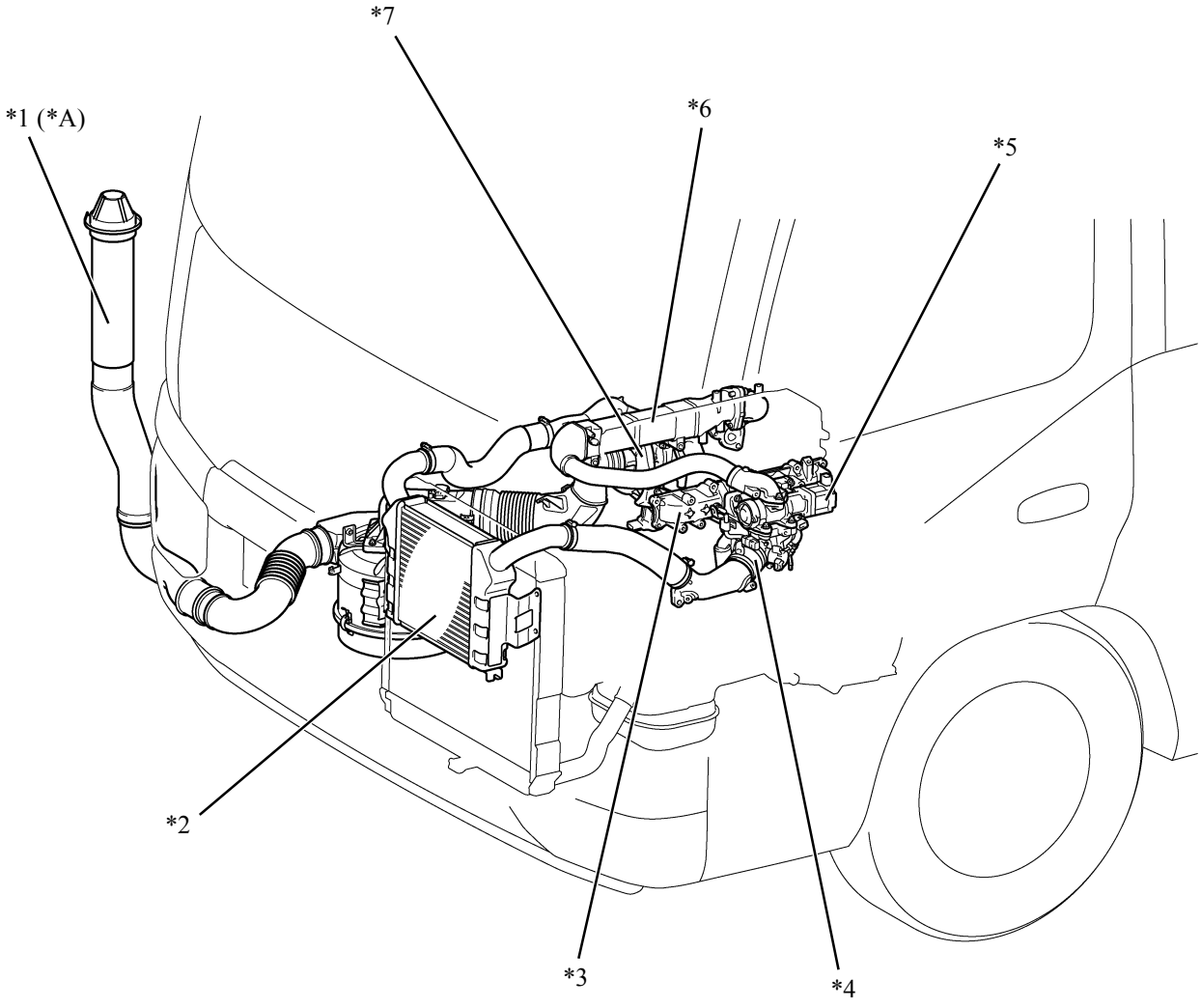
INTAKE AND EXHAUST

■ INTAKE SYSTEM

1. General

- A variable nozzle vane type turbocharger sub-assembly is used.
- A large-size intercooler with a fin type core is used.
- An intake manifold made of lightweight aluminum alloy is used.
- The venturi assembly is located in front of the intake manifold.
- A snorkel is made available depending on a specification.



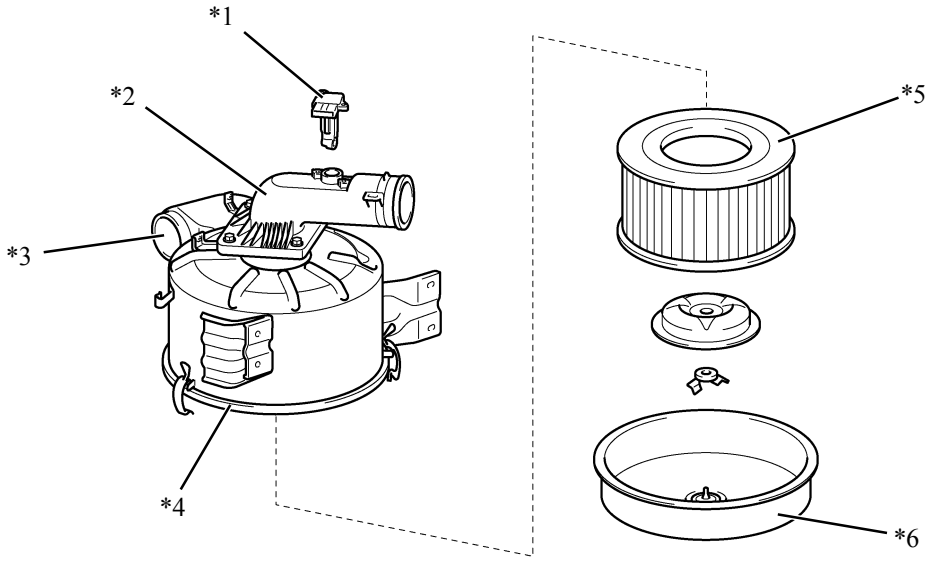
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*A	Models with Snorkel	-	-
*1	Snorkel	*2	Intercooler Assembly
*3	Intake manifold	*4	Venturi Assembly
*5	EGR Valve Assembly	*6	EGR Cooler Sub-assembly
*7	Turbocharger Sub-assembly	-	-

2. Air Cleaner

- An air inlet, air cleaner case sub-assembly and air cleaner cap sub-assembly made of steel are used.
- An intake mass air flow meter sub-assembly is provided on the outlet pipe.



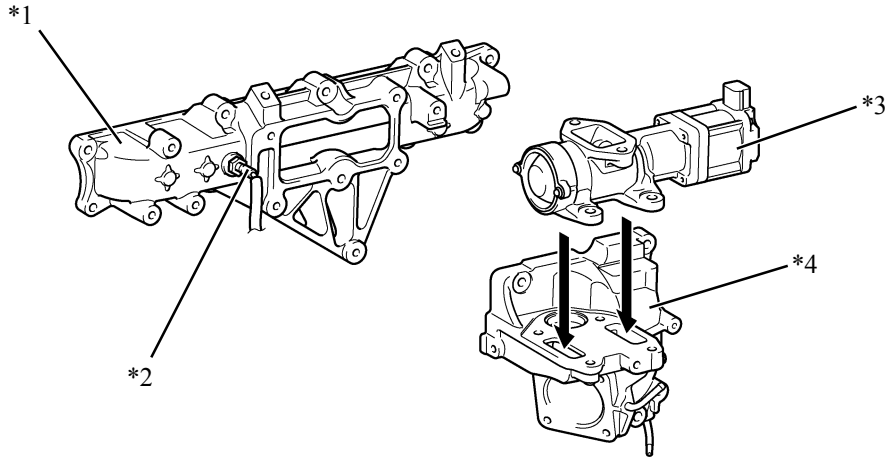
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*1	Intake Mass Air Flow Meter Sub-assembly	*2	Outlet Pipe
*3	Air Inlet	*4	Air Cleaner Case Sub-assembly
*5	Air Cleaner Filter Element Sub-assembly	*6	Air Cleaner Cap Sub-assembly

3. Intake Manifold and Intake Pipe

- An intake manifold made of lightweight aluminum alloy is used.
- An intake pipe is located in front of the intake manifold. The pipe installed inside the intake pipe promotes the mixing of EGR gas and fresh air to achieve better combustion efficiency and lower emissions.
- An EGR passage is located in the intake pipe.
- An intake air temperature sensor was installed on the intake manifold.



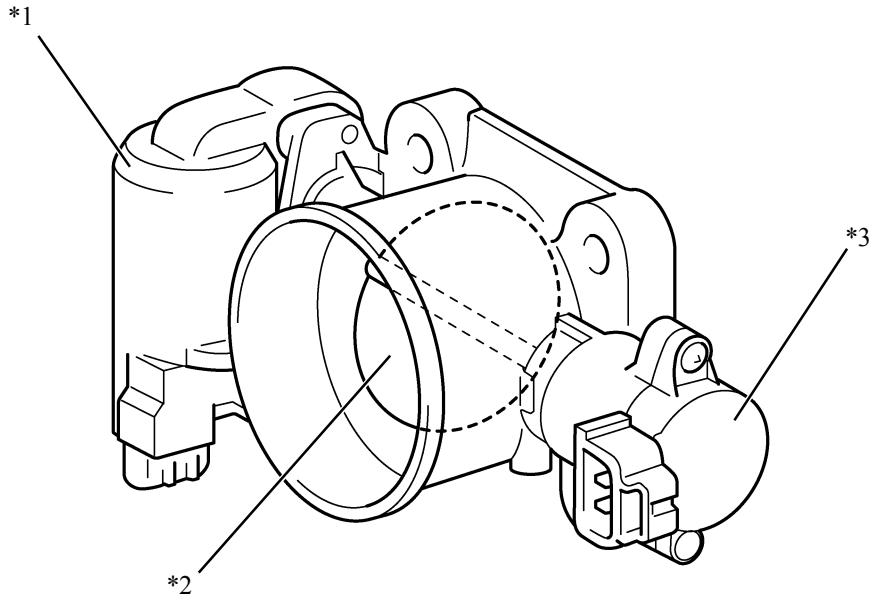
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*1	Intake Manifold	*2	Intake Air Temperature Sensor
*3	EGR Valve Assembly	*4	Intake Pipe
➡ 0479EG26	Exhaust Gas	-	-

4. Throttle Body

- A venturi assembly equipped with a rotary solenoid type throttle control motor is used.
- The signals provided by the ECM open and close the throttle valve by actuating the throttle control motor, in order to control the intake air mass.
- A non-contact type throttle position sensor is used in the throttle body.
- When the engine stops, the throttle valve is entirely closed, in order to minimize noise.



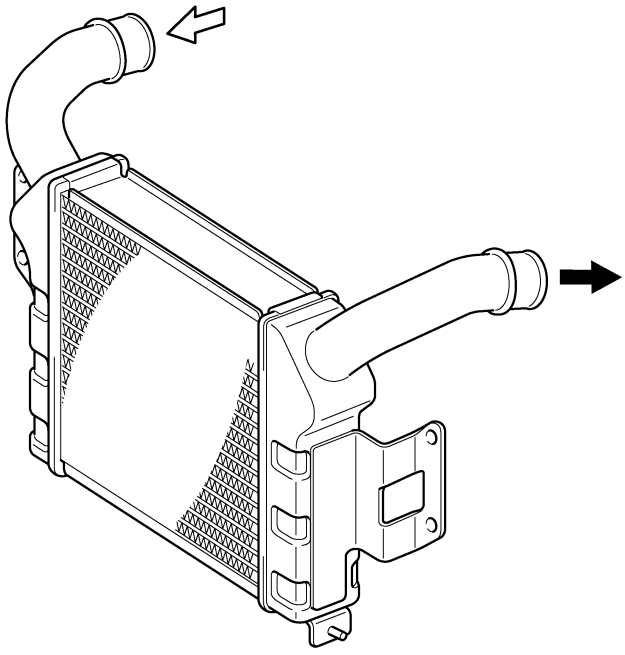
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*1	Throttle Control Motor	*2	Throttle Valve
*3	Throttle Position Sensor	-	-

5. Intercooler

- A large-capacity fin type intercooler assembly is used to improve the intake air cooling performance.
- An air-cooled intercooler assembly is used to lower the intake air temperature in order to minimize exhaust emissions and produce high power output. In addition, a stamped tank has been brazed onto the intercooler to ensure reliability.
- A large core is provided in front of the radiator to maximize cooling performance. Ample distance is provided between the intercooler and the engine to minimize the pressure loss from the cooling air.



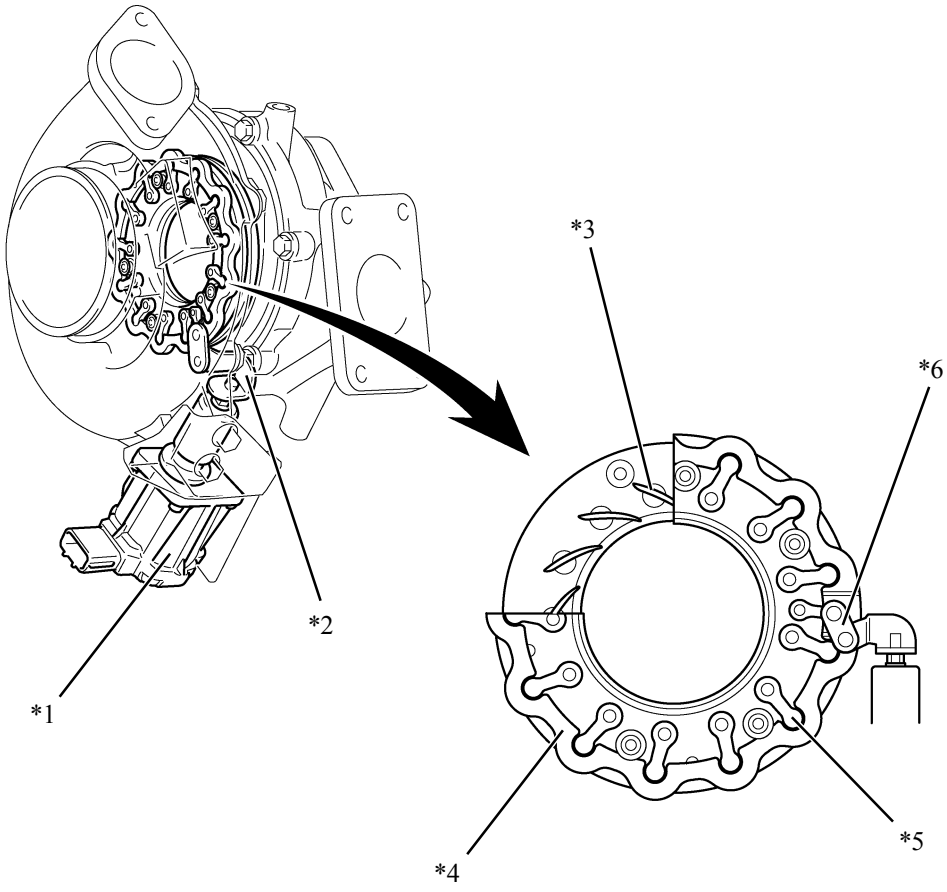
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 0479EG26	to Intake Manifold	 0479EG28	from Turbocharger Sub-assembly

6. Turbocharger

- A variable nozzle vane type turbocharger sub-assembly is used. The variable nozzle vane type turbocharger sub-assembly, which has a small-diameter turbine and which is made by Honeywell (Garrett brand), is used to improve the efficiency of the system.
- The variable nozzle vane type turbocharger sub-assembly consists primarily of a turbine wheel, compressor wheel, nozzle vane, unison ring, linkage, DC motor and turbo motor driver. The DC motor and turbo motor driver are integrated.
- This turbocharger sub-assembly has delivered 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 for the exhaust gas inflow to the turbine wheel at all times in response to the engine condition.
- The ECM outputs a signal to the turbo motor driver, which actuates the DC motor, to control the nozzle vane position. Also, the turbo motor driver detects the position of the nozzle vane.

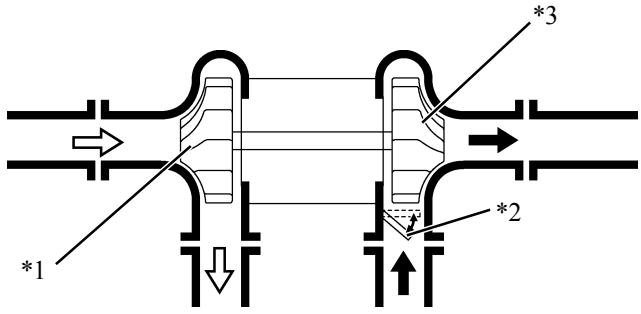


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*1	Turbo Motor Driver and DC Motor	*2	Linkage
*3	Nozzle Vane	*4	Unison Ring
*5	Driven Arm	*6	Drive Arm

- The exhaust gas from the exhaust manifold goes through the nozzle vane inside the turbocharger housing, and flows to the exhaust pipe through the turbine wheel. The speed of the turbine wheel (supercharging pressure) differs depending on the flow velocity of the exhaust gas going through the turbine wheel and the flow velocity of the exhaust gas is controlled by the opening angle of the nozzle vane. At times like during idling, when the exhaust gas is reduced, the nozzle vanes are almost fully closed, but as there is a slight clearance between the nozzle vanes, the exhaust gas flows through this clearance to the exhaust pipe. As the nozzle vanes of this type of turbocharger sub-assembly can move in this way, there is no need for bypassing as with the conventional type turbocharger.



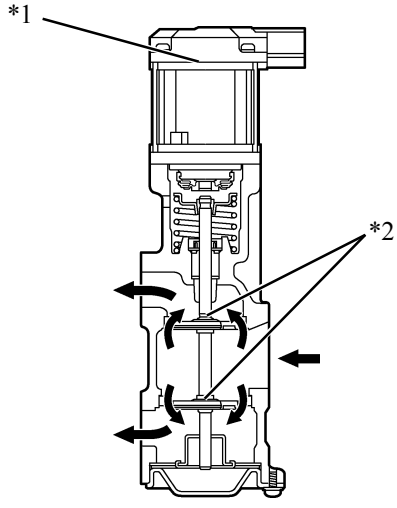
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*1	Compressor Wheel	*2	Nozzle Vane
*3	Turbine Wheel	-	-
0479EG26	Exhaust Gas	0479EG28	Intake Air

7. EGR Valve Assembly

- A DC motor type EGR valve assembly is used. Also, a dual-valve mechanism is used to cancel the effects of the exhaust pressure during actuation in order to realize quick response.
- An EGR valve position sensor is provided in the EGR valve assembly. This sensor enables EGR valve control at a higher level of precision by detecting the amount of lift of the EGR valve assembly.



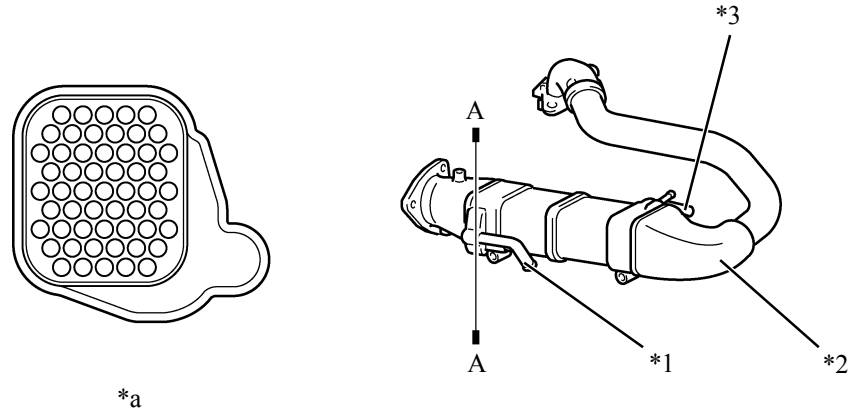
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*1	EGR Valve Position Sensor	*2	Dual Valve
0479EG26	Exhaust Gas	-	-

8. EGR Cooler Sub-assembly

- A water-cooled type EGR cooler sub-assembly is used. This improves the exhaust gas cooling performance, making recirculation control for large volumes of emissions possible, and realizes better NOx emission volume control.
- There are 55 heat exchanger tubes in the EGR cooler sub-assembly, and exhaust gas goes through each tube. The water runs around the heat exchanger tubes and absorbs the heat of the exhaust gas through the tubes.



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*1	Water Inlet	*2	EGR Cooler Sub-assembly
*3	Water Outlet	-	-
*a	A-A Cross Section	-	-