/oven refer to Section 24H for detailed procedures.

3. Disconnect electrical lead and ducts from from blower.
4. Remove mounting screws retaining blower to MotorHome body member.
5. Install new blower and tighten retaining screws, securely.
6. Connect electrical lead and ducts to blower.
7. Install any components or trim removed to gain access to blower.
8. Install furnace fuse in fuse block in living area electrical compartment.

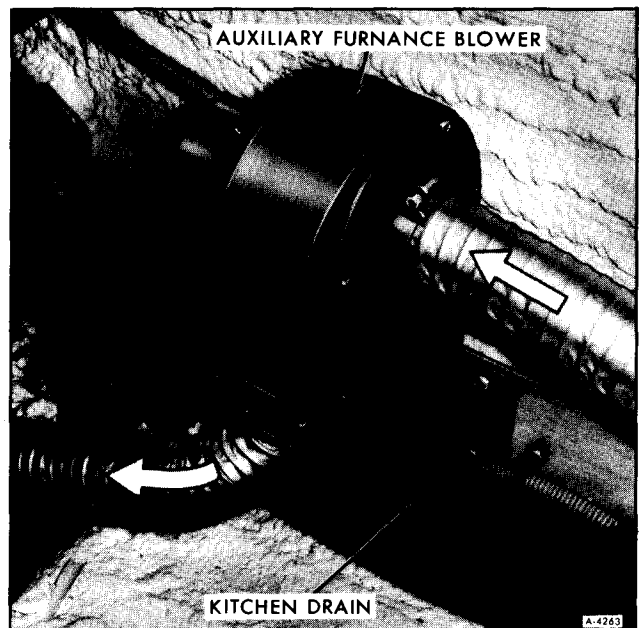


Figure 33—Auxiliary Furnace Blower (Located Behind Range/Oven)

SECTION 24H

RANGE/OVEN

GENERAL INFORMATION

The 3-burner range/oven (figure 1) used in the MotorHome is designed for operation with liquid petroleum gas (L.P.G.). Never attempt to operate the unit with any other type of fuel.

Recreational vehicle range/ovens differ from conventional residential units in several ways:

1. The units are more compact.
2. The units are equipped with thermostat controls which allow you to manually shut off the gas to the pilots when traveling.
3. Clips are provided for the top burner grates and oven rack to help prevent rattles and dislodgement while traveling.

Any time the range/oven is in operation, the

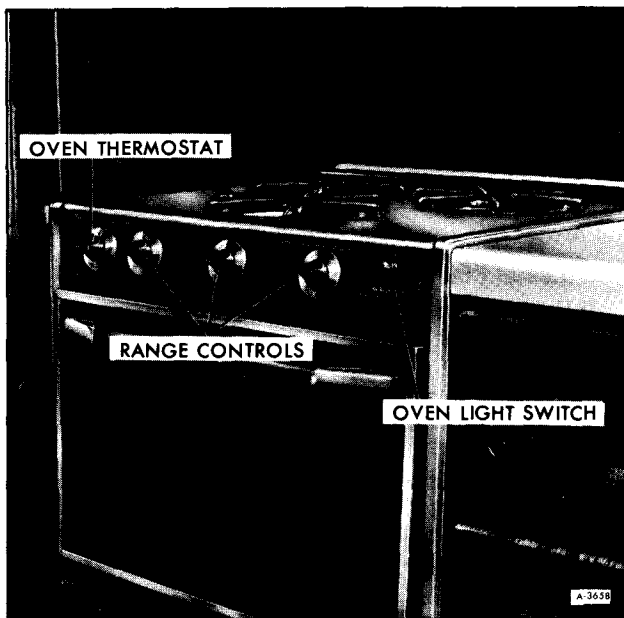


Figure 1—Range/Oven

power range hood fan should be operating to help ensure proper ventilation.

In order to operate the range/oven the gas supply must be turned on at the L.P. gas tank.

CAUTION: *The Range/Oven should not be used when the vehicle is moving, and the LP gas should be turned off at the LP gas tank. The burners or pilot lights may blow out creating a fire or explosion hazard. In addition, a sudden movement of the vehicle could throw utensils or scalding liquids from the stove which could result in serious personal injury or property damage.*

OPERATION

The 3 burner range/oven has two pilots—one for the 3 range burners and one for the oven.

Pilots

1. Turn on power range hood fan.

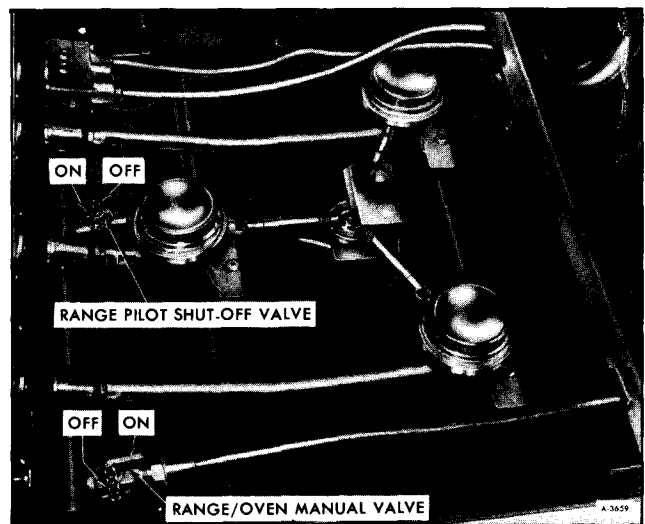


Figure 2—Range/Oven LP Gas Valves

2. Be sure manual control valve at LP gas tank is fully open.

3. Be sure all knobs are in the "OFF" position. The oven thermostat should be in the "PILOT OFF" position.

4. Lift cook top panel and turn range/oven manual valve and range pilot shut off valve to ON position (See figure 2).

5. Light range pilot with a match as shown in Figure 3.

6. Depress the oven thermostat and turn counterclockwise to OFF position.

7. Open the oven door, allow the compartment to ventilate, then light the oven pilot with a match (See figure 4). A small flame should be noted at the top of the pilot burner. After the initial light-up, it may take a minute or so to clear the air from the line so the flame stays lit.

CAUTION: *When lighting pilots, BOTH pilots must be lit, even if plans are to use just one cooking means. Once the oven thermostat is moved from the "PILOT OFF" position and the range pilot shut off valve is in the ON position, gas will issue from both range and oven pilots. Failure to light both pilots could result in fire or explosion caused by accumulating LP gas.*

8. The oven pilot is non-adjustable. The range pilot adjustment screw is located behind the range pilot shut off valve.

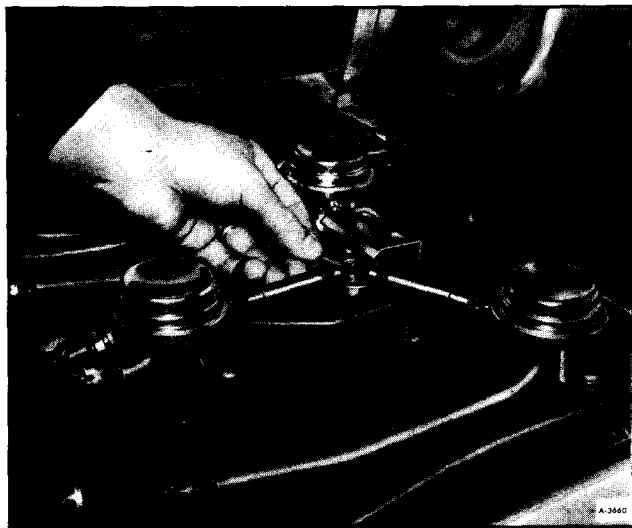


Figure 3—Lighting Range Pilot

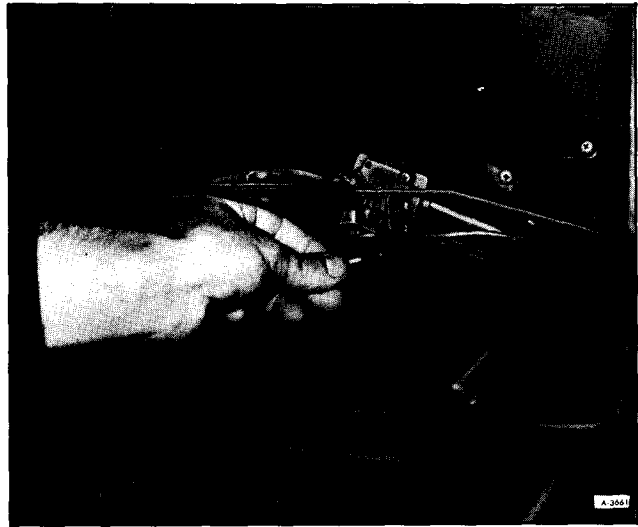


Figure 4—Lighting Oven Pilot

Range

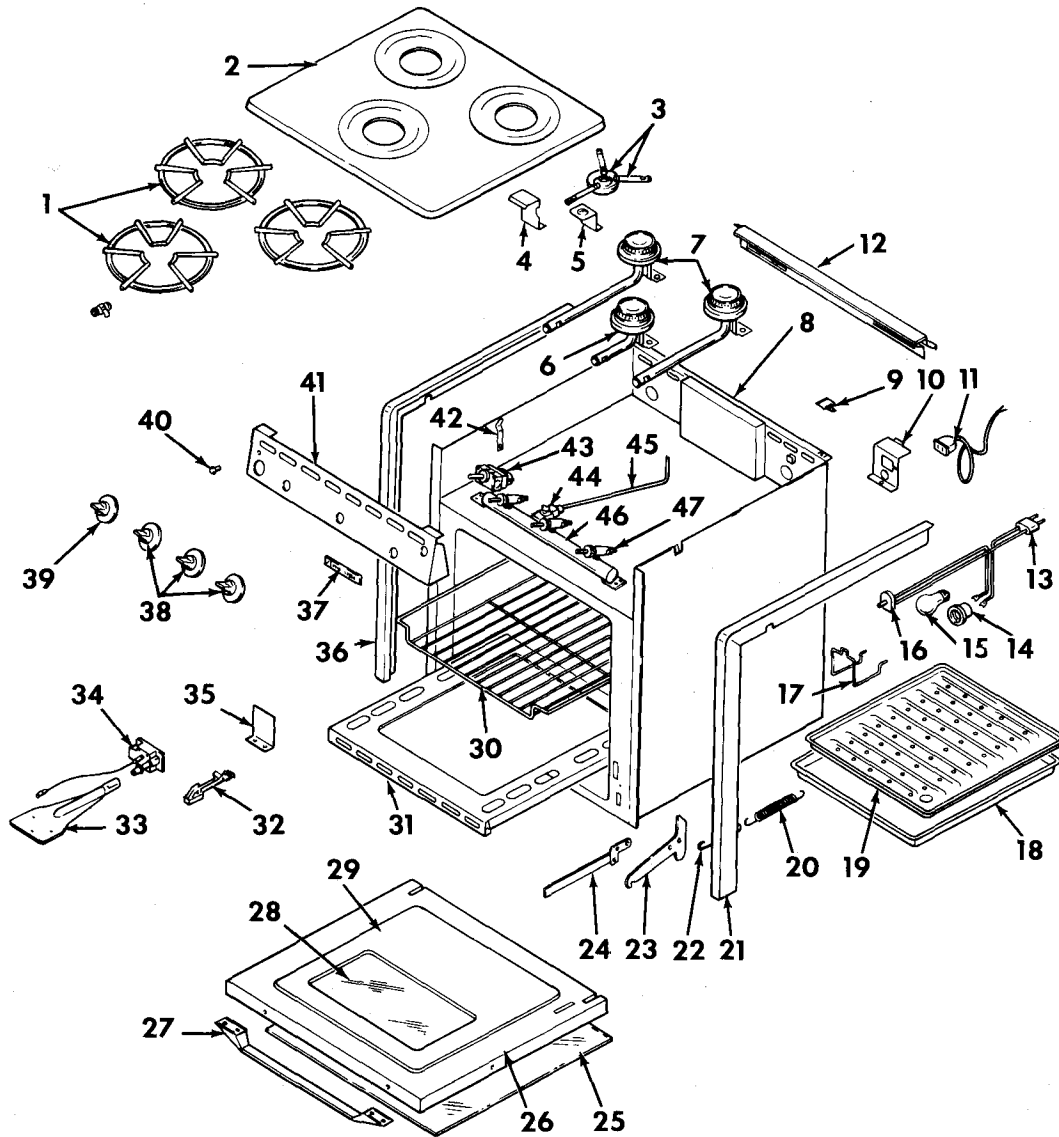
1. Be sure power range hood fan is operating.
2. Push control knob in and turn gas on counterclockwise all the way to get gas to the burner.
3. As soon as the burner lights, flame may be reduced to the desired height.
4. To turn off the burner, turn the control knob clockwise all the way to the "OFF" position. The knob is designed to lock in this position.

Oven

1. Be sure power range hood is operating.
2. To turn on the oven light, push in oven light button located at the right side of the knob panel. Push again to turn out.
3. To light the oven burner, depress and turn the thermostat dial counterclockwise to the desired temperature setting. It will take approximately 45 seconds before the safety valve will open and the oven burner ignite.
4. When through with oven, turn the thermostat dial to the "OFF" position. In this position the oven pilot will remain lit.
5. When traveling or when the MotorHome is not in operation; return the thermostat dial to the "PILOT OFF" position and turn range/oven manual valve and range pilot shut off valve to OFF position. This should turn off the gas to the range and oven pilots.

RANGE / OVEN TROUBLE DIAGNOSIS

Problem	Possible Cause	Correction
No oven burner ignition.	<ol style="list-style-type: none"> 1. Gas supply. 2. Pilot outage. 3. Oven Thermostat Control — You can tell that the thermostat is defective if you fail to get a secondary pilot immediately upon turning thermostat to the desired setting. 4. Oven Safety Valve — This can be determined as faulty if you do get a secondary pilot, upon setting the thermostat control to the desired temperature, but no oven ignition. 	<ol style="list-style-type: none"> 1. Be sure main gas valve/s are open and there is fuel in the tank. 2. Check to see that pilot is lit. 3. Replace Oven Thermostat Control. 4. Replace Oven Safety Valve.
No range burner ignition.	<ol style="list-style-type: none"> 1. Gas supply. 2. Pilot outage. 3. Burner ports are clogged. 4. Burner control valve faulty. 	<ol style="list-style-type: none"> 1. Be sure main gas supply is on. 2. Check to see that pilot is lit. Also, pilot may be improperly adjusted. 3. Make sure burner ports are not clogged. 4. Replace burner valve.
Pilot outage.	<ol style="list-style-type: none"> 1. Gas supply. 2. Air in the gas lines. 3. Pilot blowout. 4. Plugged orifice. 	<ol style="list-style-type: none"> 1. Be sure main gas valve(s) are open and there is fuel in the tank. 2. Bleed lines by holding match to burner and turning gas to that burner on fully. 3. Check for excessive drafts. 4. Carefully clean orifice with toothpick.
Noisy when traveling.	<ol style="list-style-type: none"> 1. Broiler pan. 2. Range burner grates. 3. Oven rack. 4. Cook top. 5. Oven bottom assembly. 	<ol style="list-style-type: none"> 1. It may be desirable to store pan in towel drawer adjacent to the oven. 2. Be sure grates are properly clipped. 3. Be sure rack is properly positioned in its clips. 4. Check to make sure top is properly positioned. 5. Check that oven bottom assembly is positioned and clipped.



- | | | |
|--|---------------------------|------------------------------|
| 1. Grates | 16. Oven Light Switch | 32. Oven Pilot |
| 2. Cook Top | 17. Light Bulb Guard | 33. Oven Burner |
| 3. Lighter Cup and Flash Tube Assembly | 18. Broiler Pan | 34. Safety Valve |
| 4. Pilot Shield | 19. Broiler Pan Insert | 35. Broiler Pan Stop |
| 5. Pilot Support | 20. Door Spring | 36. Side Trim - Left |
| 6. Front Burner | 21. Side Trim - Right | 37. Nameplate |
| 7. Rear Burners | 22. Oven Door Spring Hook | 38. Burner Control Knobs |
| 8. Oven Cabinet | 23. Spring Hinge Arm | 39. Thermostat Knob |
| 9. Cook Top Rear Spring | 24. Door Hinge | 40. Indicator Button |
| 10. Receptacle Support | 25. Front Glass | 41. Manifold Cover |
| 11. Service Cord | 26. Glass Door Frame | 42. Cook Top Clip |
| 12. Flue Deflector | 27. Door Handle | 43. Oven Thermostat |
| 13. Oven Light Harness | 28. Inner Door Glass | 44. Top Pilot Shut-off Valve |
| 14. Oven Light Receptacle | 29. Oven Door Liner | 45. Pilot Tube |
| 15. Oven Light Bulb | 30. Oven Rack | 46. Manifold |
| | 31. Oven Bottom | 47. Burner Control Valve |

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Figure 5—Range/Oven Components

Problem	Possible Cause	Correction
Oven burner ignites as soon as thermostat control is turned to desired temperature.	1. Oven Safety Valve — If there is not a 45 second delay before oven burner ignites after the desired oven temperature is set, the Oven Safety Valve is faulty.	1. Replace Oven Safety Valve.

RANGE / OVEN COMPONENT DISASSEMBLY PROCEDURES

WARNING: BEFORE PERFORMING ANY REMOVAL OR DISASSEMBLY PROCEDURES, BE SURE THE LP GAS IS TURNED COMPLETELY OFF AT THE LP GAS TANK.

NOTE: To gain space when working in and/or on range/oven (figure 5) it is often desirable to remove the oven door.

OVEN DOOR REPLACEMENT

1. Place screwdrivers (awls, nails, etc.) through holes in oven door hinge while door is open (figure 6).



Figure 6—Inserting Pin In Door Hinge

2. Lift door (as if to close) and disengage hinges at door (See figure 7).

3. Remove door.

4. To reinstall reverse procedure.

OVEN THERMOSTAT CONTROL REPLACEMENT

1. Remove oven door.

2. Remove cook top and grates (See figure 8).

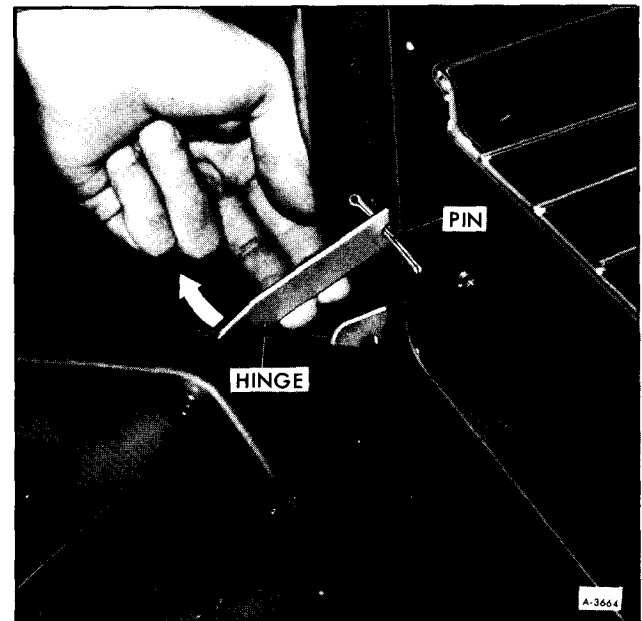


Figure 7—Disengaging Door Hinge

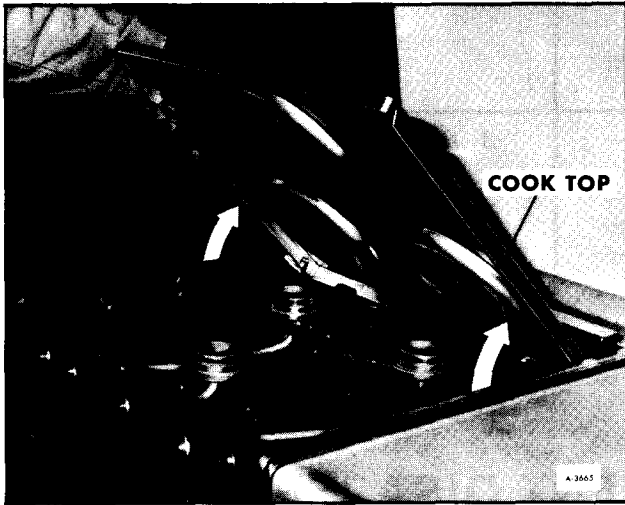


Figure 8—Cook Top Removal

3. Pull control knobs off.
4. Disconnect gas lines from rear of thermostat control as shown in Figure 9.
5. At the top of the oven compartment, remove the thermal sensing element from retaining clips and carefully feed this element up through the hole in the top of the oven compartment (figure 10).
6. Remove two screws holding oven thermostat to manifold (figure 11).
7. Replace oven thermostat control and reassemble by reversing procedure.

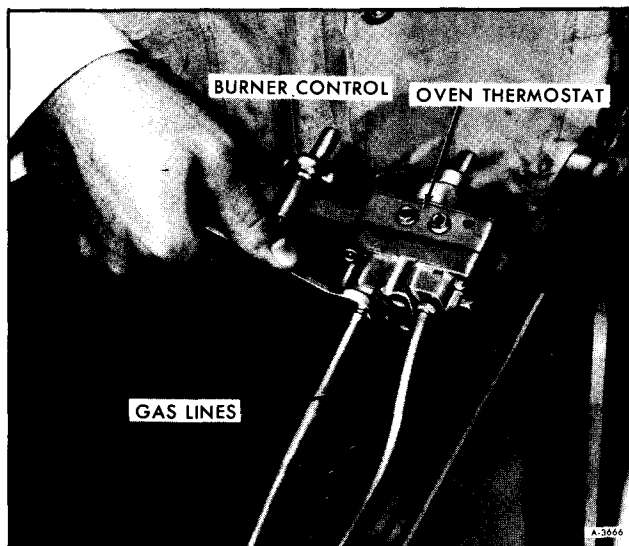


Figure 9—Disconnecting Gas Lines From Rear Of Thermostat

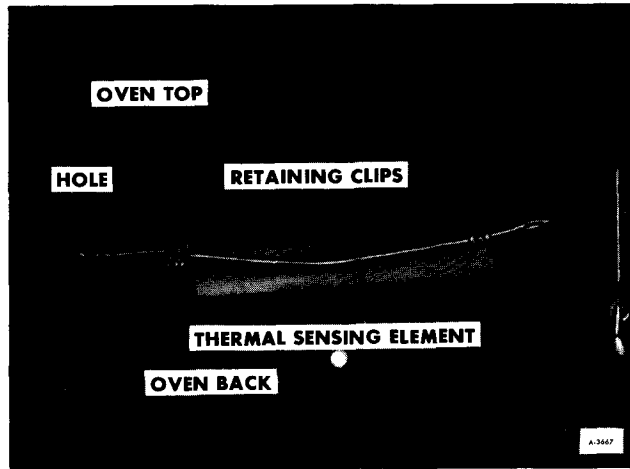


Figure 10—Location of Thermal Sensing Element in Oven

RANGE BURNER CONTROL VALVE REPLACEMENT

1. Close LP control valve on LP gas tank.
2. Remove cook top and grates (figure 8).
3. Pull control knobs off.
4. Disconnect gas lines from manifold (figures 9, 12, and 13).
5. Remove anti-rattle wire shown in Figure 24.
6. Disconnect flash tubes from top burners (figure 14).

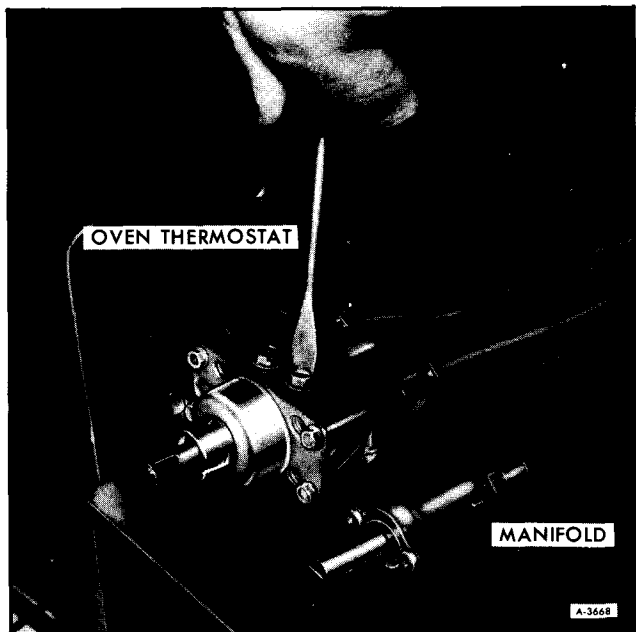


Figure 11—Removing Thermostat from Manifold

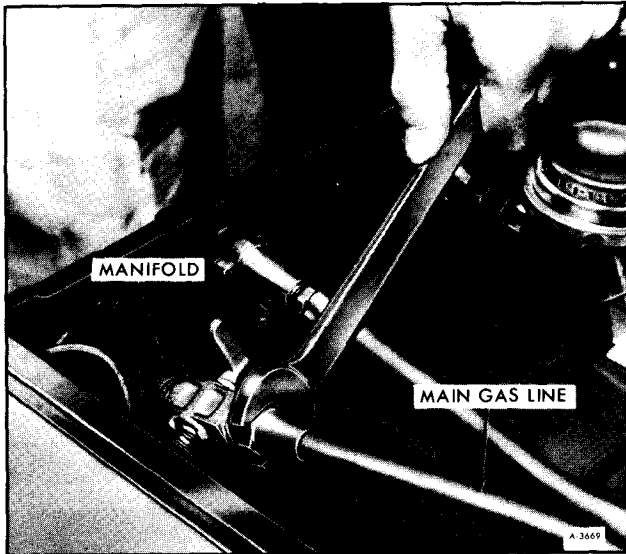


Figure 12—Disconnecting Main LP Gas Line

7. Remove top burners (figure 15).
8. Remove manifold retaining screws (figure 16).

NOTE: Burner control valves are threaded into the manifold. It will be necessary to remove the oven thermostat to replace the control valve at left end of the manifold. Figure 16 shows the thermostat removed.

9. Replace burner control valve(s) and reassemble by reversing procedure.

TOP BURNER REPLACEMENT

Should it become necessary to remove the top burners to clean or replace them, perform the following:

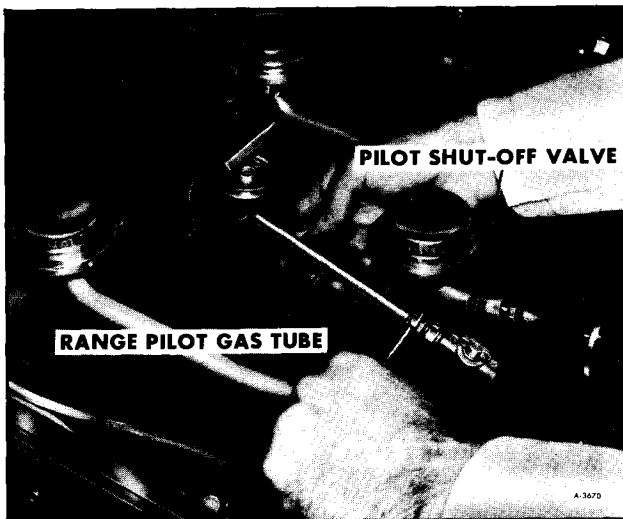


Figure 13—Disconnecting Range Pilot Gas Tube

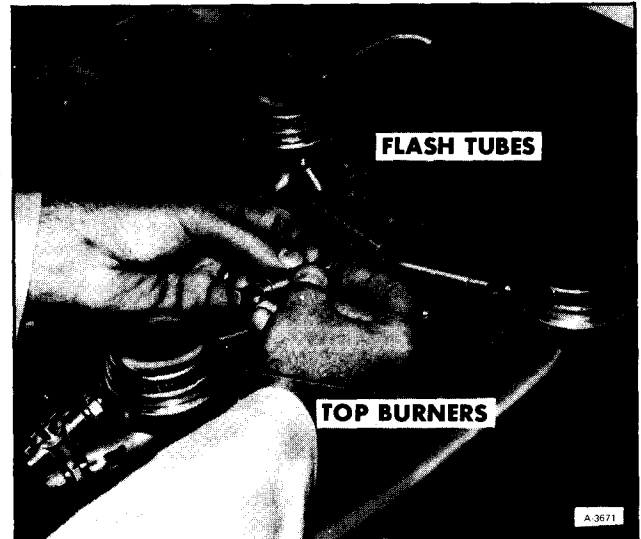


Figure 14—Disconnecting Flash Tubes

1. Remove cook top and grates (figure 8).
2. Unhook flash tube from burner (figure 14).
3. Remove single screw holding burner to range top (figure 15).
4. To install top burner reverse the above procedure.



Figure 15—Top Burner Removal

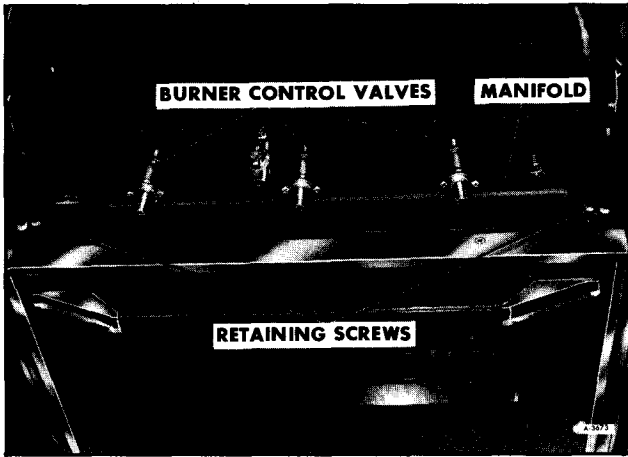


Figure 16—Manifold and Burner Control Valves Installed

OVEN SAFETY VALVE REPLACEMENT

1. Remove oven door (See “Oven Door Replacement”).
2. Remove oven rack (Item 30, figure 5).
3. Remove oven bottom assembly (Item 31, figure 5).
4. Disconnect gas line from oven pilot (figure 17) and then remove oven pilot assembly (figure 18).
5. Carefully remove capillary tube from oven pilot (figure 19).

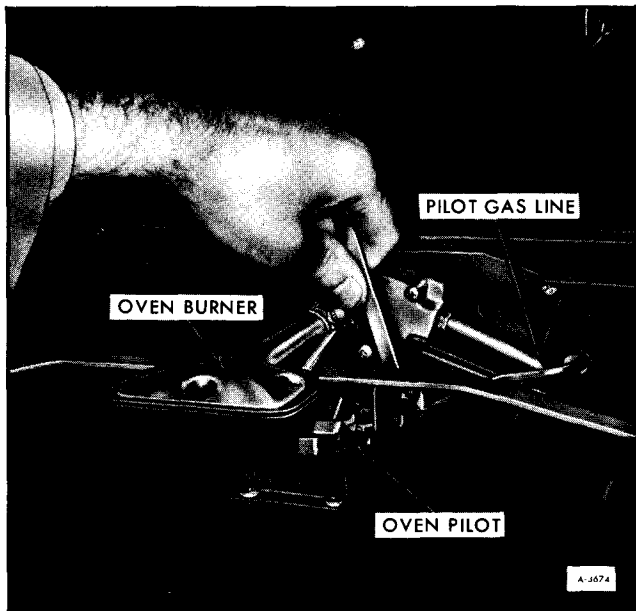


Figure 17—Disconnecting Gas Line From Oven Pilot

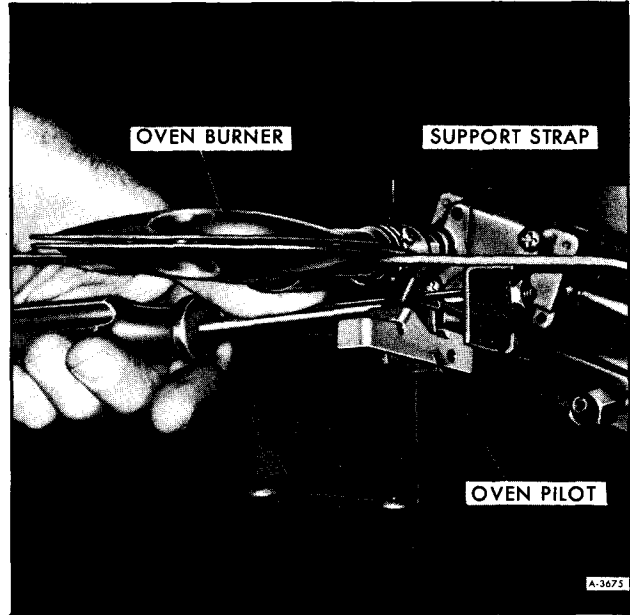


Figure 18—Removing Oven Pilot Assembly

NOTE: Capillary tube is attached to the oven safety valve. Use care when handling to avoid damage to capillary tube.

6. Remove main burner retaining screw (figure 20). Then separate the main burner from safety valve. Also remove main burner support strap.
7. Disconnect gas line from oven safety valve (figure 21).

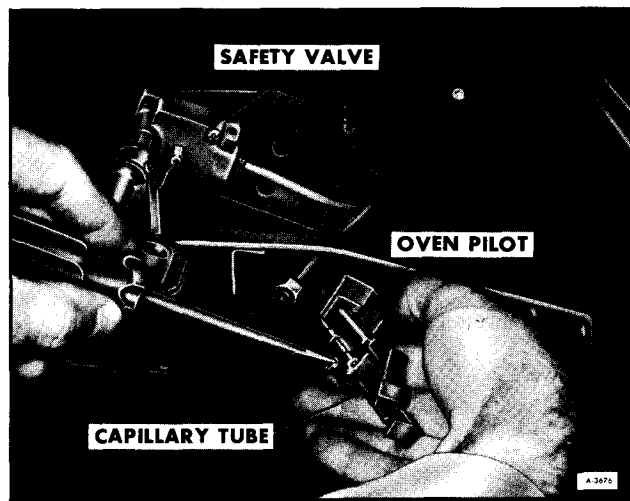


Figure 19—Removing Capillary Tube Retaining Screw

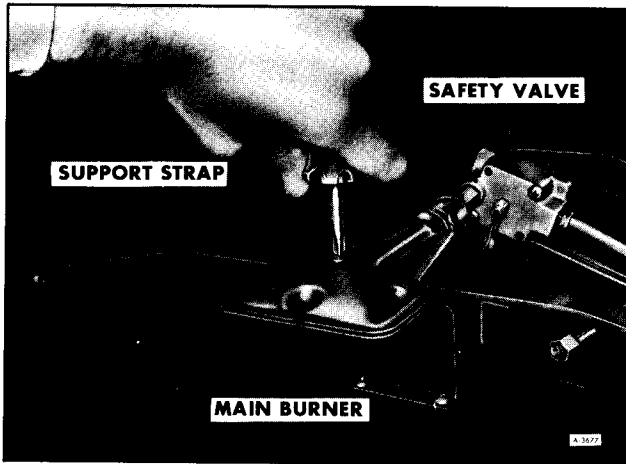


Figure 20—Removing Main Burner Retaining Screws

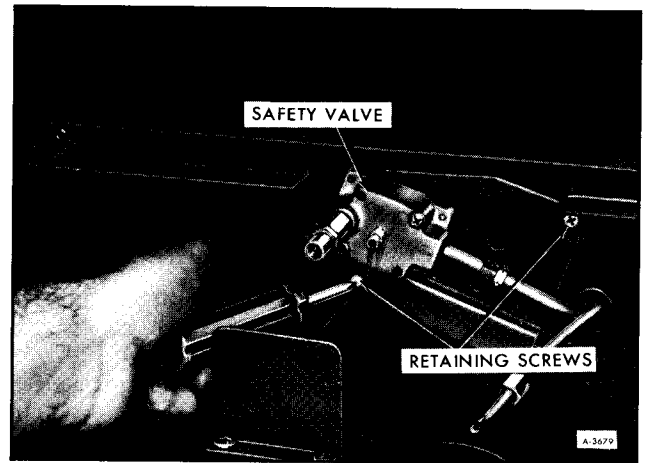


Figure 22—Removing Safety Valve Retaining Screws

9. Replace safety valve and reassemble by reversing procedure.

RANGE/OVEN UNIT REPLACEMENT

1. Close LP control valve on LP gas tank.
2. Remove cook top and grates (figure 8).
3. Disconnect main LP gas line from manifold (figure 12).
4. Remove lower mounting screws located inside side trim at bottom of oven door (figure 23).
5. Remove the upper mounting screws that hold unit to the cabinet top (figure 24).

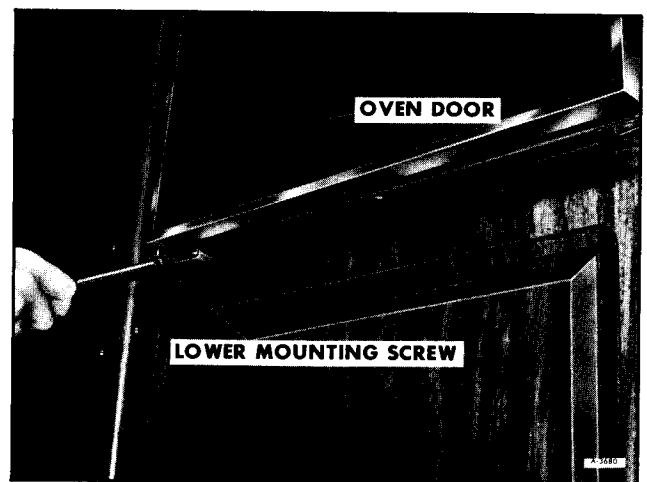


Figure 23—Removing Lower Range/Oven Mounting Screws

6. Move the range/oven forward, far enough to reach behind unit and disconnect the 12-volt service cord (Item 11, figure 5).

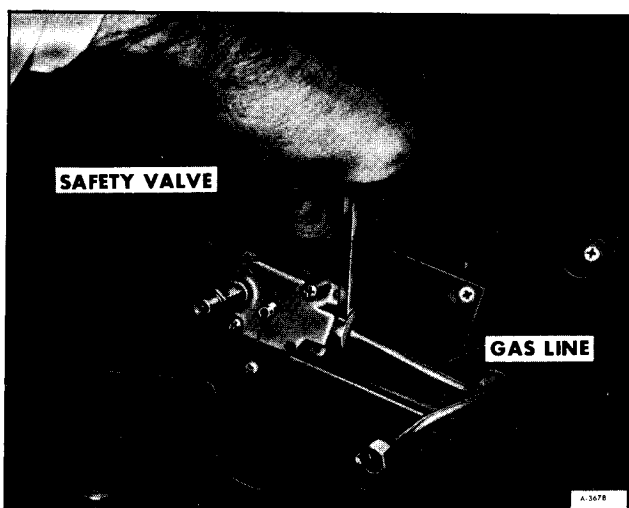


Figure 21—Disconnecting Gas Line from Safety Valve

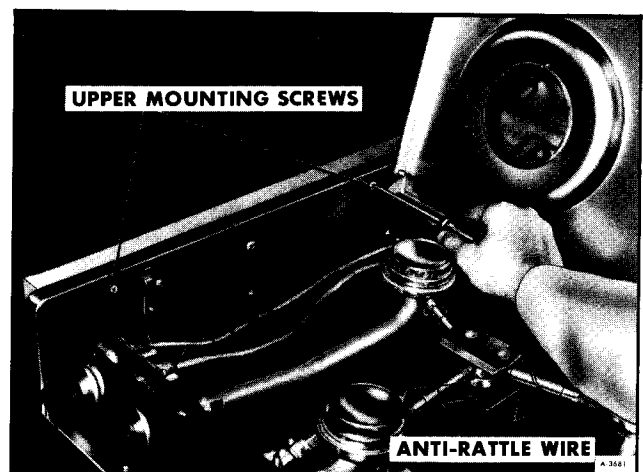


Figure 24—Removing Upper Range/Oven Mounting Screws

7. Remount unit from cabinet module.
8. To install unit reverse the above procedure.

OVEN DOOR HINGE REPLACEMENT

1. Remove range/oven unit from cabinet module (See "Range/Oven Unit Replacement").
2. Remove side trim (Items 21 and 36, figure 5) to avoid damage while servicing hinge.
3. At this point door hinge and spring is accessible for servicing, as necessary.

4. To install reverse above procedure.

OVEN DOOR GLASS REPLACEMENT

1. Remove oven door from range/oven unit (See "Oven Door Replacement").
2. Referring to Figure 5, carefully disassemble door.
3. With oven door disassembled replace glass (Items 25 or 28, figure 5).
4. Install oven door glass by reversing the above procedure.

CARE AND CLEANING

GENERAL

Regular cleaning with warm detergent solution and a soft cloth will keep your range looking bright and new. This should be done as soon as range cools.

Porcelain Enamel— Wipe surface clean immediately. Do not use metal scouring pads or cleanser containing grit or acid.

Chrome — To keep the mirror-bright finish, wipe with damp cloth and dry thoroughly. Stubborn stains may be removed with lemon juice, vinegar or chrome polish.

Glass — Wipe cooled glass with detergent and hot water. Rinse and polish with soft cloth.

BROILER PAN

Remove from oven immediately after use. Drain fat. Sprinkle rack with detergent and cover with wet paper towels and let soak, before washing in hot soapy water.

OVEN

Clean as soon as possible after use and when the oven is cool. Grease splatters that are allowed to become hard and baked on are very difficult to remove.

Care must be taken to avoid bending the tube clipped to the top of the oven. This is the thermal sensing element and could cause a variation between the oven temperature and dial setting.

If oven cleaners are used, be sure to rinse the tube thoroughly and wipe dry.

TOP BURNERS

Top burners may be cleaned with a detergent solution. If any burner port should become clogged, clean with a toothpick. Never use pins or other metal objects to clean the ports, as they may become enlarged. If the burner is washed in a sink, dry immediately by shaking off all excess water and lighting the burner until all water has evaporated.

ON-VEHICLE ADJUSTMENTS

PILOT ADJUSTMENT

The oven pilot is preadjusted and cannot be adjusted.

The range burner pilot (if so equipped) should burn with a blue flame having a slight yellow tip. The

tip of the flame should extend to approximately the top of the lighter body. The adjustment screw is located behind the range pilot shut off valve pilot remove dial and insert small screwdriver through the hole (figure 25). Rotate adjustment screw as required.

OVEN MAIN BURNER ADJUSTMENT

CAUTION: To avoid possible burns to hands or arms, prior to performing adjustment, be sure main burner is turned off and oven components are allowed to cool.

1. Loosen air deflector retaining screw (figure 26).



Figure 25—Adjusting Range Pilot

2. Rotate air deflector as necessary to supply more or less air to main burner.

3. Turn on oven and check burner flame. The main burner flame should burn with a blue flame having yellow tips.

4. Readjust position of air deflector if necessary after noting CAUTION at the beginning of "Oven Main Burner Adjustment."

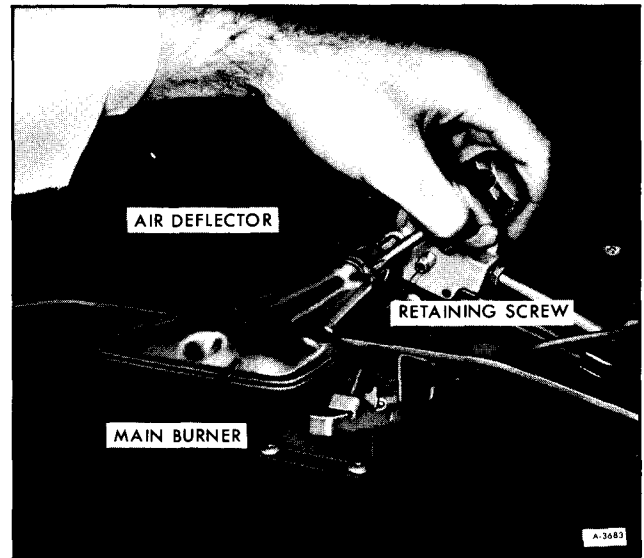


Figure 26—Location for Main Burner Adjustment

SECTION 24J

LIVING AREA WATER SYSTEM

The contents of this section are listed below:

SUBJECT	PAGE NO.
General Description-24J-00	24J-1
Trouble Diagnosis	24J-3
Draining Living Area Water System	24J-4
On-Vehicle Adjustment	24J-6
Water Tank	24J-6
Water Tank Filter-24J-00	24J-7
Water Tank Sending Unit	24J-8
Water Pump	24J-8
Water Heater	24J-19
Bathroom Sink Faucet.....	24J-22
Shower Head and Hose.....	24J-24
Galley Sink.....	24J-25
Water Purifier	24J-27
Winterization	24J-28
City Water Connection	24J-28
Plumbing Lines	24J-28

GENERAL DESCRIPTION

Your GMC MotorHome is equipped with its own self-contained water system (figure 1). The water tank and pressure pumps are located at the right rear corner of the MotorHome. The water pump switch is located near the entrance door.

The living area water system is supplied by either a demand water pump or by a city-water hook-up. There is no pressure tank in the system. Water pressure is maintained by a 12-volt water pump which is designed to automatically maintain enough pressure to ensure a steady water flow.

A pressure switch is located at the water pump to maintain line pressure between 15 psi. and 30 psi.

IMPORTANT: Do not attempt to increase water pressure with high pressure air. Be sure the water pump is turned "OFF" when the water tank is empty.

A 40 gallon water tank stores water to be drawn out by the water pump. The tank can be filled only through its own fill tube connection, located either inside the LP gas storage compartment at the right

rear corner of the vehicle or outside at the left rear side of vehicle.

A connection is provided, in the external utilities compartment, to hook-up to a city water supply. When this is done the water pump acts as a check valve and water does not enter the water tank.

The water lines are made of polybutulene and are connected with compression fittings.

There are six drain valves standard on the vehicle. There are seven drain valves on vehicles equipped with an electric (recirculating) toilet.

These valves are used to drain the water system (See figure 1).

They are located at the:

1. water tank.
2. water pump pressure line.
3. water heater.
4. electric toilet (if equipped).
5. hot water line next to galley sink.
6. cold water line next to galley sink.
7. city water connection.

24J-2 LIVING AREA WATER SYSTEM

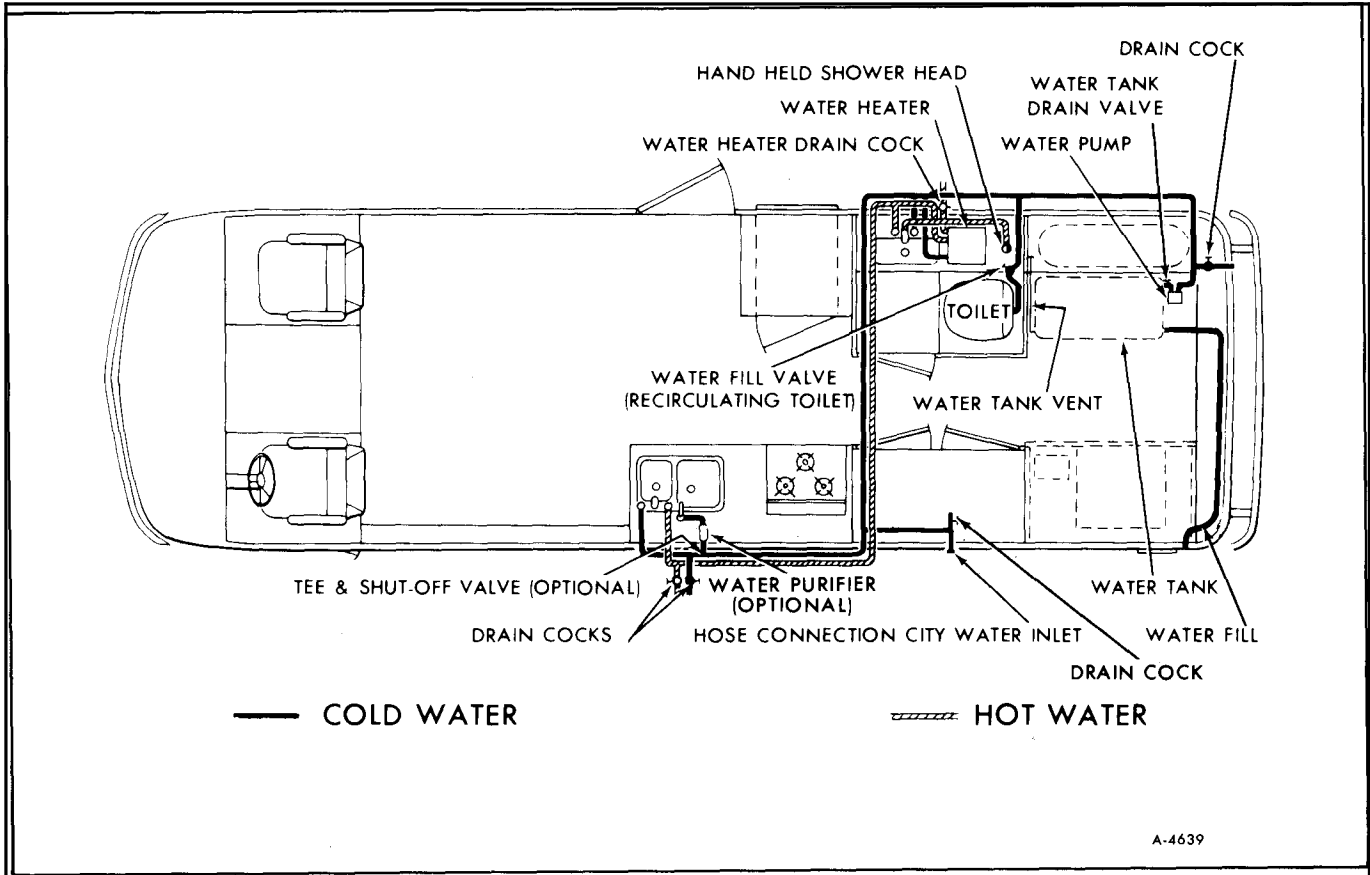


Figure 1—Living Area Water System Schematic

TROUBLE DIAGNOSIS

Problem	Possible Cause	Correction
No water.	<ol style="list-style-type: none"> 1. Water pump switch not on. 2. No water in tank. 3. Drain cocks open. 4. Pump belt broken. 5. Insufficient or no voltage at pump. (See water pump voltage check). 6. Faulty pressure switch on pump. 7. Pump motor burned out. 8. Pump is not priming itself or doesn't build up enough pressure to shut-off. 	<ol style="list-style-type: none"> 1. Turn on switch. 2. Fill tank. 3. Close all drain locks. 4. Replace belt. Refer to "Water Pump Belt Replacement" later in this section. Tension as shown in "On-Vehicle Adjustment—Water Pump Belt", later in this section. 5. Check fuse panel, replace fuse if required. Check for shorts. Check living area battery for charge. Charge if necessary. Check voltage at water pump wall switch. Voltage at the switch and not at the pump indicates a possible loose or incorrect connection or broken wire between switch and pump. Correct as necessary. 6. Check switch. Refer to "Pressure Switch" later in this section. 7. Replace motor. 8. Remove pump, dismantle and inspect check valve assemblies. Refer to "Water Pump-Disassembly" later in this section.
No or not enough hot water.	<ol style="list-style-type: none"> 1. Water Heater Switch not on. 2. Tank has overheated. 3. Low voltage. 4. Incorrect wiring. 5. Heater element burned out. 6. Thermostat burned out. 7. Water pre-heat hose (if equipped) pinched. 	<ol style="list-style-type: none"> 1. Turn on switch. 2. Push reset button. 3. Check source and correct as necessary. 4. Check wire connections and correct as necessary. 5. Replace element. Refer to "Water Heater—Removal" later in this section. 6. Replace thermostat. Refer to "Water Heater—Removal" later in this section. 7. Check pre-heat hose routings, correct as required.
Leaking water system.	<ol style="list-style-type: none"> 1. Loose or incorrect fittings. 	<ol style="list-style-type: none"> 1. Locate leak, determine cause and correct.
Water tank gauge at monitor panel does not operate.	<ol style="list-style-type: none"> 1. Defective sending unit or monitor panel gauge. 	<ol style="list-style-type: none"> 1. Refer to "Living Area Electrical" earlier in this section. Refer to "Water Tank—Sending Unit" later in this section.

DRAINING LIVING AREA WATER SYSTEM

1. Remove the water tank fill cap.
2. Open the holding tank dump valve, after making proper connection to approved dumping station.
3. Turn off water heater at switch located in Living Area Electrical Compartment. Open the water heater drain valve. The type 1 water heater drain valve is located at the front of the heater (figure 2). The type 2 water heater drain valve is located under the center of the water heater body (figure 42).
4. Open the water drain valves at the water pump and the water tank (figures 3 and 4), and the two water line drain cocks next to the kitchen sink. To gain access to water line drain cocks for kitchen sink remove the second drawer located to the left of the kitchen sink compartment door.
5. Open kitchen and bathroom faucets.
6. Turn on water pump (if not already running).
7. With the standard toilet, depress the foot pedal until water no longer enters toilet bowl.
8. Allow system to drain.
9. Turn off water pump.
10. Disconnect intake and outlet hoses on water pump.
11. With the recirculating toilet, open the toilet water line fill valve and press the flush button.

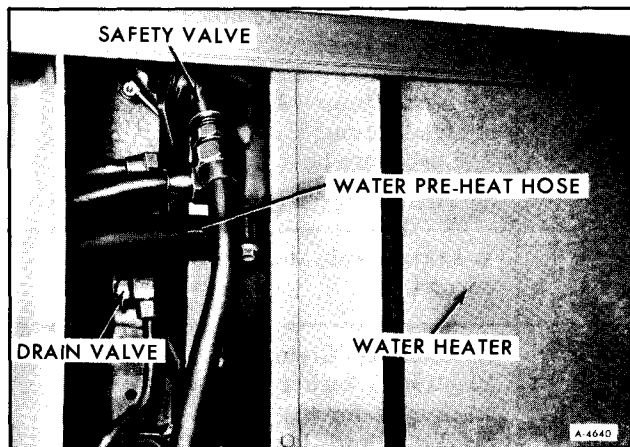


Figure 2—Water Heater - Type 1

12. Open shower head shut-off valve and turn the shower on at the bathroom faucet. Extend shower head toward sink to allow the shower head and flexible hose to drain.

13. Remove access cover near lower shelf in closet. Open drain valve (figure 5) for external water connection (inside external utilities compartment), remove hose connection cover. Depress the button on the check valve (figure 6) to allow this portion of plumbing to drain. Install hose connection cover.

14. Using low pressure (30 psi maximum), blow back through all faucets, forcing water from any low areas.

15. Connect water pump hoses and close all the water line drain cocks and valves including the water heater drain cock. Close kitchen and bathroom faucets, close toilet water line valve (if equipped). Close holding tank dump valve and latch. Stow holding tank tubes and replace dust cap. Replace water tank fill cap.

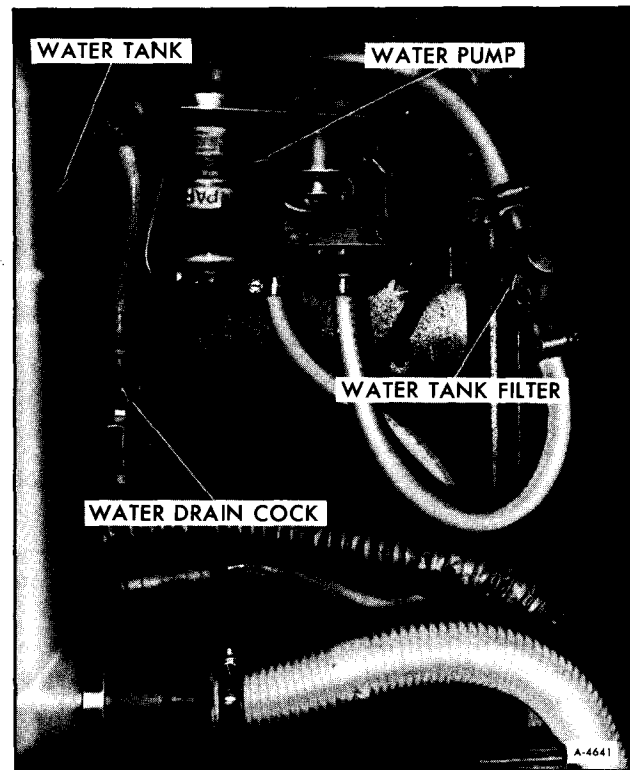


Figure 3—Water Tank Compartment (Typical)

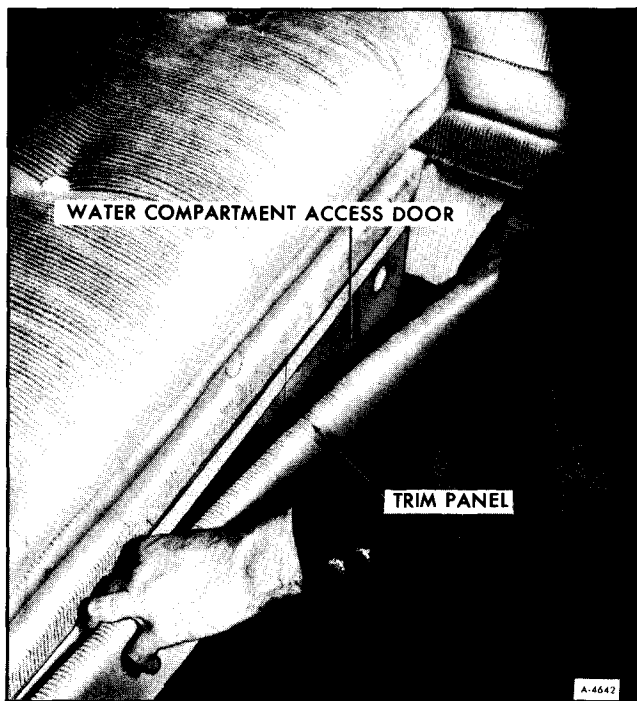


Figure 4—Access to Water Pump and Controls

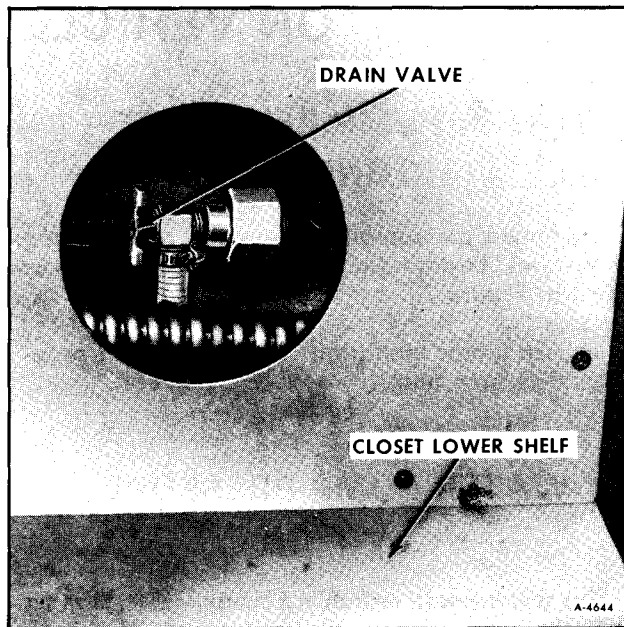


Figure 5—External Water Connection Drain Valve

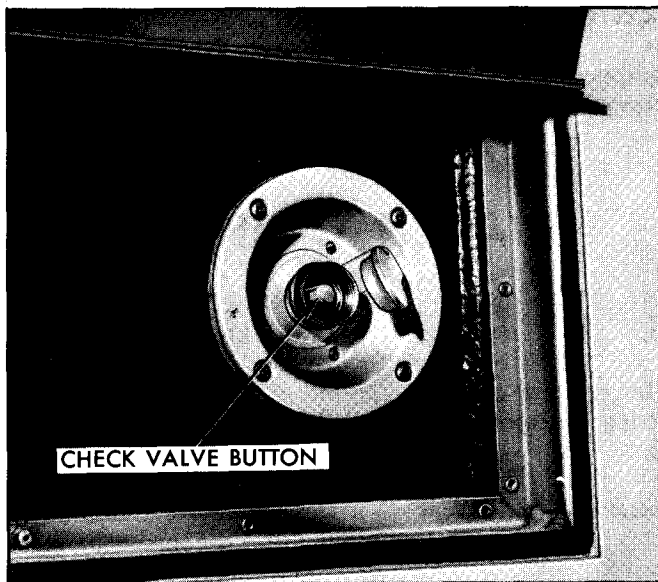


Figure 6—External Water Connection

ON VEHICLE ADJUSTMENT

WATER PUMP BELT (TYPE 1 ONLY)

To obtain maximum life from the water pump belt it should be adjusted to obtain 1/8" deflection as shown in Figure 7.

Loosen motor mounting nuts, tension belt properly and tighten nuts.

WATER PUMP PRESSURE SWITCH

The water pump switch is nonadjustable. It is set at the factory and can not be changed. If it fails, replace it.

The adjustable pressure switch on some type 1 pumps is to be replaced when adjustment becomes necessary or failure occurs, with the nonadjustable switch.

WATER HEATER THERMOSTAT

The water heater has been equipped with a non-adjustable thermostat, it was factory set and no adjustment is possible.

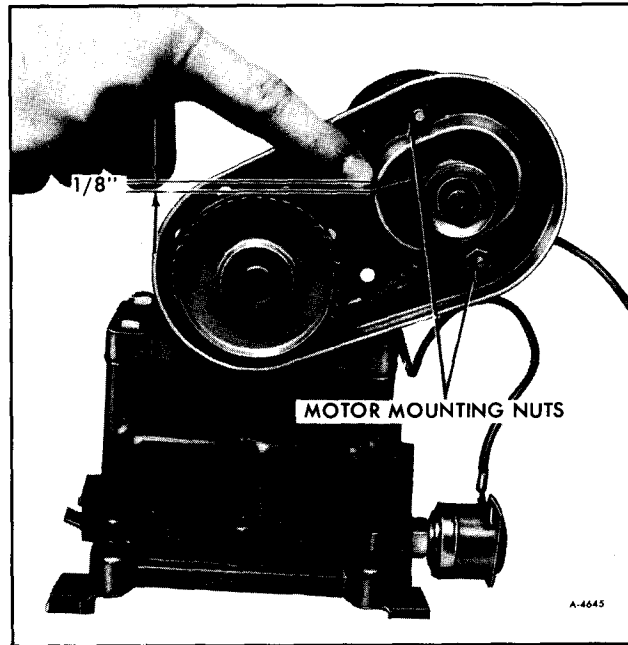


Figure 7—Water Pump Belt Tension

The water heater is equipped with a reset button. In the event the tank becomes overheated a thermal sensing switch will automatically disconnect the heater. To reset the type 1 unit remove the metal cover and push the red reset button. To reset the type 2 unit push the reset button through the hole in access cover.

WATER TANK

REMOVAL

1. Remove kick panel from lower front of seat. The panel is held by Velcro strips or equivalent, simply pull to remove (figure 4).

2. Remove two screws under seat that attach seat to mounting brackets (figure 12).

3. To remove seat pull up and out.

4. The water tank is enclosed by two wood panels, one along the top, the other along the side. The two panels are joined and can be removed together. Remove screws along the back of the top panel and at the floor side of the other panel. Remove wood panels.

5. Turn water pump switch to "OFF" position.

6. Disconnect tank vent hose.

7. Open tank drain valve and allow tank to drain (figure 8).

8. Disconnect water fill inlet tube at tank.

9. Disconnect tank sending unit wires and tank hold down strap brackets.

NOTE: Straps do not have to be cut.

10. Disconnect the suction hose at the pump.

11. Disconnect the drain hose from the tee or valve, whichever is more accessible.

12. Remove tank.

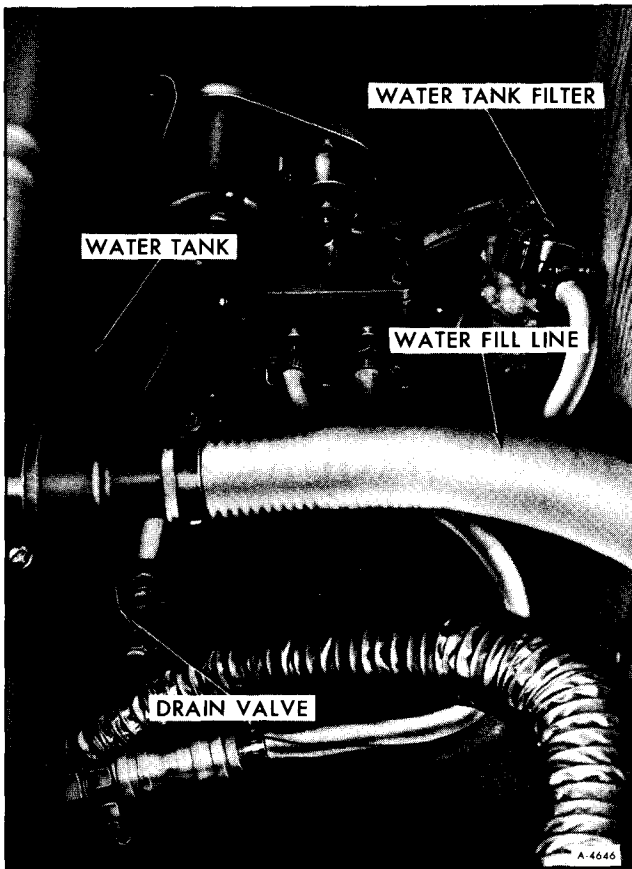


Figure 8—Water Tank Drain Valve Location

WATER TANK REPAIR

The tank is manufactured from polypropylene plastic. Except for small, clean punctures the tank is

not repairable. Polypropylene resists all common adhesives that may be used in patching or plugging. However, on small punctures a Well-Nut may be used. Enlarge the hole enough to insert the Well-Nut and tighten enough to close up the hole to make it waterproof.

INSTALLATION

1. Install tank.
2. Connect drain hose to valve or tee. Connect suction hose to water pump. Tighten clamps securely.
3. Position hold-down straps and secure strap brackets to the floor.
4. Connect tank sending unit wires, if equipped.
5. Connect water tank fill inlet tube or elbow. Tighten clamps securely.
6. Inspect dampener for excessive deformation, ruptures and cuts (figure 21).
7. Close drain valve.
8. Fill water tank and turn on pump to pressurize the system. Check for leaks.
9. Replace wood cover over water tank and cushions.

WATER TANK FILTER (FIGURE 8)

When water flows from the fresh water tank, it circulates through the water tank filter before entering the water pump.

The water tank filter, which is located in the water compartment, is transparent and should be checked periodically and cleaned annually.

A helpful sign that filter is dirty is that the transparent filter has become discolored.

REMOVING FILTER FROM WATER LINES

1. Turn water pump and water heater switches to "OFF" position.
2. Drain water tank.

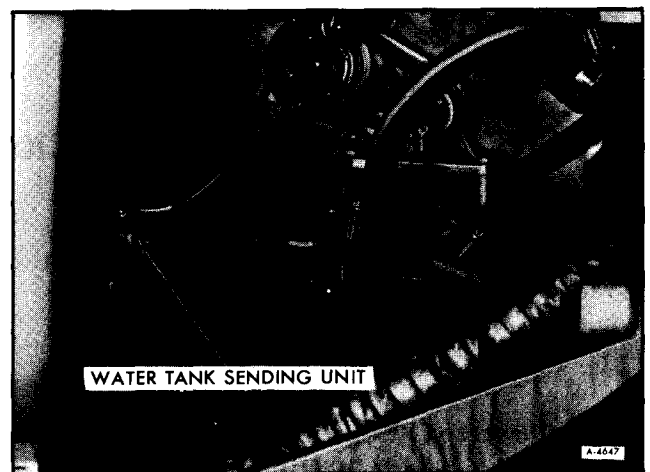


Figure 9—Water Tank Sending Unit

3. Disconnect the two clamps that attach water filter to water line hoses.
4. Separate filter from hoses.

DISASSEMBLY OF WATER FILTER

1. Remove screws which attach filter.
2. Remove filter screen.
3. Clean filter and screen with water and a soft nylon bristle brush.

ASSEMBLY OF WATER FILTER

1. Place filter screen into filter.
2. Assemble filter together with screws.

ASSEMBLY OF WATER TANK FILTER TO WATER LINES

1. Attach filter to water line hose connections.
2. Tighten hose clamps.
3. Refill water tank.

WATER TANK SENDING UNIT (FIGURE 9)

REMOVAL

1. Disconnect battery ground cables.
2. Pull kick panel off. Remove two screws holding seat on. Pull seat up and out to remove.
3. Drain tank until water level is below sending unit opening.
4. Disconnect sending unit wires and remove sending unit nuts.
5. Remove sending unit.

INSTALLATION

1. Install sending unit, tighten nuts securely.
2. Connect sending unit wires.
3. Fill tank and check for leaks.
4. Connect battery ground cables and check for proper operation of sending unit at monitor panel.
5. Install seat and secure to mounting bracket with two screws. Replace kick panel.

WATER PUMP

The water pump (Type 1 or Type 2) is mounted in the water tank compartment at the rear right hand corner of the vehicle. Access to this compartment is from inside the vehicle (See Water Pump Removal).

WATER PUMP VOLTAGE CHECK (FIGURE 10)

1. To check water pump voltage turn off all other electrical fixtures.

NOTE: Make sure there is a full charge on the living area battery.

2. Connect a DC voltmeter to the pressure switch positive lead, and the negative lead from the motor. Fully open a faucet to check for voltage with pump running.

3. Check for voltage in both battery and converter operational modes. The battery mode check is made with power supplied by living area battery. The converter mode check is made with vehicle plugged into an external power supply. Voltage reading at the pump should be 12 to 12.5 volts. It can read higher, but shouldn't read less.

WATER PUMP REMOVAL

1. Remove the front kick panel by simply pulling. Velcro strips hold it in place (figure 11).
2. Remove the two settee seat attaching screws (figure 12).
3. Remove the top cover screws and cover exposing the water pump and tank (figure 13).
4. Open tank drain valve and drain tank.

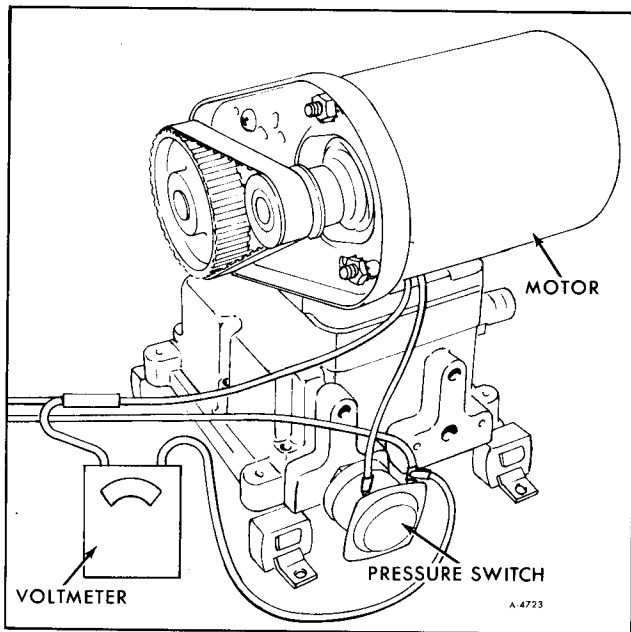


Figure 10—Water Pump Voltage Check

5. Make sure pump wall switch is turned off and remove fuse.
6. Disconnect hoses from water pump.
7. Remove four pump hold down screws.
8. Lift pump assembly out and disconnect wires from the pressure switch.



Figure 11—Removing Kick Panel

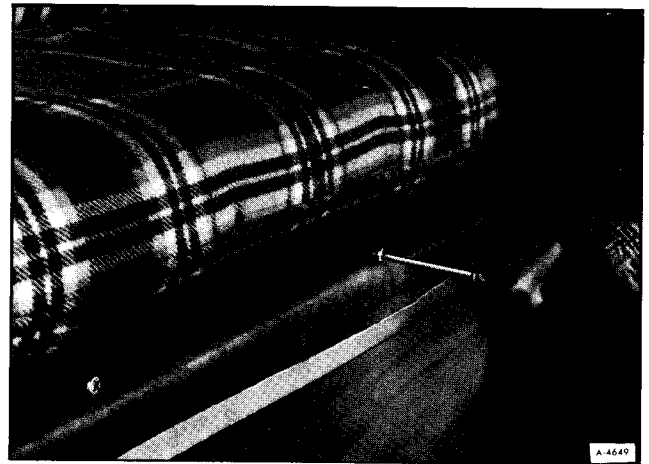


Figure 12—Removing Seat

WATER PUMP INSTALLATION

1. Place pump in mounting position and secure with four hold-down screws. If Type 2 pump is used do not depress rubber feet with mounting screws.
2. Connect wires to the pressure switch.
3. Connect hoses to water pump.
4. Replace fuse.
5. Close tank drain valve and fill tank.
6. Replace top panel and secure with screws.
7. Replace seat and secure with two screws to mounting bracket.
8. Replace front kick panel.

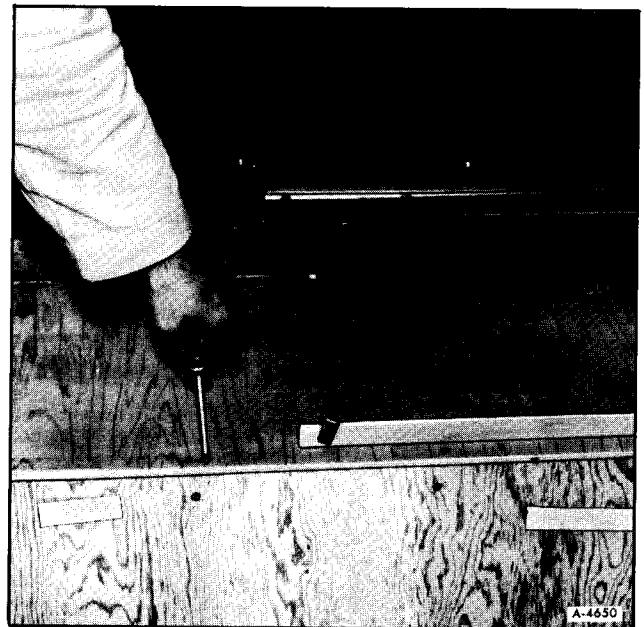
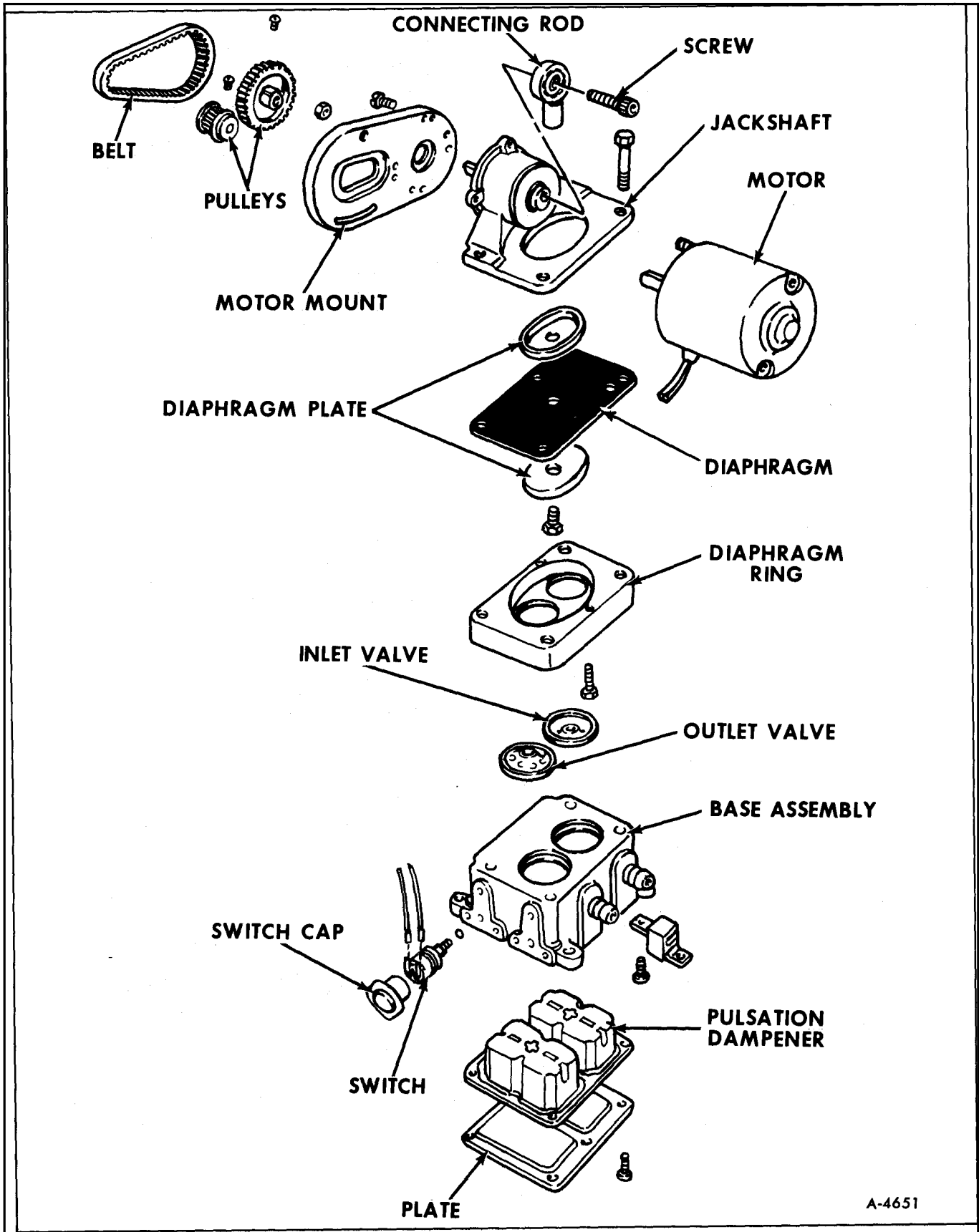


Figure 13—Removing Top Panel



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Figure 14—Type 1 Water Pump Exploded View

TYPE 1 WATER PUMP OVERHAUL (FIGURE 14)

VALVES REPLACEMENT

1. Turn off power to pump.
2. If system is filled with water, open a faucet to relieve pressure. Close intake and discharge lines near pump. Remove pump from vehicle.
3. Remove motor and four tie down screws (figure 15).
4. Expose valves by lifting jack shaft and attached diaphragm assembly from pump base. (figure 16).
5. Lift valves from pockets. Clean all foreign materials from valves and seats (figure 17).
6. Reinstall valves into same pockets, being sure rubber valve with small hole is UP on intake and rubber valve without the small hole is DOWN on discharge. NOTE: Do not use valve with small hole in rubber on discharge side of pump.
7. When reassembling, adjust belt tension to 1/8" play.

DIAPHRAGM

1. Turn off power to pump.
2. If system is filled with water, open a faucet to

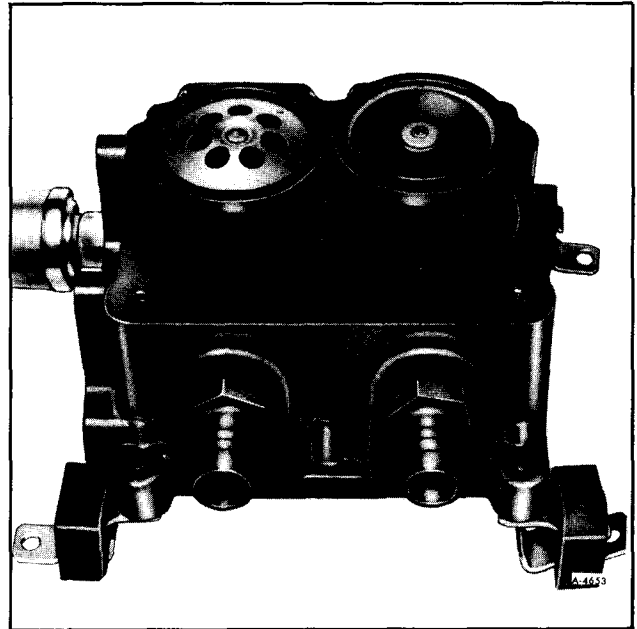


Figure 16—Water Pump Valves

relieve pressure. Close intake and discharge lines near pump. Remove pump from vehicle.

3. Remove motor and four tie down screws then lift jack shaft and attached diaphragm assembly from pump base.

4. Expose diaphragm by removing two diaphragm retain screws and detaching.

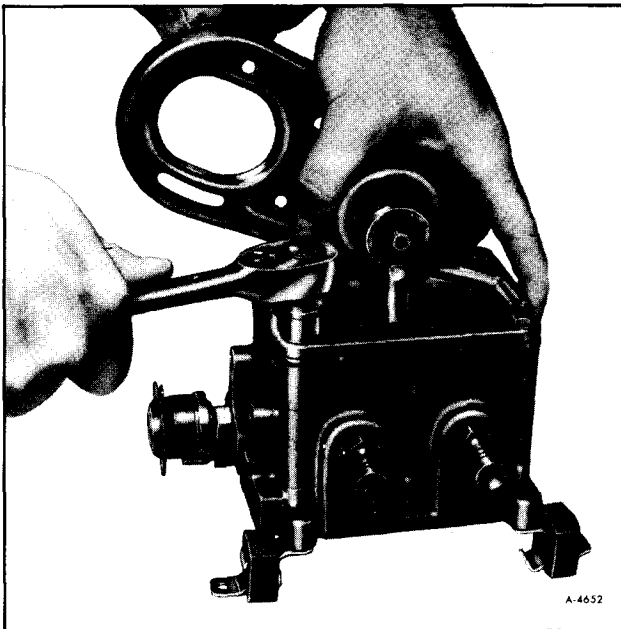


Figure 15—Opening Water Pump



Figure 17—Water Pump Valve Removed



Figure 18—Inspecting Diaphragm

5. Remove diaphragm screw to separate diaphragm and plates from connecting rod. Inspect diaphragm for cuts and ruptures (figure 18).

6. Remove eccentric screw to separate connecting rod from jack shaft (figure 19).

7. When reassembling, be sure to align diaphragm and connecting rod so that rod slips straight onto jack shaft and diaphragm rests squarely on dia-

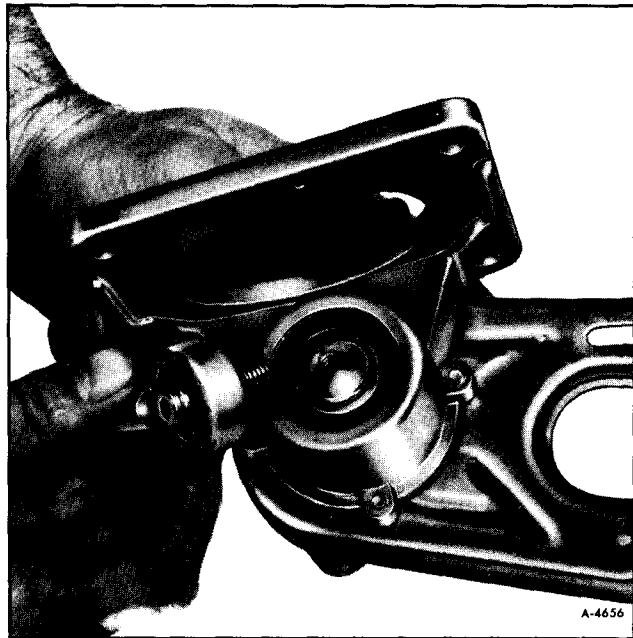


Figure 19—Separating Connecting Rod

phragm retainer. Misalignment will create a strain on diaphragm and significantly shorten its life. Adjust belt tension to 1/8" play.

PULSATION DAMPENER REPLACEMENT

1. Turn off power to pump.

2. If system is filled with water, open a faucet to relieve pressure. Close intake and discharge lines near pump.

3. Remove pump from vehicle.

4. Remove nine screws from bottom of base and bottom plate (figure 20).

5. Pull out rubber pulsation dampener from base.

6. Inspect dampener for excessive deformation, ruptures and cuts (figure 21).

7. When installing new pulsation dampener, make sure flange is well-seated to effect a proper water and air seal.

MOTOR REPLACEMENT

1. Turn off power to pump.

2. Disconnect motor wires from pressure switch terminal.

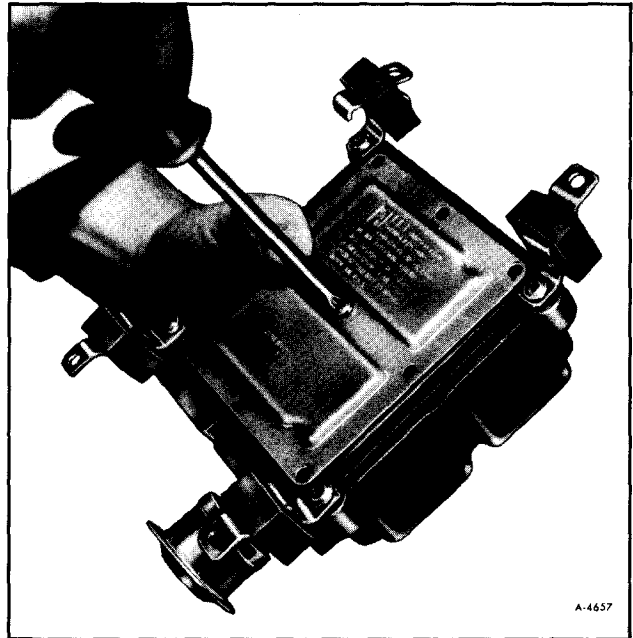


Figure 20—Removing Bottom Plate

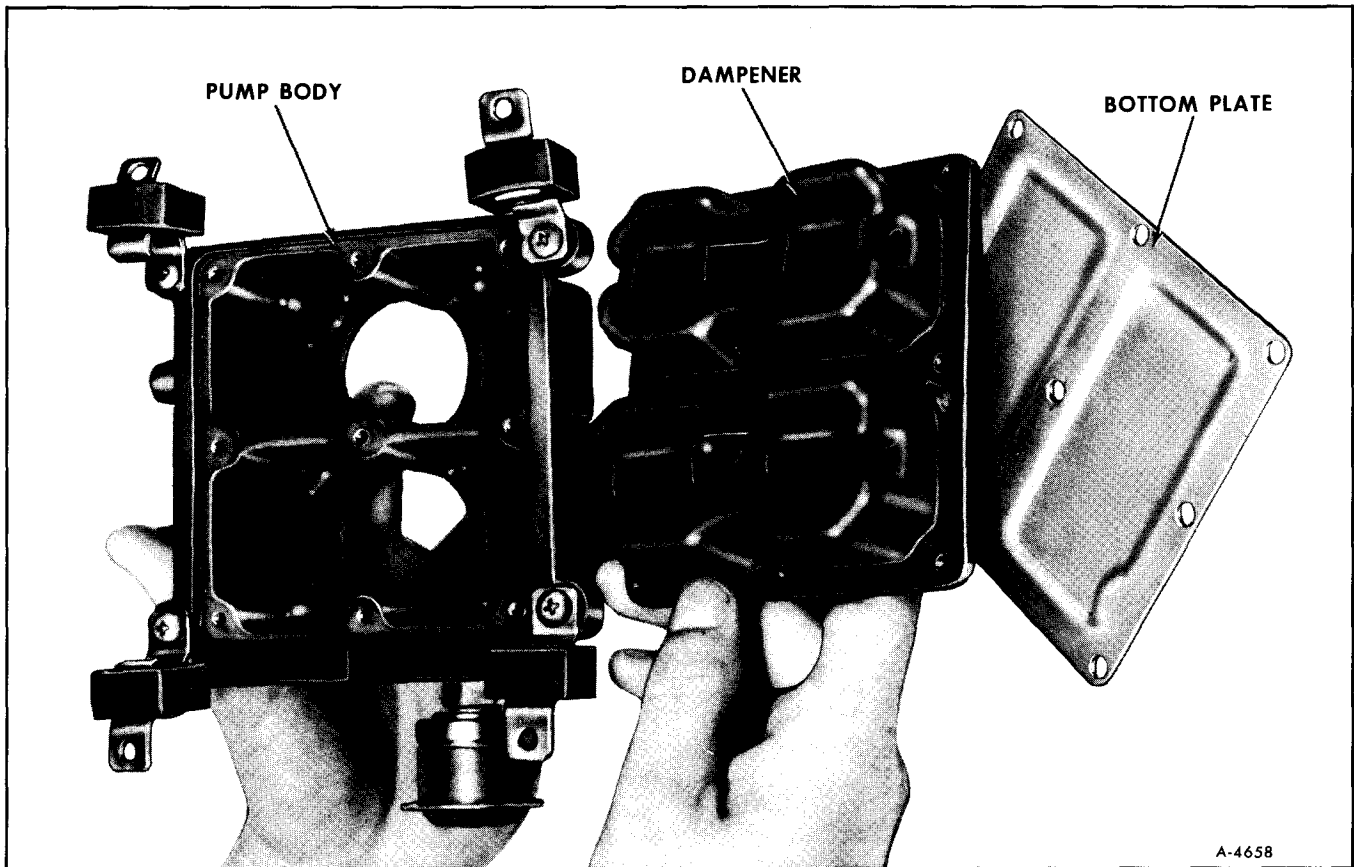


Figure 21—Inspecting Dampener

3. Remove two motor nuts to separate motor.
4. Loosen screw to slide off small pulley from motor shaft.
5. When reassembling, be sure to adjust belt tension before tightening motor nuts. Proper adjustment is made when belt can be depressed 1/8 inch at a point halfway between pulleys.

PRESSURE SWITCH (TYPE 1 WATER PUMP) (FIGURE 22)

The pressure switch, mounted on the type 1 water pump, is non-adjustable. If the switch fails to operate properly, replace it. The pump should operate between 15 psi and 30 psi.

NOTE: If the pump is equipped with an earlier adjustable pressure switch, it should be replaced when it fails or falls out of adjustment. For pump models - 1000 and above no conversion kit is necessary. Pumps below - 1000 require a service conversion kit.

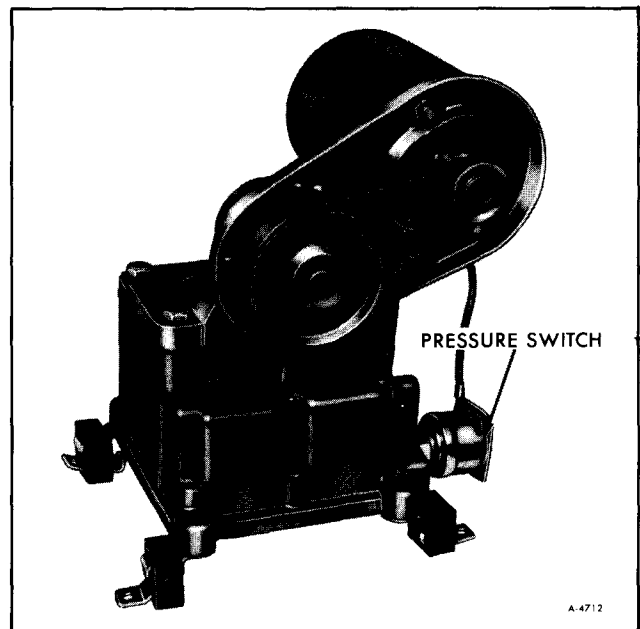


Figure 22—Water Pump With Pressure Switch

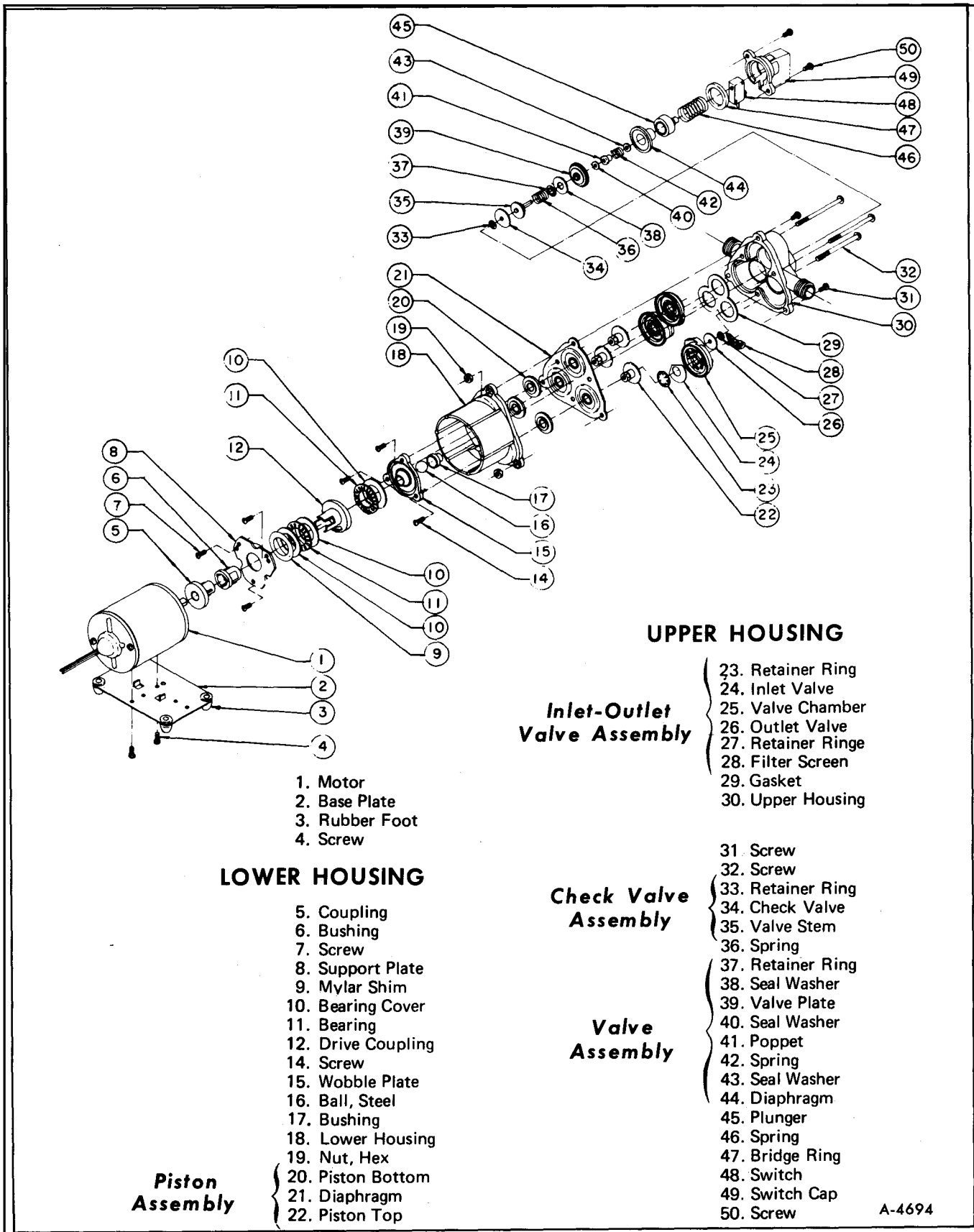


Figure 23—Type 2 Water Pump Exploded View

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REMOVAL

1. Turn pump off at light switch panel and open a faucet to relieve pressure from the system.
2. Disconnect all wires from the pressure switch.
3. Use an open end wrench on hex nut base of switch and turn switch out of mounting hole.

INSTALLATION

1. Put fiber metallic supported washer on threaded shaft of switch, with metallic side facing switch.
2. Tighten switch securely onto pump.
3. Connect wires to switch and turn on pump. Check for proper operation.

WINTER STORAGE

The Type 1 water pump will withstand frozen water damage provided the system is not under pressure prior to freezing. To prevent damage, the entire water system must be "winterized" thoroughly for winter storage. See Section 24A.

TYPE 2 WATER PUMP OVERHAUL (FIGURE 23)

DISASSEMBLY (FIGURE 24)

1. Hold switch cap securely (figure 25) while removing two screws because spring inside has

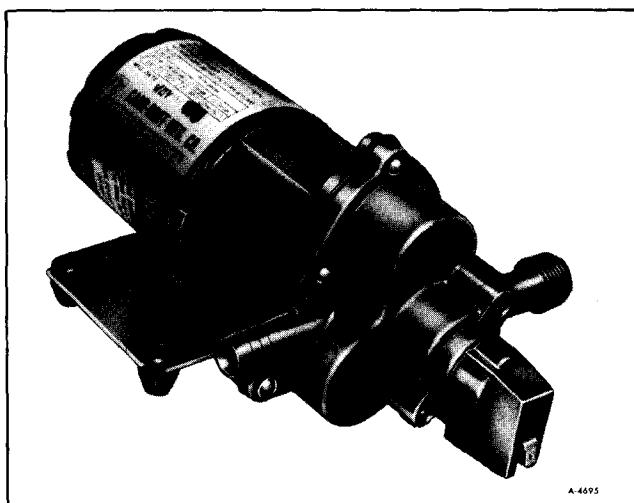


Figure 24—Type 2 Water Pump

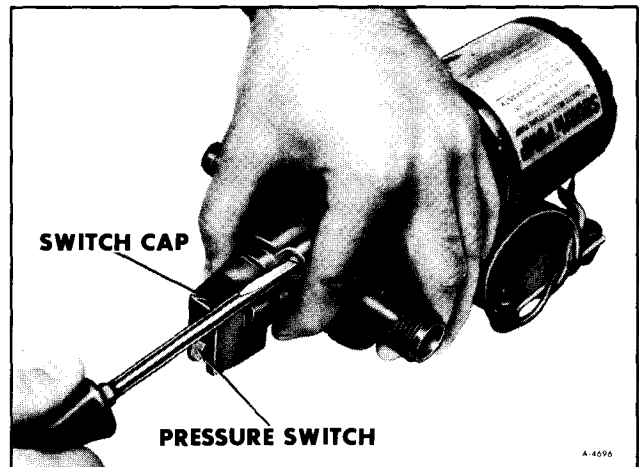


Figure 25—Removing Switch Cap

enough tension to throw the cap. Pressure switch will drop out of cap after it is removed.

2. Spring and plunger will drop off (figure 26).
3. Pull rubber diaphragm with valve assembly out of recess, then remove spring and check valve assembly (figure 27).
4. Remove three long screws and three short screws with nuts securing upper housing to lower housing, and lower housing to motor. Separate motor from housings and upper and lower housing from each other (figure 28).

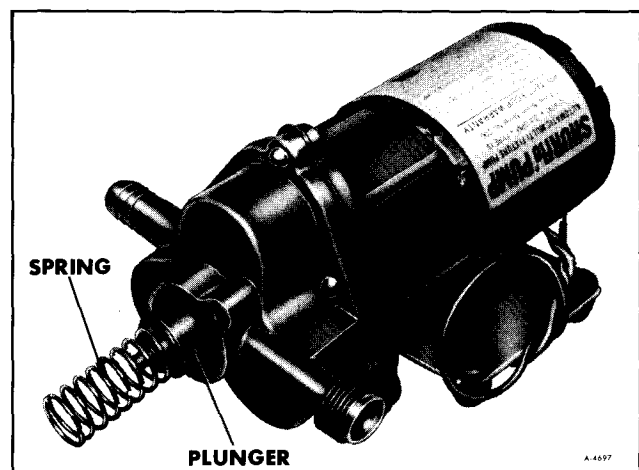


Figure 26—Switch Cap Removed

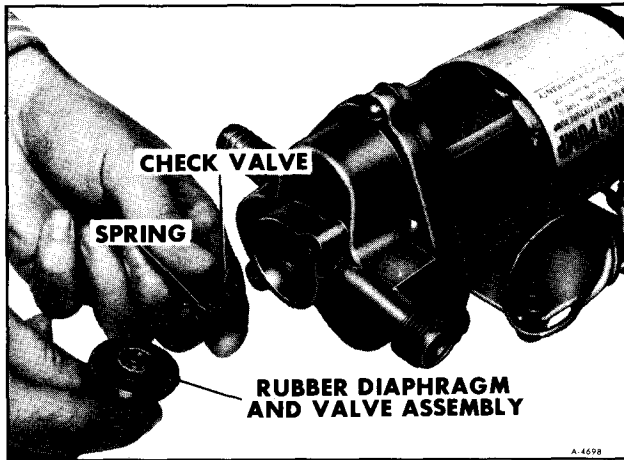


Figure 27—Removing Diaphragm and Valves from Recess

5. Inside the upper housing are three inlet-outlet valve assemblies. They can be removed by hand. After removing all three valve assemblies, remove the rubber gasket by hand (figure 29).

6. The rubber bushing is either on the motor coupling or the drive coupling and can be removed by hand. (figure 30). Remove the support plate in the lower housing by removing three screws (figure 31).

7. Remove three screws that secure the wobble plate to the piston assembly. Remove wobble plate (figure 32), steel ball, and bushing (figure 33). The drive coupling and bearings rest on the wobble plate and will be removed with the plate. Lift the coupling off the plate and lift the bearings off the coupling (figure 34).

8. Remove the piston assembly (held by screws, removed in step 7, to the wobble plate), then take the piston tops and bottoms apart from the diaphragm (figure 35).

ASSEMBLY

1. Place three piston tops through diaphragm and piston bottoms, then position on lower housing (figure 35).

2. Lubricate steel ball and place on bushing. Place bushing with ball into lower housing. Flat on bushing shaft matches flat in housing hole (figure 33).

3. Grease bearings with GM 1051344 or equivalent. Assemble to drive coupling with mylar shim and bearing covers. Place assembled parts on wobble plate (figure 34).

4. Place wobble plate in position in lower housing and secure with three screws to threaded holes in the end of piston top shafts (figure 32).

5. Place support plate over drive coupling and secure with three screws to housing (figure 36).

6. Place rubber bushing over motor coupling (figure 30).

7. Place rubber gasket in upper housing, then place three inlet-outlet valves over gasket (figure 29).

8. Secure upper housing to lower housing with three screws and nuts. Then secure housings to motor with three long screws.

9. Place check valve assembly, spring, and valve with diaphragm assembly in recess of upper housing (figure 27).

10. Place plunger over rubber diaphragm and spring over plunger (figure 26).

11. Place micro switch in switch cap (figure 37) and secure cap to upper housing with two screws. Hold cap securely against spring pressure while turning screws (figure 25).

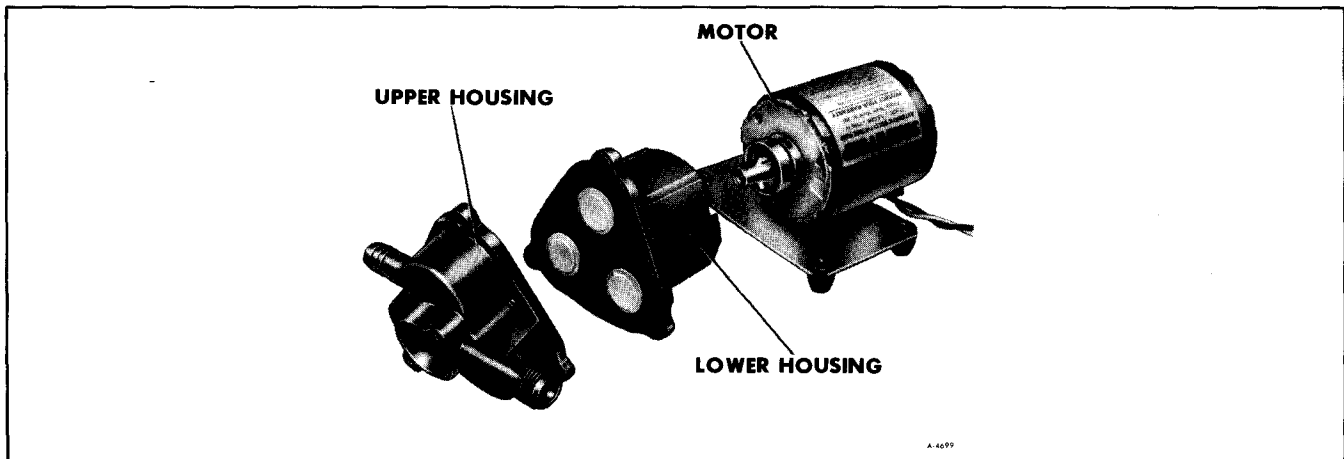


Figure 28—Upper and Lower Housings Separated from Motor

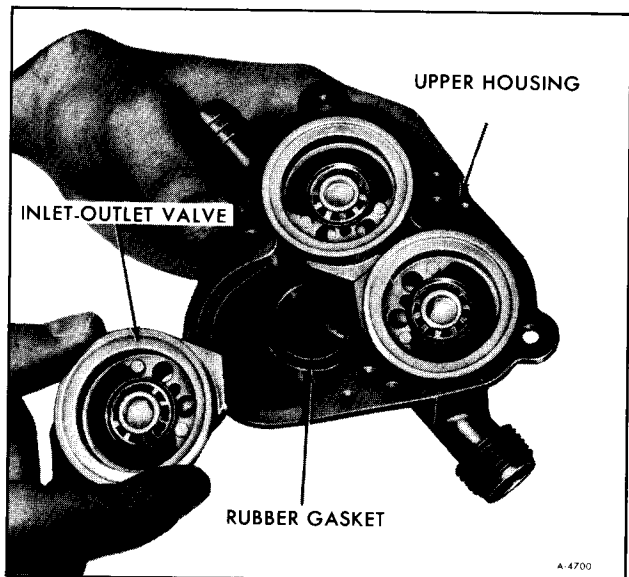


Figure 29—Removing Inlet-Outlet Valves

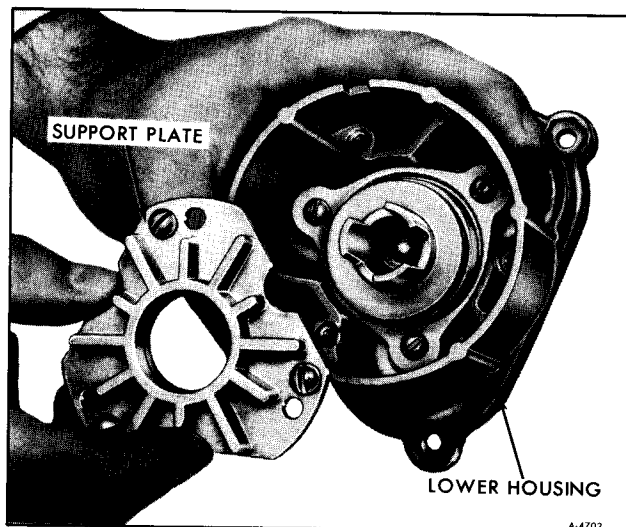


Figure 31—Removing Support Plate

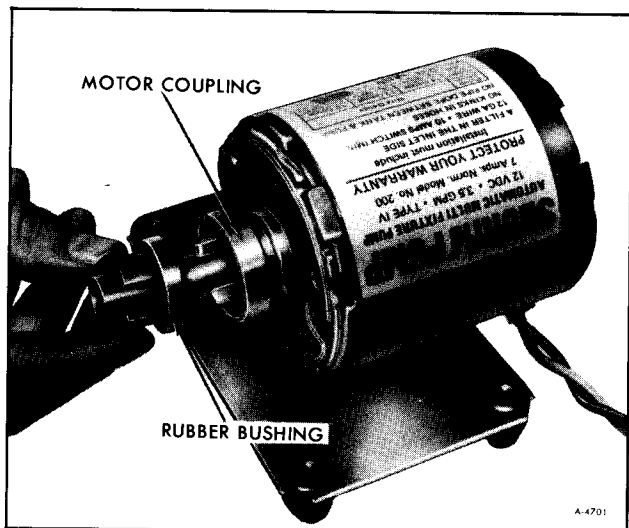


Figure 30—Removing Rubber Bushing from Motor Coupling

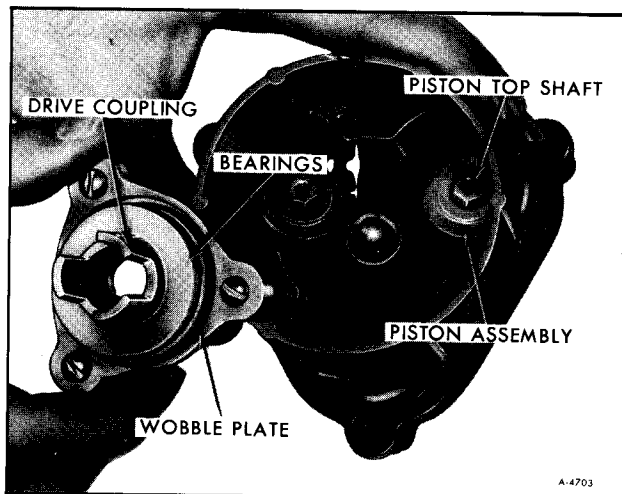


Figure 32—Removing Wobble Plate with Bearings and Drive Coupling

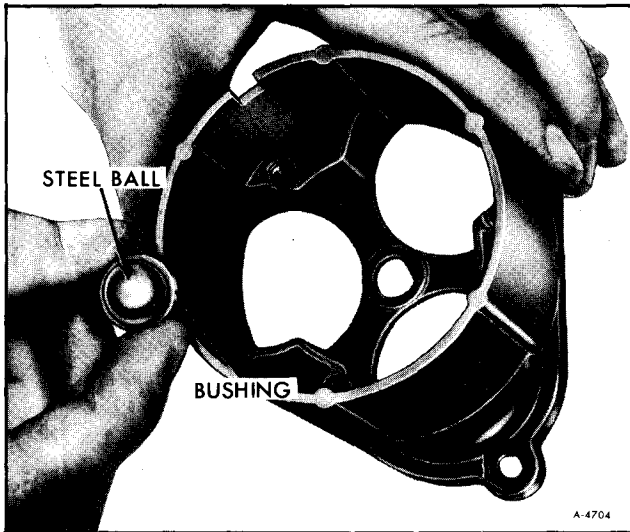


Figure 33—Removing Steel Ball and Bushing

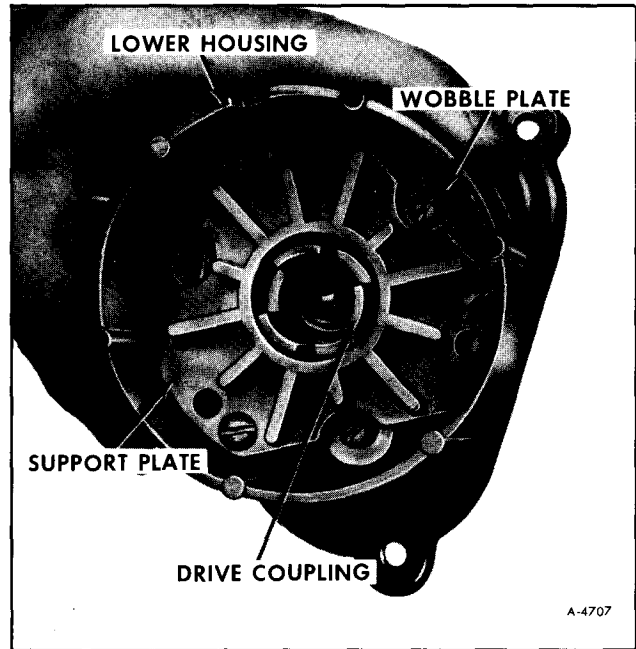


Figure 36—Support Plate, Drive Coupling, and Wobble Plate Assembled in Lower Housing

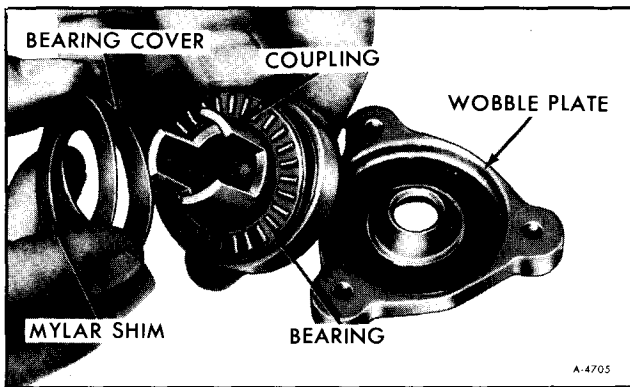


Figure 34—Removing Coupling and Bearings from Wobble Plate

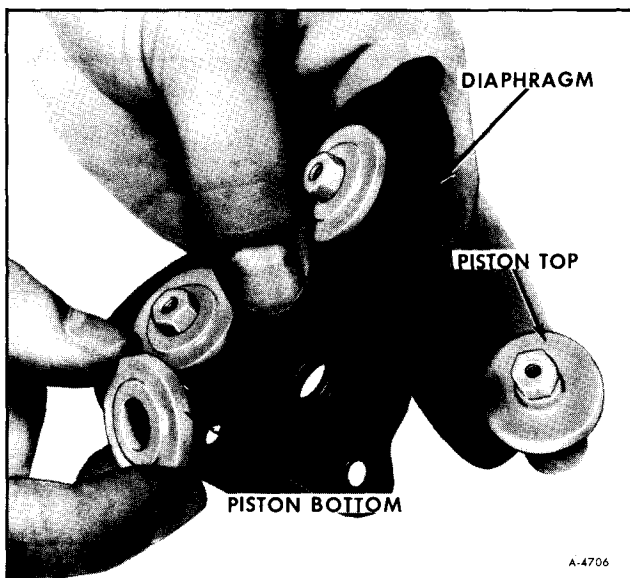


Figure 35—Removing Pistons from Diaphragm

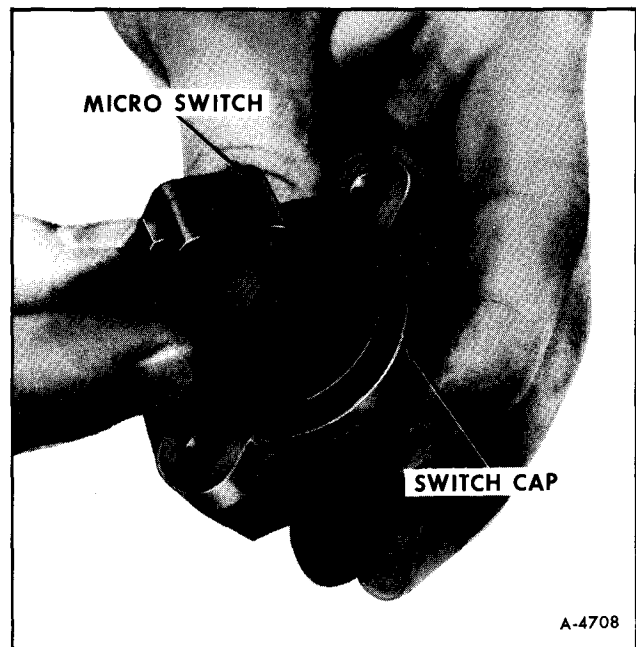


Figure 37—Putting Micro Switch in Switch Cap

WATER HEATER

TYPE 1 WATER HEATER (FIGURE 38)

REMOVAL

1. Turn off water heater switch and water pump switch. If external power connection is in use, disconnect it. Vehicle must not be running and the engine must cool at least 1/2 hour. Check the pressure in the engine cooling system at the radiator cap before the pre-heat hoses are disconnected.

WARNING: TO AVOID THE DANGER OF BEING BURNED, AND PREVENT LOSS OF COOLANT, DO NOT REMOVE THE RADIATOR CAP WHILE THE ENGINE AND RADIATOR ARE STILL HOT, BECAUSE THE COOLING SYSTEM WILL BLOW OUT SCALDING FLUID AND STEAM UNDER PRESSURE.

2. Open drain valve and allow water heater to drain.

3. Remove sliding doors, door frame and shelf liner in the bath vanity.

4. The heater pre-heat hoses can be removed only after engine is cool and system has been checked for pressure at the radiator cap. Disconnect hoses and plug ends.

5. Remove pressure-temperature relief valve tube.

6. Remove drain line.

7. Disconnect wires and armored cable from junction box on wall.

8. Remove inlet (cold) water line.

9. Disconnect outlet (hot) water line and reposition out of the way.

10. Remove banding straps.

11. While supporting heater disconnect heater support bracket and position upward and outward.

12. Toilet seat may have to be raised or removed in order to remove heater.

13. Remove heater.

DISASSEMBLY

1. Remove the pressure-temperature relief valve. Remove drain valve.

2. Remove metal cover and remove red plastic cover over electrical control assembly.

3. Disconnect wire and remove control assembly, Figure 39.

4. Remove heater element as shown in Figure 40 by removing four bolts.

5. Remove four screws attaching front of box to body.

6. Remove front of box.

7. Slide out inner tank assembly.

ASSEMBLY

1. Slide inner tank assembly into box.

2. Install front of box and secure with four screws.

3. Install heater element in the direction specified by the word UP, as shown in Figure 41.

4. Evenly tighten four bolts until element contacts tank.

5. Install electrical control assembly and connect wires.

6. Install red plastic cover and metal cover. Secure metal cover with screw.

7. Install pressure-temperature relief valve and drain valve. Use a thread sealer on all threads.

INSTALLATION

1. Cut two pieces of banding strap five feet long and string through brackets on wall.

2. Position support bracket outward and slide heater into position.

3. Secure support bracket with screws.

4. Use banding tension tool and clips to secure straps tightly around heater.

5. Connect inlet (cold) and outlet (hot) pipes. Use thread sealer.

6. Connect wires and armored cable to junction box on wall.

7. Install drain line. Use thread sealer.

8. Install pressure-temperature relief valve tube. Use thread sealer.

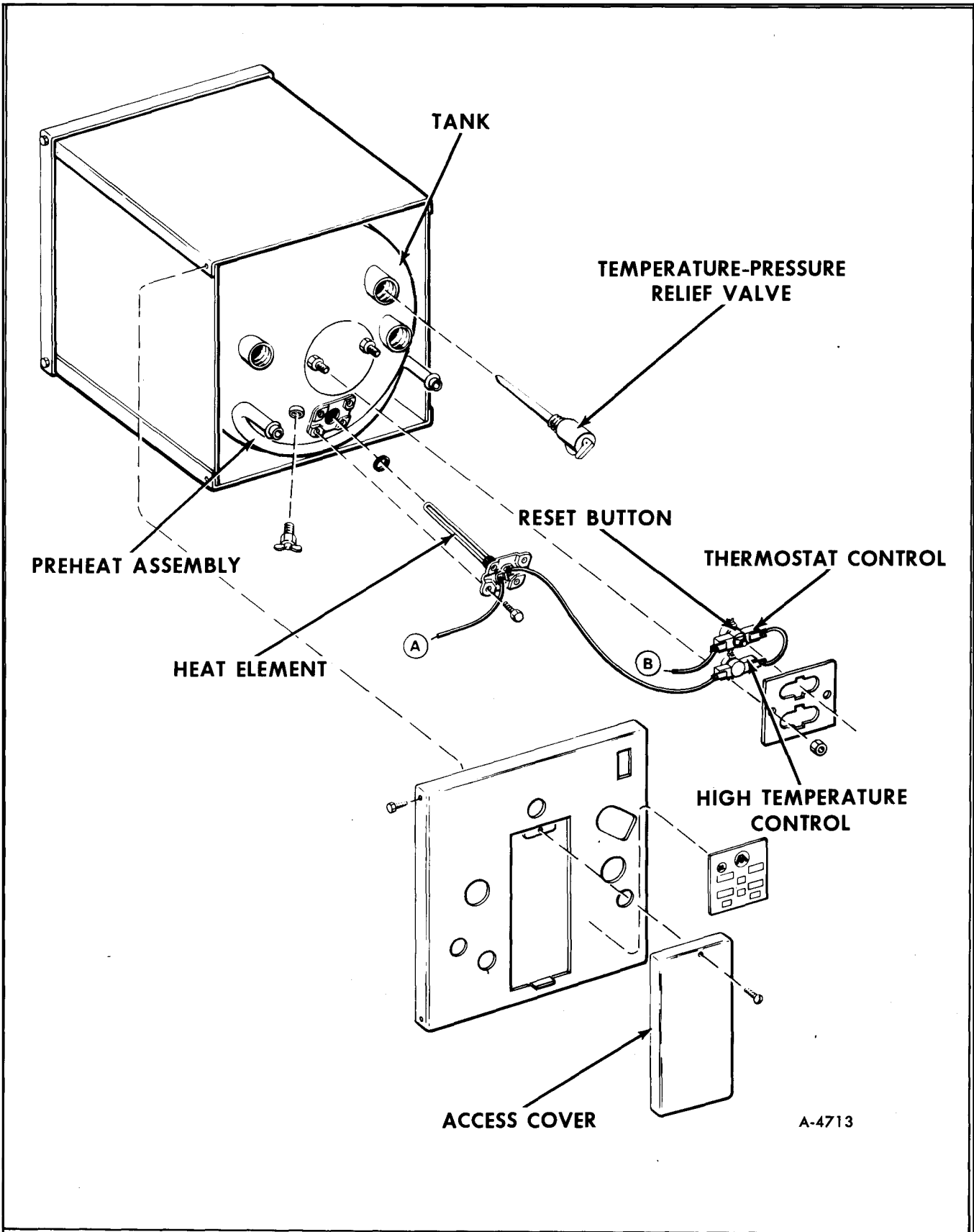


Figure 38—Type 1 Water Heater Exploded View

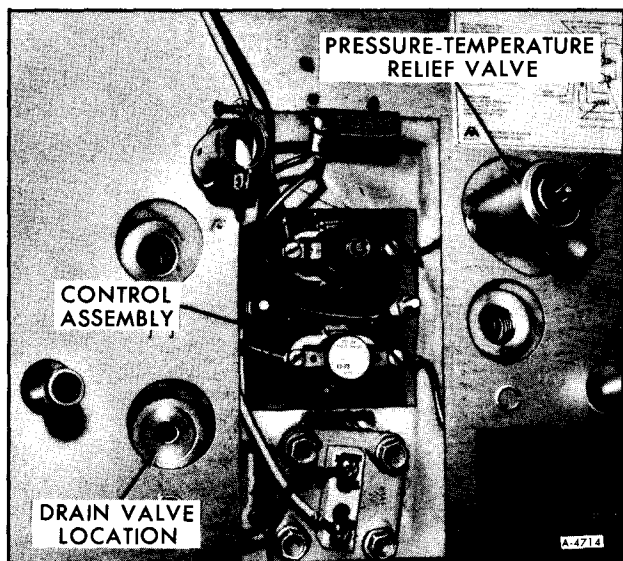


Figure 39—Control Assembly Location

9. Connect heater pre-heat hoses and secure with clamps.
10. Install shelf liner, door frame and sliding doors.
11. Close water heater drain valve.
12. Turn on water pump allow heater tank to fill. Open a hot water faucet to check if tank is filled.
13. Check for leaks.

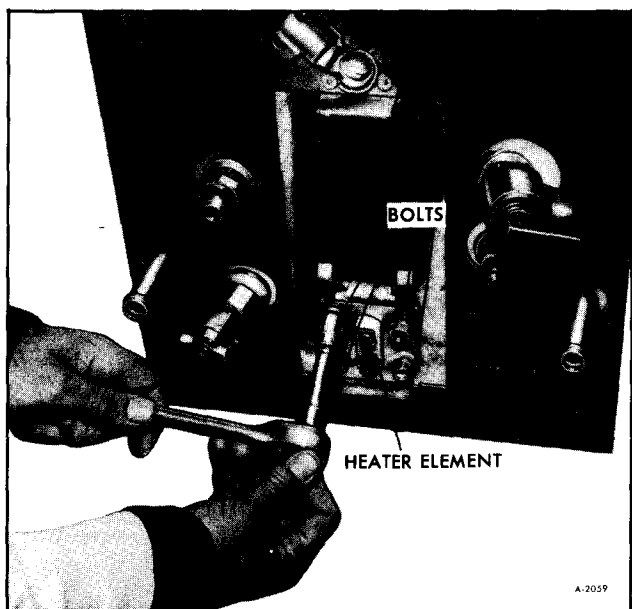


Figure 40—Removing Heater Element

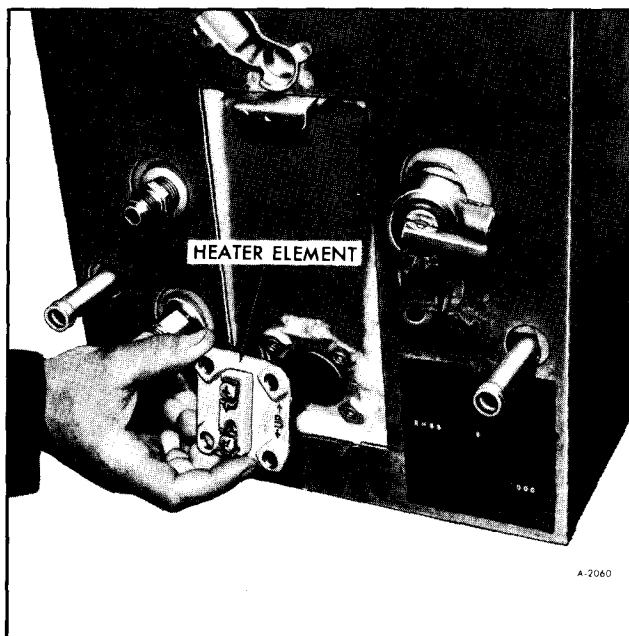


Figure 41—Installing Heater Element

14. Turn on heater switch and check for hot water after approximately 15 minutes. Be sure vehicle is connected to 120-volt AC source by running Motor Generator or external power connection.

TYPE 2 WATER HEATER (FIGURE 42)

REMOVAL

1. Turn off water heater switch and water pump switch.
2. Open drain valve and allow water heater to drain.

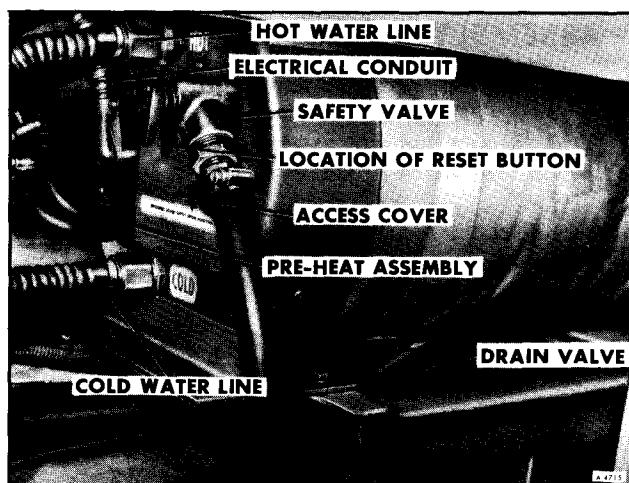


Figure 42—Type 2 Water Heater

3. Remove sliding doors, door frame and shelf liner in the bath vanity.

4. Disconnect strap holding pre-heat hoses to vehicle plumbing lines and pull pre-heat assembly from water heater body.

WARNING: IF VEHICLE HAS BEEN RECENTLY USED AND ENGINE IS HOT, PRE-HEAT HOSE AND ASSEMBLY MAY BE HOT.

5. Disconnect hose from pressure-temperature relief valve.

6. Disconnect drain line hose under water heater body.

7. Remove access panel. Disconnect two electrical wires in lower left of access opening and disconnect electrical conduit.

8. Disconnect inlet (cold) water line and outlet (hot) water line.

9. Remove four bolts and nuts securing water heater to frame.

10. Remove water heater.

DISASSEMBLY (FIGURE 43)

1. Disconnect two wires from heating element. Then remove four bolts and remove heating element.

2. Disconnect two wires to control assembly, then remove two bolts that secure control assembly to heater. Remove control assembly.

3. Remove pressure-temperature relief valve.

ASSEMBLY (FIGURE 43)

1. Replace pressure-temperature relief valve.

2. Secure control assembly with two bolts and attach two wires to assembly.

3. Secure heating element with four bolts. Connect two electrical wires to element.

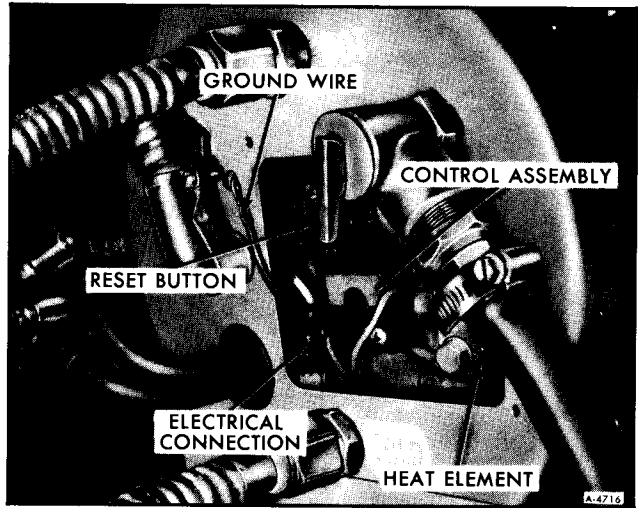


Figure 43—Type 2 Water Heater Controls

INSTALLATION

1. Install water heater and secure to frame with four bolts and nuts.

2. Connect outlet (hot) water line and inlet (cold) water line.

3. Connect electrical conduit and two electrical wires from conduit to terminal inside access. Replace access panel. Be sure ground wire is under the top left screw.

4. Connect hose to pressure-temperature relief valve.

5. Connect drain line hose under water heater body and close drain valve.

6. Install water heater pre-heat assembly and secure with strap to area plumbing.

7. Replace sliding doors, door frame and shelf liner in the bath vanity.

8. Start water pump to fill water heater.

9. Turn on water heater switch and check to see that water heater operates correctly.

BATHROOM SINK FAUCET

REMOVAL

1. Turn off water pump at wall switch. Open faucet to reduce line pressure.

2. Disconnect water lines.

3. Remove lock nuts as shown in Figure 44. Remove steel and fiber washers.

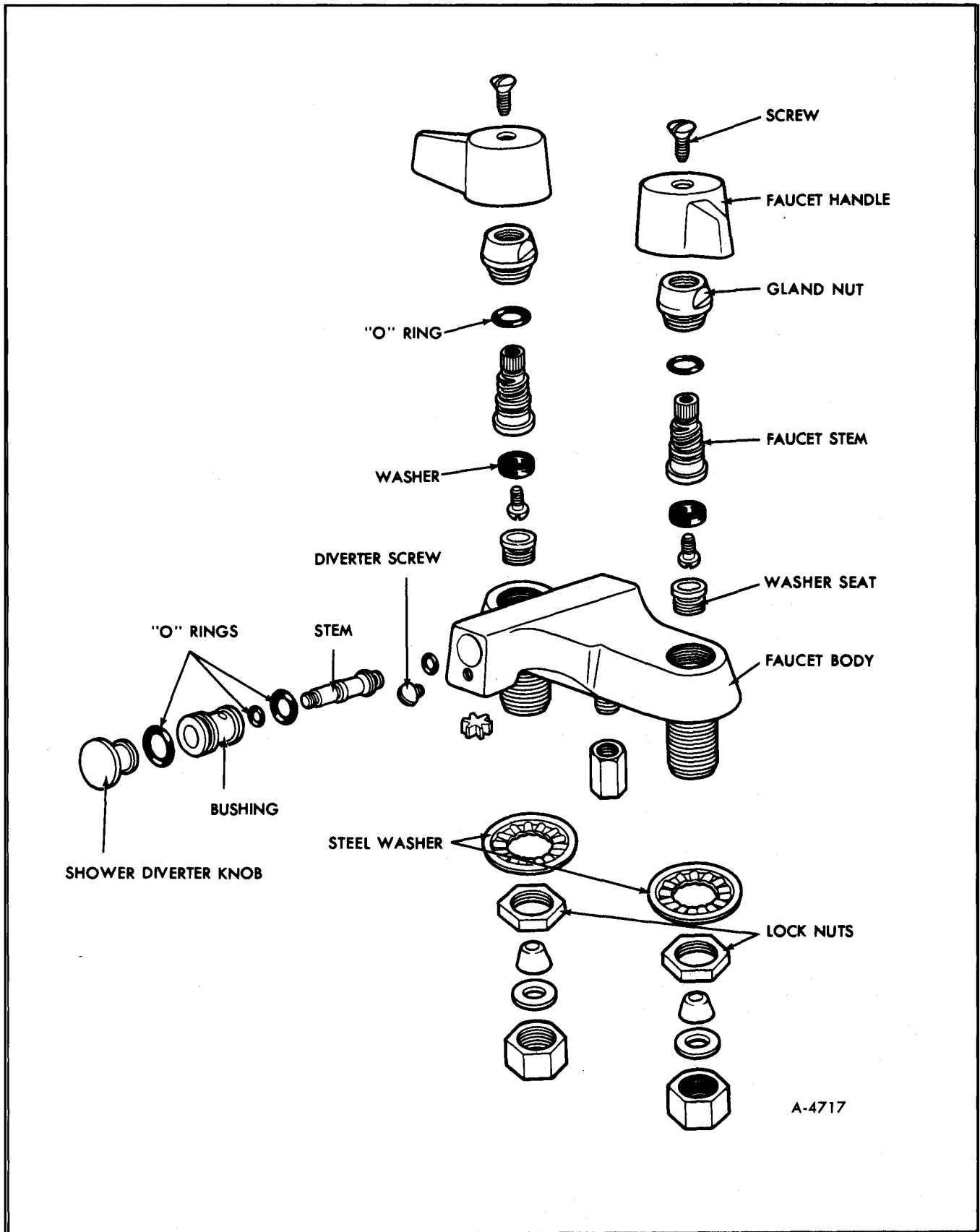


Figure 44—Bathroom Sink Faucet Assembly

A-4717

4. Disconnect shower line.
5. Remove faucet assembly.

INSTALLATION

1. Install faucet assembly.
2. Connect shower line.
3. Install fiber and steel washers.
4. Install lock nuts and tighten securely.
5. Connect water lines.
6. Turn on water pump switch and operate faucet. Check for leaks.

FAUCET WASHERS (FIGURE 44)

REMOVAL

1. Remove screw and faucet handle.
2. Remove faucet gland nut.
3. Remove faucet stem.
4. Remove screw securing washer, remove washer.
5. Inspect washer seat for excessive roughness. Replace if necessary.

INSTALLATION

1. Install washer on stem and secure with screw.
2. Install faucet stem into faucet.
3. Install gland nut.
4. Install faucet handle and secure with screw. Check for leaks.

SHOWER DIVERTER ASSEMBLY (FIGURE 44)

REMOVAL

1. Turn off water pump at wall switch. Open faucet to reduce line pressure.
2. Remove diverter screw.
3. Pull out diverter assembly.
4. Inspect "O" rings and replace if necessary.

INSTALLATION

1. Install stem, bushing and knob and secure with diverter screw.
2. Turn on water pump at wall switch. Check for leaks.

SHOWER HEAD AND HOSE

REMOVAL

1. Turn off water pump at wall switch. Open faucet to reduce line pressure.
2. Remove shower head hose from wall connection (See figures 45 and 46).
3. Remove hose from shower head connector.
4. Remove shower head from connector.

INSTALLATION

1. Install shower head to connector.
2. Install hose to shower head connector.
3. Connect hose to wall connection.
4. Turn on water pump at wall switch. Operate shower as it is directed into sink and check for leaks.

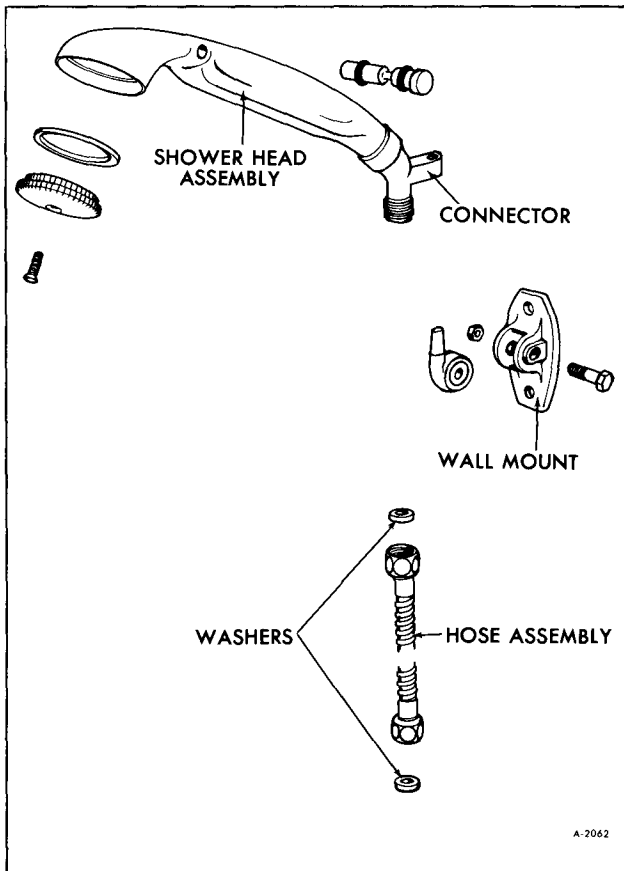


Figure 45—Type 1 Shower Head

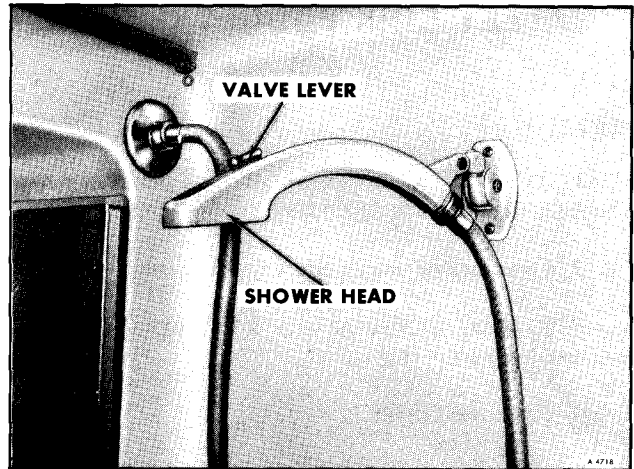


Figure 46—Type 2 Shower Head

GALLEY SINK

REMOVAL

1. Turn off water pump at wall switch. Open faucet to reduce line pressure.
2. Disconnect water lines from faucet. Disconnect water purifier spout, if equipped.
3. Remove sink retaining clips (See figure 47).
4. Disconnect drain lines.
5. Lift sink out.

INSTALLATION

1. Position sink into place and secure with clips (figure 47).
2. Connect all water lines and drain lines.
3. Turn on water pump at wall switch. Operate faucet and water purifier (if equipped) and check for leaks.

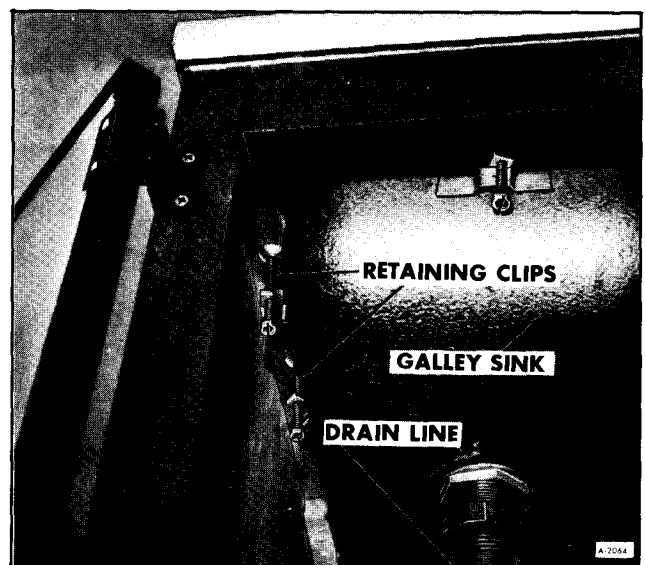


Figure 47—Sink Retaining Clips

GALLEY SINK FAUCET (FIGURE 48)

REMOVAL

1. Turn off water pump at wall switch. Open faucet to reduce line pressure.
2. Disconnect water lines from faucet.
3. Remove locknut spacer and washer from underneath counter top.
4. Remove faucet.

DISASSEMBLY

1. Turn off water pump and open faucet to relieve line pressure.
2. Remove screw at top of handle, and lift off handle, with handle cap and handle body.
3. Remove retainer nut and lift off grooved sleeve.
4. Lift spout off.
5. Pry retainer off with screwdriver.
6. Grasp cartridge stem with pliers and pull stem out of body.

ASSEMBLY

1. Push cartridge stem into body.
2. Insert retainer clip.
3. Replace spout and grooved sleeve and secure with retainer. Tighten snugly.
4. Press cartridge stem down. Holding handle up, hook ring in handle housing into groove on sleeve. Swing handle back and forth until it drops down into place.
5. Replace handle screw. Tighten securely.

INSTALLATION

1. Install faucet with gasket under escutcheon.

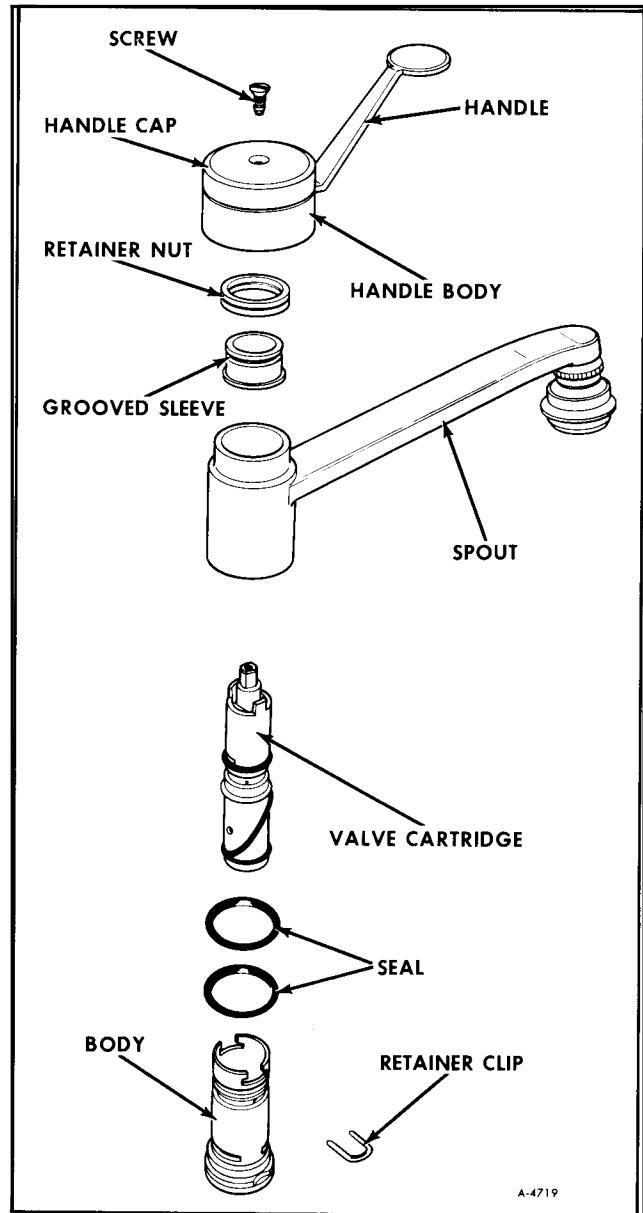


Figure 48—Galley Sink Faucet

2. Secure with spacer washer and locknut under counter top.
3. Connect water lines.
4. Turn on water pump and operate faucet. Check for leaks.

WATER PURIFIER

The optional water purifier consists of (A) three cartridges mounted under the galley sink inside the cabinet and (B) a faucet mounted to the counter top at the rear left corner of the galley sink.

CARTRIDGES (FIGURE 49)

The purification cartridges obtain water from the plumbing line under the galley sink and can be turned on or off by a valve at the connection. They are held in place by a strap.

FAUCET (FIGURE 50)

The faucet is mounted through a hole in the counter top. Water is supplied by a plastic water line from the purification cartridges.

CARTRIDGE REPLACEMENT

If at any time the water flow becomes restricted, replace the top cartridge (figure 49).

1. Shut water off at valve, and at faucet.
2. Remove mounting strap.
3. Disconnect fittings at both ends of top cartridge. Place cartridge in pail or other water tight

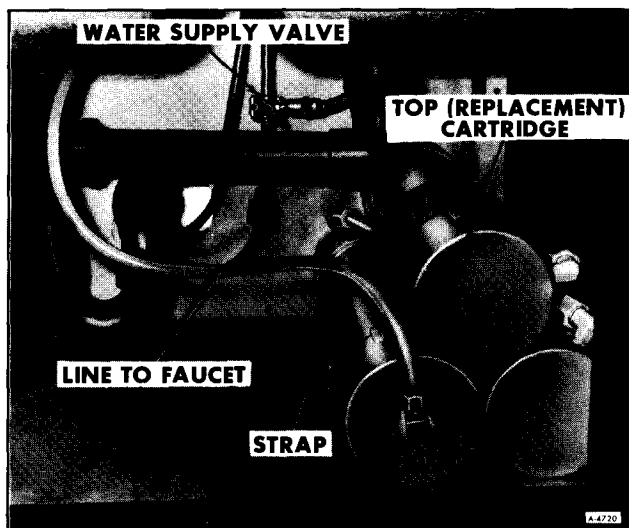


Figure 49—Water Purifier Cartridges

container to prevent spillage. Keep a towel handy to clean up spillage inside cabinet.

4. Install new cartridge in same position as discarded cartridge with arrow on label pointing to outlet end of unit. Then secure in place with strap assembly. Open water supply valve and turn on water pump. Check for operation and leaks.

NOTE: You may notice a slight gray color in the water the first few minutes. This is normal and is designed to disappear.

FAUCET REPLACEMENT (FIGURE 51)

REMOVAL

1. Turn off water pump and open faucet to relieve line pressure.
2. Turn off water purifier valve.
3. Disconnect water line from bottom of faucet.
4. Remove nut, lockwasher, flat washer, and fiber washer from bottom of faucet.
5. Remove faucet.

INSTALLATION

1. Place faucet in mounting hole through sink counter top.

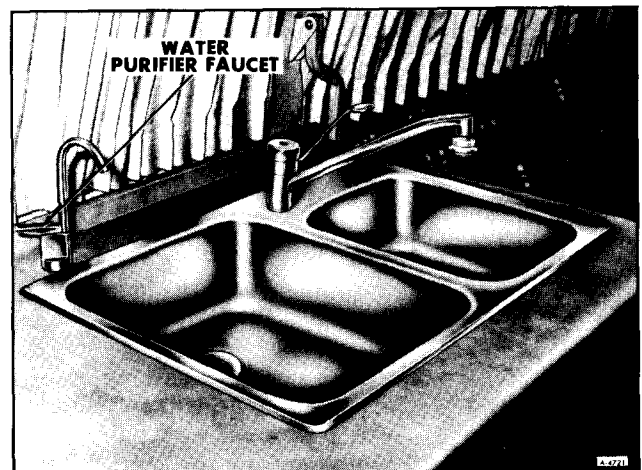


Figure 50—Galley Sink with Water Purifier

2. Secure with fiber washer, flat washer, lock-washer, and nut.
3. Connect water line to faucet.
4. Turn on water valve and water pump switch. Check water purifier for operation and leaks.

WINTERIZATION

A non-toxic anti-freeze is used in the water system when the temperatures may fall below freezing. The water purification system must be removed before the anti-freeze is added to the water. If anti-freeze is used with the purification cartridges installed, the water will taste like the anti-freeze and the purification cartridges will continue to taste like anti-freeze after the system has been purged.

CAUTION: *Freezing can destroy the cartridges. They must be removed and stored in a warm place during freezing weather.*

Before replacing the water purification car-

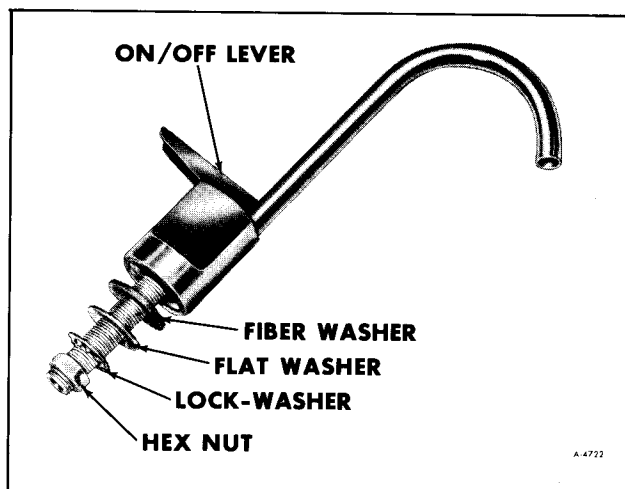


Figure 51—Water Purifier Faucet Removed

tridges, first flush the water system to remove non-toxic anti-freeze and install clean water. For complete winterizing details, refer to Section 24A.

CITY WATER CONNECTION

REMOVAL

1. Turn off water pump and open water faucet to reduce line pressure.
2. Carefully remove carpet from city water access panel in closet. Carpet is stapled in place. Remove the staples from the carpet.
3. Remove city water access panel screws and remove panel.
4. Disconnect water line from city water valve.
5. At the external utilities compartment outside the vehicle, remove four outer screws and nuts from city water valve and remove valve (figure 6).

INSTALLATION

1. Install new city water valve and secure with four screws and nuts.
2. Connect water line to city water valve.
3. Install city water valve access panel in closet.
4. Install closet carpet and staple into position.
5. Close faucet and turn pump on.

PLUMBING LINES

The living area water system plumbing consists of 3/8 inch, 1/2 inch, and 5/8 inch polybutulene lines and fittings. Water leaks can be repaired using an appropriate size coupling from the Service Repair Kit 2001630 and cutting the leaking area out of the line.

REPAIR PROCEDURE

1. Cut the line off square, removing section with the leak. Use Special Tool J-26227 to flare the line (figure 52).

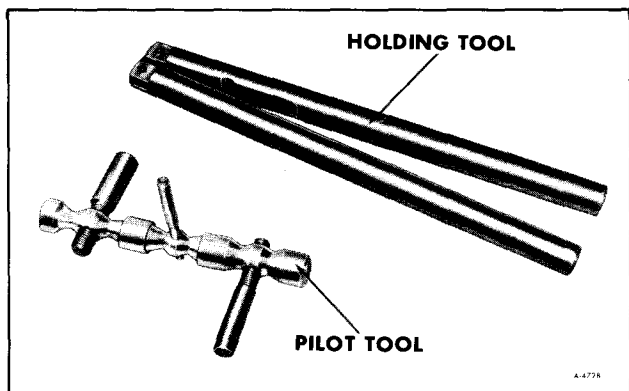


Figure 52—Special Tool J-26227

2. Turn the proper pilot out about 1/2 inch. Put the flare nut on the line and place the line to be flared over the pilot (figure 53).

3. Grasp the line over the pilot with the Holding Tool and screw the pilot into the Flaring Tool making a flare on the end of the line (figure 54).

4. Assemble the flare insert and coupling to the line so that the repaired line appears the same as that in Figure 55.

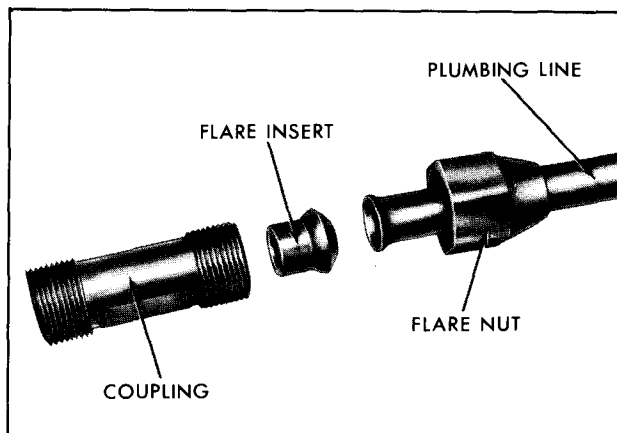


Figure 54—Plumbing Line Ready for Repair

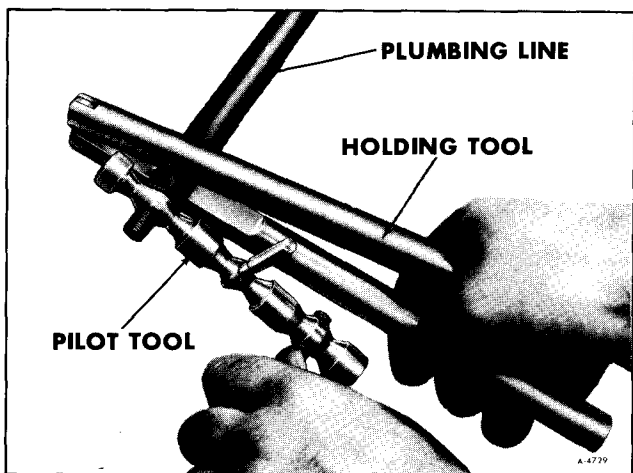


Figure 53—Flaring Plumbing Line

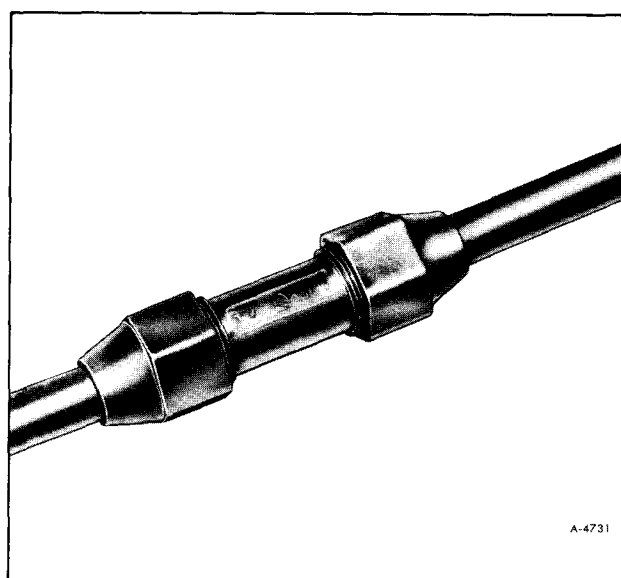


Figure 55—Typical Plumbing Line Repair

PLUMBING LINE TORQUES

Size	Torque
3/8 inch	55-60 in. lbs.
1/2 inch	55-60 in. lbs.
5/8 inch	90-100 in. lbs.

SPECIAL TOOLS

J-26227

Flaring Tool

SECTION 24K TOILET

STANDARD TOILET (AQUA-MAGIC)

GENERAL INFORMATION

The standard toilet (figure 1) is a fresh water, permanently installed sanitation system. It uses a pressure flushing system. This scours the bowl with each flush. Water injection produces a "swirl effect"

and uses a measured amount of water to rinse efficiently. The unit is a self cleaning type with an odor tight, gas tight, teflon seal which closes off the holding tank when not in use. Since every flush uses fresh water, no mandatory chemical additives are needed.

STANDARD TOILET TROUBLE DIAGNOSIS

Complaint	Possible Cause	Correction
Water keeps running into the bowl.	The blade in the bottom of the bowl is not closing completely, which in turn keeps the water control valve partially open. The groove into which the blade seats when completely closed is clogged with foreign material.	Insert the end of a coat hanger or similar object into the sealing groove and remove the foreign material. Avoid damaging the rubber seal while cleaning.
Toilet leaks. There is water on the floor.	Specify the symptom. Determine if water is leaking from: a. The vacuum breaker. b. The water control valve. c. Bowl to mechanism seal (if this is the problem, the water would not stay in the bowl).	a. The vacuum breaker—if the vacuum breaker leaks when flushing the toilet, replace the vacuum breaker. b. If the vacuum breaker leaks when the toilet is not in operation, replace the water control valve. c. Leaks at the bowl to mechanism seal—remove mechanism, and replace mechanism seal.

Complaint	Possible Cause	Correction
Contd. from previous page.	d. Closet flange base seal.	d. Leaks at closet flange area— check front and rear closet flange nuts for tightness. If leak continues remove the toilet, check the closet flange height. The height should be between 1/4" and 7/16" above the floor. Adjust closet flange height accordingly and replace closet flange seal.
Foot pedal operates harder than normal or the blade sticks.	This is generally caused by using cleansers or other abrasives to clean the bowl. The foreign material scrapes away the teflon on the blade seal and the amount of friction is increased to the point where dragging occurs. It can also be caused by using water, which contains a high content of suspended foreign material such as sand.	Wipe the blade completely dry, spray with a silicone spray and work the pedal several times. Repeat until blade works freely.

TOILET REMOVAL

1. Turn off water pump and release pressure at any faucet.
2. Disconnect toilet water line.
3. Depress flush pedal and insert block of wood or similar object in slide trap to keep trap open. This holds the flush pedal down for access to front mounting nut.
4. Remove front mounting nut.
5. Depress pedal and remove block.
6. Lift toilet seat lid and remove access cap for the rear mounting nut.
7. Remove rear mounting nut using at least a 12" extension and a universal socket through the access hole.
8. Lift off toilet.

DISASSEMBLY AND REPAIR

The toilet disassembles into four main subassemblies (See figure 1).

1. The seat and cover assembly.
2. The vacuum breaker.
3. The mechanism assembly.
4. The hopper assembly.

Any of these subassemblies may be removed from the toilet in the following manner:

1. Removal of the seat and cover assembly (figure 1):

With seat and cover assembly in the up position use a flat screwdriver or similar tool to pull out the seat hinge pins.

2. Removal of the vacuum breaker (figure 1):

Remove seat and cover assembly as explained in last paragraph. Then turn the toilet up-side-down. To remove water lines from vacuum breaker base, pinch hose clamps with a pair of pliers and slide them up the water line. Water lines may be pulled off. Remove the two vacuum breaker attachment screws.

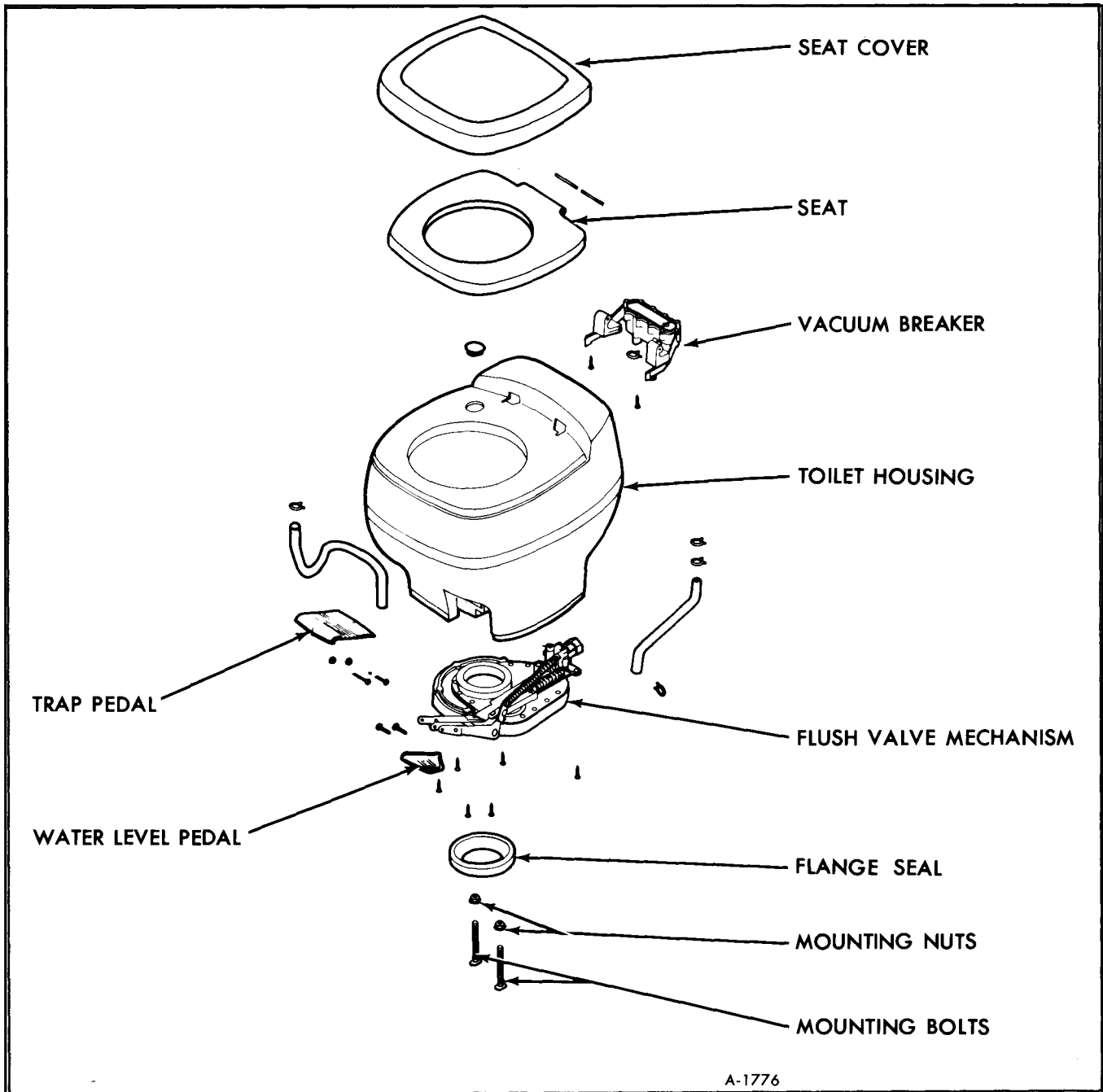


Figure 1—Standard Toilet Components

3. Removal of the mechanism assembly (figure 1):

Turn the toilet up-side-down. Remove the six screws that are now visible. Lift up mechanism to gain access to water line hose clamps. Pinch hose clamps with a pair of pliers and slide them up the water line. Pull water lines off of mechanism.

4. Service and replacement of hopper assembly:

Hopper assembly may be serviced or replaced by removing the above 3 assemblies.

TOILET INSTALLATION

1. Install a new flange seal over mechanism ring found on underside of toilet.
2. Set toilet in place and install rear mounting nut using the 12" extension and universal socket with a small amount of grease in the socket to hold the nut in place.
3. Tighten rear mounting nut.
4. Depress toilet pedal and insert block of wood in slide trap to keep the trap open. This holds the pedal down for access to front mounting bolt. Install nut and tighten.

5. Depress pedal and remove block of wood.
6. Connect toilet water line.

MAINTENANCE

No routine maintenance is required.

If the bowl sealing blade does not operate freely after extended use, it may be restored to its original, smooth operating condition by applying a light film of Silicone spray to the blade.

To clean the toilet, use any high grade, non-abrasive cleaner. Do not use highly concentrated or high acid content household cleaners. They may damage the rubber seals.

RECIRCULATING TOILET (ELECTRA-MAGIC)

GENERAL INFORMATION

The optional recirculating toilet operates by recirculating the liquid present in the toilet and a

chemical additive. The advantage is that water is conserved when flushing and also not adding to the volume of the holding tank. The toilet operates on 12-volt DC.

RECIRCULATING TOILET TROUBLE DIAGNOSIS

Complaint	Possible Cause	Correction
1. Toilet will not flush.	<ol style="list-style-type: none"> a. Blown living area fuse. b. Blown toilet fuse. c. Pump motor defective. d. Damaged timer. 	<ol style="list-style-type: none"> a. Replace blown fuse in living area electrical compartment. b. Replace toilet fuse under toilet motor cover. c. Replace pump assembly. d. Replace timer assembly.
2. Toilet does not cycle properly (5 to 9 seconds) when button is pressed.	<ol style="list-style-type: none"> a. Source of power less than 12-volts. b. Damaged timer. 	<ol style="list-style-type: none"> a. Check batteries or power converter. b. Replace timer assembly.
3. Toilet cycles when seat cover is raised.	<ol style="list-style-type: none"> a. Actuator button protrudes too far from motor cover. 	<ol style="list-style-type: none"> a. Alternately press one side of the button, then the other, to work the button back further into the housing. If button still protrudes too far, replace timer assembly.
4. Flushing action is weak or noisy.	<ol style="list-style-type: none"> a. Unit cycling without adequate water charge. b. Source of power less than 12-volts. c. Pump damaged by continuous dry operation. 	<ol style="list-style-type: none"> a. Charge unit with water to the proper level. b. Check batteries or power converter. c. Replace pump assembly.

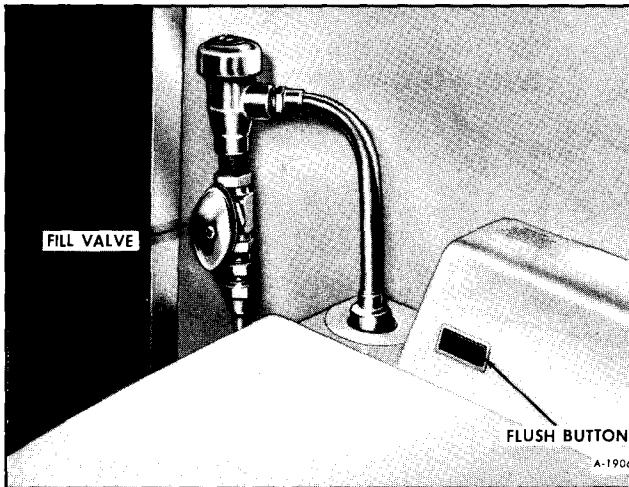


Figure 2—Toilet Water Fill Connection

TOILET REPLACEMENT

REMOVAL

1. Turn off water pump and release pressure at any faucet.
2. Disconnect toilet water fill line shown in Figure 2, and disconnect the toilet wires.
3. Remove base moldings from lower sides of toilet.
4. Remove the two nuts under the toilet securing it to the floor.
5. Lift off toilet.

INSTALLATION

1. Install new flange seal on slide valves.
2. Place toilet on flange making sure bolts line up through mounting brackets.
3. Secure toilet in place with two nuts under toilet at mounting brackets.
4. Connect toilet water fill line and wires (figure 2).

DISASSEMBLY AND REPAIR (FIGURE 3)

FUSE REPLACEMENT

1. Remove two cover mounting screws and motor cover.

2. The fuse is now accessible for checking or changing, see Figure 3.

TIMER REPLACEMENT

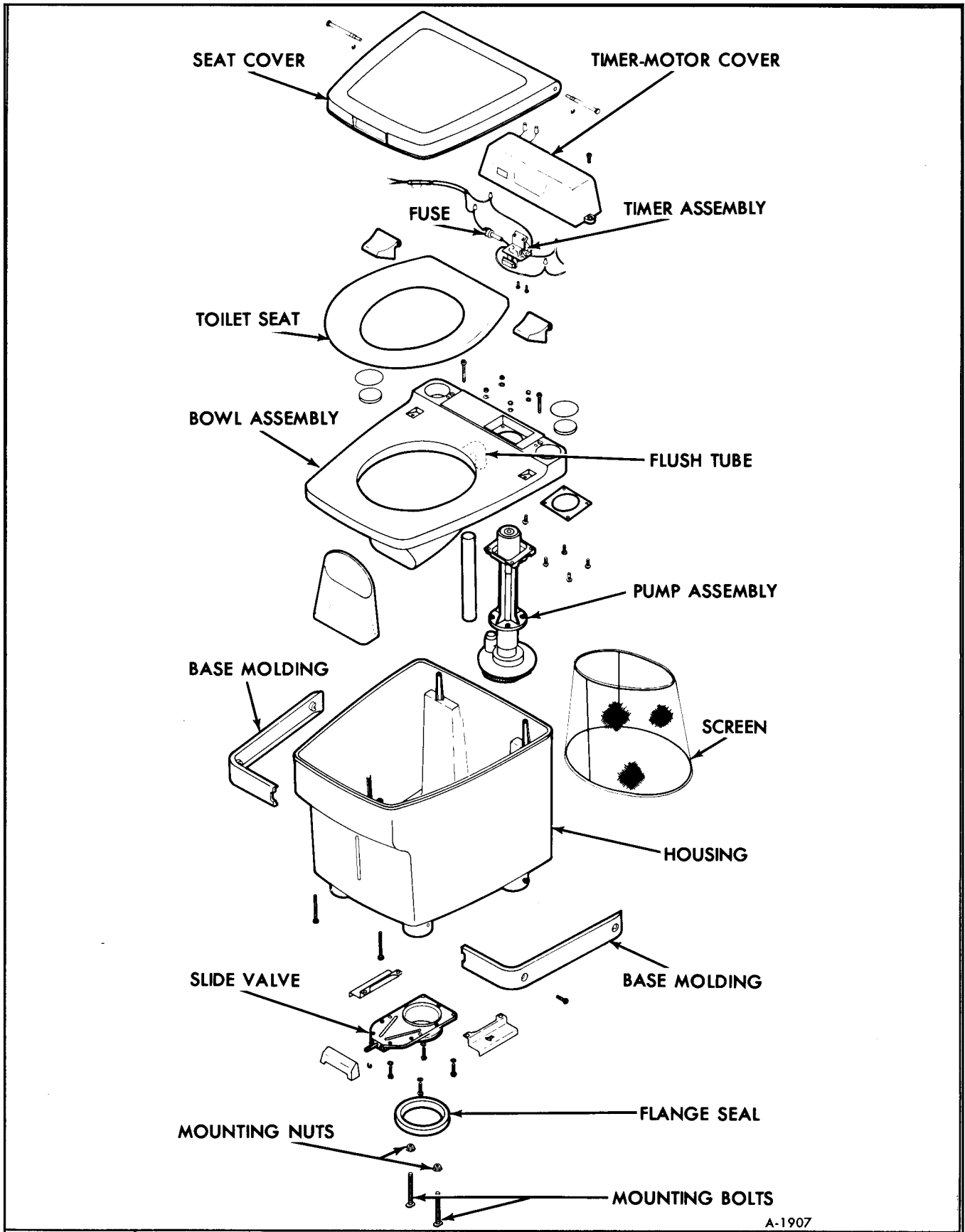
1. Disconnect lead wires from power source (figure 3).
2. Remove two cover mounting screws and motor cover (figure 1).
3. Disconnect leads from pump assembly motor (figure 3).
4. Remove two timer bracket mounting screws and timer assembly.
5. Install by reversing steps 1—4.

PUMP REPLACEMENT

1. Disconnect lead wires from power source.
2. Remove two cover mounting screws and motor cover.
3. Disconnect leads from pump assembly motor.
4. Completely evacuate unit.
5. Remove cover and bowl assembly screws (two in rear from top side and two in front from bottom side) and remove cover and bowl assembly (figure 3).
6. Remove four pump mounting screws (figure 3).
7. Disconnect flush tube from pump outlet (figure 3).
8. Remove pump assembly (figure 3).
9. Install by reversing steps 1—8.

SLIDE VALVE REPLACEMENT (FIGURE 3)

1. Remove toilet from module. See "Toilet Replacement" earlier in this section.
2. Turn toilet upside down and remove the four screws and remove valve.
3. Install by reversing steps 1 and 2.



A-1907

Figure 3—Recirculating Toilet Components

MAINTENANCE

No routine maintenance is required on the recirculating toilet other than "Charging Toilet" which is described as follows:

NOTE: Details on winterizing the recirculating toilet are covered in Section 24A of this manual.

CHARGING TOILET

1. Be sure handle on dump valve is pushed in.
 2. Open fill valve, filling toilet to the charge level as indicated by the letter "C" on prism. This will be approximately 3 gallons. Close the fill valve.
 3. Add recirculating toilet chemical as recommended by manufacturer of chemical.
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SECTION 24L HOLDING TANK AND DRAINAGE SYSTEM

The contents of this section are listed below:

SUBJECT	PAGE NO.
General Description.....	24L-1
Trouble Diagnosis	24L-2
Holding Tank.....	24L-3
Drain Pipe and Fittings	24L-6

GENERAL DESCRIPTION

The drainage system (figure 1) consists of ABS plastic pipes and fittings. A holding tank with a capacity of approximately 32 gallons stores waste water from the sinks, shower and toilet.

A tube assembly bolted to the holding tank and a detachable sewer hose are provided for dumping the contents of the holding tank.

The tank is vented through three standpipes with roof-mounted vents.

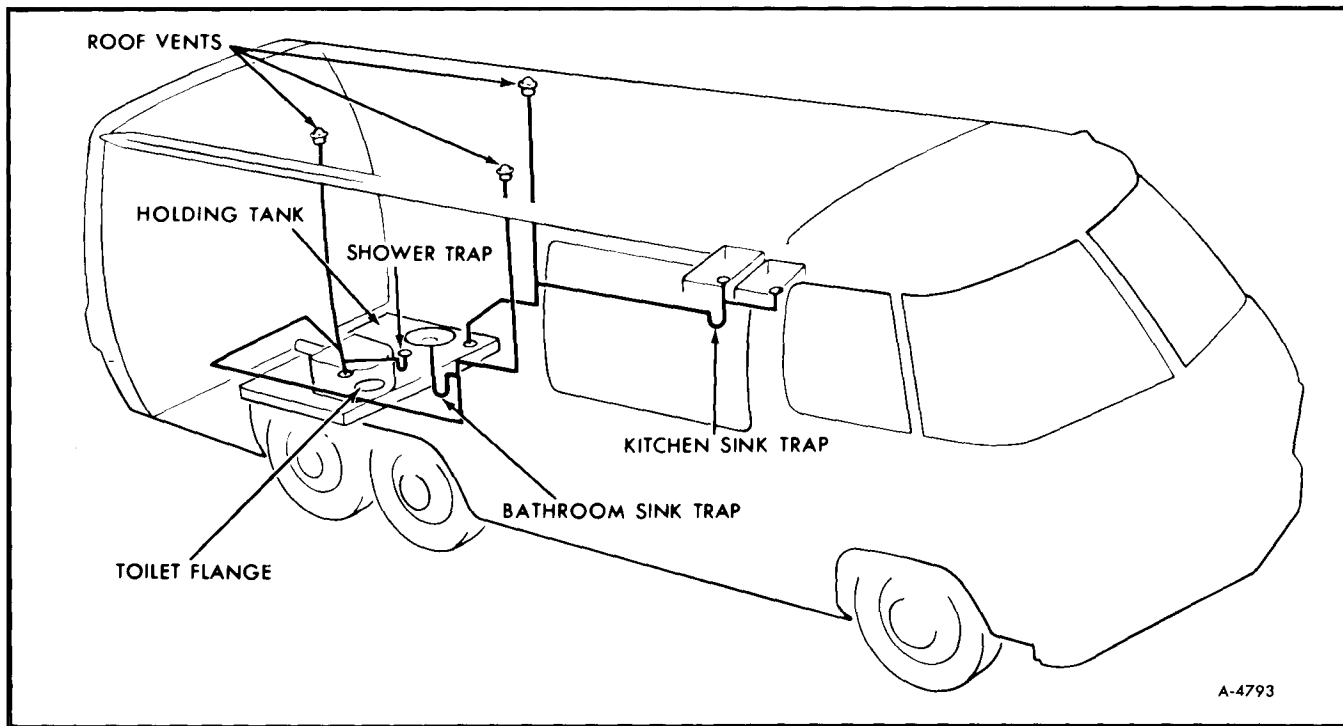


Figure 1—Drainage System

TROUBLE DIAGNOSIS

Problem	Possible Cause	Correction
Monitor panel gauge in-operative.	1. Refer to "Monitor Panel-Trouble Diagnosis" in Section 24B.	1. Refer to "Monitor Panel-Trouble Diagnosis" in Section 24B.
Holding tank leaks.	1. Seal may be damaged or misaligned at the tank sending unit or fullway dump valve. 2. Loose or misaligned fittings on top of tank. 3. Tank has been punctured.	1. Refer to "Holding Tank-Fittings" later in this section. 2. Remove tank and correct. Refer to "Holding Tank-Removal", and "Fittings" later in this section. 3. Refer to "Holding Tank-Repair" later in this section.
Holding tank plugged up and won't empty.	1. Determine if anything was dropped into tank to cause the situation. 2. Sediment has accumulated enough to block fullway valve opening. (The recommended use of bio-degradable should prevent this).	1. Flush tank adequately, add a tank chemical to eliminate odor during final flush. Remove fullway valve. Refer to "Holding Tank" later in this section. Try fishing object out through opening. 2. Use a plumbers flexible probe to break accumulation open. CAUTION: Use a hand turned probe, not a power driven probe. The power driven probe may damage the plumbing lines. NOTE: Once unplugged the contents will quickly drain so be prepared and have dump hose aimed in the desired direction.
Holding tank contents backs up through shower trap and onto bathroom floor.	1. The shower trap is the lowest point of the drainage system and an over full holding tank will back up contents at this point.	1. Caution owner to dump holding tank more frequently. 2. Install drainage plug in shower drain.
Clogged drain.	1. Accumulation of grease, hair, etc.	1. Remove "P" trap and clean. Refer to "Drain Pipes and Fitting".
Drain pipe or fitting leaks.	1. Vehicle vibration may have loosened fitting or a pipe may have a hole rubbed in it from contact with metal. 2. Broken pipe from freezing.	1. Replace pipe or fitting. Refer to "Drain Pipes and Fittings" later in this section. 2. Replace pipe or fittings.

HOLDING TANK

HOLDING TANK REMOVAL

1. Drain holding tank completely and close drain valve.
2. Remove toilet assembly. Refer to the section 24K for removal procedures.
3. Remove toilet mounting flange by removing six flange to floor mounting screws. Unscrew flange from holding tank.
4. Remove dump tube with fullway valve by removing four screws holding valve to mounting area on holding tank.
5. Remove cotter pin from valve rod and remove control rod (See figure 2).
6. Remove two electrical leads from holding tank sending unit.
7. Remove the drain pipe access cover inside the storage compartment below the Living Area Electrical Compartment then use a basin wrench as shown in Figure 3 to loosen pipe fitting from tank.
8. Remove two retaining nuts from each of the two mounting brackets (See figure 2).
9. Holding tank can now be lowered to floor.

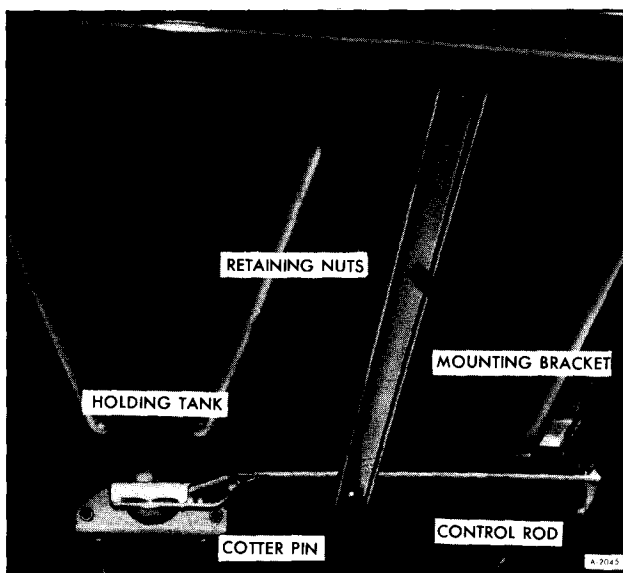


Figure 2—Holding Tank Mounting

HOLDING TANK REPAIR

Except for small, clean punctures the holding tank is not repairable. Polypropylene plastic, used to manufacture the tank, resists all common adhesives. The contents of the tank will quickly corrode any sheet metal, pop-rivets or screws used to plug or patch the tank.

A small puncture may be repaired with a well nut. Enlarge puncture hole with a drill and insert well-nut. Tighten securely.

HOLDING TANK INSTALLATION

1. Position holding tank and secure with two mounting brackets. Install nuts and tighten with fingers. Tighten pipe connector into tank, using a basin wrench as shown in Figure 3. Install drain pipe cover and secure with three screws. Torque holding tank bracket nuts to 95-145 in. lbs.



Figure 3—Loosening Pipe Fitting

2. Connect two electrical leads to holding tank gauge sending unit.
3. Install valve rod on drain valve and secure with cotter pin.
4. Install dump tube with fullway valve to holding tank with four screws.
5. Screw toilet mounting flange into holding tank and secure with six screws to floor.
6. Install toilet as described in SECTION 24K.

FULLWAY VALVE

REMOVAL

1. Drain holding tank completely and close fullway valve.
2. At dump tube assembly remove the four screws securing valve to the tank. Remove cotter pin from control rod.
3. Remove six bolts and nuts from dump tube bracket near tank.
4. Remove two bolts, washers, and nuts from clamp that secures dump tube to vehicle at bend in tube.
5. Unhook strap that supports dump tube at cap. Remove the fullway valve and the dump tube assembly.

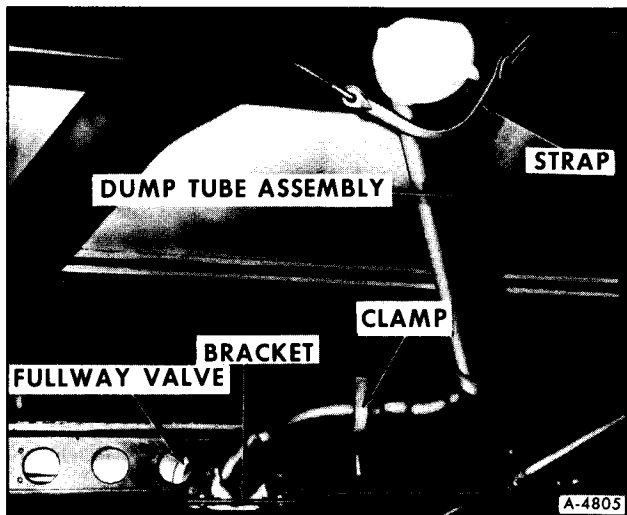


Figure 4—Dump Tube and Valve Assembly

INSTALLATION

1. At dump tube assembly, apply a film of grease to valve where "O" ring seats against valve. This will hold the new "O" ring in position while installing valve.
2. Position valve at holding tank and assemble enough to loosely install the strap (figure 4). Tighten fullway valve to tank screws.
3. Position valve with dump tube to tank and loosely install clamp to support tube.
4. Tighten fullway valve to tank screws.
5. Install bracket with six bolts and nuts. Torque to 15 ft. lbs. Tighten clamp bolts. Torque to 15-25 in. lbs.
6. Install valve rod and secure with cotter pin. Connect tube support strap.
7. Check tank and valve for leaks.

HOLDING TANK SENDING UNIT

REMOVAL

1. Disconnect two electrical leads to unit as shown in Figure 5.
2. Remove five screws retaining sending unit to holding tank, and remove sending unit.

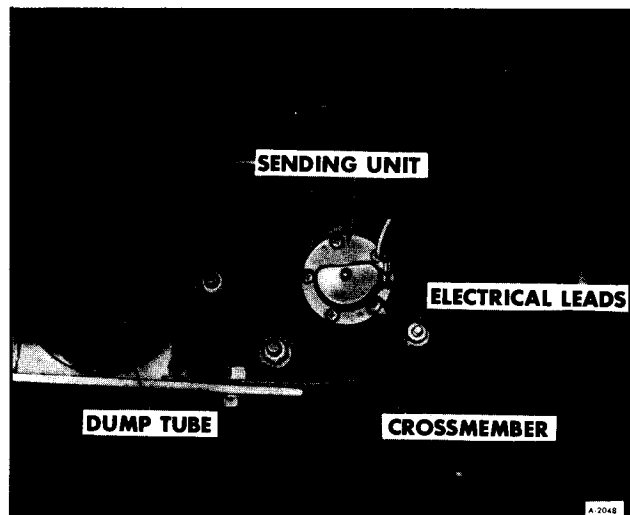


Figure 5—Holding Tank Sending Unit

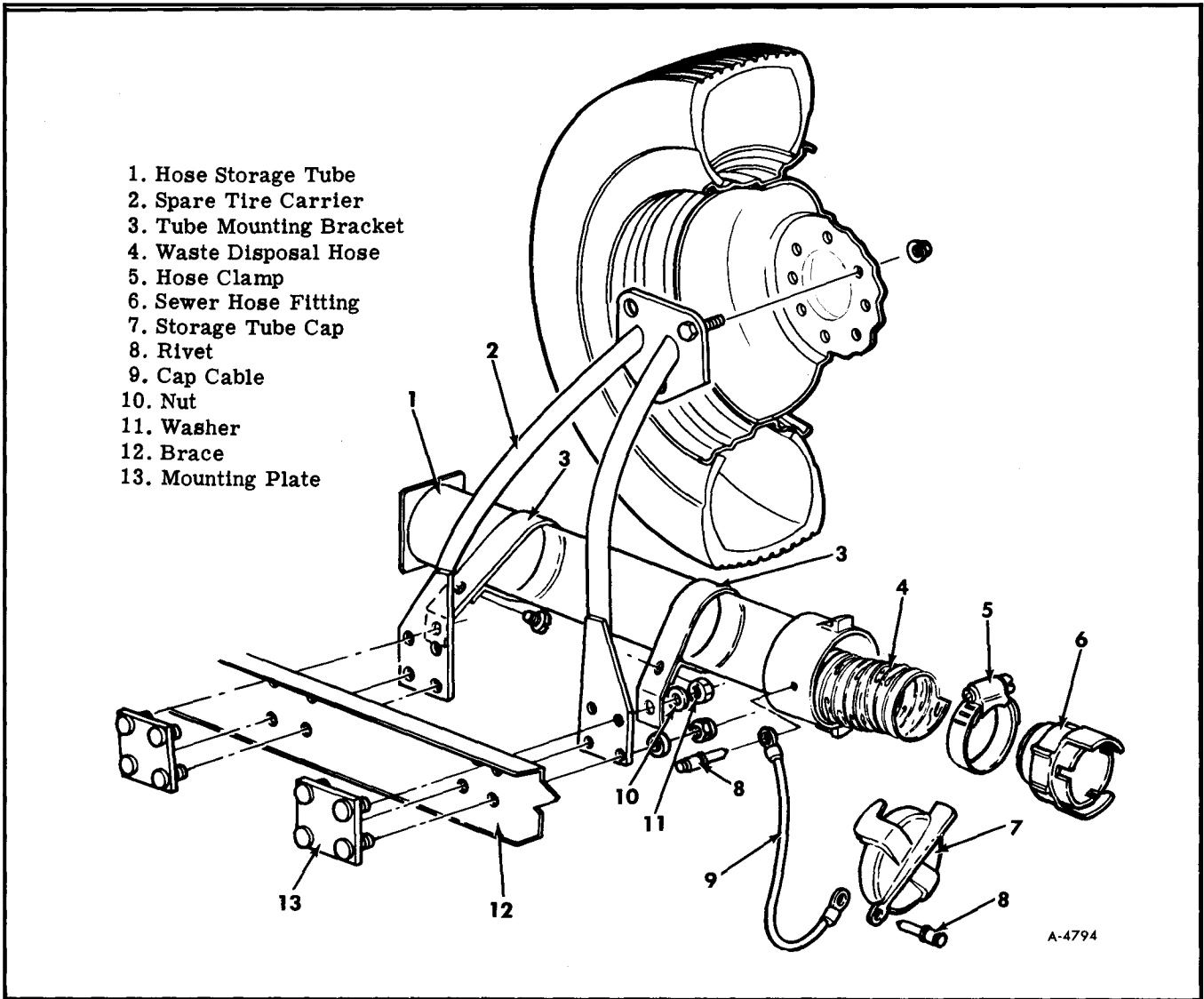


Figure 6—Sewer Hose Storage Tube - Exploded View

INSTALLATION (FIGURE 5)

1. Position sending unit and new gasket at holding tank with lead wire in the three o'clock position.
2. Install five retaining screws and hook up electrical leads.

DUMP TUBE

For dump tube removal, see "Fullway Valve Removal" earlier.

**SEWER HOSE ASSEMBLY
(FIGURE 6)**

REMOVAL

1. Open the storage tube cap (7) and remove the sewer hose assembly (4, 5, and 6).

2. Loosen hose clamp (5) and separate waste disposal tube (4) from sewer hose fitting (6).

3. Remove two upper outside nuts (10) and washers (11), that secure tube mounting brackets (3) to spare tire carrier (2). Remove hose storage tube (1) with tube mounting brackets (3).

INSTALLATION

1. Secure hose storage tube (1) by two tube mounting brackets (3) to spare tire carrier (2) with two upper outside nuts (10) and washers (11).
2. Secure sewer hose fitting (6) to waste disposal tube (4) with hose clamps (5).
3. Store sewer hose assembly in storage tube. Replace storage tube cap (7).

DRAIN PIPES AND FITTINGS

All drain pipes and fittings are made from ABS plastic. Repair using a hacksaw to cut out damaged portion of pipe. Connect a new pipe section with unions. Fittings (elbows, unions, "T's", etc.) may be more difficult to replace and some rerouting may be necessary. Follow the adhesive manufacturers recommendation for preparing the pipe and fittings for assembly.

"P" traps are easily removed for cleaning if they become clogged. To remove a "P" trap loosen compression fitting on either end of the trap as shown in Figure 7. Clean trap, position in vehicle and tighten compression fitting by hand.

VENT LINE ROOF CAPS

There are three vent lines. Each vent line has a roof mounted cap to help prevent anything from entering the system from the roof which may plug the vent line.

REMOVAL

1. Drill off heads of rivets.
2. Remove vent cap and gasket.

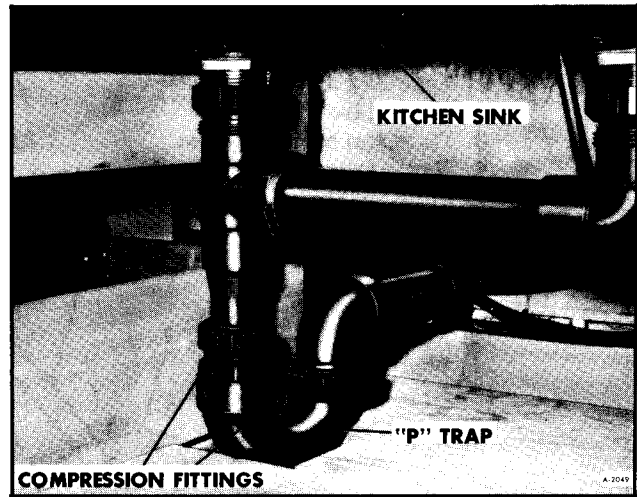


Figure 7—"P" Trap (Typical)

INSTALLATION

1. Replace gasket and vent cap. Check for proper fit, add sealer to gasket (both sides) if required.
2. Pop-rivet vent cap to roof.

SECTION 24N

CABINETS AND FURNITURE

GENERAL INFORMATION

The various cabinetry and furnishings in the GMC MotorHome can be readily replaced or repaired using standard wood working procedures. Generally these units are retained by small screws, standard fasteners, etc. When removing any unit determine the manner of attachment, note the align-

ment points, and before removing the last fastener, support the weight of the unit to avoid possible damage.

IMPORTANT: Seat belt anchor bolts must be tightened to 35-45 foot-pounds torque.

CARE AND CLEANING

GENERAL INFORMATION

Dust and loose dirt that accumulates on interior fabric trim should be removed frequently with a vacuum cleaner, whisk broom or soft brush. Vinyl or leather trim should be wiped regularly with a clean damp cloth. Normal trim soilage, spots or stains can be cleaned with GM cleaners or equivalent.

Before attempting to remove spots or stains from upholstery, determine as accurately as possible the nature and age of the spot or stain. Some spots or stains can be removed satisfactorily with water or mild soap solution (refer to "Removal of Specific Stains" later in this section). For best results, spots or stains should be removed as soon as possible.

Some types of stains or soilage such as lipsticks, some inks, certain types of grease, mustard, etc., are extremely difficult and, in some cases, impossible to completely remove. When cleaning this type of stain or soilage, care must be taken not to enlarge the soiled area. It is sometimes more desirable to have a small stain than an enlarged stain as a result of attempted cleaning.

The listed cleaners are **EXCELLENT CLEANERS** when used properly according to directions on containers and are available through most GM Dealerships.

GM Cleaners

PART NO.	QUANTITY	DESCRIPTION
1050244	16 oz. can	GM Fabric Cleaner (Solvent Type)
1050417	Gallon can	GM Fabric Cleaner (Solvent Type)
1050803	16 oz. Container	GM Multi-Purpose Powdered Cleaner (Foam Type)
1050429	6 lb. can	GM Multi-Purpose Powdered Cleaner (Foam Type)

LAP BELT CARE

- Clean only with mild soap solution and luke-warm water.
- Do not bleach or dye belts since this may severely weaken belts.

INTERIOR GLASS

The interior glass surface should be cleaned on a periodic basis for continued good visibility. A commercial household glass cleaning agent containing ammonia will remove normal tobacco smoke and dust films sometimes caused by ingredients used in vinyls, plastics, or other interior trim materials.

KITCHEN SINK

The stainless steel sink should be cleaned with a liquid or finely ground powder. Scouring powder is not recommended for stainless steel and will ruin the finish. Stainless steel cannot be harmed by boiling water. However, salt, mustard, mayonnaise and cat-sap will cause pitting and should be cleaned off immediately.

DRAPERY CARE

The draperies used in the GMC MotorHome are to be **DRY CLEANED ONLY**.

CLEANING FABRICS

IMPORTANT: Be sure vehicle is well ventilated while using the following cleaning agents. Follow manufacturer's recommendations in using such products.

CAUTION: *Many cleaners may be toxic or flammable, and their improper use may cause personal injury or may cause damage to the interior. Therefore, when cleaning the interior, do not use volatile cleaning solvents such as: acetone, lacquer thinners, enamel reducers, nail polish removers; or such cleaning materials as laundry soaps, bleaches or reducing agents (except as noted in the adjacent fabric cleaning instructions on stain removal). Never use carbon tetrachloride, gasoline or naphtha for any cleaning purpose.*

CLEANING FABRICS WITH CLEANING FLUID

GM Fabric Cleaner (Solvent Type) is excellent for spot cleaning stains containing grease, oil or fats from fabric type trim. Excess stain should be gently scraped off trim material with a clean DULL knife or scraper. **USE VERY LITTLE CLEANER**, light pressure, and clean cloths (preferably cheese cloth). Cleaning action should be from outside of stain **FEATHERING** towards center of stain and constantly changing to a clean section of cloth. When stain is cleaned from fabric, immediately dry area with an air hose, heat dryer or heat lamp to help prevent a cleaning ring (use caution with heat dryer or heat lamp to prevent damage to fabric material). If a ring forms, immediately repeat the cleaning operation over a slightly larger area with special emphasis on **FEATHERING** towards center of area. If ring still persists, mark off adjacent trim sections and clean entire affected trim panel section with GM Multi-Purpose Powdered Cleaner as described in the following:

CLEANING FABRICS WITH DETERGENT FOAM CLEANERS

GM Multi-Purpose Powdered Cleaner is excellent for this type cleaning and for cleaning a panel section where a minor cleaning ring may be left from spot cleaning.

Vacuum area thoroughly to remove excess loose dirt. **ALWAYS** clean a full trim assembly or complete trim section—mask adjacent trim along stitch or welt lines. Mix Multi-Purpose Powdered Cleaner in strict accordance with directions on label of container—mix proportionally for smaller quantities. **USE STUDS ONLY ON A CLEAN SPONGE or SOFT BRISTLE BRUSH—DO NOT WET FABRIC EXCESSIVELY OR RUB HARSHLY WITH BRUSH. IMMEDIATELY AFTER CLEANING WIPE OFF ANY CLEANER RESIDUE WITH SLIGHTLY DAMP ABSORBENT TOWEL OR CLOTH.**

IMPORTANT: —Immediately after wiping, force-dry fabric with air hose, heat dryer or heat lamp. (Use caution with heat dryer or heat lamp to prevent damage to fabric).

When trim materials with a sheen or luster finish are dry, wipe fabric lightly with a soft, dry clean cloth to restore sheen or luster.

REMOVAL OF SPECIFIC STAINS

CANDY—Chocolate, use cloth soaked in luke-warm water; other than chocolate, use very hot water. Dry if necessary, clean lightly with fabric cleaning fluid.

CHEWING GUM—Harden gum with ice cube and scrape off with dull knife. Moisten with fabric cleaning fluid and scrape again.

FRUIT STAINS, COFFEE, LIQUOR, WINE, SOFT DRINKS, ICE CREAM AND MILK—Wipe with cloth soaked in cold water. If necessary, clean lightly with fabric cleaning fluid. Soap and water is not recommended as it might set the stain.

CATSUP—Wipe with cloth soaked in cool water. If further cleaning is necessary, use a detergent foam cleaner.

GREASE, OIL, BUTTER, MARGARINE AND CRAYON—Scrape off excess with dull knife. Use fabric cleaning fluid.

PASTE OR WAX TYPE SHOE POLISH—Light application of fabric cleaning fluid.

TAR—Remove excess with dull knife, moisten with fabric cleaning fluid, scrape again, rub lightly with additional cleaner.

BALL POINT INK—Try rubbing alcohol. If stain remains after repeated operations, no other measure should be tried.

LIPSTICK—Difficult to remove. Cleaning fluid works on some brands. If stain remains after repeated applications, do not try other measures.

MUSTARD—Damp sponge with warm water, then rub detergent on dampened stain and work into fabric. Rinse with clean damp cloth. Repeat several times. Some discoloration may remain.

BLOOD—Wipe with clean cloth moistened with cold water. Use no soap.

URINE—Sponge stain with lukewarm soap suds from mild neutral soap on clean cloth, rinse with cloth soaked in cold water; saturate cloth with one part household ammonia and five parts water, apply for one minute, rinse with clean, wet cloth.

VOMITUS—Sponge with clean cloth dipped in clean, cold water. Wash lightly with lukewarm water and mild neutral soap. If odor persists, treat area with a water-baking soda solution (one teaspoon baking soda to one cup of lukewarm water). Rub again with cloth and cold water. Finally, if necessary, clean lightly with fabric cleaning fluid.

SECTION 24P

EXHAUST VENTS

DESCRIPTION

The GMC MotorHome is equipped with a number of exhaust vents, these include:

- The range/oven power hood vent to remove cooking odors and gases. The switch is on the fan.
- The power bath vent for ventilation. The control switch is on the vent.
- One or two ceiling vents (depending whether the vehicle is equipped with roof mounted air conditioning) to allow warm air to escape that may accumulate at ceiling level when the vehicle is parked in the sun. The opening of a ceiling vent and a window will aid in removing condensation from the windows.

The vents are crank-operated from inside the MotorHome. In rainy weather it is possible to leave the ceiling vents open slightly for ventilation without entry of water into the MotorHome (depending upon the magnitude and direction of rain).

NOTE: All windows and roof vents must be tightly closed when operating the air conditioner or furnace to obtain maximum cooling or heating.

Power fans are available for the ceiling vents. These will increase the efficiency of the vent. They are operated by the button switch at the corner of the vent.

VENT MOTOR DIAGNOSIS

The range/oven exhaust vent fan, the bath exhaust vent fan, and the ceiling vents with power fans are all operated by 12-volts living area electricity. Should any of these fans refuse to work make sure the living area battery is not dead. Next check the fuses in the living area electrical compartment, then

check to see that the motor is receiving power through the switch at the motor. If power is available at the motor but it still refuses to work remove the motor and test it on a direct 12-volt source. Replace motor if necessary.

RANGE / OVEN EXHAUST VENT

MOTOR REPLACEMENT (FIGURE 1)

REMOVAL

1. Remove retaining nuts at light and fan switch on bottom of exhaust hood.
2. Remove exhaust hood bottom assembly.

3. Remove two nuts holding motor mount to vent housing.

4. Disconnect motor wire.

5. Remove motor mount and fan from motor.

INSTALLATION

1. Install fan and mount to motor.

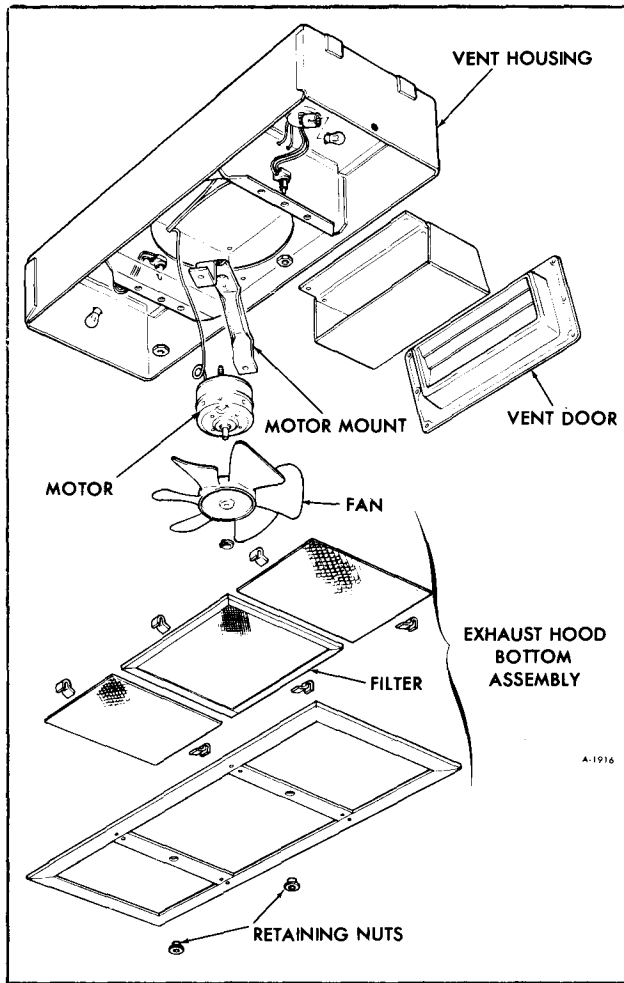


Figure 1—Range Power Vent

2. Connect motor wire to switch wire.
3. Install motor and mount assembly to vent housing and secure with two nuts.
4. Position exhaust hood bottom assembly to bottom of exhaust hood and secure with retaining nuts at switches.

RANGE/OVEN VENT FILTER (SEE FIGURE 1)

It is important that the power range hood filter be inspected frequently and cleaned as needed. To clean filter, remove retaining nuts at power hood switches, remove filter and wash in hot, soapy water. Rinse thoroughly and reinstall.

CEILING VENTS

MOTOR REPLACEMENT (POWER VENTS) (FIGURE 2)

REMOVAL

1. Remove vent crank handles (one screw each).
2. Remove vent screen (six screws).
3. Disconnect motor wires from switch and support.
4. Remove nuts retaining motor and switch to vent housing.
5. Remove fan from motor.

INSTALLATION

1. Install fan on motor.
2. Position motor and switch in vent housing and secure with retaining nuts.
3. Connect 12-volt motor wires to switch and support.

VENT SCREEN REPLACEMENT (FIGURES 2 AND 3)

REMOVAL

1. Remove vent crank handles (one screw each).

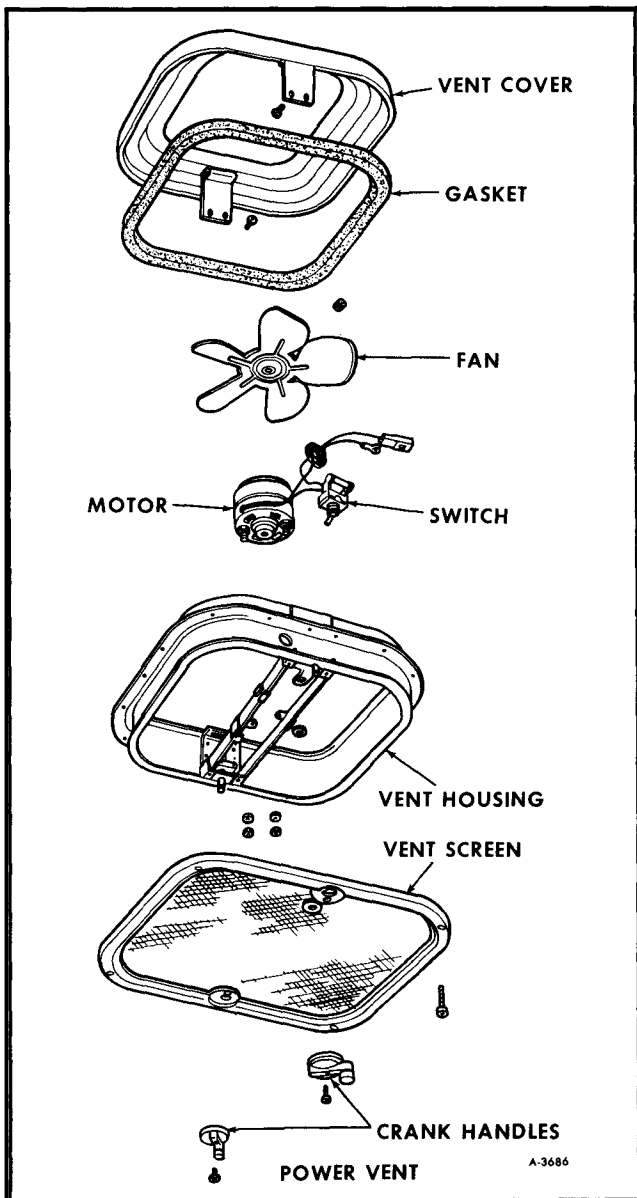


Figure 2—Ceiling Power Vent

2. Remove vent screen (six screws).

NOTE: Use lukewarm water and mild soap solution if necessary to clean vent screen.

INSTALLATION

1. Install vent screen. Tighten six retaining screws securely.
2. Install vent crank handles. Tighten retaining screws securely.

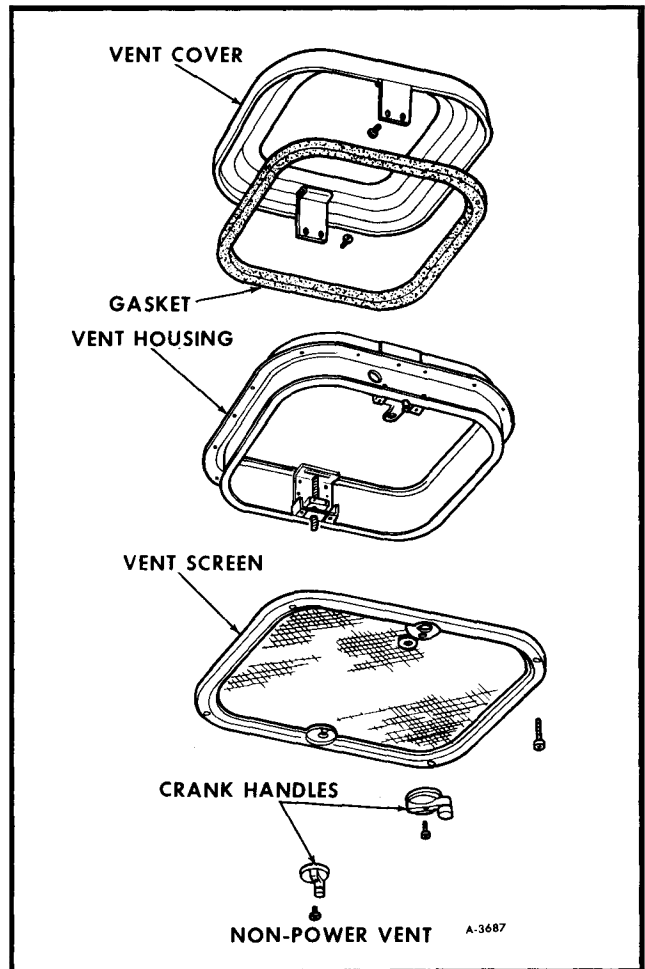


Figure 3—Ceiling Non-Power Vent

VENT GASKET REPLACEMENT

1. Fully open vent.
2. Remove vent cover by removing retaining screws from slide mechanism.
3. Carefully with the aid of a knife or other suitable tool remove gasket from vent cover.
4. Using suitable cement, secure gasket to vent cover.
5. Reinstall cover on slide mechanism. Tighten retaining screws securely.
5. Check for proper operation of vent.

BATH VENT

MOTOR REPLACEMENT (FIGURE 4)

REMOVAL

1. Remove vent ring in bath module (three screws).
2. On the roof of the vehicle remove the two screws holding plastic cover on vent.
3. Remove the entire vent assembly from roof by removing the six attaching screws pulling the unit out and disconnecting wires at quick disconnect.

4. With the unit on the bench remove vent closing handle (two screws).
5. Remove filter (two screws & switch nut).
6. Remove two screws at each motor mount.
7. Remove the two nuts at motor mounting.
8. Carefully remove the motor mount brackets.
9. Remove spring clip assemblies.
10. Disconnect wires and remove motor. Pull fan from motor.

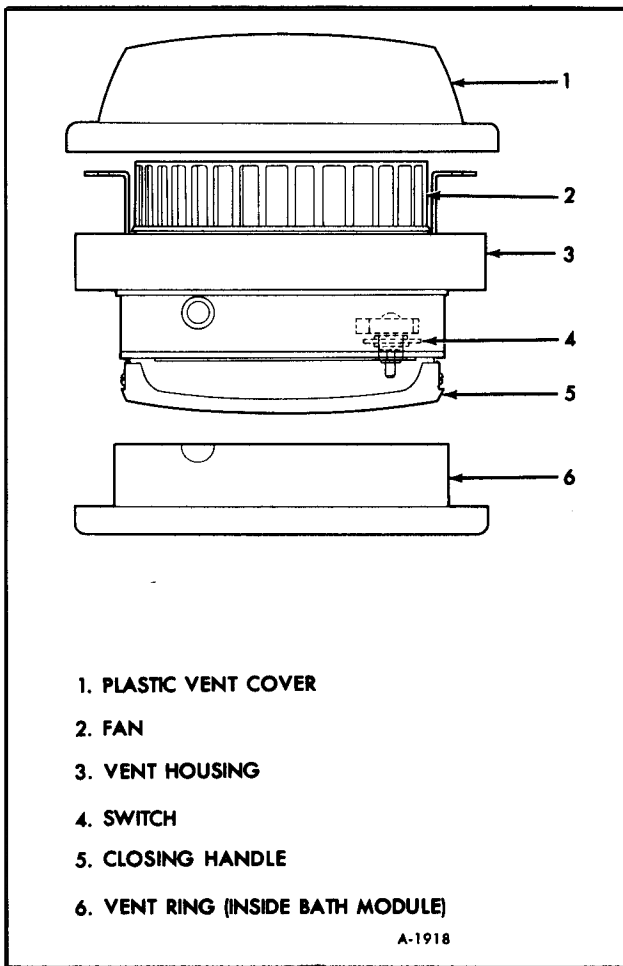


Figure 4—Bath Vent

INSTALLATION

1. Position motor with fan in housing and connect wires.
2. Position spring clip assemblies to motor studs.
3. Position motor mount brackets on motor studs and secure to vent housing with four screws.
4. Position switch on motor studs and secure motor to mounting bracket with two nuts and washers.
5. Install filter (two screws & switch nut).
6. Install closing handle (two screws).
7. Install vent assembly to roof being sure to use a sealing compound to prevent leaks.
8. Install plastic vent cover.
9. Install vent ring inside of bath module.

SECTION 24Q

OTHER EQUIPMENT

VACUUM CLEANER

GENERAL INFORMATION

The Motor Home integral vacuum cleaner (optional on Model 260) operates on 120-volt current. The vehicle must be connected to an external power source or the motor generator must be in operation in order to operate the vacuum cleaner.

Vacuum cleaner components are stored in the side of the refrigerator module near the entrance door. The vacuum cleaner storage cabinet contains a long flex hose, wand, and a wide assortment of wand attachments including one for shag carpeting (See figure 1).

To operate the vacuum system, remove flex hose



Figure 1-Vacuum Cleaner Components

from the cabinet, lift vacuum inlet hinge cap, just under the storage cabinet, and insert the proper end of the flex hose (figure 2). At this point the vacuum system will be operating and is used in the same manner as any household vacuum cleaner.

BAG AND FILTER REPLACEMENT

The vacuum cleaner contains two filters – the bag itself which catches the dirt and a secondary filter to keep any residual dirt out of the motor.

1. To remove the filled filter bag, slide cardboard end of bag with rubber seal off intake tube. Pull bag forward and out of cabinet.

2. To replace filter bag, spread new bag and position in cabinet. Slide cardboard end with rubber seal up over intake tube by starting at back of tube and pulling forward and up.

3. The secondary filter is located at the top of the filter bag chamber. The secondary filter should be removed and cleaned often.

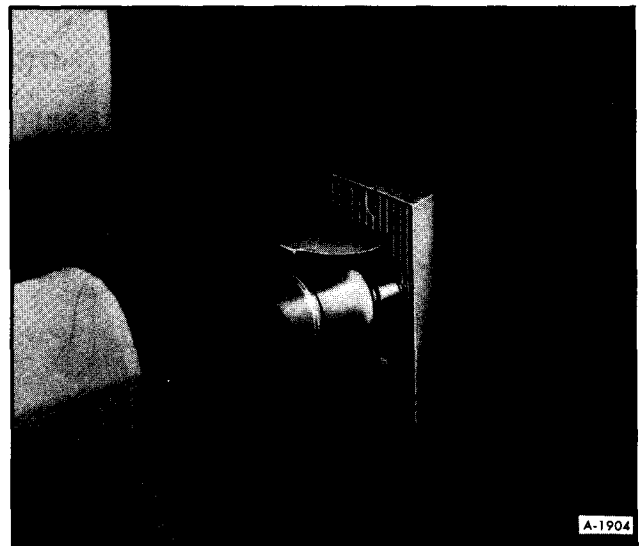


Figure 2-Connecting Flex Hose to Wall Inlet

TROUBLE DIAGNOSIS

If the vacuum cleaner fails to operate the trouble lies in one of three areas; the power source, the low voltage switch system, or the vacuum cleaner motor. This is the order in which the trouble should be examined.

1. Check first that the Motor Home is receiving 120-volt power to the external power cord. Next check the circuit breakers in the living area electrical compartment. Finally make sure the vacuum cleaner is securely plugged into the receptacle under the refrigerator module.

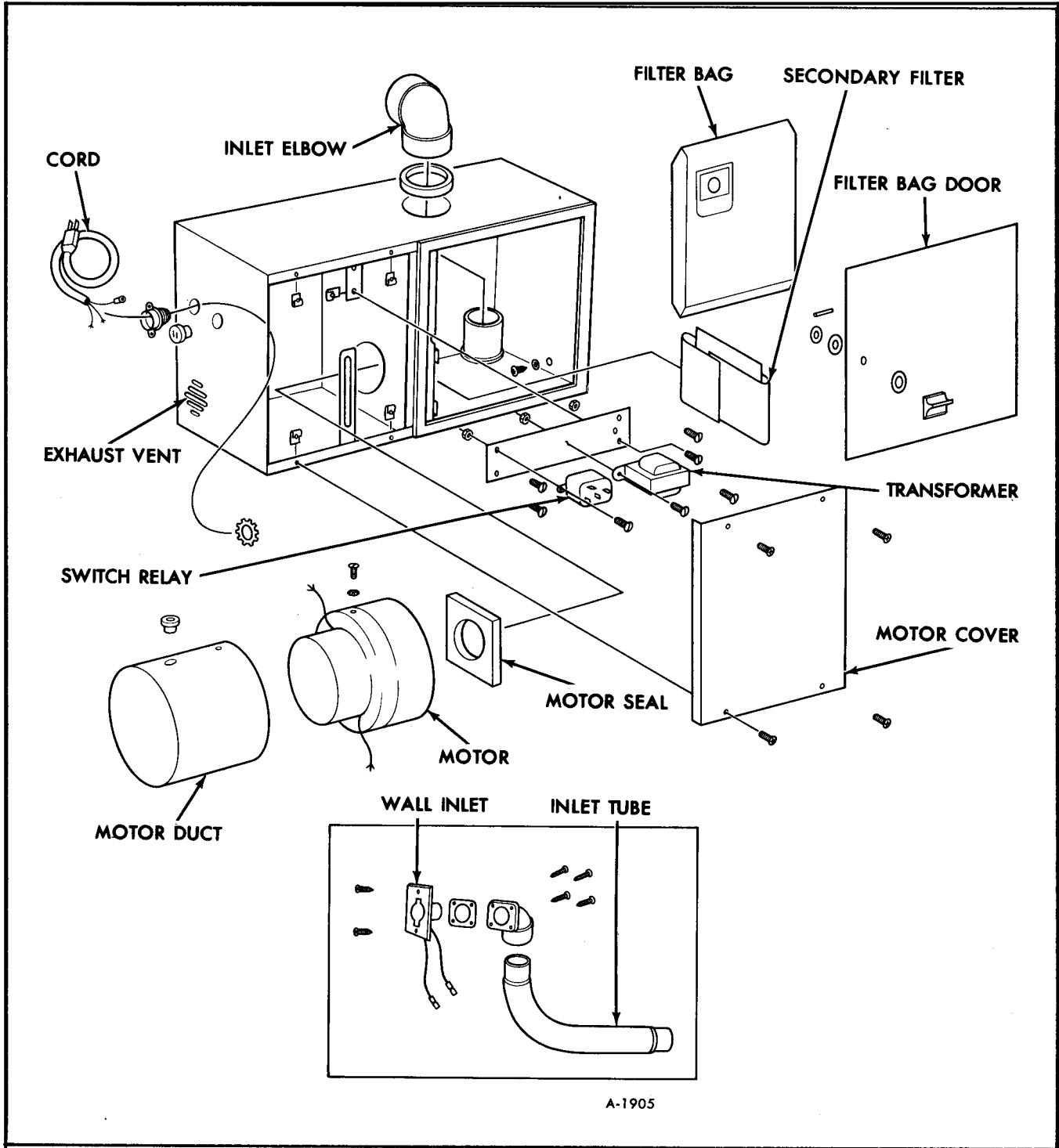


Figure 3-Vacuum Cleaner Components

2. Since the switch operates through two low voltage contacts in the hose inlet, the voltage should be checked here with a voltmeter at approximately 25 VAC. If there is no voltage at these contacts, either the transformer is faulty or the wiring is loose. If there is voltage at these contacts:

a. Unplug the 120-volt motor wires at the relay (See figure 3).

b. Next insert hose end into vacuum inlet.

c. Now check for continuity at the two terminals on the relay where the motor wires were disconnected. If there is no continuity here the relay is faulty.

d. If there is continuity at these terminals the vacuum motor is faulty and must be replaced. See "Vacuum Motor Replacement".

LOSS OF VACUUM

The reasons for loss of vacuum are usually simple and easily remedied. The following are the most common causes:

1. Hose may be obstructed. Remove from inlet. Insert a blunt object that is slightly smaller in diameter than the hose. A screwdriver (insert handle end first) or steel ball can generally be shaken through the hose to clear obstructions. A garden hose can also be used to clear vacuum hose.

2. Filter bag may be filled.

3. Door to filter area may be open or gasket surrounding door may be damaged. Door must be closed securely for efficient operation of the power unit.

4. Exhaust line may be clogged. Make a visual inspection of exterior opening. Check for lint clogging if a guard screen is being used. Clear exhaust with a probe while unit is running.

5. Something may be clogging the tube line. Start the unit, purge line by covering hose end with hand-release to send a sudden surge of air through.

VACUUM MOTOR REPLACEMENT (FIGURE 3)

REMOVAL

1. Unplug vacuum cleaner assembly from duplex receptacle.

2. Remove motor compartment cover (See figure 3).

3. Disconnect vacuum motor wires at relay and junction.

4. Remove screw at motor securing strap.

5. Remove motor and motor duct from cabinet (figure 3).

6. Remove motor from duct.

INSTALLATION

1. Install motor in duct with motor wires properly routed.

2. Install motor and motor duct in vacuum cabinet making sure motor seal is properly positioned (figure 3).

3. Secure motor with motor securing strap and screw.

4. Connect motor wires at relay and junction.

5. Install motor cover.

6. Plug vacuum cleaner into receptacle and check operation.

BATTERY OPERATED CLOCK

The optional battery-operated wall clock is located above the kitchen range.

BATTERY REPLACEMENT

Remove clock from wall by raising approxi-

mately 1/2-inch, then carefully separate clock from wall. Remove and discard used battery. Install new 1-1/2-volt "C" cell battery, being sure that positive (+) end of battery is installed as shown (when viewed from the back of clock).



Figure 4—Removing Clock from Wall

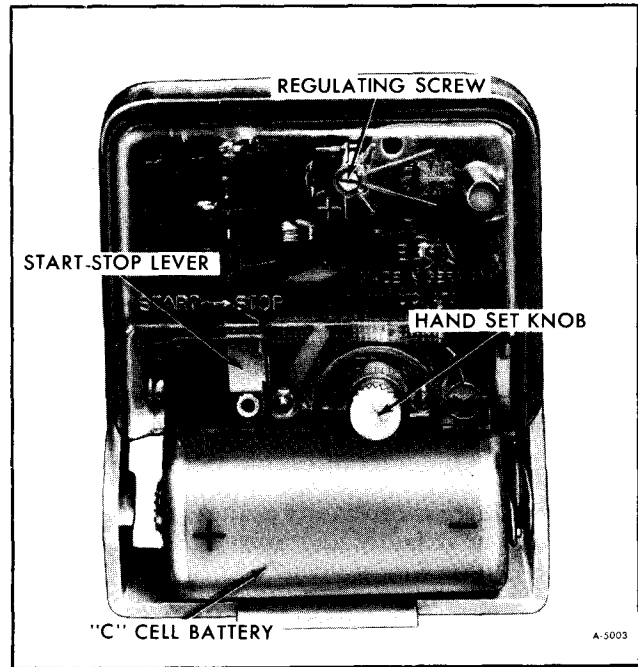


Figure 5—Backside of Clock

SETTING HANDS

To set hands, pull Hand Set Knob slightly outward and rotate it **CLOCKWISE ONLY** (as viewed from front of clock). **NEVER** move the hands **COUNTERCLOCKWISE** as this may damage the mechanism.

START CLOCK

To start clock, simply move the **START-STOP** lever to the left. If necessary to stop clock, move lever to the right.

TIME REGULATION

If clock is not maintaining proper time, it may be necessary to adjust position of regulating screw. Note the time movement cover is marked (+) and (-). If the clock runs fast, turn screw towards (-). If the clock runs slow, turn screw towards (+). A movement through one section (between slots) will adjust the timekeeping 5 seconds per day.

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Living Area

1975 120v AC

1975 12v DC

1975 / 1976 120v AC (Effective with TZE165V100893) November 1975

1975 / 1976 12v DC (Effective with TZE165V100893) November 1975

Engine Area

1975 with Breaker Points

1975 with HEI

1975 Transmode with Breaker Points

1975 Transmode with HEI

FOREWORD

This manual contains service, maintenance, and repair information on the GMC MotorHome and TransMode vehicles. Operation of the MotorHome and TransMode is contained in separate Operating Manuals which are furnished with each vehicle.

Every effort has been made to include timely and adequate information on the various units and systems used in GMC MotorHomes and TransModes. The procedures given in the various sections are the result of extensive service experience. The information should serve not only as a reference for the experienced mechanical force, but also a comprehensive text for training purposes.

References are made to special tools in the various sections of this manual. These tools, or their equivalent, are necessary and are recommended to readily and efficiently accomplish certain service operations. The tools, however, are not supplied by General Motors Corporation. Information regarding the availability of these tools can be obtained from the Zone Office or from the Service Department at the factory.

All information contained in this manual is based on the latest product information available at the time of publication. GMC Truck and Coach Division reserves the right to make changes in design or add improvements at any time without incurring any obligation to install same on vehicles previously purchased.



TRUCK & COACH DIVISION
GENERAL MOTORS CORPORATION
PONTIAC, MICHIGAN 48053

GMC

1975 & 1976

MAINTENANCE MANUAL

MotorHome

ZEO6581



TransModes

ZEO6083

ZEO6583



GMC TRUCK & COACH

Division of General Motors Corporation