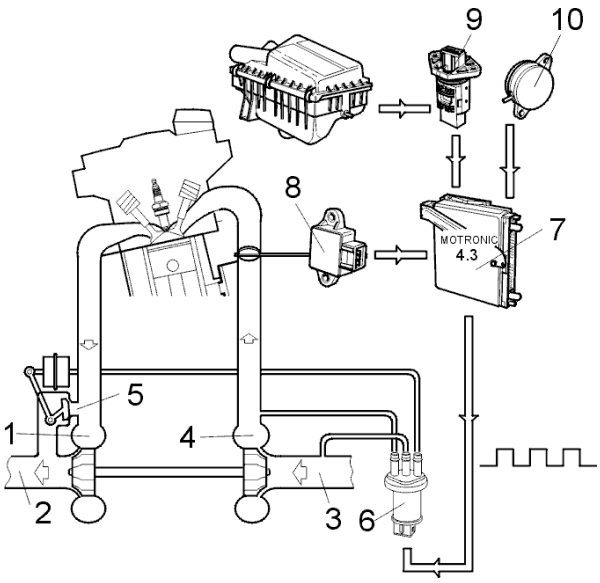
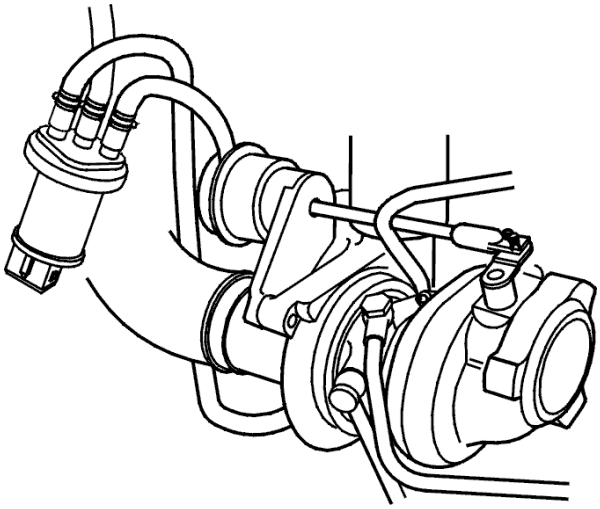
Turbo charger (TC) control

Overview



The function of the TC control system is to optimise boost pressure and, as a result, engine output under the most variable conditions. Since boost pressure is controlled electronically, the TC delivers full output at a speed as low as 2000 rpm. This, in turn, means that high torque is available throughout the entire speed range. TC boost pressure is controlled by the ECM.

Turbocharger (TC)

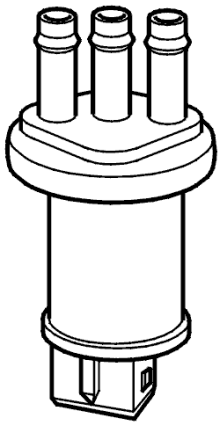


The function of the turbocharging system is to increase engine output. This is achieved by compressing the intake air in the turbocompressor. The engine management system detects that the cylinder is being charged with a greater quantity of air and responds by injecting more fuel. In other words, the cylinder is charged with a greater quantity of air/fuel mixture than would be induced normally. The pressure developed in the system is known as boost pressure.
Exhaust gases enter the turbine through the inlet chamber (1) and are discharged to the exhaust pipe (2). Fresh air is drawn through the intake pipe (3) and, following compression, flows to the engine intake manifold through the outlet chamber (4) and charge air cooler (CAC).

Wastegate valve

The boost pressure may become excessive if the turbine speed is too high. This is prevented by the wastegate valve (5), which bypasses a proportion of the exhaust gases flowing to the turbine.

TC control valve



The wastegate valve is controlled by the boost pressure by means of the TC control valve (6). An output on the ECM (7) supplies the valve with a pulsating signal, the duty cycle of which can be varied to control the pressure delivered to the wastegate valve servo. When the ECM determines that a higher boost pressure is permissible, the duty cycle of the signal delivered to the TC control valve is increased and a proportion of the pressure delivered to the servo is relieved to the air intake. The control pressure and wastegate valve opening are thereby reduced, increasing the flow of exhaust gases through the turbine and increasing boost pressure.

Control of TC boost pressure

The TC control valve duty cycle (pulsating signal) is controlled by a desired value computed by the ECM. The ECM uses signals from the following sensors for this purpose:

* TP sensor (8)
* MAF sensor (9)
* RPM sensor (10)

In other words, the system is not equipped with a pressure sensor. The ECM uses the MAF sensor signal (a measure of the flow through the ACL) to compute boost pressure.

Boost pressure reduction

When the car is driven in 1st or reverse, wheel spin may easily occur if normal turbo control is in operation. To prevent this, the boost pressure is reduced below 3000 rpm when these gears are engaged.
On manuals, the boost pressure reduction function is controlled by the ECM. On automatics, the TCM transmits a signal to the ECM requesting a reduction in the pressure and the request is implemented by the ECM if a reduction is needed.
On automatics, boost pressure reduction also takes place when the “Winter" mode is selected and when the brake light switch is closed (i.e. the brake pedal is pressed).
If the car is a manual, the ECM uses the gearbox and final drive ratios, engine speed and road speed to determine which gear is engaged.
The boost pressure may also be reduced to protect the engine from damage. If the KS detect that the engine is knocking above a certain threshold value, although the timing has been retarded and the air/fuel mixture has been enriched, the ECM will reduce the boost pressure until knock has been eliminated.
A reduction in boost pressure also takes place if there is a risk of engine overheating. If the ECT sensor indicates that the temperature has exceeded 118°C (244°F), the ECM will reduce the boost pressure to slow the temperature rise.

Boost pressure monitoring

The ECM monitors boost pressure continuously using information supplied by the MAF sensor describing the intake air quantity. If boost pressure exceeds the permissible level, the ECM will close the TC control valve so that boost pressure is limited to the basic value. If the pressure continues to rise despite this adjustment, the ECM will interrupt the fuel supply by keeping the injectors closed.
The fuel supply will be restored when the pressure has returned to the permissible value.
If the computations indicate that the boost pressure is too low, the pressure will be limited to the basic value, since the fault may be due, for example, to a blocked air intake.
The ECM will limit the pressure to the basic value in the event of a component fault which may influence computation of the pressure.