GENERAL: This group contains information on the gas system required for all domestic heating, cooking, and refrigeration.

SPECIFICS: As applicable

...Gas gauges

...Gas Regulators

...Pipes and Fittings To Range, Oven, and Refrigerator

...Storage Tank

GROUP 38

LIQUEFIED PETROLEUM (LPG) SYSTEM

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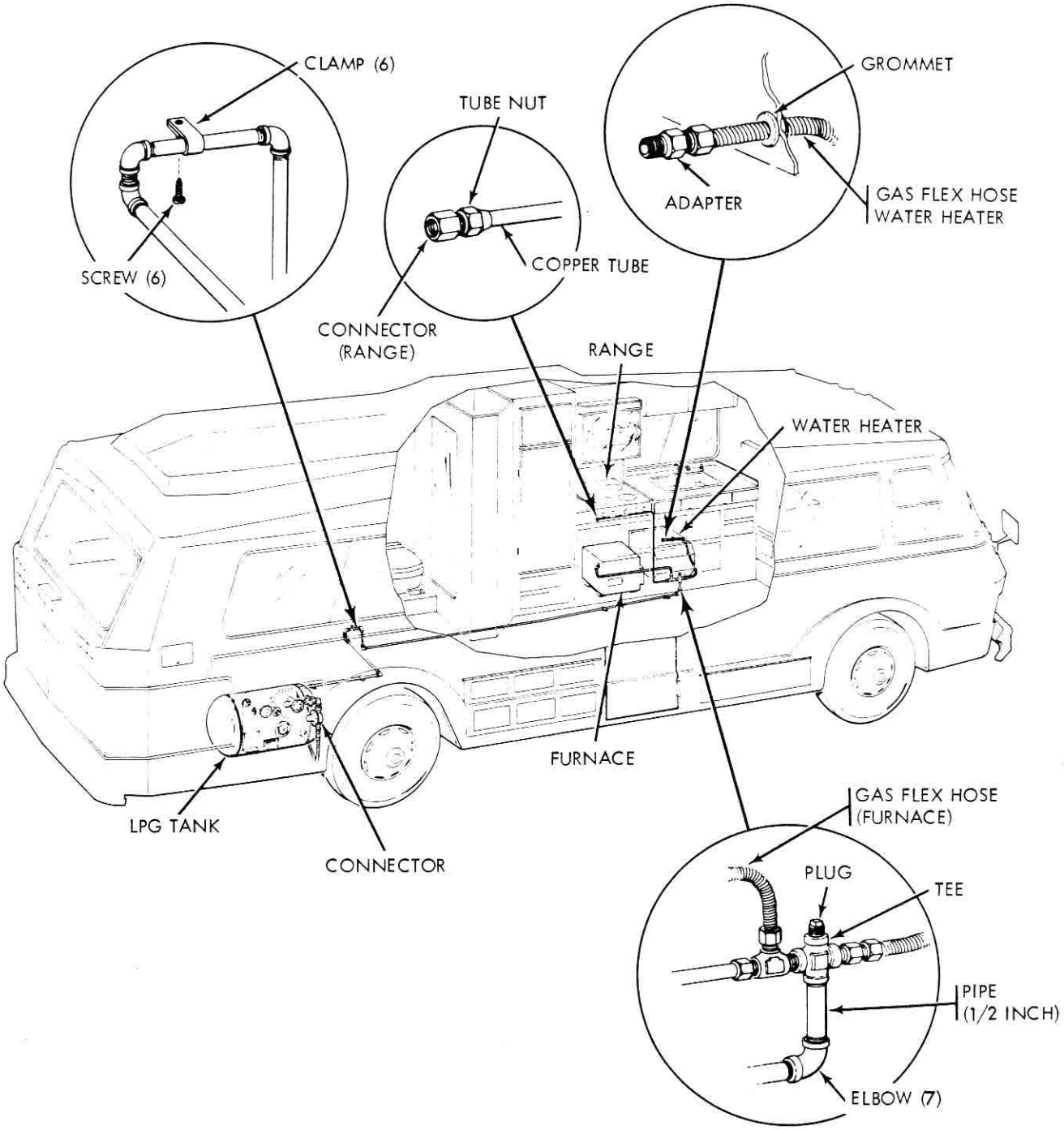

Figure 38-1. Liquefied Petroleum Gas (LPG) System

GROUP 38

LIQUEFIED PETROLEUM GAS (LPG) SYSTEM

38-1. DESCRIPTION

a. General (fig. 38-1). The liquefied petroleum gas (LPG) system supplies vaporized gases for use by the oven, range, water heater and by the furnace for central heating. The system consists of a container (tank), fill valve, outage valve, service-relief valve, two-stage regulator, sight gauge, gas supply lines, a three-way manifold and connectors.

NOTE

It is illegal in some states to leave the shutoff valve on while traveling. The regulations should be checked in areas through which the coach will travel.

b. Liquefied Petroleum Gas. Liquefied petroleum gas (LPG) is a colorless true gas compressed into liquid form. The LPG vaporizes in the tank and is distributed through valves and lines to the various appliances. LPG known as "Propane," or "bottled gas," is normally safe, economical, and easy to transport. The vaporized gas burns with a clean blue flame which provides more heat than natural gases.

Since vaporized LPG is heavier than air, it would settle toward the ground or coach floor if inadvertently released. Because the gas does not normally rise, it takes longer to dissipate to a safe (non-explosive) level. The gas has a recognizable garlic-like odor. In the event leakage is detected, immediately close the shutoff valve at the tank and dissipate leaked gas to prevent it from reaching an ignition source.

Warning

Improper use or handling of LPG can result in injury. Besides being highly flammable, breathing the gas can be lethal and must be avoided. Only qualified service representatives should make repairs or major adjustments to this system.

The hours LPG supply will last, cannot be estimated for all conditions. As a general rule, four persons can expect about two weeks use from the coach 20-gallon gas supply, depending on the living habits of the occupants. For extensive cooking or baking, hot water usage, or long operation of the furnace, the available gas supply is reduced accordingly.

c. LPG Tank (fig. 38-2). The supply tank for the LPG system, located on the right-rear side of the coach, holds up to 20 gallons of liquid propane. When the tank becomes empty, a pilot light safety device on each appliance shuts off the appliance supply line, except for the top burners on the gas range. The range burners can be closed only by the range control knobs. Before the appliance pilot lights can be relit, each safety shutoff valve must be reset. Keep the tank and its controls clean and free of dirt. Since the container and valves are designed and tested to fixed settings, do not alter, modify, or attach other components to the tank. A drain plug at the bottom of the tank is used for evacuating and cleaning the tank.

Warning

When filling the LPG tank, turn off all appliances, vehicle ignition, and the auxiliary power unit. Do not smoke, strike a match, or operate exposed electrical devices in the service area during filling, or immediately thereafter.

Keep the tank service valve closed when not in use (even when the tank is empty) to prevent moisture from collecting inside the tank or regulator.

Caution

Moisture can cause regulator freeze-up, which could damage the regulator.

In very cold weather, the gas supplier should inject a small amount of dry methylachohol (approximately 1 ounce to 20 gallons of propane) into the tank to prevent freezeup.

d. Fill Valve. The fill valve is a normally-closed, double-check valve, incorporating a standard 1-3/4 inch "acme" fitting, facilitating tank filling at most service stations. The fill valve is normally held closed by gas vapor pressure inside the tank. During filling, the pressure of the fill gas overcomes the tank internal prssure to force the valve open.

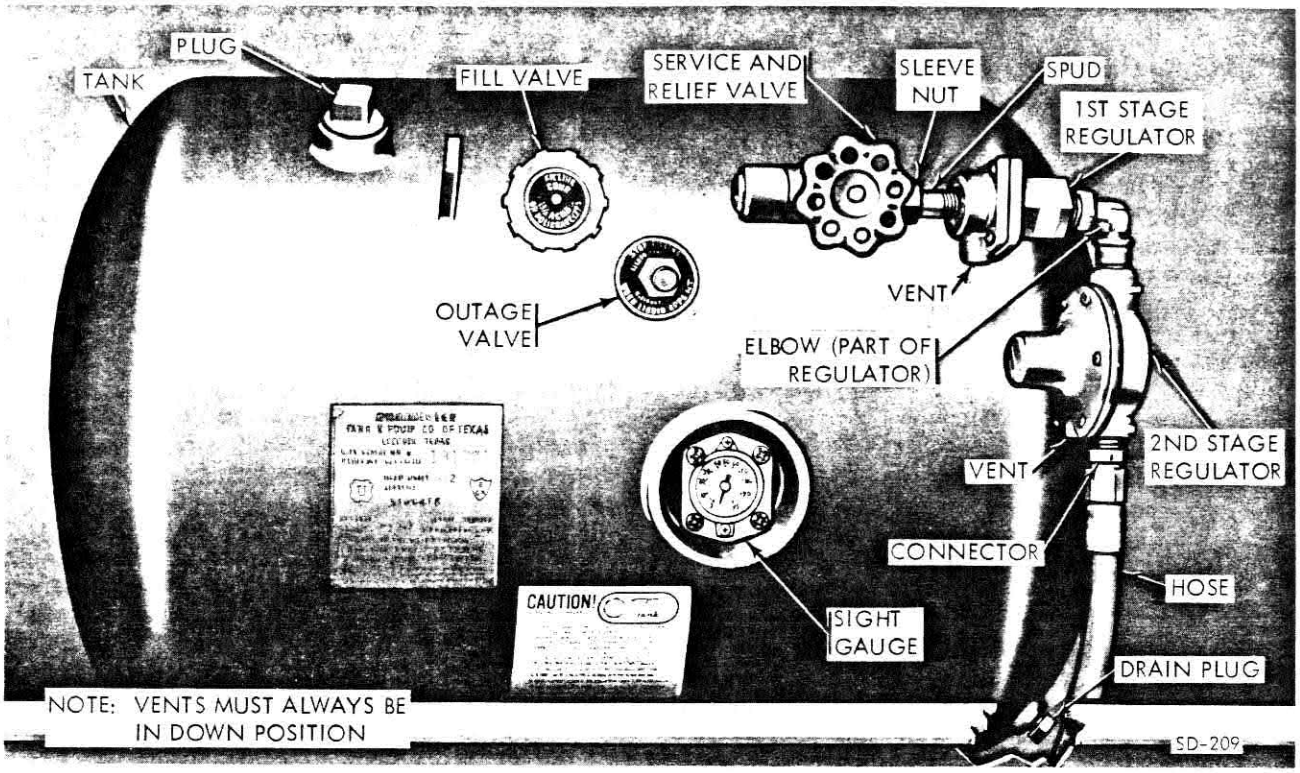

Figure 38-2. Liquefied Petroleum Gas (LPG) Tank

e. Outage Valve. The outage valve is attached to an internal pipe in the LPG tank. It is designed to pick up the liquid in the tank when it reaches the 80 degree level and let it out through the opening in the outage valve as a white mist. Stop filling at this point. Check after each filling by opening outage valve and bleed gas in well vented area until a white liquid stops. The tank contains about 20 gallons of propane liquid, which occupies 80 percent of the tank capacity. The remaining 20 percent of space in the tank contains the vaporized LPG and space for gas expansion during temperature changes. No tool, or undue force, should be used on the outage valve; it is designed to shutoff when turned finger-tight.

f. Service and Relief Valve. The service and relief valve controls the gas vapor flow to the LPG distribution line to the appliances. To supply the coach LPG appliance inlet lines with LPG, turn the valve control knob to full open, then back-off 1/4 turn.

Caution

Do not use a tool to operate the service and relief valve. It is designed to be turned by hand only.

The valve has brass fittings which require no pipe dressing compound. The valve has an integral safety relief feature (factory-set) that automatically starts to discharge pressure when exceeding 312 psi. The valve will automatically close when the tank pressure decreases to a safe range.

g. Regulator (fig. 38-2). LPG from the tank passes through a two-stage (factory-set) pressure regulator. This pressure regulator is installed in the supply line between the tank and the appliances. The regulator reduces pressure from the tank to maintain a constant of approximately 11 inches of water column (WC). The coach regulator incorporates two stages for regulation. This reduces chances of regulator malfunction in severe weather. The regulator should be adjusted only by a qualified service representative.

Caution

LPG pressure from the regulator to the appliances must not exceed 14 inches of water column, as any higher pressure could damage the controls of the gas appliances.

h. LPG Supply Lines (fig. 38-1). The LPG supply line from the supply tank is comprised of a 1/2 inch inner diameter hose, steel pipe and a four-way manifold connected to three 1/4 inch inner diameter lines. The fourth manifold outlet is plugged. The three manifold outlets in use are connected to the water heater and furnace by flexible gas pipes, and to the range by soft annealed copper tubing.

i. LPG Sight Gauge. A sight gauge installed in the outboard side of the LPG tank indicates the approximate percent of the liquid gas in the tank.

j. Burner Vents. Although the LPG appliance burners and vents are not part of the LPG supply system, some venting information is provided in this section. Each LPG appliance has an exhaust vent that routes burned gasses to the coach exterior.

Warning

Do not park coach in an enclosed area during extended operation of LPG appliances; do not park coach so any exhaust vent is obstructed; do not allow damage or foreign matter (such as mud, snow, or ice) to constrict any exhaust vent. Avoid breathing LPG fumes.

The range is vented to the coach roof. Two exhaust fans are installed in the range hood to increase flow of exhaust air. The furnace exhaust vent is located on the left side of the coach, just above the furnace intake vent. The water heater exhaust vent is located a short distance forward of the furnace vents.

38-2. TROUBLESHOOTING

Instructions for troubleshooting the LPG system are contained in table 38-1. Prior to troubleshooting, a preliminary visual inspection, to assist in locating the problem, should be made as outlined in paragraph 34-4b.

38-3. REMOVAL/INSTALLATION

a. General. Step-by-step instructions for replacement of LPG system components are provided herein. Order replacement parts as listed in the 2900R Parts Catalog. When any part of the system is replaced, the system must be leak tested. All gas connections should be made by a qualified technician in compliance with current regulations.

Table 38-1. Troubleshooting LPG System

Malfunction (symptoms)	Probable causes	Corrective action (remedies)
Pilot light will not stay on	Air or moisture in lines and/or tank	Bleed system or, if necessary, fill LPG tank; refer to paragraph 38-5b. If problem continues, or excess moisture is evidenced, clean tank
	Pilot light valve out of adjustment	Refer to Groups 34 and 36
	Constricted line(s)	Relieve constriction, or replace line(s)
Gas flame not blue and/or not producing enough heat	Not enough air in burner mixture	Adjust ratio of air to gas; refer to Groups 34 and 36
	Clogged furnace or water heater air vent	Clean vent
	Impurities in LPG system	Clean and refill system
No gas flow at burner or burner will not stay on	Defective valve, or constricted line and/or burner holes	Remove constrictions; replace defective valve, burner or LPG line

Table 38-1. Troubleshooting LPG System (Continued)

Malfunction (symptoms)	Probable Causes	Corrective Action (remedies)
No gas flow at burner or burner will not stay on (continued)	Pilot light valve out of adjustment	Refer to Groups 34 and 36
Air in coach "stuffy"	Clogged exhaust vent(s) on range, water heater, and/or furnace	Open windows, doors, and range vent to remove exhaust fumes; then remove constrictions from vents
	A "garlic" odor indicates LPG leakage, or an open unlighted burner on the range	Close service valve immediately. Open all windows, range vent, and doors. Do not light any matches or operate any gasoline or electrical equipment nearby until the leak is found and corrected, or until the interior of the coach is free of all gas vapors. Leak check system according to paragraph 38-4e
	Constricted or missing pilot light tube	Remove constriction from tube or repair pilot light tube; refer to Groups 34 and 36

b. LPG Tank Removal.

NOTE

The LPG tank and components are accessible through the access door on the right rear side of the coach.

(1) Drain LPG tank according to paragraph 38-4c, step (1).

(2) Unscrew hose fitting from connector in second-stage regulator outlet.

(3) At each end of the two steel angle supports of tank, remove bolt and nut, and two washers (one on each side of support angles).

(4) Carefully remove tank (with welded tank supports) from coach.

(5) Remove all serviceable parts from tank and install them in replacement tank; tighten all connections.

c. LPG Tank Installation.

(1) Support tank in installation position and secure with washer and bolt (downward) through one mounting hole, then attach one washer and nut on bolt (finger-tight).

(2) At mounting hole diagonally opposite to bolt just installed, install two washers, and bolt and nut as in step (1) above.

(3) Install two washers, and bolt and nut in similar manner in remaining open mounting holes.

(4) One mechanic holds wrench to keep bolt from turning, while second mechanic tightens nut.

(5) Connect LPG hose to connector in second-stage regulator outlet.

d. Fill Valve Removal.

(1) Drain LPG tank according to paragraph 34-4c, step (1).

(2) Unscrew fill valve from tank boss.

e. Fill Valve Installation.

(1) Install fill valve in tank boss.

(2) Fill tank; refer to paragraph 38-5b.

f. Outage Valve Removal.

(1) Drain LPG tank according to paragraph 38-4c, step (1).

(2) Unscrew nozzle from outage valve.

(3) Unscrew valve from tank.

g. Outage Valve Installation.

(1) Install outage valve in tank boss.

(2) Screw nozzle securely into outage valve.

(3) Fill tank; refer to paragraph 38-5b.

h. Service and Relief Valve Removal.

(1) At service valve outlet, unscrew threaded sleeve-nut and remove first stage regulator (with attached components).

(2) Unscrew service valve from tank boss.

i. Service/Relief Valve Installation.

(1) Install service valve in tank boss.

(2) Position first-stage regulaor spud in service valve outlet, then secure regulator to service valve with attached sleeve-nut.

(3) Fill tank; refer to paragraph 38-5b.

j. Regulator Removal.

(1) Close LPG service valve.

(2) Open one range burner vlave to bleed system pressure; when gas flow stops, close burner valve.

(3) Unscrew hose fitting from male connector in second-stage regulator outlet.

(4) At service valve outlet, unscrew threaded sleeve-nut and remove regulator assembly.

k. Regulator Installation.

(1) Position first-stage regulator spud in service valve outlet, then secure regulator assembly to service valve with attaching sleeve-nut.

(2) Secure LPG hose to male connector in second-stage regulator outlet.

(3) Open service valve, then check for leaks at regulator connections with mild soap solution. Test regulator and correct any leaks.

l. LPG Line Removal. Defective hoses, pipes, and fittings may be removed; however, the lines must first be de-pressurized as follows:

(1) Open valve on one range burner and make sure gas flow is ignited.

(2) Close LPG service valve, then close all LPG system valves except the one range burner.

(3) When range burner goes out, close burner valve.

(4) At outlet of second-stage regulator, unscrew hose fitting from male connector (to aid in venting any LPG trapped in the system).

(5) Remove hose, pipe and/or fittings to be replaced.

(6) Clean pipe thread connections that will be reused. If necessary, disconnect other end of LPG line at cross or tee, then blow loose material out of line with compressed air.

m. LPG Line Installation. To install new LPG lines or pipe fittings, accomplish the following:

(1) Apply pipe dressing to male threads of any new pipe to be installed.

(2) Join new hose, pipe, or fitting to LPG system and tighten connections.

(3) Wipe off any excess pipe dressing.

(4) Install new lines.

n. LPG Sight Gauge Removal.

(1) Drain tank according to paragraph 34-8c, step (1).

(2) Remove four large cross-head screws from LPG gauge with screwdriver. Remove gauge and gasket.

o. LPG Sight Gauge Installation.

(1) Place gasket on gauge mounting area, then install gauge over gasket, using four crosshead screws.

(2) Fill tank; refer to paragraph 38-5b.

38-4. INSPECTION/CLEANING

a. General. This section contains procedures for inspecting and cleaning the LPG system, including draining and cleaning the tank.

b. Inspection. Visually inspect tank as follows:

(1) Inspect LPG tank for security of mounting. Inspect connections of components mounted on tank for tightness. Tighten loose parts.

(2) Inspect tank and components for damage such as cracks, deep nicks, and dents that could interfere with correct operation. Replace unserviceable parts.

(3) Inspect LPG lines for damage such as abrasions, deep nicks, sharp bends, and loose connection. Replace damaged lines and tighten loose connections.

(4) Inspect fittings at LPG applicances for damage such as cracks, stripped thread, and loose connections. Tighten loose connections and replace unserviceable parts.

c. LPG Tank Cleaning. The LPG tank interior requires cleaning by nitrogen-purge if moisture has contaminated gas or if serviced with incorrect gas. To clean the tank, proceed as follows:

(1) Check tank sight gauge to determine amount of liquid LPG remaining in tank. If the amount is large, remove gas from tank as follows:

(a) Move coach to a well ventilated open area, away from any flame and other sources of ignition (such as operating gas and electrical motors).

(b) Slowly open drain plug in LPG tank, until there is a slight flow from the tank. Allow tank to drain slowly. When liquid stops flowing from tank, remove drain plug.

Warning

Avoid inhaling gas from tank; propane gas is noxious and can cause serious harm. Do not smoke, strike a match, or operate exposed motors in service area until gas is completely dissipated.

(c) Light range burners and burn remaining LPG in the lines.

(2) Close service valve.

(3) Close all burner valves and pilot light valves on furnace, water heater, and range.

(4) Remove outage valve from tank, then connect a regulated nitrogen source to tank opening with suitable fitting, shutoff valve, and gauge (unless already part of nitrogen source equipment).

Warning

Exercise care when handling high-pressure gases to avoid injury to personnel or damage to equipment.

(5) Slowly open shutoff valve to supply about 10 psi of nitrogen to the tank; quickly open valve several times to supply pressure bursts up to about 50 psi (to blow moisture from bottom inside of tank).

(6) When there is no longer evidence of moisture in the nitrogen coming out of LPG tank drain, close nitrogen shutoff valve.

NOTE

Check for moisture exhausting from tank.

(7) Remove fitting from boss and reinstall outage valve.

(8) Fill LPG tank according to paragraph 38-5b.

d. Regulator Test. This test requires the use of a monometer gauge, or a water manometer tube, reading in inches of water column of 0 to 16 inches, minimum range.

(1) Check that all LPG system valves are closed on tank, range, water heater, and furnace.

(2) Disconnect a range burner valve and install test gauge in its place.

(3) Open LPG service valve.

(4) Open one burner valve and light LPG at burner.

(5) If test gauge doesn't indicate 10.50 inches of water column (WC), tap gauge lightly to make certain that mechanism is not stuck. If gauge indication is still not 10.50 inches WC, remove regulator cap, turn adjustment screw until pressure is 10.50 inches WC, then reinstall cap.

(6) Close burner valve.

(7) Close service valve.

(8) Open a burner valve until pressure is reduced to 10 inches WC; close valve. After 10 minutes, check gauge again. If pressure has dropped, perform a leak check; refer to paragraph 38-4e below.

e. Leak Check. Leak check the LPG system according to the following:

(1) With LPG service and relief valve closed and tank charged with at least a small amount of LPG, apply a mild soap solution to connections at each tank opening. Tighten any leaking connections as necessary. Install fill valve cap.

(2) Check that LPG tank has enough gas to supply the system.

(3) Check that range burner valves are turned off, and pilot light valves are "off" on range, furnace, and water heater.

(4) Open service valve very slightly until gas flow is heard. If gas flow is in doubt, temporarily open a range burner until gas is heard flowing; close burner.

(5) Apply a mild soap solution to all accessible joints and connections in the LPG system, beginning at the service valve outlet. When leakage bubbles are detected, or if the garlic odor of LPG is detected, determine source of leak, then close LPG service valve.

Warning

Improper use or handling of LPG can result in injury. Besides being highly flammable, breathing the gas can be lethal and must be avoided. Only qualified service representatives should make repairs or major adjustments to this system.

(6) Correct any leakage by tightening connections and replacing defective parts.

(7) Fully open LPG service valve, then turn it back about 1/4 turn.

(8) Remove any air remaining in system by momentarily lighting at a range burner; close burner valve.

f. LPG System Test. To test the LPG system for correct operation, assuming that the regulator is functioning within the specified pressure range and no leaks are present, proceed as follows:

(1) Light pilot light on range, water heater, and furnace according to instructions in Groups 34 and 36.

(2) Check that each gas burner on range, water heater, and furnace burns steadily through full range of each gas valve.

(3) On each appliance in succession, light a burner, then close valve to pilot light. If burner does not automatically go off, the pilot light safety system is defective and must be replaced or adjusted by a qualified gas appliance serviceman; refer to Group 36.

NOTE

The operation of the outage valve, sight gauge, and filler valve may be tested during LPG tank filling; refer to paragraph 38-5b.

38-5. GENERAL INFORMATION

a. General. This section contains general information relative to data contained in the previous paragraphs.

b. Filling LPG Tank. To fill the LPG tank with liquid propane proceed as follows:

NOTE

The filling procedures also provide a means to test the operation of the filler valve, outage valve, and sight gauge.

(1) Turn off gas supply at service and relief valve.

(2) Check that all pilot lights, gas appliances, ignition, and auxiliary power unit are off, and that all appliance valves are closed.

Warning

When filling the LPG tank, turn off all appliances, vehicle ignition, and the auxiliary power unit. Do not smoke, strike a match, or operate exposed electrical devices in the service area during filling, or immediately thereafter.

(3) Clear lines by burning gas at kitchen range until flame goes out; turn burner off.

(4) Check sight gauge indication.

(5) Connect filler nozzle to tank and observe outage valve.

(6) Open valve on filler hose and fill tank until white mist vents from outage valve.

NOTE

The outage valve is designed to pick up the liquid in the tank when it reaches the 80 degree level and let it out through the opening in the outage valve as a white mist. Stop filling at this point. Check after filling by opening outage valve and bleed gas until white liquid stops. No tool, or undue force, should be used on the outage valve; it is designed to shut off when turned finger-tight.

(7) Close filler valve and outage valve.

(8) Disconnect filler nozzle.

(9) Fully open service valve, then turn it back 1/4 turn.

(10) If tank was empty, bleed air from LPG line by lighting one burner on range.

(11) Relight each LPG appliance pilot light.