1982 Turbocharging Systems

FIAT SPIDER 2000

Spider 2000

DESCRIPTION

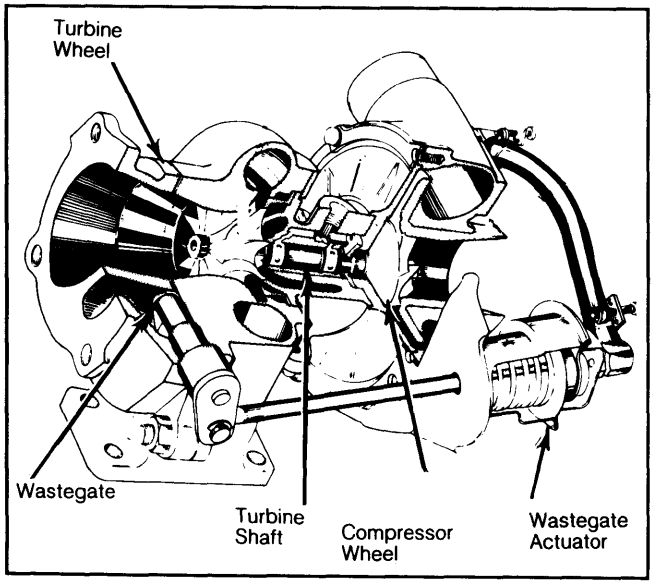
The turbocharger used on Fiat Spider 2000 Turbo models consists of a turbine wheel, compressor wheel, rotor shaft, wastegate actuator and wastegate. The rotor shaft is supported by two bearings which float on a thin film of oil. The bearings are protected from heat by seal rings and plates.

The wastegate actuator operates the wastegate to allow excessive exhaust gas to by-pass the turbine wheel during boost. This limits boost pressure generated by the turbocharger. In addition, two boost enrichment switches, a load enrichment switch and an overboost protection switch are integral with this system.

Modifications have been made to the standard 2000 cc engine to accomodate the turbocharger. These modifications are as follows: The exhaust manifold was changed to provide for turbocharger mounting. The lambda sensor on the exhaust manifold was relocated to the turbine outlet elbow. A check valve was installed in the purge line between the charcoal canister and the intake manifold. The check valve prevents boost pressure from pressurizing the canister.

The engine oil system was modified to allow for lubrication of the turbocharger shaft bearings. An external oil hose connects the turbocharger to the oil supply system at the filter housing. The oil from the turbocharger is returned directly to the oil sump through another external oil hose. A pressure gauge is installed in the instrument panel to indicate boost pressure. A red zone on the right side of the gauge indicates when boost pressure is excessive.

Fig. 1: Cutaway View of Fiat Spider 2000 Turbocharger



OPERATION

The turbocharger is mounted on the exhaust manifold so that all exhaust gases flow through the turbine. The exhaust gas starts the turbine rotating, which in turn causes the compressor wheel to rotate. As the compressor wheel rotates, it draws fresh air in from the air flow sensor and compresses it.

The compressed air is then routed to the throttle plate, increasing the charge of the air/fuel mixture, allowing for more effective combustion. The increased air/fuel mixture charge results in a boost pressure which at approximately .5 psi (.035 kg/cm^2) starts turbocharger operation.

Since exhaust gas drives the turbine, the speed of the turbine, as well as the compressor boost pressure, will increase in proportion to engine load and speed. Depending upon the amount of exhaust gas flow, the turbine wheel will spin at speeds up to 100,000 RPM. In order to prevent excessive boost pressure, which would blow the turbocharger apart, a charge boost pressure regulator (wastegate actuator) is incorporated into the unit.

WASTEGATE ACTUATOR

The wastegate actuator contains a diaphragm and a return spring. The upper chamber of the actuator is connected to the compressor outlet. The boost pressure in the outlet is applied to the diaphragm, and at approximately 6 psi (.42 kg/cm^2) the boost pressure begins to overcome the diaphragm spring pressure.

This opens the wastegate valve, allowing some of the exhaust gas to escape into the exhaust pipe, by-passing the turbine. Any increase in exhaust gas flow will result in an increase in by-pass flow to maintain maximum boost pressure at approximately 6 psi (.42 kg/cm^2).

BOOST ENRICHMENT

The Spider 2000 Turbo is also equipped with a boost enrichment circuit consisting of two boost pressure switches wired into the fuel injection electrical system. Each switch is a single-pole, two-position switch. The pressure switches are in series with the coolant temperature sensor.

When operating without boost, the sensor provides a signal to the Electronic Control Unit (ECU) for extra fuel during warm-up. When boost pressure increases to approximately .5 psi (.035 kg/cm^2), the first switch is activated. This opens the switch contact and causes the signal to pass through a resistor. This increase in resistance signals the ECU for additional fuel. When boost pressure increases to approximately 5 psi (.35 kg/cm^2) the second switch is activated and an additional resistance is added, signaling for an extra increase in fuel flow.

LOAD ENRICHMENT

A load enrichment switch is also used on Spider 2000 Turbo models. This circuit contains one boost pressure switch wired into the throttle plate switch circuit of the fuel injection electrical circuit.

This switch provides a wide open throttle signal to the ECU whenever there is boost pressure. This signals the ECU to provide power enrichment, since the engine is operating under high load.

OVERBOOST PROTECTION

An overboost protection circuit is added in case the wastegate system fails. Boost pressure is applied to a pressure switch, calibrated to open if boost

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FIAT SPIDER 2000 (Cont.)

pressure exceeds the set value. This signals the ECU which closes the fuel injectors.

The engine slows down and thereby reduces boost pressure. When boost pressure drops below the set value, the switch removes the signal from the ECU and the injectors return to normal operation.

TESTING

BOOST ENRICHMENT SWITCHES

1) Disconnect "Y" fitting from switches. Connect an air pressure regulator with a gauge to the "Y" fitting. Disconnect connectors for switches from fuel injection wire harness.

CAUTION: When operating the regulator with line pressure connected, make sure air pressure to switches does not exceed 12 psi (.84 kg/cm²).

2) Connect an ohmmeter to pins 1 and 2 of connector for boost enrichment switches. Slowly apply pressure to switches.

3) Check that switch operates (a slight audible click may be heard) at 0.5-1.5 psi (.035-.10 kg/cm²). Ohmmeter should read between 1500 and 2000 ohms.

4) Slowly increase pressure. Check that other switch operates at 4.5-5.5 psi (.31-.38 kg/cm²). Ohmmeter should read between 1750 and 2750 ohms.

LOAD ENRICHMENT & OVERBOOST PROTECTION SWITCH

1) Connect pressure regulator with gauge to "Y" fitting for load enrichment switch. Connect ohmmeter to pins 1 and 3 of connector for load enrichment/overboost switches. Zero ohmmeter.

2) Check that ohmmeter reads infinity. Slowly apply pressure to switch. Check that load switch operates at about 1 psi (.07 kg/cm²). Ohmmeter should read 0 ohms.

3) Connect ohmmeter to pins 1 and 2 of connector. Check that ohmmeter reads infinity.

4) Slowly increase pressure. Check that overboost switch operates at approximately 9 psi (.63 kg/cm²). Ohmmeter should read 0 ohms.

Fig. 2: Turbocharger Diagram for Spider 2000 Models