Universal Laser Cutter Protocol

Machine Capabilities:

Maximum material dimensions: 32"x 18" x 8.5" (813mm x 457mm x 216mm)

Maximum material thickness that can be cut: 1/2" (12.7mm) (depends on material)

Approved Materials: Acrylic, laser-grade plywood, hardwoods, real leather, and paper/cardstock. All other materials must be approved prior to cutting (*see Approved Laser-Safe Materials section below*).

General Part Tolerance: Tolerances on laser cut parts are largely dependent on the material being cut and its thickness. Additionally, the laser software does not use tool compensation. This results in external contours that are slightly smaller than designed, and internal contours that are slightly larger (*see Tool Offset section below*).

Required file format: .dxf or .ai files

How to Submit a Laser Cutter Job Request:

1. Save part as a .dxf:
   - In Solidworks, while your part file is still open, go to "*File*"
   - Select "*Make Drawing from Part*"
   - De-select "*Display Sheet Format*" – Do not include title block or borders
     o If your part is larger than 8.5", select the "*D*" style page format
   - Drag the appropriate view of the part onto the sheet
   - Ensure the part is scaled 1:1
   - Do not include dimensions
   - Do not include extra lines, hole centerlines, or hidden lines (*Eg. Countersinks*)
   - Save as a .dxf file
2. Create a .pdf file drawing of the part that contains dimensions, the number of parts you'd like, the material type, size, and thickness.
3. Email your .dxf and .pdf files to meshops-me@berkeley.edu
4. Drop off your materials at the shop with your name and your project's name written on all pieces.

Please note that the laser must only be operated by a technical staff member only

Preparing .dxf Files in Illustrator and Tool Offset on next page
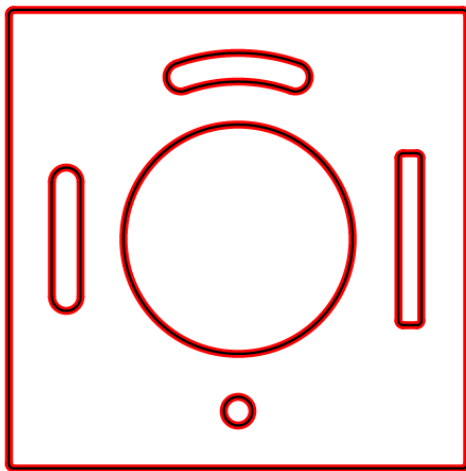
Preparing .dxf files in Illustrator:

- Select all features (*Ctrl+A*) and change stroke weight to .001 pt.
- For features that are cut all the way through, select desired features and change stroke color to true red (*RGB values should be 255, 0, 0 respectively*).
- For features that are etched/engraved, select desired features and change line color to true blue (*RGB: 0, 0, 255 respectively*).
- For features that are rasturized, select desired features and change line color to black (*RGB: 0, 0, 0*). Select the Live Paint Bucket tool. Change the fill color to black and fill in the areas you'd like rasturized.
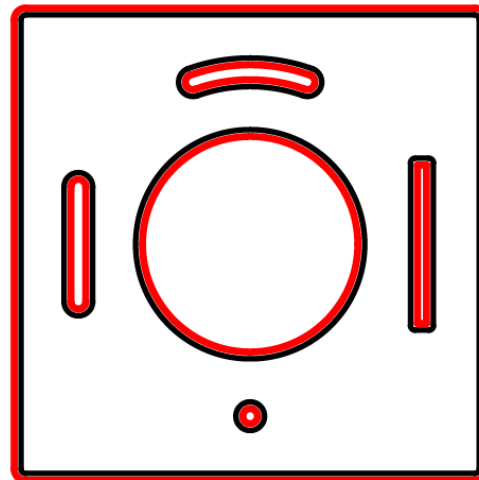
Tool Offset:

As mentioned previously, our laser doesn't have the ability to program and compensate for tool offset. The laser follows the specified contours directly in the center of the line. This results in external contours that are slightly smaller than designed, and internal contours that are larger. See below for visual representation:

The kerf, or the width of the cutting path where material is being removed, is represented in red while the part is represented in black.

No Tool Offset   Tool Offset

Part with No Tool Offset: This resembles how parts on the laser will be cut. Notice the kerf follows the center of the black lines, resulting in smaller external and larger internal contours

Part with Tool Offset: This is how parts are cut exactly to size on milling machines, water jets, etc. Notice the kerf is offset to the appropriate side of the line, so features are cut out the same size as designed.

APPROVED LASER-SAFE MATERIALS

For your health safety and others in the shop, processing any material that is not laser-safe is against our shop policy. An important consideration is the potentially hazardous fumes that might be released from processing some materials. Many materials are quite toxic when burned and could cause damage to your health. We will ONLY cut or engrave materials currently on OUR APPROVED LASER-SAFE list. Just because the material maybe on another's laser safe list does not mean it is suitable or safe for our location. We welcome other material suggestions for future approval (with proper documentation). Please send suggestions with proper documentation; manufacture's specification sheet AND SDS (Safety Data Sheet) to mccormick@berkeley.edu . We will consult with UC Berkeley's Office of Environment, Health & Safety (EH&S) and other qualified health and laser professionals to determine if the proposed materials are safe and suitable to use in our laser. Please note: the approval process can take considerable time to complete

List of Approved Laser-Safe Materials:

All materials MUST be clean, dry, and uncontaminated

- **Acrylic** - Acrylic, also known as PMMA, is a type of plastic with a variety of brand name manufacturers, including Plexiglas, Lucite, Acrylite, and Optix. Acrylic comes in a variety of thicknesses and color options. There are 2 major types of acrylic: cast and extruded. Both are approved laser-safe materials and can be cut on the machine. Maximum material thickness we can cut is 13mm (0.500"). Good sources: United States Plastics, and McMaster-Carr. Two-tone acrylic (with a thin, top layer that is a different color than the core material) is available for parts that require high-contrast engraving such as instrumentation panels, signs, and plaques. Good source: Johnson Plastics.
- **Paper / Cardstock** - Can be both etched and cut
- **Hardwood/laser-grade plywood** – Only interior grade plywood purchased from Jacobs or CED. Maximum material thickness we can cut is 6.5mm (0.250"). Laser-grade plywood is made with modified glue that is safer for laser cutting and can be both etched and cut. Good sources: Jacobs Hall Materials Store, and MacBeath Hardwood Berkeley
- **Leather** - Natural leather only, not synthetic "pleather"

Partial List of Materials Not Allowed for Laser Cutting or Engraving:

- **PVC** (aka **Polyvinyl chloride, vinyl, pleather**) - Chlorinated materials are corrosive and toxic.
- **Chlorinated rubbers -** Releases chlorine. Some paints contain chlorinated rubber.
- **Nitrile rubber** - Releases hydrogen cyanide when combusted
- **Polystyrene foam (aka Styrofoam) -** Melts and catches fire. Very dangerous.
- **Almost any foam -** Including Foam core, polypropylene foam, etc. Very dangerous.
- **Construction grade plywood** - Most plywood sold hardware stores are not bonded with modified laser-safe adhesives.
- **Masonite or MDF** – Bonded with adhesives that are not laser-safe
- **ABS** - Off-gases hydrogen cyanide in fumes, a chemical known to be very toxic to humans
- **Polycarbonate** (aka **Lexan**) - Absorbs infrared radiation, causing it to melt and warp. Looks very similar to acrylic sheets.
- **Glass**
- **Metals**