TOYOTA AIR INJECTION

Celica
Corolla
Corona
Land Cruiser
Pickup (Calif. Only)
Tercel (Calif. Only)

DESCRIPTION

Air injection is used on these models to reduce hydrocarbon (HC) and carbon monoxide (CO) emissions. Fresh air is injected at the exhaust ports, allowing the gases to continue burning as they exit through the exhaust system. An air pump provides fresh air under pressure to be injected in the exhaust ports. A control system determines when the air should be injected.

The control system varies with each model. Major components include air control valve (ACV), air switching valve (ASV), check valve, vacuum transmitting valve (VTV), bimetal vacuum switching valve (BVSV), vacuum switching valve (VSV), vacuum control valve (VCV), catalytic converter temperature sensor and oxygen sensor.

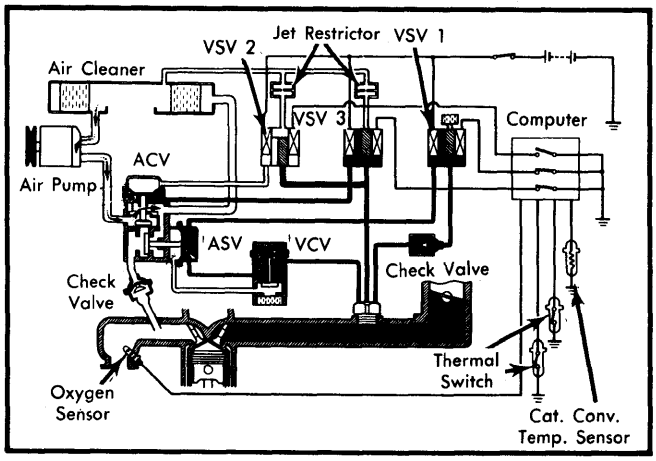

Fig. 1 Air Injection System (Celica, Corona, Pickup)

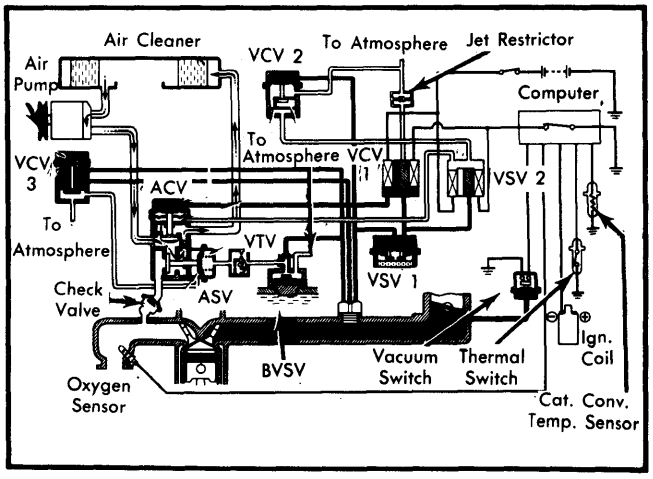

Fig. 2 Air Injection System (Corolla)

OPERATION

The air injection control systems determine when fresh air is added to the exhaust ports. The switching points will vary with each engine, but the following conditions apply to all systems. Air is not injected when the engine is cold, when coolant temperature is above 230°F (110°C), during deceleration, or when catalytic converter temperature is above 1445°F (785°C). On vehicles with oxygen sensor, air injection is switched off if air-fuel ratio is too lean.

TESTING

PRELIMINARY TEST

All Models – Check all hoses and connections. With engine coolant below 45°F (8°C), remove air by-pass hose from air cleaner housing. Start engine. Air should discharge from air by-pass hose. As engine warms up, air by-pass should stop. Leave hose disconnected and proceed with system check.

SYSTEM CHECK

Celica, Corona & Pickup – 1) Warm up engine so coolant temperature is between 64-109°F (18-43°C). Disconnect and plug vacuum hose at check valve located between VSV 1 and vacuum pipe. Check that air is not discharged from air by-pass hose.

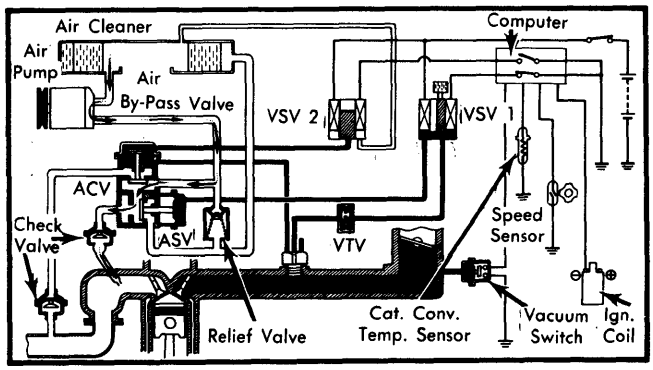

Fig. 3 Air Injection System (Land Cruiser)

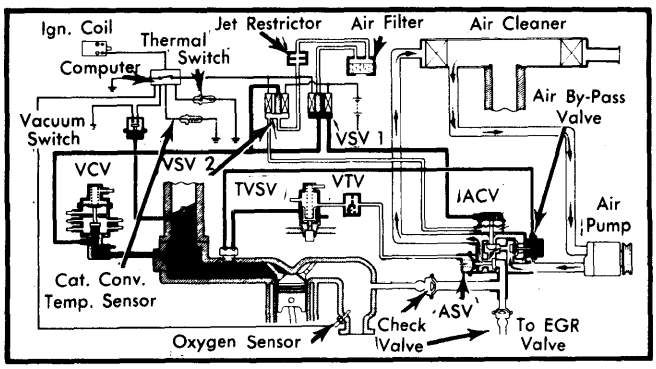

Fig. 4 Air Injection System (Tercel)

TOYOTA AIR INJECTION (Cont.)

2) Warm up engine to normal operating temperature. Set engine speed at 2000 RPM. Check that air is discharged intermittently from air by-pass hose. Race engine and quickly close throttle. Air should discharge briefly from air by-pass hose.

3) Run engine at idle. Locate service connector at left fender panel near ignition coil on Celica and Corona models or corner of left dash panel on Pickup models. Connect a wire from "TWC" terminal to "E" terminal. Check that air is discharged intermittently from air by-pass hose. Disconnect wire.

4) Stop engine and reconnect all hoses. If system performed correctly, testing is complete. If not, check individual components as necessary.

Corolla – **1)** Warm up engine to normal operating temperature. Set engine speed at 2000 RPM. Check that air is discharged intermittently from air by-pass hose. Race engine and quickly close throttle. Air should discharge briefly from air by-pass hose.

2) Run engine at idle. Disconnect vacuum hose located between VTV and 3-way connector at VTV. Check that air discharges from air by-pass hose within 15-25 seconds. Reconnect hose and check that air stops discharging after a few seconds.

3) At service connector located at corner of left dash panel, connect a wire from "TWC" terminal to "E" terminal. Air should discharge from air by-pass hose. Disconnect wire.

4) Pinch hose at vacuum switch with fingers and gradually increase engine speed. Check that intermittent air stops discharging from air by-pass hose at 2200 RPM. Release hose.

NOTE – *Perform step* **4)** *in as short a time as possible. Engine will misfire slightly while hose is pinched off since deceleration fuel cut off system is on.*

5) Stop engine and reconnect all hoses. If system performed correctly, testing is complete. If not, check individual components as necessary.

Land Cruiser – **1)** Run engine at idle. Disconnect vacuum hose from blue side of VTV. Check that air discharges from air by-pass hose within 3-10 seconds. Reconnect hose to VTV and check that air discharge stops quickly.

2) Disconnect air hose located between air by-pass valve and exhaust pipe at air by-pass valve. Disconnect vacuum hose located between air by-pass valve and VSV 2 at air by-pass valve. Plug valve at vacuum hose port.

3) Race engine and quickly close throttle. Check that air discharges momentarily from air by-pass valve. Unplug valve and reconnect vacuum hose. Connect a jumper wire to both terminals of the catalytic converter temperature sensor. Check that air discharges from air by-pass hose. Disconnect jumper wire.

4) Pinch hose at vacuum switch with fingers and gradually increase engine speed. Check that air stops discharging from air by-pass hose at 2000 RPM. Release hose.

NOTE – *Perform step* **4)** *in as short a time as possible. Engine will misfire slightly while hose is pinched off since deceleration fuel cut off system is on.*

5) Reconnect air by-pass hose to air cleaner and air hose to air by-pass valve. Using a 3-way connector, connect a vacuum gauge to hose located between air by-pass valve and VSV 2. Place gauge in driver's seat.

6) Road test vehicle observing speedometer and vacuum gauge. At speeds below 35 MPH, vacuum gauge should indicate intake manifold vacuum. At speeds above 50 MPH, no vacuum should be present. If system performed correctly, testing is complete. If not, check individual components as necessary.

Tercel – **1)** Warm up engine to normal operating temperature. Set engine speed at 2000 RPM. Check that air is discharged intermittently from air by-pass hose. Return engine speed to idle and check that air discharge stops.

2) Disconnect vacuum hose from ASV and check that air discharges from air by-pass valve. Reconnect hose. Air should stop discharging within 26 seconds.

3) Disconnect vacuum hose from air by-pass valve and check that air does not discharge from air by-pass valve. Reconnect hose. Air should momentarily discharge from air by-pass hose.

4) Pinch hose at vacuum switch with fingers and gradually increase engine speed. Check that intermittent air stops discharging from air by-pass hose at 1600 RPM. Release hose.

5) Return engine speed to idle. At service connector located on left fender panel near ignition coil, connect a wire from "TWC" terminal to "E" terminal. Air should discharge from air by-pass hose. Disconnect wire.

6) Disconnect hose located between check valve and EGR valve at check valve. Check that air is discharging from check valve. Stop engine and reconnect all hoses. If system performed correctly, testing is complete. If not, check individual components as necessary.

CHECK VALVE

Remove check valve and blow through both sides. Air should pass to manifold side, but should not pass from manifold side to pump side. Replace if defective.

PUMP AND RELIEF VALVE

1) Check air pump belt for condition and tension. Belt tension should be 60-100 lbs. with a used belt and 100-150 lbs. with a new belt. Do not pry on pump housing when tightening belt.

Air Pump Relief Valve Pressure

Application	Pressure Psi (kg/cm²)
Celica, Corona, Pickup	5.0-6.4 (.35-.44)
Corolla	4.7-6.8 (.33-.48)
Land Cruiser	5.7-8.5 (.40-.60)
Tercel	3.3-5.6 (.23-.39)

TOYOTA AIR INJECTION (Cont.)

2) Disconnect air outlet hose at check valve and install pressure gauge. Start engine, warm to operating temperature, and raise engine speed until relief valve operates. Check that pressure is correct.

VACUUM TRANSMITTING VALVE (VTV)

Remove valve and blow through both sides. On Corolla and Tercel models, air should flow with resistance in both directions. On Land Cruiser models, air should flow easily from side B to A, but with resistance from side A to B.

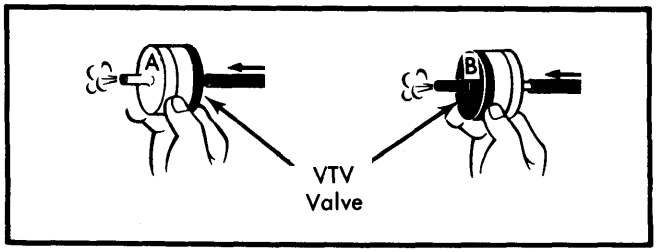

Fig. 5 Testing Vacuum Transmitting Valve

VACUUM SWITCHING VALVE (VSV)

1) Connect battery to VSV terminals as shown in *Fig. 6*. Blow into lower port of VSV — air should come out top port. Disconnect battery and blow into lower port — air should come out filter at bottom of VSV.

2) Use an ohmmeter to measure resistance between terminals where voltage was applied. Resistance should measure 38-43 ohms at room temperature. There should be no continuity between positive terminal and body of VSV.

BIMETAL VACUUM SWITCHING VALVE (BVSV)

Corolla — Drain coolant and remove BVSV. Cool in ice water to below 46° F (8° C). Plug top port and blow through other ports. Air should pass freely. Heat valve in water and check that air will not flow through (with top port plugged) when valve is above 66° F (19° C).

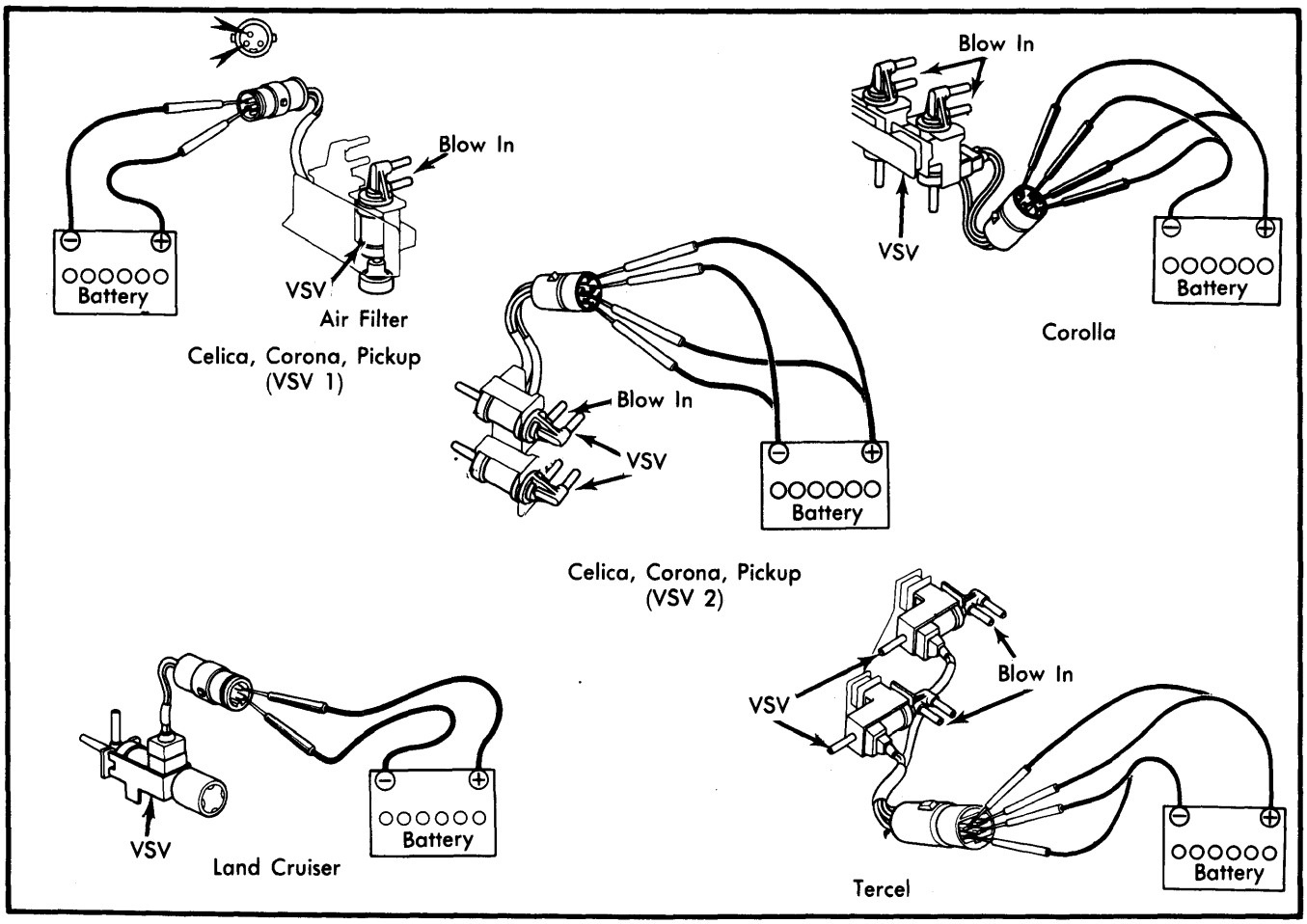

Fig. 6 Vacuum Switching Valve Test Connections

TOYOTA AIR INJECTION (Cont.)

VACUUM CONTROL VALVE (VCV)

Celica, Corona, Pickup – **1)** Disconnect and plug vacuum hose from port X. Using a jumper hose, connect port X to intake manifold. Disconnect vacuum hose from port S and Z. See *Fig. 7*.

2) Run engine at idle. Plug port Z with finger and check that no vacuum is felt. Reconnect hose to port S. Vacuum should be felt momentarily.

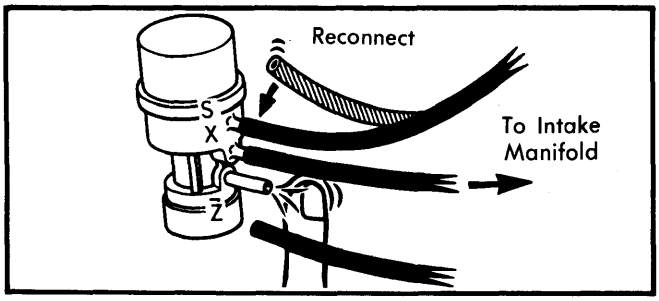

Fig. 7 Testing Vacuum Control Valve (Celica, Corona, Pickup)

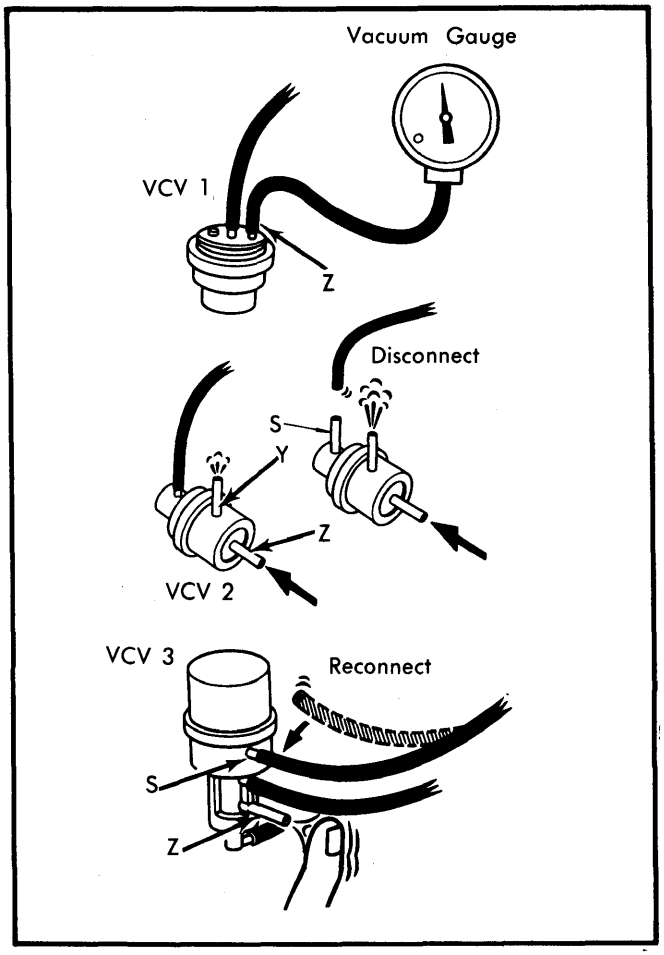

Fig. 8 Testing Vacuum Control Valve (Corolla)

Corolla – **1)** Start engine and run at idle speed. Disconnect vacuum hose from and connect vacuum gauge to port Z of VCV 1. Check that gauge indicates about 7.9 in. Hg. Reconnect hose.

2) Disconnect vacuum hose from port Y and Z of VCV 2. Check that a small amount of air flows from port Z to port Y. Disconnect vacuum hose from port S. Check that air flow increases. Reconnect hoses.

3) Disconnect vacuum hose from port S and Z of VCV 3. Plug port Z with finger and check that no vacuum is felt. Reconnect hose to port S. Vacuum should be felt momentarily. See *Fig. 8*.

CATALYTIC CONVERTER TEMPERATURE SENSOR

Unplug temperature sensor connector under driver's seat. With engine warm and idling, measure resistance across sensor terminals. Resistance should measure 2,000-200,000 ohms.

NOTE – *Insert ohmmeter probes into rear of connector to avoid damaging contacts.*

OXYGEN SENSOR

1) Warm up engine to normal operating temperature. Connect a voltmeter to service connector by attaching positive probe to "Ox" terminal and negative probe to "E" terminal. See *Fig. 9*.

NOTE – *Service connector is located on left fender panel near ignition coil on Celica, Corona and Tercel models or on left dash panel on Corolla and Pickup models.*

2) Run engine at 2500 RPM for about 90 seconds. Maintain engine speed and check that voltmeter needle fluctuates 8 or more times in 10 seconds within 0-7 volts. If not, replace oxygen sensor.

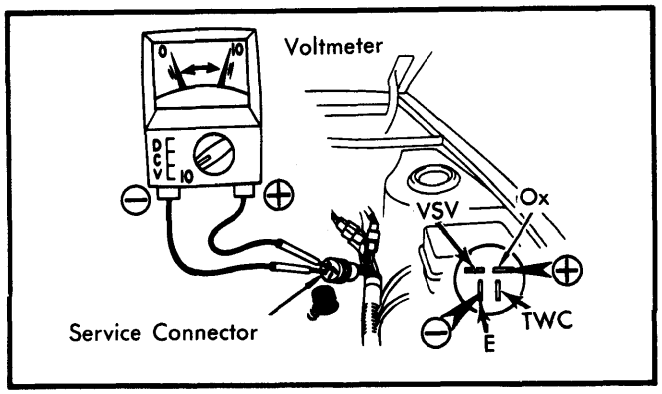

Fig. 9 Oxygen Sensor Test Connections