

How does a laser cutter work?

Introduction

Nowadays lasers are used for different purposes. For instance lasers are used for cutting metal plates, aluminium plate, mild steel and stainless steel. Laser cutting process is very accurate, it results in an excellent cut quality, it also has a small heat affected area and a very small cut width and it can cut very complex shapes and small holes.

Why using lasers for cutting?



Figure 1. Laser cutter

In compare with other cutting processes lasers have more advantages. Lasers work touch free, a laser beam cut through material without touching anything while in other sheet processing methods large tools are applied to the material with massive mechanical forces. In a laser cutting method, light waves are absorbed by material and converted into heat so that the sheets become hot and melt, burn or evaporate. In this method the workpiece does not experience a mechanical load and laser beam does not wear out like other tools. Another advantage of laser cutting method is that lasers work accurately. They only heat the material locally and the heated area is very small so the rest of the workpiece receives little or no heat. Lasers are flexible and in this cutting method, a single tool can cut in different forms and contours.

Different methods of laser cutting

There are three main methods in laser cutting. In plenty of cases, to blow out the new steel that is cut, an extremely concentrated spray of gas or water is sprayed behind the laser to leave a nice and clean cut. Another method is to heat the materials to their boiling point and vaporize them but it can be used for the materials that do not melt like wood. In the last method of laser cutting the heat of the laser beam cracks very brittle materials and direct that crack to make cuts.

Basic industrial laser

Lasers that are used for cutting are very dangerous and large. For laser cutting purposes, CO₂ or neodymium lasers are used. CO₂ lasers operate by energizing a mixture of carbon, nitrogen, hydrogen and helium gas. Neodymium lasers operate like CO₂ lasers but they use a crystal with small amounts of neodymium instead of gas.

Disadvantages of laser Cutting

In laser cutting process for plastics, the smoke that come out of plastic when it is melting can be poisonous. So the machine should be placed in a well ventilated environment and this can be expensive and also takes a lot of time. Another disadvantage of laser cutting is that not all types of metal can use laser cutting process. For example copper and aluminium are very thick and they reflect too much light so they can not use lasers to be cut. And in order to keep the laser cutting process running a lot of energy is needed. This amount of energy depends on the laser type, thickness of the material, how much of the material is being cut and the cutting rate.

How it works

In a CO₂ laser, wavelength of the laser beam is in the infrared section of the light spectrum and it can not be seen by human eye. This beam is about ¼ inch in diameter as it goes from the laser resonator that makes the beam, through the beam way of the machine. Before that this beam is focused onto the plate, beam benders or mirrors can bounce this beam in different directions. This focused laser beam travels through the hole of the nozzle before it touches the plate. A compressed gas such as oxygen or nitrogen flows through that nozzle.

Special lens or curved mirrors can be used to focus the laser beam and this process happens in the laser cutting head. The laser beam should be accurately concentrated so that the energy density and the form of the focus spot in that point are completely consistent and round and also centered in the nozzle. The density of heat in the spot that the large beam is focused down to a single point is extreme.

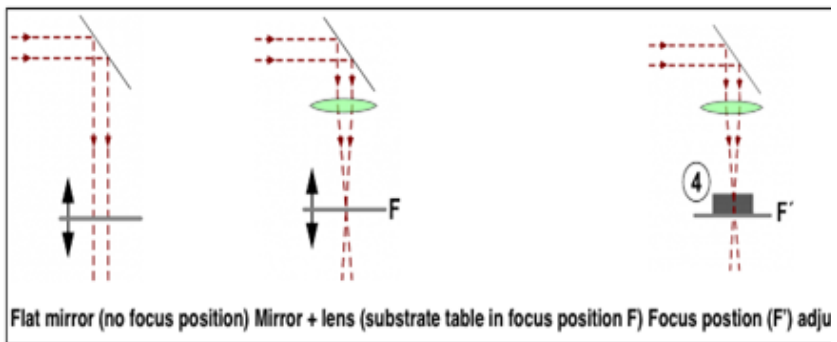


Figure 3. workpiece and focusing position

Fast heating, melting and completely or partly vaporizing of the material are the result of the high power density. In the case of cutting a mild steel, the heat of the laser beam is enough for the oxy-fuel burning process to start and pure oxygen will be the laser cutting gas. The laser beam easily melts the material in cutting stainless steel or aluminium and in order to blow the melted metal out of the notch, high pressure nitrogen is used.

In a laser cutter, for cutting the part of the plate, the laser cutting head moves over the metal plate in the form of the desired section. A very precise distance between the plate which is being cut and the end of the nozzle is maintained by a capacitive height control system. This distance specifies where the plate surface is relative to the focal point. By enhancing or reducing the focal point from above the plate surface, cut quality can be affected. When all of the parameters that can affect the cut quality are controlled correctly, laser cutting is a very accurate and reliable cutting method.

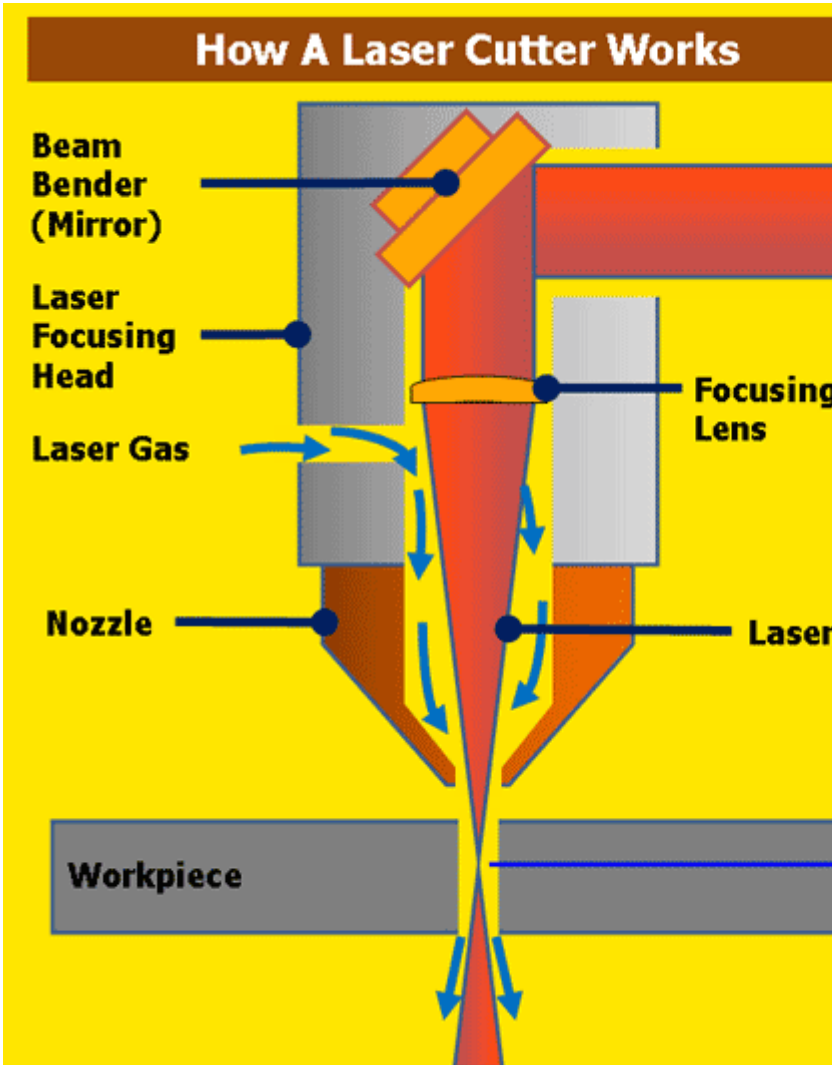


Figure 2. How a laser cutter works

Summary

To sum up, basically a powerful laser beam that is made inside a machine is called a laser cutter. A laser cutter is made up of set of mirrors which guide the laser beam onto the material to be cut. When the laser beam hits the material it cuts it by using a severe heat that vaporizes the material and leaves a polished face. After that motors move the mirrors in order to adjust the cutting position while the laser supply stay still. It maximizes the speed of movement and allow the laser cutter to cut smooth contours and straight lines. For engraving, the power settings can be decreased so that laser beam does not cut through the material. Laser cutter is appropriate for cutting foam, woods, fabric, paper, cork, board and many other materials. By using a more expensive laser, laser cutting can also be done on metal and glasses.

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