Repair Instead of Exchange

Bosch is now ready to launch repair stage 3 for Common Rail injectors, making it possible for workshops to apply tolerances of 1 µm. Being able to fully repair injectors opens up whole new avenues for car repair garages when it comes to saving money on diesel repairs.

The repair of Common Rail injectors requires maximum cleanliness. Repair stage 1 only involves replacement of the nozzle. Photo: Linzing

Car repair garages have to prepare to handle increasing numbers of diesel vehicles in their everyday workshop lives. There are already lots of older vehicles with long service lives out there using Common Rail systems. Once they lose a high-pressure component, not even Exchange, the parts replacement programme offered by Bosch for several years now, doesn't always allow economically feasible repairs. Therefore, the situation called for the development of repair methods for high-pressure components to enable workshops to serve this customer group as well.

Narrow Tolerances

The problem is that the repair of Common Rail components can be rather tricky. Factories assemble the components under pollutant-free conditions with tolerances in the neighbourhood of 1 µm. Even the tiniest of dirt particles can entail downtime and result in costly damage if a repair job is carried out improperly. That's why maximum sanitary conditions are the No. 1 Rule in repairing components.

Market situations at the time first called for the Bosch customer service engineers to develop a repair method for Common Rail high-pressure pumps. Following numerous tests and close coordination with Bosch's diesel engineers, they then gradually readied three repair stages for Common Rail injectors of the first and second generation (with solenoid valve control) for market production.

For end consumers, repairing Common Rail injectors is about 50 percent more cost-efficient than using a replacement part.

Common Rail injectors are long-lasting components. However, extreme conditions of use coupled with poor fuel quality are factors leading to their early wear. The most common type of damage occurs to injection nozzles, leaking high-pressure sealing washers of the injector control area as well signs of wear around the solenoid valve group. The Bosch customer service field repair concept (FIS) now offers with three repair stages solutions for all existing problem areas.

Stage 1: Nozzle Replacement

The first repair stage concerns the replacement of nozzles. In this procedure, the injectors undergo a visual inspection and ultrasound bath followed by an entry test on a pump test bench. If an injector only needs a nozzle replacement, it is placed in a special holding device. Diesel specialists can then take out the nozzle-retaining nut and remove the defective nozzle.

Then the partially disassembled injector is again thoroughly cleaned in the ultrasound bath. The final step is to mount a new nozzle and reassemble the injector using a special assembly device. In the process, screwing the

Repair stage 2 involves disassembling the whole injector and replacing only the high-pressure sealing washer. Photo: Linzing

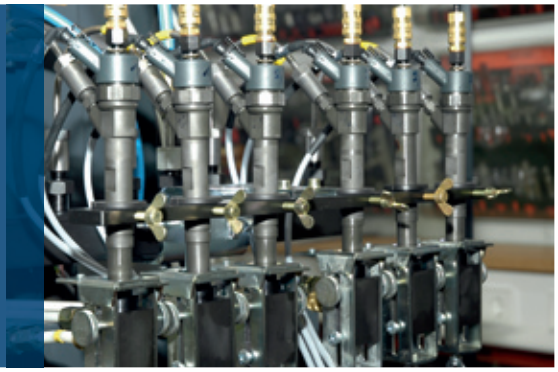
nozzle-retaining nut to the injector is one of the determining factors in making the repair a success. Even the tiniest inaccuracies can result in leaks between the injector components. To this end, Bosch's customer service and research engineers worked together to develop a special screw-fitting process specifically for workshop applications, which, if precisely adhered to, yields the same stability as that of screw-fitting processes used for mass production on costly machinery.

Once repaired, the injectors have to pass another inspection on the test bench. An automatic test run is applied to examining a minimum of five load impacts and analysing the injected quantities. If necessary, an injector receives a new code, which then has to be programmed into the vehicle's ECU.

Stage 2: High-pressure Sealing Washer Replacement

The second repair stage developed by Bosch concerns the high-pressure sealing washer. This repair method is employed whenever one or more injectors are diagnosed with excessive return quantities.

In this repair stage, injectors are disassembled completely. Their reassembly, however, only involves replacement of the high-pressure sealing washer and, where necessary, the injection nozzle. All other components such as the solenoid valve group and the valve set will be reused. In terms of cleanliness at the workplace and careful adherence to the individual work steps, this stage is subject to the same guidelines as those of repair stage 1. Bosch has developed special holding devices and tools for this repair stage too.



After the injectors have been repaired, they have to pass thorough testing before they can be reinstalled. Photo: Linzing

Stage 3: Complete Repair

For Bosch customer service engineers, repair stage 3 presents a genuine quantum leap in workshop service. Ready to launch even now, it will be available starting in late 2009. The idea was for workshops to be able to recondition solenoid-valve-controlled injectors for motor and commercial vehicles into a ready-made state. Stage 3 now enables diesel specialists to repair valve sets and magnet assemblies as well or, if necessary, to replace injector bodies. One particular challenge involves calibrating the function parameters such as valve spring strength, residual air gap, nozzle spring strength, needle lift, excess lift and armature stroke. All of these require tolerances around 1 µm. In order to make this possible in workshops, the specialists at Bosch looked to mass production processes for their tool design. These tools include a special, pneumatically supported dial gauge, diverse measuring adapters, shims, a software-supported torque wrench, controls for armature stroke and measurement pneumatics, plus a specially developed

mounting plate. At the core of repair stage 3, however, is a special type of software that provides diesel mechanics with the organisational set-up of all the tools and adapters to be used and with all the necessary set-points. The full set makes it possible to work on injectors with the same degree of precision as in the factory.

Injector Repair Is for Specialists

The repair of Common Rail injectors is exclusively reserved for specialised workshops with the corresponding technical equipment. These are usually Bosch Diesel Centers, which list pump test bench EPS 815 and measuring equipment for testing Common Rail injectors as well as the necessary tools among their inventories. Workshops lacking the equipment or trained personnel for it, should never attempt to repair Common Rail injectors for reuse themselves. That's because untested injectors can cause heavy damage to engines. The three repair stages not only offer diesel services fascinating opportunities to expand their workshops. By working together with specialists within their vicinities, general service garages can offer motorists cutting-edge diesel repair service as well.

Repair Stage 3 Factory-made Precision

Repair stage 3 for Common Rail injectors requires the kind of precision usually found only in factories. To bring that kind of precision to the workshops as well, Bosch has designed tools and test equipment based on those used for mass production.

Test set-up

Shims

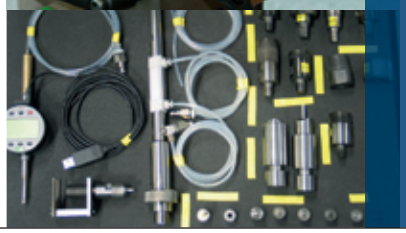
Software

Controls for armature stroke and pneumatics

Software-aided rotational/ torque wrench

Digital dial gauge for tolerances of 1 µm

Mounting plate



Measuring adapters