

# Tips & Technology

For Bosch business partners

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## Diesel injection



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## Checking two-spring nozzle holders with EPS200

### The two-spring nozzle holder in brief

The two-spring nozzle holder is a more advanced version of the standard holder for hole-type nozzles. It is designed such that the nozzle needle opens in two stages during the injection process.

Two-spring nozzle holders feature two springs located one behind the other. Initially only one spring acts on the nozzle needle, thus determining the first opening pressure.

Once this first opening pressure is attained, the nozzle needle is initially opened as far as the pre-lift  $h_1$  (0.03...0.06 mm for DI engines) with the result that only a small quantity of fuel enters the combustion chamber. This is referred to as pilot injection.

The second spring rests on a stop sleeve which limits the travel. If the pressure continues to increase, the stop sleeve is lifted off, overcoming the force of both springs. The nozzle needle is then opened to full lift to permit injection of the main quantity.

This two-stage injection process results in "softer" combustion with considerably less noise generation and often also a reduction in  $\text{NO}_x$  on account of the lower peak combustion temperature.



### **The opening pressure is the crucial factor**

At the start of injection, the opening pressure of the nozzle influences the injection pressure and thus also the atomization of the injection jet.

As a result of spring force acting on the nozzle needle, the nozzle remains closed at fuel pressures below the opening pressure level.

If the fuel pressure increases, the nozzle needle is raised on exceeding the opening pressure. As soon as pressure builds up beneath the needle seat, the area to which pressure is applied increases and an additional force acts on the nozzle needle in opposition to the spring force.

The opening pressure determines the start of combustion of an engine cylinder and is thus one of the main injection system parameters.

Accordingly, precise determination and checking of the injection pressure is essential.

In view of the enormous pressures prevailing in modern diesel injection systems and the relevance attached to the opening pressure, such checking can only be performed with suitable high-grade test equipment.

### **Always one step ahead with EPS 200**

Its ability to maintain the necessary opening pressures makes the EPS 200 from Bosch ideal for checking the opening pressure of two-spring nozzle holders.



### The EPS 200 test spectrum

The "nozzle-and-holder assembly" function provides an automatic test routine for quick and easy checking of single and two-spring nozzle-and-holder assemblies.

The following individual checks can be implemented:

- Opening pressure 1
- Opening pressure 2
- Assembly leakage
- Chatter test
- Seat leakage
- Spray pattern



#### "Opening pressure 1" test

The "Opening pressure 1" test establishes the pressure at which the nozzle opens. In the case of a two-spring nozzle holder, the opening pressure for pilot injection is checked. The result displayed is the opening pressure value at the nozzle. All other tests are governed by the determination of opening pressure 1.

As this test forms the basis for all other tests, it cannot be de-selected in the program.

#### "Opening pressure 2" test

This test can only be performed for two-spring nozzle holders. Opening pressure 2 is the pressure at which the nozzle opens the second stage.

Checking of the second opening pressure is identical to the process for the first opening pressure, except that opening pressure 1 is required for measurement of the second opening pressure.

### **"Assembly leakage" test**

In the "Assembly leakage" test, the pressure in the system must not drop by a certain amount within a defined time after closing of the nozzle.

### **Chatter test**

This test is designed to check the freedom of movement of the nozzle needle. It involves setting the previously determined opening pressure 1 and then checking whether the nozzle repeatedly opens and closes.

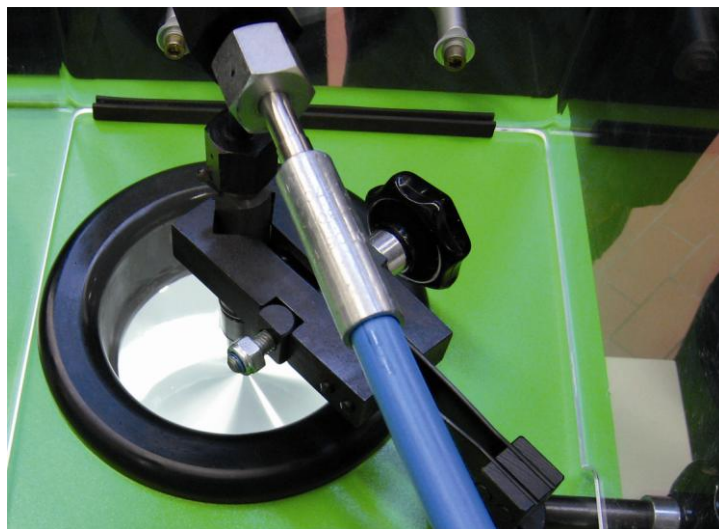
This test can only be performed in combination with the "Assembly leakage" test.

### **"Seat leakage" test**

The seat leakage test is performed at 2 MPa below opening pressure 1. It is permissible for a droplet to form at the nozzle opening on completion of a defined time, but it must not drip off. The result of the seat leakage test is assessed by the checker.

### **"Spray pattern" test**

The spray pattern is visually assessed by the checker.



### **Important information**

For safety reasons, damaged or severely corroded components are not to be tested. Nozzle components (nozzle body and nozzle needle) are never to be re-worked.

Most of the corresponding set values for the opening pressures are already contained in the EPS 200 software. The components can then be conveniently found in this database by way of the identification function.

Before starting testing, it is advisable to search for the item to be tested by way of "Load component". If the component has not yet been created, it can be added and stored in the database.

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