SBME Makerspace

Power Tools and Equipment Training

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Equipment in the Makerspace

- 3D Printers (SLA and FDM)
- Electronics Equipment
- CNC Machine
- Laser Cutter
- Soldering Station
- Drill Press
- Sanding Station
- Bandsaw
- Compound Mitre Saw
- Handheld Power Tools
- Waterjet Cutter
- Benchtop Shears
- Finger Brake
- Bench Grinder
- Spot Welder
- Wood Lathe

Equipment Requiring Training or Supervision

- Resin 3D Printers
- Ultimaker Printer
- CNC Machine
- Laser Cutter
- Soldering Station
- Drill Press
- Sanding Station
- Bandsaw
- Compound Mitre Saw
- Waterjet Cutter
- Benchtop Shears
- Finger Brake
- Bench Grinder
- Spot Welder
- Wood Lathe

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Restrictied Equipment

- Resin 3D Printers
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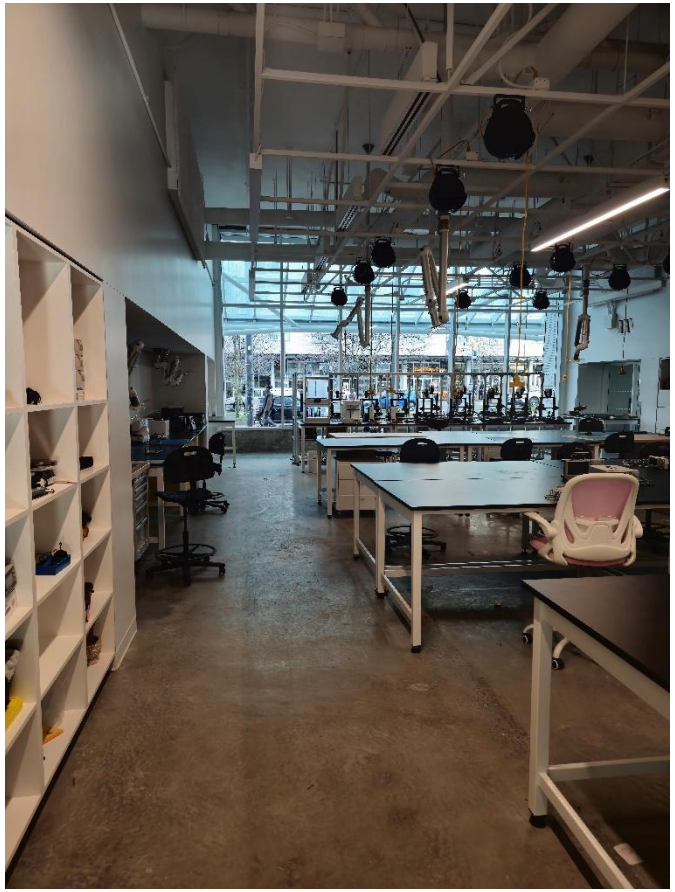
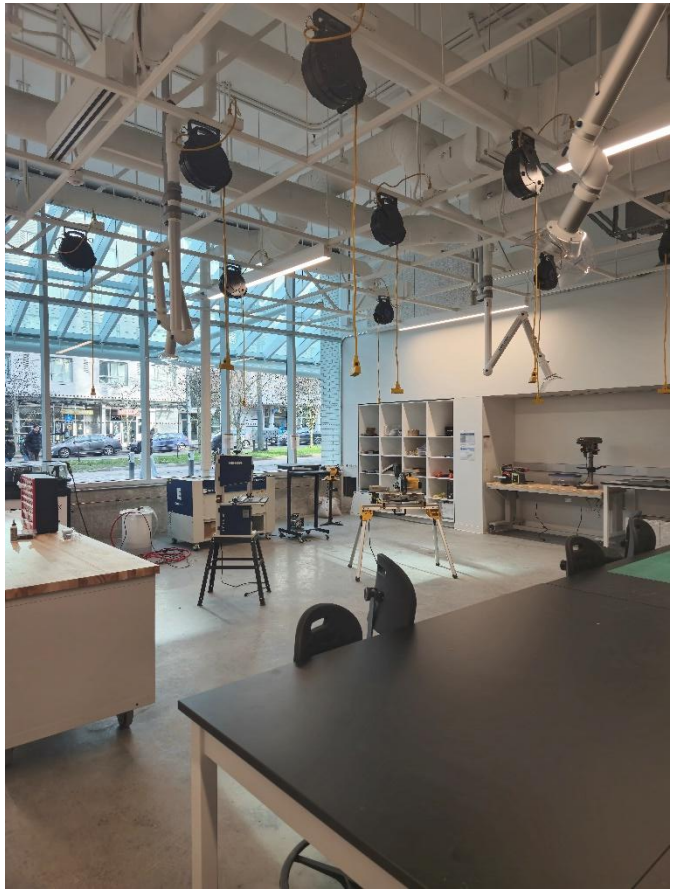
Makerspace Rooms



Rm 1009

- 3D Printing
- Electronics



Rm 1011

- Machining
- Power Tools

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General Makerspace Rules

- **Your teams must be supervised by a TA when using the space!**
- Only sealed water bottles in the makerspace (they must stay near the sink).
- We are equipped for working with wood, plastics, and soft metals. No hard metals (i.e. steel)!
- If you need to cut a material other than wood, please let a TA know so they can change the machine settings.
- Always follow your TA or instructor’s direction.
- Report all injuries (even small ones) to your TA or instructor.

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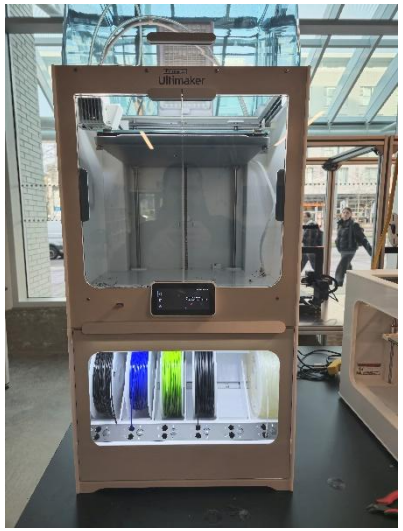
3D Printer Rules

- Do not change any machine settings or filament yourself, ask a TA / supervisor.
- Book all printer usage on the printer booking system (https://bookaspace.sbme.ubc.ca/Web/index.php?redirect=%2FWeb%2Fdashboard.php%3F).
- Monitor your prints for at least the first few layers for errors / failures.
- The Ultimaker and Resin Printer require pre-authorization to use.



Software: Cura can be used for almost all the printers (through pre-set profiles)

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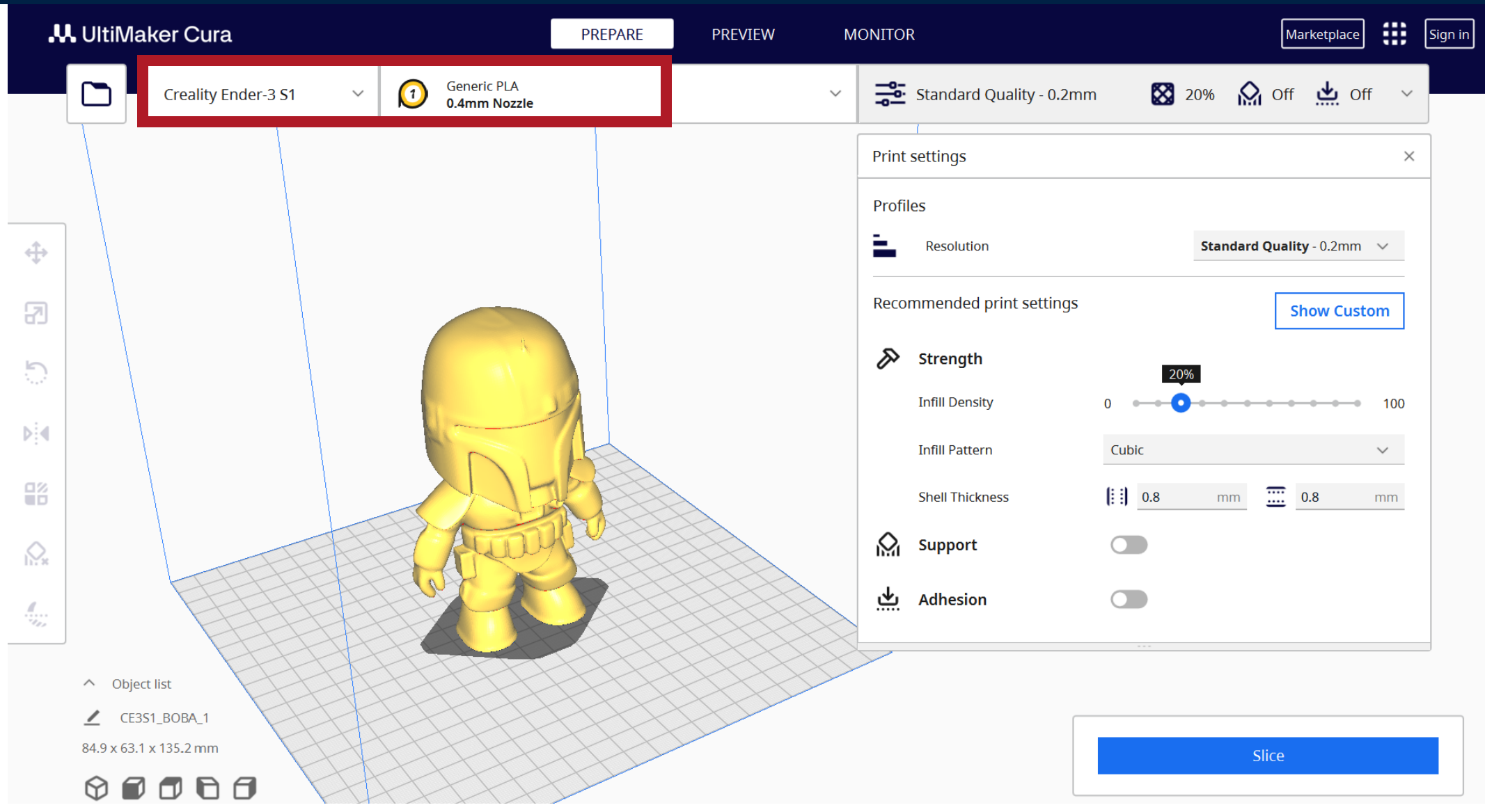
3D Print Setup

- Existing profiles can be chosen for the specific printer and material.



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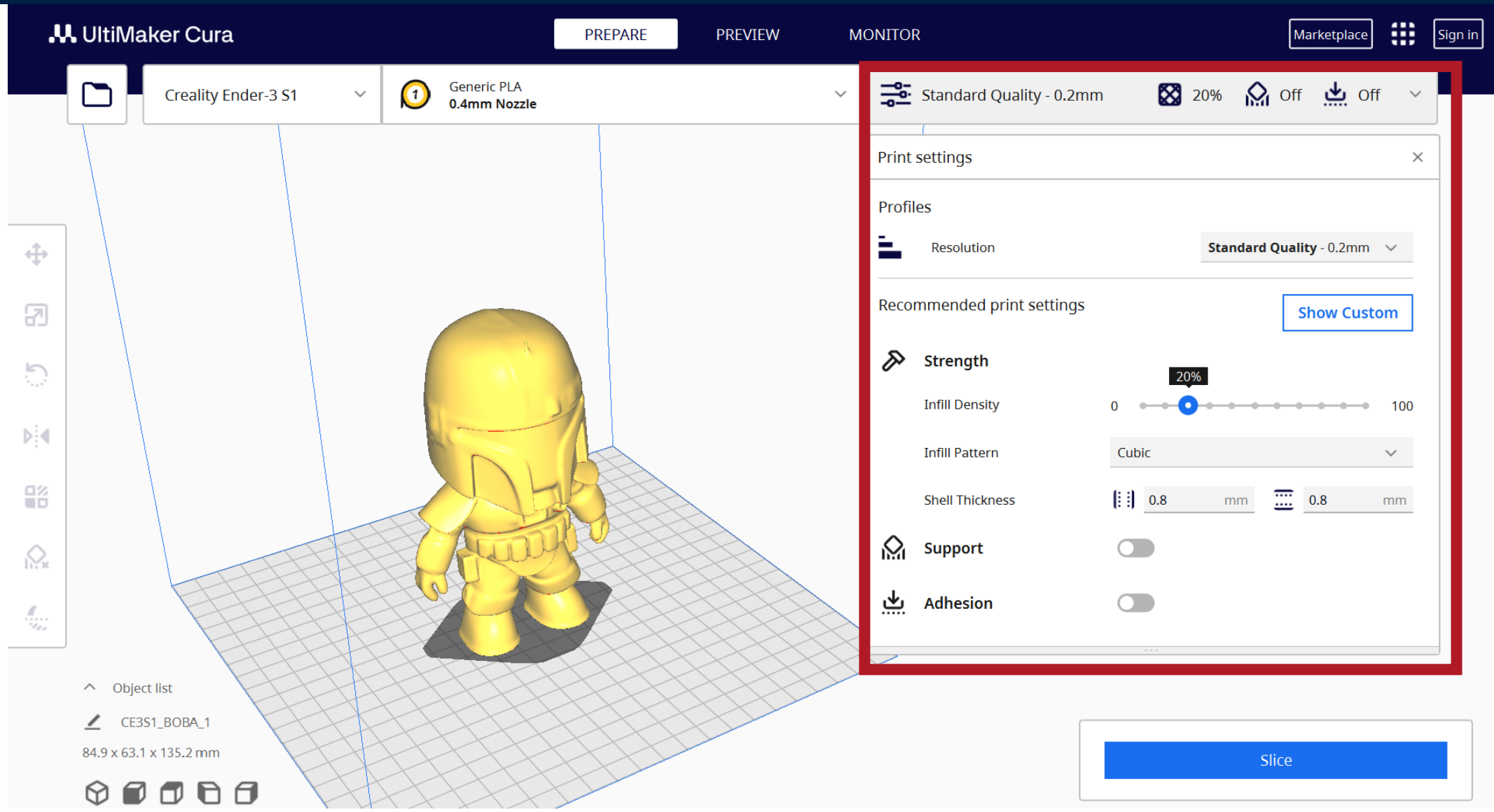
3D Print Setup

- Normally, default profiles can be used to determine things like resolution, layer height, speed, wall thickness, etc.



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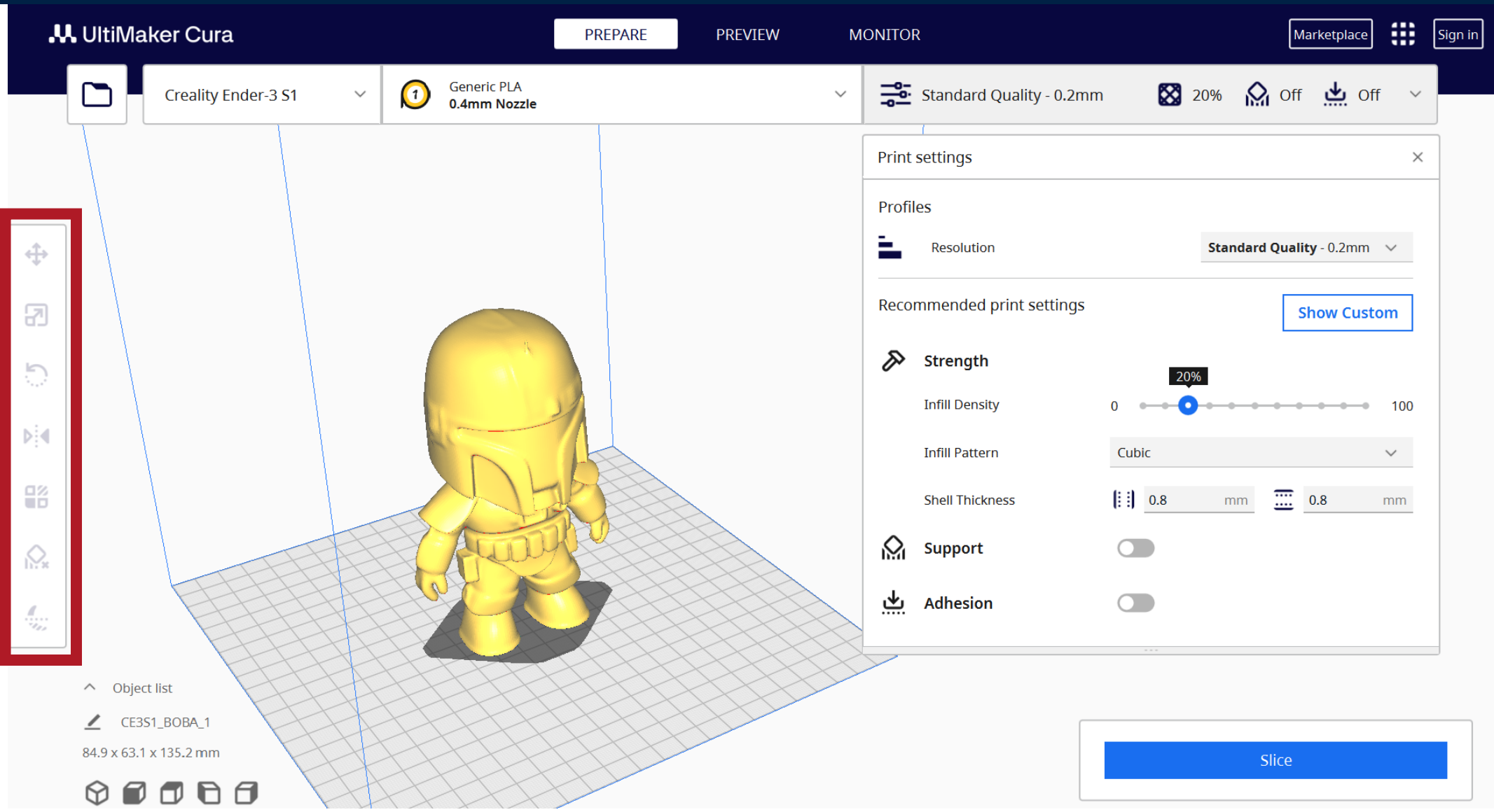
3D Print Setup

- Model settings (scale, orientation ,etc.) can be edited.



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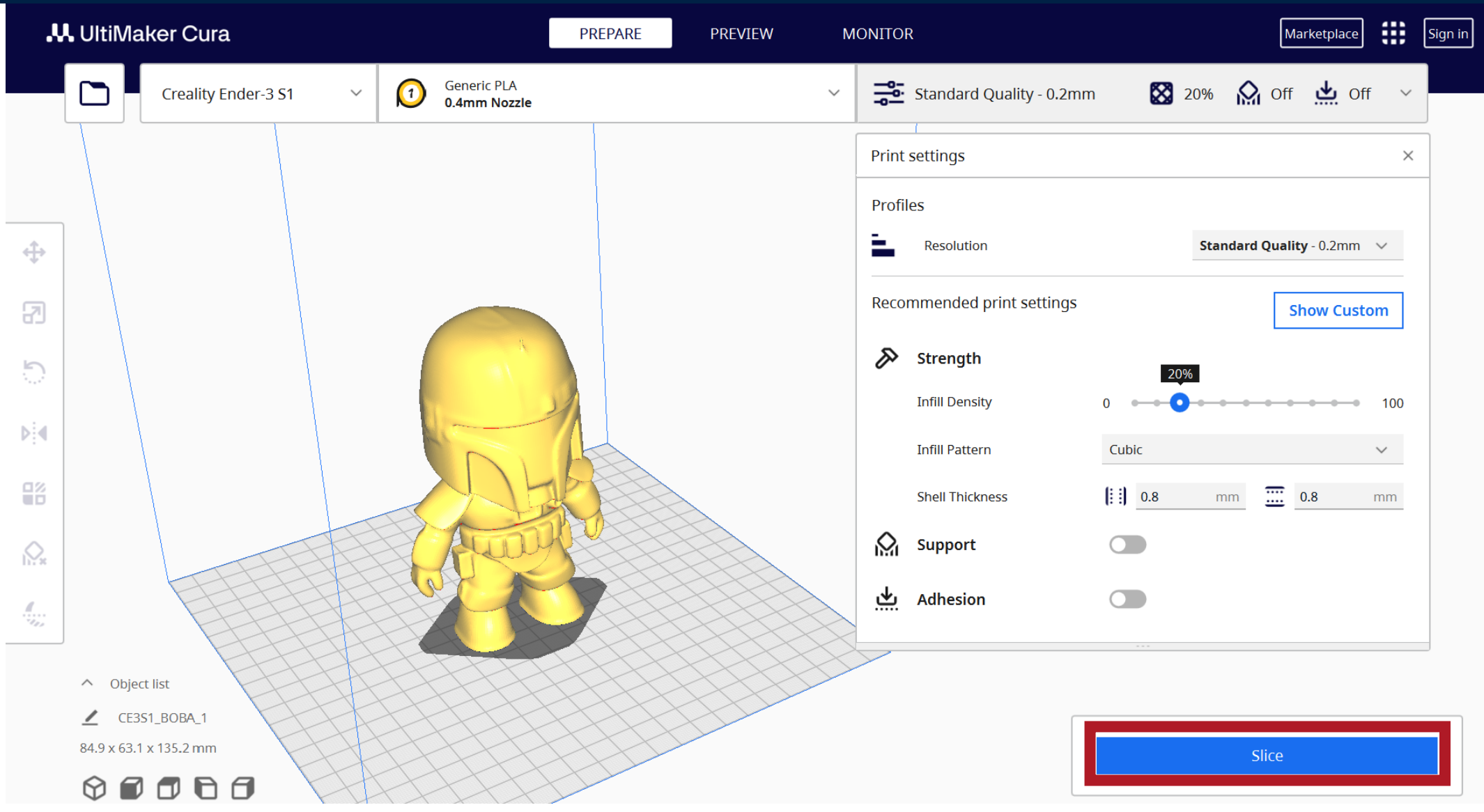
3D Print Setup

- To finalize print, select “Slice”.



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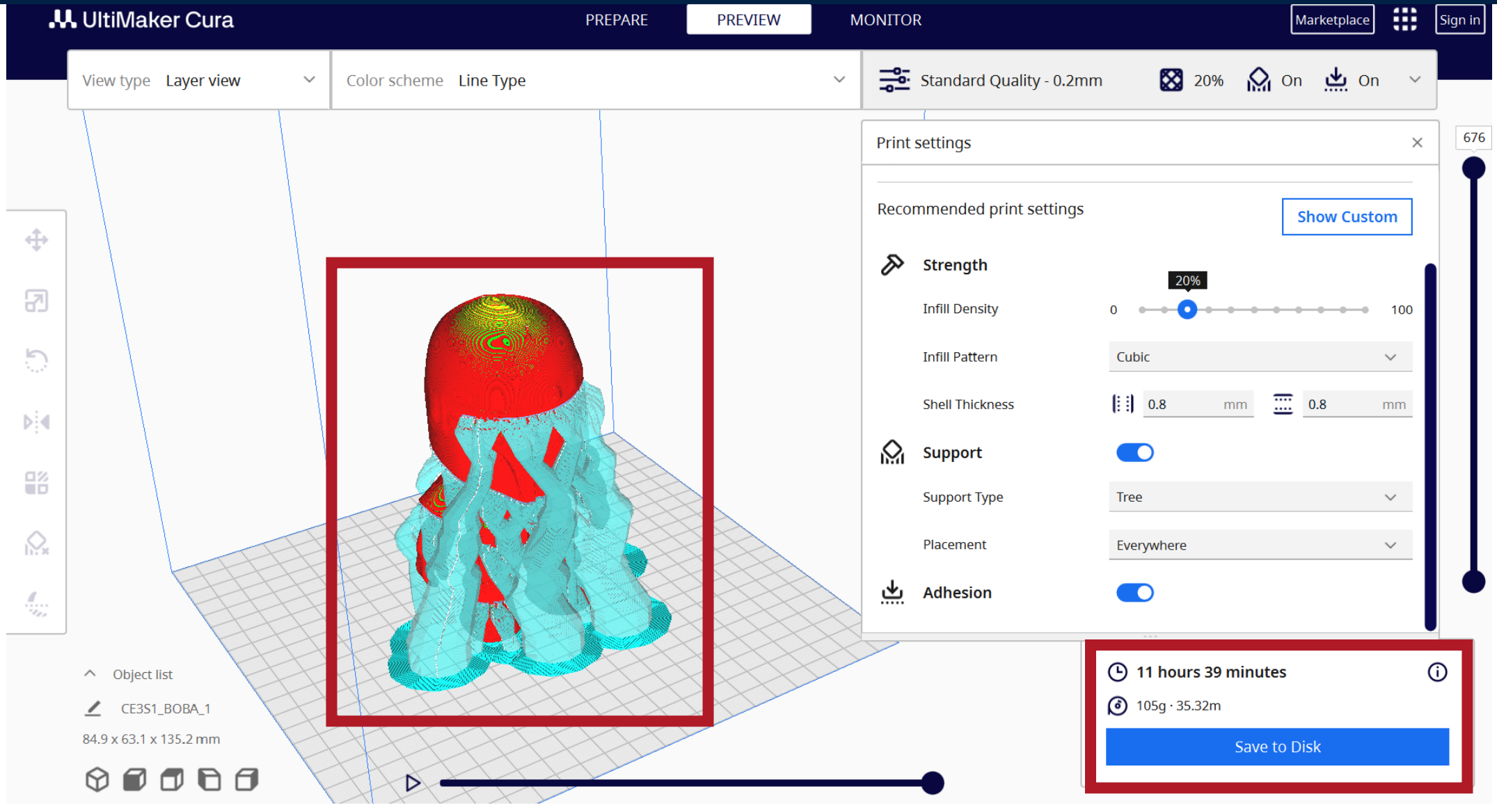
3D Print Setup

- Check print for an obvious errors and confirm print length and material usage.



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Workshop Safety Rules

- Safety guards must be in place at all times
- Never push a blade or sharp tool toward any part of your body.
- Do not use gloves with rotatory equipment.
- Do not work with small pieces on power machinery. Use hand tools instead.
- Always secure the work piece with clamps or a vise.
- Always wait for the tool to fully stop before reaching for your stock.
- Never remove metal chips, turnings, or shavings with your hands.
- No running or horseplay.
- If you are unsure of how to operate any equipment or doubts on whether you are using the right tool, ask the your TA or technician!

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PPE Guidelines

- Protective eyewear must be worn at all times in SBME 1011.
- Long hair must be tied back.
- No loose clothing, including scarves, ties, long necklaces, bracelets, rings, long sleeves, etc.
- Open-toed footwear is not permitted in the shop.
- Ear protection, gloves, masks, etc also provided.

Laser Cutting and Engraving

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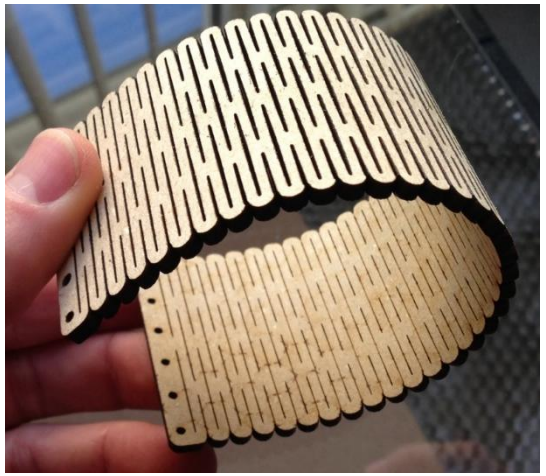
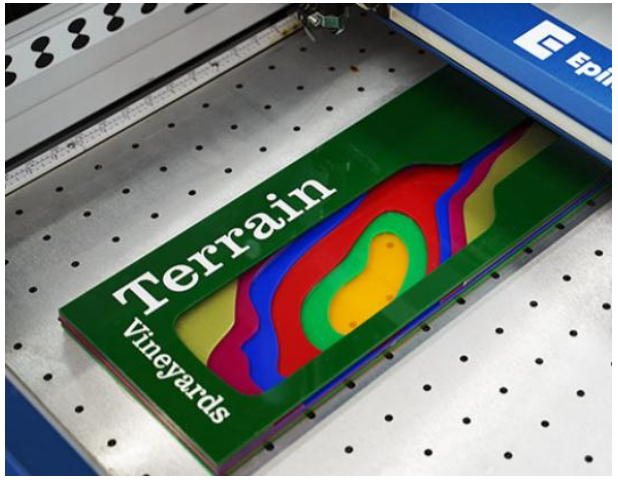
Laser Cutting Examples

Wood cutting and engraving for 3D structures


Textile and leather cutting and engraving



Acrylic cutting and engraving

Cork engraving

Aluminium engraving

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Epilog Fusion Pro 36 Laser Cutter

USES: used to cut, score, and engrave a variety of materials

MATERIALS:

- Cutting/Scoring: acrylic, delrin, fabric, fiberglass, wood, and more…
- Engraving: most plastics, anodized metals, glass, fabric, wood, and more...

REQUIREMENTS: Fume extractor and air pump must be switched on!

Epilog Fusion Pro 36 Laser 36”x24”

SOFTWARE: CorelDraw / InkScape and Epilog Job Suite

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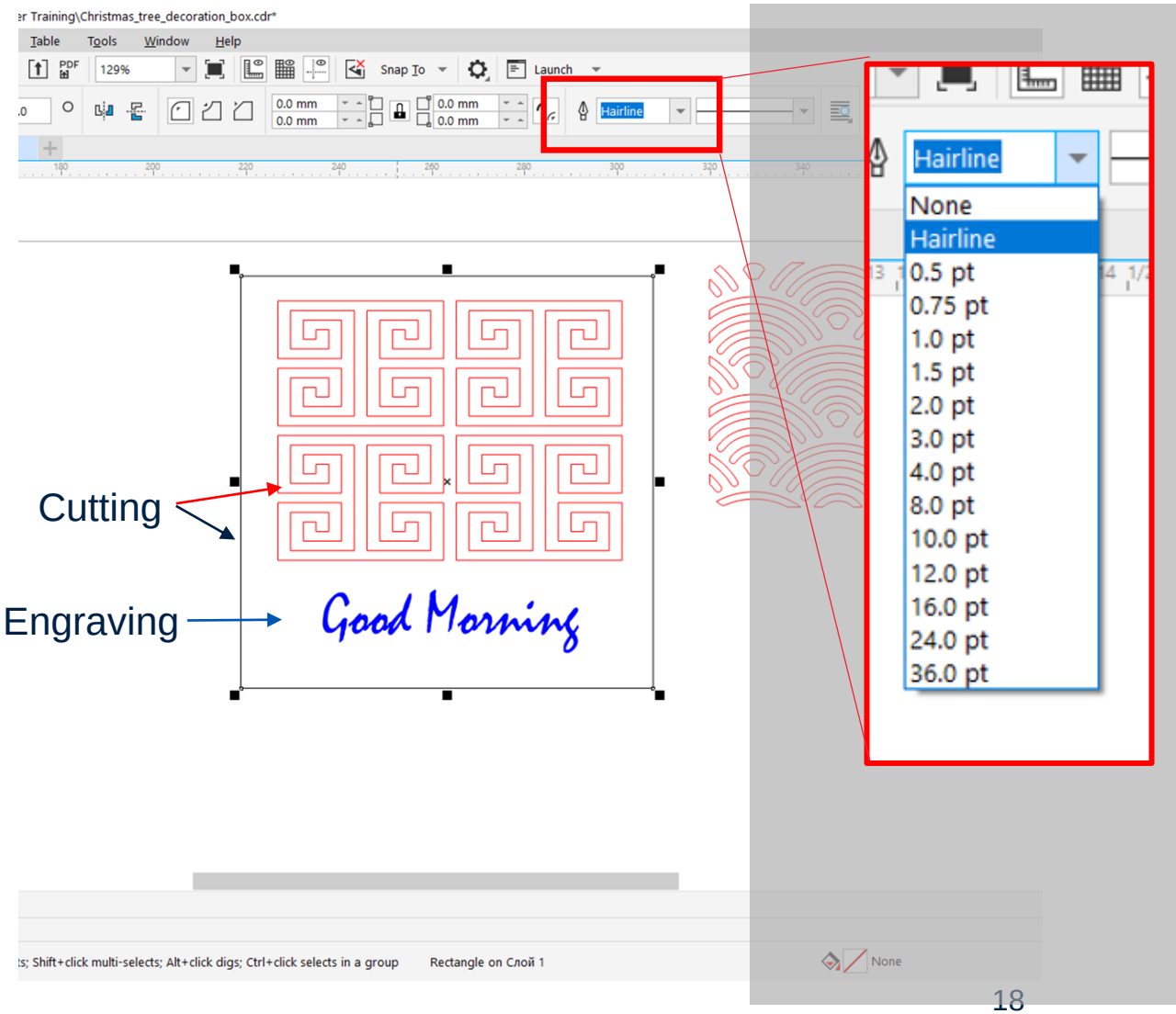
Principles of Laser Cutting

Action Defined by Element Line Thickness (L):

Cutting/Vector: L ≤ 0.1 pt (Hairline)

Engraving: L ≥ 0.1 pt



Principles of Laser Cutting

Soldering and Electronic Prototyping

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Soldering Station

What is soldering?

Soldering is the process of joining metallic surfaces together using a filler metal called solder. The solder acts as a metallic "glue" and allows electrical currents to flow across the joint surfaces.

Wire strippers are used to remove wire insulation before soldering.

Heat guns are used to heat shrink cable tubing which cover exposed soldering surfaces.

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Soldering Station

Do's

- Plug soldering iron to wall timer & set soldering time
- Turn on exhaust hood to extract soldering fumes
- Hold wires to be heated with tweezers or clamps
- Keep cleaning sponge wet during use
- Return soldering iron to its stand when not in use
- Turn soldering iron off and unplug when finished
- Vent soldering fumes.

Don't

- Never touch the soldering iron tip... 400°C!
- Never put down the soldering iron directly on workbench
- Don't melt plastic with the soldering tip
- Don't inhale flux fumes
- Don't expose heat gun to surrounding electrical components
- Don't store heat shrinks near heat gun
- Don’t use solder wire that is not from the Makerspace (we do not allow lead solder wire)

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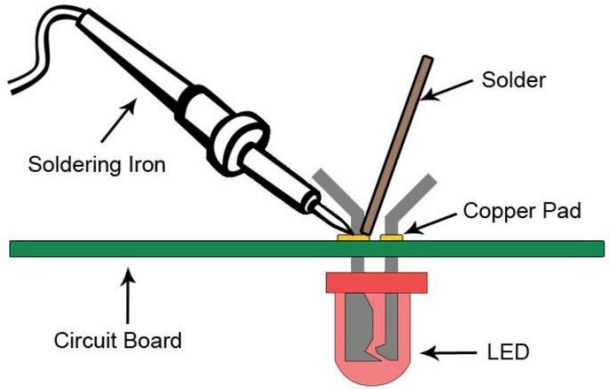
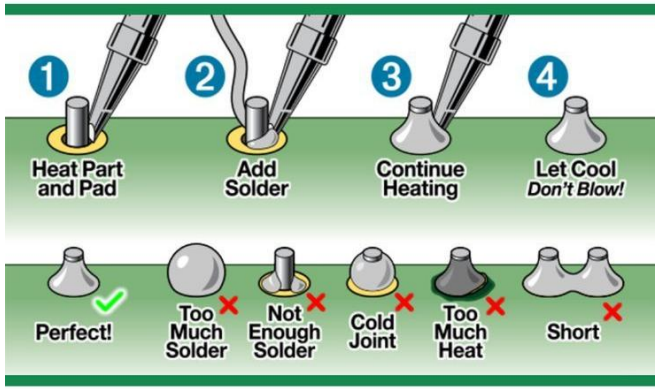
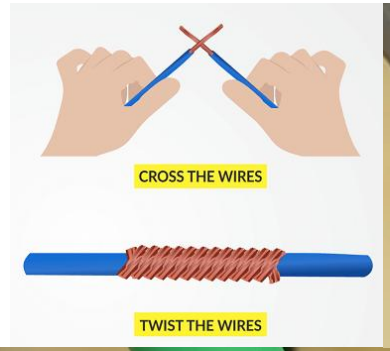
Soldering Station

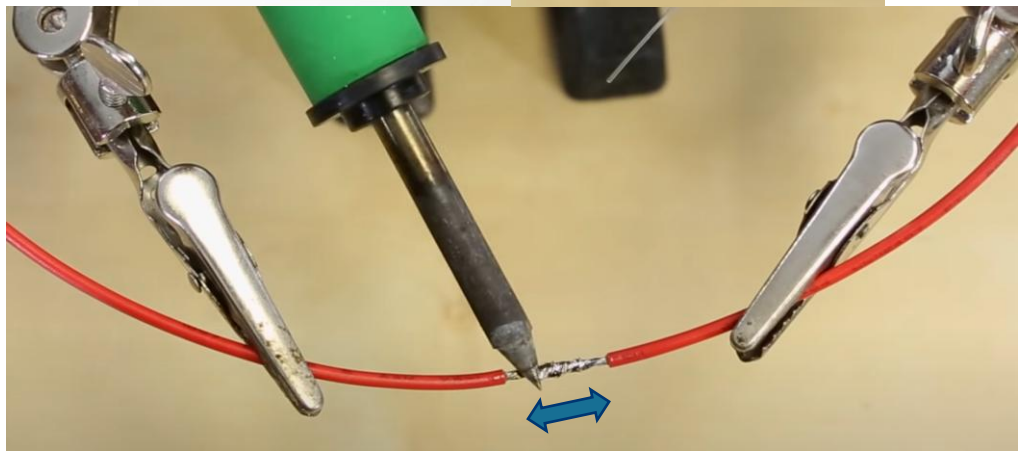
Breadboard Soldering





Component Soldering





Power Tools and Hand Tools

Anything that creates dust (sawdust, metal shavings, etc.) must be used in the SBME 1011 workshop space!

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Drill Press

USES: To bore controlled and straight holes into pieces at defined depths. Can be straight or at an angle (table tilt: -45° to 45°).

MATERIALS: Aluminum, wood, and plastic

- Working area: 9-½" x 9-½" (241 x 241 mm)
- Thickness: defined by drill bit specifications

REQUIREMENTS: Safety Glasses, No Gloves / Rings or Loose Jewelry / Clothing

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Drill Press

- When changing the drill bit, tighten the bit evenly into the chuck on all three sides as tight as possible with the chuck key.
- Double check that you've removed the chuck key. Before turning on, make sure that the workplace is clear and that there is no potential for things to get caught in the rotating parts.

- Clamp your workpiece to the table and use a sacrificial piece under it.
- Ease into the piece. Cut only as fast as the bit can on its own.
- For deep holes or dense materials, back out occasionally to remove waste and cool the bit.
- If the piece is seized by the bit or comes loose, press the stop button immediately.

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Ryobi Disc and Belt Sanding Station

USES: provide a smooth finish to your project

- Disc: outside curves
- Belt: rough sanding, surface leveling

MATERIALS: Wood and plastic

REQUIREMENTS: Safety Glasses, No Gloves / Rings or Loose Jewelry / Clothing, Dust Mask (dependent on volume / material)

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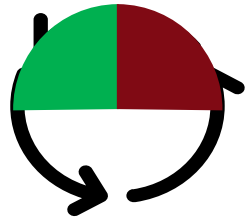
Ryobi Disc and Belt Sanding Station



- Sand on downward side of a disc sander
- Hold piece firmly against the table or edge
- Keep fingers away from the sanding belt and avoid awkward hand positions. Secure loose clothing, hair, etc.
- Avoid excessive pressure against the sandpaper
- Never reach over the disc, under the table, or behind the sander while it is running
- **Do not sand metal** or anything that has loose knots, splits, defects or foreign objects

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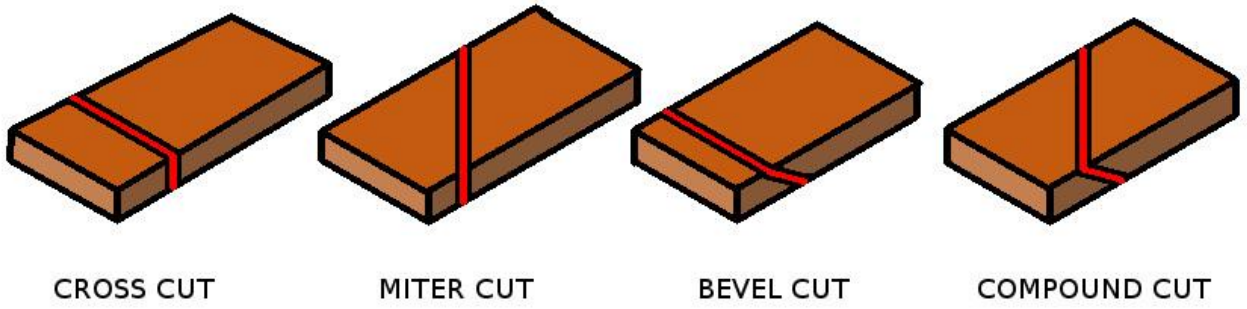
10" Dewalt Mitre Saw

USES: to perform cross cuts, bevel cuts, miter cuts, and compound cuts

MATERIALS: Wood, Plastics (special cases only! Please see Technician if you need plastic cut)

REQUIREMENTS: Safety Glasses, No Gloves / Rings or Loose Jewelry / Clothing



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10" Dewalt Mitre Saw

- Keep one hand on the trigger switch and one hand on your piece of stock, *outside of the cutting area (whenever possible, the workpiece should be clamped down)*.
- Only cut one work piece at a time.
- Do not force the saw. Cuts should be very easy and smooth.
- If performing angled cuts, make sure to lock the position before cutting.
- After the cut, release the trigger switch and wait for the blade to fully stop before lifting the blade back up.

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10" Rikon Bandsaw

USES: to cut curves, irregular shapes, or long straight cuts (ripping and resawing)

MATERIALS: Wood, plastic, and aluminum (< ¼ in)

- Height: 4-5/8" (101 mm)
- Width: 9-5/8" (228 mm)

REQUIREMENTS: Safety Glasses, No Gloves / Rings or Loose Jewelry / Clothing

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10" Rikon Bandsaw

- Raise the tension to an appropriate level.
- Lower your z-axis guard to be as close to the piece as possible (max. ¼ inch)
- When cutting close to the blade, use a push stick instead of your hands.
- Slow down when cutting curves on the bandsaw. Screeching sound indicates that the blade is under too much tension.
- After you complete your cut, loosen the tension

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Dremel 3000 Rotary Tool

USES: detailing, sculpting, shaping, smoothing, beveling, texturing, carving, and sanding

MATERIALS: metal, wood, marble, concrete, brick, porcelain, ceramics, hard epoxy, drywall, tile, and more.

REQUIREMENTS: Safety Glasses, Gloves (dependent on attached tool and material)

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Cordless Drill and Driver

USES: drilling and driving tasks.

MATERIALS: depends on the drill bit.
Mostly wood, plastic, plaster, soft metals.

REQUIREMENTS: Safety Glasses

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Tap and Die Kit

USES: to create threaded holes and threads.

MATERIALS: most metals (aluminium, brass, steel, cast iron, titanium, etc.)

REQUIREMENTS: PPE Guidelines and safety gloves. Use lubricant when necessary.

Taps

Die

Working with Sheet Metal

The only time we can use steel in the Makerspace!

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Working with Sheet Metal

Tips & Tricks

- Design for bending!
  - Quicker to waterjet and bend into a box than 3D printing

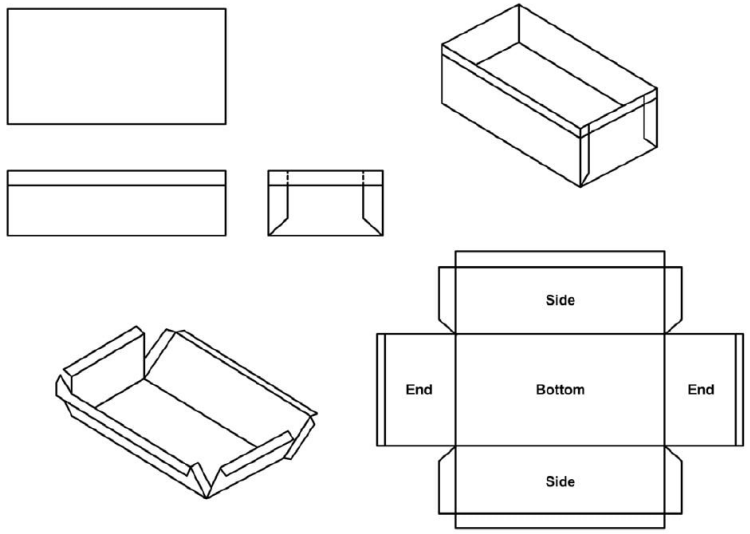


Figure 8-12 — Development of a rectangular box.

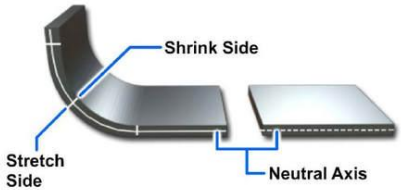


Figure 8-8 — Neutral axis.

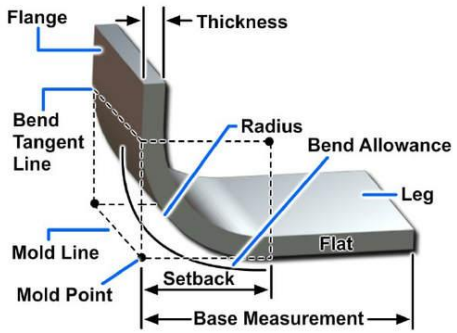
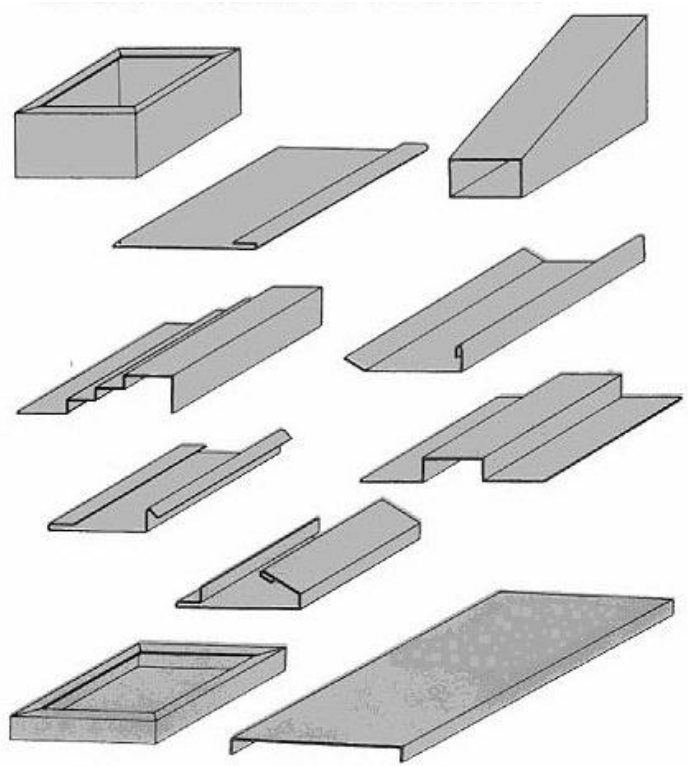


Figure 8-9 — Bend allowance terms.



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Prototyping with Sheet Metal

Cutting and bending to complex shapes

Waterjet cutting

Marble & Granite

Stainless Steel & Glass

Titanium

Stainless Steel

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Protomax Waterjet Cutter

USES: Low-volume sheet cutting system for prototyping. Cuts up to 1 in thick.

MATERIALS: Aluminum, mild steel, Delrin/Acetal, HDPE/PC, wood, and rubber

- Work Area: 12″ x 12″ (304 x 304 mm)

REQUIREMENTS: PPE Guidelines and safety gloves when handling metal

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Protomax Waterjet Cutter

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12" Grizzly Benchtop Shears

USES: Cutting large sheets of metals into smaller sizes

MATERIALS: mild sheet metal.

- 17-gauge mild steel at half width
- 20-gauge mild steel at full width
- Up to 12″ (304 mm) in width

REQUIREMENTS: PPE Guidelines and protective gloves

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12" Grizzly Pan and Finger Brake

USES: Bends sheets of metals at various angles

MATERIALS: mild sheet metal.

- 20-gauge mild steel up to 135°
- Up to 12″ (304 mm) in width

REQUIREMENTS: PPE Guidelines and protective gloves

Final Reminders

- Always clamp your equipment / material.
- Always wait for the power tool to completely stop before reaching for your stock.
- After use, *clean your space*:
  - Use the shop vac in the Makerspace to vacuum any sawdust
  - Place larger pieces of scrap material in the allocated bins
  - Place electronics waste in the electronics waste bin
  - Place any garbage in the waste bins in the Makerspace

If you ever are unsure about using any equipment in the space, please ask your TAs!
That's what they are there for! ☺

Makerspace Contacts

Kevin Gilmore, Makerspace Technician

Kevin.gilmore@ubc.ca

Makerspace Wiki: https://wiki.ubc.ca/Documentation:SBME-Teaching-Labs

Please feel free to email me if you have any questions about pretty much anything in the Makerspace, want equipment or material specs and details, or have any concerns with the space!

Other contacts:

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