1975-79 FUEL SYSTEMS
General Motors Diesel Fuel Injection

1978-79 350" V8 Diesel Engine

DESCRIPTION

A mechanical high pressure rotary pump, gear driven by the camshaft, injects a precisely metered amount of fuel to each cylinder at the proper time. The pump is mounted on top of the engine and provides necessary timing advance under all operating conditions. *See Fig. 1.*

Engine RPM is controlled by a rotary fuel metering valve. As the accelerator pedal is pushed down, a throttle cable opens the metering valve and allows increased fuel delivery.

A fuel filter is located between the mechanical fuel pump (mounted on the side of the engine block) and the injection pump. Any excess fuel is returned to the tank by a fuel return system. *See Fig. 3.*

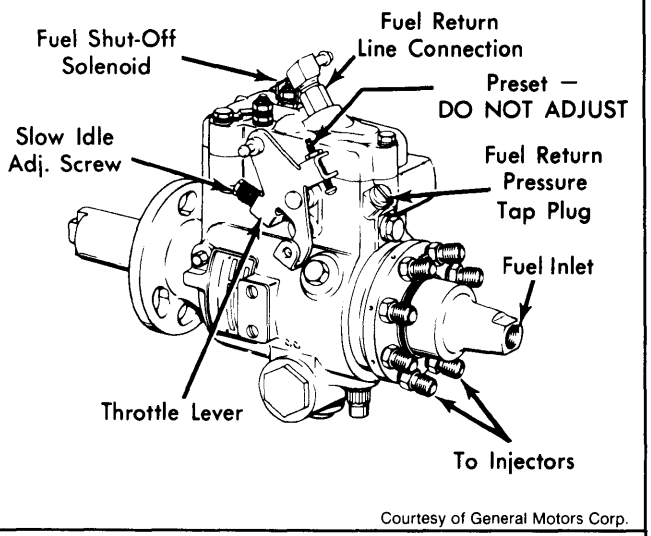

Fig. 1: Diesel Injection Pump

OPERATION

AIR INDUCTION SYSTEM

An air crossover assembly is located on top of the engine. It is bolted to the intake manifold and serves only as an air inlet. The air crossover assembly is an open chambered housing with a single inlet, drawing air through an air filter mounted above.

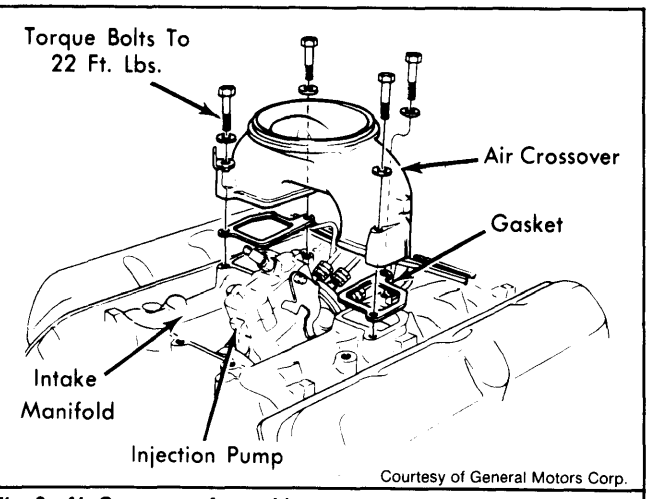

Fig. 2: Air Crossover Assembly

The air crossover assembly has 2 branches, one leading to each side of the intake manifold. *See Fig. 2.* Gaskets are installed between air crossover assembly and manifold.

FUEL DELIVERY SYSTEM

Diesel fuel drawn from the fuel tank by an engine mounted mechanical fuel pump. *See Fig. 3.* This pump is driven by an eccentric cam mounted on the camshaft and delivers 5 1/2-6 1/2 psi to the main injection pump. A small screen type filter is located in the fuel tank pick-up.

A larger sealed 11-12 micron fuel filter is located on the rear of the engine between fuel pump and main injection pump. Diesel fuel arrives at the center inlet fitting on the injection pump after leaving the filter. A fuel return line is provided to return any excess fuel to the tank.

NOTE: Never use starter fluid to aid in starting this engine.

INJECTION PUMP

The Roosa-Master injection pump is mounted on top of engine, beneath the air crossover. This pump is cam driven and delivers fuel to the injectors at 1800-2000 psi. *See Fig. 1.*

Driven at camshaft speed, the rotary pump can precisely govern time and amount of fuel injection. Eight equal-length pipes, running from pump to injectors at each cylinder, ensure that injection timing does not vary from cylinder to cylinder.

FUEL LINES

Eight high pressure lines are routed from injection pump to each injector nozzle. The lines are of equal length but are bent differently. Lines are not interchangeable and are pre-bent by the manufacturer. There are 2 types of lines used, pipes with Ferrule ends at each injector nozzle and lines with tapered ends at each injector nozzle.

DIESEL FUEL INJECTION LINES

Cylinder No.	Part No. Tapered	Part No. Ferruled
1	563611	560421
2	563612	560422
3	563613	560423
4	563614	560424
5	563615	560425
6	563616	560426
7	563617	560427
8	563618	560428

INJECTION NOZZLES

One injection nozzle is located in each combustion chamber. It has a single fuel inlet fitting and a return line for removal of excess fuel. Nozzle is retained in head by a bolt and clamp. Injection nozzles are spring loaded and calibrated to open at a specified fuel pressure. The engine end of nozzle has a replaceable compression seal and carbon stop seal.

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General Motors Diesel Fuel Injection (Cont.)

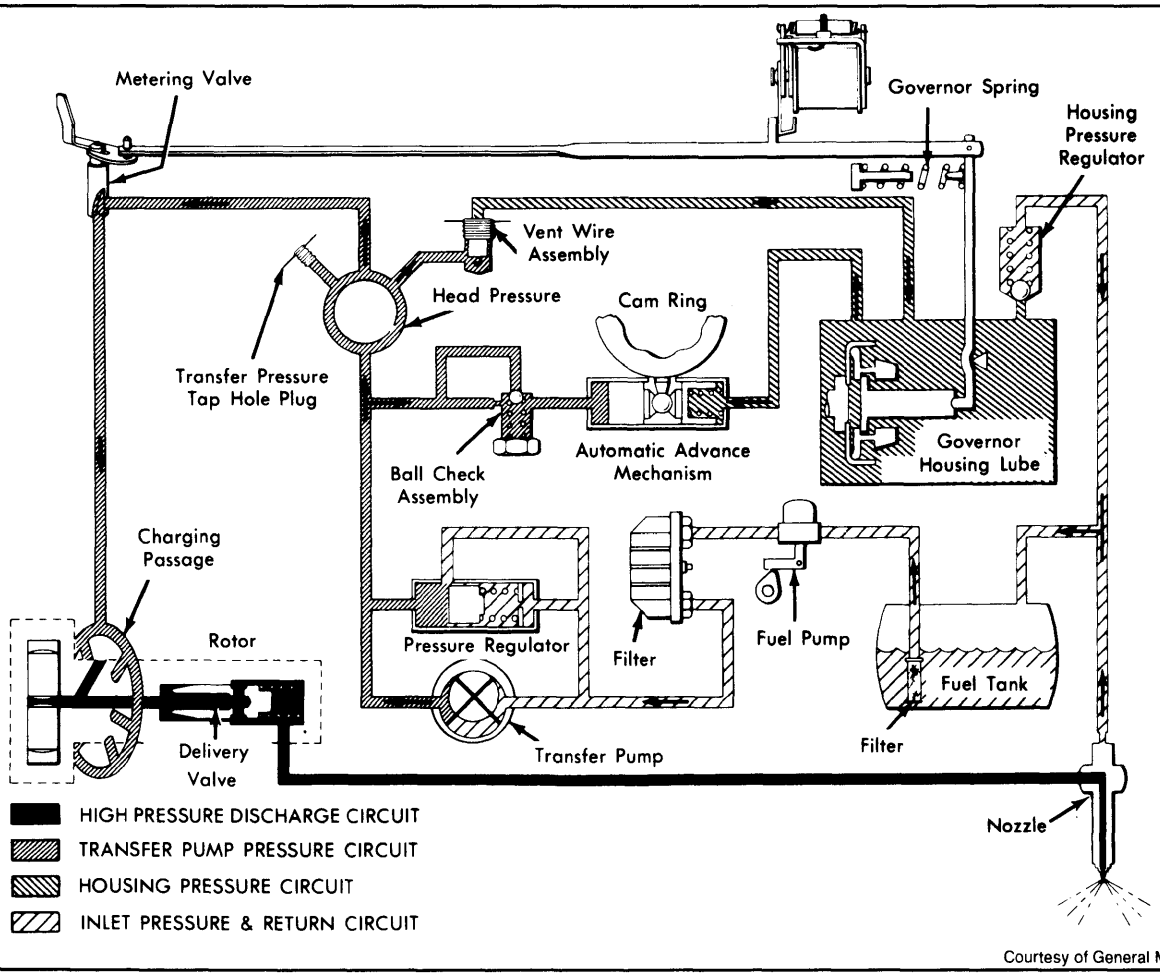


Fig. 3: Diesel Injection Pump Fuel Circuit Diagram

GLOW PLUGS

One glow plug is used in each combustion chamber. These electrically operated glow plugs are used to heat the pre-chamber to aid in starting the engine. They are actually miniature heaters that turn on when ignition key is turned to "RUN" position prior to starting the engine.

There are 2 types of glow plugs. The first type uses a continous 12 volts to heat the plug. The second type uses a controlled pulsing current with 6 volts. These plugs can be identified by the width of the electrical connection. The first type uses a 1/4" wide blade connector while the second type uses a 5/16" wide blade connector. Both types of plug remain on for a short time after engine starts.

Depending on coolant temperature, glow plugs will activate for a period of time (longer for cold engine, shorter for warm engine). A Yellow "WAIT" or "DON'T START" light on the dash panel will come on. When "WAIT" light goes out and Green indicator lights up, pre-chamber is sufficiently warm to cause combustion and start engine. At temperatures below -10°F, a block heater must be used to aid in starting.

CAUTION: Do not interchange the 2 types of glow plugs.

FLOW CONTROL VALVE

A flow control valve is installed on diesel engines to act as a PCV system. *See Fig. 4.* This valve is located just behind the air crossover assembly and connects to a "T" adapter. Branches run from the adapter to each valve cover.

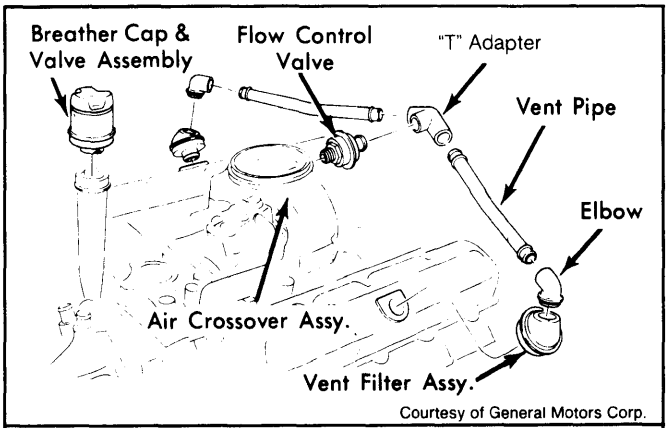


Fig. 4: Flow Control Valve

1975-79 FUEL SYSTEMS
General Motors Diesel Fuel Injection (Cont.)

VACUUM PUMP

Air conditioned vehicles, vehicles equipped with cruise control, or a transmission modulator are equipped with a cam driven mechanical vacuum pump. This pump is combined with the oil pump drive and is located at back of engine, behind air crossover assembly. *See Fig. 5.*

Maximum vacuum available at the vacuum pump is 18 in. Hg. A reducer valve in some systems cuts vacuum to 5-7 in. Hg. The engine MUST NOT be operated without vacuum pump or oil pump drive assembly installed.

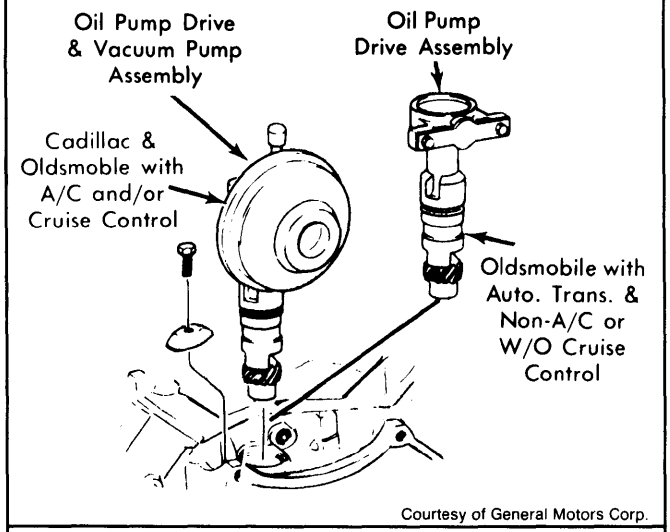


Fig. 5: Vacuum Pump & Oil Pump Drive Assemblies

TESTING

FUEL PRESSURE

1) Remove air crossover assembly. Install Screened Covers (J-26996-2) over openings in intake manifold. Remove pressure tap plug from injection pump. *See Fig. 1.*
2) Place seal from pressure tap plug onto Pressure Tap Adapter (J-28526). Screw adapter into pump in place of plug. Connect a low pressure gauge to adapter. Install magnetic pickup tachometer.
3) Start engine. Run engine at 1000 RPM with transmission in Park. Observe gauge. Pressure should be 8-12 psi with no more than 2 psi fluctuation. If pressure is incorrect, replace fuel return line connector assembly.
4) Recheck pressure. If pressure is still not correct, remove injection pump for repair. Pump must be exchanged for another unit. See INJECTION PUMP removal and installation procedures in this article.
5) Remove tachometer, pressure gauge and adapter. Install a new pressure tap plug seal on plug. Install tap plug into pump. Remove screened covers from manifold. Install air crossover assembly.

REMOVAL & INSTALLATION

FUEL LINES

Removal - 1) Remove air crossover assembly and install Screened Covers (J-26996-2) over manifold openings. Remove injection pump line clamps.
2) Remove injection pump lines and cap open lines. Disconnect lines at nozzle inlet fittings and cap open fittings on nozzle. It is not necessary to remove pump to replace a line.

NOTE: If several lines are to be replaced, start by connecting lower lines first.

Installation - Install new injection pump lines loosely. Position line and tighten. Tighten line-to-pump fitting to 35 ft. lbs. and line-to-nozzle fittings to 25 ft. lbs. Install line clamps. Start engine and check for fuel leaks. Remove screened covers from intake manifold and install air crossover and air filter assembly.

INJECTION PUMP

Removal - 1) Remove air crossover assembly and place Screened Covers (J-26996-2) over intake manifold openings. Disconnect throttle rod and return spring.
2) Remove bellcrank. Remove throttle and throttle valve cables from intake manifold brackets. Position cables away from engine. Remove lines to fuel filter and remove filter.
3) Disconnect fuel line at fuel pump and remove fuel line to injector pump. Disconnect fuel return line at injection pump. Slide clamp off fuel return lines at nozzles. Remove fuel return lines from each side of engine.
4) Using 2 wrenches, disconnect injection pump lines at nozzles. Using Injection Pump Wrench (J-26987), remove 3 nuts securing injection pump. Remove pump and cap all open lines and nozzles.

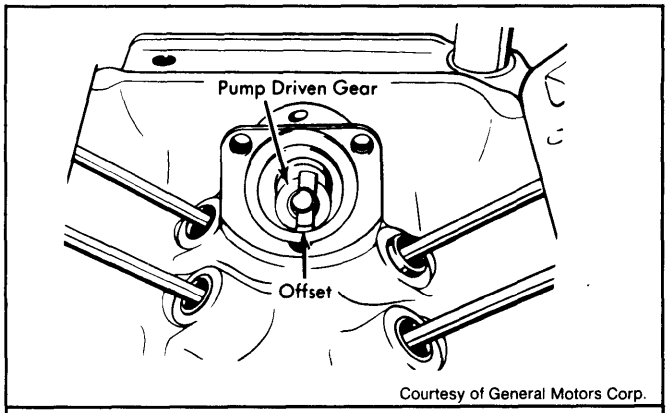


Fig. 6: Pump Driven Gear Offset (Intake Manifold Removed)

Installation - 1) Remove caps over fittings. Line up the offset tang on pump driveshaft with pump driven gear and install pump. *See Fig. 6.* Install 3 nuts and lock washers securing pump, but DO NOT tighten.
2) Connect pump lines at nozzles and tighten to 25 ft. lbs. with 2 wrenches. Connect fuel return lines to nozzles and pump. Align mark on injection pump with line on adapter. *See Fig. 7.* Tighten retaining nuts to 18 ft. lbs.

NOTE: Use a 3/4" wrench on boss at front of injection pump to help in rotating pump while aligning marks.

3) Adjust throttle rod. See ADJUSTMENTS in this article. Install fuel line from fuel pump to fuel filter. Install bellcrank and clip. Install throttle and throttle valve cables to intake manifold.
4) Attach cables to bellcrank. Connect throttle rod and return spring. Start engine and check for fuel leaks. Remove screened covers and install air crossover and filter assembly.

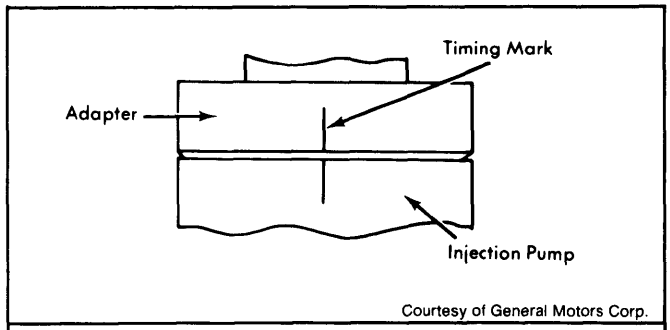


Fig. 7: Aligning Timing Marks On Pump & Adapter

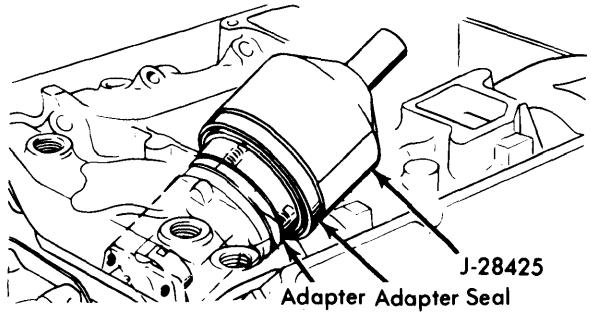
INJECTION PUMP ADAPTER, SEAL & NEW ADAPTER TIMING MARK

Removal - Remove air cleaner, air crossover, injection pump and lines. Remove injection pump adapter. Remove seal from pump adapter.

Installation - 1) File timing mark off of injection pump adapter. DO NOT file timing mark off of injection pump. Rotate engine to place No. 1 piston at TDC. Align mark on balancer with zero (0) mark on indicator.

NOTE: Index is offset to the right with No. 1 at TDC.

2) Apply chassis lube to seal area on adapter taper edge and seal area in intake manifold. Install adapter and leave loose. Lubricate seal, inside and out, with chassis lube. Install seal on Seal Installer (J-28425).

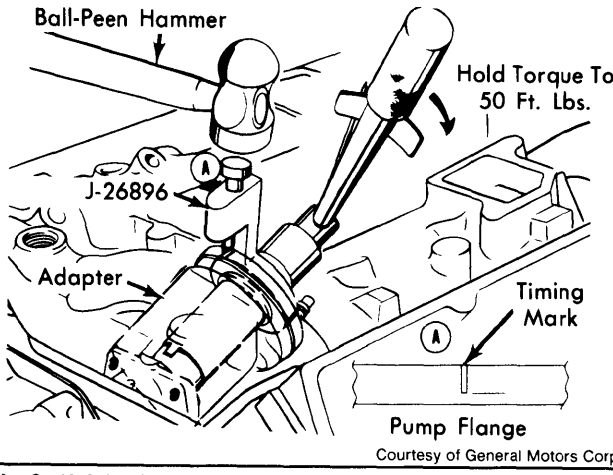


Courtesy of General Motors Corp.

Fig. 8: Installation of New Adapter Seal

3) Push seal onto pump adapter using installer. *See Fig. 8*. Remove seal intaller. Observe seal for proper positioning. Torque adapter bolts to 25 ft. lbs.

4) Install Injection Pump Timer (J-26896) into injection pump adapter. Torque timer in direction of No. 1 cylinder to 50 ft. lbs. While holding torque, mark injection pump *See Fig. 9*. Remove injection pump timer. Install injection pump, lines and air crossover assembly.



Courtesy of General Motors Corp.

Fig. 9: Holding Torque On Adapter While Marking Timing Marks

INJECTION NOZZLES

Removal - **1)** Remove fuel lines from bank of engine where nozzle is to be serviced. DO NOT bend lines out of way to remove nozzle.

2) Cap open fittings and nozzles. Remove fuel return line clamps from all nozzles on side of engine where nozzle is to be removed. Remove appropriate fuel return line(s).

3) Remove nozzle spring clamp and spacer. Remove nozzle using Injector Nozzle Remover (J-26952). Cap nozzle inlet line and nozzle tip. Tip of nozzle must be protected from any damage or dirt.

Installation - 1) If old nozzle is to be reinstalled after removal, remove old carbon stop seal and compression seal. Install new carbon stop and compression seals. *See Fig. 10*.

2) Remove caps from open fittings and lines. Install nozzle, spring clamp and spacer. Torque bolt to 25 ft. lbs. Reinstall fuel return lines and clamps. Install fuel delivery lines. Start engine and check for leaks.

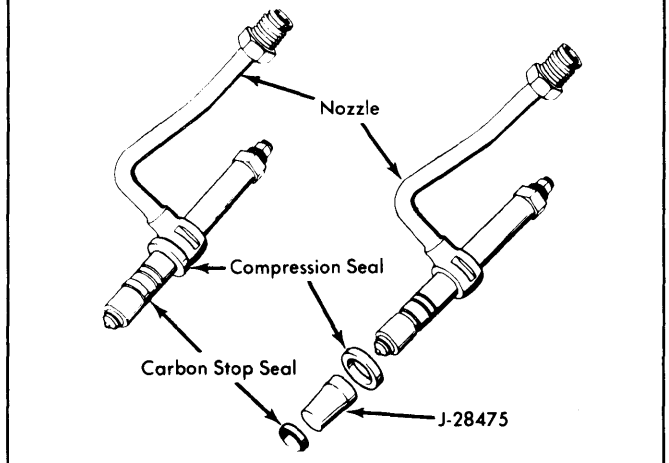


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Fig. 10: Injection Nozzle Showing Seals

GLOW PLUGS

Removal & Installation - 1) Glow plugs are mounted near each injector nozzle in the cylnder heads. They are threaded and have an electrical wire plugged into the top end.

2) Remove electrical wire from glow plug. Using deep-well socket, remove glow plug. Install new glow plug and torque to 12 ft. lbs. Connect wire to glow plug.

PRE-CHAMBER

Removal & Installation - 1) Remove cylinder head and remove pre-chamber. There is one pre-chamber for each combustion chamber in cylinder head. Pre-chamber is opposite glow plug and can be tapped out with small blunt drift.

2) When removing pre-chamber, be sure to remove injection nozzle and glow plug from head first. If not, glow plug and/or nozzle could be bent and need replacement.

ADJUSTMENTS

HOT (SLOW) IDLE RPM

See appropriate article in TUNE-UP PROCEDURES section.

COLD (FAST) IDLE RPM

See appropriate article in TUNE-UP PROCEDURES section.

INJECTION PUMP TIMING

1) Engine is properly timed when marks on top of injection pump adapter and pump flange are aligned. *See Fig. 7*. If marks are not aligned, adjustment is necessary.

2) With engine off, loosen 3 pump retaining nuts with Injection Pump Wrench (J-26987). Align mark on pump with mark on adapter and tighten nuts to 18 ft. lbs.

NOTE: Use 3/4" wrench on boss at front of pump to turn pump while aligning marks.

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General Motors Diesel Fuel Injection (Cont.)

THROTTLE ROD

1) Turn engine off. On cruise control equipped models, remove clip from cruise control rod. Remove rod from bellcrank. *See Fig. 11.*
2) Remove throttle valve cable (THM 200) or detent cable (THM 350) from bellcrank. Loosen lock nut on throttle rod. Shorten rod by several turns. Rotate bellcrank to full throttle stop.
3) Lengthen throttle rod until injection pump lever contacts injection pump full throttle stop. Release bellcrank. Tighten throttle rod lock nut. Connect throttle valve or detent cable and cruise control rod to bellcrank.

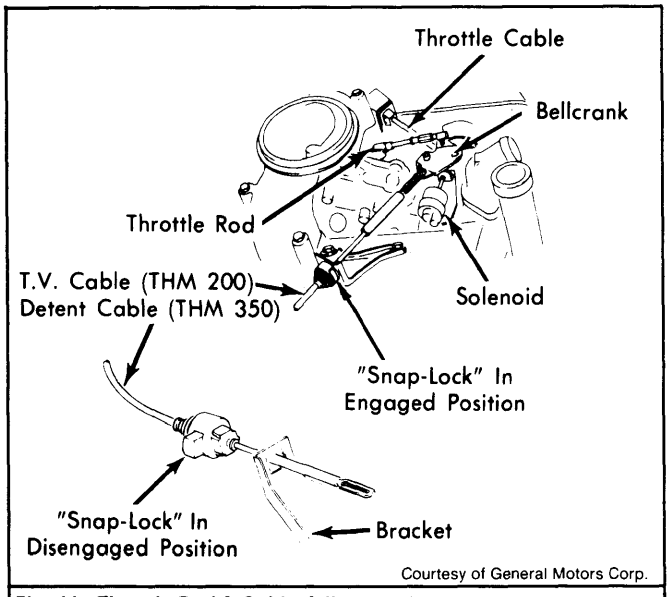

Fig. 11: Throttle Rod & Cable Adjustments

THROTTLE VALVE CABLE

Models With THM 200 Transmission - With engine off, remove throttle rod from bellcrank. Push snap-lock to disengaged position. *See Fig. 11.* Rotate bellcrank to full throttle stop and hold there. Push in snap-lock until it is even with cable end fitting. Release bellcrank. Reconnect throttle rod.

DETENT CABLE

Models With THM 350 Transmission - With engine off, remove throttle rod from bellcrank. Push "snap-lock" to disengaged position. *See Fig. 11.* Rotate bellcrank to full throttle stop and hold there. Push in "snap-lock" until it is even with cable end fitting. Release bellcrank. Reconnect throttle rod.

TRANSMISSION VACUUM VALVE

1978 Models With THM 350 Transmission - 1) Remove throttle rod from bellcrank. Loosen transmission vacuum valve bolts enough to disengage valve from injection pump shaft. Hold pump lever against injection pump full throttle stop.
2) Rotate transmission vacuum valve to full throttle stop position. Insert a .090" plug gauge to hold throttle valve in full throttle stop position. *See Fig. 12.*
3) Turn assembly clockwise until injection pump lever shaft is contacted. Tighten transmission vacuum valve bolts. Remove pin from vacuum valve and release lever. Reconnect throttle rod to bellcrank.

1979 Models With THM 350 Transmission - 1) Remove air crossover and install Screened Covers (J-26996-2). Remove throttle rod from throttle lever. Loosen transmission vacuum valve bolts.
2) Install Angle Gauge Adapter (J-26701-15) on injection pump throttle lever. Install Angle Gauge (J-26701) on adapter. Rotate throttle lever to wide open throttle position. *See Fig. 13.*

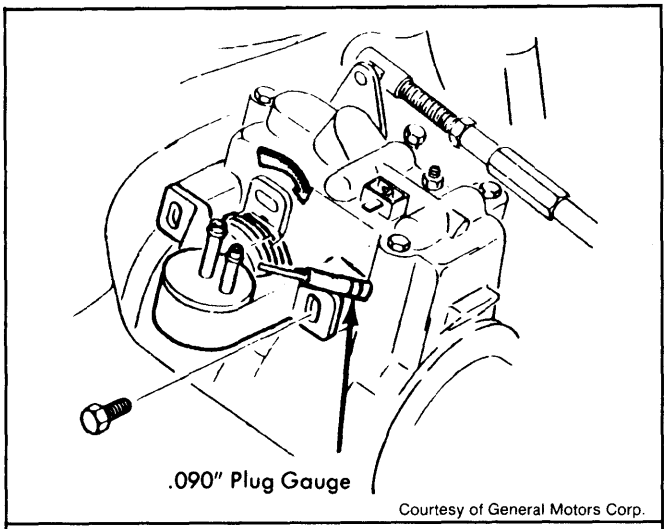

Fig. 12: 1978 Transmission Vacuum Valve Adjustment

3) Set angle gauge to zero degrees and center bubble in gauge. Reset angle gauge to 49 degrees. Rotate throttle lever until bubble in level is centered. Hold throttle lever in this position while completing adjustment.
4) Attach an outside vacuum source to center port of vacuum valve. Attach vacuum gauge to outside port of vacuum valve. Apply 18-22 in. Hg vacuum with outisde vacuum source.
5) Rotate vacuum valve until 8 1/2 in. Hg is indicated on vacuum gauge. Tighten vacuum valve bolts. Remove adapter and gauge. Install throttle rod to throttle lever. Remove screened covers and install air crossover.

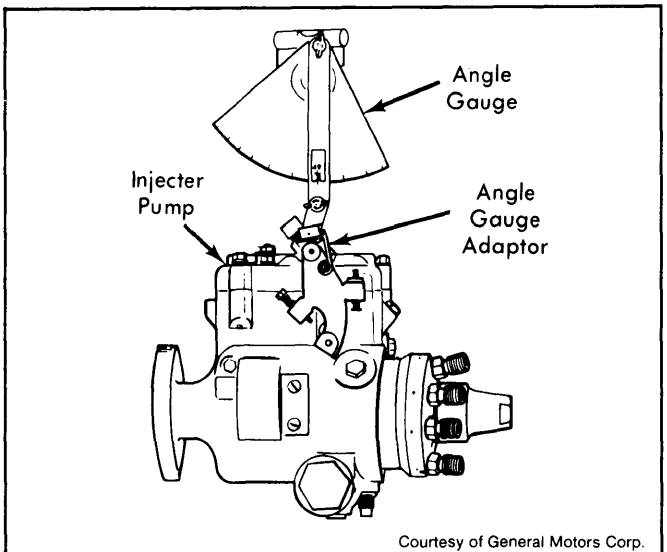

Fig. 13: 1979 Transmission Vacuum Valve Adjustment

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs.
Fuel Pump-to-Block Bolt/Nut	25
Glow Plugs	12
Injection Line Nuts-to-Nozzle	25
Injection Line Nut-to-Pump	35
Injection Pump Adapter Bolts	25
Injection Pump Attaching Nuts	18
Injection Pump Fuel Filter Inlet	20
Injection Pump Fuel Filter Outlet	10
Injection Pump Fuel Inlet Line	20
Nozzle Clamp	25