15-294 Rapid Prototyping Technologies:

Laser Cutter Intro

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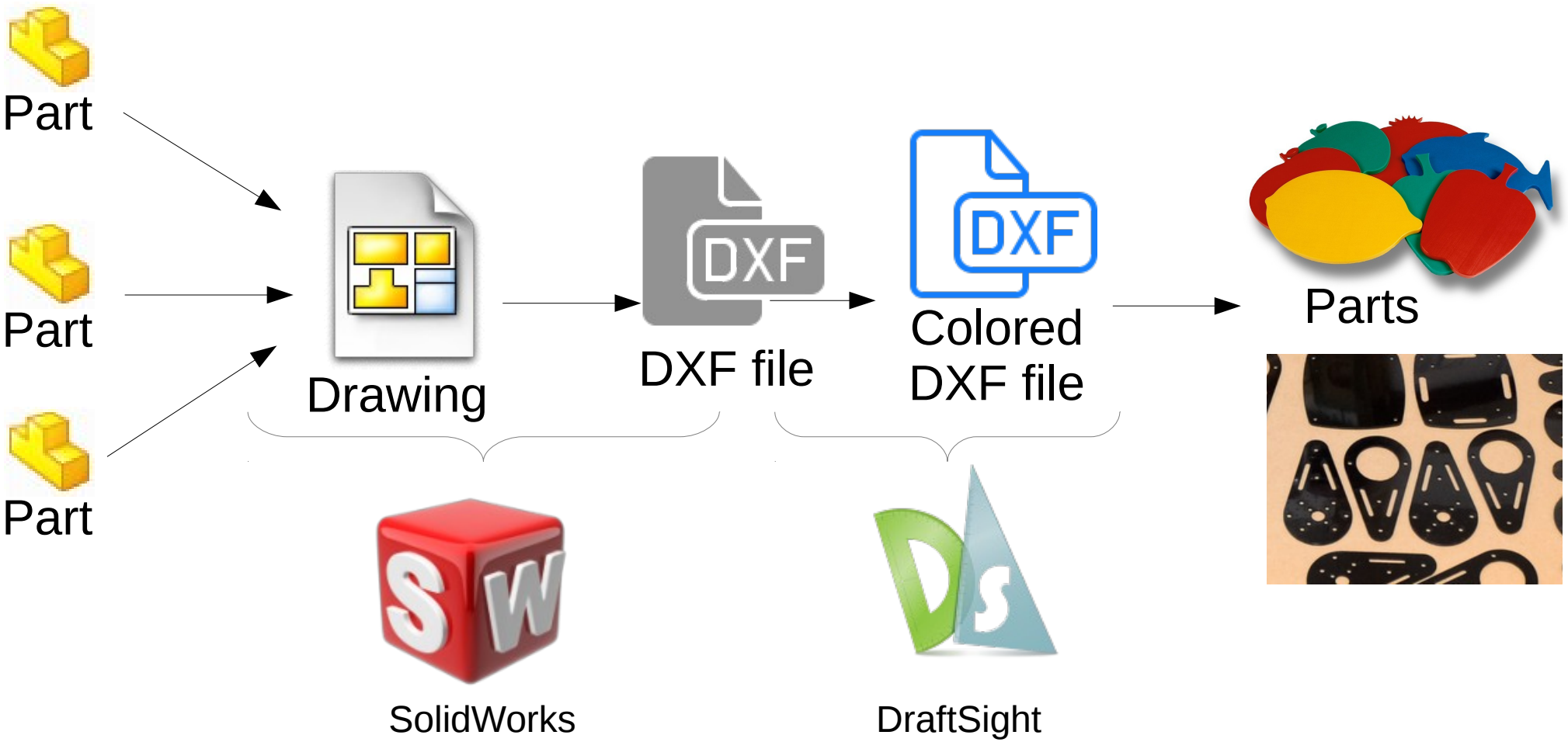
From Design to Plastic

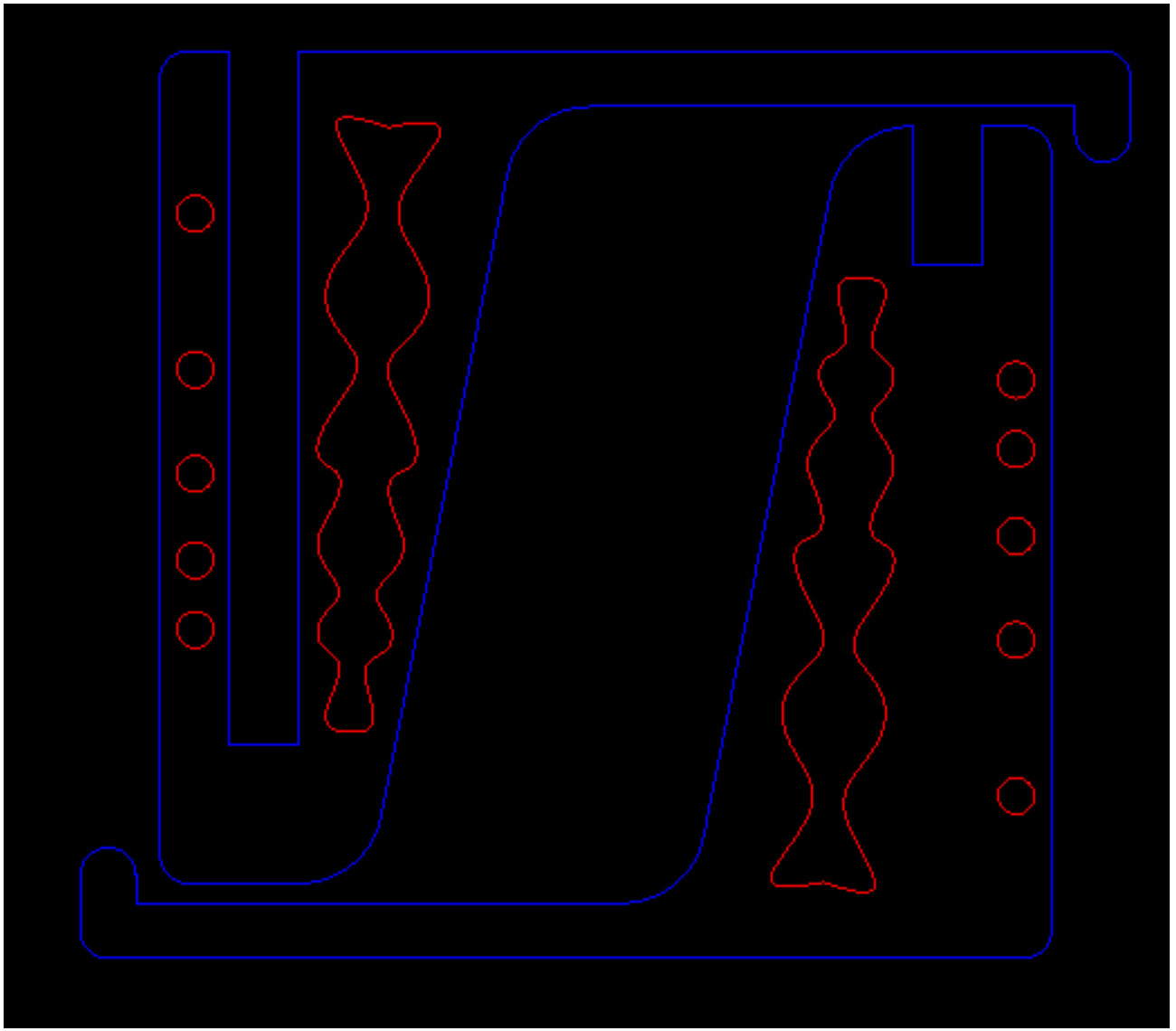


What the Colors Mean

- On older laser cutters, color meaning is fixed:
  - Red means “cut”
  - Black or blue means “engrave”

- On modern laser cutters, color meanings are user-definable.
  - Use color to define the cut ordering.
  - Always cut the holes first, then cut the outline.
  - Example: holes = red, outline = blue.
  - So tell the cutter to do red first, then blue.

Cut the Holes First, Then the Outline

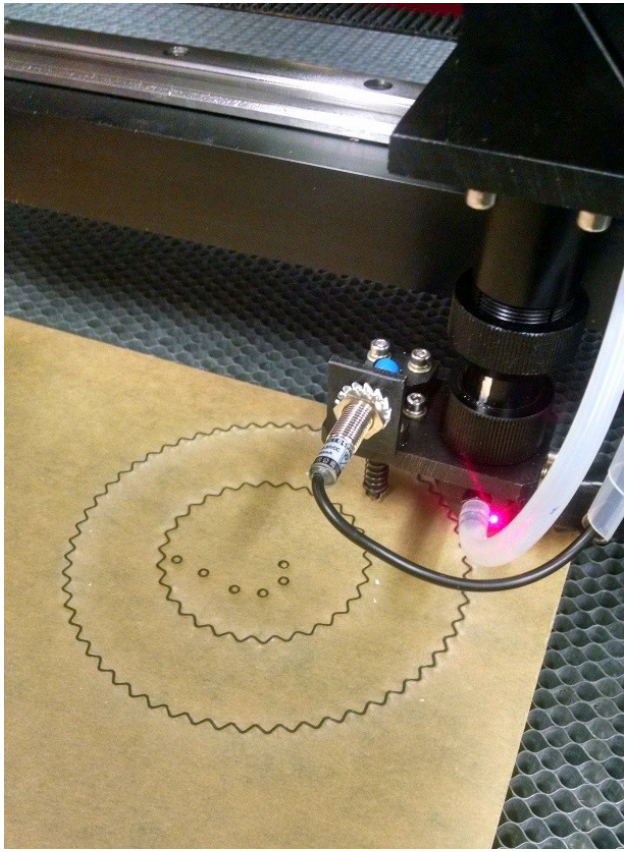


Rabbit Laser RL-80-1290

- 80 watt CO_2 laser
- 1200x900 mm bed
- Exhaust filter
- Chiller

The Laser Tube

How It Works



- Pointing laser (red, low power)
- Cutting laser (invisible, high power, dangerous!)
- Coolant chiller (stay below 32° F)
- Compressed air to clear debris
- Exhaust system with filtration
- Settings based on type of material:
  - Power level (never go above 85%)
  - Cutting speed (slower speed cuts deeper)

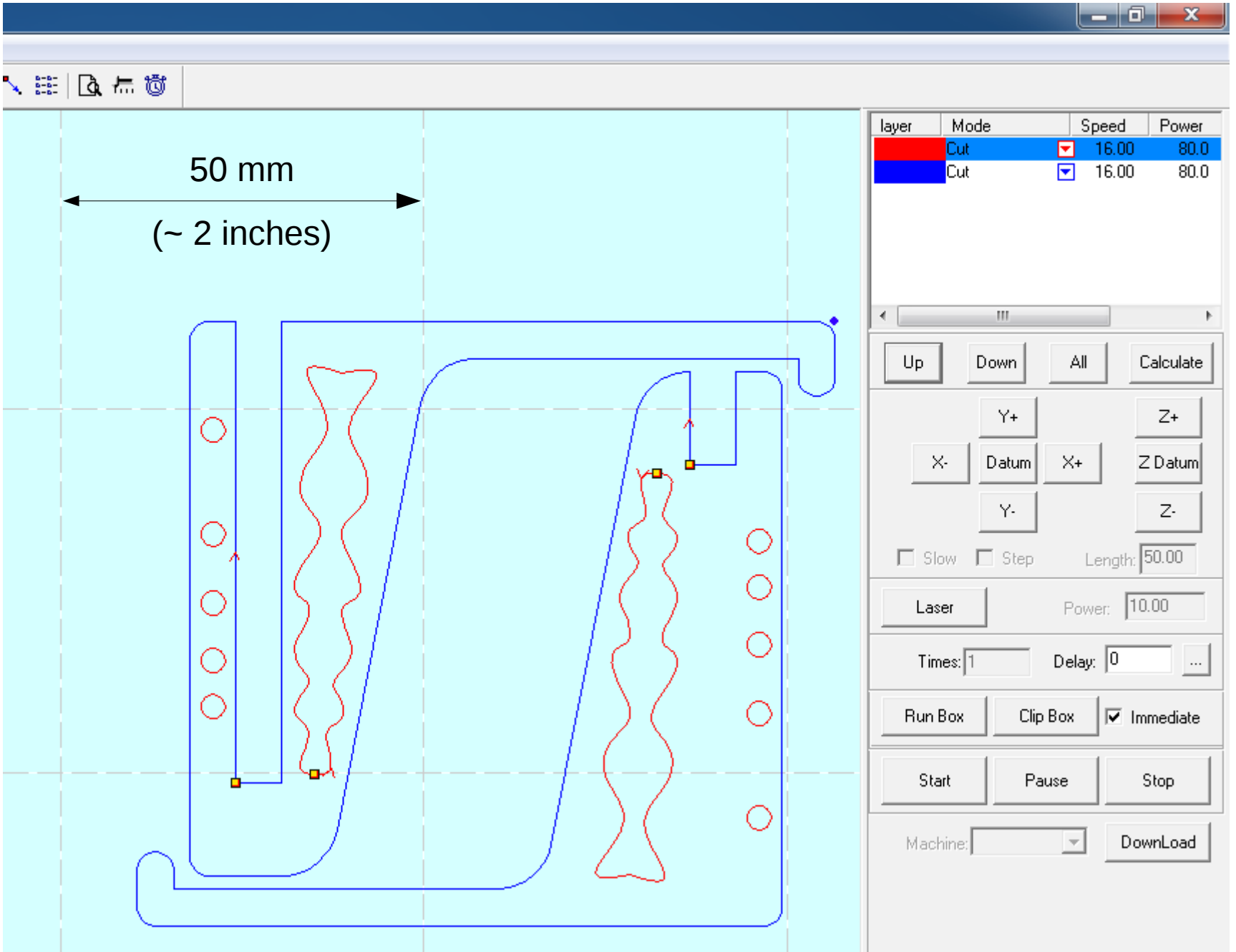
RL-80-1290 Control Panel

Emergency Stop
(E-Stop) Button

- Leave the E-Stop on.
- Leave the key turned on.
- Use the three small buttons to turn the lighting, laser tube, and blower on or off.

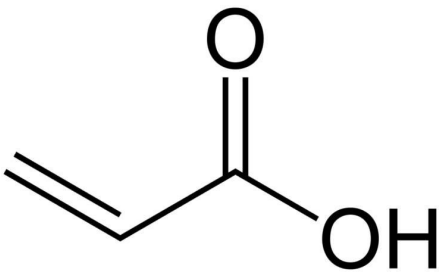
RL-80-1290 Control Panel

Lasercut53 Client Program

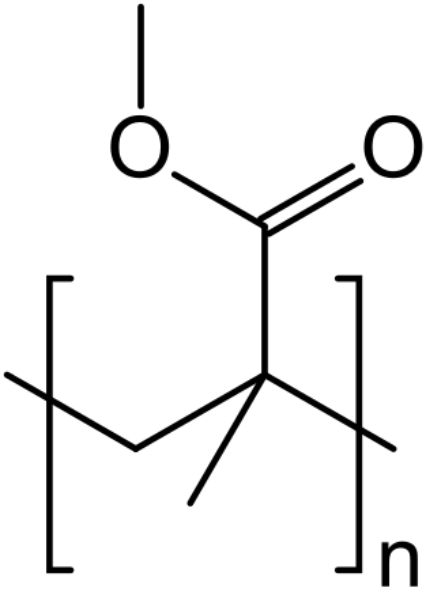


What Is Acrylic?

- Polymer of acrylic acid:
  poly (methyl methacrylate)



Acrylic acid



poly (methyl methacrylate)

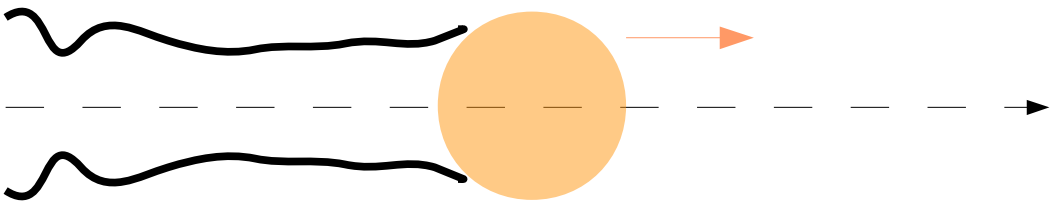
- Also known as Plexiglass, Lucite, Perspex...
- Can be either *cast* or *extruded.* Cast is better for laser cutting; extruded is easier to thermoform.

Thickness Variance

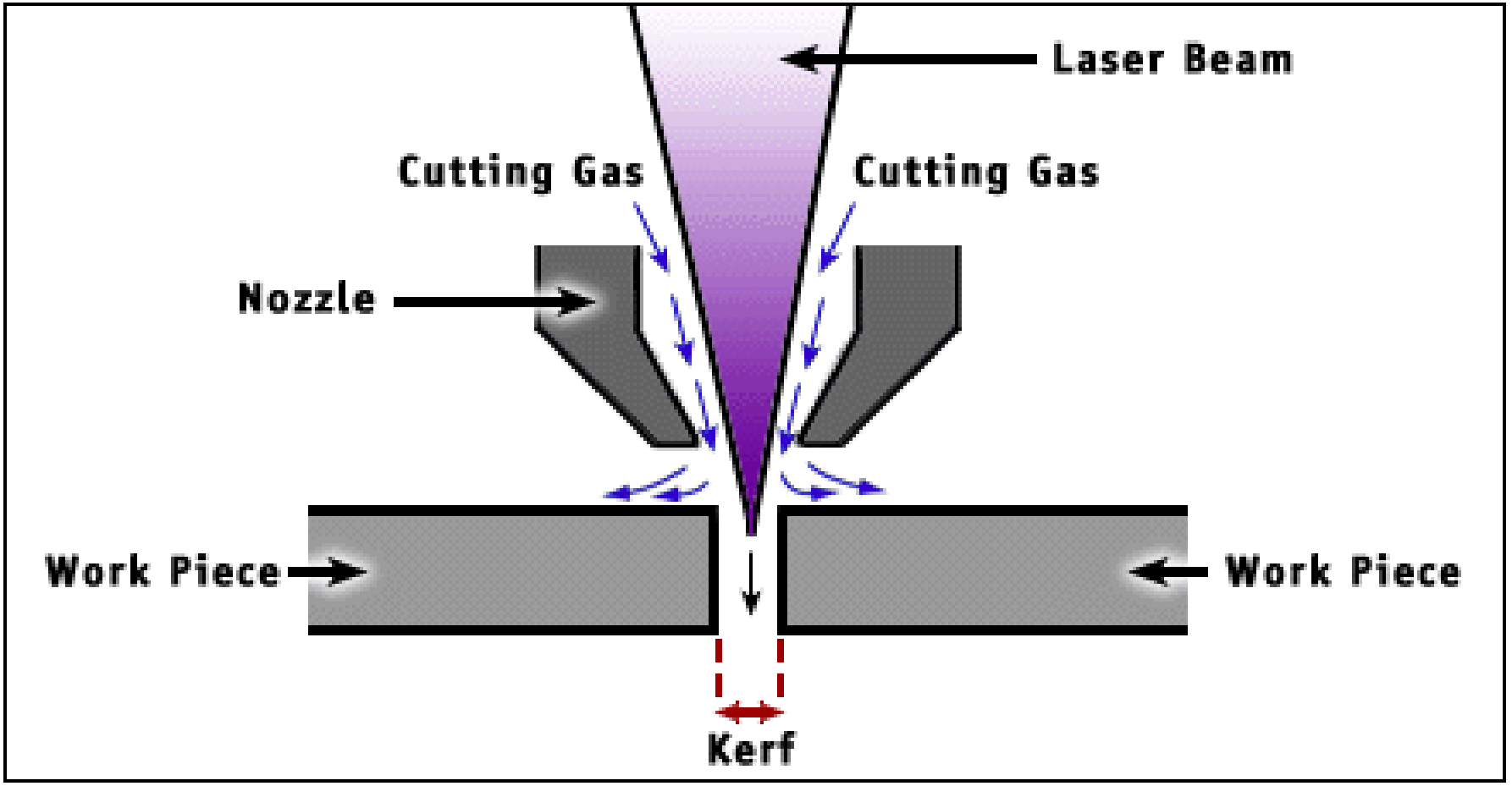
- We order 1/8 inch cast acrylic sheets.
- What we get:
  - Sometimes 0.125 inch sheets.
  - Sometimes 0.118 inch (3 mm) sheets.
- Thickness tolerance +0.015 to -0.025 inches.
- Thickness can vary:
  - From one batch to another
  - From one edge of a sheet to the other edge!
- Thickness matters for press fit.

Beam Width

- The beam cuts by burning and melting.
- The width of the beam is non-negligible.



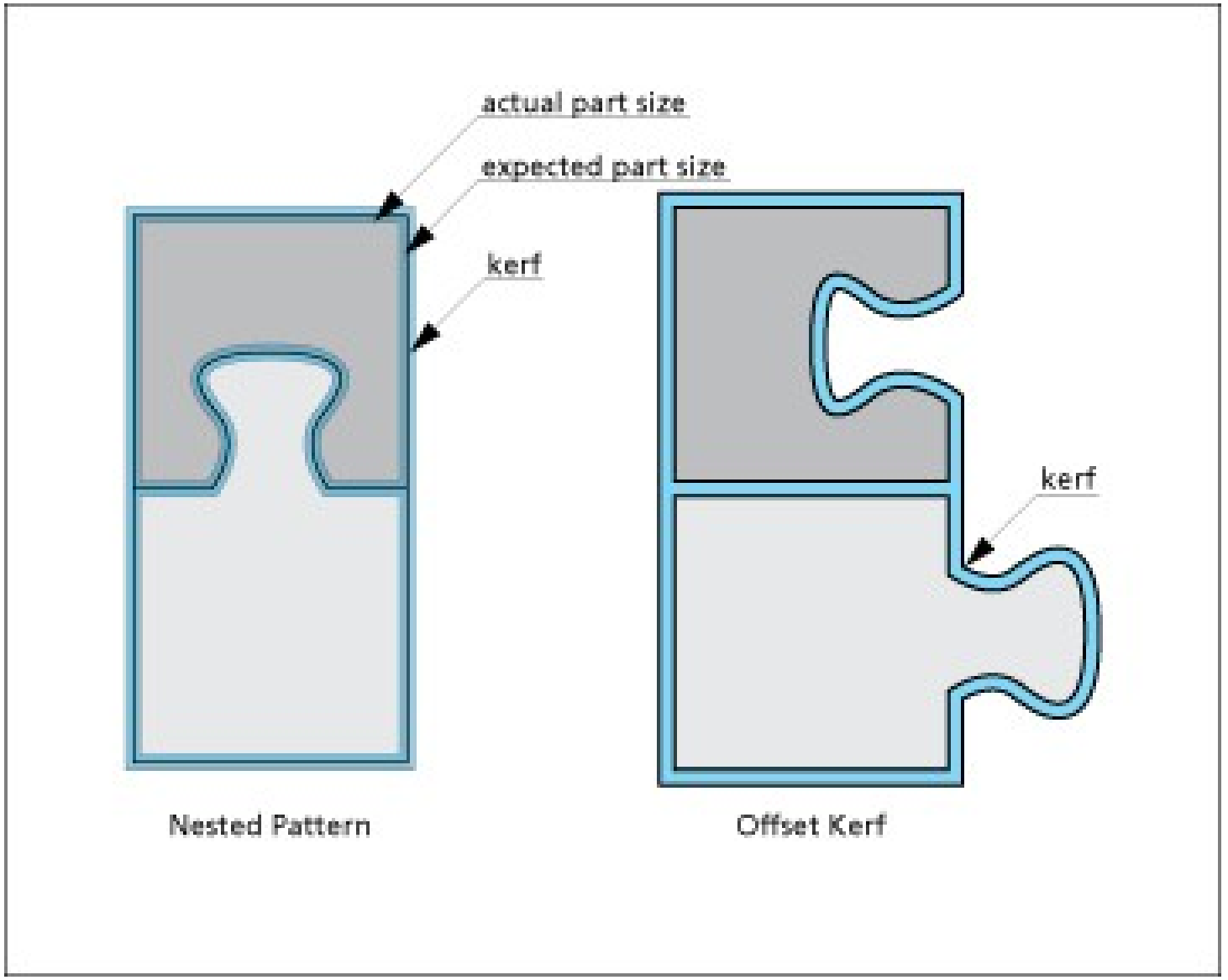
Kerf


Laser Beam
Cutting Gas
Cutting Gas
Nozzle
Work Piece
Work Piece
Kerf

Kerf

- Typically 0.08 to 0.45 mm (3 to 18 thousands of an inch), depending on:
  - Laser optics and focusing
  - Type of material
  - Thickness of material
- Consequences:
  - Parts will be undersize
  - Holes will be oversize
- Example: 0.1 inch diameter spirograph holes:
  - Measured diameter 0.106 inches (kerf 0.006”)

Kerf


actual part size
expected part size
kerf
kerf
Nested Pattern
Offset Kerf

Cut Residue

- Sometimes parts are discolored due to:
  - Smoke/ash plume from the melting plastic.
  - Residue from the honeycomb re-melting and contaminating the part.
- Wiping with isopropanol (rubbing alcohol) can clean up the part.
- Acetone (nail polish remover) sometimes works better.

How to Get a Press Fit

- Measure the actual thickness of your sheet.
- Make the slot tighter than the actual thickness, to take the kerf into account.
- If a slot is too tight, use a file to open it up.

Safety

- Fire extinguisher and smoke/heat alarm.
- Remember the E-Stop button.
- Chiller temp must be below 32^{o} F.
- Never open the door while the laser is active.
- Never cut materials not on the approved list:
  - Acrylic or Delrin are okay.
  - Cardboard, thin wood, and MDF (fiberboard) are okay.
  - Ask about other materials.
- Lots of stuff that's bad to cut:
  - ABS plastic will catch fire
  - Anything with chlorine, e.g. styrofoam, vinyl: poison gas!