

Laser Cutting: The Ultimate Guide

 **sculpteo.com**



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How does Laser Cutting work?

1. How does Laser Cutting work?

The laser originates from a laser resonator, which sends out a beam of intense light that reflects through a system of mirrors to the cutting head. Within the cutting head, the laser is focused through a lens and narrowed down to an extremely thin, concentrated beam. The beam is projected onto the material and cuts or engraves the material.

The active laser medium can be:

- a solid, such as a crystal
- a gas mixture, the oxygen is the most common type, with a mixture of composing of carbon dioxide (CO₂)
- fiber, most of the time glass fibers

There are three types of laser engraving:

- Line engraving
- Superficial surface engraving
- Deep surface engraving

Laser Cutting Guidelines

2. Laser Cutting Guidelines

When you design for Laser Cutting, there are essential guidelines you have to follow in order to successfully produce your product. We prepared for you a checklist:

- ✔ Check the kerf
Kerf is the amount of material that evaporates when the laser burns the material. Kerf depends on the material you decide to use, so check it and include it in your design, especially if your laser cuts are meant to be connected.

- ✔ Ensure your text is turned into an path correctly prepared:

YOUR WORDING ✘
YOUR WORDING ✔

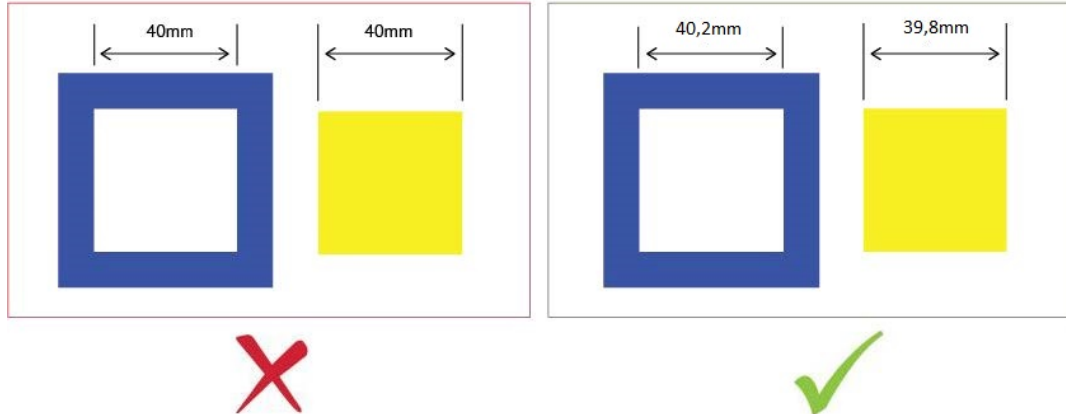
Q D B R
G A P ✔

2. Laser Cutting Guidelines

✔ Choose the right engraving if necessary

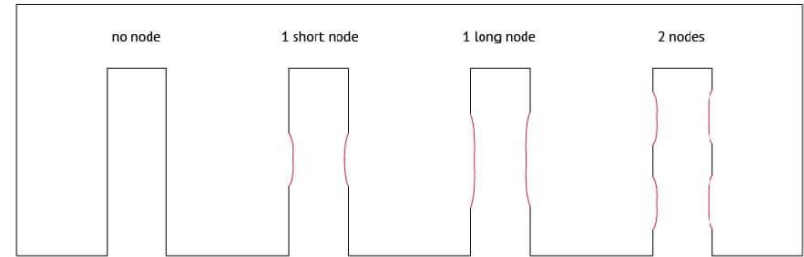
✔ Piece assembly

If you design pieces that are meant to match, you have to take kerf into consideration. That means you have to subtract half the size of kerf from one part, and add the other half of the kerf to the matching element

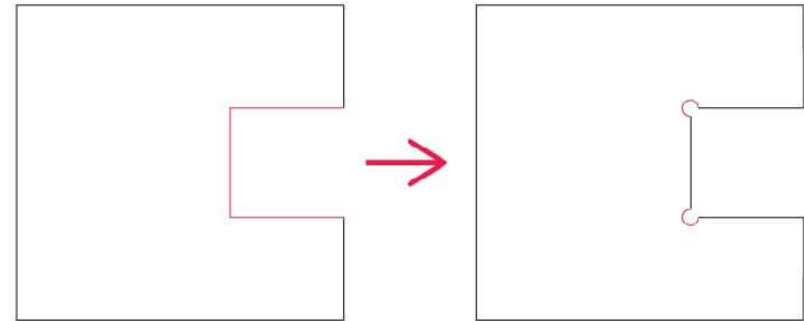


2. Laser Cutting Guidelines

- ✓ Nodes
Nodes are small bumps that allow for tighter hold between the pieces

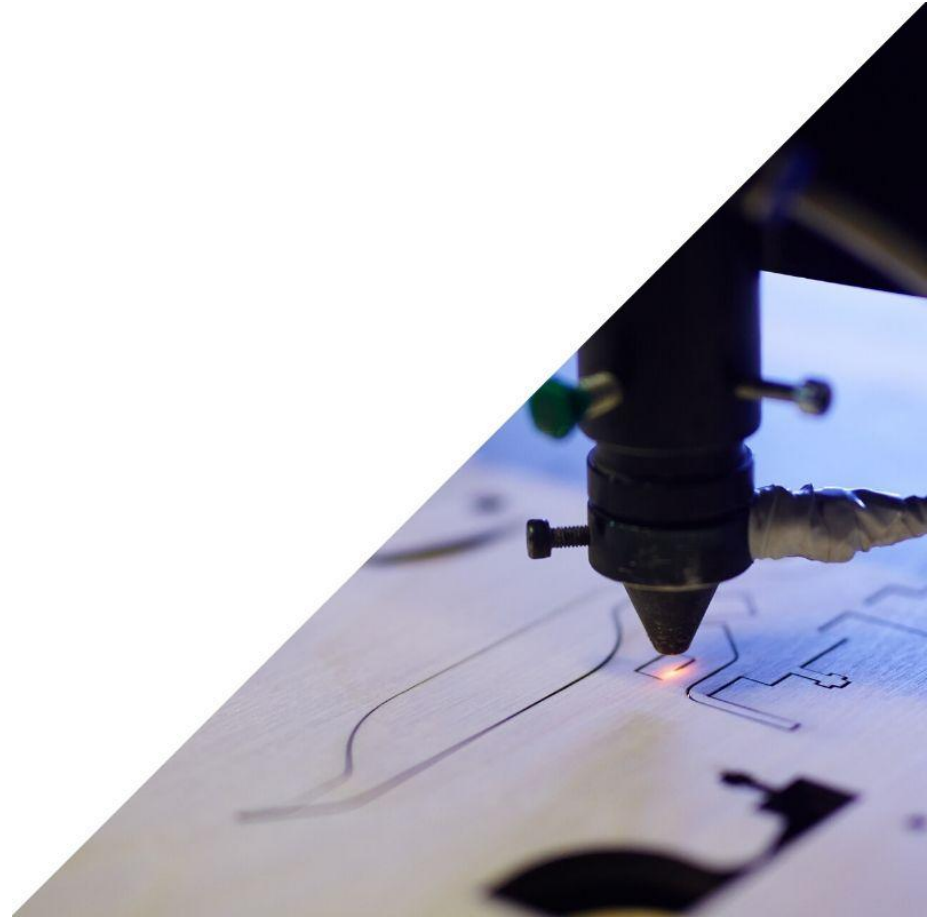


- ✓ Slots
Slots are an added hole in corners of sharp edges, thanks to them the stress will be distributed on the whole surface



2. Laser Cutting Guidelines

- ✔ Make sure all your lines are connected
- ✔ Save the right format:
 - SVG is the most commonly used
 - PDF
 - CDR
 - AI
 - EPS
 - DXF
 - DWG





How to create a Laser Cutting file?

3. How to create a Laser Cutting file?

Commonly used in the industry, laser cutting machines function from digital orders, based on the topographic information contained in a **vector file**.

Laser cutters cut or engrave the material plate in different locations, thus allowing an item's surface to be delineated and decorated. To use the laser as a cutting tool, you need a **2D vector file**, created on a dedicated software (such as Adobe Illustrator, Solidworks, Inkspace, Onshape CorelDRAW etc).

Once you have a vector file ready, the designer enters all the informations about his pattern - material, thickness, shape - before sending it to the machine. When the pieces are ready, you just need to assemble!

3. How to create a Laser Cutting file?

If you're planning to engrave, it is much more convenient to preset styles in your vector design software. Simply give them matching outlines and fill, as shown on the example below. When you upload your file, the online software will recognize the same styles and apply selected settings.

If you don't do it, you can still set it after uploading the file, but it will be more complicated, especially with detailed designs.



Laser Cutting Materials

4. Laser Cutting materials: metals

Aluminum

Metal alloy: 94% to 97% Aluminium, 2.5% to 3.6% Magnesium, and others (Chromium, Copper, Iron, Manganese, Silicon, Titanium, Zinc, Residuals)

- ⊕ Pros: high corrosion resistance, durability, high strength compared to its weight, can be drilled, sawed, bent, folded, painted, glued
- ⊖ Cons: stains, sensible to scratches

Applications: mechanical parts, medical devices, interior design, construction, ship and aircraft building



4. Laser Cutting materials: metals

Stainless Steel

stainless steel alloy, containing chromium and nickel

- ⊕ Pros: strong corrosion resistance, smooth surface finish, durability
- ⊖ Cons: sensible to scratches

Applications: food industry, architecture, medical



4. Laser Cutting materials: plastics

Acrylic

Synthetic fibers made from a polymer

- + Pros: easy to use, elastic, durable, waterproof, high quality, can be painted, glued, easy to maintain, lots of colors available
- Cons: parts with sharp edges can crack, there is also that risk if you drill holes

Applications: mechanical parts, casings, interior design, jewelry, art

Mirrored Acrylic is a translucent acrylic sheet covered with mirrored film. The properties and applications of Mirrored Acrylic are the same as acrylic's.



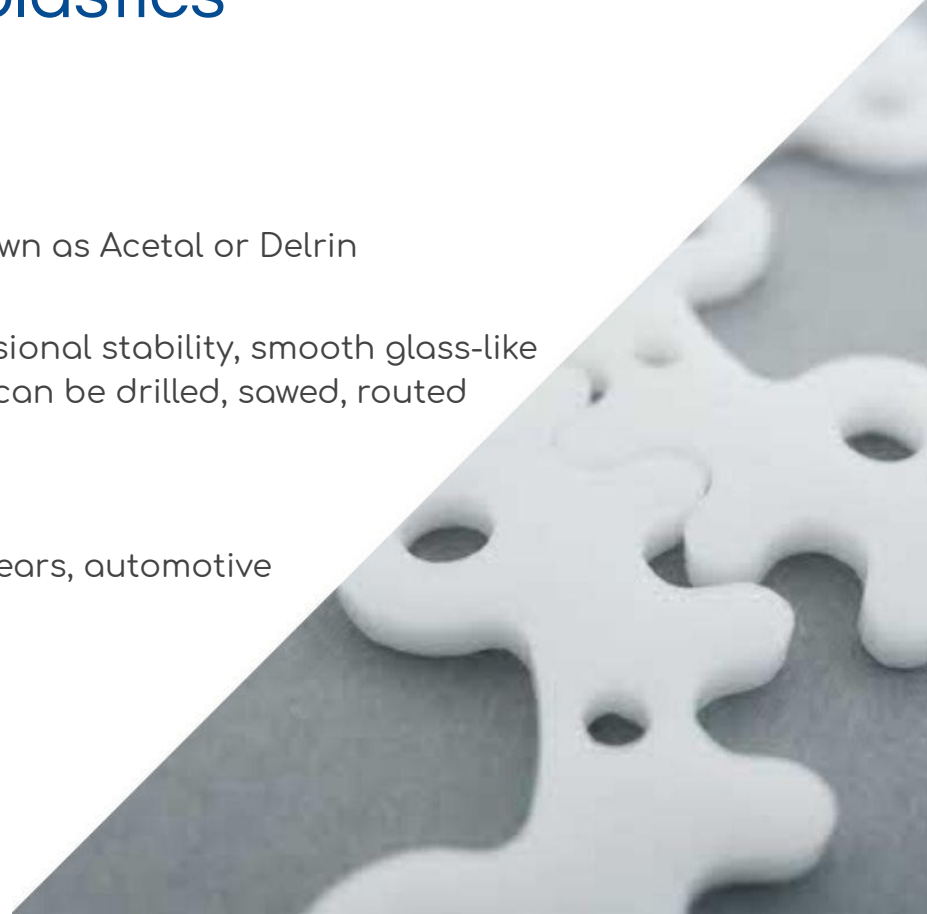
4. Laser Cutting materials: plastics

POM

Polyoxymethylene, engineering thermoplastic, also known as Acetal or Delrin

- ⊕ Pros: resistant (more than Acrylic), excellent dimensional stability, smooth glass-like surface, impact resistant, lightweight, waterproof, can be drilled, sawed, routed
- ⊖ Cons: easily shows scratches and burn marks

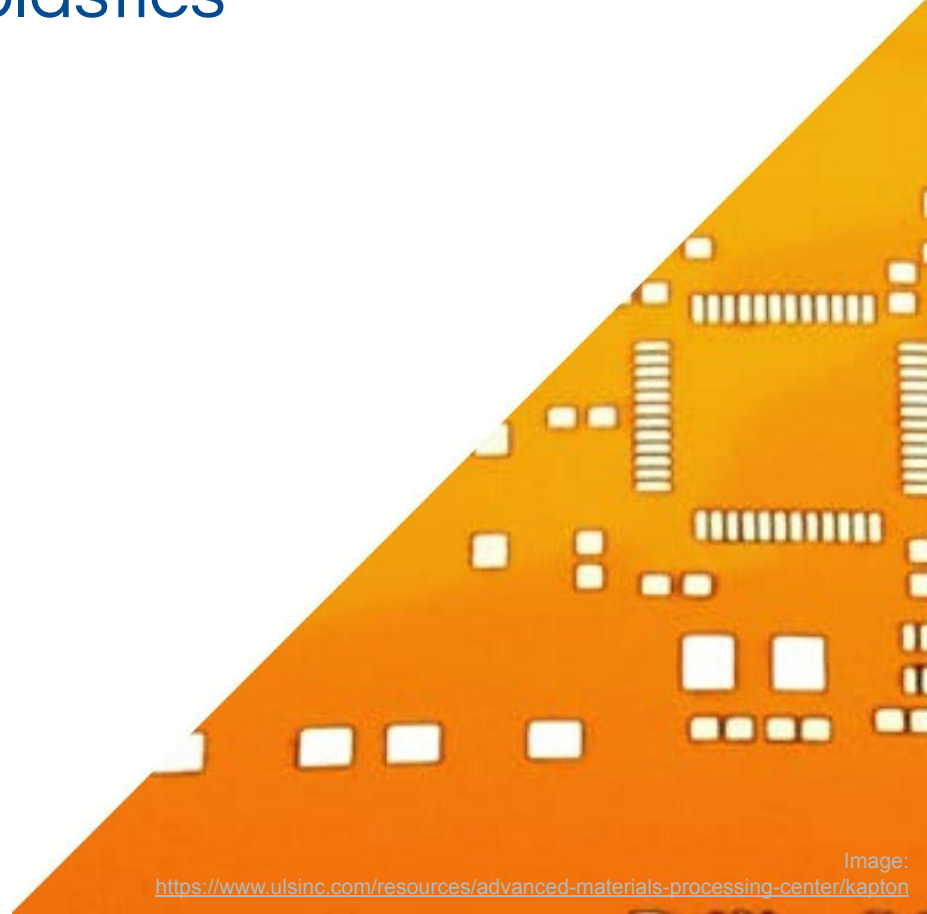
Applications: spare parts, tooling, technical projects, gears, automotive parts, hinges, locks, recommended for internal parts



4. Laser Cutting materials: plastics

Other plastic materials for Laser Cutting:

- ABS (Acrylonitrile Butadiene Styrene)
- HDPE (High density Polyethylene)
- Kapton tape (Polyimide)
- Nylon
- PETG (Polyethylene Terephthalate Glycol)
- PE (Polyethylene)
- PP (Polypropylene)
- Styrene



4. Laser Cutting materials: foam

Foam materials for Laser Cutting:

- Depron foam- often used for RC planes
- EPM
- Gator foam- foam core gets burned and eaten away compared to the top and bottom hard shell

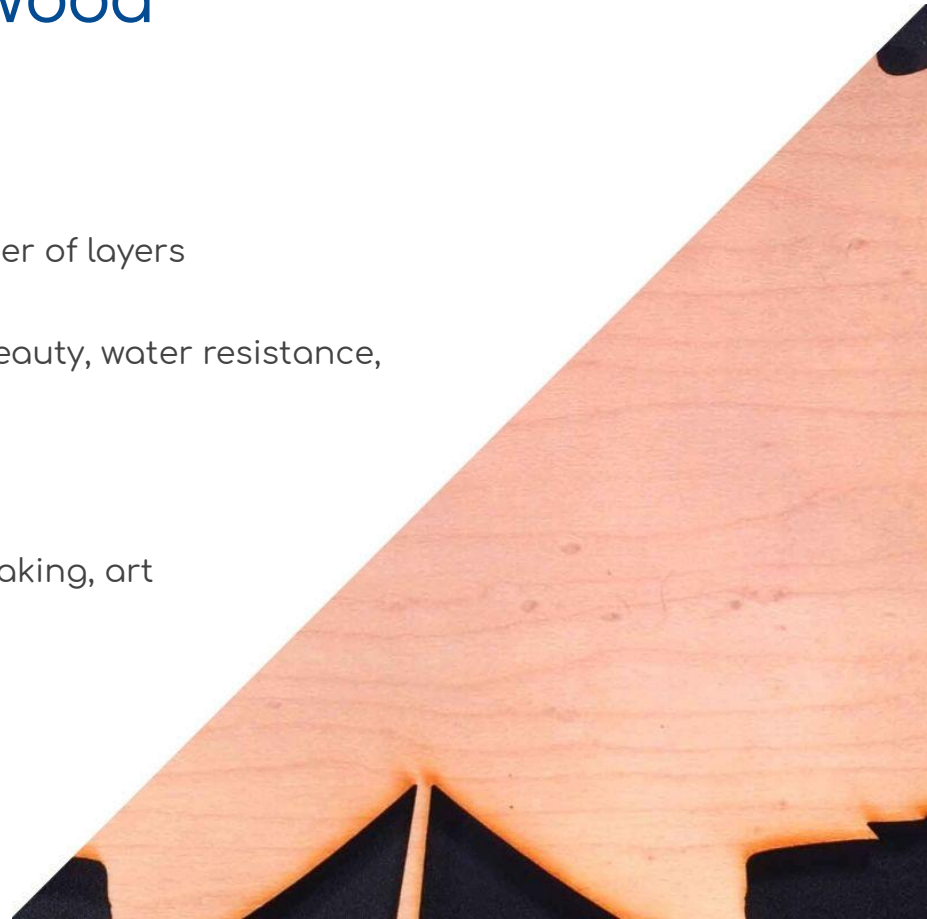
4. Laser Cutting materials: wood

Plywood

Sheets of wood glued, one on top of another in an odd number of layers

- ⊕ Pros: mechanical resistance, flexibility, aesthetic beauty, water resistance, lightness, different colors available
- ⊖ Cons: slightly rough surface, visible burned edges

Applications: furniture, structures & buildings, cabin making, art



4. Laser Cutting materials: wood

MDF

Engineering grade wood product. It's produced by breaking down hardwood or softwood residuals into wood fibers and mixing them with wax and resin binder

- ⊕ Pros: easy to use, durable, stable regarding expansion and contraction, does not contain rings or knots, different color options
- ⊖ Cons: slightly rough surface, visible burned edges

Applications: hand tools, wood screws, furniture, structures & buildings (ex. doors), cabin making, art



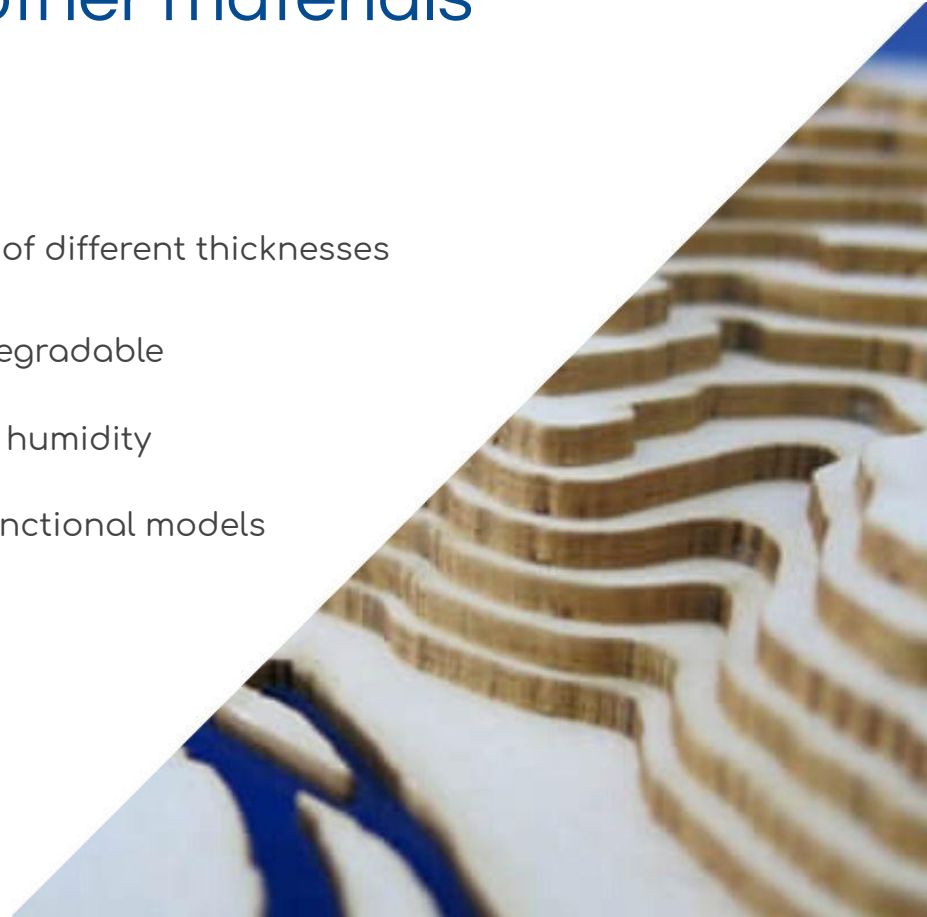
4. Laser Cutting materials: other materials

Cardboard

Laminated flat, embossed or corrugated paper sheets of different thicknesses

- ⊕ Pros: lightweight, rigid, ecological, recyclable, biodegradable
- ⊖ Cons: not waterproof, flammable, low resistance to humidity

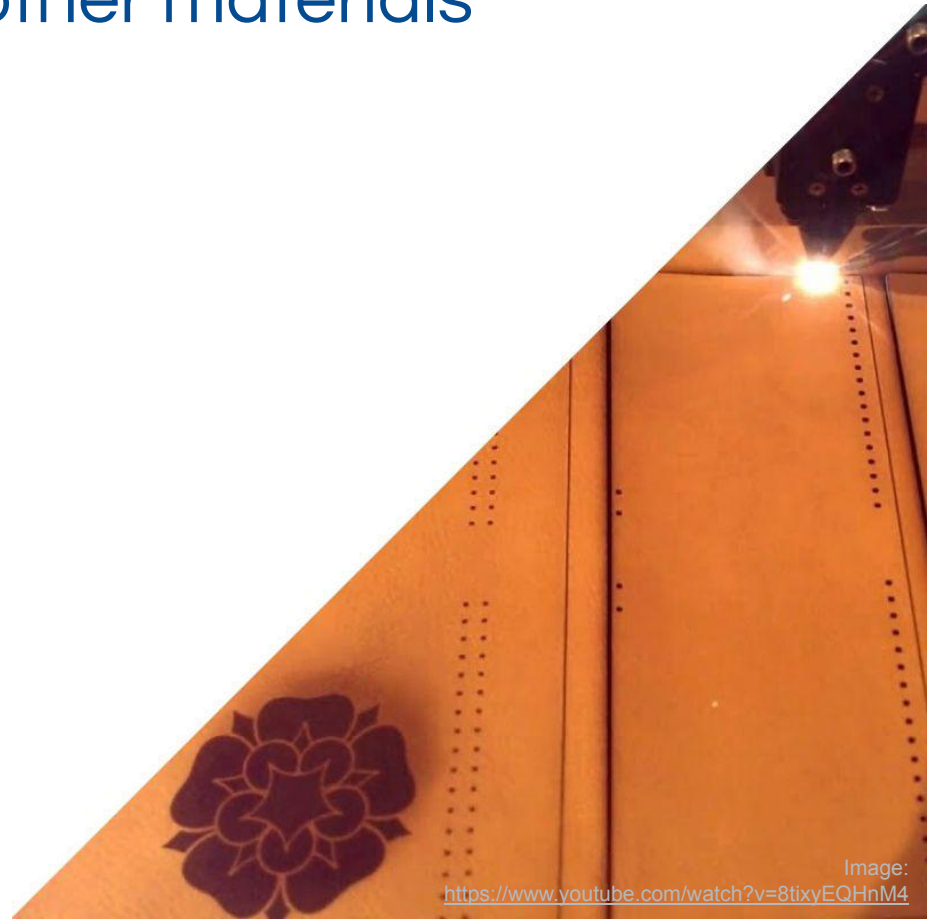
Applications: digital printing, packaging prototypes, functional models



4. Laser Cutting materials: other materials

Cloth

- Leather
- Suede
- Felt
- Hemp
- Cotton



4. Laser Cutting materials: other materials

Additional Laser Cutting materials:

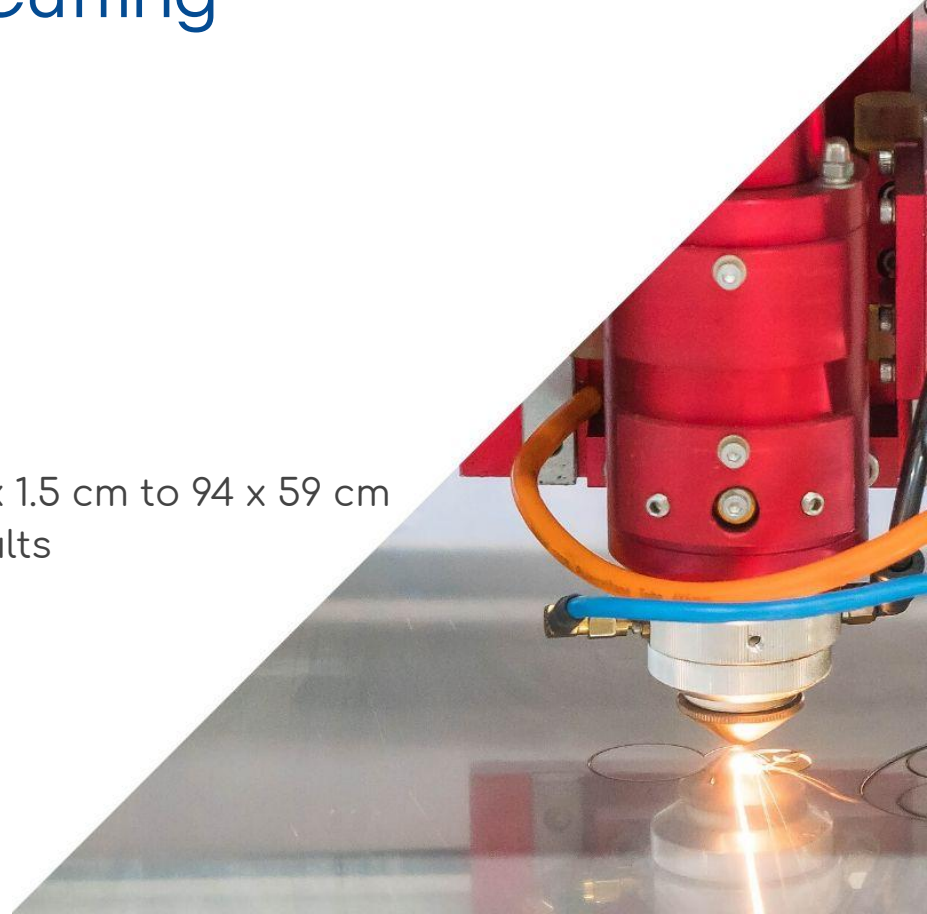
- Magnetic sheets
- Paper
- Rubbers (only if they don't contain chlorine)
- Teflon (PTFE, Polytetrafluoroethylene)
- Cork



Top 10 benefits of Laser Cutting

5. Top 10 benefits of Laser Cutting

1. Easy to integrate in production line
2. Contactless and precise process
3. Inexpensive
4. Fast manufacturing technology
5. Variety of materials and thicknesses
6. Highly accurate results
7. Design freedom: from pieces in size of 1.5 x 1.5 cm to 94 x 59 cm
8. Reliable process, always get the same results
9. Different engraving options
10. Capable of highly detailed designs



Applications of Laser Cutting

6. Applications of Laser Cutting: Aerospace

Aviation and space travel place indeed the highest demands on materials and technology: modern engines need to achieve an ever **higher performance** while, at the same time, **reducing fuel consumption**. Utilizing materials with improved strength and reduced density is by far the most efficient way to achieve this goal, and laser material processing has been proved suitable for these ambitions.

In aeronautic and aerospace, the powers of the lasers are in the order of few hundreds of watts to few thousands of watts. They are employed for the cutting and fusion welding of alloy and superalloy sheets, turbine engine deep hole drilling, repair of blades for gas turbines aircraft engines, on-the-fly drilling of de-icing panels and heat treatment of surfaces. Thanks to these techniques, the engines can operate efficiently at high temperatures.

Aeronautic and aerospace now even use **ultrafast lasers**.

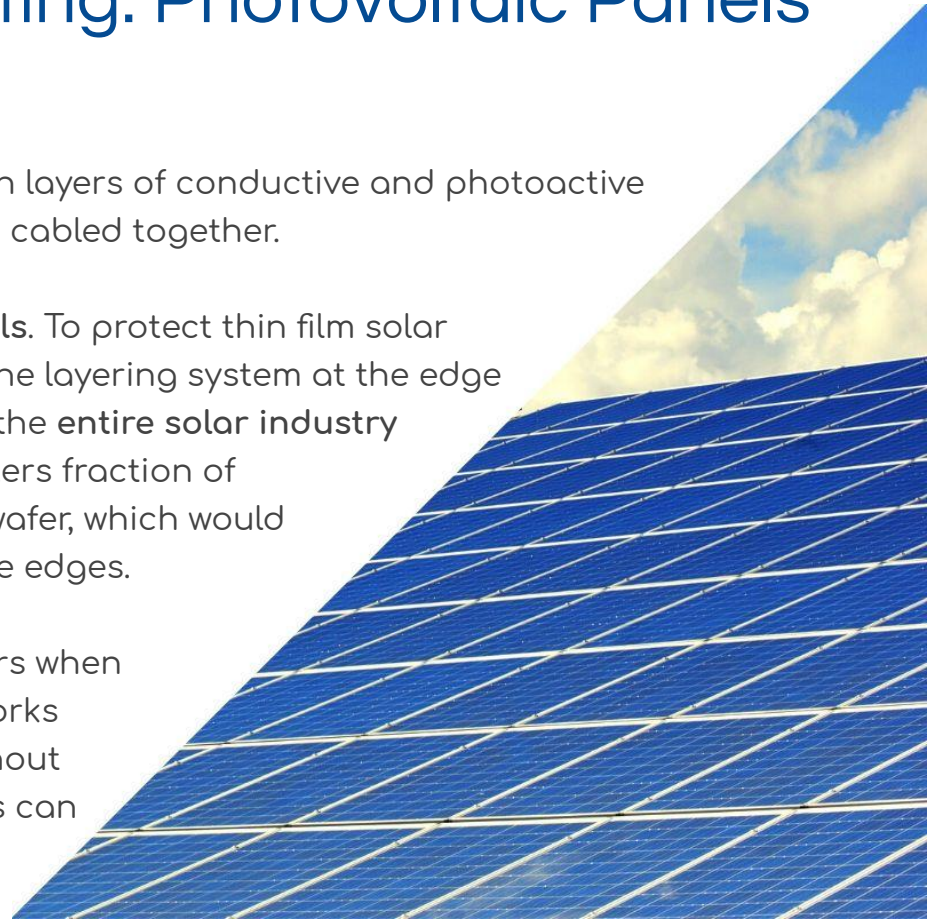


6. Applications of Laser Cutting: Photovoltaic Panels

The making of photovoltaic panels requires several thin layers of conductive and photoactive materials. These layers are then structured, drilled and cabled together.

Lasers are used for **edge deletion on thin film solar cells**. To protect thin film solar modules from corrosion and long-term short circuits, the layering system at the edge of the module is removed and laminated. In the 2000's, the **entire solar industry converted to lasers** in order to remove this few millimeters fraction of semiconductor material from the edges of the silicon wafer, which would otherwise lead to undesired short-circuiting around the edges.

A second operation successfully accomplished by lasers when Building solar panels is **drilling solar cells**. The laser works **contactless** and can get into position **very quickly**, without producing any mechanical charge. Thousands of holes can be drilled in a second.

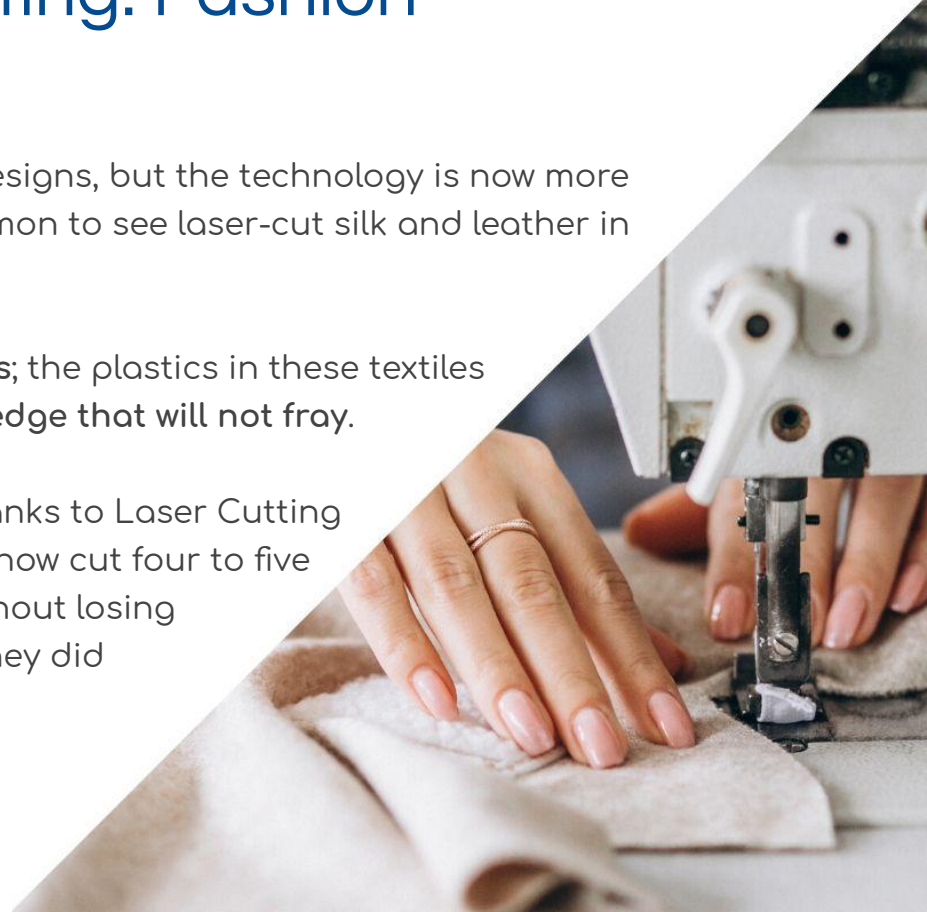


6. Applications of Laser Cutting: Fashion

Laser cutting used to be reserved for haute couture designs, but the technology is now more readily available to manufacturers. It is now more common to see laser-cut silk and leather in ready-to-wear runway collections or at retailers.

In general, laser cutting **works best on synthetic fabrics**; the plastics in these textiles melt during the process, resulting in a sealed, **perfect edge that will not fray**.

Laser works also really well on leather. For example, thanks to Laser Cutting technology, French saddler and designer Hermès can now cut four to five bags in one skin thanks to this **precise technology**, without losing as much of their precious and expensive material as they did when cutting with blades.

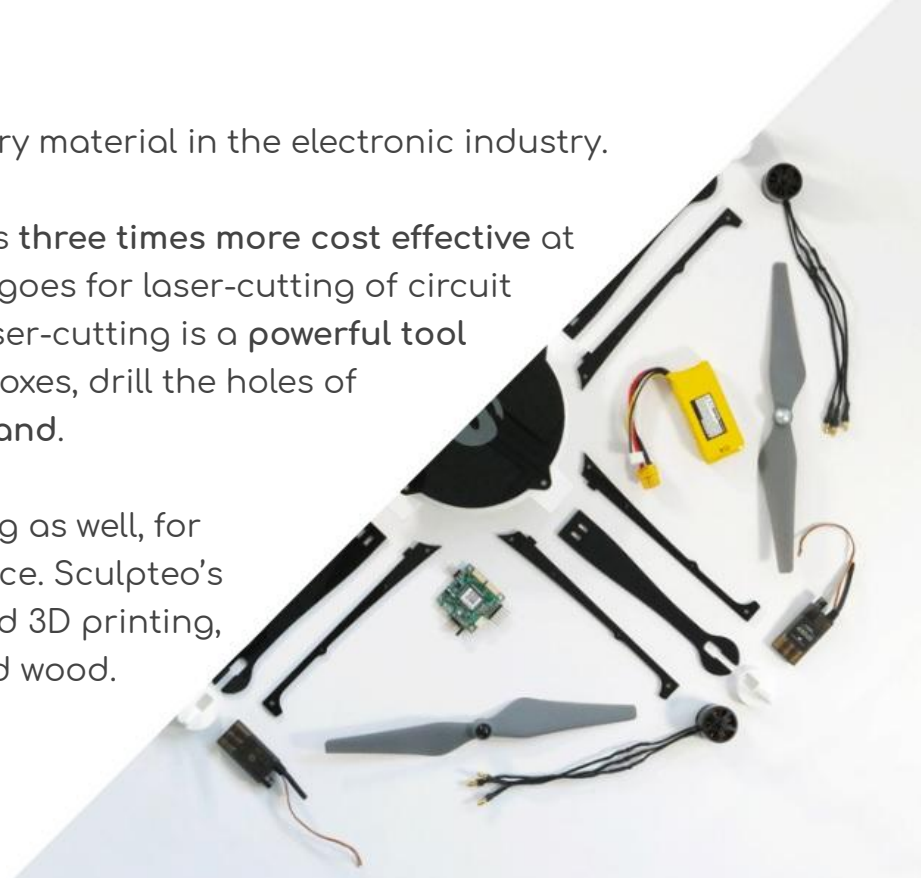


6. Applications of Laser Cutting: Robotics

Laser offers an efficient cutting solution for almost every material in the electronic industry.

For example, concerning MicroSD cards, laser cutting is **three times more cost effective** at comparable performance than water jet cutting. Same goes for laser-cutting of circuit boards. When making cellphones and smartphones, laser-cutting is a **powerful tool** in every aspects of the conception. Lasers cut plastic boxes, drill the holes of the keyboard, for the different plugs, or **engrave the brand**.

Drones and robots often require the use of laser-cutting as well, for the electronic components as for the pieces of the device. Sculpteo's team created its own [drone](#) combining laser cutting and 3D printing, cutting and sculpting all the pieces through plastic and wood.

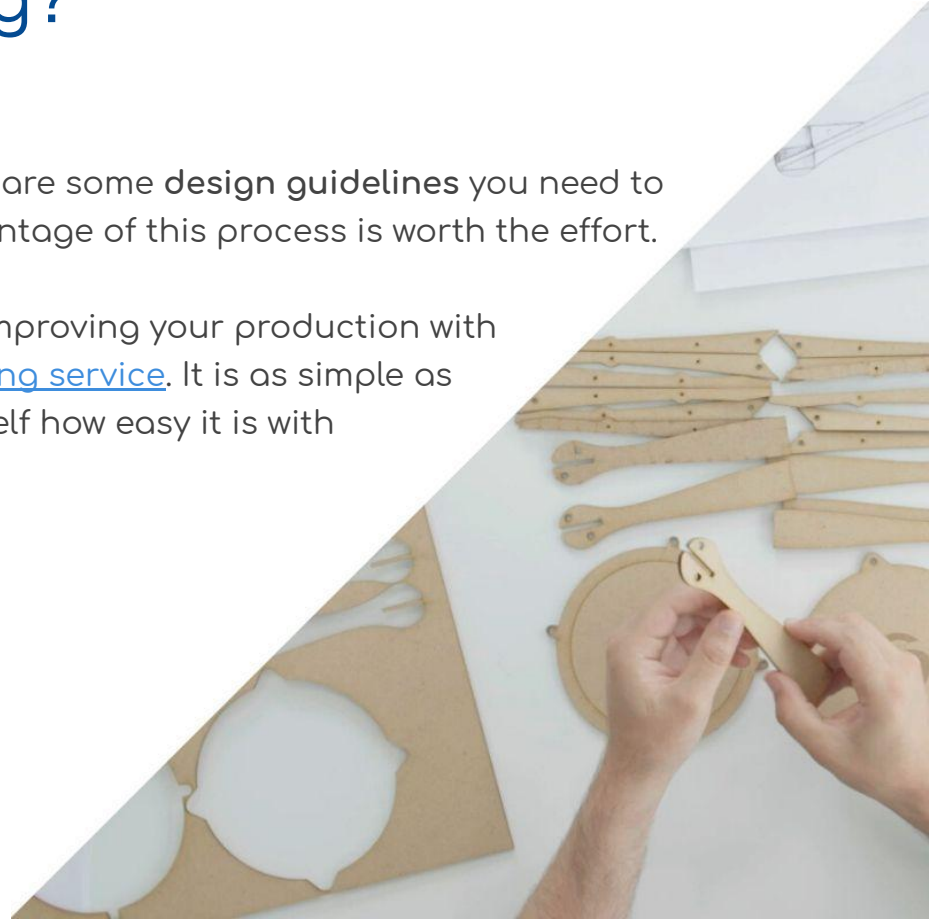


How to start Laser Cutting?

7. How to start Laser Cutting?

As you know by know, first you need a **vector file**. There are some **design guidelines** you need to follow when you design for Laser Cutting, but the advantage of this process is worth the effort.

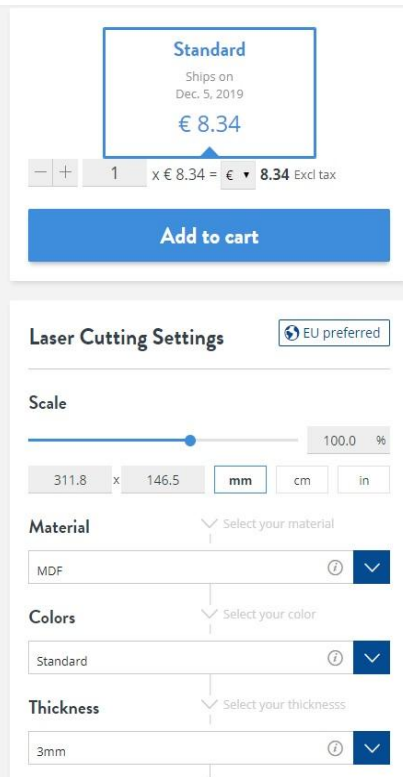
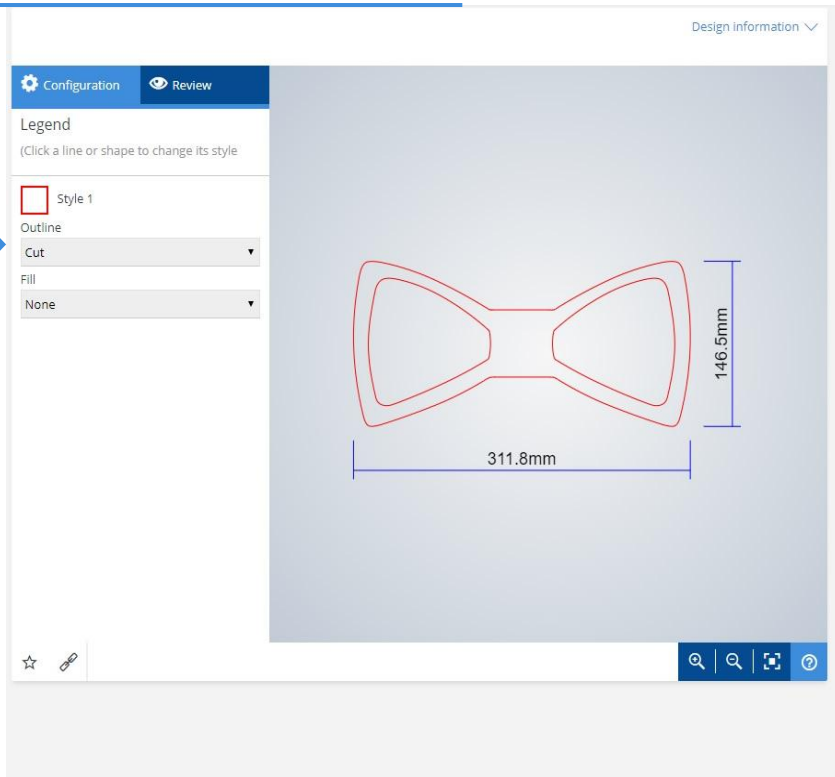
You don't need to buy an expensive machine to start improving your production with Laser Cutting. You can do it using an [online laser cutting service](#). It is as simple as [uploading your vector file](#) to our service. See for yourself how easy it is with instructions on the next page.



7. How to start Laser Cutting?

If you engrave a design, choose the engraving option and select desired lines.

Don't forget that it's easier to select engraving options if you preset the styles in your vector design software.



Pick the right catalog

Ensure your project is the right size

Pick the material

Select the color

Choose the thickness

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