## ENSIGN LPG SYSTEM

### INTERNATIONAL HARVESTER

| Application | Ensign Model No. (Carburetor) |
|---|---|
| 1965-68 | |
| BG-241 | XG |
| BG-265 | XG1 |

### SAFETY PRECAUTIONS

► *LAWS, ORDINANCES AND REGULATIONS – State, county and city laws and regulations covering the utilization of liquid petroleum gas must be adhered to when servicing vehicles equipped with LPG systems.*

► *SHOP SAFETY PRACTICES – Working area should be well ventilated with no open flame devices in area. "DANGER" signs should be displayed and a fire extinguisher (dry powder or CO-2) should be placed close by. DO NOT use LPG for cleaning parts, blowing horns or any other compressed air use.*

► *VEHICLE SAFETY PRACTICES – Before performing any work on vehicle, exhaust fuel system by closing main valves at tank and allowing engine to run, or by bleeding the fuel system outside the shop area. Remove or store vehicle outside of shop when work is not being performed. After completing servicing, raise hood allowing air to circulate to remove possible accumulated gas before starting engine. All threaded fittings should be treated with an insoluble sealer and checked for leaks with a soap lather. Pay particular attention to short rubber hoses used in the system to relieve stress and vibration.*

► *NOTE – In case of LPG fire, shut off source of gas, if possible, before extinguishing fire. If 'shut off' is not accomplished, an explosion may result.*

► *NOTE – DO NOT perform work on LPG fuel tanks. All necessary work on fuel tanks should be performed by qualified concerns normally servicing such containers.*

### DESCRIPTION

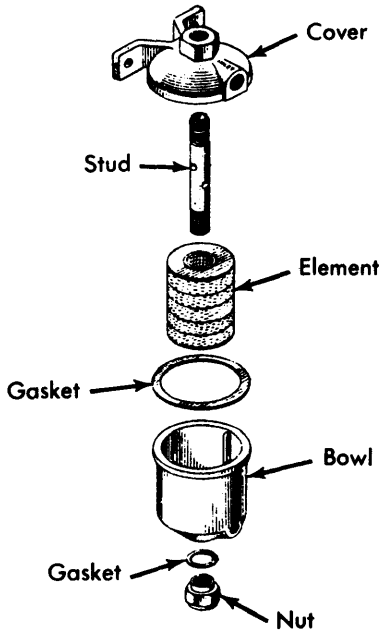
Major components in this system are as follows: Fuel tank, fuel filter assembly, solenoid valve, converter (or regulator) and carburetor.

Liquid fuel, stored in tank under pressure, flows through fuel filter assembly and then through solenoid valve to converter. In converter, pressure is lowered and liquid is heated and turned into vapor. Vapor is then drawn into carburetor and mixed with air in correct proportions for maximum engine efficiency. An engine oil pressure regulator incorporated in converter, acts to increase vaporizer output for overloads and acceleration.

### OPERATION

#### FUEL FILTER ASSEMBLY

Fuel from the tank enters through the upper (Inlet) hose and flows down through the felt filter cartridge to the outlet hose. The filtering element is composed of felts and a screen which should be removed and cleaned in solvent when required.

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**FUEL FILTER ASSEMBLY**

#### SOLENOID VALVE

The solenoid is located between fuel filter and converter, and is activated by ignition switch. When ignition is turned "OFF" valve will close fuel line preventing damage to the converter due to excessive fuel pressure. When ignition is turned "ON", the valve opens and liquid fuel is allowed to pass to converter.

#### CONVERTER (REGULATOR)

**Conversion System** – Liquid fuel enters converter through the fuel inlet and filter assembly. Major expansion of fuel occurs when the liquid fuel passes through the high pressure valve which is controlled by a pressure regulator diaphragm, lever and spring. The expanded liquid is then turned to vapor by passing through vaporizer coil, which is heated by engine coolant, and then leaves the coil at main valve at slightly below atmospheric pressure, ready for delivery to carburetor through vapor delivery outlet. The large regulator diaphragm controls vapor pressure to carburetor.

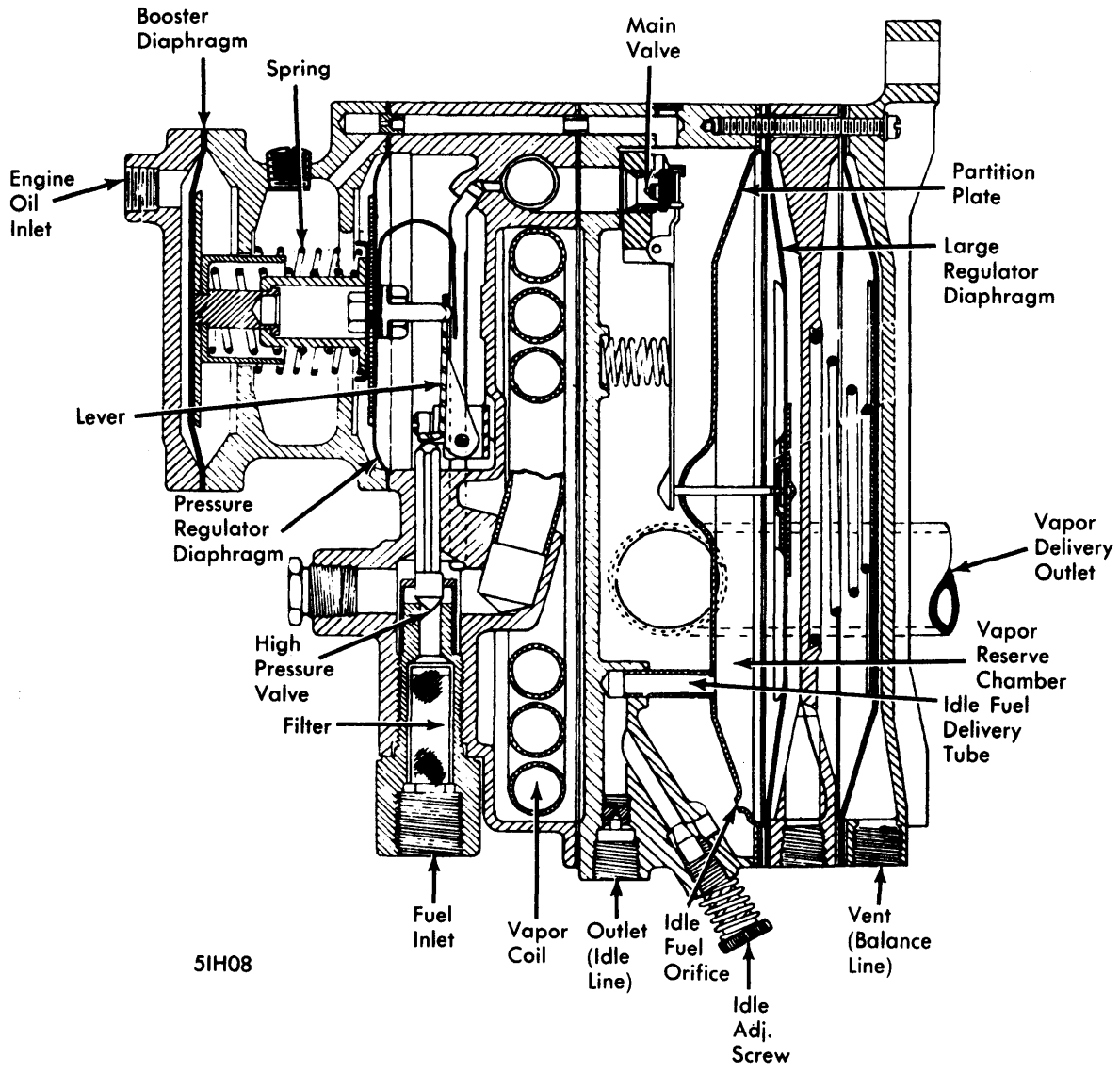
## ENSIGN LPG SYSTEM (Cont.)

**Idle System** – Fuel (vapor) for idle is drawn into the vapor reserve chamber through the idle fuel orifice. Fuel to the carburetor passes through the delivery tube, past the idle adjusting screw and out the idle line. A balance line is connected between vent on back cover plate of converter, and carburetor air horn pilot tube. Its purpose is to automatically reduce fuel flow to carburetor to compensate for air cleaner resistance.

**Regulator** – Vaporizer output is increased for overload or acceleration by engine oil pressure applied through oil inlet. Oil pressure applied to booster diaphragm is transmitted by spring pressure to pressure regulator diaphragm. Oil pressure up to 10 psi is effective. With engine "OFF", or with less than 1 psi oil pressure, lock-up of the regulator is accomplished by spring pressure.

### CARBURETOR & ECONOMIZER

Vapor enters carburetor through the economizer. It passes by the main gas load adjusting screw, through the calibrated orifice and into the venturi via main gas passage, valve and nozzles. Idle adjustment is made at converter (regulator) and idle fuel enters carburetor base through idle line. When starting engine, the choke plate is closed, simultaneously closing main gas passage. Starting air is drawn through passage in choke plate and starting fuel is drawn through starting gas orifice past adjusting screw. Economizer works from high manifold vacuum pulling diaphragm back closing valve closed so fuel will not pass. When vacuum reaches 4-6 in. Hg, spring pressure on diaphragm opens valve and allows fuel to pass through the calibrated orifice. When a governor is used, economizer must be connected to manifold on engine side of governor throttle. The balance line relays air horn air velocity to fuel regulator, automatically balancing system for variations in air cleaner resistances.




**CONVERTER ASSEMBLY**

## ENSIGN LPG SYSTEM (Cont.)

### FUEL TANK

All tanks conform to national pressure vessel codes, have been inspected, and bear the code stamp. All valves and fittings are Underwriters approved. See illustration for related valves and lines.

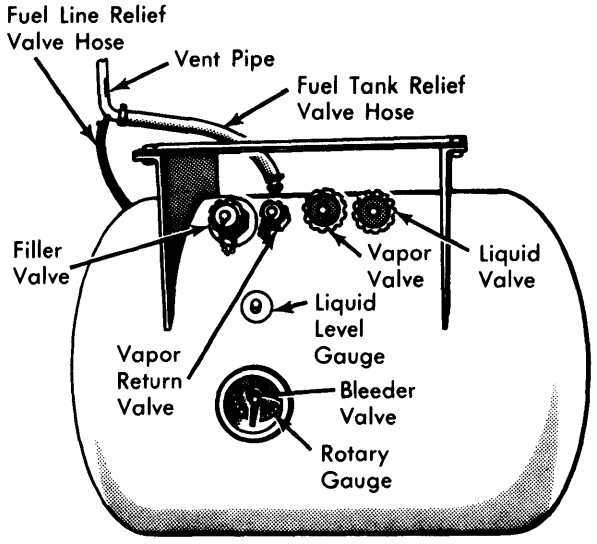
*CAUTION — Engine must be OFF when checking the fuel tanks.*

### SAFETY VALVES

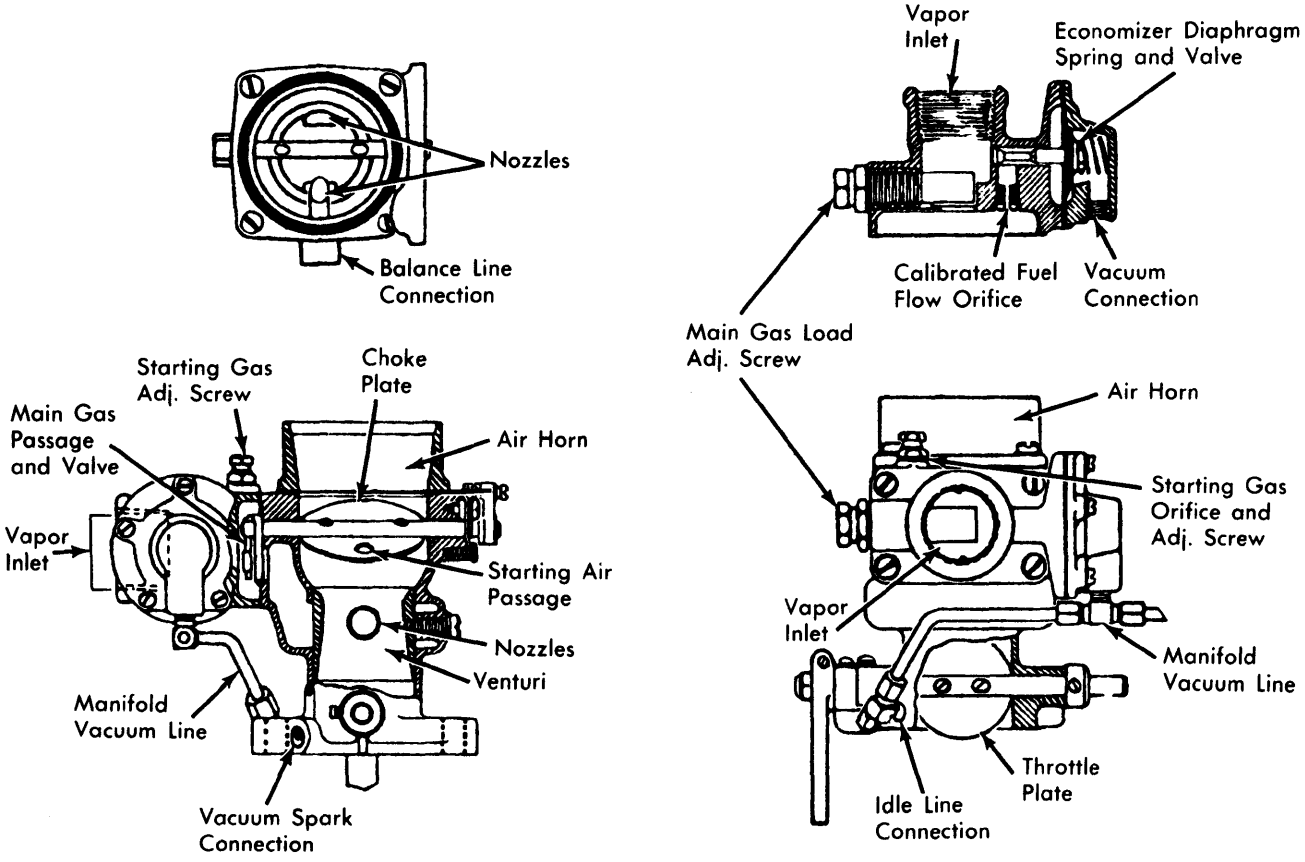
**Excess Flow Valve** — Located in fuel supply line to engine. When fuel flow through this valve exceeds a pre-determined rate, valve automatically shuts off further fuel flow. About 50 seconds are required for valve to relieve itself.

**Fuel Line Relief Valve** — Located at a point within the fuel supply line where it can sense the pressure from all tanks. When pressure exceeds a given amount, valve automatically exhausts pressure through the valve and out the vent pipe.

**Tank Relief Valve** — Located in top of each tank. When tank pressure exceeds a given amount, valve automatically bleeds pressure off through valve and out vent pipe.




**FUEL TANK, LINES & VALVES**




**CARBURETOR AND ECONOMIZER ASSEMBLY**

## ENSIGN LPG SYSTEM (Cont.)

### SUPPLY VALVES

**Vapor Valve and Liquid Valve** – Located on the fuel tank and specially designed to incorporate an excess flow valve. In case of valve damage, line or tubing failure, the excess flow valve will automatically close to prevent an excess of gas from escaping into the atmosphere.

## ADJUSTMENTS

### HOT (SLOW) IDLE RPM

*See appropriate article in TUNE-UP Section.*

### STARTING GAS ADJUSTMENT

*See appropriate article in TUNE-UP Section.*

### ECONOMIZER LOAD ADJUSTMENT

*See appropriate article in TUNE-UP Section.*

### CHOKE ADJUSTMENT

*See appropriate article in TUNE-UP Section.*

## OVERHAUL

*CAUTION – Before performing any work on system, shut off main valves at fuel tank and allow engine to run until all fuel between tank and engine is exhausted. If engine is not running, shut off main valves at tank and bleed fuel from all lines and components between tank and engine.*

### ELECTRICAL UNITS

The coil portion of solenoid valve cannot be overhauled. Replace this and any other electrical components as a unit.

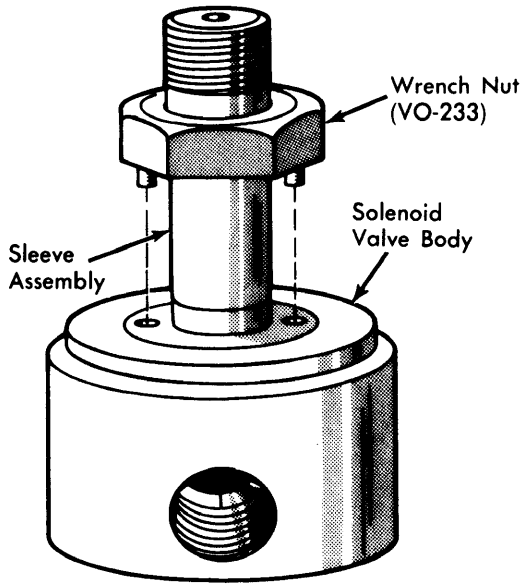
### FUEL TANK(S), VALVES & LINES

All necessary work on fuel tanks should be performed by qualified concerns normally servicing such containers. All valves and lines should be replaced (if required) with Underwriters Approved components.

### SOLENOID VALVE

**Disassembly** – Removal of fuel line to solenoid or solenoid from engine is not required, but ensure fuel is shut off and electrical lead is disconnected. Remove coil cover, cap, coil housing and coil from solenoid valve body. Using a suitable wrench nut (V0-233) remove sleeve assembly from valve body.

**Inspection** – Inspect all parts for wear or damage. *See Trouble Shooting in this article.*

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**SOLENOID VALVE ASSEMBLY AND SLEEVE REMOVING TOOL**

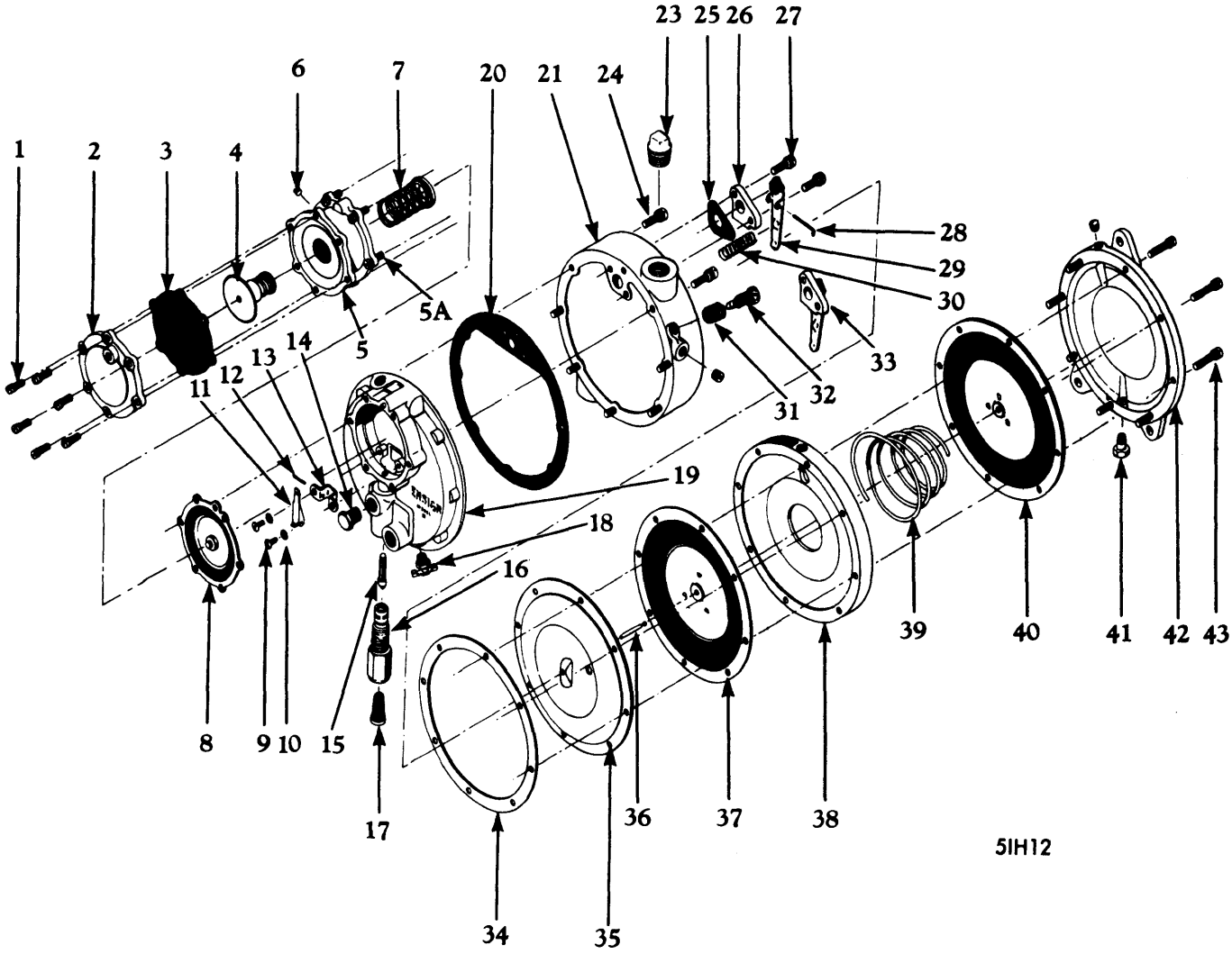
**Reassembly** – Reverse disassembly procedure using new parts as required and note the following: Ensure that seal at flange end and return spring are in place before screwing sleeve into body. With flange assembled into valve body and before assembling coil to valve, test valve by applying 90-100 psi air pressure to port which leaks into valve body chamber and check for leaks at flange using soapy water. *NOTE – When making this test on a valve equipped with a sleeve port located at top of valve, cap off this port before applying air pressure.* When installing coil cover, do not overtighten nut.

## ENSIGN LPG SYSTEM (Cont.)

### CONVERTER (REGULATOR)

**Disassembly** – Using illustration as a guide, disassemble converter, wash all parts, blow dry with air, and inspect all parts for wear or damage.

**Reassembly** – Using illustration as a guide and new parts where required, reassemble converter and note the following: After high pressure valve lever has been installed, measure distance from bottom of groove in lever to mounting point on machined face for diaphragm and regulator. Measurement should be ½" and adjustment is made by moving lever in or out with mounting screws loose. After main valve lever has been installed, measure distance between tops of the channel on either side of lever down to end of lever. Measurement should be $^{13}/_{32}$" and adjustment is made by bending end of lever.




1 – Screw/washer
2 – Regulator Cover
3 – Regulator Diaphragm
4 – Diaphragm Guide
5 – Regulator Body
5A – Screw/washer
6 – Plug
7 – Spring & Cup
8 – High Pressure Diaphragm
9 – Screw
10 – Washer
11 – High Pressure Valve Lever
12 – Lever Pivot
13 – Lever Pivot Support
14 – Plug
15 – High Pressure Valve
16 – Fuel Inlet Seat
17 – Fuel Inlet Strainer
18 – Petcock
19 – Vapor Coil Body
20 – Gasket
21 – Main Body
22 – Bleed Screw
23 – Lever Pivot Plug
24 – Screw/washer
25 – Gasket
26 – Main Valve Seat
27 – Screw/washer
28 – Main Valve Lever Pin
29 – Main Valve Lever
30 – Spring
31 – Retainer
32 – Idle Screw
33 – Main Valve & Seat
34 – Gasket
35 – Body Partition Plate
36 – Pin
37 – Large Regulator Diaphragm
38 – Accel. Plate Assembly
39 – Accel. Diaphragm Spring
40 – Accelerating Diaphragm
41 – Filter
42 – Back Support Plate
43 – Screw/washer
44 – Plug

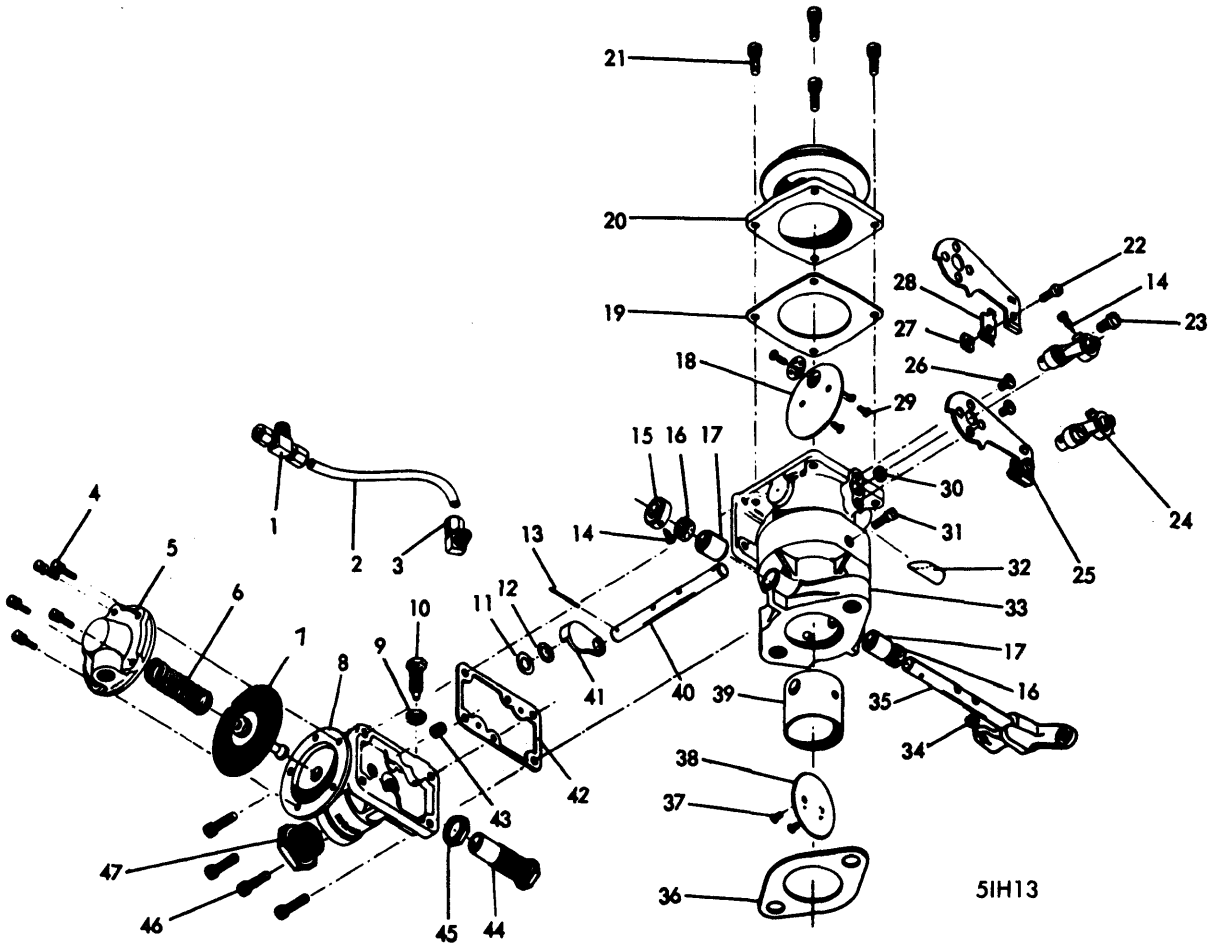
**CONVERTER (REGULATOR) DISASSEMBLED**

## ENSIGN LPG SYSTEM (Cont.)

### CARBURETOR

**Disassembly** – Using illustration as a guide, disassemble carburetor, wash all parts, blow dry with air and inspect all parts for wear or damage.

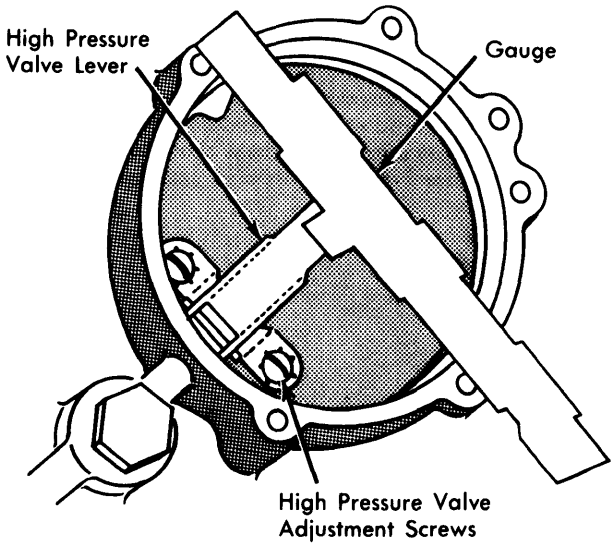
**Reassembly** – Using illustration as a guide and new parts where required, reassemble carburetor using new gaskets and note the following: Ensure choke plate moves freely from full open to full closed positions and that surface on cam lever and mating surface on carburetor are smooth and flat. Before tightening choke plate screws, pull choke shaft outward to ensure that choke valve properly seats over main gas passage.



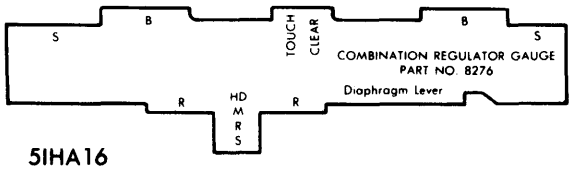

1 – Tee
2 – Vacuum Line
3 – Elbow
4 – Screw/washer
5 – Diaphragm Cover
6 – Diaphragm Spring
7 – Diaphragm
8 – Economizer Body
9 – Locknut
10 – Starting Gas Adj. Screw
11 – Washer
12 – Spring
13 – Pin
14 – Set Screw
15 – Collar
16 – Washer
17 – Bushing
18 – Choke Plate
19 – Gasket
20 – Adapter
21 – Screw/washer
22 – Screw
23 – Screw
24 – Lever
25 – Support
26 – Screw
27 – Nut
28 – Clamp
29 – Screw
30 – Washer
31 – Screw/washer
32 – Nozzle
33 – Carburetor Body
34 – Screw
35 – Throttle Shaft
36 – Gasket
37 – Screw
38 – Throttle Plate
39 – Venturi
40 – Choke Shaft
41 – Main Gas Valve
42 – Gasket
43 – Screw
44 – Main Gas Adj. Screw
45 – Locknut
46 – Screw/washer
47 – Inlet Bushing

**CARBURETOR & ECONOMIZER DISASSEMBLED**

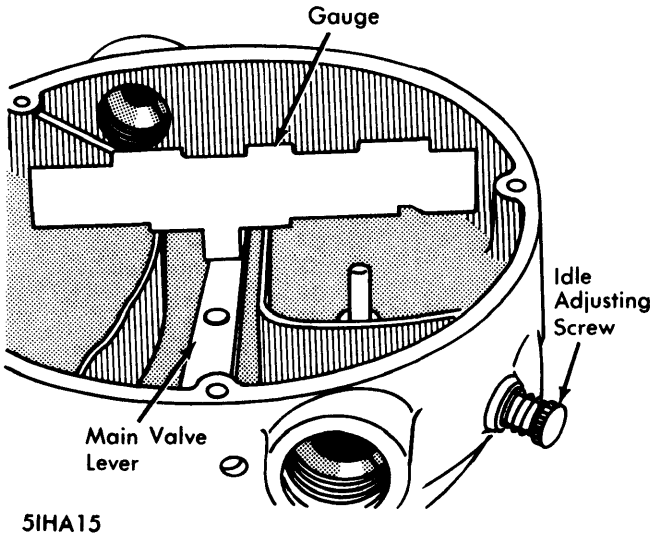
## ENSIGN LPG SYSTEM (Cont.)




**ADJUSTING HIGH PRESSURE VALVE LEVER**




**REGULATOR ADJUSTING GAUGE**




**ADJUSTING MAIN VALVE LEVER**

### SPECIFICATIONS

| | |
|---|---|
| **Converter** | |
| Model | R |
| Capacity (Horsepower) | 200 |
| Working Pressure | 250 lbs. |
| **Carburetor** | |
| Model | |
| BG-241 | XG |
| BG-265 | XG1 |
| Idle Restriction | #65 |
| Venturi | |
| BG-241 | #44 |
| BG-265 | #52 |
| Power Jet | |
| BG-241 | #27 |
| BG-265 | #22 |
| Flange | |
| BG-241 | 1 ½ SAE |
| BG-265 | 1 ¾ SAE |

### TROUBLE SHOOTING

#### SLOW STARTING

Check ignition system, tune-up items, battery and starter.

#### SLOW CRANKING SPEED

1) Check starter current draw. 2) Check lubrication oil to see if it has become too heavy. 3) Check for freeze-up in fuel system caused by the following: Coolant level too low. Defect in cooling system. Check hoses, water pump, thermostat, etc.

#### POWER LOSS

1) Check ignition system and tune-up items. 2) Check liquid level in tank; If liquid is up but does not flow through liquid valve, dip tube on liquid outlet is ruptured or broken. 3) Check fuel system for proper operation of valves, fuel delivery and vaporization.

#### POOR ECONOMY

1) Check all items under Power Loss. 2) Check calibration of fuel tank gauge. 3) At time of refueling, check for proper refueling procedure and that metering device at fuel supply pump is accurate.

#### ROUGH IDLE

1) Check ignition system and all tune-up points. 2) Check all points of vacuum for vacuum leaks.

#### ENGINE DIES WHEN VEHICLE IS BROUGHT TO STOP

1) Check fuel flow through vapor hose. 2) Check ignition system and all tune-up items. 3) Check all points of vacuum for vacuum leaks.

#### OVER-HEATING

**1) Check cooling system and all related components. 2) Check for lean air/fuel mixture.**