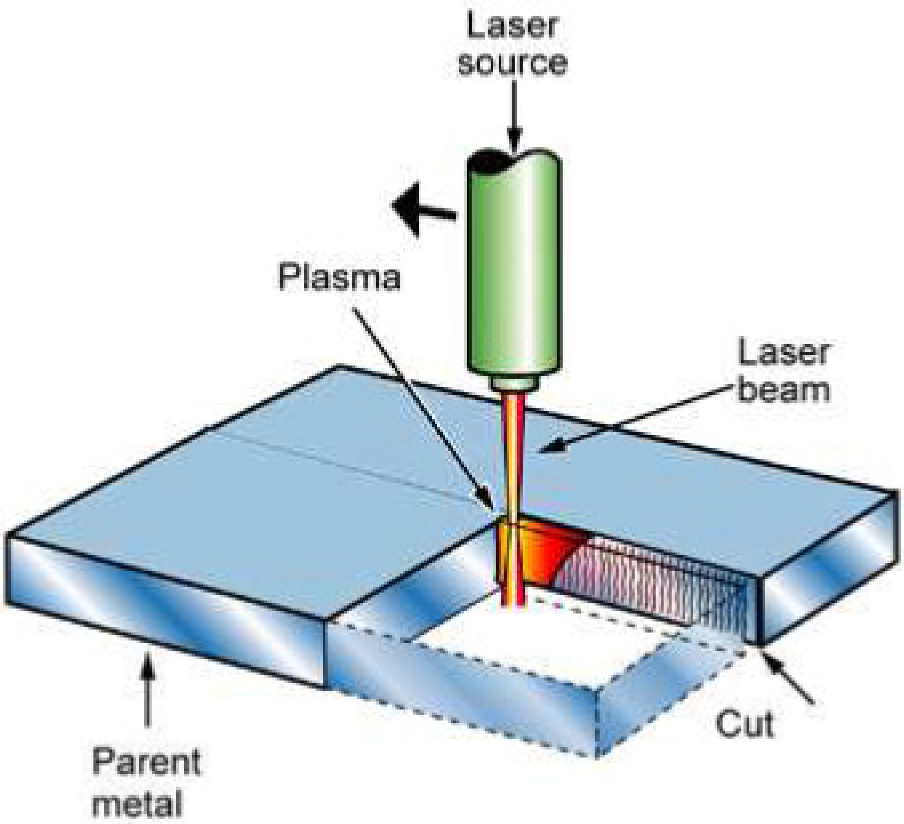
DOK-ING

INNOVATIVE SOLUTIONS

LASER SHEET METAL CUTTING, ENGRAVING AND LASER TUBE CUTTING

TECHNICAL DATA	
Laser cutting system	**Bystar L 4025-65**
Nominal sheet size	x = 6500 mm, y = 2500 mm
Cutting range	x = 6500 mm, y = 2540 mm, z = 170 mm
Tolerance	0.2 mm
Max. Workpiece wegiht	3200 kg
Laser source	Bylaser 6000
Capacity	6000 W
MAXIMUM SHEET THICKNESSES	
Structural Steel	25 mm
Stainless steel	25 mm
Aluminum	15 mm
SOFTWARE	
Laser	ByVision
Nesting	Bysoft 7



LASER SHEET METAL CUTTING, ENGRAVING AND LASER TUBE CUTTING

Laser cutting is a thermal cutting process for procesing sheet metal. The laser beam is created by the laser source (resonator), conducted by mirrors or a transport fiber in the machine cutting head where a lens focuses it at very high power on a very small diameter. This focused laser beam meets the sheet metal and melts it.

A. WHY USE LASER

Advantages of laser cutting over mechanical cutting vary according to the situation, but two important factors are the lack of physical contact (since there is no cutting edge which can become contaminated by the material or vice versa), and precision (since there is no wear on the laser). Cutting with laser produces identical parts consistently, maintains close tolerances, can be used on a wide range of materials. There is also a reduced chance of warping the material that is being cut, as laser systems have a small heat affected zone. Some materials are also very difficult or impossible to cut by more traditional means. Laser cutting offers low cost for prototype and short runs since no physical tooling is needed.

B. CUTTING PROCESS

Using high laser power, the material is heated, melted and partly vaporized. The material is blown out of the kerf. The cutting flow of gas, which aids the removal of melting, is emitted together with the laser beam out of the nozzle. The kerf is created by moving the work piece or the cutting head.

Both the piercing and the laser cutting can be aided by adding a gas and thereby influence the cutting results. The choice of piercing gas or cutting gas depends on which material is being machined and level of quality needed for the work piece.

Usually either oxygen, nitrogen, argon or simply air is used as a cutting gas.

I. Cutting with oxygen: Flame cutting

Principle - When cutting with oxygen (Gas purity 99.95 volume percent, 3.5) and a cutting gas pressure of maximum 6 bar, the material is melted and for the most part oxidized. The melting created is blown out together with the iron oxides out of the kerf.

The oxidized process supplies additional energy (exothermic reaction), which influences cutting process to the effect that higher cutting speeds are possible and greater material thicknesses can be machined then when cutting with nitrogen.

The oxidation layer, which builds up on the cutting surface, serves as corrosion protection for stainless steel surfaces. Cutting surfaces need to be refinished if parts are to be welded.

II. Cutting with nitrogen: Laser fusion cutting

Principle - Laser fusion cutting is done using nitrogen or argon as a cutting gas. This process also melts the material first and then with the help of a cutting gas - usually nitrogen - blows out the kerf. In practice, a gas pressure is used between 8 to 20 bar (so-called high-pressure cutting) with a nitrogen gas purity of 99.999 volume percent (5.0). With argon, there is a gas purity of 99.996 volume percent (4.6)

By using the high gas pressure, we can be assured that the cutting edges remain free of burr formation to a great extent and that no slag settles.

The use of inert gases provides oxid-free cutting edges, though it makes piercing at the beginning of the cutting process more difficult. For this reason, oxygen is used for piercing and cutting is then done with nitrogen.

C. ADVANTAGES AND APPLICATIONS

Advantages - In competition with the alternative slitting processes like plasma cutting, punching (blanking) and nibbling or wire erosion, laser cutting has the following advantages:

- Processing the work piece is possible without contact or force.
- As opposed to punching (blanking) and nibbling, almost every contour shape can be made, without requiring a single tool change.
- With the laser beam, both large cuts in any shape can be cut as well as small, filigree and complicated contours. Geometric shapes can be machined quickly with only a few piercing.
- Separation is precise. The extremely narrow kerf remains virtually constant. Maintaining tolerances as low as 0.05 mm is also possible in series production.
- The cutting speed is high, producing a significant acceleration of the production process in comparison to, for example, wire erosion.
- Due to high energy density, the heat-affected zone remains very small and confined. Hardness penetration depths from 0.1 to 0.2 mm are possible, an oxide film forms when cutting with oxygen. The small heat-affected zone, in turn, means that material distortion is minimal.
- The roughness of the cutting surfaces is kept to a minimum: smaller then 100 um. There is no need to refinish the work piece.
- The most commonly used steels can be cut without any burr formation, eliminating the need for subsequent burr removal.
- Due to rapid development of both laser as well as cutting technology, laser cutting has become a true commercial alternative to other techniques. If you also accept the argument of almost limitless flexibility in application, then it can be predicted, that laser cutting will gain more and more ground on the conventional techniques.