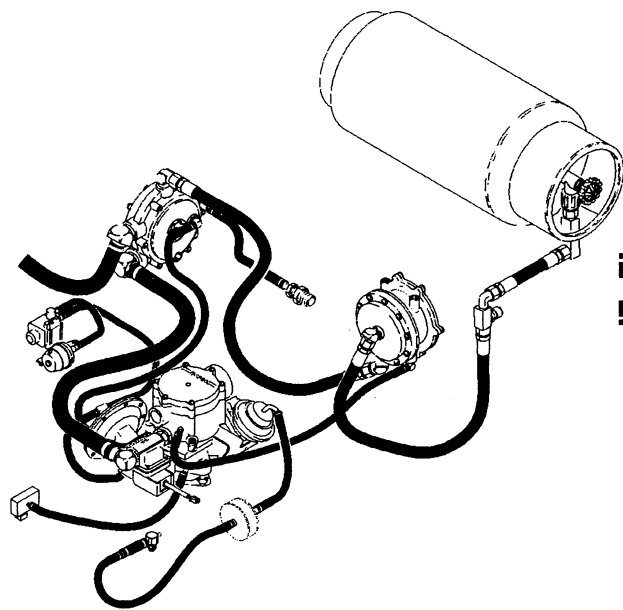


LPG FUEL SYSTEM

GM 2.2L and 3.0L
ENGINES

S/H2.00-3.20XM
(S/H40-65XM)



HYSTER

SAFETY PRECAUTIONS

MAINTENANCE AND REPAIR

- When lifting parts or assemblies, make sure that all slings, chains or cables are correctly fastened and that the load being lifted is balanced. Make sure that the crane, cables and chains have the capacity to support the weight of the load.
- Do not lift heavy parts by hand. Use a lifting mechanism.
- Wear safety glasses.
- DISCONNECT THE BATTERY CONNECTOR before doing any maintenance or repair on electric lift trucks. DISCONNECT THE BATTERY GROUND CABLE on internal combustion lift trucks.
- Always use correct blocks to prevent the unit from rolling or falling. See “How To Put The Lift Truck On Blocks” in the OPERATING MANUAL or the PERIODIC MAINTENANCE section.
- Keep the unit and working area clean and in order.
- Use the correct tools for the job.
- Keep the tools clean and in good condition.
- Always use **HYSTER APPROVED** parts when making repairs. Replacement parts must meet or exceed the specifications of the original equipment manufacturer.
- Make sure that all nuts, bolts, snap rings and other fastening devices are removed before using force to remove parts.
- Always fasten a DO NOT OPERATE sign to the controls of the unit when making repairs or if the unit needs repairs.
- Make sure you follow the DANGER, WARNING and CAUTION notes in the instructions.
- Gasoline, Liquid Petroleum Gas (LPG), and Diesel are flammable fuels. Make sure that you follow the necessary safety precautions when handling these fuels and when working on these fuel systems.
- Batteries generate flammable gas when they are being charged. Keep fire and sparks away from the area. Make sure the area has ventilation.

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This section is for the following models:
S/H2.00-3.20XM (S/H40-65XM)

INTRODUCTION

GENERAL

This section has the description, operation and the repair procedures for the parts of the LPG fuel system used on the GM 2.2L and 3.0L engines.

DESCRIPTION AND OPERATION

The LPG fuel system has a fuel tank, solenoid valve, relief valve, fuel filter and fuel valve, vaporizer, carburetor, governor controller and governor assembly. See FIGURE 1.

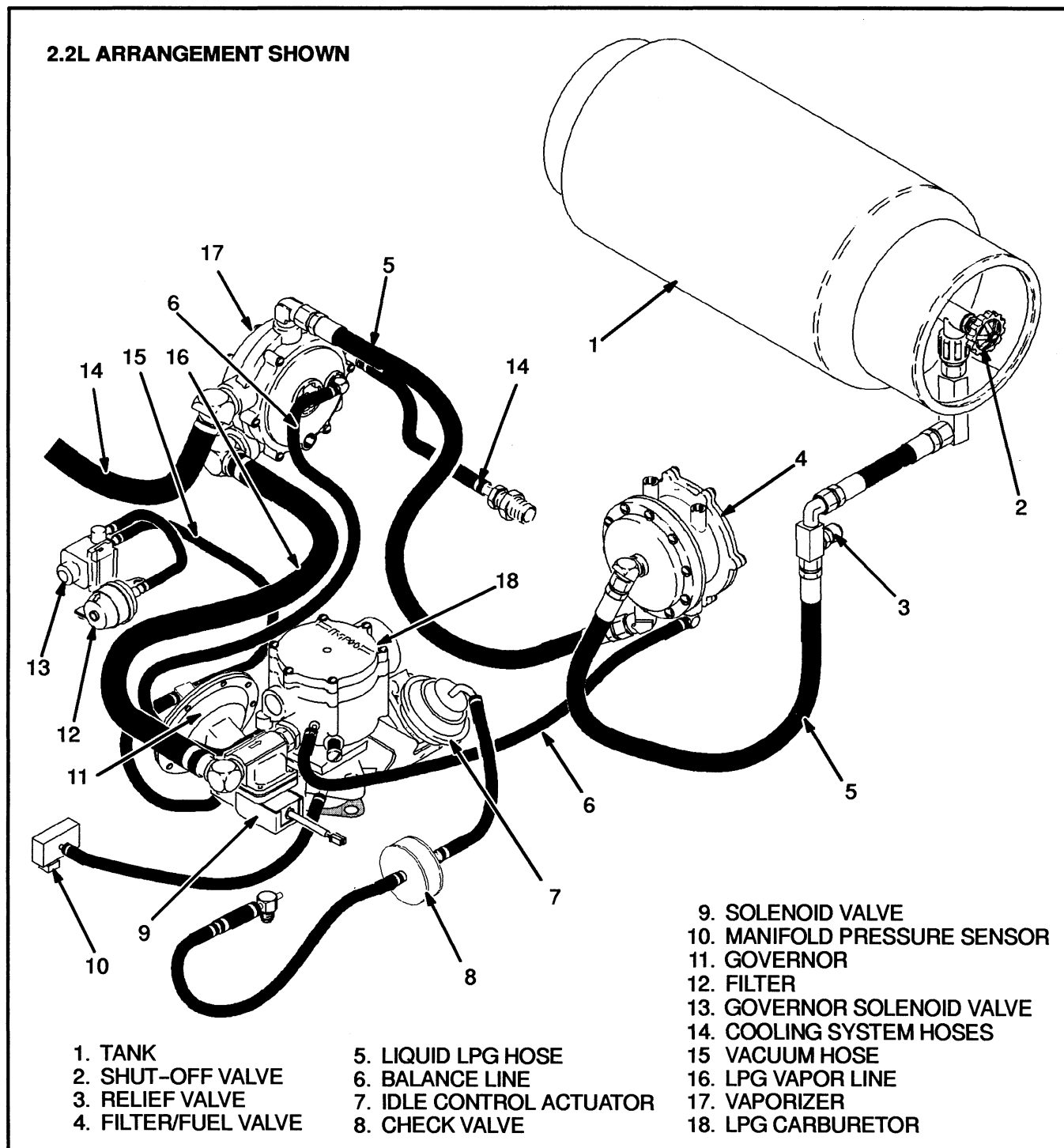


FIGURE 1. ARRANGEMENT FOR GM 2.2L ENGINE

Fuel Tank (See FIGURE 2.)

The fuel tank is the reservoir for the LPG system. The fuel tank keeps the fuel in the liquid condition. The pressure of the fuel is 1.7 MPa (240 psi) when the tank is full at a temperature of 27°C (80°F). The tank has a pressure relief valve that is set at 3.4 MPa (480 psi). The inlet tube for the pressure relief valve is in the vapor area at the top of the tank. The tank has a fuel gauge that measures the percentage of fuel that is in the tank. A liquid level valve near the pressure relief valve is used to indicate the maximum liquid level that is permitted. The tank is filled until liquid fuel flows from the liquid level valve. One end of the outlet tube inside the tank is near the lower surface of the tank. The other end of the tube is fastened to the outlet port.

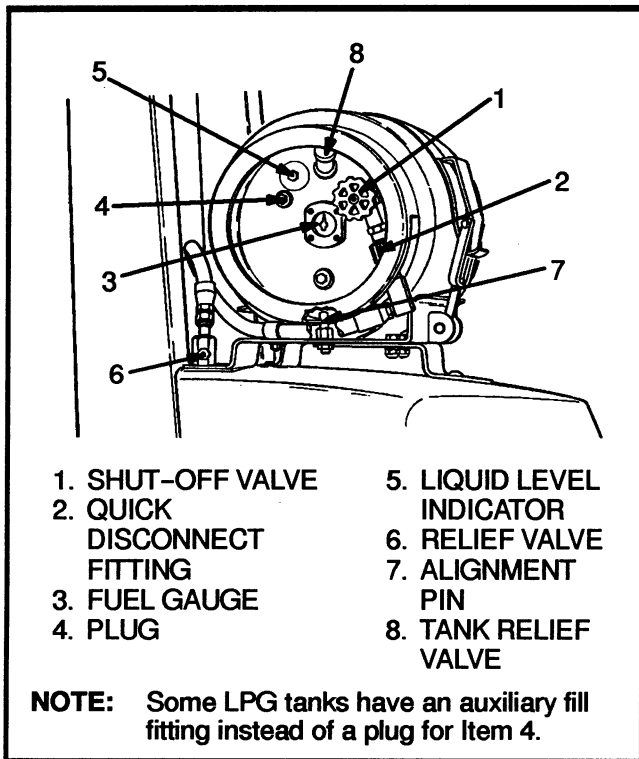


FIGURE 2. LPG TANK

A shut-off valve is installed in the outlet port of the tank. The fuel valve can prevent fuel from leaving the tank when the outlet line is disconnected. A quick disconnect fitting is installed for easy tank removal. The tank has a guard for the valves and fittings. The guard has a hole for the alignment dowel on the mount. The tank is fastened to the lift truck by metal straps with latches.

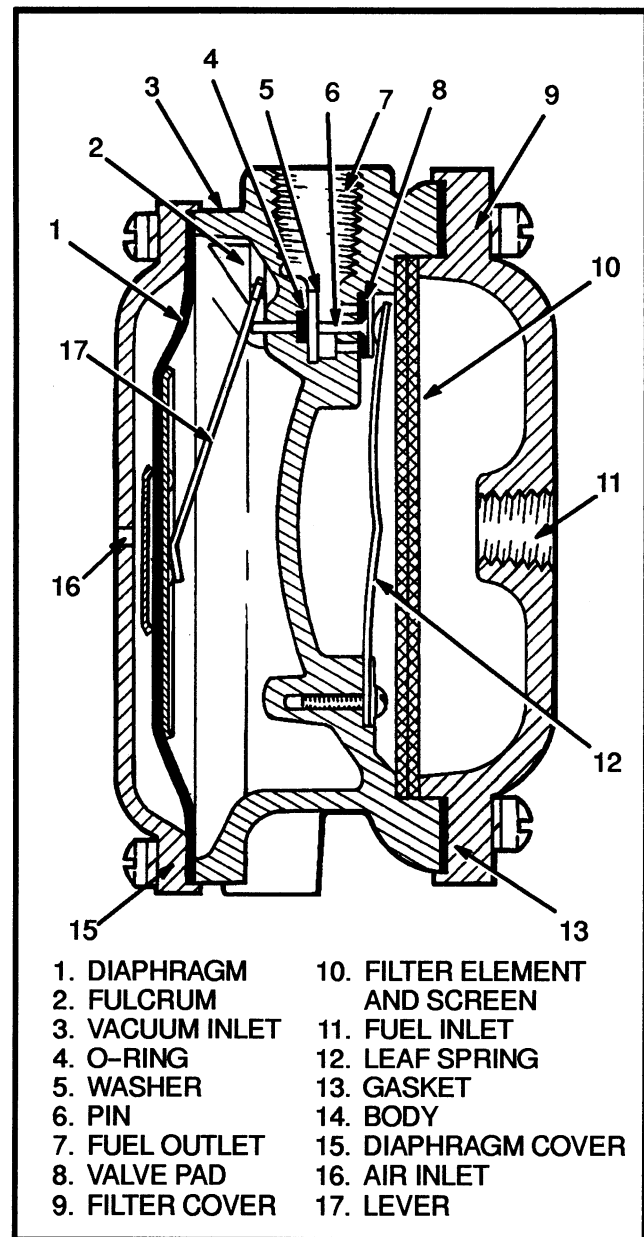


FIGURE 3. FUEL FILTER AND FUEL VALVE

Fuel Filter and Fuel Valve Unit (See FIGURE 3.)

A fuel line connects the tank to the fuel filter. The fuel filter prevents dirt from entering the vaporizer and has a fuel valve that is operated by engine vacuum. The fuel valve prevents fuel from entering the vaporizer unless the engine is being started or is running. The fuel valve has a leaf spring that holds a polyurethane pad against the seat. A diaphragm is used to open the fuel valve. Air pressure pushes on the vent side of the diaphragm. The other side of the diaphragm has inlet manifold vacuum and a lever and plunger that open the fuel valve. When the engine starts, the air pressure on the lever side of the

diaphragm decreases. Then the air pressure on the vent side of the diaphragm moves the diaphragm, lever and pin to move the valve pad from the seat. Liquid LPG then flows through the fuel valve to the vaporizer.

Vaporizer (See FIGURE 4.)

The function of the vaporizer is to change the liquid fuel to a vapor (gas) and to control the pressure of the vapor. The LPG fuel changes from a liquid to a vapor inside the expansion chamber. A liquid needs heat to change to a gas. Heat is removed from the vaporizer when the pressure of the liquid LPG is quickly decreased in the expansion chamber. The vaporizer must be heated by the engine coolant to replace the heat that is lost to the fuel. Coolant passages in the vaporizer prevent the vaporizer from being too cold to operate.

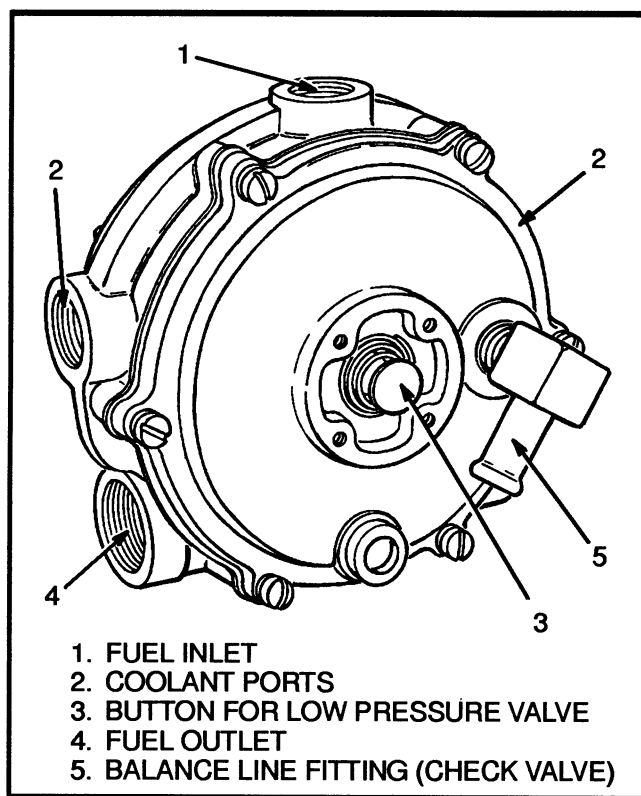


FIGURE 4. VAPORIZER

The vaporizer also controls the pressure of the gas that goes to the carburetor. The pressure reducer valve keeps the pressure of the gas in the expansion chamber at 38 mm (1.5 in) of water. When gas is required at the carburetor, there is a vacuum in the vapor chamber. The vac-

uum opens the vapor valve and permits the gas to flow to the carburetor.

Liquid fuel enters the vaporizer inlet from the filter unit. The pressure reducer valve has a polyurethane pad and a seat. When the pad is against the seat, the liquid fuel cannot enter the expansion chamber.

When the liquid fuel enters through the pressure reducer valve, the pressure of the fuel pushes on the diaphragm. The diaphragm immediately moves and closes the valve. Because only a very low pressure is needed to close the valve, the fuel pressure in the expansion chamber is very low. The sudden decrease in pressure causes the fuel to change from a liquid to a vapor. This change of condition takes heat from the surfaces of the expansion chamber. Warm coolant flows next to the surfaces of the chamber to replace the heat.

The LPG vapor is kept in the expansion chamber by the vapor valve. When the engine starts, the gas in the vapor chamber leaves the vapor chamber to flow through the carburetor. The pressure on the vapor diaphragm then decreases. Air pressure on the other side of the vapor diaphragm pushes on the diaphragm and opens the vapor valve. The gas flows from the expansion chamber to the vapor chamber and then to the solenoid valve and carburetor. The pressure in the expansion chamber decreases and again the pressure reducer valve opens to repeat the operation. When the carburetor throttle is closed, the vacuum in the vapor chamber decreases and the vapor valve closes. The pressure in the vapor chamber stays at 10.3 kPa (1.5 psi).

A balance line connects the air pressure side of the vapor diaphragm to an air inlet port at the carburetor. If the air filter has a restriction, the pressure decreases in the carburetor and in the vapor chamber of the vaporizer. When a balance line is not installed, this decrease can cause the diaphragm to move and open the vapor valve. When a balance tube is connected, the restriction causes an equal decrease on both sides of the diaphragm. The balance line prevents an increase in the fuel mixture in the carburetor. A button in the housing can be used to manually open the vapor valve. LPG vapor then flows to the carburetor for starting the engine.

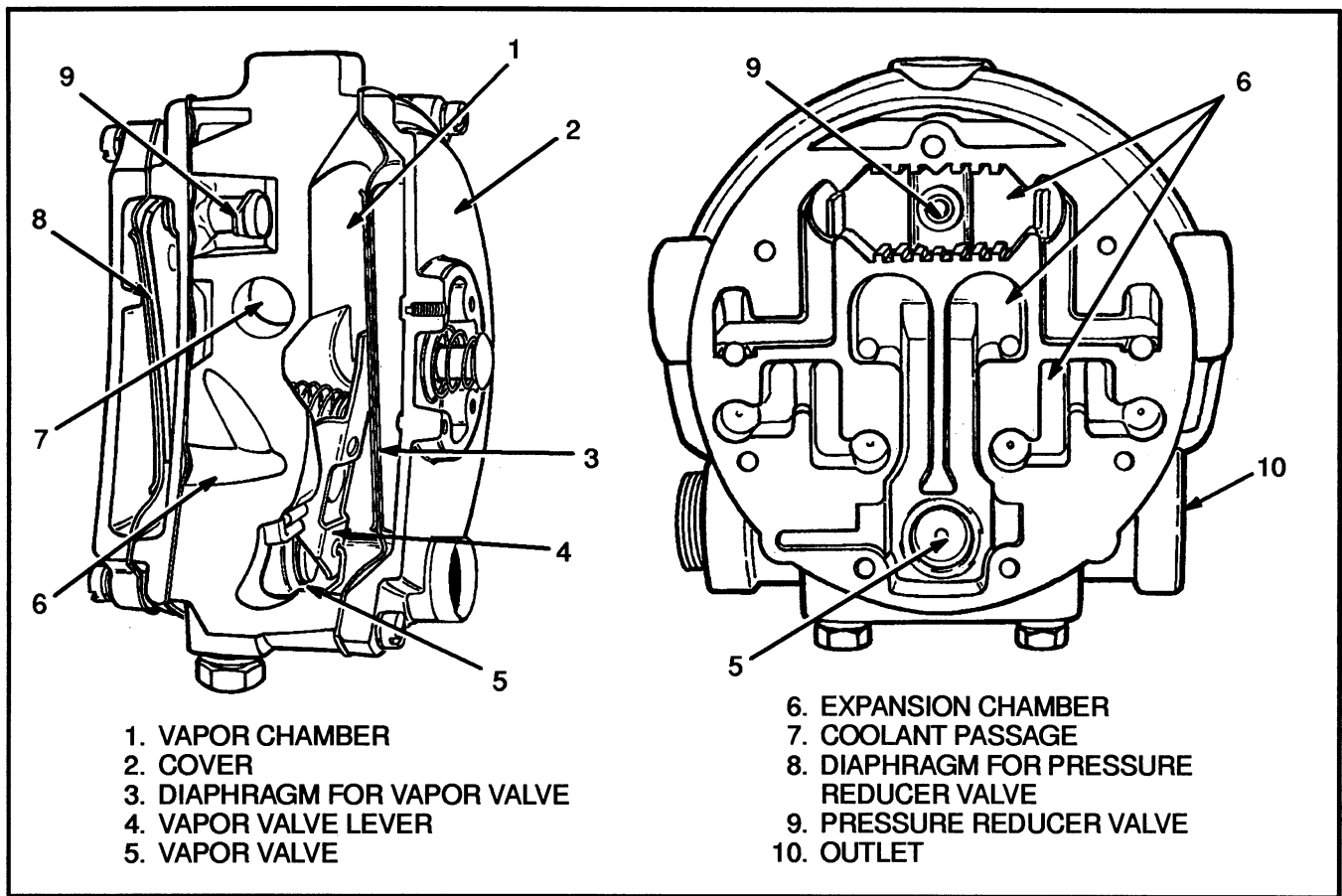


FIGURE 5. INSIDE THE VAPORIZER

Carburetor

(See FIGURE 6. through FIGURE 8.)

The carburetor has two moving parts, the throttle and a diaphragm with the fuel metering valve. The fuel tube in the center of the air tube is the seat for the fuel metering valve.

When the engine starts, the air in the air tube and in the vacuum chamber flows to the engine. Air pressure on the outside of the air tube pushes the diaphragm against the metering spring. (A dampener chamber is installed at the top of the carburetor. The chamber helps to decrease the pulses felt at the diaphragm caused by the pumping action of the pistons in the engine.) The fuel metering valve moves from its seat. Air then flows from the outside of the air tube to the inside of the air tube. The fuel pressure moves the LPG vapor past the fuel metering valve to mix with the air flowing through the air tube. Because the diaphragm causes a restriction, the pressure in the inside of the air tube is always less than on the outside of the tube. The difference in pressure

changes when the amount of air flowing through the air tube changes. The diaphragm moves according to the air flow. The amount of fuel that can flow past the fuel metering valve is controlled by the amount of air flowing into the air tube.

When the throttle plate is near the closed position, the pressure difference decreases. The metering spring pushes the fuel metering valve toward its seat and decreases fuel flow around the fuel metering valve. An idle mixture screw permits adjustment of the air supply at low engine speed.

When the throttle plate is fully open at high engine speeds, the fuel metering valve is at the top of its travel. The carburetor has an adjustable valve that controls the amount of LPG vapor that goes to the fuel metering valve. The restriction in fuel flow by this valve is small when the fuel flow is low. When more fuel flows through the valve, the valve becomes an orifice. Adjusting the valve opening changes the mixture of fuel and air when the engine is operated at high speed with a load.

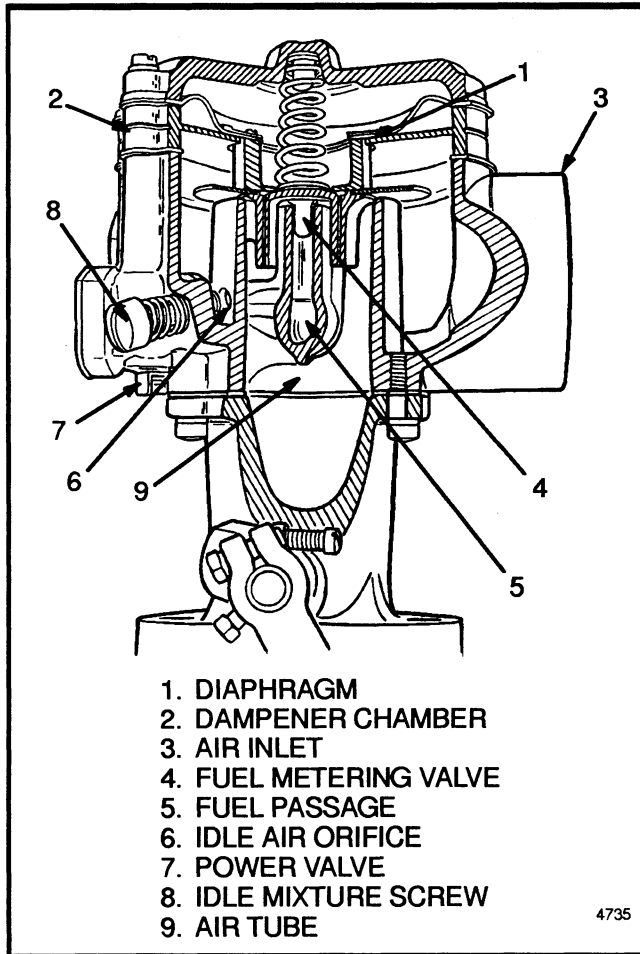


FIGURE 6. INSIDE THE CARBURETOR

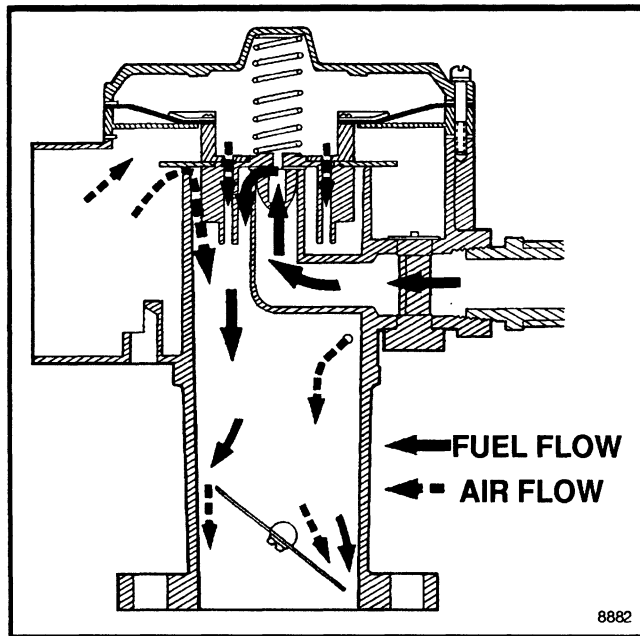


FIGURE 7. AIR AND FUEL FLOW AT IDLE

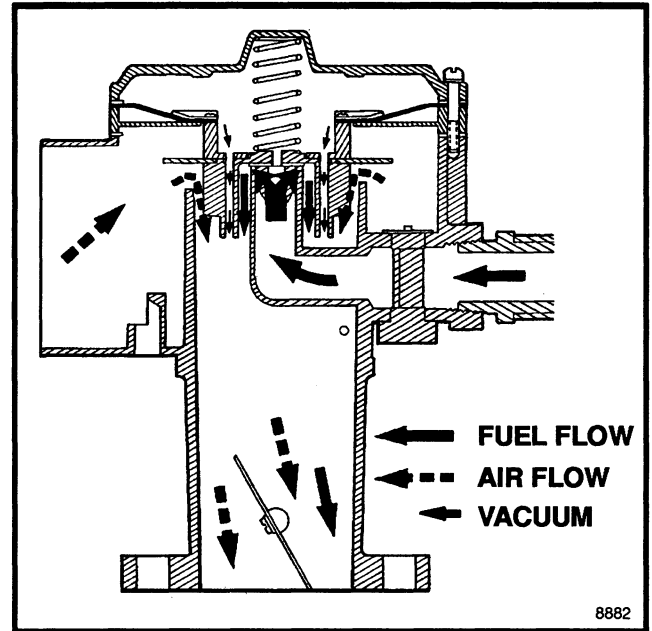


FIGURE 8. AIR-FUEL FLOW AT HIGH SPEED

Solenoid Valve (See FIGURE 1.)

The solenoid valve is installed at the fuel inlet of the carburetor. The valve opens to let fuel to the carburetor when the key switch is ON. When the key switch is OFF, the valve closes and fuel cannot flow to the carburetor.

A controller that monitors engine speed is also connected to the solenoid valve. When the engine speed exceeds the governor limit, the controller deenergizes the solenoid valve and stops the fuel flow to the carburetor. When the engine speed decreases below the governor limit, the controller energizes the solenoid valve, permitting fuel to flow to the carburetor.

Idle Control Actuator (See FIGURE 1.)

The idle control actuator is a vacuum controlled device that increases idle speed when there is a load on the engine. The idle control actuator is mounted on the carburetor and acts directly on the throttle linkage. The vacuum line is connected to the governor and senses manifold vacuum. A check valve in the vacuum line keeps the vacuum at the actuator.

During normal operation, vacuum holds the actuator rod away from the throttle linkage. When the engine is at idle speed and the throttle is depressed, manifold vacuum decreases. The decrease in vacuum lets the actuator rod extend and increase the idle speed.

Governor System (See FIGURE 1. and FIGURE 9.)

The governor system controls the maximum engine speed under variable load conditions. A sudden decrease of the engine load can cause the engine speed to increase beyond the specification limits. A sudden increase in engine load can decrease the engine speed. The governor system controls these sudden changes in engine speed.

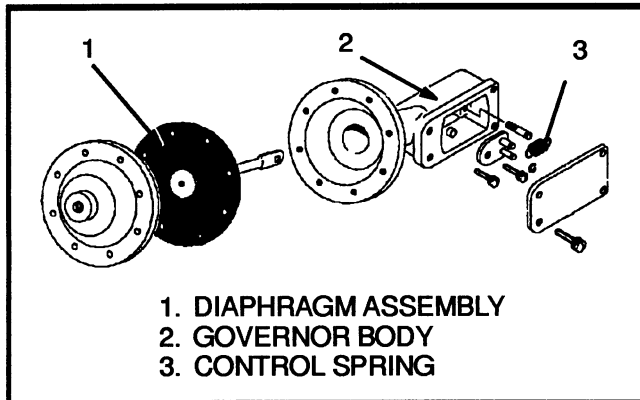


FIGURE 9. GOVERNOR

The governor attaches to the carburetor throttle assembly. The governor controller is on the cowl in the operator's compartment. Vacuum lines connect the governor

solenoid valve to the carburetor and to the diaphragm of the governor. The governor controller is electrically connected to the governor solenoid valve and the engine speed sensor on the engine.

The operation of the governor is controlled by an electronic controller. Manifold vacuum and air pressure provide the force to actuate the governor. The electronic controller controls this force. The governor diaphragm operates the throttle plate of the carburetor. Linkage from the diaphragm closes the throttle plate when the vacuum is high. A spring in the governor opens the throttle plate.

The electronic controller is connected to the ignition system and controls the operation of the governor solenoid valve. The governor solenoid valve controls the vacuum at the diaphragm in the governor. During operation, the electronic controller receives the engine speed signals. As the engine speed reaches the governed speed, current flows to the governor solenoid valve. The solenoid valve closes, causing vacuum to operate the diaphragm. When actuated, the diaphragm works against the governor spring to close the throttle plate and decrease engine speed. The governor solenoid valve opens and closes as necessary to keep the engine speed within the governor limits.

REPAIRS

REPLACEMENT OF THE HOSES

The hoses installed on LPG systems are special. Hoses that are made for use with hydraulic oil are damaged by LPG. When replacing the LPG hoses, make sure to use only HYSTER Approved LPG hose. Make sure to use the correct size of hose. When replacing the hose to the quick disconnect fitting, make sure that it is the same length as the hose it replaces. A hose that is the wrong length permits the tank to be installed in a position that is not correct.

LPG TANK

Removal (See FIGURE 10.)

⚠ WARNING

Before disconnecting any part of the LPG fuel system, close the shut-off valve on the fuel tank. Run the engine until the fuel lines are empty and the en-

gine stops. If the engine will not run, close the shut-off valve on the fuel tank and release the fuel slowly in a non-hazardous area.

⚠ WARNING

LPG can cause an explosion even when the tanks are empty. When replacing the tanks, do not weld, cause sparks or permit flammable material on or near the tanks. Do not change tanks when the engine is running. Tanks must be filled by authorized personnel. Follow all the safety rules. Do not remove any parts from the tank. Use a cloth to protect your hands from cold metal.

Frost on the surface of the tank, the valves or fittings and the odor of LPG fuel indicates a leak. Inspect the LPG system and repair a leak immediately. An LPG fuel leak creates an explosion and fire hazard. Do not attempt to start the engine if there is a leak in the LPG fuel system.

LPG tanks are heavy. The weight of an LPG tank can exceed the maximum recommended weight for safe lifting by an individual. Get assistance when lifting or lowering an LPG tank. Use correct lifting procedures.

Do not store LPG tanks near heat or an open flame. For complete instructions on the storage of LPG fuels, refer to ANSI/NFPA 58 & 505.

1. Move the lift truck to the area where tanks are changed.
2. Turn the shut-off valve clockwise until the valve is completely closed.
3. Run the engine until it stops, then turn the key to the OFF position.
4. Disconnect the quick disconnect fitting.

⚠ WARNING

LPG is very cold. Always wear gloves to protect your hands from the cold fittings. Do not permit LPG to contact the skin.

5. Release the tank latch and remove the tank from the bracket.

⚠ WARNING

Do not use any LPG tank that is damaged. Damaged tanks must be removed from service.

Installation (See FIGURE 10.)

1. Before the tank is installed on the lift truck, check the operation of the fuel gauge. Look at the fuel gauge and move the tank. The needle of the gauge must move when the fuel moves. If the needle does not move, a new tank must be installed.

⚠ WARNING

Make sure the alignment pin extends through the correct hole in the rim of the LPG tank. The hose or fittings can be damaged if the LPG tank is not installed in the correct position. A damaged hose or fitting can release LPG fuel and cause an explosion and fire hazard.

2. Install the LPG tank in its bracket so that the alignment pin is in the correct hole in the bracket. Close the latches.
3. Connect the quick disconnect fitting to the shut-off valve on the tank. Use your hand to tighten the fitting.

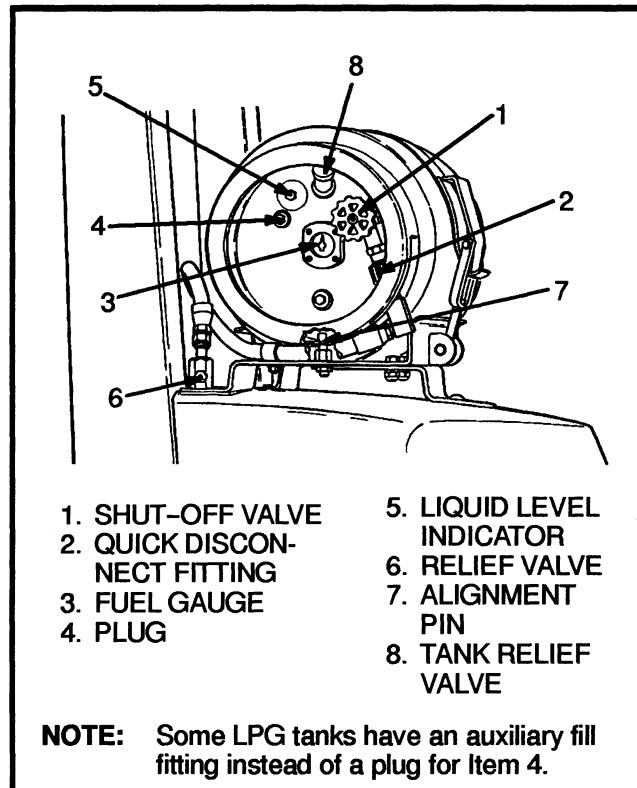


FIGURE 10. LPG TANK

4. Turn the shut-off valve counterclockwise to open the valve.
5. Inspect the fuel system for leaks when the shut-off valve is open. Frost on the surface of the tank, valves or fittings or a strong odor of LPG fuel indicates a leak.

⚠ WARNING

The shut-off valve on the tank must be closed when the truck is not being used.

HYDROSTATIC RELIEF VALVE

Removal and Installation

⚠ WARNING

LPG can cause an explosion. Do not cause sparks or permit flammable material near the LPG system. Close the fuel valve on the tank. Disconnect the negative battery cable to prevent sparks.

1. Close the shut-off valve on the tank.
2. Slowly loosen the hose fitting for the relief valve. Let the fuel drain from the fitting before removing the relief valve.

⚠ WARNING

LPG is flammable. Make sure there are no sparks or open flames in the area when the fuel lines are drained.

3. The valve cannot be repaired. If the valve does not work, install a new valve. After installation, open the shut-off valve slowly and inspect the system for leaks.

FILTER UNIT

Replacement Of The Fuel Filter Element (See FIGURE 11.)

NOTE: Use a liquid thread sealant on all fittings with threads at the filter unit.

1. Close the shut-off valve on the tank. Slowly loosen the hose fitting to the filter. Let the fuel drain from the fitting before disassembling the filter unit.

⚠ WARNING

LPG is flammable. Make sure there are no sparks or open flames in the area when the fuel lines are drained.

2. Remove the 10 screws and the filter cover. Replace the filter element.
3. Install the cover and gasket. Tighten the screws for the cover. Tighten the hose fitting.

Replacement of the Diaphragm and Fuel Valve (See FIGURE 11.)

1. Close the shut-off valve on the tank. Slowly disconnect the fittings for the inlet and outlet hoses and let the LPG drain from the lines. Remove the vacuum hose and the mount capscrews.
2. Remove the 10 screws from the filter cover. Remove the filter and screen. Remove the six screws from the diaphragm cover. Remove the covers and gaskets.
3. Remove the diaphragm. Remove the filter and screen. Remove the screw for the leaf spring. Remove the valve pad. Pull the pin from its bore.
4. Remove the fitting from the fuel outlet port. Remove the washer and O-ring through the outlet port.
5. Install a new O-ring in its bore. Align the washer with the O-ring and install the pin through the washer and O-ring.
6. Install the valve pad with the side with the polyurethane pad toward the bore. Install the leaf spring, lock washer and screw.
7. Install the screen and filter element. Put the gasket on the body and install the filter cover and the ten screws and lock washers.
8. Replace the diaphragm. Install the diaphragm so that the large plate is toward the valve. Install the cover and tighten the six screws and lock washers.
9. Install the capscrews for the mount. Connect the vacuum line. Connect the lines for the tank and the vaporizer.
10. Open the shut-off valve on the tank and check for leaks in the line to the filter unit. Start the engine and inspect for leaks on the outlet side of the filter unit.

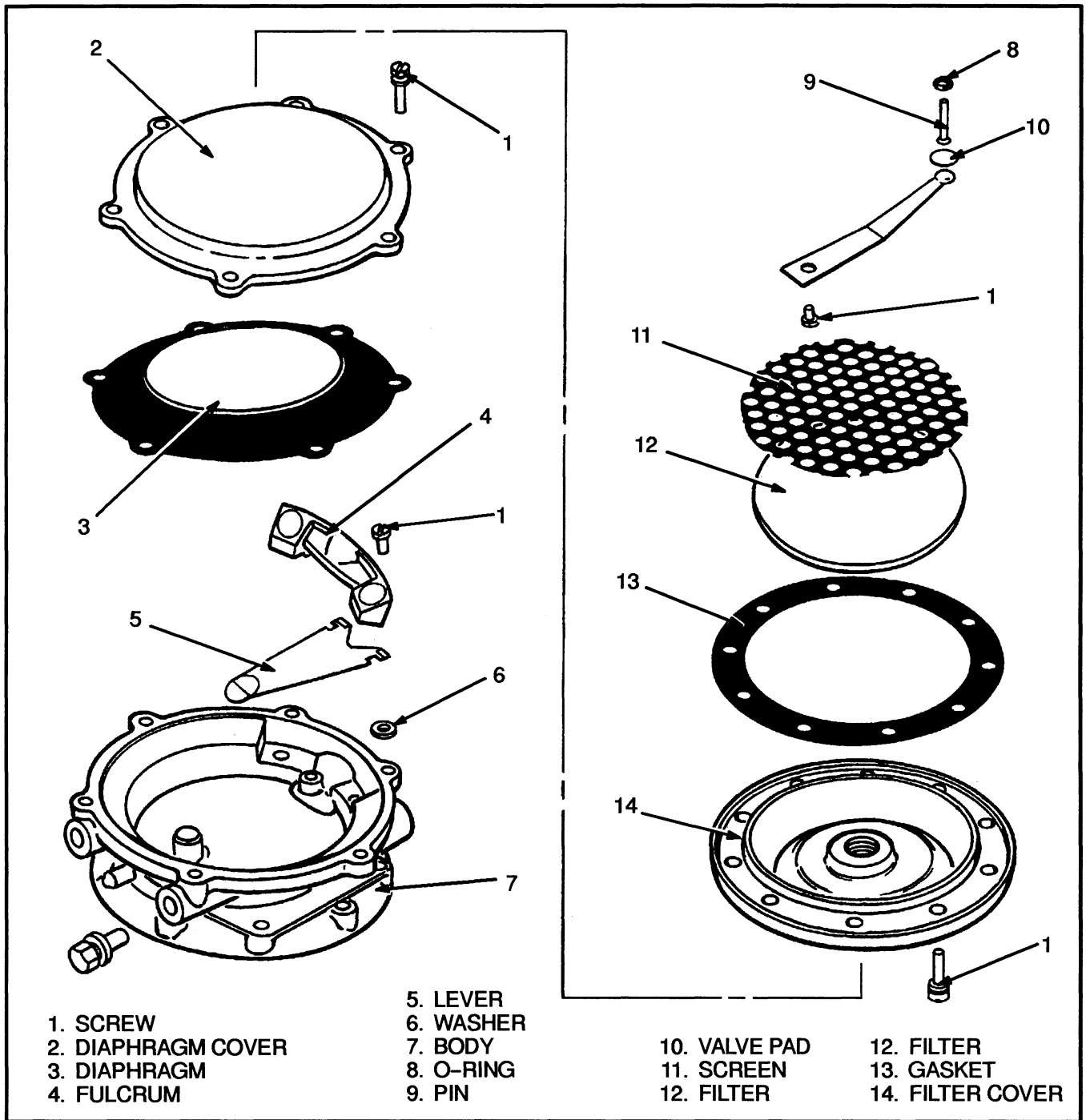


FIGURE 11. FUEL VALVE AND FUEL FILTER

VAPORIZER

Removal



WARNING
 LPG can cause an explosion. Do not permit any sparks or open flames in the work area.

1. Close the shut-off valve on the tank. Run the engine until it stops. Slowly disconnect the fitting from the filter unit on the vaporizer. Disconnect the hose to the carburetor.

2. Put a drain pan under the drain valve for the radiator. Open the drain valve so that the coolant drains in the pan.

3. Disconnect the coolant fittings to the vaporizer. Remove the balance line from the vaporizer. Remove the capscrews at the mount for the vaporizer.

Disassembly (See FIGURE 12.)

1. Remove the seven screws that hold the high pressure cover and plate to the vaporizer body. Remove the cover

and pressure reducer diaphragm. Remove the pin and spring from the plate.

2. Remove the plate and gasket. Remove the pressure reducer valve.

3. Remove the six screws that hold the cover for the vapor chamber to the vaporizer. Remove the cover. Move the diaphragm toward the inlet port to release it from the lever.

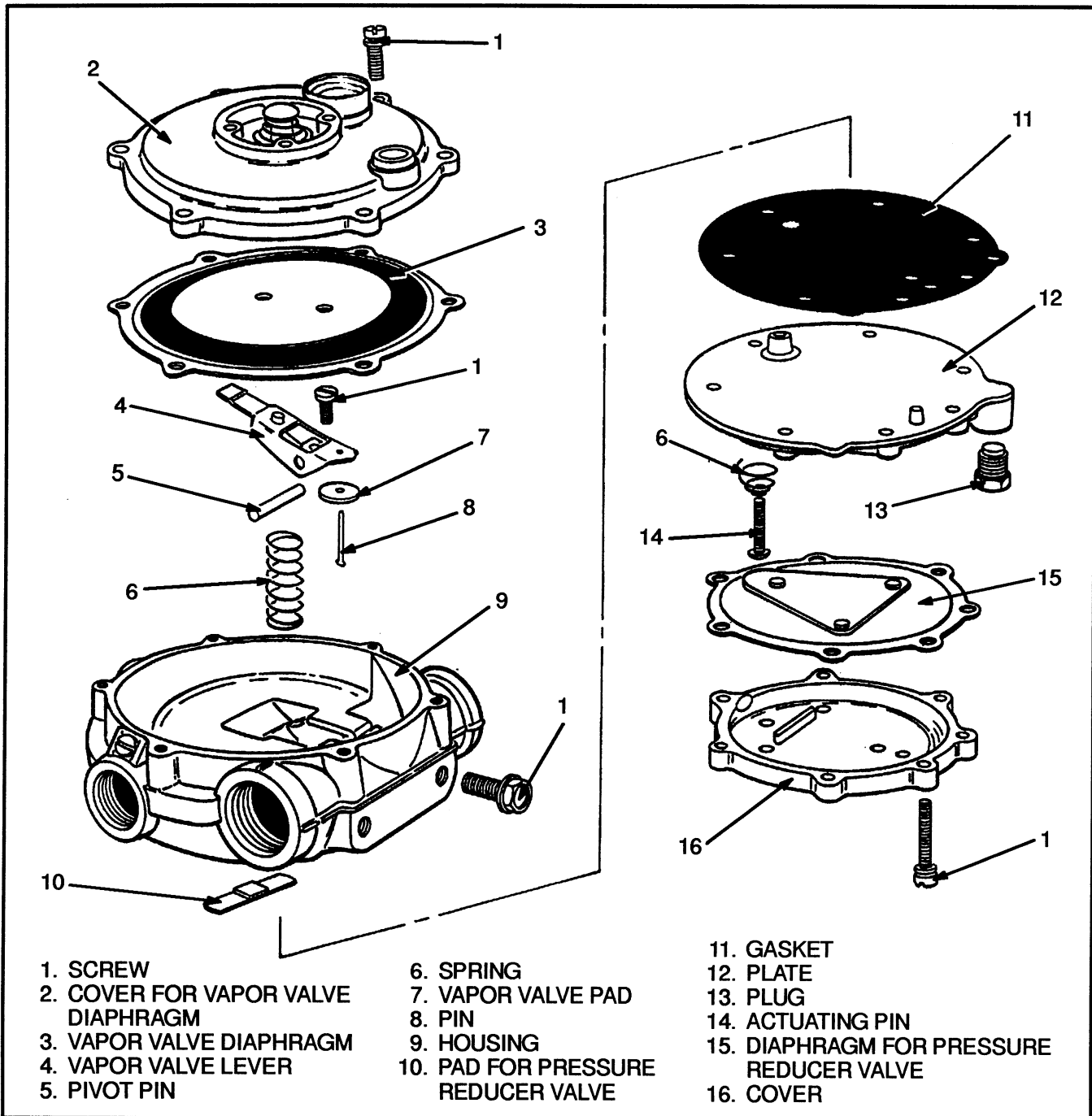


FIGURE 12. PARTS OF THE VAPORIZER

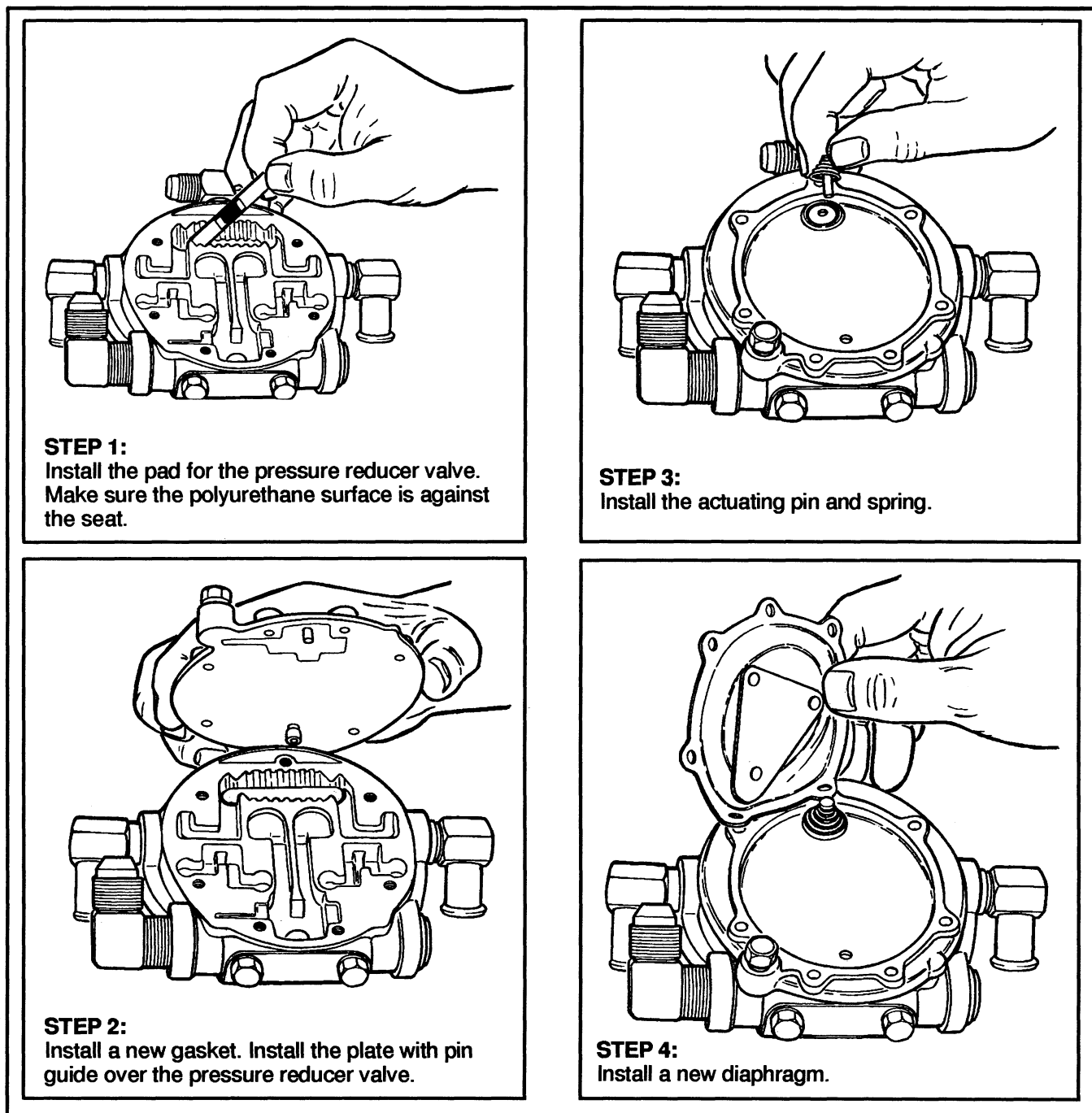


FIGURE 13. ASSEMBLY OF THE VAPORIZER (1 OF 3)

4. Remove the screw that holds the lever pin. Cut the wire that holds the vapor valve pad to the lever. Remove the pad.

Cleaning

WARNING

Cleaning solvents can be flammable and toxic, and can cause skin irritation. When using cleaning sol-

vents, always follow the recommendations of the manufacturer.

Wash all parts of the assembly, except the diaphragms in solvent. Use compressed air to dry the parts. Do not use compressed air on the diaphragms.

Inspection

Make sure the vaporizer housing does not have cracks or damage. Inspect the threads for damage. The dia-

phragms, valve pads, and gaskets are included in the repair kit. Check that the check ball in the balance line fitting moves freely.

Assembly (See FIGURE 13.)

NOTE: Use a liquid thread sealant on all fittings with threads at the vaporizer.

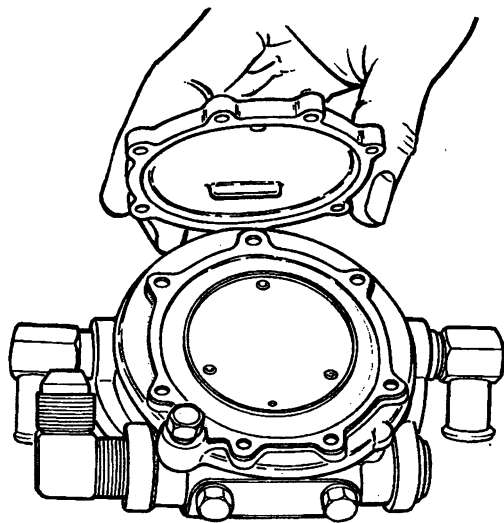
Follow the procedures shown in FIGURE 13. Always use a HYSTER Approved repair kit when assembling the vaporizer.

Installation

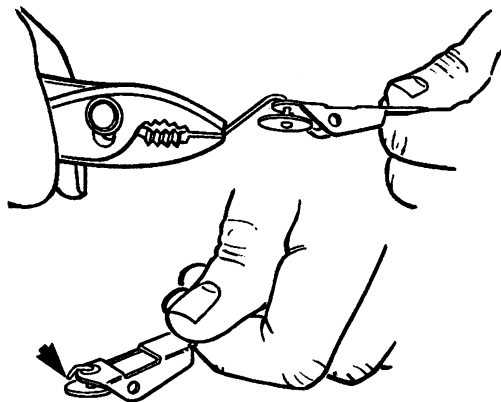
CAUTION

Use care when installing the fitting for the balance line. If the fitting is tightened more than 2 to 3 turns the washer inside the vaporizer can be damaged.

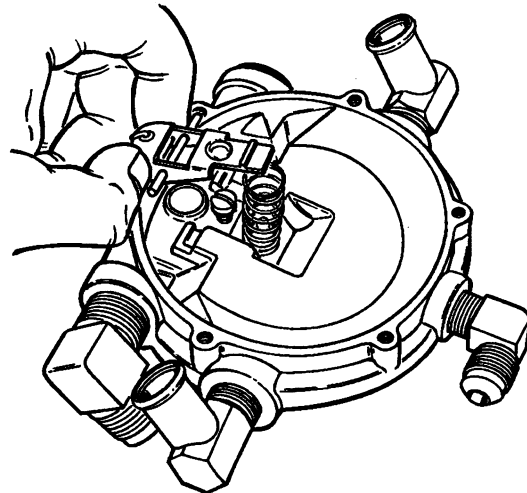
Install the mount capscrews. Connect all the lines to the fittings. Fill the radiator with coolant. Check for leaks.



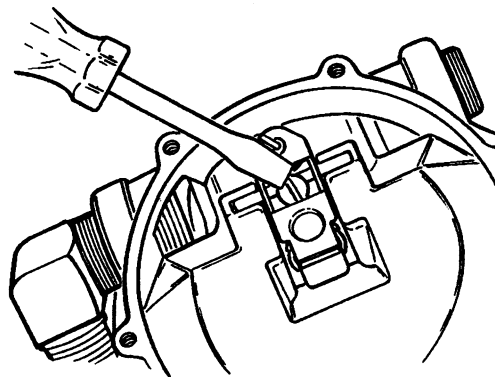
STEP 5: Install the cover. Tighten the screws.



STEP 6: Remove the vapor valve pad from the valve lever. Install a new valve pad in the lever. Leave the pad loose enough against the lever so that the pad can tilt for alignment against the seat. Bend and cut the pin shown.



STEP 7: Put the valve spring in position on the housing. Put the lever assembly over the spring. Install the screw so that the head of the screw is holding the pivot pin.



STEP 8: Tighten the screw. Make sure the lever moves freely.

FIGURE 13. ASSEMBLY OF THE VAPORIZER (2 OF 3)

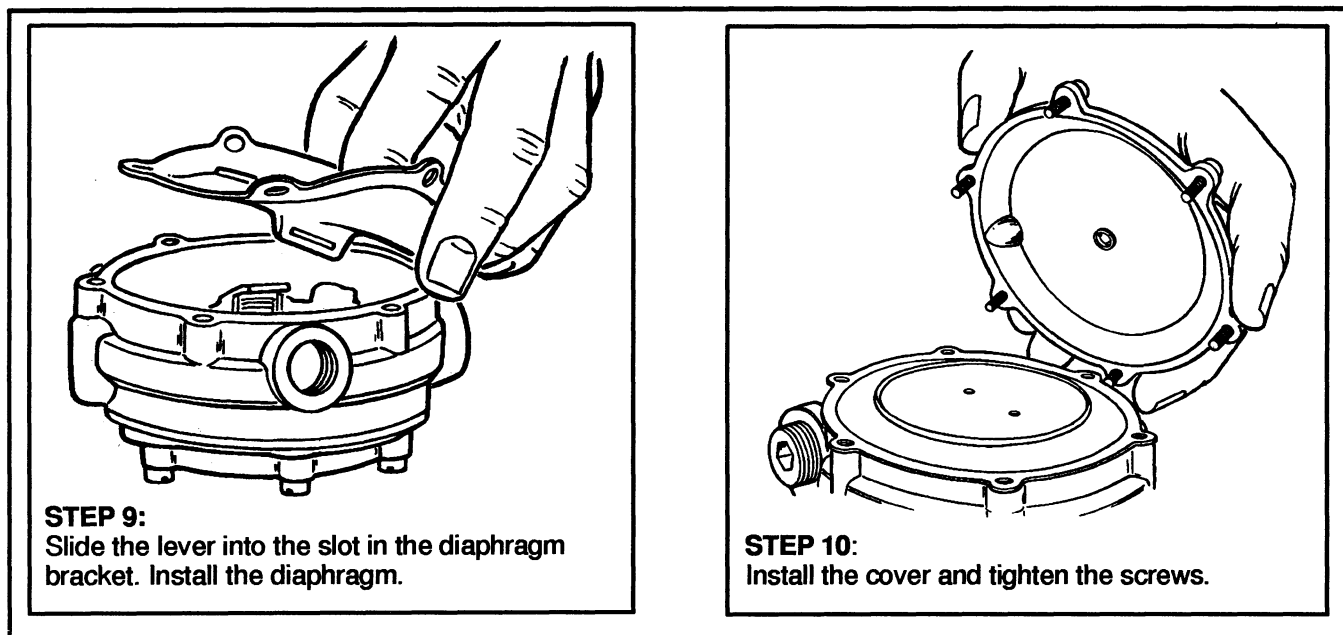


FIGURE 13. ASSEMBLY OF THE VAPORIZER (3 OF 3)

CARBURETOR

Removal

1. Remove the hose from the air cleaner at the carburetor inlet. Disconnect the wires to the fuel shut-off valve. Remove the fuel inlet hose at the fuel shut-off valve. Remove the balance lines from the carburetor. Remove the vacuum hoses from the carburetor, idle controller actuator and governor.
2. Disconnect the accelerator cable from the throttle lever. Remove the two attachment nuts at the base of the carburetor.
3. Remove the carburetor and the governor assembly.

Disassembly (See FIGURE 14.)

NOTE: Disassembly of the throttle body and throttle shaft assembly is needed only if the gaskets or seals need to be replaced. Remove the governor as needed.

1. Remove the six screws from the diaphragm cover. Remove the cover and metering spring.
2. Remove the diaphragm, dampener chamber and fuel valve assembly from the carburetor body. Remove the four screws from the diaphragm plate and disassemble the fuel valve.
3. Remove the fuel solenoid valve and the idle control actuator. Remove the idle mixture screw and spring.

4. Remove the four screws that connect the throttle body to the carburetor body. Remove the throttle body and attachment plate.

5. Remove the two screws that connect the throttle plate to the throttle shaft and remove the throttle plate.

6. Remove the cover to the governor. Remove the retainers from the throttle shaft. Disconnect the governor spring as needed to remove the governor attachment screws. Remove the attachment screws. Remove the governor from the throttle body.

7. Remove the throttle shaft from the throttle body. Remove the seal retainers and seals from the throttle shaft. If necessary, remove the bearings from the throttle body.

Cleaning

WARNING

Cleaning solvents can be flammable and toxic, and can cause skin irritation. When using cleaning solvents, always follow the recommendations of the manufacturer.

Make sure all the carburetor parts are clean before assembly. Wash all the parts, except the diaphragm, in solvent. Make sure the air passages in the metering valve are clean.

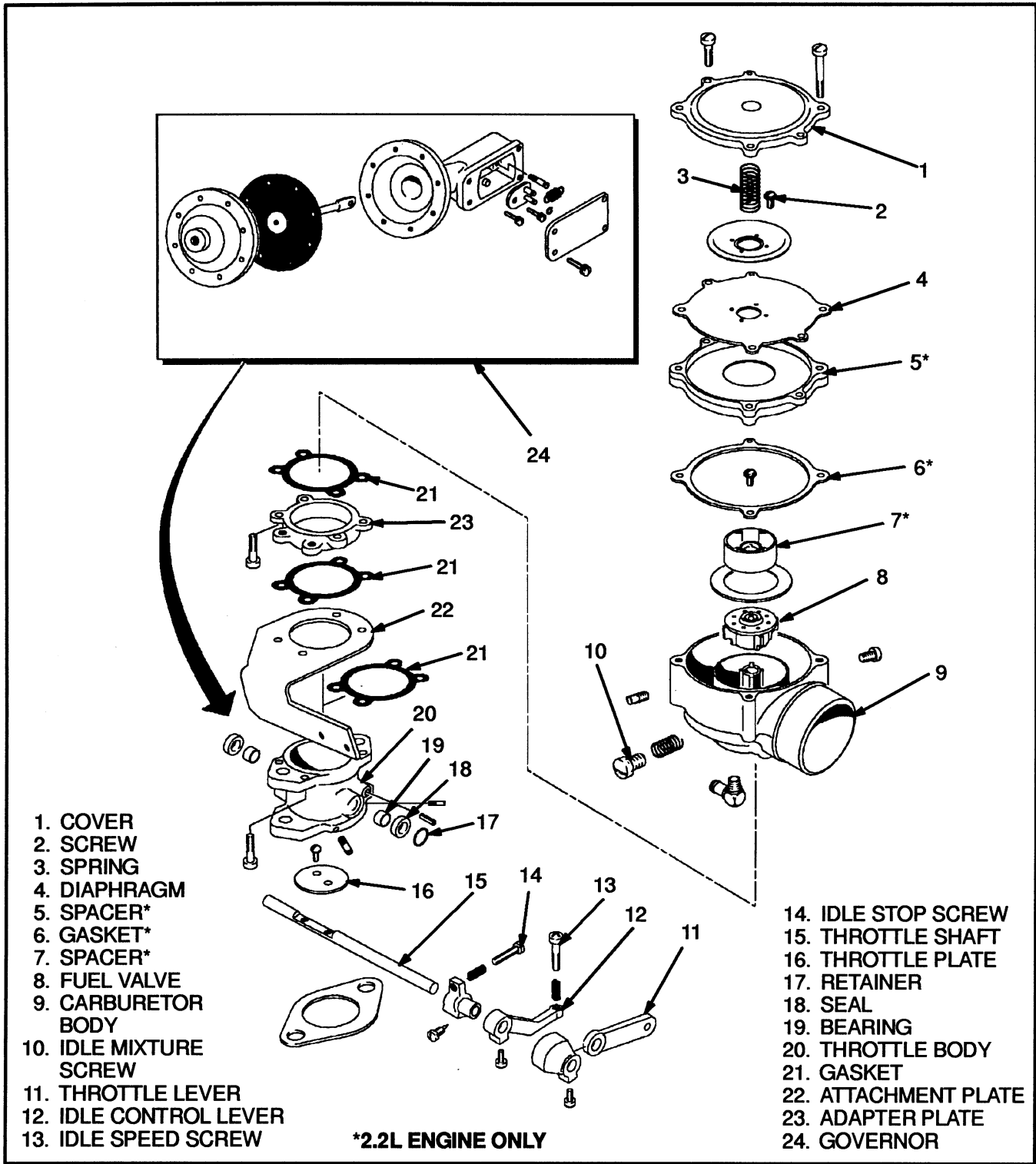


FIGURE 14. LPG CARBURETOR ASSEMBLY

Assembly (See FIGURE 14.)

NOTE: Use a liquid thread sealant on all fittings with threads at the carburetor.

Use only HYSTER Approved repair kits when repairing the carburetor.

1. Install new bearings as needed in the throttle body. Install new seals in the throttle body. Install the seal re-

tainers and the throttle shaft. Install the throttle plate to the throttle shaft using lock washers with the screws.

2. Install the governor on the throttle body. Connect the throttle shaft to the governor. Reconnect the governor spring. Install the cover on the governor.

3. Install the throttle body and attachment plate with new gaskets to the carburetor body. Install the idle speed spring and screw. Install the idle control actuator and fuel solenoid valve.

4. Assemble the fuel metering valve, air measuring plate, diaphragm and back-up plate. Install a new gasket on the carburetor body. Install the dampener chamber, then install the valve assembly in the carburetor body. Install the metering spring and cover. Make sure the spring is in the correct position before installing the cover.

Installation (See FIGURE 1.)

NOTE: Use a liquid thread sealant on all fittings with threads at the carburetor.

1. Install a new gasket on the manifold, then install the carburetor on the manifold.

2. Install the balance line and the fuel hose. Install the vacuum hose and check valve for the idle control actuator. The GRAY side of the check valve must be toward the idle control actuator.

3. Connect the throttle linkage as shown in FIGURE 18. Make sure the head of the pin is toward the carburetor.

4. Connect the wires at the solenoid valve.

5. Make sure the tee-fitting on the governor is installed correctly, then connect the vacuum hoses at the governor. The tee-fitting has two different size orifices. The black end of the fitting is the large orifice and goes toward the governor solenoid valve. The red end of the fitting is the small orifice and goes toward the governor. The large orifice is 2.13 mm (0.094 in) and the small orifice is 0.91 mm (0.036 in).

6. Connect the hose to the air cleaner.

7. Check and adjust the carburetor, throttle linkage and idle control actuator as described in CHECKS AND ADJUSTMENTS.

SOLENOID VALVE (See FIGURE 1.)

The solenoid valve cannot be repaired. If the solenoid valve does not operate, it must be replaced.

1. Disconnect the hose from the air cleaner to the carburetor inlet. Remove the fuel inlet hose. Disconnect the wires at the solenoid valve. Remove the solenoid valve.

2. Use a liquid thread sealant and install the solenoid valve on the carburetor. Connect the wires and fuel hose. Connect the hose to the air cleaner. Turn the key switch ON and OFF to check the operation of the solenoid valve. Start the engine and check for leaks.

CHECKS AND ADJUSTMENTS

WARNING

LPG can cause an explosion. Do not permit any sparks or open flames in work area.

GOVERNOR SYSTEM

If the governor is removed or replaced, adjust the throttle linkage as described in CHECKS AND ADJUST-

MENTS. If the governor is not operating correctly, check the parts of the system as follows:

NOTE: The vacuum hoses installed on the carburetor and governor are made of special high-temperature material. If any of the hoses are replaced, make sure the correct hoses are installed.

1. Check the vacuum hoses and the diaphragm in the governor for damage. Remove the plate on the side of the governor and check that the linkage and spring move freely.

2. Check the vacuum hoses for restrictions. Check the tee-fitting at the diaphragm for restrictions. Make sure the tee-fitting is correctly installed. There are orifices in the fitting. The black end of the fitting (VAL) is for the governor solenoid valve. The red end of the fitting (GOV) is for the governor.

3. Use an ohmmeter to check the solenoid valve. Disconnect the wires at the solenoid valve. Measure the resistance between the terminals of the solenoid valve. The correct resistance is 22 to 25 ohms. Measure the resistance between one of the terminals and the body of the solenoid valve. The correct resistance is 800 ohms or higher. If the readings are not correct, replace the solenoid valve. If the solenoid valve does not work, the governor controller must also be checked. A bad solenoid valve can damage the electronic controller.

4. Use a volt/ohmmeter to check the governor controller.

a. Disconnect the wiring harness at the controller. Measure the resistance between the ground terminal in the harness connector and the cowl. The correct resistance is less than 3 ohms. If the circuit is open or the resistance is high, check for a damaged wire.

b. Turn the key switch to the ON position. Do not start the engine. Use the voltmeter to check for battery voltage at the terminals in the connector for the battery and the solenoid. Check for damaged wires if the readings are not correct.

c. Turn the key switch to the OFF position. Use an ohmmeter to check the continuity of the signal input wire. Check the wire between the distributor (tachometer connector) and the harness connector.

5. If, after checking the solenoid valve, wiring, hoses and the governor, the governor still does not operate correctly, replace the electronic controller.

CHECK THE FILTER UNIT

1. Check for leaks in the fuel valve by disconnecting the fuel inlet hose at the vaporizer. Put the end of the hose in a container of water. There must be no bubbles in the water. If there are bubbles in the water, install a new valve pad in the filter unit.

2. If there are no bubbles in the water, disable the ignition system by disconnecting the plug with two terminals at the ignition module.

WARNING

Do not remove an ignition secondary wire to cause an open circuit. A spark can cause an explosion.

3. Turn the key momentarily to the START position to cause a vacuum in the inlet manifold. Bubbles must appear in the container of water.

4. If there are no bubbles seen in step 2, check the vacuum hose for a restriction. If there is vacuum to the filter unit, inspect the diaphragm for holes or cracks. Make sure the tank has fuel and that the shut-off valve is open.

5. Connect the terminal plug at the ignition module.

CHECK THE VAPORIZER

Pressure Reducer Valve

Connect a pressure gauge that can measure with accuracy a pressure below 35 kPa (5 psi) to the test port of the vaporizer. The gauge must indicate 10.5 kPa (1.5 psi) when the engine is at idle. If the gauge indicates a pressure greater than 10.5 kPa (1.5 psi), the pressure reducer valve has damage.

Vapor Valve

1. Run the engine until it is warm.

2. To check for leaks, stop the engine and disconnect the hose from the fuel inlet port at the carburetor. Put the end of the hose just below the surface of water in a container. If bubbles are seen, the vapor valve is damaged or is dirty.

3. To check the vapor diaphragm, remove the inlet hose to the vaporizer. Remove the inlet hose at the carburetor. Put the end of the hose below the surface of the water in a container. Remove the balance line from the carburetor and apply air pressure to the line. If bubbles continue to be seen in the water, the diaphragm is damaged.

ADJUST THE CARBURETOR

Idle Adjustments

(See FIGURE 15. And FIGURE 16.)

1. The engine must be at the normal operating temperature. Connect a tachometer to the engine.

2. Turn the idle speed screw (1) until the engine speed is 900 ± 50 rpm for the 2.2L engine or 800 ± 25 rpm for the 3.0L engine.

3. Changing the adjustment of the idle mixture screw (2) will change engine speed. Adjust the mixture screw (2) for maximum engine rpm.

4. Check and adjust idle speed as necessary as described in step 2.

5. Repeat steps 3 and 4 maximum idle speed from adjusting the idle mixture screw is the same specified idle speed.

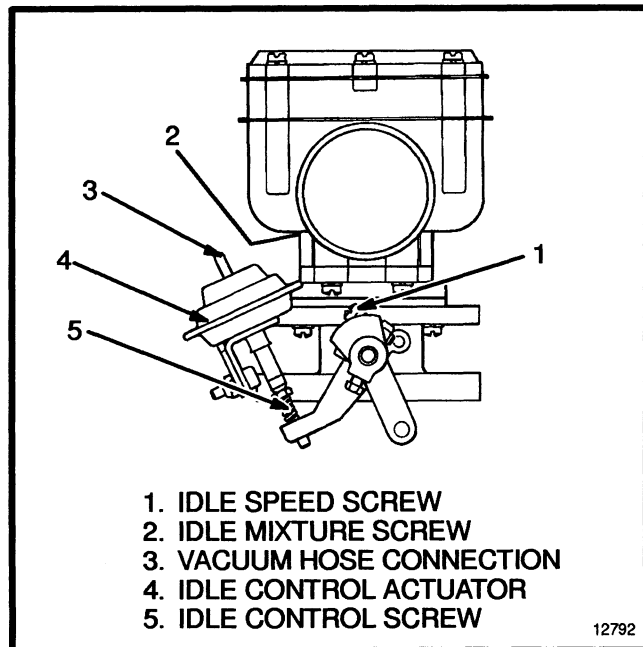


FIGURE 15. CARBURETOR ADJUSTMENTS,
2.2L ENGINE

6. Turn idle mixture screw OUT until idle speed begins to decrease. Turn idle mixture screw (2) IN 1/4 turn.

7. Check the idle control adjustment as follows:

- a. Adjust the idle speed and mixture as described above.
- b. Adjust the idle control screw (5) until there is 0.1 to 0.2 mm (0.004 to 0.008 in) clearance between the screw (5) and the rod in the actuator (4).
- c. Disconnect the vacuum hose from the actuator (3) and check engine speed. If engine speed is below 1400 rpm, no adjustment is needed. If engine speed is more than 1400 rpm, adjust the idle control screw (5) until engine speed is 1300 to 1400 rpm.

d. Install the vacuum hose and clamp to the idle control actuator (4).

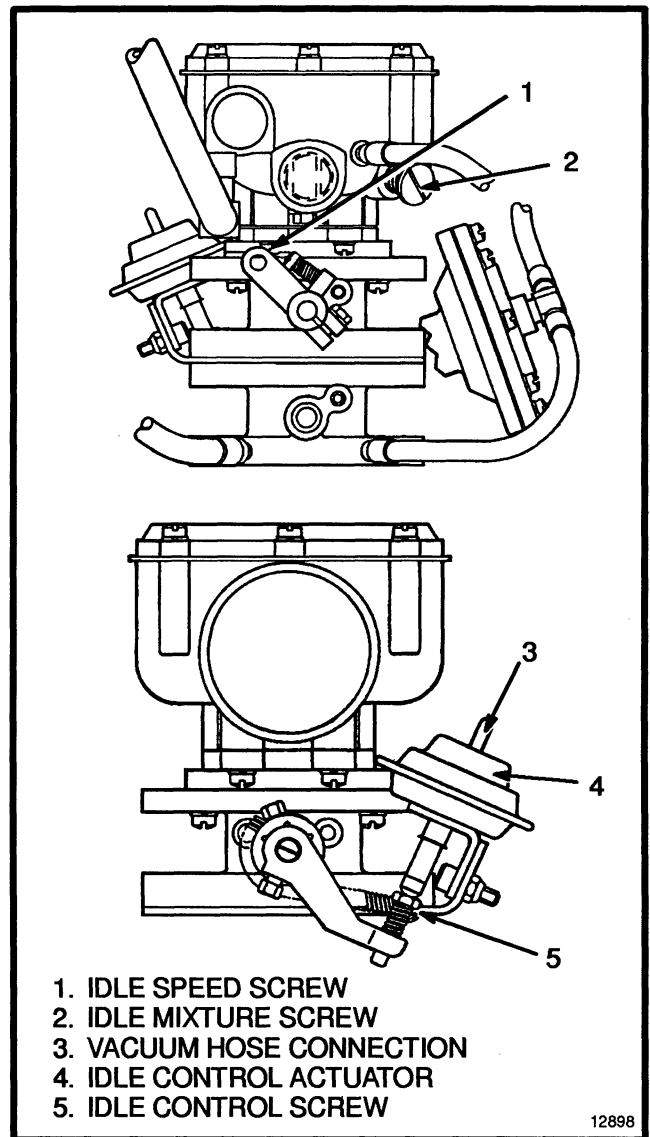


FIGURE 16. CARBURETOR ADJUSTMENTS,
3.0L ENGINE

Power Mixture (See FIGURE 17.)

The power mixture valve controls the flow of fuel to the carburetor when the engine is running near full load. Set the power mixture valve at the 3/8 mark (toward the L) for the 2.2L engine. For the 3.0L engine, set the power mixture valve to the 1/2 mark for the H-series units and to the 5/8 mark (toward the R) for the S-series. This setting will be correct for most conditions. If an exhaust analyzer is not available adjust the power mixture valve as follows:

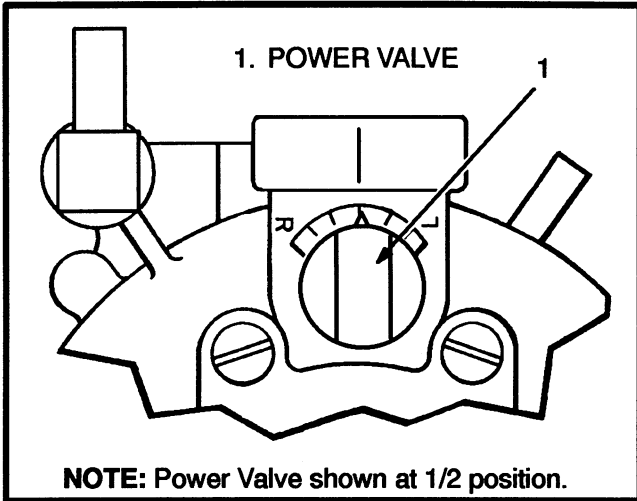


FIGURE 17. POWER MIXTURE ADJUSTMENT

CAUTION

During this test the mast must be fully extended. Make sure there is enough overhead clearance in the building or do the test outdoors.

1. Operate the lift truck until the engine, transmission and hydraulic system are at normal operating temperatures. Apply the parking brake.
2. Install an exhaust gas analyzer in the exhaust pipe. Connect a tachometer to the engine. Start the engine and fully extend the mast. Pull back on the LIFT lever to put a load on the engine. Fully depress the accelerator pedal

and turn the power mixture valve until the reading on the exhaust gas analyzer is 0.5 to 1.0% CO (carbon monoxide) maximum.

ADJUST THE THROTTLE LINKAGE
(See FIGURE 18.)

CAUTION

The adjustment of the throttle cable must be correct or the cable can break during operation. The accelerator pedal or the MONOTROL pedal must reach the pedal stop (floor plate) by the time the throttle plate in the carburetor is fully open.

NOTE: Each time the throttle system is disassembled, it is important to adjust the throttle cable.

1. Adjust the idle speed as described in Idle Speed Adjustment.
2. Make sure the throttle linkage at the pedal assembly is in the correct position.
3. Push the Monotrol or throttle pedal until it stops against the floor plate. Adjust the throttle cable so that the pedal stops against the floor plate. Depress the throttle pedal until it stops against the floor plate just as the throttle plate reaches the wide open position. Use the nuts at the pedal end of the cable housing to change the adjustment of the cable.

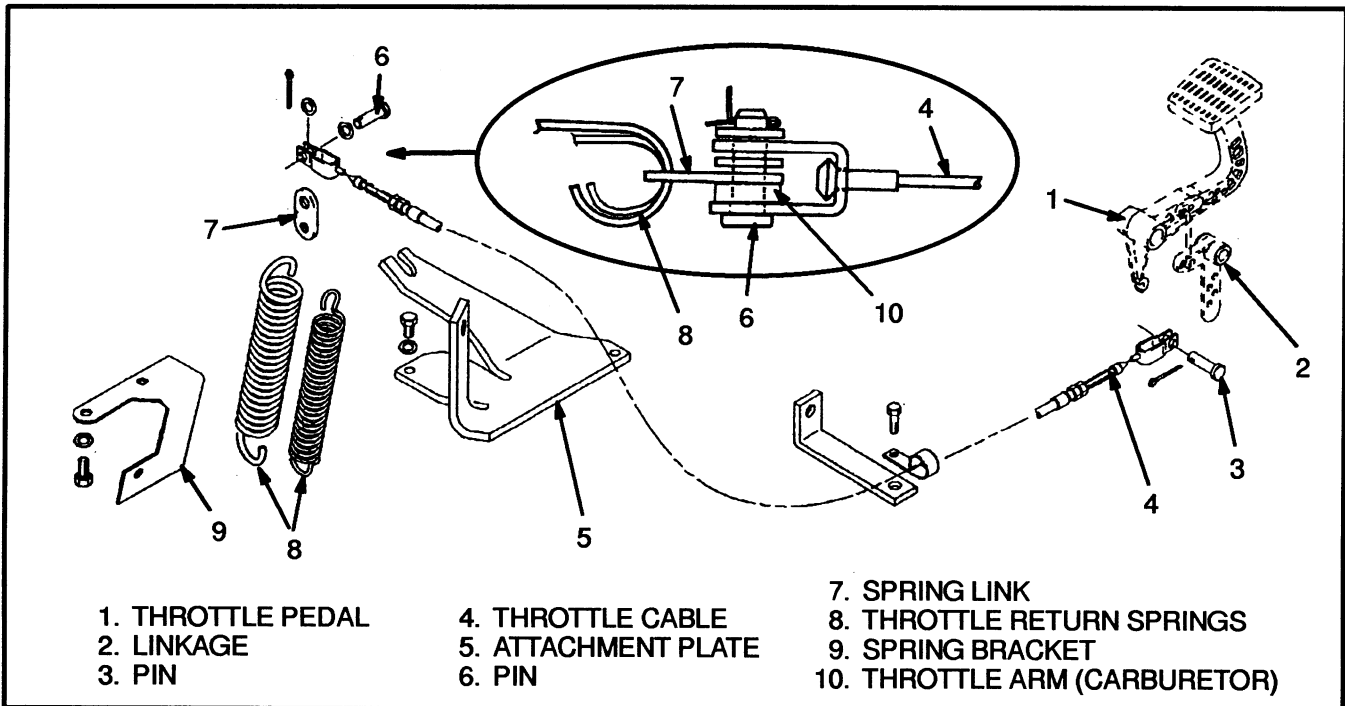


FIGURE 18. THROTTLE CABLE ARRANGEMENT

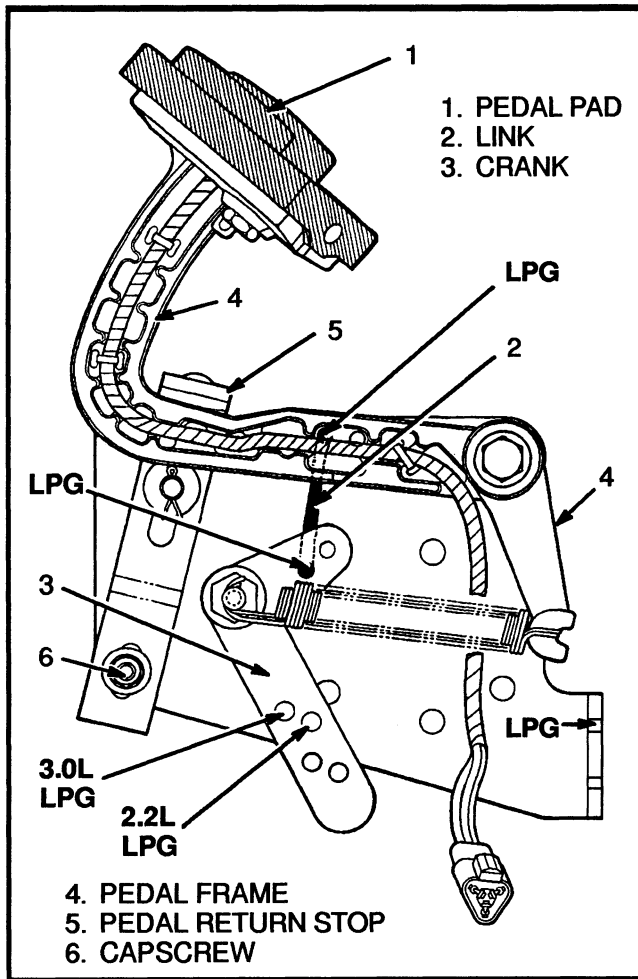


FIGURE 19. MONOTROL PEDAL

4. Adjust the pedal return stop (see FIGURE 19.) so that there is no tension on the throttle cable at the idle position. Do the following to check this adjustment:

- a. Run the engine at idle speed. Make sure the rod on the idle control actuator is retracted and the throttle linkage is against the idle control screw.
- b. When the pedal return stop is in the correct position, tighten the capscrew that holds the stop to the bracket.

5. Check that the engine runs at its governed speed when the accelerator pedal or the MONOTROL pedal reaches the floor plate. The maximum speed with no load is 2900 ± 50 rpm for both the 2.2L and the 3.0L engine.

Check The Monotrol Pedal (See FIGURE 19.)

Slowly move the Monotrol pedal pad from Forward to Reverse and Reverse to Forward. There must be some movement of the pedal pad before the pedal frame moves and the throttle opens.

TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
<p>The engine will not start easily. The vaporizer is freezing.</p>	<p>Low coolant level. Water hoses have a restriction or are too small. Air lock in coolant line to the vaporizer. Hose from vaporizer to carburetor has a leak. Thermostat does not operate correctly. Ignition system or starter is damaged. Idle mixture screw is not adjusted correctly. Fuel valve in carburetor is damaged. Air filter is dirty. Balance line is disconnected. Accelerating too soon after engine is started. Solenoid valve is disconnected or not working correctly.</p>	<p>Fill coolant system to correct level. Install correct hoses. Remove air from cooling system. Install a new hose. Install a new thermostat. Check and repair ignition system or starter. Adjust carburetor. Install new carburetor parts. Clean or install a new filter. Connect balance line. Let engine become warm. Check and repair solenoid valve.</p>
<p>Engine does not idle smoothly.</p>	<p>Idle mixture screw is not adjusted correctly. Diaphragm in carburetor is damaged. Air leak between carburetor and governor. Air leak between governor and intake manifold. PCV system has a restriction. Air leak at throttle shaft. Hose from vaporizer to carburetor is damaged. Balance line is disconnected. Pressure reducer diaphragm has a hole. Low pressure valve in vaporizer is damaged. Idle speed is too low. Idle speed screw is loose. Water in the fuel. Fuel tank is installed in the wrong position. Fuel valve on the tank is in the wrong port. Idle control actuator is not adjusted correctly or hose is disconnected.</p>	<p>Adjust carburetor. Install a new diaphragm. Check gaskets and tighten nuts. Check gaskets and tighten nuts. Clean parts in PCV circuit. Install a new carburetor body. Install a new hose. Connect balance line. Install a new diaphragm. Install a new valve. Adjust carburetor. Adjust carburetor. Install a different fuel tank. Install fuel tank correctly. Install a different fuel tank. Adjust carburetor or connect hose.</p>

TROUBLESHOOTING

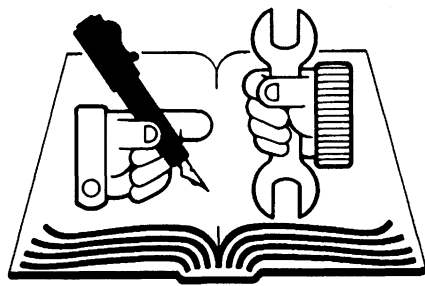
PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
Engine does not accelerate smoothly.	Not enough fuel reaching engine. Fuel line to carburetor has a restriction or is too small. Balance line has a restriction. Vaporizer does not operate correctly. Parts of the the governor are damaged. Low pressure diaphragm or valve in vaporizer is damaged. Wrong or damaged fuel valve in carburetor.	Adjust carburetor. Check fuel lines. Install a new fuel line. Install a new balance line. Repair vaporizer. Repair governor. Repair vaporizer. Repair carburetor.
Idle speed is too high.	Idle mixture screw is loose or not adjusted correctly. Idle control actuator is not adjusted correctly or hose is disconnected.	Adjust carburetor. Adjust carburetor or connect hose.
Engine does not run smoothly.	PCV system has a restriction. Air leaks in the intake manifold. Balance line has a restriction. Low pressure diaphragm or valve in vaporizer is damaged. Wrong or damaged fuel valve in carburetor.	Clean parts of PCV system. Check gaskets and tighten nuts. Install new balance line. Repair vaporizer. Repair carburetor.
Loss of power.	Air filter is dirty. PCV system has a restriction. Parts of the governor are damaged. Power mixture valve is not adjusted correctly. Hose from vaporizer to carburetor has leaks. Diaphragm in carburetor is damaged. Wrong type of fuel. Hose from vaporizer to carburetor has a restriction or is too small. Parts of the vaporizer are damaged. Ignition system does not operate correctly.	Clean or install a new filter. Clean parts of PCV system. Repair governor. Adjust carburetor. Install a new hose. Repair carburetor. Install a different fuel tank. Install a new hose. Repair vaporizer. Check and repair ignition system.

TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
<p>Engine stops running.</p>	<p>Shut-off valve on fuel tank is closed. Fuel tank is empty. Vacuum line to filter unit is disconnected. Parts of the filter unit are damaged. Parts of the vaporizer are damaged. Parts of the carburetor are damaged. Hose to carburetor is damaged. Idle speed is too low. Water in the fuel. Fuel filter is dirty. Parts of the governor are damaged. Air leak at the intake manifold. Ignition system does not operate correctly. Solenoid valve is disconnected or not working correctly.</p>	<p>Open valve. Install a full fuel tank. Connect vacuum line. Repair filter. Repair vaporizer. Repair carburetor. Install a new hose. Adjust carburetor. Install a different fuel tank. Install a new filter element. Repair governor. Check gasket and tighten nuts. Check and repair ignition system. Check and repair solenoid.</p>

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