1967-70 GENERAL MOTORS DIESEL 3-CYLINDER FUEL INJECTION

DESCRIPTION

A fuel pump draws fuel from tank through a strainer and forces it, under pressure, through a filter. Fuel is then forced through fuel inlet passage in cylinder head and through fuel lines to injectors. Fuel then passes through another filter element within injector to a chamber where it is metered, displaced and atomized through spray tip into combustion chamber. Excess fuel is circulated through injectors by pump and serves as a coolant. Circulation of excess fuel also eliminates air or vapor in lines by returning it to fuel tank where it is vented to the atmosphere. This excess fuel is returned to tank through restricted fitting in outlet fuel pipe.

OPERATION

INJECTION FUEL PUMP

Fuel enters suction side of pump to fill space between pump gear teeth. Teeth then carry fuel oil to discharge side of pump where fuel is forced out through outlet cavity. This is a continuous cycle, thus keeping fuel under pressure at all times.

PRESSURE RELIEF VALVE

Pressure relief valve relieves pressure by returning fuel from outlet side of pump to inlet side when discharge pressure reaches 65-75 psi.

GOVERNOR

Limiting Speed Governor – Limiting speed governor, mounted at rear end plate of engine, controls engine idle speed and maximum engine operating speed. This is accomplished through the balancing action between centrifugal weights and tension springs which control injector rack position.

Variable Speed Governor – Variable speed governor, mounted at rear end plate of engine, controls engine idle speed, maximum no-load speed and holds any constant speed desired by vehicle operator. This is accomplished through the balancing action between centrifugal weights and tension springs which control injector rack position.

INJECTORS

Crown Valve Injectors – Fuel enters injector through filter under pressure. It remains in supply chamber until action of injector rocker forces fuel through upper and lower helicies. The relation of these helicies to the two ports, which changes with rotation of plunger, meters fuel. As plunger moves down, fuel is pressurized and when sufficient pressure is built up, fuel forces crown valve off its seat. Fuel is then forced through small orifices in spray tip and atomized into combustion chamber.

Needle Valve Injector – Operation of needle valve injector is similar to that of crown valve injector, except fuel pressurized by plunger passes into tip cavity where it is further pressurized before being delivered to needle valve for injection into cylinder.

ADJUSTMENT

INJECTOR TIMING

With engine at normal operating temperature, place stop lever in no fuel position. Remove rocker cover and rotate engine until exhaust valves are completely open on cylinder to be timed. Place small end of suitable injector timing tool (J-1853) in hole in top of injector follower. Loosen push rod lock nut. Turn push rod and adjust injector rocker arm until extended part of tool will just pass over top of injector follower. Hold push rod and tighten lock nut. Time remaining injectors in same manner. Install new gasket and rocker cover.

GOVERNOR

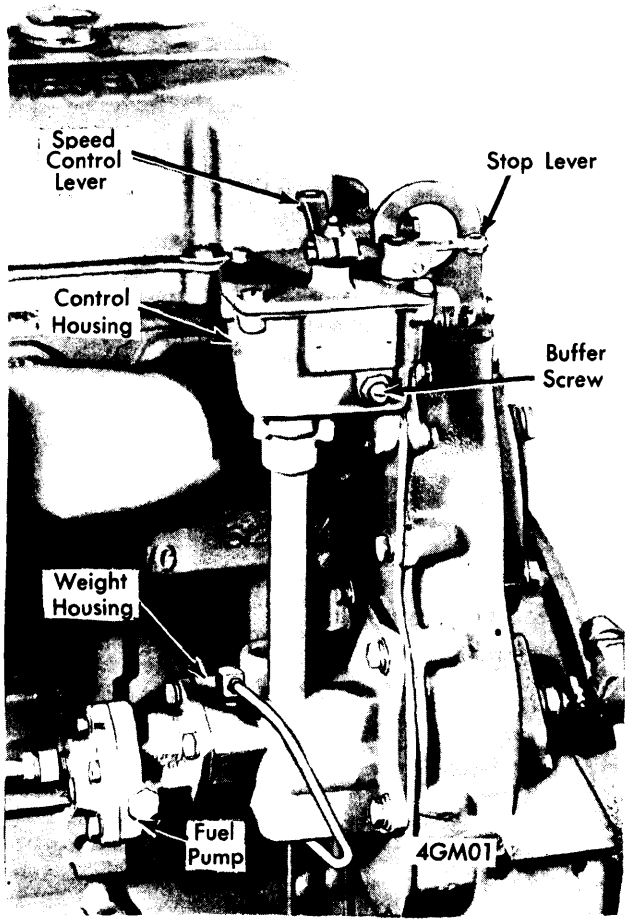
NOTE – Two types of governors are used and may be identified by letters D.W.-L.S. (double weight limiting speed) or S.W.-V.S. (single weight variable speed) stamped on name plate.

Limiting Speed Governor – 1) Remove high speed spring retainer cover. Back out buffer screw until it extends 5/8" beyond governor housing. Remove rocker cover. Start engine and adjust idle speed screw to obtain an idle of 500-600 RPM.

NOTE – Recommended idle speed is 500-600 RPM, but may vary with special engine applications.

2) Stop engine and remove governor cover. Start engine and control speed manually by operating injector control tube lever. Adjust engine speed between 800-1000 RPM. Gap between low speed spring cap and high speed spring plunger should be. 0015". Adjust gap adjusting screw as required.

3) Install governor cover, making sure speed control lever pin engages slot in differential lever. Install screws and lock washers finger tight Pull cover away from engine and tighten screws. This will properly locate cover on governor housing.



LIMITING SPEED GOVERNOR

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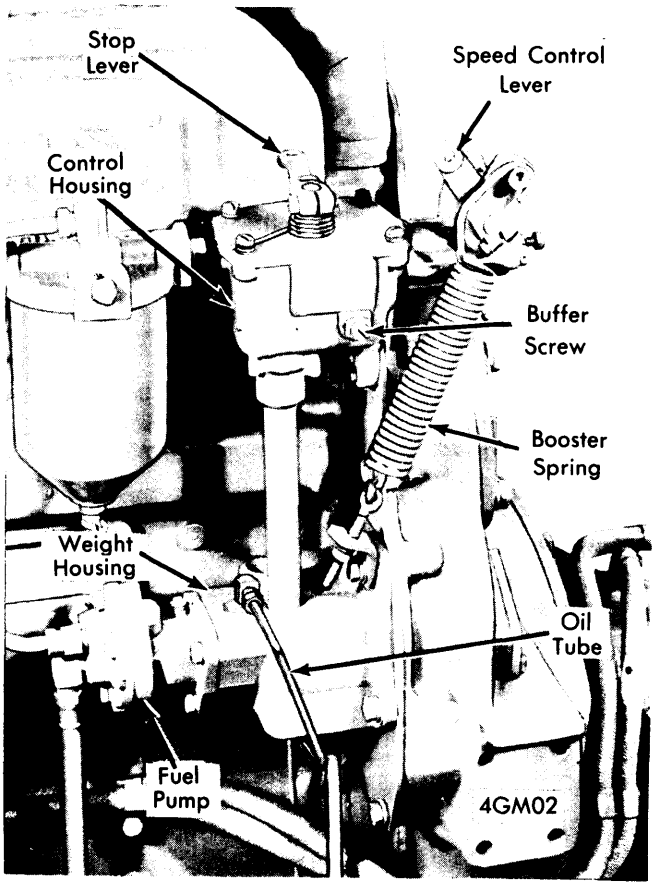
Variable Speed Governor – 1) After adjusting exhaust valves and timing fuel injectors, disconnect any linkage attached to governor levers. Remove governor cover and place speed control lever in maximum speed position.

2) Insert .006" feeler gauge between spring plunger and plunger guide, loosen lock nut and adjust screw in or out until a slight drag is noted on feeler gauge. Tighten lock nut and recheck clearance.

3) Place governor cover on housing, with pin in throttle shaft assembly entering slot in differential lever. Install cover screws and lock washers finger tight. Pull cover away from engine and tighten screws. This will properly locate cover on governor housing.



VARIABLE SPEED GOVERNOR

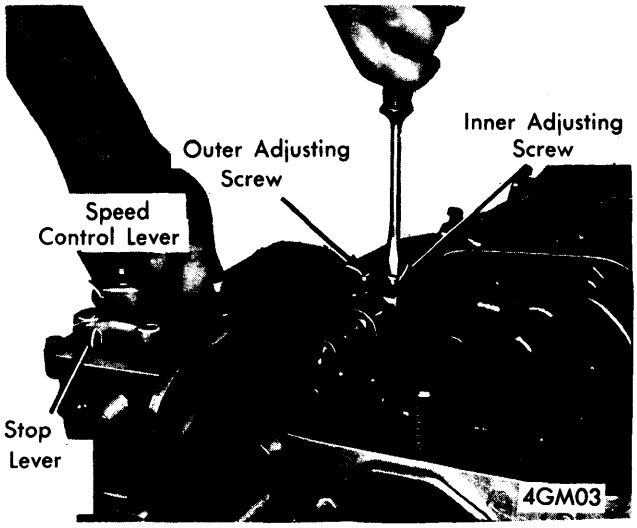
INJECTOR RACK CONTROL LEVERS

W/Limiting Speed Governor – 1) Starting with rear injector rack, disconnect any linkage attached to speed control lever. Loosen all inner and outer injector rack adjusting screws. Levers should be free on injection control tube.

2) Move speed control lever to full fuel position. Turn inner adjusting screw down on rear injector rack control lever until increased effort is noted. Turn down outer adjusting screw until it bottoms lightly on injector control tube. Then alternately tighten both inner and outer adjusting screws until they are tight.

3) To be sure of proper rack adjustment, make the following check. Hold speed lever in full fuel position. Press down on injector rack coupling to rotate. Setting is sufficiently tight if coupling returns to its original position. If coupling is too loose, back off outer adjusting screw slightly and tighten inner screw. Coupling is too tight if, when moving speed control lever from idle to maximum speed position, injector rack coupling becomes tight before speed control lever reaches full travel. Back off inner adjusting screw slightly and tighten outer adjusting screw.

4) Manually hold rear injector control lever in full fuel position and adjust adjacent lever as rear lever in previous steps. When settings are correct, racks of both injectors must be snug on ball end of their rack control levers. Position remaining racks in a like manner.



RACK ADJUSTMENT

W/Variable Speed Governor – 1) Starting with rear injector rack control lever, loosen lock nut and back buffer screw out approximately 5/8". Remove valve rocker cover. Loosen all inner and outer injector rack control lever adjusting screws. Be sure all injector rack control levers are free of injector control tube.

2) Move speed control lever to maximum speed position. Move stop lever to RUN position and hold with light finger pressure. Turn inner adjusting screw of rear injector rack control lever down until a slight movement of control is observed or a slight increase in effort is noted. This will place rear injector rack in full fuel position. Turn outer adjusting screw down until it lightly bottoms on injector control tube. Then alternately tighten both inner and outer adjusting screws.

3) Check to see that control lever is properly adjusted by holding stop lever in run position and pressing down on injector rack, causing rack to rotate. Setting is sufficiently tight if rack returns to original position when pressure is released. If rack is too loose, back off outer adjusting screw slightly and tighten inner adjusting screw. Setting is too tight if, when moving stop lever from stop to run, injector rack becomes tight before stop lever reaches end of its travel. To correct, back off inner adjusting screw slightly and tighten outer adjusting screw.

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4) Manually hold rear injector in full fuel position with lever on injector control tube. Adjust adjacent rack using same method as before. Recheck rear injector rack to be sure that it has remained snug on ball end of rack control lever. When settings are correct, racks of both injectors must be snug on ball end of their respective levers. Adjust remaining racks as previously described.

MAXIMUM NO-LOAD ENGINE SPEED

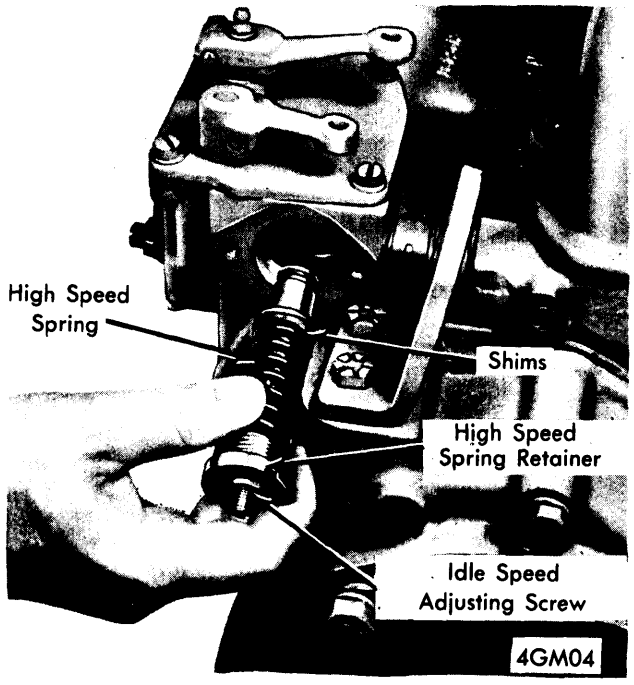
W/Limiting Speed Governor – 1) With engine at normal operating temperature, place speed control lever in maximum speed position and note engine RPM. Stop engine and if necessary, adjust engine no-load speed.

2) Remove high speed spring retainer, spring and plunger. Remove high speed spring from plunger and add or remove shims to adjust no-load speed.

CAUTION – Do not jar assembly while it is being removed, to prevent low speed spring and cap from dropping into governor.

NOTE – Shims are available in .010" and .078" thickness. Each .010" shim will increase engine speed approximately 10 RPM.

3) Replace high speed spring, plunger and retainer in governor and tighten securely. Start engine and recheck no-load RPM.



MAXIMUM NO-LOAD ENGINE SPEED ADJUSTMENT

W/Variable Speed Governor – *NOTE – Maximum no-load speed varies with full load operating speed desired. Use an accurate tachometer to determine maximum no-load speed and with Engine Speed Droop Table make following adjustments:*

Engine Speed Droop

Fuel Load RPM	Max. Governor Droop RPM
0-1200	125
1201-1400	135
1401-1600	145
1601-1800	155
1801-2000	165
2001-2200	175
2201-2400	185
2401-2600	195
2601-2800	205

EXAMPLE – If full load speed is to be 2200 RPM, then the no-load speed should be 2375 RPM. (2200+175=2375).

1) Disconnect booster spring and stop lever retracting spring. Remove attaching bolts and withdraw variable speed spring housing and variable speed spring retainer located inside of housing. Using shim table, determine shims or stops required for desired full load speed.

NOTE – A split stop can only be used with a solid stop.

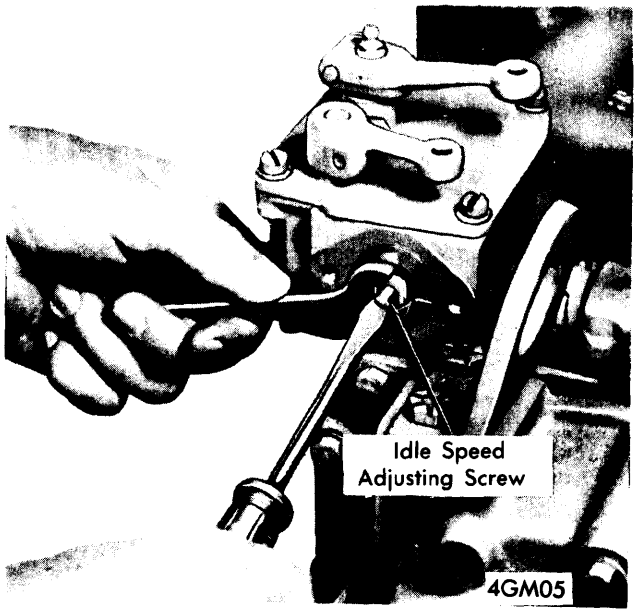
Shim Table

Full Load RPM	Stops		Shims
	Solid	Split	
1200-1575	1	2	As Needed
1576-2025	1	1	As Needed
2026-2625	1	0	As Needed
2626-2800	0	0	As Needed

2) Install variable speed spring housing. Connect booster spring and stop lever spring and recheck maximum no-load speed. If required, add shims to obtain necessary operating speed.

NOTE – For each .001" in shims added, operating range will increase approximately 2 RPM.

NOTE – If maximum no-load speed is changed more than 50 RPM by installation or removal of shims or stops, recheck governor gap. If readjustment of governor gap is required, position of injection racks must be rechecked.



IDLE SPEED ADJUSTMENT

1967-70 GENERAL MOTORS DIESEL 3-CYLINDER FUEL INJECTION (Cont.)

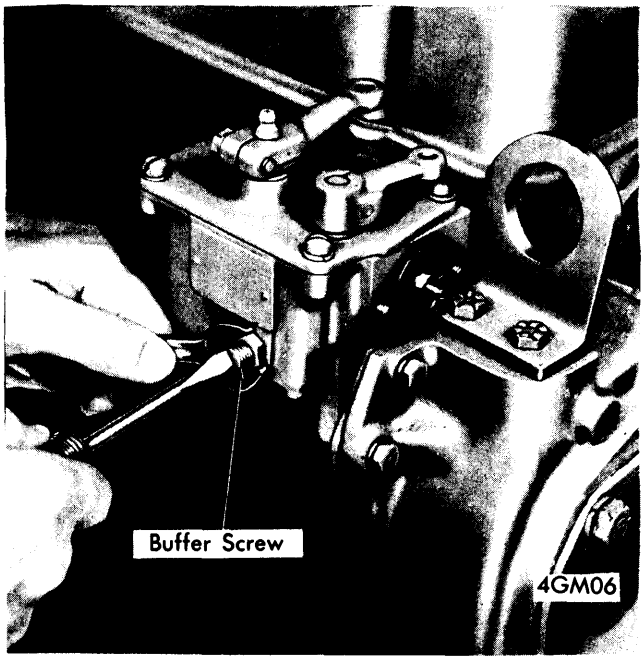
IDLE SPEED

W/Limiting Speed Governor – With maximum no-load speed properly adjusted, bring engine to normal operating temperature. Back out buffer screw to avoid contact with differential lever. Adjust idle speed screw to obtain engine speed of 500-600 RPM. Hold idle speed screw and tighten lock nut. Replace high speed spring cover and tighten attaching bolts.

W/Variable Speed Governor – With maximum no-load speed properly adjusted, place stop lever in RUN position and speed control lever in IDLE position. With engine running, loosen lock nut and turn idle speed screw in or out until engine idles at 500 RPM. Hold idle screw and tighten lock nut.

BUFFER SCREW

With engine idling at proper RPM, loosen lock nut and turn buffer screw in so that it contacts differential lever as lightly as possible and still eliminates engine roll. Hold buffer screw and tighten lock nut.



BUFFER SCREW ADJUSTMENT

BOOSTER SPRING

1) With idle speed correctly set, move speed control lever to idle position. Loosen booster spring retaining nut on speed control lever. Loosen lock nuts on eye bolt at opposite end of spring. Move spring retaining bolt in slot of speed control lever until center of bolt is on or slightly over center (toward idle speed position) of an imaginary line through bolt, lever shaft and eye bolt. Hold bolt and tighten lock nut.

2) Start engine and move speed control lever to maximum speed position and release it. Lever should return to idle speed position. If it does not, reduce booster spring tension. If it does, continue to increase spring tension until it does not return to idle, then reduce spring tension until it just returns to idle. Tighten lock nuts.

REMOVAL & REPLACEMENT

FUEL PUMP

Removal – Disconnect fuel lines from inlet and outlet fittings and disconnect drain tube from pump. Remove three pump attaching bolts and withdraw pump.

Replacement – Reverse removal procedure using new gaskets.

INJECTOR

Removal – 1) Remove rocker arm cover and remove fuel lines from both injector and fuel connector. Install shipping caps on open ends of injector and fuel connector. Crank engine until outer ends of pushrods of injector and valve rocker arms are in line horizontally.

2) Remove rocker shaft bracket bolts and swing rocker arms away from injector and valves. Remove injector clamp bolt and injector clamp. Loosen inner and outer adjusting screws on injector rack control lever and slide lever away from injector. Lift injector from cylinder head.

Replacement – Reverse removal procedure using new seals and adjust injection as outlined in *Adjustment.*