

1975-79 EXHAUST EMISSION SYSTEMS

General Motors Controlled Combustion System

1975-76 General Motors

DESCRIPTION & OPERATION

The Controlled Combustion System (CCS) is a generic term used by General Motors to define a combination of emission systems. The separate emission systems are usually called the Transmission Controlled Spark (TCS) system, Early Fuel Evaporation (EFE) and Exhaust Gas Recirculation (EGR). The CCS uses different controls (depending on application) to regulate ignition timing, EFE and EGR for optimum control of emissions.

NOTE: Spark control, EFE and EGR controls are tied together, either by vacuum, or electrically, with an EGR and/or EFE system. For more information on EGR or EFE systems, see General Motors Exhaust Gas Recirculation or Early Fuel Evaporation in this section.

The function of all system types is to control distributor advance while vehicle is operating at low speeds or at idle. Although component usage varies between vehicles, their operation is basically similar.

Transmission Controlled Spark (TCS) - Used on 1975 Chevrolet and Pontiac man. trans. and some auto. trans. models, and 1976 Chevette and Pontiac 1-Bbl. 4-Cyl. engines with manual transmis-

sions only. System consists of a temperature switch, transmission switch and a vacuum solenoid.

Some 1975 TCS systems also control EGR operation. It uses both carburetor ported and intake manifold vacuum. When ignition switch is ON, with a cold engine, circuit is completed after 20 seconds by time delay relay through temperature switch. This energizes vacuum solenoid and allows intake manifold vacuum to distributor. At the same time it also prevents EGR operation. See Fig. 1.

Most TCS systems use carburetor ported vacuum. When ignition switch is ON, with a cold engine, circuit is completed through temperature switch, this energizes vacuum solenoid and allows ported vacuum to distributor. With transmission in first or second gear and engine warm, both transmission and temperature switches are open which de-energizes vacuum solenoid and cuts off vacuum to distributor. When engine is warm and transmission is in third or fourth gear, transmission switch is closed, energizing vacuum solenoid and allowing vacuum to distributor. See Fig. 2 or 3.

NOTE: Some vehicles use ported spark vacuum source rather than full vacuum source; therefore when system allows for full vacuum spark advance, advance is cut off at closed throttle.

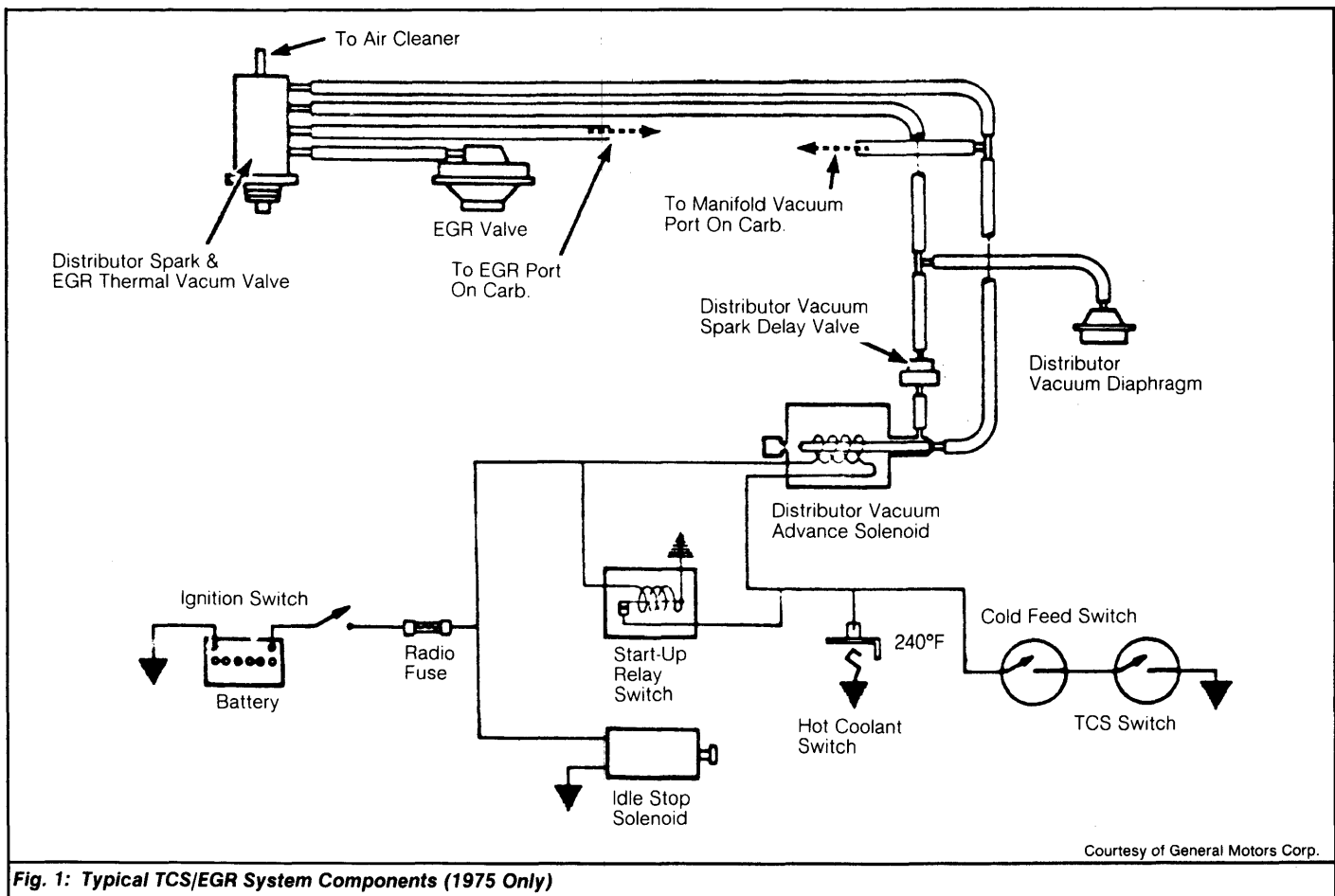


Fig. 1: Typical TCS/EGR System Components (1975 Only)

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General Motors Controlled Combustion System (Cont.)

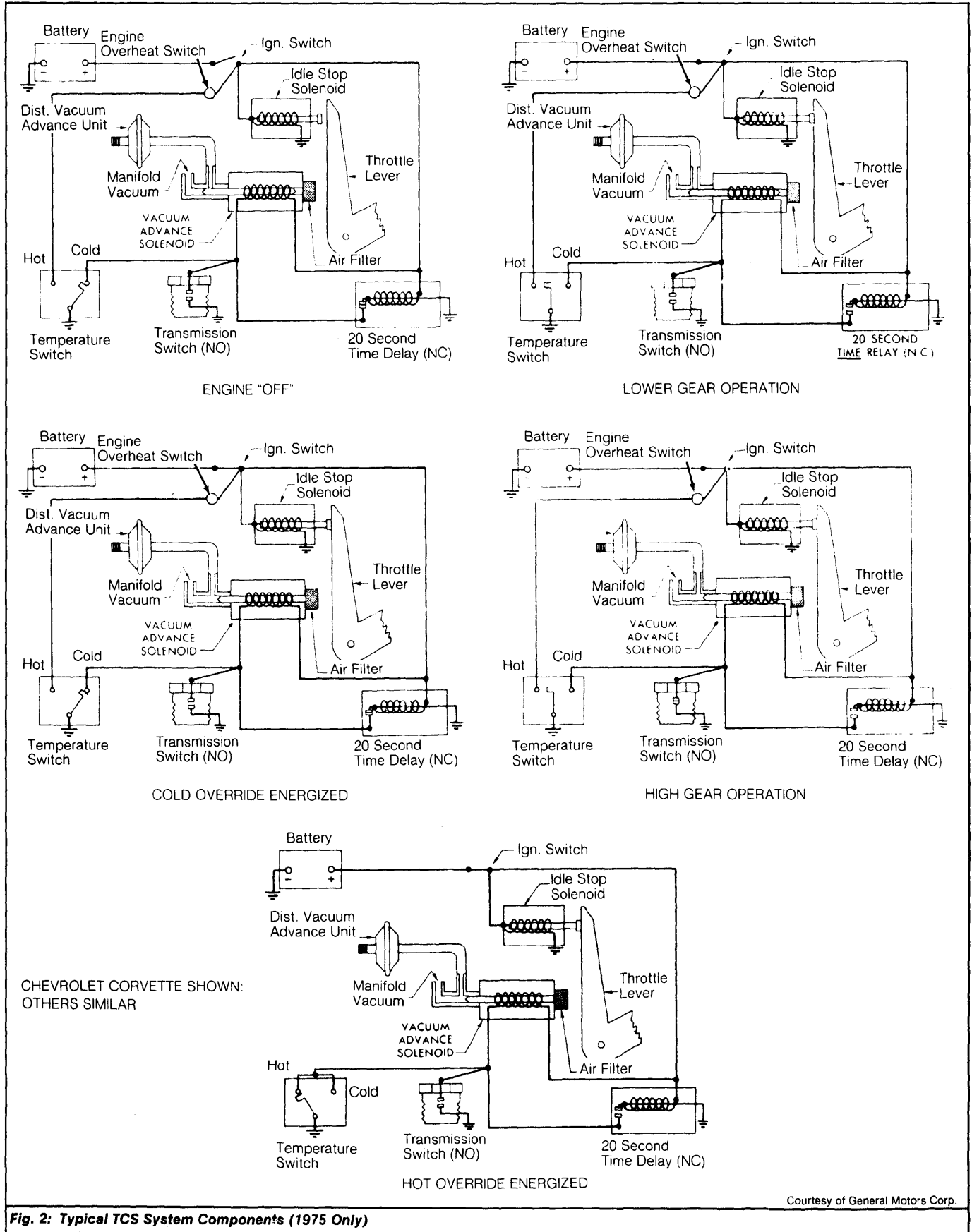


Fig. 2: Typical TCS System Components (1975 Only)

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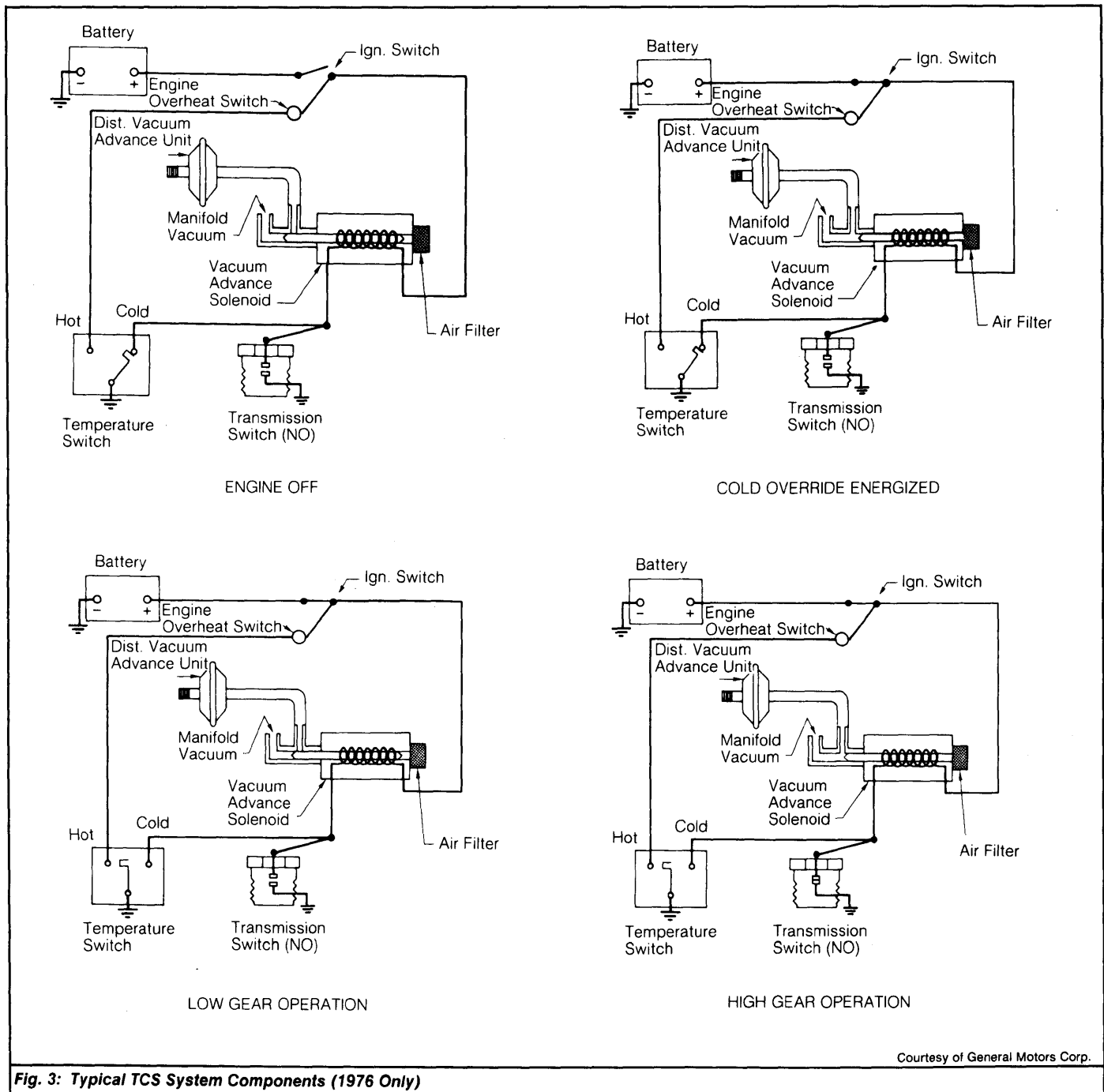
General Motors Controlled Combustion System (Cont.)

Ported Vacuum Advance with EGR (PVA/EGR) - System has direct vacuum line between ported vacuum carburetor port and distributor vacuum advance. EGR valve is connected to same line using "T" fitting (EGR valve also uses ported vacuum signal from carburetor). Direct vacuum line allows retarded vacuum advance at idle, or full vacuum advance (or closed throttle) at all other times.

Temperature Switch - Mounted on cylinder head (4-cyl. and V8's) or thermostat housing (6-cyl.), this 3-position switch has a double terminal unit with a neutral position. At coolant temperatures below 93°F, cold terminal is grounded, completing circuit to vacuum advance solenoid. In neutral position no contact is made (circuit broken). When engine starts to overheat, hot terminal is grounded and "hot" light in instrument panel is activated. On Corvette models switch also advances ignition when coolant temperature reaches 232°F.

Vacuum Delay Valve (VDV) - Used on some V8 engines. Valve is located in vacuum hose between carburetor port and "C" port of Distributor Thermal Vacuum Switch (DTVS). Distributor ported vacuum is metered through .005" orifice in valve, requiring about 40 seconds to reach full vacuum advance. When valve is in restricting position and ported vacuum drops, there is a pressure differential within valve which momentarily opens to equalize vacuum between vacuum advance and distributor to retard distributor vacuum advance. When vacuum increases at carburetor port, valve moves to restricting position so that vacuum to advance unit will have to be metered to increase distributor vacuum advance. Valve is by-passed above 220°F coolant temperature when DTVS valve makes switch.

EFE Thermal Vacuum Switch (EFE/TVS) - Used on some engine applications to activate a heat valve on exhaust manifold. At engine temperatures of less than 120°F, manifold vacuum is directed from



Courtesy of General Motors Corp.

Fig. 3: Typical TCS System Components (1976 Only)

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EFE port of EFE/TVS switch to EFE actuator which closes heat valve and increases exhaust flow through intake manifold crossover passage. Added heat from exhaust gas improves cold start performance. When temperature rises above switch point of EFE valve (120°F), valve closes and spring loaded EFE valve is held open because no vacuum is available. Exhaust gas will now exit through crossover pipe.

NOTE: For more information on EFE/TVS, see EARLY FUEL EVAPORATION article in this section.

NOTE: Hose from EFE actuator is vented at EFE/TVS switch to prevent vacuum being trapped in actuator above switching point.

Distributor Vacuum Valve (DVV) – DVV valve is used on some V8 engine allows vacuum to distributor vacuum advance unit from ported spark port of carburetor until vacuum increases up to 8 in. Hg (7 in. Hg Calif.). The valve then switches so vacuum is directed from carburetor EGR port to distributor vacuum advance. This valve increases driveability of vehicle.

Distributor Thermal Vacuum Switch (DTVS) – DTVS is used to advance ignition timing at idle when coolant temperature is high. Valve within TVS is actuated when temperature rises above 220°F and, if not equipped with a vacuum reducer valve, directs full vacuum to distributor vacuum advance. Engines with vacuum reducer valve will supply vacuum at 1½ in. Hg less than manifold vacuum, which advances timing to allow engine to run cooler. This is only time vacuum is directed to distributor at idle. On 231" V6 and Omega 350" V8, DTVS does not use vacuum reducer valve and receives ported vacuum, switched at 231°F.

Distributor Vacuum Advance Solenoid – This electrically operated 2-position plunger controlled valve serves to supply or deny vacuum to distributor vacuum advance unit. When energized, plunger opens vacuum port from carburetor while simultaneously closing air vent (fresh air) port, allowing normal vacuum advance. When de-energizing, the spring loaded plunger seats against vacuum inlet and opens distributor advance unit to fresh air vent. Solenoid is used in conjunction with TCS system.

Idle Stop Solenoid – This 2-position electrically operated control is used to provide a predetermined throttle setting. In energized position (plunger extended), plunger controls carburetor throttle lever and prevents full closing of carburetor throttle plates. When ignition is turned off, solenoid is de-energized (plunger retracted) and allows throttle plates to shut off completely, thereby preventing dieseling.

TESTING

TCS System – 1) Remove vacuum hose at distributor and connect a vacuum gauge to hose. Place gauge so it can be read from drivers seat. Run engine until thoroughly warm (about ten minutes). With transmission in Neutral, depress throttle slightly. Vacuum should be present.

2) With throttle still depressed, shift transmission into first gear. No vacuum should be present. If vacuum reading is constant at all times (caused by closed circuit), check for grounded wire in circuit, thermal override switch stuck closed (activated) or transmission switch stuck closed.

3) If no vacuum was present during test (caused by open circuit), check for blockage in vacuum lines, carburetor fitting or carburetor. Also check for blown radio fuse, broken wire in system, or solenoid coil wire broken or open. Check all hoses for proper routing and good connections.

NOTE: This test also checks PVA system.

EFE/TVS System – 1) With engine cold (coolant temperature at 120°F or cooler), disconnect hose from port "D" (or "2") on TVS and connect vacuum gauge to port. Start engine, if hoses are connected properly, full manifold vacuum should be present at port "D" ("2"). If no vacuum is present, check for manifold vacuum at hose "C" (or "3"), if vacuum is found in this hose, replace switch. Secure switch using a soft-setting sealant on threads.

2) For warm engine check (coolant temperature at 120°F or hotter), disconnect hose from port "D" ("2") on EFE/TVS and connect vacuum gauge to port. Start engine, if hoses are connected to proper ports, less than 5 in. Hg vacuum should be present at port "D" ("2"). If more than 5 in. Hg vacuum is noted, replace switch. Secure switch using a soft-setting sealant on threads.

DTVS (Engine with Ported Spark) – Disconnect distributor vacuum hose at port "D" of TVS, connect vacuum gauge and check for vacuum with engine idling at normal operating temperature. If more than 5 in. Hg vacuum is present and hoses are connected to proper ports, check using vacuum pump. Replace switch if not to specification.

DTVS (Engine with Full Manifold Vacuum Spark) – Disconnect distributor vacuum hose at port "D" and connect vacuum gauge. Check with engine idling at normal operating temperature, full manifold vacuum should be present. Reconnect distributor vacuum hose. Disconnect and plug vacuum reducer vacuum hose from TVS switch. Connect vacuum gauge to vacuum reducer valve port of TVS and check for vacuum with engine idling at normal operating temperature. If more than 5 in. Hg vacuum is present and all hoses are connected to proper ports, replace TVS switch. Use soft-setting sealant on threads.

Choke Thermal Vacuum Switch (CTVS) – Used on 250" 6-cyl. engines, some 400" V8 engines w/2-Bbl., and all 4-Bbl. carburetor engines except Omega 350" V8 engine. Application gives richer choke operation when engine coolant is less than 57°F (most V8), 60°F (6-cyl.), or 62°F (400" V8). Carburetors are equipped with 2 vacuum breaks. Choke thermal vacuum switch controls vacuum to carburetor, front or auxiliary vacuum break. When engine is started and coolant temperature is greater than specified, both vacuum breaks pull choke to leanest position. If coolant temperature is less than specified, choke TVS closes preventing vacuum break from pulling, which gives a richer start and improved cold driveability.

ADJUSTMENTS

CTVS – When engine is cold, valve should be closed. If valve is open, it should be replaced. Valve is more likely to malfunction in closed position. At normal operating temperatures, valve should be in open position.

Transmission Switch – Disconnect connector from switch. Connect test light from switch terminal to a 12-volt source. Test light should be on when in high gear and off in lower gears.

NOTE: Test lamp must not be larger than an 1893 bulb (dash light bulb). Larger bulbs using more than .8 amps will damage switch contacts.

MAINTENANCE

No maintenance is required of any component in system. If any component is not functioning properly, it should be replaced.