X-7425

1973 GMC Motorhome Maintenance Manual

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GMC MOTOR HOME SERVICE

NOVEMBER,1973

SECTION 24
MISCELLANEOUS LIVING AREA FACILITIES

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GMC MOTOR HOME SERVICE

SECTION 24A
PERIODIC MAINTENANCE AND LUBRICATION

PERIODIC MAINTENANCE

MOTOR GENERATOR MAINTENANCE INTERVALS

Regularly scheduled maintenance is the key to lower operating costs and longer service life for the unit. The following schedules (figures 1 and 2) 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

SERVICE THESE ITEMS	AFTER EACH CYCLE OF INDICATED HOURS						
	8	100	200	400	500	1000	1500
General Inspection	4,000/6,000 watt						
Check Oil Level	4,000/6,000 watt						
Change Crankcase Oil		4,000/6,000 watt (1)					
Clean Air Cleaner		4,000/6,000 watt (1)					
Check Spark Plugs		4,000/6,000 watt					
Fuel Filter—Check				4,000 watt (2)	6,000 watt (2)		
Check Breaker Points		4,000 watt 6,000watt(2)					
Clean Cooling Fins			4,000/6,000 watt (1)				
Change Oil Filter			4,000/6,000 watt (1)				
Replace Breaker Points			4,000 watt				
Replace Air Cleaner			4,000 watt (1)		6,000 watt (1)		
Remove Carbon From Heads			4,000 watt		6,000 watt		
Adjust Tappets				4,000 watt	6,000 watt		
Check Generator Brushes						4,000 watt	6,000 watt
Complete Reconditioning (If Required)						4,000 watt	6,000 watt

(1) Perform more often in extremely dusty conditions. (2) Replace if necessary. A-2074

Figure 1–Onan Motor Generator Maintenance Schedule

SERVICE THESE ITEMS	AFTER EACH CYCLE OF INDICATED HOURS			
	8	50	100	200
General Inspection	X			
Check Oil Level	X			
Change Crankcase Oil (1)		X		
Clean Air Cleaner Element		X		
Replace Air Cleaner Element			X	
Check Spark Plugs			X	
Clean Cooling Fins				X
Check Breaker Points				X
Replace Fuel Filter			X	
General Tune-Up				X

(1) Initial oil change after 5 operational hours. A-2075

Figure 2–Kohler Motor Generator Maintenance Schedule

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.

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.

CAUTION: *If the vehicle is equipped with a Thermasan waste destruction system, it is especially important that flammable cleaning agents, solvents or other highly combustible materials never be allowed to enter the holding tank via the kitchen or bathroom sinks, toilet or shower drains. These materials could create an explosion hazard in the vehicle exhaust system.*

VEHICLE STORAGE

The Motor Home 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.

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

b. Park Motor Home as level as possible, end for end and side to side.

c. Wash Motor Home. If exposed to road salts the exterior and underside should be thoroughly washed and flushed.

d. Check to make sure battery boost switch is left in the "BAT NORMAL" position. If left in the "BAT BOOST" position for extended periods, battery discharge will occur.

e. Remove all perishables, leave refrigerator door open. Be sure controls are turned off.

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

g. 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.

h. Turn off LP gas at tank valve.

i. Make sure 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."

j. Plug or tape all drains to retard evaporation of residual moisture in drain traps.

k. 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.

l. Check Motor Home 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.

m. Maintain tire pressure of 60 psi.

n. Crack one window for ventilation, close all others as well as roof vents.

o. 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.

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

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

r. 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.

a. Perform all of the above steps except for Step r.

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

c. Motor Homes 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.

3. WINTER STORAGE - BELOW 32° F.

a. While many of the steps in preparing your Motor Home 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 – 35° F.).

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

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

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

g. Check to make sure battery boost switch is left in "BAT NORMAL" position. If left in the "BAT BOOST" position for extended periods, battery discharge will occur.

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. Be sure the water pump and water heater are turned off.

k. Turn off LP gas at tank valve.

l. Make sure 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.

KOHLER MOTOR GENERATOR STORAGE

If the motor generator will not be used for an extended period of time, follow this procedure:

1. Drain oil from crankcase (while hot), then flush with clean light oil. Refill crankcase after flushing.

2. Drain fuel from sediment bowl and carburetor.

3. Clean exterior of plant, then spread a light film of oil on unpainted metal surfaces.

4. Remove spark plug and pour a tablespoon of oil (S.A.E. 30) into spark plug hole, turn engine over several times. Spark plug should be reinstalled.

5. Service air cleaner.

6. Plug exhaust outlet to prevent entrance of moisture, dirt, bugs, etc.

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.

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. 0°F. to 30°F. Below 0°F.	SAE 30 SAE 5W30 or 10W40 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.

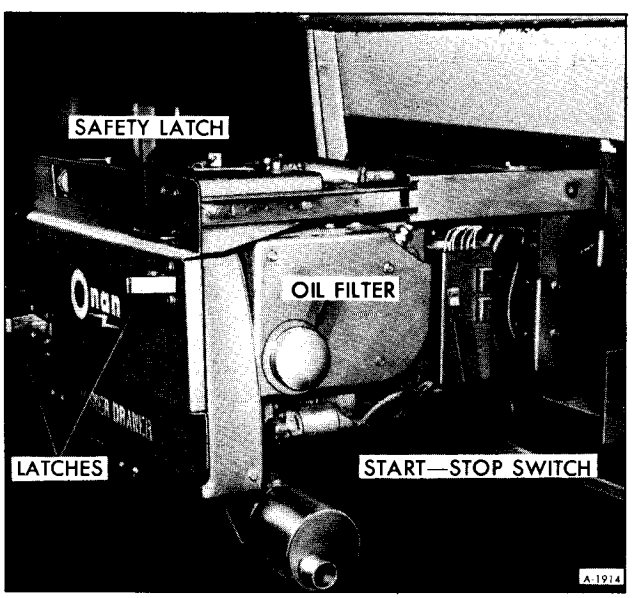


Figure 3–Onan Motor Generator

OIL FILTER (FIGURE 3)

Change the crankcase oil filter at least every 200 hours on the 4KW Model and every 100 hours on the 6KW Model. The filter is located on the right side of the unit (facing the compartment). Remove by turning couterclockwise with a 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.*

KOHLER MOTOR GENERATOR

SERVICE INTERVALS

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

CRANKCASE OIL (FIGURE 4)

The oil level should be checked every time the unit is operated. The unit must not be operated if the oil level is above the "F" mark, or below the "L" mark on the dipstick. The oil level should not be checked when the unit is running as oil may splash from the dipstick opening.

Use a good quality detergent oil that meets the A.P.I. (American Petroleum Institute) Service Designation SE/CC. use the proper SAE oil for expected temperature conditions.

Temperature	Recommended Oil
Above 30°F. 0°F. to 30°F. Below 0°F.	SAE 30 SAE 10W-30 SAE 5W-20

NOTE: Fill engine through dipstick tube.

IMPORTANT: The initial oil change should be at the end of 5 operational hours.

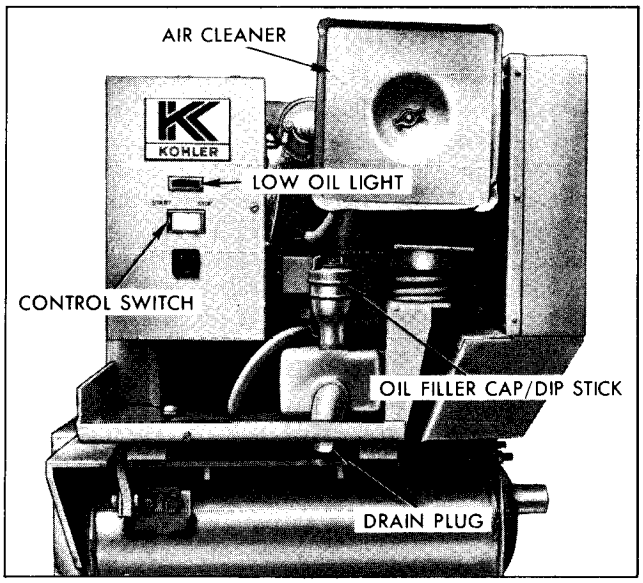


Figure 4–Kohler Motor Generator

The oil change interval is every 50 operational hours, or every 6 months, whichever comes first. If possible, change the oil while it is hot. The crankcase capacity is 3 quarts. The oil drain plug is located under the oil filler cap shown in Figure 4.

GMC MOTOR HOME SERVICE

SECTION 24B
LIVING AREA ELECTRICAL SYSTEM

Contents of this section are listed below:

GENERAL INFORMATION

The Motor Home 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 Motor Home is equipped with a motor generator, the vehicle will be supplied with 120-volt and 12-volt power throughout the living area, and recharge the living area battery, any time the motor generator is 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. 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

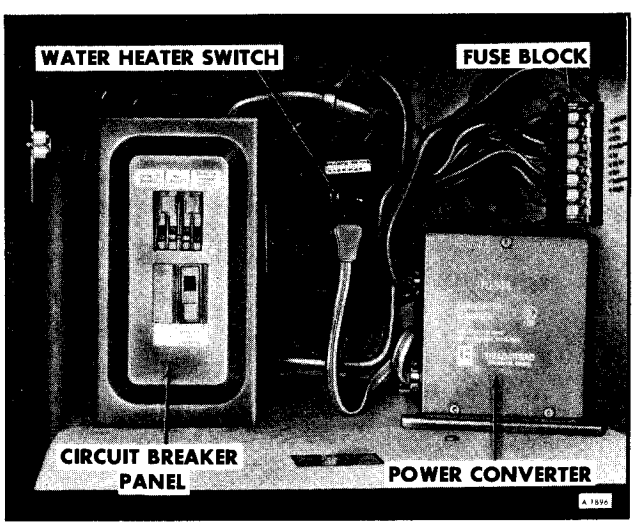


Figure 1–Living Area Electrical Compartment

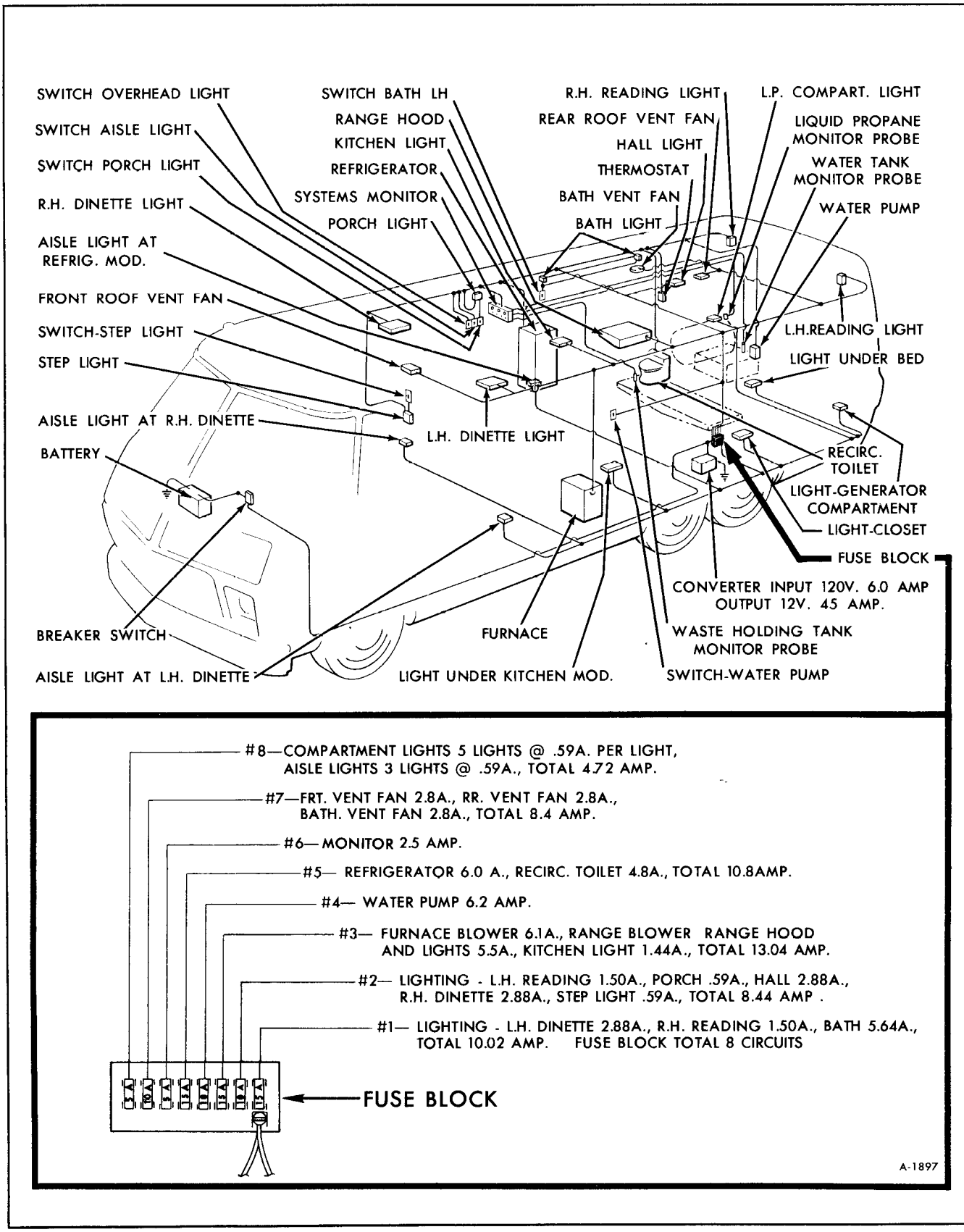


Figure 2–Living Area 12-Volt DC Electrical System (Typical)

the living area electrical compartment, contains circuit breakers to protect the 120-volt Motor Home circuits from overloads. These circuit breakers are designed to snap to the "OFF" 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.

120-VOLT to 12-VOLT CONVERTER AND BATTERY CHARGER

The Motor Home is equipped with either a 30 amp or 45 amp 120-volt to 12-volt power converter. 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 Motor Home. 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.

All switching operations in the power converter are automatic. It should remain plugged in at all times.

The power converter, requires no periodic maintenance but care must be taken to ensure a proper flow of air through and around the unit. Do not set objects close to or on top of it. Do not let the power converter get wet and keep it as clean as possible to help assure long life. The unit could be cleaned with air pressure if necessary.

The power converter has no moving parts, but should you suspect that the unit is not functioning properly, remove it from the electrical compartment, plug it into a reliable power source and measure the voltage at the converter output with a voltmeter. If you don't get a reading of approximately 14 volts, replace the unit with a new one. Note that the input to converter should be 120 volts.

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.

EXTERNAL POWER

GENERAL INFORMATION

The external utilities compartment located in the left side of the Motor Home contains the 25 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. All internal switching will take place automatically. 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 Motor Home electrical system. If the vehicle is not equipped with a motor generator simply coil the power cord neatly within the external utilities compartment.

The Motor Home's external power cord contains two 120-volt circuits, each rated to carry 20 amperes. 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.

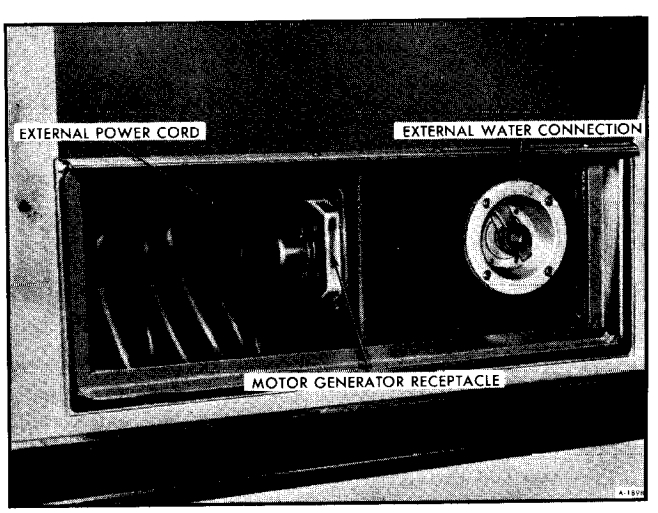


Figure 3–External Utilities Compartment

CAUTION: *If the available power supply is other than 120/240 volt, 60 cycle rating, or is not properly grounded, it is essential that no attempt be made to plug in. The Motor Home'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 Motor Home 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 and the aisle lights (if vehicle is so equipped) (figure 4).

A step light near the entrance door is designed to automatically come on when the entrance door is opened.

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.

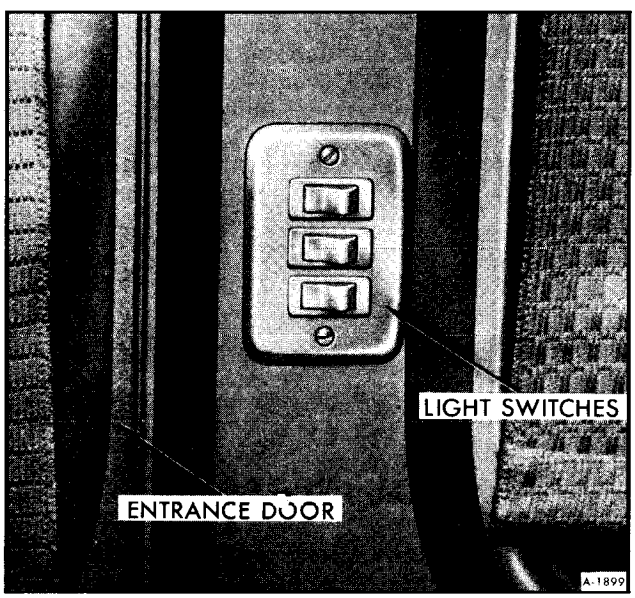
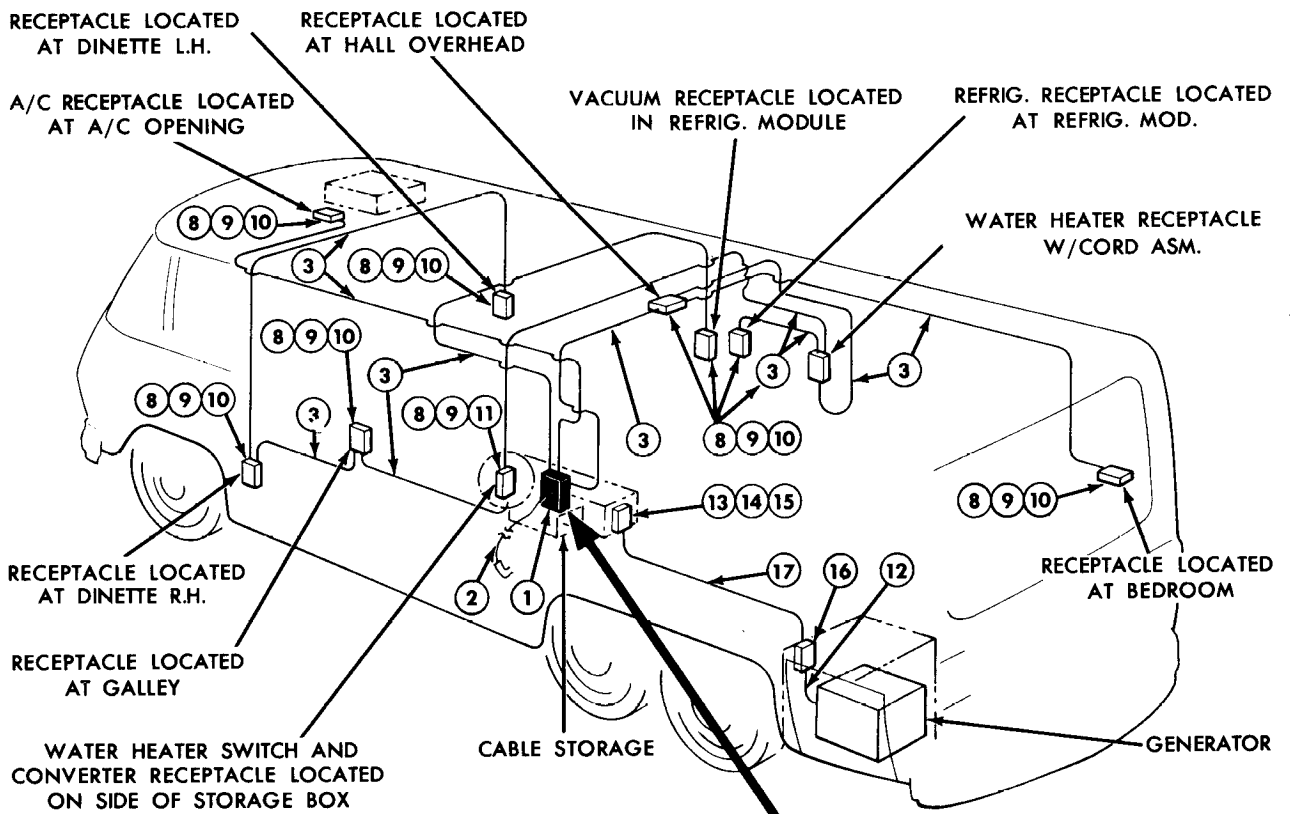


Figure 4–Light Switch Panel

120-VOLT AC ELECTRICAL SYSTEM

The Motor Home living area is equipped with 120-volt wiring and duplex receptacles like those found in modern homes. These receptacles, the power converter and the water heater are operational whenever the Motor Home is connected to an external power source or the motor generator is operating. If the Motor Home is equipped with a roof mounted air conditioner or a vacuum cleaner these will also be run by the 120-volt system.

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



ITEM NO.	PART NAME
1	CIRCUIT BREAKER PANEL
2	#8—4 WIRE CORD TYPE "SO" W/PLUG
3	WIRE 12/2 W/GROUND WIRE
4	40 AMP BREAKER
5	20 AMP BREAKER
6	CABLE CONNECTOR
7	#8 COPPER GROUND WIRE
8	OUTLET BOX
9	DUPLEX RECEPTACLE
10	OUTLET PLATE
11	SWITCH & RECEPTACLE
12	#8-4 WIRE CORD TYPE "SO"
13	3 POLE 4 WIRE RECEPTACLE
14	OUTLET BOX
15	OUTLET PLATE
16	"J" BOX
17	#8-4 WIRE CORD ROMEX

CIRCUIT BREAKER PANEL			
CIRCUIT #1	CIRCUIT #2	CIRCUIT #3	CIRCUIT #4
CONVERTER RECEPT.	HALL OVER RECEPT.	AIR COND. RECEPT.	VACUUM RECEPT.
GALLY RECEPT.	BEDROOM RECEPT.		
L.H. DINETTE RECEPT.	BATH & WATER HEAT. RECEPT.		
R.H. DINETTE RECEPT.			

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

MONITOR PANEL (FIGURE 6)

DESCRIPTION

The optional Motor Home 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 lining 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.

• 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.

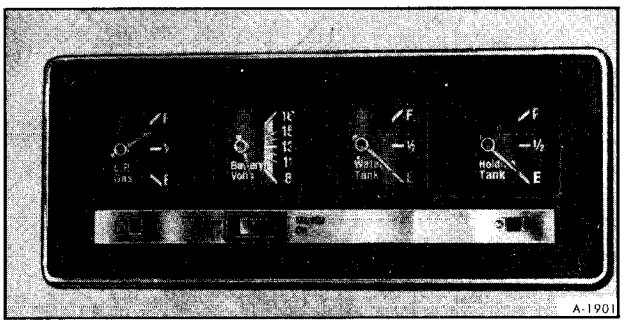


Figure 6–Monitor Panel

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.

MONITOR PANEL GAUGE DIAGNOSIS CHART

Complaint	Possible Cause	Correction
Gauge reads "E" all the time.	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.	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.	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.	1. Clean terminals or repair wires. 2. Install new tank unit.* 3. Reposition needle. 4. Free binding float or install new tank unit.*

Complaint	Possible Cause	Correction
Erratic reading	1. Loose connection anywhere in circuit.	1. Inspect and if necessary, clean and tighten all connections in circuit.
Needle does not move	1. Lack of 12-volt supply to gauge. 2. Needle rubbing on face of gauge. 3. Tank float hang-up.	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.	1. Tank float hang-up or malfunction in sending unit. 2. Malfunction in gauge.	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 7)

REMOVAL

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

1. Remove monitor panel fuse and disconnect battery ground cables. Pull the complete monitor panel assembly out of wall mounting (it is held in by spring clips).

2. Disconnect wiring harness from rear of panel.

3. With monitor panel at the bench remove the four screws holding bezel on panel.

4. 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. Connect wiring harness at rear of panel.

4. Push monitor panel into position.

5. Reconnect electrical power and check gauge operation.

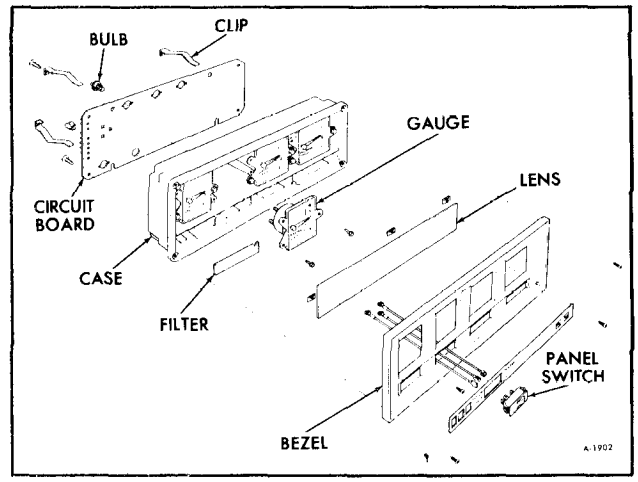


Figure 7–Monitor Panel Components

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. Dinette Light R.H. Reading Light Bath Light	1	AGC-15
L.H. Reading Light Porch Light Hall Light R.H. Dinette Light Step Light	2	AGC-10
Furnace Blower Range Hood and Lights Kitchen Light	3	AGC-15
Water Pump	4	AGC-10
Refrigerator Recir. Toilet	5	AGC-15
Monitor	6	AGC-5
Roof Vent Fans	7	AGC-10
Compartment Lights Aisle Lights	8	AGC-5

LIGHT BULB SPECIFICATIONS (LIVING AREA)

Usage	Quantity	Bulb. No.
R.H. Dinette Light	2	1141
L.H. Dinette Light	2	1141
Kitchen Light	2	1141
Hall Light	2	1141
Porch Light	1	1141
Compartment Lights	5	1141
Range Hood Lights	2	1156
Rear Compartment Reading Lights	2	1383
Bathroom Lights	6	93
Aisle Lights	3	68
Step Light	1	68

120-VOLT SYSTEM CURRENT RATING

Water Heater ..... 10.0 Amp.
Power Converter ..... 6.8 Amp.
Mark IV Roof Mount Air Conditioner ..... 16.5 Amp.
Vacuum Cleaner ..... 7.0 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 ..... 1.44 Amp.
Aisle Lights (Per Light) ..... 0.59 Amp.
Compartment Lights (Per Light) ..... 0.59 Amp.
Porch Light ..... 0.59 Amp.
Step Light ..... 0.59 Amp.
Bath Room Lights ..... 5.64 Amps.
Range Hood Vent Fan and Lights ..... 5.50 Amps.
Furnace Blower ..... 6.1 Amp.
Water Pump ..... 6.2 Amp.
All-Electric Regrigerator ..... 6.0 Amp.
Gas/Electric Refrigerator ..... 20.0 Amp
Recirculating Toilet ..... 4.8 Amp.
Monitor Panel ..... 2.5 Amp.
Front Vent Fan ..... 2.8 Amp.
Rear Vent Fan ..... 2.8 Amp.
Bath Vent Fan ..... 2.8 Amp.

GMC MOTOR HOME SERVICE

SECTION 24C
MOTOR GENERATOR

This section includes the following:

ONAN MOTOR GENERATOR

Contents of this sub-section are listed below:

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 55 amp hour battery located in the compartment with the generator. A permanent magnet flywheel alternator and solid state voltage regulator-rectifier are used to charge the battery.

Lubrication is provided by a pressure oil system. A spin-on type oil filter is utilized.

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

ONAN MOTOR GENERATOR TROUBLE DIAGNOSIS

CONTROL SYSTEM TROUBLESHOOTING GUIDE

Each Probable Cause is numbered and has a short title. These numbers correspond to a corrective action, given on the following pages.

NOTE: *Use the schematic wiring diagram (figure 80) to help trace problems.*

CONDITION: Cranks Slowly	Cranks - No Start	Fails to Crank	Runs 3-4 Seconds	Runs and Surges	Fails to Run	Does Not Stop	Stops	No Stop in Low Oil	Low Charging	Corrective Action: PROBABLE CAUSE	
											CONTROL SYSTEM TROUBLESHOOTING GUIDE
●		●								1	Bad Battery Connection
●		●								2	Low Battery - BT1
●		●								3	Faulty Starter - B1
	●	●								4	Faulty Start Solenoid - K1
					●		●		●	5	Faulty Alternator - G1
	●						●			6	Faulty Ign. - T1 Coil, S1 Points
	●				●		●			7	Faulty Fuel Pump - E2
			●				●	●		8	Faulty LOP Switch - S2
	●			●						9	Faulty Choke - E1
			●							10	Grounded LOP Circuit
	●			●	●		●			11	Low or No Fuel
			●				●			12	Low Oil Level
									●	13	Faulty Regulator - VR1
										14	**Printed Circuit Board Faults**
	●				●		●			15	Fuse Out - F1
	●				●					16	Faulty Disconnect Circuit
						●				17	Faulty Stop Switch - S3
	●	●			●					18	Faulty Contacts - K2
	●									19	Faulty Relay - K3
			●					●		20	Faulty LOP Circuit

Control System Troubleshooting Guide

CORRECTIVE ACTION TO TROUBLESHOOTING GUIDE

1. Clean and tighten all battery terminals. Check for loose wires and correct connections. See steps 2 and 3.

2. Check specific gravity. Recharge or replace battery if necessary. See Step 5.

3. Check starter brushes and/or substitute with a new starter. Replace if defective. See Step 4.

4. When cranking, check K1 coil voltage. There should be approximately 12V DC across terminals 11 (+) and 7 (-), 10 (+) and 1 (-), B1-S (+) and 1 (-) ground. If this voltage is not present at any of these terminals, replace start solenoid. Check condition 18 to eliminate PC board faults.

5. Measure AC voltage of alternator G1 during cranking. Approximately 6 volts AC should be present at terminals 8 and K1 battery terminal. If there is zero volts then check the wiring for a short circuit. If the alternator fails to charge when running at 1800 RPM, replace alternator; see Step 13 and preceding paragraph, *Charge Ammeter.*

6. Visually check ignition points to see if they are opening and closing. If not, adjust to engine specifications. Voltage to ground at the battery side of T1 coil should be 12 volts. At the ignition point side to ground, the voltage should be zero when the points are closed and 12 volts when the points are open.

7. Remove S lead on starter B1. Push start button then listen for fuel pump clicking. Next check by connecting fuel pump lead directly to +12V. If it does not operate, replace fuel pump. See Step 11 also.

8. With engine not running, voltage from terminal 11 to 12 should be 12 volts. With proper oil level, start and run engine; voltage from terminal 11-12 should drop to zero volts. If not, replace low oil pressure switch. See steps 10, 12 and 20.

9. Manually check choke arm for free movement to be sure it is not stuck in the open or closed position. Voltage at choke terminal, supplied by K1-I terminal should be 12 volts during cranking and drop to zero during run. See Step 4 to check choke supply voltage. If choke does not move at room temperature with 12 volts applied, replace.

10. Check oil pressure sensor wire for short to ground by visually tracking the wire routing under cover edges to S2 switch. Move wire to free space to correct problem. See Step 8.

11. Refill fuel tank.

12. Refill to proper oil level.

13. Insert an ammeter to measure charging current. It should be 8-10 amperes at 12 volts (1800 RPM - room temperature) then drop to zero amperes at 14-15 volts. If alternator is OK (Step 5) then replace regulator VRI.

14. All faults 16 thru 23 will be on the PC control board and should be checked with care. Control cover should be removed and relay covers can be removed to manually operate relay to confirm start and run functions.

15. Measure voltage at terminals 5 to GND. If not 12 volts, replace. fuse.

16. Measure voltage across capacitor C1 terminals. During cranking, this should increase to approximately 6 volts and relay K2 should not be energized.

If voltage does not build up refer to Step 5 and also check CR1, C1 and R1. As engine starts, voltage should build up to 13 volts minimum and energize relay K2. If it does not, check coil (500 ohm).

17. When running, voltage at terminal 2 to 1 should be 10 volts. When stop switch is pushed this voltage should drop to zero. If it does not, replace switch.

18. During cranking, voltage from terminals 3 to 7 should be zero. When engine starts and runs this voltage should increase to 12 volts with start switch held in. If it does not increase to 12 volts, then these normally closed contacts are not opening and may be faulty. During cranking, voltage at terminals 6 to 1 should be 10 volts. When engine runs this voltage should increase to 12V. or above. If it does not increase, then K2 open contacts may not be closing. Replace K2 if faulty.

19. During start or run, 9 volts should be present at terminals 2 (+) and 1 (-) to energize K3. Check K2 contacts, CR5, CR7 and R2 for defects. If K3 does not pick up with 9V, replace K3.

Measure voltage from terminal 9 to 1 (-) when cranking. If fuse F1 is good but battery voltage is not present at terminal 9, replace K3, and/or check PC board.

20. With unit stopped, connect voltmeter to terminals 4 (+) and 1 (-), remove K2 relay cover and manually hold K2 contact closed. After a short time delay, the voltage at terminals 4 to 1 should decrease from 9 to 2 volts. Reset by releasing K2. If voltage does not appear at terminals 4-1 check R2, R3, R4, R5, R6, R7, C3, C4, Q1, CR6, CR7, and CR8. Replace defective part.

ENGINE TROUBLE DIAGNOSIS

TROUBLE / CAUSE	Backfire at Carburetor	Bearing Wear	Black Exhaust	Blue Exhaust	Burned Valves	Connecting Rod Wear	Cranks Slowly	Cylinder Wear	Engine Stops	Failure to Start	Governor Hunting	High Oil Pressure	Low Oil Pressure	Loss of Coolant (Water Cooled)	Mechanical Knocks	Misfiring	Overheating (Air Cooled)	Overheating (Water Cooled)	Piston Wear	Poor Compression	Ring Wear	Sticking Valves
GASOLINE ENGINE TROUBLESHOOTING GUIDE																						
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 in fuel bowl plugged.	5. Remove fuel bowl. Invert bowl and tap on flat surface. Clean thoroughly and replace.

Problem	Possible Cause	Correction
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.
	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.
	2. 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.

Problem	Possible Cause	Correction
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. Clean or replace brush holder.
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. One defective rectifier in bridge.	3. Test with ohmmeter and replace if defective.
	4. Shorted or grounded circuit in field or armature winding.	4. Test with series test lamp or ohmmeter and replace if defective.
	5. Engine not running properly causing generator to slow down.	5. 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 (MODEL 230)

1. Open access door and support in this position.

2. Slide unit out of compartment.

3. Disconnect neg. terminal on 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.

6. Remove bolts holding ends of sliding arm to generator as shown in Figure 1.

7. Remove mounting fasteners from rear mount (figure 2).

8. Remove circuit breaker bracket from its mounting.

9. Disconnect fuel line and all electrical leads.

10. Remove unit from its slide rails and place on a suitable bench or stand.

INSTALLATION (MODEL 230)

1. Extend mounting slides to their full position.

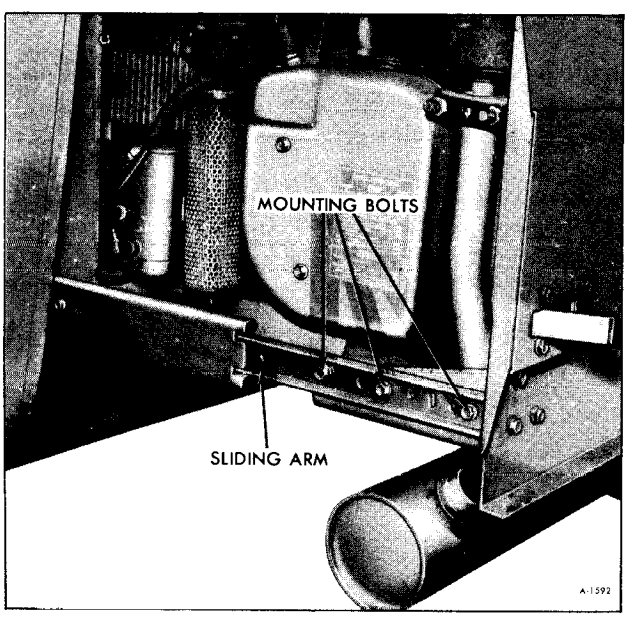


Figure 1–Disconnecting Sliding Arm

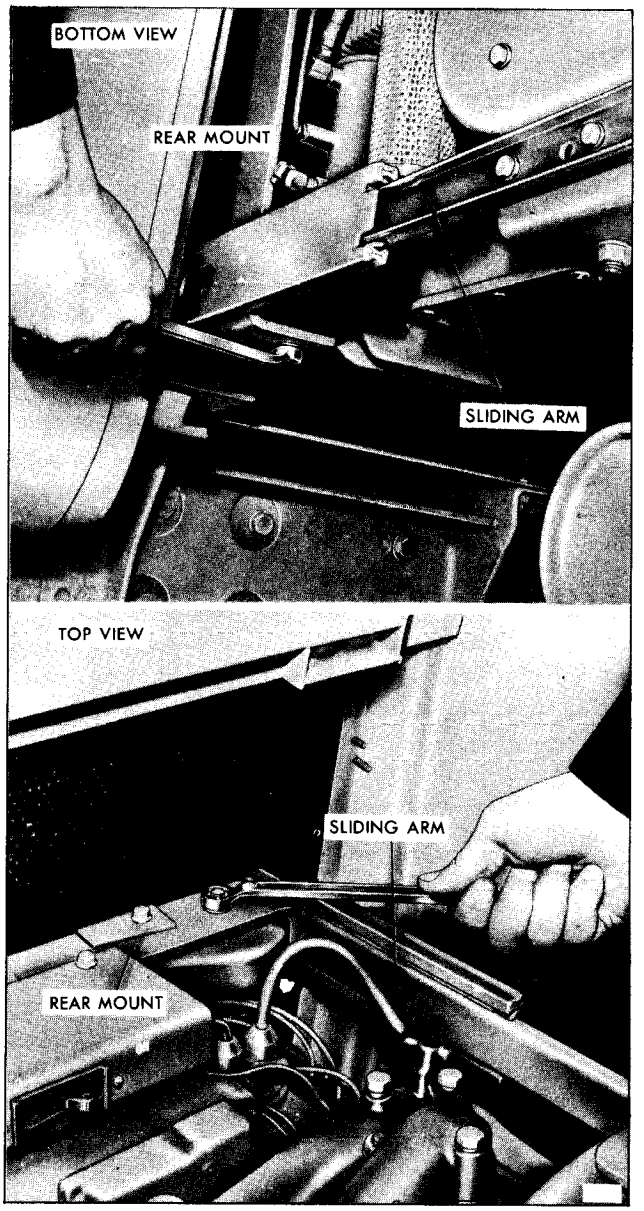


Figure 2–Disconnecting Rear Mounts

2. Supporting the unit with a suitable hoist, position it in the slide rails.

3. Connect fuel line and all electrical leads.

4. Install circuit breaker on rear mounting bracket.

5. Install rear mounting fasteners as shown in Figure 2.

6. Install mounting bolts to slides as shown in Figure 1.

Figure 3–Disconnecting Sliding Arm (6KW)

7. Remove hoist and lifting eye.

REMOVAL (MODEL 260)

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.

6. Remove bolts from both sliding arms (figures 3 and 4).

NOTE: The bolts on the 4KW motor generator are readily accessible, as shown in Figure 4, whereas the mounting of the 6KW unit requires one of the bolts to be removed as shown in Figure 3.

7. Disconnect fuel lines and all electrical leads.

8. Remove unit from its slide rail and place on a suitable bench or stand.

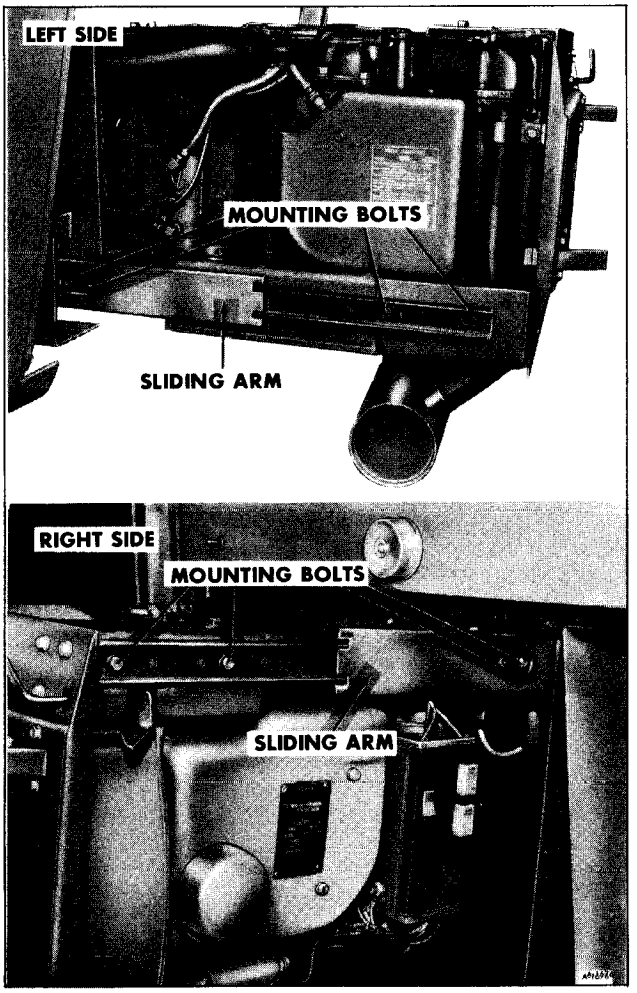


Figure 4–Disconnecting Sliding Arms (4KW)

INSTALLATION (MODEL 260)

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 Figures 3 and 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.

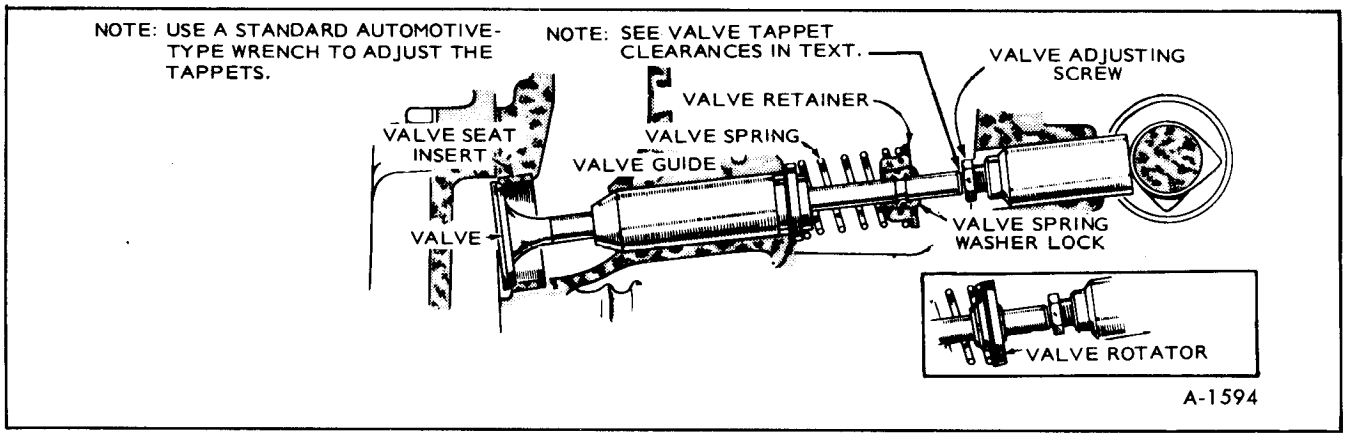


Figure 5–Valve System

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 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 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 tap-

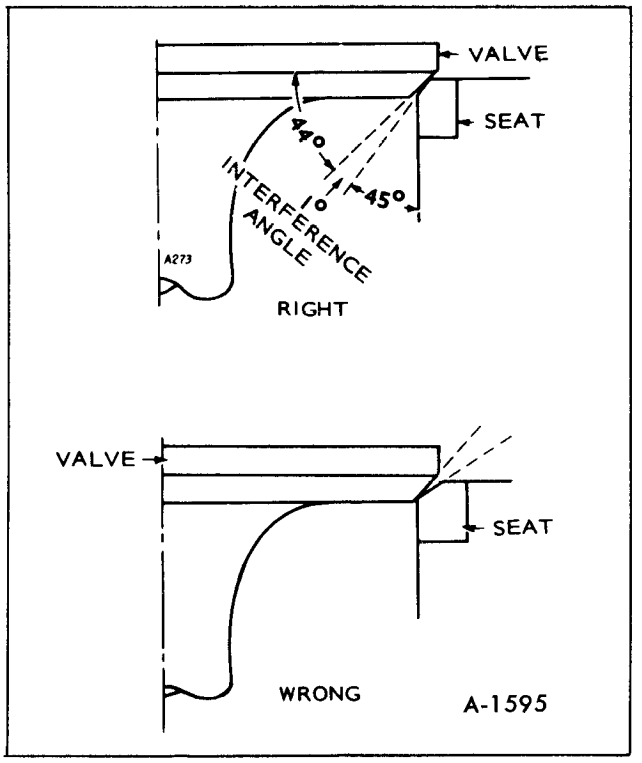


Figure 6–Valve Interference Angle

pets. 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 obtain 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.

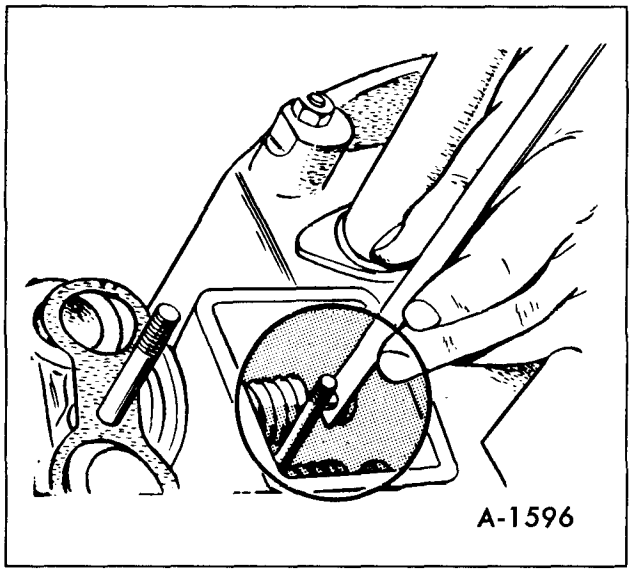


Figure 7–Adjusting Valves

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.

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.

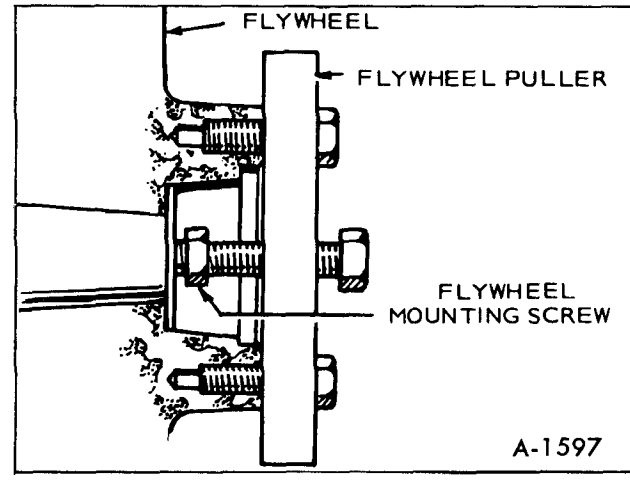


Figure 8–Flywheel Removal

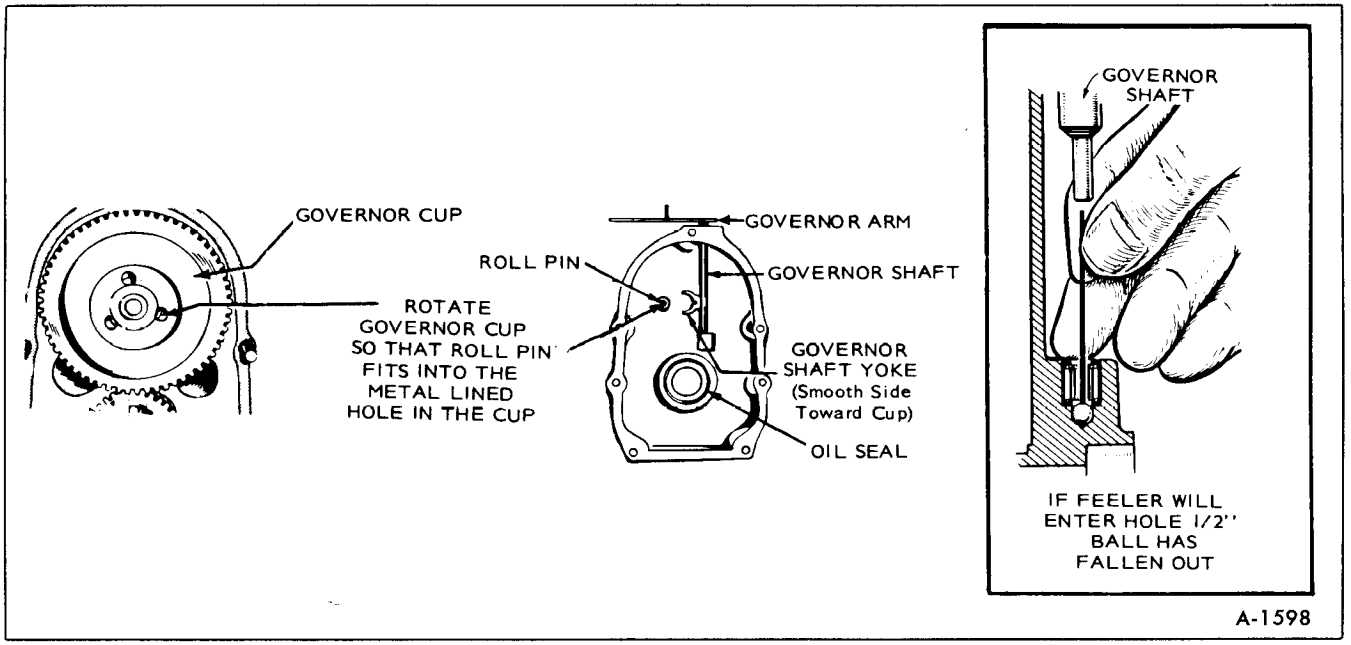


Figure 9–Gear Cover Assembly

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.

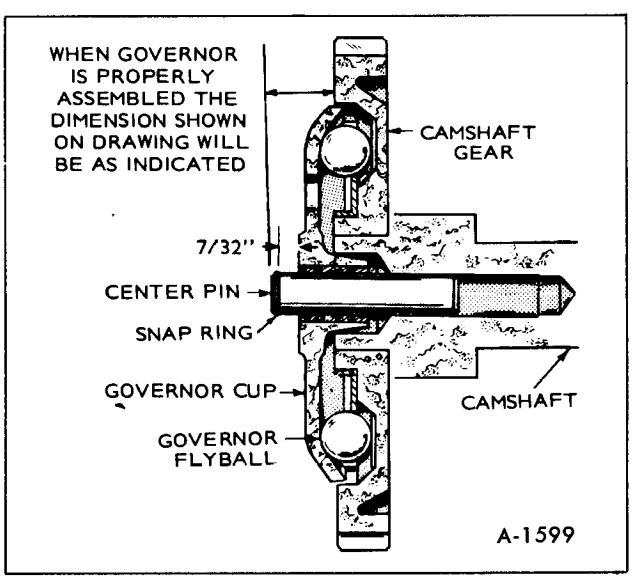


Figure 10–Governor Cup (Cross-Section)

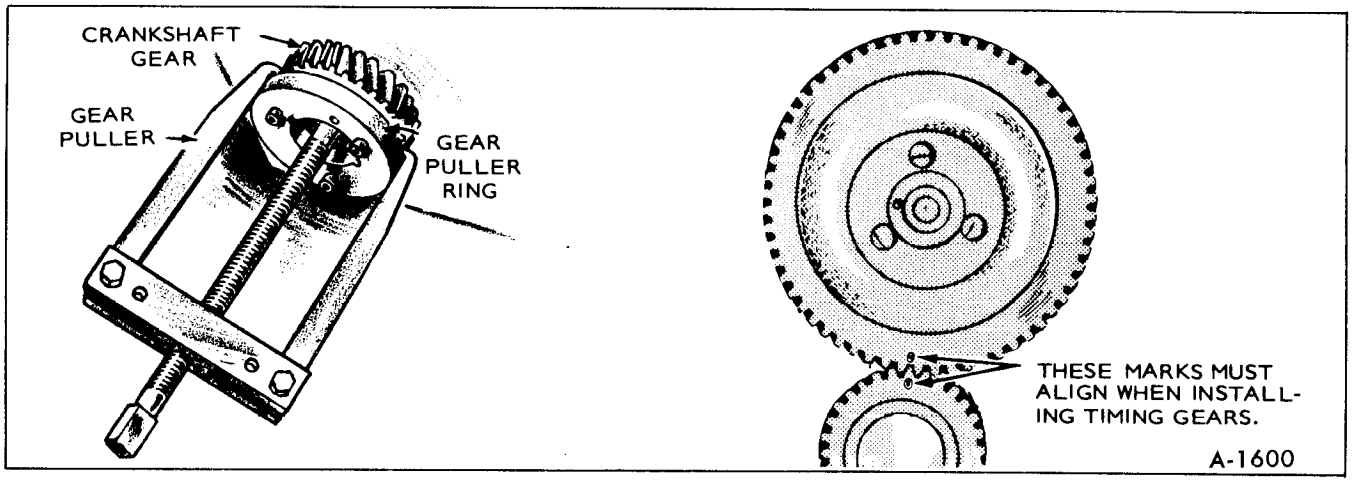


Figure 11–Timing Gear Removal and Installation

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.

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.

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.

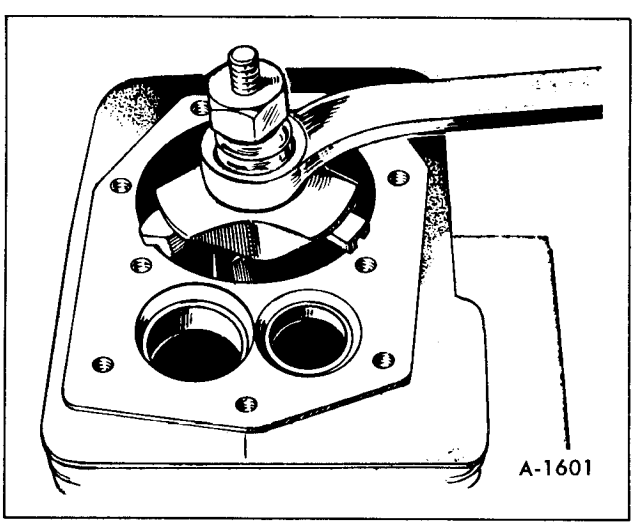


Figure 12–Removing Ridge From The Cylinder

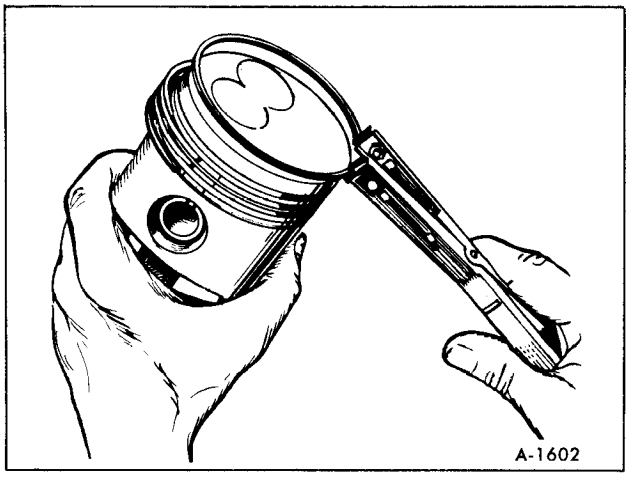


Figure 13–Removing Piston Rings

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.

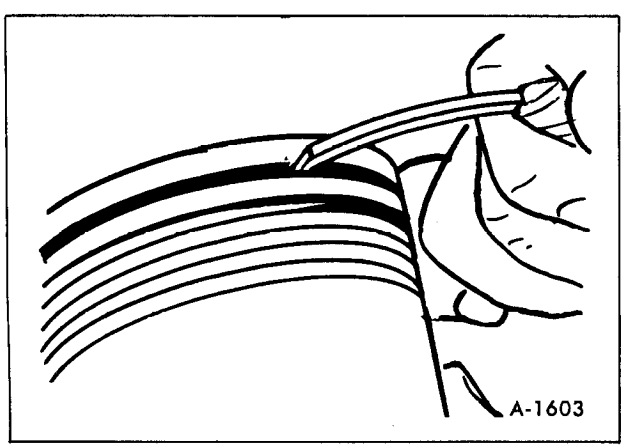


Figure 14–Piston Groove Cleaning

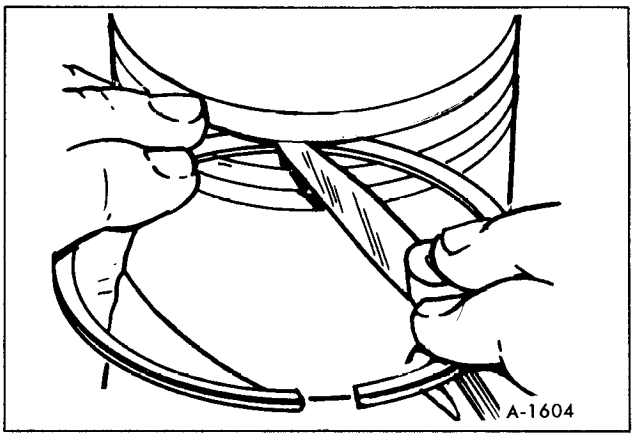


Figure 15–Checking Ring Side Clearance

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

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.

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

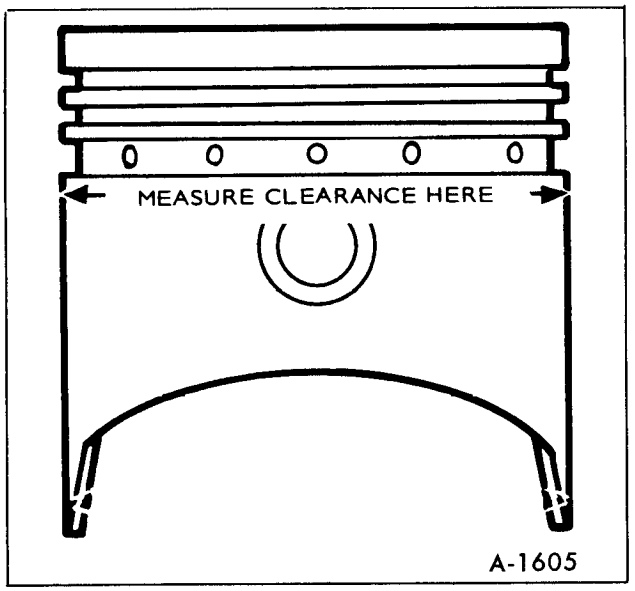


Figure 16–Measuring Diameter of Piston

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".

CYLINDER BLOCK

INSPECTION:

1. Make a thorough check for cracks. Small

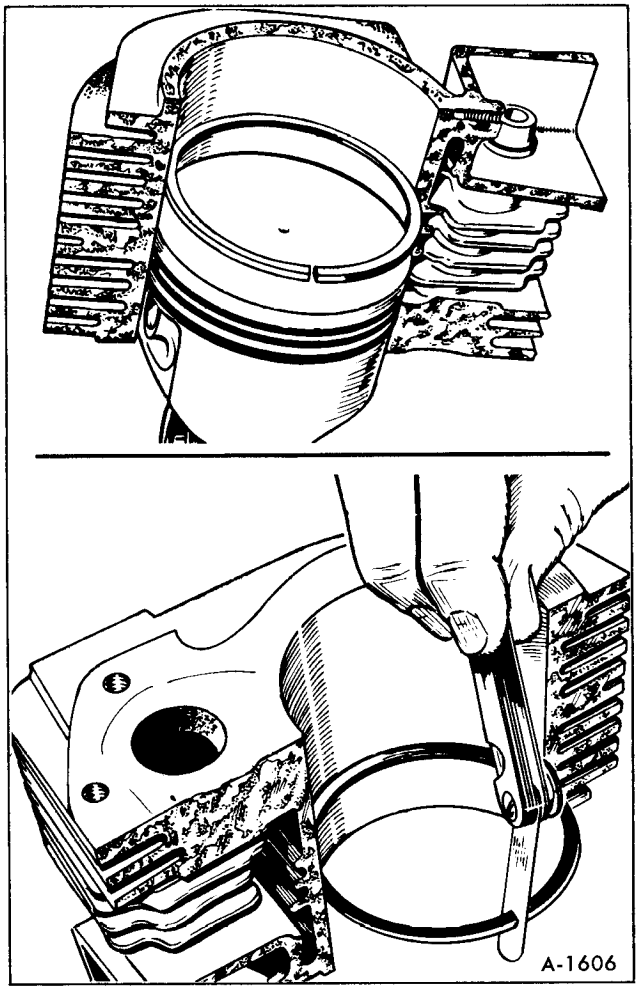


Figure 17–Checking Ring End Gap

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.

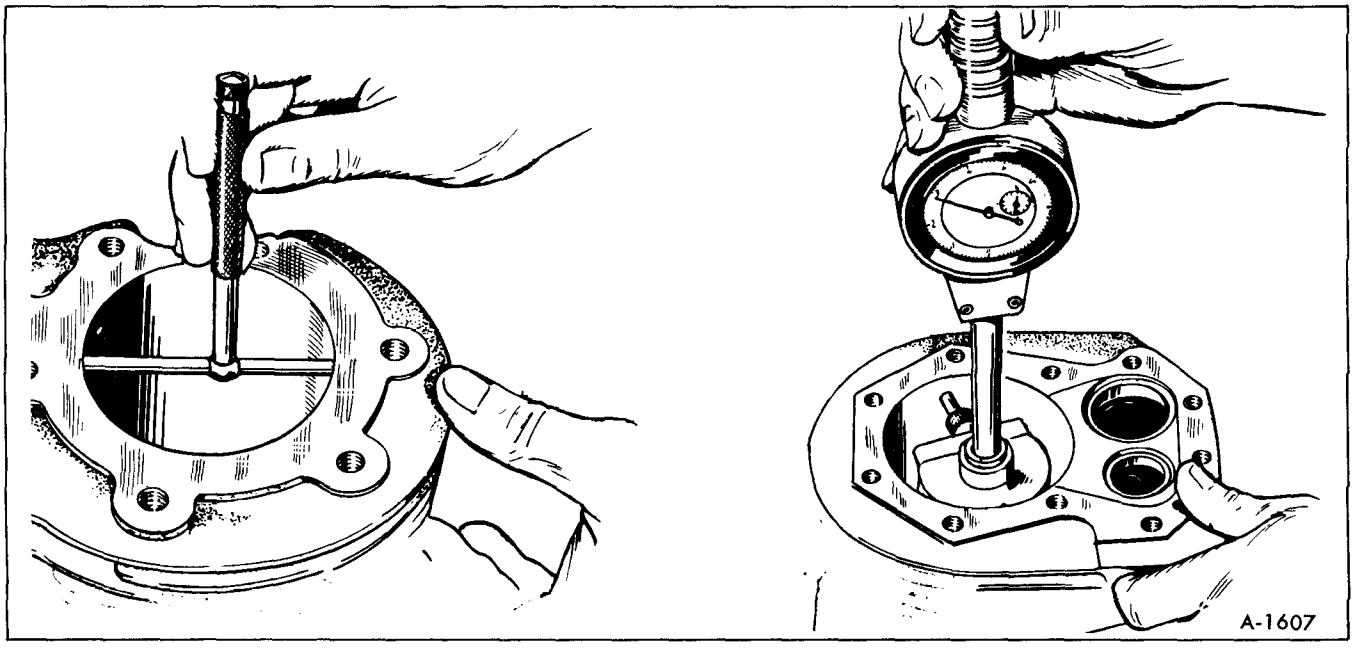


Figure 18–Methods of Measuring The Diameter of a Cylinder

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.

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", rebore 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

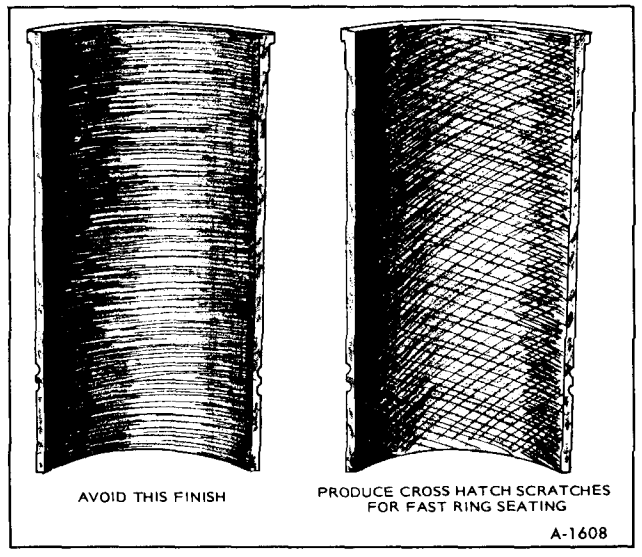


Figure 19–Crosshatching Cylinder Block

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.

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.

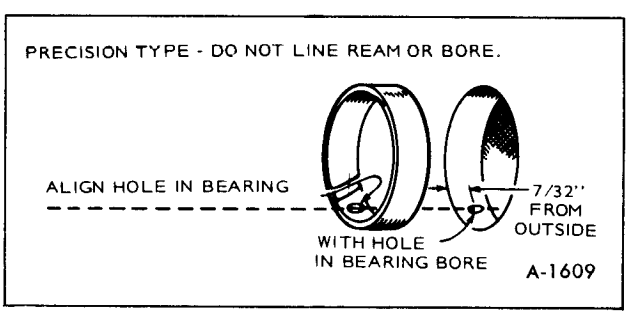


Figure 20–Crankshaft Bearing

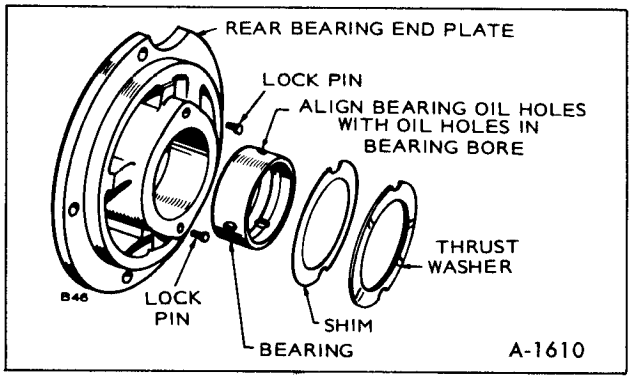


Figure 21–Bearing For Rear Bearing Plate

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

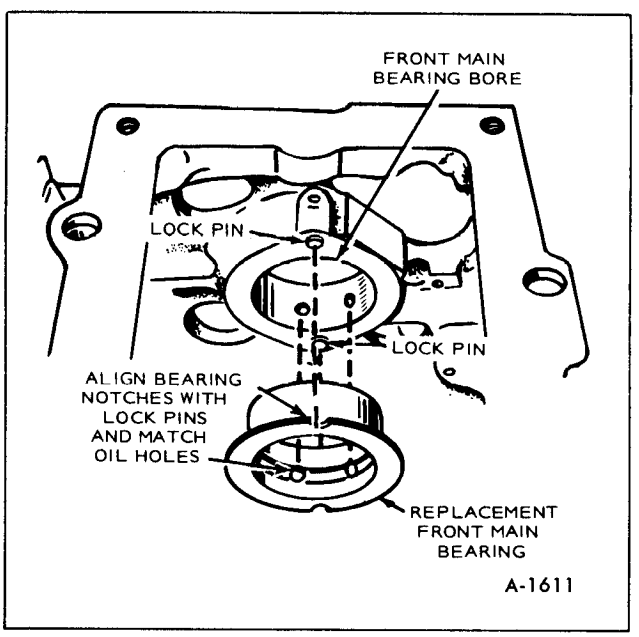


Figure 22–Front Bearing Installation

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 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.

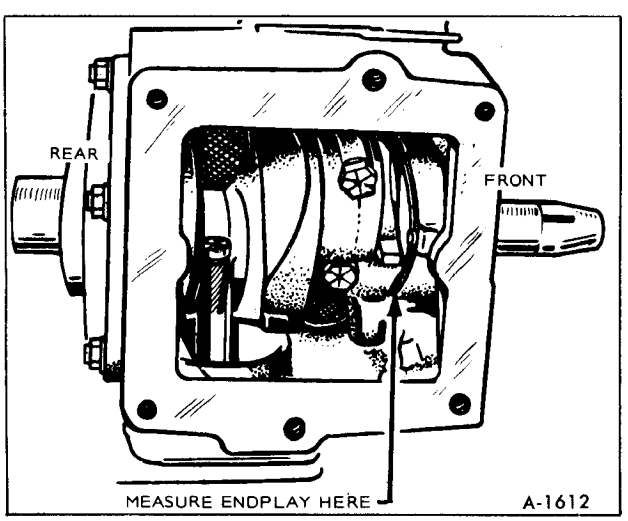


Figure 23–Crankshaft Endplay

CHECKING BEARING CLEARANCE WITH PLASTIGAUGE

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

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.

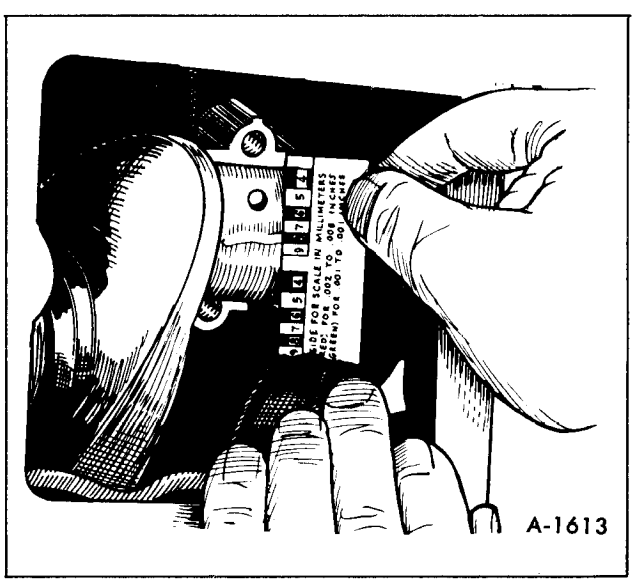


Figure 24–Measuring Bearing Clearance

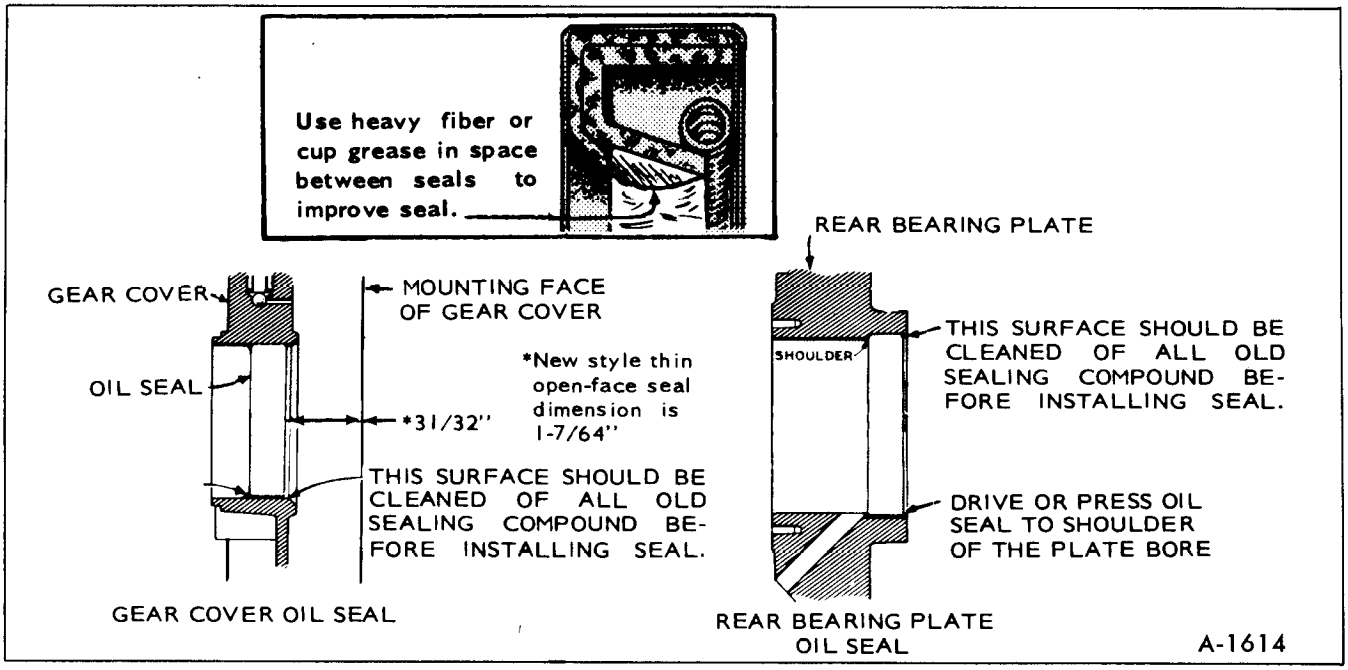


Figure 25–Gear Cover and Rear Bearing Plate Oil Seals

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.

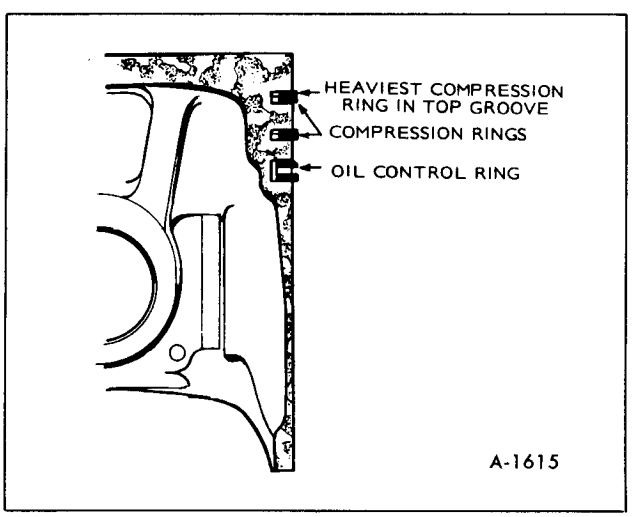


Figure 26–Piston Rings

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 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

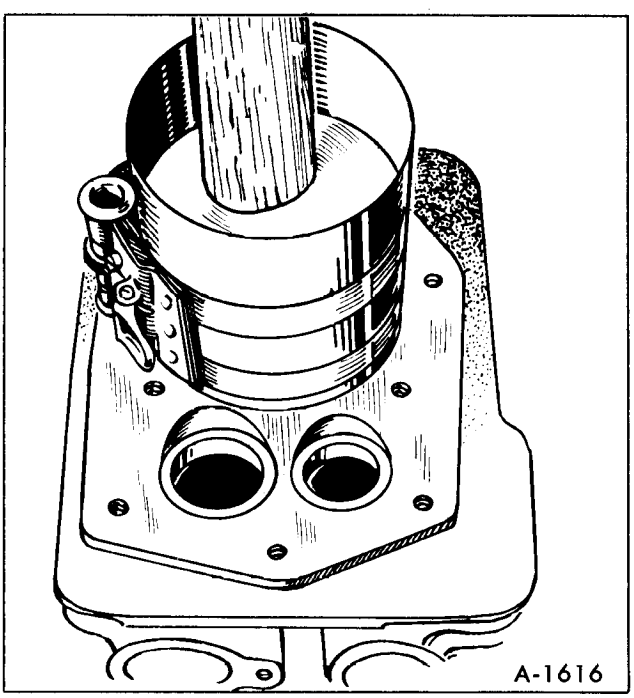


Figure 27–Installing Piston

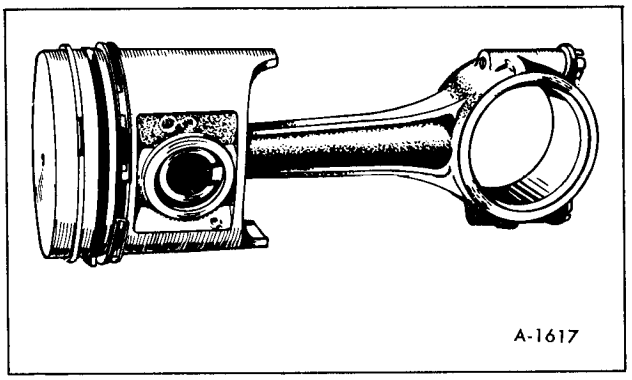


Figure 28–Piston Assembly

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.

5. Install the oil base with a new gasket.

Torque oil base thru-bolts to 18-23 ft.-lb.

Torque oil pan bolts to 8-12 ft.-lb.

6. Install the cylinder heads and torque 14-16 ft. lb. (17-19 ft. lb. on 6KW).

7. Réplace 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.

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

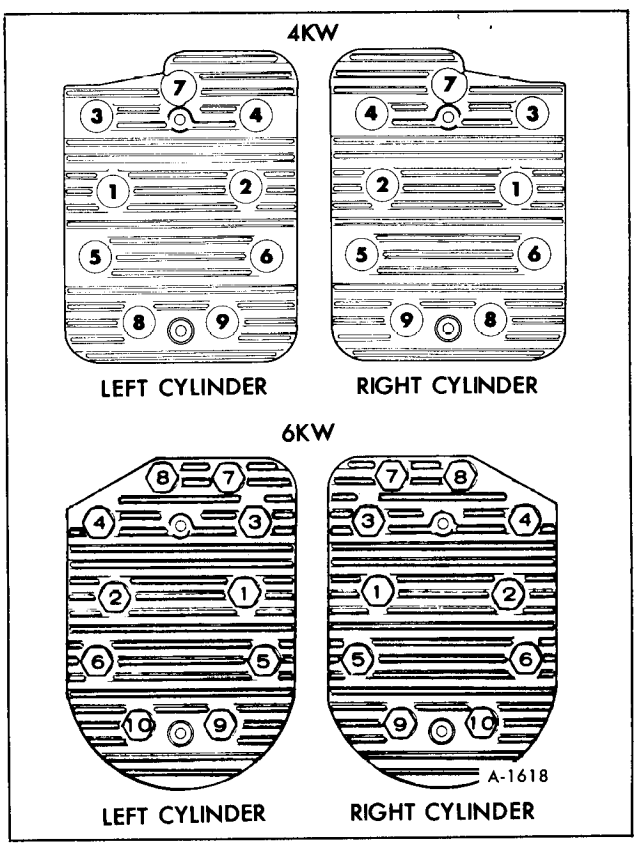


Figure 29–Cylinder Head Tightening Sequence

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.

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.

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.

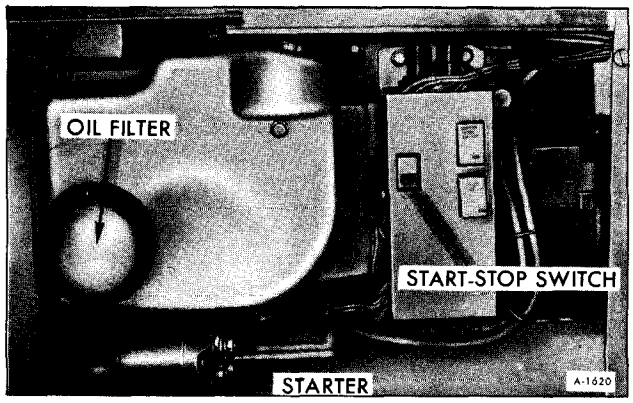


Figure 30–Oil Filter Location

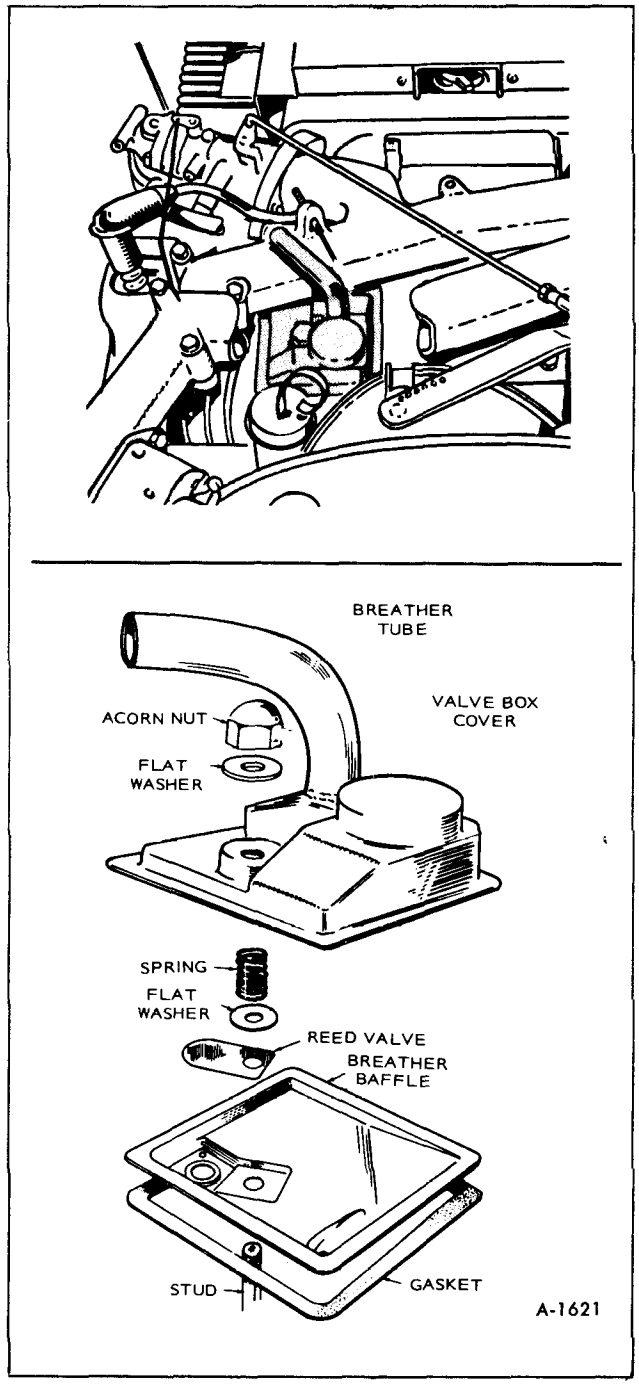


Figure 31–Crankcase Breather

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.

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.

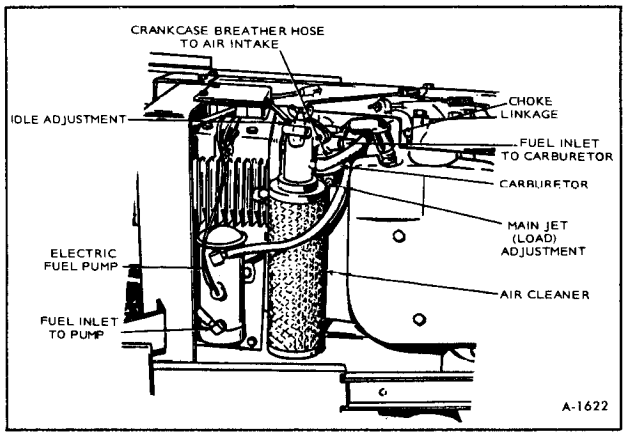


Figure 32–Fuel System (Typical)

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.

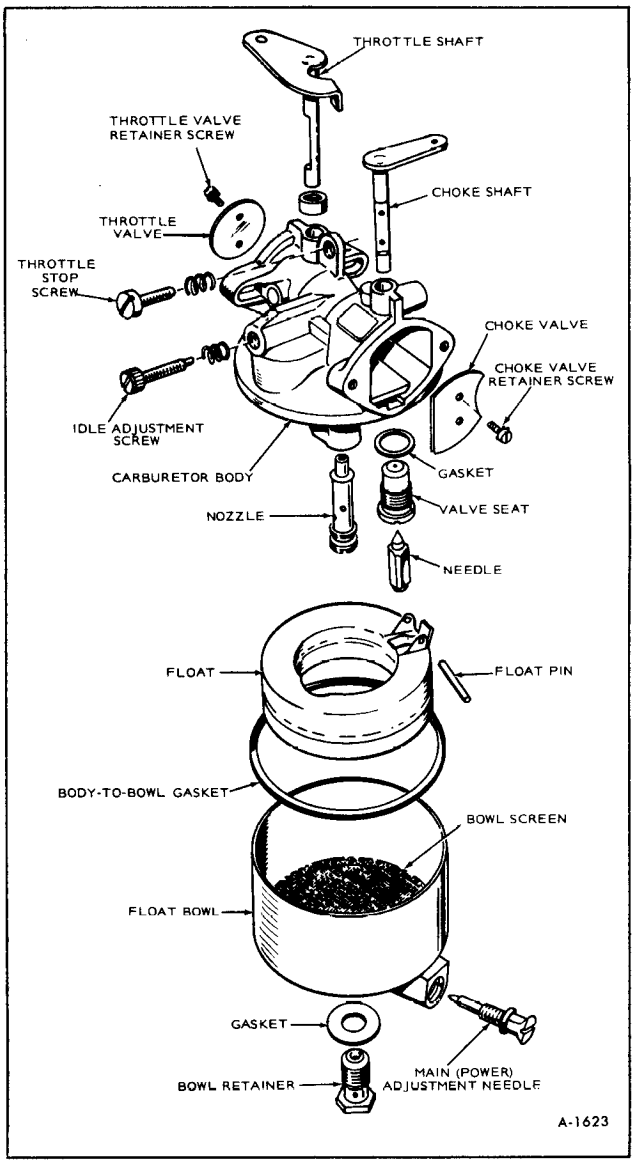


Figure 33–Carburetor Components

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.

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.

6. Install new gaskets when reassembling.

FUEL PUMP FILTER ELEMENT (FIGURE 35)

Every 400 hours or sooner on the 4KW, and every 500 hours on the 6KW, 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.

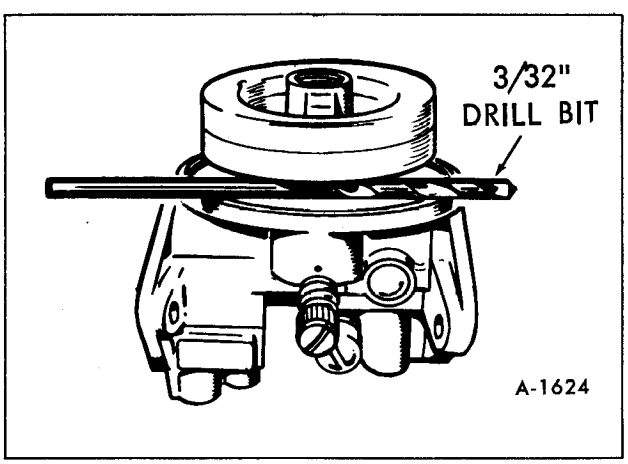


Figure 34–Carburetor Float Adjustment

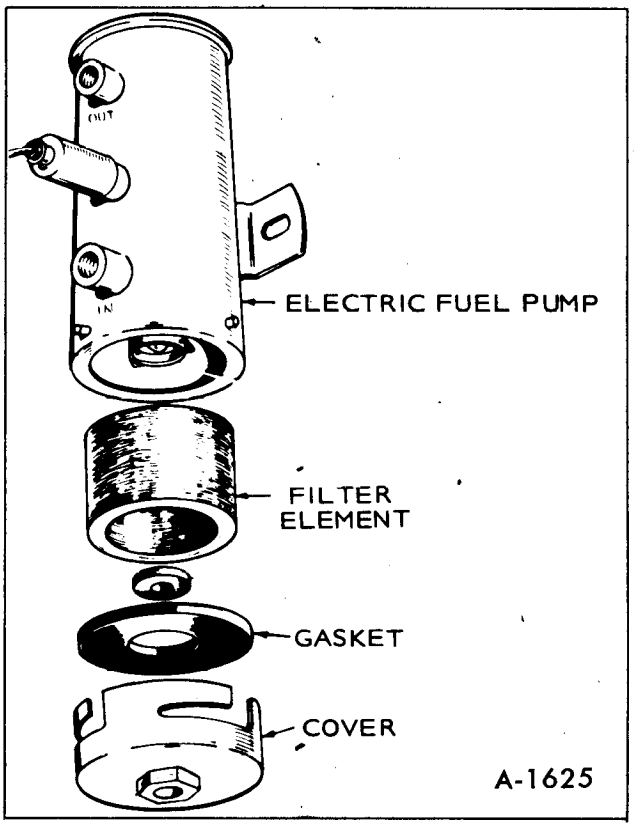


Figure 35–Fuel Pump Filter Element

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

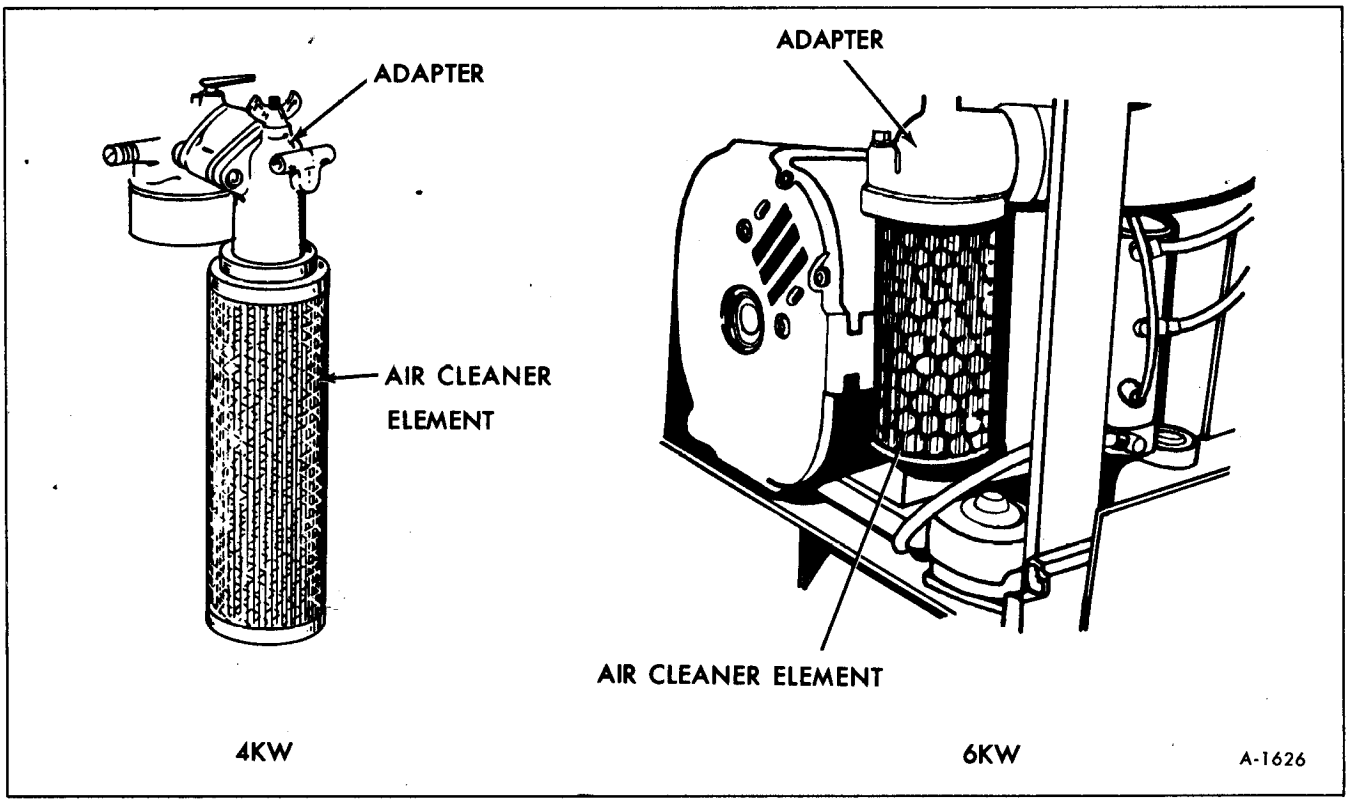


Figure 36–Air Cleaner Element

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.

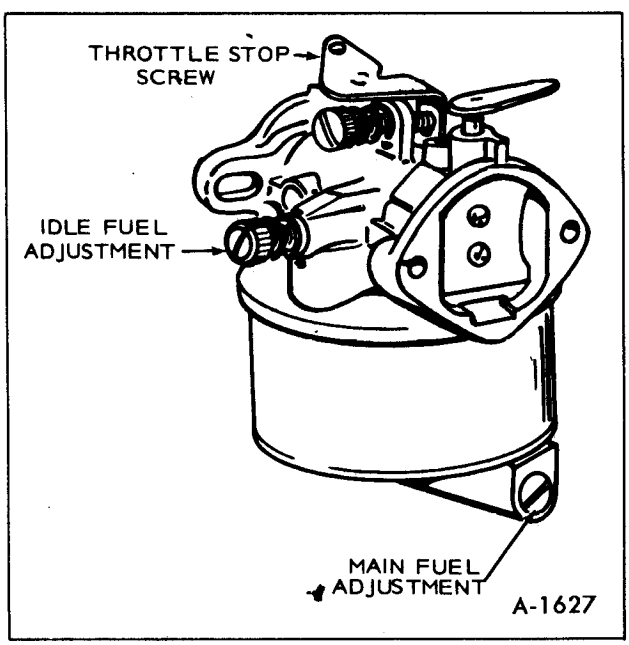


Figure 37–Carburetor Adjustment Screws

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 unitl 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.

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 noticable 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 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.

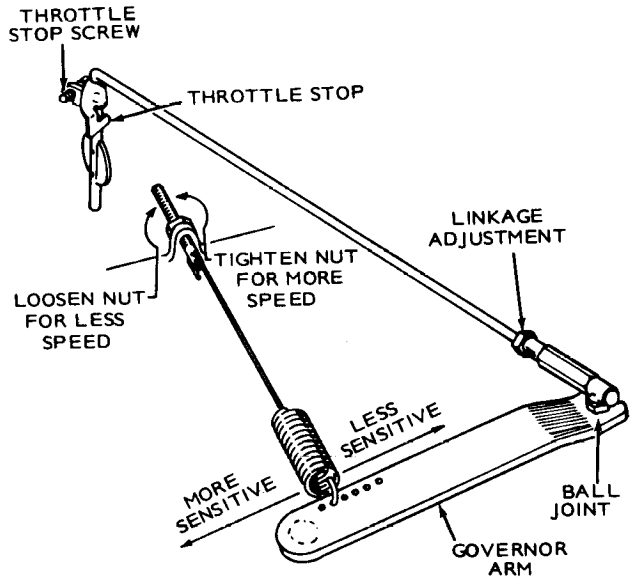
7. Set the carburetor throttle stop screw.

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,



VOLTAGE CHART FOR CHECKING GOVERNOR REGULATION	120 VOLT 1 PHASE 2 WIRE
MAXIMUM NO-LOAD VOLTAGE	126
MINIMUM FULL-LOAD VOLTAGE	110

SPEED CHART FOR CHECKING GOVERNOR REGULATION	
MAXIMUM NO-LOAD SPEED (RPM)	1890
HERTZ (CURRENT FREQUENCY)	63
MINIMUM FULL-LOAD SPEED (RPM)	1770
HERTZ	59

A-1628

Figure 38–Governor Adjustments

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.

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 25° BTC mark aligns with hole. Turn another 1/4 turn (90°) to ensure points are fully open.

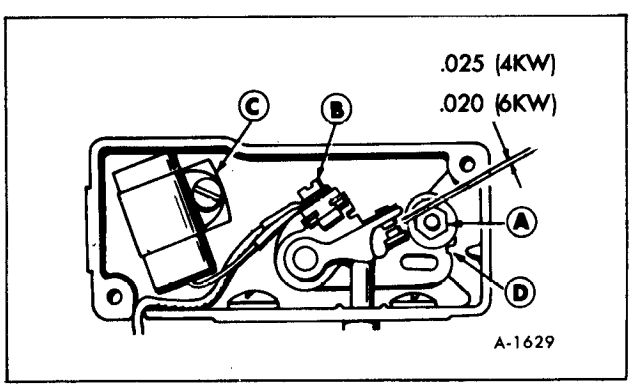


Figure 39–Breaker Point Adjustments

8. Using a screwdriver inserted in notch (D) on the right side of points, turn points until gap measures .025" (.020" 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 according 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 2/5 (25° BTC).

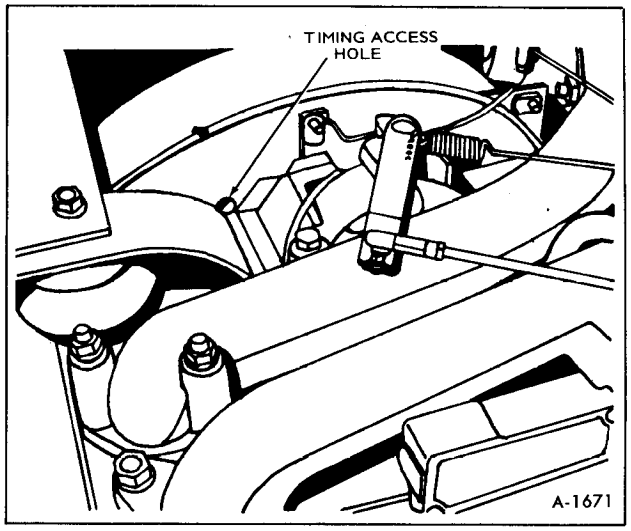


Figure 40–Timing Access Hole Location

3. Start the engine and check the timing. The 2/5 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

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.

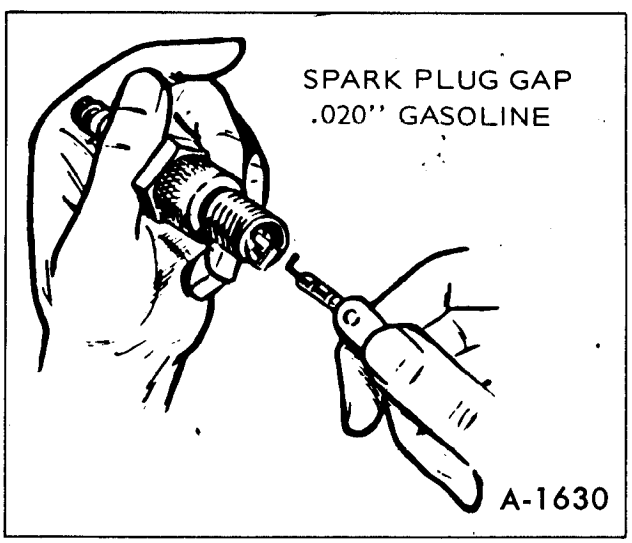


Figure 41–Checking Spark Plug Gap

2. Turn crankshaft against rotation (counter-clockwise) 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 25° 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.

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 (±10%) ohms.

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

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

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.*

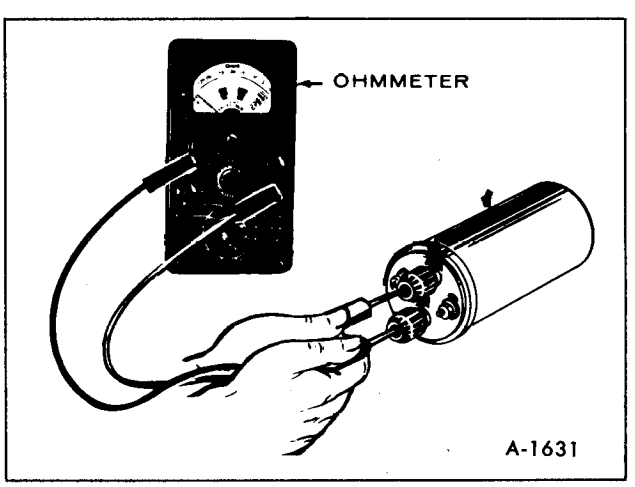


Figure 42–Coil Test

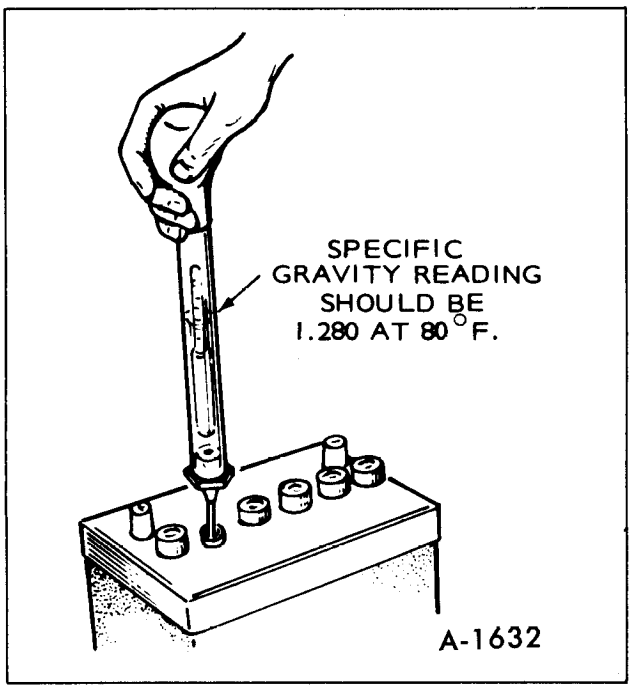


Figure 43–Specific Gravity Test

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.

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.

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.

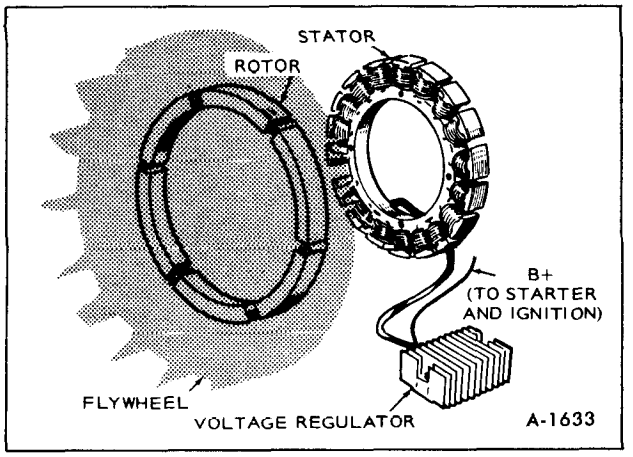


Figure 44–Flywheel Alternator System

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.

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 battery and its connection to be sure it is serviceable.

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 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 AC voltmeter 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.	28 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 armature. 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

NOTE: Starter removal requires removal of the generating set from its slide rails and mounts.

1. Remove blower scroll from front of engine by removing four screws (figure 46).

2. Remove flywheel with a flywheel puller or loosen center cap screw and direct a sharp blow to loosen. It helps to pull forward on one side of flywheel when striking with a hammer. If using this procedure be sure to leave center cap screw loosely in place or blower wheel will fall on floor.

3. Remove left and right hand air shrouds that cover cylinder heads.

4. Remove exhaust manifold.

5. Remove blower scroll backing plate (two screws on bottom – two on gear cover) as shown in Figure 47.

6. Disconnect heavy wire that connects to starter.

7. Remove two starter hold-down studs and lift out starter.

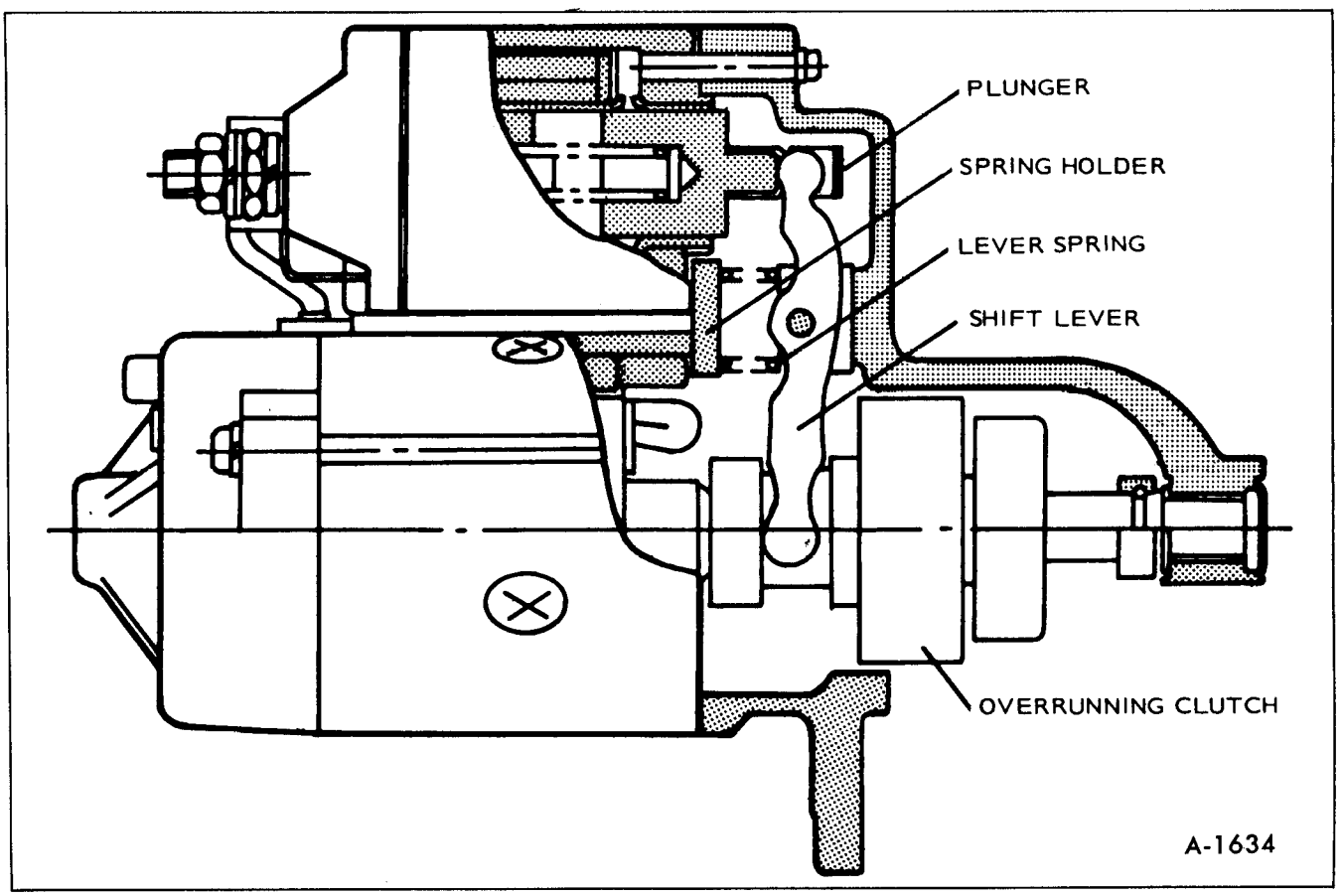


Figure 45–Starter

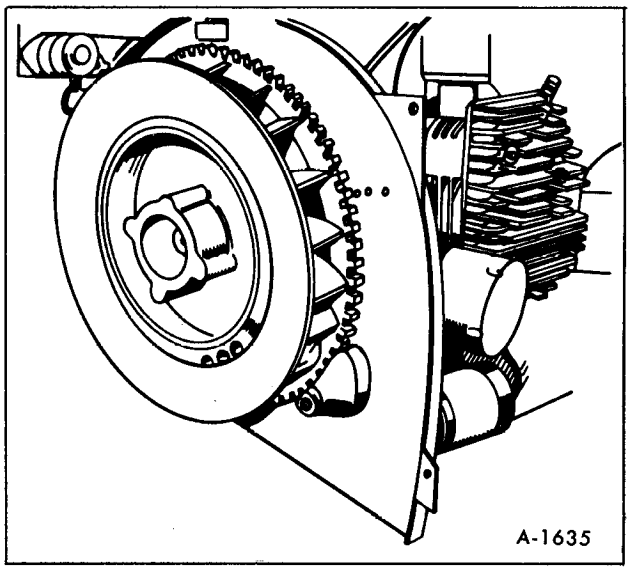


Figure 46–Blower Scroll Removed

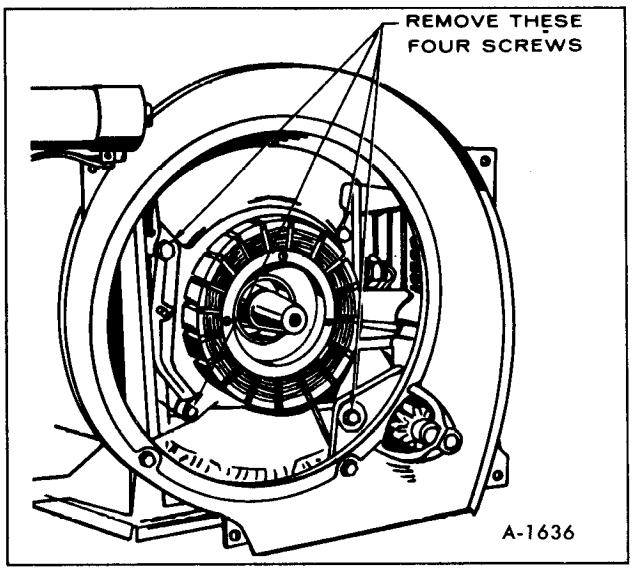


Figure 47–Removing Backing Plate

STARTER DISASSEMBLY–4KW (FIGURE 48)

1. Loosen the nut that attaches the solenoid motor terminal to the field coil connector lead and take off the connector lead (figure 49).

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 50).

3. Unscrew the through bolts and separate the

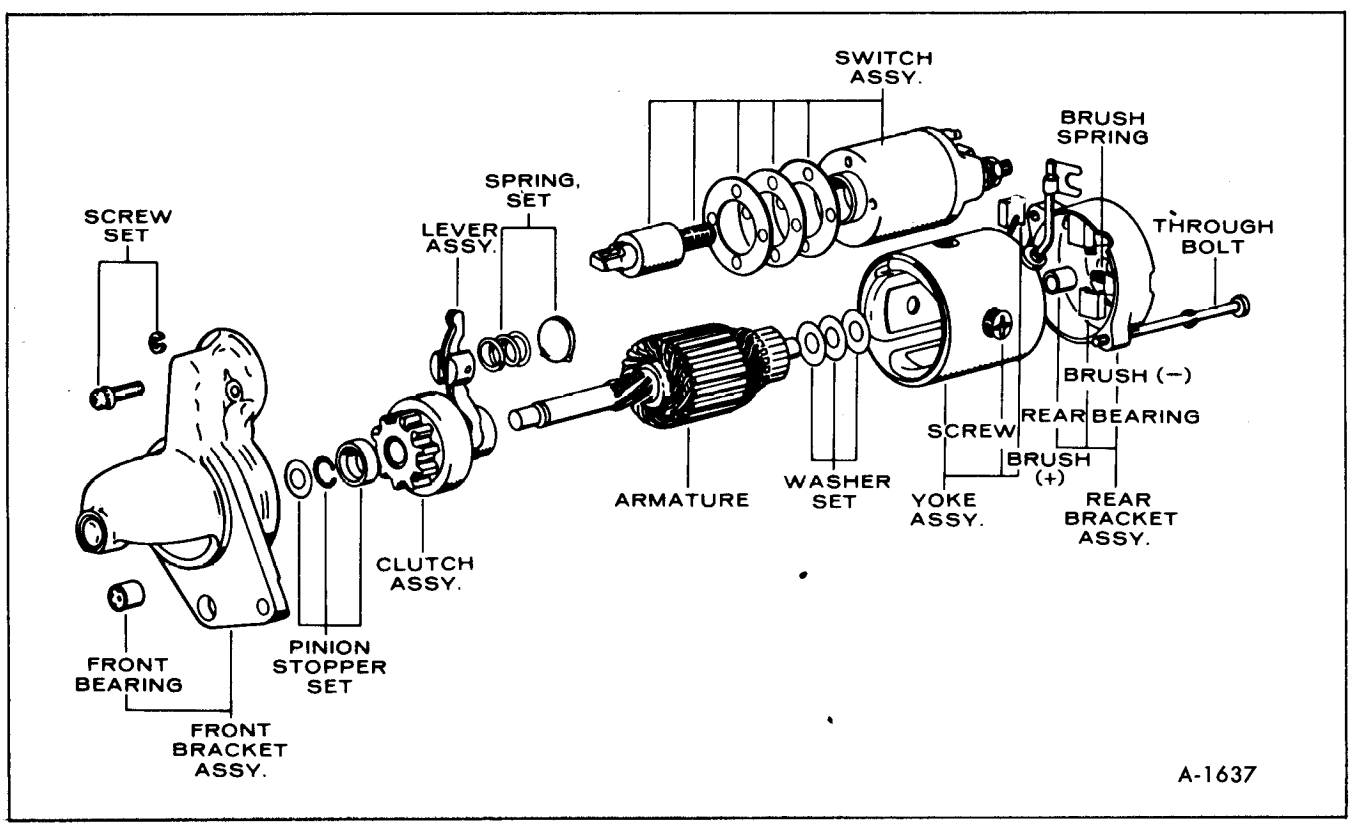


Figure 48–Starter (4KW)

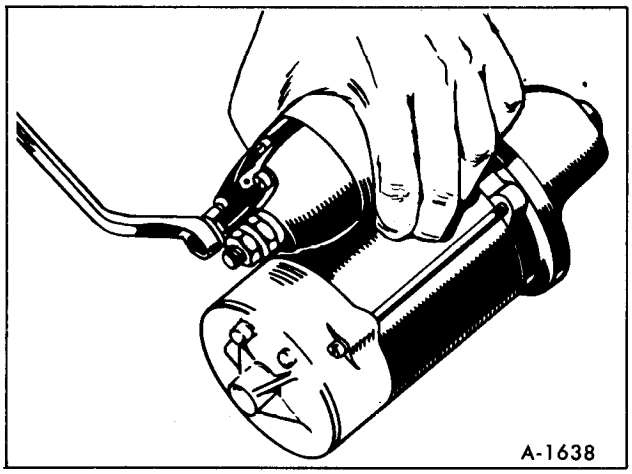


Figure 49–Removing Connector Lead

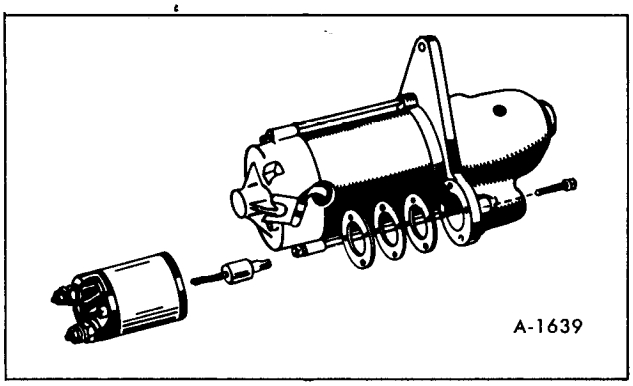


Figure 50–Removing Solenoid

yoke with the rear bracket from the front bracket (figure 51).

4. Remove the armature from the front bracket. Simultaneouly, the shift lever the lever spring and the spring holder will be removed (figure 52).

5. Removing the insulated brush from the brush holder permits separation of the rear bracket from the yoke (figure 53).

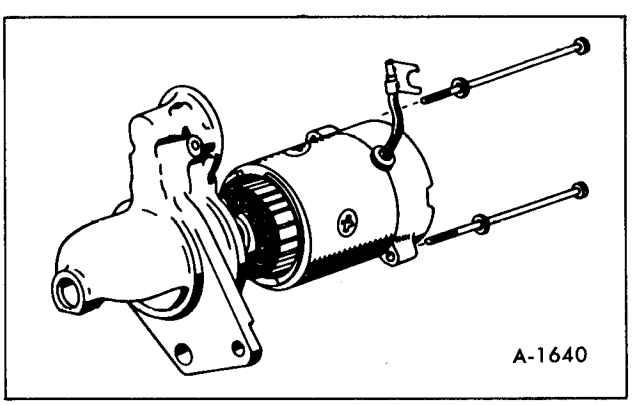


Figure 51–Removing Yoke

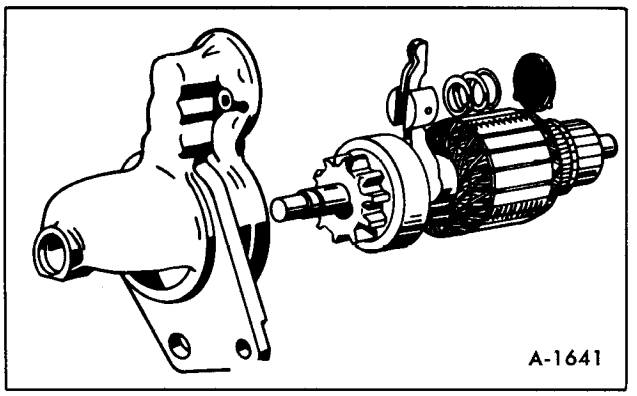


Figure 52–Removing Armature

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 54)

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

1. Loosen the nut that attaches the solenoid motor terminal to the field coil connector lead and take off the connector lead (figure 49).

2. Loosen the retaining screws and remove the solenoid from the front bracket. Simultaneouly, the fiber washers, the return spring and the solenoid plunger will be removed (figure 50).

3. Unscrew the through bolts and the screws attaching the brush holder assembly to the rear bracket, so the rear bracket will be removed from the yoke.

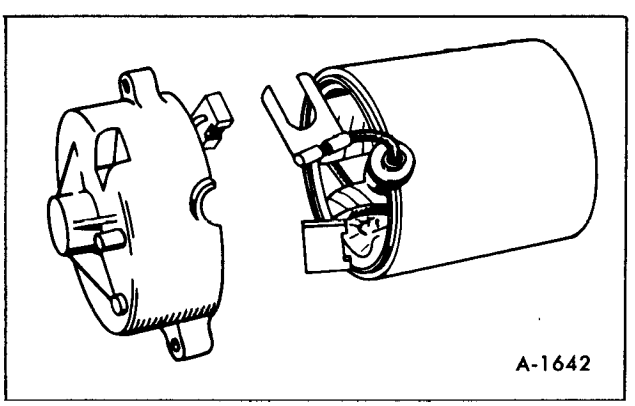


Figure 53–Separating Yoke and Rear Bracket

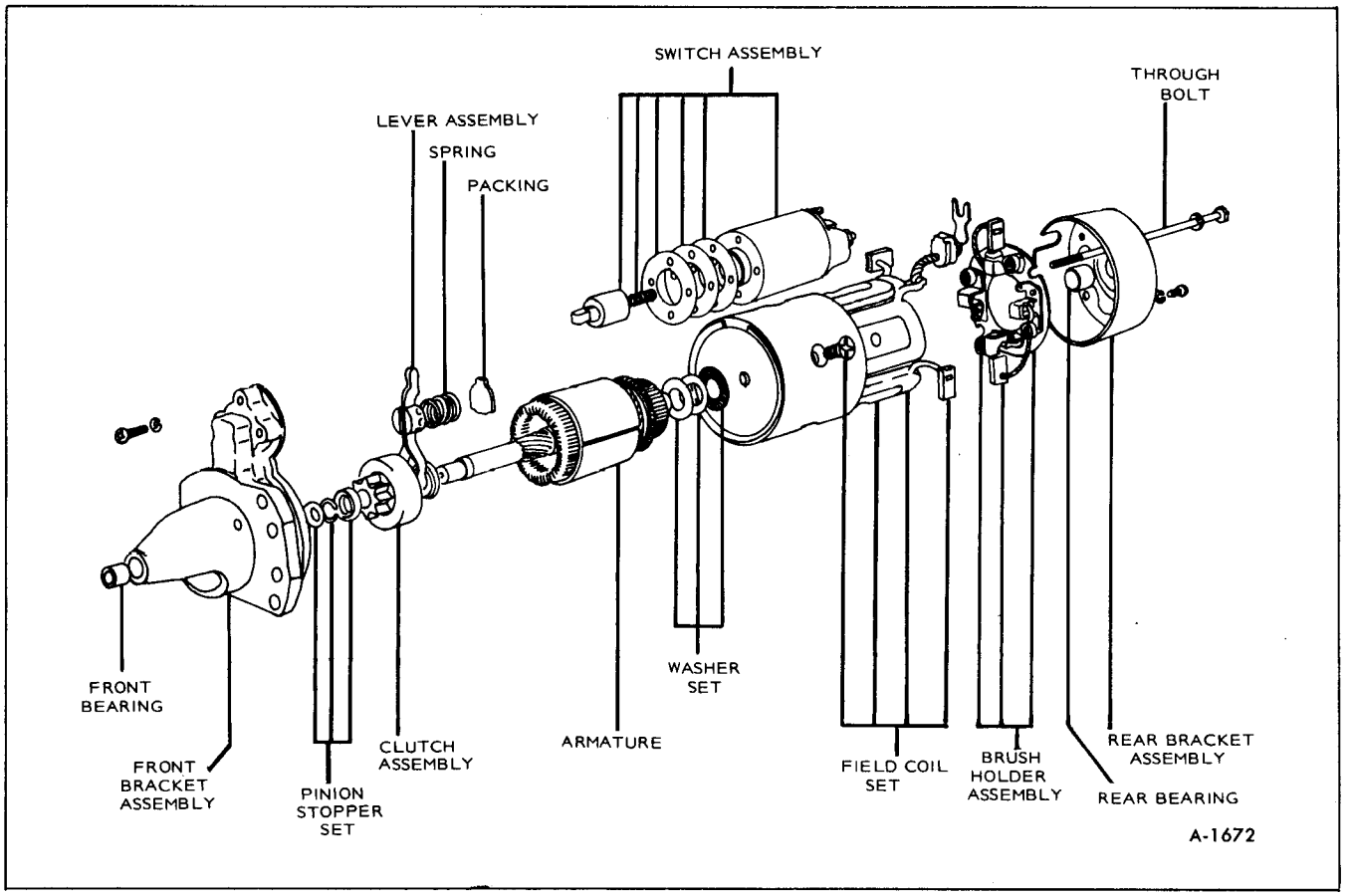


Figure 54–Starter (6KW)

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

GROUNDED ARMATURE: Use a 120 volt test lamp set for testing armature for grounds as shown in Figure 55. 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 56) Use a growler tester for testing armature for a short circuit. 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.

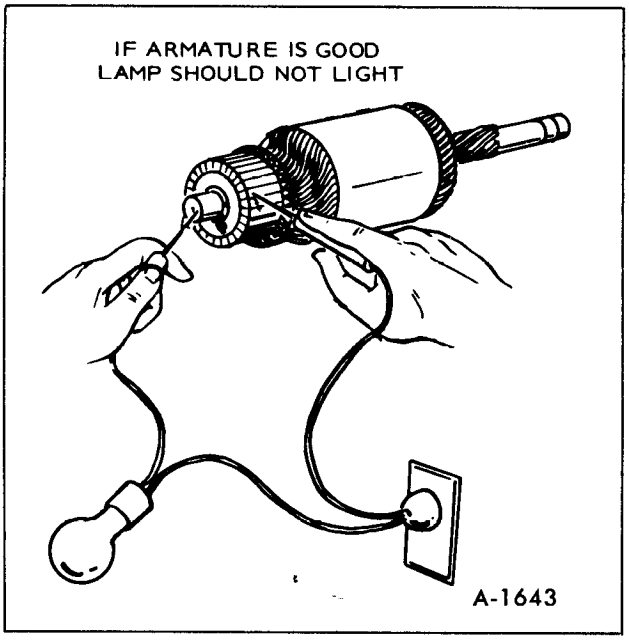


Figure 55–Testing for Grounded Armature

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 57. 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.

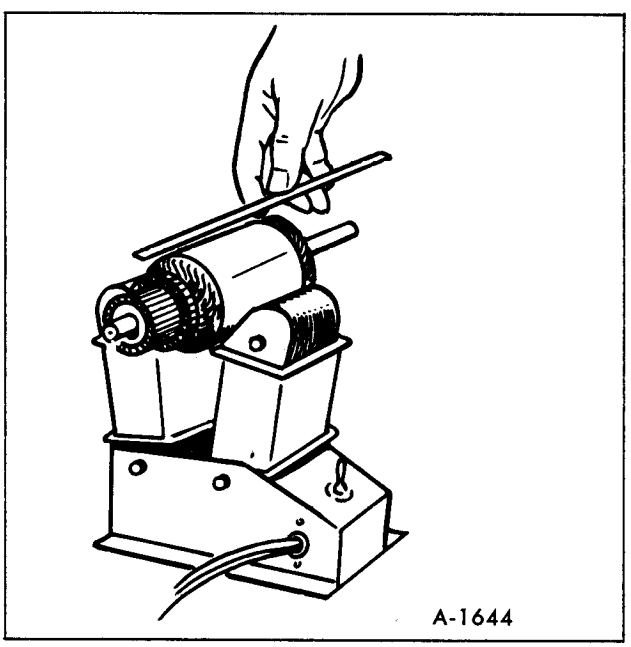


Figure 56–Testing for a Short Circuit

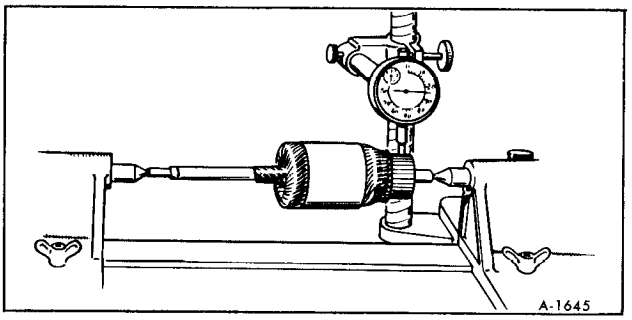


Figure 57–Testing Commutator Runout

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.

GROUNDED FIELD COIL: Use a 120 volt test lamp set for testing for a grounded field coil. First disconnect the grounded end of shunt coil as shown in Figure 58. 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 59. Brushes can be replaced after removing the rear bracket.

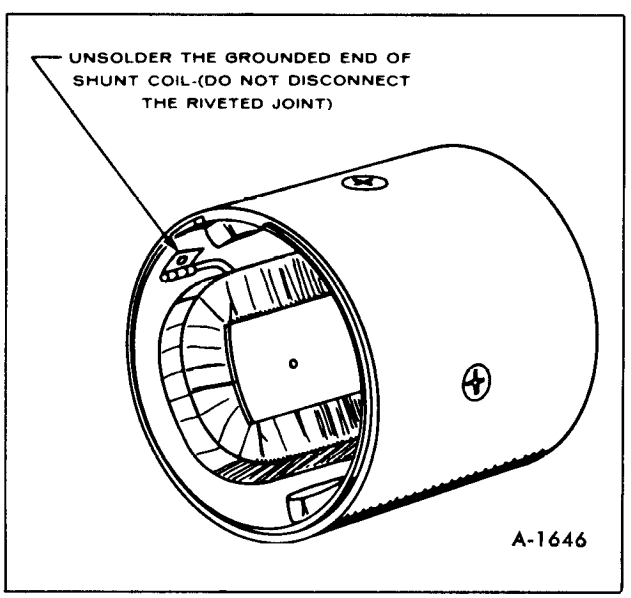


Figure 58–Testing Field Coil

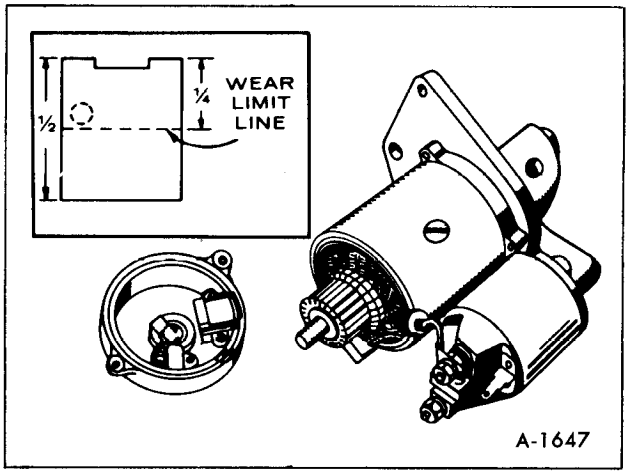


Figure 59–Brush Replacement

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. See Figure 60.

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.

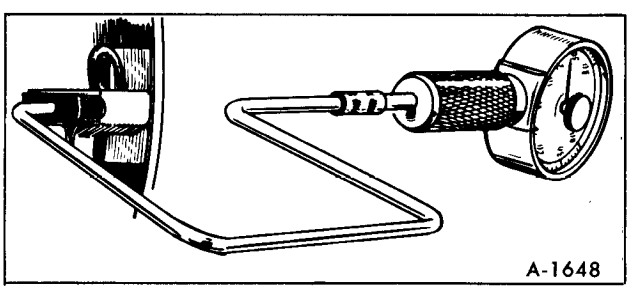


Figure 60–Testing Brush Spring Tension

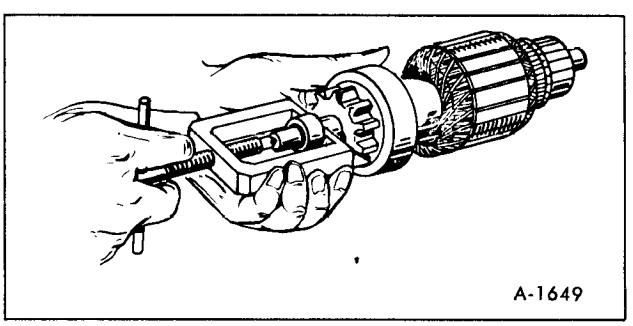


Figure 61–Installing Overrunning Clutch

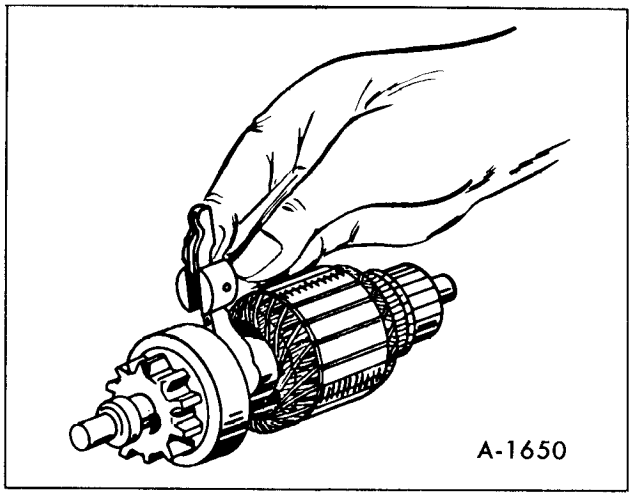


Figure 62–Installing Shift Lever

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 61) 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 62. 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.

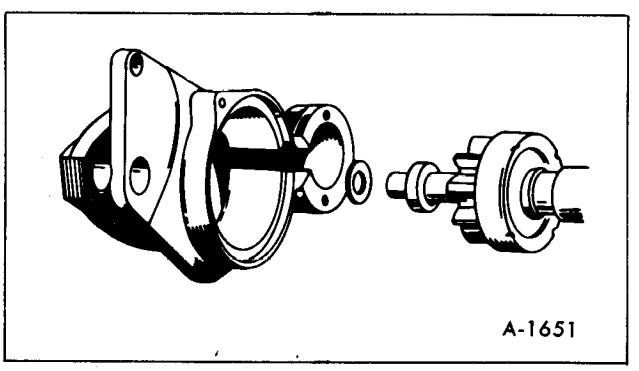


Figure 63–Installing Front Bracket

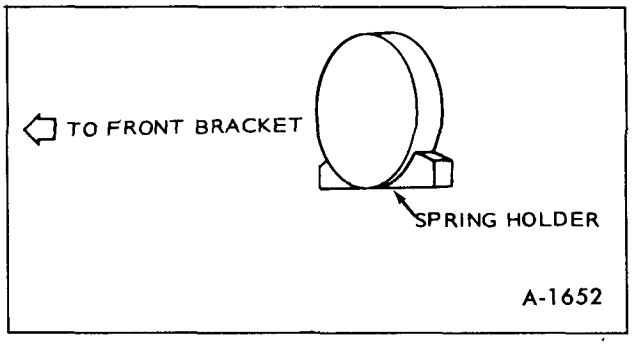


Figure 64–Spring Holder Placement

4. Place the thrust washer on the drive end of the shaft. Slide the armature with the lever into the front bracket (figure 63).

5. Place the lever spring and the spring holder into the front bracket with the direction shown in Figure 64.

6. Position the Yoke to the front bracket. Be sure that the yoke is properly indexed to the front bracket (figure 65).

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 66).

NOTE: In case three washers are used, the fiber washer is placed between the steel 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 67.

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

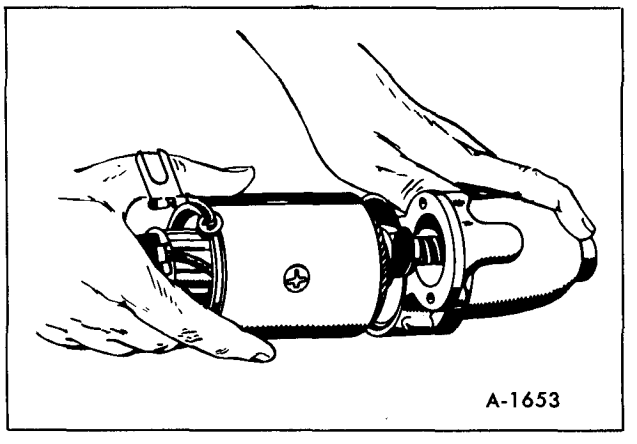


Figure 65–Yoke to Front Bracket Installation

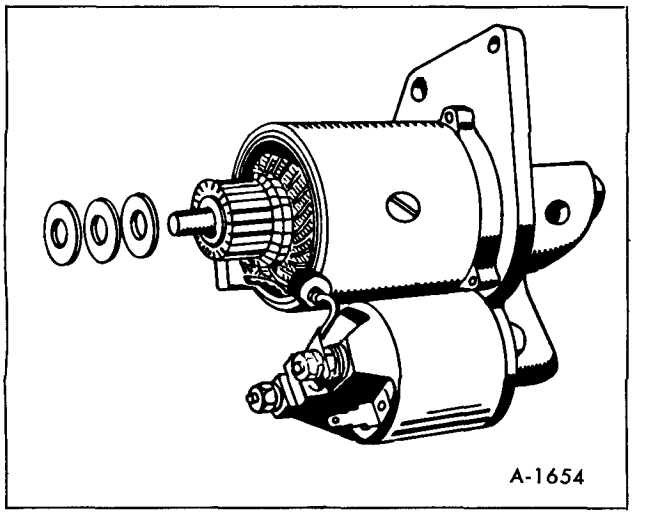


Figure 66–Installing Thrust Washers

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.

11. Install the solenoid plunger over the top of the shift lever in the front bracket as shown in Figure 68. 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

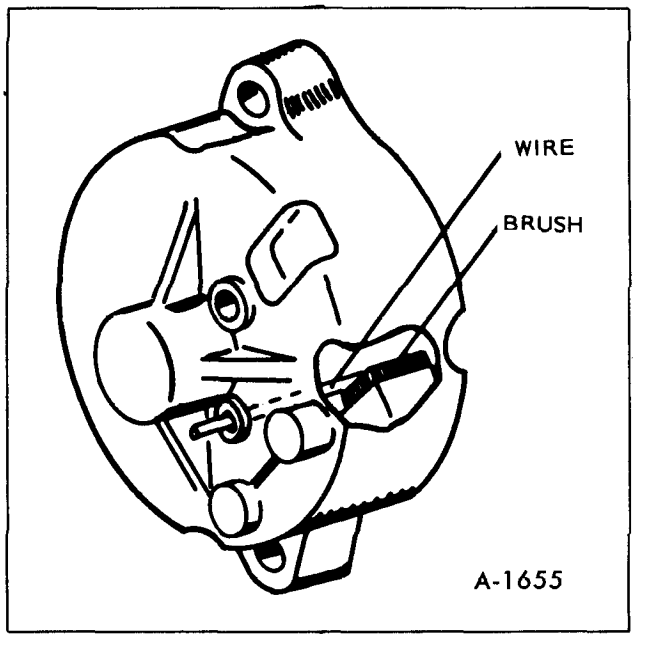


Figure 67–Brush Installation

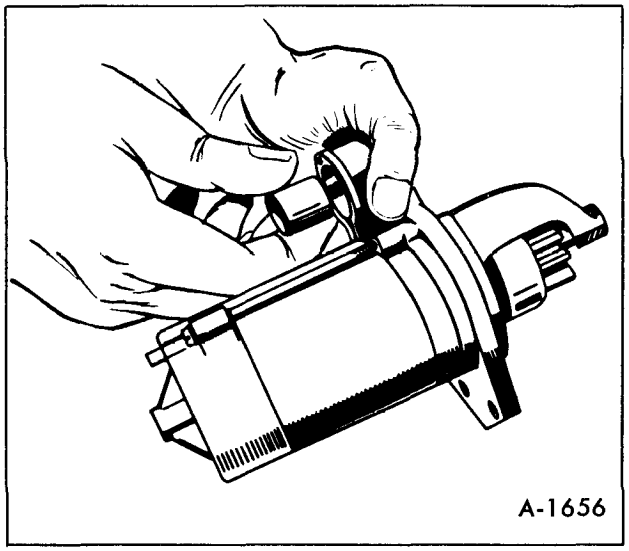


Figure 68–Installing Solenoid Plunger

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.

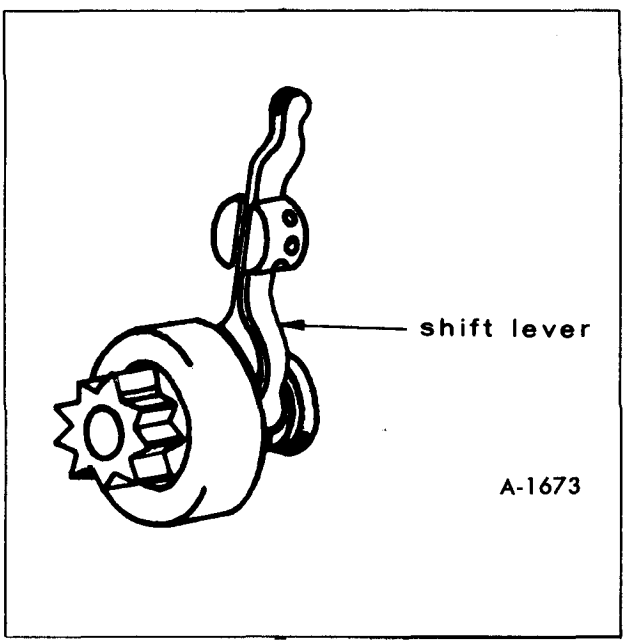


Figure 69–Shift Lever

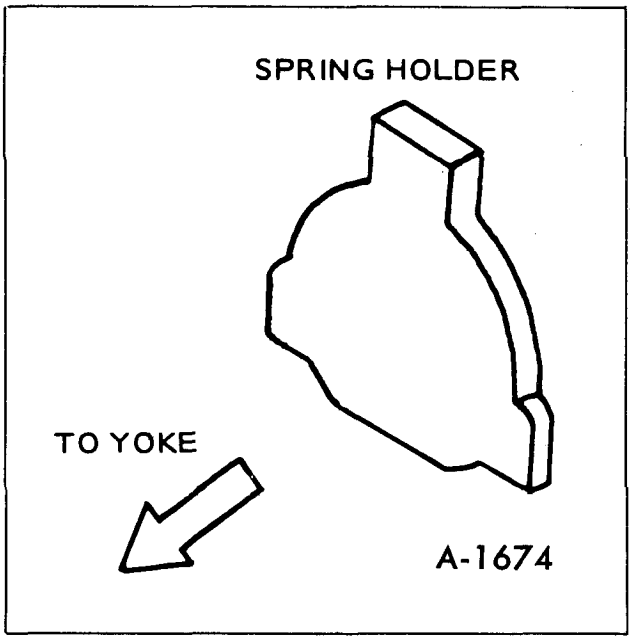


Figure 70–Spring Holder

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 69. 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.

5. Place the lever spring and the spring holder into the front bracket in the direction shown in Figure 70.

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.

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.

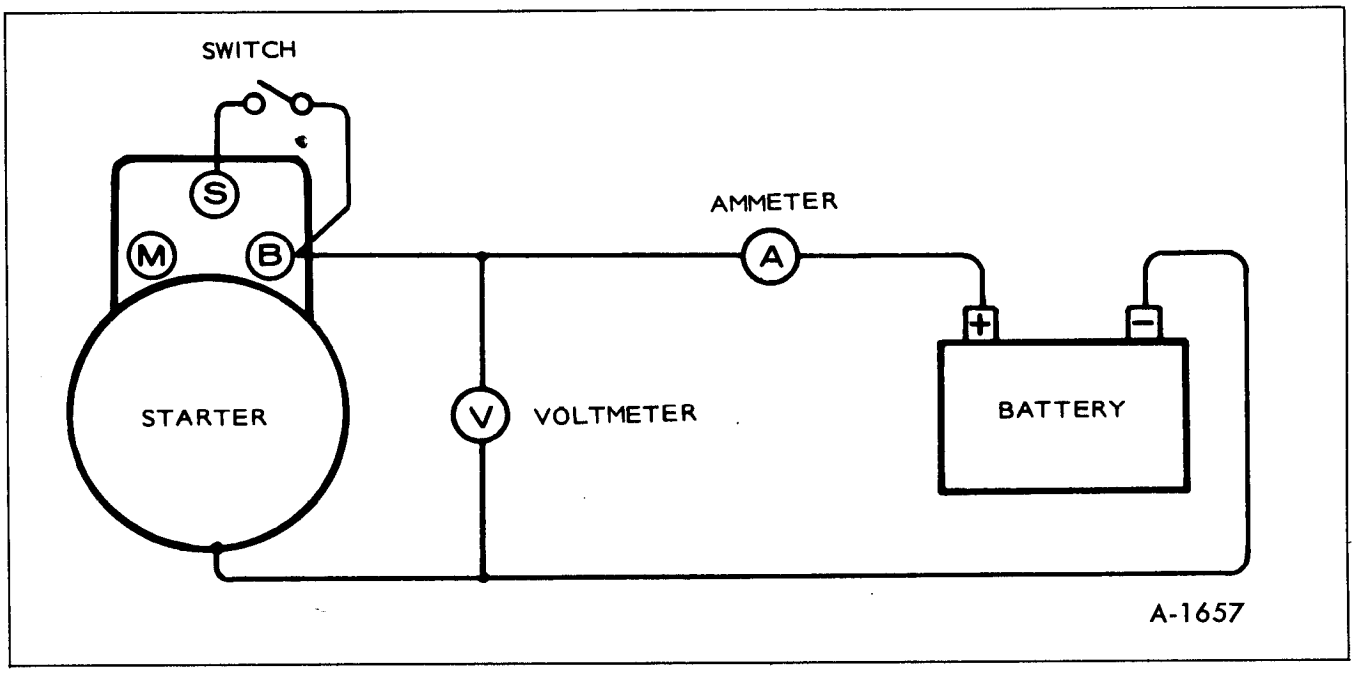


Figure 71–No Load Test

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 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 71. The values of this test should be as follows:

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. 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 72. 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.

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 73)

1. Remove power plant from its slide rails.

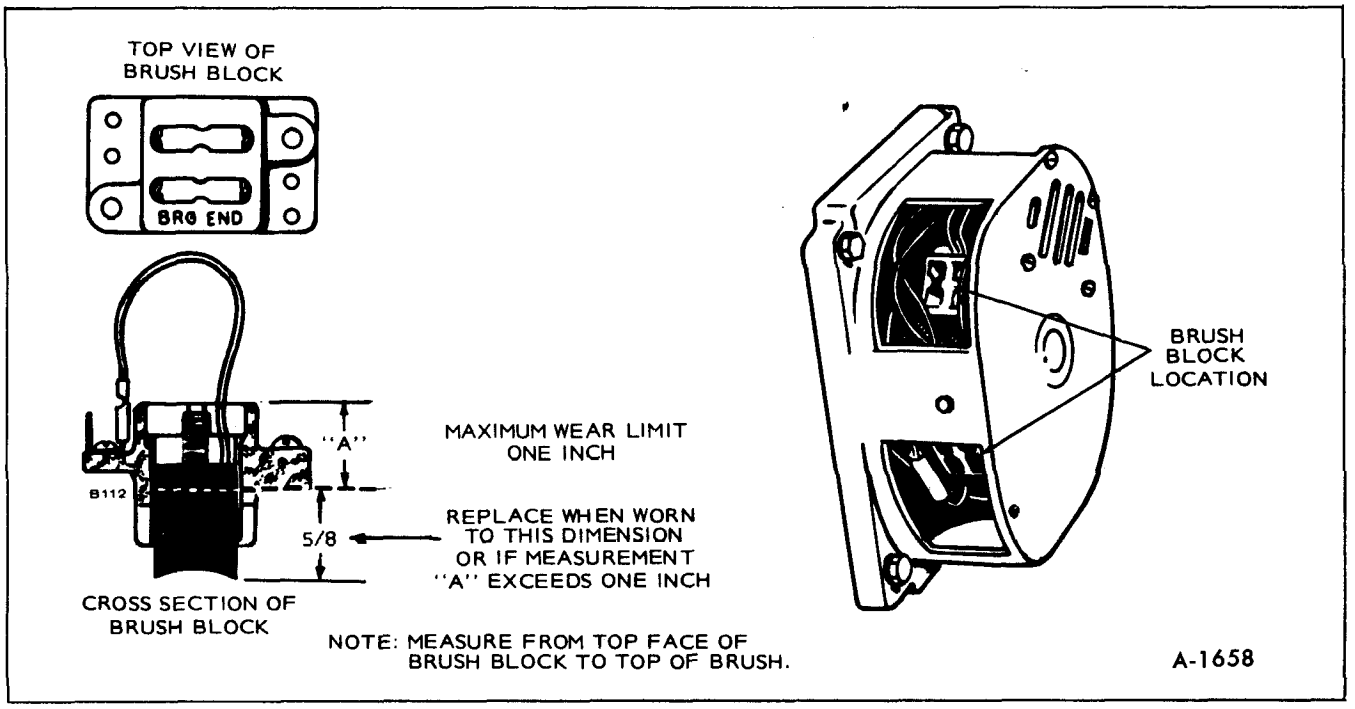


Figure 72–Brush Wear Limits

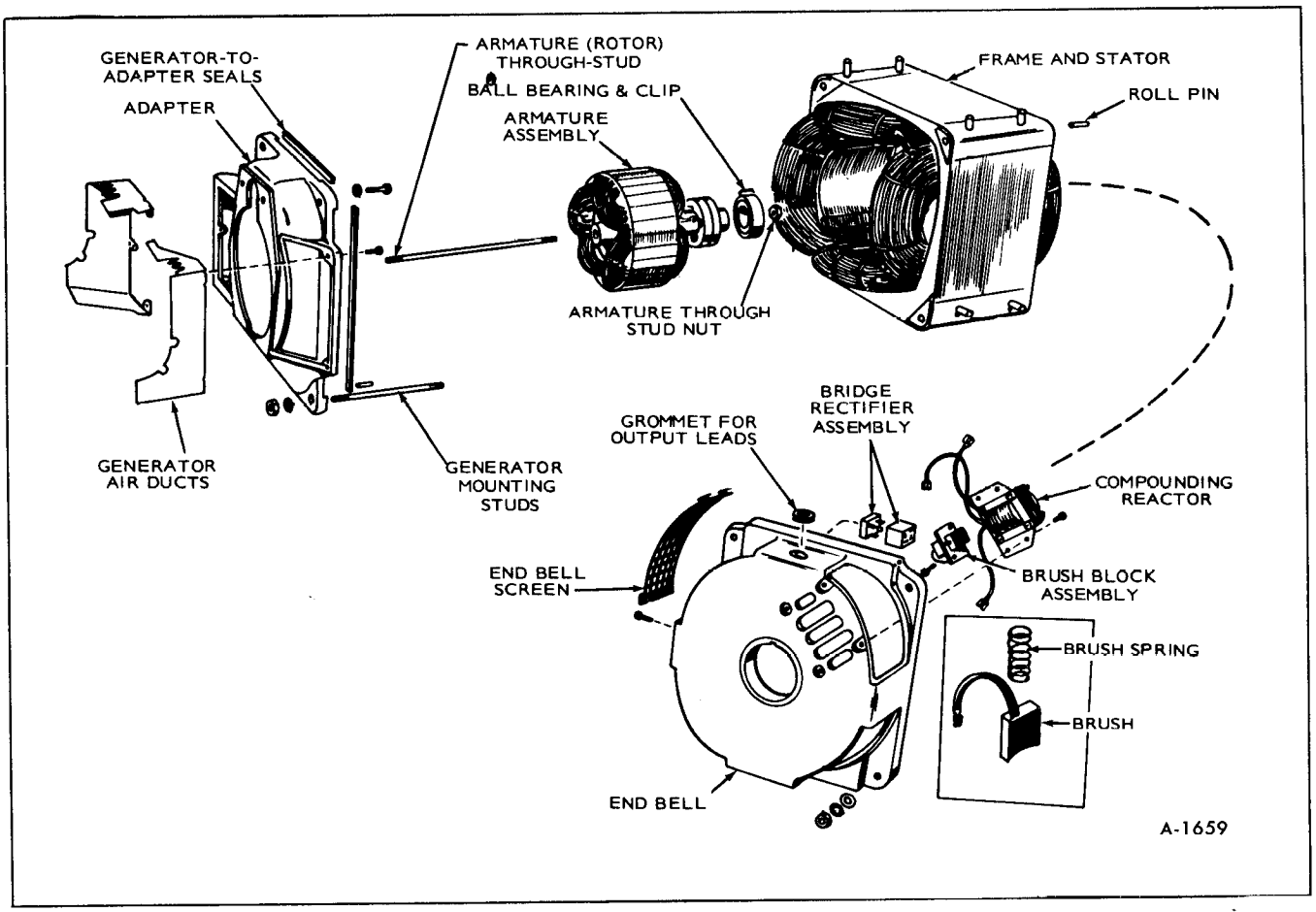


Figure 73–Generator Components

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-generator 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.

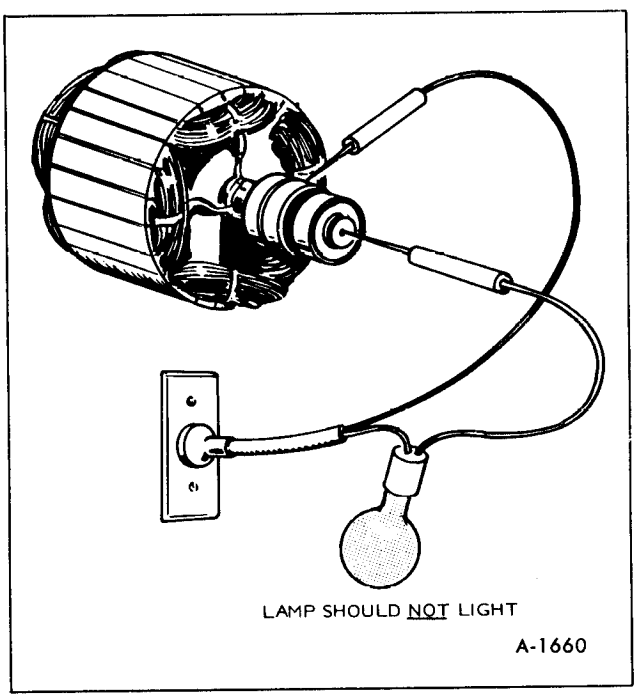


Figure 74–Armature Ground Test

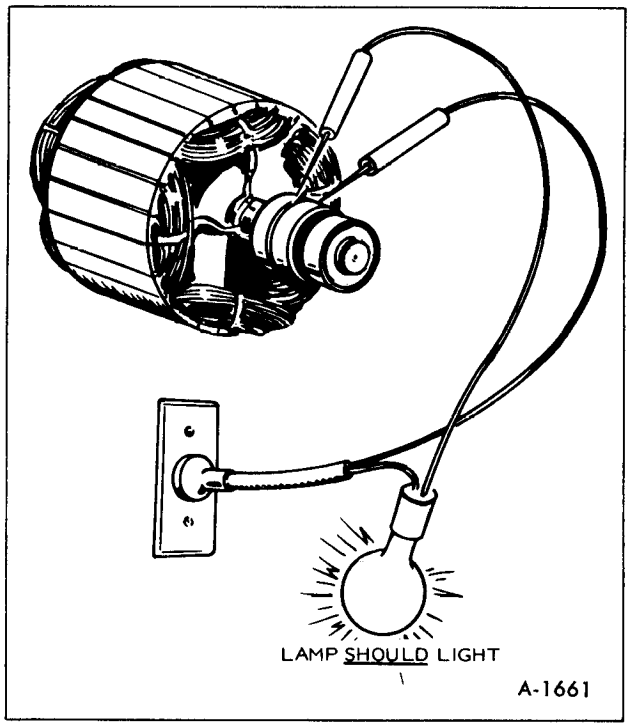


Figure 75–Armature Open Test

9. While pulling outward with on 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 winding or a collector ring is grounded to the shaft. Test both collector rings in this manner, refer to Figure 74.

ARMATURE OPEN TEST (FIGURE 75)

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 76)

To test the field assembly for grounds, disconnect

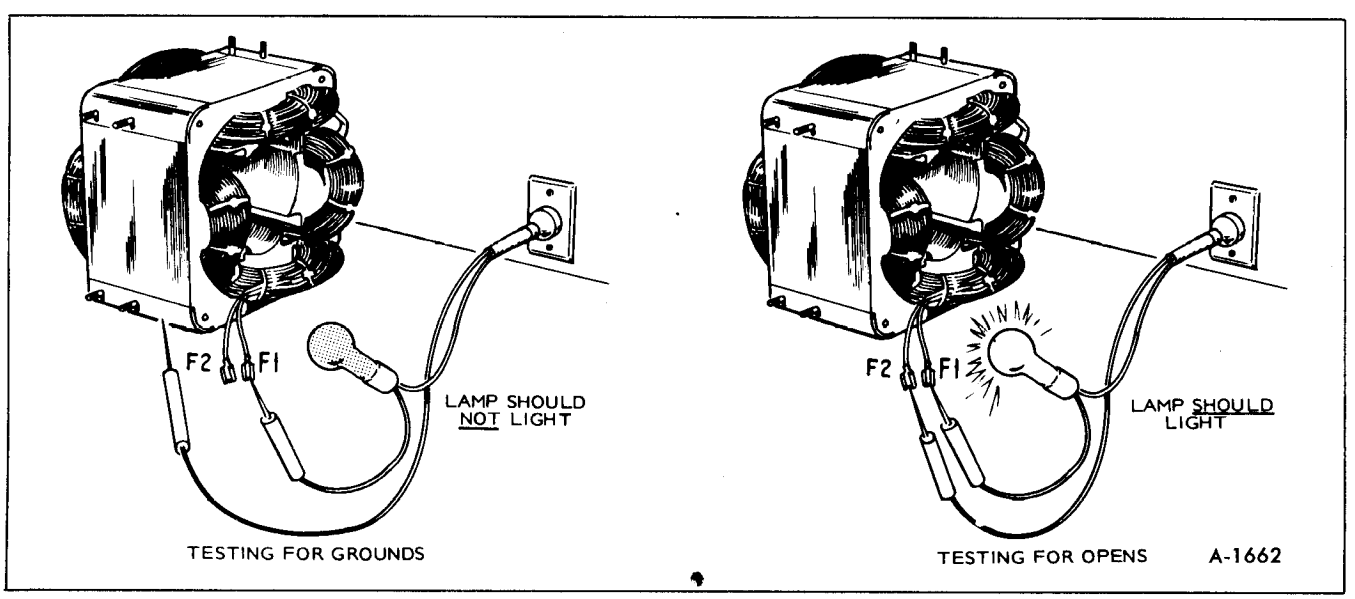


Figure 76–Testing Field Windings

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 76)

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

Using an Ohmmeter: Disconnect external leads and connect ohmmeter leads to F1 (+) and F2 (-). Resistance in the windings should read 28.8 ohms (± 3%) at 70 F.

Using a Test Lamp Set: Disconnect external leads and touch test prods to F1 and F2. The lamp should light. If not, field widing 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 77 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 78 and note readings from following table:

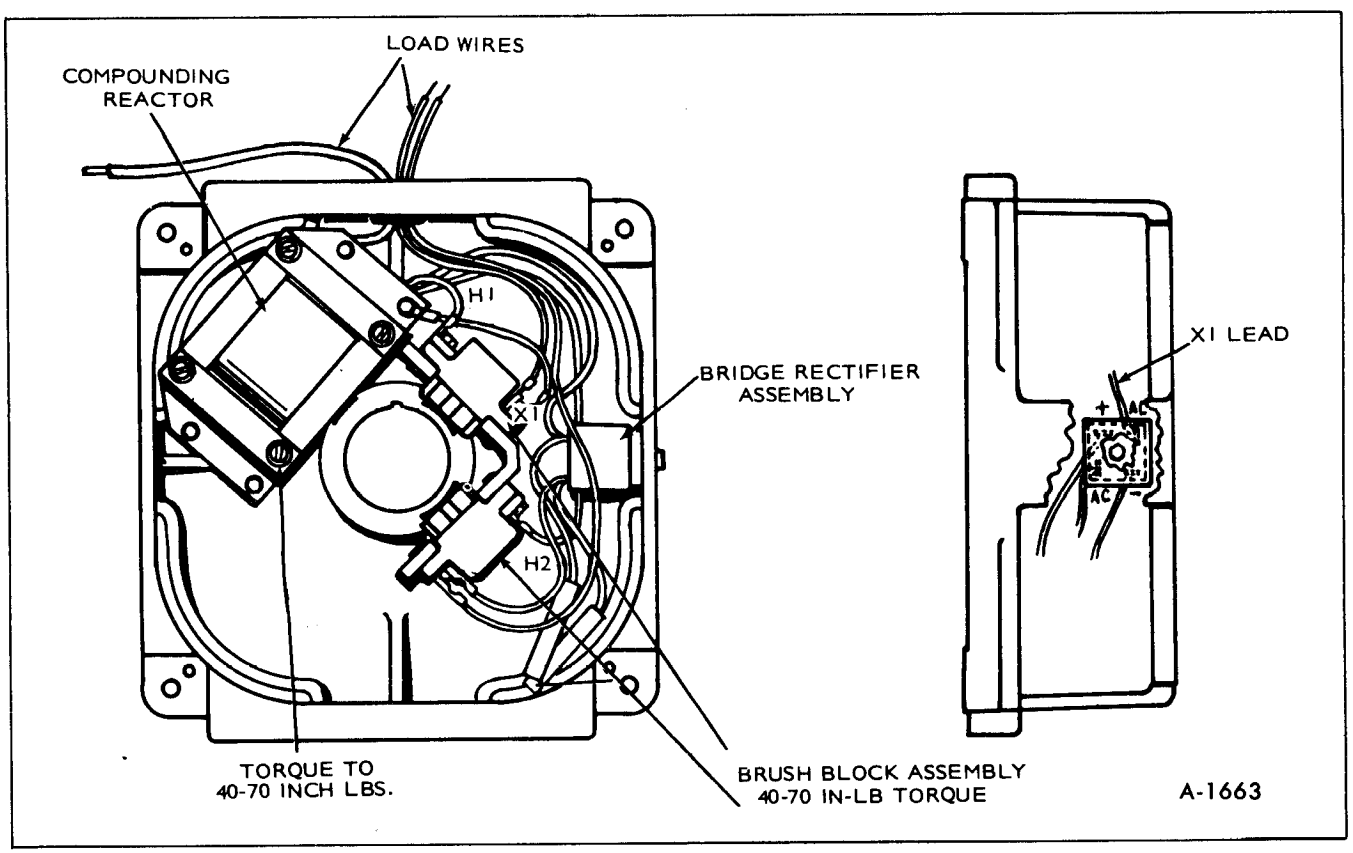


Figure 77–End Bell Assembly

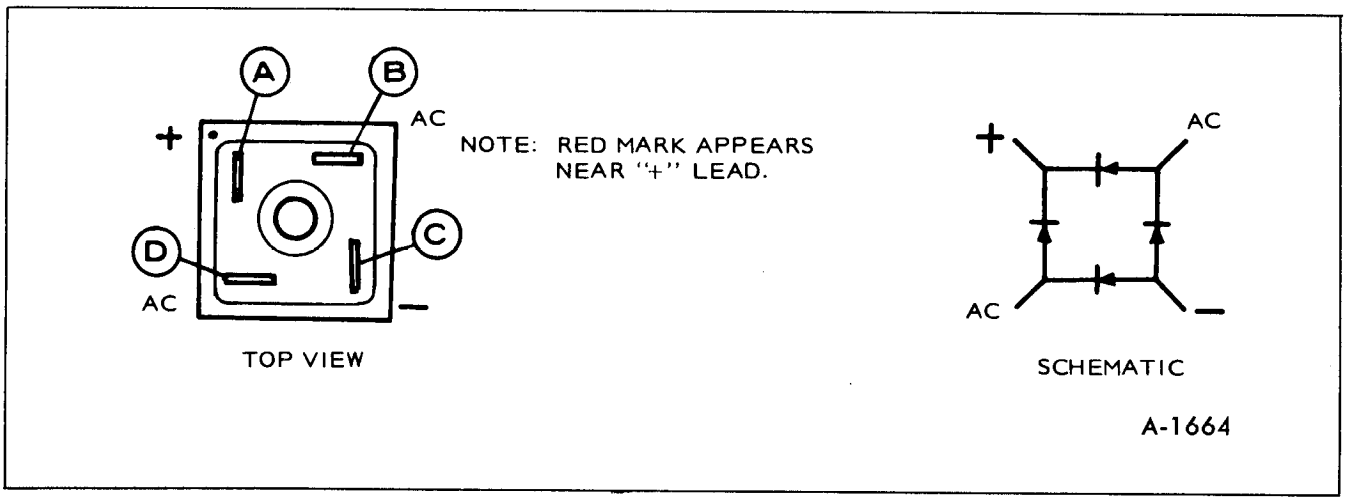


Figure 78–Testing Bridge Rectifier

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

* ± 10% – Readings taken at 70 F.

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

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.*

COLLECTOR RINGS

Collector rings acquire a glossy brown finish in 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 (#00) 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.

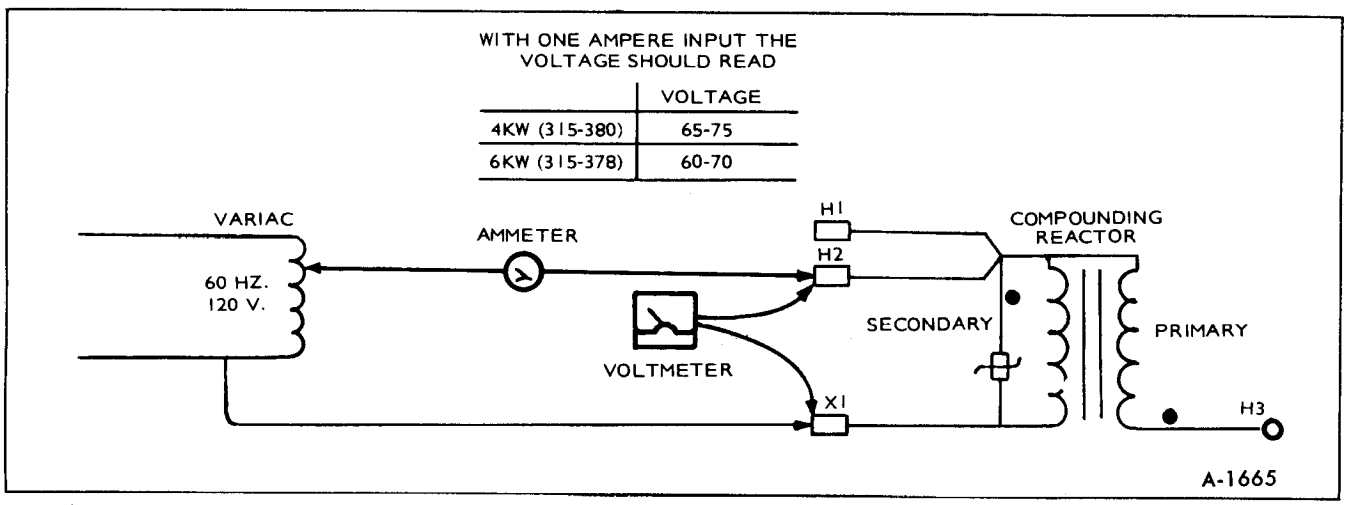


Figure 79–Testing Compounding Reactor

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 79, using a Variac.

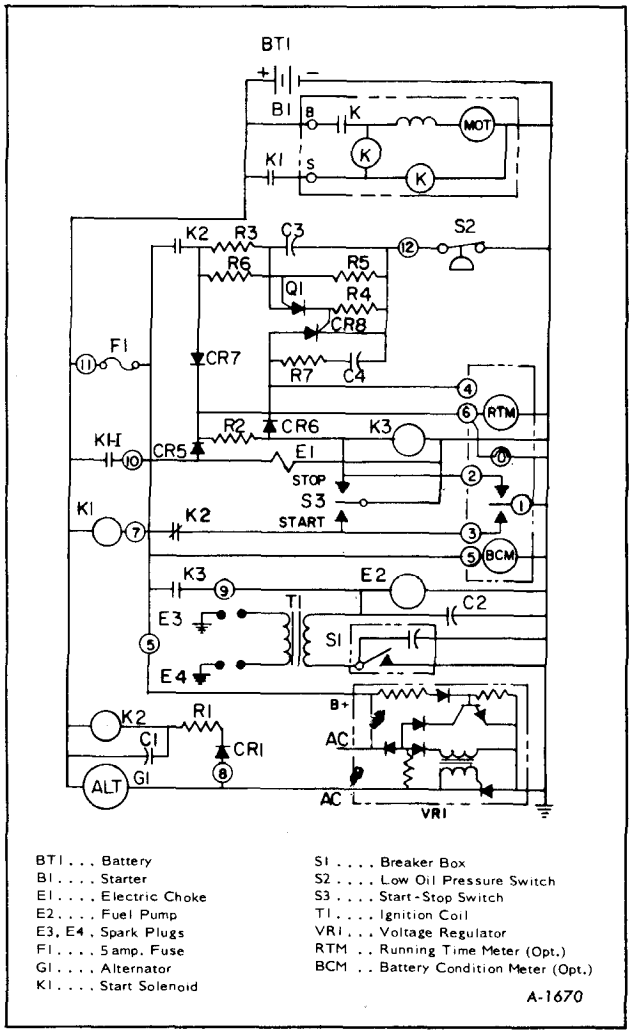
CONTROLS

OPERATION (FIGURE 80)

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 and fuel pump. The engine cranks and the fuel pump and ignition operate to start the engine. The remote start switch is connected as shown in Figure 81.

NOTE: For details on control panel, refer to figures 82 and 83.



BTI . . . Battery
BI . . . . Starter
EI . . . . Electric Choke
E2. . . . Fuel Pump
E3, E4 . Spark Plugs
FI . . . . 5 amp. Fuse
GI . . . . Alternator
KI . . . . Start Solenoid
SI . . . . Breaker Box
S2 . . . . Low Oil Pressure Switch
S3 . . . . Start-Stop Switch
TI . . . . Ignition Coil
VRI . . . Voltage Regulator
RTM . . Running Time Meter (Opt.)
BCM . . Battery Condition Meter (Opt.)

A-1670

Figure 80–Control System Schematic

ENGINE STARTS:

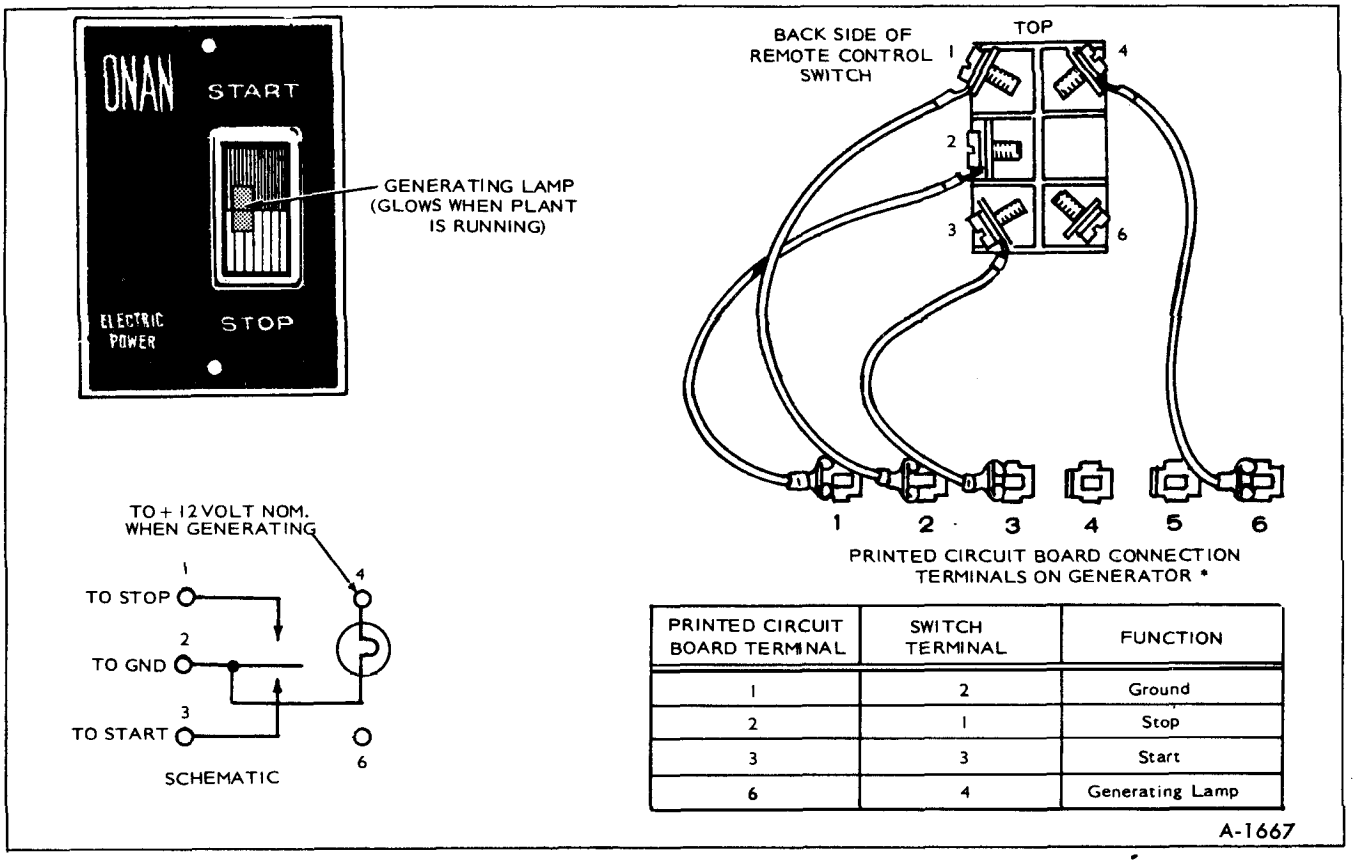
When the starting rpm increases, the alterantor develops a voltage great enough to be rectified and energize relay K2. Relay K2 contacts close to hold relay K3 energized, and K2 normally closed contacts open to drop K1 start solenoid. K3 contacts maintain current to ignition coil and fuel pump. The engine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



PRINTED CIRCUIT BOARD TERMINAL	SWITCH TERMINAL	FUNCTION
1	2	Ground
2	1	Stop
3	3	Start
6	4	Generating Lamp

Figure 81–Remote Control Switch

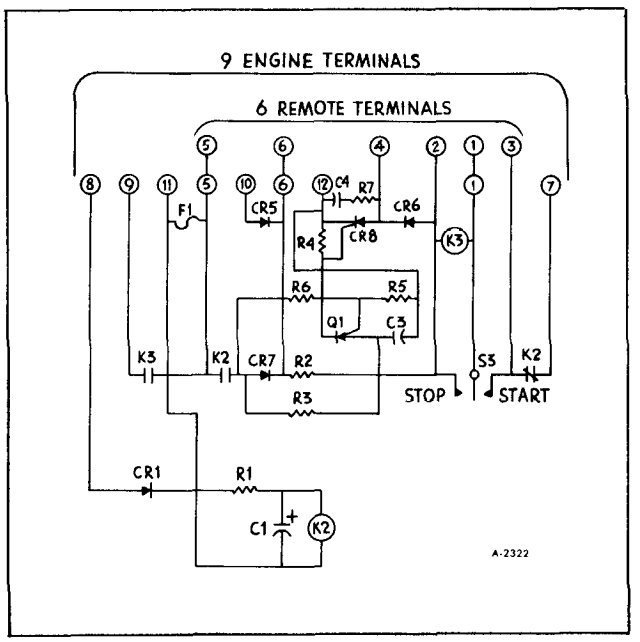
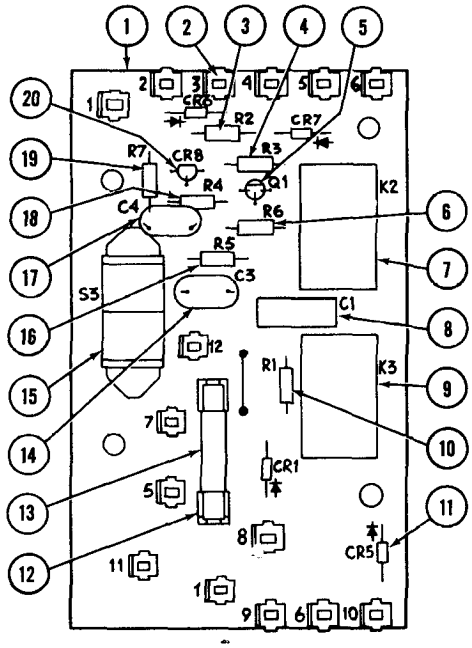


Figure 82–Control Panel Wiring

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.*



ITEM	SYMBOL	DESCRIPTION
1		Printed Circuit Board
2		Terminal
3	R2	Resistor—150 Ω, ½W 10%
4	R3	Resistor—470K Ω, ½W 10%
5	Q1	Transistor—Unijunction, 2N6027
6	R6	Resistor—16K Ω, ½W 5%
7	K2	Start Disconnect Relay
8	C1	Capacitor—100 MFD, 25VDC
9	K3	Engine Stop Relay
10	R1	Resistor—200 Ω, ½W 5%
11	CR1-7	Silicon Rectifier—.5A, 100V
12		Fuse Clip
13	F1	Fuse—5A
14	C3	Capacitor—5 MFD, 25V
15	S3	Rocker Switch
16	R5	Resistor—27K Ω, ½W 5%
17	C4	Capacitor—.1 MFD, 100V
18	R4	Resistor—100 Ω, ½W, 10%
19	R7	Resistor—2.7 Ω, ½W 5%
20	CR8	Gate Control Rectifier—.8A, 30V

A-2323

Figure 83–Control Panel

SPECIFICATIONS

4KW MODEL

ENGINE

Engine Manufacturer ..... Onan
Engine Design ..... Four Cycle, Air Cooled, L Head
Fuel Used ..... Gasoline (Regular Grade)
Number of Cylinders ..... Two
Bore ..... 3-1/8 inch
Stroke ..... 2-5/8 inch
Oil Capacity ..... 3 quarts
(With Filger Change) ..... 3-1/2 quarts
Battery Voltage ..... 12 volt
Starting System ..... Solenoid Shift
Battery Charging System ..... *10 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 ..... Gasoline, Regular Grade
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 Gap ..... .020 inch
Breaker Point Gap (Full Separation) ..... .020 inch
Ignition Timing (Engine Running or Static) ..... 25° BTC
Tappet Adjustment (Engine Cold)
Intake ..... .003 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

	INCHES		
CYLINDER AND PISTON			
Piston to Pin (70°)	.0001	–	.0005
Pin to Connecting Rod Clearances	.0002	–	.0007
Piston Ring Gap in Cylinder	.010	–	.020

Piston Clearance in Cylinder Solid Type-Measured .10 Below Oil Controlling Ring – 90° From Pin	.003	–	.005
Cylinder Bore-Honed Std.	3.1265	–	3.1275
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″	
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		45°	
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″
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″	–	0.003″
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-controlling ring – 90° from pin Clearance	0.0015″	–	0.0035″
Piston Pin Diameter	0.7500″	–	0.7502″
Piston Pin in Piston		Thumb Push Fit	
Piston Pin in Rod	0.0001″	–	0.0005″
Piston Ring Groove Width			
Top 1	0.0955″	–	0.0965″
Top 2	0.0955″	–	0.0965″
Top 3	0.1880″	–	0.1890″
Crankshaft Main Bearing Journal – Standard Size	1.9992″	–	2.000″
Main Bearing Diameter	2.0015″	–	2.0040″
Main Bearing Clearance	0.0015″	–	0.0043″
Crankshaft Rod Bearing Journal – Standard Size	1.6252″	–	1.6260″
Cylinder Bore – Standard Size	3.5625″	–	3.5635″

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
Generator Through – Studs	15-18
Armature Hold-down Nut (12-Point)	45-50
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
Oil Pan Screws (18)	8-12

Starter Mounting Bolts	18-20
Generator Through-Studs	15-18
Armature Hold-Down Nut (12 Point)	45-50
Spark Plugs	15-20
GENERATOR (4KW and 6KW)	**FT.-LBS.**
Generator Through Studs (4)	15-18
Armature Hold Down Nut-12 Point	45-50
Compounding Reactor Studs	4-6
Brush Block Assembly Studs	4-6

KOHLER MOTOR GENERATOR

Contents of this sub-section are listed below:

GENERAL INFORMATION

The 4,000 watt Kohler motor generator (figure 1) is powered by a single, horizontally mounted, cylinder gasoline engine. The generator has a built-in exciter which functions as a starter motor to crank the engine during starting then switches to its generating function after the engine starts. The exciter functions as a battery charger while the engine is operating.

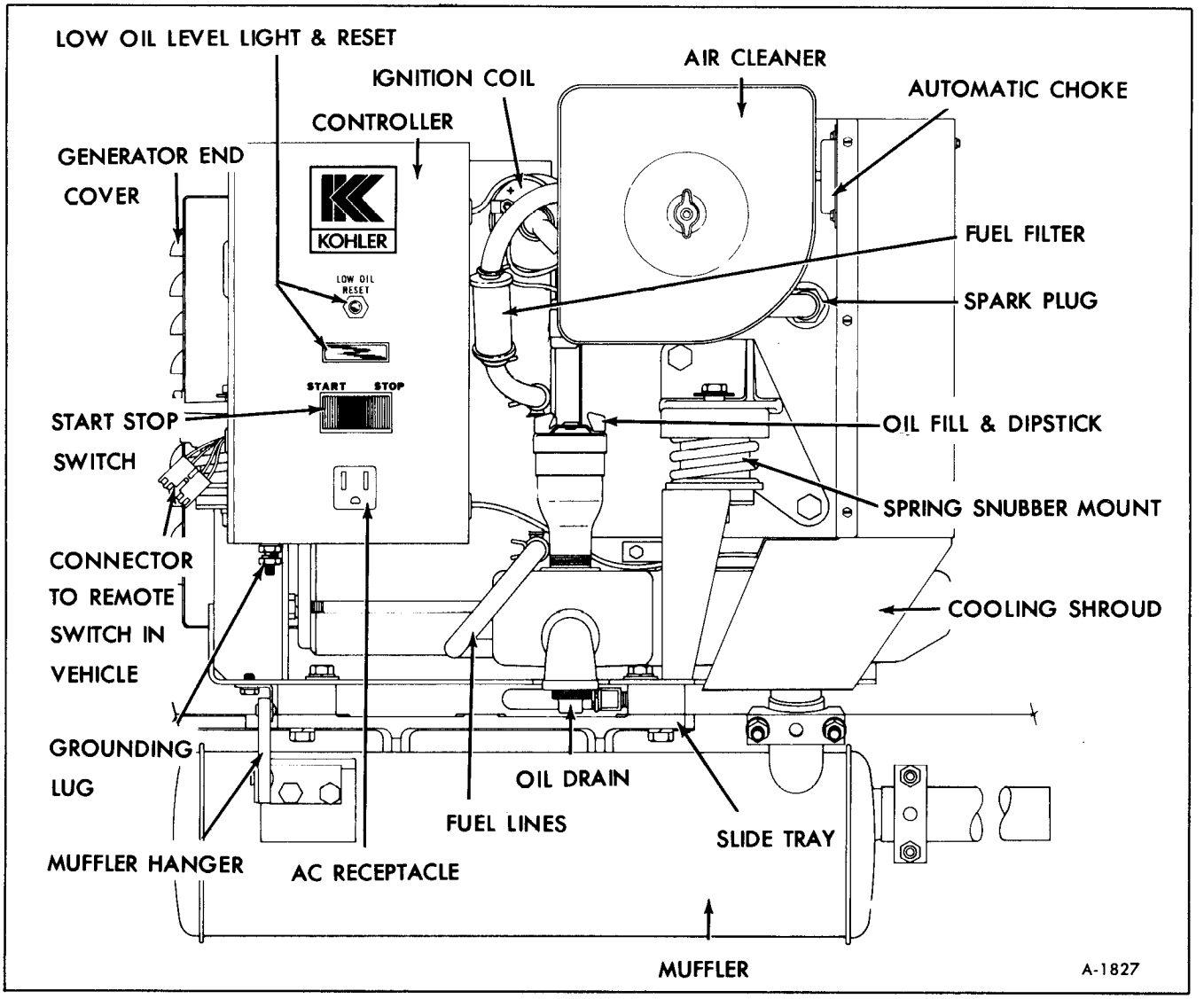


Figure 1–4KW Kohler Motor Generator

Lubrication is provided by a splash type oil system. a low oil sensor is built into the unit to protect the engine.

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

MOTOR GENERATOR TROUBLE DIAGNOSIS

ENGINE DIAGNOSIS

When troubles occur, don't overlook simple causes which might seem too obvious to be considered. A starting problem could, for example, be attributed simply to an empty fuel tank. The chart below lists some common causes of engine troubles – use this as a guide to locate causing factors.

PROBLEM	FUEL RELATED CAUSES			IGNITION CAUSES		OTHER CAUSES						
	NO FUEL	IMPROPER FUEL	FUEL MIX. WRONG	NO SPARK	POOR IGNITION	IMPROPER COOLING	IMPROPER LUBRICATION	POOR COMPRESSION	VALVE PROBLEMS	CARBON BUILD-UP	GOVERNOR FAULTY	ENGINE OVERLOADED
WILL NOT START	X			X				X	X			
HARD STARTING		X	X		X	X		X	X			
STOPS SUDDENLY	X			X			X		X			
LACKS POWER		X	X		X	X		X	X	X		X
OPERATES ERRATICALLY		X	X		X						X	
KNOCKS OR PINGS		X	X			X				X		X
"SKIPS" OR MISFIRES			X		X							
BACKFIRES			X		X				X			
OVERHEATS			X		X	X			X			X

Kohler Motor Generator Diagnosis

GENERATOR DIAGNOSIS

Problem	Possible Cause
No output.	LOOSE TERMINAL CONNECTIONS: Check for loose or bad connections. BRUSHES NOT SEATED: Check for loose springs or brushes sticking in holder. DIRTY COMMUTATOR: Poor contact caused by build up of dirt or oily film on commutator. SHORT IN AC CIRCUIT: If engine labors while running, check for short circuit in AC line. If a short develops in the AC armature, the armature will get very hot. BATTERY CONNECTIONS REVERSED (MUST BE NEGATIVE GROUND)

Problem	Possible Cause
Low output or excessive drop in voltage.	ENGINE SPEED TOO LOW: Check with tachometer. Readjust governor speed. OVERLOAD: Make sure plant capacity is not being exceeded. ENGINE IN POOR CONDITION: Poor compression, excessive carbon, faulty ignition, wrong polarity or any other condition causing poor performance may show up in reduced output. CYCLIC COMPENSATOR DEFECTIVE BRUSHES WORN EXCESSIVELY
	BRUSHES STICKING: If brushes are wrong size, they may stick in holder and chatter. BRUSH TENSION WRONG: If spring tension is wrong, brushes may chatter. WRONG BRUSHES: Brush grade and material must be correct – use only specified brushes.

CYCLIC COMPENSATOR DIAGNOSIS

Some problems that could be attributed to defects in the Cyclic Compensator circuit are described in the following.

1. *No AC output.* If the battery cables are reversed, no output can be obtained because the diode acts to block the shunt field circuit. The battery must have a negative ground. Failure of the diode in the open mode could also be the cause of no output.

2. *Abnormal AC output voltage.* Variations in voltage could be caused by loose connections in the circuit – if this condition is found, the Cyclic Compensator could be damaged as a result. Higher than normal voltage may be an indication that the compensator is continuously shorting out the field resistor. Lower than normal voltage may indicate that the compensator is not triggering.

3. *Test to establish cause.* Since the symptoms described in foregoing may be due to causes other than a faulty Cyclic Compensator, make the following test to determine if the compensator is actually at fault.

STEP A: Operate the generator set and record the output voltages.

STEP B: Stop the set then disconnect the red lead at the field resistor. CAUTION: Severe arcing will occur if the set is running when this lead is disconnected.

STEP C: Restart the set and compare output voltage to that obtained in Step A. If voltage was high and decreases with red lead disconnected, the Cyclic Compensator has failed "shorted". If voltage was low and disconnecting the red lead has no effect, the compensator has failed "open" or the connections to it are not proper. Shorting the resistor should cause the voltage to go higher than normal.

MOTOR GENERATOR REPLACEMENT

REMOVAL

1. Disconnect the fuel inlet line at the fitting on the bottom of the mounting skid.

2. Disconnect battery leads from solenoid inside the controller then unplug the switch leads from the

connector at the side of the controller box. The set is grounded to the vehicle frame, disconnect this lead from the connector on the upper corner of the generator frame. Disconnect load leads from terminals L1, L2 and L3 inside controller.

3. Remove the muffler from the bottom of the mounting skid.

4. Remove the four capscrews which secure the mounting skid to the support rails then slide the set out of vehicle.

5. Disconnect the fuel line running from the skid to the fuel pump at the fitting on the pump, remove the mounting screw from each of the four rubber mounts then lift the engine-generator off the mounting skid (figure 2).

INSTALLATION

1. Position motor generator on mounting skid and install mounting screw at each of the four rubber mounts. Connect fuel line to fuel pump.

2. Position motor generator and mounting skid assembly on support rails and secure with four cap screws.

3. Install muffler to bottom of mounting skid.

4. Connect load leads to terminals L1, L2 and L3 inside controller. Connect ground lead to upper corner of generator frame. Connect switch leads at connector at side of controller box. Connect battery leads to solenoid inside controller.

5. Connect fuel inlet line at fitting on bottom of mounting skid.

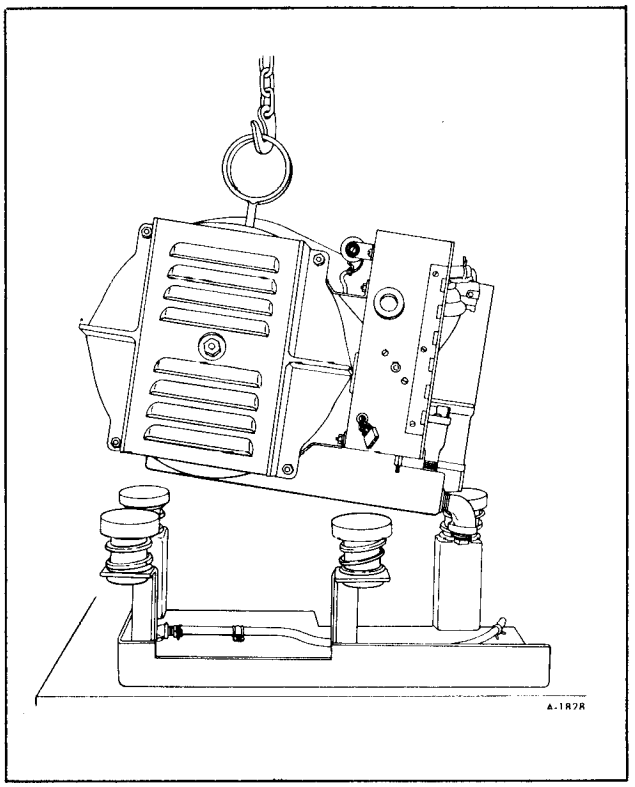


Figure 2–Separating Generator Set from Mounting Skid

ENGINE REPAIR

The generator set must be completely removed from the vehicle to make the repairs described in this section. The motor generator must also be separated from the mounting skid – the threaded hole at the top of the generator frame is for a lifting eye.

SEPARATING GENERATOR FROM ENGINE

After removing the mounting skid, place blocks under the motor generator so that the weight of the unit rests on the oil pan of the engine then remove the generator using the following procedure.

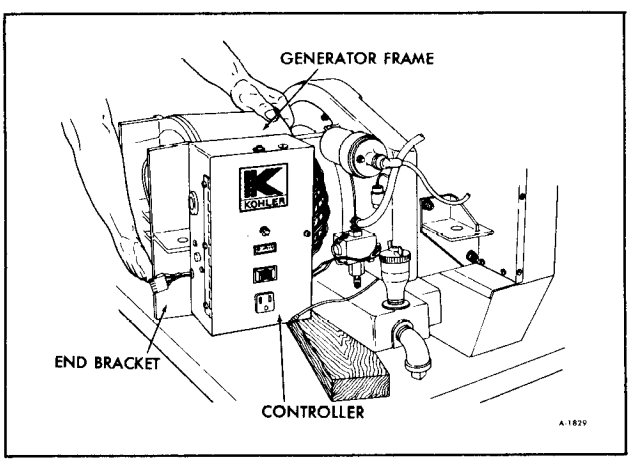


Figure 3–Removing End Bracket

1. Disconnect leads at terminal 5 in the controller – these go to ignition coil and electric fuel pump.

2. Remove generator end cover, lift AC and DC brushes then remove the four nuts which secure the end bracket assembly to the frame of the generator. Use puller to separate the end bracket from the ball bearing (figure 3).

3. The end bracket and generator frame (with controller attached) can now be slipped over the end of the armature and removed.

4. Remove the air baffle from the fan housing, (figure 4) turn the thru bolt out about 2-3 turns then bump the end of the thru bolt (with soft head hammer) until the armature separates from the taper on the engine crankshat (figure 5). Do not separate the rotor and adapter from the armature unless it is necessary to replace either of these items.

5. To avoid bending the studs or resulting breakage of the fan housing at the stud bosses, remove the 4 long studs from the housing – this completes the procedure for removing the generator from the engine.

ROTOR ADAPTER

The generator must be disassembled to replace the rotor adapter or rotor. The adapter and rotor are secured as a unit to the generator armature. If rotor replacement is needed, it is not necessary to separate the adapter from the armature. If replacing the adapter, make sure the roll pin is used to locate the replacement adapter – this is for balancing the rotor adapter.

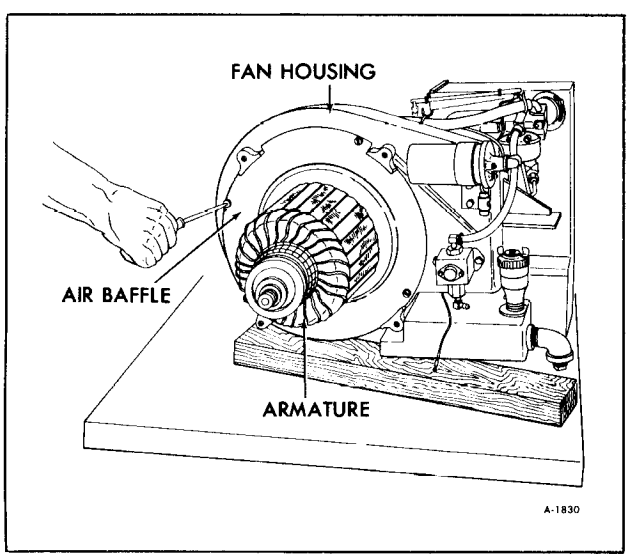


Figure 4–Removing Air Baffle From Fan Housing

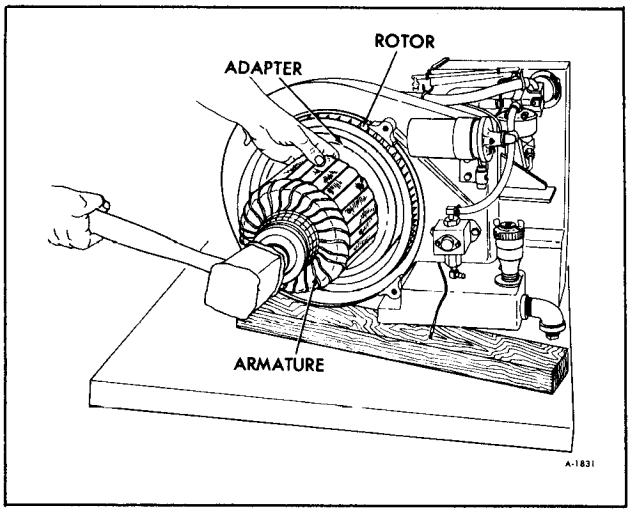


Figure 5–Separating Armature From Crankshaft

BALL BEARING

The generator must be separated from the engine and the crankshaft removed from the engine to replace either of the ball bearings. After removing the fan housing and closure plate, disconnect the connecting rod then press the crankshaft out of the crankcase. The ball bearings are press fitted on the crankshaft – use an arbor press to remove the faulty bearing and also to press the replacement bearing on the shaft. Crankshaft end play must be checked after reinstallation (refer to crankshaft procedure) and new oil seals should also be installed.

CAMSHAFT

To repair or replace the ACR actuating spring on the cam gear, remove the gear cover at top of engine and turn the crankshaft until the ACR mechanism appears. To replace the camshaft, removal of the generator, fan housing, closure plate and crankshaft is required. The camshaft is hollow and rides on a pin pressed into both sides of the crankcase. Press the pin out thru the fan housing side of the crankcase then remove the camshaft. When installing replacement camshaft, use .005 and .010" spacers as required to establish .005-.010" end play – refer to Figure 6 for end play. The pin must be pressed in from the fan housing side of the crankcase due to tapered bore on the opposite end of the crankcase (figure 7).

CRANKCASE

The generator must be removed and the engine completely disassembled to facilitate replacement or reboring of the crankcase. If the engine is damaged

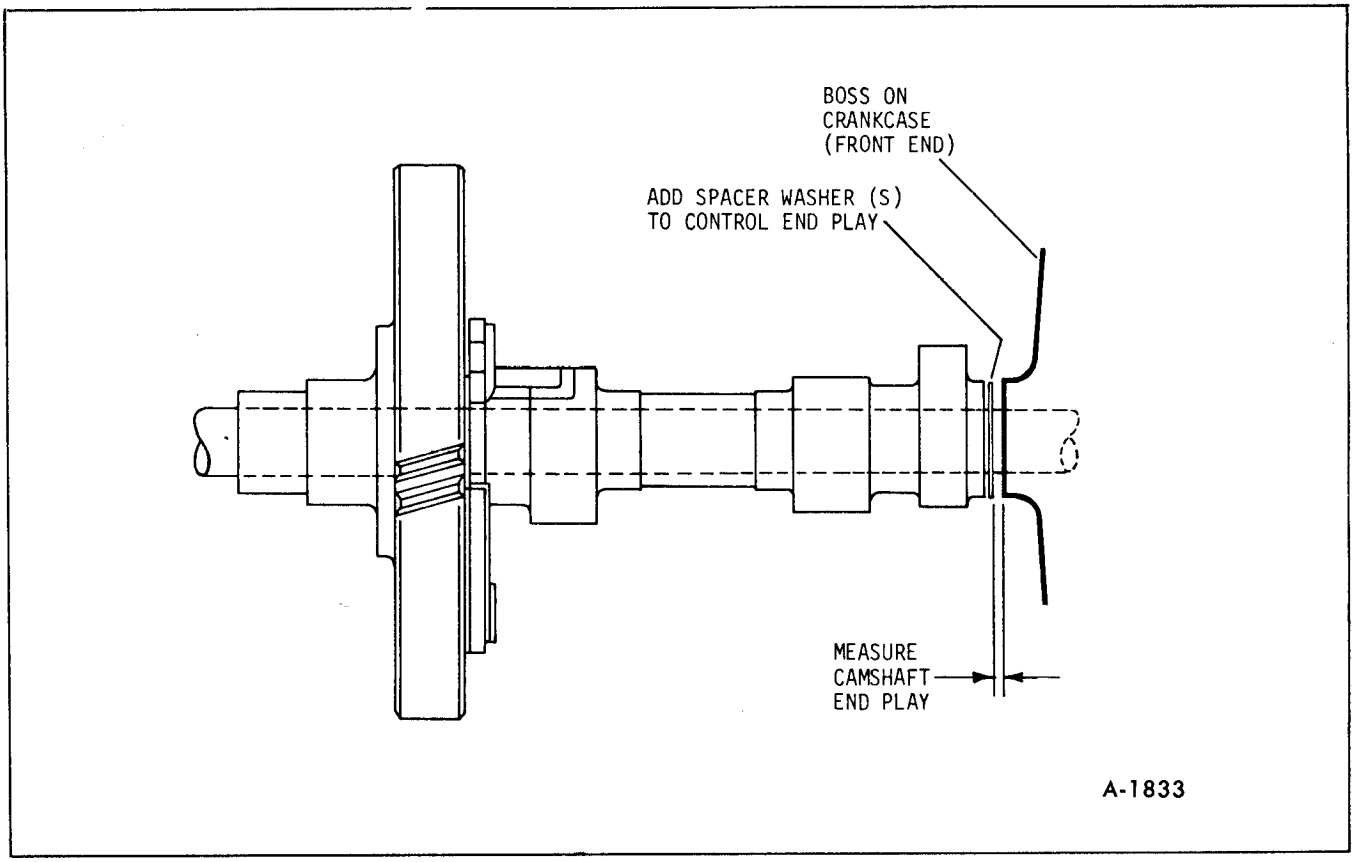


Figure 6–Camshaft Endplay Adjustment

extensively, a new short block assembly should be used. The short block includes crankcase with all internal parts such as crankcase, camshaft, piston-rod, valves plus fan housing installed. All other items are either transferred from the failed engine or taken from stock to build the short block up to a complete engine. If reboring is needed, rebore cylinder .010, .020 or .030" oversize and use the corresponding

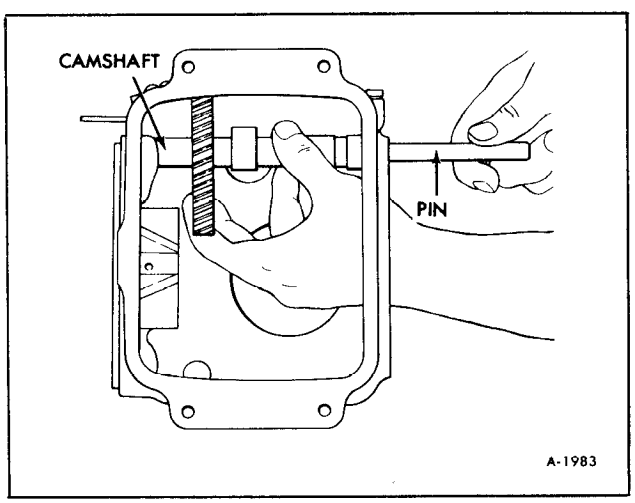


Figure 7–Installing Camshaft Pin

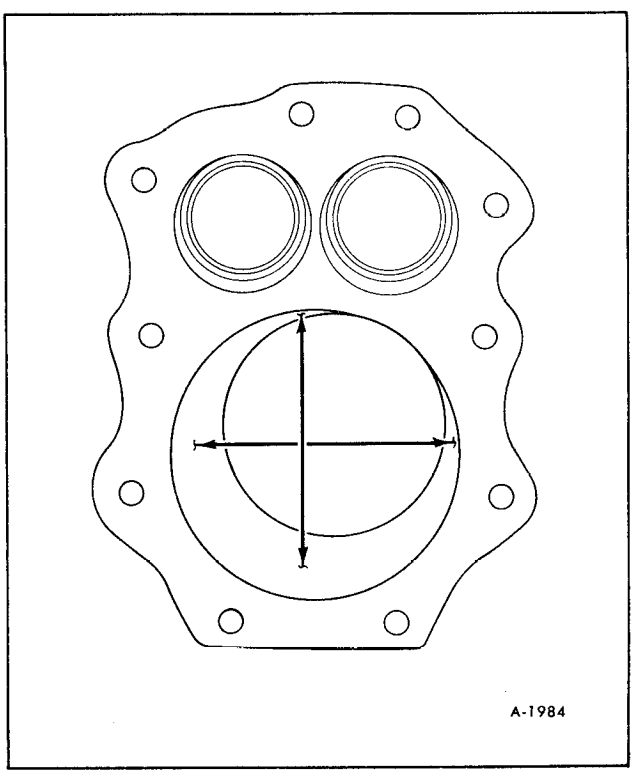


Figure 8–Measuring Cylinder Bore For Out of Round

oversize piston-ring assembly. New diameter of the cylinder is 3.750" – rebore to the nearest oversize when cylinder bore is worn to 3.753" or taper exceeds .0015" or the bore is out of round more than .005". These measurements are shown in Figure 8.

CYLINDER REBORING PROCEDURE: (figure 9) While most commercially available cylinder bores can be used with either portable drills or drill presses, the use of a low speed drill press is preferred as it facilitates more accurate alignment of the bore in relation to the crankshaft crossbore. Reboring is best accomplished at drill speed of about 600 RPM. After installing coarse stones in hone, proceed as follows.

1. Lower hone into bore and after centering, adjust so that stones are in contact with walls. Diesel fuel oil or kerosene can be applied to the stones as a cutting-cooling agent.

2. With the lower edge of each stone positioned even with the lowest edge of the bore, start drill and honing process. Move hone up and down while reboring to prevent formation of cutting ridges. Check size frequently.

3. When bore is within .0025 of desired size, remove coarse stones and replace with burnishing stones. Continue with burnishing stones until within .0005 of desired size then use finish stones and polish to final size.

4. After reboring, carefully clean cylinder wall with soap and water, then after drying thoroughly, apply light coat of SAE 10 oil to prevent rust.

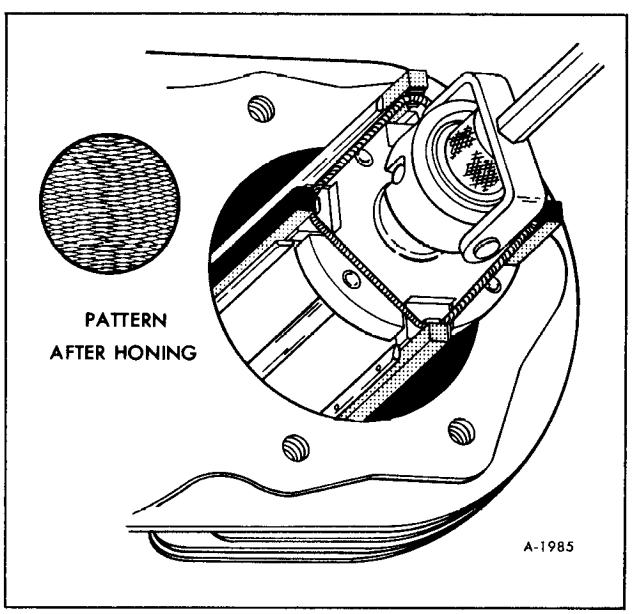


Figure 9–Reboring Cylinder with Hone

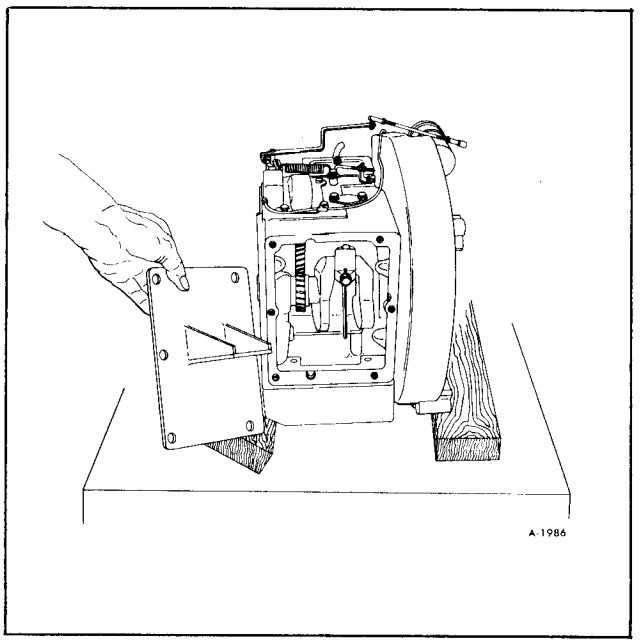


Figure 10–Removing Closure Plate

CRANKSHAFT

The generator, closure plate and fan housing must be removed before the crankshaft can be removed (figure 10). New diameter of the crankpin is 1.500 – regrind crankpin or replace crankshaft if the crankpin out of round exceeds .0005 or if the taper exceeds .001". If keyway or gear teeth are worn or chipped, replace the crankshaft. Slight scoring of the crankpin can be cleaned with crocus cloth soaked in oil. If crankpin limits stated above are exceeded, replace crankshaft or regrind crankpin to use the .010" undersize connecting rod. Crankshaft end play

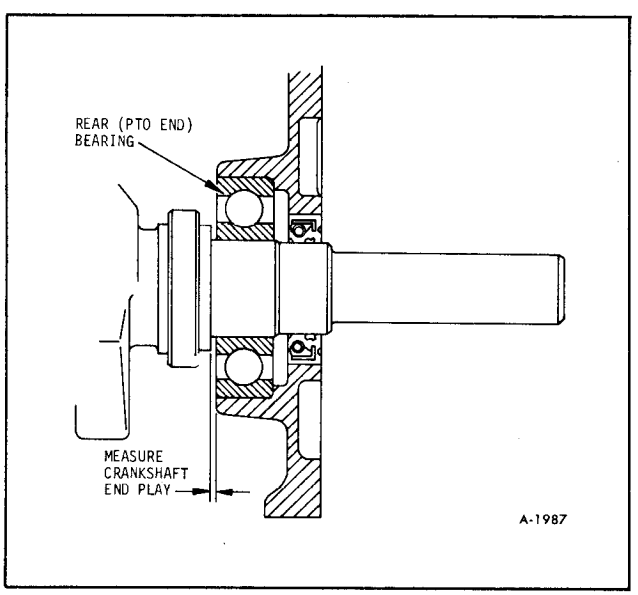


Figure 11–Crankshaft Endplay Adjustment

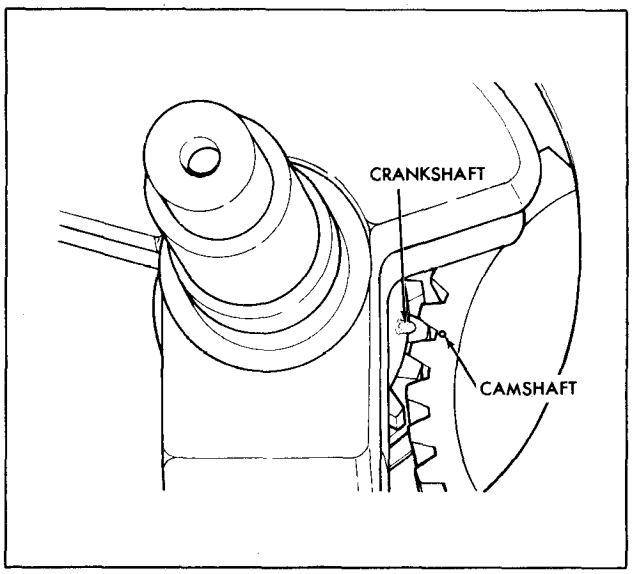


Figure 12–Timing Marks on Crankshaft and Camshaft

is established by installation of .010 and .020" fan housing gaskets as required to obtain correct end play of .002-.030" – refer to Figure 11 for details. Install thick gasket next to crankcase. When installing crankshaft, the timing marks on crankshaft and camshaft must be aligned as shown in Figure 12.

GOVERNOR GEAR

The generator, fan housing, crankshaft and camshaft must be removed before the governor gear assembly can be replaced. Individual components of this assembly are non-serviceable – the assembly must be completely replaced if faulty. To replace, remove the welch plug, cross shaft bushing (see Figure 13) then pull the governor cross shaft out of the bushing so that it can be moved out of the way of the gear assembly. Press the gear assembly out of the crankcase, install new spacer washer, then replacement gear assembly. Reinstall cross shaft, welch plug, etc. The spacer washer eliminates the necessity for end play adjustment.

VALVE GUIDE

To replace the valve guides, remove the valve cover, crankcase breather parts, cylinder head and valves then press guides into the valve chamber and carefully break protruding end until guide is completely removed. The guides should be replaced when the guide to valve stem clearance exceeds .0045". Install replacement guides to depth shown in Figure 21, then ream guide to .312-.313" I.D. with suitable valve guide reamer.

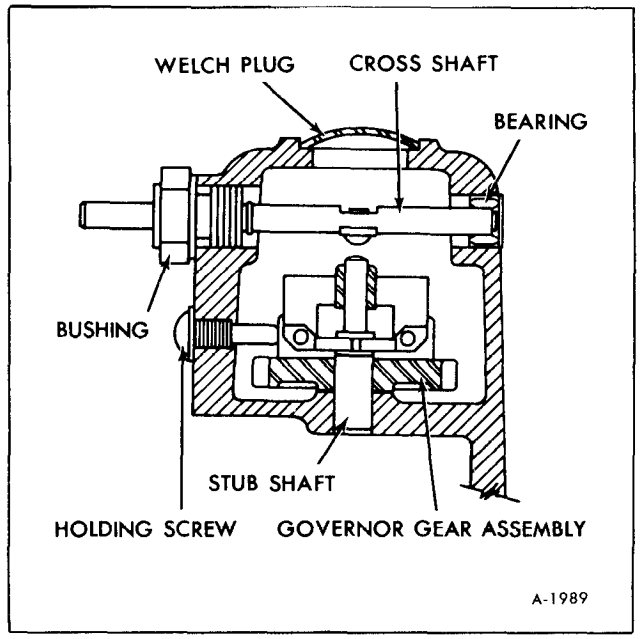


Figure 13–Cutaway View of Governor

FAN HOUSING

Generator must be removed to replace the fan housing. The housing is secured to the engine crankcase with four countersunk screws. Detach the ignition coil, condenser and electric fuel pump from housing being replaced and install these on replacement housing after it is in position.

NOTE: Use same number of gaskets between housing and crankcase as this controls crankshaft end play.

VALVE SEAT INSERT

Cylinder head and valves must be removed to inspect or recondition the valve seat inserts. Seating surfaces can usually be reconditioned – seating angle is 89° and width should be as close to 1/32" as possible. If width exceeds 1/16", recondition with 45° and 15° cutters. After recutting, valves must be tapped in to provide proper seat. Make sure valve clearance is readjusted after reconditioning the seat inserts.

OIL PAN

To replace the oil pan or gasket, drain oil from pan, disconnect the engine and generator mounts, lift the engine-generator off the mounting skid then remove the four capscrews securing the pan to the crankcase then remove the oil pan. If the pan is to

be replaced, remove the oil level indicator mechanism and transfer to the replacement pan.

CYLINDER HEAD

To remove the cylinder head, disconnect the engine and generator mounts, then lift the engine-generator off the mounting frame. After this is done, remove the front mount support, spark plug, carburetor (detach at adapter), side air duct then the cylinder head and gasket. Blocked cooling fins often cause localized "hot spots" which can result in "blown" cylinder head gaskets. If gasket fails in area surrounding one of the retaining capscrews, high temperature combustion bases can burn away portions of aluminum alloy head. If no evidence of this is found, head should be checked for flatness. A slightly warped head can be resurfaced by simply rubbing it on a piece of sandpaper positioned on a flat surface. Carefully clean carbon deposits from cylinder head if it is to be reused – use putty knife of similar blade to scrape deposits. Be careful not to nick or scratch aluminum, especially in gasket seat area. Always use new cylinder head gasket and tighten cylinder head bolts in the sequence specified (Refer to figure 14). Torque bolts to 25 foot-pounds.

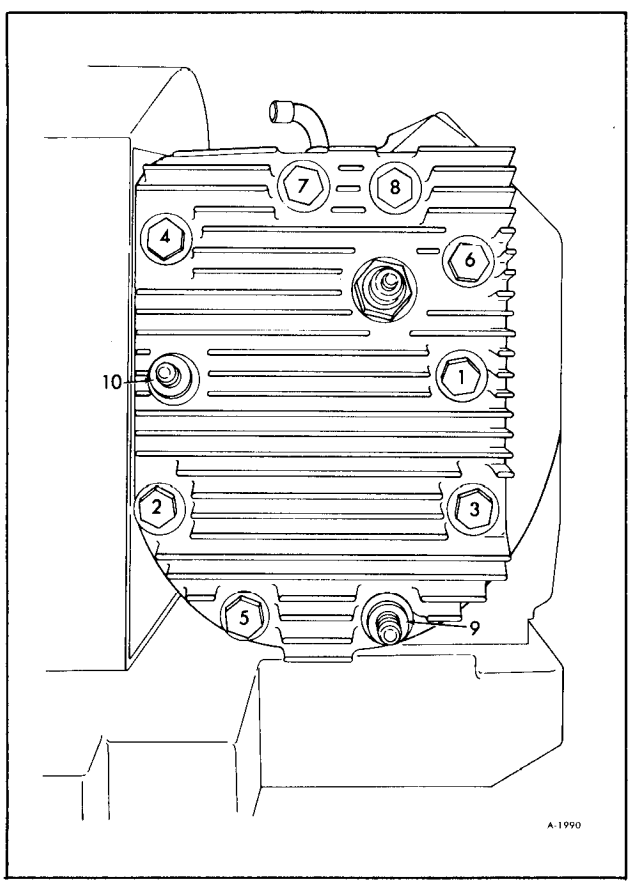


Figure 14–Cylinder Head Tightening Sequence

PISTON AND PISTON RINGS

The piston-rod assembly can be removed without complete disassembly of the engine. To remove, disconnect motor generator from the skid, lift the motor generator off the skid then remove closure plate and cylinder head. Detach connecting rod from crankshaft then push piston-rod out thru head side of the cylinder. If a ridge has formed on outer edge of the cylinder, this will have to be removed with reamer before piston can be pushed out. Always install new piston rings – service rings are available in a standard set for use with original bore size and in .010", .020" and .030" oversize sets for rebored cylinders. Piston assemblies, including rings, pin and retaining rings, are also available in standard size and .010", .020" and .030" oversizes.

DAMAGE ANALYSIS: Scuffing and scoring of pistons and cylinder walls occurs when internal temperatures approach the melting point of the piston. Temperatures high enough to do this are created either by friction, which is usually attributed to improper lubrication, and/or overheating of the engine itself due to improper cooling. Ring failure is usually indicated by excessive oil consumption and blue exhaust smoke. When rings fail, oil is allowed to enter the combustion chamber where it is burned along with the fuel. High oil consumption can also occur when ring gap is incorrect – rings cannot properly conform to the cylinder walls under this condition. Oil control is also lost when ring gaps are not staggered during installation. When cylinder temperatures get too high, lacquer and varnish collect on pistons causing rings to stick which results in rapid wear of rings. A worn ring takes on a shiny or bright appearance. Scratches on rings and pistons are caused by abrasive material such as carbon or pieces of hard metal. Detonation damage occurs when a portion of the fuel charge ignites spontaneously from heat and pressure shortly after ignition. This creates two flame fronts which meet and explode to create extreme hammering pressures on a specific area of the piston. Detonation generally occurs from using fuels with too low octane rating. Pre-ignition or ignition of fuel charge before the timed spark can cause damage similar to detonation. Pre-ignition damage is often more severe than detonation damage – often, a hole is quickly burned right thru the piston dome by pre-ignition. Pre-ignition is caused by a hot spot in the combustion chamber such as glowing carbon deposits, blocked fins. improperly seated valves or wrong spark plug.

INSTALLATION: (figure 15 and 16) Before installing rings on piston, insert rings in cylinder bore to check for proper end gap. If cylinder bore is original size, ring end gap will be .010-.020" – if the bore is worn but within tolerances, end gap up to .030" is acceptable (figure 17). Replace piston if thrust face diameter is worn beyond 3.7425 – measure this just

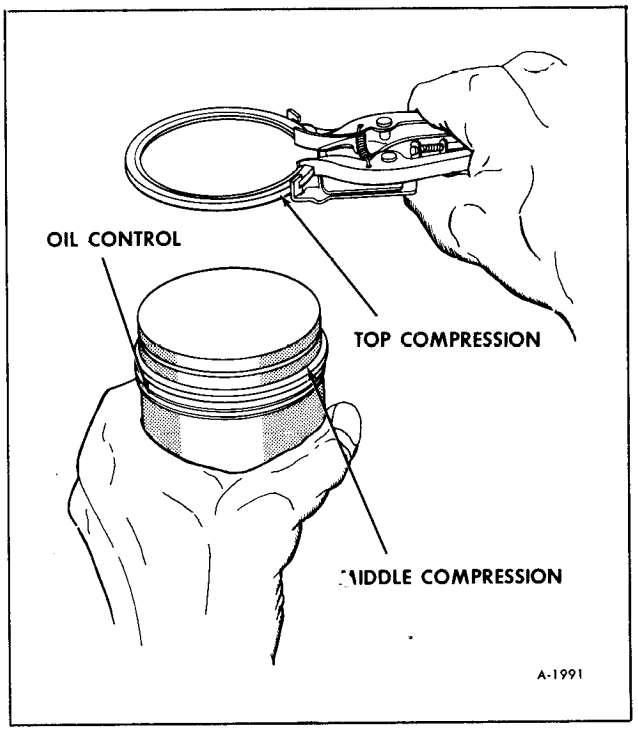


Figure 15–Installing Piston Rings

below the oil control ring groove and at right angles to the piston pin. Cylinder bore must be deglazed before using service ring sets.

CONNECTING ROD

Inspection of the connecting rod can be accom-

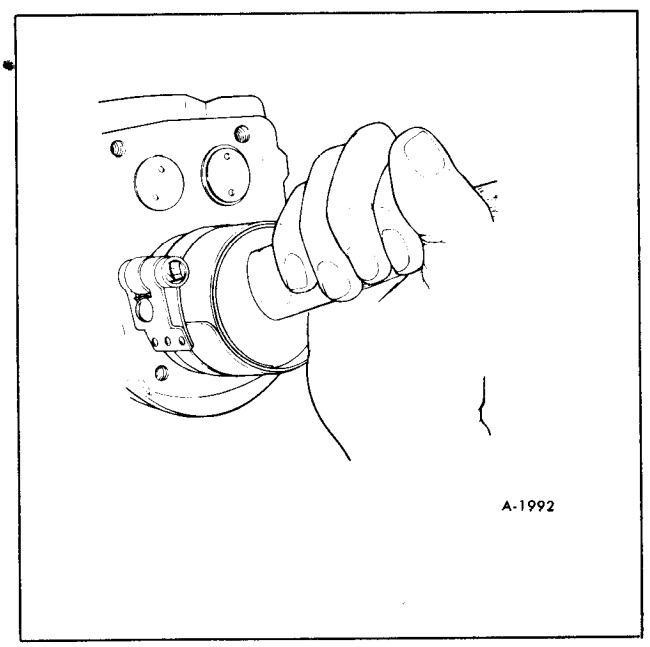


Figure 16–Using Ring Compressor To Install Piston

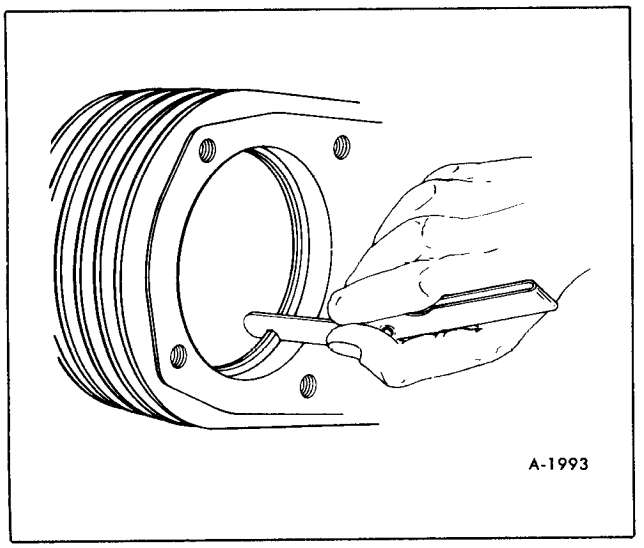


Figure 17–Measuring Piston Ring End Gap

plished after lifting the motor generator off the mounting skid and removing the closure plate.

DAMAGE ANALYSIS: Whenever a rod failure is encountered, look for telltale signs of heat discoloration in the big end area. Note that tin-plated connecting rods do not become black from overheating as do rods that are not plated – tin-plated rods will, however, discolor sufficiently to recognize overheating. Discoloration indicates overheating due to lack of proper lubrication. Improper lubrication re-

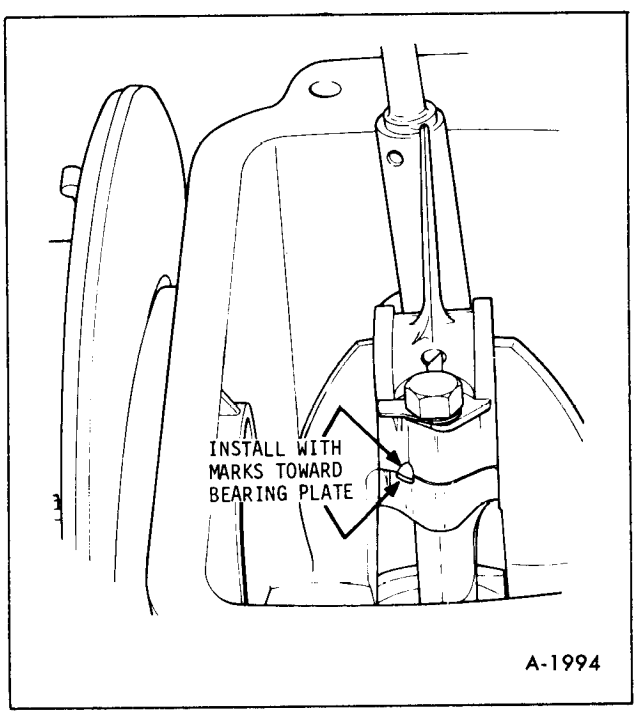


Figure 18–Match Marks on Connecting Rod and Cap

sults from using the wrong type of oil, operating with contaminated oil or oil that has broken down from extensive use. Running completely out of oil or operation with oil level below or above the safe range also contributes to rod failures. When such indicators are noted, stress the importance of using the right oil, keeping the level in the safe range, and changing oil at the specified intervals. Rod failures also occur from carelessness during installation. Apply liberal amounts of oil on crankpin, rod cap and capscrews and tighten rods to the torque valves specified. When a rod literally pounds to pieces, the rod capscrews were probably undertightened.

ROD REPLACEMENT: (figure 18) The cylinder head and piston-rod assembly must be removed to replace the rod. Check big end (or crankpin end) for score marks, excessive running and/or side clearance. Replace rod if big end diameter exceeds 1.5025 or if rod to crankpin clearance exceeds .0035". Side clearance should be 1.180". Rods are available in .010" undersize for use with reground crankshaft.

OIL SEAL

The seal on the outside of the crankcase can be replaced without any disassembly. The generator must be removed to gain access to the inner oil seal which is pressed into the fan housing.

INSTALLATION: Care must be used during installation to prevent the lip of the seal from rolling and creasing. Apply a liberal amount of light grease such as Lubriplate on the seal lip area. Use seal driver and seal sleeve of appropriate size. Press only against outer edge of seal when installing. Press squarely into position to the depth specified in Figure 19.

OIL LEVEL INDICATOR SWITCH

The switch can be replaced or readjusted without

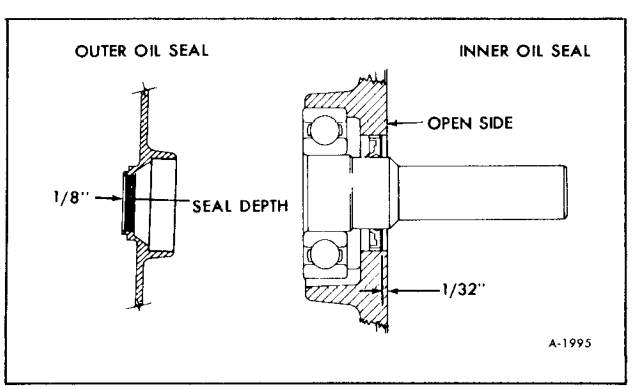


Figure 19–Oil Seal Installation Details

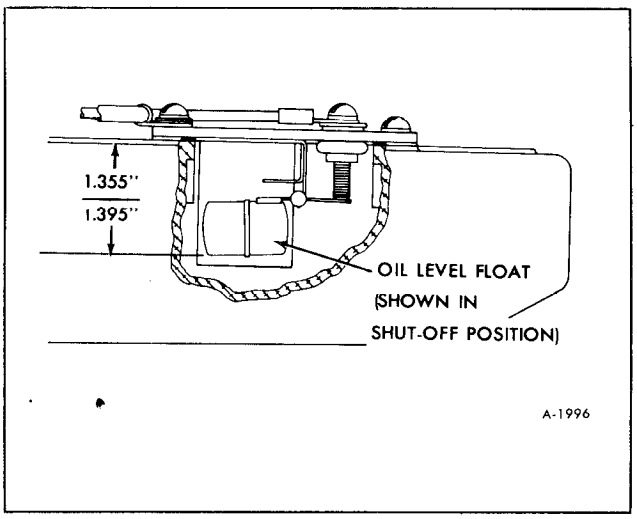


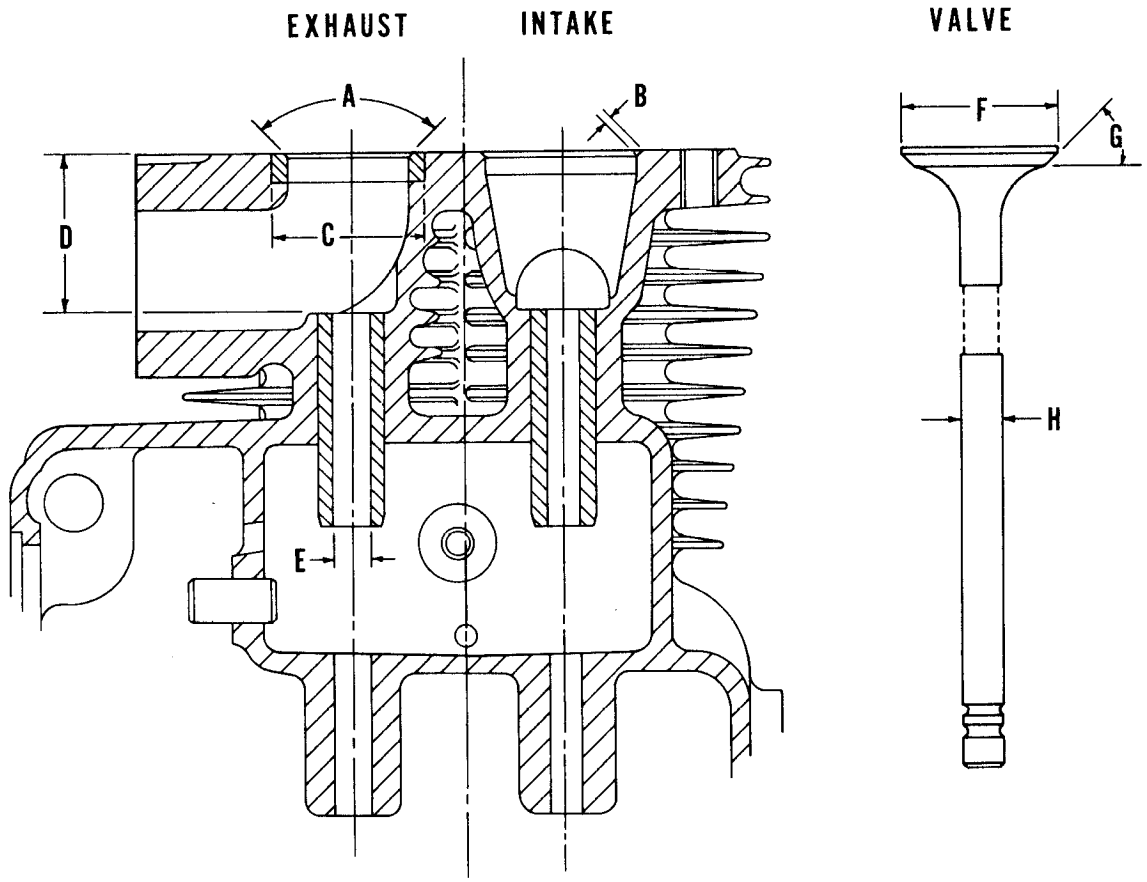
Figure 20–Oil Level Indicator Float Adjustment

any disassembly of engine or generator. Refer to Figure 20 for correct adjustment of float level. To replace or readjust the indicator switch, simply remove the cover on the outside edge of the oil pan. Make sure lead is connected to the correct post.

VALVE MECHANISM (FIGURE 21)

Valve clearance can be checked without disassembly of generator or engine. To check or replace valves, valve springs, etc., the engine-generator must be lifted off the mounting skid and the cylinder head must be removed. Hard starting, loss of power accompanied by high fuel consumption could be symptoms of faulty valves although these symptoms could also be attributed to faulty rings – check the valves first.

VALVE ANALYSIS: After removal, clean valve head, face and stem with power wire brush then carefully inspect for defects such as warped head, excessive corrosion, worn stem end. If face and margin are in good shape and the margin is not less than 1/32", the valve could be reconditioned and reused. Corrosion on stem occurs from condensation due to improper preservation during storage or when engine is repeatedly stopped before it has a chance to reach normal operating temperatures. Replace corroded valves. An exhaust valve subject to overheating will have dark discoloration in area above valve guide – worn guides or faulty valve springs could cause this – also check for clogged air intake, blocked cooling fins, or too lean fuel mixture setting when this condition is found. Lead build-up on the inside of the intake valve head indicates the valve is leaking, allowing exhaust gases to enter the intake port. Gum deposits result from using stale fuel – fuel must be drained during the off season to prevent this condition.



VALVE	A SEAT ANGLE	B SEAT WIDTH	C INSERT O.D.	D GUIDE DEPTH	E GUIDE I.D.	F VALVE HEAD DIA.	G VALVE FACE ANGLE	H VALVE STEM DIA.
INTAKE	89°	.037" / .045"	---	1.586"	.312" / .313"	1.380" / 1.370"	45°	.3110" / .3103"
EXHAUST	89°	.037" / .045"	1.5045" / 1.5035"	1.497"	.312" / .313"	1.380" / 1.370"	45°	.3091" / .3085"

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Figure 21–Valve Port Specifications

REPLACEMENT: After removing the cylinder head and breather components, compress the valve spring with valve compressor, remove keepers, rotator, spring and retainer then release the compressor and remove the valve. If seating surface is in good condition (refer to Insert-Valve Seat), insert replacement valve then lap in to provide proper seat. Use a valve grinder with suction cup and coat valve face with a "fine" grade of grinding compound. Continue rotating valve on seat until a smooth surface is obtained on seat and valve. Remove all traces of grinding compound before reassembly of valve components. Readjust valve clearance before reinstalling breather parts and cylinder head.

VALVE ADJUSTMENT: Turn crankshaft until both valves are closed. In this position, the cam has no effect on the tappets. Correct valve stem to tappet clearance (engine cold) is .008-.010" for the intake and .017-.020" for the exhaust valve. To adjust, turn the self-locking setscrew on tappet in or out until clearance is correct.

ENGINE OVERHAUL

The following is the suggested sequence of disassembly to be used in the event the engine must be completely disassembled (See figure 22). Refer to "Engine Repair" for the reconditioning procedure for individual items or also for repairs requiring only partial disassembly. Reassembly is essentially the reverse of the sequence listed below.

1. Air cleaner
2. Carburetor
3. Carburetor adapter
4. Ignition coil, condenser
5. Spark plug, breaker points
6. Fuel pump and lines
7. Breather – valve cover
8. Mounting bracket (cyl. head)
9. Air ducts, chute
10. Exhaust elbow; tubes
11. Fan housing
12. Closure plate
13. Cylinder head
14. Oil pan
15. Valve mechanism
16. Connecting rod cap
17. Piston – ring – assembly
18. Crankshaft
19. Camshaft
20. Tappets
21. Valve guides
22. Seat inserts

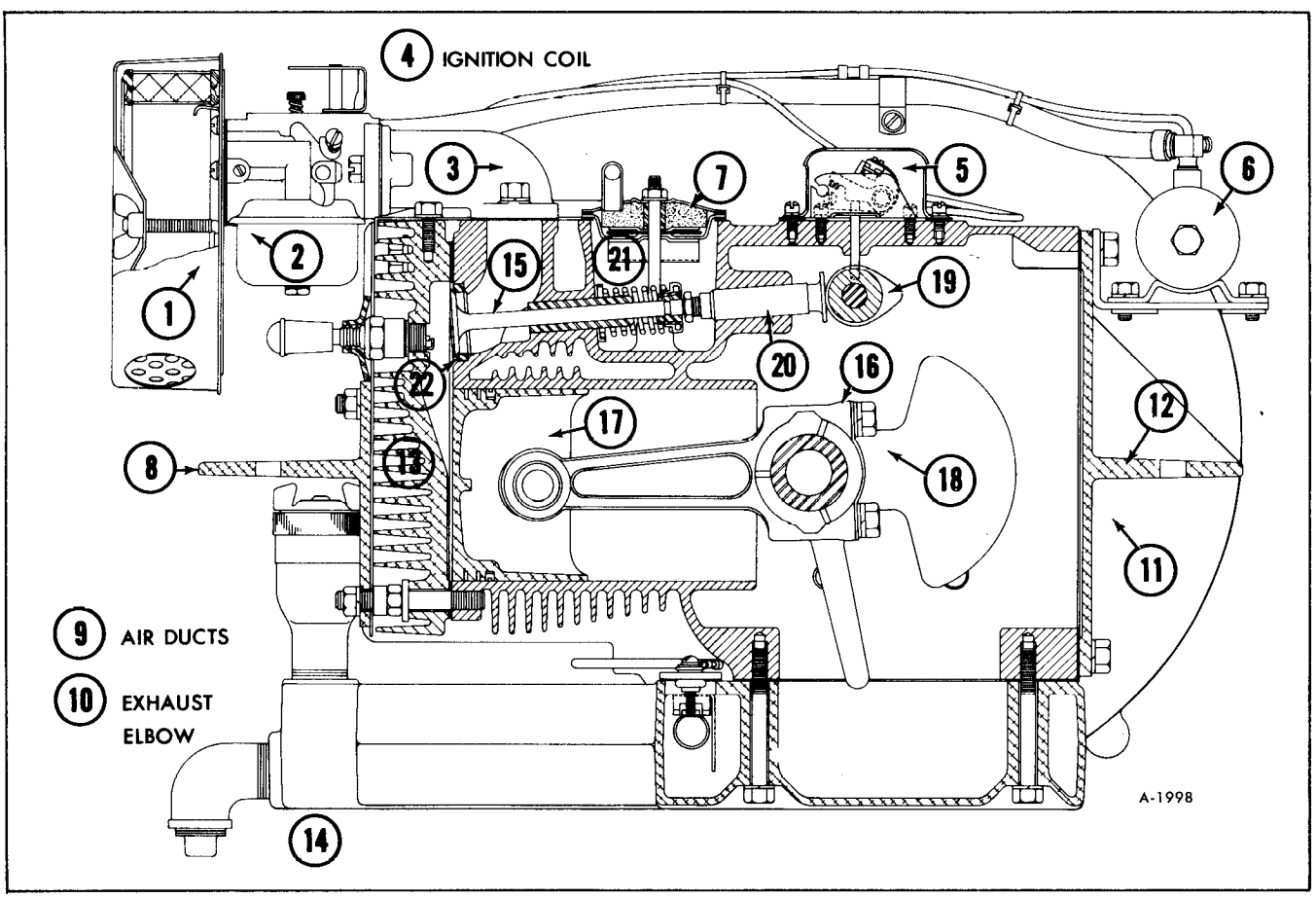


Figure 22–Cutaway View of Engine

ON VEHICLE ADJUSTMENTS AND SERVICING

AIR CLEANER (FIGURE 23)

This engine is equipped with dry element air cleaner. Under normal operating conditions, the element should be removed for cleaning every 50 hours or every 6 months, whichever occurs first. To clean, tap the element lightly against a flat surface – this will dislodge loose dirt from the element surface. Do not clean element in any liquid or clean with compressed air as this will ruin the filter material. Replace the element after 100 hours.

COOLING SYSTEM

Cooling air is drawn into the fan housing by fan blades on the rotor which is attached to the armature of the generator. The air is then forced past the cooling fins on the cylinder block and head and into ductwork where it is expelled as heated air outside the vehicle. The rotor also draws cooling air in thru the louvers in the generator end bracket cover and circulates this air thru the generator internally. The exhaust outlet elbow and tube are located inside the ductwork to help keep the compartment cool. Keep all air inlet and outlets into the compartment and on the generator set clean and clear of obstruction at all times to prevent overheating. Optimum operating temperatures can be maintained with a properly serviced system even at ambient temperatures up to 110°F.

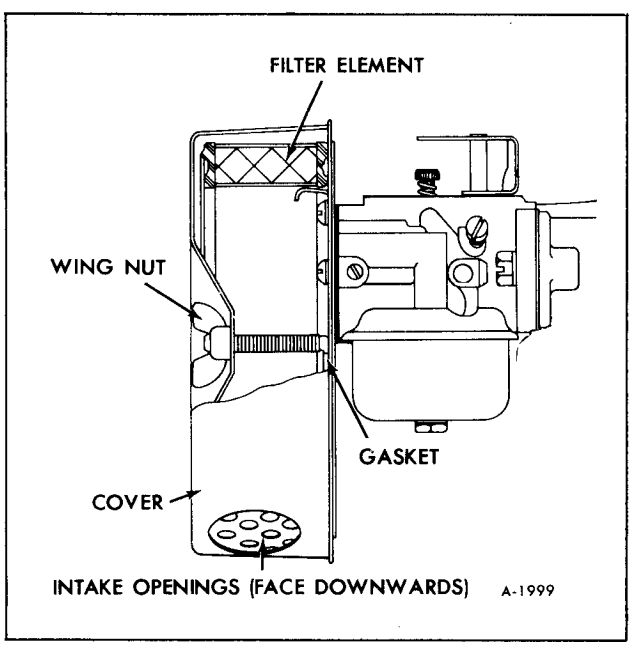


Figure 23–Air Cleaner

GOVERNOR ADJUSTMENT (FIGURE 24)

The governor functions to maintain engine speed under changing load conditions and also acts as a speed limiting device. Governor is set in the factory and further adjustment should not be required unless linkage works loose or becomes disconnected. Readjustment should be made if engine surges with changing load or if speed drops considerably when a normal load is applied.

INITIAL ADJUSTMENT: With engine stopped, loosen (do not remove) hex nut securing governor arm to governor cross shaft. Grasp end of cross shaft with pliers and turn shaft as far as possible in counterclockwise direction – tab on shaft will stop internally against governor gear mechanism. Hold shaft in this position, pull governor arm all the way away from carburetor then retighten governor arm nut to complete initial adjustment.

SPEED ADJUSTMENT: This engine must be operated at 1890 RPM no load or 1800 RPM at full load. If frequency or overspeed condition is suspected, check RPM with hand tachometer or frequency meter and readjust; loosen speed adjusting nut to decrease, or tighten to increase speed.

SENSITIVITY ADJUSTMENT: If speed drops considerably when a normal load is applied, governor should be set for greater sensitivity. If set too sensitive, speed surging will occur with changing load. Governor sensitivity is adjusted by repositioning governor spring in holes provided on arm and speed control brackets. Increase tension on spring (and sensitivity) by moving spring hooks into holes spaced further apart – conversely, decrease sensitivity by reducing tension on spring.

CARBURETOR ADJUSTMENT (FIGURE 25)

Lack of power and black sooty exhaust smoke usually indicates that fuel mixture is too rich. An "overrich" mixture may also be caused by a clogged air cleaner – check this before readjusting carburetor. Fuel mixutre may be too lean if engine "skips" or backfires.

MAIN FUEL ADJUSTMENT: For preliminary setting, turn MAIN FUEL screw in clockwise direction until it bottoms lightly (do not force) then back

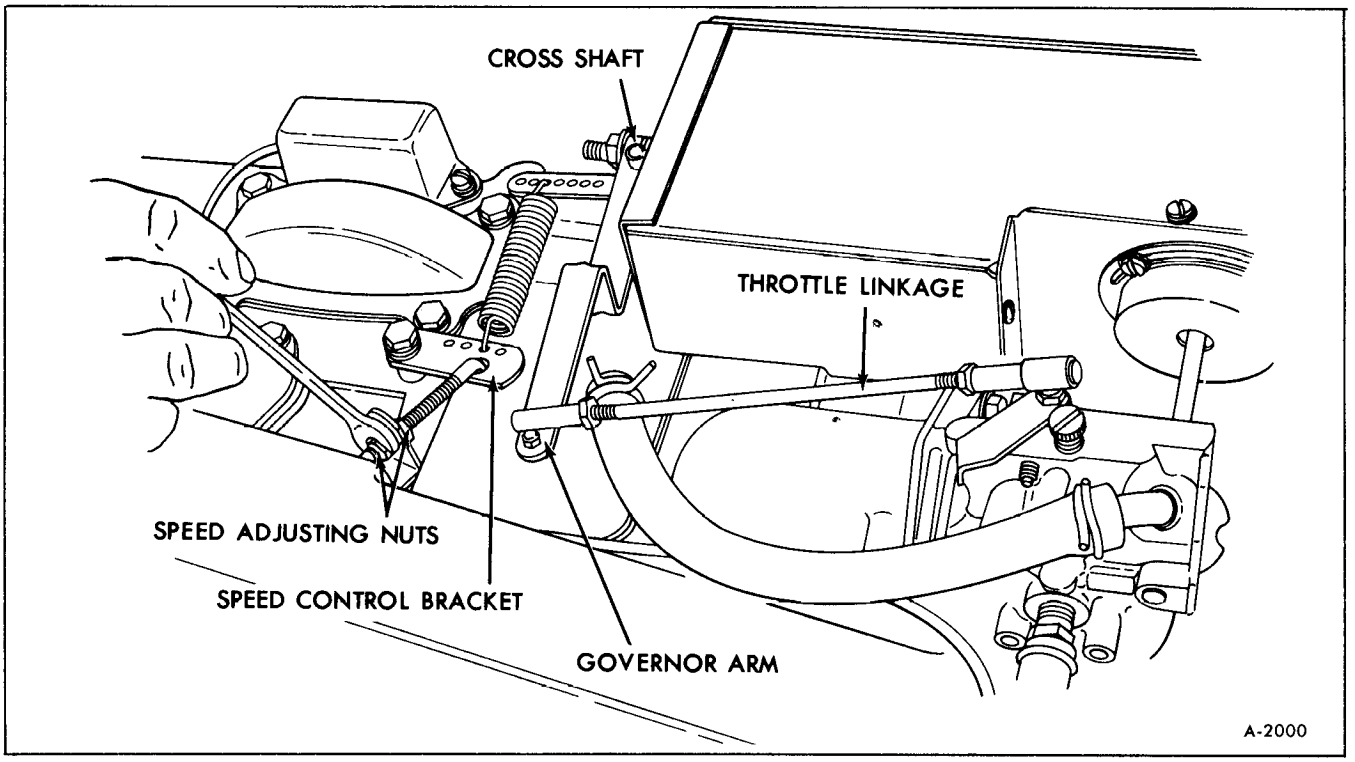


Figure 24–Governor Adjustment

out 2-1/2 turns. With engine thoroughly warmed up and running at 1800 RPM and full load, turn MAIN FUEL screw in until engine slows down (lean setting) then turn screw out until engine regains speed and then starts to slow down (overrich setting). Turn screw back in until it is positioned halfway between lean and overrich settings – when properly adjusted, engine will operate with steady governor action.

IDLE ADJUSTMENT: On this generator set, the idle system functions only as the engine comes up thru idle range to 1800 RPM. For this reason, idle system has only a momentary effect. To adjust, stop engine then turn IDLE FUEL screw all the way in (clockwise) until it bottoms lightly (do not force screw), then back out 3 turns – no further adjustment is needed.

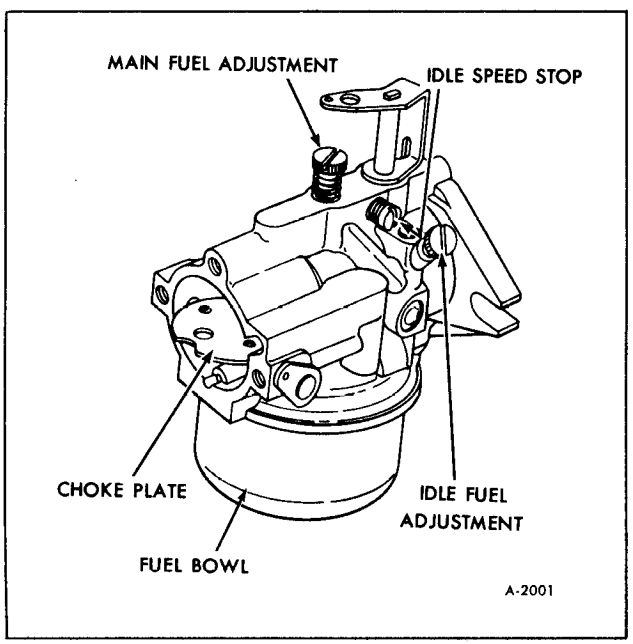


Figure 25–Carburetor Components and Adjustments

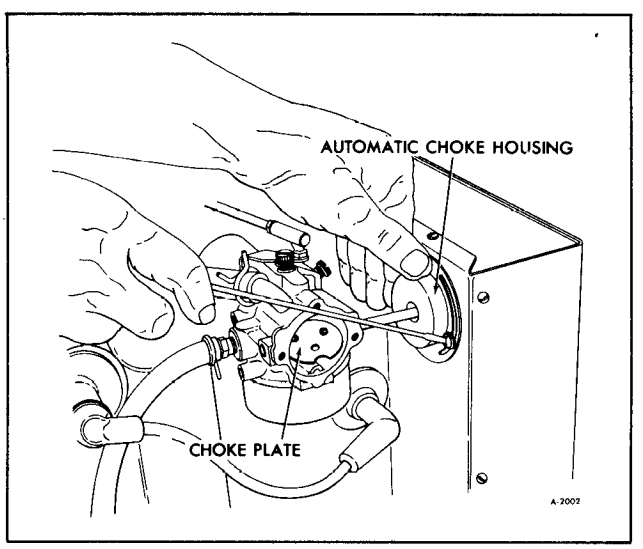


Figure 26–Automatic Choke Adjustment

AUTOMATIC CHOKE (FIGURE 26)

Chokes are set at the factory but may have to be readjusted to suit local conditions. Remove air cleaner from carburetor to observe position of choke plate. Choke adjustment must be made on cold engine. If starting in extreme cold, choke should be 35° from full open position before engine is started. A lesser degree of choking may be needed in milder temperatures. If adjustment is required, loosen screws which secure the choke housing to the ductwork and rotate the housing until the choke plate is 35° from full open position (with ambient 75° temperature).

IGNITION SYSTEM

Hard starting, roughness, low power and erratic operation are often attributed to faulty ignition. All ignition components must be in top condition and the ignition spark must be properly timed to maintain good performance.

Spark Plug: Every 100 hours remove plug and check condition. Good operating conditions are indicated if plug has light coating of gray or tan deposit. A dead white, blistered coating could indicate overheating. A black (carbon) coating may indicate an "overrich" fuel mixture caused by clogged air cleaner or improper carburetor adjustment. Do not sandblast, wire brush, scrape or otherwise service plug in poor condition – best results are obtained with new plug. Set standard type spark plug gap at .025". Tighten plug to 22 ft. lbs. (264 in. lbs.) torque when installing.

Breaker Points: (figure 27) Every 200 hours breaker points should be inspected and serviced as needed. If oxidized, dirty or oily, clean with coarse cloth – do not use emery cloth or sandpaper. Slightly pitted points can be dressed with point file – replace badly pitted or burned points. The gap must be adjusted after points are serviced or replaced since this setting establishes ignition timing. To adjust, crank engine until points are at maximum opening – check with feeler gauge. If gap is not .020", loosen adjusting screw then shift movable plate until .020" gap is obtained. After retightening screw, recheck to make sure gap is still properly set, then replace cover.

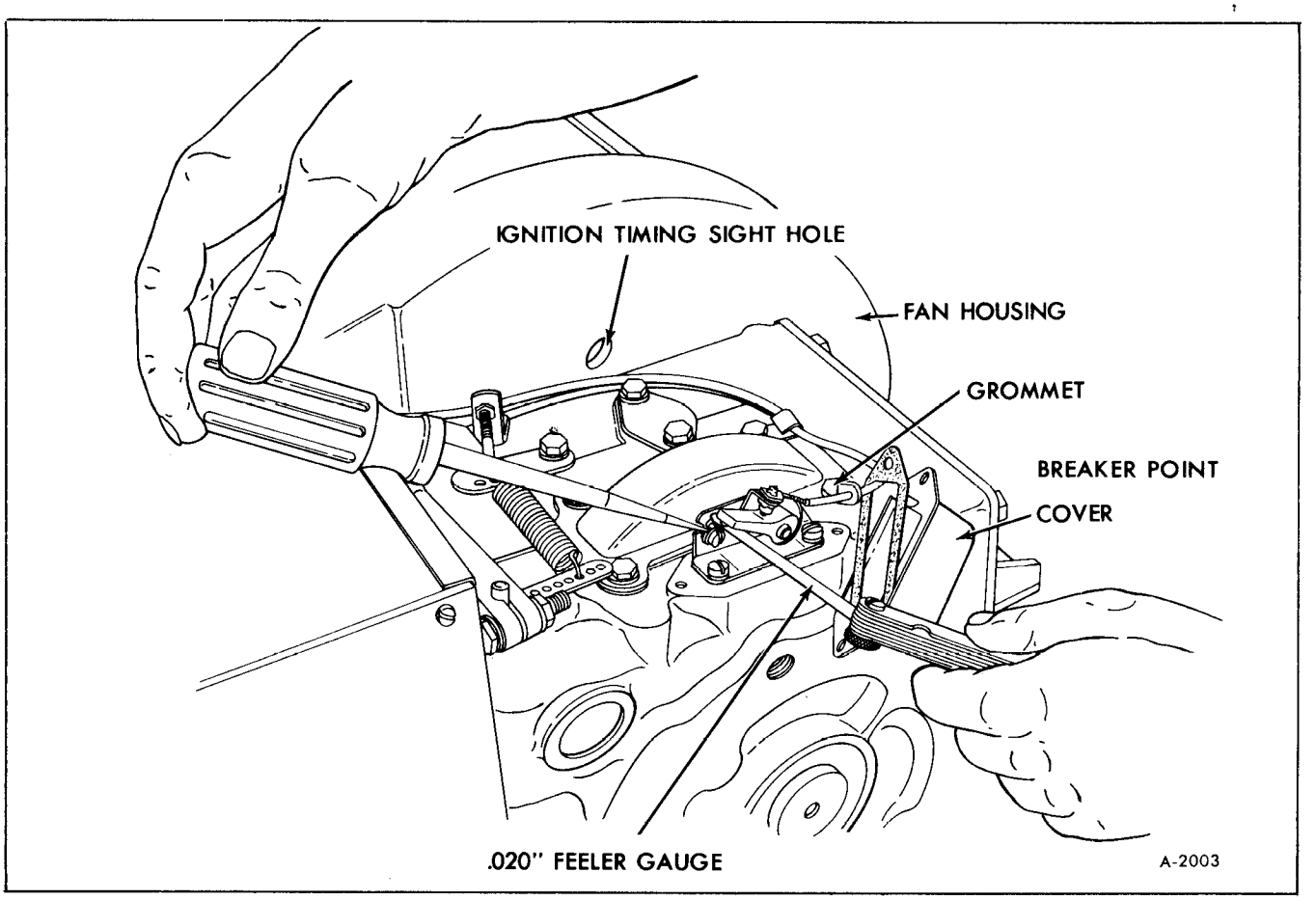


Figure 27–Adjusting Breaker Points

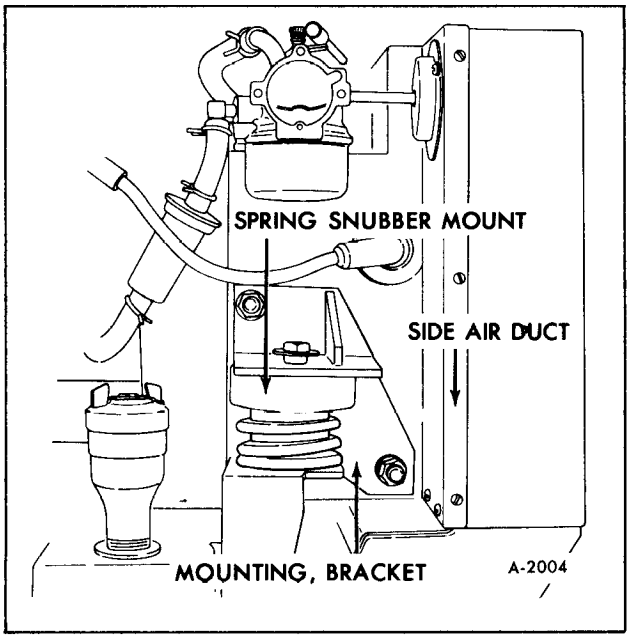


Figure 28–Cylinder Head Removal

CYLINDER HEAD SERVICE

To retain top operating efficiency and performance, the cylinder head should be removed for carbon cleaning after every 200 operating hours. To service the head, pull the generator set out of the compartment, lift the engine end of the unit then disconnect the spring snubber mount from the mounting bracket attached to the cylinder head. Remove the mounting bracket, side air duct and the cylinder head (Refer to figure 28).

To remove the carbon, use a piece of wood or plastic material to avoid scratching the aluminum head. After cleaning, install a new cylinder head gasket and reinstall the cylinder head – tighten head bolts to 25 foot-pounds torque as shown in Figure 14.

FUEL PUMP (FIGURE 29)

A serviceable fuel filter element is located inside the electric fuel pump. Remove the cover of the fuel pump and service this element at the end of each operating season or more frequently if an unusual amount of impurities are noted in the see-thru filter. To clean the element, swish in cleaning solvent or in fresh, clean gasoline. Make sure that the cover is securely tightened after reinstalling the serviced filter element.

This fuel pump includes a check valve which prevents drain back of the fuel when the set stops. If the pump malfunctions, replace the complete unit.

VALVE CLEARANCE ADJUSTMENT

After each 500 hours of operation, remove the

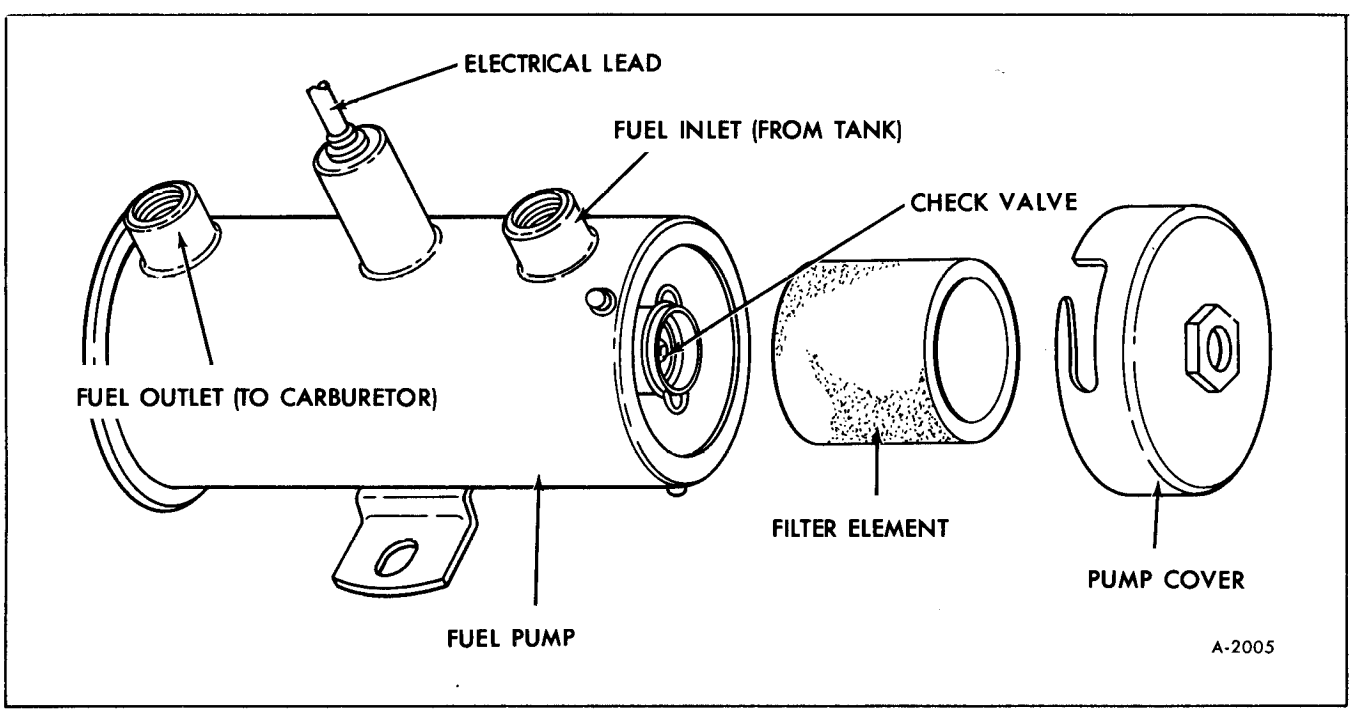


Figure 29–Electric Fuel Pump

valve cover and check the clearance between the end of the valve stems and the tappets. Clearance is checked when both valves are closed at which point the cam will have no effect on the tappets. Check clearance with cold engine. Cold clearance should be set at .008 - .010 on the intake valve and .017 - .020 on the exhaust valve. To adjust, turn adjusting screw on tappet in or out until proper clearance is obtained. Adjusting screw is self-locking. Reinstall crankcase breather components in proper sequence after adjusting valve clearances.

GENERATOR SERVICE (FIGURE 30)

Generators do not normally require service on a regular basis; however, it is a good idea to remove the end cover and check the commutator and brushes at least every six months (or every 50 hours) or more often under dusty, dirty conditions. Make a visual check of the commutator first – if a thin skinlike film of uniform thickness is evident on the surface, this usually indicates normal operation – this film acts as a lubricant and promotes longer brush life. If the surface is streaked or has ridges of dirt, clean it with a coarse cloth or, if this doesn't work, use fine sandpaper or a commutator stone – do not use emery cloth. Lift brushes and check surface – replace brush if unevenly worn or when worn down to about 5/16" or 1/2 original length. Use correct replacement brushes only – substitutes may not be of correct material and will wear out rapidly or cause commutator damage. Other common causes for rapid brush wear are wrong brush tension, rough commutator surface, high mica on commutator and brush chatter. Blow dust out with dry compressed air after servicing.

CYCLIC COMPENSATOR (FIGURE 31)

At the relatively low speed of 1800 RPM, the speed of a single cylinder engine decreases slightly as the piston approaches the ignition point on the compression stroke and increases on the following power stroke. Although the speed change is hardly perceptible, the associated change in voltage is noticed as an

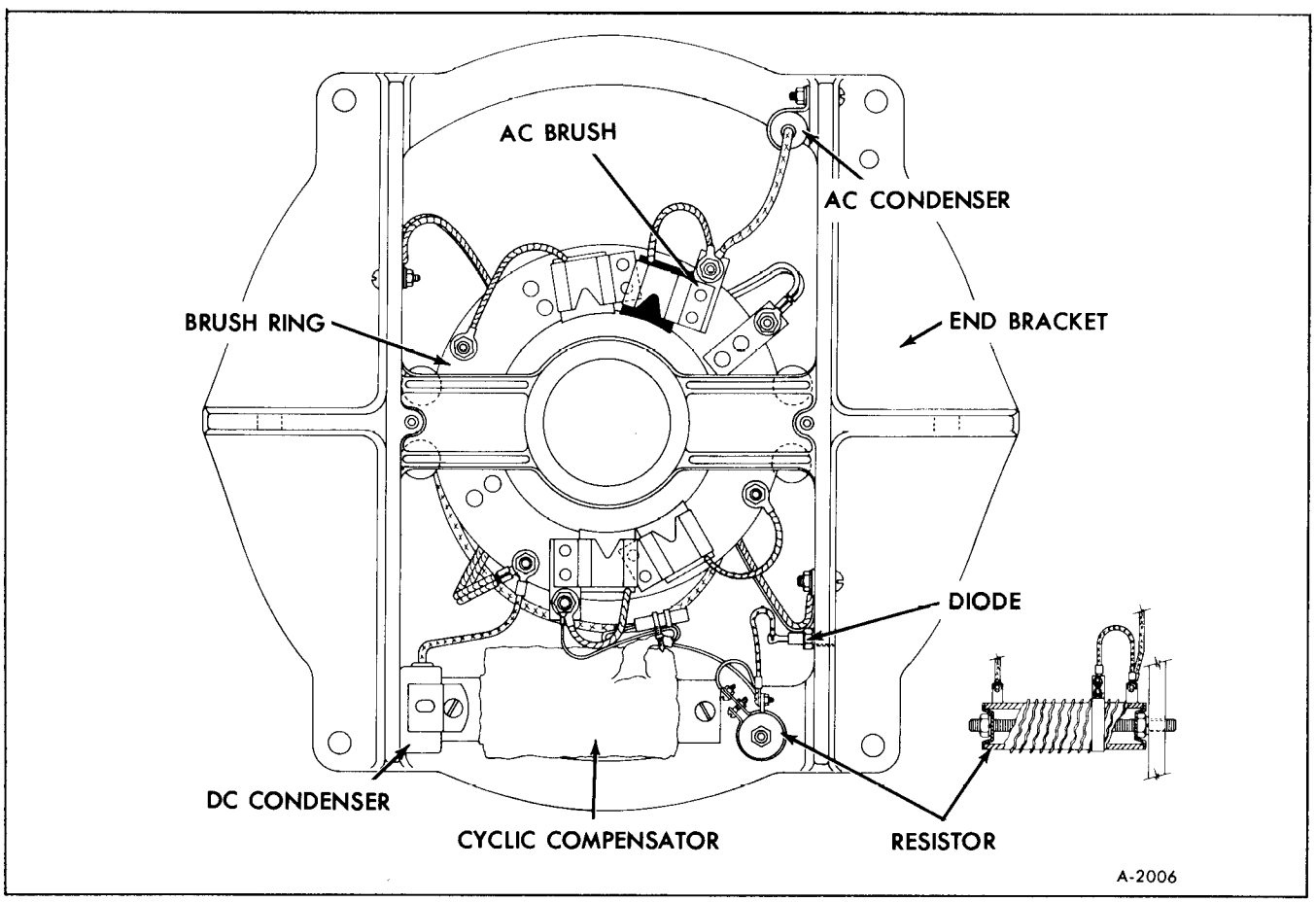


Figure 30–Generator With End Cover Removed For Brush Service

annoying flicker of the lights. The Cyclic Compensator momentarily functions as a voltage regulator to keep the voltage within specific limits where the variation will not cause flicker. It does this through an electronic circuit which is triggered by the engine ignition breaker points. The Cyclic Compensator shorts out the field resistor to increase field current during the "slow" or compression portion of the cycle which, in turn, restores the voltage to acceptable levels. The resistor is kept in the circuit while the piston is on the remaining strokes. The field resistor is adjusted during run-in tests at the factory for the best compensation – the minimum resistance setting is 3.0 ohms while the maximum is 3.8 with an average of about 3.5 ohms. If the resistance value is lowered, voltage will increase; however, this also reduces the anti-flicker effect. Increasing the resistance reduces voltage but increases the anti-flicker effect. Because of this effect on voltage, the resistor should not be readjusted out of these limits. CAUTION: DO NOT adjust the resistor when set is running – compensator may fail as a result if this is done.

CONTROLLER (FIGURE 32)

The controller includes a push button for starting and stopping the generator set. The switch must be held in the START position until the engine starts running and held in the STOP position until the engine comes to a complete halt. It also provides regulated battery charging for maintaining charge in the generator set battery. The engine is cranked by the exciter by means of a 12 volt - negative ground storage battery. The controller has a safety shutdown circuit which functions when a low oil level condition occurs. The sequence of operation is briefly outlined as follows:

1. Press and hold Start button until set starts.
2. Cranking contactor C energizes.
3. Engine cranks and runs.
4. Relay ICR energizes.
5. Power supplied to load.
6. Press and hold stop switch until set stops.

BATTERY CHARGING: Charging is provided from the exciter thru the contact of relay ICR and parallel resistors R2 and IR2. Regulator relay RR senses battery voltage and automatically varies the charge rate from 6 to .3 amps.

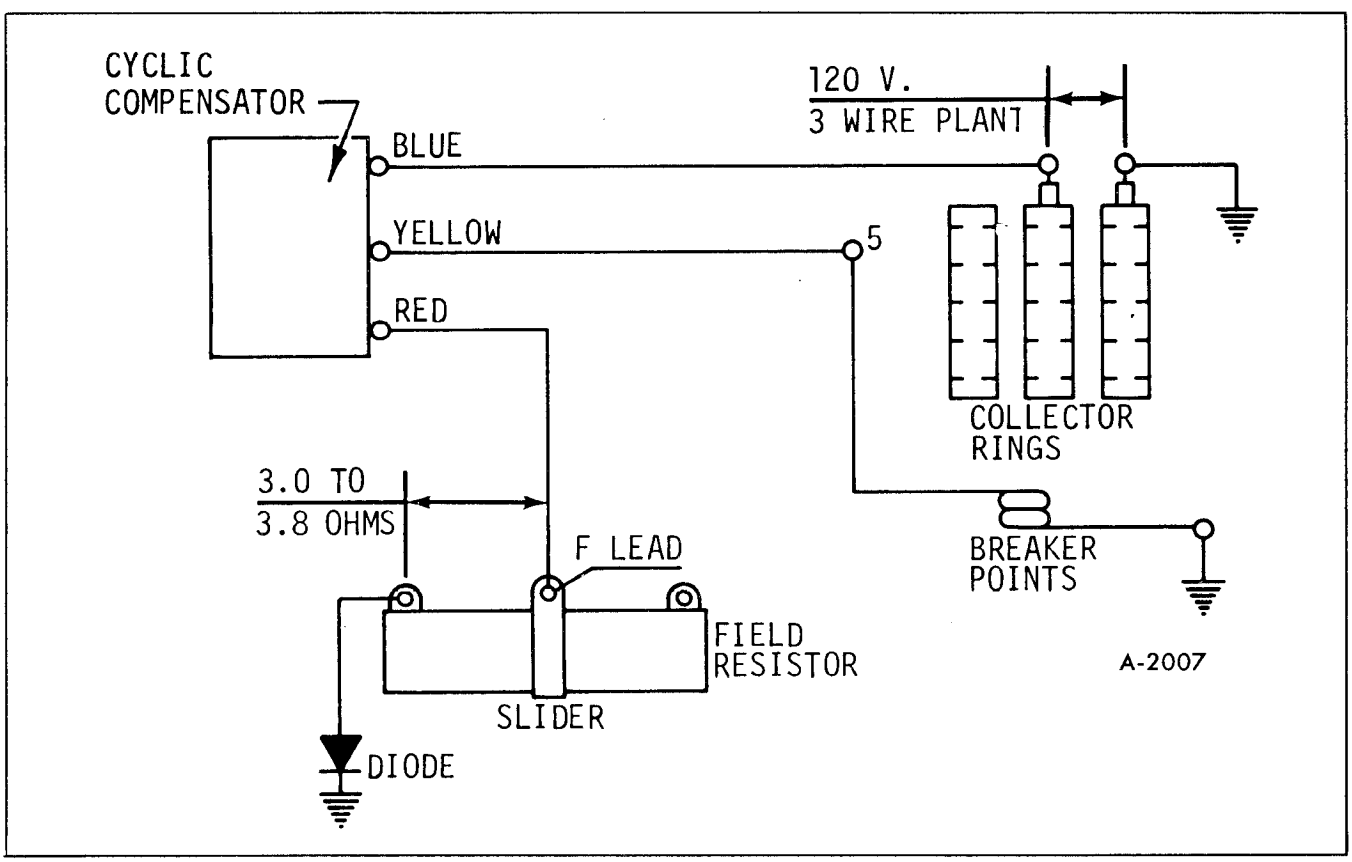


Figure 31–Cyclic Compensator Circuit

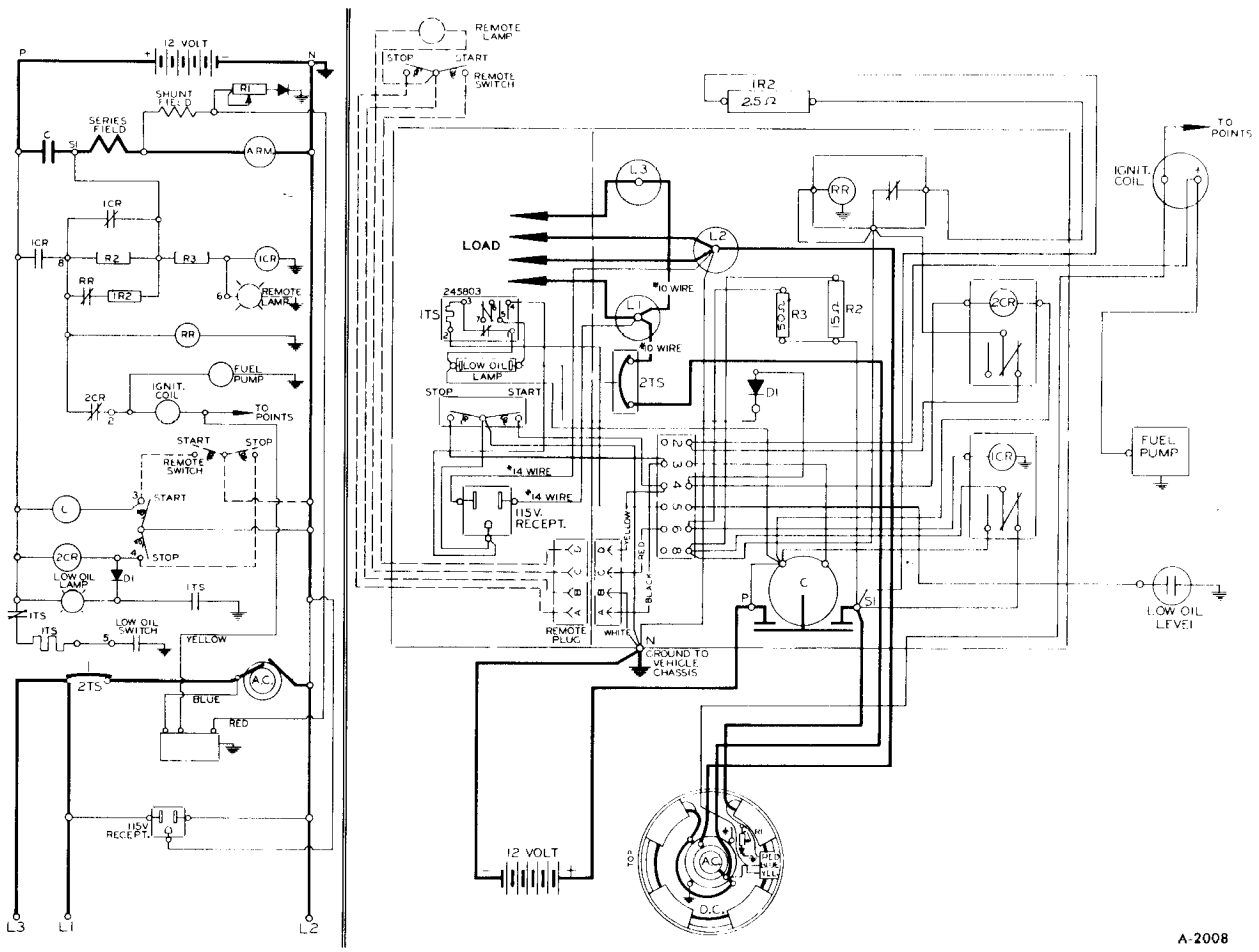


Figure 32–Kohler Motor Generator Wiring Diagram

LOW OIL SHUT-DOWN: This circuit includes a float switch mounted in the oil pan, a time delay thermal switch and a low oil level indicator lamp. The lamp lights and the thermal switch trips when the set shuts down on low oil level. To restart, the oil must be added to proper level and the oil reset button (on cover) pressed.

CIRCUIT BREAKER: The circuit breaker (2TS) protects the main AC circuit against overload.

OPERATIONAL SEQUENCE: Paths of current in the various steps of operation may be traced as follows:

1. Press Start button to connect battery negative to solenoid coil C. Battery current flows to terminal P, coil of cranking contactor C, terminal 3, start switch to ground and back to the battery.

2. Cranking contactor C energizes allowing heavy current from battery to flow to terminal P, contacts of C, terminal S1, cranking series field of generator, exciter armature to ground and back to the battery. Current also flows thru the normally closed contacts of ICR to terminal 8, thru normally closed contacts of 2CR to terminal 2, to the ignition coil and electric fuel pump and back to ground.

3. Engine cranks and runs: After engine starts and runs, release start switch.

4. Relay ICR energizes: As exciter voltage builds, relay ICR energizes. Due to a higher voltage potential of the exciter, current will flow from the exciter thru the series field to S1, thru resistor R2 and IR2, thru normally closed contacts of relay RR to terminal 8, thru now closed contacts of relay ICR to the battery. Regulator relay RR energizes only when battery voltage reaches approximately 14.2 volts. This will break the current path thru resistor IR2. The R2 resistor (greater resistance) will allow a smaller amount of current to flow to the battery.

5. Power is supplied to load – Power is furnished to the load from collector rings through the 2TS and terminals L1, L2 and L3.

6. Press stop switch to stop engine – To stop the generator set, press and hold the stop switch which energizes the 2CR relay causing 2CR contact to open. When 2CR contact opens, current to the fuel pump and to the ignition coil is disrupted, causing the engine to stop. This controller is designed so that remote start-stop switch is connected to terminals A, B, C and D.

SPECIFICATIONS

Engine Model	KL341
Output – watts	4000
Output – voltage (regulation ± 5%)	120
Cyclic Compensator Setting	3.5 ohms
Exciter Voltage	36 - 40
Battery charge rate-high	6 amps
Battery charge rate-low	.3 amps
Shunt Field Resistance – Cold	3 ohms
Shunt Field Resistance – Hot	3.7 ohms
Bore X stroke	3-3/4 x 3-1/4
Displacement (cubic inches)	35.89
Oil Capacity	3 Quarts
Spark Plug	AC CR 45L
Spark Plug Gap	.025"
Breaker Point Gap	.020"
Ignition Spark Run (Piston Degrees BTDC)	20° BTDC
Battery (Negative Ground)	12 Volt
Fuel (Regular Grade Gasoline)	90 Octane (min.)
Starting	Electric-Exciter Crank
CYLINDER BORE	
New Diameter	3.750"
Wear Diameter - Maximum	3.753"
Taper - Maximum	.0015"
Out of Round - Maximum	.005"
CRANKSHAFT	
End Play (Free)	.002-.030"
Crankpin - New Diameter	1.500"
Crankpin - Max. Out of Round	.0005"
Crankpin - Max. Taper	.001"
CAMSHAFT	
Running Clearance on Pin	.001-.0035"
End Play	.005-.010"
CONNECTING ROD	
Big End - Max. Diameter	1.5025"
Rod To Crankpin - Max. Clearance	.0035"
Small End - New Diameter	.87585"
Rod To Pin Clearance	.0003-.0008"
PISTON - PISTON RINGS	
Thrust Face - Max. Wear Diameter	3.7425"
Thrust Face to Bore Clearance	.007-.010"
Ring - Max. Side Clearance	.006"
Ring End Gap - New Bore	.010-.020"
Ring End Gap - Max. In Worn Bore	.030"
VALVE - INTAKE	
Cold Clearance - Valve to Tappet	.008-.010"
Valve Lift - Zero Lash	.324"
Stem to Guide - Max. Clearance	.0045"
Tappet Clearance in Block	.0008-.0023"
VALVE - EXHAUST	
Cold Clearance - Valve to Tappet	.017-.020"
Valve Lift - Zero Lash	.324"
Stem to Guide - Max. Clearance	.0065"
Tappet Clearance in Block	.0008-.0023"
TORQUE SPECIFICATIONS	
Spark Plug	18-22 ft. lbs.
Cylinder Head	25 ft. lbs.
Connecting Rod	300 in. lbs.

SECTION 24D
REFRIGERATOR

This section includes the following:

NORCOLD REFRIGERATOR

Contents of this sub-section are listed below:

GENERAL INFORMATION

The Norcold refrigerator operates on the 12-volt DC system of the vehicle. It uses the same principle as the standard domestic refrigerator. It has an electrically-operated compressor and uses freon as its refrigerating medium.

The swing motor type compressor, used on both the six and seven and one-half cubic foot model, operates on A.C. voltage only. The six cubic foot model requires 20 volts A.C. and the seven and one half cubic foot model requires 23 volts A.C. An inverter-transformer assembly inverts 12 bolts DC to 11 volts A.C., and then transforms this voltage to 20/23 volts A.C. This is then supplied to the swing motor compressor.

NORCOLD REFRIGERATOR TROUBLE DIAGNOSIS

Problem	Possible Cause	Correction
Compressor does not run.	1. Fuse "blown" in living area fuse block.	1. Correct electrical problem that caused fuse to "blow" and replace fuse.
	2. Circuit breaker in refrigerator has "tripped."	2. Correct electrical problem that caused circuit breaker to trip and reset circuit breaker.
	3. Faulty electrical source.	3. Check 12-volt DC source at the point where it enters the inverter assembly. The problem may lie in the source and not in the refrigerator.
	4. Defective thermostat	4. Replace thermostat.
	5. Defective inverter assembly.	5. Replace inverter assembly.
	6. Open or short circuit in swing motor compressor.	6. Replace swing motor compressor.

Problem	Possible Cause	Correction
Insufficient cooling, compressor runs.	1. Improper thermostat setting.	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. Overpacking of cabinet.	2. Space must be left in between food to allow for proper convective heat transfer.
	3. Insufficient heat radiation at condenser.	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". b. Dust may have collected on condenser restricting air flow and must be removed.
	4. Excess frost build up in freezer compartment.	4. A frost build up of over one quarter inch should be avoided. Defrost refrigerator.
	5. Freon overcharge or undercharge.	5. Can be determined by testing compressor amperage. In either case the entire cooling system must be replaced.
	6. Insufficient voltage source.	6. Check 12-volt D.C. supply.
	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.	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.	1. Thermostat "sticking". 2. Thermostat sensing bulb loose on evaporator plate mounting.	1. Replace thermostat 2. Tighten mounting screws to make sure bulb has good contact with evaporator plate.

COMPONENT TESTING

COMPRESSOR VOLTAGE

The refrigerator must be removed from vehicle to check compressor voltage. The voltage is checked at the compressor terminals with an A.C. voltmeter (figure 1).

The voltage at the compressor should be 28.2 ± 1 volts A.C. for the six cubic foot model and 32.5 ± 1 volts A.C. for the seven and one-half cubic foot model.

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

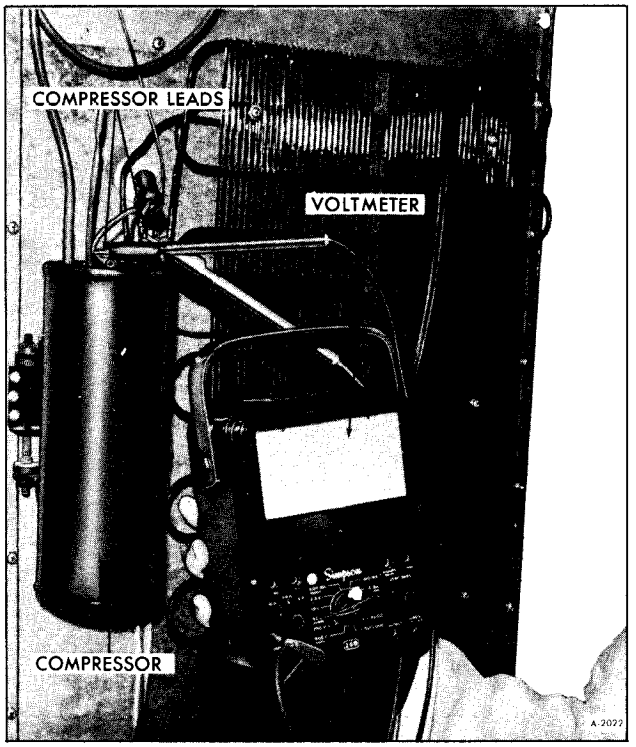


Figure 1–Checking Compressor Voltage

COMPRESSOR AMPERAGE

One method of determining whether or not the proper amount of freon is in the cooling unit is to measure the number of amps drawn by the compressor.

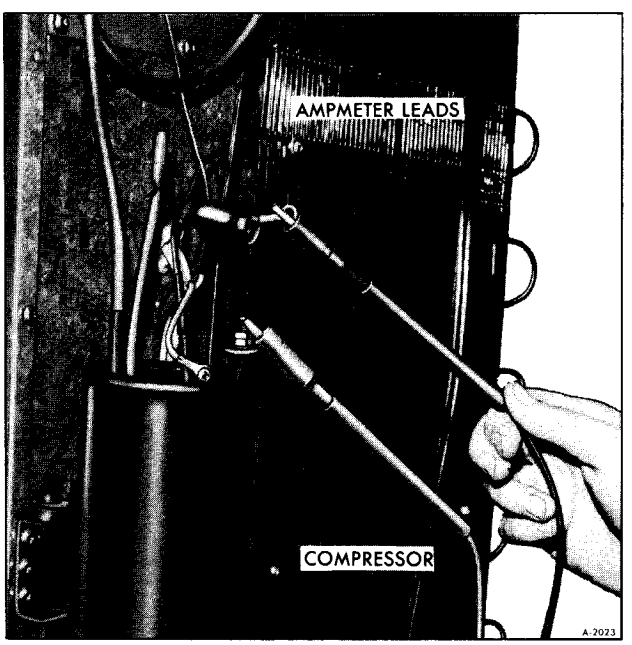


Figure 2–Checking Compressor Amperage

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 amps should be read for the six cubic foot model and approximately 2.6 amps for the 7 1/2 cubic foot model.

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 tha the system is under or overcharged the entire cooling system must be replaced.

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 thermostat motor leads. Connect a ohmeter 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 in-

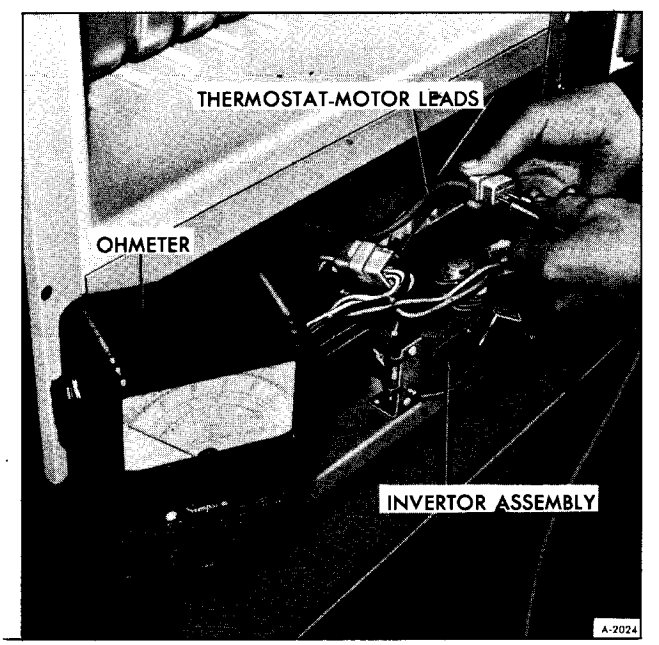


Figure 3–Checking Thermostat at Inverter

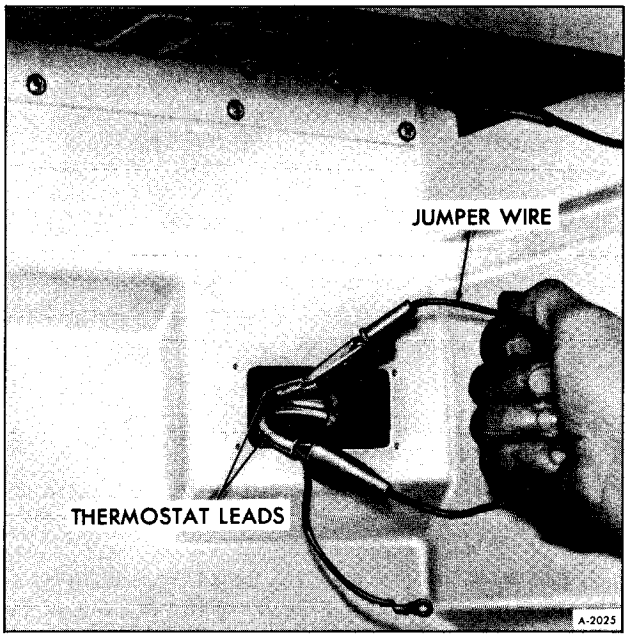


Figure 4–Jumper Wire at Thermostat

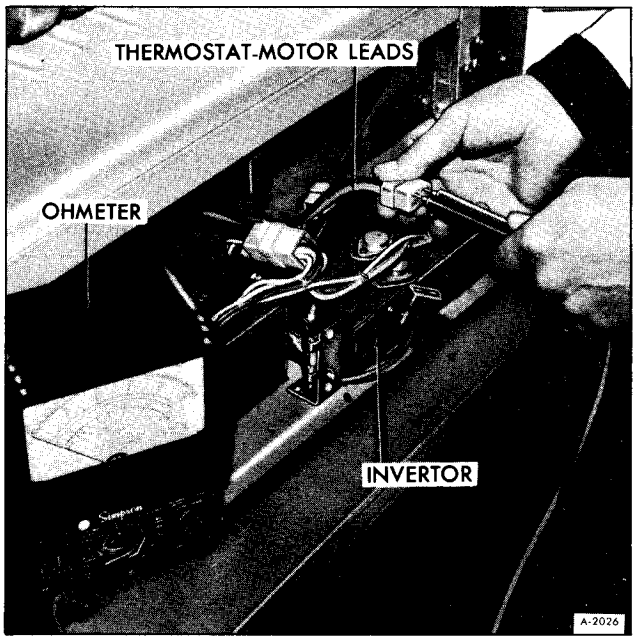


Figure 5–Testing Compressor Resistance

verter 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 ohmeter 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.

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.

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).

3. Reconnect 12-volt electrical connector behind kick plate.

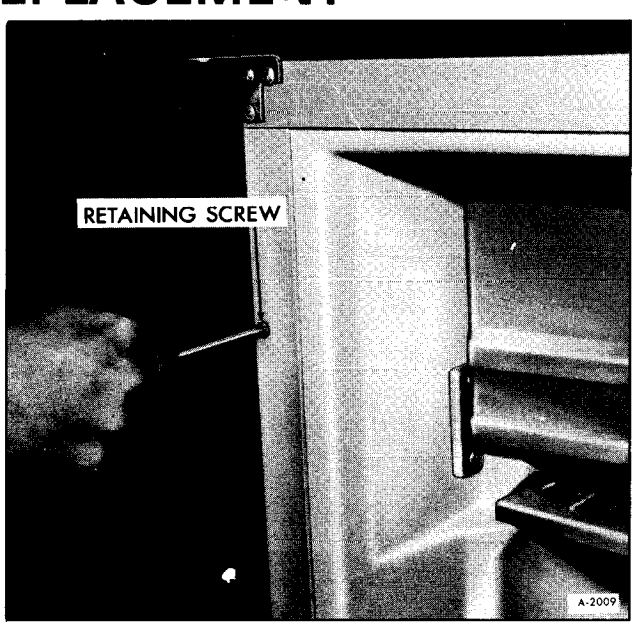


Figure 6–Removing Refrigerator Retaining Screws

4. Install kick plate.

5. Install door(s).

COMPONENT REMOVAL

DOOR REMOVAL (6 CU. FT.)

1. Remove screw at top of door hinge and release travel lock (figure 7).

2. Tilt door out at top and lift door up and off bottom hinge pin, as shown in Figure 8.

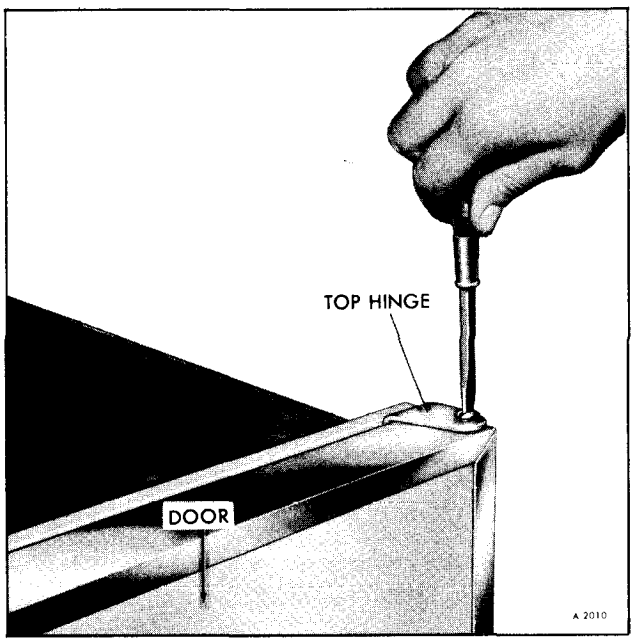


Figure 7–Removing Top Door Hinge

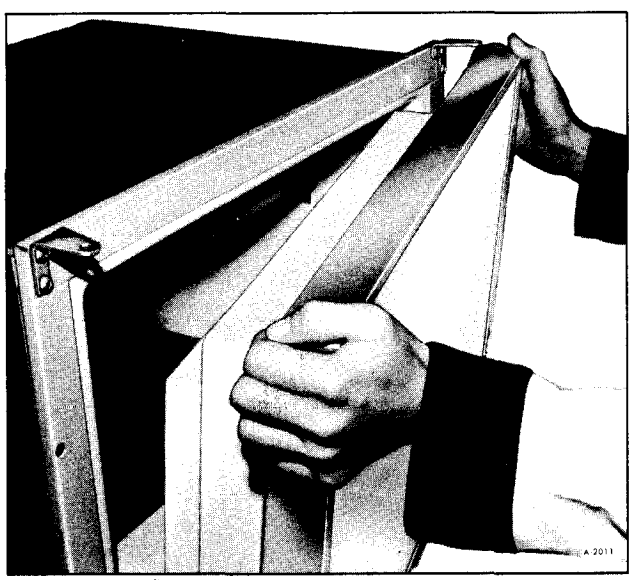


Figure 8–Removing Door

DOOR REMOVAL (7 1/2 CU. FT.)

1. Remove screw top of freezer door hinge, release travel lock.

2. Tilt top of freezer door out and lift door off hinge.

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.

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.

Figure 9–Removing Center Hinge Pin

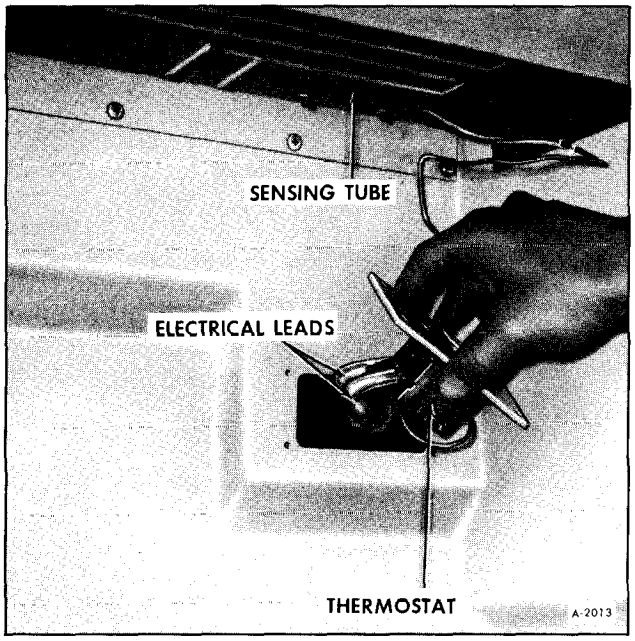


Figure 10–Removing Thermostat

COOLING UNIT REMOVAL

1. Remove refrigerator from vehicle.

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. Remove ten screws from blind cover in back of evaporator plates.

5. Disconnect electrical leads to the compressor.

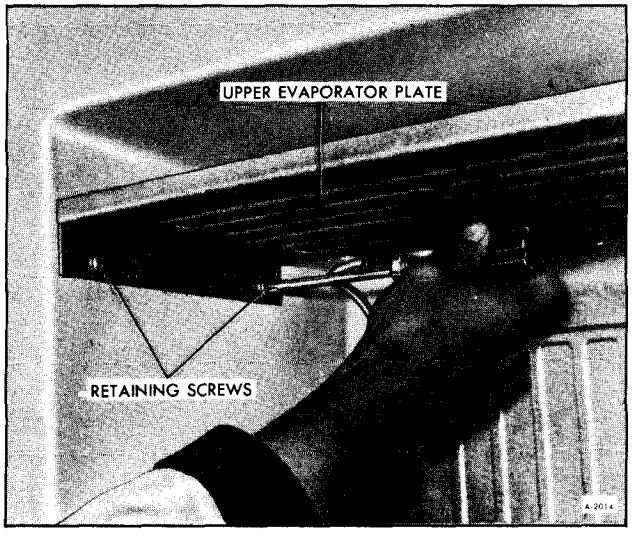


Figure 11–Removing Evaporator Screws

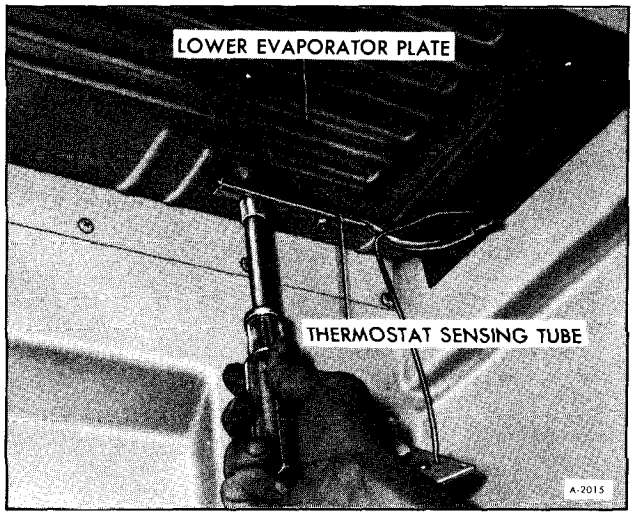


Figure 12–Removing Thermostat Sensing Tube

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.*

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

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

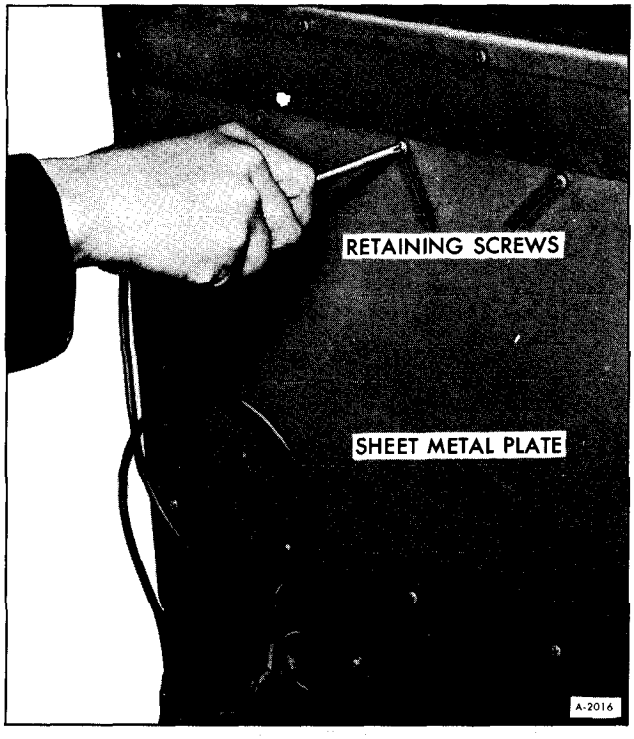


Figure 13–Removing Sheet Metal Plate

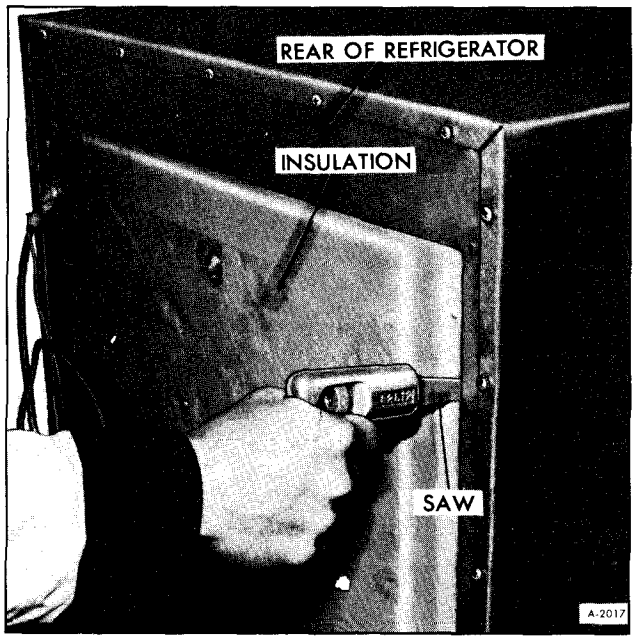


Figure 14–Cutting Insulation

8. Remove eight retaining screws from condenser.

9. Remove mounting screws from compressor.

10. Cut out insulation from opening where sheet metal plate was removed (figure 14).

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

INVERTER ASSEMBLY REMOVAL

1. Remove kick plate.

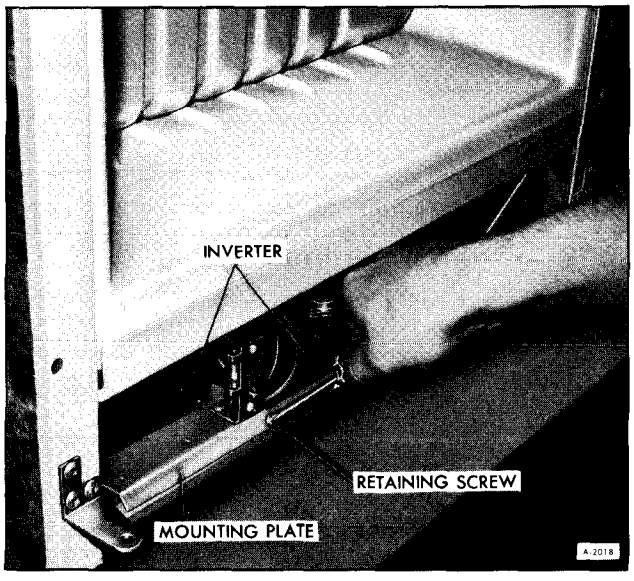


Figure 15–Removing Inverter Assembly

Figure 16–Disconnecting Wiring

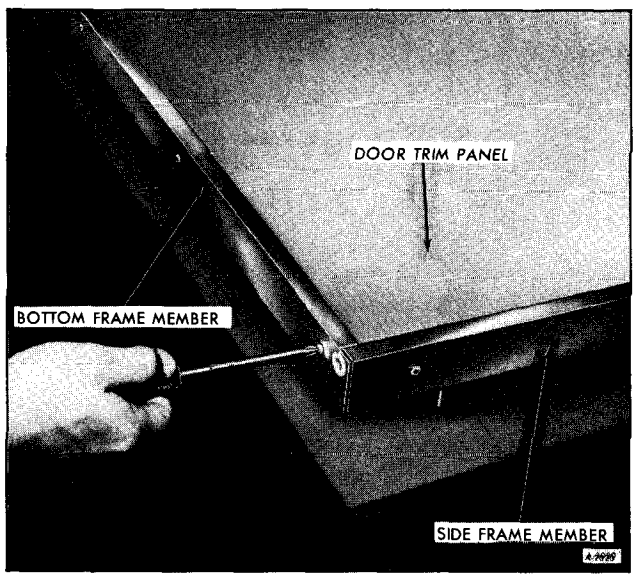


Figure 17–Removing Bottom Frame

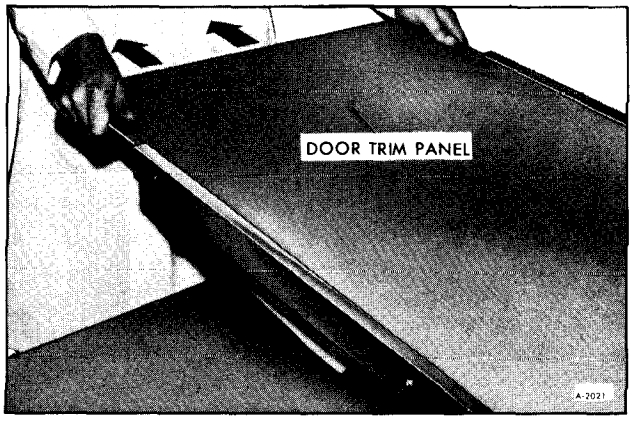


Figure 18–Removing Trim Panel

2. Remove screw at front of inverter assembly mounting plate (figure 15). Lift assembly out of refrigerator.

3. Disconnect wiring from back of assembly (figure 16).

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 17.

3. Loosen three screws on both side frame members.

4. Trim panel can now be removed by sliding it out the bottom (figure 18).

COMPONENT INSTALLATION

DOOR INSTALLATION (6 CU. FT.)

1. Place door on botton hinge pin, push door to its normal position.

2. Install top hinge pin (figure 7), and fasten travel lock.

DOOR INSTALLATION (7-1/2 CU. FT.)

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.

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 16.

2. Place inverter assembly in position and secure with screw at mounting plate, as shown in Figure 15.

3. Install kick plate.

COOLING UNIT INSTALLATION

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

2. Install mounting screws in compressor.

3. Install eight mounting screws in condenser.

4. Replace foam insulation in rear opening.

5. Install blind cover to inside of cabinet behind evaporators.

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

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

8. Apply sealer to seal hole where capillary and return tubes pass through.

9. Connect electrical leads to compressor.

10. Reinstall thermostat sensing tube to bottom of lower evaporator plate.

11. Install refrigerator in Motor Home.

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 17).

4. Mount door(s) back on refrigerator.

NORCOLD SPECIFICATIONS

Model	6 Cubic Ft.	7.5 Cubic Ft.
Power	40 Watts	60 Watts
Amps Required	2 Amps	2.6 Amps
Volts Required	28.2 Volts A.C.	32.5 Volts A.C.
Compressor Motor Resistance	2-3 Ohms	2-3 Ohms
Compressor Motor Speed	60 Strokes/Sec.	60 Strokes/Sec.
Inverter Output	11 Volts A.C.	11 Volts A.C.
Transformer Output	28.2 Volts A.C.	32.5 Volts A.C.
Input Voltage	12 Volts D.C.	12 Volts D.C.

INSTAMATIC REFRIGERATOR

Contents of this sub-section are listed below:

GENERAL INFORMATION

The continuous absorption type of cooling unit is operated by the application of a limited amount of heat by either gas or electricity. No moving parts are employed.

The unit consists of four main parts the boiler system, condenser, evaporator and absorber. All parts are connected by tubes, the whole construction being of steel welded together. The unit can either be run on electricity or gas.

The unit charge consists of a quantity of ammonia, water and hydrogen under pressure sufficient to condense ammonia at ordinary room temperature. The unit is then sealed off.

Air circulating over the fins of the condenser takes up sufficient heat from the ammonia vapor to cause it to condense to liquid ammonia in which state it flows into the low temperature evaporator, situated at the base of the frozen storage compartment.

The ammonia passes from the low temperature evaporator into the high temperature evaporator, situated at the rear inside the cabinet.

The low temperature evaporator and the high temperature evaporator are also supplied with hydrogen. The hydrogen passes across the surface of the ammonia and lowers the ammonia vapor pressure sufficiently to allow the liquid ammonia to evaporate. The evaporation of the ammonia extracts heat from the evaporator and from the food storage space, thereby lowering the temperature inside the refrigerator.

The mixture of ammonia and hydrogen vapor passes from the evaporator to the absorber vessel.

Entering the upper portion of the absorber is a continuous trickle of weak ammonia solution. This weak solution, flowing down through the absorber, comes into contact with the mixed ammonia and hydrogen gases and readily absorbs the ammonia from the mixture, leaving the hydrogen free to rise through the absorber coil and to return to the evaporator.

The hydrogen thus circulates continuously between the absorber and the evaporator.

The strong ammonia solution produced in the absorber flows down to the absorber vessel and thence to the boiler system, thus completing the full cycle of operation.

The liquid circulation of the unit is purely gravitational. It is therefore essential that the unit stands upright.

Heat is generated in the absorber by the process of absorption. This heat must be dissipated into the surrounding air. Heat must also be dissipated from the condenser in order to cool the ammonia vapor sufficiently for it to liquefy. Free air circulation is therefore necessary over the absorber and condenser.

The whole unit operates by the heat applied to the boiler system and it is of paramount importance that this heat is kept within the necessary limits and is properly applied.

AUTOMATIC FLAME FAILURE SAFETY DEVICE

The thermoelectric safety device functions as follows:

By pressing the pushbutton, the gas valve is opened and the gas can pass the housing on to the burner. At the burner, the feeler is located. When the gas flame of the burner is lit, some heat is transferred to the feeler. The hot junction of the thermocouple

is thus heated and an electric current is generated. This current passes through the copper wire, the electromagnet in the case and back through the outer tube. As soon as the electric current and magnetism is generated, the valve is attracted toward the case, allowing the gas to pass, whereby the pushbutton may be released.

As long as current is flowing, the valve is kept open and allows gas to pass to the burner. When the flame is extinguished, the heat transfer to the hot junction is interrupted and no electric current is generated. The valve is then forced back by the spring and the gas flow through the valve is closed.

FLUE SYSTEM

The flue system consists of the following parts:

1. Central tube (built-in part of the boiler system and cannot be removed).

2. Flue with bracket.

3. Flue baffle with support wire.

The purpose of the flue system is to provide a draft which will pull the burner flame into the central tube and supply sufficient primary and secondary air to the flame.

The right flue draft will not be obtained before the burner has warmed up the flue system to the proper temperature.

The flue baffle which is inserted in the central tube distributes the heat produced by the burner to the boiler system.

It is important that the correct size of baffle is used and that it is correctly located in the central tube in order to obtain the best cooling performance.

IGNITION DEVICE

A piezoelectric ignition device is used to ignite the gas burner. It is completely self contained and requires no outside electrical source.

INSTAMATIC REFRIGERATOR TROUBLE DIAGNOSIS (GAS)

REFRIGERATOR TOO COLD

1. Dirt in thermostat or valve seat.

   Replace thermostat.

2. By-pass flame too large.

   Adjust by-pass flame at thermostat.

3. Thermostat set to high.

   Adjust thermostat setting.

4. Incomplete contact of thermostat sensing tube.

   Sensing tube not properly inserted in its tube on the evaporator.

5. Ambient temperature to low.

   Decrease thermostat setting.

REFRIGERATOR NOT COLD ENOUGH OR NO REFRIGERATION

1. Ventilation not adequate.

   Be sure vents are not obstructed in any manner.

2. Refrigerator not level.

   Refrigerator must be level at evaporator plates.

3. Burner orifice clogged.

   Replace orifice.

4. Inproper flame (small).

   Check gas pressure and/or replace orifice, clean flue.

5. By-pass flame to small.

Adjust flame size at thermostat, check flue, check gas pressure.

6. Burner head clogged.

Clean or replace burner head.

7. Improper position of flue baffle.

Clean flue, reposition baffle.

8. Unstable burner flame.

Check gas pressure, clean or replace burner orifice.

9. Inproper food storage.

Rearrange food stuffs.

10. Thermostat set to low.

Raise thermostat setting.

11. Leaky cabinet seals.

Replace seals.

12. Obstructed flue.

Clean flue.

13. Lost thermostat charge.

If flame does not increase in size when end of sensing tube is held in hand, replace thermostat.

14. Failed refrigerating unit.

Replace with new refrigerating unit.

ODOR OUTSIDE CABINET

1. Obstructed flue.

Clean flue.

2. Flame contacts central flue or baffle.

Reposition burner head or reposition baffle.

3. Insufficient primary air.

Burner orifice clogged, replace orifice.

ODOR INSIDE CABINET

1. Infrequent cleaning of food compartment.

Clean food compartment.

2. Refrigerator shut off with door closed.

Refrigerator should be stored with door open.

BURNER FLAME GOES OUT

NOTE: Check LP gas tank. Refill if necessary.

1. Orifice clogged.

Replace orifice.

2. Thermocouple tip not in position.

Adjust tip of thermocouple so its tip is in the flame.

3. No contact between thermocouple and safety valve magnet.

The wire between the thermocouple and the safety valve has failed and the thermocouple must be replaced.

4. Faulty safety valve magnet.

Replace magnet.

5. By-pass flame too small.

Adjust flame size at thermostat.

6. Burner head clogged.

Clean or replace burner head.

7. Improper position of flue baffle.

Reposition flue baffle.

FROST FORMS TOO RAPIDLY

1. Dirt in thermostat or valve seat.

Replace thermostat.

2. By-pass flame too large.

Adjust flame size at thermostat.

3. Improper storage of liquid or moist food.

Store these foods in covered containers.

4. Leaky cabinet seal.

Replace seal.

5. Obstructed flue.

Clean flue.

6. Incomplete contact of thermostat sensing tube.

Sensing tube not properly inserted in its tube on the evaporator.

BURNER FLAME EXTINGUISHES WHEN THE THERMOSTAT REDUCES FLAME TO BY-PASS SIZE

1. Feeler (thermocouple) of flame failure device is located too far from flame.

Bend burner bracket so feeler is closer to flame, so flame failure device does not shut the gas supply off.

2. Retainer holding electromagnet at gas control not tight enough.

Tighten to 5-6 inch lbs.

BURNER FAILS TO LIGHT AND LIGHTING PROCEDURE HAS TO BE REPEATED

1. At first ignition, air may be present in line.

Push ignition button in for a period of one minute to remove air from line and repeat lighting procedure.

2. Plug of ignition device may be to far away from burner head.

Adjust plug in bracket or bend bracket so plug sparks properly.

3. Soot has accumulated on tip of plug.

Remove soot.

4. Short in ignition device.

Repair or replace ignition device.

BURNER FLAME BLOWS OUT

1. Windy conditions.

Place vehicle so wind does not blow directly into vents.

2. Poor sealing around refrigerator.

Seal all gaps between refrigerator and sealing wall, and around control panel and under frame.

INSTAMATIC REFRIGERATOR TROUBLE DIAGNOSIS (ELECTRIC)

REFRIGERATOR TOO COLD

1. Thermostat incorrectly set.

Adjust thermostat setting.

2. Incomplete contact of sensing tube.

Sensing tube not properly inserted in its tube on the evaporator.

3. Ambient temperature too low.

Decrease thermostat setting.

REFRIGERATOR NOT COLD ENOUGH

1. Ventilation not adequate.

Be sure vents are not obstructed in any manner.

2. Refrigerator not level.

Refrigerator must be level at evaporator plates.

3. Heater faulty, wrong voltage or type.

Replace with a unit of the proper voltage and type.

4. Voltage not constant.

Check wiring and voltage source.

5. Heater not inserted correctly in its pocket.

Make sure that the heater is inserted to its full length in its pocket.

6. Improper food storage.

Rearrange foodstuffs to allow for adequate air circulation.

7. Thermostat incorrectly set.

Adjust thermostat setting.

8. Leaky cabinet seals.

Replace cabinet seals.

9. Lost thermostat charge.

Replace thermostat.

10. Failed refrigerating unit.

Replace refrigerating unit.

NO REFRIGERATION

1. Faulty electrical connections.

Repair connections.

2. Refer to Refrigerator Not Cold Enough.

FROST FORMS RAPIDLY

1. Improper storage of liquid and moist foods.

These foods should be stored in covered containers.

2. Leaky cabinet seal(s).

Replace seal.

3. Incomplete contact of sensing tube.

Sensing tube not properly inserted in its tube on the evaporator.

ODORS INSIDE CABINET

1. Infrequent cleaning of food compartment.

Clean food compartment.

2. Refrigerator shut off with door closed.

Refrigerator should be stored with door open.

REFRIGERATOR REPLACEMENT

REMOVAL

1. Shut off LPG at tank.

2. Disconnect battery ground cables.

3. Remove louvered panel at rear of refrigerator.

4. Disconnect 12-volt D.C. leads and LPG line from rear of refrigerator (outside Motor Home).

5. Remove two mounting screws from rear of refrigerator.

6. With the aid of an assistant remove the refrigerator from the vehicle and set the unit on a suitable bench.

INSTALLATION

1. Position refrigerator in its opening and secure with two mounting screws at rear of refrigerator.

2. Connect 12-volt D.C. leads and L.P.G. line to rear of refrigerator.

3. Turn on LPG at tank and leak test all connections at refrigerator.

COMPONENT REMOVAL

REMOVAL ELECTRIC HEATING ELEMENT

1. Remove louvered vent (outside Motor Home) to gain access to rear of refrigerator.

2. Remove stack cover from burner stack (figure 1).

3. Remove insulation from around heating element.

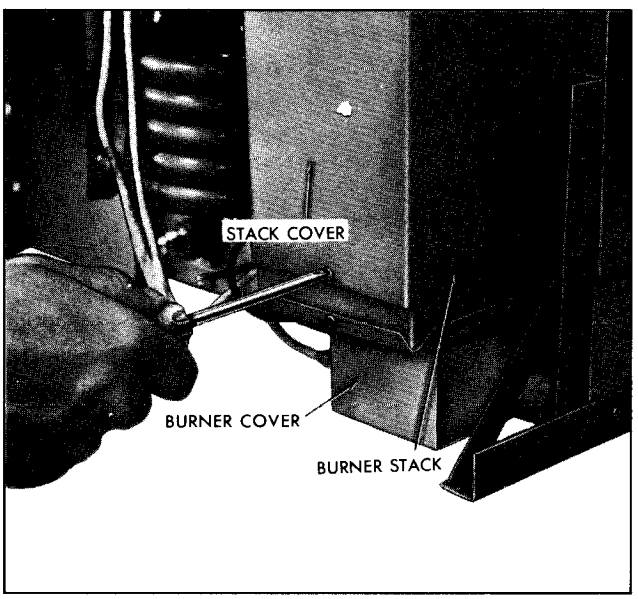


Figure 1–Removing Plate on Burner Stack

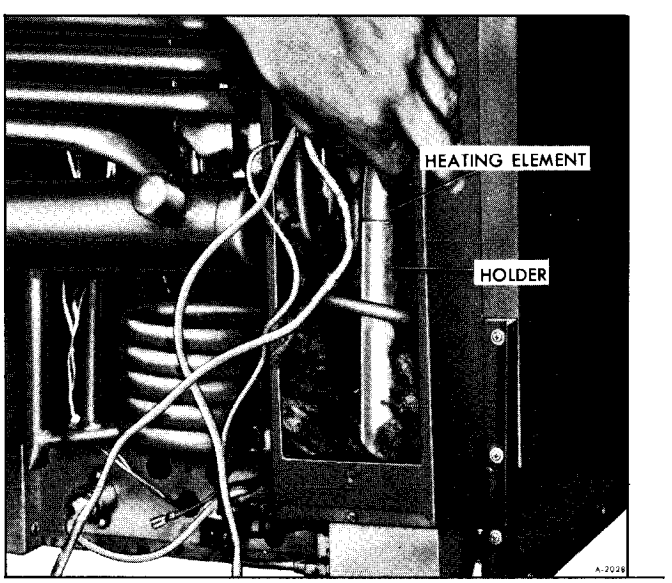


Figure 2–Removing Heating Element

4. Disconnect electrical leads.

5. Pull heating element out of holder (figure 2).

REMOVING IGNITION PLUG

1. At rear of refrigerator, remove burner cover (figure 1) by removing two screws and sliding it out of position.

2. Remove two screws on retaining bracket and remove ignition plug from burner housing (figure 3).

3. Cut insulation around ignition plug and remove it.

4. Remove ignition plug from wire by rotating it counter clockwise.

THERMOCOUPLE REMOVAL

1. Remove burner cover by removing two screws and sliding it out of position.

2. Remove retaining nuts at end of thermocouple and remove tip from burner box (figure 4).

3. Remove thermocouple lead from electromagnet as shown in Figure 5.

4. Remove thermocouple assembly from control pan.

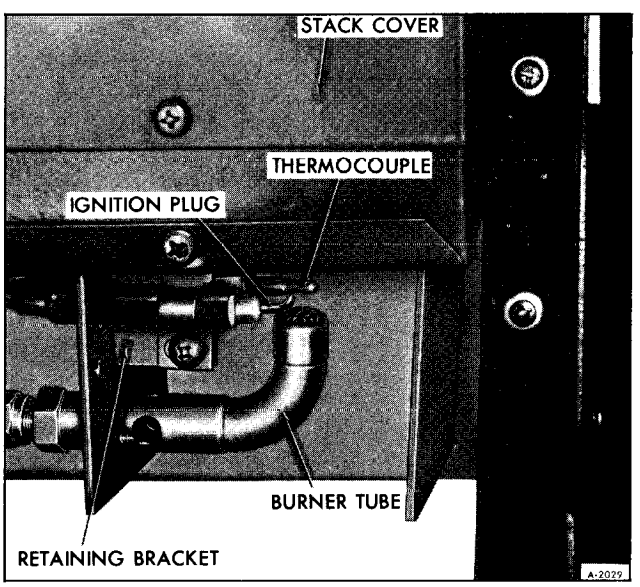


Figure 3–Burner Cover Removed

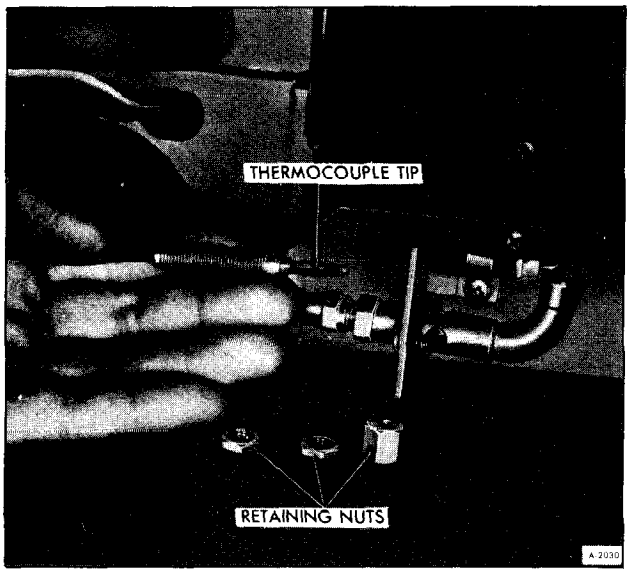


Figure 4–Thermocouple Removed From Burner Box

BURNER TUBE REMOVAL (FIGURE 6)

1. Turn off LPG at storage tank.

2. Remove gas line from burner orifice fitting.

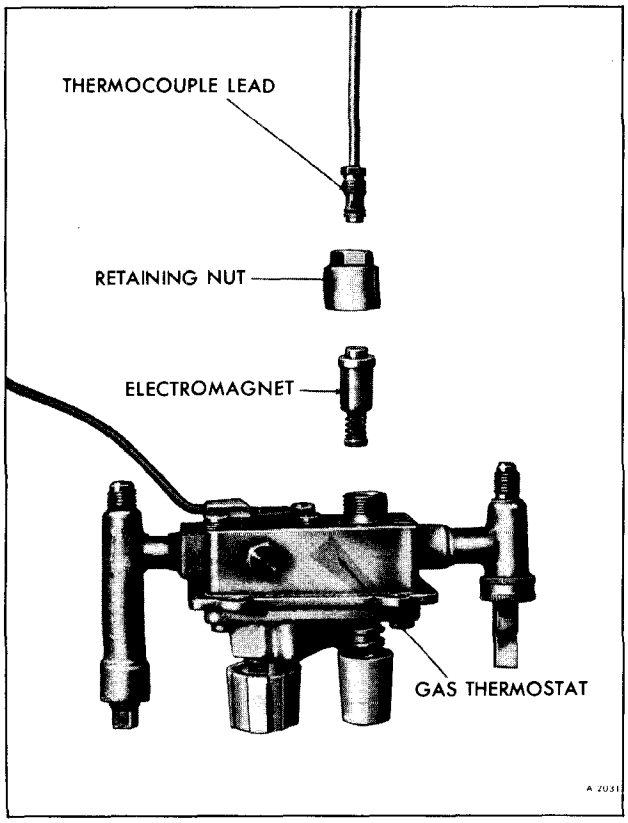


Figure 5–Thermocouple Lead and Electromagnet

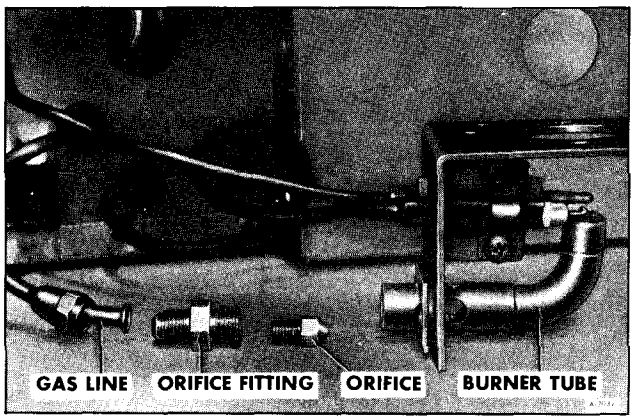


Figure 6–Burner Assembly

3. Remove two retaining screws from burner tube mounting bracket and remove burner tube.

4. Remove orifice fitting and burner orifice from burner tube.

BURNER ORIFICE REMOVAL (FIGURE 6)

1. Turn off LPG at storage tank.

2. Remove gas line from orifice fitting.

3. Remove orifice and orifice fitting, from burner tube.

4. Remove orifice from orifice fitting.

GAS THERMOSTAT REMOVAL

1. Turn off LPG at storage tank.

2. Pull control pan forward.

3. Remove thermostat sensing tube from its holder at evaporator plate.

4. At back of refrigerator remove cork plug which seals hole where sensing tube protrudes and pull tube through hole.

5. Remove thermocouple lead from thermostat (figure 5).

6. Remove control knobs for both gas and electric thermostats.

7. Remove control face plate.

8. Remove all gas lines to thermostat.

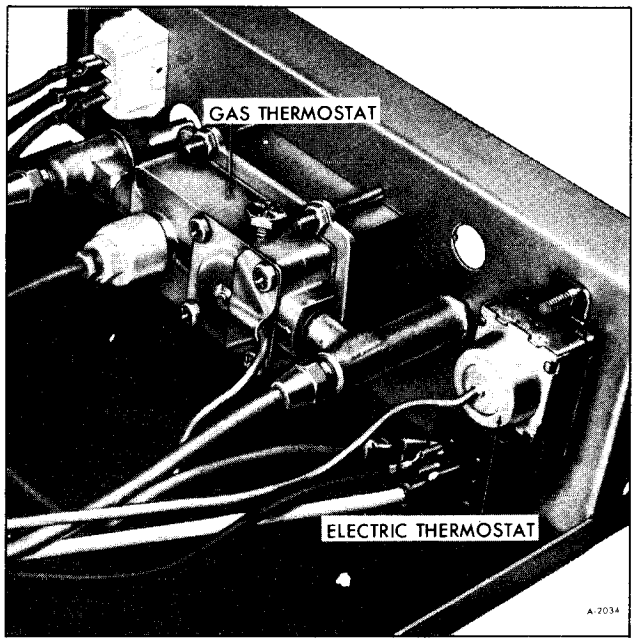


Figure 7–Thermostats

9. Remove four nuts and bolts retaining gas thermostat to control pan, and remove thermostat (figure 7).

ELECTRIC THERMOSTAT REMOVAL (FIGURE 7)

1. Pull control pan forward.

2. Remove sensing tube from holder on evaporator plate.

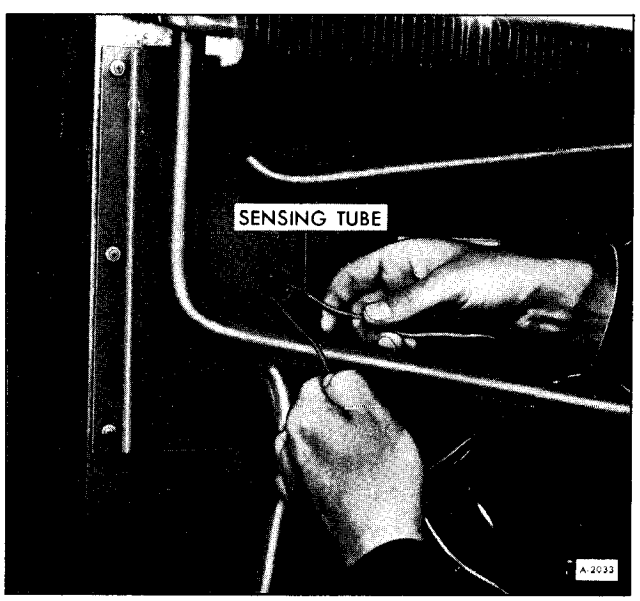


Figure 8–Removing Thermostat Sensing Element

3. At back of refrigerator remove cork plug which seals hole where sensing tube comes through, and pull tube through hole (figure 8).

4. Remove electrical leads from thermostat.

5. Remove control knobs, and control face plate.

6. Remove two retaining screws and remove thermostat.

CONTROL PAN REMOVAL

1. Remove louvered vent (outside Motor Home) to gain access to rear of refrigerator.

2. Turn off LPG at storage tank, and disconnect battery ground cables.

3. Disconnect LPG supply at back of refrigerator.

4. Disconnect 12-volt D.C. leads.

5. Remove four screws from rear of control pan. Refer to Figure 9.

6. Remove kickplate at front of refrigerator to gain access to controls.

7. Remove four screws from front of control pan.

8. Slide control pan out as shown in Figure 10.

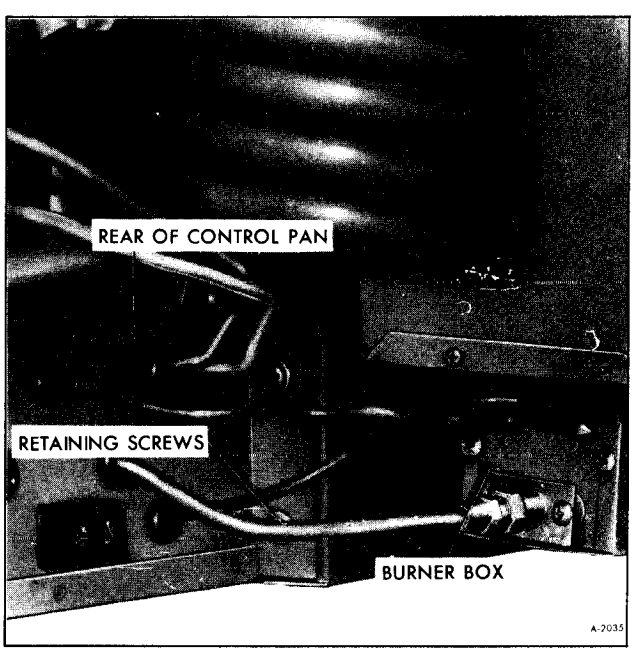


Figure 9–Control Pan (Rear)

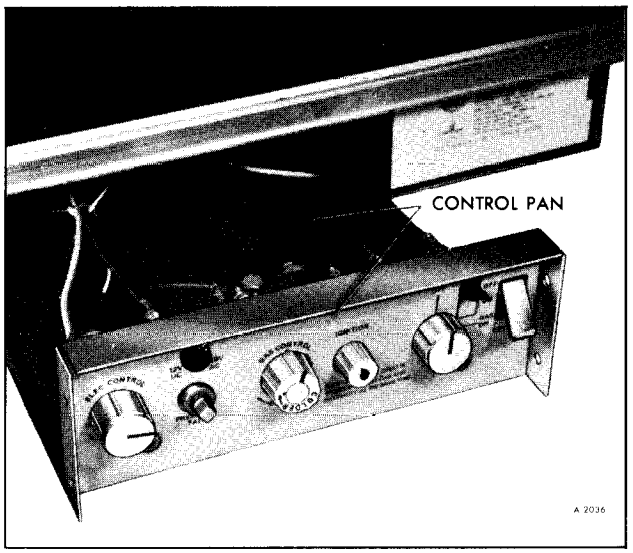


Figure 10–Control Pan (Front)

NOTE: Removal of control pan to this point, will allow servicing or replacement to be performed on controls.

COOLING UNIT REMOVAL

1. Remove refrigerator from Motor Home.

2. Remove drip pan under freezer.

3. Remove trim plate from secondary evaporator under freezer.

4. Remove five screws retaining primary evaporator to freezer compartment.

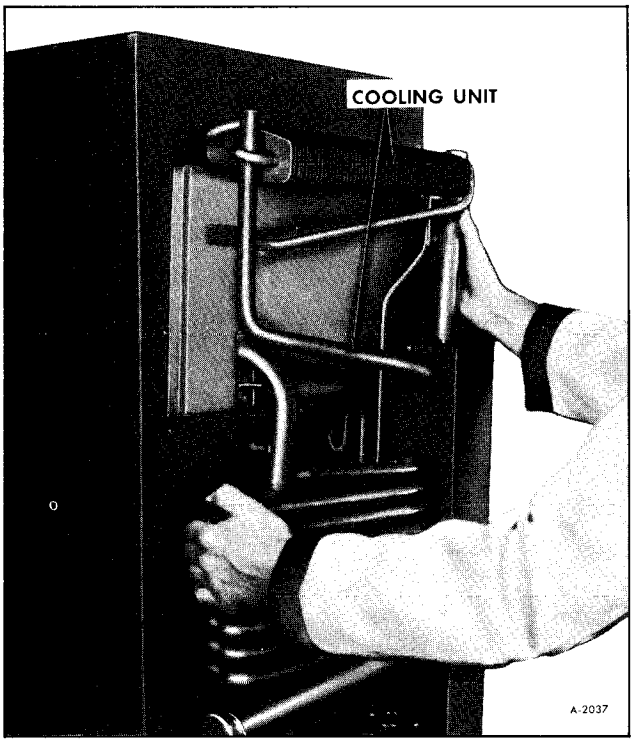


Figure 11–Removing Cooling Unit

5. Disconnect electrical leads to electric heating element.

6. Disconnect thermostat sensing tubes and pull them through back of refrigerator.

7. Disconnect burner box from flue.

8. Remove nine screws retaining cooling unit to back of refrigerator, and remove cooling unit (figure 11).

CLEANING AND INSPECTION

GAS LINE

LP gas is highly inflammable and it is of extreme importance to ensure not only that all joints in piping carrying the gas from the storage tank to the appliances are and will remain absolutely gas tight, but that any non-metallic packings used in such joints are made from materials that will not deteriorate from contact with LP gas.

The gas line should be free of kinks and sharp ends.

Periodically, the gas should be turned on, and all joints in the gas line must be checked for leaks up to the burner by use of soap and water solution.

BURNER ORIFICE CLOGGED

When the burner orifice is clogged, the flame will become too small on the maximum setting of the thermostat which may affect the burner heating output and result in decrease of cooling efficiency. For taking out the clog or replacing the burner orifice, first remove flared connector, then the orifice. The burner is easily reached from the rear of refrigerator. Refer to Figure 6.

LOST THERMOSTAT CHARGE

If the thermostat control assembly loses its charge, it will become inactive.

Make a lost charge test in case the flame stays minimum despite the proper setting up of the thermostat.

Proceed as follows for the test:

Remove the sensing tube from the sleeve at the evaporator. Warm up the free end of the capillary tube by holding it with the palm of the hand. If the flame fails to magnify in size, the thermostat has lost its charge and the thermostat must be replaced.

COOLING UNIT

If an excessive vaporizing of the ammonia within the boiler occurs due to improper heat input, unlevel operation or inadequate vetilation. The liquid mixture in the boiler becomes very weak and the pump will cease to operate, which means that the circulation of liquid stops with the result that the evaporator inside the cabinet ceases to produce cooling.

Such a blockage of the unit in the liquid circuit is most usually made evident by signs of overheating on the vapor pipe leading from the boiler to the condenser, the paint on this pipe being blistered and the metal becoming discolored. This condition can only be corrected by replacing the cooling unit.

The temperatures on various parts of a unit vary continuously when it is operating on thermostatic control and it is impossible to base a judgement on the symptoms given unless the refrigerator has been operating continuously on fully correct heat input for at least five hours, and preferably 12 hours, prior to examination. In many cases, this can be arranged by a telephone call to the customer, asking him to switch the thermostat to "coldest" on the day before the inspection call. If after 12 hours operation on "coldest" the performance is satisfactory, the unit is not at fault unless the complaint is one of varying or intermittent performance. In this connection, the room temperature at the time of the complaint must be considered, as a unit which is satisfactory at an ambient temperature of 50°F may not be satisfactory at 95°F.

In cases where satisfactory performance is obtained on "coldest" but not on other settings, the thermostat is to be suspected.

When a normal unit is working on "coldest" the absorber coil will be warmer at the bottom than at the top. The absorber vessel will be warmer. The vapor cooling pipe from the boiler to the condenser will be warm, bearable to the hand, at the bend where it joins the condenser, with a gradual rise in temperature towards the boiler.

LEAKS

Unsatisfactory unit performance due to an ammonia leak can be determined in the case of a visible leak by traces of a yellow deposit at the point where the ammonia is bleeding. If there is a leak on the evaporator inside the cabinet, ammonia smell may result.

HEATING ELEMENT (FIGURE 12)

The heating element can be tested with an ohmmeter. Disconnect the 12-volt D.C. leads to the heating element. Connect an ohmmeter across these two leads a reading of .5 to .65 ohms should be obtained. If not the element has a short or open and must be replaced.

FLUE TUBE

Once a year the flue tube should be cleaned as follows:

1. Remove refrigerator from Motor Home.

2. Place a clean cloth over burner head.

3. Remove flue baffle.

4. Using a stiff brush, such as one used to clean shotguns, clean the full length of the flue tube.

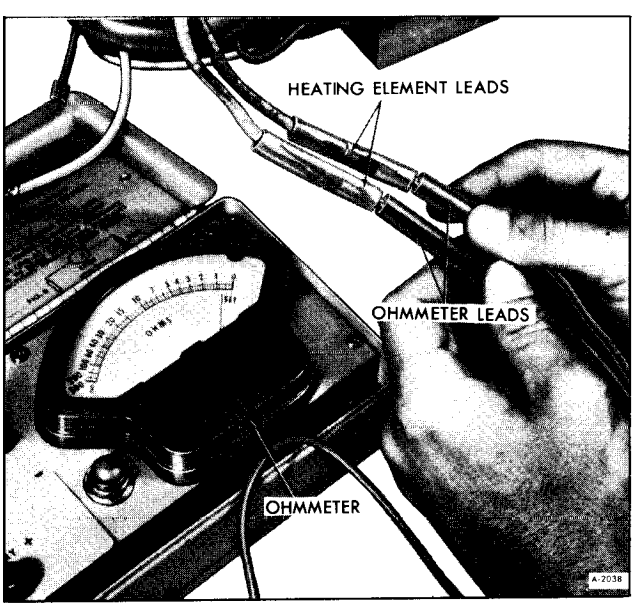


Figure 12–Testing Electric Heating Element

COMPONENT INSTALLATION

HEATING ELEMENT INSTALLATION

1. Place heating element in holder (figure 2).

2. Connect 12-volt D.C. leads.

3. Repack insulation in burner stack and install cover.

4. Install vent on exterior of Motor Home.

INSTALLATION IGNITION PLUG

1. Screw ignition plug into wire by rotating it clockwise.

2. Place new shrink tube over ignition plug and position as shown in Figure 13.

3. Heat shrink tube, made of thermosetting resin, uniformly with a lighter or match until a good fit is obtained (figure 14).

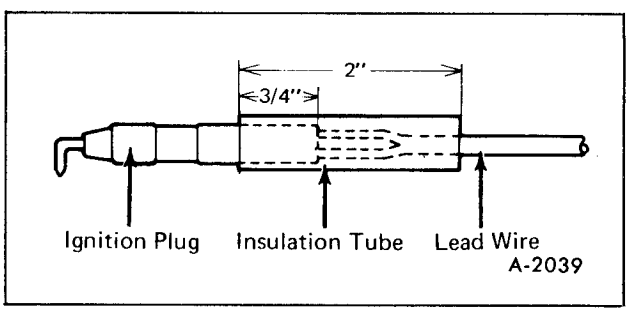


Figure 13–Fitting Shrink Tube on Ignition Plug

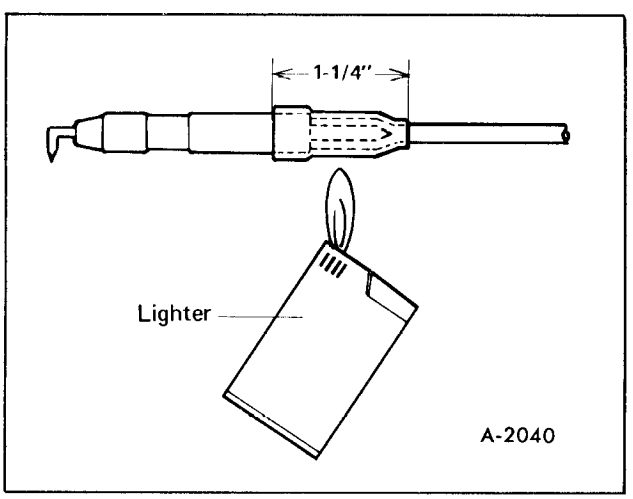


Figure 14–Heating Shrink Tube

THERMOCOUPLE INSTALLATION

1. Position thermocouple and lead in control pan.

2. Install thermocouple lead in electromagnet and torque nut to 5-6 inch lbs. (figure 5).

3. Install thermocouple tip in burner box and secure with retaining nuts. Be sure tip is positioned so it will still contact flame when burner is operating on by-pass flame.

4. Install burner cover and secure with two screws.

BURNER TUBE INSTALLATION (FIGURE 6)

1. Install burner orifice and orifice fitting in burner tube.

2. Install burner tube and secure with two retaining screws through bracket. Check position of ignition plug and thermocouple.

3. Install gas line to orifice fitting.

4. Turn on LPG gas and leak test all fittings.

BURNER ORIFICE INSTALLATION (FIGURE 6)

1. Install orifice in orifice fitting.

2. Install orifice and orifice fitting in burner tube.

3. Install gas line to orifice fitting.

4. Turn on LP gas at tank and leak test all fittings.

GAS THERMOSTAT INSTALLATION

1. Position thermostat in control pan, and secure with four nuts and bolts.

2. Connect all gas lines to thermostat.

3. Install control face plate and control knobs to front of control pan.

4. Install thermocouple lead to back of thermostat and torque nut to 5-6 in. lbs.

5. Run thermostat sensing tube through back of control pan and through hole at back of refrigerator.

6. Position end of sensing tube in its holder at evaporator plate.

7. Turn on LP gas at storage tank and leak test all fittings.

8. Position control pan in refrigerator and secure with retaining screws.

ELECTRIC THERMOSTAT INSTALLATION

1. Position thermostat and secure with two screws.

2. Install face plate and control knobs to front of control pan.

3. Connect electrical leads.

4. Run sensing tube through back of control pan, and through hole in back of refrigerator and seal hole with cork plug.

5. Position end of sensing tube in its holder at evaporator plate.

6. Position control pan in refrigerator and secure with retaining screws.

CONTROL PAN INSTALLATION (FIGURE 10)

1. Position control pan under refrigerator.

2. Secure at front with four retaining screws.

3. Install kickplate.

4. Secure at rear with four retaining screws.

5. Connect LP gas line to back of refrigerator.

6. Connect 12-volt D.C. leads to terminal block at back of refrigerator.

7. Turn on LP gas at storage tank and leak test all fittings.

8. Connect battery ground cables.

COOLING UNIT INSTALLATION

1. Position cooling unit on back of refrigerator and secure with nine screws (figure 11).

2. Connect burner box on bottom of flue.

3. Install thermostat sensing tubes, and connect leads to electric heating element.

4. Secure primary evaporator to freezer compartment with five retaining screws.

5. Install trim plate on secondary evaporator.

6. Install drip pan under freezer.

7. Install refrigerator in Motor Home.

ON VEHICLE ADJUSTMENTS

BURNER TUBE

The burner tube should be positioned in such a way that its center line should be aligned center to center with the flue tube (See figure 15).

This can be accomplished by bending burner box until proper position is obtained.

GAS THERMOSTAT (FIGURE 16)

Immediately to the right of the cold control knob are two adjustment screws. The lower adjustment screw controls the gas pressure to the burner. This adjustment should remain open since gas pressure is regulated at the regulator on the gas tank.

LOW FLAME

The upper adjustment screw adjusts the flame size when gas control is on by-pass. This may be adjusted while on by-pass flame. DO NOT REMOVE THE COLD CONTROL KNOB.

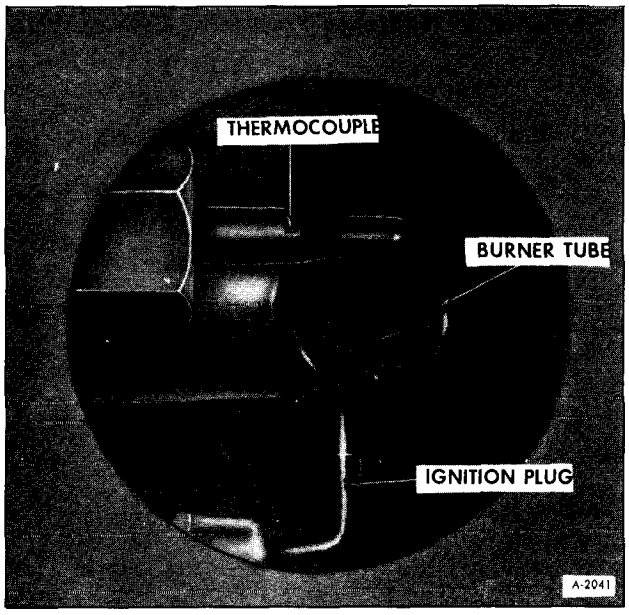


Figure 15–Proper Burner, Ignition Plug, and Thermocouple Placement

THERMOSTAT SENSING TUBE

At the bottom of the freezing compartment is a sleeve in which the end of the thermostat sensing tube must be inserted. If the sensing tube is not properly inserted in its sleeve, the burner will operate continuously at maximum flame. It will cause too low cabinet temperatures.

IGNITION DEVICE

If when pushing ignition button connected with the ignition device, LP gas is not ignited despite proper sparking, adjust the ignition tip.

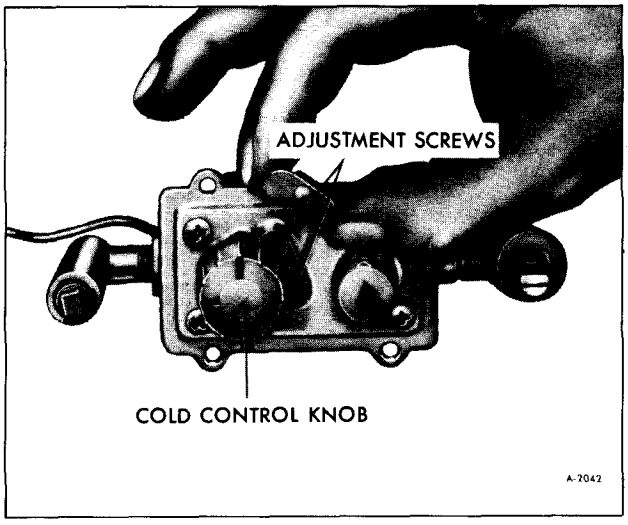


Figure 16–Thermostat Adjustment

The ignition tip should be positioned as shown in Figure 15, so that the spark will arc to the screening on top of the burner tube.

THERMOCOUPLE TIP POSITION (FIGURE 15)

The tip of the thermocouple must be placed so that its tip is in the flame while the burner is operating on a by-pass flame. If its tip is not in the flame the automatic flame failure device will sense that there is no flame and shut off the gas supply.

The thermocouple position can be adjusted by bending its mount on the burner box (figure 17).

WARNING: BE SURE REFRIGERATOR IS TURNED OFF AND COMPONENTS HAVE BEEN ALLOWED TO COOL PRIOR TO ADJUSTMENT OF THERMOCOUPLE TIP. THIS IS TO PREVENT BURNING OF FINGERS DURING ADJUSTMENT.

LP GAS PRESSURE

The pressure of the LP gas may be measured at the pressure tap on the control panel on the refrigerator. A monometer or low pressure gauge should be used.

The pressure of the burner should be checked at the time the refrigerator is started up. After connecting the pressure gauge, set the thermostat dial at "coldest".

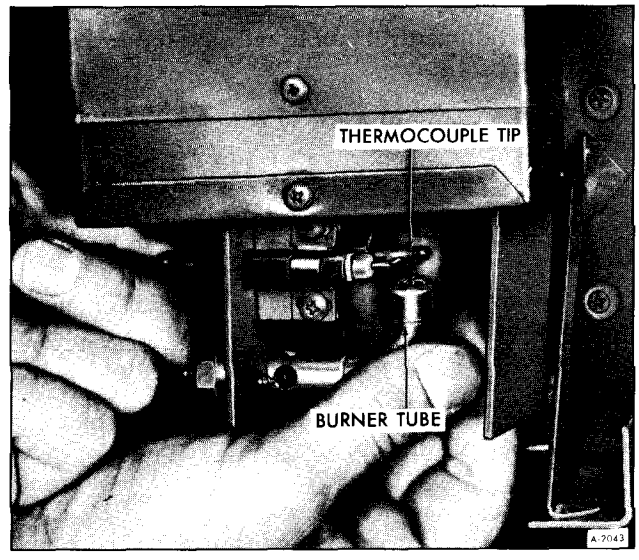


Figure 17–Thermocouple Adjustment

Turn on the gas and light the burner. At the "coldest" setting the pressure reading should be at a minimum 10 1/2" or a maximum of 11 1/4" as the LP gas is supplied directly to the refrigerator from the regulator on the gas tank at pressure of 11".

LEVELING

In the boiler of the cooling unit, ammonia vapor is distilled from an ammonia-water mixture and carried to the finned condenser where it liquefies. The liquid flows to the evaporator inside the cabinet where it cools, evaporating into a circulating flow of hydrogen gas. If the evaporator is not level, the liquid readily accumulates, forming pockets which can impair the gas circulation or block it completely, resulting in suspension of cooling action.

When the vehicle is stationary, it must be leveled to be comfortable to live in. If the refrigerator is properly installed, i.e. the ice tray compartment shelf is parallel with the floor, the refrigerator will operate properly. To check this, a bubble level should be used. With the level placed on the ice tray compartment shelf, check the position of the bubble (if necessary, with the aid of a small mirror).

Adjust the position of the vehicle so that the bubble is in the center ring of the level.

When the vehicle is moving, the continuous rolling and pitching movement will not affect the refrigerator as long as the movement passes either side of level but when the vehicle is temporarily parked, the sensitivity of the refrigerator should be kept in mind.

DOOR SEAL

It is essential, for correct operation, that the door gasket make a good seal all around, against the front of the cabinet.

The gasket should just contact the front of the cabinet when the door is closed. This is normally allowed for during manufacturing.

Failure of the door gasket to contact the front of the cabinet can be determined visually when the door is closed. Run a piece of thin cardboard along the door seal, inserted between the gasket and the cabinet front.

Nowhere should the card feel loose. Improper door sealing on cabinets provided with magnetic door gasket can be corrected by slackening the upper and lower hinge fixing screws and moving the door inwards or outwards by inserting a washer or taking away to correct the door as required until a satisfactory seal is obtained. If a good seal cannot be obtained, a new gasket should be installed.

GMC MOTOR HOME SERVICE

NOVEMBER, 1973

SECTION 24E
ROOF MOUNTED AIR CONDITIONER

Information for servicing the roof mounted air conditioner was not available at time of printing.

GMC MOTOR HOME SERVICE

SECTION 24F
LP GAS SYSTEM

The contents of this section are listed below:

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 vehicles range/oven, furnace and optional gas/electric refrigerator as shown in Figure 1. The LP gas tank, which stores the fuel, is located in its compartment at the right rear of the vehicle. The standard tank is 30" long and holds 44.5 lbs of LP gas and the optional 40" tank holds 65 lbs. The tank is equipped with a fill valve, liquid level outage valve, vapor POL valve, tank float gauge assembly and a regulator.

The copper gas lines on both model Motor Homes are laid out so that most connections are outside the vehicle. The lines go inside the vehicle only to reach an appliance.

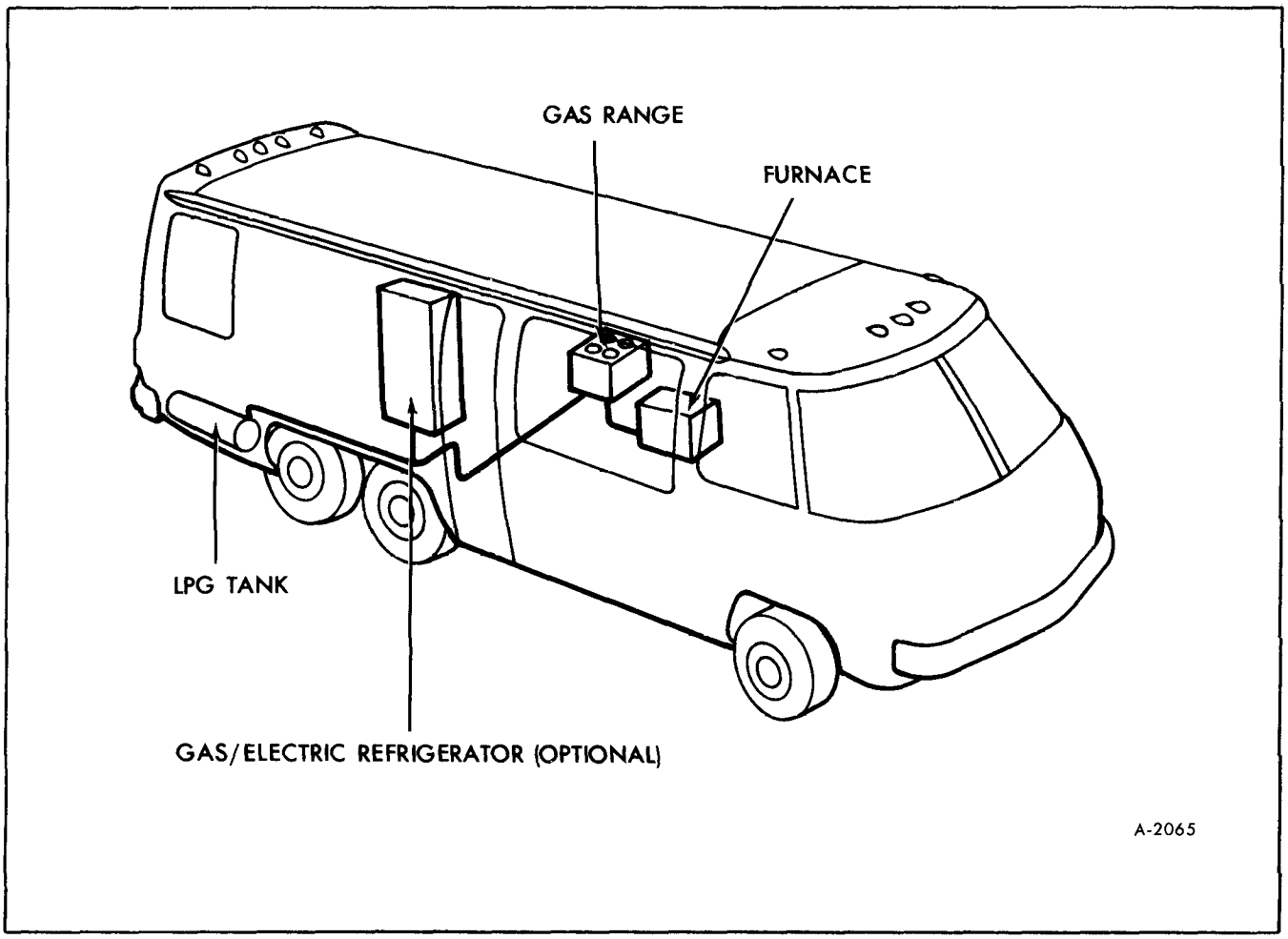


Figure 1-LP Gas System (Model 260 Shown)

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 Leak in LP gas system.	Open valve completely. Refer to "ON VEHICLE ADJUSTMENTS" for regulator pressure specifications. 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.

Problem	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 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.
	In freezing weather, water in the system may freeze and block regulator or lines.	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 eleven inches of water pressure as measured on a monometer.

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.

1. Connect a monometer to a range spud exposed after removing a burner from the range.

2. Turn on the corresponding burner valve all the way. If the dial does not read eleven inches of water pressure, the regulator needs adjusting.

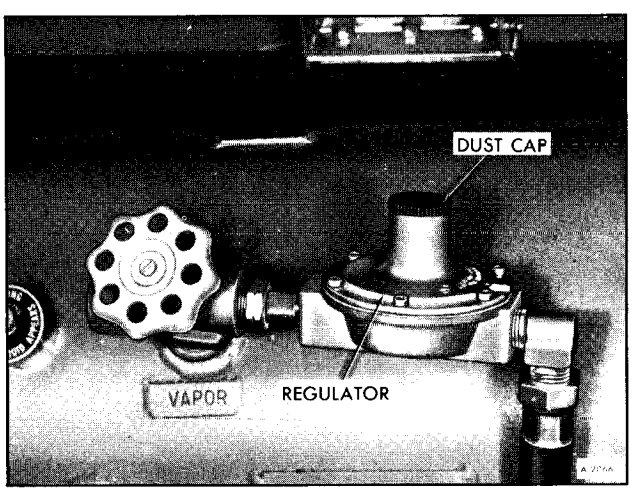


Figure 2–Regulator

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

4. Turn the adjusting slot clockwise to increase the pressure and counter-clockwise to decrease the pressure (See figure 3).

5. 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.

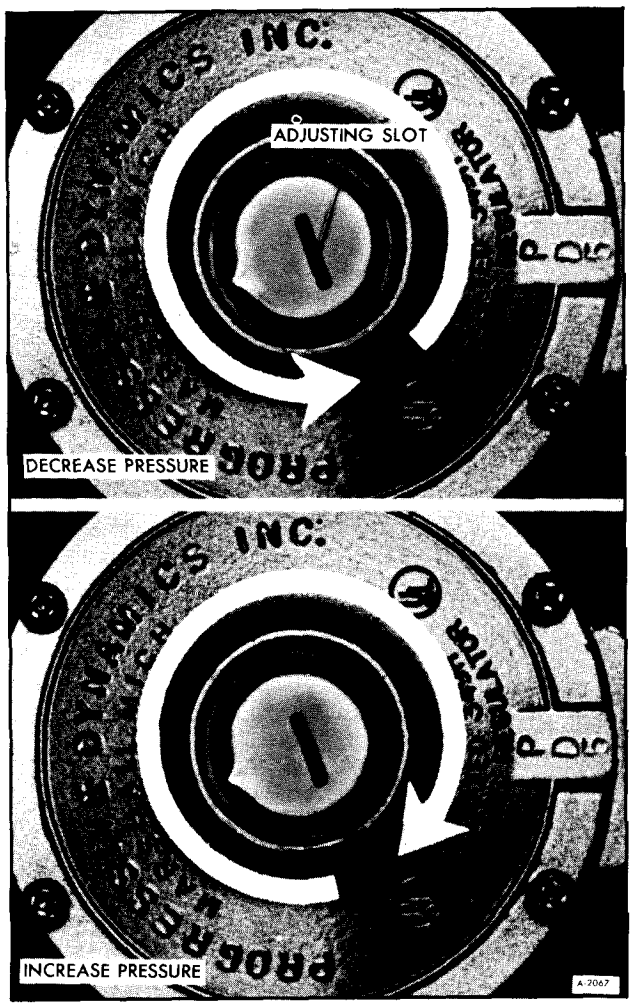


Figure 3–Regulator Adjustment

COMPONENT REPLACEMENT

FILL VALVE (FIGURE 4)

REMOVAL

1. Empty tank. Refer to WARNING at the beginning of this section.

2. Removethe fill valve cap.

3. Remove the fill valve.

INSTALLATION

1. Wrap threads with teflon tape and install valve into tank.

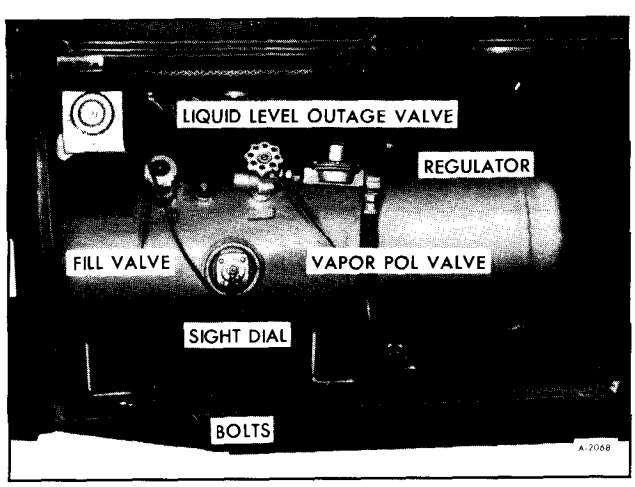


Figure 4–LP Gas Tank Valves

2. Tighten all fittings securely.

3. Fill tank.

LIQUID LEVEL OUTAGE VALVE

REMOVAL (FIGURE 4)

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 4)

REMOVAL

1. Empty tank. Refer to WARNING at beginning of this section.

2. Remove valve handle securing screw. Remove handle (See figure 6).

3. Remove valve stem (See figure 6).

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.

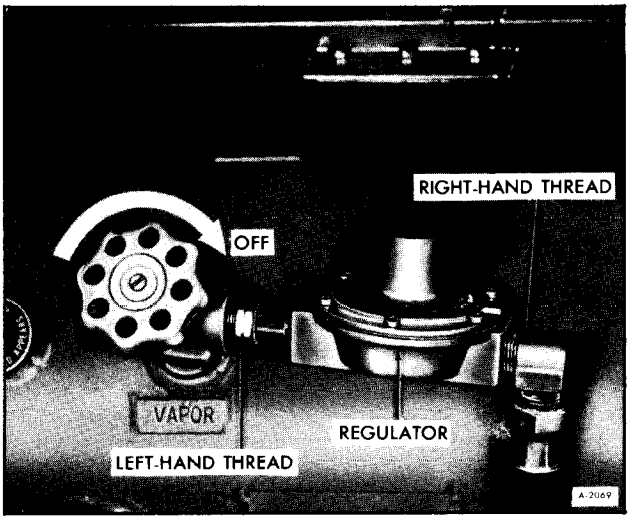


Figure 5–Regulator Attachment

REMOVAL

1. Turn off gas at the tank (See figure 5).

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 5).

INSTALLATION

1. Install regulator to POL valve.

2. Connect hose assembly to regulator. Use teflon tape on threads.

3. Position regulator as shown in Figure 5 and tighten all fittings securely.

GAS TANK SIGHT VALVE DIAL

REMOVAL

1. Remove two (2) retaining screws (See figure 6).

2. Remove wire retaining screw and wire, if so equipped.

3. Remove sight dial.

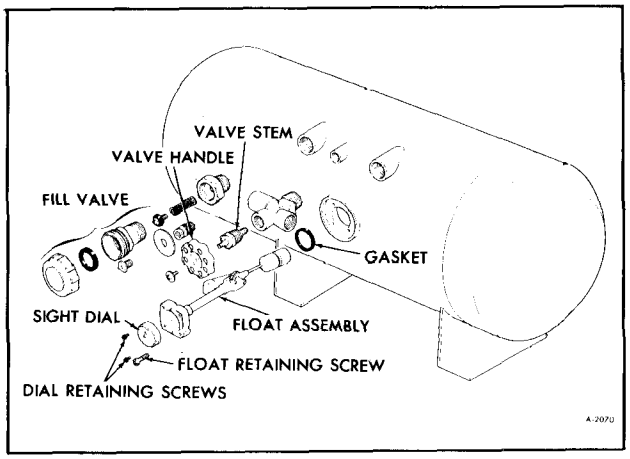


Figure 6–LP Gas Tank Components

INSTALLATION

1. Install sight dial.
2. Install two (2) dial retaining screws.
3. Install wire and retainer screw if removed.

GAS TANK FLOAT ASSEMBLY

REMOVAL

1. Empty tank. Refer to WARNING at beginning of this section.
2. Remove four (4) float retaining screws (See figure 6).
3. Disconnect wire at sight dial, if equipped.
4. Remove float assembly.

NOTE: Position float as shown in Figure 6 while removing from tank.

INSTALLATION

1. Install float assembly.
2. Install and tighten four (4) retaining screws.
3. Connect wire to sight dial, if equipped.
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. Remove four (4) nuts and bolts securing tank to vehicle (See figure 4).
4. Disconnect wire from sight dial, if equipped.
5. Remove tank.

INSTALLATION

1. Install tank and four (4) bolt and nut assemblies. Torque nuts to 30 ft. lbs.
2. Connect wire to sight dial, if removed.
3. Apply teflon tape to threads and connect hose assembly to regulator.
4. Fill tank.

LP GAS LINES AND FITTINGS (FIGURE 7)

LP gas lines are standard copper tubing connected with AGA (American Gas Association) fittings. The lines are replaceable or repairable. A damaged portion of the line may be cut out and union's used to connect a new section of tube to the line. Be sure that 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.

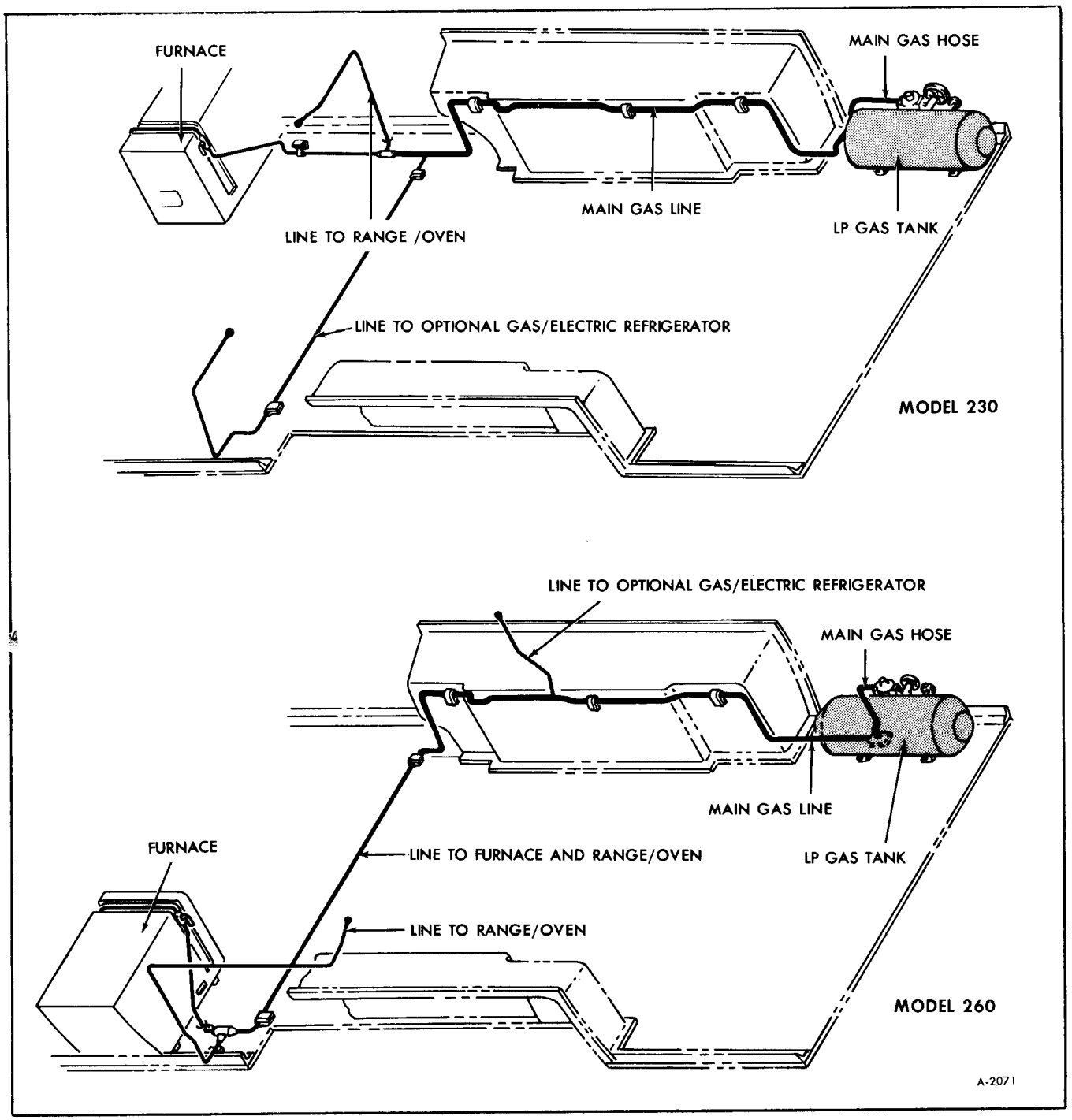


Figure 7–LP Gas Lines

GMC MOTOR HOME SERVICE

SECTION 24G
FURNACE

Contents of this section are listed below:

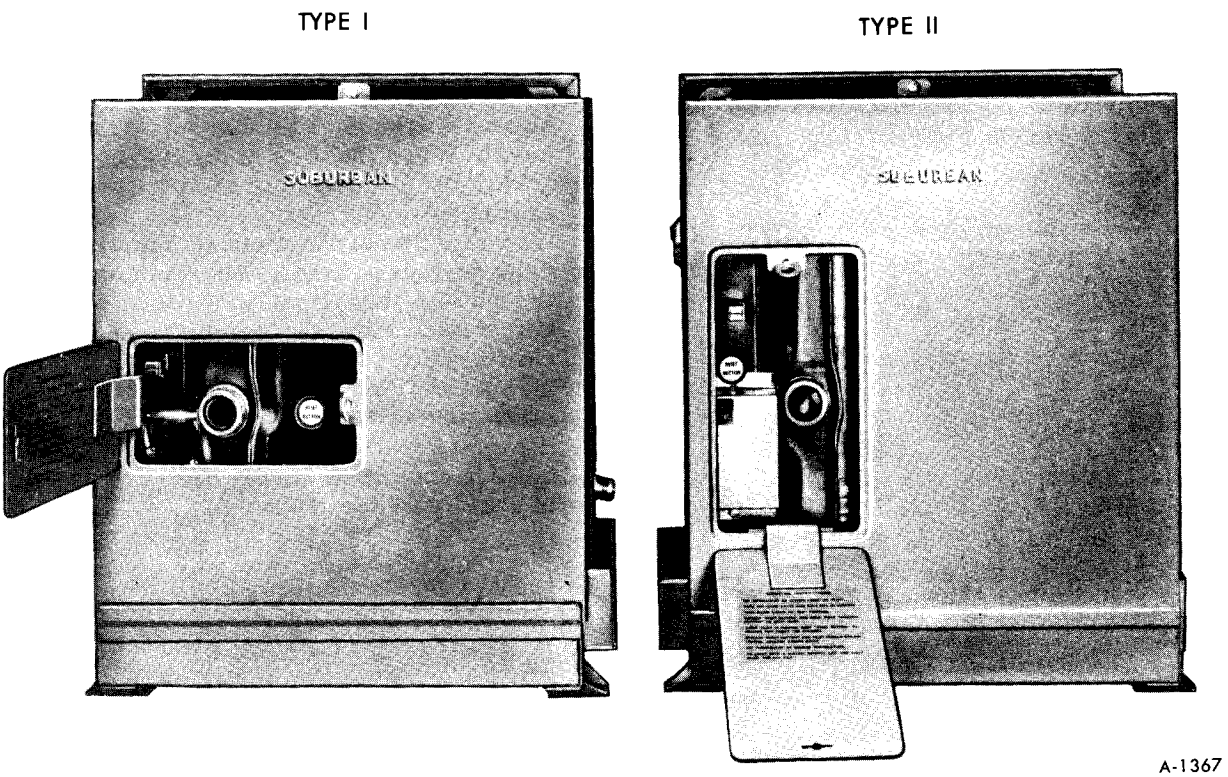


Figure 1–Type I and II Furnaces

GENERAL INFORMATION

WARNING: BEFORE ANY REMOVAL OR DISASSEMBLY PROCEDURES ARE PERFORMED ON THE FURNACE, BE SURE L.P. GAS IS COMPLETELY TURNED OFF AT THE LP GAS TANK.

The furnace in the Motor Home is a Suburban Dyno-Trail furnace. It is a sealed combustion system furnace and is one of the following models:

NT-22G TYPE I (22,000 B.T.U.)

NT-32G TYPE I (30,000 B.T.U.)

NT-22G TYPE II (22,000 B.T.U.)

NT-32G TYPE II (30,000 B.T.U.)

Basically the combustion chamber is the same in all models as well as the blower, burner, and control assembly. But before any repairs or disassembly is attempted, it is necessary to be able to identify which model you are working with.

To do this, first determine whether the furnace you are working with is TYPE I or TYPE II. This can be quickly done by opening the furnace control access door. If the door opens horizontally, as shown in Figure 1, it is a TYPE I furnace. If the door opens vertically, as shown in Figure 1, the furnace is a TYPE II.

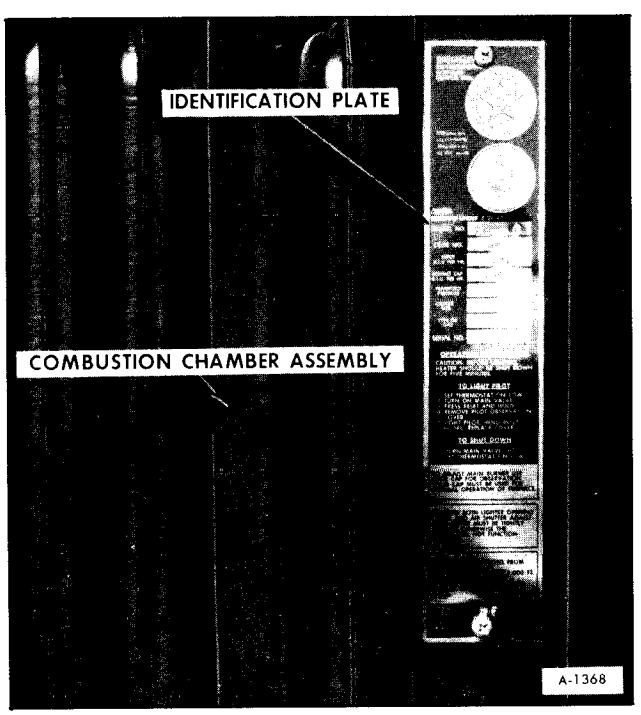


Figure 2–Furnace Identification Plate

Once it is determined whether the furnace is TYPE I or TYPE II you can then determine whether the furnace is a NT-22G or NT-32G by removing the cabinet front (one screw at top of cabinet) and reading the model number on the Furnace Identification Plate, located on the front of the combustion chamber (See figure 2).

This furnace utilizes a sealed combustion system with a patented dual blower, one of which circulates room air while the other furnishes outside air for combustion. The combustion air blower then forces the flue products to the outside for maximum safety and heating efficiency. The furnace operates on 12-volts and it's wiring diagram is shown in Figure 3.

NOTE: Combustion air must not be drawn from the living area!

Some of the components essential for proper furnace operation are:

FAN SWITCH (FIGURE 4)

The fan switch is to control the sequence of the blower operation. The fan switch is a two pole switch. When the bimetal disc of the fan switch is heated to the operating temperature, the switch changes positions. This completes a circuit through the motor from a direct source. The blower will continue to run as long as the chamber is hot even though the thermostat is satisfied and the main burner is off. When the chamber cools, the fan switch changes back to its original position and shuts the blower off. If burner and blower shut off simultaneously after about 2 minutes of operation, and the thermostat is still calling for heat, then the fan switch failed to completely change over. This is a symptom of a faulty switch–replace it.

LIMIT SWITCH (FIGURE 4)

The purpose of the limit control is to turn off the gas to the main burner if for any reason the furnace becomes hotter than that which is safe. Improper operation of the furnace due to the limit control does not always indicate a defective control. If the circulating air is blocked or only partially so, the limit control will function and cause the main burner to cycle. Cycling on the limit is not always undesirable–if it happens only occasionally. This is a good indication of safe operation and will most likely happen on a warm day. If cycling happens too often or for an extended period, the circulating air system should be thoroughly cleaned.

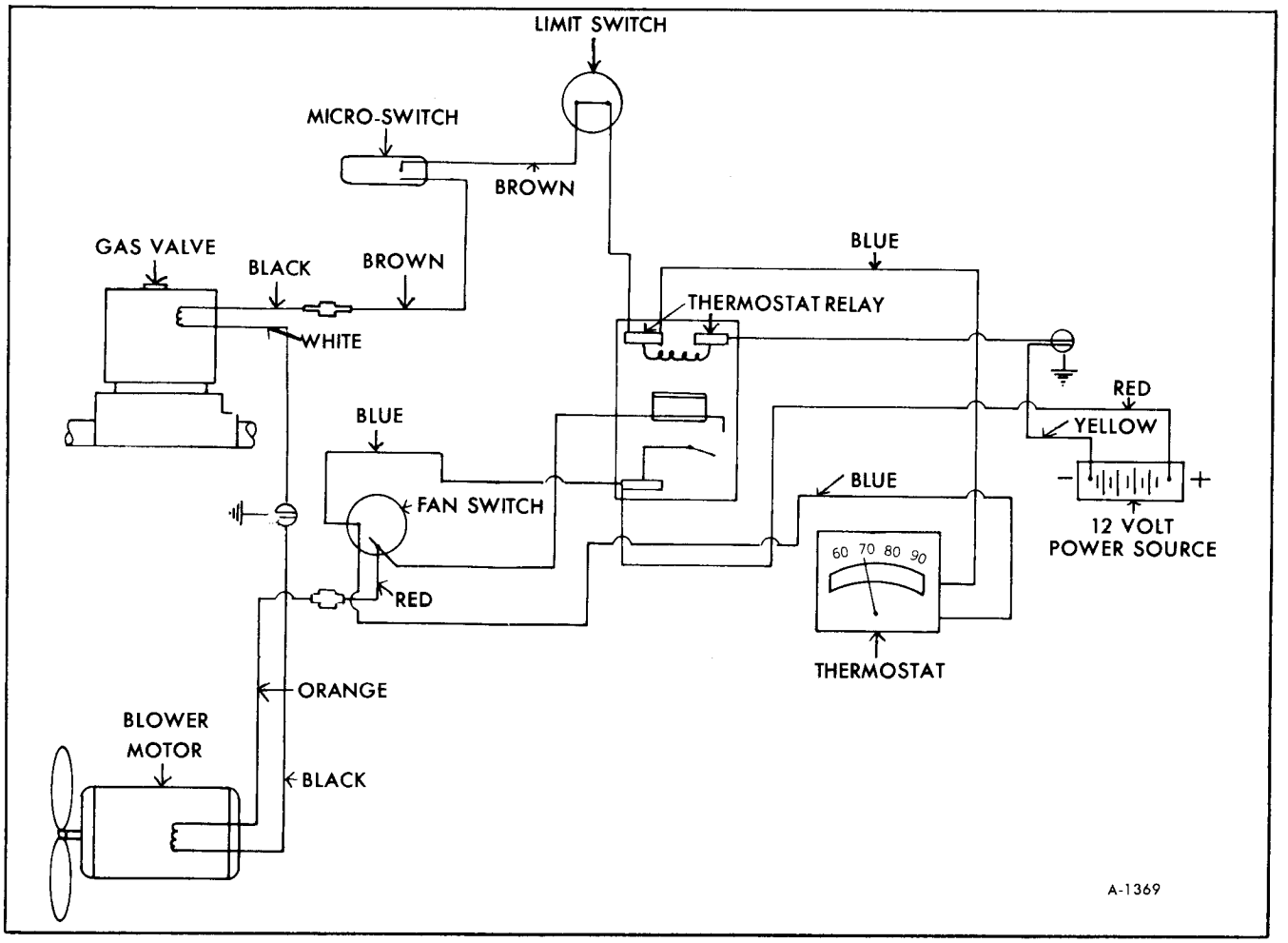


Figure 3–Furnace Wiring Diagram

If for any reason the limit control is found to be defective, there is no recommended method of repairing it. Because of its importance for safety reasons, it should be replaced with a new one. CAUTION: NEVER SHUNT THE LIMIT CONTROL EVEN FOR ONLY TEMPORARY OPERATION.

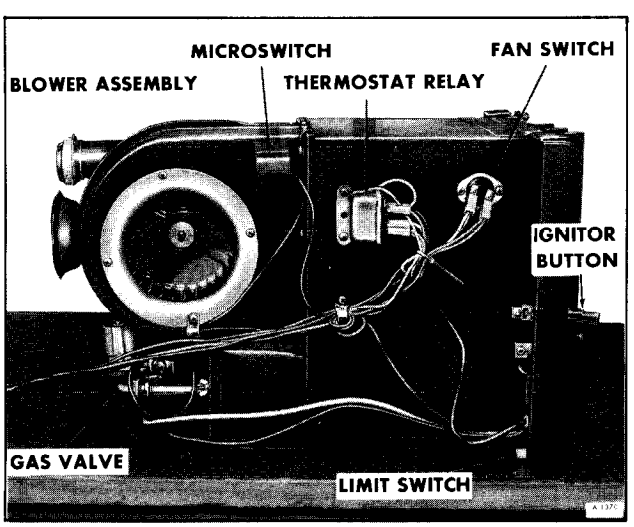


Figure 4–Furnace Components (Typical)

MICROSWITCH (FIGURE 4)

The microswitch has two purposes:

1. It is an "air prover." It operates in response to the current of air generated by the blower. Hence, if for any reason the air from the blower is not sufficient, the switch will not operate. This may be caused by a slow motor due to low voltage, restricted return air, or lint accumulation on the blower wheel.

2. The switch allows time for the blower to pull in a sufficient amount of air to support combustion before it engages. Once it engages, the solenoid valve opens, gas flows to burner, and ignition occurs.

BLOWER ASSEMBLY (FIGURE 4)

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

IMPACT IGNITION SYSTEM (FIGURE 4)

This spark ignitor has been added to facilitate lighting. It is a solid state device with no outside current required.

Depressing the "Ignition Button" operates a lever on the device which, in turn, creates a spark at the ignitor tip. Normally the unit will ignite with the first spark. In the event the unit doesn't readily light with the ignitor, it's possible the ignitor tip may need repositioning–aligning the ignitor tip with the pilot gas flow can be accomplished through the lighter hole.

On initial lighting, air in the gas line may require several pumps of the "Ignitor Button" for ignition.

The ignitor does not prevent the lighting by match if desired.

FURNACE OPERATION

1. To light the furnace, turn the manual valve (See figure 5) to the "off" position and wait 5 minutes. Set the thermostat at its lowest setting. Open manual valve. Correct operating characteristics depend on this valve being positioned fully open. Never attempt to operate with valve partially closed.

2. Open access door and remove lighter cap.

3. Press reset button and hold. Depress the impact ignitor button (See figure 5). On the initial lighting the pilot may not light immediately due to air in the gas line. If such is the case it may be necessary to hold the reset button in for a minute or more before the pilot lights. When the pilot is burning, continue to hold the reset button in for approximately 30 seconds or until the pilot continues to burn when the reset button is released.

4. Replace the lighter hole cap.

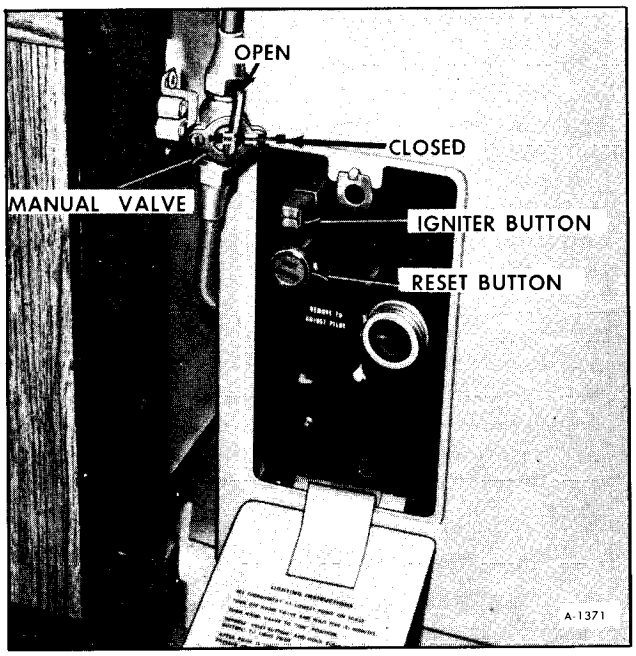


Figure 5–Manual Valve, Reset and Ignitor Buttons

5. Close access door.

6. Set thermostat at desired position.

SEQUENCE OF NORMAL OPERATION

1. When the thermostat calls for heat, the blower motor is energized immediately.

2. As the blower motor reaches approximately 75 percent of the normal r.p.m. (within 3 to 5 seconds) the microswitch, in response to the air flow, will engage allowing current flow to the solenoid valve or baso valve.

3. The current to the valve opens it and allows gas to the main burner. The pilot light then ignites the main burner.

4. If within a period of approximately 2 minutes after the main burner is lit, the thermostat is turned back, both the blower motor and gas valve are deenergized. However, if the furnace continues to run longer than 2 minutes, which it normally should, a slight snap can be heard from within the casing. The snap is caused by the fan switch as it changes its position. After this occurs, if the thermostat is satisfied or turned back, the gas valve will close, the flame on the main burner will go out, but the blower will continue to run for a short period of time and will then shut off. The purpose of this is to remove most of the remaining gases from the heat exchanger. Be assured that this period of blower override is a part of the unit's normal operation.

FURNACE TROUBLE DIAGNOSIS CHART

Problem	Possible Cause	Correction
No heat.	1. Thermostat off.	1. Check to be sure thermostat is calling for heat. Wire to thermostat could be off terminal.
	2. Gas supply.	2. Be sure manual gas valve is in the open position (level parallel to gas line). Also, check to be sure there is LP gas in the LP tank.
	3. Pilot.	3. Check to see that pilot is lit. (See Problem-Pilot Outage).
	4. Electrical connections or power.	4. Battery must be charged. If battery is low, there will be sufficient power to run the blower, but not enough to run the blower at full speed. If blower doesn't run at its prescribed speed, the microswitch cannot be engaged and gas will not flow to the main burner. Be sure the connection of the voltage lines in the terminal block are tight.
	5. Malfunctioning microswitch.	5. Be sure the microswitch is "sailing" in far enough to open the gas valve. If the switch is not "sailing" in, clean any dust or dirt from the actuator pin. Other reasons for switch not sailing in are: a. Insufficient blower speed (slow motor due to low charged battery, faulty motor, or lint and dust accumulation on the blower wheels, or restriction of return air to furnace). Check wiring in accordance with unit's wiring diagram to assure the proper polarity of the 12-volt d.c. power supply is observed. This polarity must be observed so the motor will run the proper direction of rotation to insure correct air delivery. b. Faulty microswitch–Replace switch if valve doesn't open when switch is manually engaged. Switch should also be replaced if battery is fully charged and blower motor running at top speed fails to engage switch within 6 to 7 seconds. NOTE: To service switch, combustion chamber must be pulled out.

Problem	Possible Cause	Correction
	6. Gas valve.	6. Gas valve–With test light check gas valve terminals in the terminal block. If current is present, but valve is not opening (when micro-switch engages), replace gas valve. The chamber must also be removed to check the above.
	7. Blower not operating.	7. Check for burned-out motor.
	8. Short cycling (fan switch)–If burner and fan shut off simultaneously when the fan switch closes (2 or 3 minutes after burner comes on) it indicates a shorted fan switch.	8. Replace fan switch.
	9. Defective thermostat relay–Relay may be faulty if motor fails to start when thermostat calls for heat. This will be evidenced when the wall thermostat is turned up but the motor fails to start and there is no "click" in the thermostat relay. If a "click" is heard in the thermostat relay but the motor fails to start then it is the motor that is defective.	9. Replace thermostat relay.
Pilot Outage Pilot outage can be due to several reasons. To isolate the source of a pilot outage complaint, it is very helpful to determine exactly when the pilot is going out. There are three phases of the unit operation: a. Off phase. b. Start up or ignition phase. c. Operating phase. If the time of outage can be linked to one of these phases, then possible sources can be isolated.	A. Off Phase 1. Weak thermocouple or gas valve–Thermocouples are generally long lived, but failures can occur after a period of use. If the pilot is observed going out during the off cycle, it could be due to either a weak thermocouple or safety pilot valve. A simple check can be made in the field by a time check. Remove the lighter hole cap and extinguish the flame after the pilot has been lit for approximately 5 minutes. Use a watch to check the time that elapses between extinguishing the pilot and the snap of the safety valve. If this is less than 30 seconds, it indicates a weak thermocouple or gas valve.	A. Off Phase 1. Replace the thermocouple first and repeat the test for the safety pilot valve. If the time lapse is still less than 30 seconds, replace the safety pilot valve.

Problem	Possible Cause	Correction
(continued from previous page).	2. Air leakage-Draft should not affect the pilot. The unit has a sealed combustion chamber with an air intake and exhaust subject to the same atmospheric pressure. Therefore, the pressure within the chamber is equalized and air is steady. Regardless of the wind or draft condition the pilot will not be blown out as long as the chamber is sealed properly. If, however, a leak is evident, it would disrupt the pressurized chamber, and a draft air movement would commence. As a result the pilot could possibly go out.	2. The following are points to check for air leakage. The unit should be pulled and all of these points should be carefully checked. a. Pilot burner gasket must be absolutely tight. b. Air shutter adjustment cover gasket must be absolutely tight. c. Vacuum cup on air intake tube should fit against cabinet back so that no room air can enter air intake. d. Asbestos exhaust gasket should be fitted properly at the end of the exhaust tube to insure proper seal. e. Lead-in wires to the blower motor should be sealed where they enter the blower housing. f. All other gasket points; e.g., blower assemblies, sponge rubber gaskets. g. It is possible that the felt gasket on the interior of the blower assembly may not be properly sealed. If not, air can flow from the sealed combustion compartment which is, in effect, air leakage. Checking this point will necessitate breaking down the blower assembly; therefore, it should be the last point to check. Nevertheless, this is an important hint as this could also be a contributing factor to pilot outage. h. Restriction of exhaust tube–Visually check rear exhaust tube opening for blocking of discharge of exhaust products. i. Crossover tube between lower section of blower assembly and burner tunnel may be cracked, deteriorated, or off the blower assembly flange or burner tunnel. Replace if cracked or deteriorated.

Problem	Possible Cause	Correction
(Continued from previous page).	3. Lack of sufficient air–Another reason for pilot outage during the off cycle is the lack of sufficient air to support proper pilot flame adjustment. It is important that the flame be the proper size. Unlike most heating equipment, too large a flame is a common cause of pilot outage. It should be just high enough to envelop the thermocouple. If the pilot flame is other than this or yellowish in color, replace the pilot orifice.	3. Replace the pilot orifice.
	4. Leaky gas valve–If gas leaks by the gas valve during the off burner periods, it burns, using the oxygen in the chamber and causing the pilot to go out because of lack of oxygen. Observe the main burner through the lighter hole to be sure that the burner cuts off completely on the off cycle. If a flame is present, no matter how small, it indicates that a small amount of gas is leaking through.	4. If there is leakage, inspect the valve to be sure there is no dirt between the valve and valve seat. If there is no dirt to account for the trouble, replace the valve.
	5. Malfunctioning microswitch–Make sure the microswitch is dropping all the way out and breaking the connection in the gas valve on the off cycle of the blower.	5. Replace microswitch.
	6. Gas supply–Check gauge for proper gas supply and pressure.	6. Check for proper gas supply and pressure.
	7. Clogged pilot orifice–Evident by small pilot flame.	7. Replace the pilot orifice.
	8. Pilot adjustment.	8. Pilot should be adjusted to where the pilot flame just envelops the thermocouple tip.
	B. Start-up or Ignition Phase If the pilot is observed and is going out when the burner comes on, check for the following:	B. Start-up or Ignition Phase

Problem	Possible Cause	Correction
(continued from previous page).	1. Malfunctioning microswitch–The microswitch allows gas to reach the main burner by closing the circuit through the gas valve, after the blower motor has started and reached approximately 75 percent of its maximum r.p.m. This takes about 3 to 5 seconds. If the microswitch opens the gas valve too soon, the main burner flame may float and pull the pilot flame out. This is caused by lack of oxygen in the combustion chamber.	1. If microswitch is engaging too fast, replace switch.
	2. Primary air–Too little primary air will cause burner to float on ignition and could pull pilot out.	2. Adjust primary air. (See Burner Adjustment).
	C. Operation Phase 1. If burner and fan shut off simultaneously when the fan switch closes 2 to 3 minutes after the burner comes on, it indicates a shorted fan switch. Replace the switch. If this symptom occurs, it is also possible for the pilot to go out because the blower was not allowed to run and purge out the combustion products. The excessive amount of combustion products can smother the pilot.	C. Operation Phase 1. Replace the fan switch.
Excessive Noise.	1. Blower out of balance. 2. Motor hum. 3. Air adjustment–A screeching or howling noise while burner is on is due to excessive primary air.	1. Replace blower. 2. Replace motor. 3. Adjust primary air. (See Burner Adjustment)
Erratic Blower operation	1. Automatic blower motor overload switch may be defective. 2. Blower assembly may be loose causing squirrel cage wheel to drag.	1. Replace blower 2. Check blower assembly - secure if loose.

Problem	Possible Cause	Correction
Furnace will not operate.	1. Power supply. 2. Wall thermostat–Be sure thermostat is set for a temperature higher than that of the Motor Home 3. Loose or shorted wiring.	1. Check power source and fuse. 2. Remove wall thermostat and connect the two wires to it together. If the furnace starts, replace thermostat. 3. Check all wiring to assure proper connections or detect possible shorts.

COMBUSTION CHAMBER 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.

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 L.P. gas is turned off at the tank. Turn the electricity off at the thermostat as shown in Figure 6.

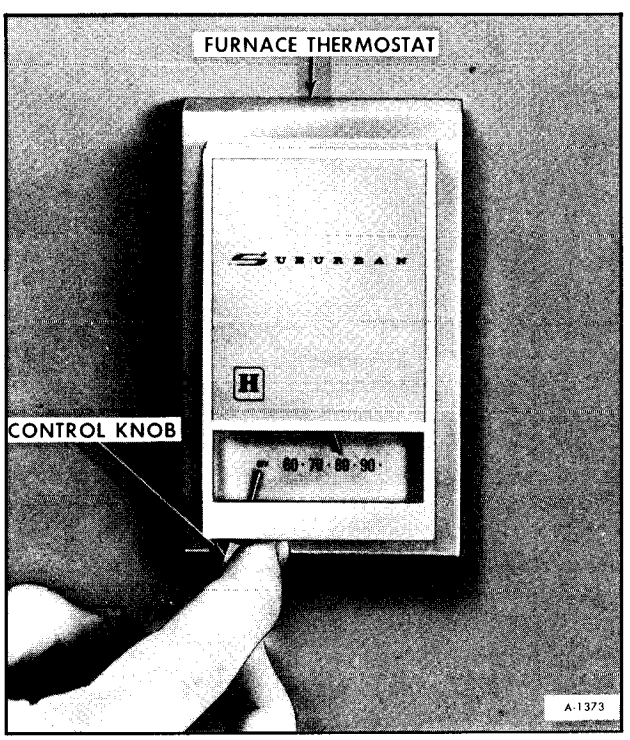


Figure 6–Turning Off Electricity To Furnace At Thermostat

2. Disconnect the main gas line at elbow fitting.

3. Remove cabinet front (one screw at top of cabinet front) (figure 7).

4. Remove the screw securing chamber to cabinet (lower right corner) as shown in Figure 8.

5. Remove the four vent cap screws (outside vehicle). Then remove the vent cap adapter screws (two) to free the exhaust tube (See figures 9 and 10).

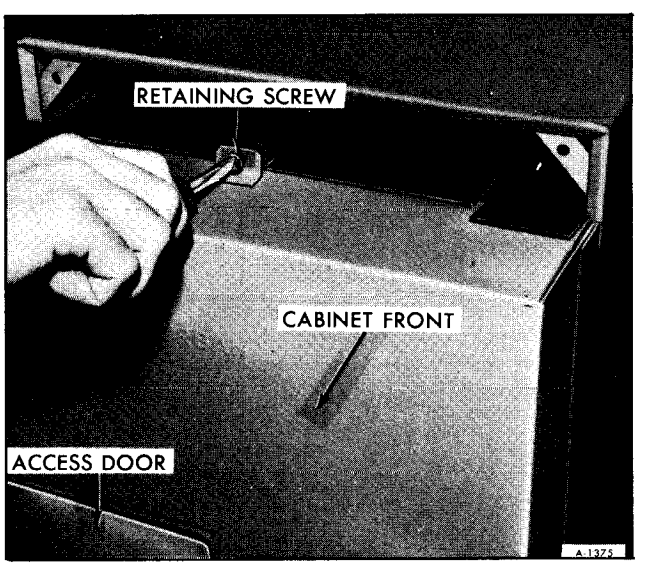


Figure 7–Removing Cabinet Front

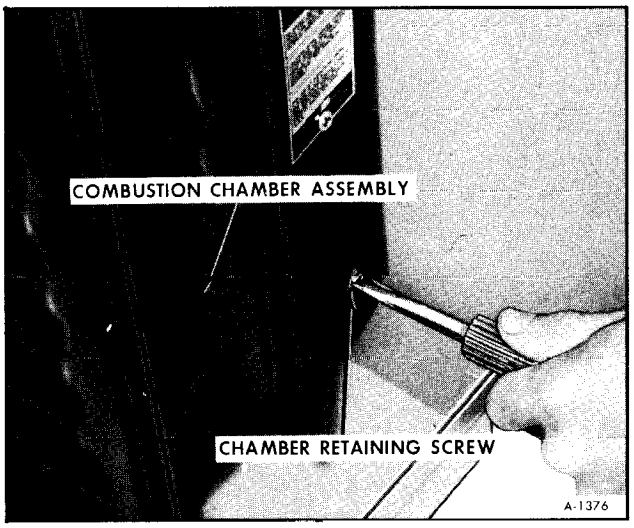


Figure 8–Removing Chamber Retaining Screw

6. Pull chamber forward until wires can be disconnected at the terminal connecter (See figure 11). Remove chamber.

INSTALLATION

1. Position rear of combustion chamber in cabinet slides, and move it partially in until the wires can be connected at the terminal connecter (See figure 11). Push chamber all the way in to cabinet.

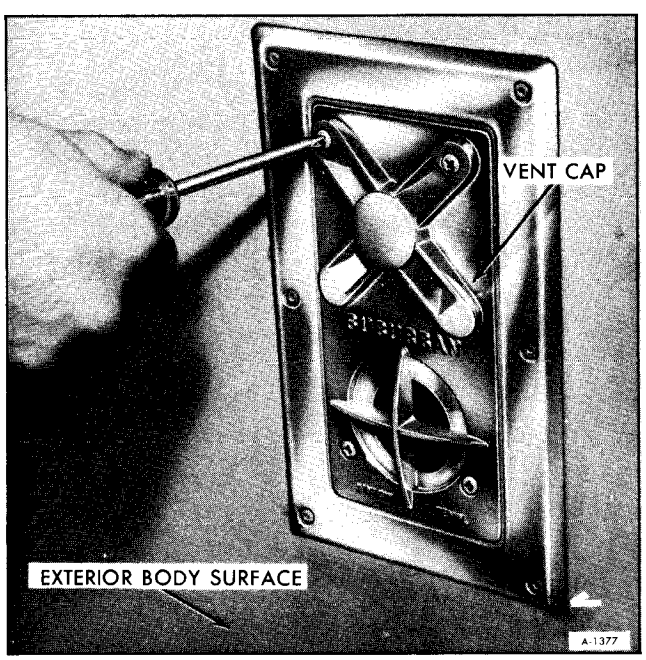


Figure 9–Removing Vent Cap

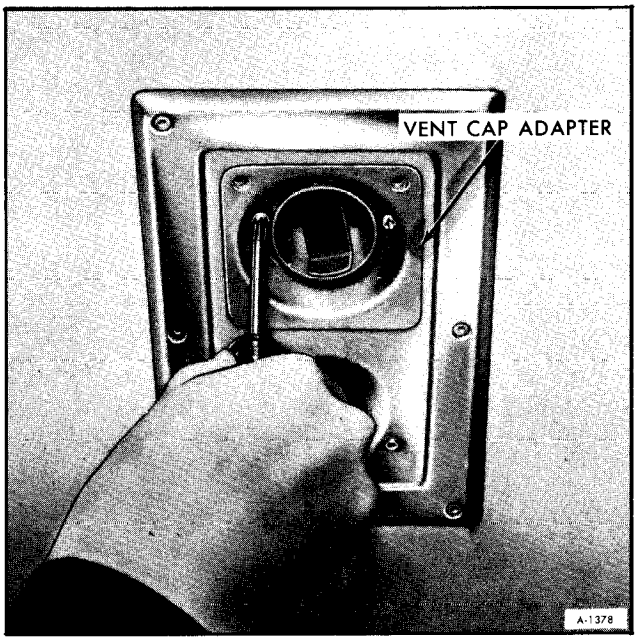


Figure 10–Removing Vent Cap Adapter

2. Install vent cap adapter and be sure rubber cup is properly seated. Install the vent cap (outside vehicle) (See figures 9 and 10).

3. Install screw securing chamber to cabinet (lower right corner) (figure 8).

4. Install cabinet front being sure the edges are set properly in all groves. Secure with one screw at top (See figure 7).

5. Connect the main gas line and connect or turn on electricity (figure 6).

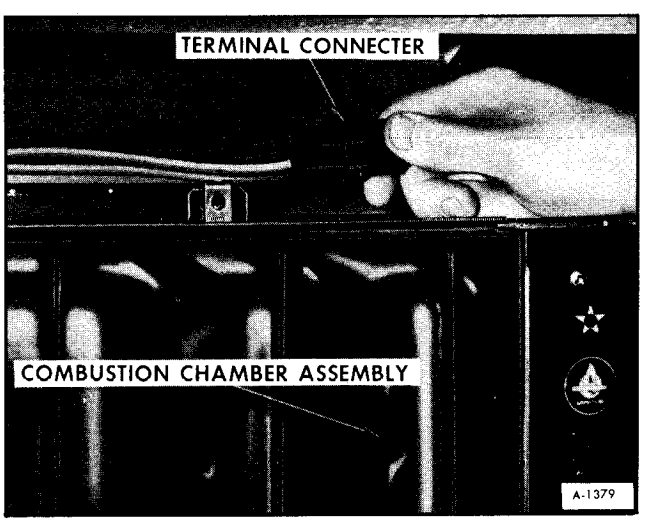


Figure 11–Furnace Thermal Connecter

COMPONENT REPAIR

NOTE: For furnace model identification refer to "General Information" as described at the beginning of this section.

MICROSWITCH REPLACEMENT

REMOVAL

1. Remove combustion chamber from cabinet (See Combustion Chamber Replacement).

2. Remove microswitch shield (figure 12).

3. Remove two screws and nuts holding microswitch assembly in blower housing and remove switch (See figure 13).

4. Disconnect microswitch wires at gas valve and limit switch (remove wire clip).

INSTALLATION

1. Install microswitch in blower housing and secure with two screws and nuts (figure 13).

2. Connect microswitch wires.

3. Install microswitch shield (figure 12).

4. Install combustion chamber in cabinet (See Combustion Chamber Replacement).

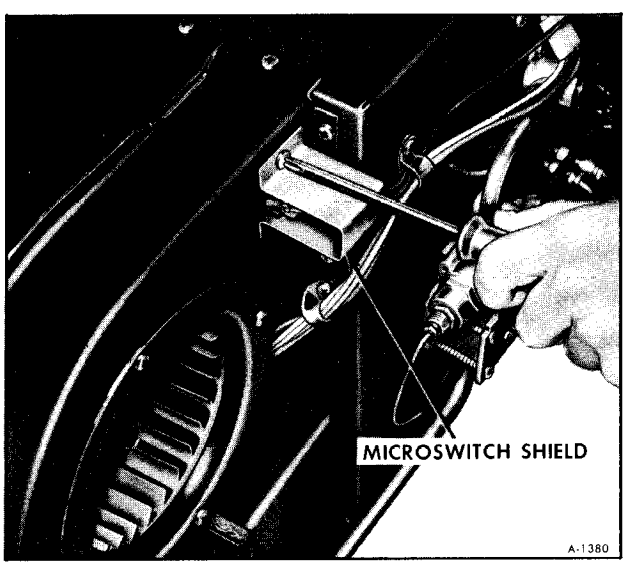


Figure 12–Removing Microswitch Shield

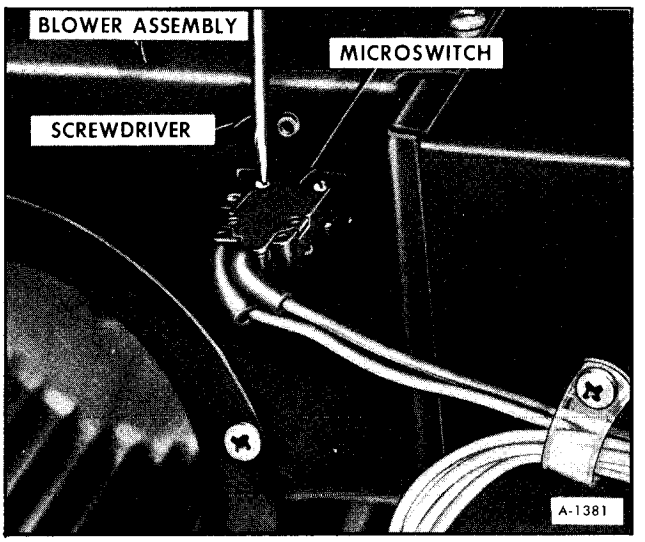


Figure 13–Removing Microswitch

GAS VALVE OR PILOT SAFETY REPLACEMENT (TYPE I FURNACES)

NOTE: The NT-22G TYPE I has its gas valve and pilot safety as two separate valves (See figure 14), whereas the NT-32G TYPE I has both these valves incorporated into one (See figure 15). But, the gas valve (and pilot safety) replacement procedures are similar for both the NT-22G TYPE I and the NT-32G TYPE I.

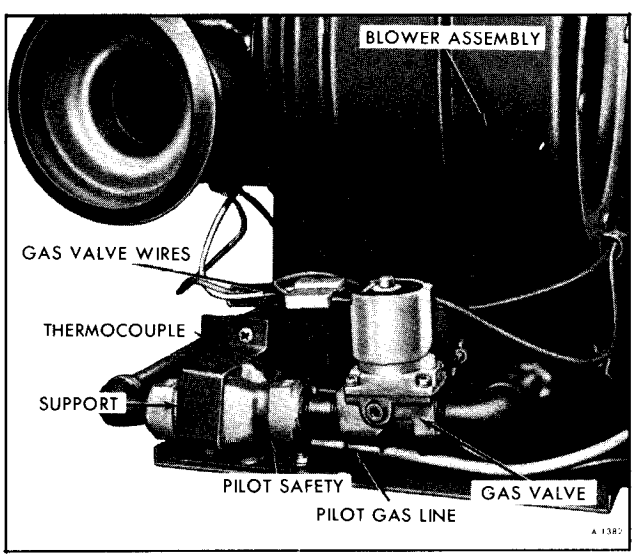


Figure 14–(NT-22G) Gas and Pilot Safety Valve

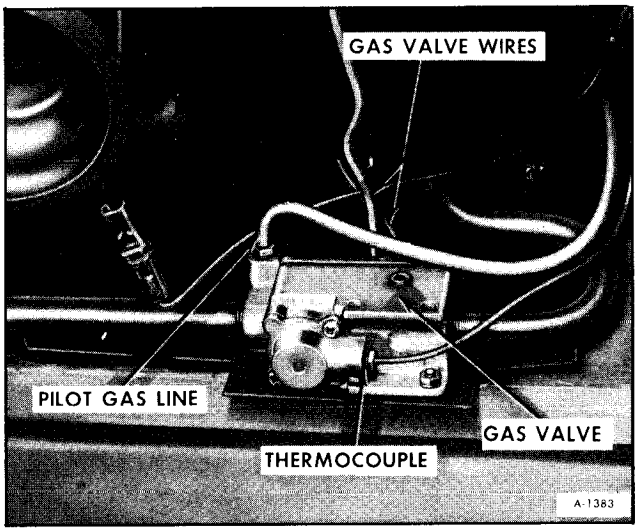


Figure 15–(NT-32G) Gas Valve

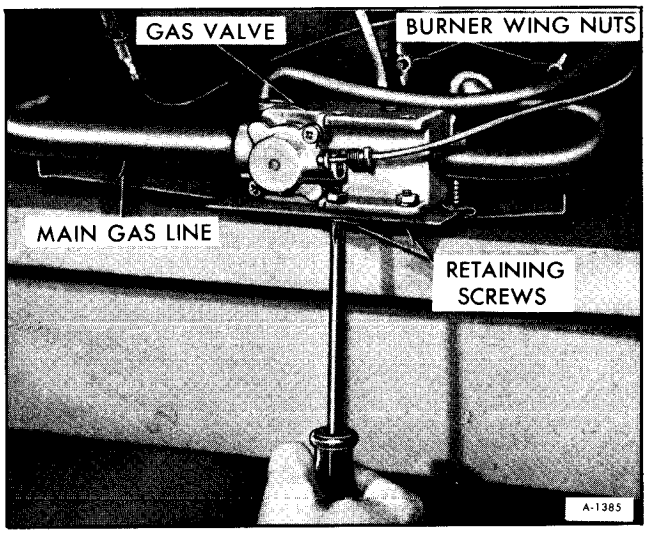


Figure 17–(NT-32G) Removing Gas Valve Retaining Screws

REMOVAL

1. Remove combustion chamber from cabinet (See Combustion Chamber Replacement).

2. Disconnect pilot gas line, thermocouple and wires from valve(s) (See figures 14 and 15).

3. Remove main gas line support(s).

4. Remove screws and nuts holding valve to chamber (See figures 16 and 17).

5. Remove two wing nuts at rear of burner compartment.

6. Remove burner, valve(s), and main gas linc all as a unit (See figure 18).

7. Disassemble and remove defective component (See figure 19).

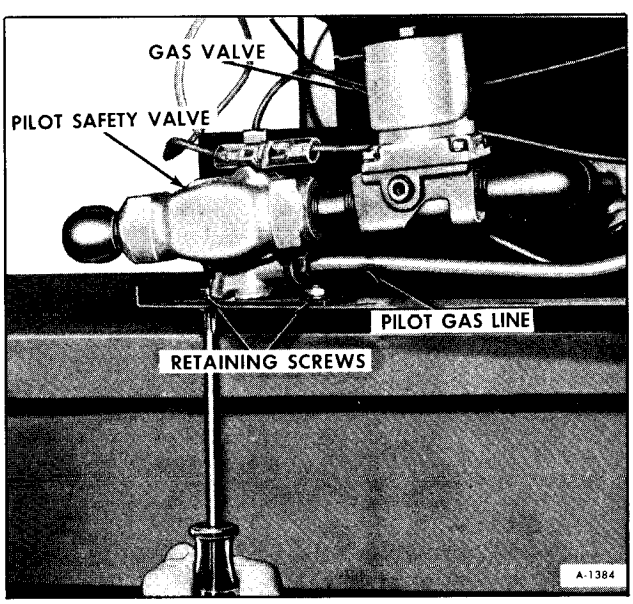


Figure 16–(NT-22G) Removing Pilot Safety Valve Retaining Screws

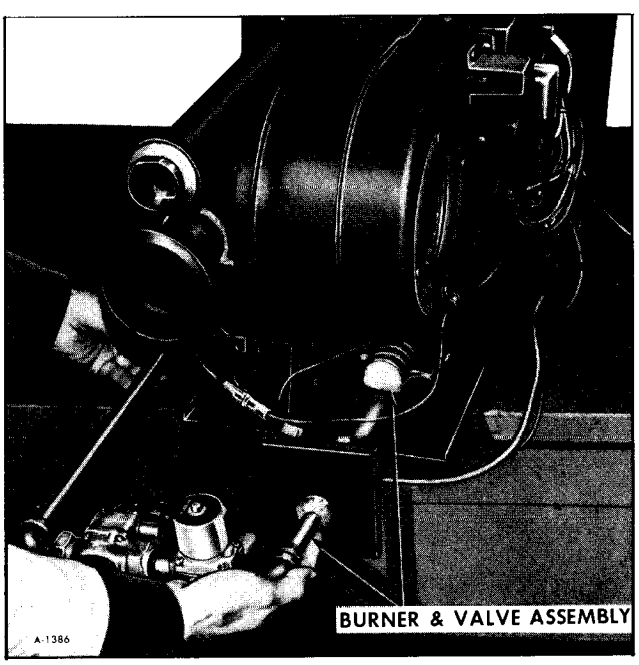


Figure 18–Removing Burner and Valve

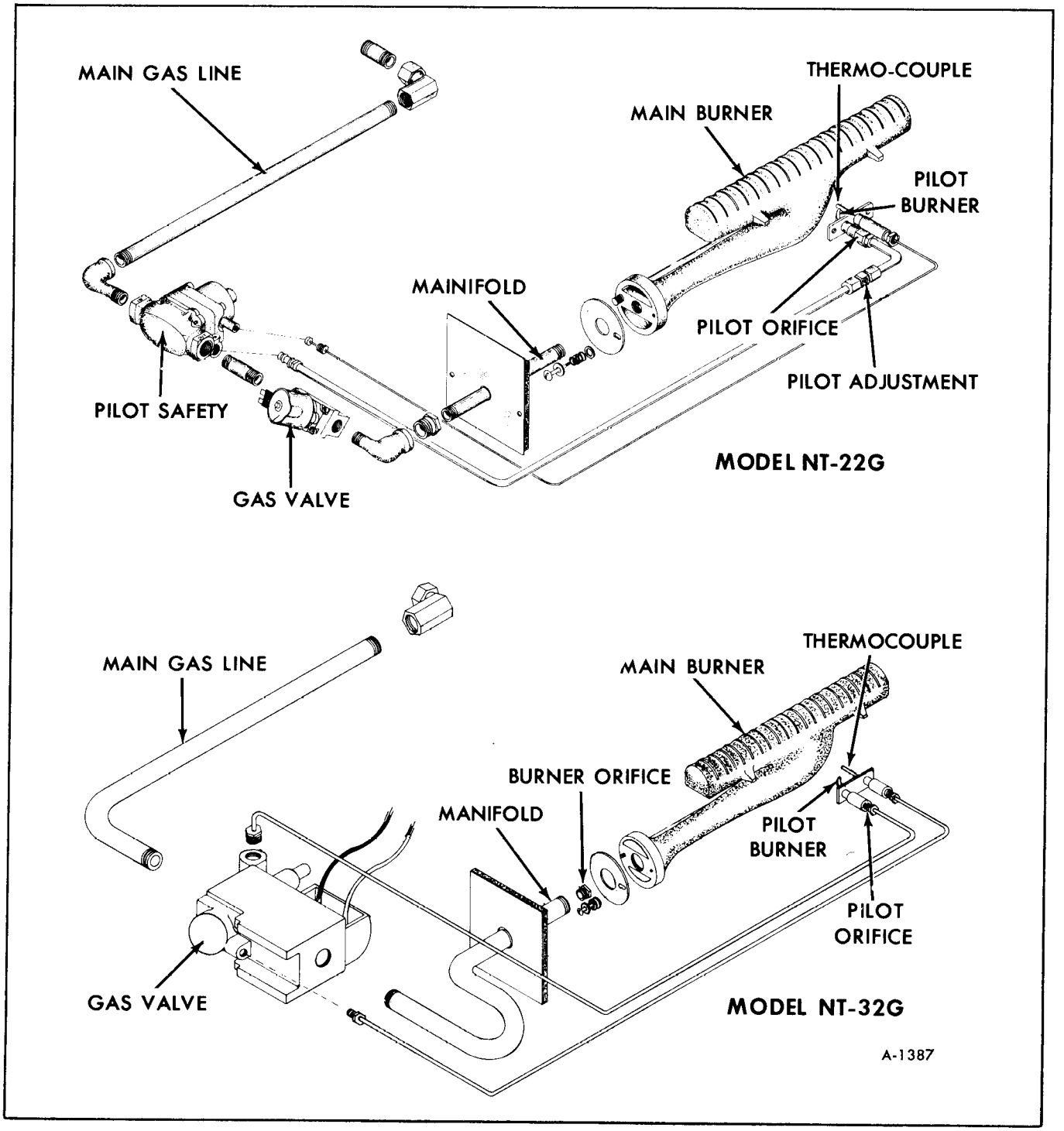


Figure 19–(NT-22G and NT-32G) Valve and Burner Assemblies

INSTALLATION

1. Assemble burner, valve(s), and gas line as a unit (figure 19).

2. Install burner, valve(s) and gas lines in combustion chamber as a unit (See figure 18).

3. Install wing nuts at rear of burner compartment.

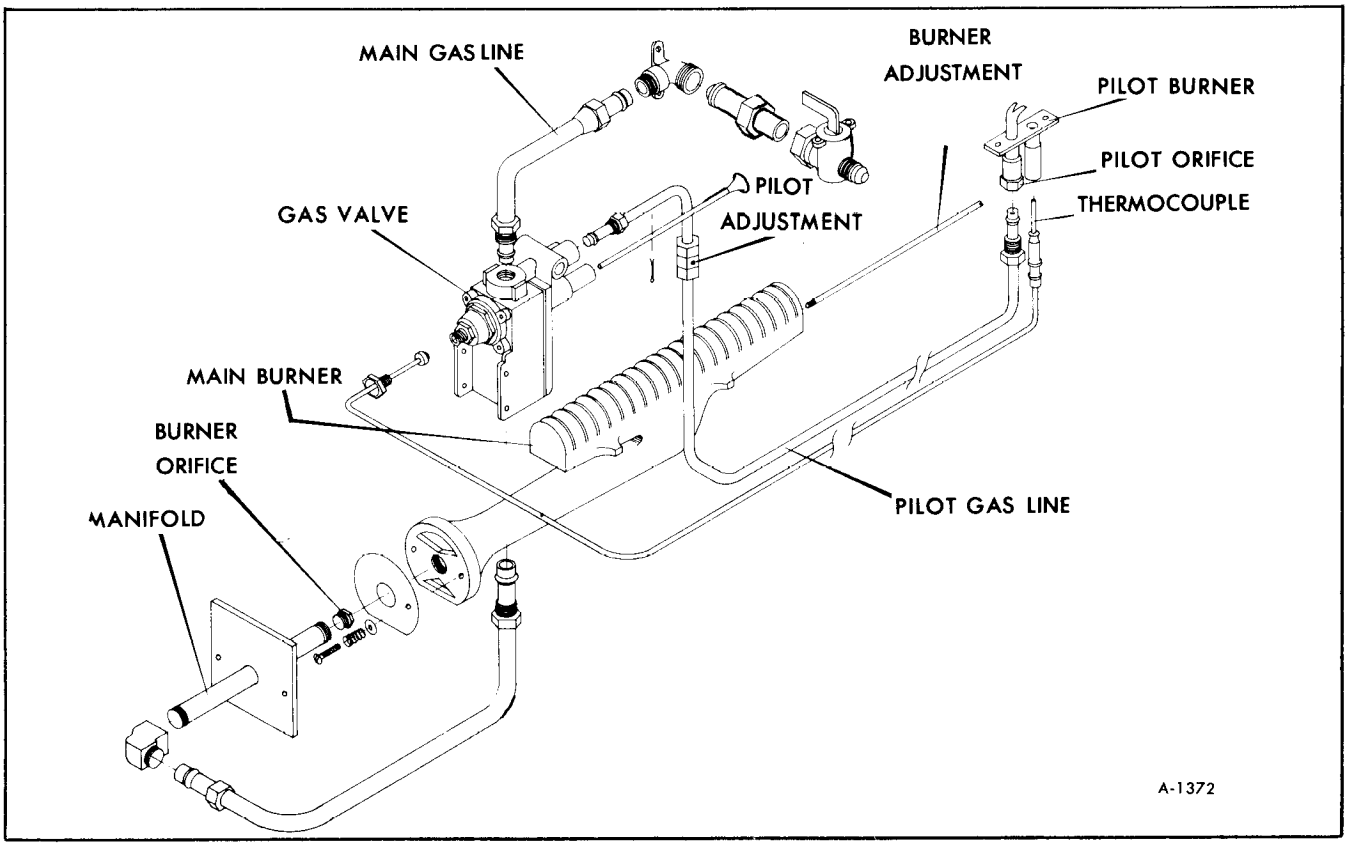


Figure 20–Type II Valve and Burner Assembly

4. Install screws and nuts holding valve to chamber (figures 16 and 17). Be sure pilot reset rod and bracket are properly aligned.

5. Install main gas line support(s).

6. Connect pilot gas line, thermocouple, and wires at valve(s) (figures 14 and 15).

7. Install combustion chamber in cabinet (See Combustion Chamber Replacement).

GAS VALVE REPLACEMENT (TYPE II FURNACES)

REMOVAL (FIGURE 20)

1. Remove combustion chamber from cabinet (See "Combustion Chamber Replacement").

2. Disconnect the two wires at gas valve shown in Figure 21.

3. Disconnect all lines from gas valve (inlet, outlet, pilot, and thermocouple (figure 21).

4. Remove the two screws holding gas valve to the chamber side as shown in Figure 22.

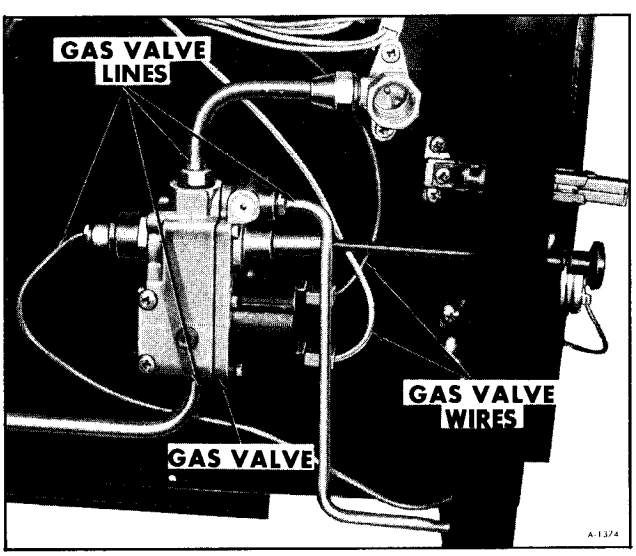


Figure 21–Gas Valve Wires and Lines

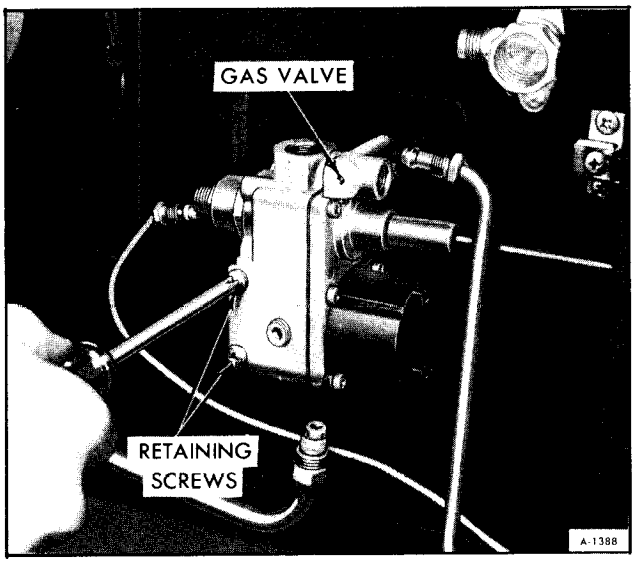


Figure 22–Removing Gas Valve

INSTALLATION

1. Secure gas valve to chamber side with two screws (figure 22) (be sure pilot reset rod is properly positioned in valve).

2. Connect all lines to gas valve (See figure 21) inlet, outlet, pilot and thermocouple.

3. Connect two wires at gas valve.

4. Install combustion chamber in cabinet (See "Combustion Chamber Replacement").

BLOWER ASSEMBLY (NT-22G) (FIGURE 23)

DISASSEMBLY

1. Remove combustion chamber from cabinet (See Combustion Chamber Replacement).

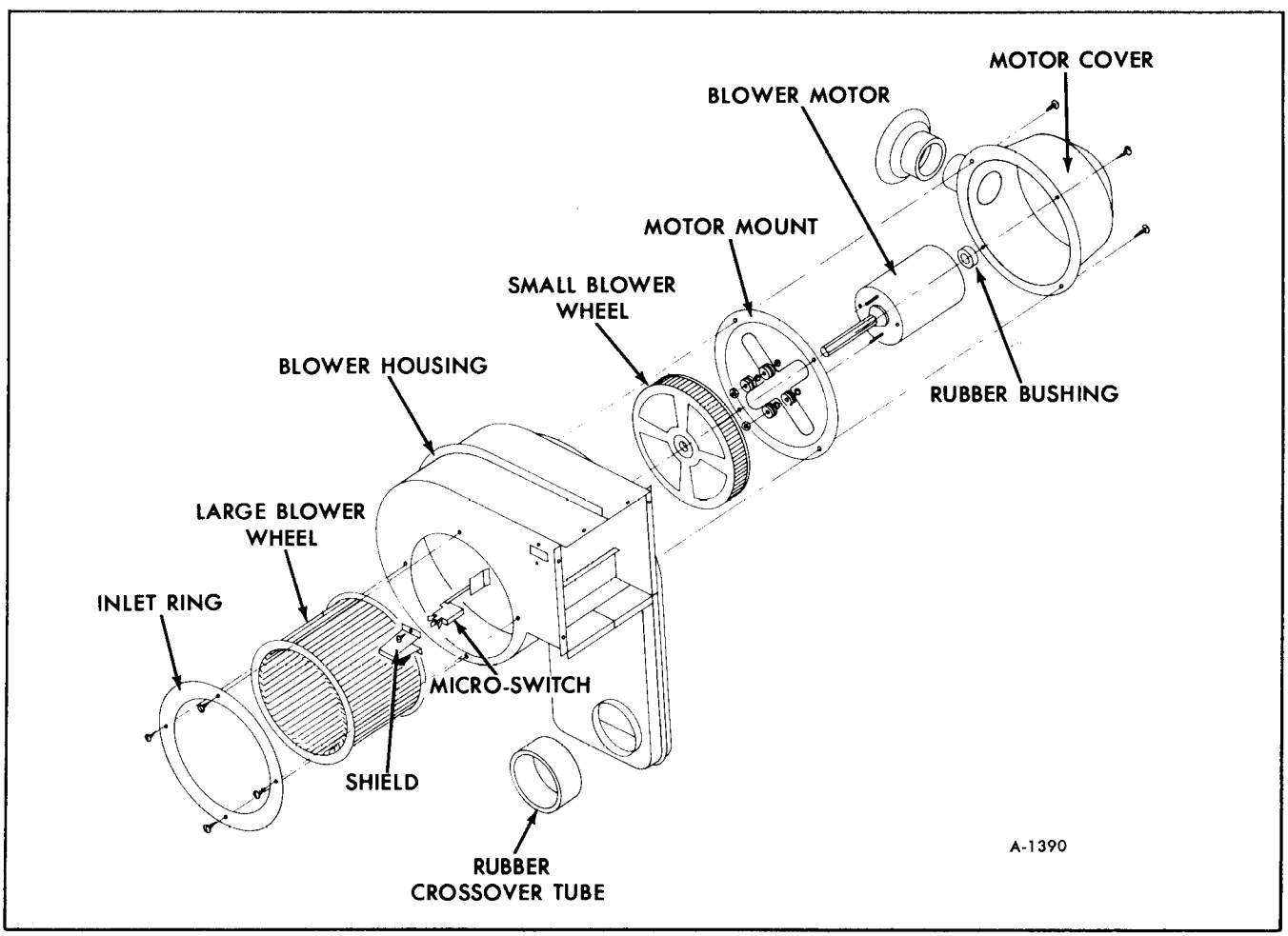


Figure 23–(NT-22G) Blower Assembly

2. Disconnect microswitch wires at gas valve and limit switch.

3. Disconnect red blower motor wire at quick disconnect.

4. Remove five screws holding blower assembly to furnace (figure 24).

5. Remove blower assembly.

6. Remove large blower wheel inlet ring (4 screws) (figure 25).

7. Remove large blower wheel (1/8 inch Allen wrench) (See figure 26).

8. Remove motor cover (4 screws) (See figure 27). Motor, motor mount assembly, and small blower wheel will then come free from the blower housing (See figure 23).

9. Remove small blower wheel (1/8 inch Allen wrench.

10. Remove motor mount assembly from motor (2 nuts) as shown in Figure 23.

ASSEMBLY

1. Assemble motor to motor mount assembly (2 nuts).

2. Install small blower wheel on motor shaft (1/8" Allen wrench).

3. Position motor, motor mount assembly, and small blower wheel on blower housing and align screw holes (See figure 23).

4. Position motor cover over motor, being sure rubber bushing is properly installed between motor and cover (figure 23).

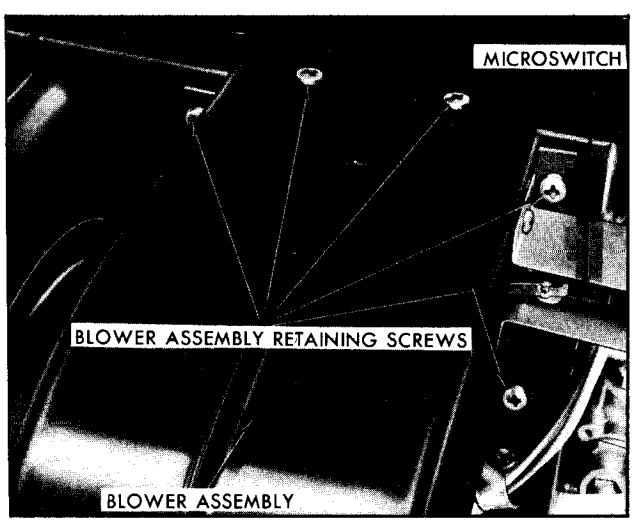


Figure 24–Blower Assembly Mounting Screws

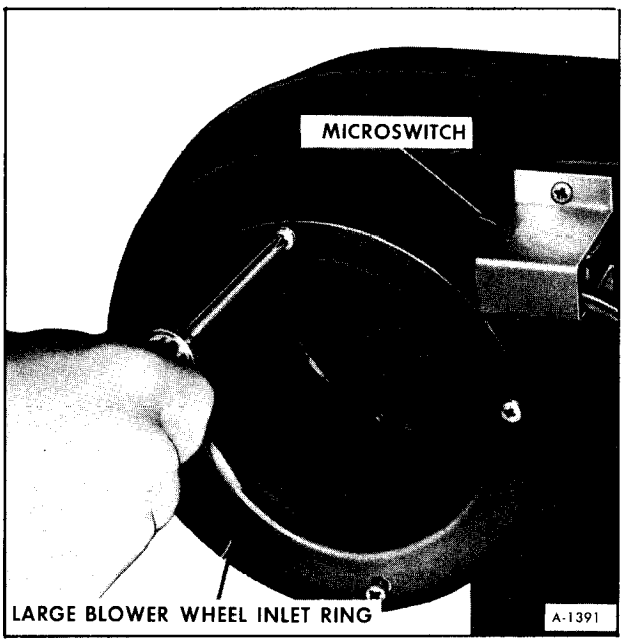


Figure 25–Removing Blower Wheel Inlet Ring

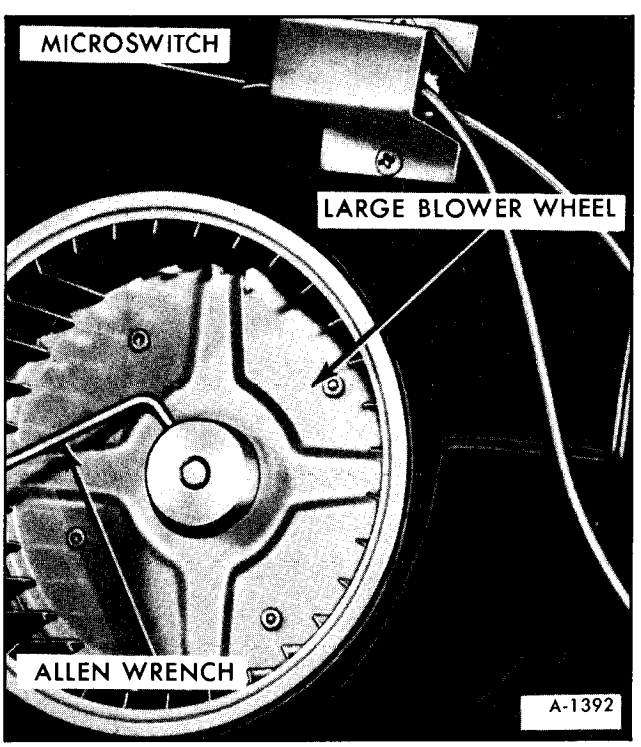


Figure 26–Removing Large Blower Wheel

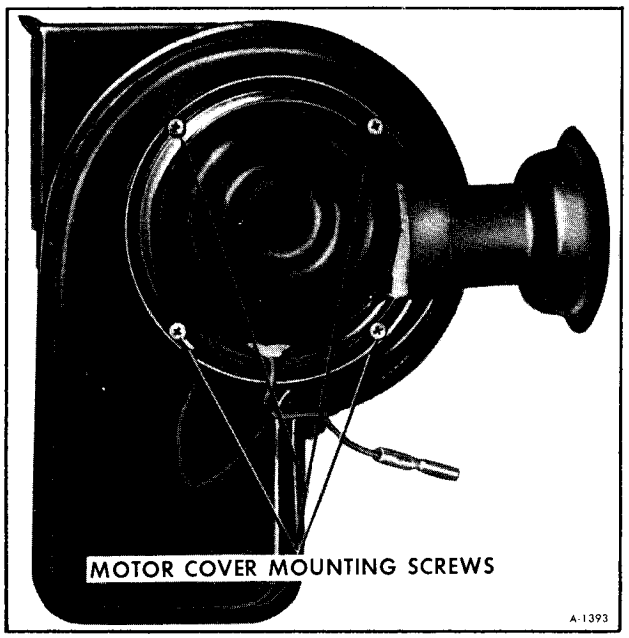


Figure 27–Motor Cover Mounting Screws

5. Align holes with those in motor mount assembly and install screws (See figure 23). (The motor ground wire attaches to one of these screws).

6. Install large blower wheel on motor shaft (1/8" Allen wrench) (figure 26).

7. Install large blower wheel inlet ring to housing (4 screws) (figure 25).

8. Position blower assembly on furnace, being sure rubber crossover tube is properly seated at combustion chamber and at bottom of blower.

9. Install the five screws holding blower assembly to the furnace shown in Figure 24.

10. Connect blower motor wire at quick disconnect.

11. Connect microswitch wires at gas valve and limit switch.

12. Install combustion chamber in cabinet (See Combustion Chamber Replacement).

BLOWER ASSEMBLY (NT-32G) (FIGURE 28)

DISASSEMBLY

1. Remove combustion chamber from cabinet (See Combustion Chamber Replacement).

2. Disconnect microswitch wires at gas valve and limit switch.

3. Disconnect the two blower motor wires.

4. Remove the six screws holding blower assembly to furnace (See figure 29) (one at bottom of assembly).

5. Remove blower assembly (figure 30).

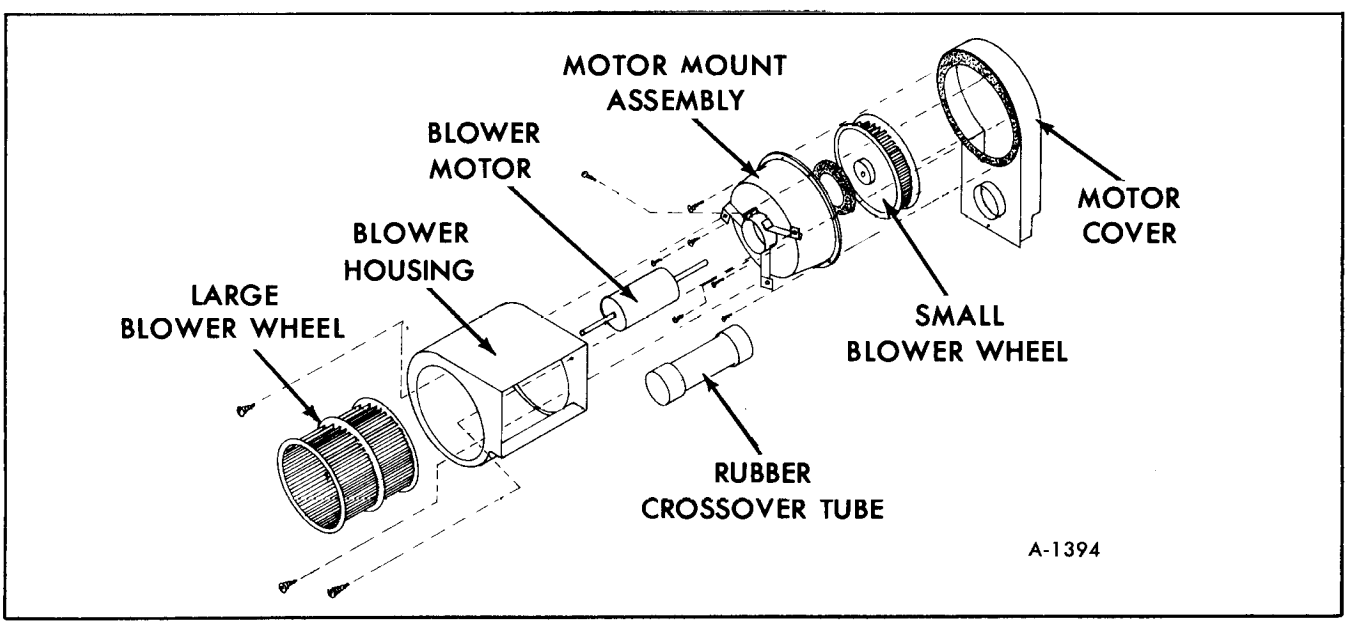


Figure 28–(NT-32G) Blower Assembly

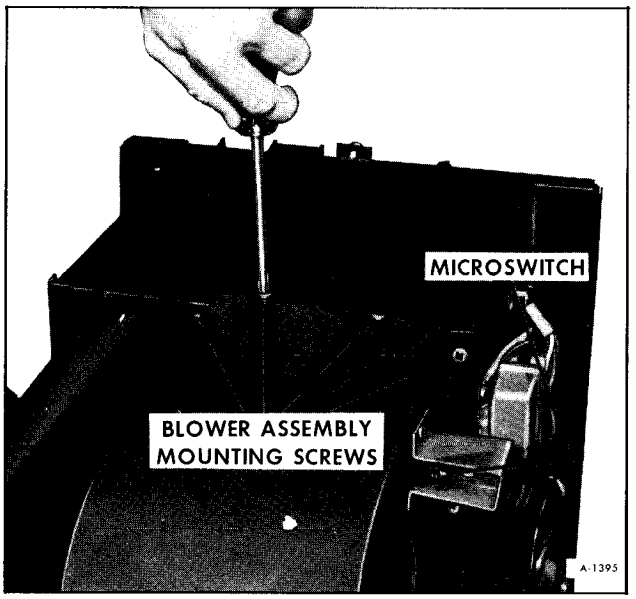


Figure 29–Removing Blower Assembly Screws

6. Remove large blower wheel (1/8" Allen wrench) (See figure 26).

7. Remove three screws and nuts holding large blower wheel housing (Shown in figure 28).

8. Remove motor mount assembly from motor cover (5 screws) (figure 31).

9. Loosen motor cinch screw and push motor and small blower wheel out of motor housing (See figure 32).

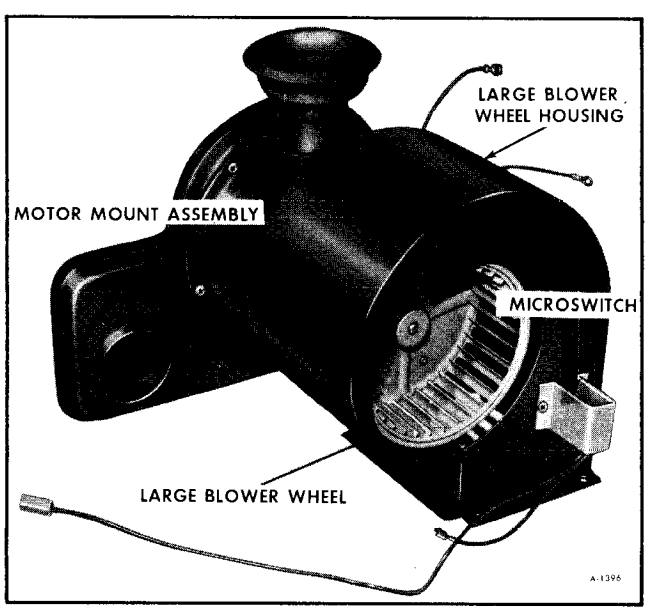


Figure 30–Blower Assembly - Removed

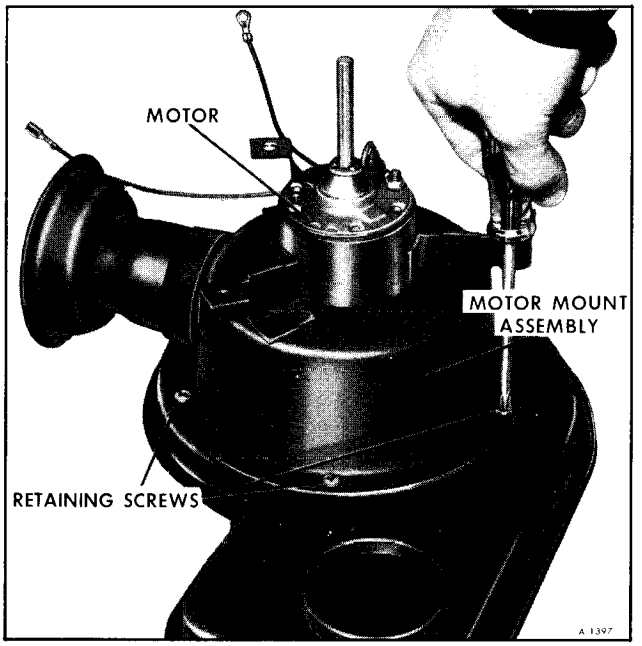


Figure 31–Removing Motor and Mount Assembly Retaining Screws

10. Remove small blower wheel (1/8" Allen wrench) (Figure 28).

ASSEMBLY

1. Position motor in motor mount assembly. Tighten cinch screw (figure 32).

2. Install small blower wheel (figure 28).

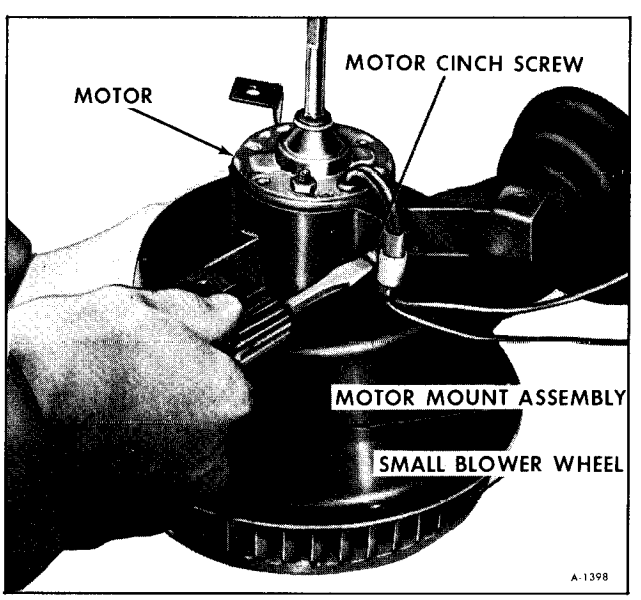


Figure 32–Removing Motor Cinch Screw

3. Assemble motor housing to small blower wheel housing (5 screws) (See figure 31).

4. Install large blower wheel housing to motor housing brackets (See figure 28) (3 screws and nuts).

5. Install large blower wheel (1/8" Allen wrench) (figure 26).

6. Position blower assembly on furnace being sure rubber crossover tube is properly seated at combustion chamber and at bottom of blower assembly. Install all screws.

7. Connect the two blower motor wires.

8. Connect the microswitch wires.

9. Install combustion chamber in cabinet (See Combustion Chamber Replacement).

FAN SWITCH REPLACEMENT

REMOVAL

1. Remove combustion chamber from cabinet (See Combustion Chamber Replacement).

2. Disconnect wires from fan switch shown in Figure 33.

3. Remove two screws holding fan switch.

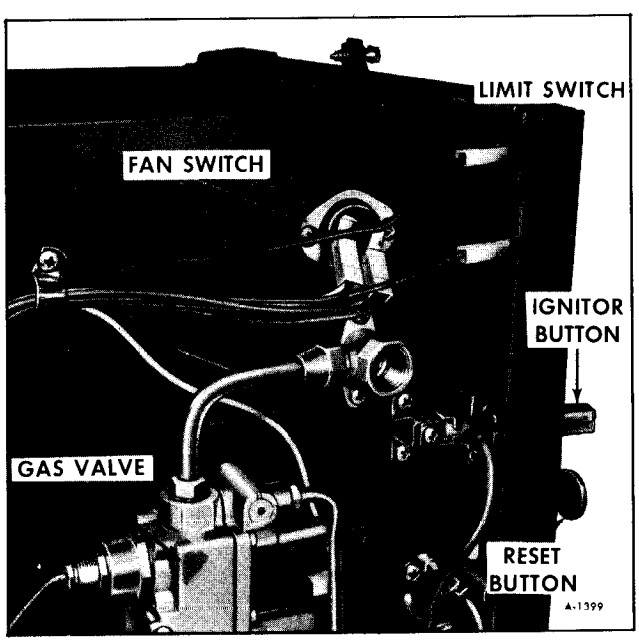


Figure 33–Fan Switch

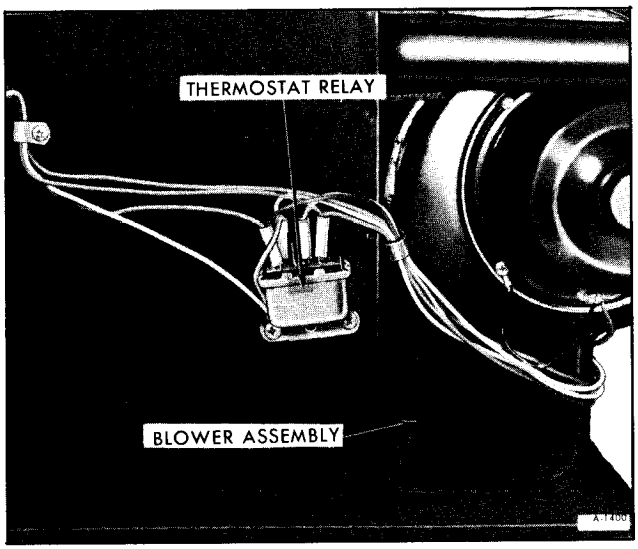


Figure 34–Thermostat Relay

INSTALLATION

1. Install fan switch on combustion chamber side with two screws (figure 33).

2. Connect wires to fan switch.

3. Install combustion chamber in cabinet (See Combustion Chamber Replacement).

THERMOSTAT RELAY REPLACEMENT

REMOVAL

1. Remove combustion chamber from cabinet (See Combustion Chamber Replacement).

2. Disconnect wires at thermostat relay (right side on TYPE I FURNACES, left side on TYPE II FURNACES) (See figure 34).

3. Remove two screws holding thermostat relay.

INSTALLATION

1. Install thermostat relay on combustion chamber side with two screws.

2. Connect wires to thermostat relay shown in Figure 34.

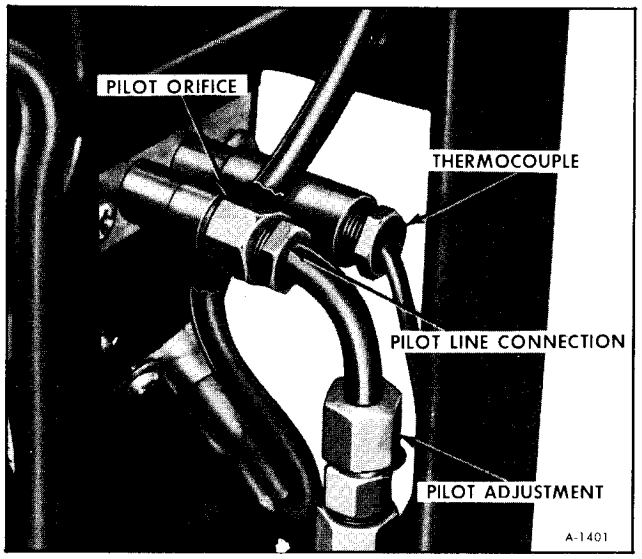


Figure 35–Pilot Orifice

3. Install combustion chamber in cabinet (See Combustion Chamber Replacement).

THERMOCOUPLE REPLACEMENT

REMOVAL

1. Remove combustion chamber from cabinet (See Combustion Chamber Replacement).

2. Disconnect thermocouple at pilot burner, and at rear of gas valve, (Refer to figure 20) (pilot safety on NT-22G TYPE I).

INSTALLATION

1. Install thermocouple at pilot burner and at gas valve.

2. Install combustion chamber in cabinet (See Combustion Chamber Installation).

PILOT ORIFICE REPLACEMENT

REMOVAL

1. Remove combustion chamber from cabinet (See Combustion Chamber Replacement).

2. Disconnect pilot line at pilot orifice (See figure 35).

3. Remove the pilot orifice (figure 35).

INSTALLATION

1. Install pilot orifice in pilot burner.

2. Connect the pilot gas line, at pilot orifice (See figure 35).

3. Install combustion chamber in cabinet (See Combustion Chamber Replacement).

PILOT BURNER REPLACEMENT

REMOVAL

1. Remove combustion chamber from cabinet (See Combustion Chamber Replacement).

2. Remove pilot adjustment cover as shown in Figure 36.

3. Disconnect pilot gas line.

4. Remove two screws holding burner as shown in Figure 37.

5. Pull burner clear of combustion chamber.

6. Disconnect thermocouple.

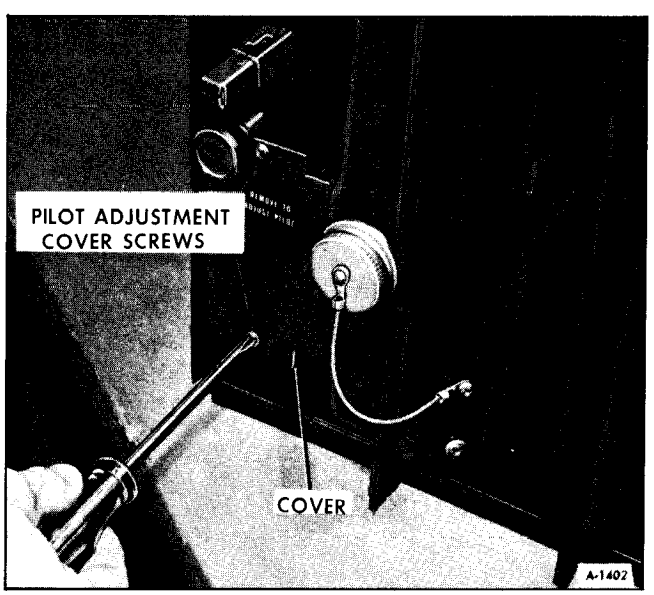


Figure 36–Removing Pilot Adjustment Cover

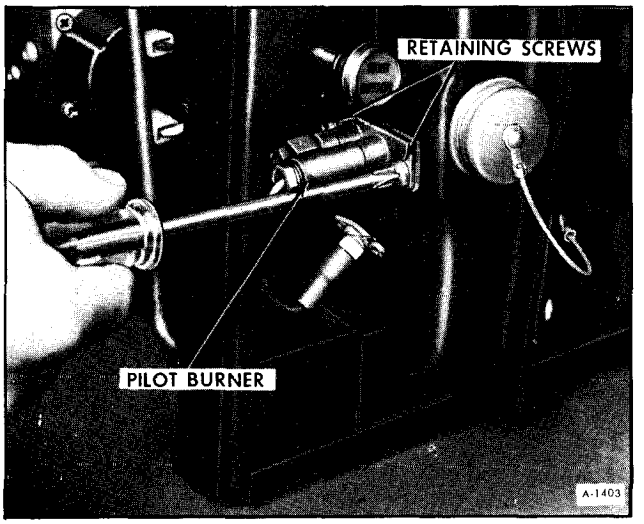


Figure 37–Removing Pilot Burner

INSTALLATION

1. Connect thermocouple to pilot burner.

2. Position pilot burner in combustion chamber and secure with two screws (figure 37).

3. Connect pilot gas line.

4. Install pilot adjustment cover (figure 36).

5. Install combustion chamber in cabinet (See Combustion Chamber Replacement).

MAIN BURNER REPLACEMENT (TYPE I FURNACE)

REMOVAL

1. See "Gas Valve or Pilot Safety Replacement" as described earlier in this section.

2. Once burner, valve(s), and main gas line are removed from combustion chamber as a unit, the burner can be removed (See figure 19).

INSTALLATION

1. See "Gas Valve or Pilot Safety Replacement" as described earlier in this section.

MAIN BURNER REPLACEMENT (TYPE II FURNACE)

REMOVAL

1. Remove combustion chamber from cabinet (See Combustion Chamber Replacement).

2. Disconnect gas line at rear of main burner manifold, as shown in Figure 38.

3. Remove wing nuts from rear of burner compartment (See figure 39).

4. Pull burner assembly out as shown in Figure 40.

5. Disassemble manifold pipe from burner (See figure 20).

INSTALLATION

1. Assemble main burner to manifold pipe (See figure 20).

2. Install burner assembly in combustion chamber (figure 40).

3. Secure with wing nuts at rear of burner compartment (figure 39).

4. Connect gas line at rear of main burner manifold (figure 38).

5. Install combustion chamber in cabinet (See-Combustion Chamber Replacement).

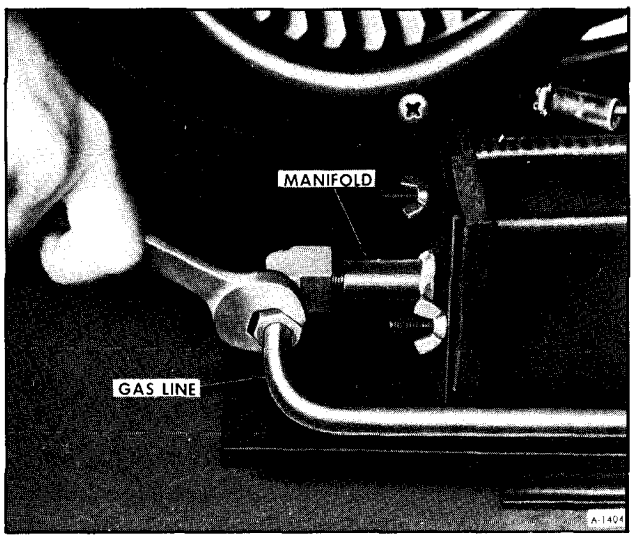


Figure 38–Disconnecting Gas Line at Manifold

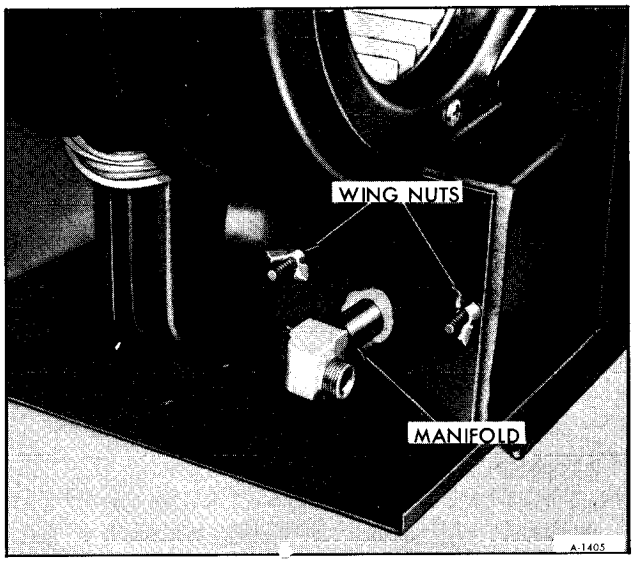


Figure 39–Wing Nuts at Rear of Burner

MAIN BURNER ORIFICE REPLACEMENT (TYPE I FURNACE)

REMOVAL

1. See "Gas Valve or Pilot Safety Replacement" as described earlier in this section.

2. Once main burner, valve(s), and main gas line are removed from the combustion chamber as a unit, remove main burner from manifold pipe and replace orifice in end of manifold pipe (figures 19 and 41).

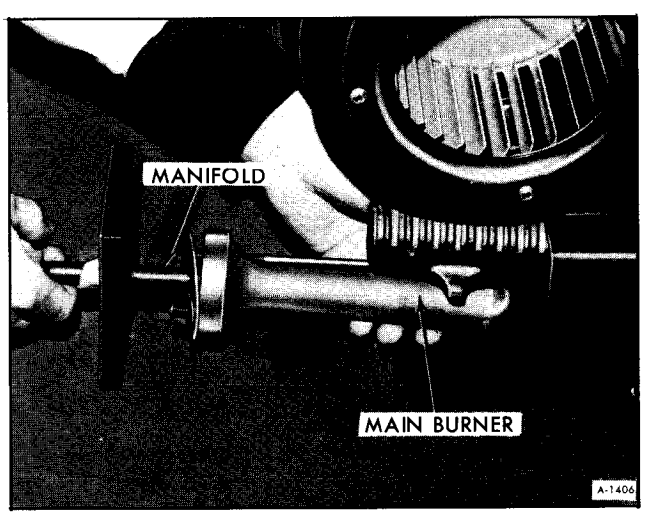


Figure 40–Removing Main Burner

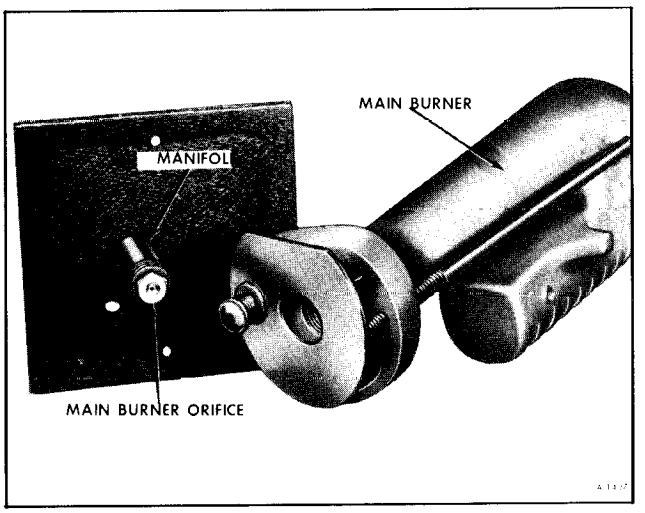


Figure 41–Main Burner Orifice

INSTALLATION

1. See "Gas Valve or Pilot Safety Replacement" as described earlier in this section.

MAIN BURNER ORIFICE REPLACEMENT (TYPE II FURNACE)

REMOVAL

1. Remove combustion chamber from cabinet (See Combustion Chamber Replacement).

2. Disconnect gas line at rear of main burner manifold (See figure 38).

3. Remove wing nuts from burner compartment door (figure 39).

4. Pull burner assembly out (figure 40).

5. Disassemble manifold pipe from burner and remove burner orifice. See Figures 41 and 20.

INSTALLATION

1. Install main burner orifice in the end of the manifold pipe (figures 20 and 41).

2. Assemble main burner and manifold pipe. See Figure 20.

3. Install burner assembly in combustion chamber (figure 40).

4. Secure burner assembly with two wing nuts (figure 39).

5. Connect gas line at rear of main burner manifold (figure 38).

6. Install combustion chamber in cabinet (See Combustion Chamber Replacement).

LIMIT SWITCH REPLACEMENT (TYPE I FURNACE)

REMOVAL

1. Remove combustion chamber from cabinet (See Combustion Chamber Replacement).

2. Disconnect two wires from rear of limit switch located at lower front corner (figure 42).

3. Remove two screws holding switch.

INSTALLATION

1. Install limit switch and secure with two screws (figure 42).

2. Connect wires to switch.

3. Install combustion chamber in cabinet (See Combustion Chamber Replacement).

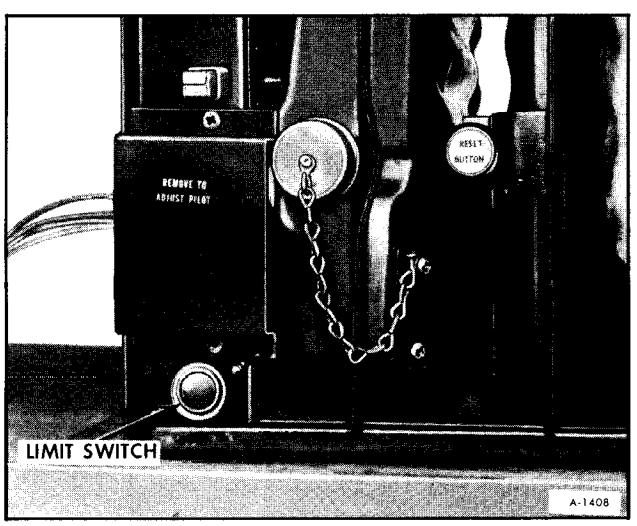


Figure 42–Type I Furnace Limit Switch

LIMIT SWITCH REPLACEMENT (TYPE II FURNACE)

REMOVAL

1. Remove cabinet front (one screw at top of cabinet front).

2. Disconnect two wires at rear of limit switch located at upper front corner (See figure 43).

3. Remove two screws holding limit switch.

INSTALLATION

1. Install limit switch and secure with two screws (figure 43).

2. Connect wires to rear of switch.

3. Install cabinet front, making sure it is properly seated in all grooves (1 screw at top of cabinet front).

WALL THERMOSTAT REPLACEMENT

REMOVAL

1. Turn thermostat to "OFF" position, as shown in Figure 7.

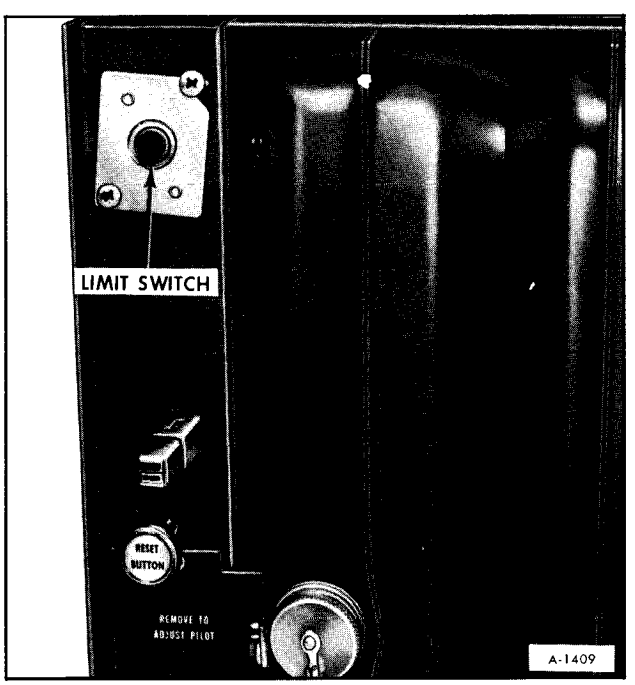


Figure 43–Type II Furnace Limit Switch

2. Remove thermostat cover.

3. Remove two screws holding thermostat body to wall.

4. Disconnect two wires.

INSTALLATION

1. Connect wires to thermostat.

2. Secure thermostat body to wall with two screws.

3. Install thermostat cover.

ON VEHICLE ADJUSTMENTS

PILOT ADJUSTMENT

To adjust the furnace pilot it is necessary to gain access first through the access door and then by removing the pilot adjustment cover directly under the ignitor button (2 screws). The pilot gas line accessible at this point will have the pilot adjustment located in the line as shown in Figure 44.

It is important that the pilot flame be the proper size. Unlike most heating equipment, in this furnace too large a flame is a common cause of pilot outage due to lack of sufficient air. It should be just high enough to envelop the thermocouple. If the pilot flame cannot be adjusted to this point or is yellowish in color, replace the pilot orifice.

BURNER ADJUSTMENT

After the pilot is lit, the furnace is ready for adjustment and observation of the main burner and pilot flame.

To adjust primary air to the main burner, it is necessary to gain access the same way as with lighting the pilot. The small sheet metal cover found just below and to the right of the lighter opening must be removed. Behind the cover is a slotted screw head. With a screwdriver, turn screw head counterclockwise for less primary air and clockwise for more primary air (Refer to figure 45). A symptom of too much primary air will be a howling or screeching noise when the burner is on (reduce air to correct). A symptom of too little primary air will be sooting on the exterior vent and a distinct yellow and floating flame (increase air to correct). A slight trace of orange should remain at the tip of the burner flame– this is a sign of correct adjustment.

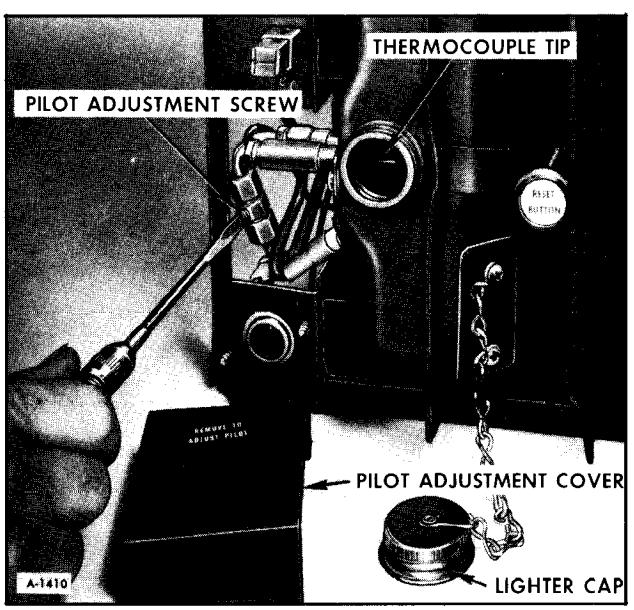


Figure 44–Adjusting Pilot

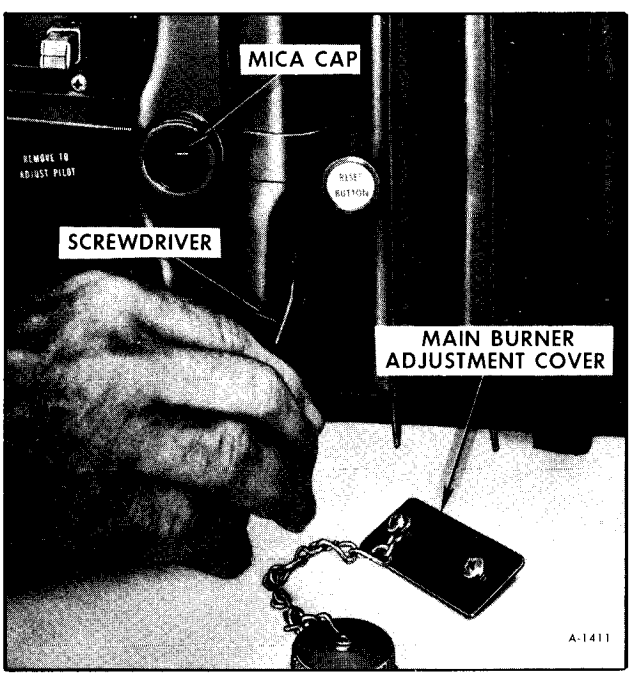


Figure 45–Adjusting Main Burner

GMC MOTOR HOME SERVICE

SECTION 24H
RANGE/OVEN
GENERAL INFORMATION

With the exception of the range pilot and one burner, both range/oven models used in the Motor Home are similar and are designed for operation with liquid petroleum gas (L.P.G.) only (See figure 1 figure 2). Never attempt to operate these units with any other type of fuel.

The range/oven in the Motor Home differs from a conventional residential range in as much as it is equipped with a thermostat control where you can shut-off the gas to the pilot(s) when traveling. Also clips are provided for the top burner grates and oven rack to prevent rattles and dislodgement while the vehicle is in motion.

OPERATION

1. Turn on hood vent fan.

2. Be sure all knobs are in the "OFF" position.

The oven thermostat should be in the "PILOTS OFF" position.

3. Depress the oven thermostat and turn to the "OVEN OFF" position.

4. Lift the cook top panel and light range burner

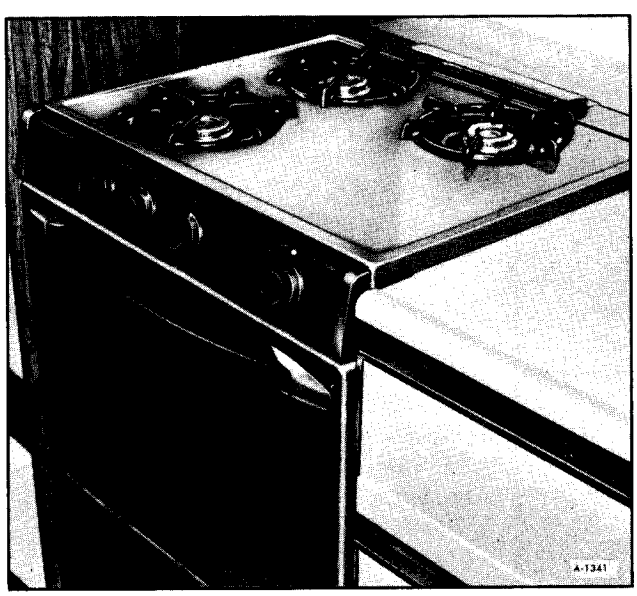


Figure 1–Three Burner Range/Oven

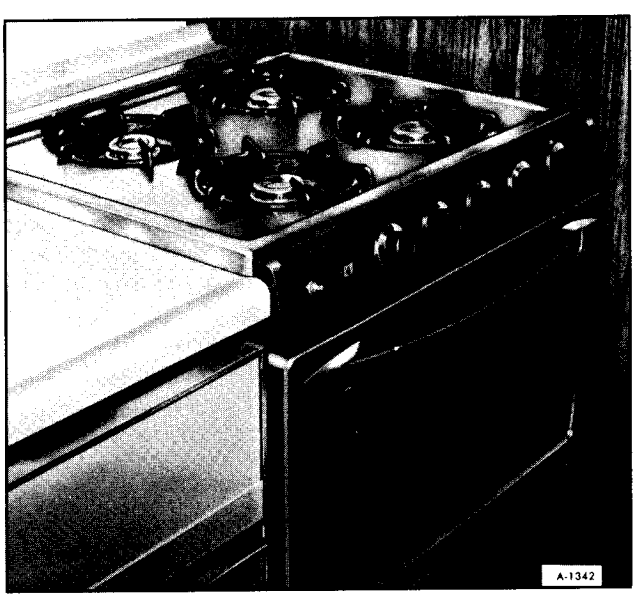


Figure 2–Four Burner Range/Oven

pilot with a match (Four burner unit only).

5. Open the oven door and light the oven pilot with a match. A small flame will be noted at the top of the pilot burner. Upon the initial light-up it may take a minute or so to clear the air from the lines.

6. To light range burner push desired burner knob in and turn gas on all the way to get gas to the burner. As soon as burner lights, flame may be reduced to the desired height. Note on three burner unit each burner must be lit with a match.

7. To light oven burner depress and turn the thermostat dial to the desired temperature setting.

SEQUENCE OF NORMAL OPERATION

1. On the range burners with the pilots lit, it will take 3 to 5 seconds for the burner to come on after the burner control is turned from the "OFF" position to the full on position.

2. On the oven burner with the pilot lit, you will get a secondary pilot immediately upon turning the oven thermostat control to the desired temperature setting - i.e. the pilot will burn larger and brighter at this time. Approximately 10-15 seconds later the main burner will ignite.

RANGE/OVEN TROUBLE DIAGNOSIS

Problem	Possible Cause	Correction
No oven burner ignition.	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. (SEE "SEQUENCE OF NORMAL OPERATION") 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.	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.	1. Gas supply. 2. Pilot outage. (If so equipped). 3. Burner ports are clogged. 4. Burner control valve faulty.	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.

Problem	Possible Cause	Correction
Pilot outage.	1. Gas supply. 2. Air in the gas lines. 3. Pilot blowout. 4. Plugged orifice.	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.	1. Broiler pan. 2. Range burner grates. 3. Oven rack. 4. Cook top. 5. Oven bottom assembly.	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.
Oven burner ignites as soon as thermostat control is turned to desired temperature.	1. Oven Safety Valve – If there is not a 10 to 15 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 (figures 3 or 4) 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 4).

2. Lift door (as if to close) and disengage hinges at door (See figure 5).

3. Remove door.

4. To reinstall reverse procedure.

OVEN THERMOSTAT CONTROL REPLACEMENT

1. Remove oven door.

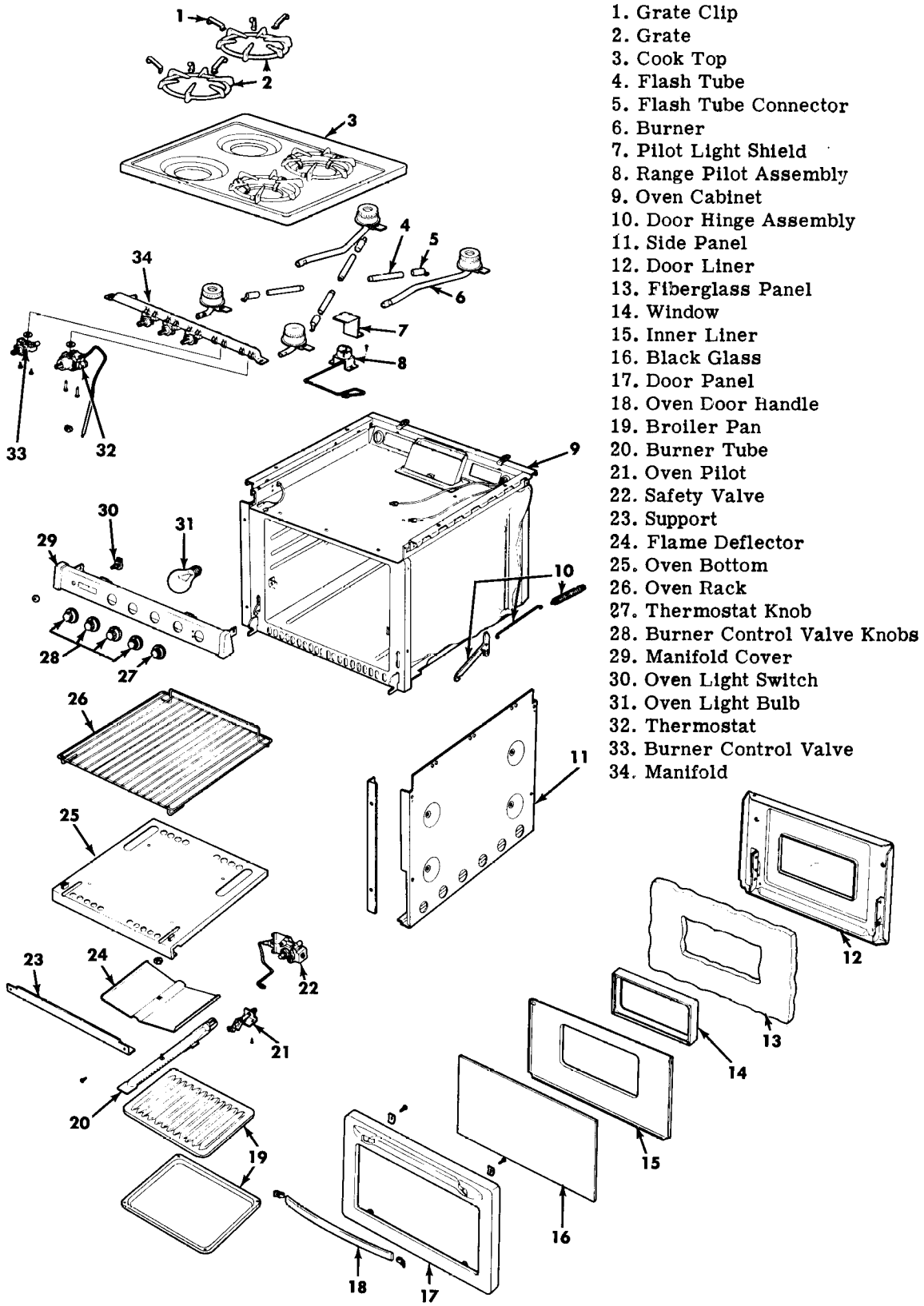


Figure 3–Four Burner Range/Oven Components

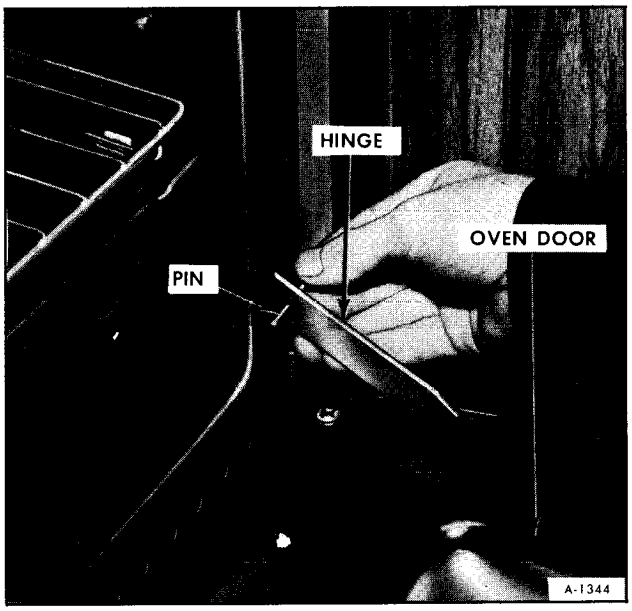


Figure 4–Inserting Pin In Door Hinge

2. Remove cook top and grates (See figure 6).

3. Pull control knobs off.

4. Remove manifold cover by disconnecting light switch, (if so equipped) and removing six screws (two at each side and two at bottom) (See figures 7 and 8).

5. Disconnect gas lines from rear of thermostat control as shown in Figure 9.

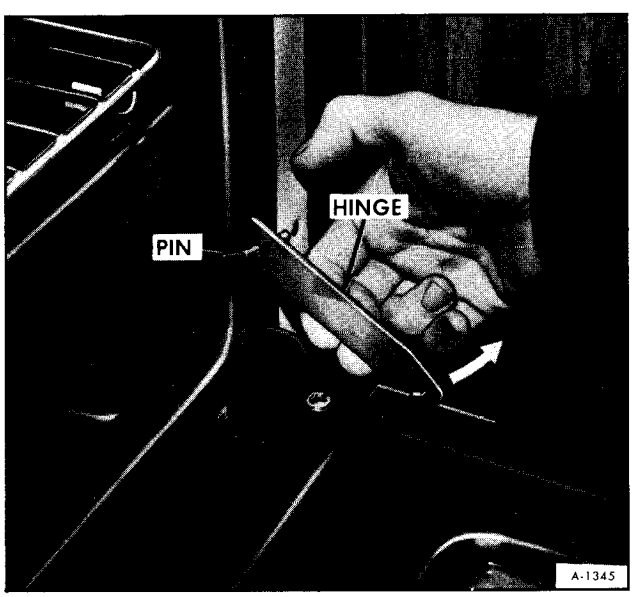


Figure 5–Disengaging Door Hinge

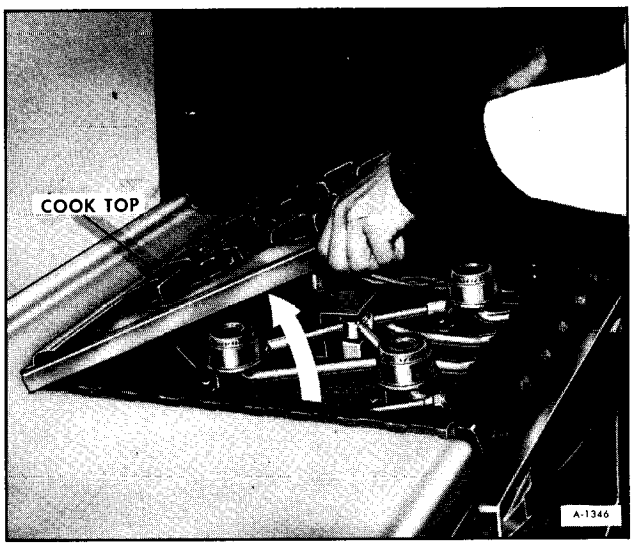


Figure 6–Cook Top Removal

6. At the top of the oven compartment, remove the clip holding the thermal sensing element and carefully feed this element up through the hole in the top of the oven compartment (figure 10).

7. Disconnect the main fuel line from the manifold and remove the two screws holding manifold in place (one at each end) (figure 11 and figure 12).

Figure 7–Removing Manifold Cover Screws (Upper)

Figure 8–Removing Manifold Cover Screws (Lower)

8. Move manifold forward and disengage burner valves from burner tubes.

9. Turn manifold over and remove the two screws (figure 13) holding thermostat control and remove it from manifold.

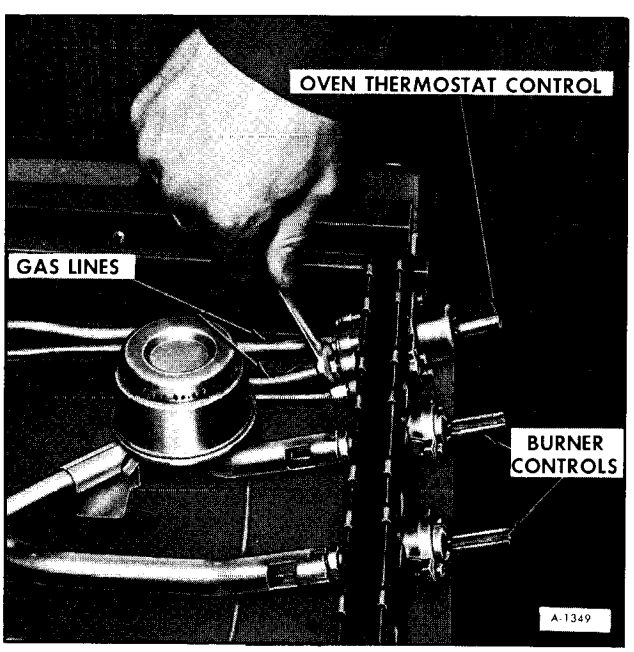


Figure 9–Disconnecting Gas Lines From Rear Of Thermostat

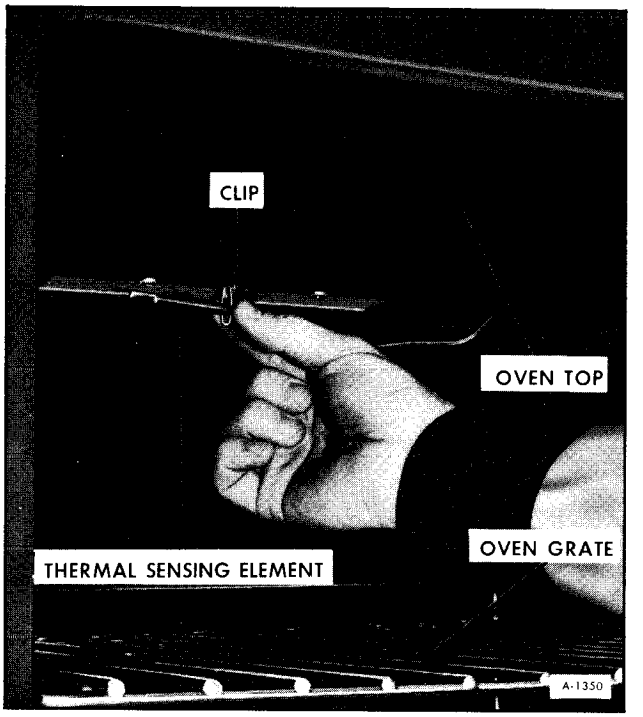


Figure 10–Removing Thermal Sensing Element

10. Replace thermostat control and gasket and reassemble by reversing procedure.

OVEN SAFETY VALVE REPLACEMENT

1. Remove oven door (See "Oven Door Replacement").

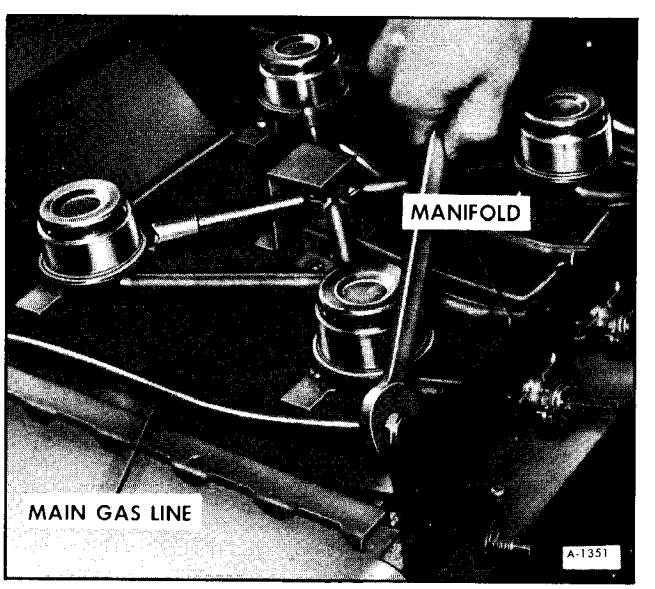


Figure 11–Disconnecting Main LP Gas Line

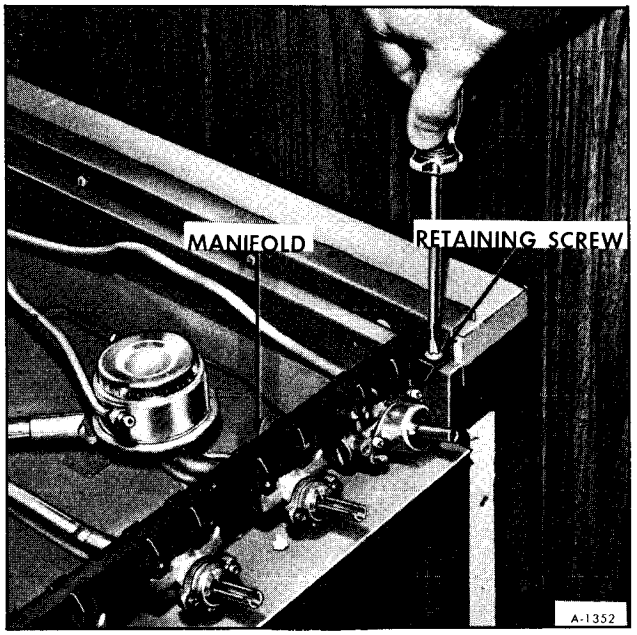


Figure 12–Removing Manifold Retaining Screws

2. Remove oven rack.

3. Remove oven bottom assembly by pulling outward (See figure 14).

4. Remove flame deflector (figure 15) from top of burner tube (held with one nut).

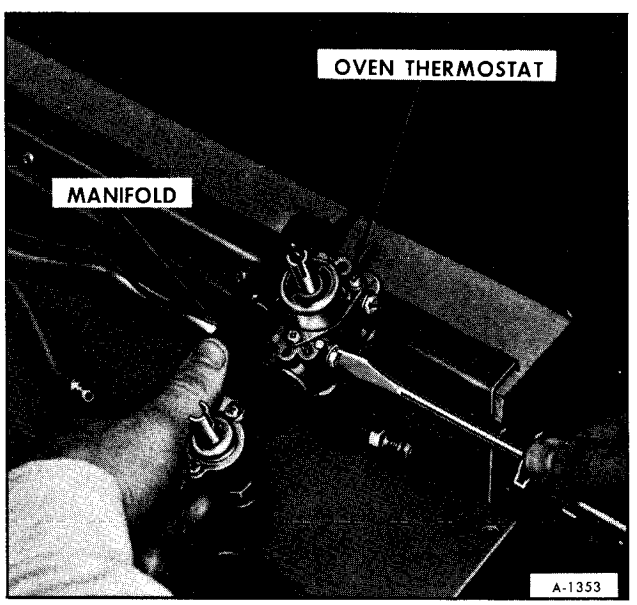


Figure 13–Removing Thermostat From Manifold

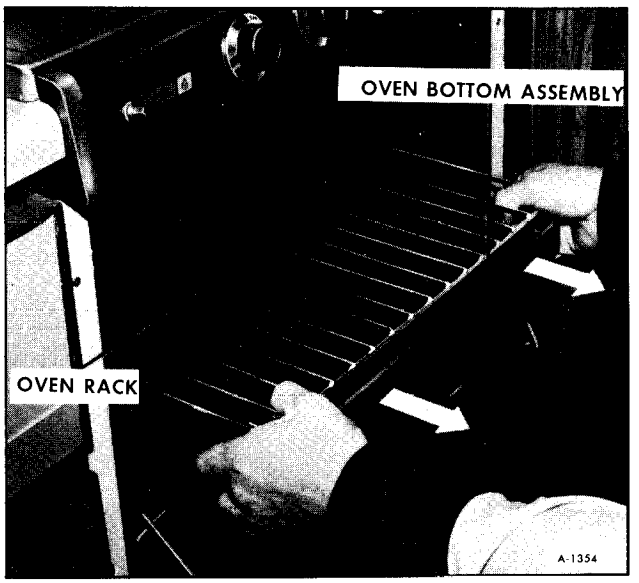


Figure 14–Removing Oven Bottom Assembly

5. Disconnect the two gas lines, one at the oven pilot and one at the safety valve (See figures 16 and 17).

6. Remove the two nuts holding the safety valve to the oven back wall as shown in Figure 18.

7. Remove the screw from the front of the burner tube (figure 19).

8. Gently remove the burner tube and the safety

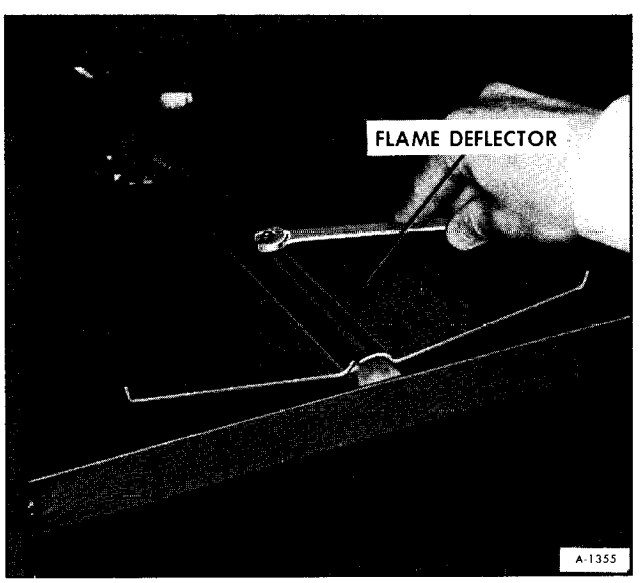


Figure 15–Removing Flame Deflector

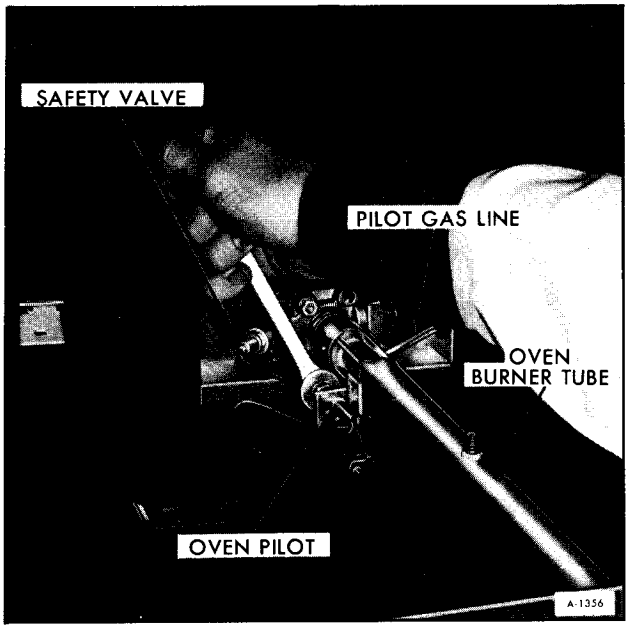


Figure 16–Disconnecting Gas Line at Oven Pilot

valve as one unit being careful not to break the capillary tube connected from the safety valve to the burner tube (See figure 20).

9. Loosen screw holding the capillary tube bulb to the burner tube and disconnect capillary tube.

10. Replace oven safety valve and reassemble by reversing procedure.

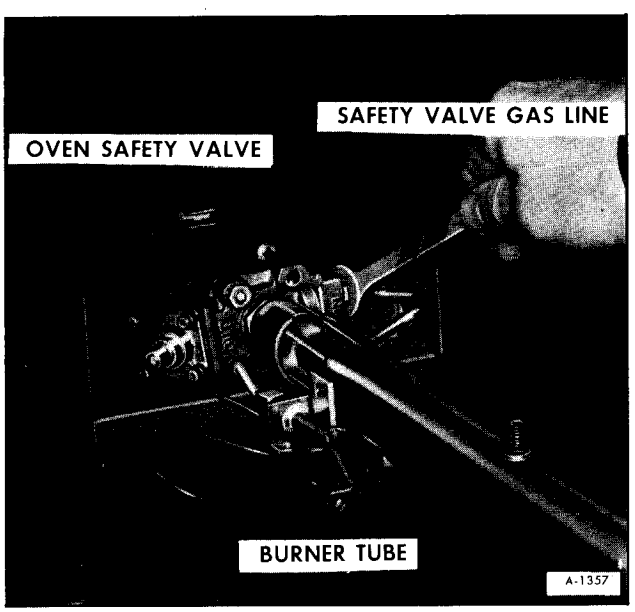


Figure 17–Disconnecting Gas Line at Safety Valve

Figure 18–Removing Nuts Holding Safety Valve

RANGE BURNER CONTROL VALVE REPLACEMENT

1. Remove oven door, (if desired).

2. Remove cook top and grates (See figure 6).

3. Remove control knobs.

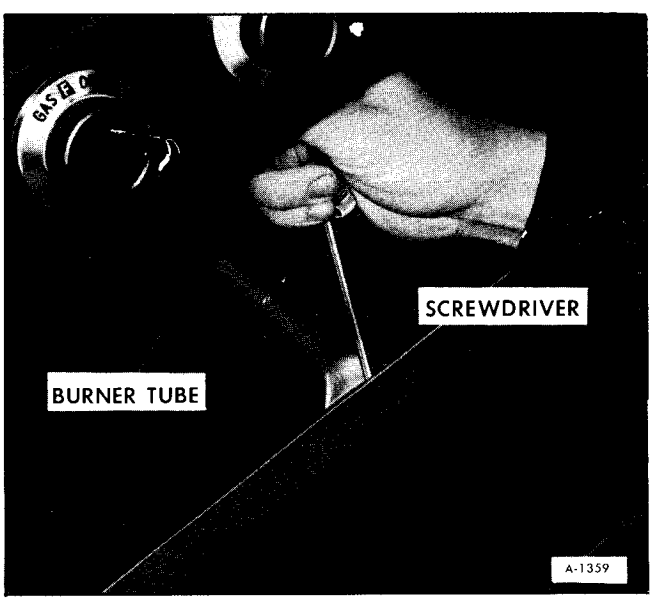


Figure 19–Removing Retaining Screw at Front of Burner Tube

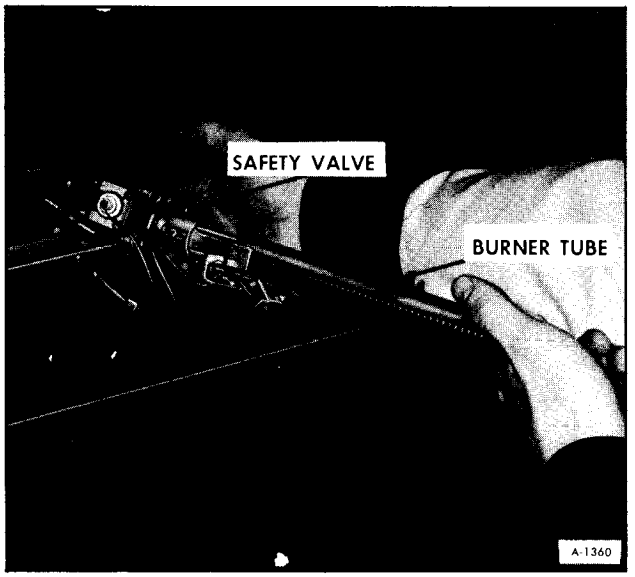


Figure 20–Removing Burner Tube and Safety Valve as a Unit

4. Remove manifold cover by disconnecting the light switch (if so equipped), and removing the six screws holding the cover (two at each side and two at the bottom of the cover) (See figures 7 and 8).

5. Disconnect the main fuel line from the manifold and remove the two screws holding the manifold in place (one at each end) as shown in Figures 11 and 12.

6. Move manifold forward and disengage burner control valves from burner tubes.

7. Tilt manifold upward enough to make the screws at the bottom of the burner control valves accessible (See figure 21).

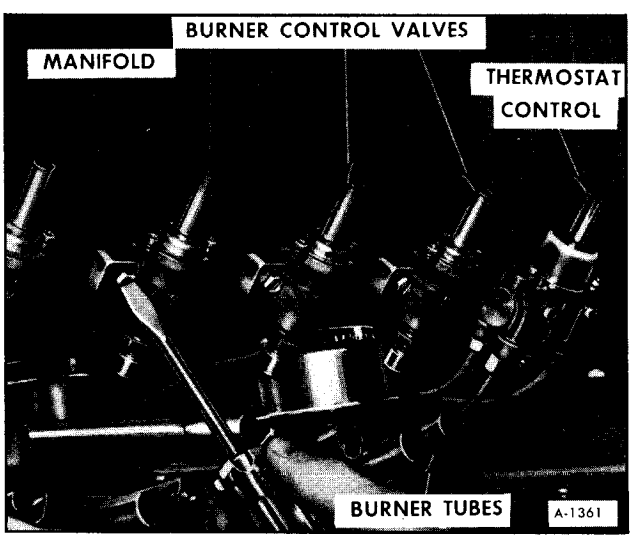


Figure 21–Removing Burner Control Valve

8. Remove the two screws holding the affected valve and remove it from manifold.

9. Replace burner control valve and gasket 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:

1. Remove cook top and grates (See figure 6).

2. Remove single screw holding burner head to range top (figure 22).

3. If range is equipped with range pilot, unhook flash tube from burner.

4. Disengage burner and burner tube from burner control valve (See "Care and Cleaning" for cleaning instructions).

5. To install top burner reverse the above procedure.

RANGE/OVEN UNIT REPLACEMENT

Only in rare instances will it become necessary to remove the complete Range/Oven from the cabinet module. Should this become necessary it's possible by:

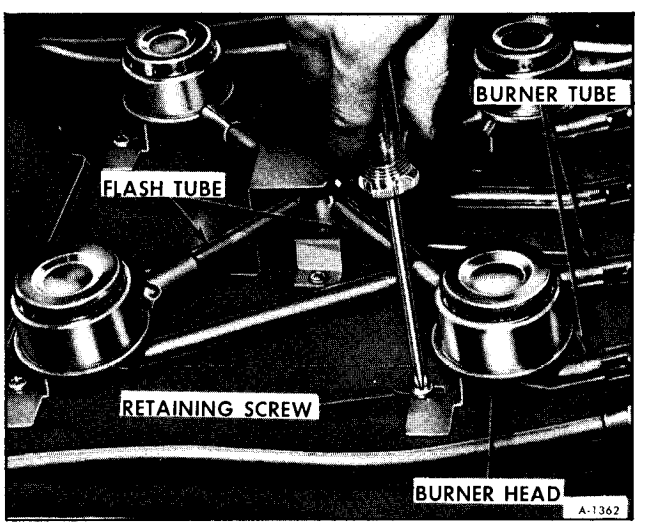


Figure 22–Top Burner Removal

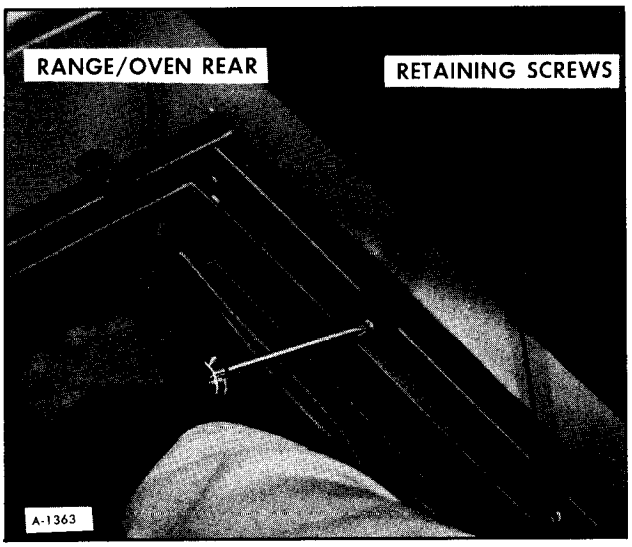


Figure 23–Removing Upper Range/Oven Anchor Screws

1. Removing cook top and grates.

2. Disconnect gas line from manifold (figure 11).

3. Remove the two screws through each upper side wall that hold unit to the cabinet top (figure 23).

4. Open oven door and remove two screws from each side of the oven front trim strips that hold unit to cabinet front (figure 24).

5. If Range/Oven is equipped with an oven light, move the unit forward far enough to enable you to reach behind unit and disconnect the 12 volt wire.

6. Remove unit from the cabinet module.

7. To install unit reverse the above procedure.

OVEN DOOR HINGE REPLACEMENT

Should it become necessary to service the oven door hinges this can be accomplished by:

1. Remove Range/Oven unit from cabinet module (See "Range/Oven Unit Replacement").

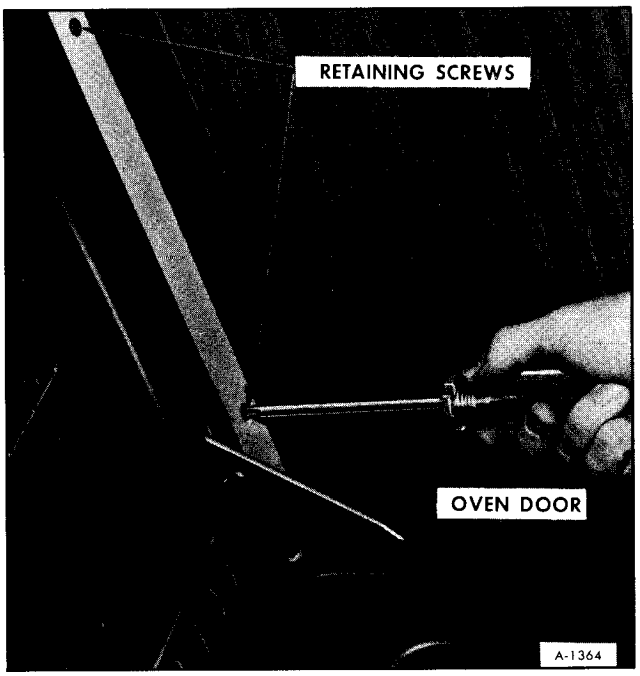


Figure 24–Removing Front Range/Oven Anchor Screws

2. Remove the eleven screws holding the outer oven side panel (See figure 3).

3. Remove outer side panel and lift insulation. At this point the oven door hinge and spring are accessible for servicing.

4. To install reverse the above procedure.

OVEN DOOR GLASS REPLACEMENT (FOUR BURNER UNIT ONLY)

1. Remove oven door from Range/Oven unit (See "Oven Door Replacement").

2. With oven door face down on a bench remove the four screws from inner door panel.

3. With oven door disassembled replace glass (See figure 3).

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 oven thermostat control dial. To adjust pilot remove dial and insert small screwdriver through the hole (figure 25). Rotate adjustment screw as required.

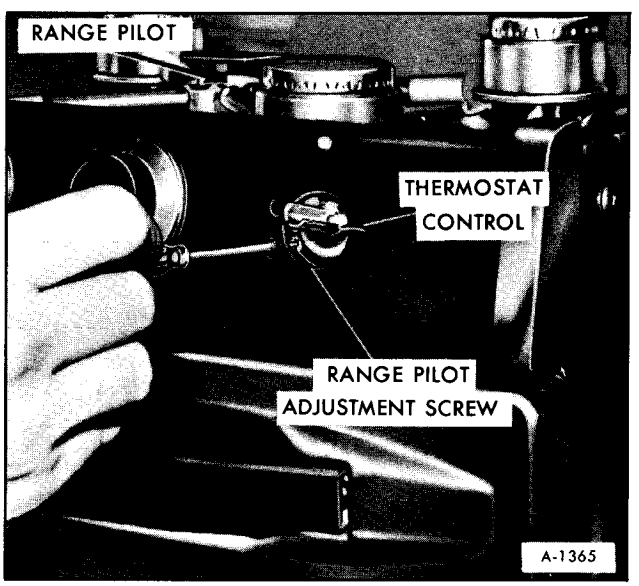


Figure 25–Adjusting Range Pilot

GMC MOTOR HOME SERVICE

NOVEMBER, 1973

SECTION 24J
LIVING AREA WATER SYSTEM

The contents of this section are listed below:

GENERAL DESCRIPTION

Living area water system (figure 1) is supplied by either a demand water pump or by a city-water hook-up. There is no pressure tank in the system. When a faucet is opened and the water pump switch is on, or toilet is flushed, the pump will come on when the water line pressure drops below 20 PSI. When the faucet is closed the pump will run long enough to raise the line pressure to 30 PSI, then it will shut-off automatically.

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.

A connection is provided 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 copper and are connected with compression flared, or sweat fittings.

There are five (5) drain valves standard on the vehicle. There are six (6) 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 holding tank.
2. water pump pressure line.
3. water heater.
4. electric toilet (if equipped).
5. hot water line behind galley sink.
6. cold water line behind galley sink.

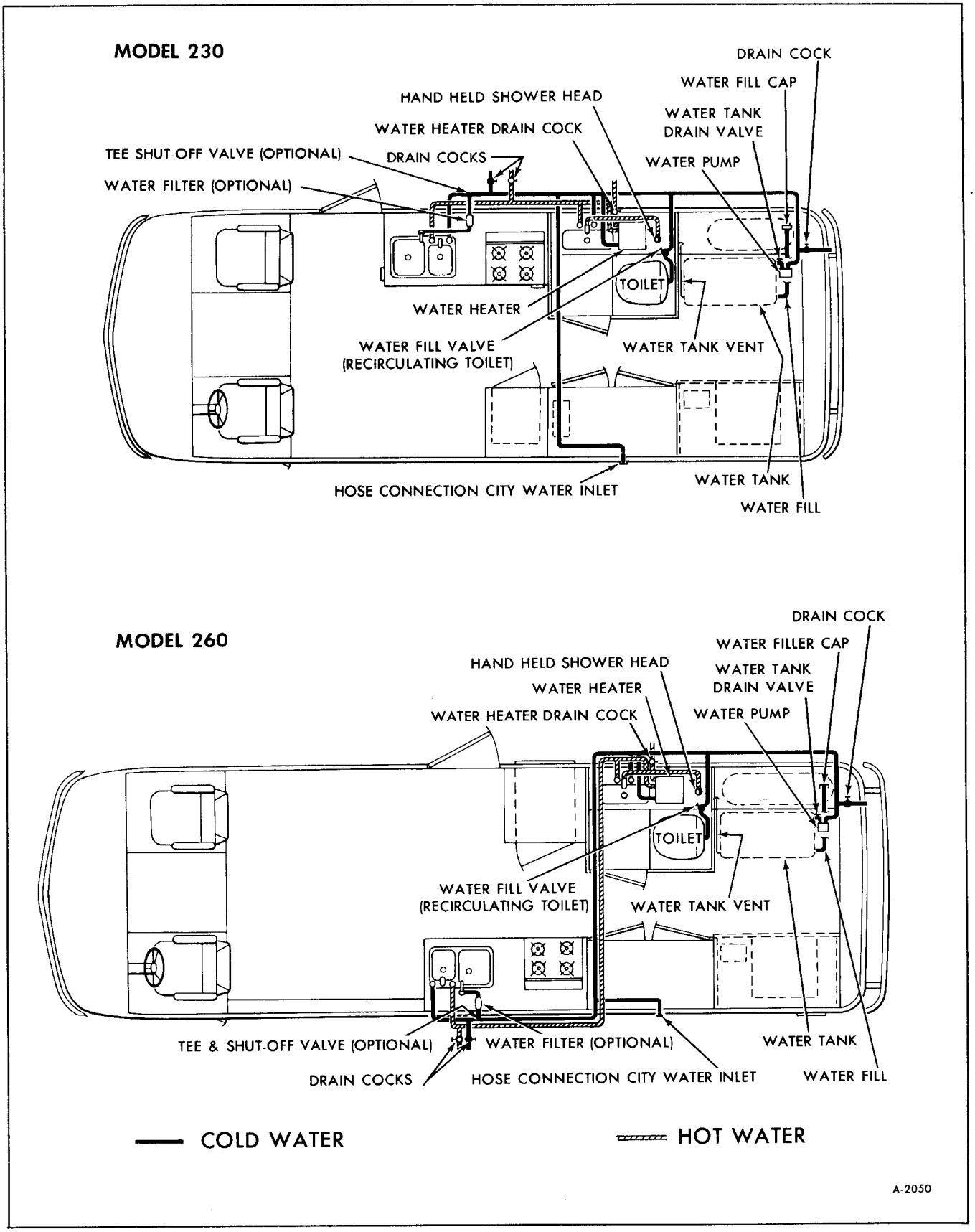


Figure 1–Living Area Water System Schematic

TROUBLE DIANOSIS

Problem	Possible Cause	Correction
No water.	1. Water pump switch not on.	1. Turn on switch.
	2. No water in tank.	2. Fill tank.
	3. Drain cocks open.	3. Close all drain locks.
	4. Pump belt broken.	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. Insufficient or no voltage at pump.	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. Faulty pressure switch on pump.	6. Check switch. Refer to "Pressure Switch" later in this section.
	7. Pump motor burned out.	7. Replace motor.
	8. Pump is not priming itself or doesn't build up enough pressure to shut-off.	8. Remove pump, dismantle and inspect check valve assemblies. Refer to "Water Pump-Disassembly" later in this section.
No or not enough hot water.	1. Water Heater Switch not on.	1. Turn on switch.
	2. Tank has overheated.	2. Remove metal cover and push reset button.
	3. Water heater thermostat not properly set.	3. Check thermostat and reset if necessary. Refer to "On-Vehicle Adjustmen–Water Heater" later in this section.
	4. Low voltage.	4. Check source and correct as necessary.
	5. Incorrect wiring.	5. Check wire connections and correct as necessary.
	6. Heater element burned out.	6. Replace element. Refer to "Water Heater–Removal" later in this section.
	7. Thermostat burned out.	7. Replace thermostat. Refer to "Water Heater–Removal" later in this section.
	8. Water pre-heat hose (if equipped) pinched.	8. Check pre-heat hose routings, correct as required.
Leaking water system.	1. Loose on incorrect fittings.	1. Locate leak, determine cause and correct.

Problem	Possible Cause	Correction
Water tank gauge at monitor panel does not operate (if equipped).	1. Defective sending unit or monitor panel gauge.	1. Refer to "Living Area Electrical" earlier in this manual. Refer to "Water Tank–Sending Unit" later in this section.

ON VEHICLE ADJUSTMENT

WATER PUMP BELT

To obtain maximum life from the water pump belt it should be adjusted to obtain 1/8" deflection as shown in Figure 2.

Loosen motor mounting nuts, tension belt properly and tighten nuts.

WATER PUMP PRESSURE SWITCH

Both the cut-on and cut-off points may be adjusted after removing the pressure switch cover. To effectively due this, remove the four (4) pump assembly hold down screws and reposition pump for better

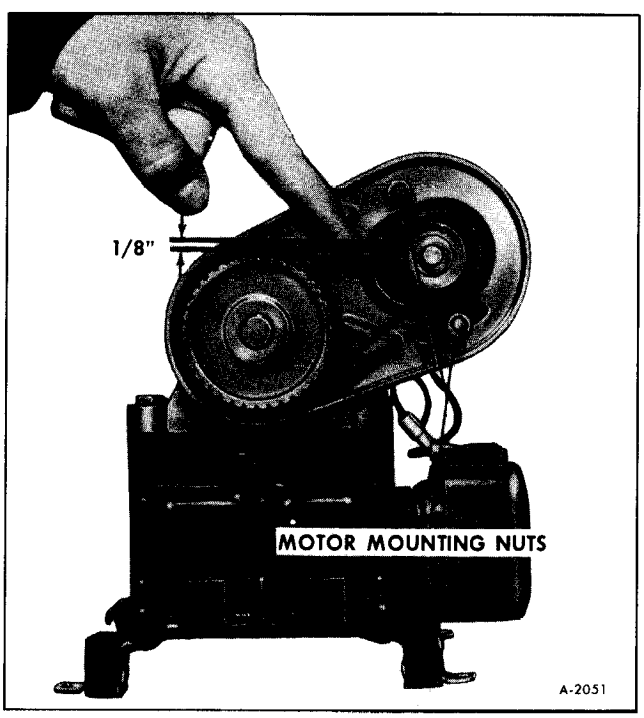


Figure 2–Water Pump Belt Tension

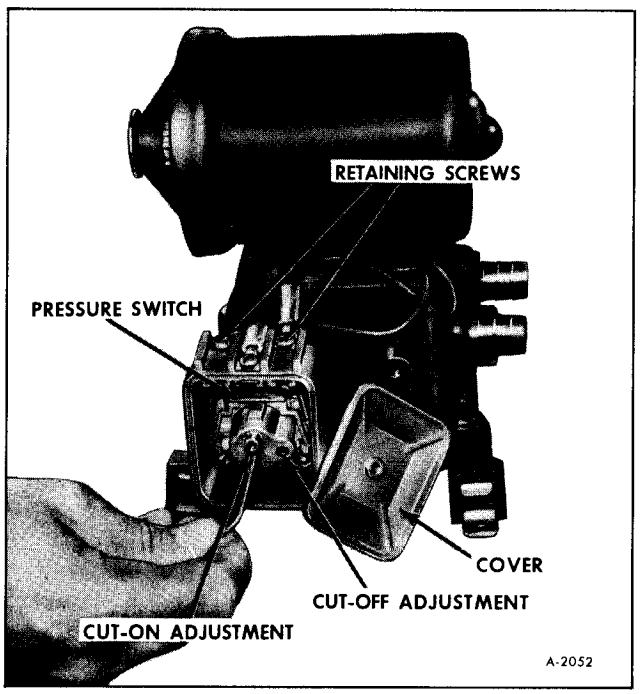


Figure 3–Adjusting Cut-On and Cut-Off at Pressure Switch

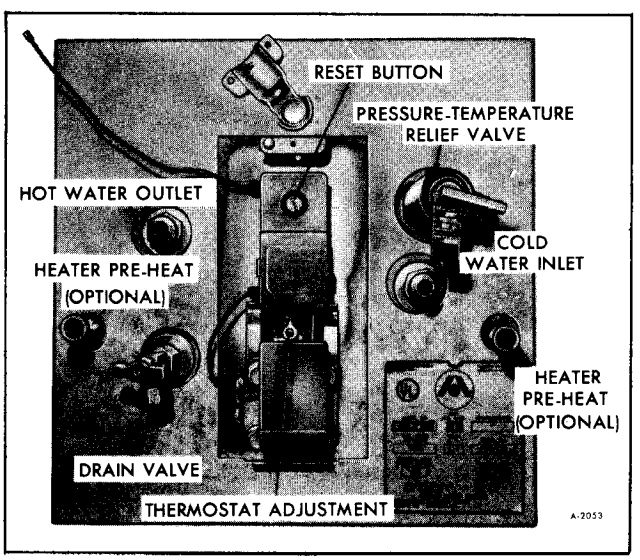


Figure 4–Water Heater

access. With the cover removed turn the adjusting screws shown in Figure 3, as required to obtain a cut-on setting of 20 PSI and a cut-off setting of 30 psi.

WATER HEATER THERMOSTAT

NOTE: Recent production water heaters are equipped with a non-adjustable thermostat. These units were factory set and no additional adjustment is possible. Early production water heaters are equipped with an adjustable thermostat (See figure 4). To adjust thermostat perform the following:

Remove the metal cover after making sure the water heater switch is turned off. Adjust thermostat to desired setting (See figure 4).

The water heater is equipped with a reset button. In the event the tank gets overheated a thermal sensing switch will automatically disconnect the heater. To reset the unit remove the metal cover and push the red reset button.

WATER TANK

REMOVAL

1. Remove cushions and wood cover over water tank.

2. Open tank drain valve as shown in Figure 5 and allow tank to drain.

3. Disconnect tank vent hose.

4. Disconnect water fill inlet tube or elbow at tank.

5. Disconnect tank sending unit wires if equipped and tank hold down strap brackets.

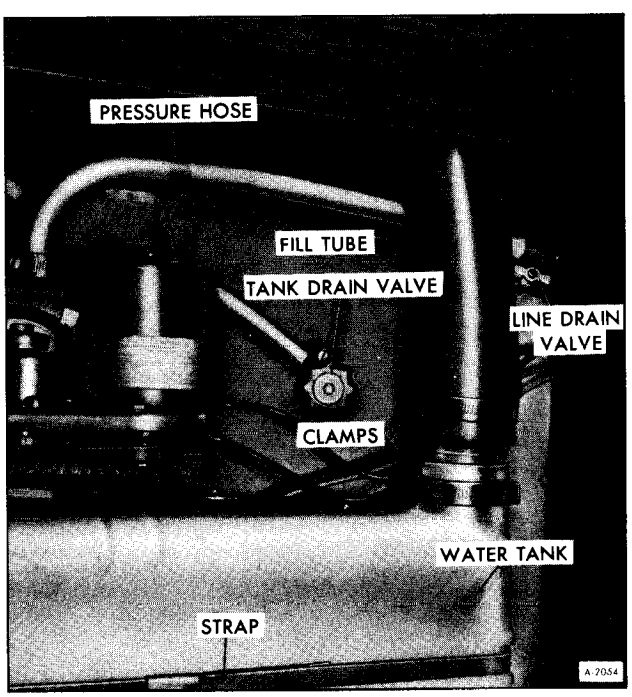


Figure 5–Water Tank Drain Valve Location

NOTE: Straps do not have to be cut.

6. Disconnect the suction hose at the pump and the drain hose from the tee or valve depending on which is more accessible.

7. Remove tank.

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. Connect tank vent hose and tighten clamp securely.

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 SENDING UNIT (IF EQUIPPED)

REMOVAL

1. Disconnect battery ground cables and then remove cushions and wood cover over water tank.

2. Drain tank enough so water is below sending unit opening.

3. Disconnect water tank inlet elbow or tube at the tank and position out of the way.

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. Connect tank fill tube or elbow at tank and tighten clamp securely.

4. Fill tank and check for leaks.

5. Install wood cover and cushions.

6. Connect battery ground cables and then at monitor panel check for proper operation of sending unit.

WATER PUMP

REMOVAL

1. Remove wood cover over water tank compartment.

2. Open tank drain valve and drain tank.

3. Make sure pump wall switch is turned off and disconnect battery ground cables.

4. Disconnect hoses from water pump. See Figure 6.

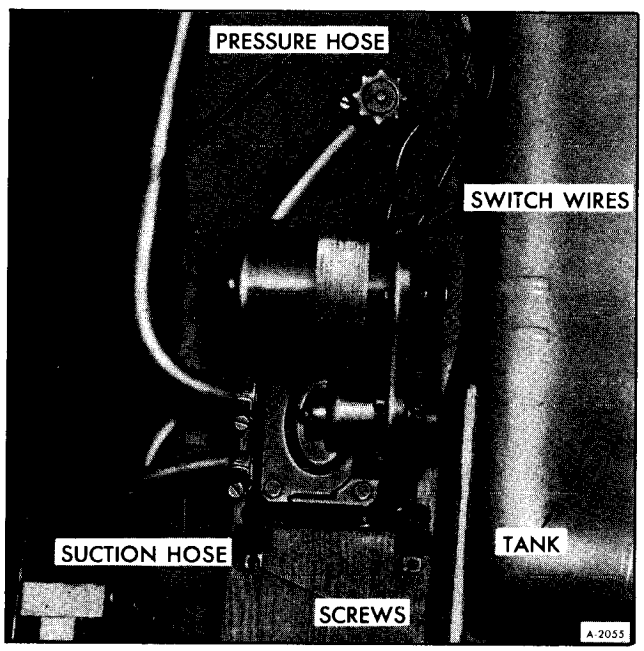


Figure 6–Water Pump

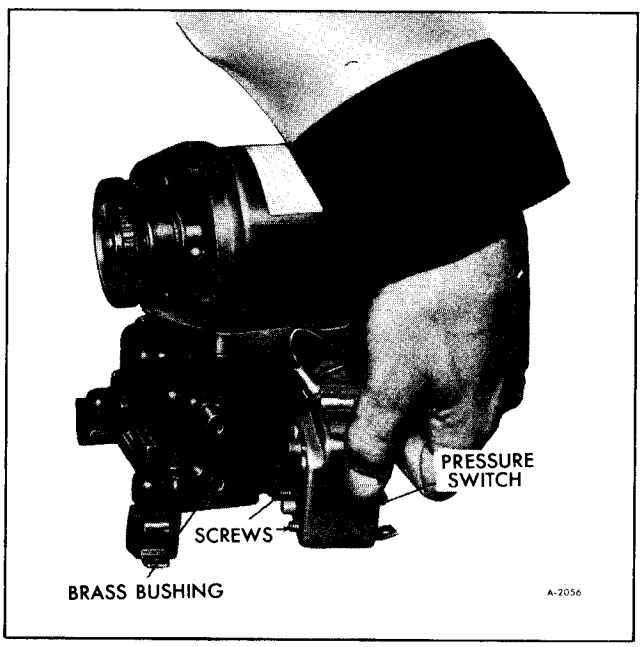


Figure 7–Removing Pressure Switch

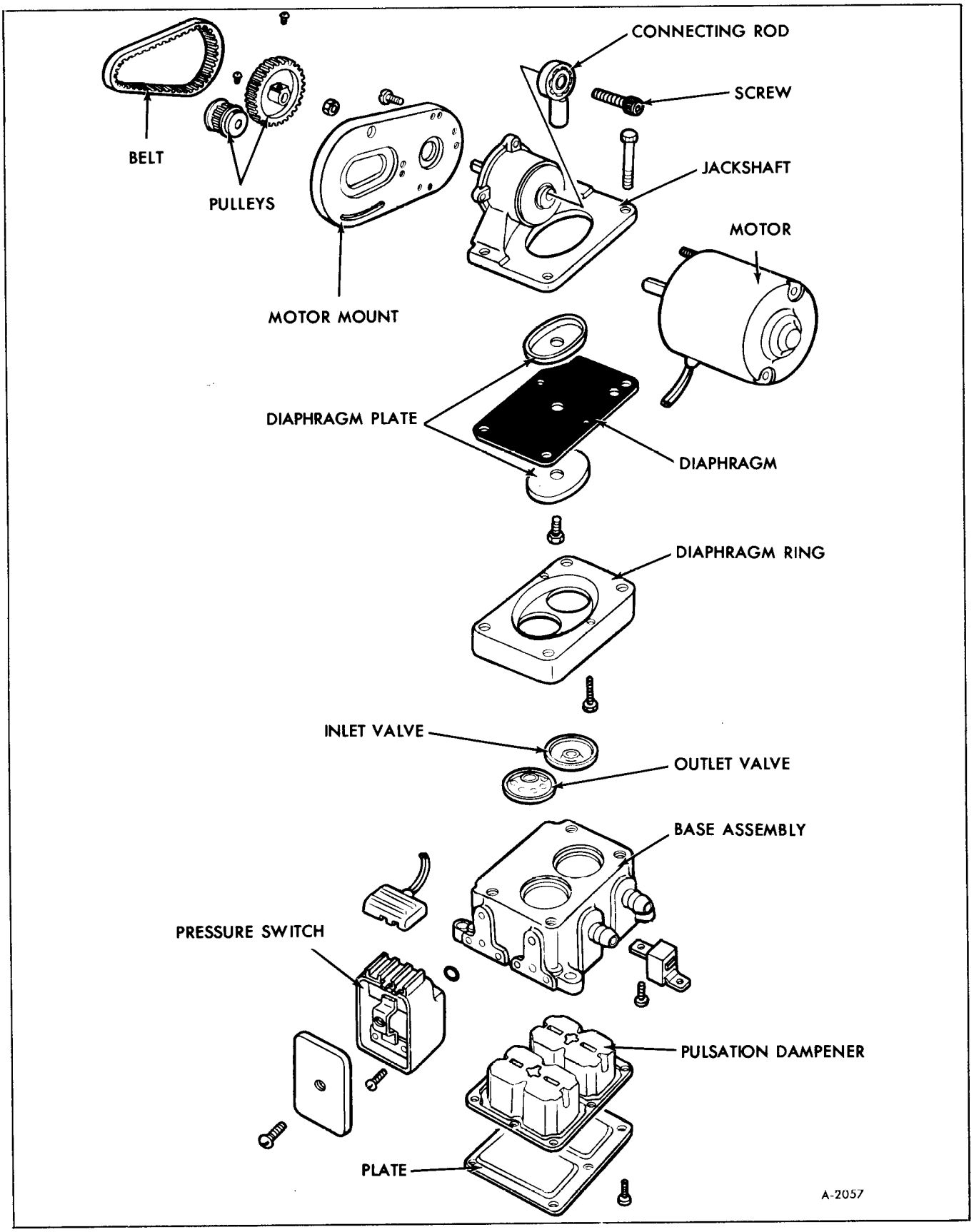


Figure 8–Water Pump Components

5. Disconnect tank fill elbow at the tank if equipped.

6. Remove four (4) pump hold down screws. See Figure 6.

7. Lift pump assembly out and disconnect wires from the pressure switch.

DISASSEMBLY

1. Remove two (2) nuts as shown in Figure 2 and remove belt.

2. Remove both pulleys.

3. Remove two (2) screws securing motor mount to the jack shaft assembly.

4. Remove pressure switch cover and loosen two (2) screws securing the switch to the base assembly. See Figure 7.

5. Remove switch from base assembly and disconnect wires from the switch.

6. Remove motor assembly.

7. Remove connecting rod screw and slip connecting rod off jack shaft (See figure 8).

8. Remove four (4) screws securing the jack shaft assembly to the base assembly and lift the jack shaft and diaphragm ring off the base assembly. Inspect diaphragm for cracks, replace if necessary.

9. Lift valve assemblies from pockets and clean all foreign material from valve and valve seat.

10. Remove nine (9) screws securing bottom plate to base assembly (See figure 8).

11. Remove plate and pulsation dampener. Check dampener for a rupture. Replace if ruptured.

ASSEMBLY

1. Install pulsation dampener being careful that all dampener flanges will properly seat with plate.

2. Install bottom plate and nine (9) screws.

CAUTION: *To avoid casting damage and obtain proper compression on dampener flange, tighten screws evenly until flange edge of bottom plate is flush with bottom of case casting.*

3. Install valve assemblies back in same pockets, being sure rubber valve with small hole is up on intake side of base assembly and rubber without small hole is down on discharge side of base assembly (See figure 8).

4. Install diaphragm ring, diaphragm and jack shaft assembly. Install four (4) screws and tighten securely.

5. Install connecting rod screw.

6. Install motor mount to jack shaft assembly and secure with two (2) screws.

7. Install motor and loosely secure with two (2) nuts.

8. Install wires from motor to pressure switch and install pressure switch. Be sure to include brass bushing as shown in Figure 7. Secure pressure switch with two (2) screws.

9. Install pressure switch cover.

10. Install both pulleys and secure with set screws.

11. Install belt and tension properly. Refer to "On-Vehicle Adjustment–Water Pump Belt" earlier in this section.

INSTALLATION

1. Connect wires to pressure switch and install pump assembly.

2. Install four (4) pump hold down screws.

3. Connect water tank fill elbow at the tank, if removed, and secure with clamp.

4. Connect hoses to water pump and secure with clamps.

5. Close tank drain valve and fill water tank.

6. Connect battery ground cables and turn on wall switch and open faucet. Close faucet and allow system to pressurize. Check for leaks at the water pump and hose connections.

7. Install wood cover and cushions.

BELT REPLACEMENT

REMOVAL

1. Turn off pump at wall switch.

2. Loosen two (2) nuts as shown in Figure 2.

3. Slide motor toward jack shaft assembly to release tension.

4. Remove belt.

INSTALLATION

1. Position belt over pulleys.

2. Tension belt as described in "On-Vehicle Adjustment–Water Pump Belt".

3. Tighten nuts.

4. Turn on pump at wall switch and check for proper operation.

PRESSURE SWITCH

REMOVAL

1. Disconnect battery ground cables and turn off pump at the wall switch.

2. Remove four (4) screws securing pump assembly (See figure 6).

3. Lift pump assembly and position so access may be gained to the pressure switch.

4. Remove switch cover and two (2) screws attaching switch to pump.

5. Remove switch and disconnect wires.

6. Inspect switch contact points for corrosion. Clean with sand paper or small file if necessary.

INSTALLATION

1. Connect wires to switch and secure switch to pump.

2. Install switch cover.

3. Place pump assembly in original position and secure with four (4) screws and connect battery ground cables.

4. Turn on pump at wall switch.

WATER HEATER

REMOVAL

1. Disconnect battery ground cables, and turn off water heater switch and turn off water pump switch.

2. Open drain valve and allow water heater to drain (See figure 4).

3. Remove sliding doors, door frame and shelf liner in the bath vanity.

4. Disconnect heater pre-heat hoses if equipped and plug the hoses.

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 the water heater 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 (See figure 4). Remove drain valve.

2. Remove metal cover and remove red plastic cover over electrical control assembly (See figure 4).

3. Disconnect wire and remove control assembly as shown in Figure 9.

4. Remove heater element as shown in Figure 10 by removing four (4) bolts.

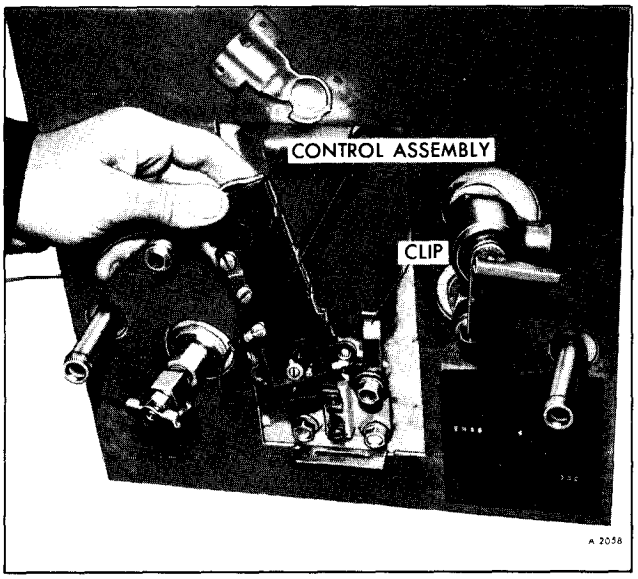


Figure 9–Removing Control Assembly

5. Remove four (4) 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 (4) screws.

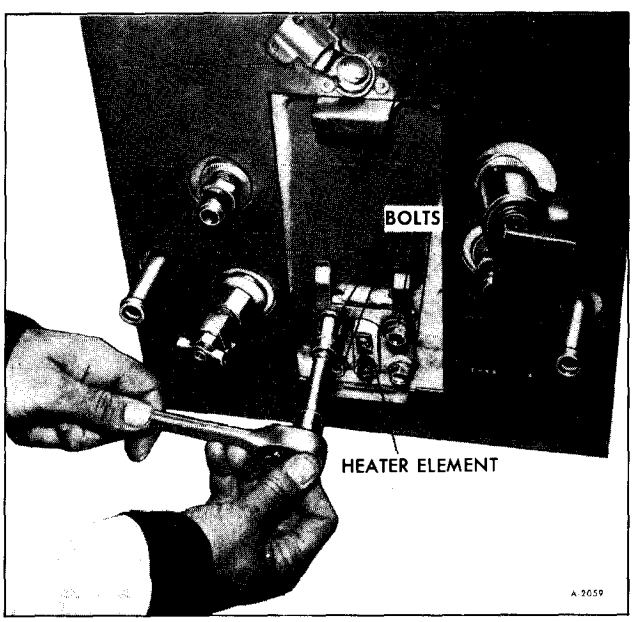


Figure 10–Removing Heater Element

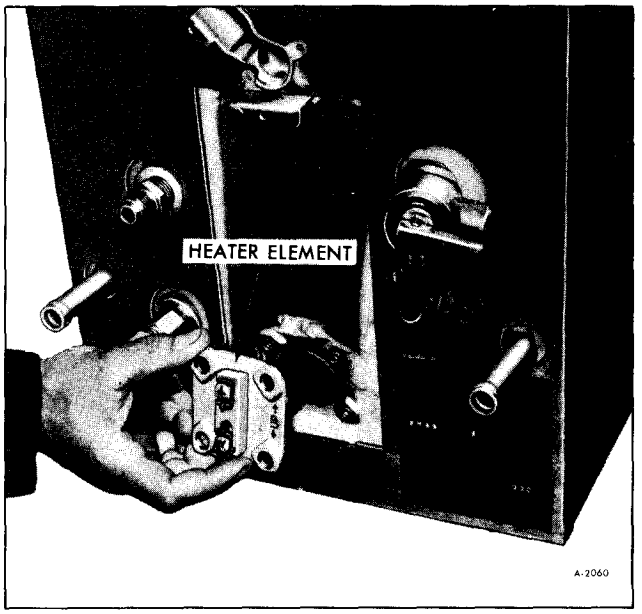


Figure 11–Installing Heater Element

3. Install heater element in the direction specified by the word UP, as shown in Figure 11.

4. Evenly tighten four (4) 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 (5) long and string through brackets on wall.

2. Position support bracket outward and slide heater into postion.

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.

9. Connect heater pre-heat hoses if equipped and secure with clamps.

10. Install shelf liner, door frame and sliding doors.

11. Close water heater drain valve. Connect battery ground cables.

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.

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.

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 12. Remove steel and fiber washers.

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 12)

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 12)

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.

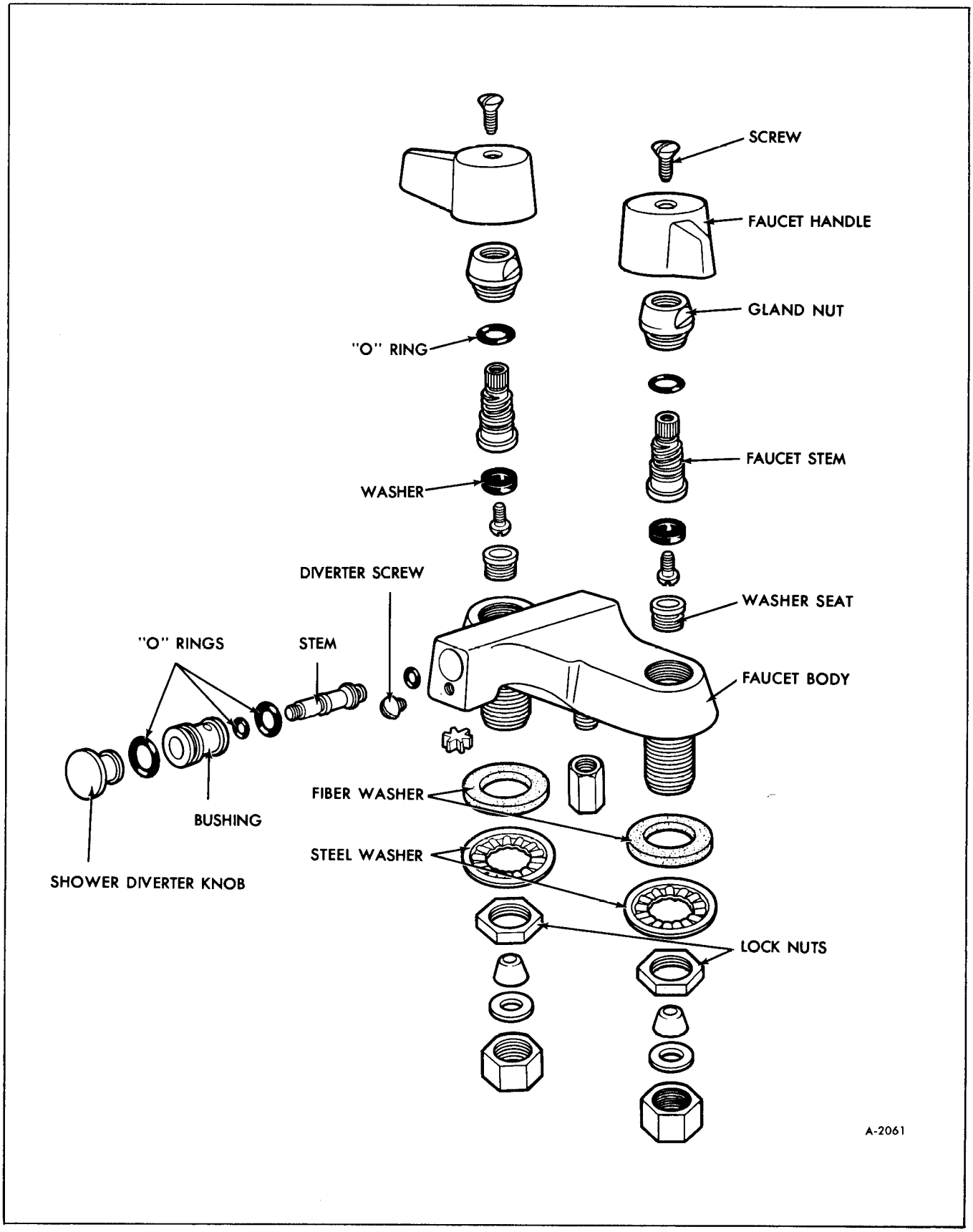


Figure 12–Bathroom Sink Faucet Assembly

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 figure 13).

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.

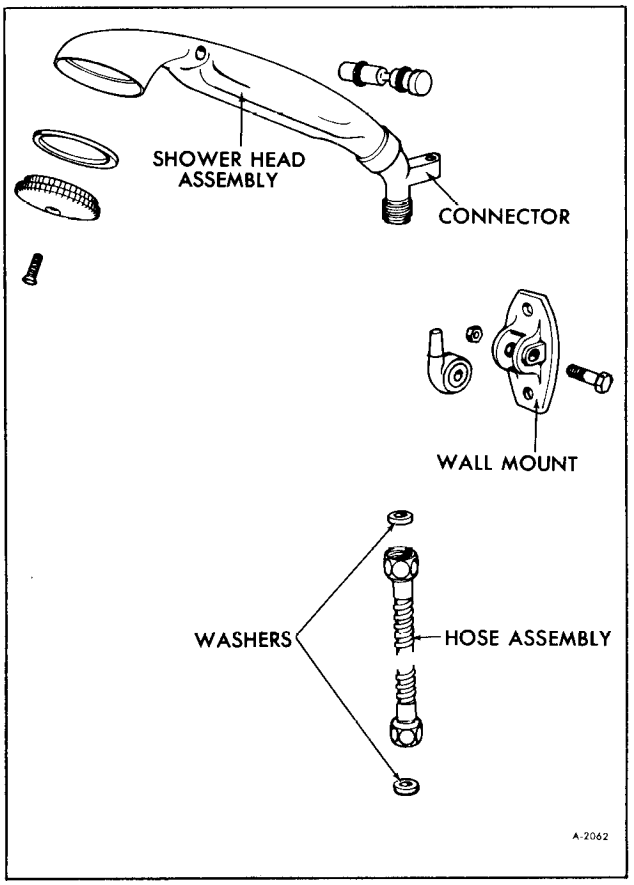


Figure 13–Shower Head Components

GALLEY SINK

REMOVAL (FIGURE 14)

1. Turn off water pump at wall switch. Open faucet to reduce line pressure.

2. Disconnect water lines from faucet. Include, disconnect water purifier spout, if equipped.

3. Remove sink retaining clips (See figure 15).

4. Disconnect drain lines.

5. Lift sink out.

INSTALLATION (FIGURE 14)

1. Position sink into place and secure with clips (figure 15).

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.

GALLEY SINK FAUCET

REMOVAL

1. Turn off water pump at wall switch. Open faucet to reduce line pressure.

2. Disconnect water lines from faucet.

3. Remove lock nuts steel and fiber washers (See figure 14).

4. Remove faucet.

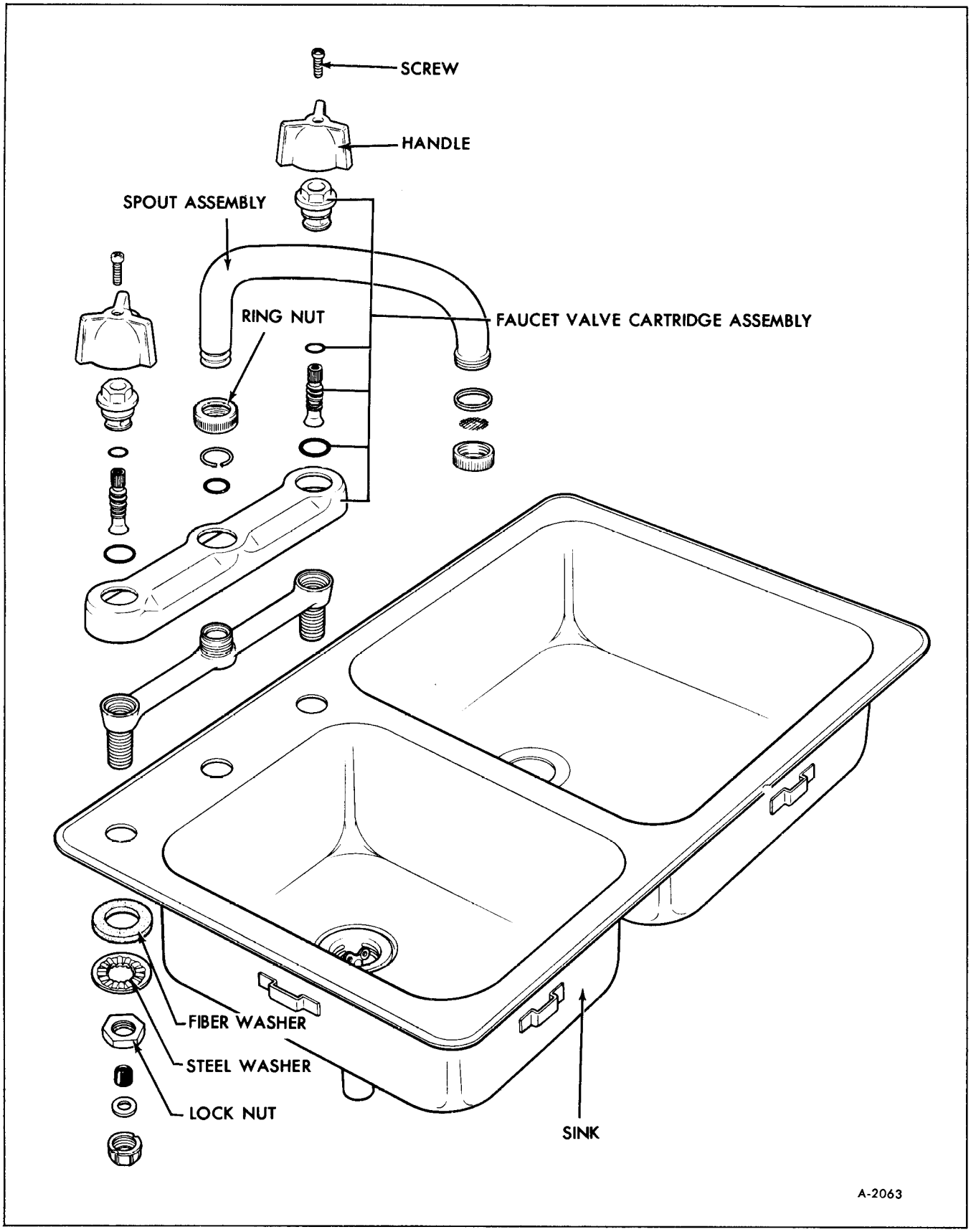


Figure 14–Galley Sink Components

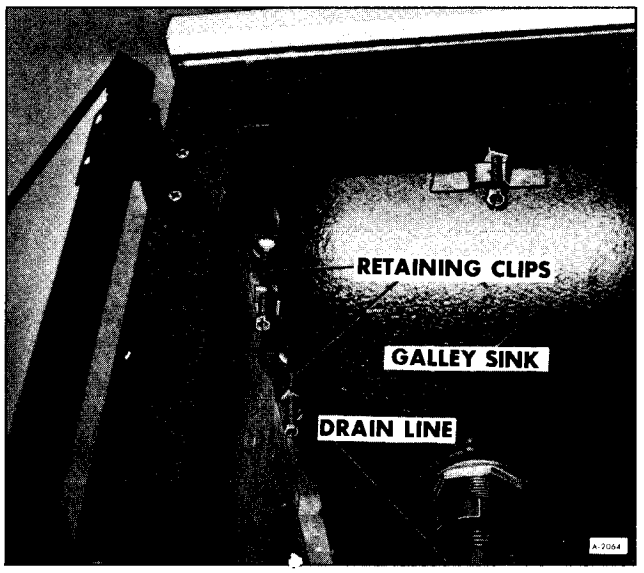


Figure 15–Sink Retaining Clips

INSTALLATION

1. Install faucet, fiber and steel washers. Secure with lock nuts.

2. Connect water lines.

3. Turn on water pump and operate faucet. Check for leaks.

FAUCET VALVE CARTRIDGE ASSEMBLY

REMOVAL (FIGURE 14)

1. Turn off water pump wall switch. Open faucet to reduce line pressure.

2. Remove handle retaining screw and handle.

3. Remove faucet valve cartridge assembly.

INSTALLATION (FIGURE 14)

1. Install faucet valve cartridge assembly.

2. Install handle and secure with screw.

3. Turn on water pump, operate faucet and check for leaks.

FAUCET SPOUT

REMOVAL (FIGURE 14)

1. Turn off water pump and open valve to reduce line pressure.

2. Remove spout to faucet ring nut.

3. Remove spout.

INSTALLATION (FIGURE 14)

1. Install spout and secure with ring nut.

2. Turn on water pump, operate faucet and check spout for leaks.

WATER PURIFIER (OPTIONAL)

FAUCET REMOVAL

1. Turn off water pump and open faucet to reduce line pressure.

2. Disconnect water line.

3. Remove lock nut, steel and fiber washers (See figure 16).

4. Remove faucet assembly.

FAUCET INSTALLATION

1. Install faucet assembly, fiber and steel washer. Secure with lock nut.

2. Connect water line.

3. Turn on water pump and operate purifier. Check for leaks.

PURIFIER VALVE STEM

REMOVAL (FIGURE 16)

1. Turn off water at in line valve and depress purifier button to reduce line pressure.

2. Remove push button and stem assembly.

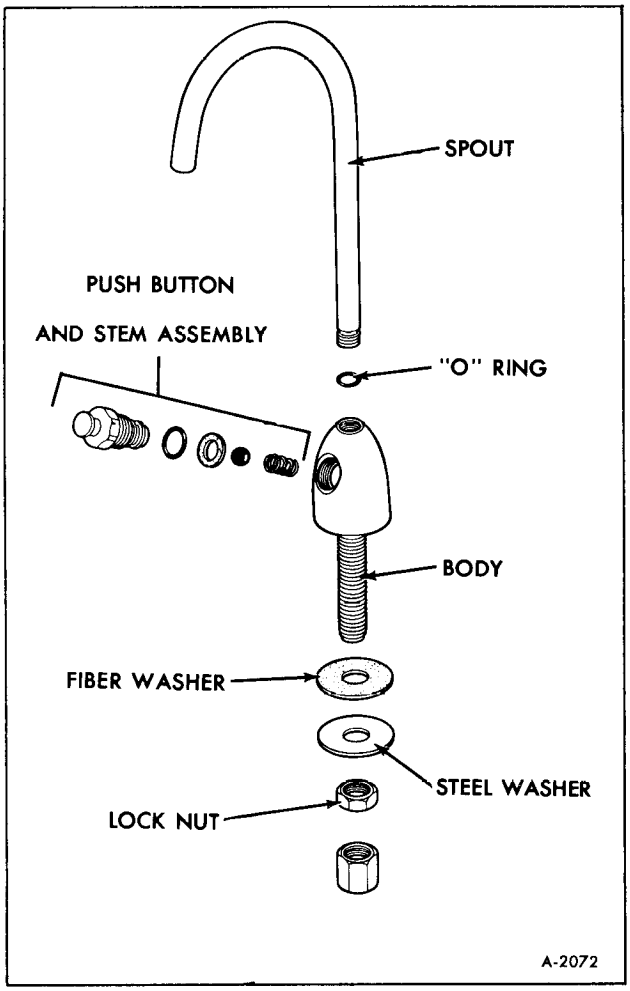


Figure 16–Water Purifier Faucet

3. Inspect washer, "O" ring and check ball for roughness.

INSTALLATION (FIGURE 16)

1. Install push button and stem assembly. Tighten lock nut securely.

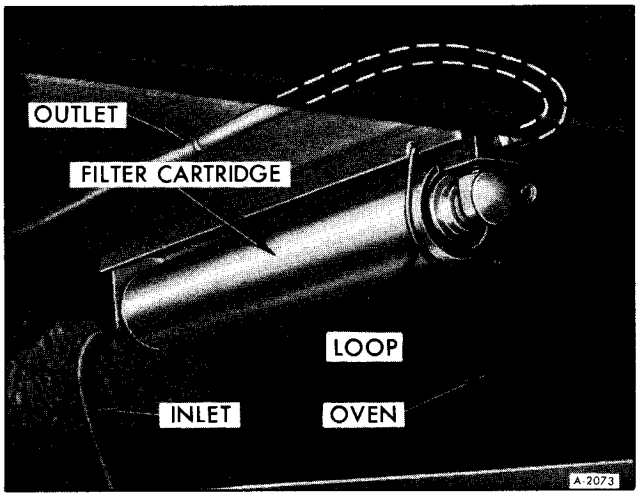


Figure 17–Water Purifier Cartridge

2. Turn on water at valve and operate purifier. Check for leaks.

WATER PURIFIER CARTRIDGE

REMOVAL

1. Turn off water at in line valve. Depress purifier button to reduce line pressure.

2. Slide cartridge retaining bail (See figure 17).

3. Pull cartridge down approximately one (1) inch then outward to remove.

INSTALLATION

1. Insert cartridge into bracket and swing bail over the end (figure 17).

2. Turn on water at valve, operate purifier and check for leaks.

CITY WATER CONNECTION

REMOVAL

1. Turn off water pump, open faucet to reduce line pressure.

2. Remove four (4) retainer screws on outer ring and six (6) screws on inner ring.

3. Remove retainer ring and valve assembly.

4. Remove wooden, access cover from inside of clothes closet.

5. Remove valve base plate.

INSTALLATION

1. Install valve base plate.
2. Install valve assembly and retainer ring.
3. Secure inner and outer rings with screws.
4. Turn on water pump and lightly depress gray button in valve until water appears. Release button and check for leaks.
5. Install wooden access cover in clothes closet.

WATER LINES AND CONNECTIONS

All waterlines are made of copper except the following: The water pump inlet and outlet is serviced by short pieces of rubber hose.

Copper fittings include compression, sweat solder and flared connections. Repair of these fittings is by standard plumbing methods.

GMC MOTOR HOME SERVICE

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 manditory 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.

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.

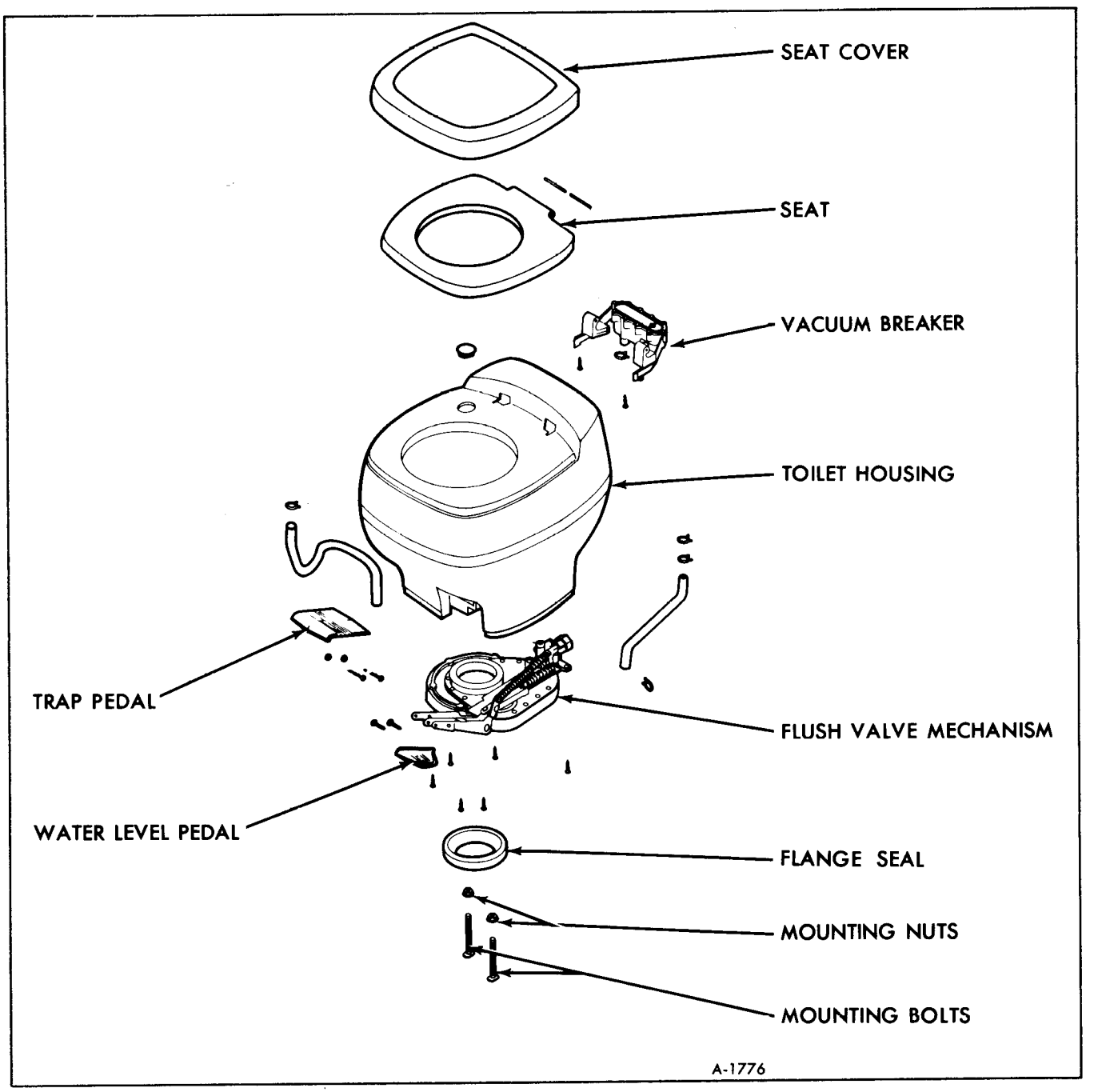


Figure 1–Standard Toilet Components

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 volumn of the holding tank. The toilet operates on 12-volt DC.

RECIRCULATING TOILET TROUBLE DIAGNOSIS

Complaint	Possible Cause	Correction
1. Toilet will not flush.	a. Blown living area fuse. b. Blown toilet fuse. c. Pump motor defective. d. Damaged timer.	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.	a. Source of power less than 12-volts. b. Damaged timer.	a. Check batteries or power converter. b. Replace timer assembly.
3. Toilet cycles when seat cover is raised.	a. Actuator button protrudes too far from motor cover.	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.	a. Unit cycling without adequate water charge. b. Source of power less than 12-volts. c. Pump damaged by continuous dry operation.	a. Charge unit with water to the proper level. b. Check batteries or power converter. c. Replace pump assembly.

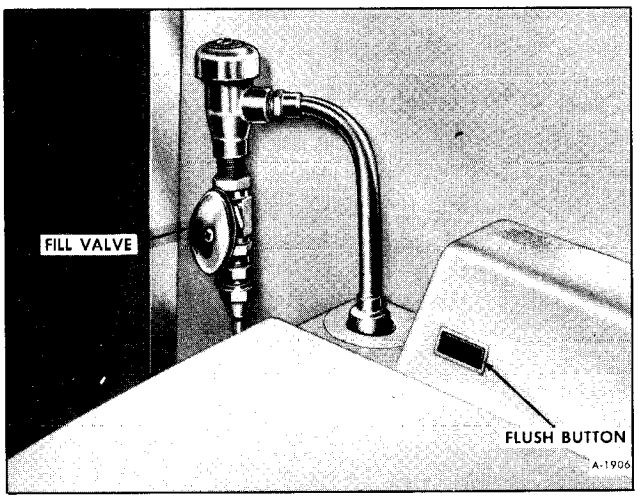


Figure 2–Toilet Water Fill Connection

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.

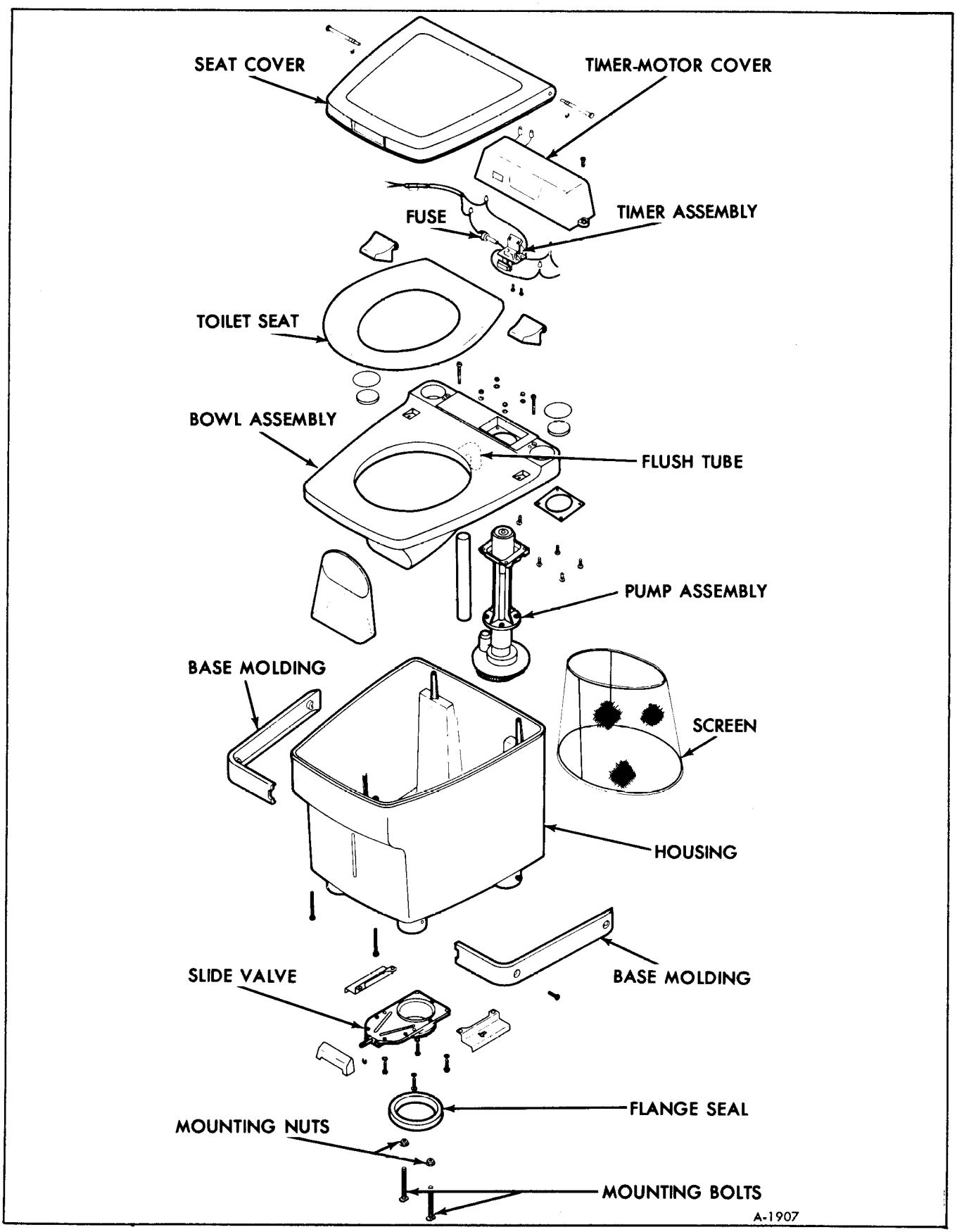


Figure 3–Recirculating Toilet Components

MAINTENANCE

No routine maintenance is required on the recirculating toilet other than "Charging Toilet" which is described as follows:

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.

GMC MOTOR HOME SERVICE

SECTION 24L
HOLDING TANK AND DRAINAGE SYSTEM

The contents of this section are listed below:

GENERAL DESCRIPTION

The drainage system (figure 1) consists of ABS plastic pipes and fittings. A holding tank with a capacity of approximately 32 gallons provides a place for storage of waste water from the sinks, shower and toilet.

The tank is vented through standpipes with roof-mounted vents (2 vents on Model 230; 3 vents on Model 260).

A permanently attached hose or tube assembly to the holding tank along with a detachable sewer hose is provided for dumping the contents of the holding tank.

TROUBLE DIAGNOSIS

Problem	Possible Cause	Correction
Monitor panel gauge inoperative.	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 (if equipped), thermasan pick-up in tank (if equipped) or fullway dump valve. 2. Loose or misaligned fittings on top of tank. 3. Tank has been punctured.	1. Refer to "Holding Tank" 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.	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 probe such as a broomstick handle to clear sediment away from opening. NOTE: Once unplugged the contents will quickly drain so be prepared and have dump hose aimed in the desired direction.

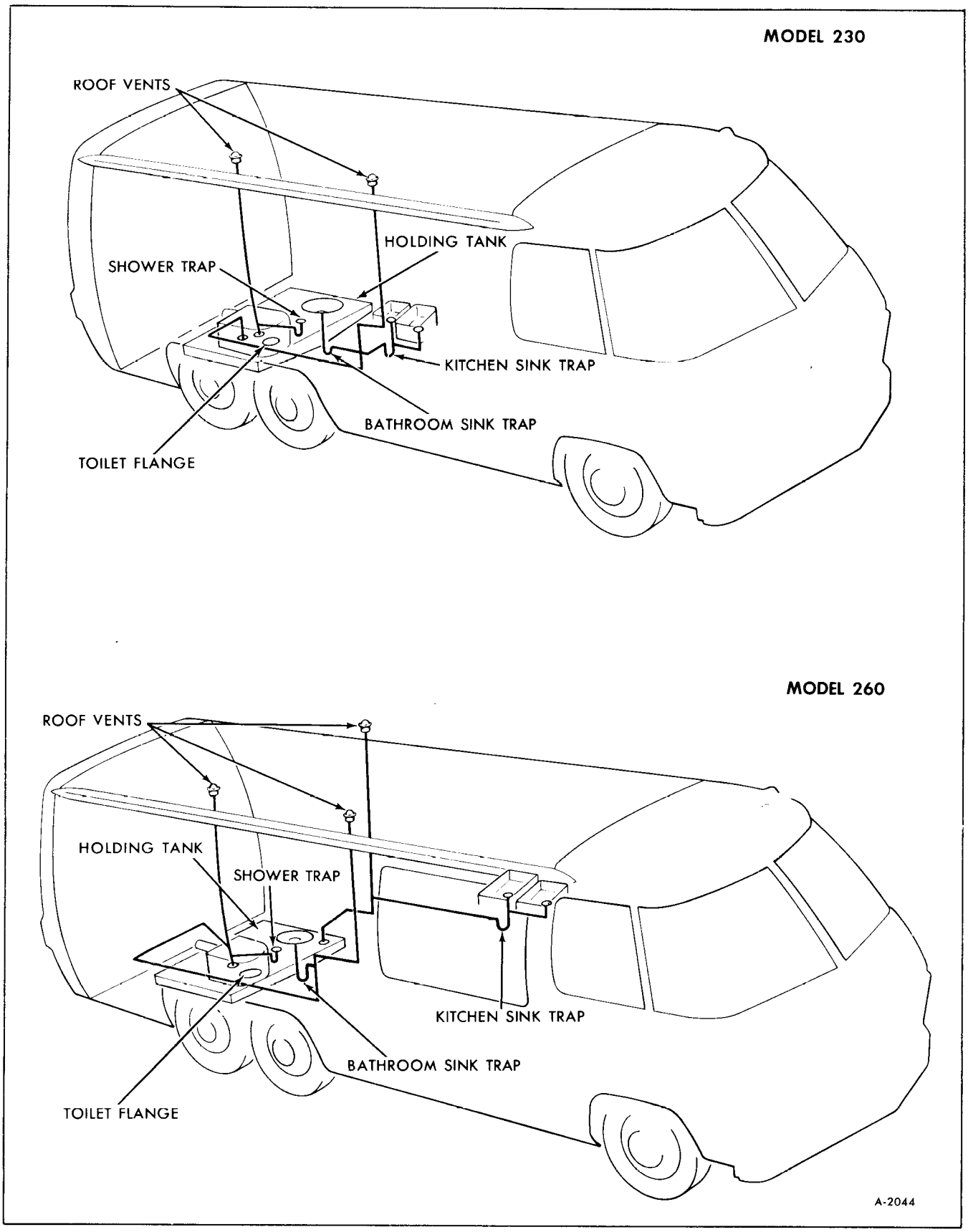


Figure 1–Drainage System

Problem	Possible Cause	Correction
Holding tank contents backs up through shower trap and onto bathroom floor, this situation may be more common on vehicles not equipped with a monitor panel.	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.
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 by being in contact with a piece of 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. Either remove flexible discharge hose at valve by loosening hose clamp and sliding hose from valve, or remove rigid dump tube by refering to "Fullway Valve-Removal" later in this section.

5. Remove cotter pin from valve rod and remove control rod (See figure 2).

6. Remove two electrical leads from holding tank sending unit, if so equipped.

7. Remove electrical leads and hose from thermasan pick-up unit in holding tank, if so equipped.

8. On Model 260, 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.

9. Remove two retaining nuts from each of the two mounting brackets (See figure 2).

10. Holding tank can now be lowered to floor.

HOLDING TANK REPAIR

Except for small, clean punctures the holding tank is not repairable. Polypropylene plastic is used to manufacture the tank. This material resists all common adhesives that may be used in plugging or patching the tank. The very corrosive contents of the tank will quickly corrode any sheet metal, pop-rivets or screws used to plug or patch the tank.

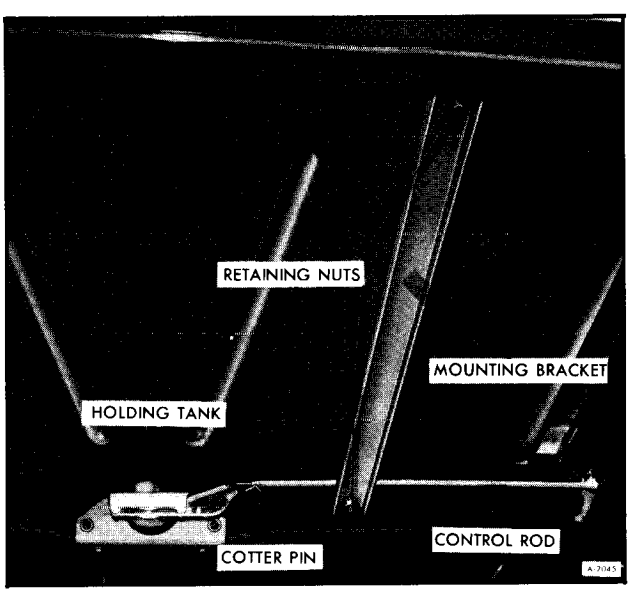


Figure 2–Holding Tank Mounting

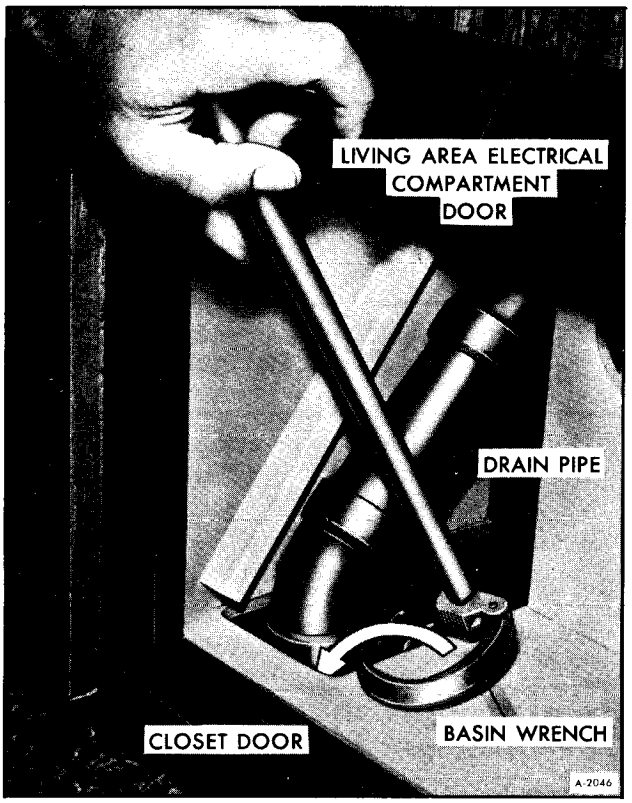


Figure 3–Loosening Pipe Fitting-Model 260

A small puncture may be repaired with the use of a well-nut. Enlarge puncture hole with a drill enough to insert well-nut. Tighten securely.

HOLDING TANK INSTALLATION

1. Position holding tank and secure with two mounting brackets. On Model 230 torque nuts to 95-145 in.-lbs. On Model 260 install nuts and tighten with fingers. Tighten pipe connector into tank, using a basin wrench as shown in Figure 3. Install and secure drain pipe cover with three (3) screws. Torque holding tank bracket nuts to 95-145 in. lbs.

2. Connect electrical leads and hose to thermasan pick up unit in holding tank, if so equipped.

3. Connect two electrical leads to holding tank gauge sending unit, if so equipped.

4. Install valve rod on drain valve and secure with cotter pin.

5. Either connect flexible discharge hose to drain valve and secure with hose clamp or install rigid dump tube refer to "Fullway Valve-Installation" later in this section.

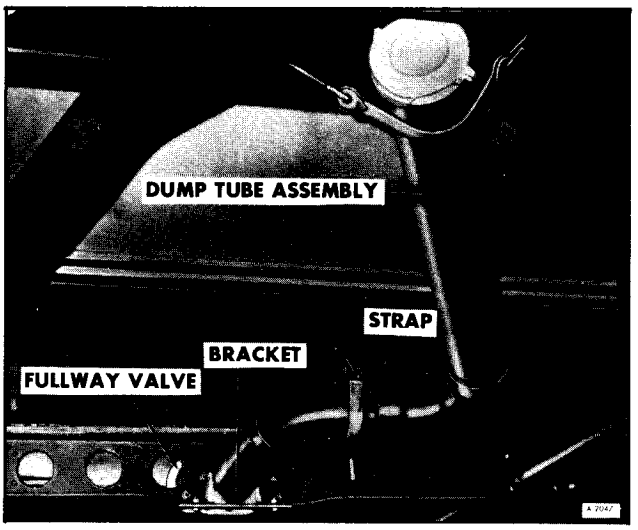


Figure 4–Dump Tube and Valve Assembly

6. Screw toilet mounting flange into holding tank and secure with six screws to floor.

7. Install toilet as described in SECTION 24K.

FULLWAY VALVE

REMOVAL

1. Drain holding tank completely and close fullway valve.

2. On vehicles equipped with a rigid dump tube assembly remove the four (4) screws securing valve to the tank. Remove cotter pin from control rod, then remove the bracket and strap as shown in Figure 4. Remove the fullway valve and tube assembly.

3. On vehicles equipped with a flexible hose at the holding tank, remove the hose from the valve by loosening the hose clamp and sliding the hose off the valve. Remove the cotter pin from the control rod. Remove the four (4) screws securing the valve to the tank. Remove the valve.

INSTALLATION

1. On vehicles equipped with a rigid 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.

a. Position valve at holding tank and assemble enough to loosely install the strap (figure 4). Tighten fullway valve to tank screws.

b. Install bracket and torque to 15 ft. lbs. Tighten nuts securing strap.

c. Install valve rod and secure with cotter pin.

d. Check tank and valve for leaks.

2. On vehicles equipped with a flexible dump hose 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.

a. Position valve on holding tank and secure with four (4) screws.

b. Position discharge hose on valve and secure with hose clamp.

c. Install valve rod and secure with cotter pin.

d. Check tank and valve for leaks.

HOLDING TANK SENDING UNIT (OPTIONAL)

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.

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.

DISCHARGE HOSE

REMOVAL

On vehicles equipped with a flexible dump hose:

1. Remove hose at drain valve by loosening hose clamp and sliding hose off valve.

2. Loosen hose clamp at center bracket enough to allow it to slide off center support.

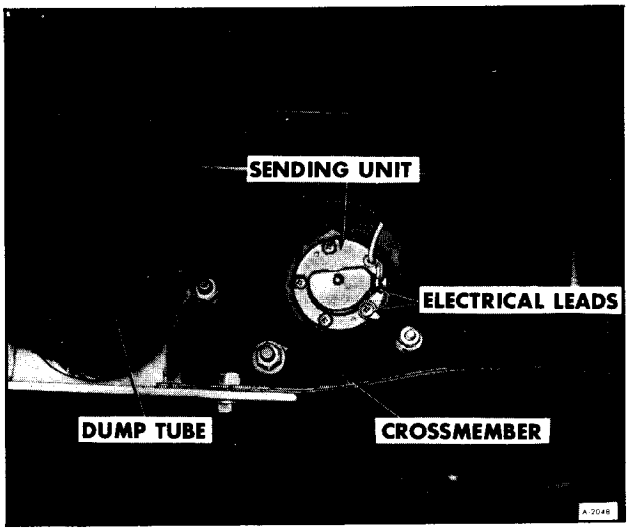


Figure 5–Holding Tank Sending Unit

3. Remove hose.

NOTE: On vehicles equipped with a rigid dump tube assembly refer to "Fullway Valve-Removal" earlier in this section.

INSTALLATION

On vehicles equipped with a flexible dump hose:

1. Position hose through hole in frame crossmember, and support bracket.

2. Slide end of hose over drain valve and secure with hose clamp.

3. Secure with hose clamp at center support bracket.

NOTE: On vehicles equipped with a rigid dump tube assembly refer to "Fullway Valve-Installation" earlier in this section.

SEWER HOSE ASSEMBLY

REMOVAL

1. Remove sewer hose from its storage tube.

2. Remove bumper bolts attaching storage tube to bumper.

3. Remove end mounting bracket by removing inside energy absorber mounting bolts.

INSTALLATION

1. Install end mounting bracket and retain with inside energy absorber bolts.

2. Fasten storage tube to bumper with bumper bolts.

3. Install sewer hose in storage tube and fasten to end mounting bracket.

DRAIN PIPES AND FITTINGS

All drain pipes and fittings are made from ABS plastic. Repair is easily made using a hacksaw to cut out damaged portion of pipe and replace the pipe and connect it into the system 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 6. Clean trap as required and position in vehicle and tighten compression fitting by hand.

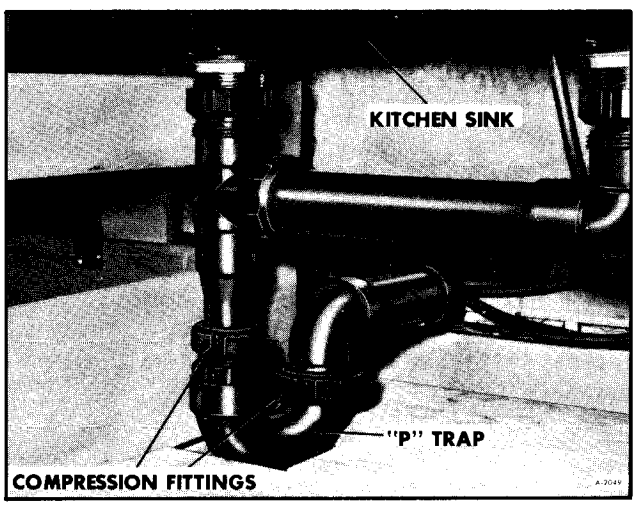


Figure 6–"P" Trap (Typical)

VENT LINE ROOF CAPS

Model 230 has two (2) vent lines serving the drainage system (See figure 1). Model 260 has three (3) 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.

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.

GMC MOTOR HOME SERVICE

SECTION 24M
THERMASAN SYSTEM

Contents of this section are listed below:

GENERAL INFORMATION

SYSTEM OPERATION

The Thermasan System is a waste destruction system that eliminates the inconvenience of holding tank evacuation stops. A chemical reaction occurs first in the contents of the holding tank. This waste is then pumped into the engines exhaust system through an ejection orifice. The waste is destroyed to the extent that all remaining gaseous by-products are rendered invisible, bacteria free, harmless and meet emission requirements of Public Health and Federal Emission Standards. The system is not designed to empty the holding tank but lower the level to a point where frequent holding tank dumpings are minimized.

To operate the Thermasan System, two factors must be present:

1. Exhaust temperature of at least 900-1000°F.

2. Vehicle speed must exceed 35 mph. Operation of the control panel without these factors being present will not start the system. If the exhaust temperature should drop below limits, or if vehicle speed is reduced, system operation will be temporarily interrupted.

CONTROL PANEL OPERATION

The thermasan controls are located to the right of the steering column in the driver's compartment. The panel face contains an "ON/OFF" switch, and three indicator lights. The "ON/OFF" switch contains a rheostat control for dimming if desired during night operation and a "PULL TO TEST" feature for testing pump operation.

When switched to the "ON" position, the green "READY" indicator will light. This is an indication that the system is operational. When the speed and temperature requirements are met, the red "REACTION" indicator will light, indicating physical destruction of waste if present. When the white indicator light is lit, the system has destroyed all waste available and should be turned "OFF". When the "ON/OFF" switch is in the "ON" position and is pulled out, this will produce flashing of the "REACTION" light indicating actual pump operation and waste ejection.

The system operates on 12-volts DC and will destroy up to five gallons of waste per hour (For wiring diagram see figure 3).

CAUTION: *Do not put any combustible material such as kerosene, alcohol, or gasoline in the holding tank as this could result in system damage.*

Do not winterize the Motor Home with fuel oil or kerosene, which might get into the holding tank. We also recommend that facial type tissue be kept from the holding tank because it has "wet strength" which will not properly dissolve for passage through the waste pump. Toilet paper MUST BE water soluble.

Occasional draining of the holding tank at an approved dumping station is recommended. This should be done once or twice annually to remove any foreign particles or insoluble matter.

SYSTEM COMPONENTS

The Thermasan System contains six basic components (Refer to figure 1):

1. pump
2. control panel
3. speed switch
4. heat switch
5. holding tank
6. ejection orifice

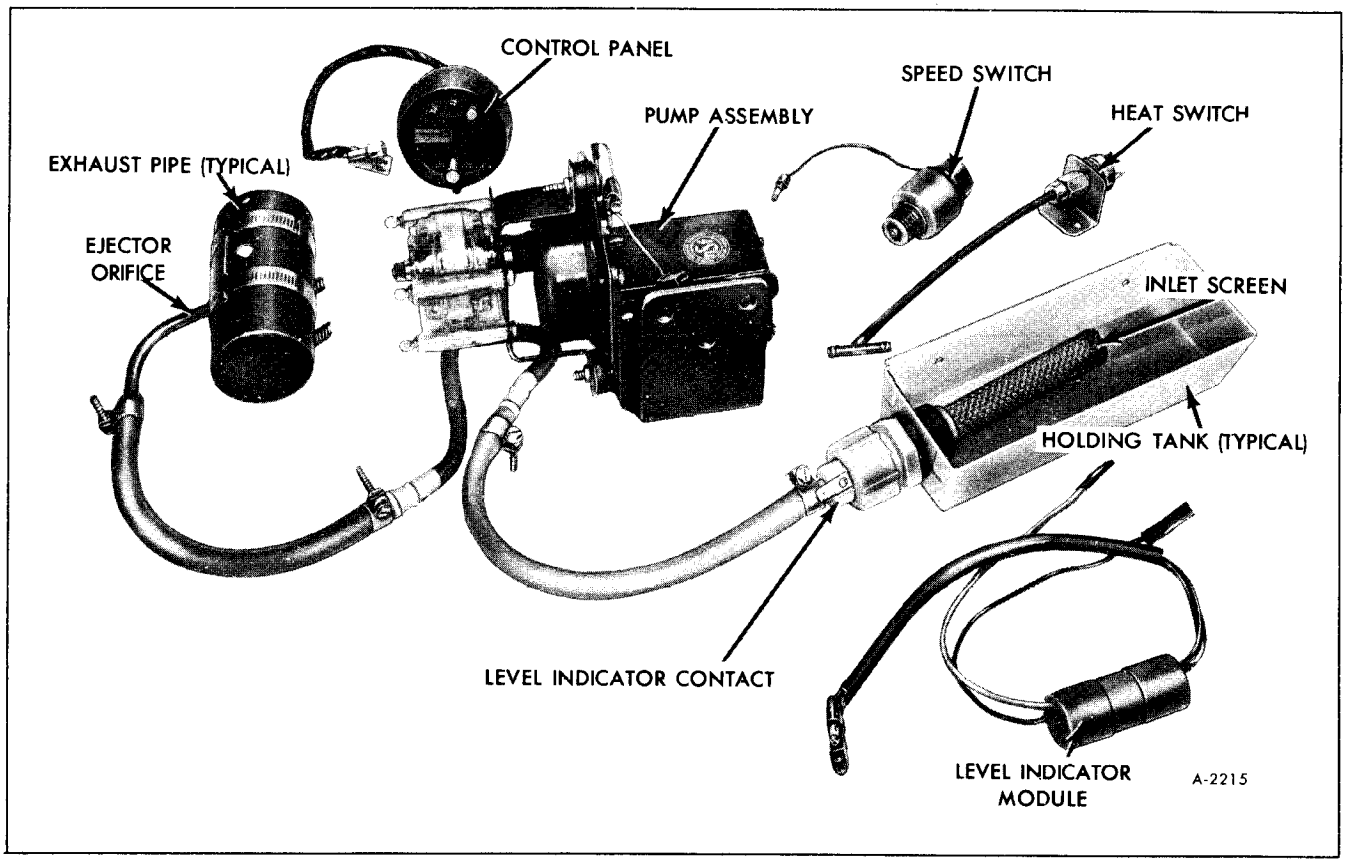


Figure 1–Thermasan Components

WASTE PUMP

The pump, is basically a windshield wiper motor connected to a tube pump which moves the liquid wastes from the holding tank to the vehicle exhaust pipe. When the system is turned "ON" and operating conditions are met, the pump will force waste material into the vehicles exhaust system until the holding tank level is below the pick-up screen. At that time the "EMPTY" light will come on and the system should be turned "OFF".

After the "EMPTY" light first comes on, due to remaining tank material slosh, it will probably flicker for another 1/2 hour of operation. The remaining waste material can be removed by manually dumping holding tank, however it is not necessary that the tank be completely empty. By leaving an amount of liquid material in the tank, it prevents hardening of remaining material.

CONTROL PANEL

The control module is used to provide the operator, at a glance with what the waste disposal system is doing and when the system should be turned off. The control module lights are the replaceable type and should be checked first when the system operates abnormally. The "PULL TO TEST" feature of the control panel, meters the waste pump breaker points which open and close the "REACTION" light circuit. The system will operate the same whether the "ON/OFF" switch is in or out. The ON/OFF switch also controls "READY" and "REACTION" light intensity by rotating the knob.

SPEED SWITCH

The speed sensor provides a ground for the ejection pump circuit when the vehicle speed is 35 mph or more. The switch is driven off the transmission and works in conjunction with the heat switch to allow the "REACTION" light to glow.

HEAT SWITCH

The exhaust temperature switch used on the Thermasan System is a normally open vacuum

switch which is calibrated at 16 1/2-inches vacuum. When the engine vacuum drops below the 16 1/2-inch limit the switch contacts complete the pump circuit providing vehicle speed is 35 mph or more.

With 16 1/2-inches or less vacuum, engine exhaust temperature is above the 900°F requirement. The vacuum switch is wired in series with the speed switch and both must provide circuit continuity for system operation.

HOLDING TANK

The waste pump is fed from the holding tank through a screen which filters out any insoluable waste material. This screen is completely removable by disconnecting the waste pump feed line at the tank and pulling the screen out. The coupled end of the feed hose from the pump houses the low level contacts which activate the control module "EMPTY" light.

EJECTION ORIFICE

The ejection orifice is located just behind the transmission and ahead of one of the vehicle mufflers. It consists merely of a tube connected to the pump by a high temperature hose to resist high temperatures developed.

Clamped connections should be checked when dripping or leaking occurs when the system is operating.

TROUBLE DIAGNOSIS

CHECK OUT PROCEDURE

To check the operation of the control panel and waste pump, the following procedure can be used.

1. Disconnect the white connector from the heat switch.

2. Connect a jumper to ground from the heat switch terminal.

3. With the control panel switched to the "ON" position the green "READY" light will light and the red "REACTION" light will come on and the pump will run.

4. If the holding tank is empty the "EMPTY" light should come on.

5. When the "ON/OFF" switch is pulled out the red "REACTION" light should flash intermittantly if the pump is working.

With the system connected but not operating as explained above, the following conditions should be checked for problem source:

READY OR REACTION LIGHTS DO NOT GLOW WHEN SYSTEM IS TURNED ON

1. Inspect the power feed connection at the vehicle positive battery stud located on the bulkhead panel behind the right hand access door.

2. Remove and inspect the in-line fuse on the red lead near the battery stud connection. If this fuse is blown, it indicates a possible short in the entire Thermasan harness and its' connections should be inspected for possible frayed or burned wires or loose connections allowing a short to ground.

> **NOTE:** DO NOT replace the 5 amp fuse until the harness has been inspected and under no circumstances should a larger amperage fuse be used.

3. Check the connector between the harness and control panel for proper connections. The male and female pins housed within the connector body should be straight and of equal height. They should be firmly attached to their respective wires (See figure 2).

When inspection is completed carefully mate the connector bodies and press firmly until the snap tabs are locked into place.

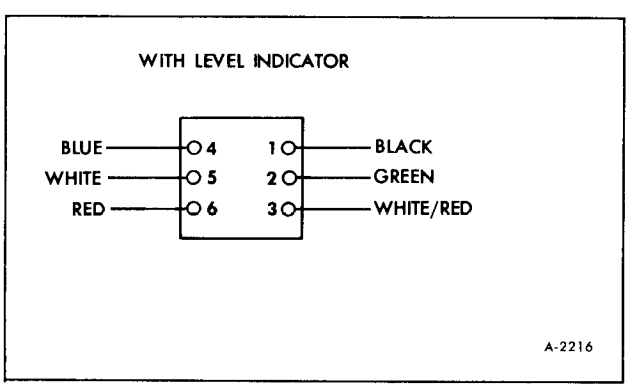


Figure 2–Control Panel Connector

4. Test the switch and its connections for defects.

a. Remove the set screw from the side of the base on the control panel. Slide the control panel off its base by exerting a firm forward pull.

b. Remove the screw from the back of the control panel and separate the housing from the bezel. Using a test lamp for locating shorts, check the switch. By reversing the steps above, reinstall the control panel.

READY LIGHT WORKS, REACTION LIGHT DOES NOT LIGHT ABOVE 35 MILES PER HOUR

1. Check for a burned out bulb and/or loose connections.

2. Inspect the connector between the harness and the control panel.

3. Check the heat switch leads for loose connections at the terminals.

4. Test for a possible faulty control panel relay.

a. Disconnect the blue lead from the harness to the heat switch.

b. Turn the system on and ground the lead to any clean unpainted part of the frame.

c. If the ready light does not come on, the relay is faulty. Replace the control panel.

5. Test for a possible faulty heat switch.

a. Turn the system on with the engine not running ground the blue lead from the heat switch to the speed switch.

b. If the system does not operate the heat switch is at fault. Replace the heat switch.

6. If after testing for above conditions, the system does not operate at 35 mph, the problem lies with the speed switch and it must be replaced.

a. Remove the speedometer cable from the speed switch and disconnect its electrical fitting.

b. Unscrew the speed switch and replace it with a new part by reversing this procedure.

BOTH LIGHTS WORK, BUT UNIT DOES NOT SEEM TO PUMP WASTE

1. Pump motor leads may be disconnected.

a. Remove the (2) pan head screws holding the terminal dust cover in place.

b. Check the terminals and their leads for a faulty connection.

c. Inspect the connections in the plastic pin housing that plugs into the dust cover.

d. Install cover and replace screws.

2. Inspect all waste lines for possible kinks.

3. Inspect all waste lines for possible plugs. Clean by using compressed air or a steel rod to force plug from hose if present. In the case where a line blockage has caused hose rupture within the pump, refer to "Pump Repair."

4. Check the holding tank evacuation probe (inlet screen) and inspect it for possible clog (See figure 1).

a. Remove the evacuation probe inlet screen by unscrewing the plastic nut on the outside of the holding tank.

b. If the system has a level indicator, note alignment of the terminals.

c. Flush the screen to remove the plugging.

d. Reinstall the screen, washer and nut.

e. Align level indicator connectors. They should be at 45° to the pavement.

NOTE: Either lead can be placed on the right or left terminals.

f. Inspect all hose clamps for possible air leaks.

REACTION LIGHT STAYS ON EVEN WHEN DECELERATING

This indicates a faulty heat sensor and it should be replaced.

BOTH READY AND REACTION LIGHTS FLICKER ON AND OFF

1. If the lights flicker at a constant rate, the prob-

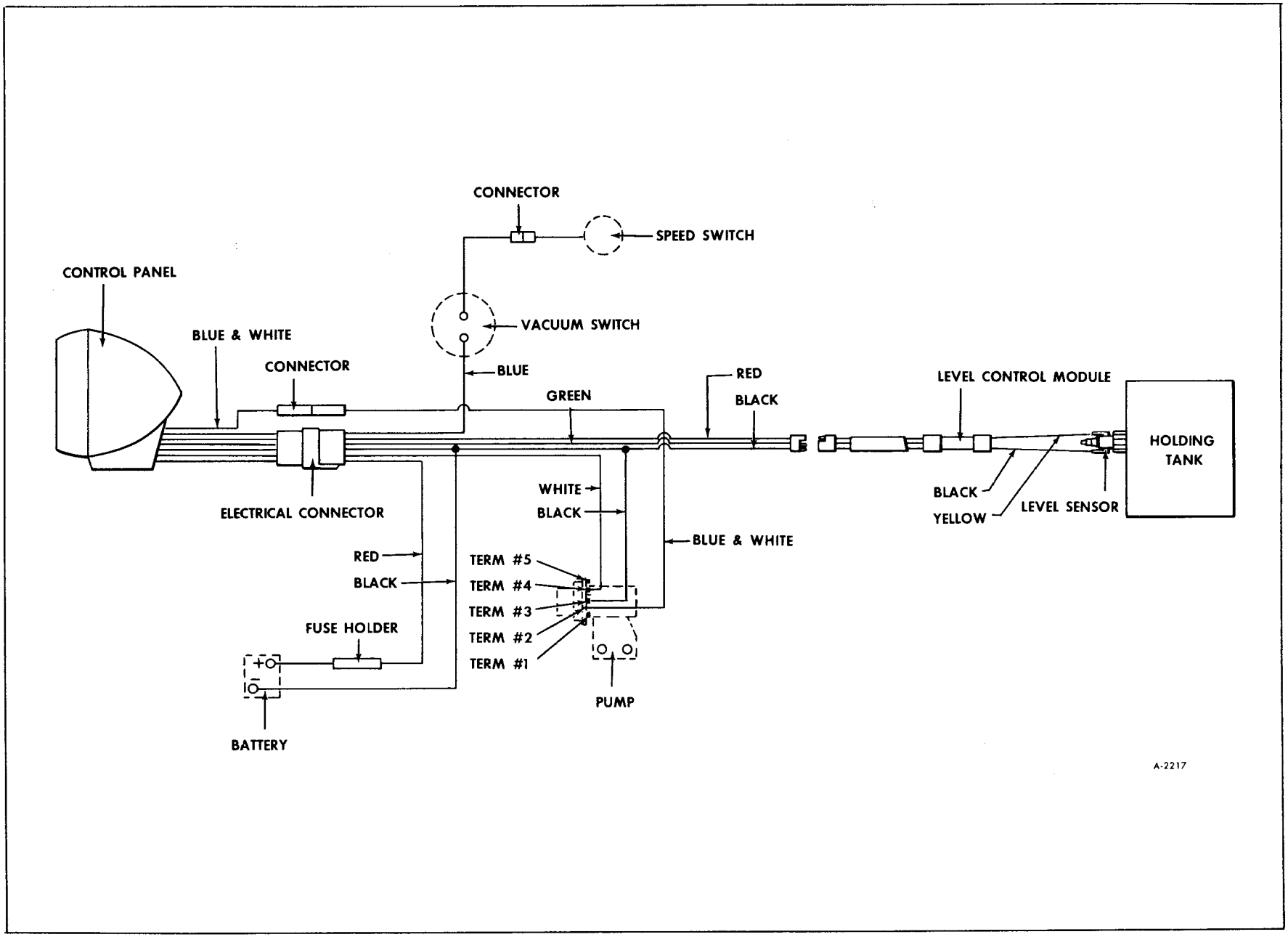


Figure 3–Thermasan Wiring

lem may be in the "PULL TO TEST" circuit. Check the leads for a broken solder joint. If none is indicated replace control panel.

2. If the wiring harness ground is not connected, the ready and reaction lights may flicker. Inspect the contact of the black wire at the battery.

GREEN LIGHT FLICKERS ON AND OFF

Check for possible loose lead at the light, on/off switch or power source. Check and secure all connections.

REACTION LIGHT FLICKERS ON AND OFF WHEN OPERATING CONDITIONS PERMIT SYSTEM OPERATION CONTINOUSLY

1. If the flicker is constant, the speed sensor is faulty. Replace the speed sensor.

NOTE: When tightening the speed sensor to the transmission, 1/4 turn past finger tight is sufficient.

2. If the flicker is intermittent type, a loose connection is at fault.

a. Inspect the blue wire to the heat switch and speed switch for a possible short or incomplete connection.

b. Check six pin plastic connector near the control panel (figure 2) and inspect the pins to be certain they are seated properly and making good connection.

READY AND REACTION LIGHT WORK BUT DO NOT PULSE WHEN "PULL TO TEST" IS SWITCHED

1. Check the (1) pin connector near the control panel.

2. Inspect the blue/white wire at the pump for proper connection.

3. Remove the control panel and check the ON-OFF switch for broken or poor solder joints.

EMPTY LIGHT DOES NOT GO OFF

1. This is normal system operation, indicates the holding tank level is below the probe.

2. If the light is on and visual inspection indicates the tank is full, then:

a. Inspect the black and yellow connections to the evacuation probe.

b. Test for a possible defective level indicator module. Remove the yellow lead to the evacuation probe. Jump the yellow wire to the black wire. If the light remains on, replace the level indicator module.

WASTE PUMP REPAIR

The pumping tube used in the waste pump should be checked at 500 operational hour intervals for possible tube fatigue. In the case of tube rupture, the following procedure should be used to replace hose:

1. Disconnect battery ground cables. Remove the pump cover by removing the 2 thumb screws which hold the pump cover to the mounting bracket. The pump body and roller assembly will remain attached to the mounting bracket.

2. Holding the roller assembly in position, remove the defective hose. Should the roller assembly release from the pump body, return it to position making sure that the drive key on the motor shaft lines up with the key slot in the end of the roller shaft assembly. This will allow the roller to drop into position.

3. Take the new hose and insert it between the rollers and the pump body. Stretching the hose makes it slide easier into position.

4. Re-assemble the pump. Make sure the cover fits snugly against the pump body. Do not pinch the hose.

5. Tape the two hoses together just below the pump outlet with plastic electrical tape.

6. When placing the pump in the vehicle, make sure that the correct hose is coupled to the line from the holding tank.

7. Connect battery ground cables and check system for proper operation.

GMC MOTOR HOME SERVICE

SECTION 24N
CABINETS AND FURNITURE

GENERAL INFORMATION

The various cabinetry and furnishings in the GMC Motor Home 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 alignment points, and before removing the last fastener, support the weight of the unit to avoid possible damage.

CARE AND CLEANING

Dust and loose dirt that accumulate on interior fabric trim should be removed frequently with a vacuum cleaner, whisk broom or soft brush. Vinyl or leather trim should be wiped clean and a damp cloth. Normal cleanable trim soilage, spots or stains can be cleaned with the proper use of trim cleaners available through General Motors Dealers or other reputable supply outlets

IMPORTANT: Do not use commercial paint, chrome or glass cleaners on interior bright trim or painted surfaces. If cleaning is required, lukewarm water and a neutral soap may be used.

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.

CAUTION: *When cleaning 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 instructions on "Cleaning Fabrics" and "Removal of Specific Stains.") Never use carbon tetrachloride, gasoline, or naphtha for any cleaning purpose. The above materials may be toxic or flammable, or may cause damage to interior.*

LAP BELT CARE

- Clean only with mild soap solution and lukewarm water.

- Do not bleach or dye belts since this may severely weaken them.

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, mayonaise and catsup will cause pitting and should be cleaned off immediately.

CLEANING FABRICS

IMPORTANT: Be sure vehicle is well ventilated while using the following cleaning agents. Follow manufacturer's recommendations in using such products.

CLEANING FABRICS WITH CLEANING FLUID

This type of cleaner should be used for cleaning stains containing grease, oil, or fats. Excess stain should be gently scraped off trim with a clean dull knife or scraper. Use very little cleaner, light pressure, and clean cloths (preferably cheesecloth). Cleaning action with cloth should be from outside of stain towards center and constantly changing to a clean section of cloth. When stain is cleaned from fabric, immediately wipe area briskly with a clean absorbent towel or cheesecloth to help dry area and prevent a cleaning ring. If ring forms, immediately clean entire area of panel section of the trim assembly.

NOTE: Sometimes a difficult spot may require a second application of cleaning fluid followed immediately by a soft brush to completely remove the spot.

CLEANING FABRICS WITH DETERGENT FOAM CLEANERS

This type of cleaner is excellent for cleaning general soilage from fabrics and for cleaning a panel section where a minor cleaning ring may be left from spot cleaning. Vacuum area to remove excess loose dirt. Always clean at least a full trim panel or section of trim. Mask adjacent trim along stitch or weld lines. Mix detergent type foam cleaners in strict accordance with directions on label of container. Use foam only on a clean sponge or soft bristle brush – Do not wet fabric excessively or rub harshly with brush. Wipe clean with a slightly damp absorbent towel or cloth. Immediately after cleaning fabric, dry fabric with a dry towel or hair dryer. Rewipe fabric with dry absorbent towel or cloth to restore the luster of the trim and to eliminate any dried residue.

REMOVAL OF SPECIFIC STAINS

CANDY-Chocolate, use cloth soaked in lukewarm 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.

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.

GMC MOTOR HOME SERVICE

SECTION 24P
EXHAUST VENTS

DESCRIPTION

The GMC Motor Home 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 Motor Home. In rainy weather it is possible to leave the ceiling vents open slightly for ventilation without entry of water into the Motor Home (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.
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.

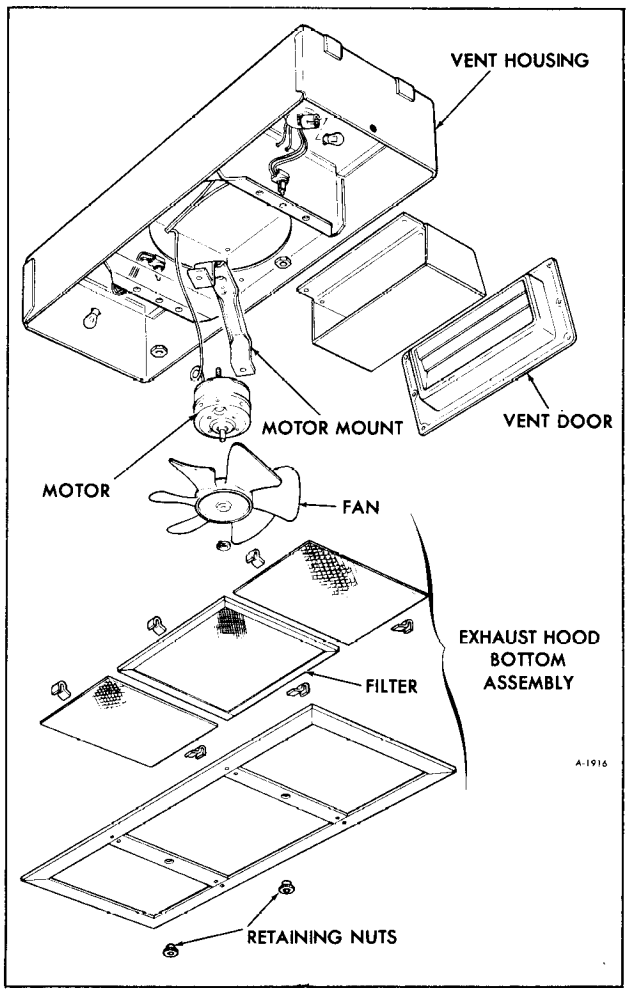


Figure 1–Range Power Vent

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 handle (one screw).
2. Remove vent screen (two screws).
3. Remove cover on switch box and disconnect motor wires.
4. Loosen cinching strap sufficiently to remove motor and fan assembly.
5. Remove fan from motor.

INSTALLATION

1. Install fan on motor.
2. Position motor and fan assembly in vent housing and secure in place with cinch strap.
3. Connect motor wires in switch box and install cover.
4. Install vent screen, secure with two screws.
5. Install vent crank handle.

CRANK ASSEMBLY REPLACEMENT

REMOVAL (SEE FIGURE 2)

1. Partially open vent.

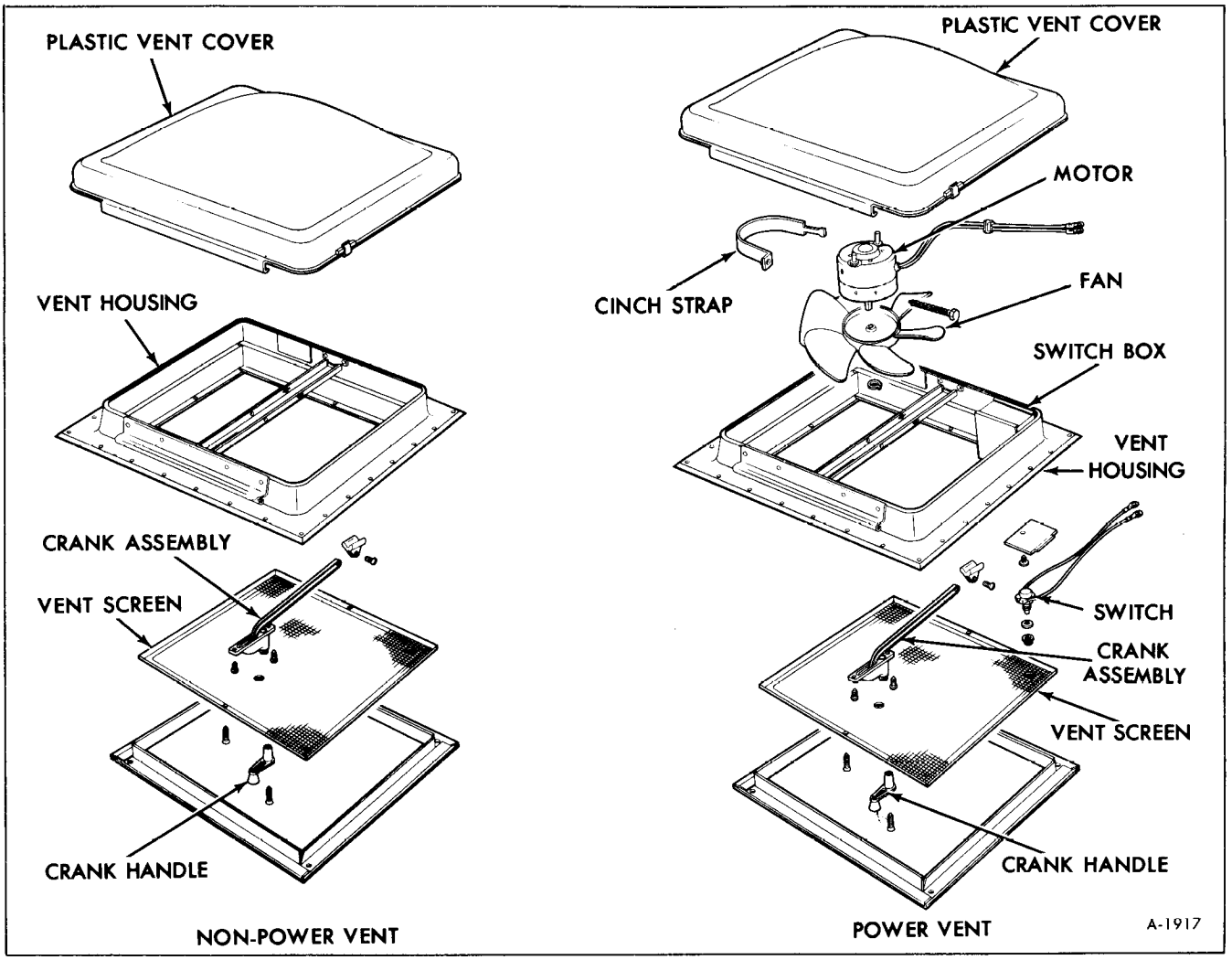


Figure 2–Ceiling Vents

2. Remove vent crank handle (one screw).

3. Remove vent screen (two screws).

4. Remove screw connecting crank lift arm to plastic slide.

5. Remove crank assembly from vent support bar (two screws).

INSTALLATION

1. Position crank assembly through vent support bar, secure with two screws.

2. Connect crank lift arm to plastic slide with screw.

3. Install vent screen and secure with two screws.

4. Install crank handle.

BATH VENT

MOTOR REPLACEMENT (FIGURE 3)

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.

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.

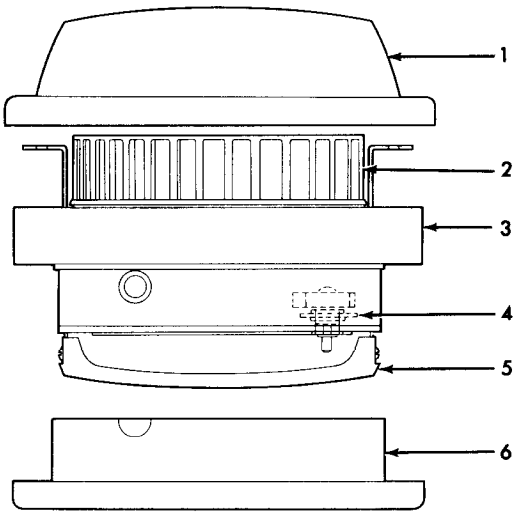
4. Position switch on motor studs and secure motor to mounting bracket with two nuts and washers.

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.



1. PLASTIC VENT COVER
2. FAN
3. VENT HOUSING
4. SWITCH
5. CLOSING HANDLE
6. VENT RING (INSIDE BATH MODULE)

A-1918

Figure 3–Bath Vent

9. Install vent ring inside of bath module.

GMC MOTOR HOME SERVICE

NOVEMBER, 1973

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 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.

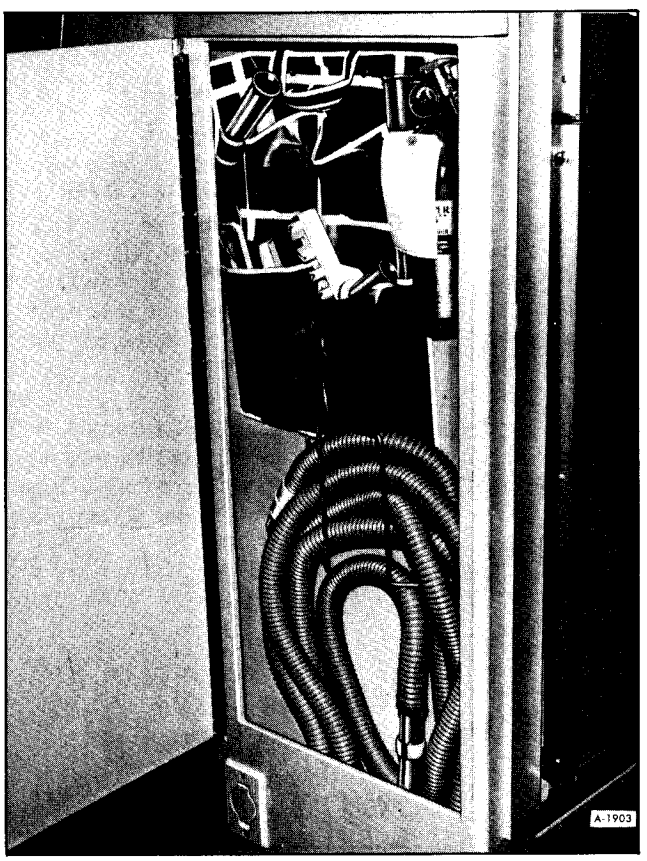


Figure 1–Vacuum Cleaner Components

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.

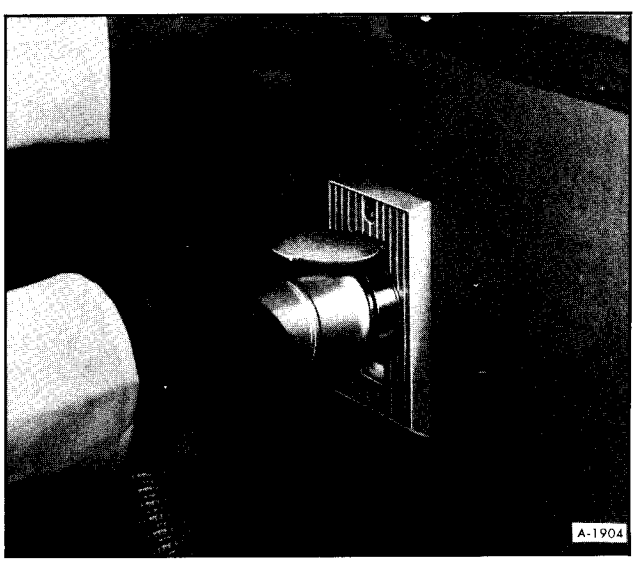


Figure 2–Connecting Flex Hose to Wall Inlet

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.

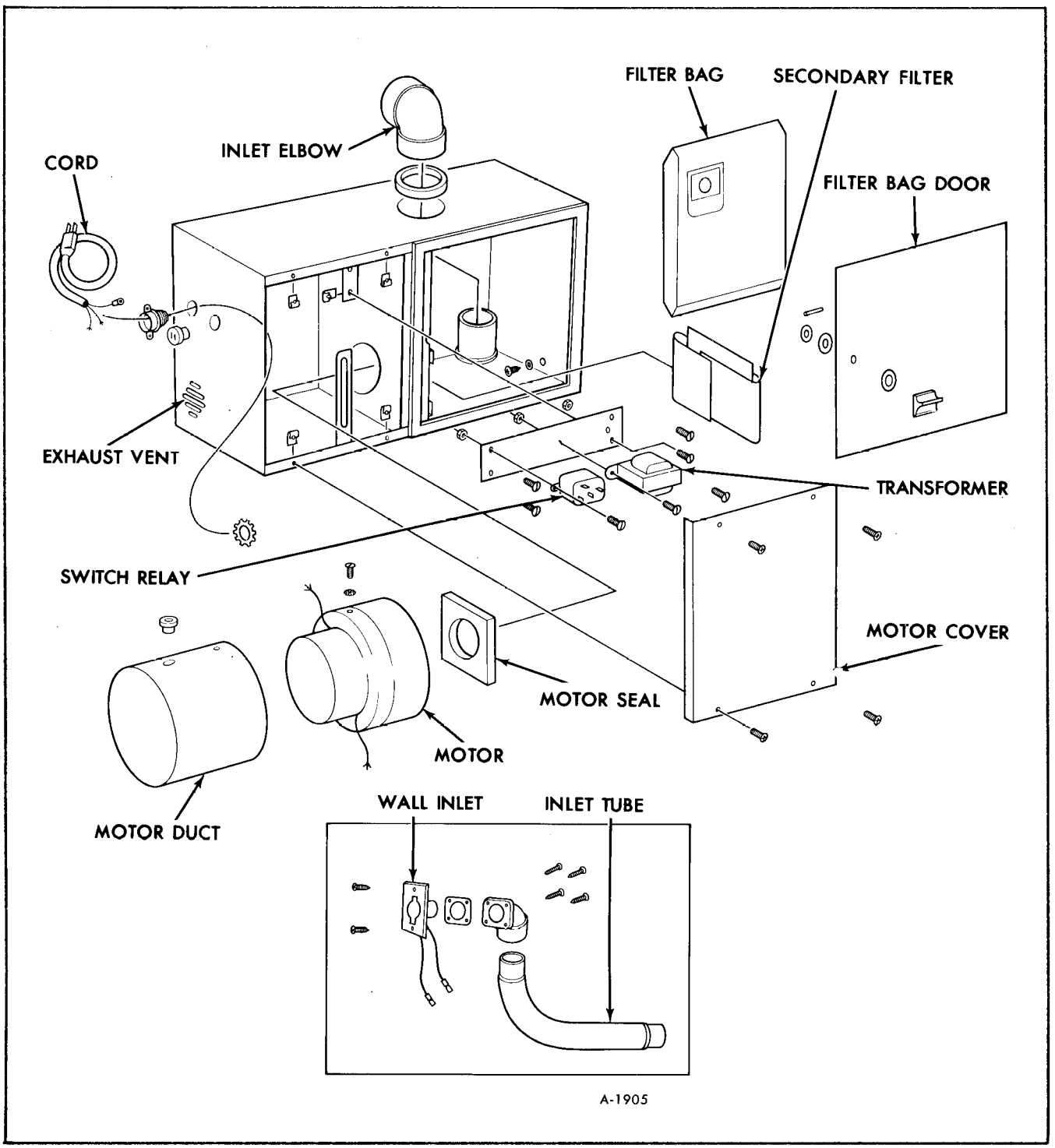


Figure 3–Vacuum Cleaner Components

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-volts. 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.

Wiring Diagrams

Living Area 12v DC
Engine Area 12v DC