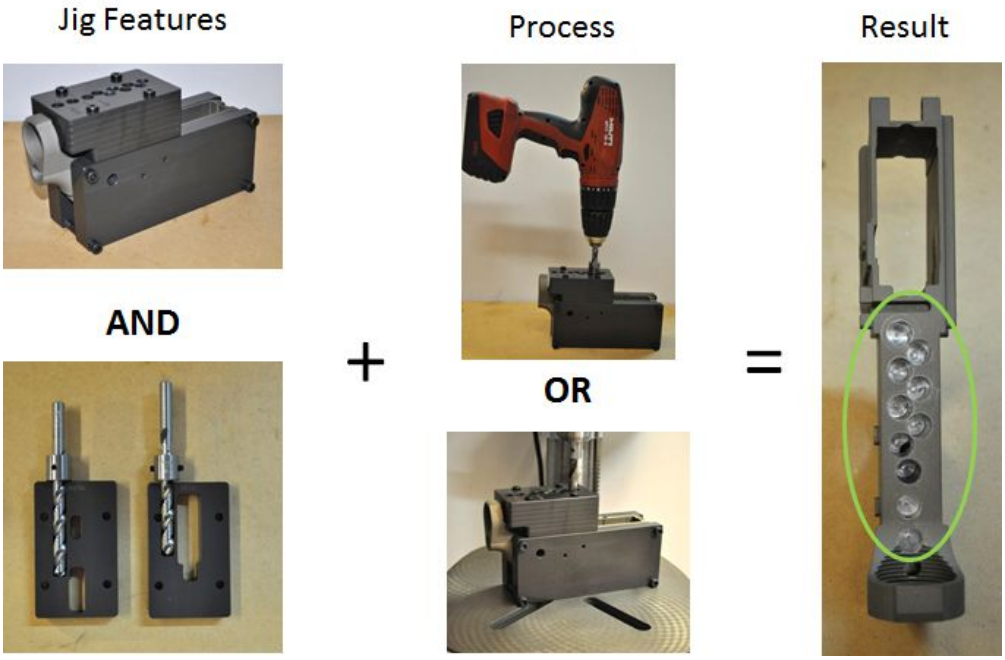
80% AR15 Lower “EZ JIG” Instructions

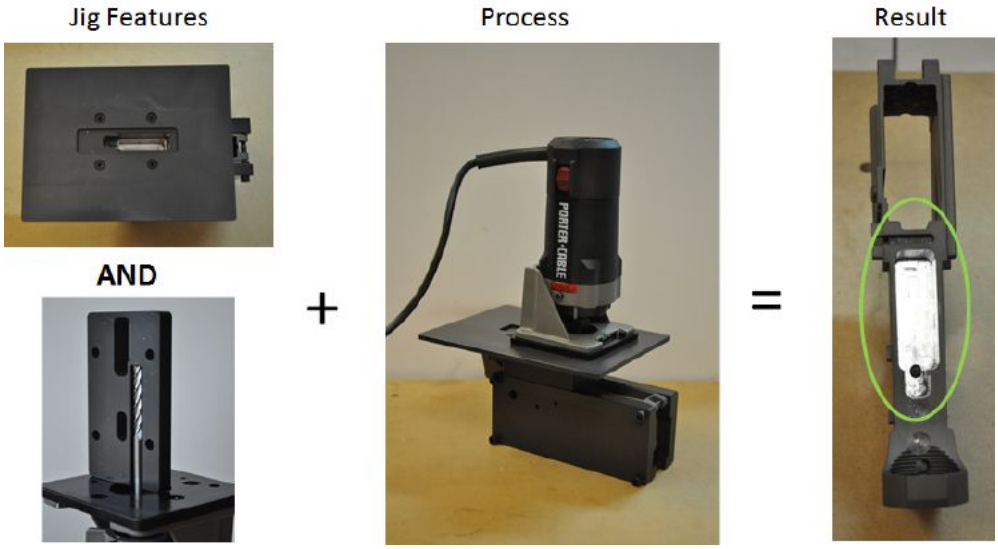
The novel “EZ-Jig” simplifies the 80% AR-15 lower fabrication process, reduces the total build, reduces the risk of failure, and makes substantial improvement in the overall build quality and precision. ***Please keep in mind that once you start the process to finish an 80% lower, it becomes a firearm and all local, state, and federal firearms laws apply. It is your responsibility to check the legality of finishing an 80% lower in your area.*** Eye protection is required for all steps. Hearing protection is highly recommended with the router. ***Power tools are dangerous and can cause severe injury, please make sure you read the manufacture’s manuals and are familiar with its operation before using this jig.*** The black colored text is instructional in nature while blue colored text provides hints and suggestions.

"EZ-Jig" 80% Lower Build Process Summary

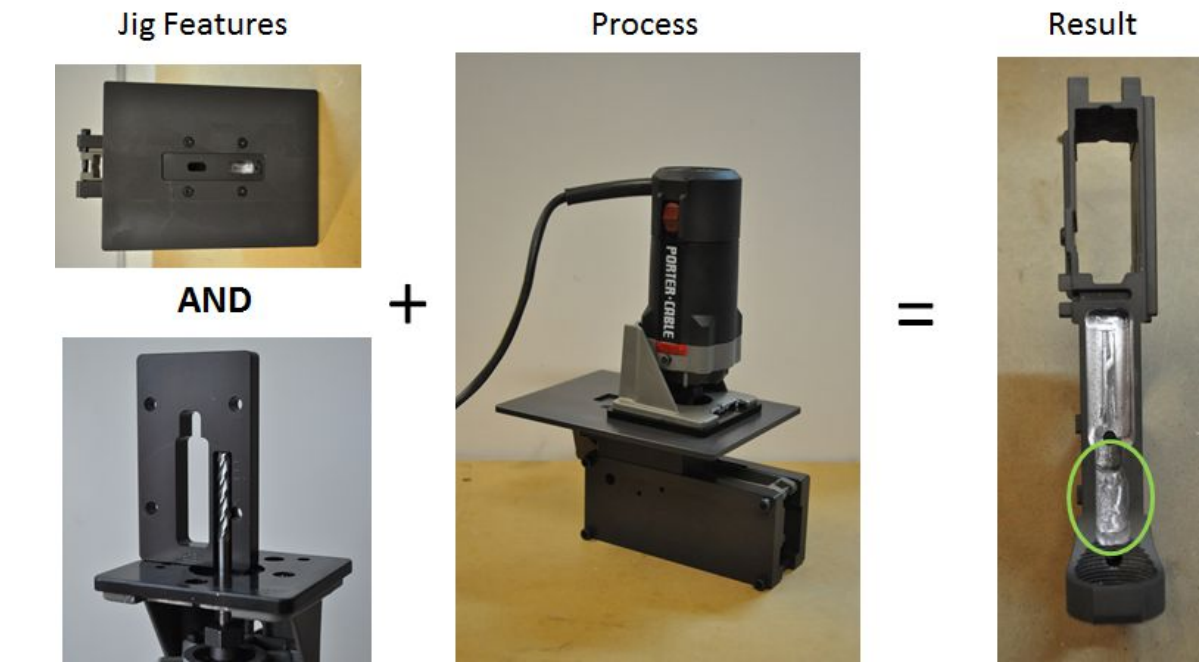
Step 1: Assemble jig



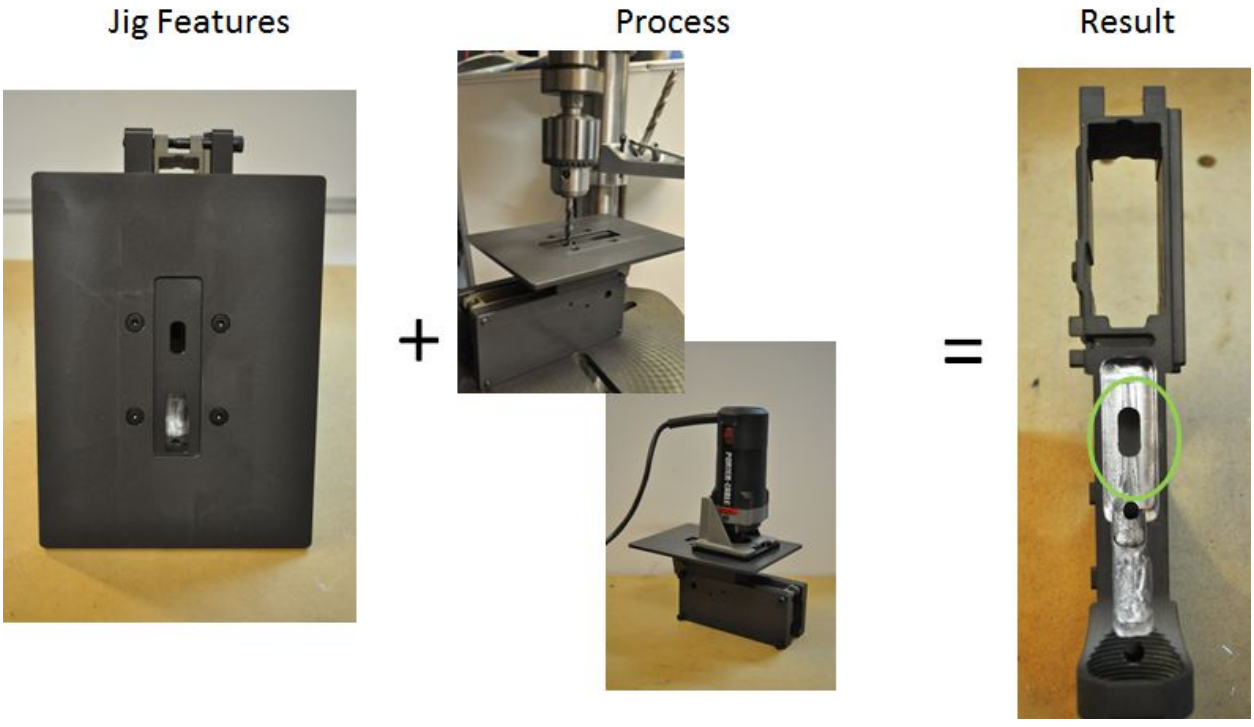
Step 2: Rough out the trigger and rear-shelf pockets



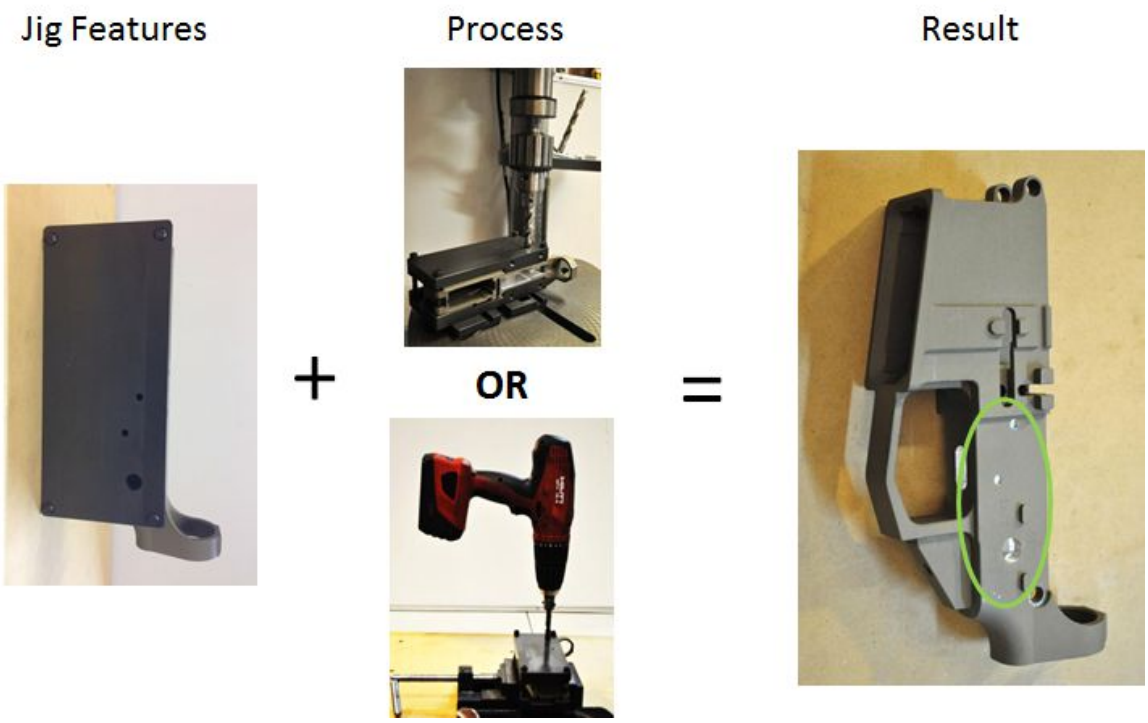
Step 3: Mill out the trigger pocket



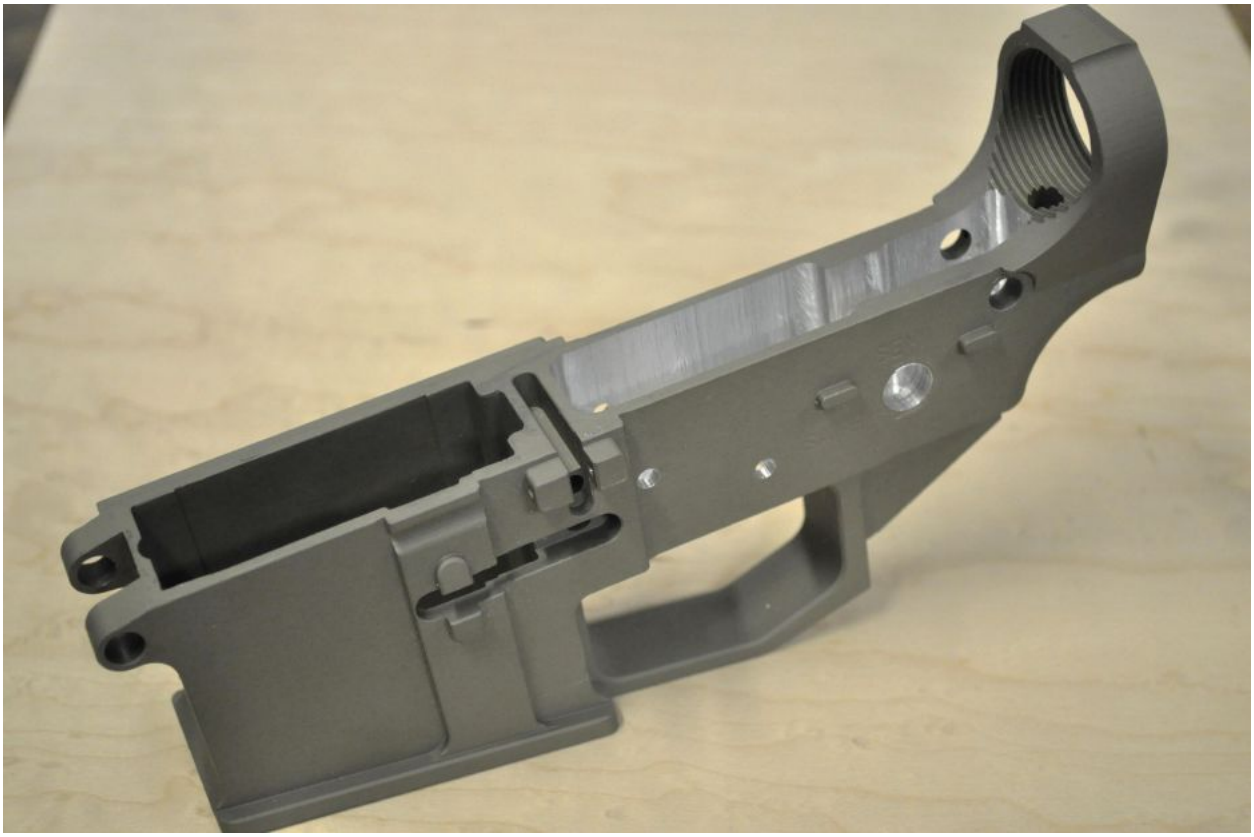
Step 4a: Mill out the rear shelf



Step 4b: Mill out the trigger slot



Step 5: Drill the holes for the trigger group pins safety selector



Step 6: Done

“EZ JIG” feature highlights:

- Built in drill/end-mill depth gauge for the trigger and rear-shelf pockets
    - Eliminates the need for expensive measurement tools
    - Quick verification of depth setting – eliminates slippage issues that can ruin parts
    - Eliminates ad-hoc measurement techniques to determine depth while milling
- Router based milling instead of drill-press milling
    - Router is designed for cutting pockets using a template
    - Safer – end-mill downward force can’t separate the drill press taper chuck
    - Safer – to move router by hand than to move jig
    - Faster – trigger pocket can be cut in 6 to 11 passes vs 25 with a drill press
- Compatible with common hand-tools
    - Jigs are designed to hold tolerances using a common hand-drill
    - Hand-drill which is more common than drill presses
    - Routers and drills are portable – can be easily borrowed or rented and commonly owned
- Faster
    - Pocket drilling requires 10 holes drilled once – Traditional jigs require 42 holes to be drilled once, precisely aligned and clamped, then re-drilled to a larger diameter
    - Router cuts pockets 5-6x faster
    - Hand-drilling the trigger group/safety selector holes is faster to setup

“EZ Jig” Part Description

The “EZ” jig basic kit includes the following item labeled in figure 1:

1. Right Jig Wall (1x)
2. Left Jig Wall (1x)
3. Pocket Drilling template (1x)
4. Template Spacer (1x)
5. Trigger pocket template (1x)
6. Rear-shelf pocket template (1x)
7. Router base support plate (1)
8. Bolt set containing 2.5” Jig Wall screws (4x), 1.75” template screws (4x), 0.75” trigger milling screws (2x)

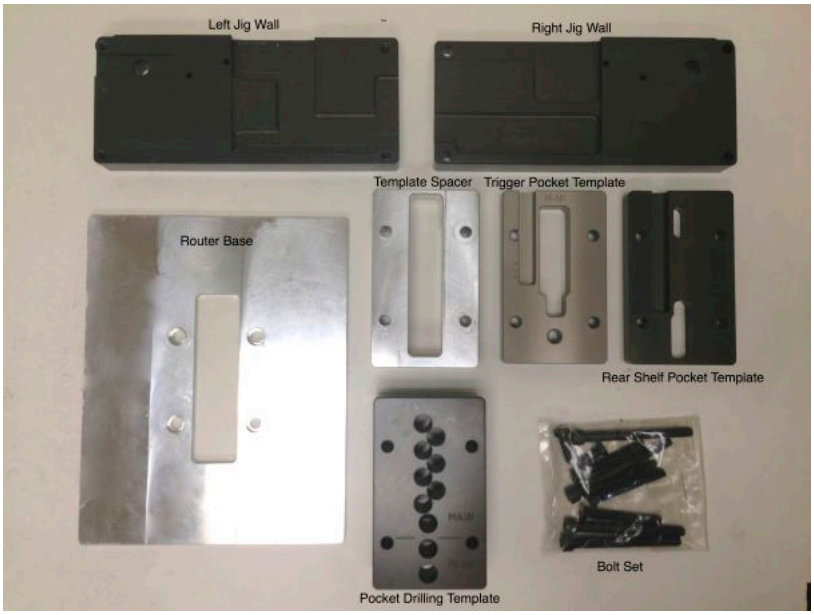


Figure 1: “EZ Jig” Basic kit components

The optional "EZ" jig tool kit includes the following items:

1. ¼" dia. X 4" long 3-flute carbide end-mill
2. 3/8" drill stop (metal, do not use plastic!)
3. 3/8" drill bit (Must be sharp / new)
4. 5/32" jobber length drill bit
5. 19/64 jobber length drill bit

The following tools (not included) are required for use with the "EZ Jig"

1. Safety Glasses
2. Hearing protection
3. Hand drill with ½" drill chuck
4. Router or Laminate router with ¼" collet
5. 3/16", 1/8", and 3/32" Allen wrenches
6. Vice
7. C-clamps for vice if not mounted
8. Cutting and tapping fluid*
9. Ruler

* You can substitute WD-40 for cutting and tapping fluid, but it's not ideal.

The following tools can simplify the build process

1. Drill Press – Can speed up hole drilling and reduce physical effort when used in-lieu of a hand-drill
2. Shop-vac: Clearing chips during drilling and routing process
3. Paint brush – Clearing chips from the lower and from the jig
4. Tooth brush – Applying controlled amount of lubricant to the drill bit or end-mill, clean chips off the screw threads
5. De-burring tool – to de-burr the drilled holes

Step 1: Jig Assembly & Setup

- Make sure that the fixture and the 80% lower is clean and free of chips.
  - A paint brush can quickly clear parts of chips, especially when changing templates
- Sandwich the left and right jig wall parts on either side of the 80% lower as shown figure 1.1 and assemble using the four 2.5" jig wall screws. This is the jig screw standard position.
  - The top side screw holes on the jig side should be closest to the buffer tube mount
  - Do not over tighten the screws, just torque down until snug

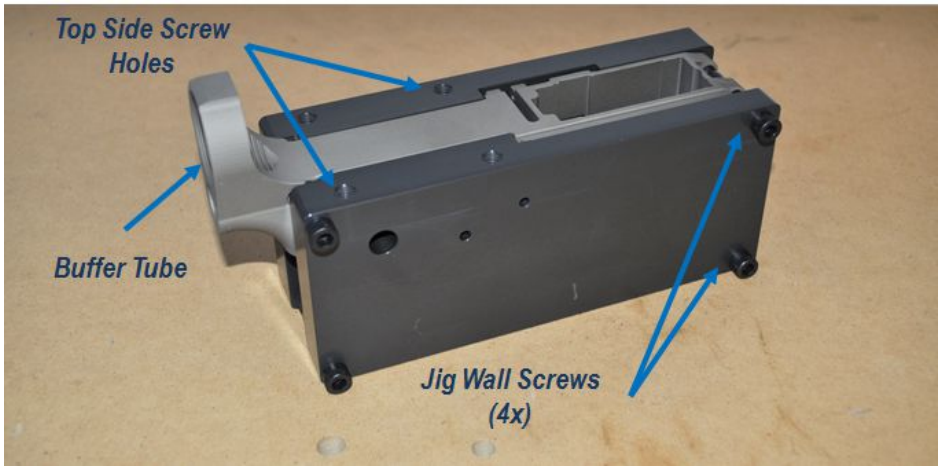


Figure 1.1: Left and right jig wall sandwiching the 80% lower, jig wall screws are in the standard position

Step 2a: Roughing out the pockets (jig assembly)

- With 1.75" template screws, attach the pocket drilling template to fixture as shown in figure 2.1.

- If necessary, loosen the side plate screws and tighten after the template is installed

- Secure EZ-jig fixture into vice as shown in figure 2.1 (use C-clamps to secure vice if necessary).

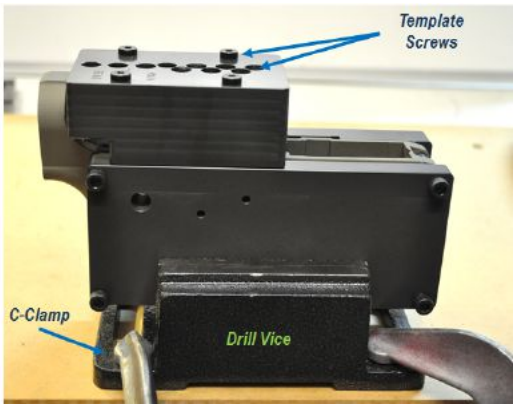


Figure 2.1 (left): fixture assembled with drill template and depth gauge
Figure 2.2 (right): top of the drilling template shown the demarcation between the longer and shorter holes.

- The trigger pocket needs to be drilled to 1.249" (main holes) (right of line in figure 2.2)
- The rear-shelf needs to be drilled to 0.630" (rear holes). (left of line in figure 2.2)
  - Optional: Tape over the rear two holes as a reminder to avoid drilling the wrong holes
- Drill depths are set using the drill/mill stops built into the two templates (see figure 2.3)
  - The main depth gauge (1.249") is on the rear-shelf template
  - The rear depth gauge (0.630") is on the trigger template
- Place the 3/8" drill bit into depth gauge with drill tip at bottom of jig (see figure 2.4).
- Slide 3/8" drill stop over the bit until it touches the jig and tighten both set screws.
- Insert drill bit into drill.

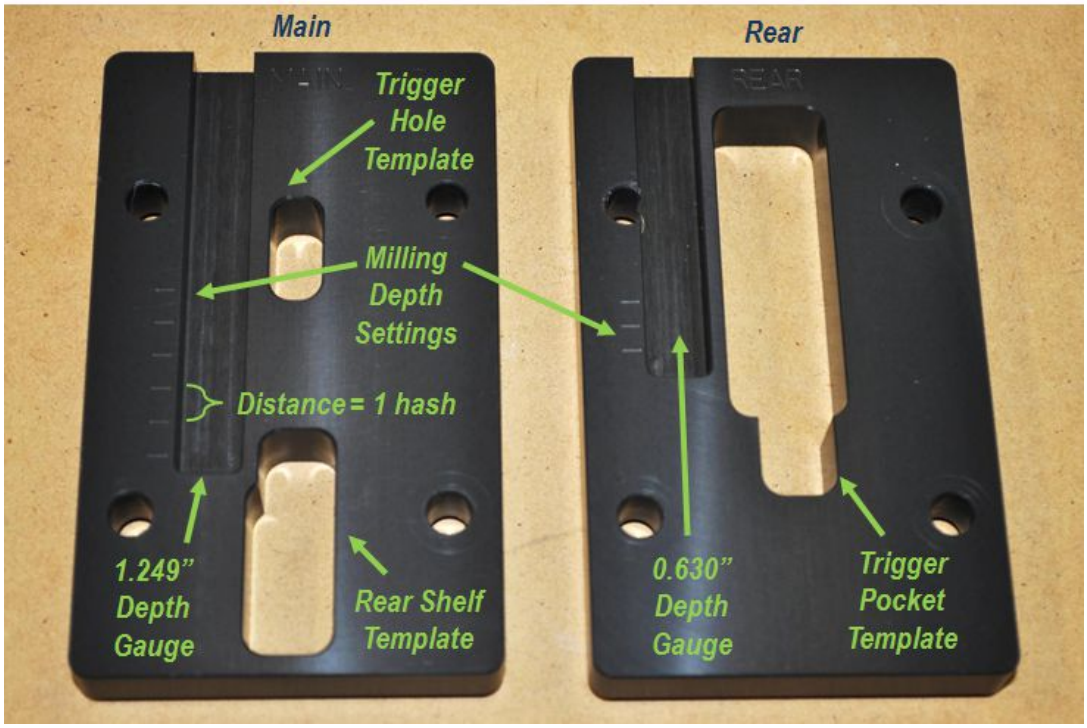


Figure 2.3: Templates are used to control the dimension of the required milled features. The depth gauge allows fast and simple setup and verification of the drill and end-mill depth. The hash marks are used to control the amount of material removed in one pass. The distance between two hash marks is referenced as the "hash"

Figure 2.4 (left): Depth gauge used to set the drill bit for a finished depth of 1.249" (Main) or 0.630" (Rear) in the lower receiver

Step 2b: Roughing out the pockets (drilling holes to rough)

- Drill out the eight "main" holes to a depth of 1.249" with the drill depth set with the "Main" gauge (left example in figure 2.4). Stop when the drill stop just touches the template surface.
    - Apply steady downward pressure to generate spiral chips.
    - Frequently lift with the drill running to clear chips inside of the hole

- **The template channel needs to be periodically cleared of chips!!!**
- A toothbrush can be used to apply a controlled amount of oil on the drill bit

- Hand-drill (figure 2.5): The drilling template is designed to maintain the proper angle.
  - User should avoid excessive side-to-side pressure that will wear jig
  - Use medium (3 speed) or low (2 speed) speed on cordless drill
  - This step requires some physical effort, should be used if drill-press is not available
  - Cordless drill will likely require more than one battery charge to complete
- Drill-press (figure 2.6): Reduces physical effort to drill holes
  - Set drill press to approximately 2500 rpm for 3/8" bit
  - Caution: higher downward pressure makes it more likely for the drill stop to slip
  - A drill press reduces the effort and time for this step
  - A drill press is recommended to drill 7075 alloy lowers. 7075 takes much longer to drill than 6061 alloy. Budget extra time if you use a hand drill for 7075 alloy lowers.
- Use the depth gauge to verify that drill-stop has not slipped between holes.

Figure 2.5 (left): Hand-drill at proper depth when the drill stop just touches the drill template
Figure 2.6 (right): Drill-press at proper depth when the drill stop just touches the drill template

Figure 2.7: Remove the screw closest to the buffer tube – photo shows it removed and inserted into the other side for clarity

- Remove screw in figure 2.7
    - This prevents drilling through the screw to create small sharp steel splinters
- Use "rear" template to set the drill bit depth (figure 2.4, right) and drill out the two holes
- Unscrew and remove the drill, remove the jig from the vice to clear chips.
- Figure 2.8 shows what the 80% lower should look like at this point.

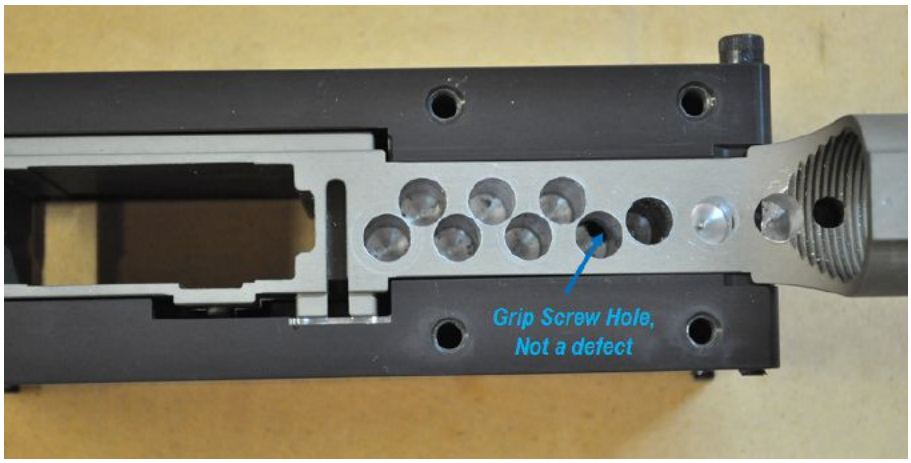


Figure 2.8 (right): lower with all roughing holes drilled and ready for the next step

Step 3a: Milling out the trigger pocket (Jig Assembly)

- Re-install the 2.5" jig wall screw that was removed
- Assemble the jig using the stack-up shown in figure 3.1.
    - Spacer – orientate so the notch goes over the buffer tube

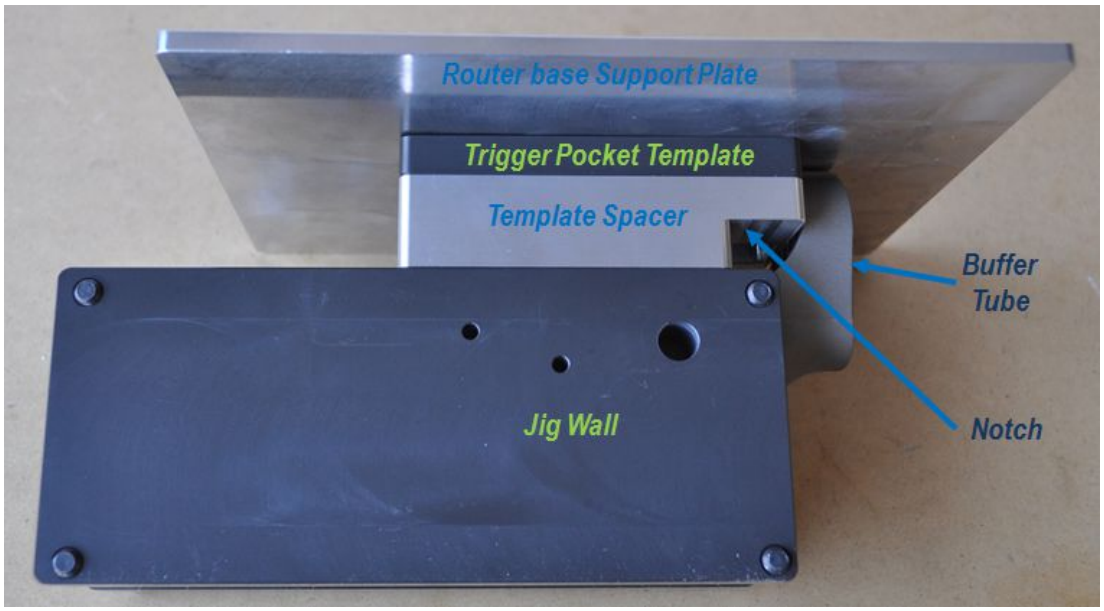


Figure 3.1: "EZ jig" for trigger pocket milling showing the stack-up.

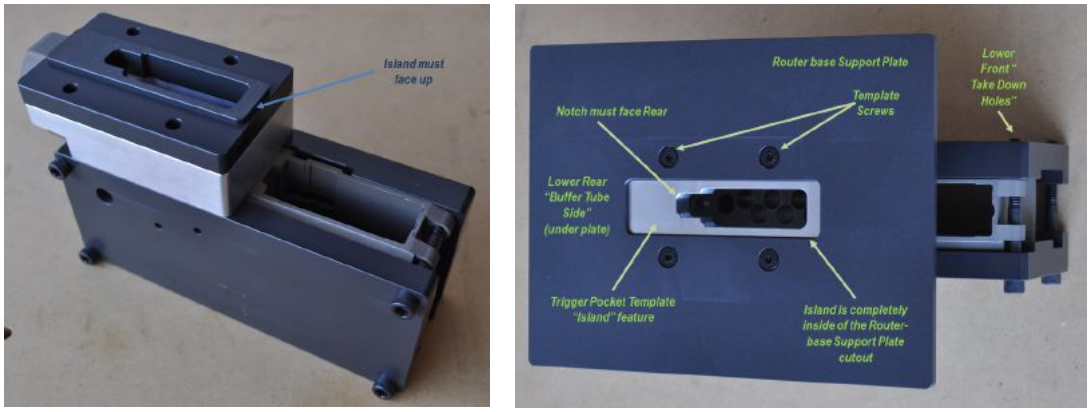


Figure 3.2: Trigger pocket orientation shown the "island feature" and proper orientation (Silver parts are used for clarify, all jig parts are the same color)

- Trigger pocket template –"island" feature up and notch to the rear (figure 3.2)
  - Careful: The trigger pocket template can be installed two different ways
- Router Base Support Plate – orientated with counter-bore facing up.
  - Incorrect orientation if template island feature will not be 100% enclosed by the router-base support plate cutout
- Using the 1.75" template screws, secure the assembly (see figure 3.2).
  - Verify that the cap screw heads are below surface of the router support base
- Secure jig assembly into vice (c-clamp if necessary) as shown in figure 3.3.
  - Some prefer to have the buffer tube side towards the users; however, chips will exit out of the buffer tube will be directed towards the user

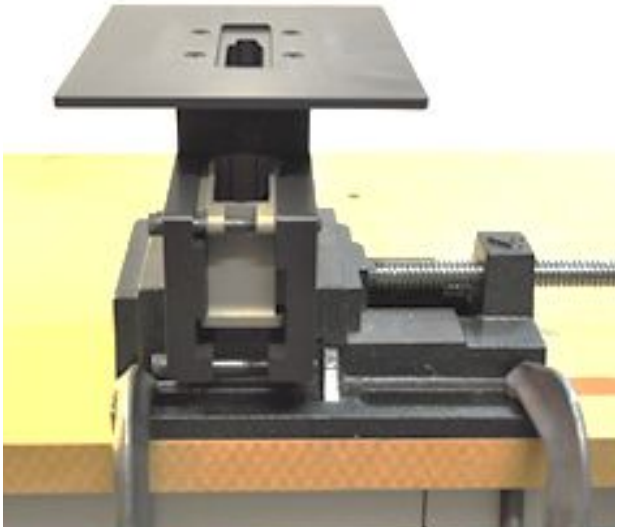


Figure 3.3 (left): Jig clamped on vice with proper orientation as viewed from the user's observation point

- Using the ¼" router collet, install ¼" end-mill following the router manufacturer's instructions.
    - End-mills will pull the bit away from the router.
    - Always assure that the end-mill is seated in the router collet to a safe depth

Step 3b: Milling out the trigger pocket

- The main depth gauge sets the router bit depth for each pass (see figure 3.4)
    - Hash marks provide a reference to set the depth of the router bit for each cut.
    - The distance between the hash marks is called the hash (see figure 2.3).
    - The suggested cut depth for normal 6061 alloy lowers is 1/3 to 1/2 hash for each pass. Never exceed 1 hash per pass. For 7075 alloy lowers, take lighter passes, 1/4 to 1/5 hash per pass.

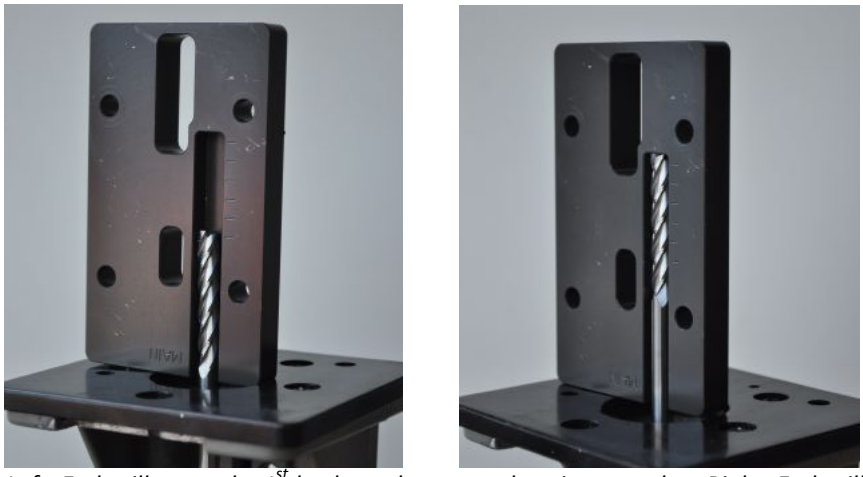


Figure 3.4: Left: End-mill set to the 1st hash mark to start the trigger pocket, Right: End-mill set to the final depth resulting in a finished 1.249" deep trigger pocket

- **Roughing pass ------- !!! Don't allow the end mill cutting surface to touch the jig wall !!!**
    a. With the router off, carefully set the end mill inside the front 3/8" drill hole (figure 3.5)
    b. Start with the end-mill set to the 1st hash mark (figure 3.4 left)

Figure 3.5: Starting with the end-mill inside of a drilled hole not touching the sides (photo is with a full sized router not a laminate router)

    c. Turn on the router while maintaining a firm grip with the other hand
    d. In a clock-wise manner, make arc-like passes with a light cut with the goal to adjoining the adjacent holes (figure 3.6 & 3.7). Repeat until all holes are adjoined (see figure 3.8)

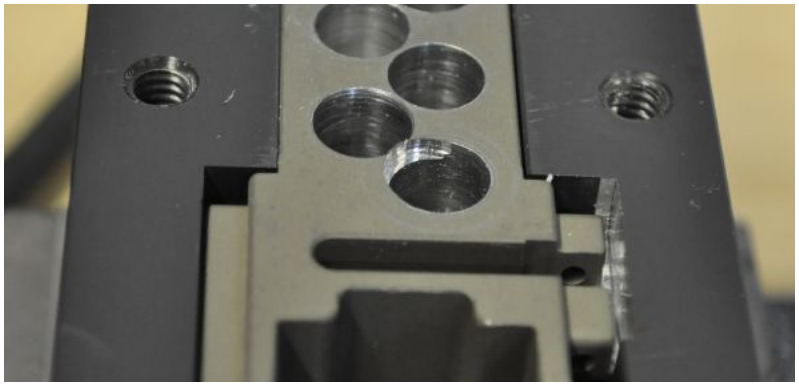


Figure 3.6: After three light passes, the holes are merging together

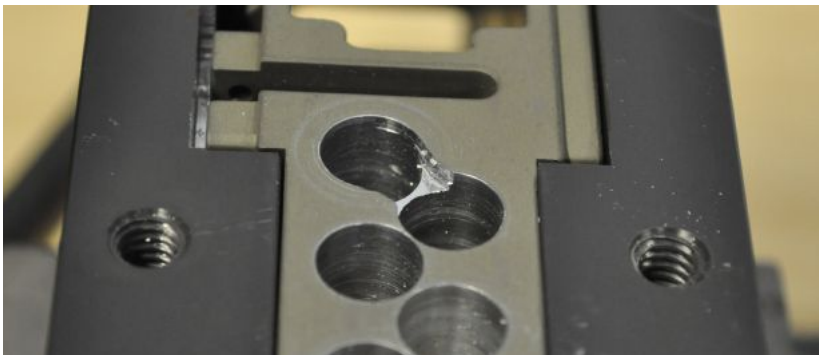


Figure 3.7: The 1st two holes are adjoined

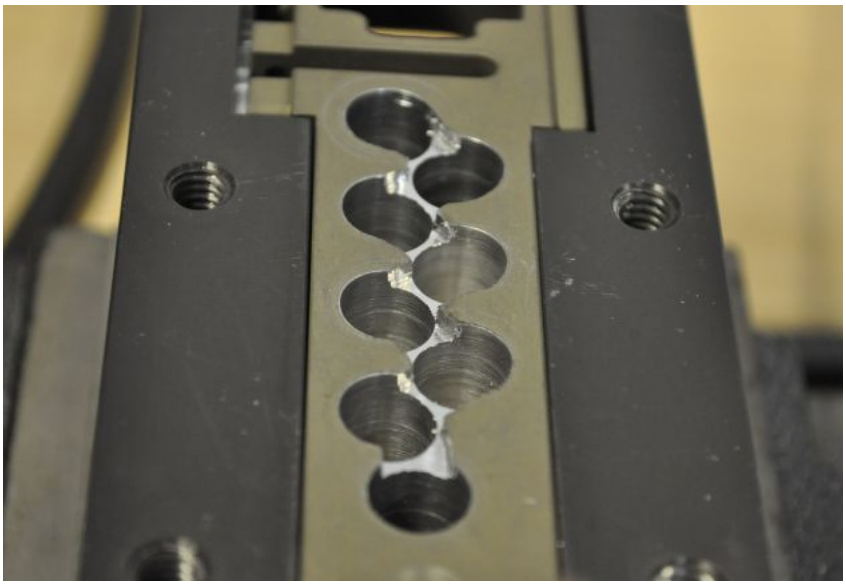


Figure 3.8: All of the holes are adjoined

e. Form polygon with 1/16” gap between end mill and template (figure 3.9)
   - Cut with clock-wise motion, work on one peak at a time
   - **At first, the end-mill cutting surface can damage the jig if contact is made**

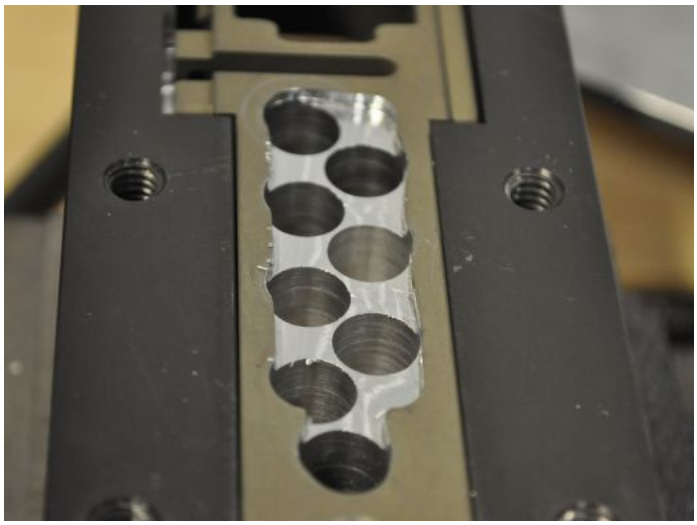


Figure 3.9: Polygon formed without the end-mill touching the jig (1/16" approx. gap)

f. Move the router to the center, turn off, and remove after the end-mill stops spinning
   - Spinning end-mill and accidental jig contact will damage jig and/or the end-mill

g. Using the depth gauge, verify depth setting
   - Common depth changes are due to 1) router collet is not tight enough or 2) the depth adjustment on the router is not properly tightened or adjusted

h. Before starting the next pass, clear the chips by inverting or using a shop-vac.

i. In a repeating fashion, Use gauge to incrementally increase the end-mill depth by ½ to 1/3 hash and execute a rough pass until the depth of 2.5 to 2.66 hash is achieved (figure 3.10)

j. Move the router to the center, turn off, and remove after the end-mill stops spinning

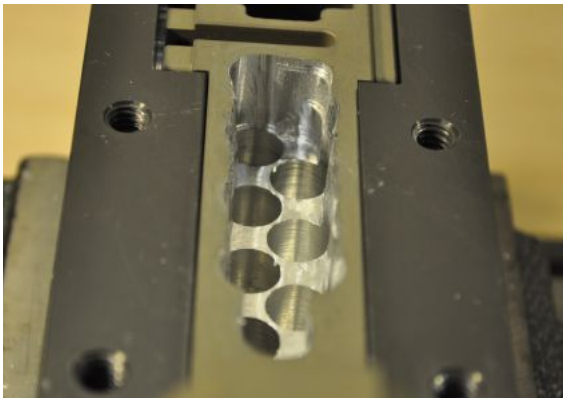


Figure 3.10: Lower after consecutive roughing passes from start to 2.5 hash

- **Finishing pass** (allow the end mill shank to touch the jig wall)

Under no circumstances should the cutting surface of the end mill ever touch the jig. Only the smooth part of the end mill (called the shank) should

ever touch the template. You MUST verify that the cutting surface of your end mill has cleared the template before executing a finishing pass.

a. This process is used after multiple roughing passes have allowed your end mill to reach deep enough into the lower so that the cutting surface of the end mill can no longer come into contact with the trigger pocket template.
b. The finishing pass is always done at the same depth as the last roughing pass after completing step J.
c. From the center, make multiple light clockwise passes following the jig contour until the end-mill shank touches the template in a spiral fashion (figure 3.11) **(Again, only the smooth part of the end mill (the "shank") should ever touch the jig).**
d. Finishing Pass is complete when you can move end mill all the way around the template without encountering any material on the side of the lower left over from the initial roughing passes.
e. In a repeating fashion, increase the end-mill depth by ½ to 1/3 hash and continue making passes until the depth of 6 hash is achieved – last hash mark
f. Set the depth to the final cut (see figure 3.4 right)
g. For the final cut, the drill holes have tapered to a small diameter and the router cannot be started within a drill hole.
    - Insert router into the template (targeting the middle). With the router above and parallel to the support plate and the end-mill not touching the bottom, start the router and carefully dig a hole to the final depth (targeting a drill dimple if possible)
    - Rough with clock wise circular patterns – go slow since quite a bit of metal needs to be removed
    - After the roughing polygon has been formed, execute the final finishing pass (see figure 3.12)
    - Relax, the most time consuming part of the lower build is done and we are now 75% into the "EZ-jig" process

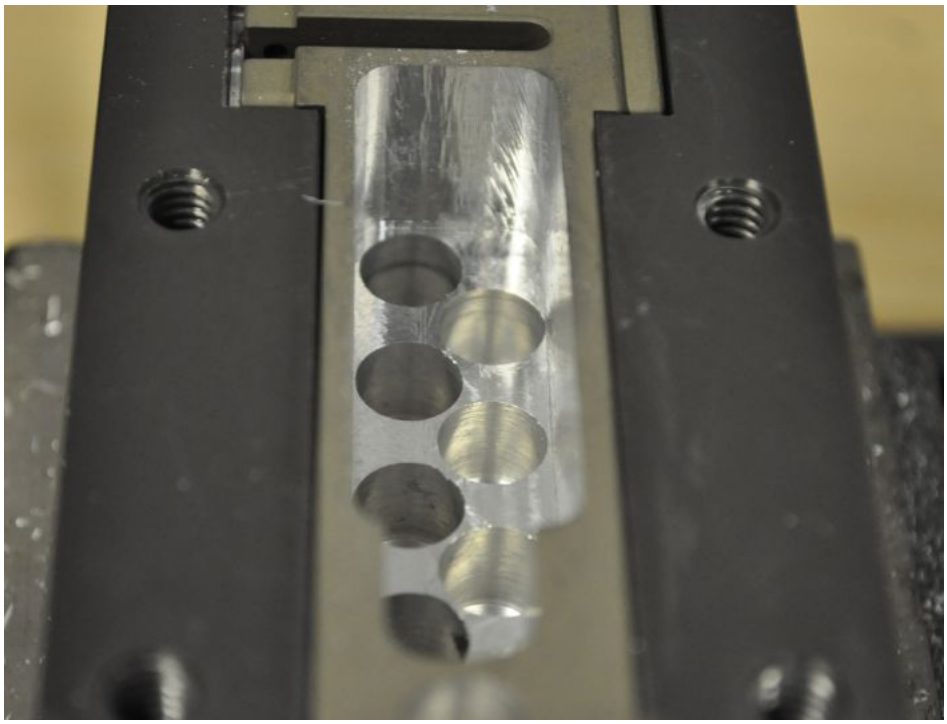


Figure 3.11: 1st Finishing pass at the depth of 3 hash marks

Helpful hints for using a router

- Start with the hole closest to the user and move away when adjoining holes
- Steady downward pressure is required to keep the router from moving up and down which can damage the end-mill - downward pressure should be 4-6x the pressure to move the router.
- **Deep cuts and lack of downward pressure can cause the router to jump potentially causing injury to the user and damage to the jig, end-mill, or lower**
- The router when working correctly should be able to cut through the metal like butter
    - One should be able to move the router with very light pressure.
- Excessive side to side pressure required to cut (loss of the cut like butter feeling) indicates that metal has clogged at least one of the flutes
    - Caused by too aggressive of a cut or by lack of cutting oil on the router bit
    - Clogging must be cleared
- Cutting oil be applied via toothbrush to the bottom ½" of the end-mill after each pass.
    - Avoid oil on the guiding edge of the template.

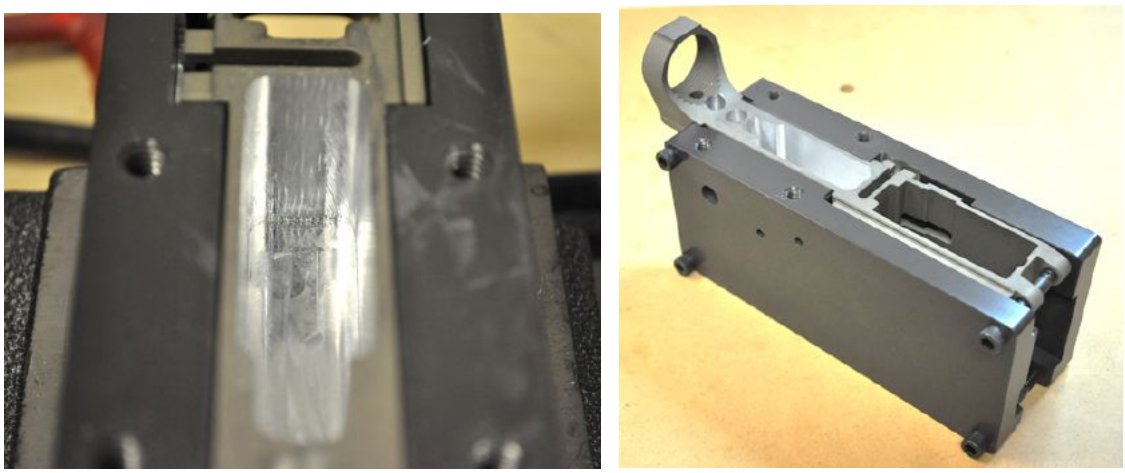


Figure 3.12: Finished trigger pocket to a depth of 1.249”

Step 4a: Milling out the rear-shelf pocket

- Assemble jig as shown in figure 4.1 using the same stack up as the previous trigger pocket setup. Verify correct orientation of parts
    - Use the rear shelf pocket template shown in 4.1
    - Remove the screw closest to the buffer tube (figure 2.7)
- Using the depth gage labeled “rear”, set up the end-mill to the starting position (figure 4.2, left)
- Start roughing process using hole created during the previous drilling step
    - Repeat roughing passes until the 3rd hash mark is reached in ½ hash increments (use smaller hash increments for 7075 alloy). Do not let end mill come into contact with the jig, maintain about between 1/16 and 1/8 of an inch separation just like in the trigger pocket milling step.
- Set depth to final pass (fig. 4.2 right) and execute a roughing pass followed by a finishing pass. Finishing pass must occur AFTER end mill is deep enough in the lower to allow the cutting surface of the end mill to clear the jig. Only the smooth shank of the end mill can touch the jig.

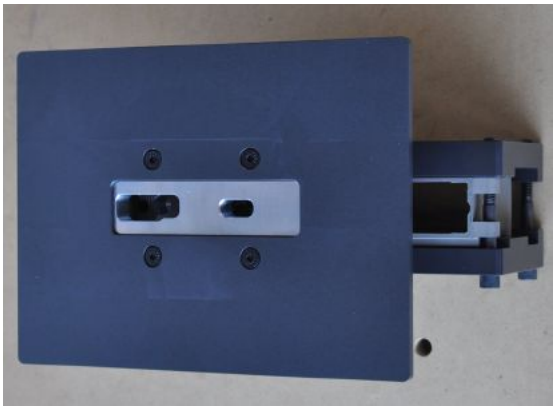


Figure 4.1: Trigger pocket orientation shown the “island feature” and proper orientation
(Silver parts are used for clarify, all jig parts are the same color)

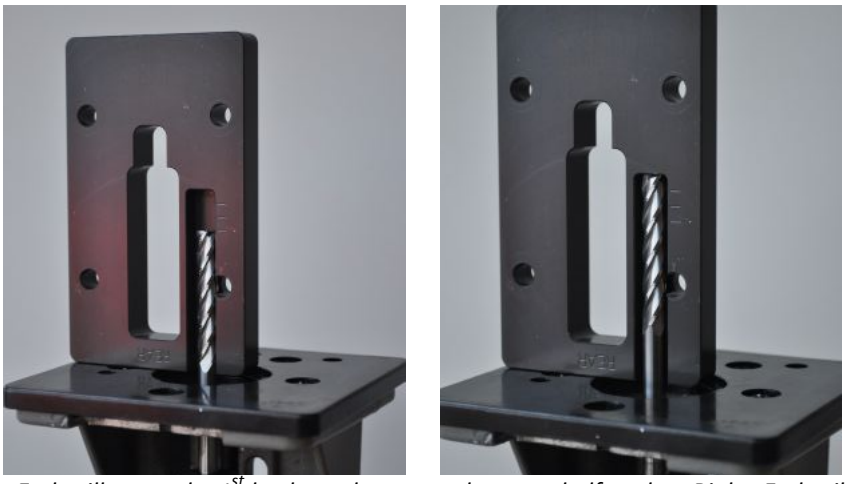


Figure 4.2: Left: End-mill set to the 1st hash mark to start the rear-shelf pocket, Right: End-mill set to the final depth resulting in a finished 0.630" deep rear-shelf pocket

Step 4b: Milling out the trigger hole

- Remove the plates and install the trigger template as shown in figure 4.3 using the 0.75" screws
    - Make sure the island is down and the jig orientated as shown in figure 4.3
    - The front set of holes in the jig wall and the back set of holes in the jig should be used
- With a drill-press, drill a 19/64" hole using the 19/64" hole in the template as a guide
- With a hand drill, use the jig that is not installed as a 90 deg reference and 19/64" drill bit to center the bit as shown in figure 4.4
    - When square, use a hammer to center punch the hole as shown in figure 4.4
    - If the mark is hard to see, remove the template and use a marker to highlight the dimple and reinstall the template
    - Insert the 19/64" drill bit into the hand-drill, insert through the jig template hole and make sure the bit is touching the center punch mark, carefully drill through the lower
    - Remove the template and the lower should look like figure 4.5
- Install the trigger template and the router plate as shown in figure 4.6 using the 0.75" screws
    - The template island should be facing up
    - The front set of holes in the jig wall and the back set of holes in the jig should be used
- Make sure the end-mill is set deeply into the router and fully retract the router base.
    - The cutting surface at the top of end-mill will be used to cut the trigger slot to minimize end-mill flex
- Mill the trigger slot (see figure 4.7)
    - Insert the router end-mill into the hole, make sure the end mill is not touching the lower (center as best as possible)
    - Apply firm downward pressure to make sure the router doesn't jump when started and turn on the router

- Mill the trigger pocket with light cuts in a clock wise pattern until the end mill touches the jig
- Return the router to the center of the slot, turn off the router, wait till the bit stops and remove router

- Remove the template, complete trigger slot is shown in figure 4.8

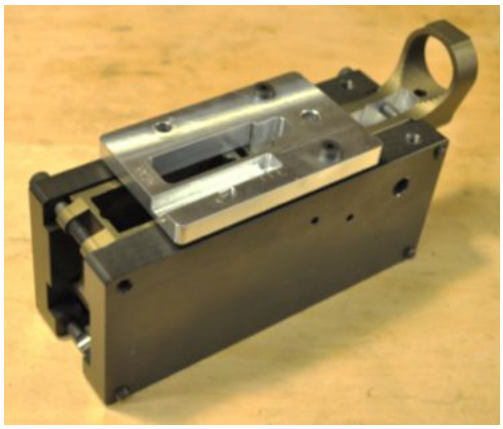
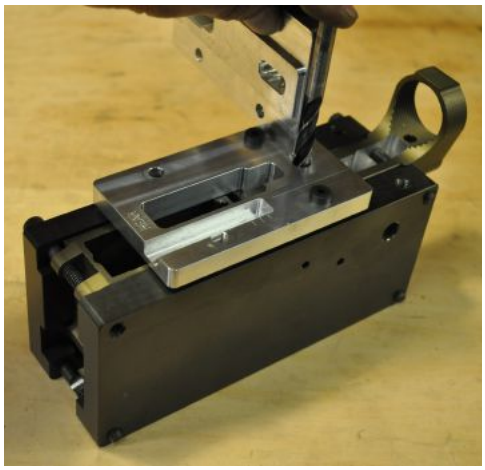


Figure 4.3 (left) installation of the trigger pocket jig to locate starting hole for trigger hole



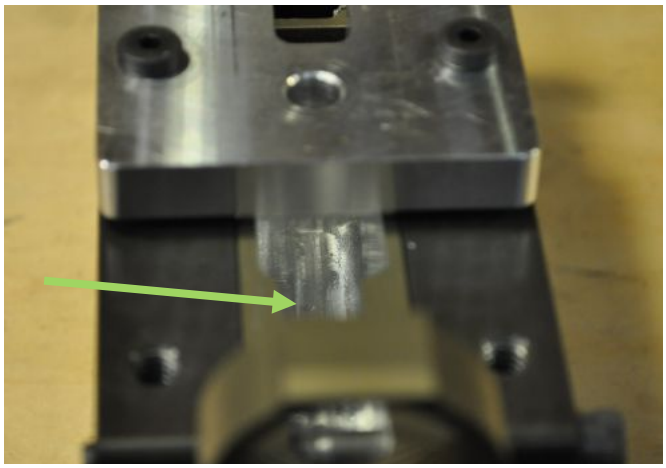


Figure 4.4 (left) using the jig and drill bit to make sure the bit is centered, use a hammer to center punch
Figure 4.4 (right) arrow shows center punch mark

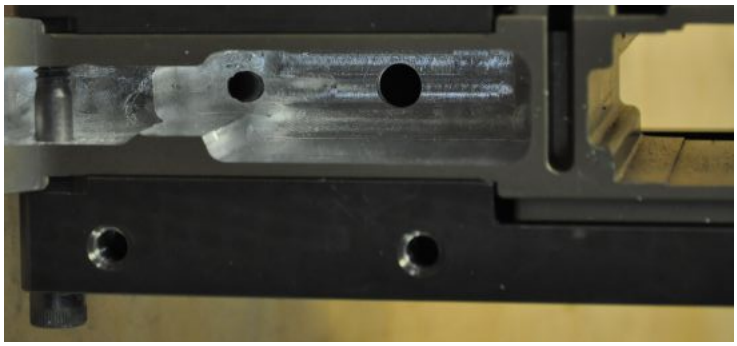


Figure 4.5 trigger starting hole through the lower

Figure 4.6 Install the rear shelf jig to mill out the trigger hole through the lower

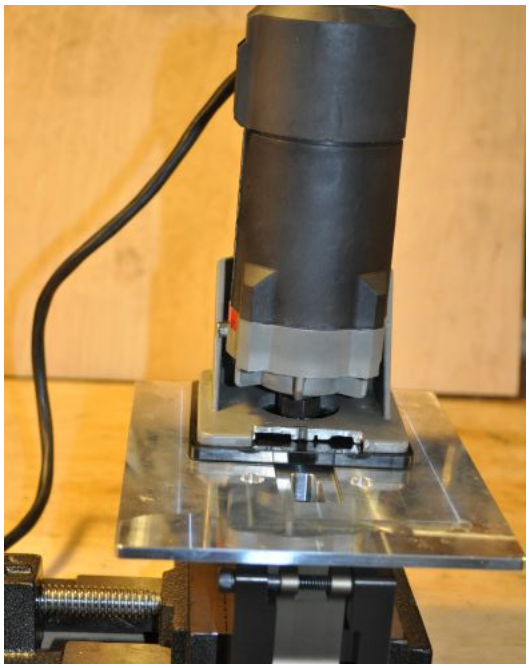


Figure 4.7 router inserted into lower hole, careful to start the router without touching the lower

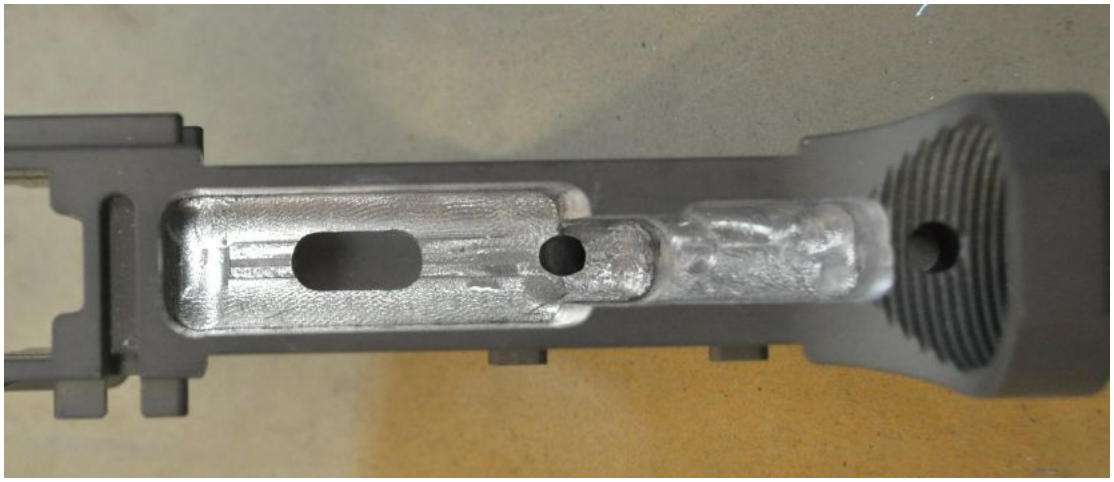


Figure 4.8: With the trigger and rear-shelf pockets finished and the trigger slot cut

Step 5: Drilling out the holes for the fire control group

- For hand-drill (see figure 5.1)
    - Jig walls are designed to maintain the proper angle alignment
    - Clamp jig in vice before drilling
- For drill-press (see figure 5.2)
    - Use the templates as spacers so the screws do not touch the drill press or templates
    - Make sure drill press is adjusted so its square in both the x and y directions

- Set the jig wall screws to the standard position
- Insert the 5/32” bit into the drill
- Drill both 5/32” hole through one wall of the receiver only.
    - Remove the drill bit up and down while drilling to clear chips.
- Repeat with the 5/32” holes on the other side
- Repeat the process with the 3/8” bit, drilling through one wall at a time

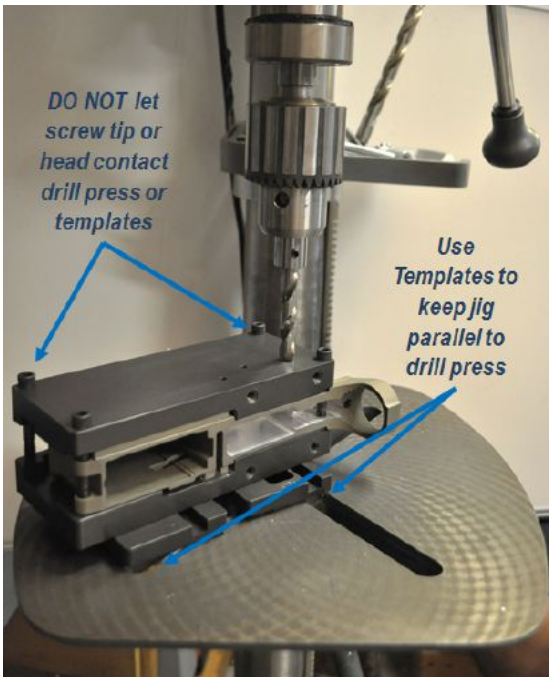


Figure 5.1 (left): Hand-drill used to drill trigger and safety selector holes

Figure 5.2 (center): Drill-press: Using the jig templates to keep screw heads and tips away from the drill press

Step 6: Completing the Lower

- Remove the finished lower from the jig
- If necessary, de-burr the fire-control holes inside of the pockets
- De-burr the safety detent hole where the 3/8” hole is drilled (figure 6.1)
    - Check that the detent can move freely. If it does not move freely, use a paper clip to scrape out the hole. It’s common have a little bur in there that will make detent get stuck if the bur is not removed. If your selector detent does not move freely, it will cause your selector to not “snap” into fire / safe positions.

Figure 6.1: Difficult to clear burr in safety selector hole

Figure 6.2: Example of finished lower "EZ" jig

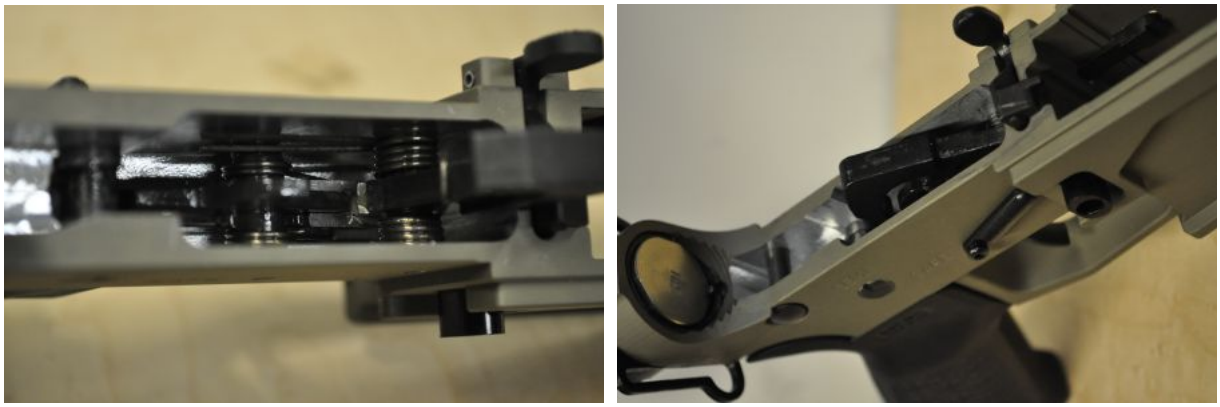


Figure 6.3: Finish lower and make sure is fully functional and safe before using