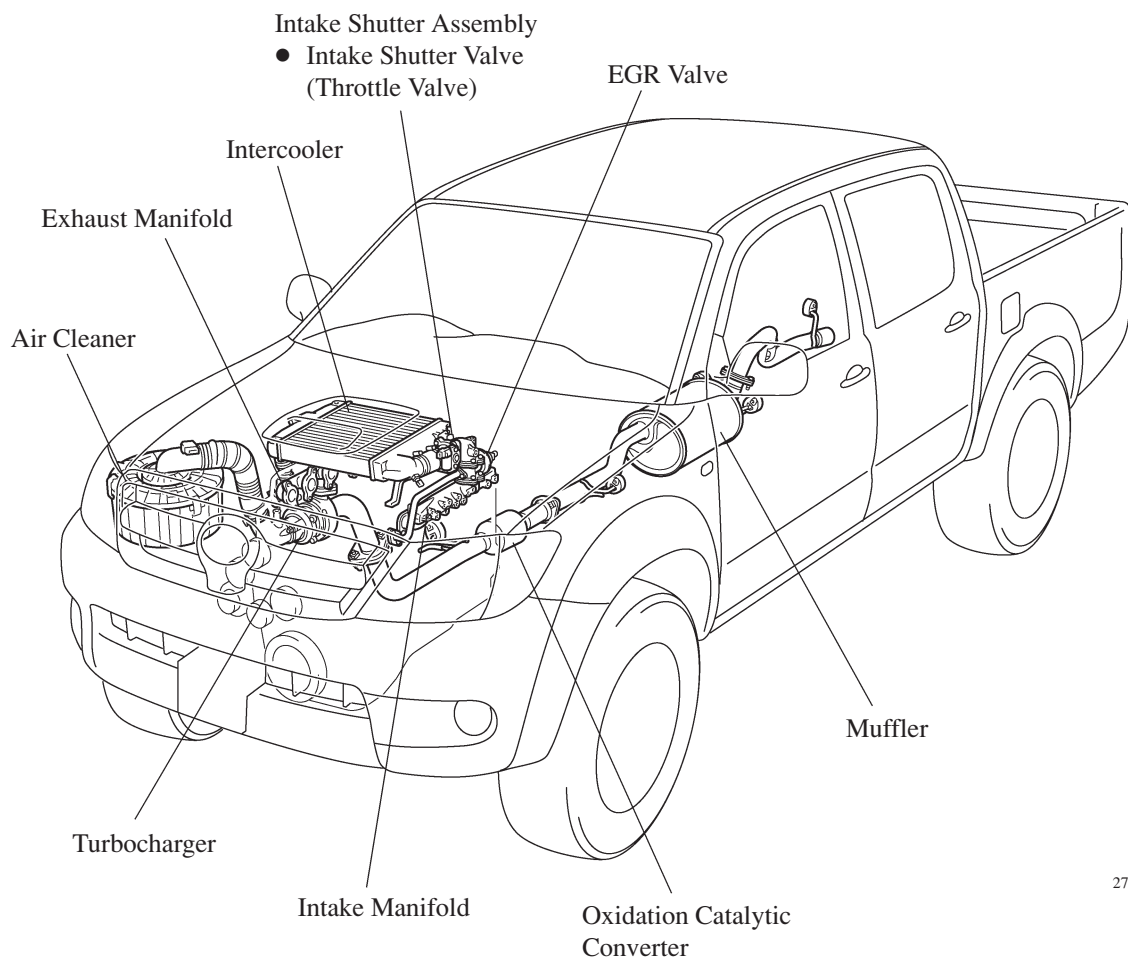


■ INTAKE AND EXHAUST SYSTEM

1. General

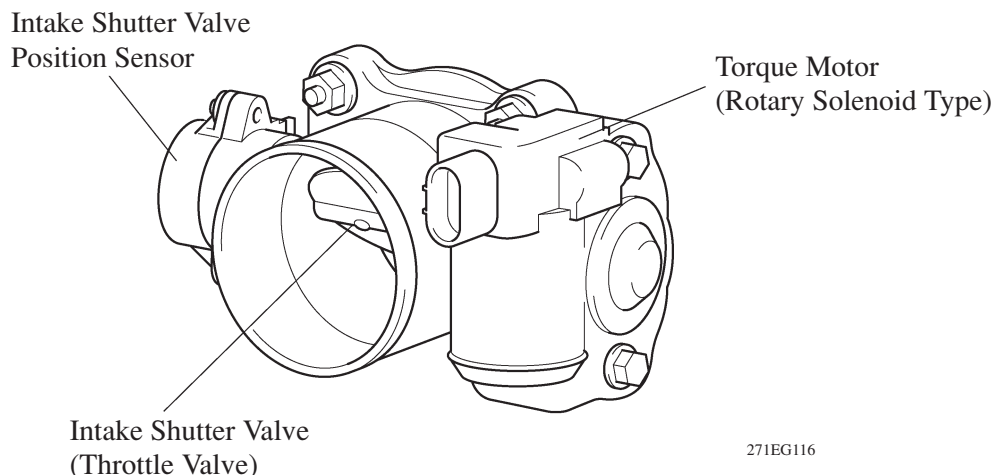
- An intake shutter valve (throttle valve) equipped with a torque motor (rotary solenoid type) is used
- Swirl control valves are provided in the intake manifold of the 1KD-FTV engine.
- A stainless steel exhaust pipe is used for weight reduction and improved rust resistance.
- An air-cooled intercooler is provided on the 1KD-FTV engine and 2KD-FTV High Version engine for Thailand.
- An EGR system is provided on the models complying with the emission regulations (EURO III, EURO I, and Tier 1). This system is designed to reduce and control NO_x formation through a slight reduction of peak temperature in the engine combustion chamber, which is accomplished by introducing a small amount of inert gas into the intake manifold. For details on EGR control, [see page EG-169](#).
- A variable nozzle vane type turbocharger is used on the 1KD-FTV engine.
- An air-cooled type turbocharger is used on the 2KD-FTV engine.
- An oxidation catalytic converter is provided on the models complying with the EURO III or Tier 1 emission regulation.



271EG115

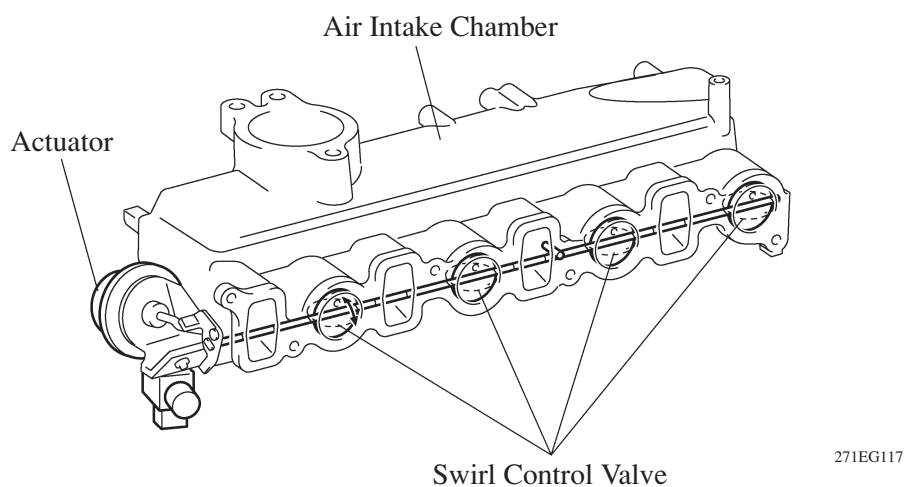
2. Intake Shutter Assembly

The intake shutter valve (throttle valve) equipped with the torque motor (rotary solenoid type) is used to improve EGR performance and to reduce the vibration and noise when stopping the engine. The torque motor (rotary solenoid type) makes the intake shutter valve (throttle valve) respond quickly.



3. Intake Manifold

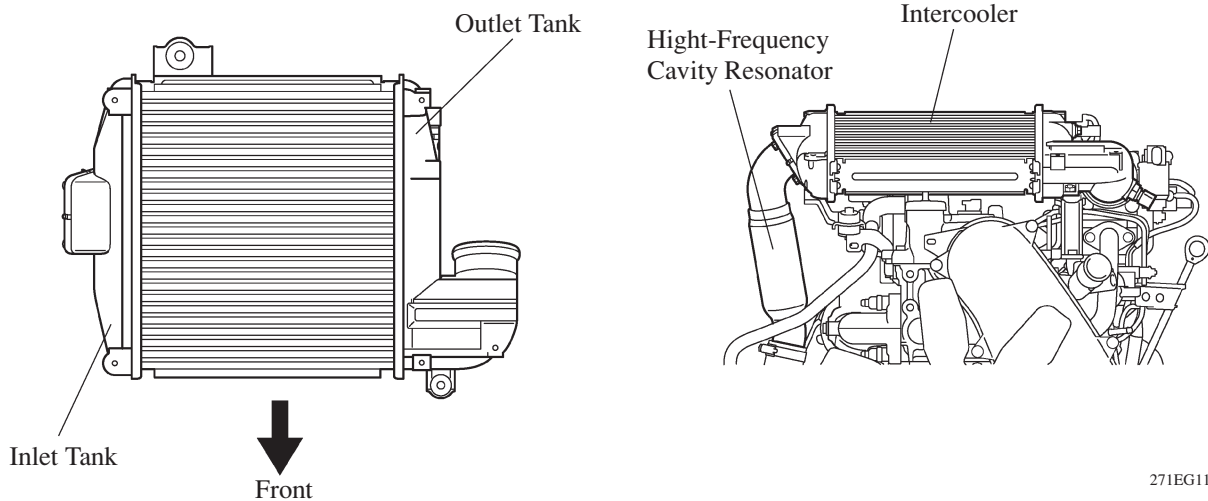
- In conjunction with the adoption of the direct injection system, an intake manifold provided with an air intake chamber is used in order to reduce the swirl variances between the cylinders.
- On the 1KD-FTV engine, a vacuum-actuated swirl control valve is provided in one of the two intake ports provided for each cylinder. A swirl control valve consists of a stainless steel shaft and an actuator, which are integrated in the valve. For details, [see page EG-164](#).



1KD-FTV Engine

4. Intercooler

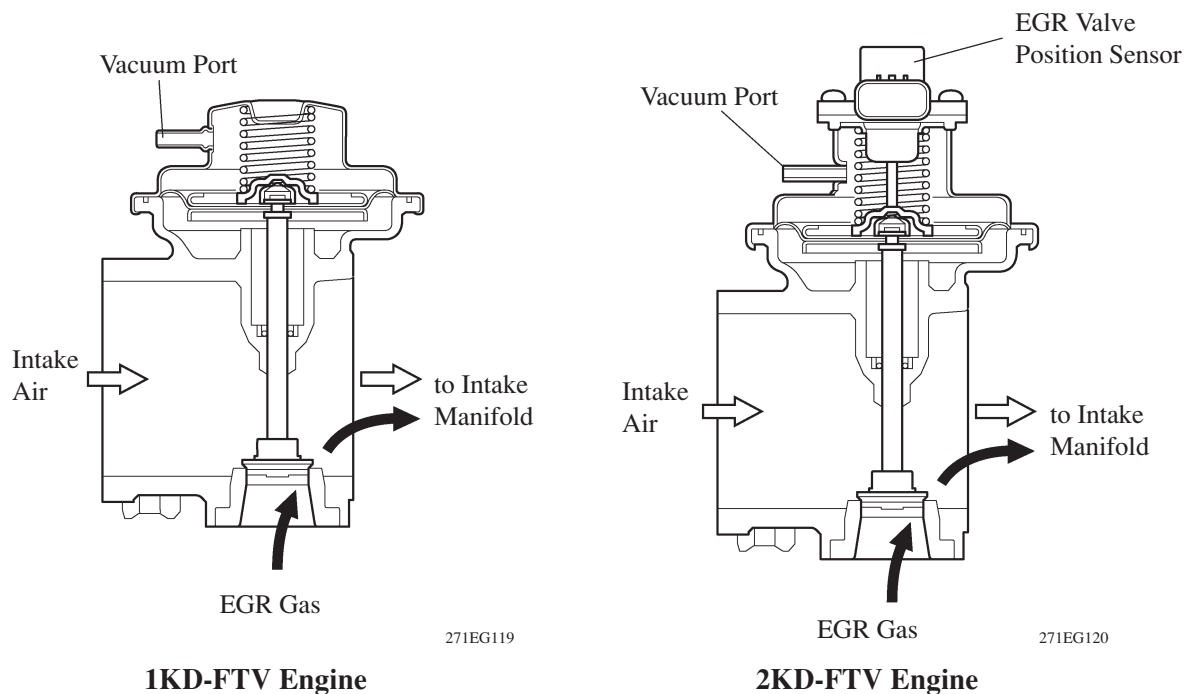
- An air-cooled intercooler is used in order to lower the intake air temperature, improve engine performance, and to realize cleaner exhaust gas emissions. It is located directly on top of the engine.
- The intercooler and the inlet tank are made of aluminum and the outlet tank is made of plastic for weight reduction.
- A dual construction, high-frequency cavity resonator is used for the pipe between the turbocharger and the intercooler.



271EG118

5. EGR Valve

- An EGR valve is provided midstream in the intake air passage. By cooling the EGR valve in this manner, a greater volume of exhaust gas can be processed.
- On the 1KD-FTV engine, a vacuum port for a VSV (for EGR Valve Close) to cut off EGR is used to improve valve closure response.
- On the 2KD-FTV engine, an EGR valve position sensor has been provided in the EGR valve in order to directly measure the actual amount of the valve opening. This measurement is then input into the engine ECU in order to improve the precision of EGR control.



271EG119

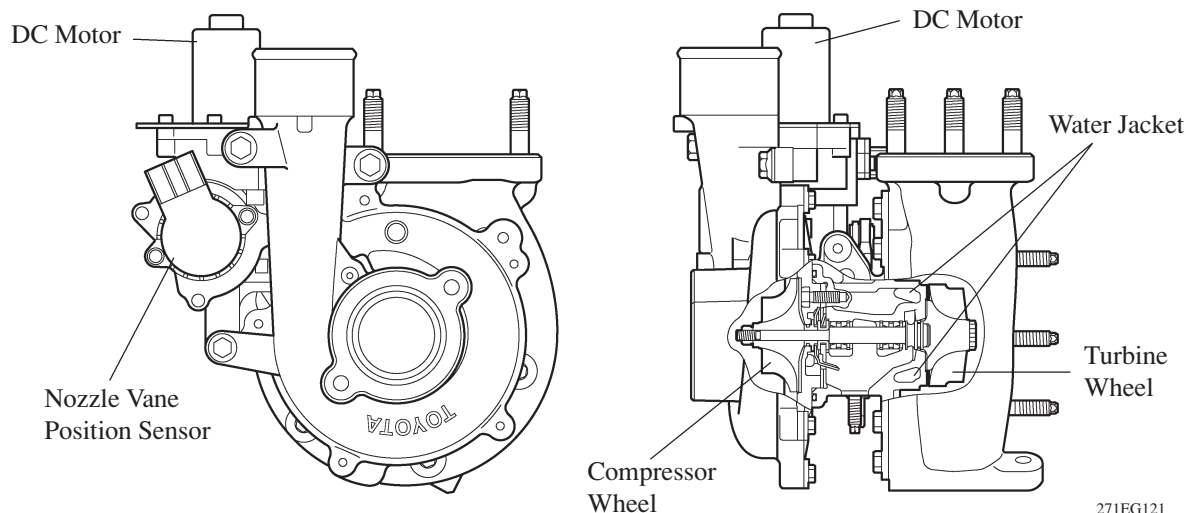
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6. Turbocharger

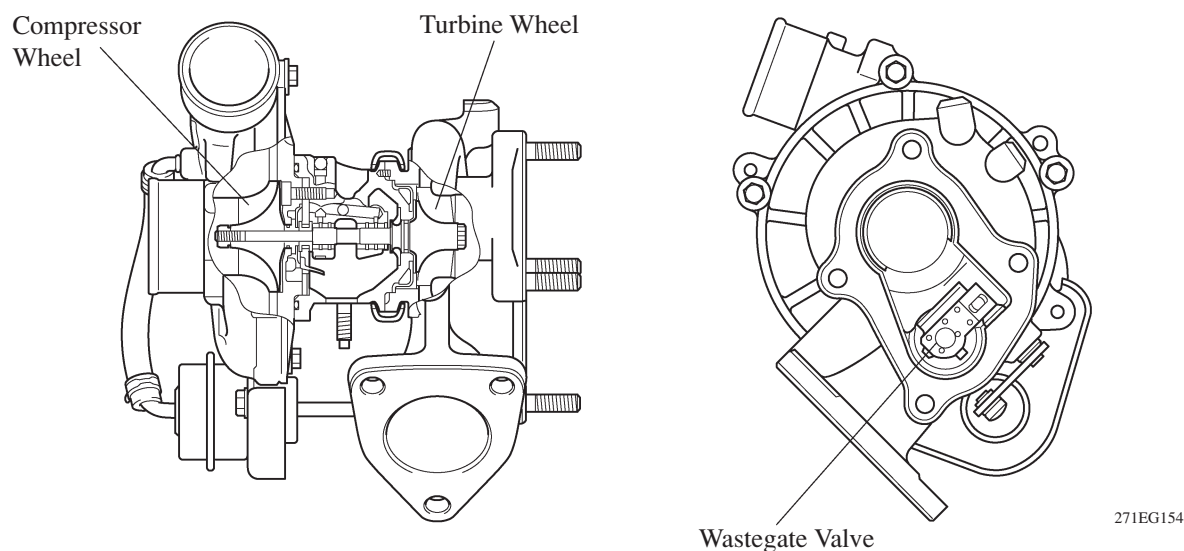
General

- A variable nozzle vane type turbocharger is used for 1KD-FTV engine. A water jacket is provided in the bearing housing to improve the cooling performance of the turbocharger.
- A lightweight and compact air cooled type turbocharger is used for 2KD-FTV engine. To control the turbo pressure, this turbocharger is provided with a wastegate valve and an actuator that operates mechanically in accordance with the turbo pressure.

► 1KD-FTV Engine ◀



► 2KD-FTV Engine without Intercooler ◀



Service Tip

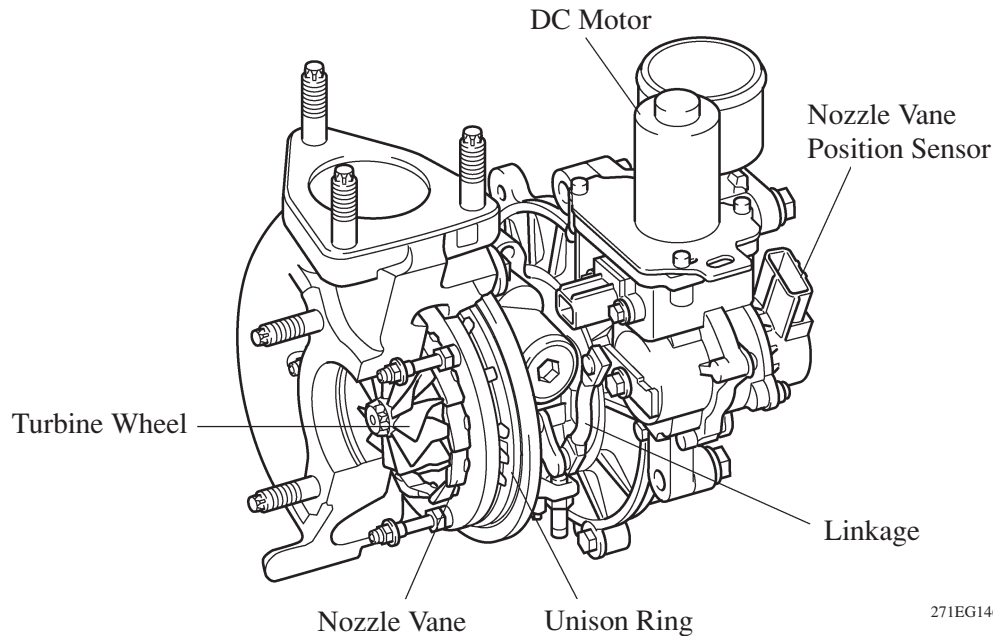
Only for 2KD-FTV Engine Models

The engine ECU determines altitude using the atmospheric pressure sensor. If the sensor indication value is approx. 85kPa or less (Altitude: Higher than approx. 1,500 m), the engine ECU lowers the preset maximum engine speed*, in order to prevent the turbine wheel from racing when the vehicle is driven in high altitude areas (where the atmospheric pressure is low). Therefore, the preset maximum engine speed is lower than standard. However, this is not an engine malfunction. For details, see the Hilux Repair Manual.

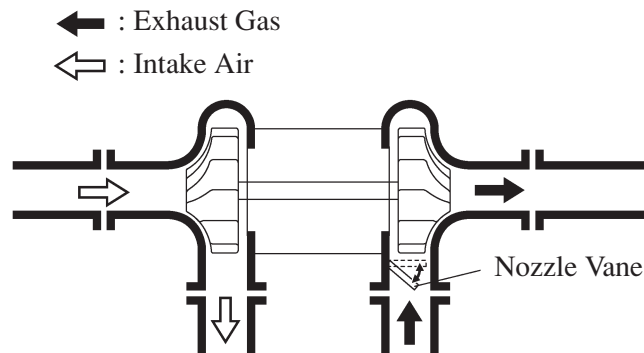
*: Varies in accordance with altitude. As the altitude increases (the atmospheric pressure sensor indication value decreases), the preset maximum engine speed is decreased.

Variable Nozzle Vane type Turbocharger

- Variable nozzle vane type turbocharger consists primarily of an impeller, turbine, nozzle vane, unison ring, DC motor and nozzle vane position sensor.
- This turbocharger has realized great improvements in low-speed torque, maximum output, fuel consumption, and emission reduction. These improvements have been accomplished through variable control of the nozzle vane position, and an optimal velocity of the exhaust gas inflow to the turbine at all times in response to the engine condition.
- The engine ECU outputs a signal to the turbo motor driver, which actuates the DC motor, to control the nozzle vane position. For details on the turbocharger control, [see page EG-165](#).



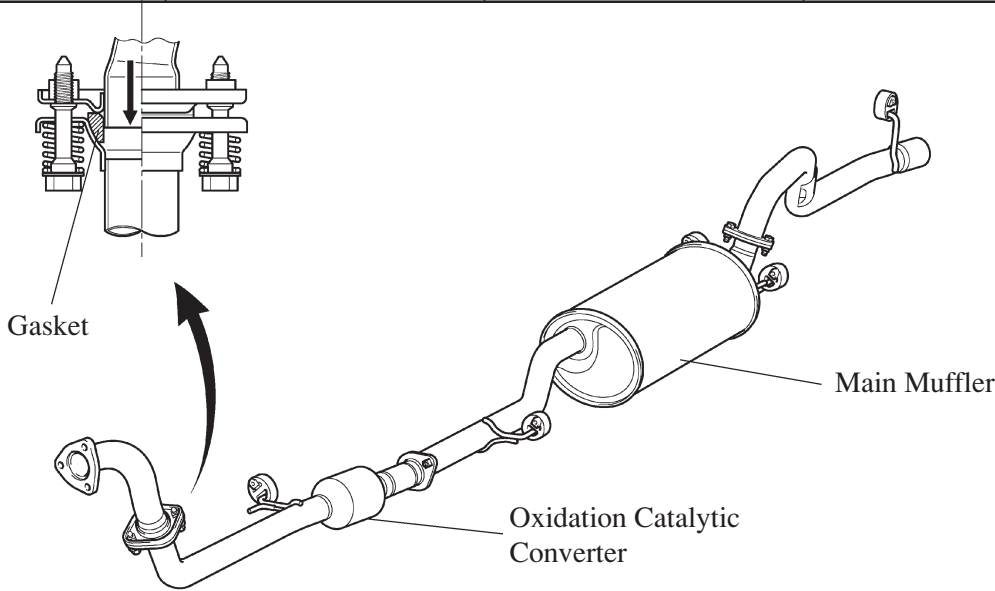
- The exhaust gas from the exhaust manifold goes through the nozzle vane inside the turbo charger housing, and flows to the exhaust pipe through the turbine. The speed of the turbine (supercharging pressure) differs depending on the flow velocity of the exhaust gas going through the turbine and the flow velocity of the exhaust gas is controlled by the opening. In such a time like idling, when the exhaust gas is less, the nozzle vane is almost fully closed, but as there is a slight clearance between the vanes, the exhaust gas flows through this clearance to the exhaust pipe. Therefore, there is no bypass.



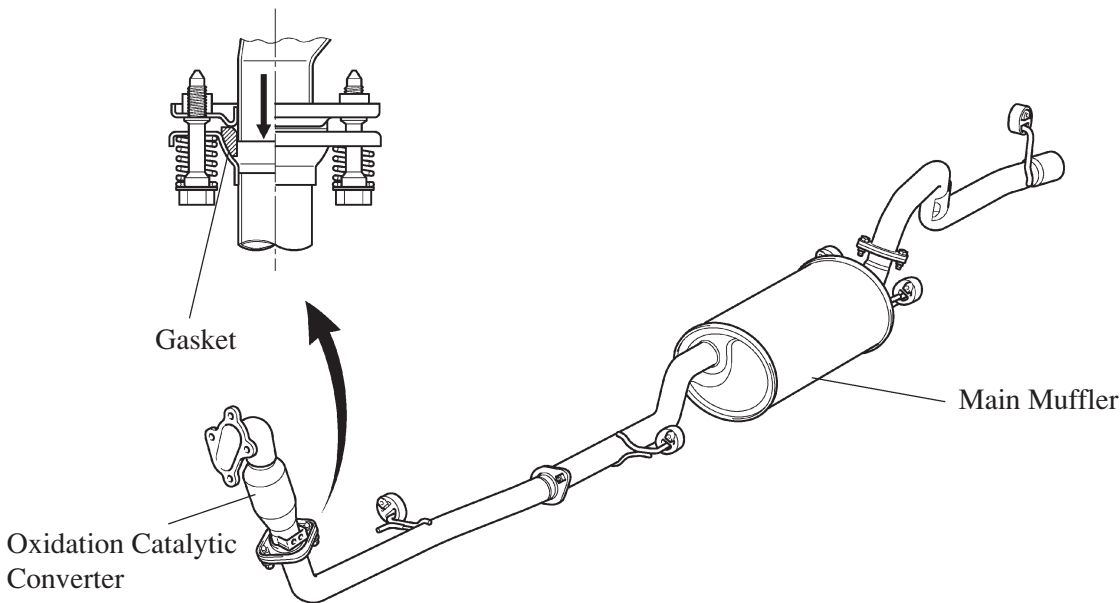
7. Exhaust Pipe

- A stainless steel exhaust pipe is used for weight reduction and rust resistance.
- A ball joint is used to join the exhaust front pipe and exhaust manifold. As a result, a simple and reliable construction for reducing vibration has been realized.
- The oxidation catalytic converter is used to clean the exhaust gas particulates, HC and CO. The table below describes the location of the converter (where equipped), in accordance with the engine type and exhaust emission regulation compliance.

Emission Regulation	EURO III or Tier 1		EURO I or Non-Compliance
Engine Type	1KD-FTV 2KD-FTV High Version (with Intercooler)	2KD-FTV High Version (without Intercooler)	All
Location of Oxidation Catalytic Converter	Integrated with Front Exhaust Pipe	Below Exhaust Manifold	—



1KD-FTV Engine and 2KD-FTV Engine with Intercooler



2KD-FTV Engine without Intercooler