AR-15 Lower Receiver Completion Guide
Manual Mill

Please carefully read these instructions in entirety before beginning.

Overview:

These instructions are meant to give you some direction in completing your Optimus Defense 80% Lower Receiver. To complete the lower you will be drilling three holes and machining two pockets. To keep the lower receiver within tolerance, pay close attention to the tolerances as you machine. We offer recommended speeds, depths of cuts, and stick out lengths on the final page of this manual. This guide will cover manually machining your lower. It is possible to use drill jigs or a CNC machine if you so choose.

Cutters:

These tools are included in the Optimus Defense tool kit available for purchase:

- 7/16" Endmill with a 3/8" shank
- 5/16" Endmill with a 3/8" shank
- 3/8" Stub split tip drill bit
- 5/32" Stub split tip drill bit
- 1/4" Precision ground rod for part zero

Figure 1

Other Tools:

- Mill with Vise (needs to be squared)
- Edge Finder or suitable touch off method
- Safety Glasses
- Cutting Fluid (recommended but not required) such as A-9 or Tap Magic Aluminum
- Dykem (blue dye) or dark color Sharpie
- Manual Mill Drawings and Inspection Drawings (available at **optimusdefense.com/documents**)

Procedure:

Hammer and Trigger pin holes

1. Clamp the lower in the vise with the Lower's left side facing up.

Note: Place the lower on parallels or a sacrificial parallel block to avoid drilling the vise.

2. Zero X and Y; Place the 1/4" precision rod in a tool holder and center the rod over the take down hole. Adjust the table until the rod drops smoothly and easily into the take down pin hole. See Figure 2.

Note: A high quality 1/4" drill bit can be used instead of the 1/4" precision rod.

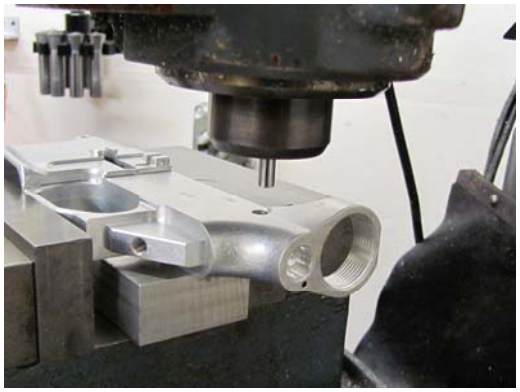


Figure 2

3. Using the 5/32" drill bit, drill the hammer and trigger pin holes.

Selector Hole

4. Using the 3/8" drill bit, drill the selector hole.

5. After drilling all three holes remove the lower from the vise and carefully inspect it using the inspection drawing.

Fire Control Pocket

6. Place the lower in the vise in the upright position, with the trigger guard flat on the bottom of the vise.

Note: Make sure that the lower is sitting flat. Check with a square or dial indicator.

7. Insert the 1/4” precision rod in the take down hole and touch off on one side. The rod is precision ground to diameter 0.250”. The center of the rod is your X Zero. See Figure 3.

Note: Remember to adjust for the precision rod and edge finder radiuses.


Figure 3

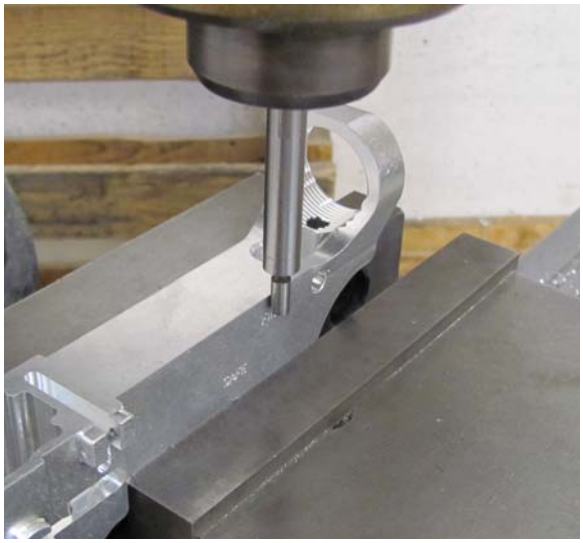


Figure 4

8. Touch off the left side of the lower, this will be your Y Zero. See Figure 4.

Note: Remember to adjust for the edge finder radius.

9. Using the 7/16” endmill, zero Z off the top surface of the lower. See Figure 5.

10. Machine the fire control pocket to a depth of approximately .020" deep. Then use Dykem (blue dye) or a dark color Sharpie to color the fire control pocket. This provides a visual reference for roughing.

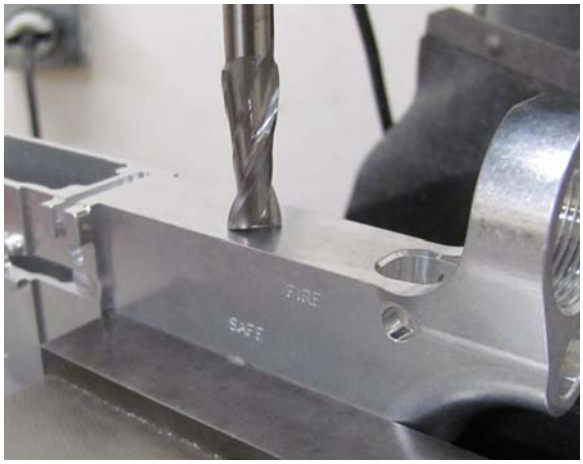


Figure 5

11. Visually rough out the large pocket of the fire control pocket, but not the rear slot, to a depth of 1.250". Leave an allowance of about 0.010" to 0.020" around the pocket. This allowance will be machined during the finish pass. See Figure 6.

12. Perform a full depth finish pass to bring the pocket to its finished dimensions.

Note: Due to tool deflection, conventional milling tends to cut a slightly larger pocket. You may want to cut slightly undersized. You can always remove more material.

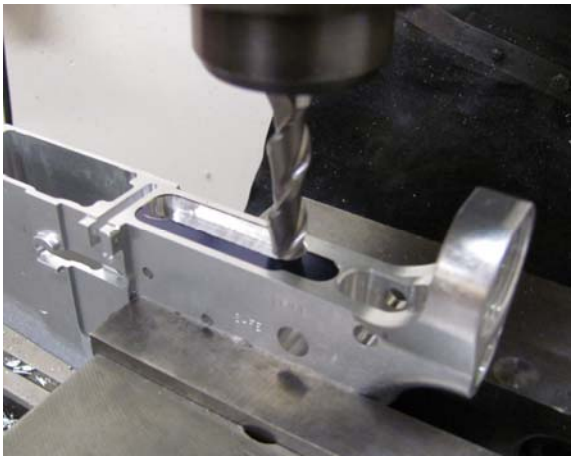


Figure 6

Figure 7

13. Machine the rear slot of the fire control pocket. See Figure 7.

Note: No finish pass. Just slot in and out at the same depth of cuts as rough milling the fire control pocket.

Trigger Slot

14. Using the 5/16" endmill, machine the trigger slot. See Figure 8.

Note: Ensure the tool is sticking out enough to avoid any collisions with the mill head and/or tool holder.

15. After milling both pockets take some measurements and compare it to the inspection drawing. All dimensions should be within the tolerance noted on the drawing. If out of tolerance, carefully consider how it will affect the function of your lower.

Figure 8

Debur

16. Using a suitable debur tool or sandpaper, carefully take down any sharp edges.

Warning: *Once you have machined any of the hammer, trigger and selector holes or the fire control pocket and trigger slot, you have what is legally considered a firearm. This firearm can not be traded, gifted or sold without the assistance of a FFL. Optimus Defense assumes no liability for the actions of the user of this product. You are responsible for knowing all laws and regulations in your area relating to this product. We are not lawyers, and this is not legal advice.*

Recommended Cutting Parameters

7/16" Endmill
Speed: 1750 RPM
Stick Out: 1-3/4"
Roughing Depth of Cut: 0.220"

5/16" Endmill
Speed: 2450 RPM
Stick Out: 1-1/2"
Roughing Depth of Cut: 0.150"

3/8" Drill
Speed: 2000 RPM
Stick Out: 1-1/2"
Peck Drill: 0.190"

5/32" Drill
Speed: 4800 RPM
Stick Out: 1-1/2"
Peck Drill: 0.080"

Calculations

Definitions
RPM – Revolutions per Minute
SFM – Surface Feet per Minute
Dia – Diameter of cutter

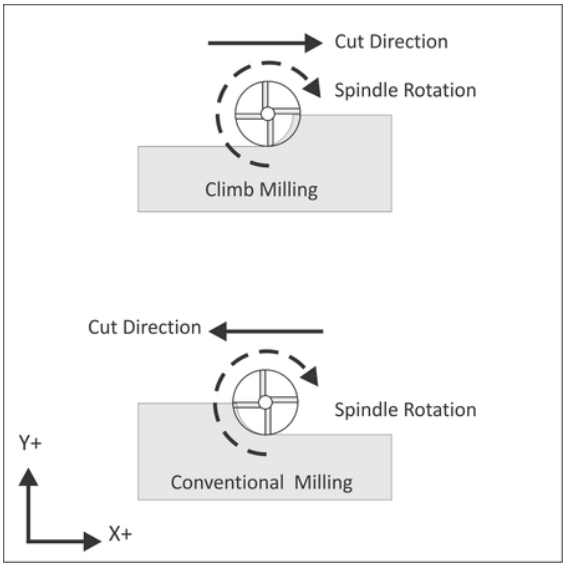
Formulas
RPM = SFM * 3.82 / Dia

SFM for High Speed Steel cutting Aluminum is 200. (conservative cutting)

Recommended RPMs are based off the above calculation. You can use a slower RPM and compensate by lowering your feed rate as well.

Other Information:

Climb vs Conventional Milling:
Conventional milling is recommended for manual machining since it keeps pressure against the table of the mill. For the fire control pocket, it is recommended to machine in a conventional pattern. This is generally moving the cutter clockwise around the inside of the pocket.



Tool Chatter:
Tool chatter may occur due to the long length of these cutters. If you are experiencing excessive chatter or getting a bad surface finish, reduce the spindle RPM.

Cutting Fluid:
Using a cutting fluid that is made for machining aluminum, such as A-9 or Tap Magic Aluminum, will greatly improve the machining finish, reduce tool chatter, and improve tool life.

Warning: *Manual machining can be dangerous. You should know how to safely operate the tools and equipment before attempting to complete an AR-15 Lower Receiver. Always were safety glasses. This Guide is for informational and educational purposes only. Optimus Defense is not liable for an property damage, personal injury, or death, as a result of using this Guide.*