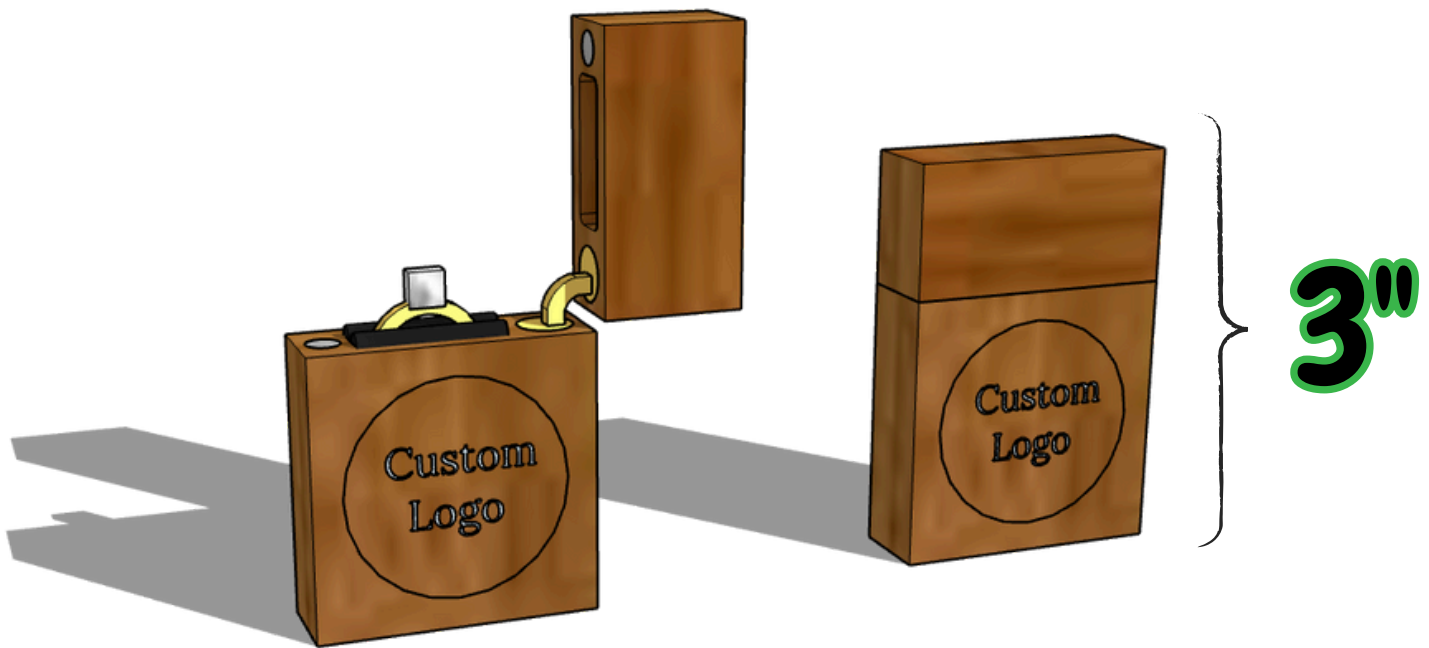# "Zippo Lighter" Ring Box



3"

## AquaVitae WOODWORKS
EST. 2021

# Desktop CNC Build Manual

*.SVG Files -Material Prep*
*Toolpath Guide - Assembly Instructions*

**Invented, Designed, and Produced**
**by AQUA VITAE WOODWORKS**

These files are a product of extensive effort, involving not only the creation of Instruction Manuals, but also the invention, design, and prototyping of physical products. My intention is to enable you to profit from the items you build. You are permitted to sell the physical products resulting from your work, but **distribution or sale of the included files and manual themselves is prohibited.**

# TABLE OF CONTENTS

# ABOUT THESE PLANS

*These comprehensive build plans, complete with downloadable SVG files, are tailor-made for **Desktop CNC Router Machines**. This package provides not only a list of required materials and cut lists, but step-by-step instructions on toolpath assignment, and clear assembly guidelines.*

*For a more in-depth understanding of the building process, and to see other projects I've designed, I encourage you to visit my YouTube Channel. There, you'll find a collection of tutorial build videos covering most of the CNC projects for which I offer plans. Even if this specific project isn't listed, these videos utilize the same techniques, ensuring a smooth and successful build.*
*Happy Building!*

### Aqua Vitae Woodworks

**You Tube**

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# CORRISPONDING SVG FILES:

**(with full purchase of plans)**

**🛒 BUY NOW**

*Required to build Project*

1. *Jig - 1 Inch Stock - 12 x 7.5*
2. *Main Body - .75 Inch Stock - 6.75 x 2*
3. *Hardware Carve- 2.625 Inch Stock - 6.25 x 3.25*

⚠️ *The provided SVG files must be imported into your your CNC/CAD program, NOT A WEB BROWSER. I often get questions about this. If all you see is a bunch of numbers, then this is most likely the error.*

*Below, you'll find a list of all the parts and materials you'll need to bring this project to life. Additionally, please keep in mind that certain standard workshop essentials, such as sandpaper, double-sided tape, and glue, are often required for my projects. **These plans also assume you have a set of common woodworking tools readily available**, including a planer, router, and saws.*

# CNC ROUTER BITS:

- **_1/32" Downcut Bit:_** *Exceptional for extremely fine details and delicate work, ensuring high precision in very small features and patterns. Extremely tiny...be gentle!*

- **_1/16" Downcut Bit:_** *Excellent for fine details and intricate work, ensuring precision in small features and patterns, just bigger than the 1/32" bit*

- **_1/8" Downcut Bit:_** *Ideal for semi-fine details, drilling, and tight corners, providing precision for intricate designs.*

- **_1/4" Downcut Bit:_** *Perfect for larger cuts, contours, an  pockets.*

*I used these in my Youtube Tutorial but you may not need them depending on what Custom Logo you choose to carve.*

*For affiliate links to the precise tools and materials required for this project, please refer to the description section of the corresponding YouTube video.*
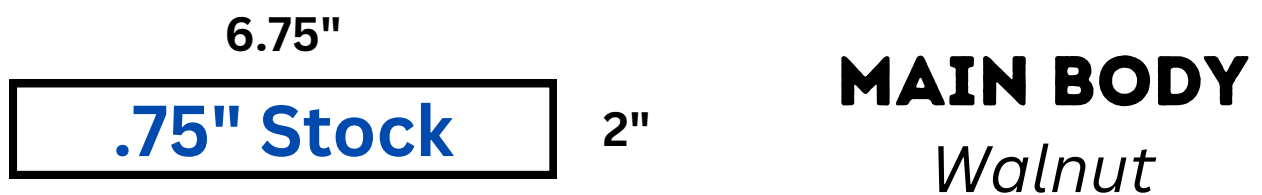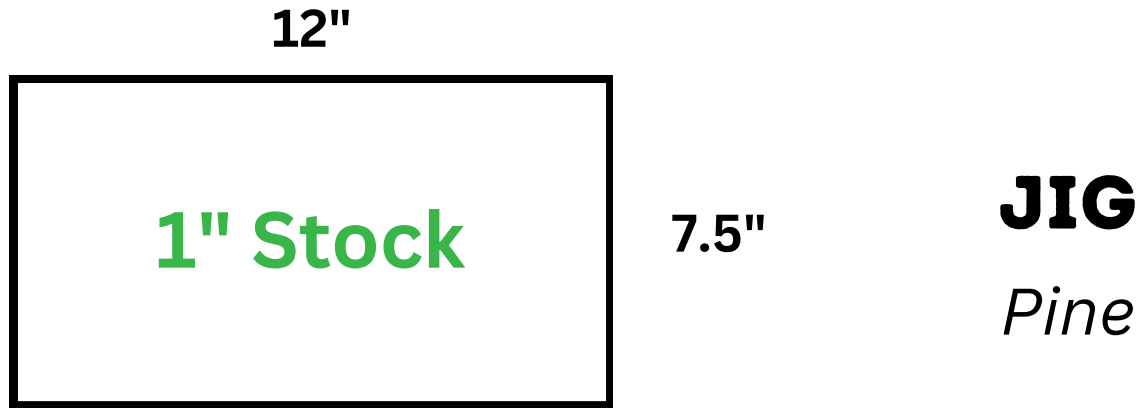
# HARDWARE/MATERIALS:

- *Barrel Hinges*
- *6mm x 2m Round Magnets*
- *Felt Sheet*

- *Epoxy Resin*
- *Color Pigment (for epoxy)*
- *Sewing Needle and Thread*

**4**

# CNC MATERIAL PREP

*Mill material to the dimensions listed below.*
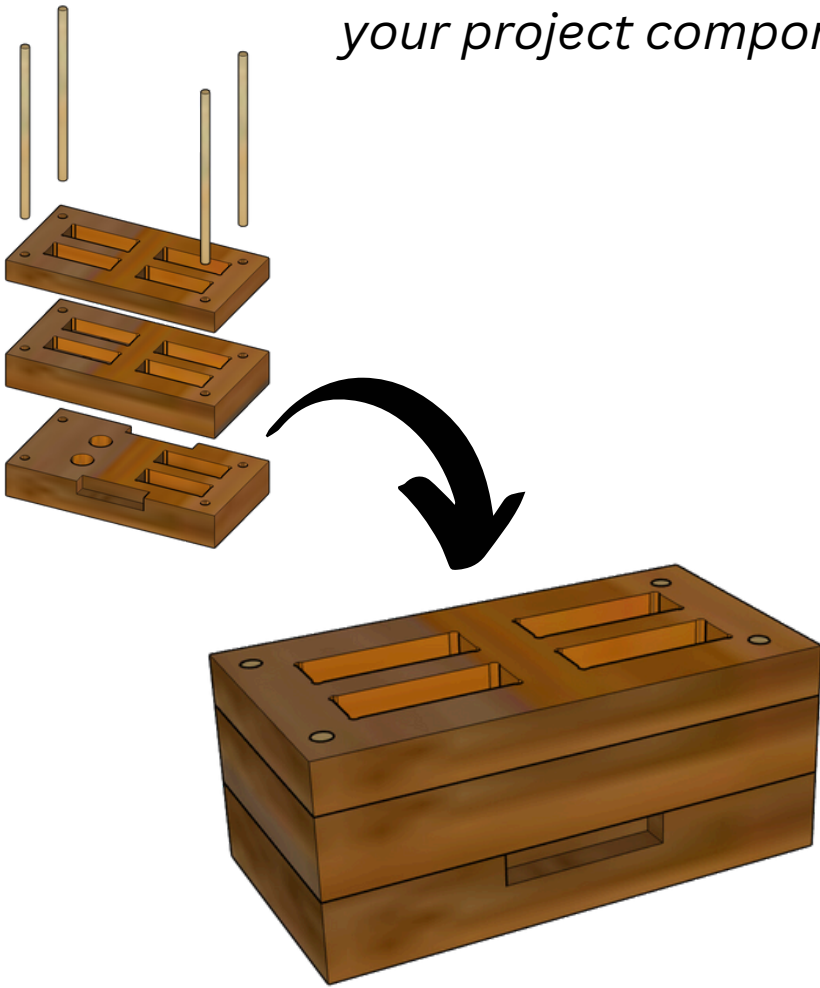*The diagrams provided are not drawn to scale.*

## THESE PLANS MAKE TWO (2) BOXES

12"

| 1" Stock |

7.5"

**JIG**

*Pine*

6.75"

.75" Stock

2"

**MAIN BODY**

*Walnut*

## NON- CNC COMPONENTS:
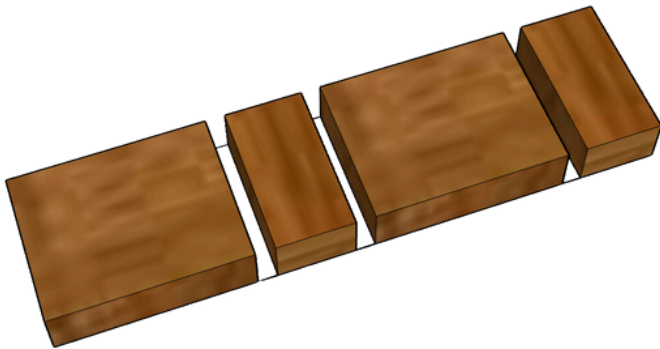
3.5"

**X4**

**1/4" DOWEL**

*Wood*

# COMPONENTS

*This page offers a visual guide for your project components.*



JIG



MAIN BODY

# ASSIGNING G-CODE

To get started, you'll need your CAD program of choice, as well as the .svg files included with your purchase. These files are designed to be compatible with a wide range of CNC design programs that are **capable of importing SVG Files**. While I use a fairly simple program, Carbide Create Pro, you can seamlessly adapt these instructions to any program you normally work with.

For each component, you'll find a set of step-by-step instructions. These instructions will specify the CNC bit to use, the type of tool path to assign, and the depth at which to carve. The vectors corresponding to the above information will be highlighted in **RED** for each step of the process.

**It's important to note that these instructions will not provide specific feed rates and router speeds.** The choice of these settings depends on factors such as the type of wood you're using and your personal preferences. Let's Get To It!

## HELPFUL TIPS:

- **Sequentially Assign Toolpaths:** It is crucial to assign toolpaths in the given order for each component. I've made this before, and this is what I know works. Put a little faith in me!

- **Implement Tabs for Contours:** Remember to incorporate tabs when assigning contour toolpaths that carve all the way to the stock bottom. This prevents the piece from detaching prematurely.

- **Stock Bottom really means .05" more!** I like to add .05" to my "Stock Bottom" depth assignments to ensure a clean break of material on the bottom. Who cares if your waste board looks beat up after a few months. That's what it's for!

## HOW TO ZOOM IN ON PDF DOCUMENT

Press the "Ctrl" key (or "Cmd" key on Mac) and scroll up with your mouse wheel or trackpad, or by clicking the zoom-in icon within the PDF reader's toolbar. Enlarging the content will provide a clearer and more detailed view of the selected vector lines required for assigning toolpaths.

# UNDERSTANDING TOOLPATHS

✳ *Used in this Project*

---

✳ ## POCKET TOOLPATHS:
*Pocket toolpaths are used to create recessed or pocketed areas within a material. This involves removing excess material from specific regions, resulting in cavities or depressions.*

## INSIDE CONTOUR TOOLPATHS:
*Inside contour toolpaths involve cutting along the inner edges or contours of a shape or component. This is used to define the internal features of a part, ensuring it fits and functions as intended.*

✳ ## OUTSIDE CONTOUR TOOLPATHS:
*Outside contour toolpaths, on the other hand, are used to cut along the outer edges or contours of a component. This shapes the external profile of the project, giving it its final shape and dimensions.*

## NO OFFSET CONTOUR TOOLPATHS:
*Contour toolpaths with no offset involve cutting precisely along the original outlines of a shape or component without any inward or outward deviation. This method is useful for projects requiring exact replication of the design's contours, ensuring accuracy and consistency in the final product's shape.*

## DRILLING TOOLPATHS:
*Drilling toolpaths are employed to create holes or perforations at specific points within the material. This process is crucial for various applications, such as adding fasteners or creating openings for other components in the project.*

✳ ## REST MACHINING POCKET TOOLPATHS: *
*Rest Machining toolpaths are employed to remove remaining material after initial, larger bit machining processes. They ensure precision by focusing on areas that were not adequately addressed in previous toolpaths, resulting in a more accurate and refined final product. This is particularly useful for intricate designs and complex components.*

## KEYHOLE TOOLPATHS:
*In addition to the above, keyhole toolpaths are employed to create specialized openings, resembling keyholes, in the material. This particular toolpath is valuable for accommodating fasteners or mounting elements, enhancing the versatility of your project.*

## V-CARVE TOOLPATHS:
*V-carve toolpaths are utilized to create decorative or intricate designs by cutting with a V-shaped bit at varying depths. This technique is commonly employed for engraving text, logos, or artistic patterns onto the surface of the material. By adjusting the cutting depth and angle, v-carve toolpaths can achieve stunning visual effects, adding depth and dimension to your project.*

## ADVANCED V-CARVE TOOLPATH:
*A two-step process to efficiently carve intricate designs. First, the bulk of the material within the designated area is removed at a set depth using an endmill. Once the roughing pass is complete, a V-bit is employed to carve intricate details into the edges and tight spaces of the design. This sequential approach significantly reduces machining time while maintaining precision and detail.*

*\*Can be substituted with Inside Contour. It will accomplish the same task, but take longer.*

# Import
## Jig - _1 Inch Stock_ - 12 x 7.5
# Into CAD Program
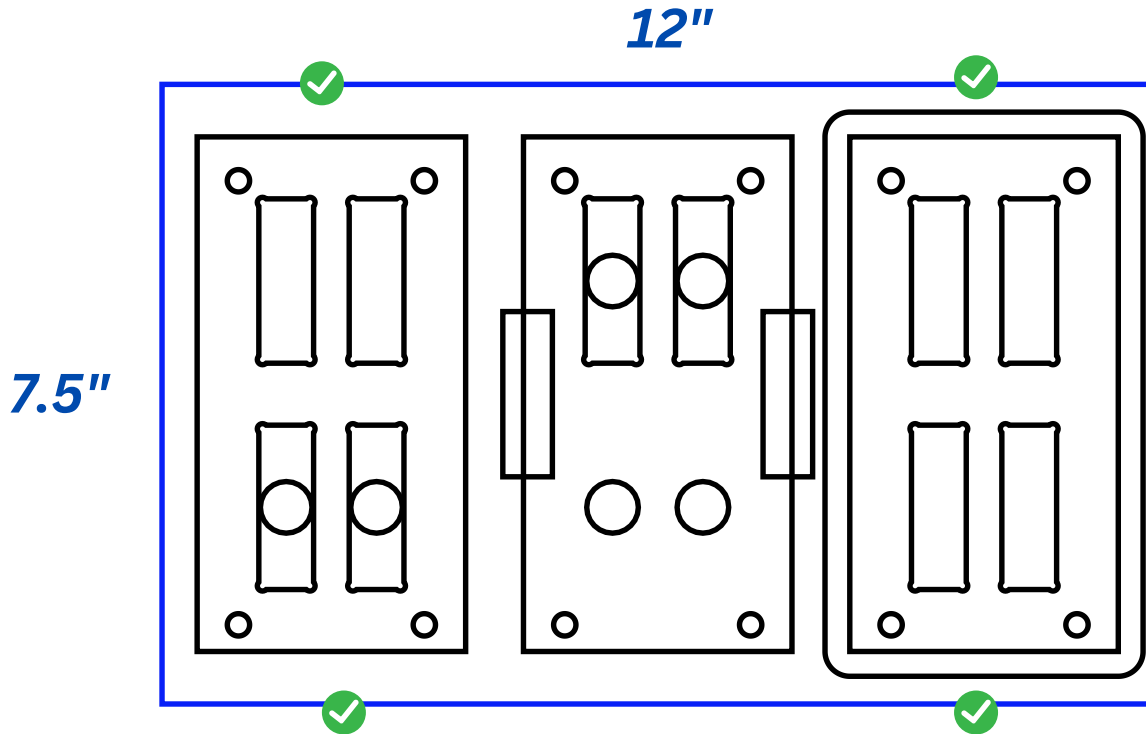
**12"**

**7.5"**

**Blue Perimeter Line**
*Represents the Overall Stock Dimension.
If scale is off after importing SVG File,
adjust accordingly.*

✓ **Clamp Locations**
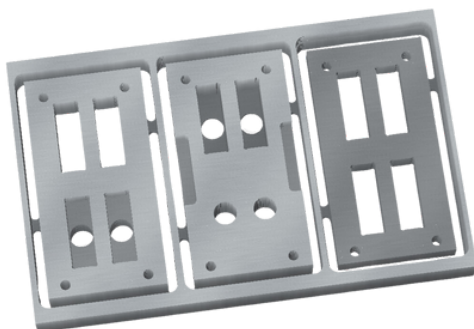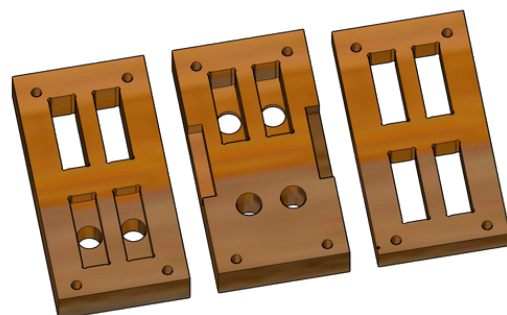
---

## CNC Bits Used:

- *1/4" Downcut*
- *1/8" Downcut*

## Toolpaths Used:

- *Pocket*
- *Rest Machining Pocket*
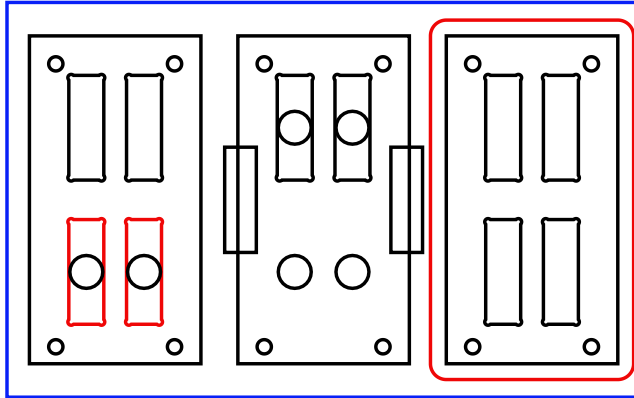- *Outside Contour*
- *Inside Contour*

**3D CAD Rendering**
*(Carbide Create)*

**3D CAD Rendering**
*(Sketchup)*

**SELECTED VECTORS**         **TOOLPATH/BIT/DEPTH**

**1.**  

### Pocket
*1/4" Downcut*
***.375" Depth***

**2.**  
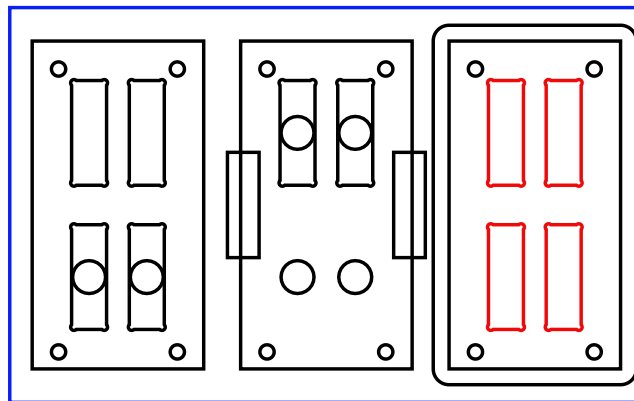
### Pocket
*1/4" Downcut*
**.375" Start Depth**
**Stock Bottom**

**3.**  
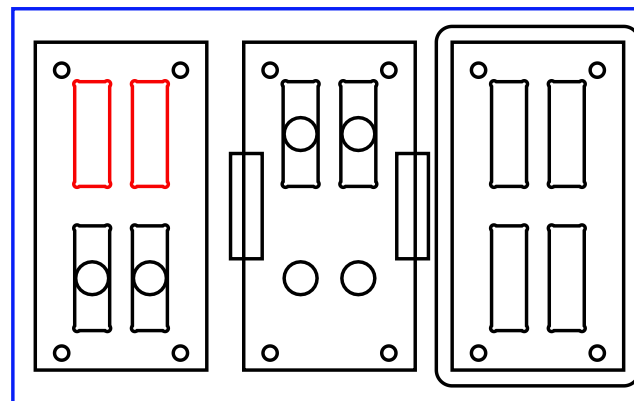
### Pocket
*1/4" Downcut*
**Stock Bottom**

**4.**  

### Pocket
*1/4" Downcut*
***.375" Depth***

**10**
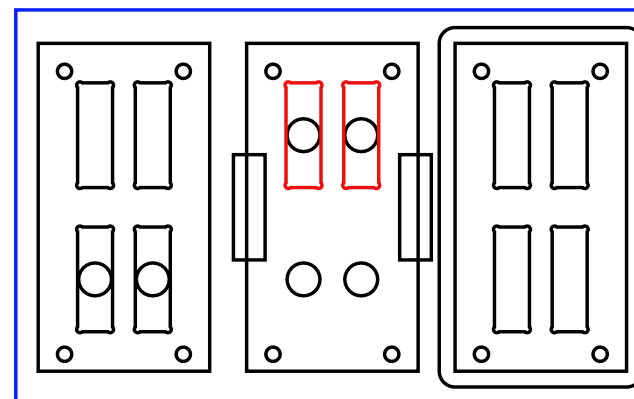
## SELECTED VECTORS

## TOOLPATH/BIT/DEPTH

**5.**
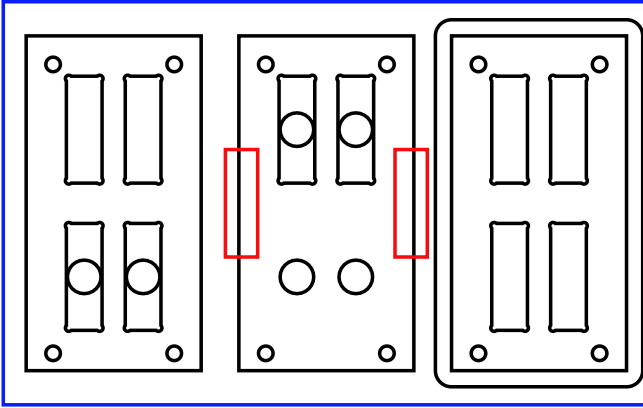


### *Pocket*
*1/4" Downcut*

**.4" Depth**

**6.**
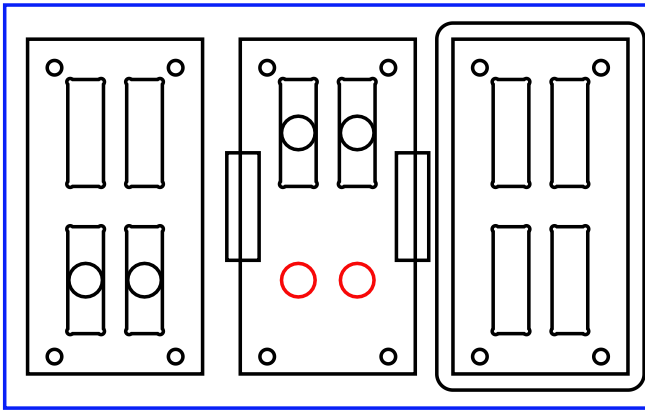


### *Pocket*
*1/4" Downcut*

**Stock Bottom**

**7.**
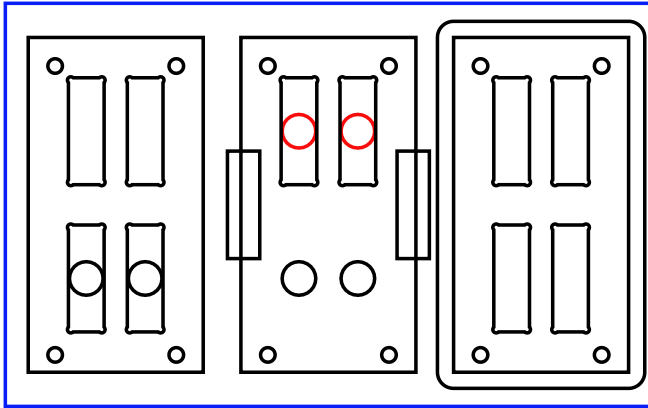


### *Pocket*
*1/4" Downcut*

**.375 Start Depth**

**Stock Bottom**

**8.**
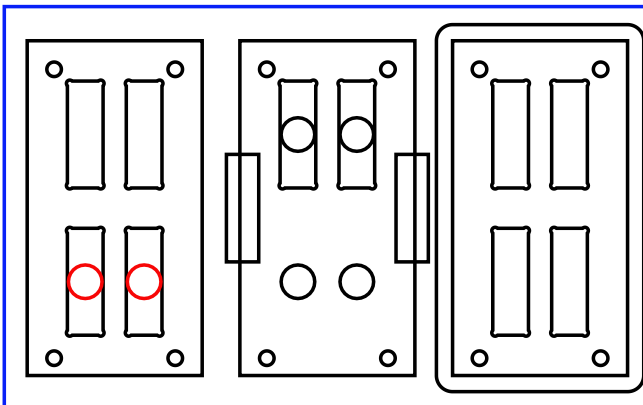


### *Pocket*
*1/4" Downcut*

**.375 Start Depth**

**Stock Bottom**

## SELECTED VECTORS

## TOOLPATH/BIT/DEPTH

**9.**
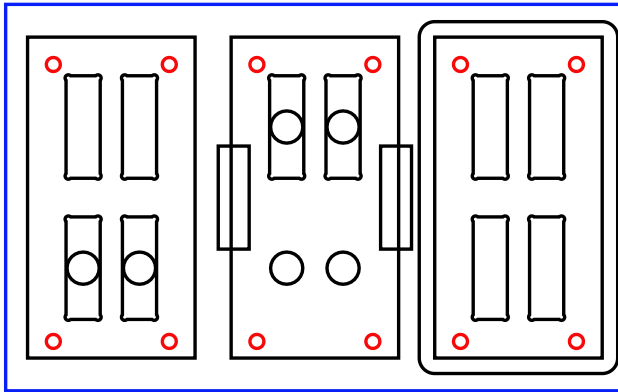


***Pocket***
*1/4" Downcut*
***Stock Bottom***

**TOOL CHANGE!**

**10.**
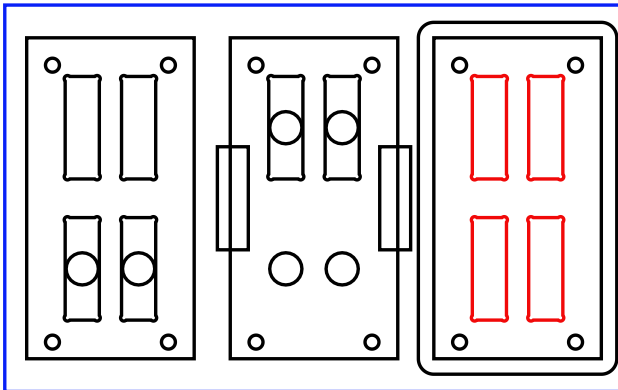


***Rest Machining Pocket***
*1/8" Downcut*
***.375" Start Depth***
***Stock Bottom***

**11.**
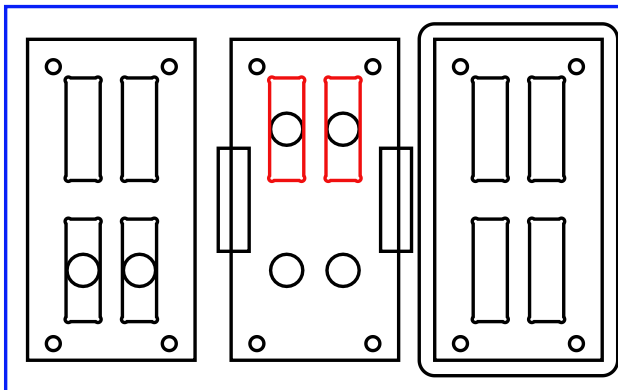


***Rest Machining Pocket***
*1/8" Downcut*
***.375" Depth***

**12.**
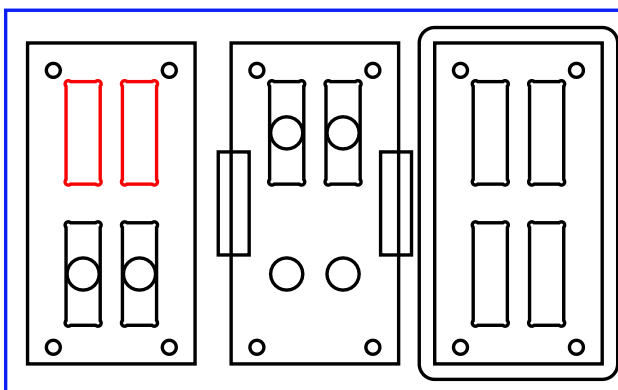


***Rest Machining Pocket***
*1/8" Downcut*
***Stock Bottom***

**SELECTED VECTORS**   **TOOLPATH/BIT/DEPTH**

**13.**
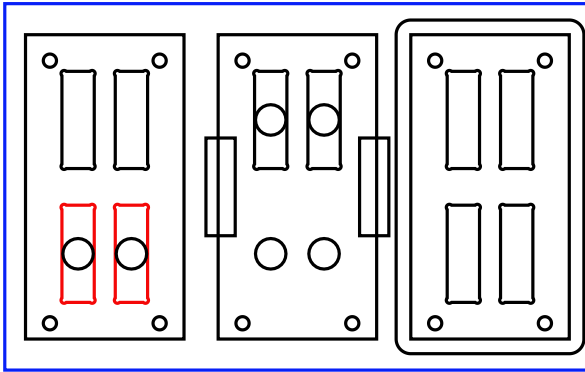
### *Rest Machining Pocket*
*1/8" Downcut*
***.375" Depth***

**TOOL CHANGE!**

**14.**
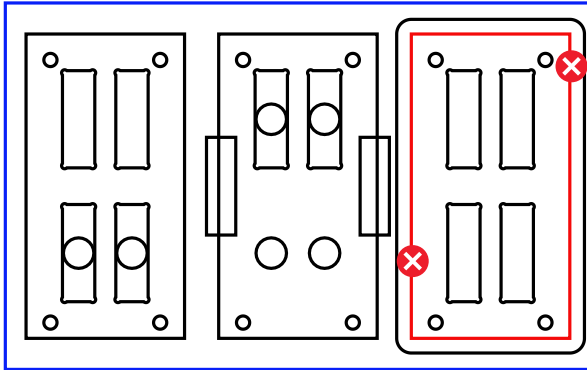
### *Outside Contour*
*1/4" Downcut*
***.375" Start Depth***
***Stock Bottom***

❌ **= Tabs**

**15.**
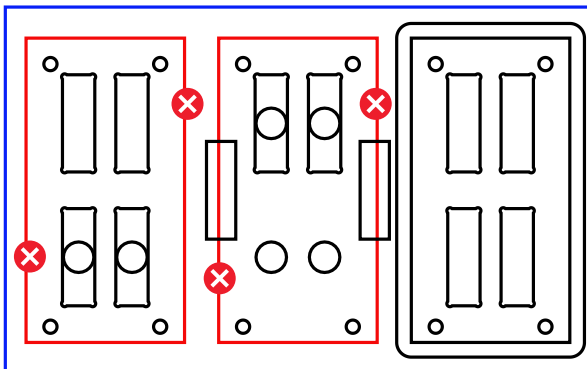
### *Outside Contour*
*1/4" Downcut*
***Stock Bottom***

❌ **= Tabs**

1/4" Dowels
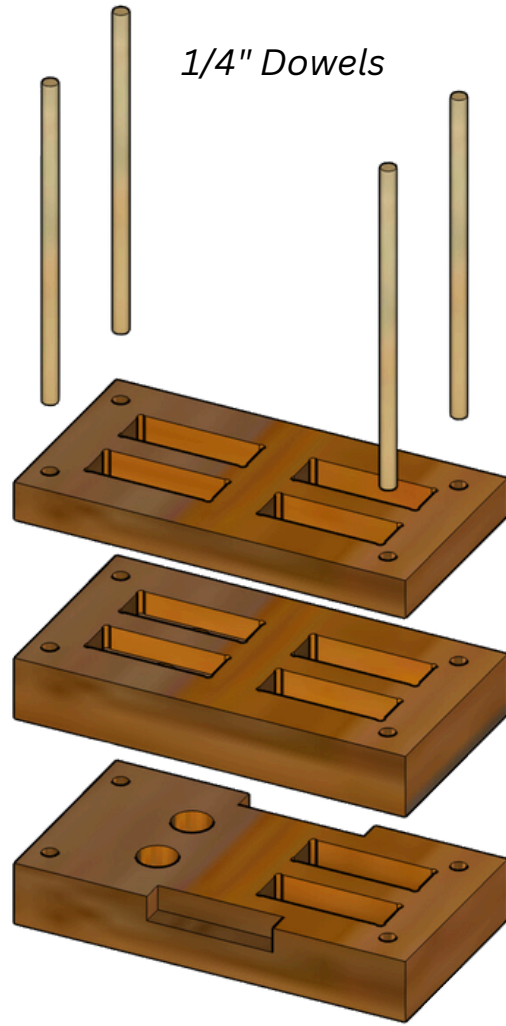
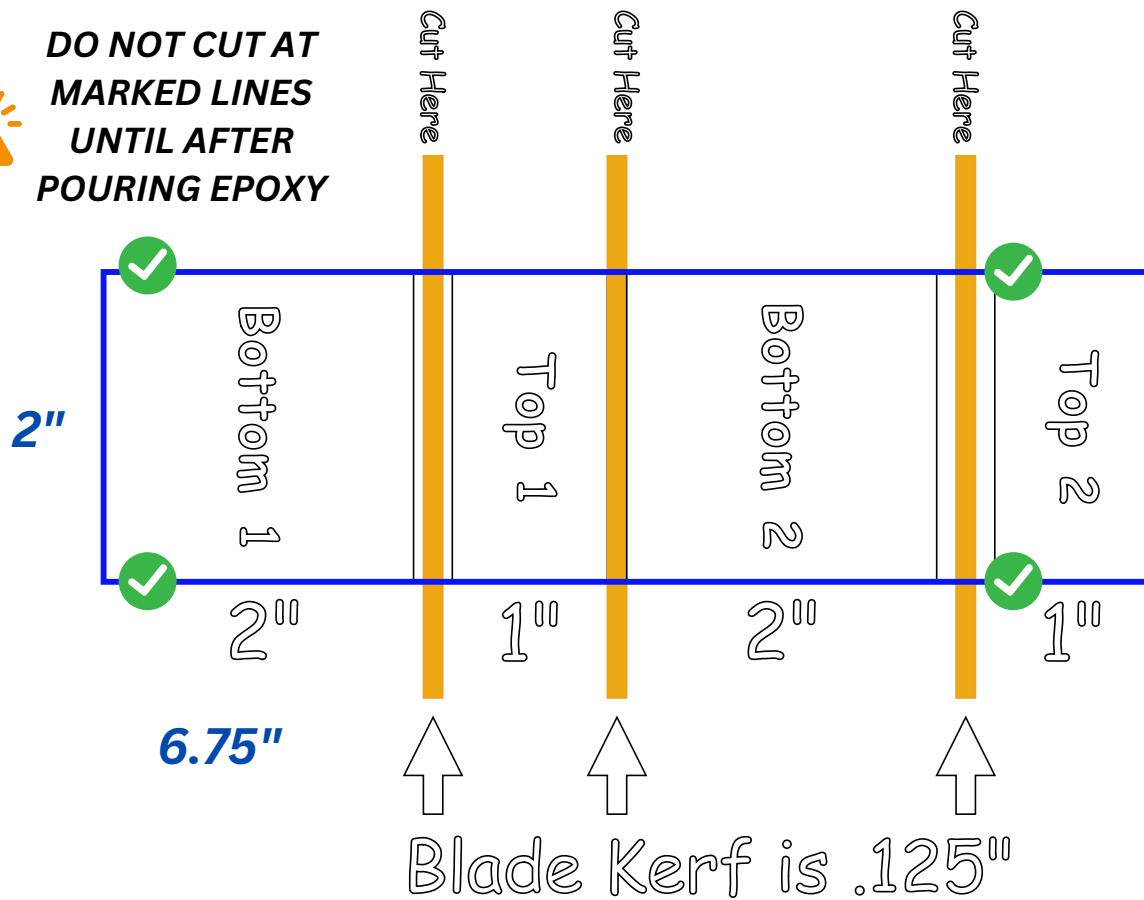## Glue and Clamp Components
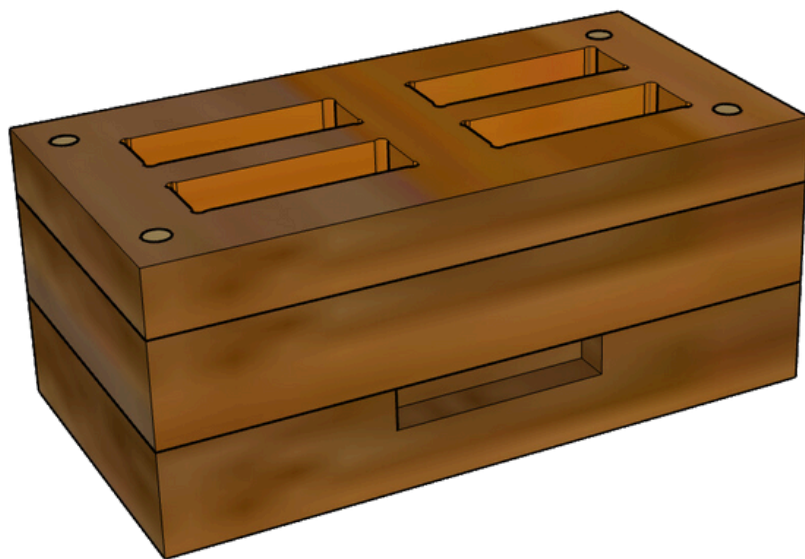
## Flush Cut Dowel Ends
## Sand

**14**

# MAIN BODY

## Import
## Main Body - .75 Inch Stock - 6.75 x 2
## Into CAD Program

⚠️ **DO NOT CUT AT MARKED LINES UNTIL AFTER POURING EPOXY**

Cut Here    Cut Here    Cut Here

**2"**

Bottom 1    Top 1    Bottom 2    Top 2

**2"**    **1"**    **2"**    **1"**

**6.75"**

⬆    ⬆         ⬆

Blade Kerf is .125"

**Blue Perimeter Line**
*Represents the Overall Stock Dimension. If scale is off after importing SVG File, adjust accordingly.*

✅ **Clamp Locations**

Add text or logo of your choice and assign toolpaths based on needs.

**"Bottom" and "Top" text designates center of component.**

I carved a Pocket at .05" depth in order to fill with epoxy, but you could also use Oramask and Paint.
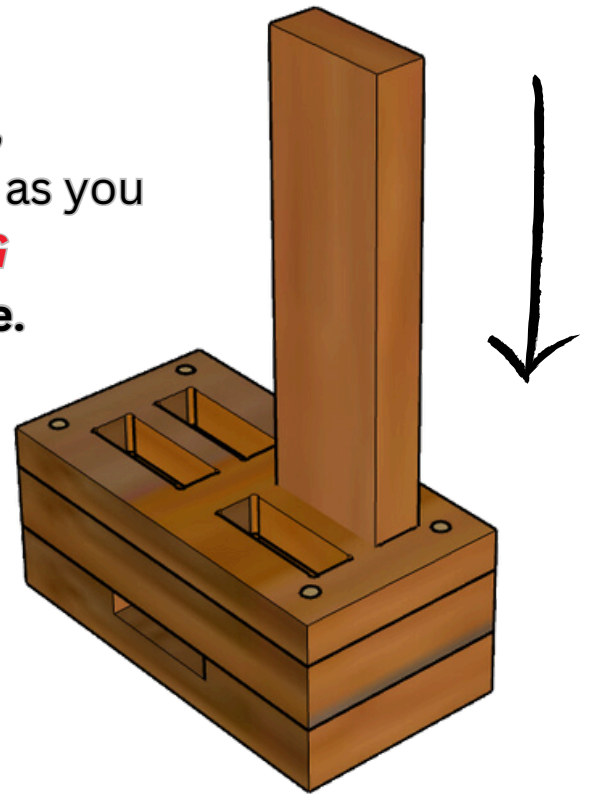
---

## CNC Bits Used:
- Depends on Logo Choice
- I used 1/16" and 1/32" Downcut

## Toolpaths Used:
- Also your preference
- I used Pocket and Rest Machining

**15**

After pouring epoxy or painting,
slowly shave component down to size as you
**INSERT ONE END INTO THE JIG**
making it as **tight a fit as possible.**

**QUICK TIPS**

*When using epoxy, I surfaced my cured overfill using a Drum Sander. You can also use a hand sander or planer...carefully!*

5.5"

3.25"

2.0625"

6.75"
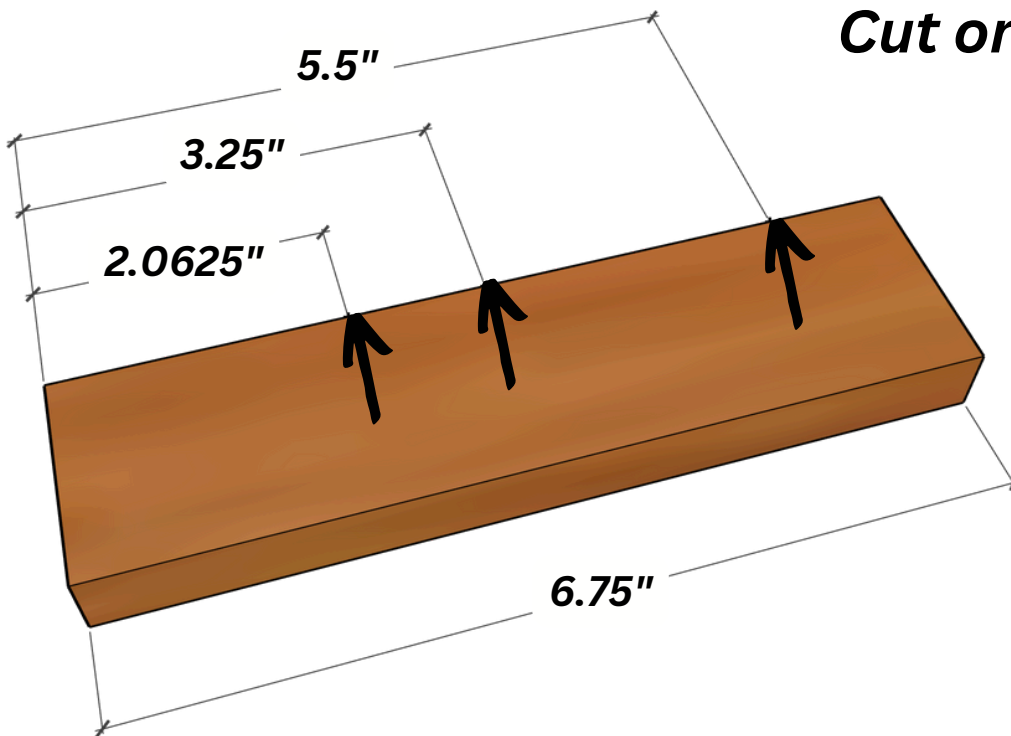
**Cut on this side of line!**

Once sized to fit jig, cut at
marked locations using a .125" Kerf Blade.
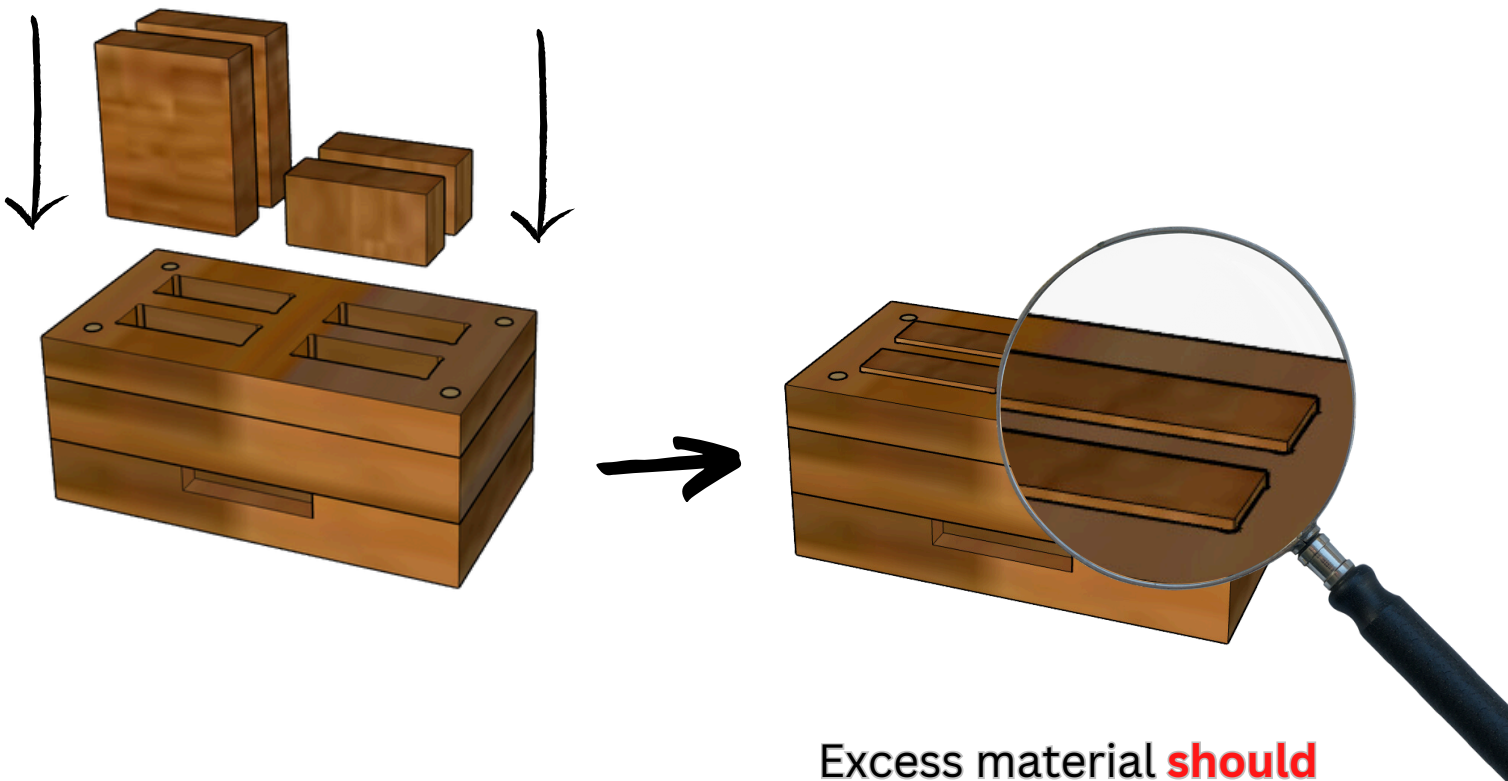
**16**

*The Arrows to the right represent which way is <span style="color:red">UP</span> once the components are in the jig.*

*Use your custom logo or text as reference to determine up and down.*

*Depending on which direction you position the front of the boxes as they carve, the hardware can be set for left or right handed opening boxes.*
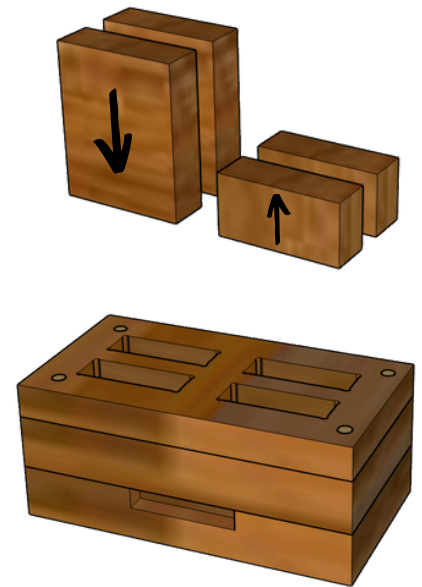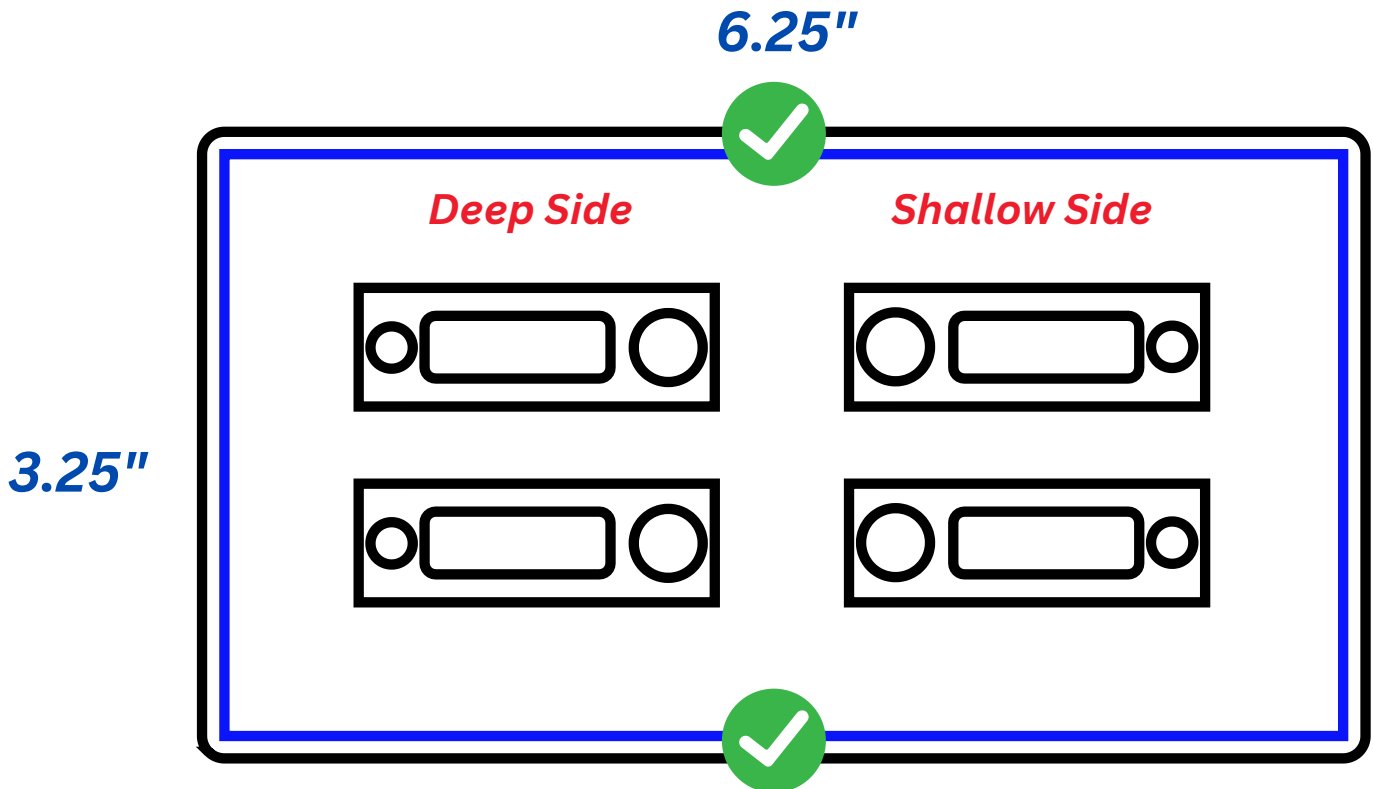
# Insert components into Jig using rubber mallet.

Excess material **should** stick out on top

**17**

# HARDWARE CARVE

**6.25"**

✅

**Deep Side**     **Shallow Side**

**3.25"**

✅

**Blue Perimeter Line**
*Represents the Overall Stock Dimension. If scale is off after importing SVG File, adjust accordingly.*

✅ **Clamp Locations**

**Set your X and Y locations to the bottom left corner of THE JIG. Set your Z at the top.**

**This is not a deep carve, but does require a clearance for your bit that's HIGHER than 2.625".**

## CNC Bits Used:
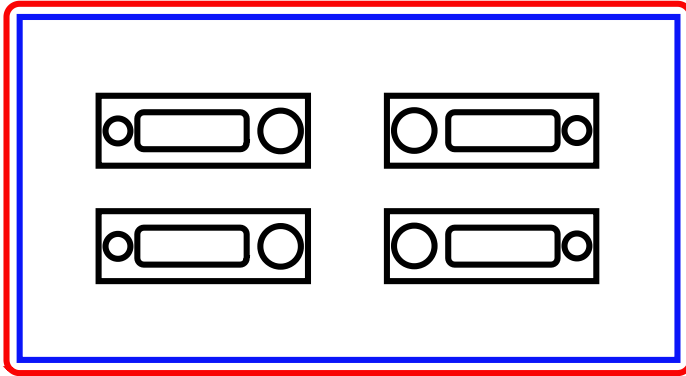- *1/4" Downcut Bit*
- *1/8" Downcut Bit*

## Toolpaths Used:
- *Pocket Toolpath*

**18**

## SELECTED VECTORS

## TOOLPATH/BIT/DEPTH

**1.**

### Pocket
*1/4" Downcut*
**.002" Depth**

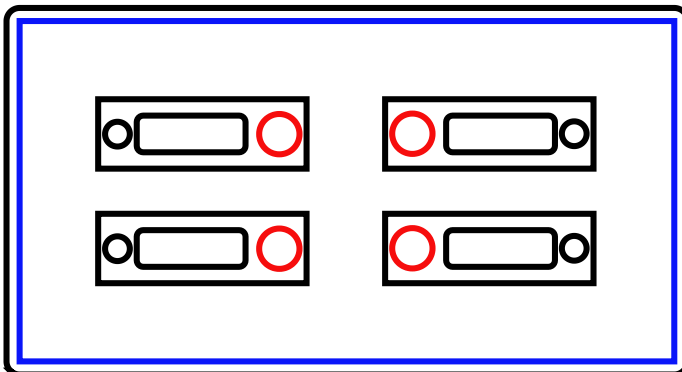*This is a surfacing carve to make everything flat.*

**TOOL CHANGE!**

**2.**
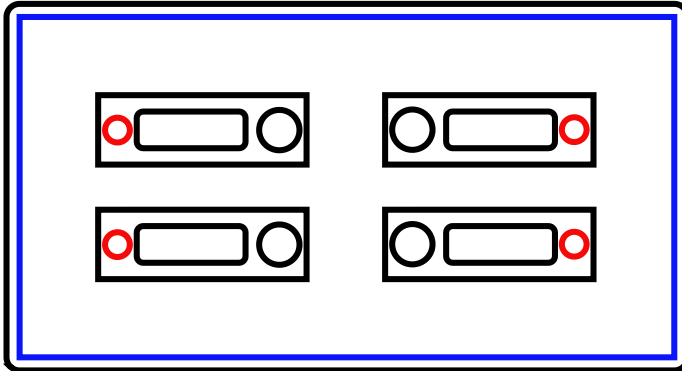
### Pocket
*1/8" Downcut*
**.08" Depth**

**3.**

### Pocket
*1/8" Downcut*
**.442" Depth**

**4.**
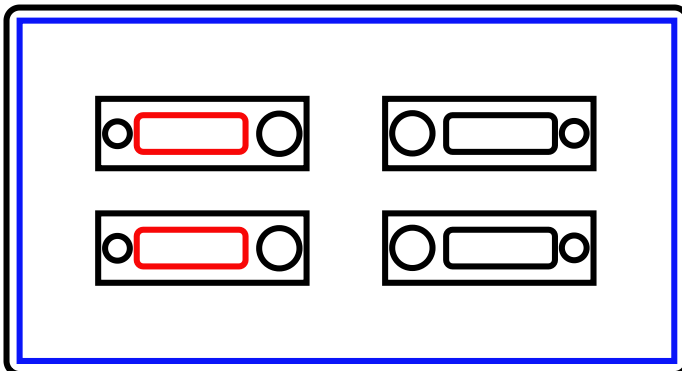
### Pocket
*1/8" Downcut*
**.5" Depth**

**19**

**SELECTED VECTORS**  **TOOLPATH/BIT/DEPTH**

**5.**
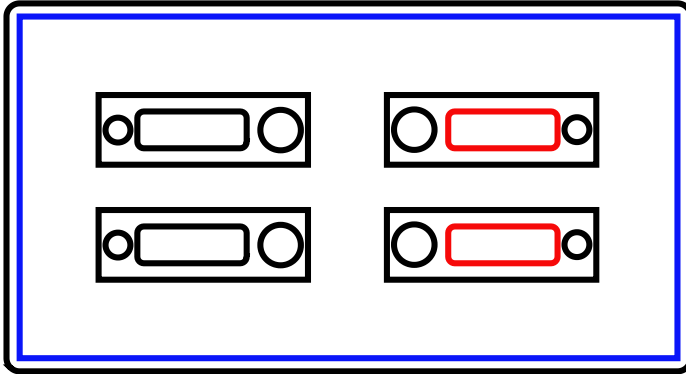


***Pocket***
*1/8" Downcut*
***.75" Depth***

**Remove components by hammering a dowel through the holes on the bottom.**

**20**

# FINISHING

## Hardware Linked in Youtube Tutorial

---

- *Insert Magnets and secure with CA Glue.*

- *Install Barrel Hinges. Secure with set screw.*

- *Sand to 320 Grit*

- *Round corners if desired*

- *Round over edges if desired*

- *Sand again*

- *Apply Varnish of Choice*

## RING INSERT

- *To secure the ring, I folded a small piece of Felt into an "M" Shape and sewed the bottom together.*

- *After shoving it into the pocketed out area, the two top peaks of the "M" squeeze the ring in place.*

- *There may be better methods than this one, but I'll let you play around with other options. This worked for me.*