

# Exhaust Emission Systems

## TOYOTA IMPROVED COMBUSTION SYSTEM (WITH TRANSMISSION CONTROLLED SPARK)

### 8R-C Engine

- Corona (1971-72)
- Corona Mk II (1971-72)
- Hi-Lux (1971-72)

### 2T-C Engine

- Corolla (1971)

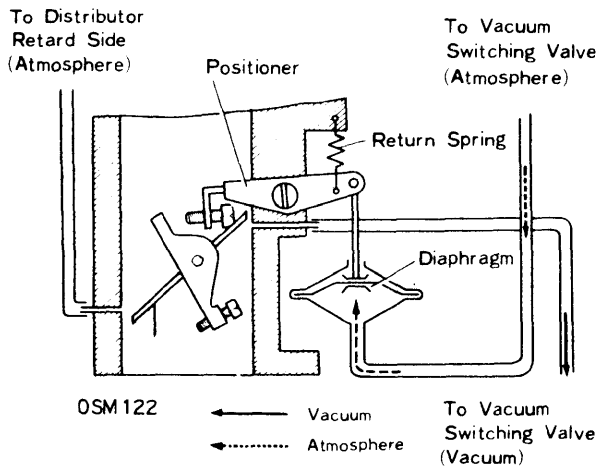
NOTE - Some engines use other systems. See 1972-73 Toyota Transmission Controlled Spark.

### DESCRIPTION

System consists of a modified carburetor with throttle positioner, transmission controlled spark circuits, vacuum advance and retard diaphragm, speed marker thermo-sensor, vacuum switching valve, shift point sensor (8R-C manual transmission) and a modified distributor.

**Carburetor** - Modifications to improve combustion of lean mixtures and reduce emissions of unburned hydrocarbons and carbon monoxide. Jet specifications are not changed. Throttle linkage has been modified for installation of throttle positioner on carburetor to control throttle opening during deceleration.

**Throttle Positioner** - Diaphragm type vacuum actuator is linked to carburetor throttle lever and controlled by vacuum switching valve to prevent throttle from closing completely during periods of deceleration.

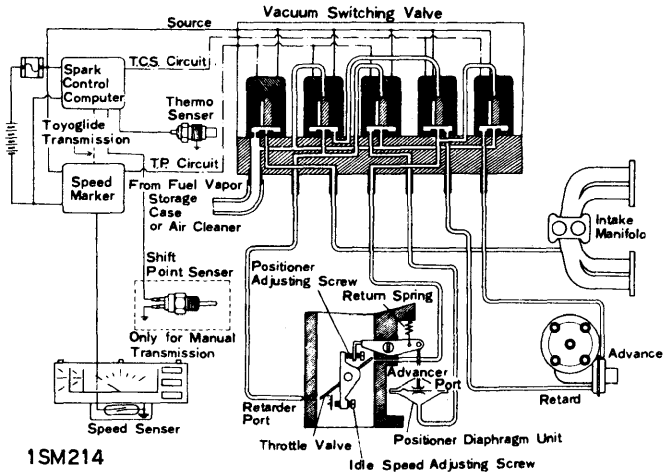


THROTTLE POSITIONER SECTIONAL VIEW

**Speed Marker** - This solid state circuit device is activated by pulses from speed sensor. In turn the speed marker actuates vacuum switching valve.

**Speed Sensor** - Speed sensor consists of a magnet driven by speedometer cable and an on-off reed switch which is actuated by a magnetic field of the magnet. Reed switch produces six pulses (four pulses on 2T-C) for each revolution of speedometer cable. At 60 MPH, 6,000 pulses (4,000 pulses on 2T-C) are produced and fed into speed marker which then actuates that unit.

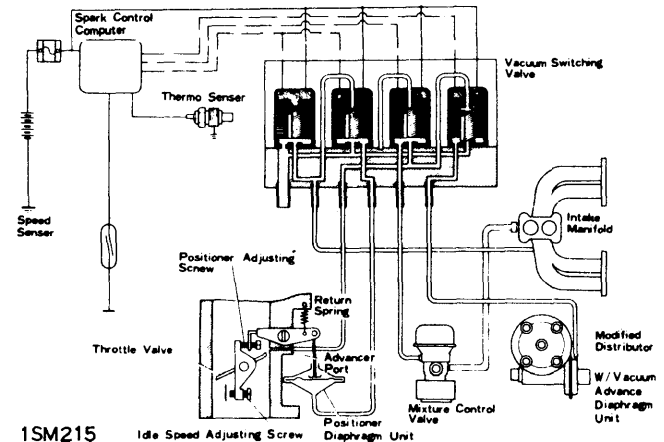
**Vacuum Switching Valve** - This solenoid operated vacuum valve unit controls operation of throttle positioner and Transmission Controlled Spark circuit (T.C.S.). On 2T-C engine it also controls a mixture control valve. Vacuum switching valve is controlled by speed sensor and switches vacuum circuits on acceleration at 25 MPH (8R-C engine) or 14 MPH (2T-C engine). At deceleration, circuits are switched at 11 MPH.



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### 8R-C IMPROVED COMBUSTION SYSTEM WITH T.C.S.

**Transmission Controlled Spark (T.C.S.)** - System operation depends on vehicle speed, engine temperature and gear shift location, on 8R-C engines only. On 8R-C engines, T.C.S. retards ignition timing. On 2T-C engines vacuum advance is shut off and only centrifugal advance is utilized.



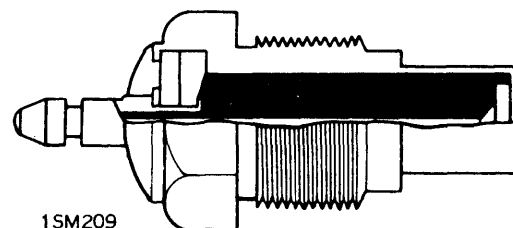
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### 2T-C IMPROVED COMBUSTION SYSTEM WITH T.C.S.

**Mixture Control Valve** - Valve allows fresh air to pass into intake manifold to control air/fuel ratio. Valve operates only when vehicle speed exceeds 35 MPH.

**Shift Point Sensor** - When transmission is shifted to 4th gear, sensor is switched on and turns T.C.S. off. At all other gear positions, sensor is in off position.

**Thermo-Sensor** - Unit is a thermistor which possesses qualities of low resistance at high temperatures, and high resistance at low temperatures.



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### THERMO-SENSOR

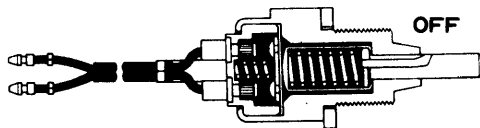
## TOYOTA IMPROVED COMBUSTION SYSTEM (Cont.) (WITH TRANSMISSION CONTROLLED SPARK) OPERATION

1) When vehicle speed exceeds 11 MPH, switching valve is actuated by speed marker and allows atmospheric pressure to throttle positioner diaphragm. As accelerator is depressed, throttle positioner is pulled away from diaphragm by a return spring. Its lower end moves downward to a set position. When accelerator is let off, throttle valve is held open by throttle positioner at an angle slightly larger than that of idle speed.

2) When speed decreases below 11 MPH, circuit to switching valve is open. This movement changes passage of vacuum and pressure, intake manifold vacuum acts on positioner diaphragm through switching valve. Throttle positioner is pulled closer to diaphragm unit and permits throttle valve to close to idle speed position.

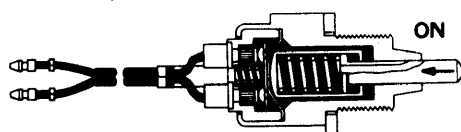
3) T.C.S. system delays ignition timing when vehicle speed drops below 35 MPH (4th gear engaged on 8R-C with manual transmission) and coolant temperature is between 140° and 203°F. When decelerating, however, T.C.S. will not operate until vehicle speed decreases to 13 MPH (8R-C with automatic transmission), or 30 MPH (2T-C engine).

At Except 4th Speed Position



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At 4th Speed Position



SHIFT POINT SENSOR

4) T.C.S. system does not operate at speeds above 35 MPH (automatic transmission or when 4th gear is engaged on 8R-C with manual transmission). At coolant temperature below 140°F or above 203°F, T.C.S. system does not operate.

5) When T.C.S. is in off state, vacuum at carburetor advance post permits vacuum advance. Mixture control valve (2T-C engine) prevents mixture from becoming too rich upon decelerating from speeds above 35 MPH.

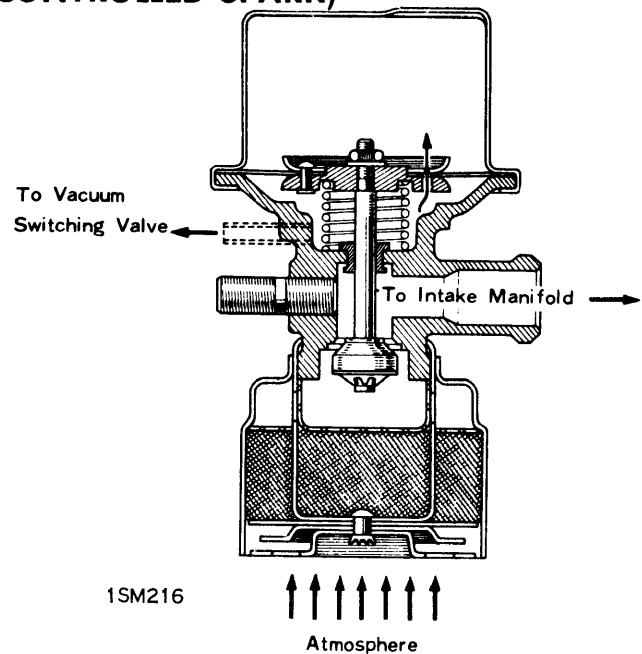
## PERIODIC SERVICE

Periodic inspection and service as detailed below is required to maintain satisfactory engine performance and to reduce exhaust emission pollutants to designed limits. For all specifications, refer to Foreign Car Tune-Up Chart.

### ENGINE TUNE-UP

**Carburetor Idle Speed and Mixture Adjustment** – Check and adjust after first 1,000 miles and then at 3,000 mile intervals. Connect vacuum gauge and tachometer. With engine at normal operating temperature, adjust as follows:

- 1) Adjust idle speed to specified RPM by turning idle speed adjusting screw.
- 2) Turn idle mixture adjusting screw to obtain maximum vacuum gauge reading.



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MIXTURE CONTROL VALVE (2T-C ENGINE ONLY)

3) Repeat idle speed and mixture adjustment (steps 1 & 2) as required to obtain specified settings.

4) For final step, turn idle mixture adjusting screw to obtain lean best idle setting.

**Distributor** – Check points and adjust gap after first 1,000 miles and then at 3,000 mile intervals.

**Ignition Timing** – Check and adjust after first 1,000 miles and then at 3,000 mile intervals.

**Spark Plugs** – Check and adjust after first 1,000 miles and then at 6,000 mile intervals. Replace every 12,000 miles.

**Valve Clearance** – Check and adjust after first 1,000 miles and then at 6,000 mile intervals.

## EMISSION CONTROL UNITS

Check all components for proper operation after first 1,000 miles and then at 12,000 mile intervals. Also check condition of all lines and hoses and make certain connections are tight.

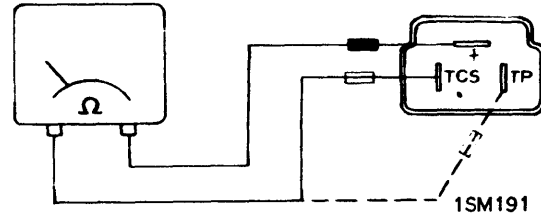
## MAINTENANCE

**Throttle Positioner** – With engine idle speed adjusted to specifications and engine at normal operating temperature, disconnect vacuum hose from positioner diaphragm and plug hose. Raise engine RPM slightly by depressing accelerator pedal to set throttle positioner in place, then adjust positioner adjusting screw to obtain 1400 RPM in neutral. Connect hose to positioner diaphragm. Throttle lever should become free from throttle positioner as soon as hose has been connected and engine should idle at specified idle speed. If operation is not correct, inspect throttle positioner linkage, diaphragm, vacuum switching valve and speed marker operation. Check vacuum hoses and connections for leaks.

# Exhaust Emission Systems

## TOYOTA IMPROVED COMBUSTION SYSTEM (Cont.) (WITH TRANSMISSION CONTROLLED SPARK)

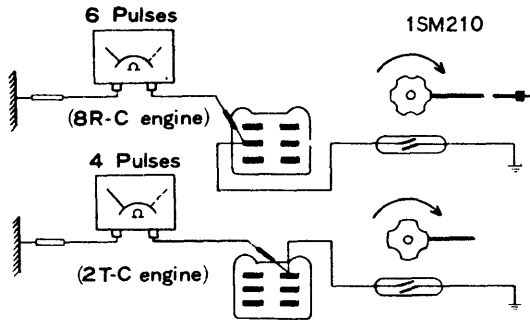
**Distributor Vacuum Unit** – Connect tachometer, with engine at normal operating temperature, adjust idle speed to specifications. Disconnect and plug hose leading from vacuum switching valve to adapter on intake manifold. Disconnect hose connecting vacuum switching valve with retard chamber of distributor unit at switching valve and connect it with intake manifold adapter. Engine RPM should decrease due to retard action. If there is no change in RPM, replace distributor assembly.



TESTING VACUUM SWITCHING VALVE (8R-C ENGINE)

(+) and T.C.S., resistance should be 28 ohms. Disconnect wiring and remove switching valve from vehicle. Blow air into each passage and inspect operation of each valve. Check for defects in wiring connections. Replace vacuum switching valve assembly if defect is not in wiring. Check valves as follows:

- 1) In "OFF" position air should pass from "A" to "F", "B" to "E", and from "D" to "G".
- 2) In "ON" position (TP off), air should pass from "A" to "G", "B" to "E", and "D" to "F".
- 3) In "ON" position (TP on), air should pass from "A", "C", "E" and "G" in any combination of directions. Air should also be able to pass from "D" to "F".
- 4) In "OFF" position (TP on), air should pass from "A", "C" and "E" in any combination of directions. Air should also be able to pass from "B" to "F" and from "D" to "G".

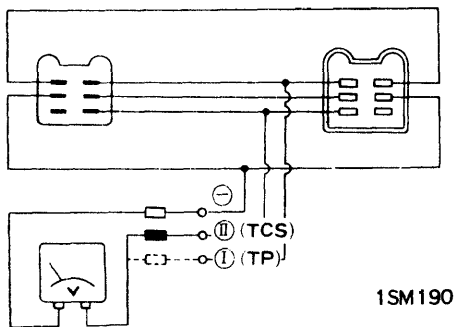


SPEED SENSOR

**Speed Sensor** – To check sensor with vehicle stationary, disconnect speedometer cable from transmission. Using a circuit tester, make sure there are 6 on-off pulses on 8R-C engine (4 on-off pulses on 2T-C engine) for each speedometer cable rotation. Speed sensor can also be checked while driving. With vehicle moving at 10 MPH, and using an oscilloscope, number of pulses should be 900 to 1150 per minute, 8R-C engine. On 2T-C engine number should be 600 to 766 per minute. If unable to obtain measured values, replace speedometer assembly.

**Speed Marker** – Disconnect speed marker socket and drive vehicle with a voltmeter connected as shown in illustration. When accelerating, voltage should drop from 12 to 0 volts at 25 MPH. When decelerating, voltage should increase from 0 to 12 volts at 11 MPH.

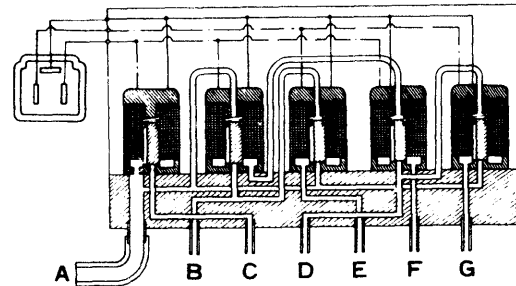
Wiring Side                      Speed Marker Side



TESTING SPEED MARKER AND T.C.S.

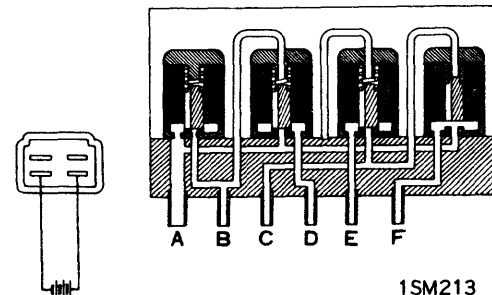
**Transmission Controlled Spark (T.C.S.) Circuit** – Disconnect speed marker circuit. Drive vehicle with voltage tester connected as shown in illustration. When accelerating, voltage should drop from 7 to 0 volts at 35 MPH. When decelerating, voltage should go from 0 to 7 volts and 13 MPH.

**Vacuum Switching Valve (8R-C)** – Measure resistance of magnetic coil. Measure resistance between (+) and TP, resistance should be 18.7 ohms. Measure resistance between



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8R-C VACUUM SWITCHING VALVE (SECTIONAL VIEW)



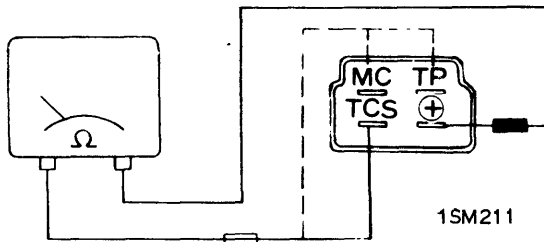
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2T-C VACUUM SWITCHING VALVE (SECTIONAL VIEW)

**Vacuum Switching Valve (2T-C)** – Measure resistance of magnetic coil. Measure resistance between (+) and TP, resistance should be 28 ohms. Measure resistance between (+) and MC, resistance should be 56 ohms. Measure resistance between (+) and T.C.S., resistance should be 56 ohms. Disconnect wiring, remove switch from vehicle. Blow air into each passage and inspect operation of each valve. Check for defects in wiring connections. Replace vacuum switching valve assembly if defect is not in wiring. Check valves as follows:

## TOYOTA IMPROVED COMBUSTION SYSTEM (Cont.) (WITH TRANSMISSION CONTROLLED SPARK)

- 1) In "OFF" position, air flow should flow between "B" and "D". Air should also be able to pass from "C" to "F".
- 2) With T.C.S. on, TP and MC off, air should pass between "A" and "F", also air should be able to pass between "B" and "D".
- 3) With T.C.S. on, TP on, and MC off, air should pass from "A", "B", "D" and "F" in any combination of directions.
- 4) With T.C.S. off, TP and MC on, air should pass from "A", "B" and "D" in any combination of directions. Air should also be able to pass from "C", "E" and "F" in any combination of directions.



TESTING VACUUM SWITCHING VALVE (2T-C ENGINE)

**Vacuum Hoses & Fittings** – Check for leakage and proper connections. Remove all hoses and blow them out with air. Replace all hoses that cannot be cleaned with compressed air.

### TROUBLE SHOOTING

**Abnormal Idle Speed** – Faulty carburetor, sticking carburetor linkage or choke valve. Throttle positioner faulty or positioner linkage sticking. Leaking diaphragm, vacuum switching valve faulty. Vacuum hoses or tubes disconnected or clogged.

**Rough Engine Idle** – Idle speed, carburetor idle mixture, ignition timing or valve clearance improperly adjusted. Vacuum hoses or lines disconnected or leaking, air or fuel leakage caused by loose manifold bolts or carburetor flange attaching nuts. Stuck ventilation valve, or vacuum switching valve faulty.

**Insufficient Engine Braking Effect** – Engine idle or throttle positioner improperly adjusted. Distributor retard and advance unit diaphragm faulty or leaking. Vacuum hoses or lines clogged or disconnected. Speed detector, speed marker, T.C.S. circuit, or vacuum switching valve faulty.

**Power Loss at High Speed** – Faulty speed sensor, speed marker or T.C.S. circuit.