

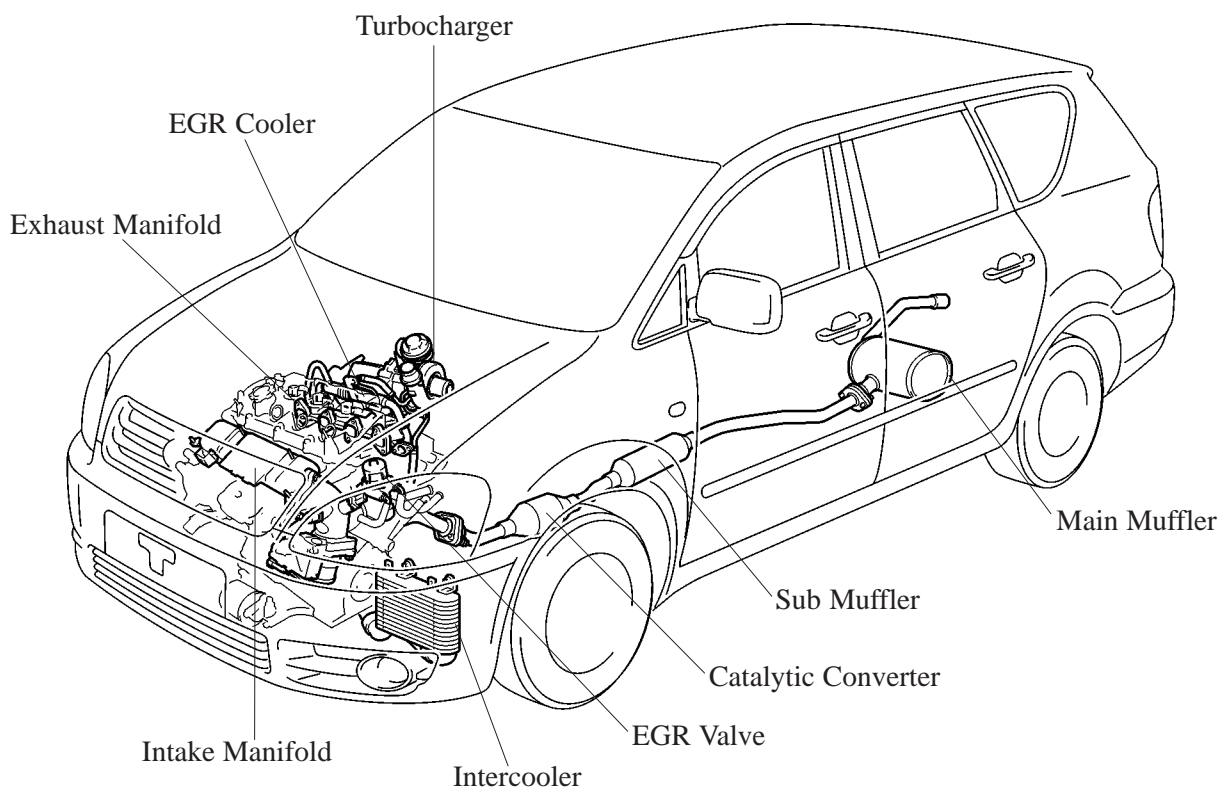
■ INTAKE AND EXHAUST SYSTEM

1. General

- In conjunction with the adoption of the direct injection system, an equal-length port intake manifold provided with an intake chamber has been adopted in order to reduce the swirl variances among the cylinders.
- A step motor type throttle has been adopted to improve EGR performance and to reduce the vibration when stopping the engine.
- An air-cooled intercooler has been adopted.

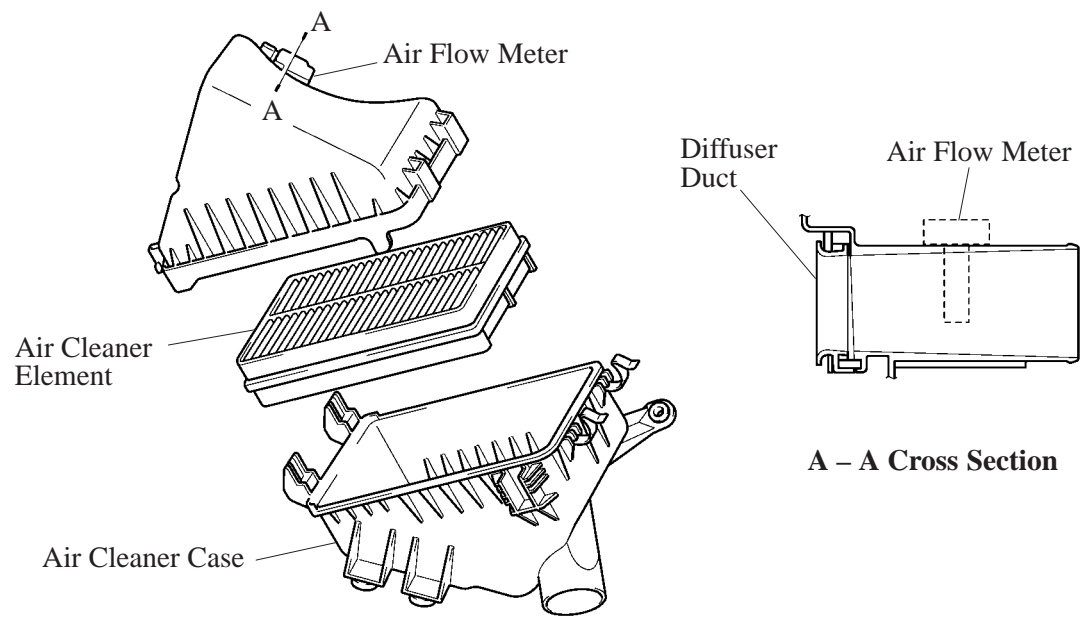
— Changes (from Avensis) —

- A step motor has been provided on the EGR valve. Accordingly, the vacuum regulating valve and the VSV (for cutoff) have been discontinued.
- The water-cooling type EGR cooler has been adopted.
- A variable nozzle vane type turbocharger has been adopted.
- Two catalytic converters have been adopted in order to comply with the European STEP III regulations.



2. Air Cleaner

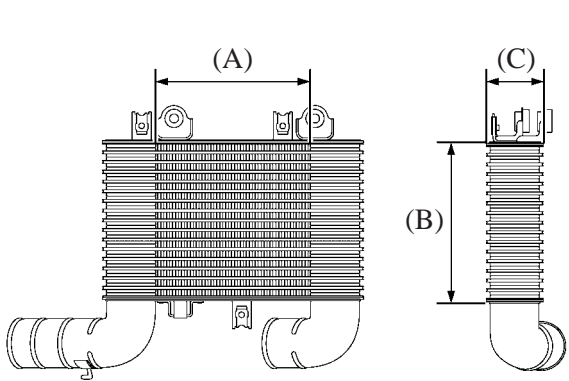
- The air cleaner case has been increased in size to help reduce the amount of intake air noise.
- A diffuser duct has been provided in the air cleaner case in order to help reduce the intake resistance.



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3. Intercooler

An air cooled intercooler has been adopted in order to lower the intake air temperature, improve engine performance, and to realize cleaner exhaust gas emissions.



► Specifications ◀

Type			Drawn Cup
Core Size	(A)	Height	175.0 mm (6.89 in.)
	(B)	Width	187.6 mm (7.39 in.)
	(C)	Thickness	65 mm (2.56 in.)
Material			Aluminum

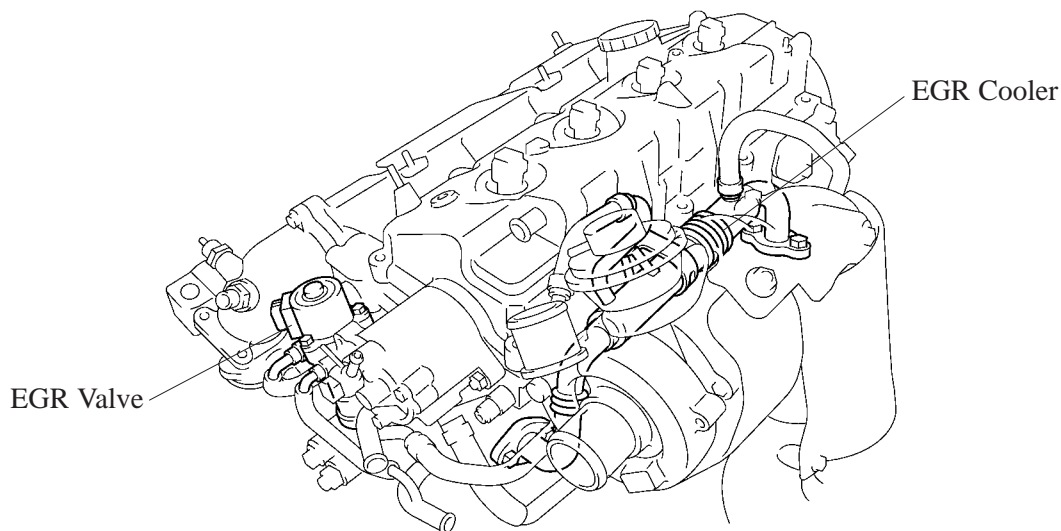
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4. EGR System

General

This system is designed to help reduce and control NO_x formation due to a slight reduction of peak temperature in the engine combustion chamber, which is accomplished by introducing a small amount of inert gas into intake manifold.

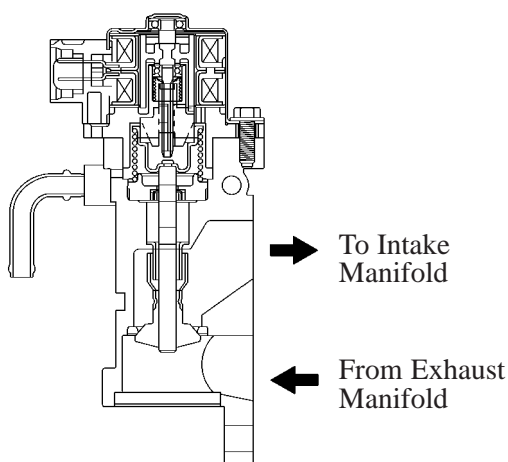
By adopting the exhaust gas passage in the cylinder head and the water cooling type EGR cooler, this makes it possible to lower the temperature of the exhaust gas and re-circulate the great amount of exhaust gas.



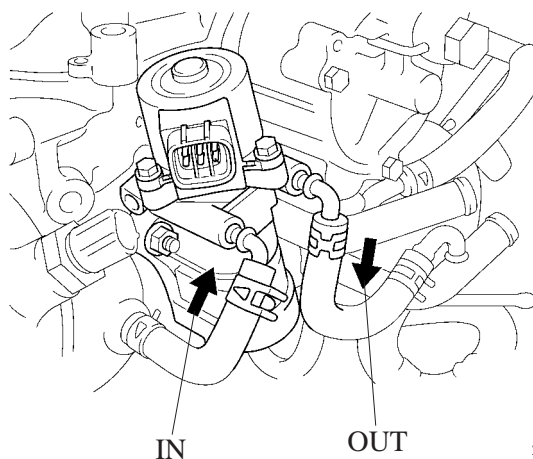
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EGR Valve

- A step motor has been adopted on the EGR valve to enable the engine ECU to directly control the EGR valve.
- The engine coolant circulates through the EGR valve to ensure proper cooling performance.



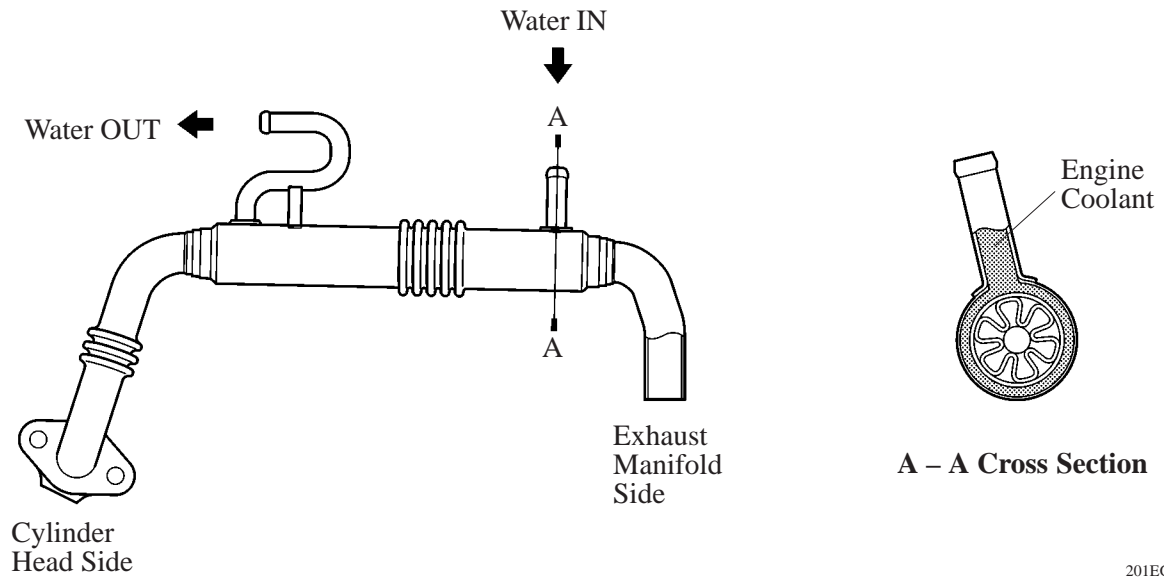
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EGR Cooler

The water cooling type EGR cooler has been established in the EGR passage between the exhaust manifold and the cylinder head.

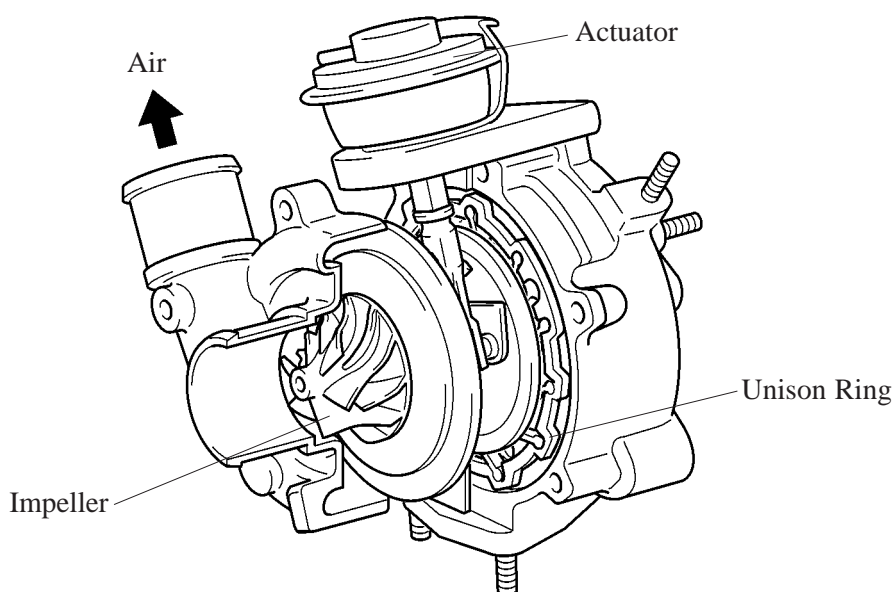


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5. Turbocharger

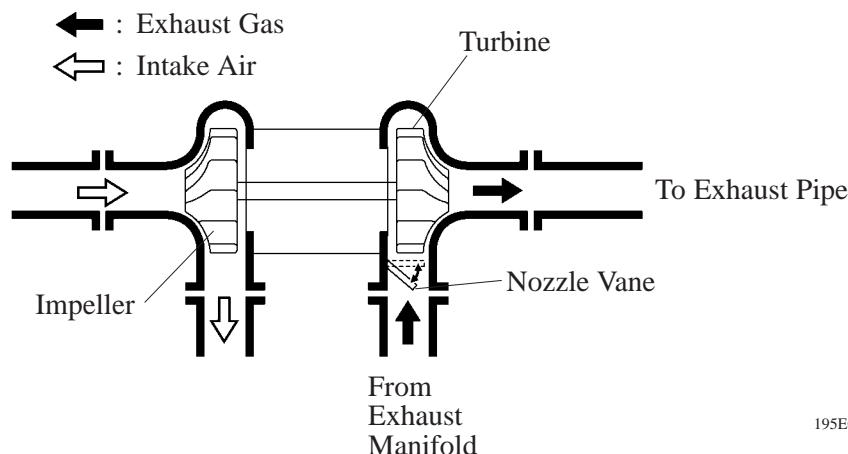
General

- This turbocharger has been realized the great improvements of low speed torque, maximum output, fuel consumption and noise and emission reduction by controlling the nozzle vane variably and making the most suitable velocity of the exhaust gas inflow to the turbine at all times in response to the engine condition.
- The actuator is actuated by the vacuum pressure that has been regulated by the VRV (Vacuum Regulating Valve) in accordance with the signals from the engine ECU.



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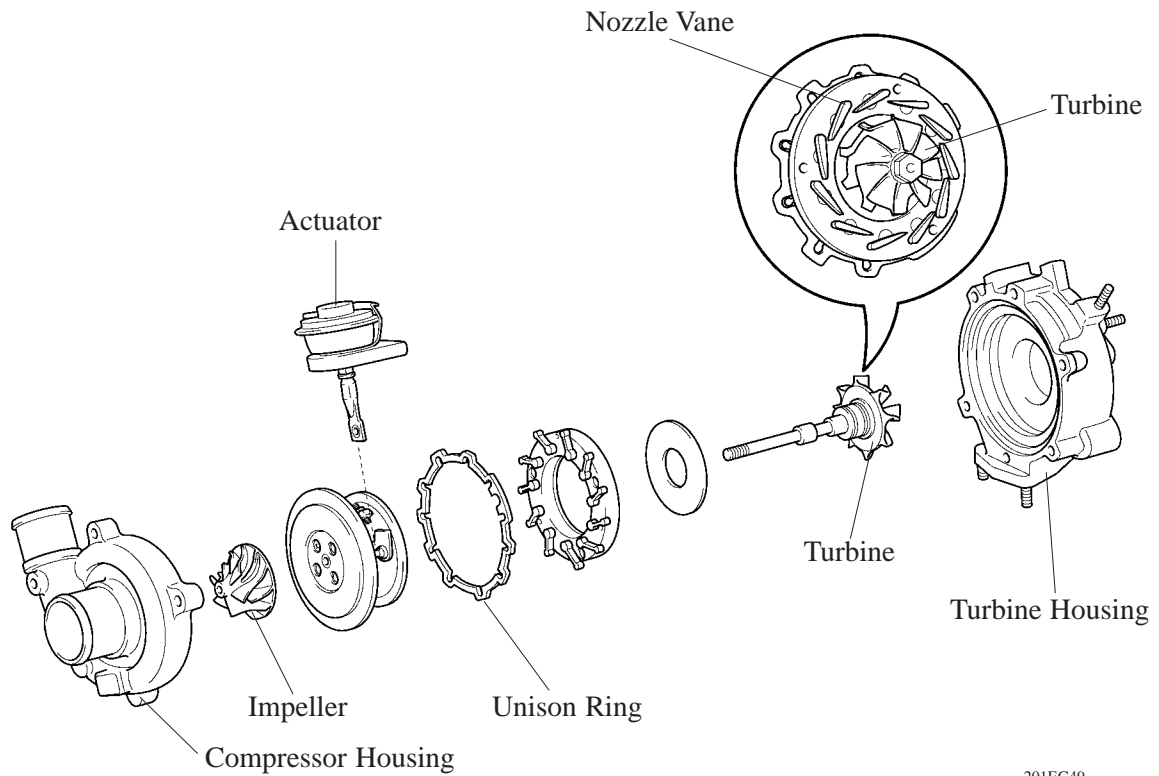
- The exhaust gas from the exhaust manifold goes through the nozzle vane inside the turbo charger housing, and flows to the exhaust pipe through the turbine. The speed of the turbine (supercharging pressure) differs depending on the flow velocity of the exhaust gas going through the turbine and the flow 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 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.



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Construction

This turbocharger consists primarily of a impeller, turbine, actuator, nozzle vane, and unison ring.



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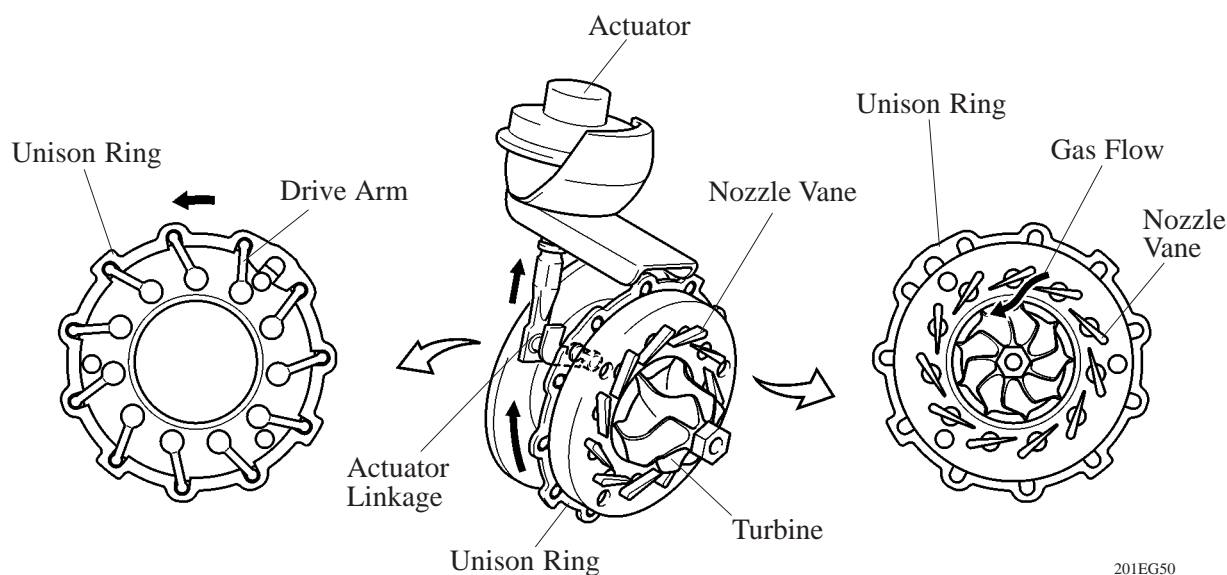
Service Tip

The inspection items and measurement values have been changed in conjunction with the adoption of the variable nozzle vane type turbocharger. Furthermore, this turbocharger cannot be disassembled. For details, refer to the 1CD-FTV Engine Repair Manual (Pub. No. RM866E).

Operation

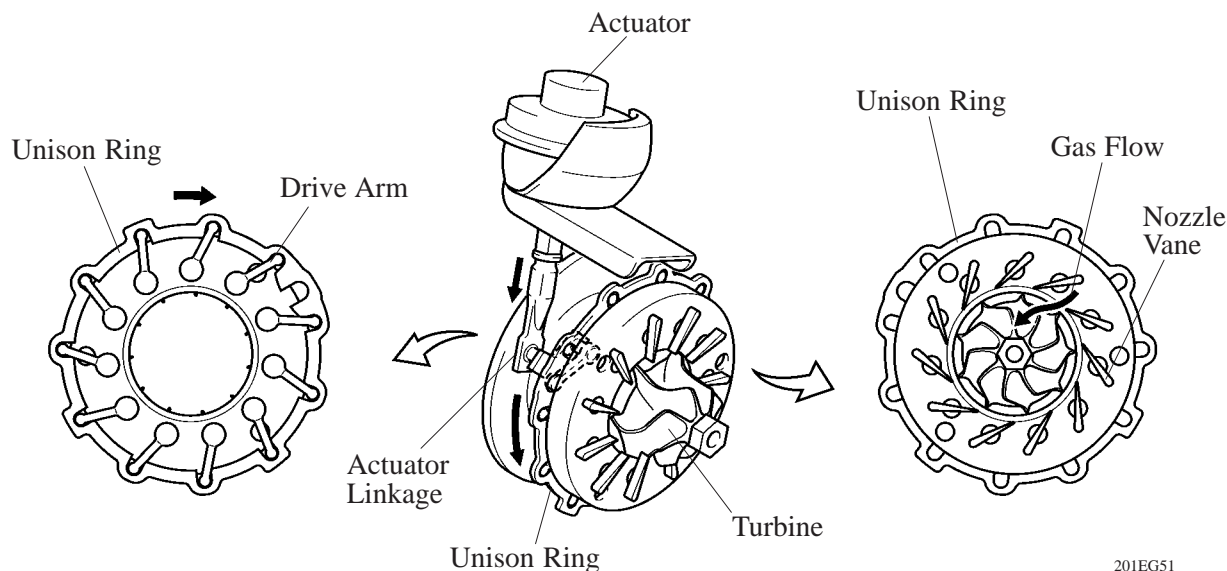
a) At Low Load Range

When the engine is running in a low load range, the actuator pull up the linkage by a signal from the engine ECU. The tip of the actuator linkage is connected to the unison ring and turns it counter clockwise. The unison ring has a drive arm through the unison ring packet and this drive arm also moves according to the rotation direction of the unison ring. The fulcrum of the drive arm is an axis which is integrated with a nozzle vane behind the plated. When the drive arm moves counter-clockwise, the nozzle vane moves toward closing direction resulting in keeping up the suitable velocity of the exhaust gas running to the turbine and speed of the turbine, and then the torque will be improved when the engine is running at a low load.



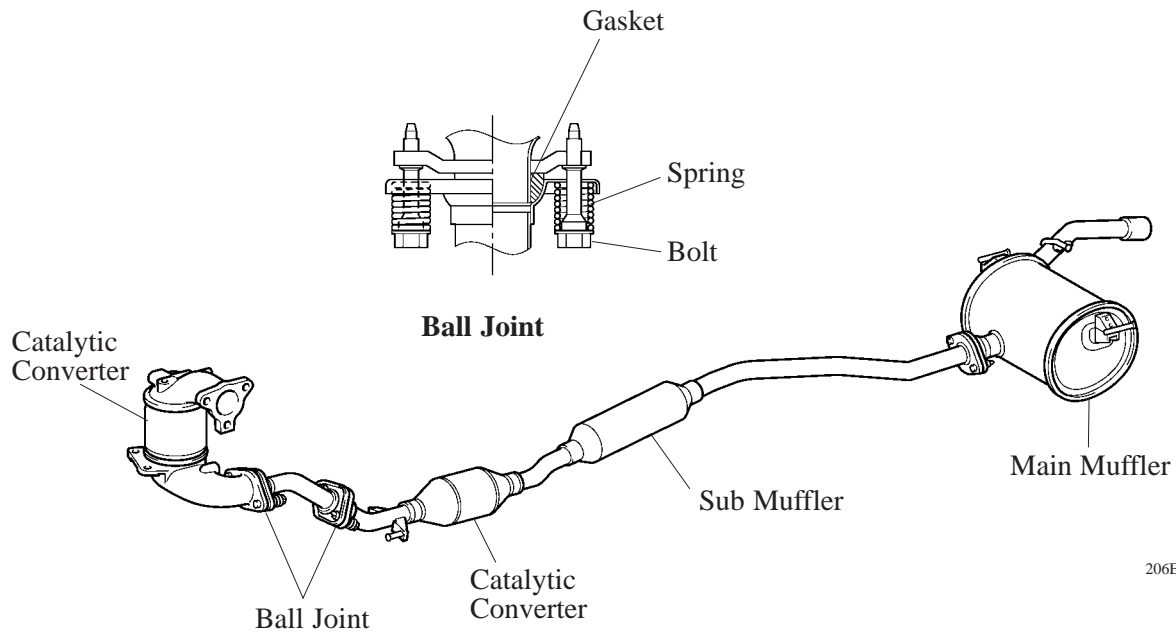
b) At High Load Range

When the engine is running in a high load range, the actuator pull down the linkage by a signal from the engine ECU. With this, the drive arm moves clockwise and this opens the nozzle vane and holds the specified supercharging pressure. Thus, lowering the exhaust gas back pressure and improving the out put and fuel consumption.



6. Exhaust Pipe

- A ball joint has been adopted in two locations to reduce vibration.
- One of the catalytic converters has been placed directly below the engine and the other under the floor in order to ensure cleaner emissions even at low exhaust gas temperature, in order to comply with the European STEP III regulations.



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