ENGINE COOLING SYSTEM COMPLAINT

2. IS OVERHEATING OCCURRING AFTER PROLONGED IDLE, IN GEAR, A/C SYSTEM OPERATING?

If answer is affirmative, the driver should practice certain driving techniques that would avoid overheating, such as:

a. Idle in neutral as much as possible – Increase engine rpm to get higher air flow and water flow through the radiator.
b. Turn air conditioning system off during extended idling if overheating is indicated by hot light or temperature gauge.

3. IS OVERHEATING OCCURRING AFTER PROLONGED DRIVING IN SLOW CITY TRAFFIC, TRAFFIC JAMS, PARADES, ETC.?

If answer is affirmative, the driver should practice techniques that would avoid overheating – same as for prolonged idling. Further checks should not be required.

IF NONE OF THE ABOVE APPLY, GO TO THE DIAGNOSTIC CHART (*See figure 31*).

To effectively use this chart, the driver should practice certain driving techniques that would avoid overheating (see paragraphs a and b, immediately preceding).

To effectively use this chart, determine which of the following categories applies to the complaint:

a. Hot Light or hot indication on the temperature gauge.
b. Boiling.
c. Coolant loss.

1. **If Complaint is Hot Light or Hot indication on Temperature Gauge:**

Was Hot Light accompanied by boiling? If answer is "Yes."
Go to Boiling on Chart.
If answer is "No."
Go to Hot Light on Chart.

2. **If Complaint is Boiling** – Go to Boiling on Chart.

3. If complaint is cooling loss, determine if system is being overfilled. This would normally result in small amounts of coolant loss through the overflow tube. If this is the case, check system for proper level. If overfilling is not the problem, go to Coolant Loss on the chart.

NOTE: Anytime cooling system is obviously contaminated, the system should be drained and flushed.

CAUTION – The cooling system is designed to operate at 15 psi pressure at temperatures exceeding 200°F. CAUTION SHOULD BE EXERCISED WHEN REMOVING PRESSURE CAP OR WHEN SERVICING THE SYSTEM.

ON VEHICLE SERVICE

WATER PUMP

Removal

1. Disconnect battery negative cable at battery.
2. Drain cooling system.
3. Remove accessory drive belts.
4. Remove fan to water pump hub (or fan clutch to water pump hub) attaching bolts (or nuts) and remove fan and pulley.
5. Remove generator lower brace to water pump attaching bolts and swing brace down and out of way.
6. Remove generator upper brace to water pump attaching bolts.
7. Remove lower radiator hose and heater hose from water pump. On 7.4 liter engine, remove bypass hose.
8. Remove water pump to block attaching bolts and remove pump.

Installation – If installing new water pump, transfer heater hose fitting from old unit. On 7.4 liter engine, also transfer bypass fitting.

1. With clean sealing surfaces on both water pump and block, place 1/8" (3mm) bead of RTV or equivalent, along the sealing edge of each water pump leg. Place pump against block and retain with attaching bolts. Torque bolts to 20 N-m.
2. Attach lower radiator hose and heater hose to water pump. On 7.4-liter engine, install bypass hose.
3. Attach generator upper and lower braces to water pump. Torque bolts to 35 N-m.
4. Install water pump pulley and fan (or fan clutch) to water pump hub. Torque fasteners to 30 N-m.
5. Install acessory drive belts. Adjust to specifications.
6. Connect battery negative cable.
7. Fill cooling system with an ethylene glycol anti-freeze and water mixture of 50/50%.
8. Start engine and run, with radiator cap removed, until radiator upper hose becomes hot (thermostat open).
9. With engine idling, add coolant to radiator until level reaches bottom of filler neck.
10. Install cap, making sure arrows line up with overflow tube.

THERMOSTAT

Removal (All Engines)

1. Disconnect battery negative cable at battery.
2. Drain cooling system until radiator coolant level is below thermostat.
3. Remove water outlet attaching bolts and remove outlet. Remove thermostat.

Installation (All Engines) – Prior to installing thermostat, make sure thermostat housing and coolant outlet sealing surfaces are clean.

1. Place a 1/8" (3mm) bead of RTV sealer, No. 1052366 or equivalent, all around the coolant outlet sealing surface on the thermostat housing.

ENGINE AND DRIVING GEAR (Continued)

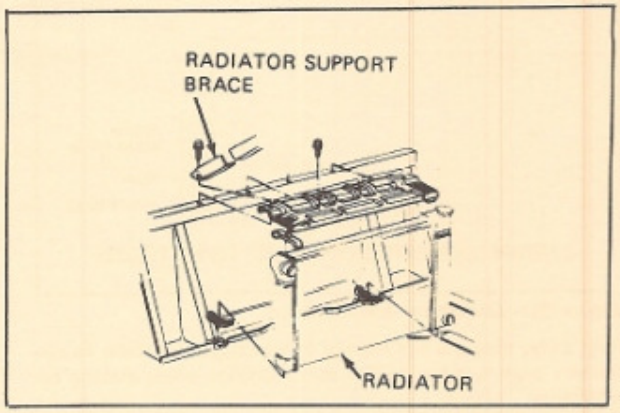


Figure 32 — Radiator Support Bracket

2. Place thermostat in housing.
3. Install coolant outlet while RTV is still wet. Torque retaining bolts to 20 lbs. ft. (27 N-m).
4. Connect battery negative cable.
5. Fill cooling system with an ethylene glycol anti-freeze and water mixture of 50/50%.
6. Start engine and run, with radiator cap removed, until radiator upper hose becomes hot (thermostat open).
7. With engine idling, add coolant to radiator until level reaches bottom of filler neck.
8. Install cap, making sure arrows line up with overflow tube.

RADIATOR *(See figure 32.)*

Removal

1. Disconnect battery negative cable at battery.
2. Drain cooling system.
3. Remove radiator hoses from radiator.
4. Remove overflow hose from radiator.
5. Remove fan shroud, and disconnect transmission cooler lines.
6. Remove radiator to radiator support retainers and remove radiator down between subframe rails.

Installation

1. Place radiator in vehicle and install radiator to radiator support retainers.
2. Install fan shroud.
3. Connect overflow hose to radiator.
4. Connect radiator hoses to radiator.
5. Connect battery negative cable.
6. Fill cooling system with an ethylene glycol anti-freeze and water mixture of 50/50%.
7. Start engine and run, with radiator cap removed, until radiator upper hose becomes hot (thermostat open).
8. With engine idling, add coolant to radiator until level reaches bottom of filler neck.
9. Install cap, making sure arrows line up with overflow tube.

FAN SHROUD *(See figure 33.)*

Removal

1. Disconnect battery negative cable.
2. Remove fan shroud to radiator retainer attaching screws.
3. Remove fan clutch to water pump hub attachments.
4. Remove shroud by pulling up and out of lower retaining clips. Fan shroud and fan clutch assembly must be removed together.

Installation

1. Lower fan shroud and fan clutch along back of radiator. Make sure lower edge fits into lower retaining clips.
2. Install fan clutch to water pump attachments and torque to 27 N-m.
3. Install shroud to radiator retainer attaching screws. Torque to 6 N-m.
4. Connect battery negative cable.

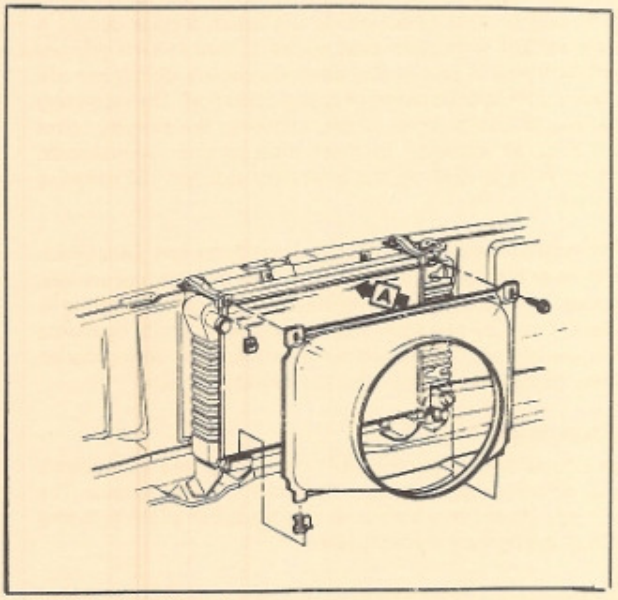


Figure 33 - Fan Shroud

FAN/ FAN CLUTCH

Removal (All)

1. Remove battery negative cable at battery.
2. Remove radiator fan shroud as required.
3. Remove fan clutch hub-to-water pump hub attaching bolts or nuts, as applicable, and remove fan clutch assembly.
4. Remove fan from fan clutch hub.

Installation (All)

CAUTION: If a fan blade is bent or damaged in any way, no attempt should be made to repair and/or reuse the damaged part. A bent or damaged fan assembly should always be replaced with a new fan assembly.

CAUTION: It is essential that the fan assembly remain in proper balance. Balance cannot be assured once a fan assembly has been bent or damaged. A fan assembly that is not in proper balance could fail and fly apart during subsequent use, creating an extremely dangerous condition.

All mating surfaces (water pump hub and fan clutch hub) should be inspected for smoothness and reworked as necessary to eliminate burrs or other imperfections.

1. With fan on fan clutch hub, install fan clutch assembly to water pump hub. Torque attaching bolts, or nuts, to 20 lb. ft. (27 N-m). Be sure to align reference marks on both hubs.
2. Install radiator shroud as required.
3. Connect battery negative cable.

CARBURETOR MODEL M4MC

GENERAL DESCRIPTION

A hot air choke model M4MC carburetor is used on the REVCON vehicle. This carburetor is a 4-barrel, 2-stage design. A triple venturi with plain tube nozzle is used in each primary bore resulting in precise fuel metering control during the off-idle and part throttle ranges of engine operation. The secondary side has two large bores which, added to the primary, gives sufficient air capacity to meet most engine requirements. An air valve is used on the secondary side for fuel metering control.

The main metering system has separate main fuel wells which feed each fuel nozzle for good fuel flow through the venturi. During off-idle and part throttle operation, fuel metering is accomplished by two tapered primary metering rods, operating in metering jets, positioned by a conventional spring-loaded power piston that is responsive to manifold vacuum.

Adjustable Part Throttle

An adjustable part throttle (APT) feature is used to provide a close tolerance adjustment in the main metering system. The APT adjustment very accurately sets the depth of the metering rods in the primary metering jets.

The adjustment feature consists of a pin pressed in the side of the power piston which extends through a slot in the side of the piston well. When the power piston is down (economy position), the side of the pin stops on top of a flat surface on the adjustment screw located in the cavity next to the power piston. The adjustment screw is held from turning by a tension spring beneath the head of the adjustment screw. During production flow test, this adjustment screw is turned up or down which in turn raises or lowers the power piston and metering rod assembly. This very accurately controls the fuel flow between the rods and jets to meet emission requirements.

No attempt should be made to change the APT adjustment. If float bowl replacement is required, the new bowl assembly will include an adjustment screw pre-set by the factory.

Carburetor Operation

The carburetor M4MC has six basic systems. They are float, idle, main metering, power, pump, and choke.

ON-VEHICLE SERVICE

GENERAL INFORMATION

A carburetor is designed to meet the particular requirements of the engine, transmission and vehicle and although they may look alike, they are not usually interchangeable. Refer to carburetor part number and/or specifications when making adjustments.

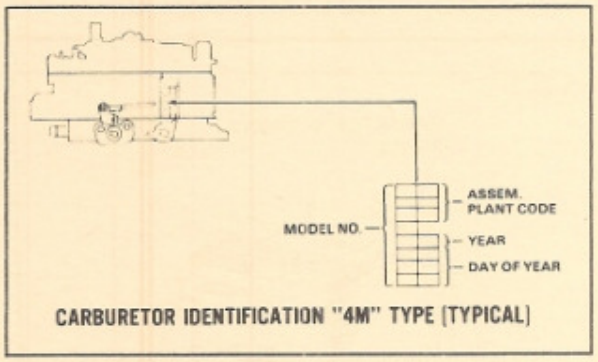


Figure 34 – Carburetor Identification

Before checking or resetting the carburetor as the cause of poor engine performance or rough idle; check ignition system including distributor, timing, spark plugs and wires. Check air cleaner, evaporative emission system, EFE System, PCV system, and engine compression. Also inspect intake manifold, vacuum hoses and connections for leaks and check torque of carburetor mounting bolts/nuts. Make all adjustments with engine at normal operating temperature, choke full open, air cleaner installed. Except as noted air conditioning should be "off" and all vacuum lines and all electrical leads connected. Set parking brake and block drive wheels. Air cleaner can be removed for set-up accessibility but must be completely installed during actual setting.

EXTERNAL FLOAT CHECK

The float level can be checked without removing the air horn by using float gauge J-9789-130 or equivalent and following external float level checking procedures.

CARBURETOR CHOKE CHECK

General Procedure

1. Remove air cleaner. With engine off, hold throttle half open. Open and close choke several times. Watch linkage to be certain all links are connected and there are no signs of damage.
2. If choke or linkage binds, sticks or works sluggishly, clean with choke cleaner X-20-A or equivalent. Use cleaner as directed on can.
3. Visually inspect carburetor to be certain all vacuum hoses are connected. Inspect hoses for cracks, abrasions, hardness or other signs of deterioration. Replace or correct as necessary.
4. Make sure the vacuum break diaphragm shaft is fully extended when engine is off. If shaft is not fully extended, replace vacuum break assembly. Shaft should fully retract within 10 seconds after starting engine. If unit fails to retract, replace vacuum break assembly.

Checking Hot Air Choke

1. With parking brake applied, drive wheels blocked, transmission in Park or Neutral, start engine and allow engine

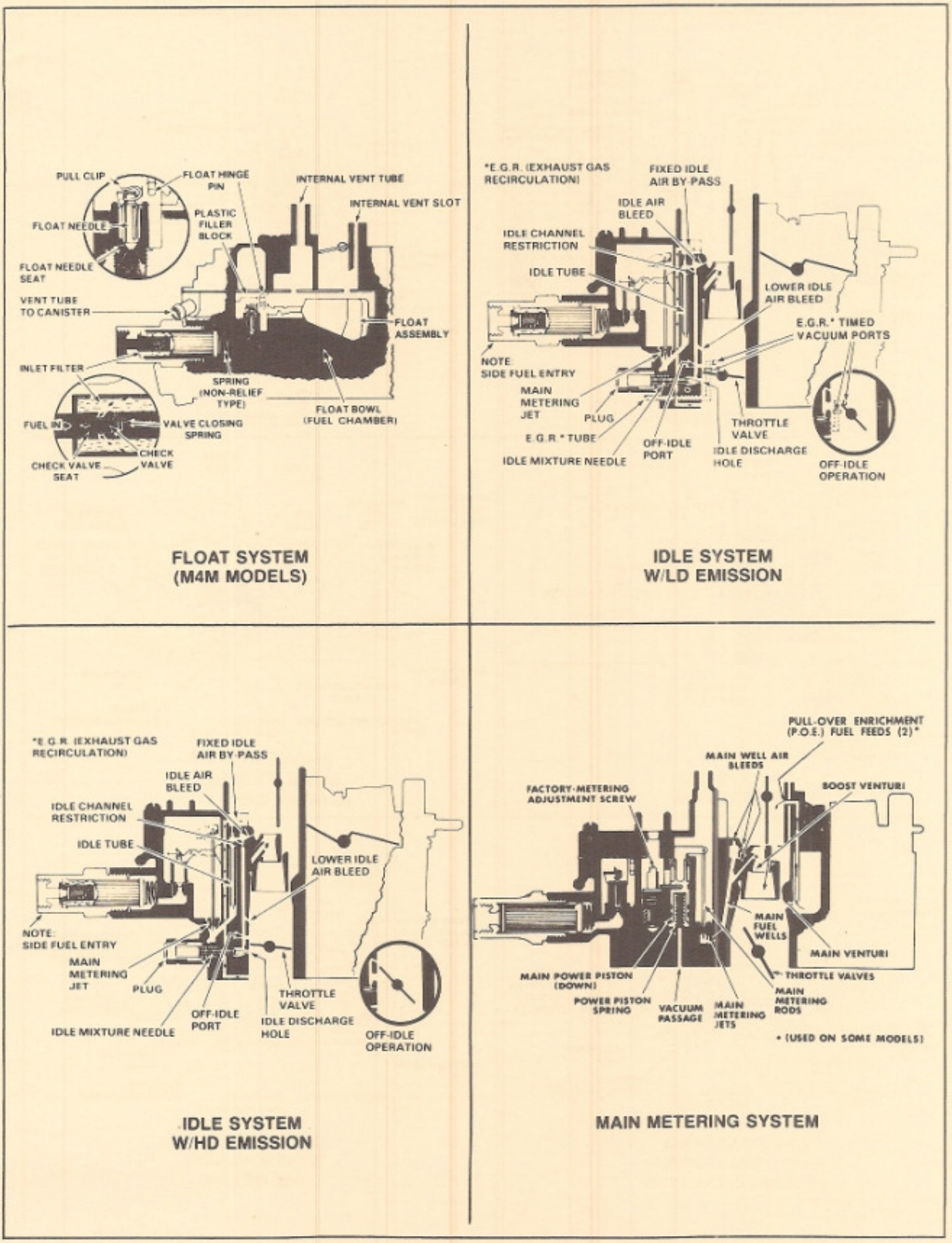


Figure 35 – Carburetor Model M4MC (Float, Idle, Main Metering Systems)

ENGINE AND DRIVING GEAR (Continued)

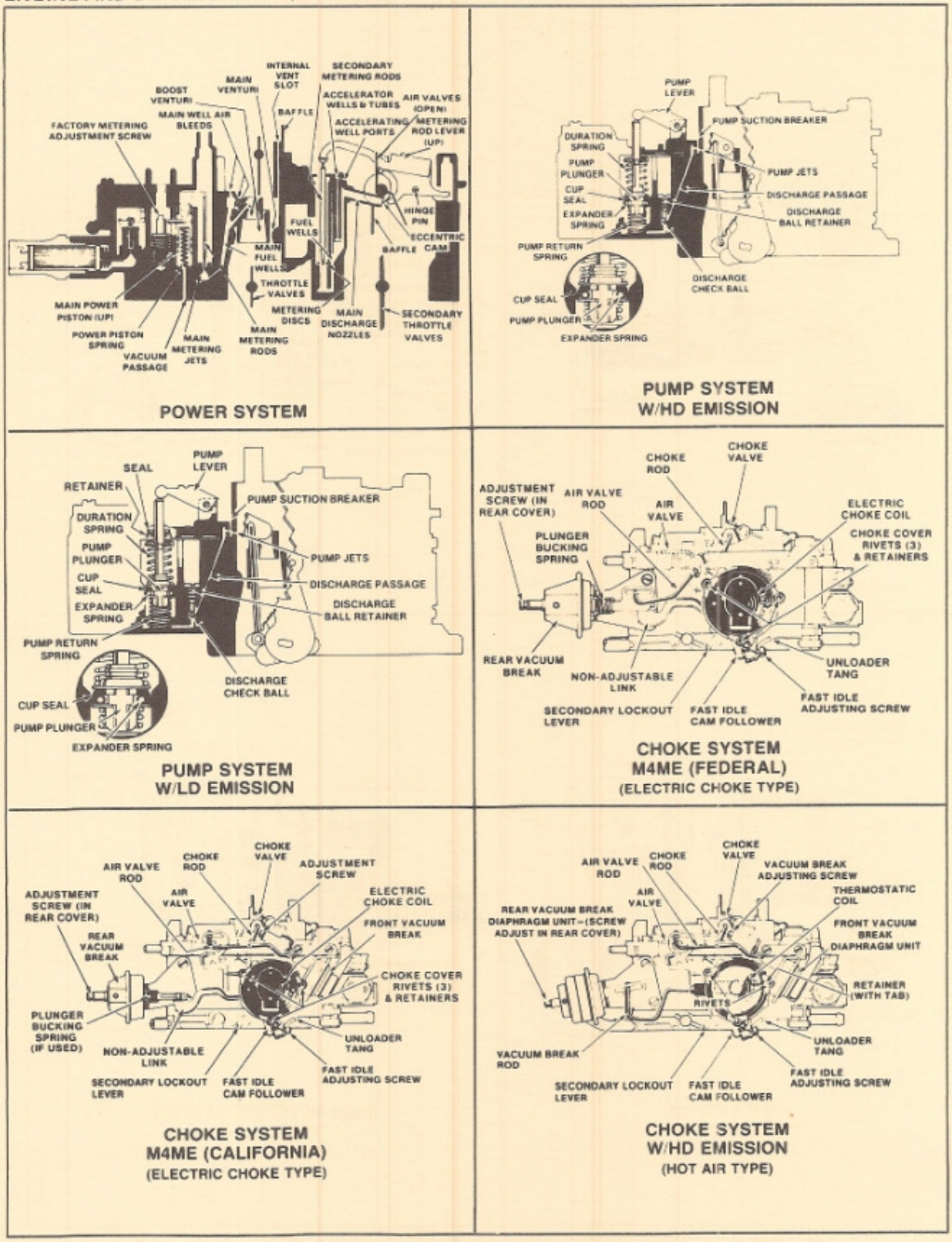


Figure 36 – Carburetor Model M4MC (Power, Pump, Choke Systems)

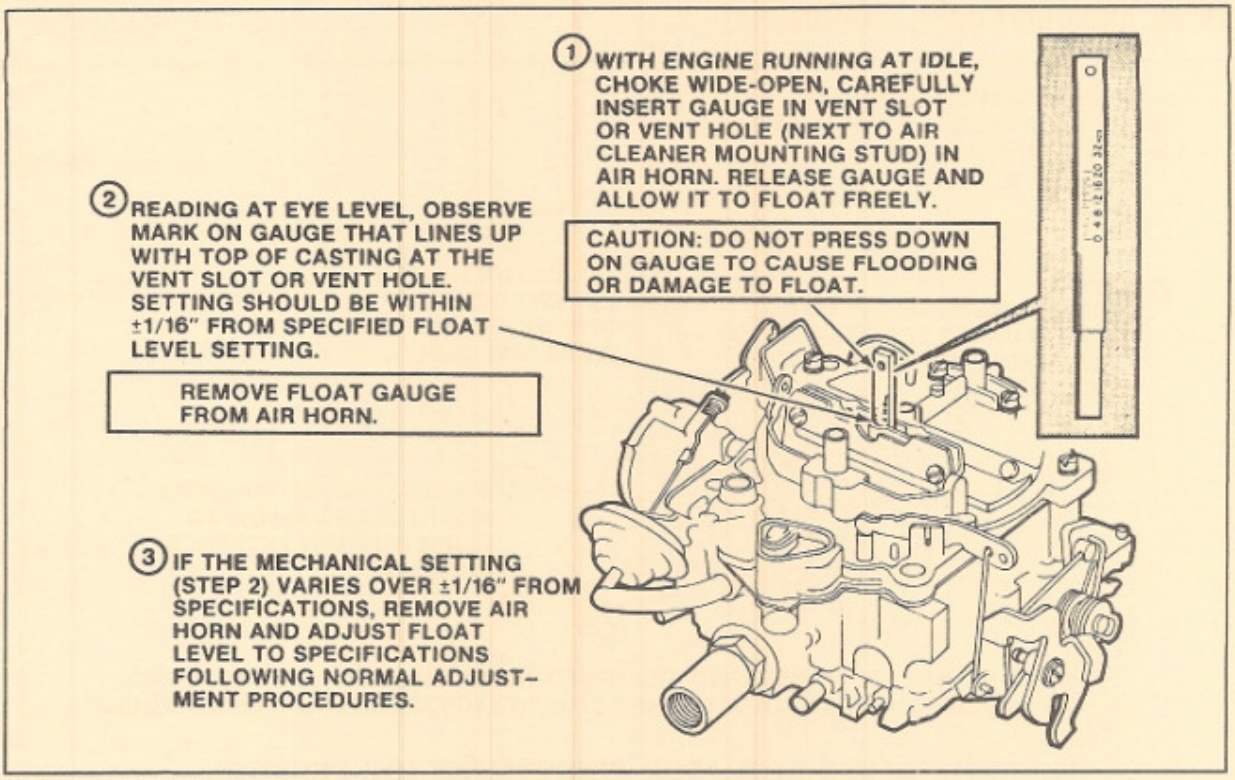


Figure 37 – External Float Level Check

to warm up, visually checking to be certain choke valve opens fully.

2. If choke valve fails to open fully, momentarily touch choke housing and hot air inlet pipe or hose to determine if sufficient heat is reaching the choke coil.

   CAUTION: The choke housing and hot air inlet pipe or hose are "Hot" to the touch. Use care to prevent burning of hands.

3. If choke housing and/or heat inlet are cool to the touch, check for loss of vacuum to the housing, restricted heat inlet in the choke housing or choke heat pipe, collapsed or deteriorated heat inlet hose, or restricted passages in the manifold choke heat stove. Replace or correct as necessary.

SPEED ADJUSTMENTS

Refer to figure 38 for throttle lever actuator adjustment.

IDLE MIXTURE ADJUSTMENT - BEST IDLE METHOD

Idle mixture needles have been preset at the factory and sealed. Idle mixture should be adjusted only in the case of major carburetor overhaul, throttle body replacement, or high emissions as determined by official inspections.

If necessary, remove idle needle plugs.

Perform this adjustment with engine at operating temperature, parking brake applied, drive wheels blocked and transmission in park or neutral.

1. Remove air cleaner.
2. Connect tachometer and vacuum gauge to engine.
3. As a preliminary adjustment, turn idle mixture needles in lightly to seat and back out 2 turns.

   NOTICE: Do not turn idle mixture needle tightly against seat or damage may result.

4. With engine running (choke wide open and transmission in neutral) adjust idle speed screw to idle speed specified on Vehicle Emission Control Information label.
5. Adjust each idle mixture needle to obtain highest RPM.

ENGINE AND DRIVE GEAR (Continued)

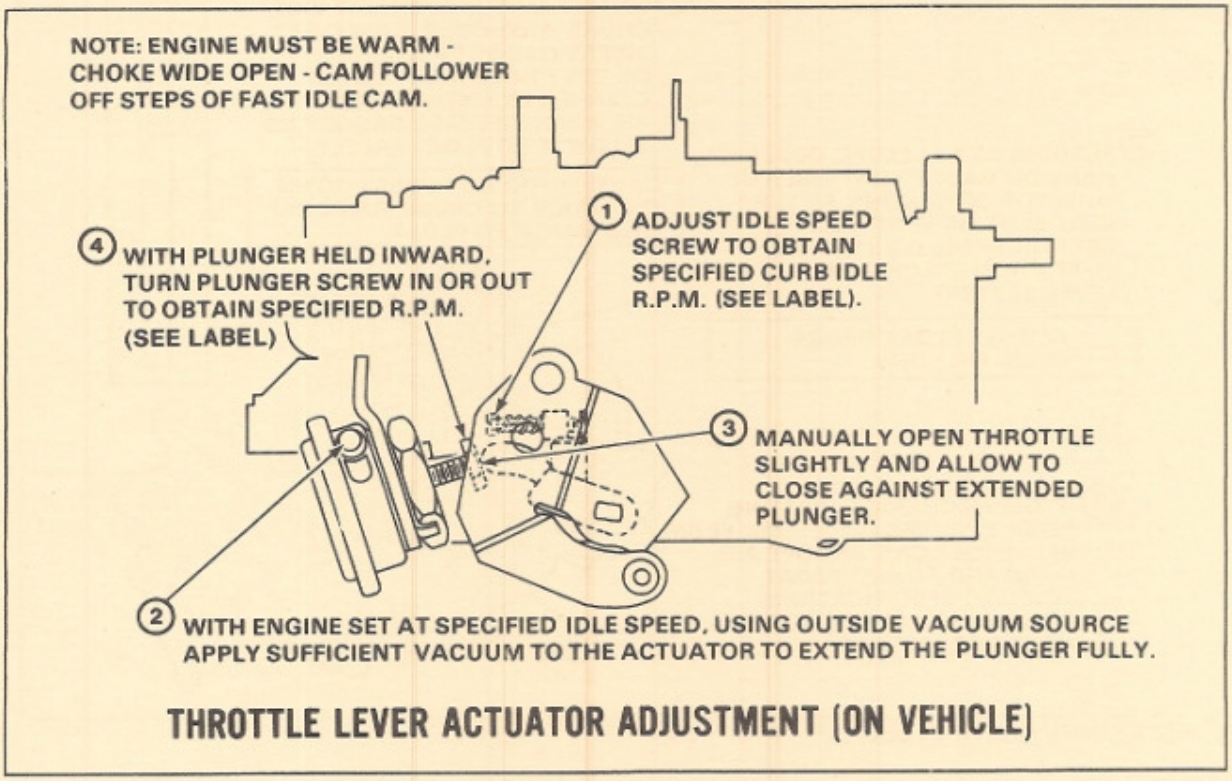


Figure 38 – Throttle Lever Actuator Adjustment

6. Repeat steps 4 and 5 until "best" idle is obtained.
7. If necessary, reset curb idle speed to specifications on underhood label.
8. After adjustments are complete, seal the idle mixture needle setting using silicone sealant RTV rubber or equivalent. The sealer is required to prevent tampering with the setting and to prevent the possibility of loss of fuel vapors.
9. Check and, if necessary, adjust throttle lever actuator.
10. Check and, if necessary, adjust fast idle speed as described on Emission Control Information label.
11. Turn off engine, remove gauges, unplug and reconnect vacuum hoses. Install air cleaner.
12. Remove block from drive wheels.

CARBURETOR MOUNTING TORQUE

When torquing carburetor after removal overhaul, replacement or when installing a new heat insulator, torque mounting bolts, in a clockwise direction, to 16 N·m (144 in. lbs.). When retorquing carburetor at recommended maintenance intervals, check in clockwise direction. If less than 7 N·m (60 in. lbs.), retorque to 11 N·m (96 in. lbs.); if greater than 7 N·m (60 in. lbs.) do not retorque.

CARBURETOR REPLACEMENT

Removal

Flooding, stumble on acceleration and other performance complaints are in many instances, caused by presence of dirt, water, or other foreign matter in the carburetor. To aid in diagnosis, the carburetor should be carefully removed from engine without draining fuel from bowl. Contents of fuel bowl may then be examined for contamination as carburetor is disassembled. Check filter.

Removal procedure

1. Remove air cleaner and gasket.
2. Disconnect wire at solenoid, if equipped.
3. Disconnect fuel pipe and vacuum lines.
4. Disconnect choke system.
5. Disconnect accelerator linkage.
6. If equipped with cruise control, disconnect linkage.
7. Remove carburetor attaching bolt, carburetor and insulator.

Installation

1. Clean sealing surfaces on intake manifold and carburetor.
2. Fill carburetor bowl before installing carburetor.
3. Install carburetor with new insulator and tighten bolts to correct torque (See Carburetor Mounting Torque).
4. Connect cruise control cable as required.
5. Connect accelerator linkage.
6. Connect choke system.
7. Connect fuel pipe and vacuum hoses.
8. Connect solenoid as required.
9. Install air cleaner.
10. Check and adjust idle speed.

FUEL FEED AND VAPOR PIPES

GENERAL DESCRIPTION

Fuel feed pipes are secured to the underbody with clamp and screw assemblies. Flexible hoses are located at fuel tank fuel, vapor and return lines and fuel pump. The pipes should be inspected occasionally for leaks, kinks or dents. If evidence of dirt or foreign material is found in carburetor, fuel pump or pipes, pipe should be disconnected and blown out. Dirt or foreign material may be caused by a damaged or omitted fuel strainer in fuel tank.

ON-VEHICLE SERVICE

Fuel Line Repair

Replacement

1. If replacement of a fuel feed, fuel return or emission pipe is required use welded steel tubing meeting GM Specification 124-M or its equivalent.
2. Do not use copper or aluminum tubing to replace steel tubing. Those materials do not have satisfactory durability to withstand normal vehicle vibrations.
3. When rubber hose is used to replace pipe, use only reinforced fuel resistant hose which meets GM Specification 6165-M. Hose inside diameter must match pipe outside diameter.
4. Do not use rubber hose within 4" (100 mm) of any part of the exhaust system.
5. In repairable areas, cut a piece of fuel hose 4" (100 mm) longer than portion of the line removed.

   If more than a 6 inch (152 mm) length of pipe is removed, use a combination of steel pipe and hose so that hose lengths will not be more than 10 inches (254 mm).

   Follow the same routing as the original pipe.
6. Cut ends of pipe remaining on vehicle square with a tube cutter. Using the first step of a double flaring tool, form a bead on the end of both pipe sections. If pipe is too corroded to withstand bead operation without damage, the pipe should be replaced. If a new section of pipe is used, form a bead on both ends of it also.
7. Use screw type hose clamp, Part Number 2494772, or equivalent. Slide clamps onto pipe and push hose 2" (51 mm) onto each portion of fuel pipe. Tighten clamps on each side of repair.
8. Pipes must be properly secured to the frame to prevent chafing.

EVAPORATIVE CONTROL SYSTEM (ECS)

GENERAL DESCRIPTION (See Diagram, page 67.)

The REVCON is equipped with a system designed to prevent escape of fuel vapor to the atmosphere. Vapor generated by evaporation of fuel in the tank, previously exhausted to the atmosphere, is transferred by an emission line to the engine compartment, During periods of operation, vapors are fed directly to the engine for consumption. During periods of inoperation, an activated charcoal conister located in the emission line stores any vapor generated for consumption during the next period of operation.

The amount of vapor drawn into the engine at any time is too small to have any effect on fuel economy or engine operation.

With this closed system it is extremely important that only vapors be transferred to the engine. To avoid the possibility of liquid fuel being drawn into the system, these following features are included as part of the total system:

1. A fuel tank overfill protector is provided on all series to assure adequate room for expansion of liquid fuel volume with temperature changes.
2. A one point fuel tank venting system is provided on all series to assure that the tank will be vented under any conceivable vehicle attitude.
3. To protect the tank from mechanical damage in the event of excessive internal or external pressures resulting from the operation of this closed system, a pressure-vacuum relief valve, located in the gas cap, will control the tank internal pressure.

ON-VEHICLE SERVICE

Maintenance requirement is that the oiled fiberglass filter assembled in the bottom of the canister, be replaced at intervals shown on page 29 . Under extremely dusty conditions, more frequent attention may be required.

Check operation of bowl vent and purge valve.

Canister and Filter

Removal

1. Note installed position of hoses on canister.
2. Disconnect hoses from top of canister.
3. Loosen clamps and remove canister.
4. If replacing filter, pull out filter from bottom of canister with your fingers.

Inspection

1. Check hose connection openings. Assure that they are open.
2. Check operation of purge valve by applying vacuum to the valve. A good valve will hold vacuum.

Installation

1. Install new filter.
2. Install canister and tighten clamp.
3. Connect hoses in same order.

Canister Purge Valve

Disassembly

1. Disconnect lines at valve.
2. Snap off valve cap (slowly remove cap as diaphragm is under spring tension). Remove diaphragm, spring retainer and spring.
3. Replace parts as necessary. Check orifice openings.

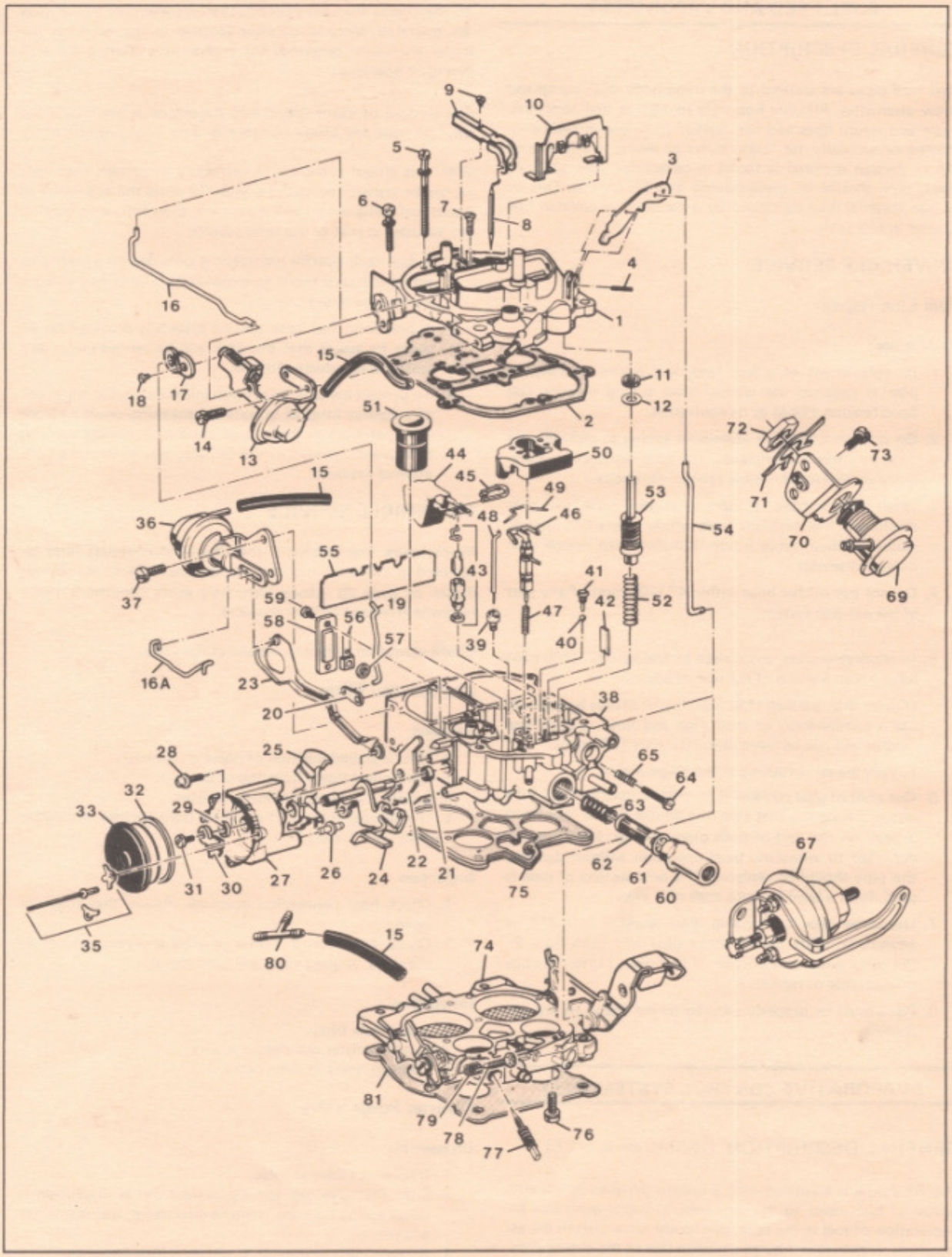


Figure 39 – Carburetor Exploded View

AIR HORN PARTS

1 – Air Horn Assy.
2 – Gasket – Air Horn
3 – Lever – Pump Actuating
4 – Roll Pin – Pump Lever Hinge
5 – Screw – Air Horn Long (2)
6 – Screw – Air Horn Short ( )
7 – Screw – Air Horn Countersunk (2)
8 – Metering Rod – Secondary (2)
9 – Holder and Screw – Secondary Metering Rod
10 – Baffle – Secondary Air
11 – Seal – Pump Plunger
12 – Retainer – Pump Seal

CHOKE PARTS

13 – Vac. Brake Control & Bracket – Front
14 – Screw – Control Attaching (2)
15 – Hose – Vacuum
16 – Rod – Air Valve
16A– Rod – Air Valve (Truck)
17 – Lever – Choke Rod (Upper)
18 – Screw – Choke Lever
19 – Rod – Choke
20 – Lever – Choke Rod (Lower)
21 – Seal – Intermediate Choke Shaft
22 – Lever – Secondary Lockout
23 – Link – Rear Vacuum Break
24 – Int. Choke Shaft & Lever
25 – Cam – Fast Idle
26 – Seal – Choke Housing to Bowl (Hot Air Choke)
27 – Kit – Choke Housing
28 – Screw – Choke Housing to Bowl
29 – Seal – Intermediate Choke Shaft (Hot Air Choke)
30 – Lever – Choke Coil
31 – Screw – Choke Coil Lever
32 – Gasket – Stat Cover (Hot Air Choke)
33 – Stat Cover & Coil Assy. (Hot Air Choke)
35 – Kit Stat Cover Attaching
36 – Rear Vacuum Break Assembly
37 – Screw – Vacuum Break Attaching (2)

FLOAT BOWL PARTS

38 – Float Bowl Assembly
39 – Jet – Primary Metering (2)
40 – Ball – Pump Discharge
41 – Retainer – Pump Discharge Ball
42 – Baffle – Pump Well
43 – Needle & Seat Assembly
44 – Float Assembly
45 – Hinge Pin – Float Assembly
46 – Power Piston Assembly
47 – Spring – Power Piston
48 – Rod – Primary Metering (2)
49 – Spring – Metering Rod Retainer
50 – Insert – Float Bowl
51 – Insert – Bowl Cavity
52 – Spring – Pump Return
53 – Pump Assembly
54 – Rod – Pump
55 – Baffle – Secondary Bores
56 – Idle Compensator Assembly
57 – Seal – Idle Compensator
58 – Cover – Idle Compensator
59 – Screw – Idle Compensator Cover (2)
60 – Filter Nut – Fuel Inlet
61 – Gasket – Filter Nut
62 – Filter – Fuel Inlet
63 – Spring – Fuel Filter
64 – Screw – Idle Stop
65 – Spring – Idle Stop Screw
66 – Idle Speed Solenoid & Bracket Assembly
67 – Idle Load Compensator & Bracket Assembly
68 –
69 – Actuator – Throttle Lever
70 – Bracket – Throttle Lever Actuator
71 – Washer – Actuator Nut
72 – Nut – Actuator Attaching
73 – Screw – Bracket Attaching (2)

THROTTLE BODY PARTS

74 – Throttle Body Assembly
75 – Gasket – Throttle Body
76 – Screw – Throttle Body (3)
77 – Idle Mixture Needle & Spring Assy. (2)
78 – Screw – Fast Idle Adjusting
79 – Spring – Fast Idle Screw
80 – Tee – Vacuum Hose
81 – Gasket – Flange

Assembly

1. Install spring, spring retainer, diaphragm and cap.
2. Connect lines to valve.

Checking Purge Valve

1. Remove purge valve control vacuum line. Check for a vacuum signal with engine operating above idle (1500 RPM).
2. Apply an external vacuum source to the purge valve control diaphragm. A good valve will hold vacuum.
3. If the valve will not hold vacuum, replace canister.
4. If valve holds vacuum, remove purge line and check for vacuum. If no vacuum, check PCV hoses and system. Repair or replace as necessary.

Checking Bowl Vent Valve

1. Remove the bowl vent vapor hose from the carburetor.
2. Check the open condition of the valve by connecting to a manual vacuum pump. It should not be possible to obtain .5 inch Hg if the valve is open.
3. If a high resistance or plugged system is found, check for a plugged or restricted hose. Hose may be cleared with compressed air. If the hose is clear, remove the canister filler. If the restriction persists, replace the canister.
4. A simple check of the valve closed condition can be obtained with the same procedure as in Step 2, but with the engine operating at operating temperature. Manifold vacuum will be applied to the valve through the control line. The bowl vent line should exhibit a plugged condition.

5. If the valve is not closed, remove the control vacuum line and check for vacuum. If no vacuum is present, check hose for restriction or vacuum leak. Repair or replace as required. If vacuum is present, replace canister.

Pressure Checking Evaporative Control System

1. Stabilize vehicle by operating until warmed up.
2. Remove tank line at canister and observe for liquid in the line. Hook-up pressure device.
3. Apply 15" H_2O pressure to the fuel vapor line.
   a. Observe for excessive loss of pressure.
   b. If negligible pressure loss occurs observe for fuel vapor smell or fuel loss at connection points.
   c. Remove fuel filler cap(s) and observe for pressure in tank(s).

ACCELERATOR CONTROLS

General – The accelerator control system is cable type. There are no linkage adjustments. A reference between the bottom of accelerator pedal and floor pan should be used only as a check for bent bracket assembly. Check torque references. Check for correct opening and closing positions by operating the accelerator pedal and if any binding is present, check routing of cable.

ACCELERATOR CONTROL CABLE – Refer to figure 41 for removal and installation of accelerator control cable.

ACCELERATOR PEDAL – Refer to figure 40 for removal and installation of accelerator pedal.

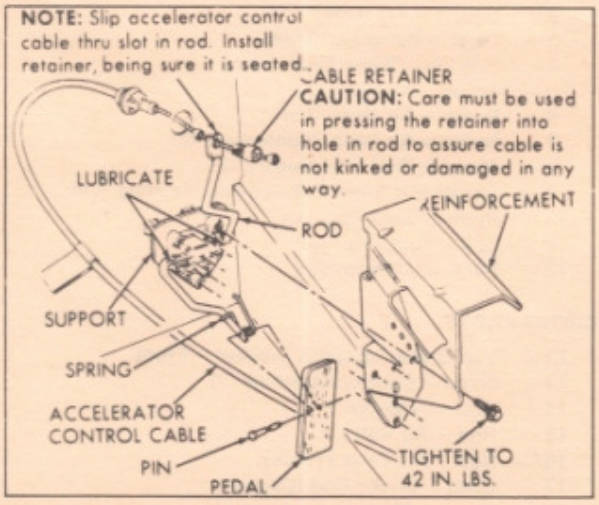


Figure 40 – Accelerator Pedal

GENERATOR

General – The generator does not require periodic lubrication. The rotor shaft is mounted on ball bearings at the drive end and roller bearings at the slip ring end, and each contains a permanent grease supply. At periodic intervals, check mounting bolts for tightness and adjust belt tension. When adjusting belt tension, apply pressure at center of generator, never against either end frame.

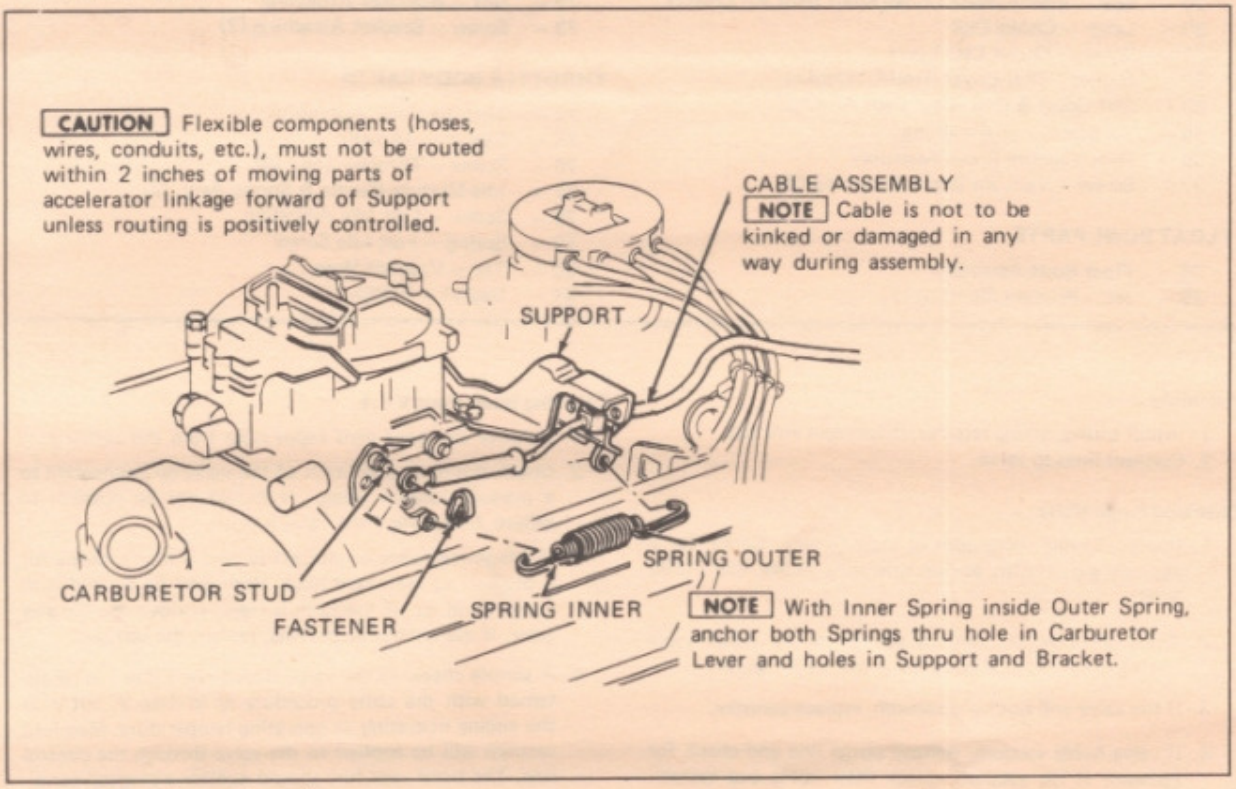


Figure 41 – Accelerator Controls

Removal

1. Disconnect negative battery terminal at battery.

CAUTION: Failure to observe this step may result in an injury from hot battery lead at generator.

2. Remove terminal plug and battery leads on back of generator.
3. Loosen adjusting bolts.
4. Remove generator drive belt.
5. Remove through bolt which retains generator.
6. Remove generator from vehicle.

Installation

1. If removed from vehicle, install generator to mounting bracket with bolts, washers, and nuts. Do not tighten.
2. Install generator drive belt.
3. Tighten belt to the specified belt tension. See Engine Cooling Section for proper belt tensioning procedures.
4. Tighten bolts.
5. Install generator terminal plug and battery lead to generator.
6. Connect negative battery terminal.

AUTOMATIC TRANSMISSION

General – The service procedures contained in this section are common to the automatic transmission sections contained in the manual. Refer to the proper automatic transmission section for specific service procedures.

Diagnosis – Before diagnosis of any transmission complaint is attempted, there must be understanding of oil checking procedure and what appearance the oil should have. Many times a transmission malfunction can be traced to low oil level or improper reading of the dipstick. Due to the transmission fluid that is now being used, it may appear to be darker and have a stronger odor. This is normal, and not a positive sign of required maintenance or transmission failure.

Also, when the dipstick is removed, it should be noted whether the oil is devoid of air bubbles or not. Oil with air bubbles gives an indication of an air leak in the suction lines, which can cause erratic operation and slippage. Water in the oil imparts a milky, pink cast to the oil and can cause spewing. Water in the oil can also cause swelling of nylon parts.

Preliminary Check Procedure

1. Check and correct oil level (see fluid level and capacity).
2. Road test vehicle to verify transmission problem using all selective ranges, noting discrepancies in operation.
3. If engine performance indicates an engine tune-up is required, this should be performed before road testing is completed or transmission correction attempted. Poor engine performance can result in transmission problems.
4. Check and correct vacuum lines and fittings.
5. Check and correct manual linkage.
6. Install oil pressure gauge and compare with pressure readings in the appropriate transmission section.
7. Isolate the unit or circuit involved in the malfunction.

R.T.V. Silicone Sealant – Various transmission models may be built with R.T.V. (room temperature vulcanizing) Silicone Sealant in place of some gaskets – i.e, oil pan and side cover. Refer to specific transmission section for removal procedure if R.T.V. Sealant has been used as a gasket on any part.

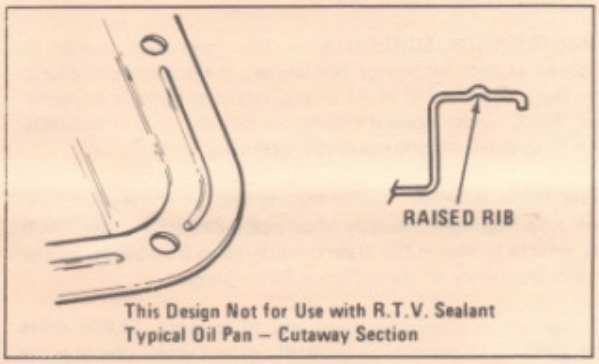


Figure 42 – Raised Rib Oil Pan Design

Sealant Application

1. R.T.V. Sealant is an effective gasket substitute for the following applications, depending on pan design. If R.T.V is used on an oil pan or side cover, the flange surface must be either flat or have depressed stiffening ribs. Do not use R.T.V. on pans which have raised stiffening ribs (see figure 42).
2. Before applying R.T.V. Sealant, the mating surfacses of both parts must be cleaned with solvent and air dried.
3. Apply a (1/16") bead of R.T.V. Sealant to the part flange and assemble wet. The bead of R.T.V. should be applied around the inside of the bolt holes. If the part

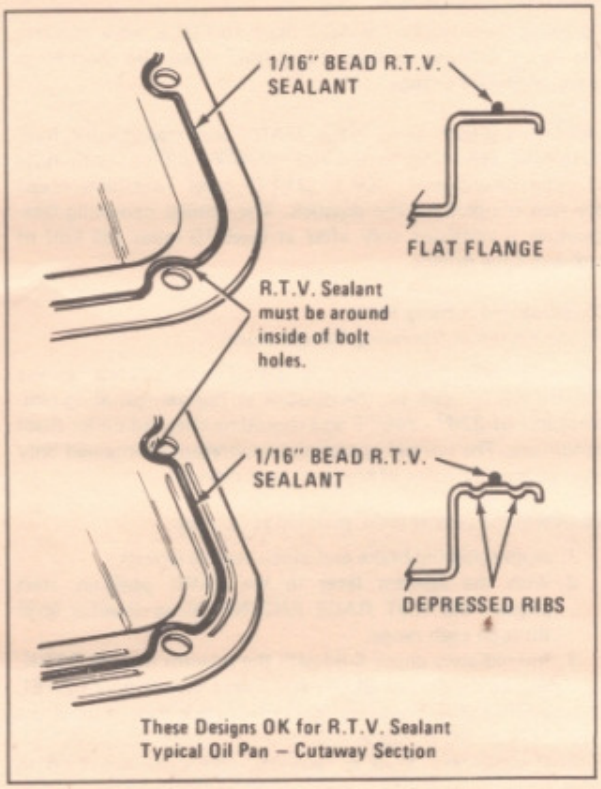


Figure 43 – Depressed Ribs

has depressed stiffening ribs, the bead of R.T.V. must be installed on the high portion of the surface, not in the groove. (See figure 42.)

MAINTENANCE SCHEDULE – The fluid level should be checked at each oil change (see below). When adding or changing fluid, use DEXRON -II or equivalent automatic transmission fluid. Under normal driving conditions, change transmission fluid every 24,000 miles (39, 000 km).

Fluid Drain Intervals – The transmission operating temperature resulting from the type of driving conditions under which the vehicle is used is the main consideration in establishing the proper frequency of transmission fluid changes.

Change the transmission fluid and filter every 12,000 miles (19,200 km) if the vehicle is usually driven under one or more of the following conditions which are considered severe transmission service.

1. In heavy city traffic where the outside temperature regularly reaches 90^{o}_{F} (32^{o}C).
2. In very hilly or mountainous areas.
3. Frequent trailing pulling.
4. Commercial use, such as taxi, police car, or delivery service.

If the vehicle is not used under any of these conditions, change the fluid filter every 24,000 miles (39,000 km).

Fluid Level and Capacity

To bring fluid level from ADD mark to FULL mark requires one pint (.5 liters) of fluid. Fluid level should be checked at every engine oil change.

Fluid level should be to FULL MARK with transmission fluid at normal operating temperature 220^{o}F (93^{o}C). With fluid at room temperature, 70^{o} F (21^{o} C), level will be between the two dimples on the dipstick. The normal operating temperature is obtained only after at least 15 miles (24 km) of highway type driving.

Checking and Adding Fluid
(Transmission at Operating Temperature)

The automatic transmission is designed to operate at the "FULL HOT" mark on the dipstick at normal operating temperatures of 220^{o} - 240^{o} F and should be checked under these conditions. The normal operating temperature is obtained only after at least 15 miles of highway type driving.

To determine proper level, proceed as follows:

1. Apply parking brake and block vehicle wheels.
2. With the selector lever in the PARK position, start engine. DO NOT RACE ENGINE. Move selector lever through each range.
3. Immediately check fluid with the selector lever in PARK, engine running at SLOW IDLE and the car on a LEVEL surface. The fluid level on the dipstick should be at the "FULL HOT" mark.
4. If additional fluid is required, add sufficient fluid to bring to the "FULL HOT" mark on the dipstick.

Checking and Adding Fluid
(Transmission at Room Temperature 65^{o} to 85^{o} F)
(18^{o} to 29^{o} C)

Automatic transmissions are frequently overfilled because the fluid level is checked when the fluid is cold and the dipstick indicates fluid should be added. However, the low reading is normal since the level will rise as the fluid temperature increases. A level change of over 19.05mm (3/4") will occur as fluid temperature rises from 60^{o} to 180^{o} F (16^{o} to 82^{o} C). (See figure 44.)

Overfilling can cause foaming and loss of fluid through the vent. Slippage and transmission failure can result.

Fluid level too low can cause slipping, particularly, when the transmission is cold or the vehicle is on a hill.

Check the transmission fluid level with the engine running, the shift lever in park, and the vehicle level.

If the vehicle has recently been operated for an extended period at high speed or in city traffic in hot weather or the vehicle is being used to pull a trailer, an accurate fluid level cannot be determined until the fluid has cooled down, usually about 30 minutes after the vehicle has been parked.

Remove the dipstick and touch the transmission end of the dipstick cautiously to find out if the fluid is cool, warm or hot.

Wipe it clean and re-insert until cap seats. Remove dipstick and note reading.

1. If the fluid feels cool, about room temperature, 65^{o} to 85^{o} F (18^{o} to 29^{o} C), the level should be between the two dimples below the "ADD" mark.
2. If it feels warm, the level should be close to the "ADD" mark (either above or below).
3. If it feels hot (cannot be held comfortably), the level should be between the "ADD" and "FULL" marks.

Changing Fluid

1. Raise vehicle.
2. With the drain pan placed under transmission oil pan, remove oil pan attaching bolts from front end and side of pan.
3. Loosen rear pan attaching bolts approximately four (4) turns.
4. Carefully pry transmission oil pan loose with screwdriver, allowing fluid to drain.
5. Remove remaining bolts and remove oil pan and gasket.
6. Drain fluid from oil pan. Clean pan with solvent and dry thoroughly with clean compressed air.
7. If required, remove screen/filter-to-valve body bolts. Remove screen/filter and gasket.
8. Thoroughly clean screen assembly in solvent and dry thoroughly with clean compressed air. Paper or felt type filters should be replaced.
9. Install as required, a new gasket or "O" ring onto the screen/filter assembly. Lubricate "O" rings with petrolatum. If required, install screen/filter attaching bolts and torque bolts as specified in each transmission section.

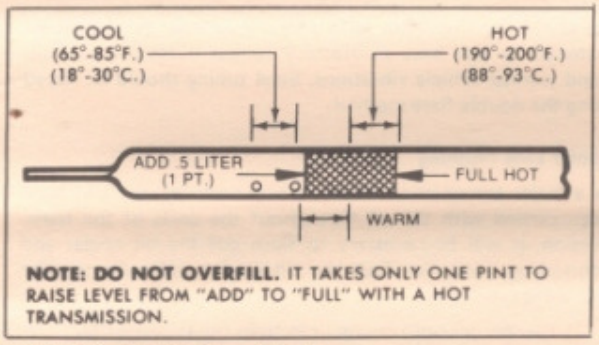


Figure 44 – Transmission Dipstick

10. Install new gasket on oil pan and install oil pan. Torque attaching bolts as specified in each transmission section.
11. Lower vehicle and then add the proper amount of DEXRON-II automatic transmission fluid or its equivalent through filler tube
12. With selector lever in PARK position, apply parking brake, start engine and let idle (carburetor off fast idle step.) DO NOT RACE ENGINE.
13. Move selector lever through each range and, with selector lever in PARK range, check fluid level.
14. Add additional fluid to bring level between the dimples on the dipstick (cool level).

DETENT DOWNSHIFT SWITCH

Vacuum Modulator System

A vacuum modulator is used to automatically sense any change in torque input to the transmission. The vacuum modulator transmits this signal to the pressure regulator, which controls line pressure, so that all torque requirements of the transmission are met and smooth shifts are obtained at all throttle openings.

Vacuum Modulator Diagnosis

A failed vacuum modulator can cause one or more of the following complaints.

1. Harsh upshifts and downshifts.
2. Delayed upshifts.
3. Soft upshifts and downshifts.
4. Slips in low, drive and reverse.
5. Transmission overheating.
6. Engine burning transmission oil.

If any one of the above complaints are encountered, the modulator must be checked.

Vacuum Diaphragm Check

Turn modulator so vacuum line stem points downward. If transmission oil comes out, the vacuum diaphragm is bad.

Gasoline and/or water vapor may settle in the vacuum side of the modulator. If this is found in a vehicle which may be exposed to 10° F (-12° C) temperatures or below, the modulator must be changed.

Check solution that comes out of the modulator for evidence of lubricity. If the solution does not have the feel of oiliness, it can be assumed the solution is a mixture of gas and/or water.

The only way transmission oil can be on the vacuum side of the modulator is by a leak in the vacuum diaphragm.

If oil is found, the modulator must be replaced. If oil is not found in the vacuum side of the modulator, but the transmission oil level is continually low, and no external leaks are found, there is a possibility that a pin hole leak exists in the diaphragm and the modulator should be replaced.

Atmospheric Leak Check

1. Apply a liberal coating of soap bubble solution to the vacuum connector pipe seam, the crimped upper to lower housing seam.
2. Using a short piece of rubber hose, apply air pressure to the vacuum pipe by blowing into the tube and looking for bubbles. If bubbles appear, replace the modulator. Do not use any method other than human lung power for applying air pressure, as pressures over 6 psi may damage the modulator.

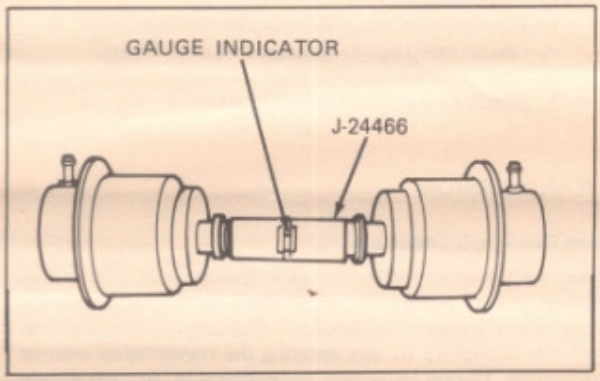


Figure 45 – Checking Modulator

Load Check

This check is made using an available tool, J-24466. The gauge compares the load of a known good modulator with a modulator being checked.

1. Install the modulator that is known to be acceptable on either end of the gauge.
2. Install the modulator in question on the opposite end of the gauge (see figure 45).
3. Holding the modulators in a horizontal position, bring them slowly together under pressure. If the modulator in question is bad, the gauge line will remain blue. If the modulator is good, the gauge line will be white. When making the comparison, make sure that both modulators are of the same type. The part numbers are stamped on the dome of the modulator.

Sleeve Alignment Check

Roll the main body of the modulator on a flat surface and observe the sleeve for concentricity to the can. If the sleeve is concentric and the plunger is free, the modulator is acceptable.

If the modulator passes the above checks, the following items should also be checked as a possible cause of the problem.

1. Check freeness of modulator valve in transmission case.

ENGINE AND DRIVE GEAR (Continued)

2. Check the vacuum line from the manifold to modulator for holes, cracks or dents. Check the rubber hose connection at the modulator and at the intake manifold for leaks.

Causes of Improper Vacuum At Modulator

1. Engine.
   a. Tune up.
   b. Loose vacuum fittings or improperly routed hoses/lines.
   c. Vacuum operated accessory leak – (hoses, vacuum valve, etc.).
   d. Engine exhaust system restricted.

2. Vacuum line to modulator.
   a. Leak.
   b. Loose fitting.
   c. Restricted orifice or incorrect orifice size.
   d. Carbon build up at modulator vacuum fitting.
   e. Pinched line.
   f. Grease in pipe (delayed or no upshift-cold).

TRANSMISSION

Parts Cleaning & Inspection

Cleanliness is an important factor in the overhaul of the transmission. Before attempting any disassembly operation, the exterior of the transmission should be thoroughly cleaned to prevent the possibility of dirt entering the transmission internal mechanism. During inspection and reassembly, all parts should be thoroughly cleaned with cleaning fluid and then air dried. Wiping cloths or rags should not be used to dry parts. Do not use solvents on neoprene seals, composition-faced clutch plates or thrust washers. All oil passages should be blown out and checked to make sure that they are not obstructed. Small passages should be checked with tag wire. All parts should be inspected to determine which parts are to be replaced.

The various inspections of parts are as follows:

1. Inspect linkage and pivot points for excessive wear.
2. Bearing and thrust surfaces of all parts should be checked for excessive wear and scoring.
3. Check for broken seal rings, damaged ring lands and damaged threads.
4. Inspect seals and "O" rings.
5. Mating surfaces of castings and end plate should be checked for burrs and irregularities. These may be removed by lapping the surface with crocus cloth. The crocus cloth should be laid on a flat surface such as a piece of plate glass.
6. Castings should be checked for cracks and sand holes.

Oil Cooler Lines

If replacement of transmission steel tubing cooler lines is required, use only double wrapped and brazed steel tubing meeting GM specification 123M or equivalent. Under no condition use copper or aluminum tubing to replace steel tubing. Those materials do not have satisfactory fatigue durability to withstand normal vehicle vibrations. Steel tubing should be flared using the double flare method.

Cooler Line Flushing

In a major transmission failure, where particles of metal have been carried with the oil throughout the units of the transmission, it will be necessary to flush out the oil cooler and connecting lines. To flush the oil cooler and lines, use the following procedure:

1. Disconnect both cooler lines from the transmission.
2. Place a hose over the end of the cooler inlet line (from the bottom of the cooler) and insert the hose into an empty container.
3. Flush clean oleum solvent or equivalent through the return line (from the top of the cooler) using an oil suction gun until clean solvent comes out of the hose. This will "back flush" the cooler.
4. Remove the hose from the inlet cooler line and place it on the return line.
5. Flush clean oleum solvent or equivalent through the inlet line until clean solvent comes out the return line. Remove remaining solvent from cooler with compressed air applied to the return line and flush with transmission fluid.
6. Reconnect oil cooler lines and torque nuts to 17 N·m (12 ft. lbs.).

SPEEDOMETER DRIVEN GEAR

Removal and Installation

1. Disconnect speedometer cable.
2. Remove retainer bolt, retainer, speedometer driven gear and "O" ring seal.
3. To install, reverse removal procedure, using new "O" ring seal (if required) and adjust fluid level.

REAR OIL SEAL

Removal and Installation

1. Remove propeller shaft.
2. Pry out lip oil seal with suitable tool.
3. Coat outer casing of new lip oil seal with a non-hardening sealer and drive it into place with Installer J-21359 or J-24057.
4. Install propeller shaft and adjust fluid level.

GOVERNOR (475)

Removal and Installation

1. Raise vehicle.
2. Remove governor cover attaching screws, cover and gasket. Discard gasket.
3. Remove governor assembly from case.
4. Install governor.
5. Using a new gasket, install cover and retaining bolts.
6. Lower vehicle and adjust fluid level.

THE FOLLOWING PARTS CAN BE SERVICED WITH THE TRANSMISSION IN THE VEHICLE.

1. Governor Cover and Seals
2. Governor Assembly
3. Governor Pipes
4. Intermediate Servo Piston Assembly
5. Rear Servo Assembly
6. Front Servo Assembly
7. Oil Pan and Oil Screen (Intake Pipe) Assembly
8. Control Valve Assembly (Valve Body)
9. Check Balls and Valve Body Space Plates and Gaskets
10. Pressure Regulator Parts
11. Manual Detent Roller and Spring Assembly
12. Parking Pawl Actuator Rod
13. Parking Pawl Bracket
14. Parking Pawl
15. Manual Shaft and Seal
16. Manual Valve
17. Manual Valve Link
18. Extension Housing and Gasket
19. Rear Seal
20. 1-2 Accumulator Assembly
21. Vacuum Modulator
22. Cooler Fittings
23. Oil Filter Pipe and 'O' Ring
24. Speedometer Driven Gear Assembly
25. Down Shift Solenoid
26. Electrical Connectors
27. Governor Feed Screen
28. Pump Pressure Screen
29. Modulator Valve

ENGINE COMPARTMENT

ENGINE ACCESSIBILITY

Access to the engine is provided by an engine cover located between the driver and passenger seats. The cover is designed to be secured by spring-loaded latches.

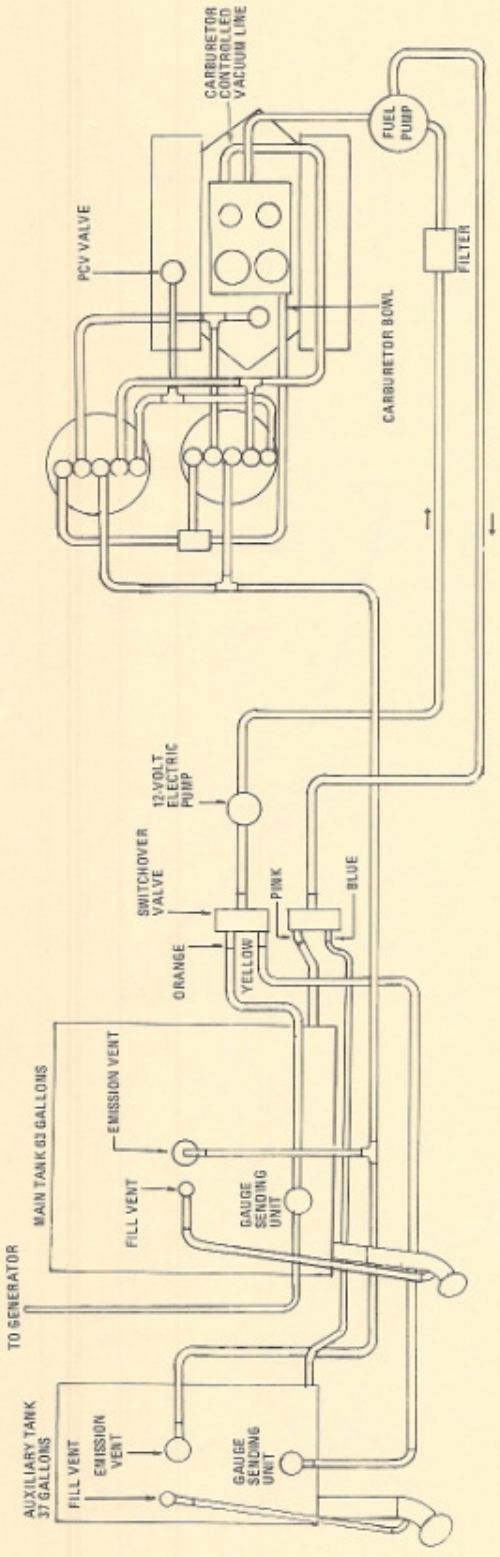


Figure 45A – Evaporative Control System Diagram

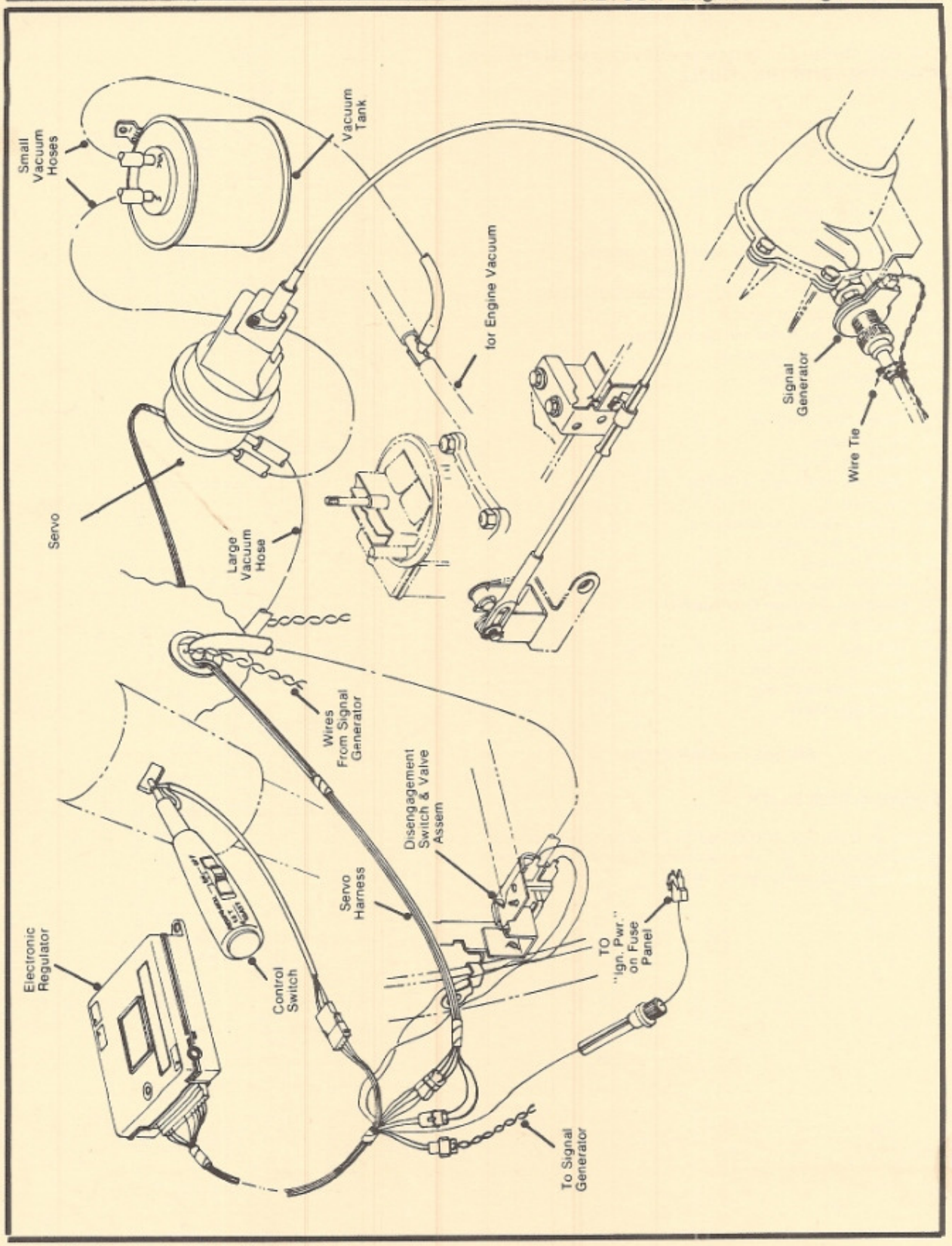
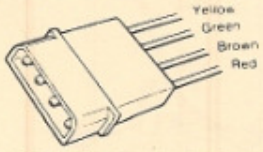


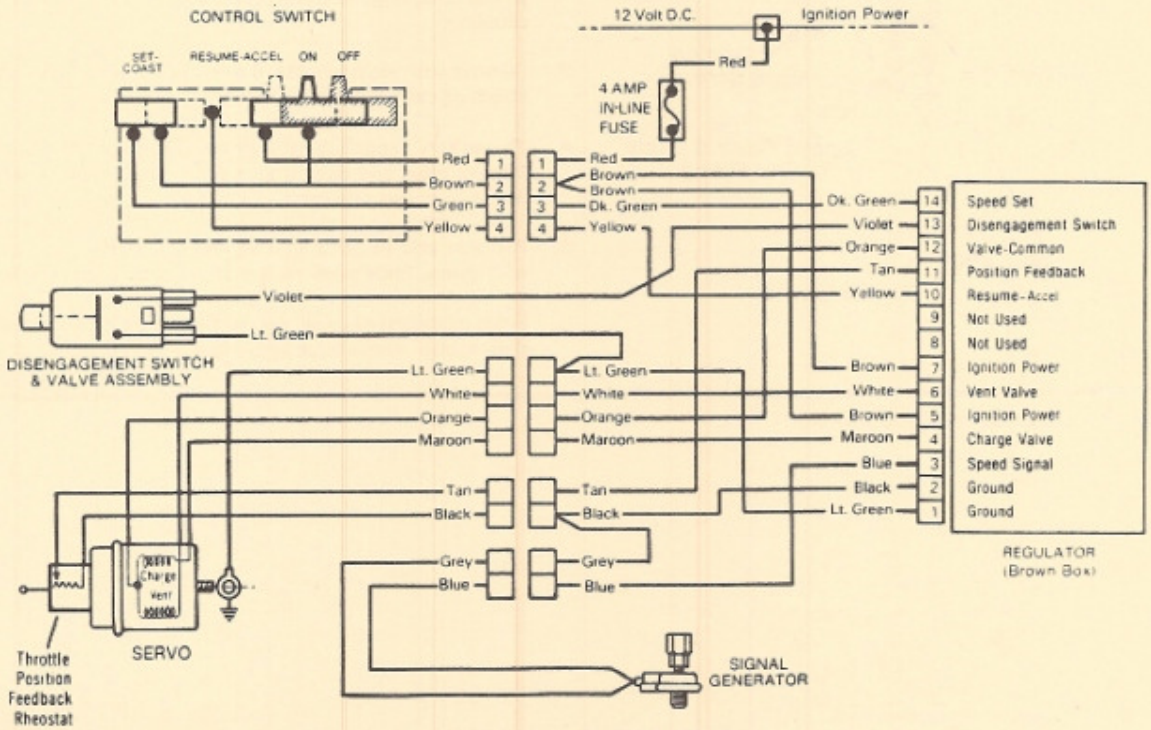
Figure 46 – Dana Perfect Circle Electronic Cruise Control

CONTROL SWITCH

Use 12 volt test light and jumper wire. Disconnect **Control Switch** at flat, 4-wire harness connector. Connect jumper wire from 12 volt power source to red wire terminal of **Control Switch.**



TEST CONDITION	WIRE COLOR	LIGHT SWITCH O.K.	LIGHT REPLACE SWITCH
Slide switch **OFF**, ground one test light lead, touch other test lead in turn, to terminal of	Brown Green Yellow	OFF OFF OFF	ON ON ON
Slide switch **ON**, ground one test light lead, touch other test lead in turn, to terminal of:	Brown Green Yellow	ON ON OFF	OFF OFF ON
Slide switch **ON**, hold **"SET/COAST"** button in. Ground one test light lead, touch other test lead in turn, to terminal of:	Brown Green Yellow	ON OFF ON	OFF ON OFF
Press and hold **"RESUME/ACCEL"** slide. Ground one test light lead, touch other test lead in turn, to terminal of:	Brown Green Yellow	ON ON ON	OFF OFF OFF



WIRING SCHEMATIC

Figure 47 — Dana Perfect Circle Electronic Cruise Control — Test & Wiring Schematic