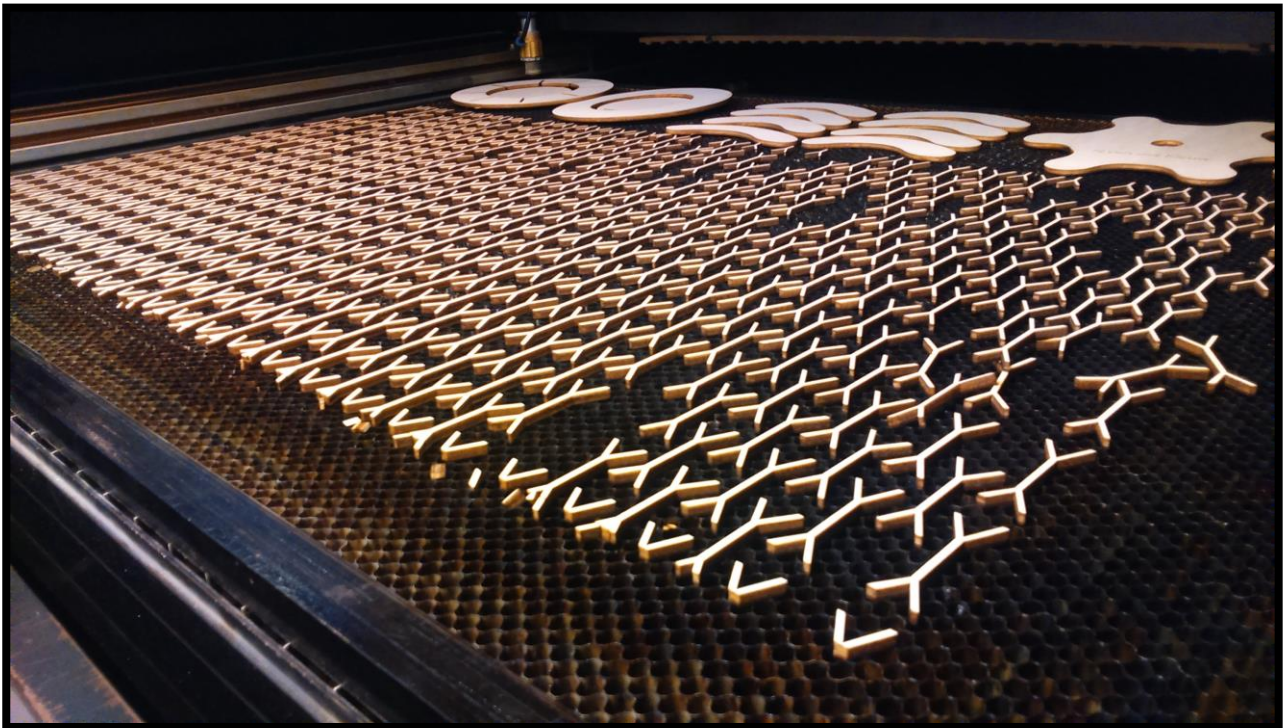


Guidelines for lasercutting and engraving

Files for lasercutting can be offered to the PMB staff from Monday to Friday from 8:30 to 9:30 AM

- The files should be practically ready to be cut or engraved using the guidelines found in this document.
- It is your own responsibility to provide files of sufficient quality to be processed.
- **The costs of lasercutting are 25 euros/hour**
- The PMB cannot be hold responsible for the quality and execution of your parts.
- University projects and especially graduating students have priority on personal projects.
- The lasercutter is only available for students and employees of **Industrial Design Engineering**.
- **Follow the tips and guidelines of the following document attentively!**



The lasercutter can produce thousands of parts in a relatively short period of time if the files to cut are well prepared.

Procedure for lasercutting via Solidworks.

In short the four steps needed to cut parts on the lasercutter through Solidworks:

- Download all the Templates for Lasercutting on the website of the PMB (www.pmb.tudelft.nl)
- Solidworks Parts > Solidworks Assembly > **Lasercutting Template Solidworks** > Save As Illustrator
- **Lasercutting Template Illustrator** > Illustrator Actions > Save to USB-stick > Waiting...
- **Lasercutting** > Pay and retrieve your parts at the PMB

Preparations.

- Model your **Solidworks Parts** . If needed print a few Drawing Views on a 1:1 scale to get a feeling of the dimensions of the parts.
- For a single part saving a **DXF file** is enough (see tips and tricks on the following chapter). To create a layout of different parts make a **Solidworks Assembly**, check the next pages for good examples.
- Place all the parts in the **Assembly** at once, select the faces of all the **Parts** and **Mate** them on the same surface. Move them **as close as possible** to each other.
- If you need various parts you can use the feature **Insert > Component Patterns**.
- Open the **Lasercutting Template Solidworks** (Drawing based) that you can find on the PMB website, it has **the dimensions of the work area** of the lasercutter.
- The dimension of the work area are **700 x 1220 mm**.
- Place the **Parts** or your **Assembly** in the **Lasercutting Template Solidworks**
- It is very important that the scale is set **to 1:1**, in theory the **Sheet scale** is automatically set to this value but always check your **dimensions and scale** before handing in your files at the PMB!
- In the **Lasercutting Template Solidworks** save your file as Adobe Illustrator:
File > Save As > filename.ai
- Open this file in **Illustrator**, select all lines (**Ctrl+A**) and copy them (**Ctrl+C**)
- Open the **Lasercutting Template Illustrator** and paste your drawings (**Ctrl+V**).
- Through preprogrammed **Actions** (**Window > Actions** or **Venster > Handelingen** in Dutch) you can eliminate double lines and set the right color and stroke for cut and engraving lines with one click.
- In the '**Lasercutting PMB**' folder on the site you can download these **Actions**, save them and load them in Illustrator. In the Actions window, click in the **upper right corner of the dropdown menu** on '**Load Actions**'. Now select the **Trotec SP500 Actions.aia**, the new Actions will now be available.
- Run the first Action '**Overlapping cutting lines and strokes**'; select it and click on the '**Play**' icon : all lines will become red and with the right stroke thickness.
- If you have drawn engraving lines or text select them and run the Action '**Engraving lines or text**' or give them directly the **blue color** needed with **RGB code (0,255,0)**.
- If you want to engrave your text, create outlines with the Action '**Text to engraving lines**'.

- Line thicknesses and colors are normally set with these **Actions**, if you want to do this manually:

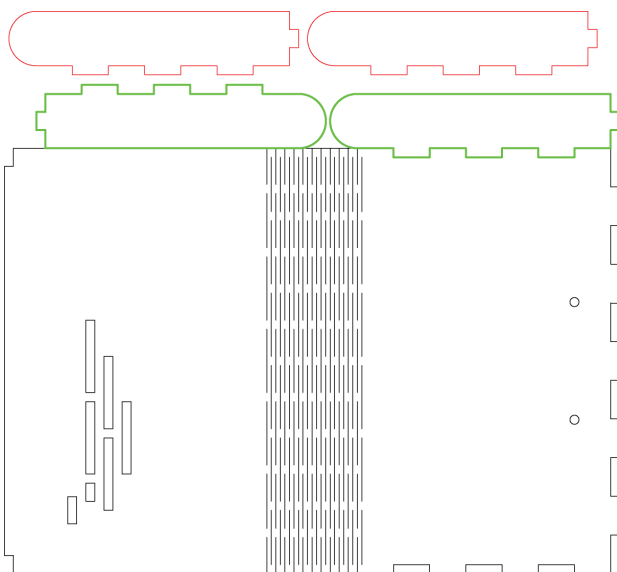
Color mode file : RGB mode (**File > Color Mode > RGB mode**)
Stroke cutting and engraving lines: 0.01 mm
Color cuttinglines: Red RGB (255,0,0)
Color cut and engrave lines : Black RGB (0,0,0)
Color engraving text: Blue RGB (0,0,255) with Stroke $\geq 0,01$ mm and/or Fill
Color engraving surfaces : Blue RGB (0,0,255) can be time=cost consuming

Cut and engrave lines on big surfaces are made much faster than engraving over big surfaces. Keep this into account, changing your strategy can save you a lot of money!

- Save everything as an Illustrator file indicating the material, your name and phone number:
File > Save As > Material, Name, Phone number.ai
- Copy this file to a USB-stick and bring it to the lasercutter at the PMB **between 8:45 and 9:45 AM!**
- The staff members can give an indication of the time needed to cut your parts but **it is not possible to guarantee when they will be actually cut!**
- If you don't prepare your files with the **necessary care and attention** you will end up behind in the waiting line.

Tips & Tricks lasercutting

- The cutting width of the laser beam is 0.1 – 0.2 mm depending on the material and its thickness. It is therefore possible to put parts tightly against each other to use material efficiently.
- If your parts have a specific tolerance requirement it is advised to make some test parts and determine the final dimensions that fit your tolerance.
- You can even combine cuttinglines of straight or complex parts. This lowers the cutting time and costs by approximately 50%. See the example below.



- In an **Assembly** you can **Mate** Parts together. By sharing cutting lines you save time, materials, energy and costs.
- To cut a single **Solidworks Part** the easiest way is to use **File > Save As > DXF** to export the file. Select the view that you want to cut, '**Current view**' for example, or use the option '**Faces / loops / edges**'.

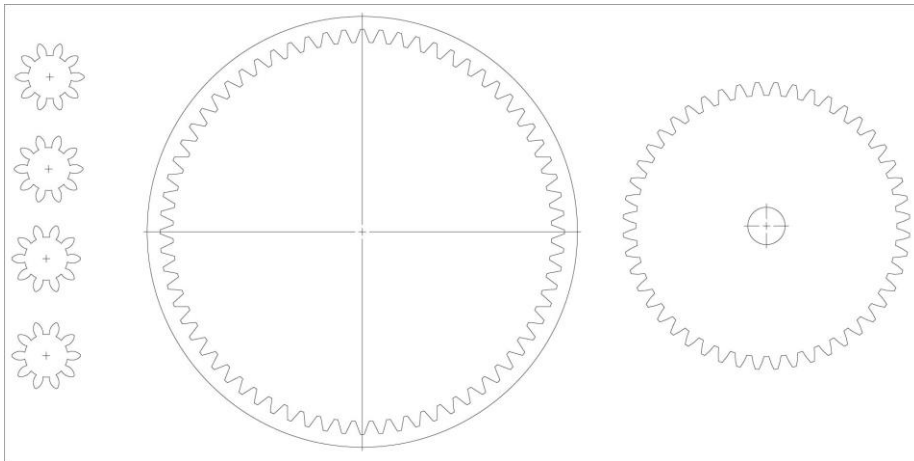
*Drawings for lasercutting, bending lines and flat swallow tail connections.
Courtesy Diego Renting.*

Nesting parts

Nesting of parts creates is crucial, it creates a layout of the parts you have to cut that uses the material in the most efficient way. This doesn't only save materials but indirectly also energy, transport and money, eventually making your product more sustainable as well.

Example

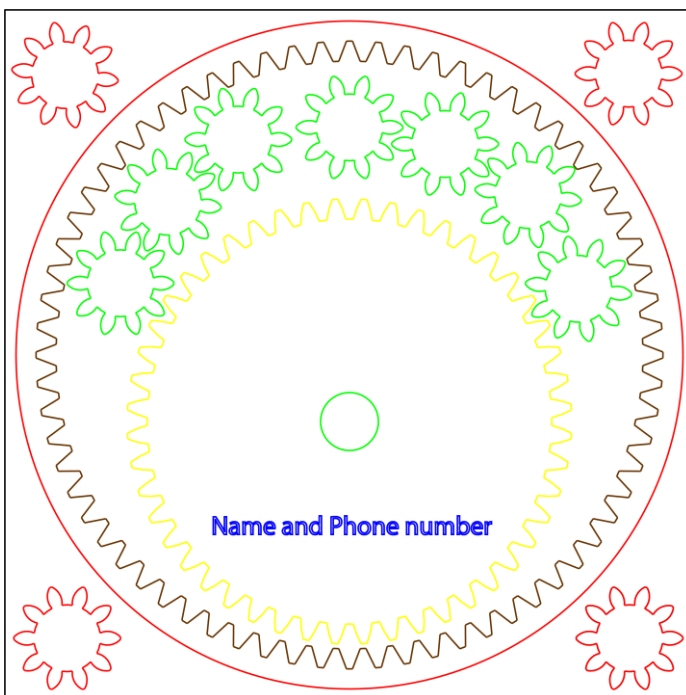
The next image shows a layout that is exported from Solidworks without any nesting. All black lines will be cut, including centermarks. The internal gear will simply be cut in four pieces. The parts are also placed at great distance from each other using the material inefficiently.



By nesting efficiently as you can see below more parts come out of an 88% smaller panel!

The cutting procedure is: **First cut : Green** – **Second cut : Yellow** – **Third cut : Brown** – **Last cut : Red**.

In simple drawings you will just use **First cut : Green** and for the **Last cut : Red** !



The **blue color RGB (0,0,255)** is used to engrave text and surfaces.

The **green color (RGB 0,255,0)** is the first one to be cut. This is especially important for the bore of the gear. If the gear is cut first it is possible that it will move slightly after cutting the outlines. Cutting the bore afterwards may result in the hole not being perpendicular and centered with the gear. In Illustrator select the parts with care and use the Action **'First Cut'** to set all requested values.

The **Yellow color RGB (255,255,0)** is used to cut the big gear. You always work from the inner shapes outwards.

The **brown color RGB (102,51,0)** cuts the internal gear following the right procedure.

The **red color RGB (255,0,0)** is for the final cut.

Good luck with your projects !

Appendix: Text Lasercutting Templates Solidworks en Illustrator (useful to print!)

Lasercutting Template Solidworks

Trotec SP500 lasercutter 120 Watt

Working area : 1220 x 700 mm

Multiplex panels : 1220 x 700 mm

- Model **Solidworks Parts** to cut, print some drawing views on **scale 1:1** to realize their size!
- Create a layout of the parts in an **Assembly**, you can select/place various **Parts** at once.
- Multiple parts can be placed with **Insert > Component Patterns**
- **Mate Parts** together to **share cutting lines!**
- Optimize nesting by hand dragging or with **Move Component > Dynamic Clearance**
- **The cutting line** of the lasercutter lies **around 0.1 to 0.2 mm** so you can place components nearly against each other as the gears shown in the manual for example
- Insert the **Assembly** into this template **Insert> Drawing View>Model**
- Check that the **scale is set on 1:1**, it should be automatically
- Save as Adobe Illustrator **File > Save As > Filename.ai**
- Open the **Lasercutting Template Illustrator.ai**
- Follow instructions on the right of the template with care!

Good luck with your projects!

Lasercutting Template Illustrator

Trotec SP500 lasercutter 120 Watt

Working area : 1220 x 700 mm

- **Open** the drawings saved as Illustrator file from the **Lasercutting Template Solidworks**
- Select all the lines (**Ctrl+A**) , copy them (**Ctrl+C**) and paste them (**Ctrl+V**) in the **Lasercutting Template Illustrator**
- Save the newest **Trotec SP500 Actions.aia** file downloaded on the PMB website on your computer.
- Open the actions window by clicking **Window > Actions (Venster>Handelingen in NL)**
- In the upper right corner use the dropdown menu and click on **Load Actions**
- Select the **Trotec SP500 Actions.aia** file that you just saved
- Click on the dropdown menu to see the predefined **Actions**
- Run the first Action '**Overlapping lines and strokes**', select it and click the '**Play**' button.
This will eliminate overlapping lines and give the lines the right thickness and red stroke colour to cut.
- Give colours to the lines to create a cutting order (Mostly: **First cut : Green - Last cut : Red**):
First cut:Green (0,255,0)– Second:Yellow (255,255,0)– Third: Brown (102,51,0)–Last cut: Red (255,0,0)
- Write your **Name and Phone number** on a part (shortcut **T** in Illustrator)
- Use the Action '**Engraving text**' which gives the **Fill color** in **RGB (0,0,255)**)
- Use the Action '**Engrave outline text**' to engrave (**Stroke ≥ 0.1 mm** in **RGB (0,0,255)**)
- All the **Text based** Actions will change the text to **Outlines**, it will preserve the design of the font even if it isn't installed on the computer of the lasercutter. **You can still scale it but can't edit it like text.**
- Use the Action '**Engrave lines**' to engrave a line (**Stroke= 0.01 mm** in **RGB (0,0,0)**)
- Save the file with the following format: **Material and thickness, Name, Phone number.ai**
- Copy it to a memory stick and hand it in at the PMB lasercutter between 8:30 and 9:30 AM.

Good luck with your projects!