S05C-TA, S05C-TB ENGINES

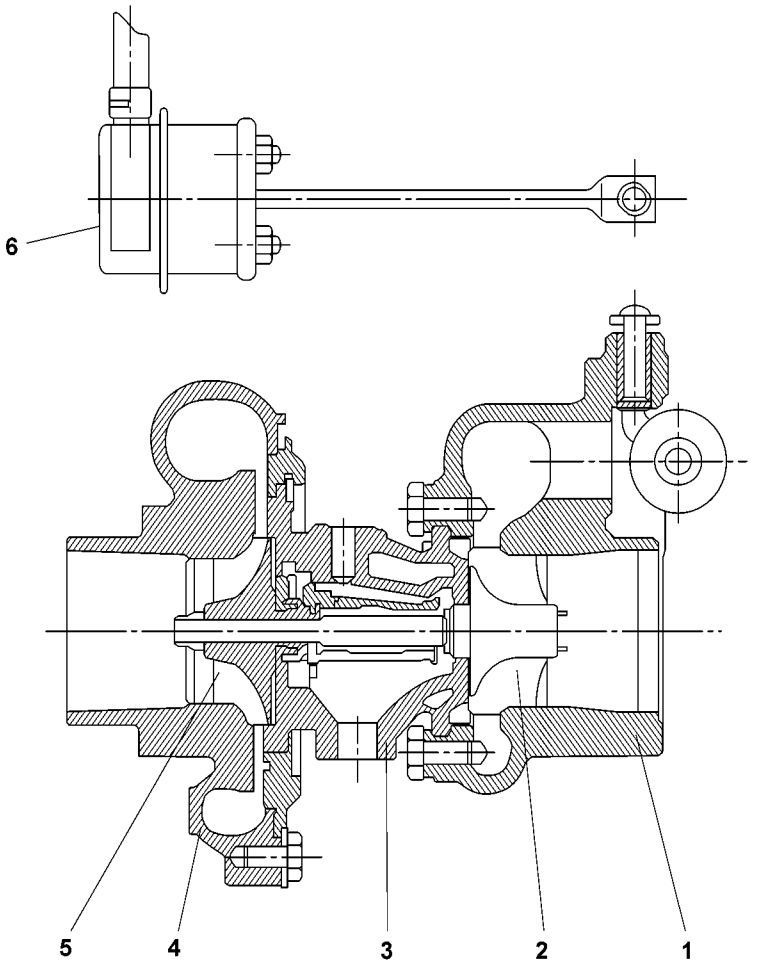
■ TURBOCHARGER

1. Outline

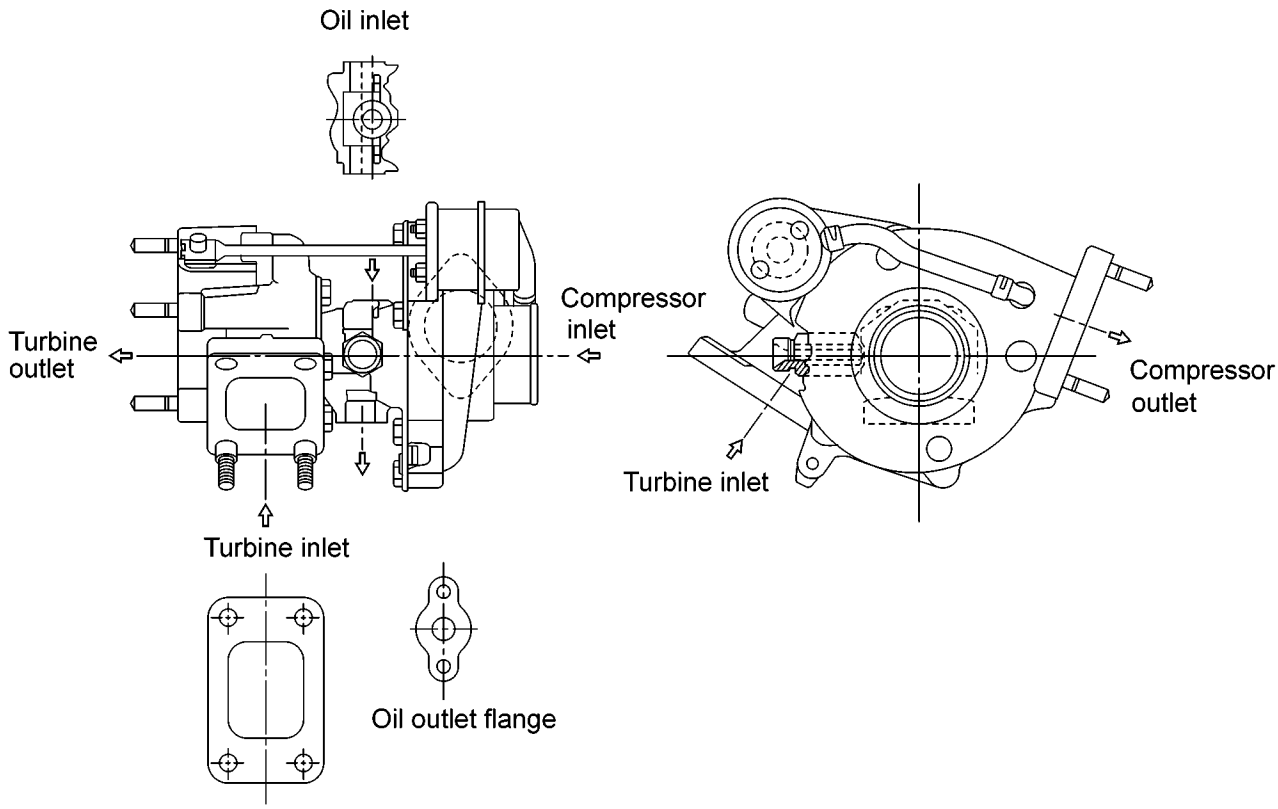
The turbocharger is designed to use the energy of the engine exhaust gas to improve output and increase heat efficiency. It is made up of a turbine case, blower case, and a cartridge.
The cartridge is the most important part of the turbocharger, for it includes the center housing, turbine, impeller, shaft, and various bearings.
The turbine and blower are a single unit; the turbine is operated by the exhaust gas and the blower compresses the air from the air cleaner and feeds large quantities of air into the cylinders.

2. Construction

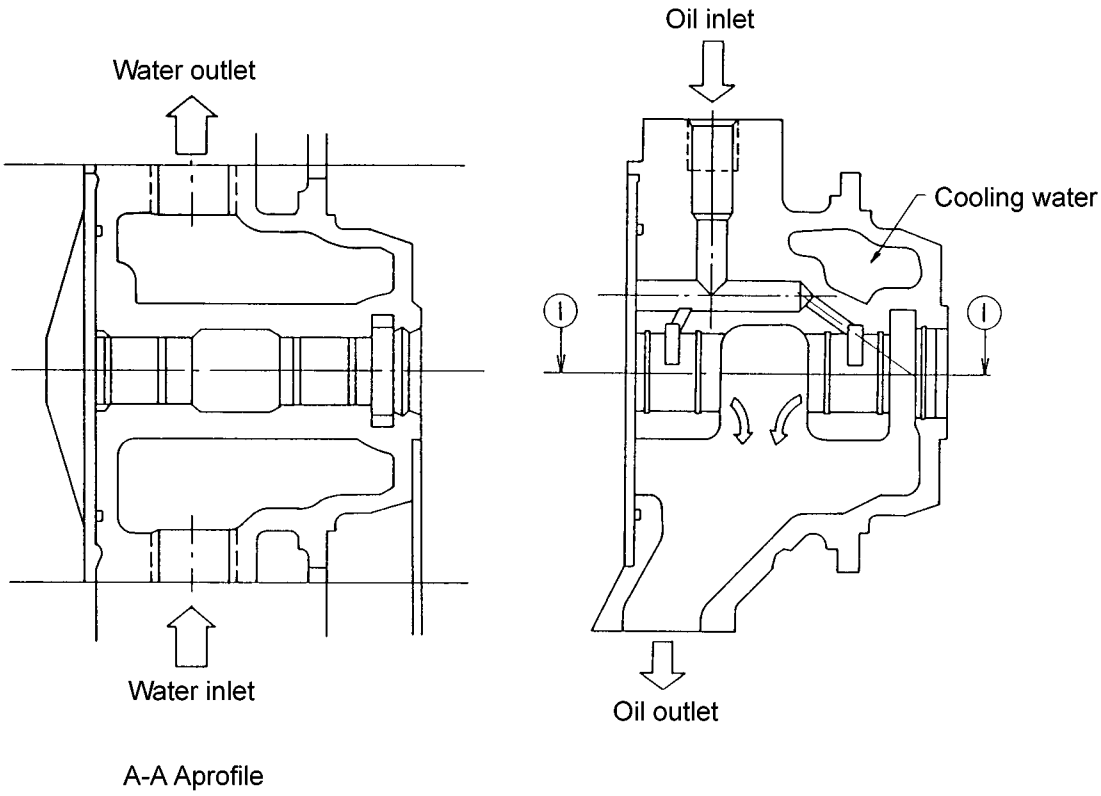
As shown in the figure, the turbine wheel and rotating shaft are integrated as a shaft-wheel assembly, and the wheel is made of a heat-resistant alloy that can withstand temperatures as high as 700°C (1292°F).
The impeller is made of a light alloy and is mounted on the other end of the shaft and fixed in place with a lock nut.
The bearing is a full-float type plain bearing; it is lubricated with engine oil and cooled with cooling water fed into the center housing.
Oil enters through the center housing's inlet and is divided in 3 directions, lubricating the 2 rotary bearings and thrust bearings. It is then passed through the oil outlet and returned to the oil pan. The oil is filtered with a fine-meshed filter and is moved by forced circulation under normal engine oil pressure.
Cooling water is introduced through the center housing's water inlet, where it is used for forced cooling of the bearing housing part, and it is then returned to the water jacket cover, passing first through the water outlet and the water pipe.
The wheel shroud isolates the heat of the exhaust gas and prevents deterioration of the oil inside the center housing.



1. Turbine housing
2. Turbine wheel
3. Center housing
4. Compressor housing
5. Compressor wheel
6. Actuator assembly



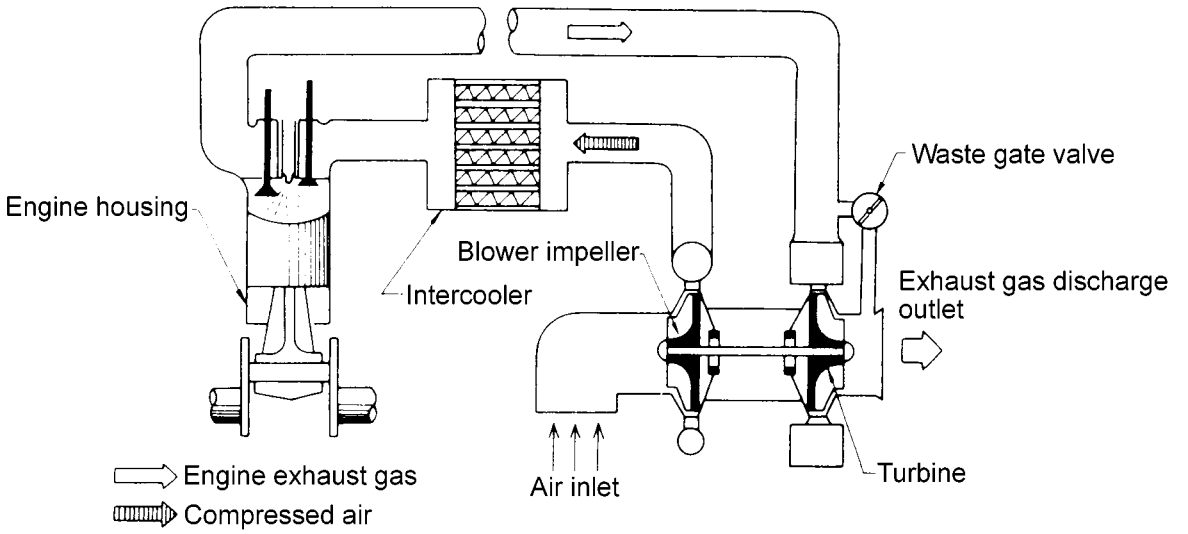
External view of turbocharger



Center housing construction

3. Function

The engine's exhaust gas enters the turbine case from the exhaust manifold and turns the turbine wheel, which drives the blower impeller installed on the other end of the shaft that is integrated with the turbine wheel. The blower impeller compresses the supply air from the air cleaner and discharges it from the blower case's outlet. The air, which has been compressed and is at a high temperature, is cooled by the intercooler, becoming highly dense, and is then supplied to the cylinders. If the quantity of exhaust gas increases, the turbine wheel's number of revolutions also increases, while at the same time the blower impeller's number of revolution increases and a greater quantity of air is supplied to the intake manifold. If the quantity of exhaust gas decreases, the quantity or air supplied to the intake manifold also decreases.
Lubrication/cooling of the turbocharger's bearings is performed by engine oil, supplied through the top of the center housing after it has been filtered. The engine oil is returned to the oil pan, passing through the bottom of the housing and through a drain pipe. With this turbocharger, moreover, a cooling system is provided in which a cooling channel is equipped in the center housing and cooling water is circulated through the channel to cool the bearings, seal rings, and other parts.
Cooling water is sent to the turbocharger from the pump outlet pipe through a steel pipe, and after cooling the bearings and other parts as described previously, it is returned to the thermostat case via the steel pipe.



Turbocharger's working principle

The purpose of the waste gate system is to improve the engine low-speed torque and deliver better acceleration characteristics than those of a normal turbocharged engine. This system most effectively utilizes the turbocharger in the engine low-and medium-speed ranges, using a portion of the gas exhausted from the engine and bypassing it away from the turbocharger turbine.
The turbocharger uses a small-type turbine to match the engine speed in the engine low-and medium-speed ranges and to increase the supercharging effect. For super-rotation (high boost) in the high-speed range, an exhaust gas bypass is provided and equipped with a waste gate control unit with a built-in valve system. This control unit suppresses the booster pressure and keeps it constant.

4. Inspection of Turbocharger and Air Supply System

Check the booster pressure to determine if the turbocharger is operating normally or there are air leaks in the air supply system, including the intercooler.

[1] Checking booster pressure

Remove the bull plug on the intake pipe and connect it to the intake manifold, using the special tool provided for that purpose (Hose 17108-1040 for booster pressure measurement and Gauge 09444-1250/1230). (When installing the bull plug on the intake pipe, use the washer used with the bull plug.)
Draw the gauge into the cab interior and engage the clutch and fully depress the accelerator pedal. Measure the booster pressure under no-load maximum-speed conditions. Make sure the engine has adequately warmed up before making the measurement. Keep the gauge vertical to prevent oscillation of the needle. (After the measurement has been taken, re-install the seal, washer, and bull plug in their original positions.)

[2] Booster pressure criteria and measures

With this measurement method, a pressure less than 19.6 kPa (0.20 kgf/cm^2) indicates that the air intake/exhaust system (including the intercooler) and the turbocharger need to be checked and repaired. (Check the booster pressure about once a year when the vehicle is being serviced or other time.)