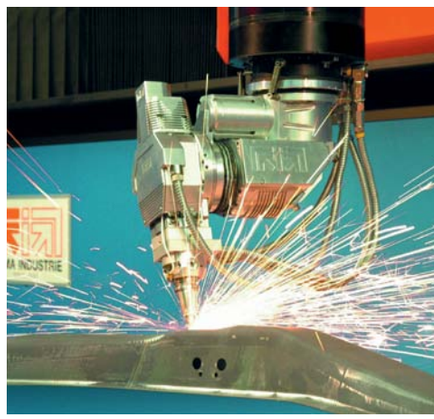
The unbeatable laser



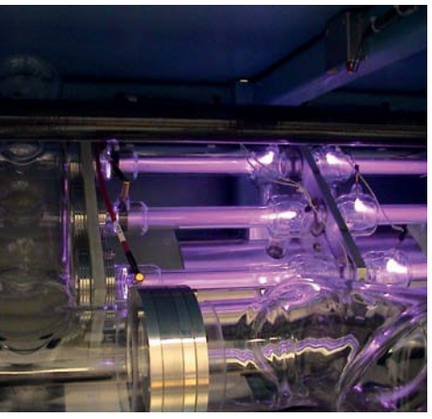
TODAY, EUROPEAN AND AMERICAN VEHICLE MANUFACTURERS INCREASINGLY SPECIFY USE OF PARTS IN BORON STEEL IN THEIR VEHICLES TO TAKE ADVANTAGE OF THE GREATER RESISTANCE OF HOT MOULDED AND QUENCHED PARTS. MANY OF THESE PARTS ARE MANUFACTURED IN PLANTS BASED ON THREE-DIMENSIONAL LASER CUTTING MACHINERY BUILT BY PRIMA POWER.

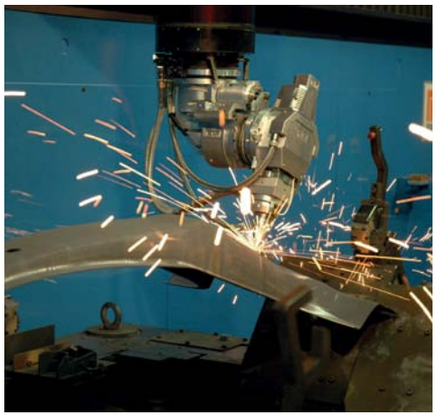
Prima Power is the pioneer in the use of three-dimensional laser systems in automotive applications. In fact, for over 30 years it has been manufacturing machines for body part prototyping and since 1994 has collaborated with its clients to develop the laser cutting process for bodywork detail manufactured in high strength steel. Today, most of us travel in vehicles made safer and less polluting thanks to use of these parts, but most of us probably ignore the importance of the laser cutting process to create them.

Continuous improvements in vehicle safety combined with reduced weights is closely linked to the introduction of new materials. The use of aluminium, magnesium and various polymers is on the increase, however use of boron steel alloys for structural parts of vehicles is even more popular. Combined with so-called active safety systems such as safety belts, airbags or electronic traction control, passive systems such as safety cages to enclose the vehicle are decisive to obtain the highest points in crash tests. Increased strength of the safety cage based on traditional materials can only occur by increasing the thickness of the parts, resulting in increased weight of the vehicle that consequently impacts on fuel consumption and emissions. Instead, use of boron steel enables the requested stress resistance objectives to be achieved without impact and even enabling savings on the weight of parts.

However, moulding of parts in steel and boron alloy requires a process that is different from "cold" moulding, characteristic of traditional parts. This process, called "hot" moulding, combines the moulding process with quenching (martensitic hardening) thanks to the properties of boron steel to guarantee good hardening, even when cooling takes place over a relatively long time. The steel sheets are in fact brought to temperatures between 900° and 950° in a furnace and then quickly transferred to a mould combined with a cooling system. This material is particularly ductile between 800° and 650° and can be moulded, even for complex moulding, with a single strike of the press.

Quenching occurs simultaneously or immediately after moulding and the austenitic structure becomes martensitic thanks to quick cooling which typically takes place at rates of 50° and 100° per second. Thanks to this process, stress tensioning even up to 1500 MPa can be obtained, more than double that for the inbound materials and, furthermore, given cooling takes place inside the mould, elastic return phenomena are reduced to a minimum. The extraordinary hardness of these materials however makes them difficult to work with in the phases following moulding. The trimming processes and creation of slits and perforations on assembly of the bodywork parts, typically implemented via blanking, require an in-depth review when applied to hot moulded steel parts. In fact, wear of tools due to material hardness makes the blanking process costly and as a result is replaced with the three-dimensional laser cutting process. This process involves appropriately focusing the heat source, the laser generator, to fuse the material and create a groove that is one or two centimetres thick and the so-called "assistance" gas blown at high pressure in the groove to remove any fused material and enable high precision and fast cutting. For typical thicknesses of the parts considered, ranging from 1 to 2 mm, today the work advancement speed





For typical thicknesses of the parts considered, ranging from 1 to 2 mm, today the work advancement speed obtained is over 20 metres per minute, with a process duration of about 30 seconds per part.

obtained is over 20 metres per minute, with a process duration of about 30 seconds per part. Thanks to the evolution of Prima Power three-dimensional laser cutting systems, it is currently possible to use the laser cutting process to implement standard production of these parts. Today, European and American vehicle manufacturers increasingly specify use of parts in boron steel in their vehicles to take advantage of the greater resistance of hot moulded and quenched parts. The hot moulding process is today applied to front and rear bumper parts, central and front risers, the roof and side supports and tunnel and door reinforcements, to name but a few.

Use of boron steel sheets in vehicles in Europe alone has gone from 60,000 tons in 2004 to over 300,000 in 2010 and America and Japan are also following similar trends, with further growth planned in the future. Many of these parts are manufactured in plants based on three-dimensional laser cutting machinery built by Prima Power in Italy. ■

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