

PRESS INFORMATION

Automotive Industry

High Quality needs High Technology

Siemens VDO is using the latest ROFIN solid state lasers for the production of injector nozzles

Mercedes, Opel, Renault and many more – all of the leading automotive manufacturers have something in common: their motors use Siemens VDO injector nozzles produced with the latest laser technology.

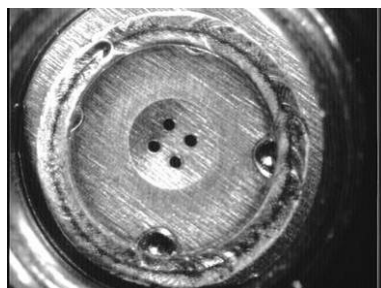
In the production halls there is an impressive atmosphere: loud and rhythmic hissing and pitching, production lines wherever you look, test facilities and stockyards. In between staff members wearing smocks and caps are working amongst clean room conditions in this almost completely automated fabrication. Siemens VDO, the specialist for electronics and mechatronics, produces about 27 million injector nozzles for the automotive industry per annum. The product range runs from classical injectors and intake-manifold fuel injection to the highly innovative direct injecting valves for petrol-operated engines. When the location in San Piero, in the near of Pisa, was founded in 1987, it first was considered to be a think tank for development and production planning. But shortly after, the labors expanded towards a manufacturing location particularly for the European market. In the meantime there are two locations, San Piero and Fauglia, with about 900 employees for the categories High Pressure (direct injection) and Low Pressure (intake-manifold fuel injection). Since opening, the Italians have been facing a positive business development and the 250 millionth injector nozzle established a production record two years ago. "Since the beginning of production, we have been extending and strengthening our market position step by step. For the current injectors for intake-manifold fuel injection, we for example worked out a market share of 40–45% with a production output of 16 million pieces. Thus, we are market leaders for this area", says Mr. Riccardo Toncelli who is responsible for the production in the section Low Pressure. Being security relevant for vehicles, fuel-injection systems are subject to special requirements. A comprehensive inspection for very high production quality is essential and Siemens VDO has been depending on laser technique for many years. Mr. Marco Fiaschi and Mr Alessandro Baldini, the Laser Process engineers of the section Low pressure, report: "Here in Pisa we have about 50 solid-state lasers of all kinds that are welding and marking in all production lines almost round the clock: from lamp- and diode pumped rod lasers up to the new disc laser. Our injector valves are fine mechanical high-precision units for which you have to hold narrow tolerances and it is very important to control the welding process as exactly as possible. Especially the solid state technology offers us a good supervision of laser power and therefore is the perfect tool for us."



Picture 1: The production of injection valves demands highest precision amongst clean room conditions

Precision mechanical challenge

Due to the excellent cost-value ratio, the ever-enhanced, modern intake manifold valves still have a big potential, even though Siemens has already developed the first fuel direct injection valves with the XL 2 series. That means the DEKA family is in its seventh generation now, whereas quality and efficiency of the production have been improved. The number of single components was clearly reduced and the construction was changed so that the injectors now do not need any susceptible to deterioration seal anymore.



Picture 2: Before the nozzle head is welded with the valve body, it will be fixed by 4 spot welds

16 laser sources at 18 welding stations by the laser specialist ROFIN are involved in both DEKA VII production lines and add the precision mechanical puzzle together every second. Step by step the single pieces are connected to each other with altogether 9 sorts of welding seams: spaced spot weld, fillet weld, lap weld or butt weld. At last the injectors get a DataMatrix code at 2 marking stations by contact-free laser marking, before they are put to test in an automated test stand and delivered to the engine works of European automotive manufacturers.

Hightech-heart beats every 2.3 seconds

To meet the continuing high demand, one new valve is produced every 3 seconds. Six days a week, three shifts round the clock, every day 60,000 units satisfy the need of 15,000 four-cylinder-engines. Eight application stations are positioned u-shaped and adjusted to supply, fix and process each unit within 3 seconds, which is an impressive high ratio for these high-precision valves. "Over the years we have gained a lot of experience in using the different laser applications, which helps us to skip down times. Due to the high demands on the unit, finding the right parameter, the correct protection gas or the suitable power is not that easy", explains Riccardo Toncelli. The lasers are positioned in a separate room in the immediate vicinity of the production line. No signs of the task work next-door; only a quiet, constant hum tells that the lasers are in use. From here the laser light goes through fiber optics to different application stations. Altogether, 3 km fiber optics are snaking through the production halls, bringing the laser light flexibly and safely to its site. With multiple beam switches per laser, applications at different stations can take place at the same time. This means with about 50 lasers in production more than double application stations can be operated. The high volume of lasers requires dependable service. "Due to the mass production rates of the valves, it is very important for us to receive from laser manufacturer quick and efficient assistance and spare parts availability. This is what we've received from Rofin up to now and this is what we need even more in the future".



Picture 3: One of 8 application stations of the DEKA VII-plant

With one eye on the trends of the market

The good business relationship over the years was for sure one reason to again choose ROFIN for the new production plants of the Piezo and XL-2 injectors. These direct injection valves are able to gain more power for the same cubic capacity and at the same time it is possible to reduce the consumption. These production lines require highest precision at minimal tolerances. With the new disc laser technology, Siemens VDO counts on the latest solid state technology. The excellent beam quality of 8 mm*mrad is much better than that of rod lasers (12 resp. 24 mm*mrad) and therefore allows even finer welding seams. "On the one hand, our very first lasers are still welding in our production effortlessly, on the other hand we need our developments for new production methods and the latest laser technology. And for sure this will not change in the near future." summarizes Ing. Baldini.



Picture 4: Laser room of the DEKA-VII production with diode pumped solid state lasers from ROFIN

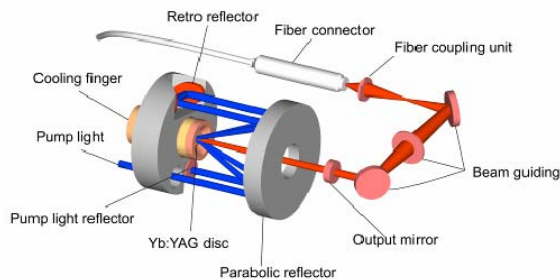


Picture 5: Injection valve of Piezo-series

Description field 1:

Siemens VDO Automotive, Pisa

Siemens VDO Automotive is one of the leading global subcontractors to the automotive industry for electronics and mechatronics. The subsidiary of Siemens Corporation gained a sales volume of 9.6 billion Euro with more than 50,000 employees in the business year 2005 (30.9.2005). The company is sectioned in four self dependent business areas with the technological emphases on Powertrain, Chassis & Carbody, Interior & Infotainment as well as Service & Special Solutions. The Powertrain section has a total of 800 employees in both San Piero and Fauglia in Pisa, responsible for the production of unit-injector fuel-injection systems for the European market. About 23 million valves for direct and intake-manifold fuel injection are produced and delivered every year. The location in Pisa belongs to the world-wide development network of Siemens VDO and is responsible for research and development of new technologies.



Picture 6: Principle of a diode-pumped disc laser

Description field 2:

Solid state technology – The future has begun

As efficient tools for cutting, welding, surface treatment and marking, high power solid-state lasers have been integrated in industrial manufacturing for many years. Unlike gas lasers, the solid-state laser gets its laser active medium from a crystalline material. Mostly ytterbium-aluminum-garnet (YAG) crystals are used, in which the real laser active neodymium (Nd) or ytterbium (Yb) ions are placed in storage. There are two distinct configurations

and technologies offered by RoFin: rod and disc lasers. Combined with flexible beam delivery options and fibers up to 100m in length, the lasers become a versatile tool able to meet tight production floor needs and capable of processing 3-dimensional geometries.

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*Dipl.-Wirtschaftsing.(FH) Sonja Müller, ROFIN-SINAR Laser GmbH, 22113 Hamburg, Germany
Tel.: +49-(0)40/733 63-178, E-Mail: s.mueller@rofin-ham.de, www.rofin.com*