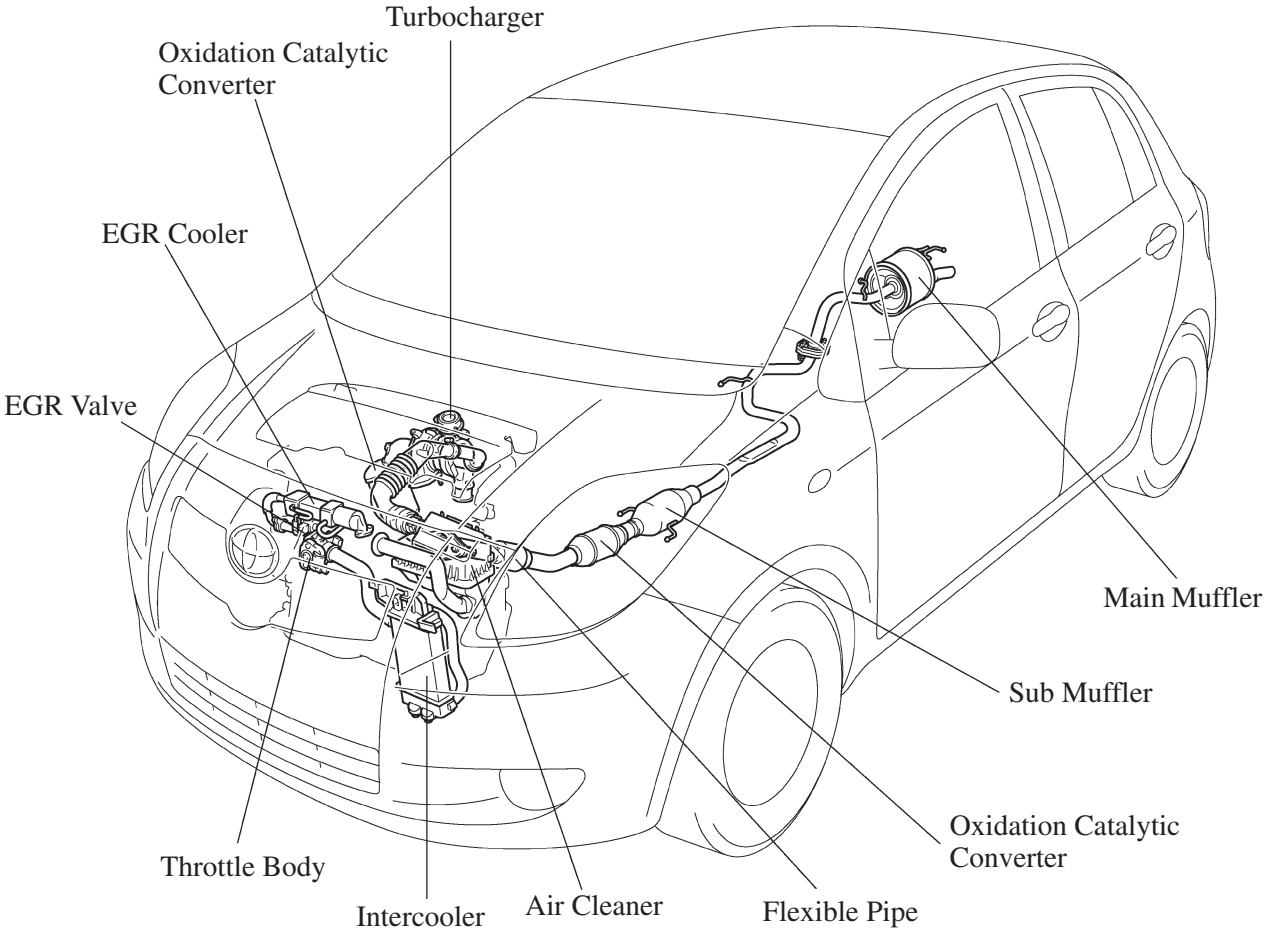
## ■INTAKE AND EXHAUST SYSTEM

### 1. General

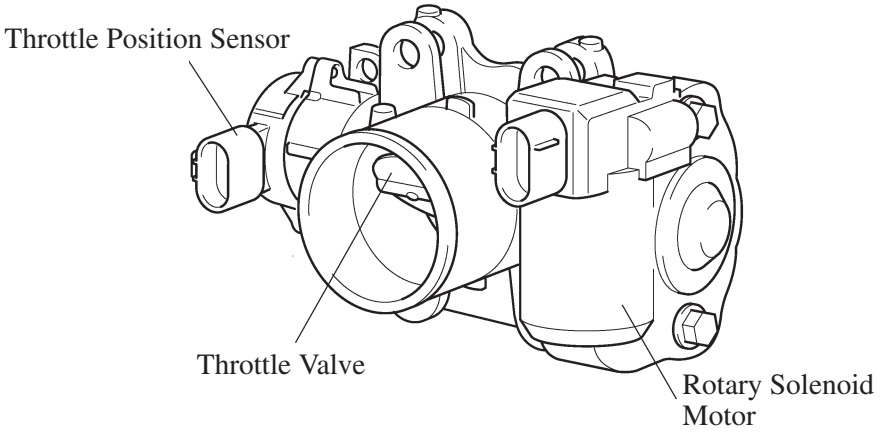
- The intake manifold and passage for the EGR system is integrated the cylinder head to realize lightweight and compact design.
- An EGR control system is used. This system is designed to help reduce and control NOx formation due to a slight reduction of peak temperature in the engine combustion chamber, which is accomplished by introducing a small amount of inert gas into intake manifold. For details of the EGR system, see page EG-185.
- A torque motor (rotary solenoid type) throttle valve is used to improve EGR performance and to reduce the vibration when stopping the engine.
- A variable nozzle vane type turbocharger is used.
- An air-cooled type intercooler is used.
- A step motor type EGR valve and a water-cooled type EGR cooler are used to ensure high EGR performance.



## 2. Throttle Body

A linkless-type throttle body in which the diesel throttle control motor and the throttle position sensor are integrated is used.

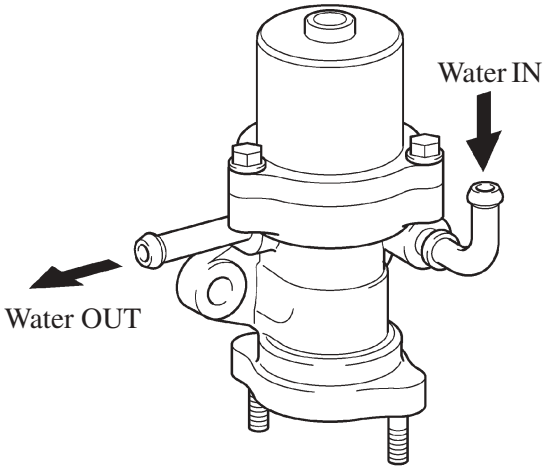
- In the diesel throttle control motor, a rotary solenoid motor is used to control the throttle valve.
- A non-contact type throttle position sensor is used.

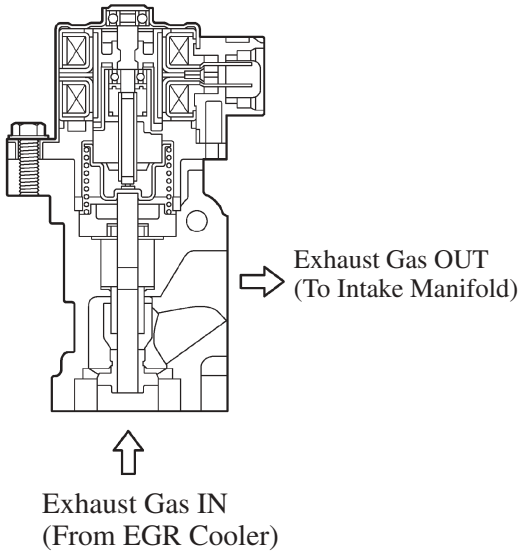



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## 3. EGR Valve

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



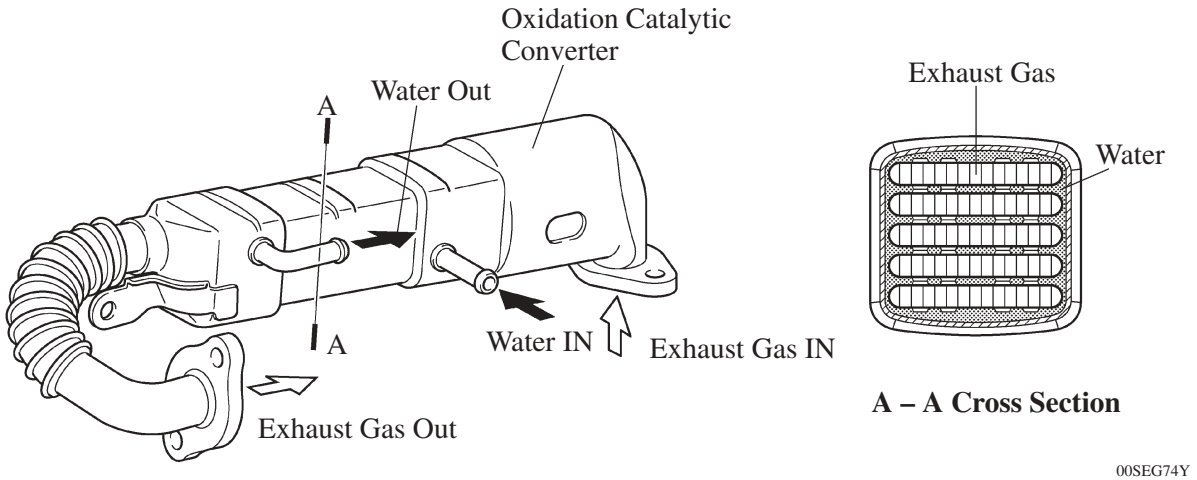




**EGR Valve Cross Section**

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## 4. EGR Cooler

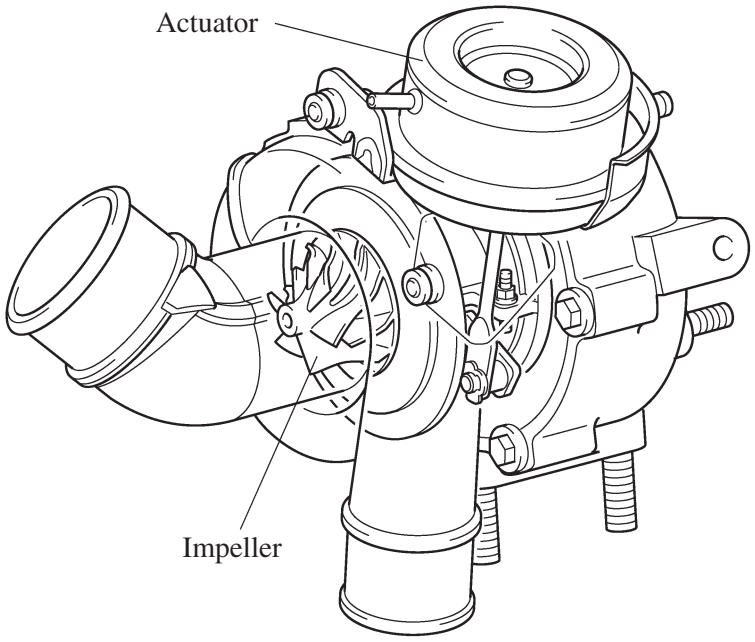
- The water-cooled type EGR cooler is used in the EGR passage between the cylinder head and EGR valve.
- In the water-cooled type EGR cooler, water flows the five-layered gas passage to cool down.
- The oxidation catalytic converter has been located in upper flow of the EGR cooler to clean the HC that are contained in the exhaust gases and prevent the EGR cooler from becoming clogged. This restricts any reduction in the cooling performance of the EGR cooler.



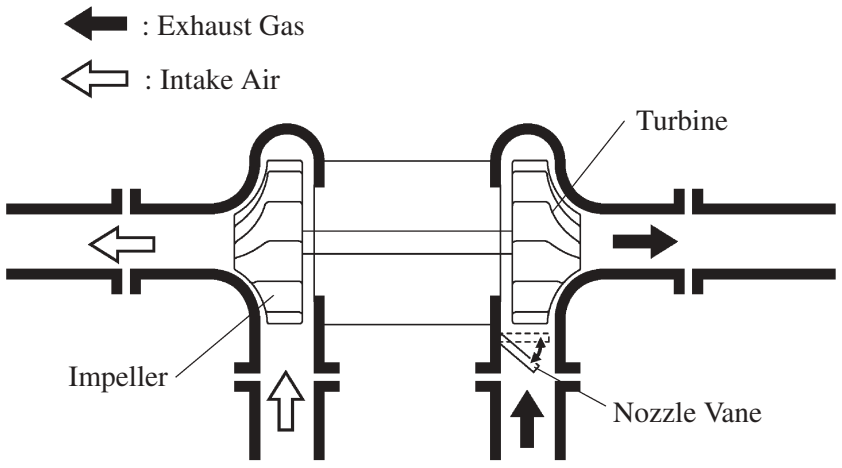

## 5. Variable Nozzle Vane Type Turbocharger

### General

- This turbocharger has realized great performance for low speed torque, maximum output, fuel consumption, 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 which activates the nozzle vane 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.



- 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. When idling, the exhaust gas is less and 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.

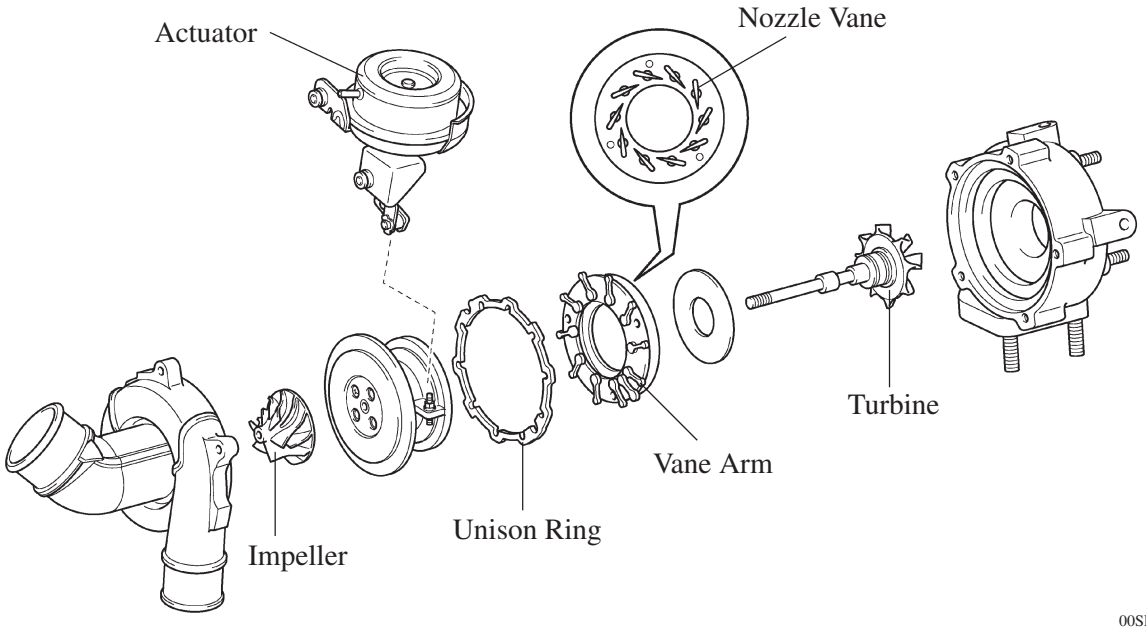



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## Construction

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




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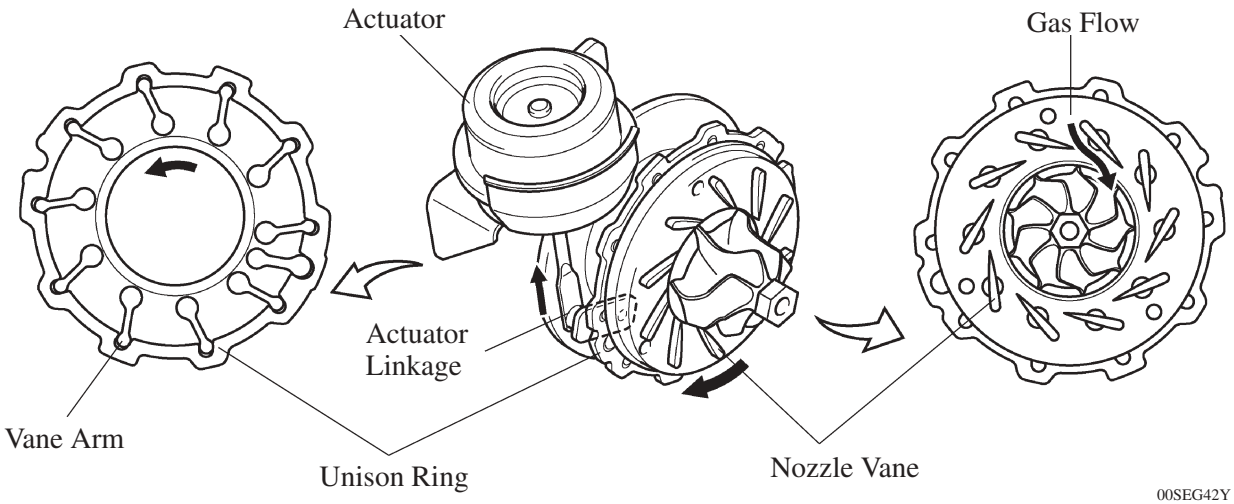
**Service Tip**

The inspection items and measurement valves 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 Yaris Repair Manual (Pub. No. RM00S1E).

## Operation

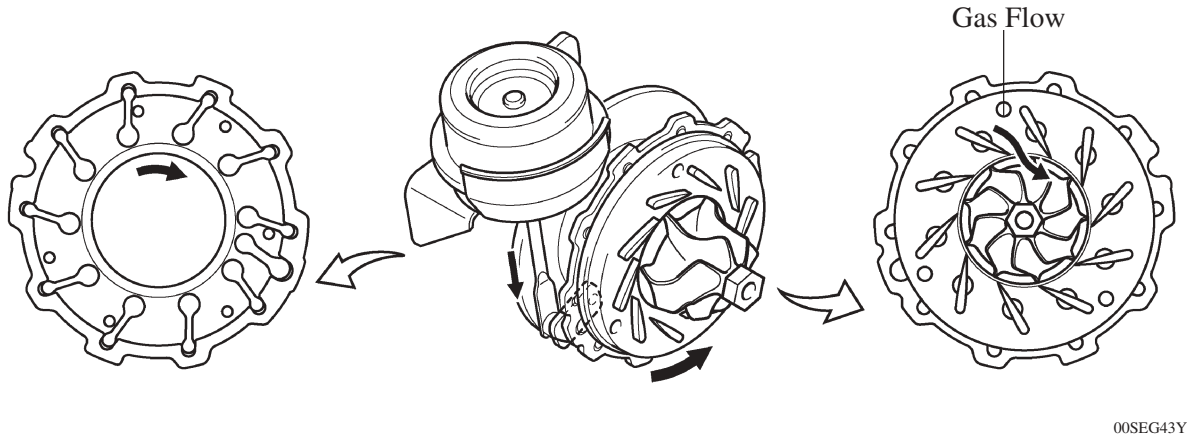
### 1) At Low Load Range

When the engine is running in a low load range, the actuator pulls 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 counterclockwise. 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 plate. When the drive arm moves counterclockwise, 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.




### 2) At High Load Range

When the engine is running in a high load range, the actuator pulls 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, the exhaust gas back pressure is lowered and the output and fuel consumption are improved.



## 6. Exhaust Pipe

- The oxidation catalytic converter has been placed directly below the engine in order to ensure clean emissions even at low engine temperature, in order to comply with the EURO IV regulation requirements.
- A flexible pipe is used to reduce vibration.

