



### HL 1006 D: Lifesaving Laser Seam

It's the size of a one-Euro coin and is as thin as a knifeblade. It separates the gas from the ignition charge and can save lives, but it must be properly fitted so that it does not leak. »Laser is still our first choice when the task requires welding,« says Jonny Åhs, Production Engineering Manager at Autoflator in Vårgårda, Sweden. He's referring to the tiny, designated breaking membrane which separates the argon gas (which inflates automobile airbags upon impact) from the ignition charge in the gas generator. Normally, it should remain tightly sealed during the lifetime of a car. But in the case of impact, when the airbag must be instantly deployed, a projectile must pierce the membrane, allowing gas to fill the airbag – at a rate of 142 liters in seven hundredths of a second. In combination with the safety belt, the airbag reduces the risk of death in head-on collisions by 20 percent. Åhs knows exactly how well this works – from first-hand experience.

»I was on my way to work when suddenly, an oncoming car started skidding, and then ended up in my lane,« Åhs recalls. The two vehicles collided head-on in a deafening crash. But Åhs was protected from serious injury, thanks to the combination of safety belt and airbag. »The airbag that opened in my car wasn't even one of those manufactured by us, we only manufacture airbags for passenger

seats,« says Åhs. He then explained the function of the designated breaking membrane: Upon impact, an electronic pulse is triggered, igniting the powder. The trigger pulse activates a projectile which punctures the membrane, releasing the gas to fill the airbag. This takes four hundredths of a second. In the next three hundredths of a second, the airbag is blown up, and the gas is heated by the ignition until the airbag is completely filled.

The passenger now »lands« on the cushion created by the airbag, preventing serious injury. The force required to deploy the airbag can be compared to the energy required to shoot a car tire up to a height of 10 to 20 meters. Of course this depends on the type of generator used. Truly, there is a powerful force lying dormant under the dashboards of most cars. This is why it is imperative that

*Three 1kW solid-state lasers by TRUMPF Laser are stationed at the ready on Autoflator assembly lines.*



## Customer Focus



*21 mm wide and 0.8 mm deep, the laser welding seam of the designated breaking membrane remains tight, but instantly springs into action when needed.*

all welding seams be completely leak-proof, restraining that tremendous force until needed to save lives.

»During heavy impact, both airbag phases are triggered; that is, the airbag is blown up harder, while only the first phase is required following a lighter impact,« explains Åhs. The steel-made gas generator contains 30 parts which are assembled on seven different assembly lines. The HL 1006 D, a 1kW solid-state laser by TRUMPF Laser, was the laser of choice for each of the last three lines installed.

»The 21 mm wide and 0.8 mm deep laser welding seam is solid and its quality can be easily verified. This is why the laser is our first choice,« says Åhs. Each welding seam is tested, documented and recorded for 15 years so that we can trace back, if necessary, to determine whether everything was in order during manufacturing. A bar code is affixed to each gas generator so that it can be easily identified.

»We put very high demands on the technical performance,« says Åhs. All gas containers are pressure tested by filling them with a gas mixture of argon and five percent helium. The helium is used to detect leaks, and also to determine whether there is gas in the container. »Helium atoms are so small that they continuously permeate the casing,« says Åhs. This means that if there is a helium leak (0.0000001 mbar l/sec.) then there is also at least 15 years' worth of argon in the cartridge.

After extensive pre-production material testing, during the actual production phase, checks are carried out on every 250th welding joint. If no defects are found within eight checks, the checks are then performed on every 500th joint. If there are no defects found, subsequent checks are performed on every 1,000th gas generator produced. »We stay at this level during the entire remaining production – which can comprise from 800,000 to 1.6 million welding seams per year – depending on whether one or two phase generators



*Johnny Åhs knows first-hand how airbags save lives every day. The tool laser is his first choice: »The laser welding seam is solid and remains tight for the car's full lifetime.«*

are being produced on the corresponding assembly line,« reports Magnus Halén, Quality Assurance Manager. He places a sawn up inner tube containing the laser welded membrane under a microscope, adjusting focus and magnification on the object. The picture becomes visible on the PC screen. The laser's welding seam inside the tube becomes clearly visible; it is easy to read off the 0.98 millimeters. The value is, thus, far above the 0.40 millimeters limit. »This machine does not make mistakes. Most of the time, the membrane is contaminated by the operator or the piece gets smudged when he positions it during assembly,« says Halén. The operator now uses a small vacuum instead of his hands to position the workpiece.

»The laser welding seam is well suited for our purposes,« states Halén. In Quality Assurance, twelve employees work in multiple shifts, around the clock, five days a week – all working toward getting the airbags inspected, approved and into cars. The airbag is an essential safeguard for the millions of people who travel by car every day. As drivers, we rarely think about them, but when the unimaginable happens, we all expect the airbag to do its job in a fraction of a second. Two years ago, on the fateful morning of his collision, Åhs learned first-hand just how much depends on a functioning airbag.

### Autoflator (Sweden)

Autoflator is part of the Autoliv Inc. Group, the world market leader in the production of passenger protection systems, generating annual revenues of US\$ 4.43 billion. Autoflator has been making airbags, safety belts and other passenger safety equipment for passenger vehicles since 1994, and today shows annual revenues of Euro 66 million. With a workforce of 300 employees, this progressive enterprise develops and manufactures hybrid gas generators. Approximately 4.34 million generators leave the seven assembly lines in Vårgårda, Sweden, every year. Prominent customers include Volvo, Audi, Mercedes, Hyundai, Mitsubishi, Ford and BMW.