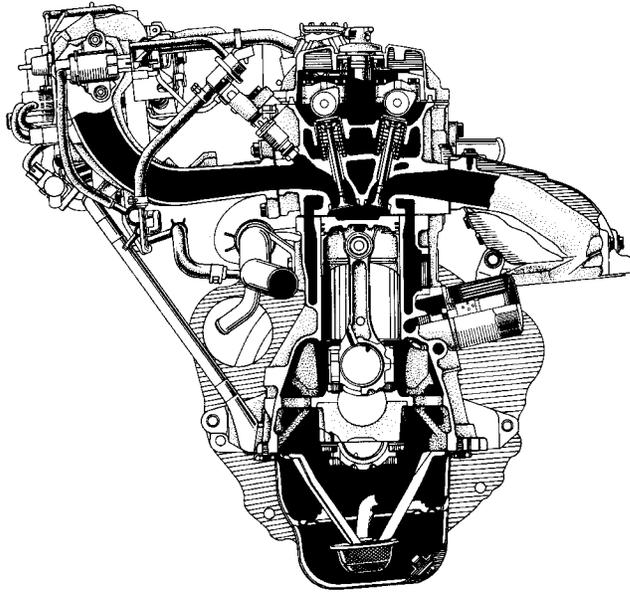
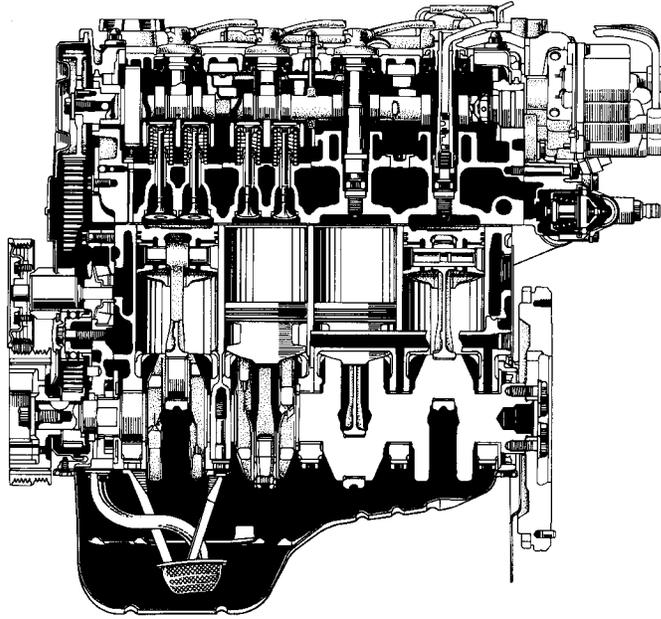


## 4A-FE ENGINE

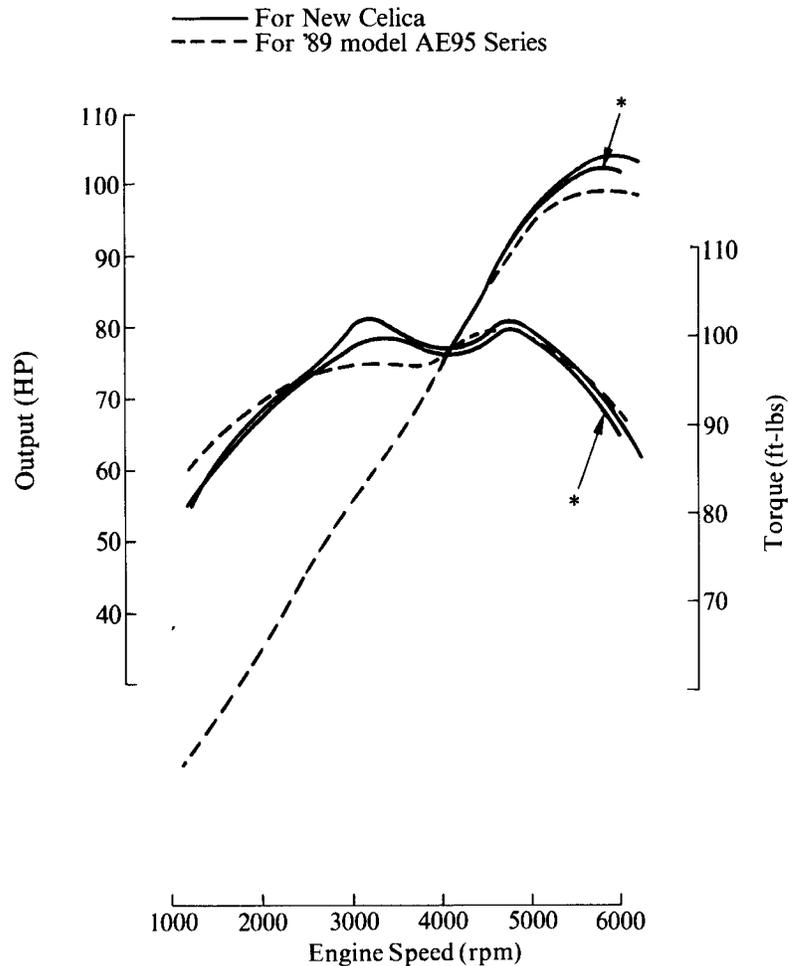
### ■ DESCRIPTION

The 4A-FE engine is the dependable, lightweight and compact DOHC engine that is currently carried in the Corolla All-Trac/4WD station wagons ('89 model AE95 series). Although the basic construction and operation are identical to the engine used in the '89 model AE95 series, the crankshaft pulley, intake manifold, throttle body, engine mount, etc., were modified to ensure a better match with the new Celica.



## ENGINE SPECIFICATIONS AND PERFORMANCE CURVE

Engine		4A-FE (for new Celica)	4A-FE (for '89 model AE95 series)
Item			
No. of Cyls. & Arrangement		4-cylinder, In-line	←
Valve Mechanism		4 Valves, DOHC, Belt & Gear Drive	←
Combustion Chamber		Pentroof Type	←
Manifolds		Cross-flow	←
Displacement	cu. in. (cc)	96.8 (1587)	←
Bore x Stroke	in. (mm)	3.19 x 3.03 (81 x 77)	←
Compression Ratio		9.5 : 1	←
Max. Output	(SAE-NET)	103 HP @ 6000 rpm 102 HP @ 5800 rpm*	100 HP @ 5600 rpm
Max. Torque	(SAE-NET)	102 HP @ 3200 rpm 101 ft-lbs @ 4800 rpm*	101 ft-lbs @ 4400 rpm
Fuel Octane Number	(RON)	91	←
Oil Grade		API SG	API SF or SG

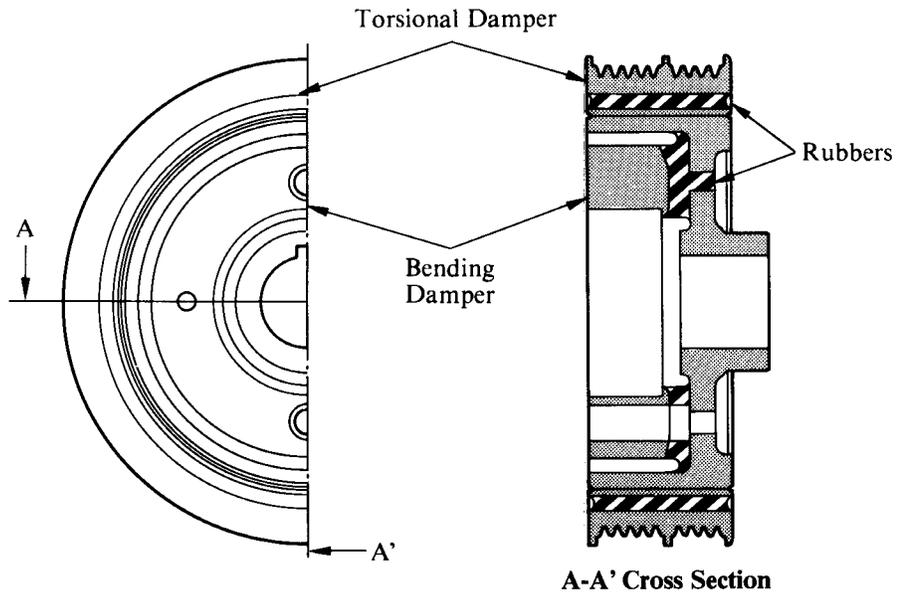


\*: Applicable only to California specification vehicles.

## ENGINE

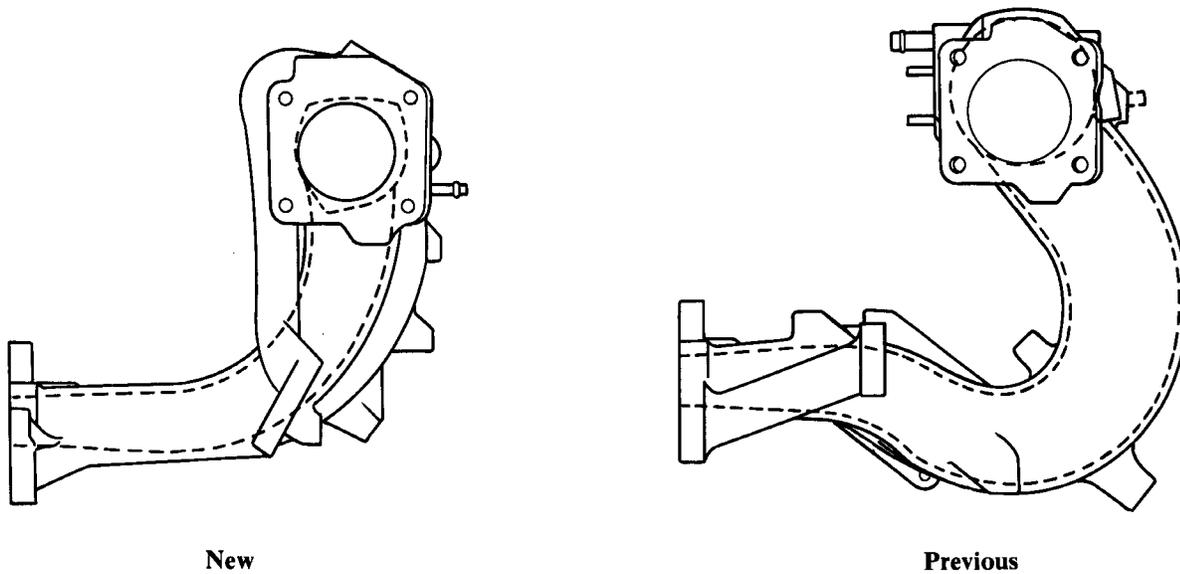
### 1. Crankshaft Pulley

The crankshaft pulley has a torsional damper that reduces torsional vibration of the crankshaft. In addition, it has a longitudinal damper to reduce longitudinal vibration of the crankshaft. These dampers jointly minimize vibration and noise.



### 2. Intake Manifold

The intake manifold is integrated with the intake air chamber to reduce the overall weight. The intake pipe length and the port diameter were optimized to further increase torque in low to medium speed ranges.



### **3. Throttle Body**

The construction of the throttle body has been changed from the type with incorporated air valve in the '89 model AE95 series to the type with separate air valve. The basic operation is unchanged.

## **■ ENGINE MOUNTING**

### **1. Cylindrical Liquid-filled Compound Mount**

A newly-developed cylindrical liquid-filled compound mount is used in both the left and right mounts. See page 75 under 5S-FE engine for detail.

## ENGINE CONTROL SYSTEM

### 1. General

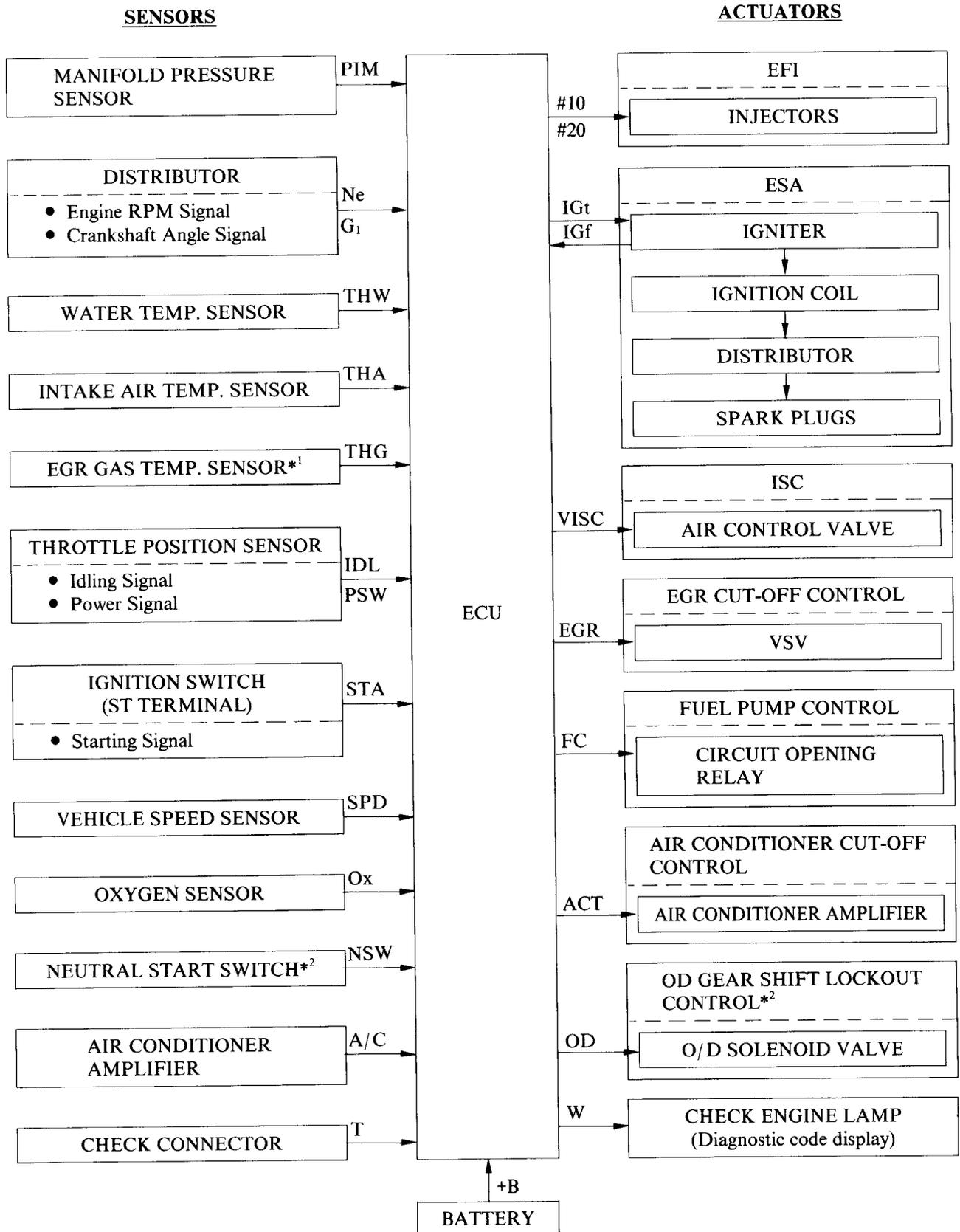
The engine control system of the 4A-FE engine for the new Celica is basically the same functionally as the 4A-FE engine carried in the Corolla All-Trac/4WD station wagons ('89 model AE95 series), but it incorporates some modifications. The following table compares the engine control systems between the new Celica and the '89 model AE95 series:

Engine System	New 4A-FE (for new Celica)	Previous 4A-FE (for '89 model AE95 series)
EFI (Electronic Fuel Injection)	<ul style="list-style-type: none"> <li>A D-type EFI system is used which indirectly detects intake air volume by the manifold pressure sensor signal.</li> <li>The fuel injection system is simultaneously an all injection system.</li> </ul>	←
ESA (Electronic Spark Advance)	Ignition timing is determined by the ECU (Electronic Control Unit) based on signals from various sensors.	←
ISC (Idle Speed Control)	ACV regulates air volume by passing throttle valve and controls idling speed.	←
EGR Cut-Off Control	The EGR is cut off under light engine loads or low temperature conditions to maintain drivability.	N.A.
Fuel Pump Control	Fuel pump operation is controlled by signals from ECU.	←
Air Conditioner Cut-Off Control	By controlling the air conditioner compressor in accordance with the throttle valve opening angle and the vehicle speed, drivability is maintained.	N.A.
OD Gear Shift Lockout Control*	Prohibits OD gear shift depending on engine condition to main good drivability and acceleration performance.	N.A.
Diagnosis	<ul style="list-style-type: none"> <li>When a malfunction occurs, the ECU diagnoses and memorizes the failed section.</li> <li>14 diagnostic items are monitored by the ECU.</li> </ul>	
Fail-Safe	When a malfunction occurs, the ECU stops or controls the engine according to the data already stored in memory.	←

\*: Applicable only to automatic transaxle models.

## 2. Construction

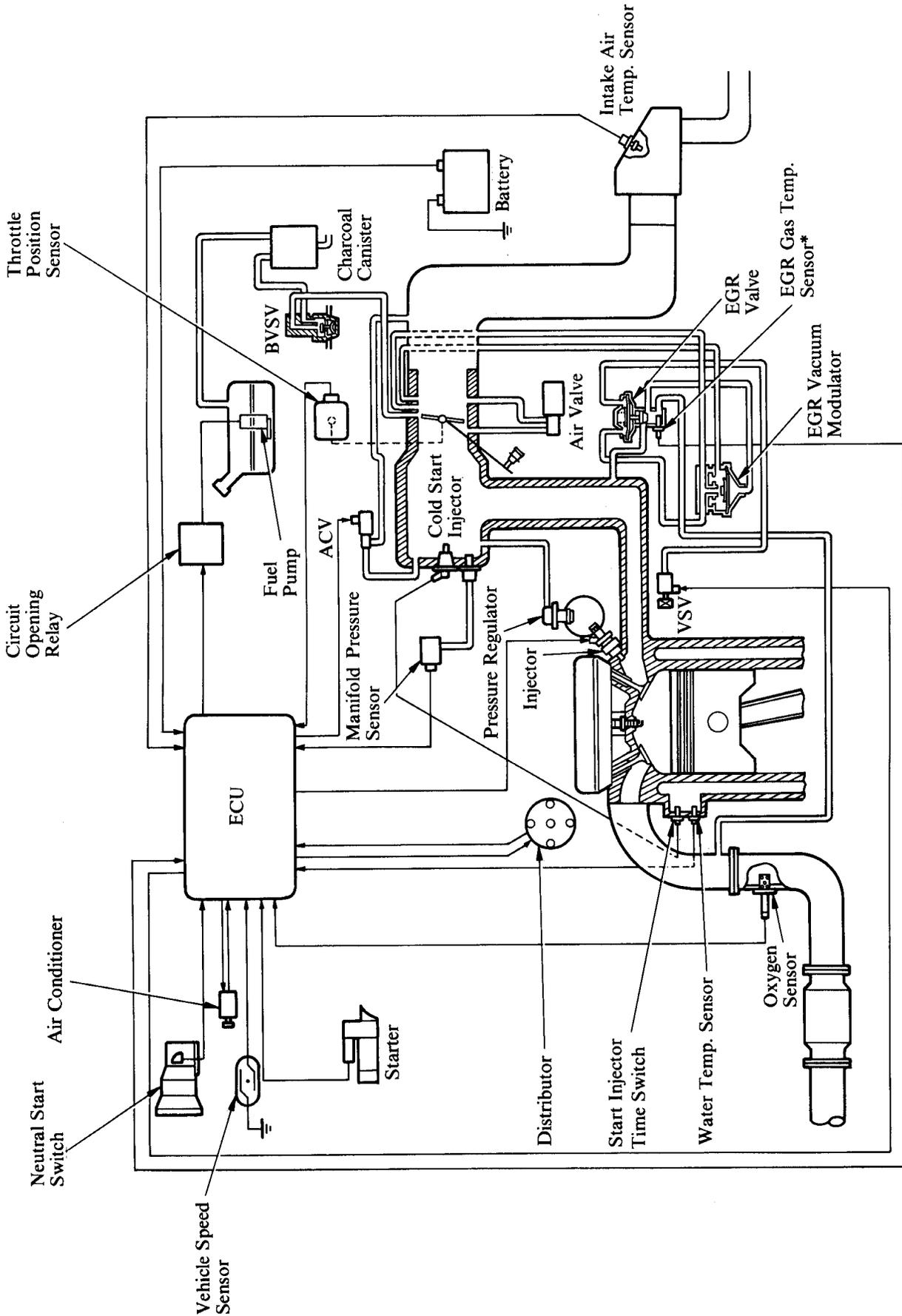
The engine control system can be divided into three groups; the sensors, ECU and actuators.



\*1: Applicable only to California specification vehicles.

\*2: Applicable only to automatic transaxle models.

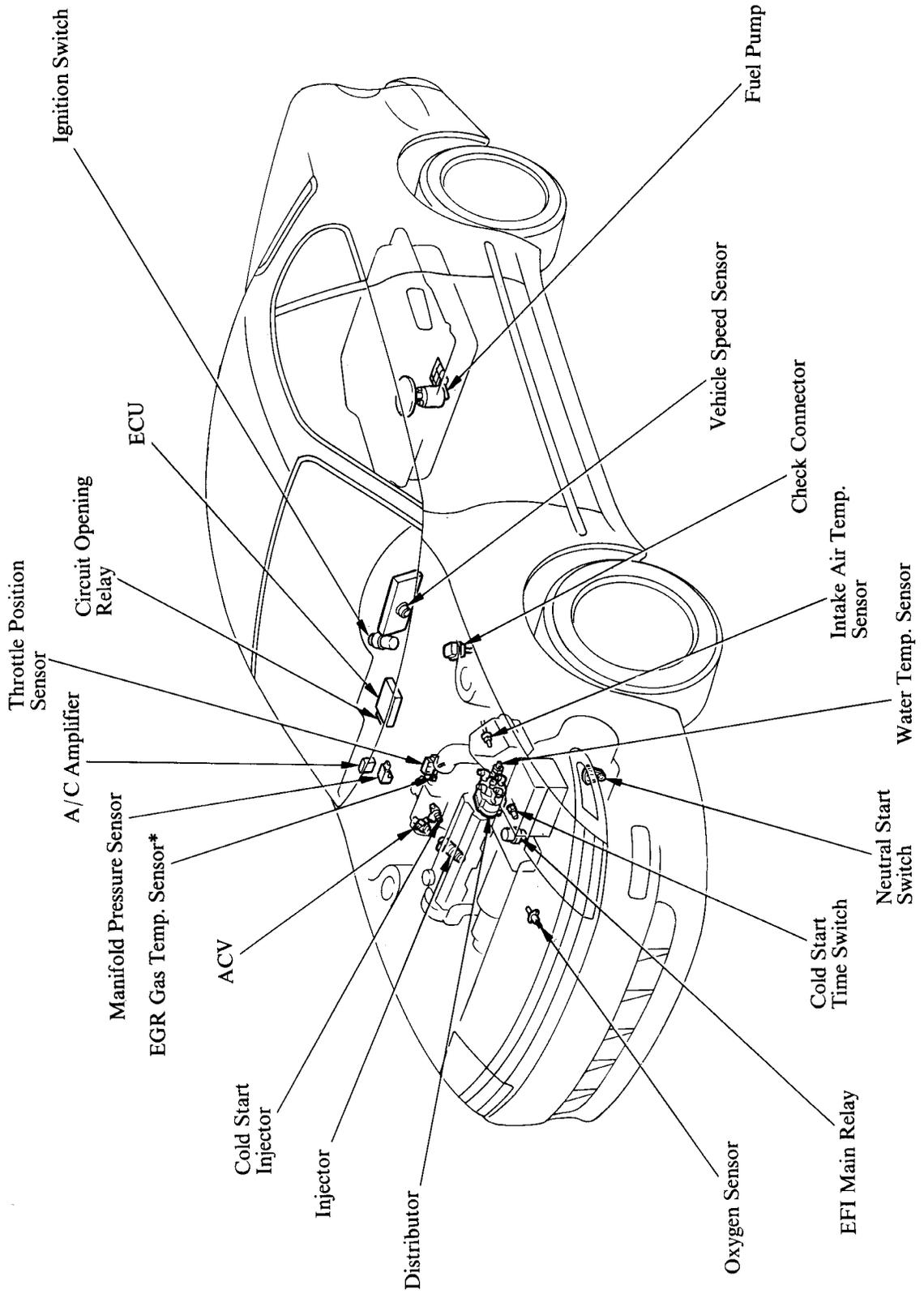
### 3. Engine Control System Diagram



\* Applicable only to California specification vehicles.

### 4. Arrangement of Engine Control System Components

\* Applicable only to California specification vehicles.

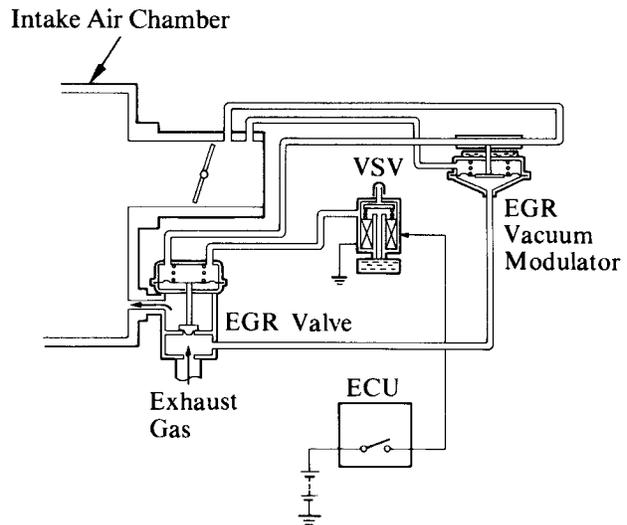


## 5. EGR Cut-Off Control

This system actuates the VSV to replace intake manifold vacuum acting on the EGR vacuum modulator with atmospheric air and thus cuts the EGR from the system.

### Operation

To maintain vehicle drivability and durability of the EGR components, the ECU actuates off the VSV and cuts the EGR when the coolant temperature is below 127°F (53°C) and the engine load is above a predetermined level.



## 6. Air Conditioner Cut-Off Control

The ECU sends a signal to the air conditioner amplifier to disengage the air conditioner compressor magnet clutch and cuts off the air conditioning operation according to the engine speed, intake manifold pressure, vehicle speed and throttle valve opening angle.

### Operation

The air conditioner is turned off during quick acceleration from a low engine speed, depending on the vehicle speed, throttle valve position and the intake manifold pressure. This helps maintain good acceleration performance.

The air conditioner is also turned off when the engine is idling at a speed below 500 rpm. This prevents the engine from stalling.

#### RELEVANT SIGNALS

- Throttle position (IDL, PSW)
- Vehicle speed (SPD)
- Intake manifold pressure (PIM)
- Engine speed (Ne)
- Neutral start switch\* (NSW)

\*: Applicable only to automatic transaxle models.

## 7. OD Gear Shift Lockout Control (for A240L Automatic Transaxle Models)

The ECU turns the OD solenoid valve of the automatic transaxle on depending on the coolant temperature and the acceleration condition of the vehicle. This prohibits shifting to the OD gear to maintain good drivability and acceleration performance.

### Operation

This control is used when the coolant temperature is below 122°F (50°C) to maintain good drivability. The same control used to be done by the water temperature switch in the previous engine, but is now done by the engine ECU in the new 4A-FE engine. Shifting to the OD gear is also prohibited during quick acceleration in low to medium speed ranges to maintain good acceleration performance.

#### RELEVANT SIGNALS

- Coolant temperature (THW)
- Vehicle speed (SPD)
- Engine speed (Ne)
- Throttle position (PSW)
- Intake manifold pressure (PIM)

## 8. Diagnosis

The diagnostic system in the 4A-FE engine for the new Celica monitors fourteen conditions in the chart below. The purpose of this system is the same as the 4A-FE engine for '89 model AE95 series, but diagnostic items have been changed to match the 4A-FE engine for the new Celica.

### Diagnostic Items

Code No.	Item	Diagnosis	Trouble Area	"CHECK ENGINE" Lamp	
12	RPM Signal	No "Ne" signal to ECU within 2 seconds after the engine is cranked.	<ul style="list-style-type: none"> <li>• Distributor circuit</li> <li>• Distributor</li> <li>• Starter signal circuit</li> <li>• ECU</li> </ul>	ON	
13	RPM Signal	No "Ne" signal to ECU when the engine speed is above 1000 rpm.	<ul style="list-style-type: none"> <li>• Distributor circuit</li> <li>• Distributor</li> <li>• ECU</li> </ul>	ON	
14	Ignition Signal	No "IGf" signal to ECU 4 times in succession.	<ul style="list-style-type: none"> <li>• Igniter circuit</li> <li>• Igniter</li> <li>• ECU</li> </ul>	ON	
21	Oxygen Sensor Signal	During air-fuel ratio feedback correction, voltage output from the oxygen sensor does not exceed a set value on the lean side and the rich side continuously for a certain period.	<ul style="list-style-type: none"> <li>• Oxygen sensor circuit</li> <li>• Oxygen sensor</li> </ul>	ON	
22	Water Temp. Sensor Signal	Open or short circuit in water temp. sensor signal (THW).	<ul style="list-style-type: none"> <li>• Water temp. sensor circuit</li> <li>• Water temp. sensor</li> <li>• ECU</li> </ul>	ON	
24	Intake Air Temp. Sensor Signal	Open or short circuit in intake air temp. sensor signal (THA).	<ul style="list-style-type: none"> <li>• Intake air temp. sensor circuit</li> <li>• Intake air temp. sensor</li> <li>• ECU</li> </ul>	ON*	
25	Air-fuel Ratio Lean Malfunction	1)* When air-fuel ratio feedback correction value or adaptive control value continues at the upper (lean) or lower (rich) limit for a certain period of time or adaptive control value is not renewed for a certain period of time.	<ul style="list-style-type: none"> <li>• Injector circuit</li> <li>• Injector</li> <li>• Fuel line pressure</li> <li>• Oxygen sensor circuit</li> <li>• Oxygen sensor</li> <li>• Manifold pressure sensor</li> <li>• Water temp. sensor</li> <li>• ECU</li> </ul>	ON	ON*
26	Air-fuel Ratio Rich Malfunction	2)* When marked variation is detected in engine revolutions for each cylinder during idle switch on and feedback condition. 3) Open or short circuit in oxygen sensor signal (Ox).	<ul style="list-style-type: none"> <li>• Injector circuit</li> <li>• Injector</li> <li>• Fuel line pressure</li> <li>• Oxygen sensor circuit</li> <li>• Oxygen sensor</li> <li>• Cold start injector circuit</li> <li>• Cold start injector</li> <li>• Manifold pressure sensor</li> <li>• Water temp. sensor</li> <li>• ECU</li> </ul>		ON*

\*: Applicable only to California specification vehicles.

Code No.	Item	Diagnosis	Trouble Area	“CHECK ENGINE” Lamp
31	Manifold Pressure Sensor Signal	Open or short circuit in manifold pressure sensor signal (PIM).	<ul style="list-style-type: none"> <li>• Manifold pressure sensor circuit</li> <li>• Manifold pressure sensor</li> <li>• ECU</li> </ul>	ON
41	Throttle Position Sensor Signal	The “IDL” and “PSW” signals are output simultaneously for several seconds.	<ul style="list-style-type: none"> <li>• Throttle position sensor circuit</li> <li>• Throttle position sensor</li> <li>• ECU</li> </ul>	ON*
42	Vehicle Speed Sensor Signal	Open or short circuit in vehicle speed sensor signal.	<ul style="list-style-type: none"> <li>• Vehicle speed sensor circuit</li> <li>• Vehicle speed sensor</li> <li>• ECU</li> </ul>	OFF
43	Starter Signal	No “STA” signal to ECU until engine speed reaches 800 rpm with vehicle not moving.	<ul style="list-style-type: none"> <li>• Starter signal circuit</li> <li>• Ignition switch, main relay circuit</li> <li>• ECU</li> </ul>	OFF
71*	EGR System Malfunction	<ul style="list-style-type: none"> <li>• EGR gas temp. below a predetermined level during EGR operation.</li> <li>• Open circuit in EGR gas temp. sensor signal (THG).</li> </ul>	<ul style="list-style-type: none"> <li>• EGR system components</li> <li>• EGR gas temp. sensor circuit</li> <li>• EGR gas temp. sensor</li> <li>• ECU</li> </ul>	ON
51	Switch Condition Signal	No “IDL” signal or No “NSW” signal or “A/C” signal to ECU, with the check terminals T and E <sub>1</sub> connected.	<ul style="list-style-type: none"> <li>• A/C amplifier</li> <li>• A/C switch circuit</li> <li>• Neutral start switch circuit</li> <li>• Neutral start switch</li> <li>• Accelerator pedal and cable</li> <li>• Throttle position sensor circuit</li> <li>• Throttle position sensor</li> <li>• ECU</li> </ul>	OFF

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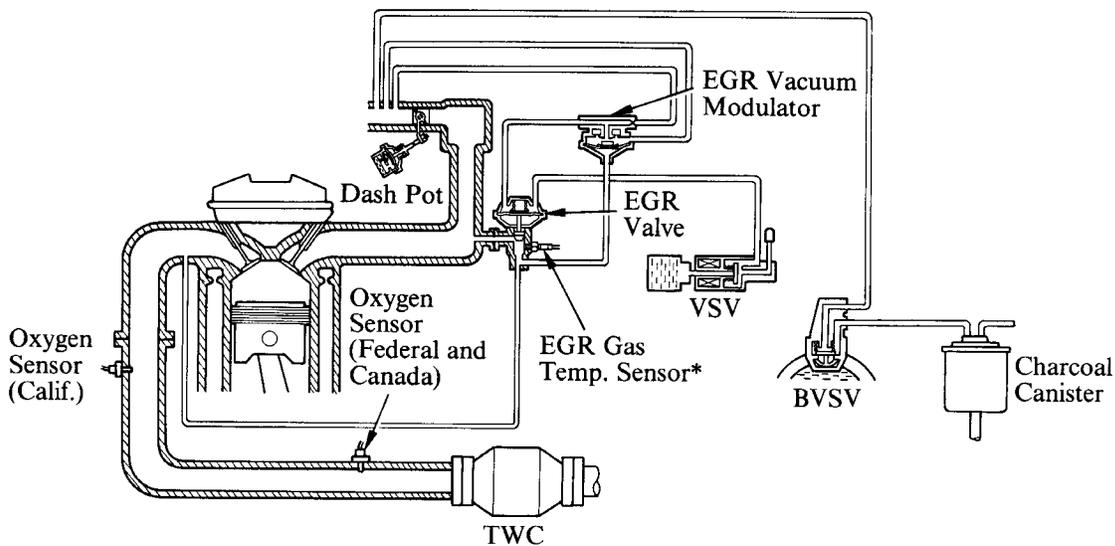
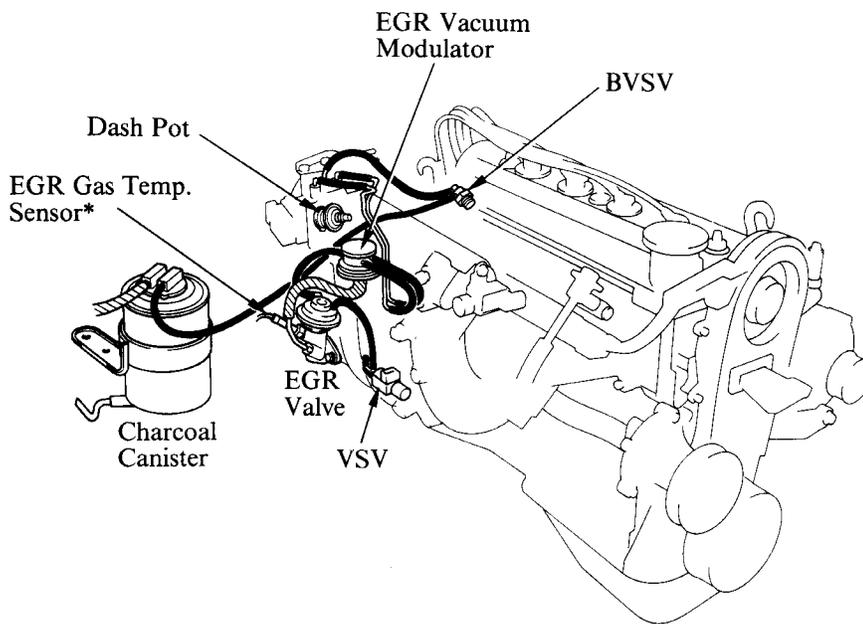
- NOTE:**
- If two or more malfunctions are present at the same time, the lowest-numbered diagnostic code will be displayed first.
  - All detected diagnostic codes, except 51, will be retained in memory by the ECU from the time of detection until cancelled out.
  - Once the malfunction is corrected, the “CHECK ENGINE” warning lamp will go out but the diagnostic code(s) will remain stored in the ECU memory (except for code 51).
  - After the malfunction is corrected, the diagnostic code is cleared by removing the EFI fuse for more than 10 seconds with the ignition switch off.

**EMISSION CONTROL SYSTEM**

**1. System Purpose**

System	Abbreviation	Purpose
Positive crankcase ventilation	PCV	Reduces blow-by gas (HC)
Evaporative emission control	EVAP	Reduces evaporative HC
Exhaust gas recirculation	EGR	Reduces NOx
Three-way catalyst	TWC	Reduces HC, CO and NOx
Electronic fuel injection	EFI	Regulates all engine conditions for reduction of exhaust emission

**2. Component Layout and Schematic Drawing**



\*: Applicable only to California specification vehicles.