L-Jetronic

Since their introduction, Jetronic fuel-injection systems have proved themselves millions of times over.
The advantages inherent in fuel injection with regard to the demands for fuel economy, engine power, and not least of all for improved environmental compatibility, played a major role in these developments.
Ongoing ECU and sensor developments were instrumental in the transition from the original D-Jetronic to the L-Jetronic, an electronically controlled multipoint fuel-injection system which is even more precise and reliable than its predecessors.
This manual describes the L-Jetronic and its most important features. Until 1996, this fuel-injection system was installed as an independent system in series-production vehicles, and in this configuration is today only of interest as far as servicing and repair is concerned.
Modern series-production vehicles are equipped with combined ignition and fuel-injection (Motronic). Linking this to the vehicle's other electronic systems permits the joint optimisation of all systems so that comprehensive engine-management becomes a reality.
These engine-management systems with their integrated ignition are described in the manual “Motronic Engine Management”.

Fuel-injection valves

The electronically controlled fuel-injection valves inject precisely metered fuel into the intake ports and onto the intake valves.

Each engine cylinder has its own fuel-injection valve. The valves are solenoid-operated and are opened and closed by means of electric pulses from the electronic control unit. The fuel-injection valve consists of a valve body and the needle valve with fitted solenoid armature. The valve body contains the solenoid winding and the guide for the needle valve. When there is no current flowing in the solenoid winding, the needle valve is pressed against its seat on the valve outlet by a helical spring. When a current is passed through the solenoid winding, the needle valve is lifted by approximately 0.1 mm from its seat and the fuel can be injected through the precision annular orifice. The front end of the needle valve has a specially ground pintle for atomizing the fuel (Figure 8). The pickup and release times of the valve lie in the range of 1 to 1.5 ms. To achieve good fuel distribution together with low condensation loss, it is necessary that wetting of the intake-manifold walls be avoided.

The means that a particular spray angle in conjunction with a particular distance of the injection valve from the intake valve must therefore be maintained, specific to the engine concerned. The fuel-injection valves are fitted with the help of special holders and are mounted in rubber mouldings in these holders. The insulation from the heat of the engine thereby achieved prevents the formation of fuel-vapour bubbles and guarantees good hot-starting characteristics. The rubber mouldings also ensure that the fuel-injection valves are not subjected to excessive vibration.

Fuel-pressure regulator

1 Intake-manifold connection, **2** Spring, **3** Valve holder, **4** Diaphragm, **5** Valve, **6** Fuel inlet, **7** Fuel return.

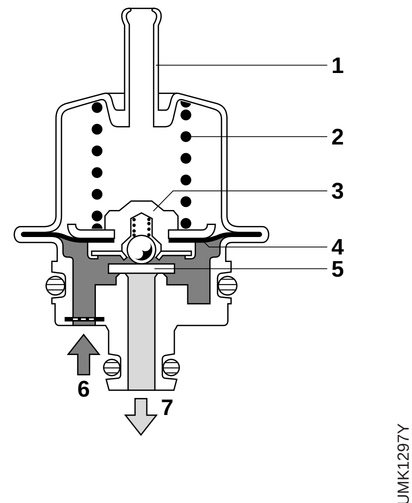
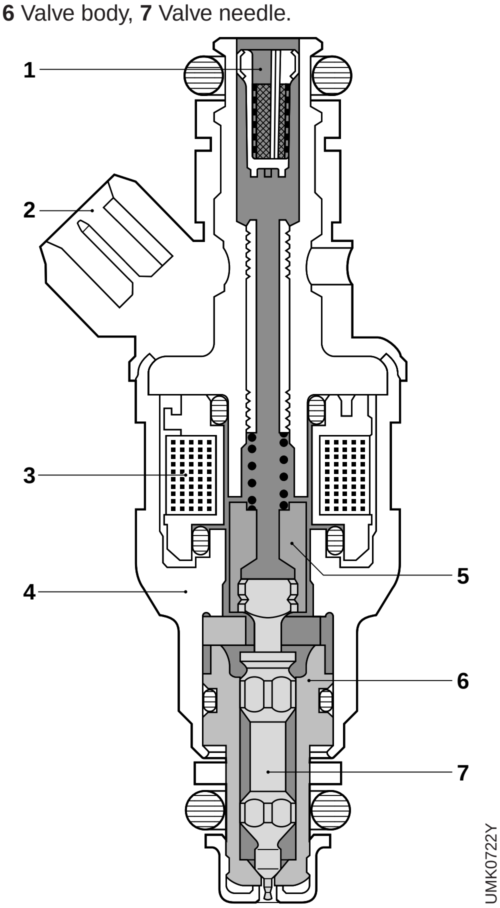


Fig. 7

Fig. 8

Solenoid-operated fuel-injection valve (injector)

1 Filter in fuel inlet, **2** Electrical connection, **3** Solenoid winding, **4** Valve housing, **5** Armature, **6** Valve body, **7** Valve needle.



Operating-data sensing system

Sensors detect the operating mode of the engine and signal this condition electrically to the control unit. The sensors and ECU form the control system. The sensors are described in conjunction with the relevant main function or compensation function.

Measured variables
The measured variables characterizing the operating mode of the engine are as follows:
– Main measured variables,
– Measured variables for compensation,
– Measured variables for precision compensation.

The ECU evaluates all measured variables together so that the engine is always supplied with exactly the amount of fuel required for the instantaneous operating mode. This achieves optimum driveability.

Main measured variables
The main measured variables are the engine speed and the amount of air drawn in by the engine. These determine the amount of air per stroke which then serves as a direct measure for the loading condition of the engine.

Measured variables for compensation
For operating conditions such as cold start and warm-up and the various load conditions which deviate from normal operation, the mixture must be adapted to the modified conditions. Starting and warm-up conditions are detected by sensors which transmit the engine temperature to the control unit. For compensating various load conditions, the load range (idle, part-load, full-load) is transmitted to the control unit via the throttle-valve switch.

Measured variables for precision compensation
In order to achieve optimum driving behavior, further operating ranges and influences can be considered: the sensors mentioned above detect the data for transition response when accelerating, for maximum engine-speed limitation and during overrun. The sensor signals have a particular relationship to each other in these operating ranges. The control unit recognizes these relationships and influences the control signals of the injection valves accordingly.

Calculating engine speed
Information on engine speed and the start of injection is passed on to the L-Jetronic ECU in breaker-triggered ignition systems by the contact-breaker points in the ignition distributor, and, in breakerless ignition systems, by terminal 1 of the ignition coil (Fig. 9).

Measuring the air flow
The amount of air drawn in by the engine is a measure of its loading condition. The air-flow measurement system allows for all changes which may take place in the engine during the service life of the vehicle, e.g. wear, combustion-chamber deposits and changes to the valve settings.
Since the quantity of air drawn in must first pass through the air-flow sensor before entering the engine, this means that, during acceleration, the signal leaves the sensor before the air is actually drawn into the cylinder. This permits correct mixture adaptation at any time during load changes.

Fig. 9
Calculating engine speed with a breaker-triggered ignition system
1 Ignition distributor, **2** ECU.
n Engine speed.