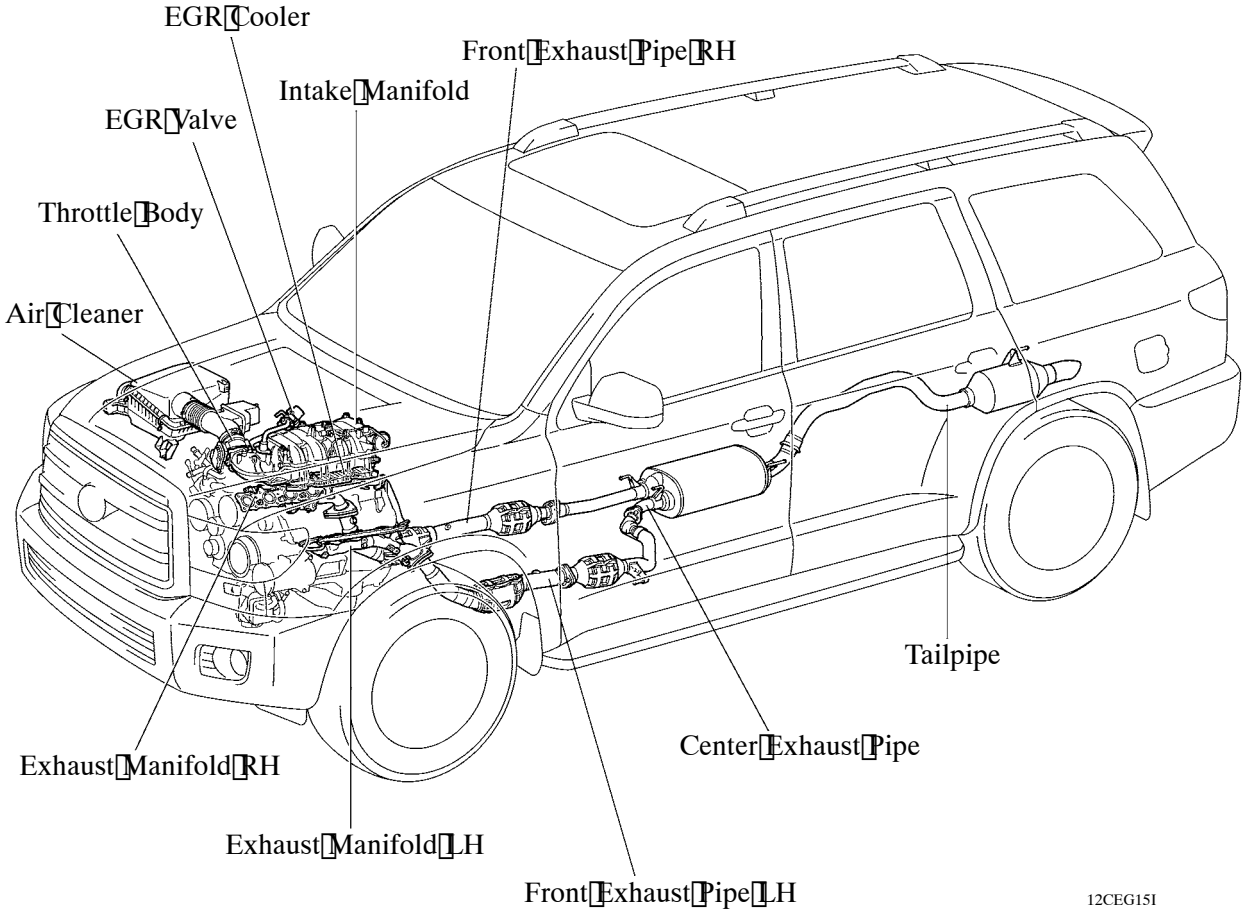
7. Intake and Exhaust System

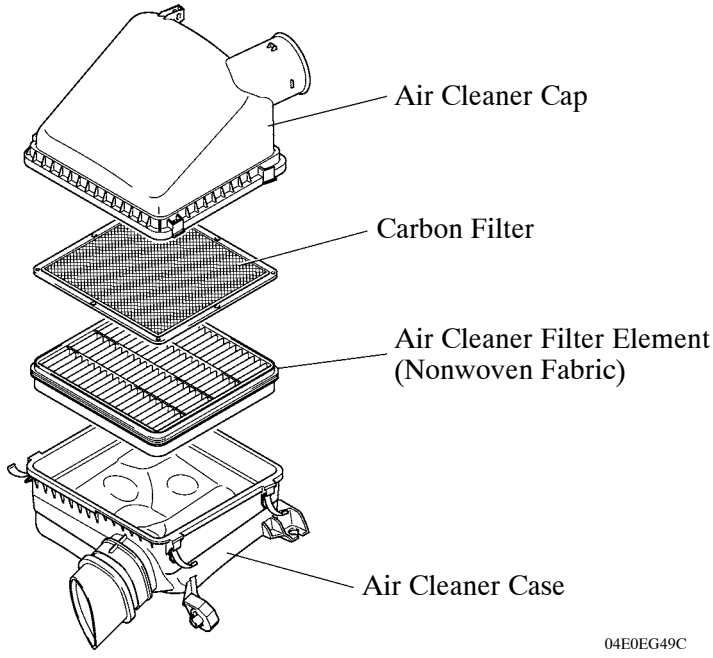
General

- A linkless-type throttle body is used, thus achieving excellent throttle control.
- The Electronic Throttle Control System-intelligent (ETCS-i) is used to ensure excellent throttle control in all operating ranges. For details, see page 69.
- The Acoustic Control Induction System (ACIS) is used to improve engine performance in all speed ranges. For details, see page 80.
- A plastic intake manifold is used.
- A step motor type EGR valve and a water-cooled EGR cooler are used in order to improve fuel economy.
- Stainless steel exhaust manifolds and exhaust pipes are used.



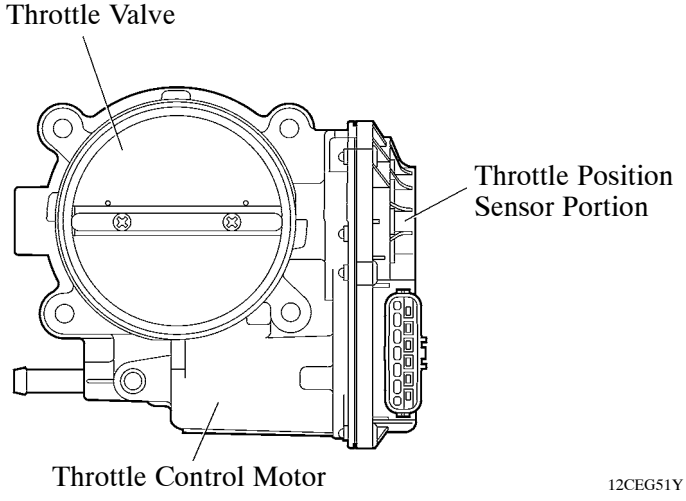
Air Cleaner

- A nonwoven fabric type air cleaner filter element is used.
- A carbon filter, which absorbs the HC that accumulates in the intake system when the engine is stopped, is used in the air cleaner case in order to reduce evaporative emissions. This filter is maintenance-free.



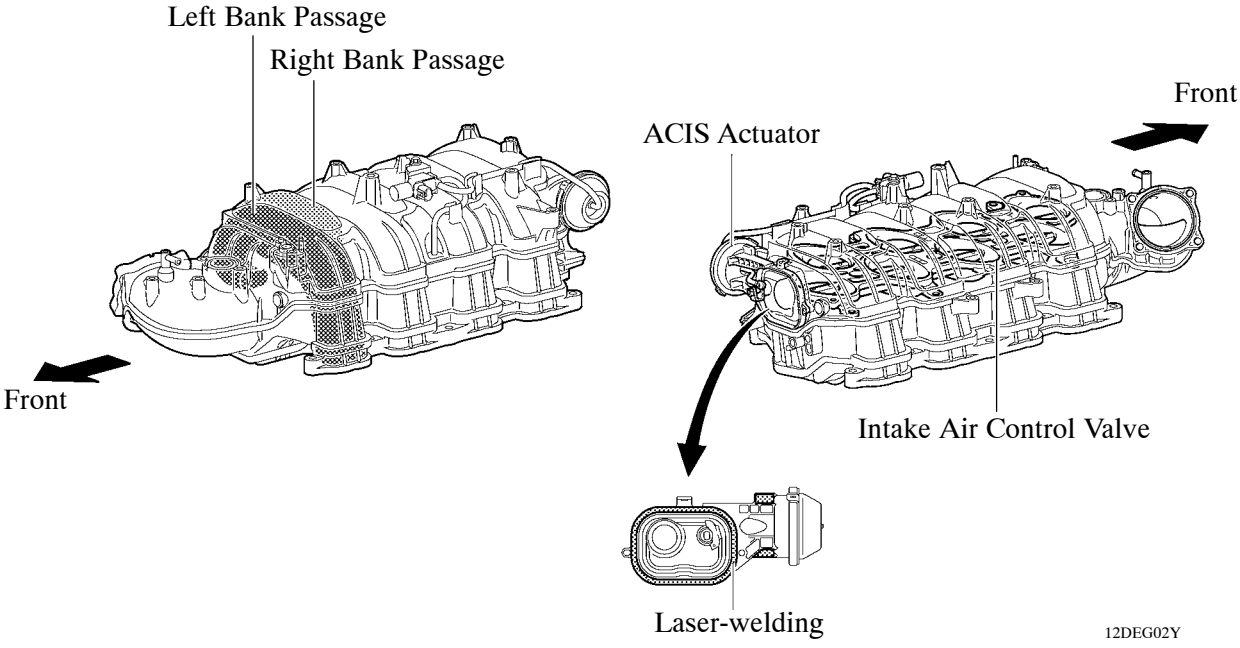
Throttle Body

- A linkless-type throttle body, in which the throttle position sensor and the throttle control motor are integrated, is used. It achieves excellent throttle valve control.
- For the throttle control motor, a DC motor with excellent response and minimal power consumption is used. The ECM performs duty cycle control of the direction and the amperage of the current supplied to the throttle control motor in order to regulate the throttle valve angle.



Intake Manifold

- An intake manifold with a built-in plastic intake air chamber is used for weight reduction.
- The diameter and length of the port have been optimized to achieve high torque in all driving ranges.
- The intake manifold contains valves for the Acoustic Control Induction System (ACIS), and the actuator is laser-welded to the intake manifold.



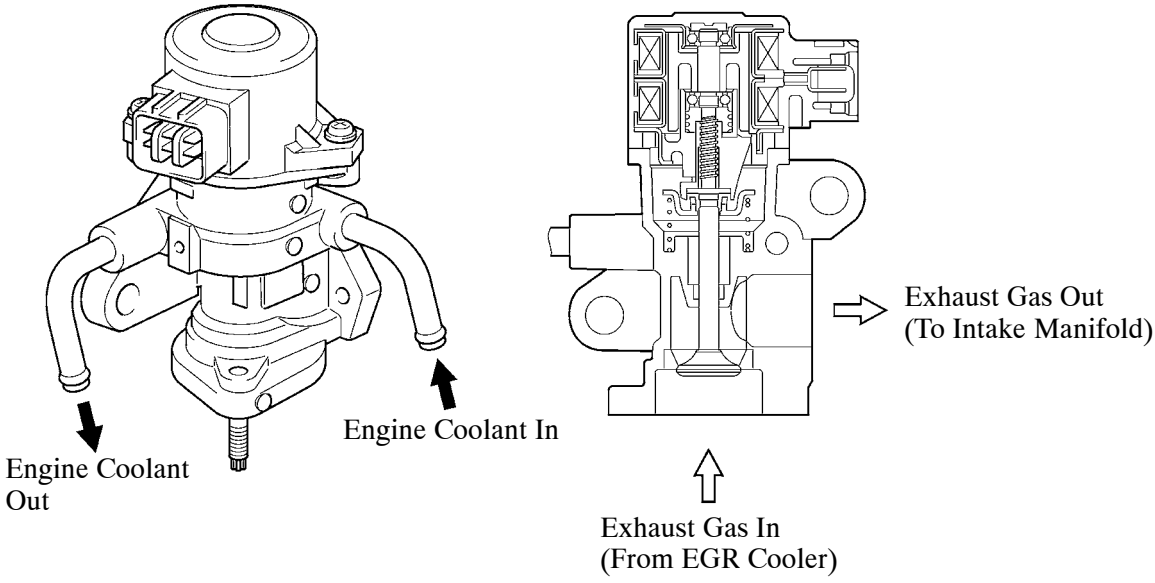
— REFERENCE —

Laser-welding:

In laser-welding, a laser-absorbing material (for the intake manifold) is joined to a laser-transmitting material (for the ACIS actuator). Laser beams are then irradiated from the laser-transmitting side. The beams penetrate the laser-transmitting material to heat and melt the surface of the laser-absorbing material. Then, the heat of the laser-absorbing material melts the laser-transmitting material and causes both materials to become welded.

EGR Valve

- A step motor is used on the EGR valve to enable the ECM to directly control the EGR valve.
- The water circulates through the EGR valve to ensure proper cooling performance.

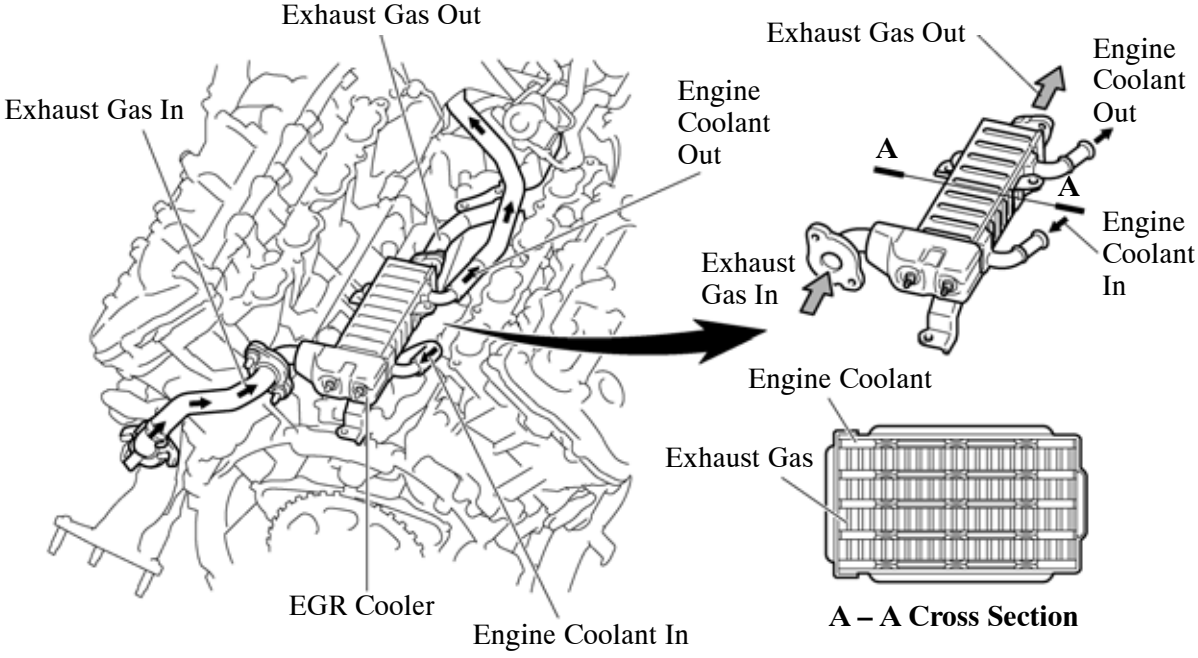


EGR Valve Cross Section

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EGR Cooler

- The water-cooled type EGR cooler is used in the EGR passage between the cylinder head and EGR valve.
- In the water-cooled type EGR cooler, engine coolant flows to the 4-layered gas passage to cool down.

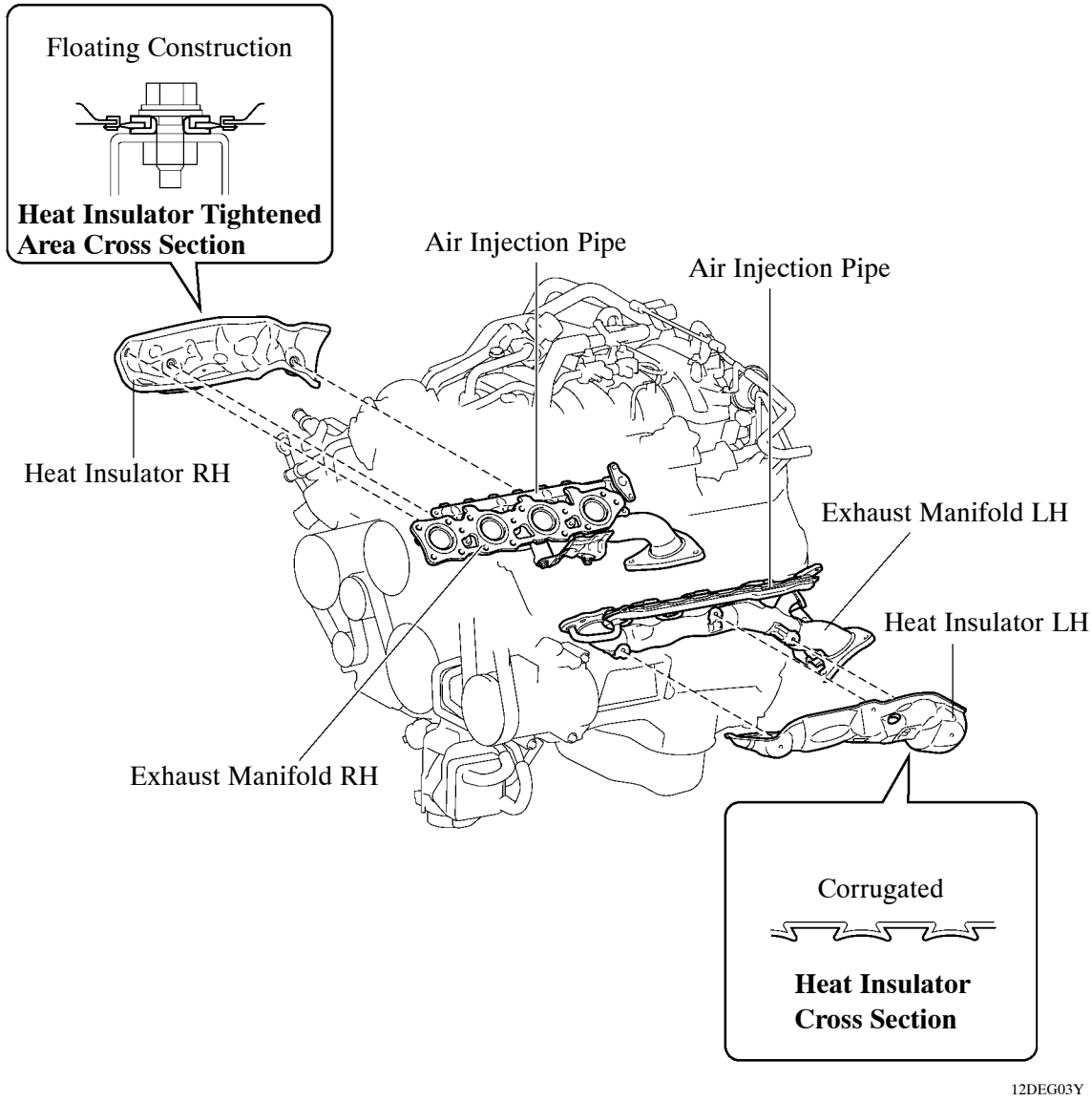


A – A Cross Section

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Exhaust Manifold

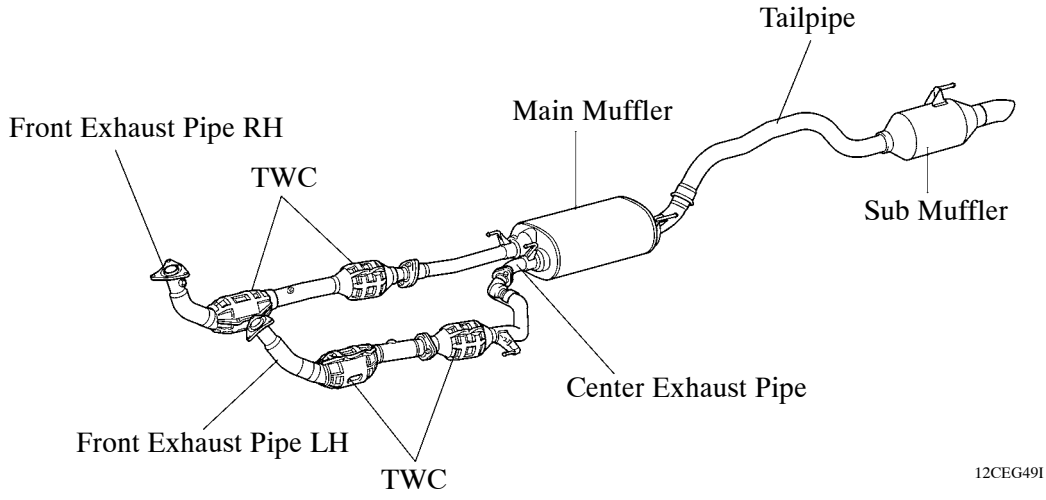
- A stainless steel exhaust manifold is used for weight reduction and rust resistance.
- The exhaust manifold for each bank uses a single structure (in a 4-1 grouping).
- The exhaust manifold heat insulator is made of corrugated aluminum. This ensures rigidity, and at the same time, increases the surface area to improve heat dissipation. Furthermore, a floating construction is used in the tightened area to reduce the transfer of heat and vibration to the heat insulator and to improve reliability.
- Along with the use of the air injection system, air injection pipes are provided for the right and left bank exhaust manifolds.



Exhaust Pipe

1) General

- The exhaust pipes are made of stainless steel to reduce their weight and improve rust resistance.
- A 2-way exhaust control system is provided in the muffler.
- 2 ceramic type Three-Way Catalytic converters (TWCs) are provided in the front exhaust pipe for the right bank, and another 2 are also provided for the left bank. As a result, the exhaust emission performance of the engine is improved.



2) 2-way Exhaust Control System

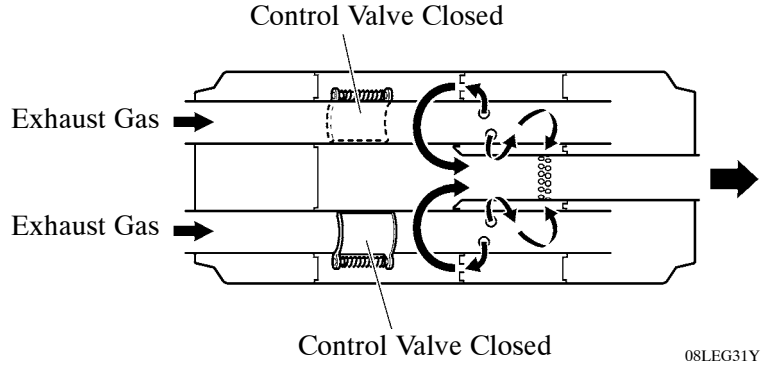
a. General

- The 2-way exhaust control system reduces the back pressure by opening and closing a control valve enclosed in the main muffler, thus varying the exhaust gas pressure.
- The control valve opens steplessly in accordance with the operating condition of the engine, thus enabling a quieter operation at lower engine speeds, and reducing back pressure at higher engine speeds.
- The back pressure overcomes the spring force of the control valve. The control valve opens steplessly in accordance with the exhaust gas pressure.

b. Operation

i) When Control Valve is Closed (Low Engine Speed)

When the pressure in the main muffler is low, the control valve is closed. Hence, exhaust gas does not pass the bypass, and exhaust noise is decreased in the main muffler.



ii) When Control Valve is Open (Middle to High Engine Speed)

The valve opens as the engine speed and the back pressure in the main muffler increase. This allows a large volume of exhaust gas to pass the bypass, thus substantially decreasing the back pressure.

