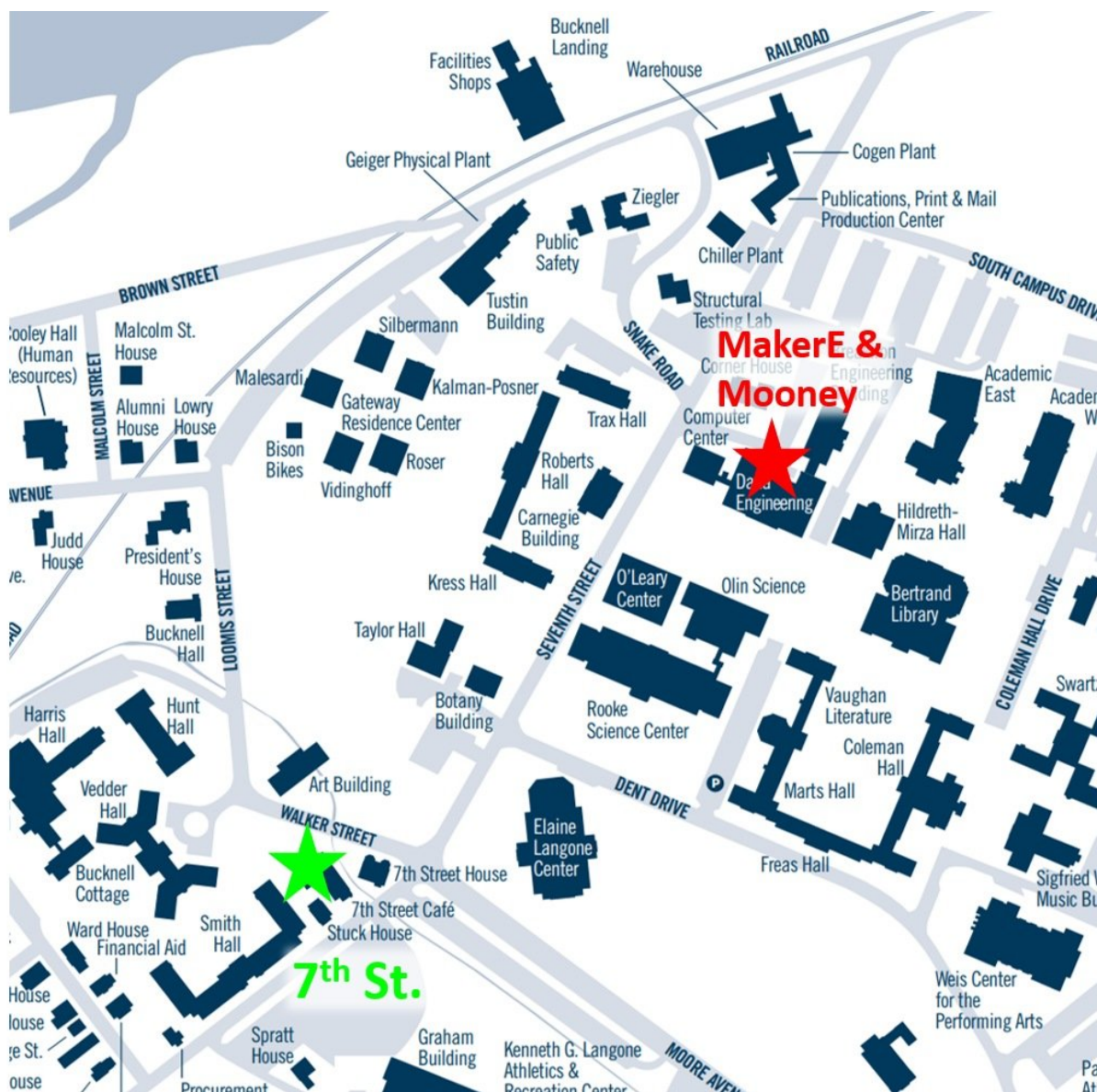**Bucknell**
UNIVERSITY

Getting Started with Thunder Laser - Keychain Project

This guide is a concise compendium of information for projects using the Thunder Laser.

Written By: Alan

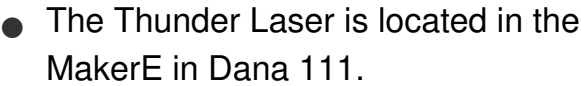This document was generated on 2022-02-02 05:24:09 AM (MST).

INTRODUCTION

This guide is a concise compendium of information for projects using the Thunder Laser. After completing this tutorial you will have learned how to use the Thunder Laser for simple project by making a key chain.

🔧 TOOLS:

- laser cutter (1)

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Step 1 — Location: MakerE

- The Thunder Laser is located in the MakerE in Dana 111.

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Step 2 — Safety Information

⚠ Any use of a laser cutter is potentially hazardous. Materials can catch on fire, disabling machine interlocks can potentially expose you to laser radiation capable of blinding you, and cutting the wrong materials can release toxic gasses.

● Before you start cutting know where the fire extinguisher is in case materials catch on fire.

● If you are unsure if a material is safe to cut, ask first. Many plastics contain chlorine or fluorine and materials like PVC, vinyl records, and Teflon are never safe to cut.

⚠ You must keep an eye on the laser cutter during any cuts in case there is a fire. Leaving the immediate area during a cut is a violation of the MakerE User Agreement and may result in penalties up to permanent expulsion from the space.

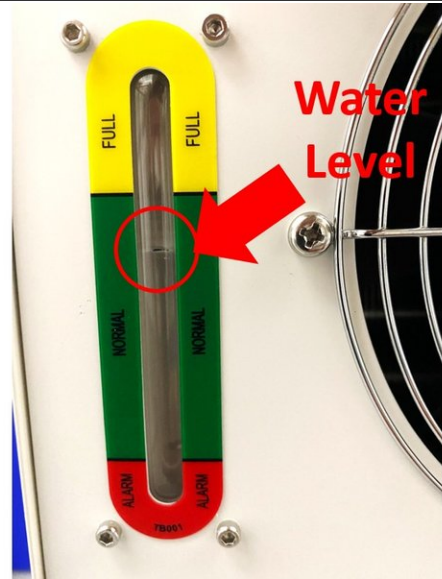This document was generated on 2022-02-02 05:24:09 AM (MST).

Step 3 — Materials for Laser Cutting
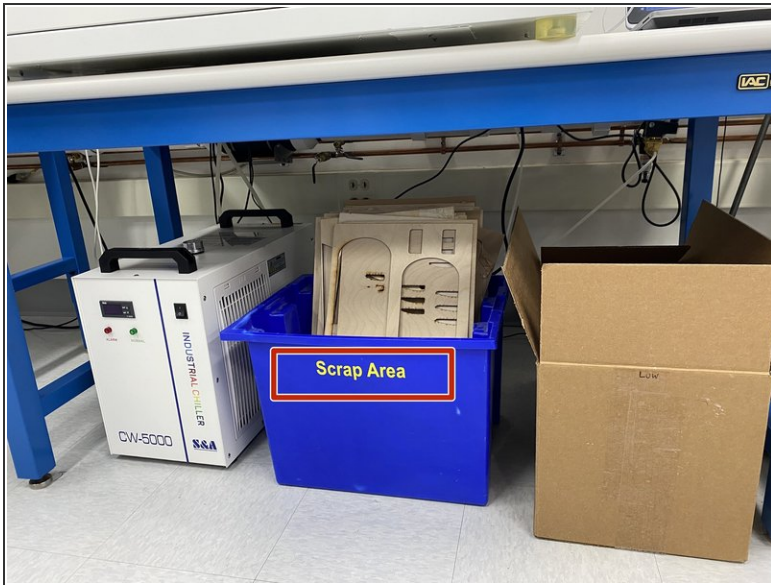
- Check the bin below the Thunder laser first to see if you can use has already used material. It is wasteful to always use fresh stock when working on a project. Whenever possible you should sort through the used stock in the blue bin underneath the plywood table.

- For this project you will need a piece of material with an area about 3" x 3" square.

- Grab a ruler and measure the remaining areas on scrap material to see if your project will fit on one or more pieces of scrap.

- If your work is too large to fit on scrap then feel free to use new stock located on the shelves near the laser cutter.

- If you are doing preliminary cuts or simply testing a design we recommend using cardboard rather than wood or acrylic. It is cheaper and faster.

⚠ Again, if you are not sure what is safe to cut, check with a MakerE Tech!

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Step 4 — Check the Cooler

- Every user should check the following before turning on the Thunder Laser:
  - Make sure the switch on the chiller unit below the laser is turned to the on (I) position.

📌 MakerE Techs: Every week check the back of the chiller to make sure the water level is in the green region. If it is not stop you will need to fill the chiller with distilled or RO water.

⚠️ Only after you have checked the switch and made sure it is on are you ready to turn on the laser cutter.

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## Step 5 — Turning on the machine and moving the head and bed

- Before you turn on the Thunder Laser make sure your access card is in the Portal Box and it is green.

  - Do NOT start the LightBurn software yet since it may throw an error if it cannot find the laser. You must turn the laser on before starting the software.

- Turn on the Thunder Laser using the Main Switch which is the upper of the two switches on the right side of the machine.

⚠ DO NOT turn on the lower, Laser, switch yet since that turns on the laser tube. For safety leave it in the off, O, position for now.
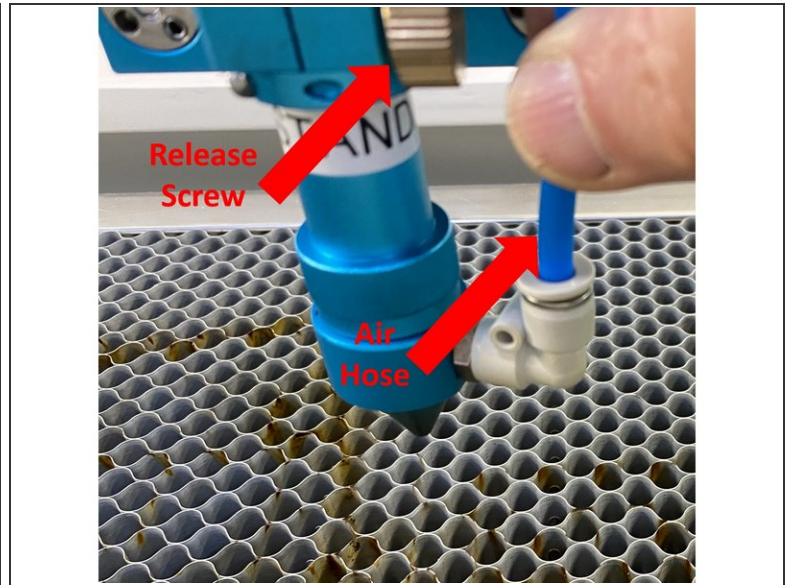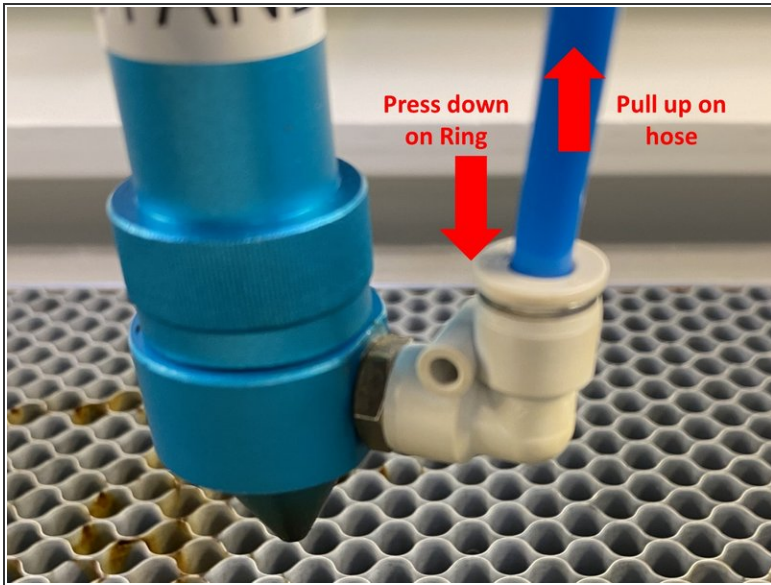
- Once the machine is on you can move the laser head by using the four arrow buttons shown. The two other arrow buttons move the bed up and down.

- Move the laser head to the back, left position and drop the bed so you can load your material without hitting the laser head.

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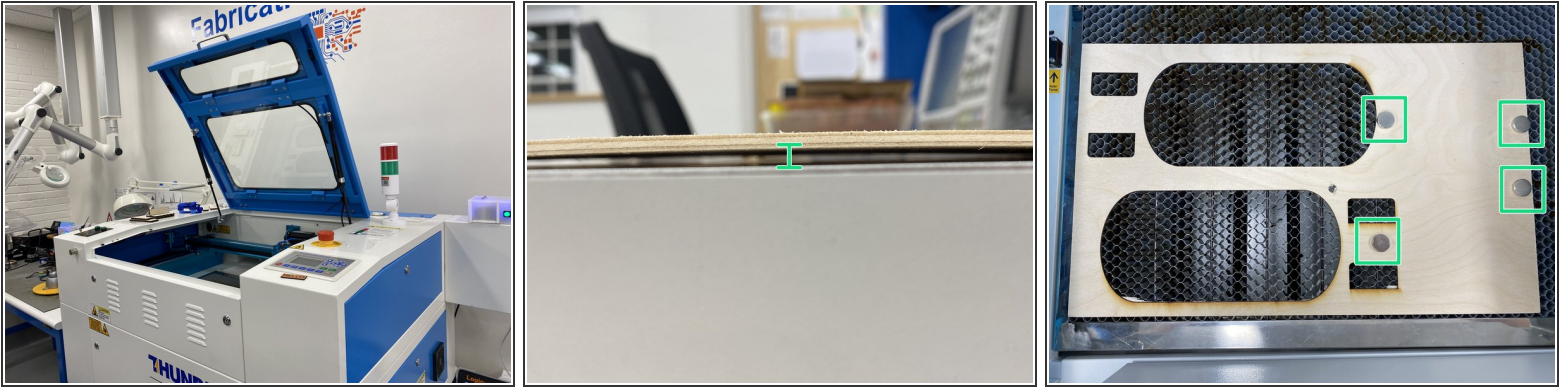
Step 6 — Check which head is on the machine.
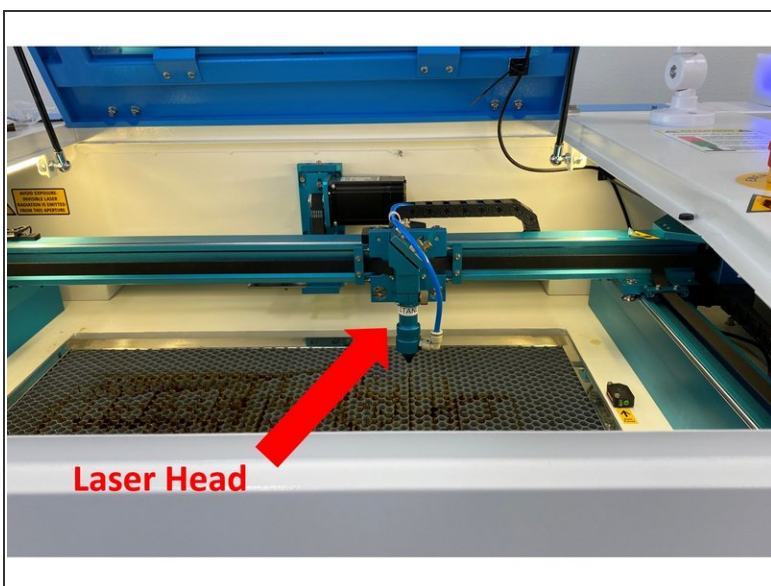
ⓘ Cutting settings are in the PDF document attached to this guide. Scroll to the bottom to access the file.

- Note that we have several different laser heads that will affect cutting power and speed so verify which head is currently on the laser before cutting. The spot size and focal lengths vary.

  - The **standard** head is for most cutting and has a laser spot size of 0.0039 inches or 0.1 mm and focal length of 5 to 6.5 mm.

  - The **4 inch** head is to cut materials over 10 mm thick and has a laser spot size of 0.008 inches or 0.2 mm and a focal length of 9 to 11 mm.

  - The high resolution head is for engraving photos up to 1000 lines per inch. It will only cut materials 1 mm thick or less, has a 0.002 inch or 0.05 mm focal spot with a 3-4 mm focal length.

- If the head on the machine works for your job skip ahead to step 7, otherwise change the head as described in the next step...

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Step 7 — Changing Air Nozzles (usually skipped)

- You will want to use the standard nozzle for almost all your cutting so if that nozzle is installed you can skip this step.

- To change the nozzle first remove the air hose by pushing down on the ring around the fitting and gently pulling up on the hose. It should release easily.

- Then loosen the brass release screw knob about half a turn once the air hose has been disconnected, and slowly lower the nozzle to pull it out. If the bed is too high you'll have to jump ahead in the tutorial to learn how to lower the bed.

- Put on the new head, making sure to reattach the air hose. It should just slip into the fitting.

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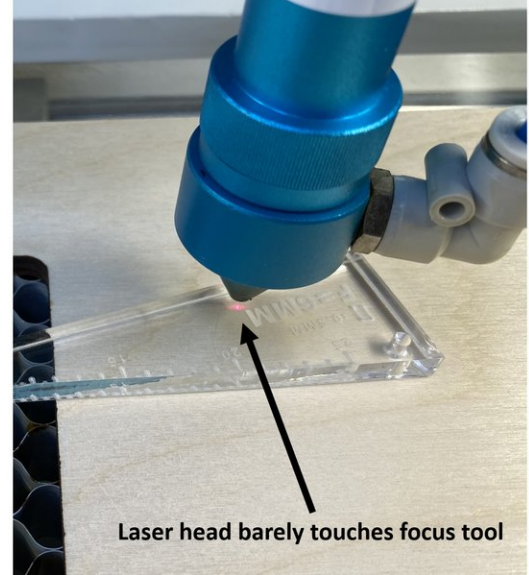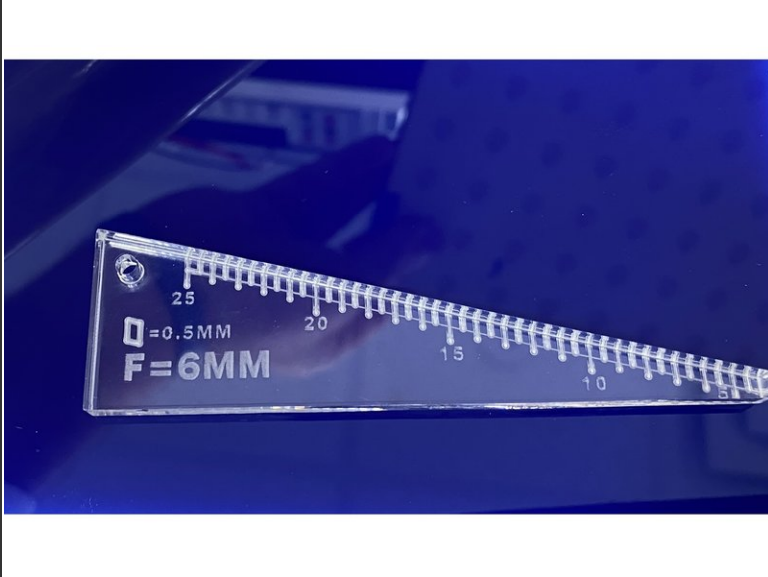© 2022　　　bucknellmakers.dozuki.com/　　　Page 9 of 28

Step 8 — Inserting Material

- If you have not done it yet, use the arrow keys or origin button to move the laser head to the back of the unit.

- Slide material in making sure not to bump the head

- Check to make sure your material is flat. The area of the laser focus where it will cut well depends on the nozzle you use, but is generally only a few mm. If your material is warped more than a few mm it may not etch well or cut all the way through.

- Use the magnets which will be somewhere on the case of the laser to hold the material flat if necessary.

⚠ If you use magnets make sure they are out of the path of the laser head!

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Step 9 — Setting the Laser Focus

Laser head barely touches focus tool

- Using the arrows on the control panel raise the bed so the top of your piece is about 6 mm below the tapered bottom of the laser head.

- Using the triangular focal tool (see image) try to slip it between the laser head and work piece. It should just barely slide in.

- If it is 'way off use the control panel buttons to adjust the height of the bed. If it is close then release the brass knurled knob on the laser head (see photo) slightly and move the head so it just touches the workpiece.

- This sets the focus properly - remove the focus tool and you are ready to go!

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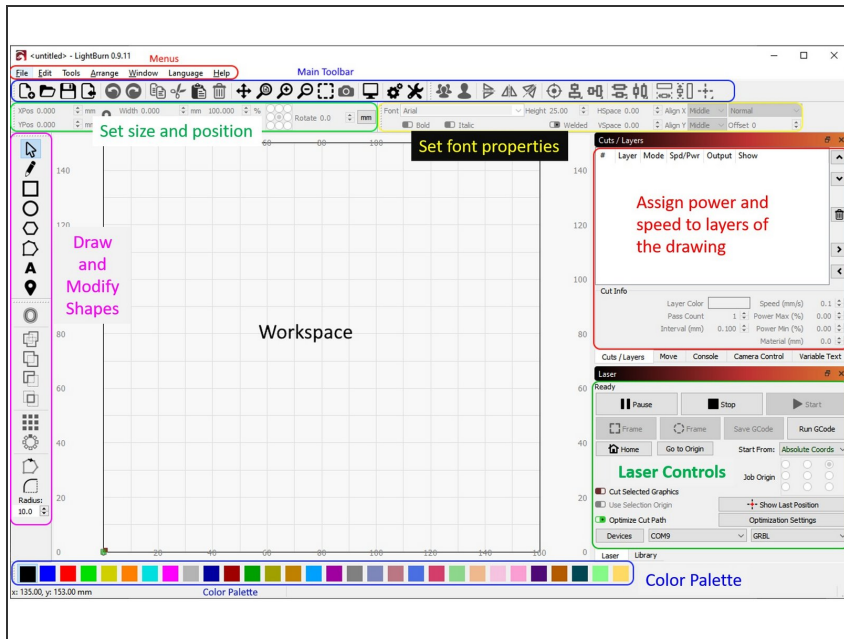
Step 10 — Start the LightBurn Software

- Begin by inserting an authorized makerspace card into the Portal box **BEFORE** launching the software.

- Login to the computer next to the laser cutter using the following credentials:
  - Login: makerquip
  - Password: BucknellMaker-3

- Open the LightBurn software from the computer desktop.

- For this tutorial we will create a Bison keychain fob. Click to download the Bison Keychain file.

- I chose to make this one out of leather, but you can choose whatever material you wish.

  ⚠ Note that the laser cutter can process vegetable tanned leather but not chrome-tanned (often colored) leather since it will release toxic chemicals!

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Step 11 — Overview of Lightburn Software

- The Lightburn software interface is somewhat intimidating since it supports a lot of features. The next few steps will walk you through the basic steps of cutting and engraving. For a more in-depth exploration see this tutorial.

- The image shows the various parts of the Lightburn software work area. To import then engrave or cut your project you will have to:

  - Import a .svg file for cuts and engraves, or an image file if you just want to engrave using the file menu.

  - Make any modifications to the file such as changing the size, adding text or shapes, etc. using the tools on the left of the screen.

  - Assign power and speed levels to the layers on the drawing (different colors correspond to different layers) that match with the material you are cutting or engraving. You may have to change colors using the color palette.

  - Put the layers to cut in the right order - this is important and not doing so can ruin your project.

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- Set cutting parameters such as airflow in the layers section on the upper right.

- Send the job to the ThunderLaser using the controls on the lower right.

## Step 12 — Importing the File into Lightburn
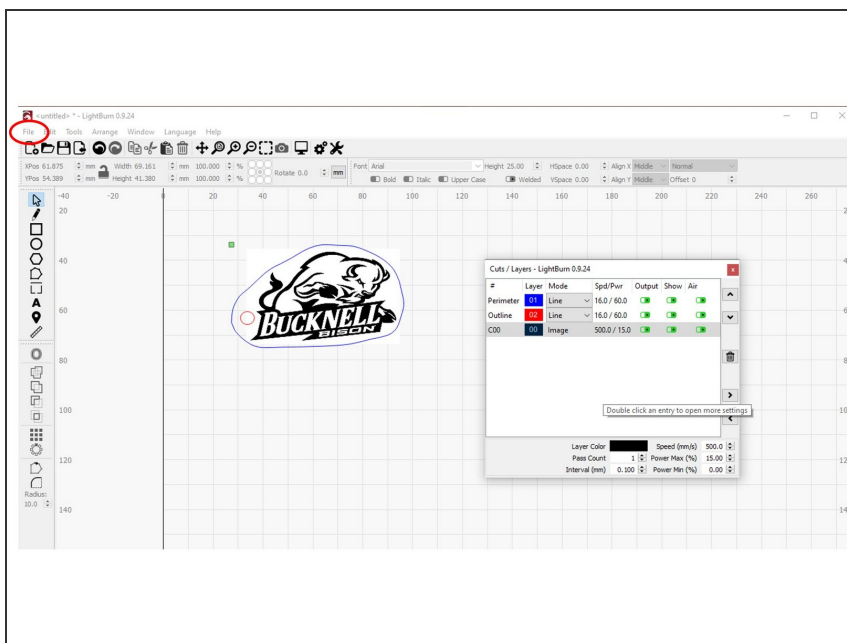
- Use the File → Import menu to load the keychain .svg file.

- If you would like to create a different design that is discussed in the next (optional) step.

- In the keychain file there are three different colors which tell the laser to use different speeds and powers.

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Step 13 — Optional - Using your own image
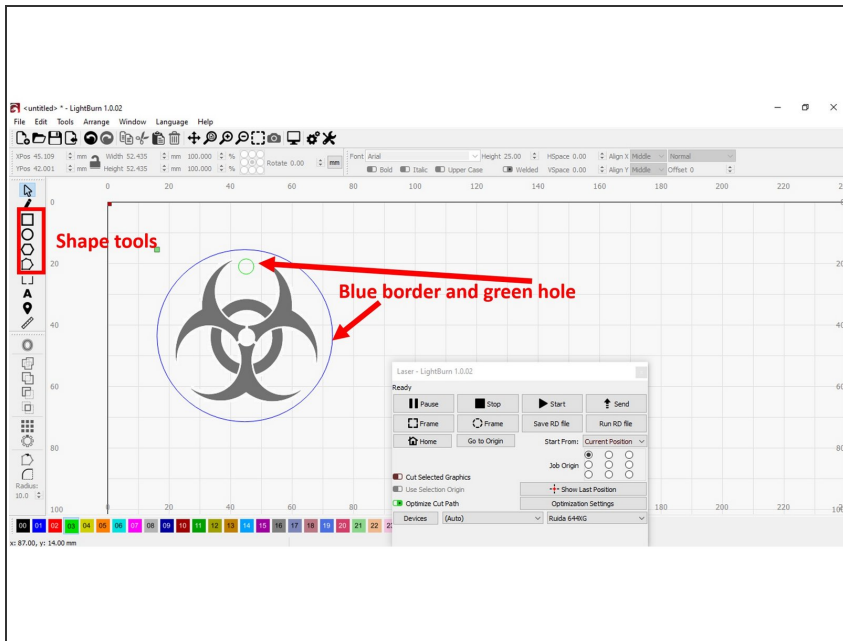
- If you would like to use your own image for the keychain then import the image into Lightburn. It should be high contrast black and white or greyscale, and sized to fit on the keychain you would like to make.

- Refer to steps 5-8 of the Glowforge tutorial for creating your own design in Inkscape or other software.

- After the image is loaded use the box or circle tool in LightBurn to make a border around the image. This will be the outer diameter which is cut by the laser.

- Make sure to leave room for a hole for the keychain to go through.

- Add a hole about 0.2 inches in diameter inside the border.

- Using the select tool, click the border then go to the color palette and click on a different color than the image, here it is blue. The border should turn this color.

- Do the same for the hole, using a third color that is different than the image or the border, in this case green.

Step 14 — About colors, cuts, and order
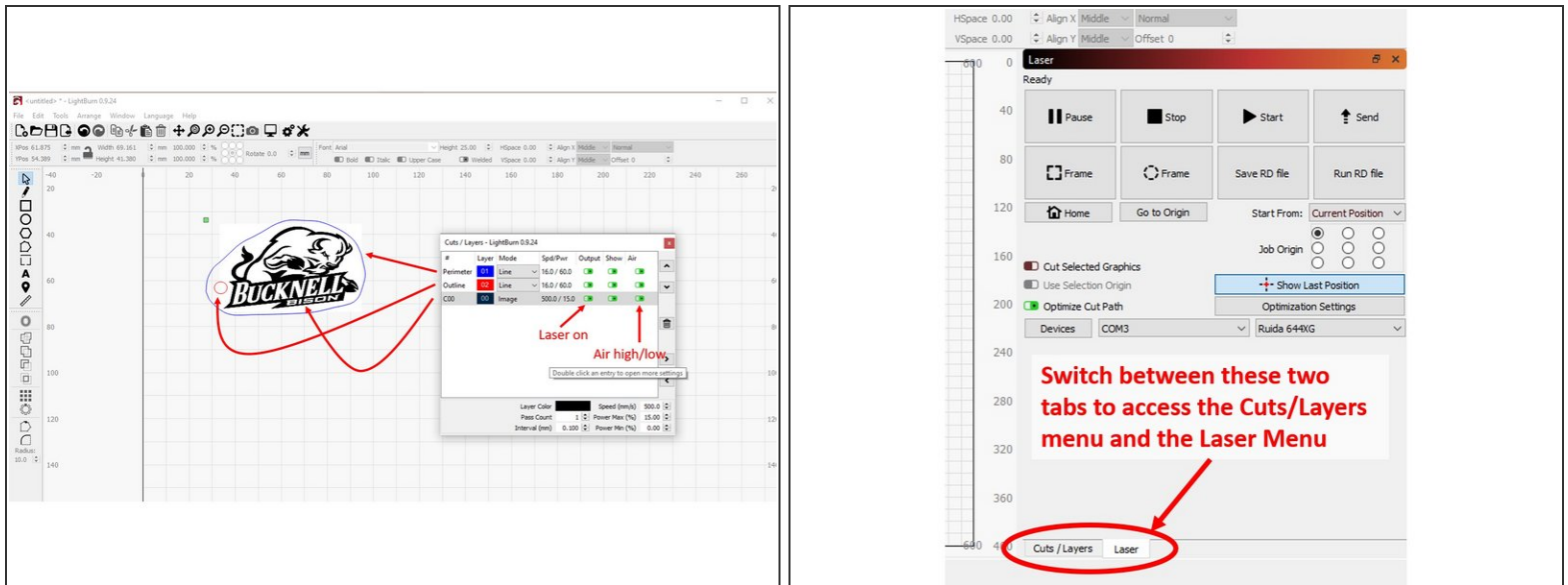
(i) Different laser powers and speed for example cutting and engraving are represented by different colors in the image.

- The order in which cuts happen is very important. For example if you cut out the outline of your project first, it is likely the air shooting out of the nozzle will move your part around, ruining any image.

- For this reason, make sure any frames or outlines of the drawing which if cut separate your work from the substrate material are different colors than the rest of the cuts.
  - In the image shown there are three layers (blue, black, and red) each with different laser parameters.

- If you need to set the colors after importing a file, you can use the select tool (arrow at the top of the left tool bar) to select part of your drawing then the color palette at the bottom to set the color.
  - If you cannot select just the outline, then you will have to go back and fix your file before you can cut.

(i) Depending on how the windows are set up in LightBurn you may be able to easily switch between the Layers menu and the Laser menu using the tabs as shown in the second image.

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Step 15 — Choosing cutting powers and speeds

THUNDER LASER USA

60-Watt Laser Parameters

CUTTING

Laser head: Standard Head (2")

Materials	Thickness (mm)	Speed (mm/s)	Max Power
MDF	2.3	15	90
Acrylic	2.7	14	90
Acrylic	5.0	9	90
Acrylic	10.0	3	90
Foam	17.0	6	90
Plywood	2.0	50	90
Plywood	4.5	15	90
Cardboard	6.5	30	90
Cloth	0.2	300	22
Leather	1.5	16	90
Rubber	4.0	4	90
Double Color Boards	1.5	20	90
Bamboo	7.0	6	90
Paper	0.1	200	20
Kraft paper	0.5	100	90
Plastics	/	/	90
Taekwondo Wood	8.0	6	90
Glass	/	/	/
Granite	/	/	/
Marble	/	/	/
Ceramic Cup	/	/	/
Rostone	/	/	/
Anodized Aluminum	/	/	/
Grip Tape	/	/	/

ENGRAVING

Laser head: Standard Head (2")

| Materials	Speed (mm/s)	Max Power	Interval (mm)
MDF	400	22	0.08
Acrylic	450	20	0.08
Bamboo	400	18	0.08
Plywood	400	20	0.08
Cardboard	400	16	0.08
Paper	500	15	0.08
Painted Aluminum	400	22	0.08
Cherry Wood	500	20	0.08
Anodized Aluminum	500	25	0.08
Plastic	500	25	0.08
Glass	500	36	0.08
Kraft paper	500	15	0.08
Leather	500	18	0.08
Cloth	500	18	0.08
Rubber	500	70	0.06
Metal	500	/	0.08
Double Color Boards	500	18	0.08
Granite	500	35	0.08
Marble	500	35	0.08
Ceramic Cup	500	35	0.08
Rostone	500	35	0.08
Grip Tape	500	22	0.08
Taekwondo Wood	500	20	0.08

- Doing a successful cut or engrave depends on setting the right cutting power and laser head speed.

- The linked PDF document has suggested power and speed settings for common materials for this particular laser cutter (Nova 24). You should open this now to make sure your settings are correct! [Download the speeds and settings guide.](#)

  - 📌 There are settings for engraving images and separate settings for cutting materials. Make sure you choose the right ones!

- ⓘ Materials are not ideal so these settings are good starting points but won't always work. Plywood or MDF particularly have a lot of variation between pieces. We recommend doing a small test cut or engrave and dialing in settings before starting a big project!

- ⚠ Not all materials can be processed on a laser cutter and some materials such as PVC plastic or chrome-tanned leather can release toxic and/or corrosive chemicals. If you are not sure about a material being safe ask before you cut!

- ⓘ Many plywood in MakerE is of 3mm that's not showing on the docs. Use Speed: 32 mm/s Power: 90%

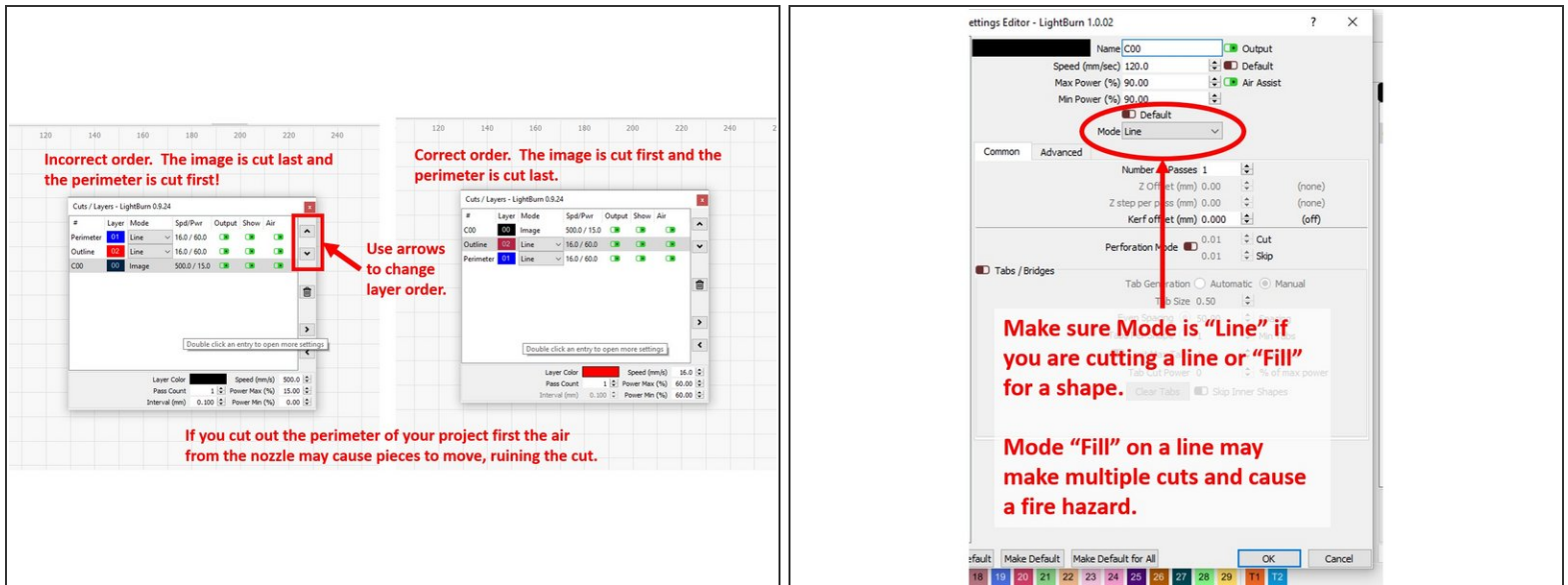This document was generated on 2022-02-02 05:24:09 AM (MST).

Step 16 — Set cut powers and speeds
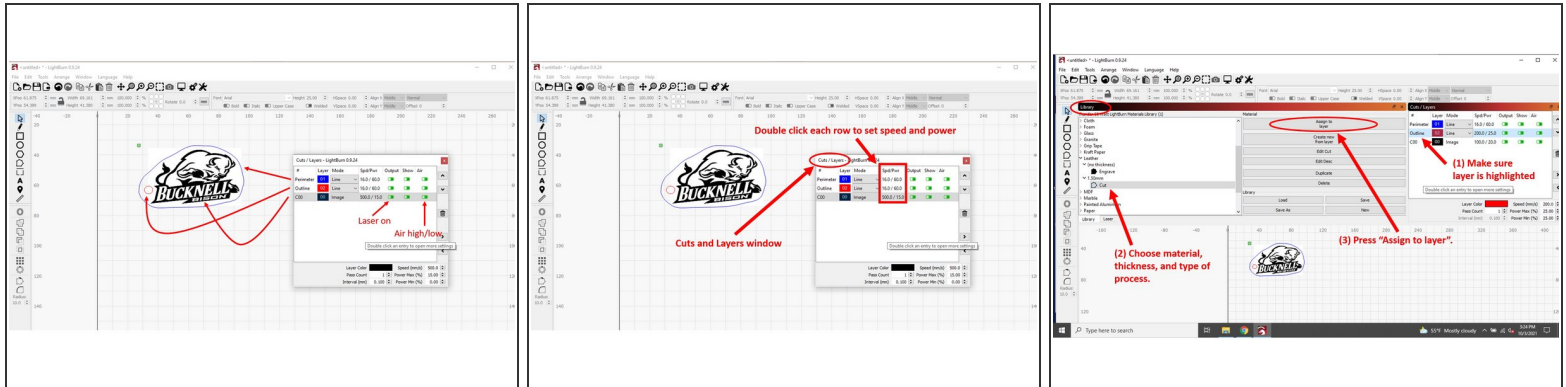
- Once you have your file in Lightburn and all the various parts that need different cut speeds and powers in different colors, the next step is to assign powers and speeds to each layer.

  - Each color corresponds to a different layer. Note you can also set whether the laser is on or off for a layer, or also the air setting (on = high, off = low).

- Find the Cuts/Layers menu window shown in the figure. If it is not visible then open the Windows menu at the top and make sure it is selected. If it is uncheck it then check it again and it should appear.

- In the menu window you will have one line for each of the layers (colors) in your figure. On the first figure there are three layers: blue, red, and black.

- There are two ways to set the power and speed for each layer.

  - The first, recommended way is to double click on each entry in the Cuts/Layers menu window and set the correct power and speed from the PDF guide. This is shown in the second image.

  - The second way is to assign a material from the Library window to each layer. Make sure the layer is highlighted then go to the Library window, find the material, and click "Assign to layer" as shown in the third image
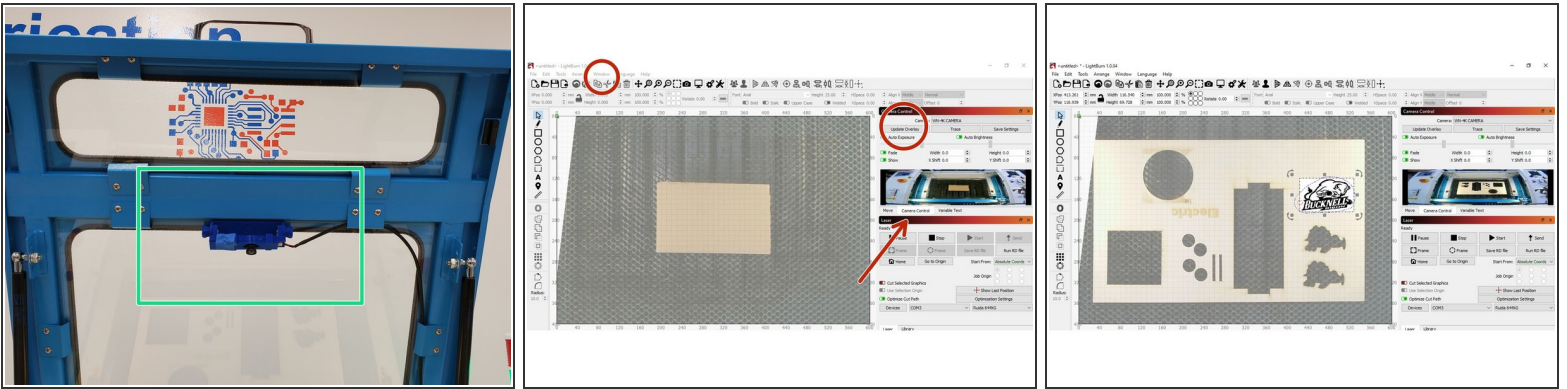
  - ⚠ Note that the powers and speeds in the library may not be correct so make sure you double check them with the Thunder Laser settings table!

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Step 17 — Set the order of cuts and engraves

- Before beginning your cut you will have to make sure the order of cuts and engraves is correct.

- The layer (color) at the top will be cut first, and the one on the bottom last.

- ⚠ Make sure any outlines that will disconnect the piece you are cutting out from the main body of your material are *last* in the cutting order.
  - Cutting the piece out first may cause it to move midway through cutting, ruining the project.
    - Small pieces may even be blown out of the path of the laser, potentially getting stuck and then hit by the laser head.

- Make sure that the Mode setting (see second image) matches what you want the laser to do. Cuts should be set to "Line" and engraves to "Fill".

- ⚠ If the line on your drawing is thick and the mode is set to fill, the laser may do multiple cuts, which creates a fire hazard!

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Step 18 — Use camera to verify placement

- The Thunder Laser is now equipped with a camera to help with the placement of your cut. This step is important to make sure your cut will actually fit on your material.

- ⚠ DO NOT physically move or adjust the camera. The camera is designed to be used only with the lid open. You usually won't have to recalibrate the camera every time you use it but if you move it you will have to.

- In the Windows drop-down, make sure that "Camera Control" is selected. It will appear on the left as a tab. You may need to exit whatever current window is open for the tab to appear. Select it, and you should see a live feed of the laser bed from the camera.

- With the Camera Control window up, verify that you can see your material in the live feed. Click the "Update Overlay" button to set the background of the workspace to a captured image from the laser bed.

- ⓘ If the overlay image seems excessively crooked or distorted, find the lab director or a tech to help you follow the built-in tutorial to recalibrate the camera.

- Select and drag your image to where you want it cut. You can scale and rotate as needed if necessary.

Step 19 — Fire up laser and upload file to laser
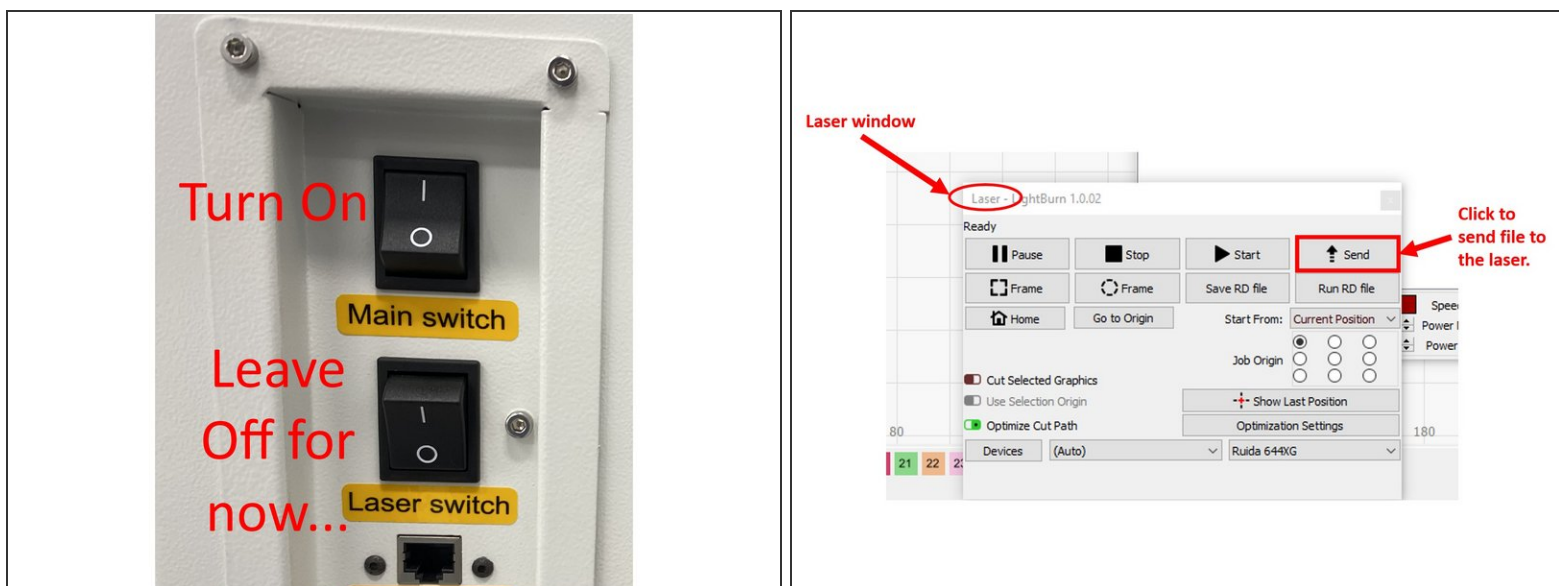
📌 **If you encounter a communication error, stop and make sure your Maker card is in the Portal box and you are authorized to use this laser cutter.** You must insert a makerspace card **BEFORE** launching the LightBurn software!

- Turn on the lower laser switch on the side of the Thunder Laser that you left turned off earlier. It now time to BURN!

- Using the Laser window (you may have to turn it on by clicking Window → Laser) upload the file as shown in the second image by clicking the Send button.
  - You should see a progress bar appear. If you are not authorized to use the laser cutter the file won't upload.

  - Make sure the file loads correctly and no error windows appear in Lightburn. An incorrect file upload can ruin your project.

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Step 20 — Optional - Setting Air Assist

- ⓘ For most cutting jobs this step is optional since the airflow will already be set correctly. If you need to set the air flow continue reading, if not skip to the next step.

- In some cases where you are cutting particular materials or engraving at high resolution, you may need to set the amount of air coming out of the laser head.

- Air flow is set by turning the knurled shafts at the bottom of the Air-assist Control on the left side of the laser as shown in the photo.
  - Turning the knob CW reduces the amount of airflow, turning it CCW increases the amount of air.

- You generally want to use high volume on the air assist for cutting, and low volume for engraving.

- Setting which air assist is used in the LightBurn software is covered in [this video](). Basically if you turn air assist off in software it uses the low pressure, turning it on in LightBurn uses high flow.
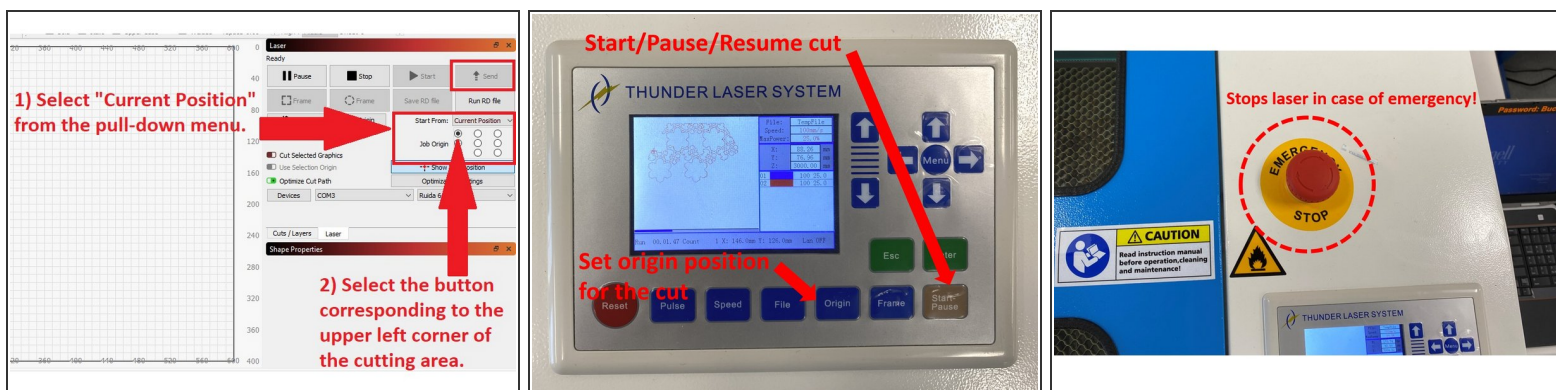
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Step 21 — Position the laser head for your material
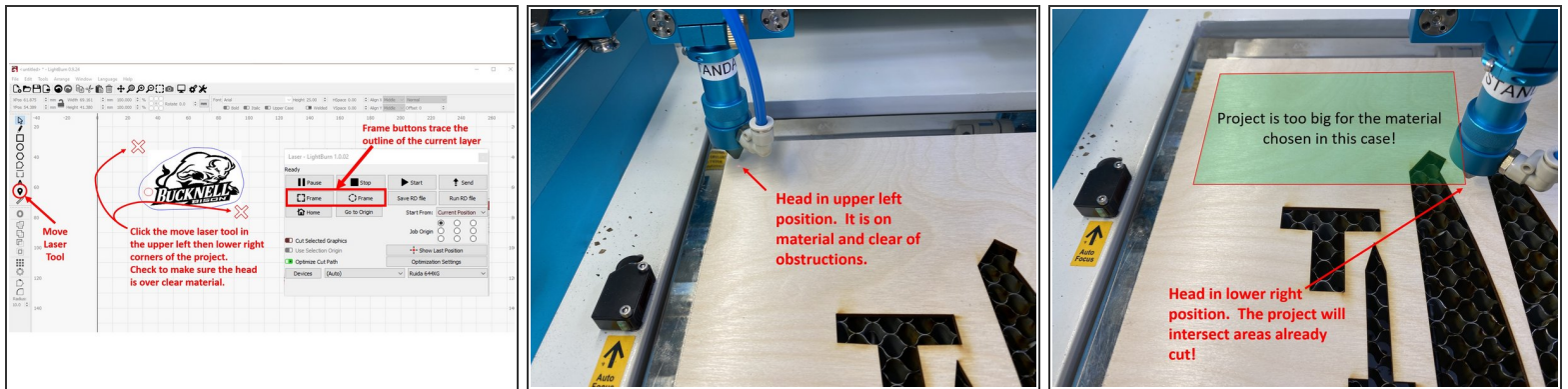
(i) This is a very important step which if not followed can ruin your project or waste material!

- You will want to set the position of the laser head so it starts at the upper left hand corner of the piece you are cutting. Go into the Lightburn window, select the click-to-position (Move Laser) tool and click on the upper left corner. It should be marked by a green box.
  - The laser head will move to this position. Make sure it is on your material and the head won't hit a magnet or other obstruction! This is shown in the second image.

- Now move the click-to-position tool to the lower right corner of your drawing and click again.
  - Again the laser head will move to this position and you will verify it is on the material and won't hit any obstructions. The third image shows a case where the project is too big for the material chosen.

- Finally in the laser window press the Frame button. The laser head should trace out the outline of the area of the selected layer. Make sure the design fits your material.

- IMPORTANT - Move the head back to the upper left corner of your drawing which will be the starting cutting position.

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Step 22 — Starting your cut

⚠️ The laser can catch materials on fire. Once you start your cut you must watch for fires and may not leave the area! Go to the bathroom now or get a snack before you move on!

- Call up the Laser menu. Again you may need to use Window → Laser to see it.

📌 Double check to make sure the laser head is in the upper left corner of the area you want to cut your material in.

- In the Laser window of LightBurn make sure the starting point is set to Current Position and the radio select button in the 3x3 grid is also in the upper left corner is selected.

  - These two settings tell the laser where to start cutting. You can cut on other parts of your material by changing them, but if they aren't right you can waste material.

  - **Important:** Set the origin on the laser: Go to the laser control panel and press "Origin" as shown in the second image which will tell the laser the current position of the head will be treated as the origin.

- When you are sure everything is ready and the lid is closed. **Hold Shift on the keyboard and simultaneously press the Send button and the laser should immediately start cutting**. If it does not, press the brown start button on the laser control panel.

⚠️ If there are any issues or flame, hit the emergency stop button!

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Step 23 — Optional - No Enough Extend Space error

- The "No enough extend space" error might show up, and that's because there's not enough space for the cutter to accelerate/deaccelerate.

- Try one or multiple of the following: 1. Move the image closer to the center. 2. Make the image larger. 3. Slow down the speed
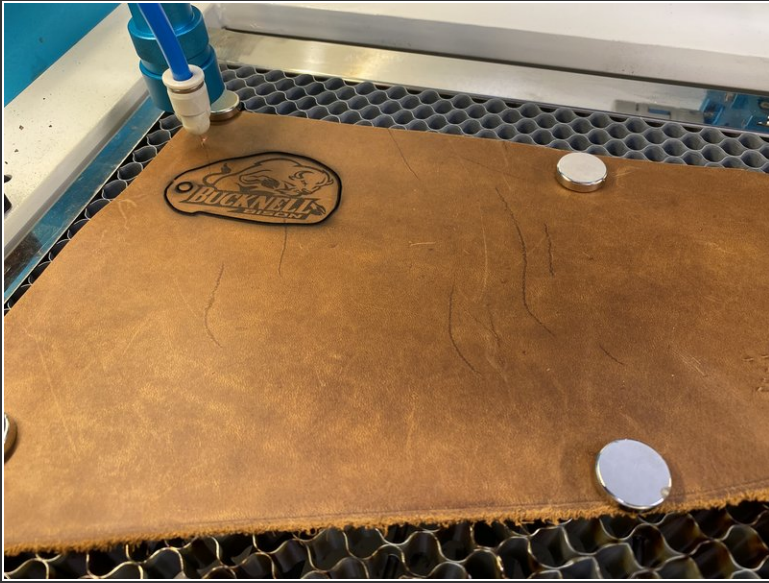
Step 24 — Removing the Design When Finished
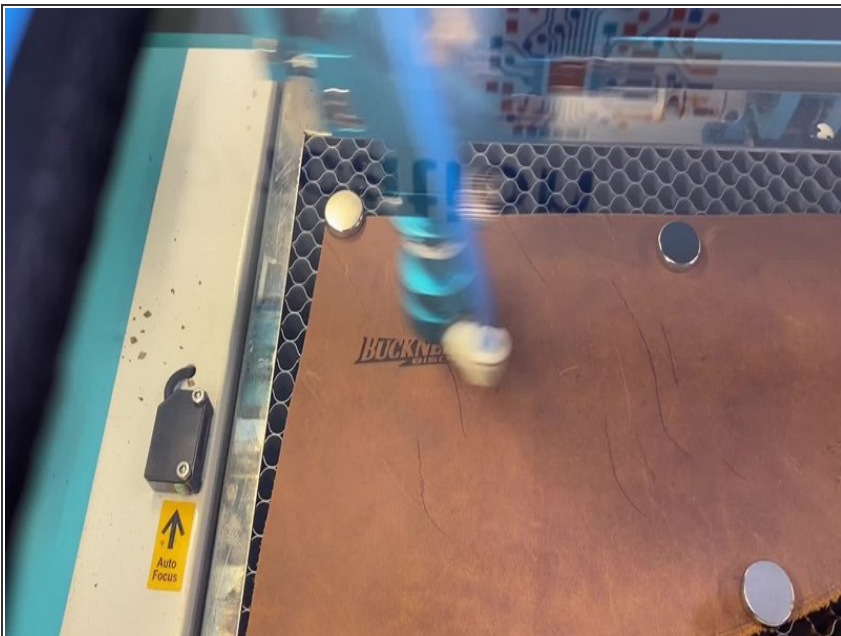
- The laser should do any engraving first followed by cuts if you got the layers set in the right order. The

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video shows the laser etching the surface of leather for the keychain project.

- After the cut is finished the laser head will move back to the set origin.

- Wait about one minute, for any smoke to clear, then lift the lid and remove the design, making sure not to hit the Laser head along the way. Use the control panel buttons to move the laser head or drop the bed if you need to. Be aware that if you're cutting, your design is no longer attached to the larger piece of material.

- Now that you're done cutting, you can turn off the Laser Switch then the Main Switch.

- (i) If you are working with wood, there is a good chance that as you move the design/material, you will see smoke. Do not worry too much about this.

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Step 25 — Cleaning Up

- When your design and the excess material has been removed, place the excess back to where the laser cutter material is, unless you are using your own custom material or there is no good space left on the sheet you used.

- Clean the bed of the cutter for other people to use in the future. Make sure any pieces of material that are stuck in the grid get pushed out to avoid a fire hazard!

- Close the lid of the cutter and double check to make sure it is turned off when you are done cleaning up.

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Step 26 — You are now certified!

- Congratulations! You have just cut out your first design on the Thunder laser cutter!

- Show your keychain fob to one of the MakerE Techs and ask them to certify you for using the ThunderLaser.

- See some of our other tutorials for more advanced cutting and engraving ideas.