# Gen 3 Stock

Printing and Assembling the Gen 3 Stock System

# 1 Introduction

The *Gen 3 Stock System* is a fixed stock intended for use on AR pattern rifles that use a mil-spec carbine buffer tube.

The goal of the system is to provide an ergonomically correct, light weight stock that is positively retained to the buffer tube and blended smoothly with the lower receiver.

The stock has three choices for butt pads and five different lengths available for full customization. Four different adapters are included to blend with all of the Hoffman Tactical lowers as well as a mil-spec aluminum lower. More options may be available in the future.

The retention device clamps into the bottom of the buffer tube, making for a very strong hold. This allows the rifle to hang from the wall by the stock.

The stock features printed-in-place QD points for attaching sling swivels.

The butt pads may be printed using TPU for maximum comfort and grip.

A few small screws and nuts are needed, the rest of the parts are printed.

This is an advanced print. Print pauses, infill modifiers, filament changes, and part scaling will be required to print the stock. Your printer will also need to be properly calibrated to insure a proper fit of the stock over the buffer tube.

This instruction book will walk you through the process of printing the parts and assembling the stock.

In the download SolidWorks part files were included for the pad and adapters. This will allow someone with a compatible program to easily redesign the adapter to blend with other lowers, as well as customize the pad.

Be sure to read the entire instruction book before proceeding, this is not a step-by-step guide, information is listed in a non-linear format.

The primary limitation of this stock system is that it must be used with a mil-spec buffer tube. Commercial spec, rifle, and pistol tubes will not work. Fortunately, mil-spec tubes are the most common.

A bonus file is included in the download. The wall hanger bracket. This is an exsparimental option to hang the rifle on a wall by the stock.

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# How The System Works

There are a number of different parts, it's important to understand how all of them work together before proceeding with the build.

## 2.1 Overview

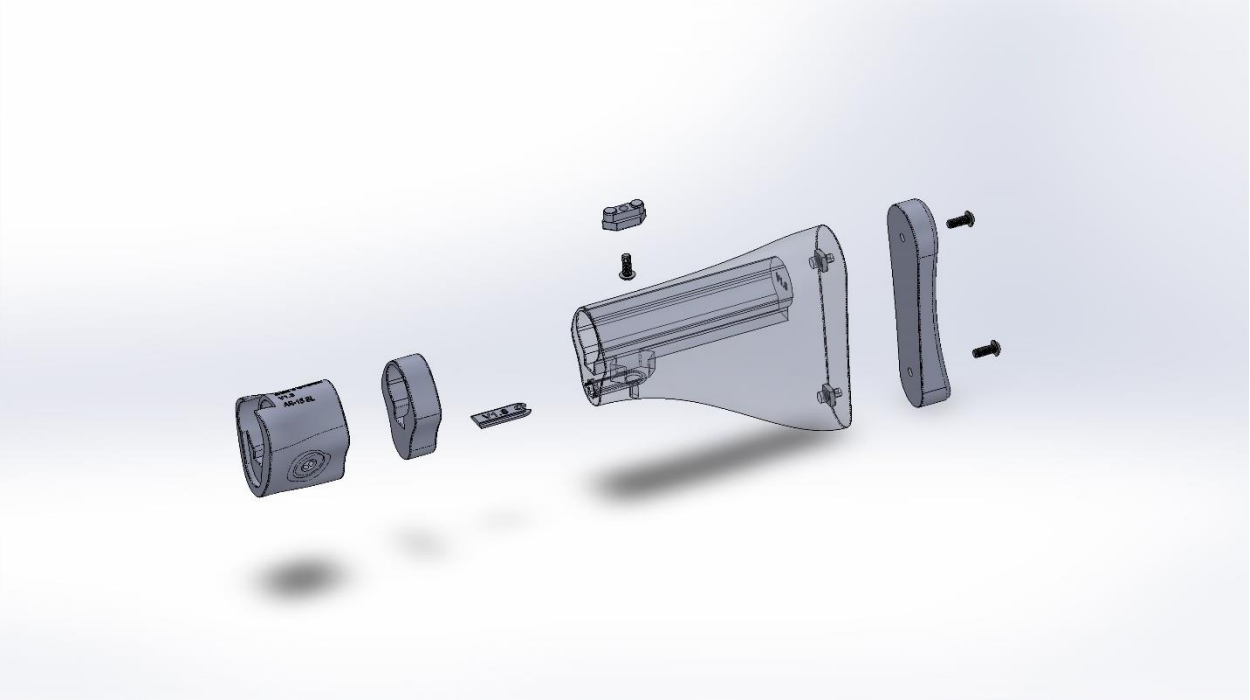

*Figure 1 From left to right. Adapter, Neck, Butt, and Pad. Small parts are the retention assembly.*

The system consists of four main components and the retention assembly.

The *adapter* interfaces between the stock and the buffer tower of the lower receiver. It also houses the QD sockets.

The *neck* is the spacer between the butt and the adapter, its length varies depending on the desired length of pull.

The *butt* is the primary component of the stock. It houses the retention assembly and supports the pad.

The *pad* is the part that contact your shoulder.

The adapter, neck, and butt slide over the buffer tube. The pad is fastened to the butt via a pair of screws.

The retention assembly consists of a block that is pressed onto the bottom of the buffer tube via a screw and nut. The screw head is fully captured by the plate.

Two bosses on the top of the block engage with the holes on the bottom of the buffer tube, resulting in a positive retention.

When the screw is turned counter clockwise it forces the nut and block up against the buffer tube. When the screw is turned clockwise it pulls the block back down, releasing its hold on the buffer tube.

The plate holds the head of the screw into its pocket, and allow the block to be successfully retracted.

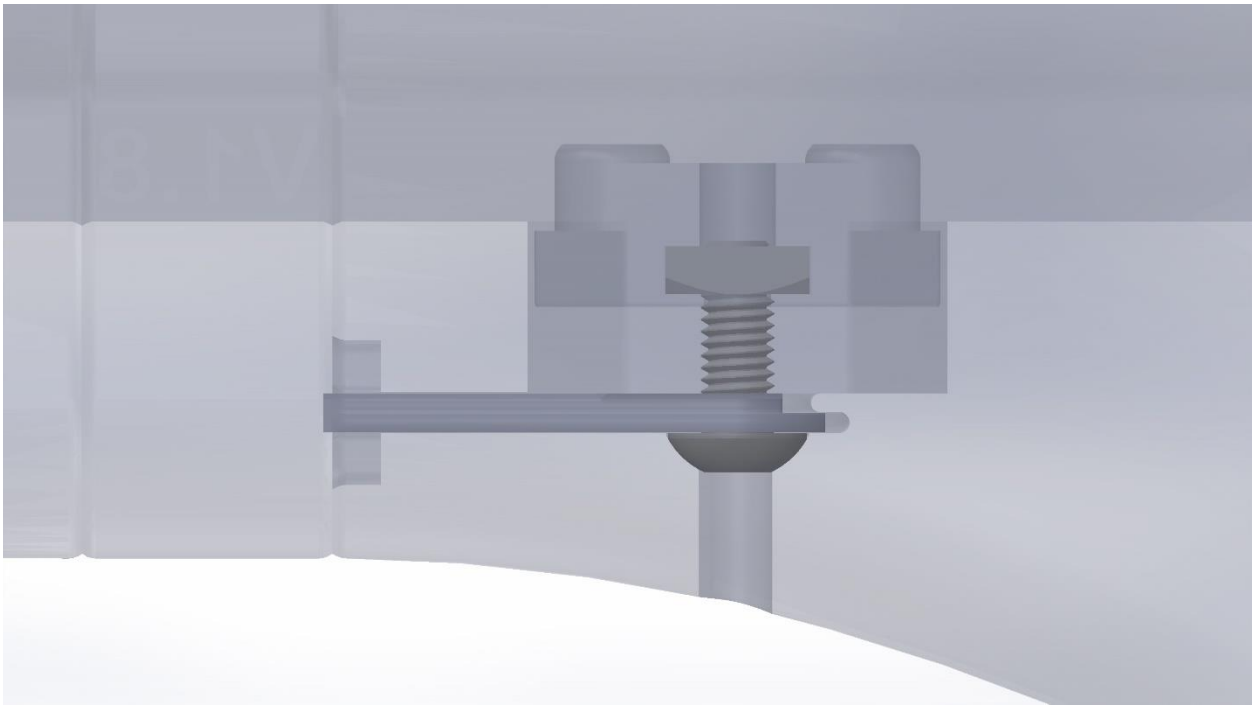

*Figure 2 Retention Assembly. The screw head is held into its pocket by the plate.*

## 2.2 Length of Pull

The length of pull is the distance from the trigger to the rear of the pad. This can be adjusted from approximately 11.750” to 14.250” on an AR-15 and 12.375” to 14.875” on an LR-308.

The difference is because the buffer tower extends further to the rear on the LR-308. The length of pull can be adjusted on 0.650” increments by engaging the block into another pair of holes on the buffer tube.

The optimal length of pull depends on the shooter’s preference. However, a good rule of thumb is to hold the pistol grip and then extend the stock until it meets your arm at your elbow joint.

## 2.3 Choosing the Right Pad

Three pads are included in the download. *Heavy*, *standard*, and *classic*. The standard pad is intended for all around comfort and speed. The classic pad is contoured like many common stocks, such as Magpul. The heavy pad is intended to have a firm grip on the shoulder for firing more heavily recoiling weapons faster or from a prone position. The choice is up to user preference.

## 2.4 Choosing the Right Adapter

The adapter blends the stock into the buffer tower for a smooth lower receiver. There are four options in the current release.

Three of the options are designed for the Hoffman Tactical lowers. The fourth option is designed to blend with a “mil-spec” lower, such as an 80% lower. Choose the adapter that matched your lower. All adapters feature QD sockets on the left and right side.

# 3 Required Resources

Hardware and filament are needed to complete the stock.

## 3.1 Parts

- (3) 10-32 x 0.5” Button Head Hex Drive Screw. It’s important to use the correct screw, the shape of the head is critical. We recommend this screw or a similar one: **https://www.mcmaster.com/97763A232/**
- (3) 10-32 Square Nut. Must be 0.375” Wide and 0.125” Thick. We recommend this one or an equivalent: **https://www.mcmaster.com/94785A411/**

## 3.2 Filament

For the large stock parts:

- PLA+. Polymaker PLA Pro or Keene Village Performance PLA is recommended.
- Carbon Fiber Nylon. A low fiber content option such as Push Plastic Carbon Fiber Nylon or Matter Hackers NylonX is recommended. (Best).

For the butt pad:

- PLA+.
- A combination of PLA+ and TPU. Ninja Tech Ninjaflex is recommended. (Best).

For the plate:

- PLA+.
- Polycarbonate. (Best).
- Carbon Fiber Nylon.

For the block:

- PLA+
- Nylon. Taulman Glass Fiber Nylon, carbon fiber Nylon, or a plain Nylon. (Best).
- Polycarbonate.

PLA+ will work for all parts, however, there are better options, marked as “best” above. I chose a low carbon content carbon fiber Nylon as the best option for the larger parts because it is not abrasive to the skin, has good layer adhesion, temperature resistance, and is light weight.

Polycarbonate is best for the plate because of its high stiffness.

Any Nylon Is good for the block because if its abrasion resistance.

Don’t let these expensive filaments lead you to believe that PLA+ will make for a bad stock, it will make a great stock. Using Nylons will only make the stock marginally better. It’s up for you to decide if it’s worth it.

## 3.3 Tools

- 3D Printer (obviously).
- Computer with slicing software (I hope this was also obvious).
- Allen wrench to tighten the screws with. Our recommended screws use a 0.125” Allen wrench.
- Calipers or other precision measuring device.
- Pliers

A basic printer that can run PLA+ will do the job. However, if you want to print with TPU or any of the other more exotic filaments, you will need a machine capable of it.

Printer size should be equivalent to an Ender 3 or Prusa i3 MK3. The tallest part is 153 MM high.

Using infill modifiers is easier in Prusa Slicer. It’s recommended to use that slicer and have it set up with your printer. Cura will work, but you will need to know how to operate it. Examples in this book are for Prusa Slicer.

# 4 Printing The Parts

This section will walk you through a few key concepts and print settings needed to print the stock. It is assumed that you are already printing functional parts such as lower receivers and that your slicing profile works with your printer. Your current slicer settings will probably work, but there are a few listed below that should be followed.

## 4.1 General Print Settings

Mechanical settings for the large parts:

- 0.2 MM layer height. You can use less, but it has little advantage.
- Two or three walls. Less is lighter. More is better if intending to use the stock as a club. I use two walls.
- 10% to 15% gyroid infill. Same as above. I use 10%. You can also use honeycomb infill for additional strength, though gyroid is a little lighter. I do not recommend other infill patterns. Modifiers should be 50% infill.
- 0.45 MM line width for infill and walls. Assuming a 0.4 MM nozzle.
- 0.40 MM line width for the top and bottom layer.
- Use your default print speeds for quality parts. This depends on your printer.
- Set the seam position to “Random” or use paint on seams to place the seam along the bottom edge of the stock.
- Six top layers and four bottom layers.

For the TPU Pad:

- 15% to 20% infill.
- Two walls.
- Three top layers

If printing the pad from a solid plastic like PLA+, ignore these settings and use the large part settings.

For the small parts:

- Four walls.
- 50% gyroid infill.
- No need for fancy seam position settings.
- All other settings the same.

Thermal settings:

- When printing the larger parts with PLA+, be sure to set the bed temp to 65 C for the first layer, **and 45 C for the remaining layers**. This is critical to prevent the bottom of the part from slumping. Use glue stick.
- The block and plate, when printed in PLA+, should be printed with a 65 C bed throughout the print.
- Follow the manufactures recommended nozzle temperature.

- Most Nylons print great with the bed at 90 C for the first layer and 35 C for the remaining layers.

No support material is needed.

## 4.2 Print Orientation

All parts come properly oriented. However, it is always good to double check. Parts should be printed with their largest flat surface on the bed.

## 4.3 Using Modifiers

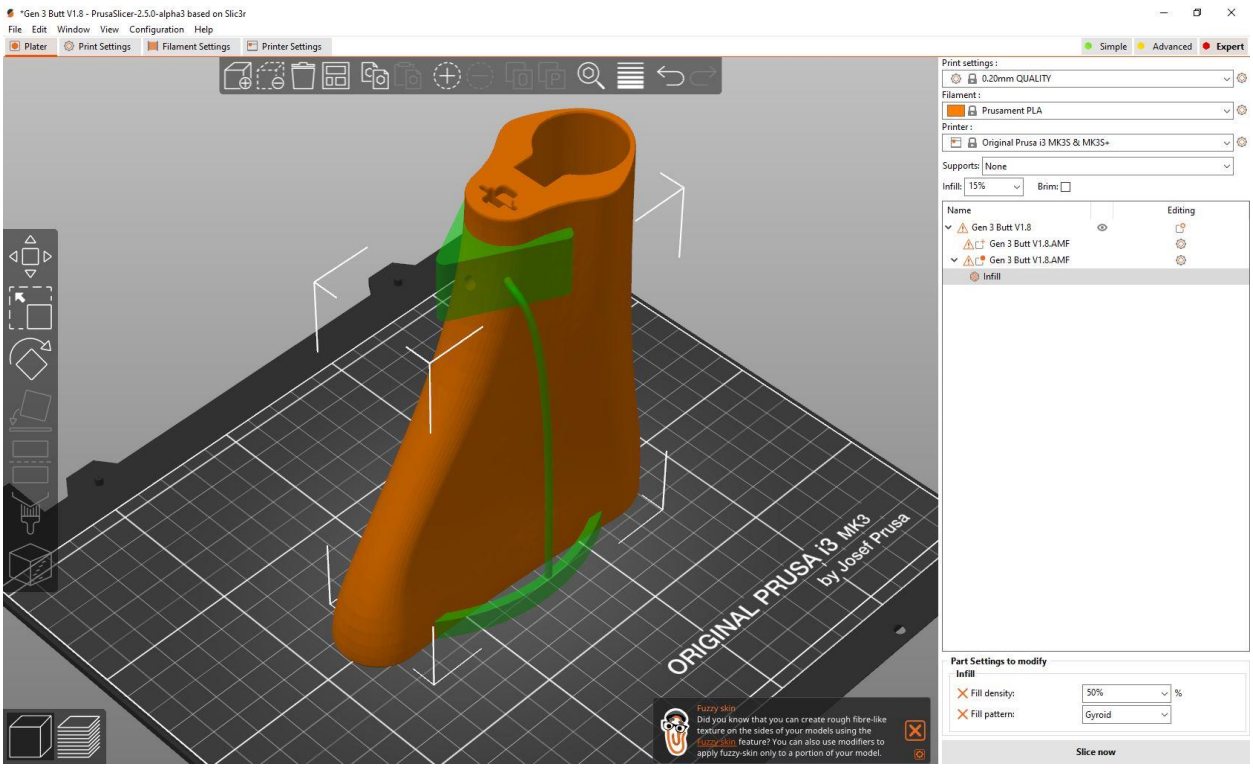


*Figure 3 A modifier (mask) used to adjust the infill density.*

The butt and the adapters all use *modifiers*. A modifier is a second body in the slicer that overlaps with the main part, it is not printed, but rather modifies the settings of the main part in the areas of overlap. You will notice that the butt and adapters are not in the form of an STL file, but rather an AMF file. This is because the modifiers are included in the file. Modifiers are also known as *masks*.

When you import the file into the slicer, it will ask you if you want to treat the file as multiple parts, or a single part with multiple bodies, always select the latter option.

The part will look strange, there will be blocky protrusions, these are the modifiers.

The first step is to change these bodies from solids to modifiers, that way the slicer knows how to treat them. In Prusa Slicer you can do this in the right-hand panel. Select the body that is to be the modifier, and right click on the gear icon. Select the “change type” option. A menu will

appear that will allow you to change the part to a modifier. In most cases this will already be done.

The modifier should now be transparent. To adjust the infill where the modifier overlaps with the main part, right click on the gear icon again and select “infill”. Modifiers should be set to 50% infill.

For a more detailed discussion of modifiers, see the Prusa Slicer documentation: **https://help.prusa3d.com/article/modifiers_1767#modifier-meshes**

## 4.4 Scaling to Fit

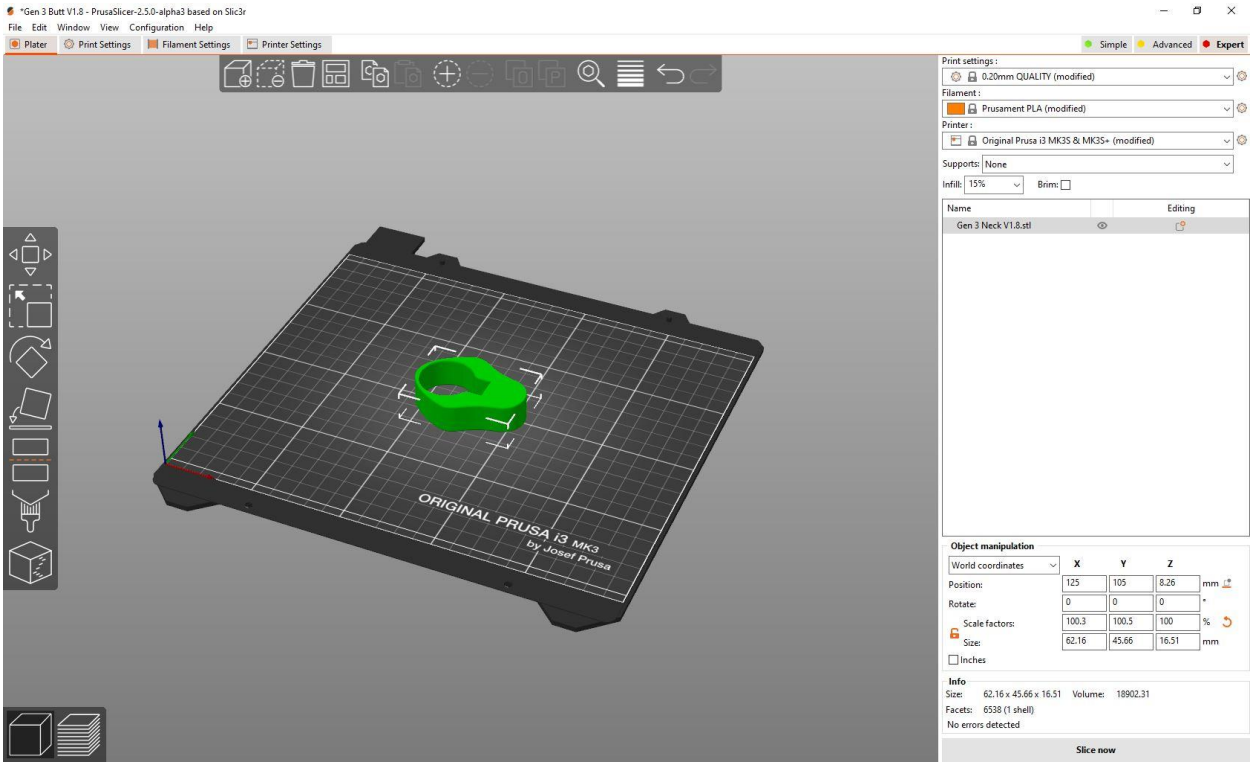


*Figure 4 Using the "Object manipulation" box to adjust the scaling.*

The stock pieces should slide over the buffer tube with minimal force. However, they should not be loose. A small amount of friction indicates a good fit. Unfortunately, even with a properly calibrated printer, the fit may be too tight, or loose. Its highly recommended to do one or more test prints first. Use the neck piece because it is small and a quick print. Use the recommended print settings to print it. If the part slides tightly over the buffer tube, or will not fit at all, you will need to scale it up.

Using a pair of calipers, measure the distance from the top of the inside of the neck down to the bottom of the inside. This should be 1.450”. If it is less, divide 1.450” by the measured value and multiply the result by 100, this will give you an approximant value to scale by. You may need to scale by as much as 101%. On my Prusa printer I typically scale by around 100.3%.

In Prusa Slicer you will need to unlock the X, Y, and Z axis before adjusting the scaling, you only want to change the X and Y, the Z should stay the same. Click the small lock icon to unlock.

Keep in mind that the X and Y axis of your printer may have different amounts of error, but this method should get you close enough.

Reprint with the new scaling settings. If the part is too loose, you can move back down nearer to 100%.

Something to keep in mind, we are scaling these parts to account for a lack of precision in the printer. This is not necessarily caused by the steps / MM being wrong, but is instead more likely caused by the slicers internal method and errors associated with extruding plastic in curved lines. There are more advanced ways of correcting these errors that I am pursuing, but scaling is the easiest one for simple parts like these.

Once you have the fit dialed in where you want it, record the scaling factor that worked for you. You will use this for the rest of the large parts, including the pad.

There is no reason to scale the small retention parts, as they are more forgiving.

## 4.5 Scaling the Neck

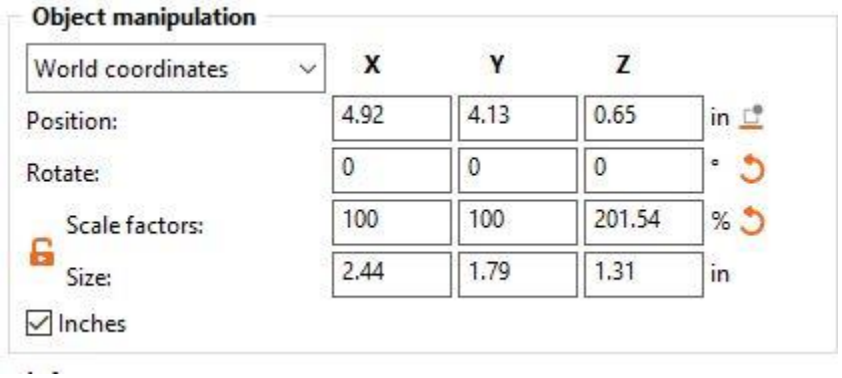


*Figure 5 The height of the neck will be 1.31", in this example.*

Rather than include a different file for each of the stock length options, I included one file that you can easily scale in the slicer to the exact length needed.

This is also handy because buffer tube threads are not timed, so the distance from the retention holes on the tube and the buffer tower can vary by the pitch of the threads, because of this, printing a custom length neck piece makes sense.

You will need to scale the Z axis of the neck to the proper length to fit your length of pull. This is really easy to do. Once you unlock the axis, the lock should show orange, change the Z axis size to the proper value. This corresponds directly to the height of the part. Remember to also scale the X and Y axis to insure proper fit.

## 4.6 Pausing Prints and Inserting Nuts

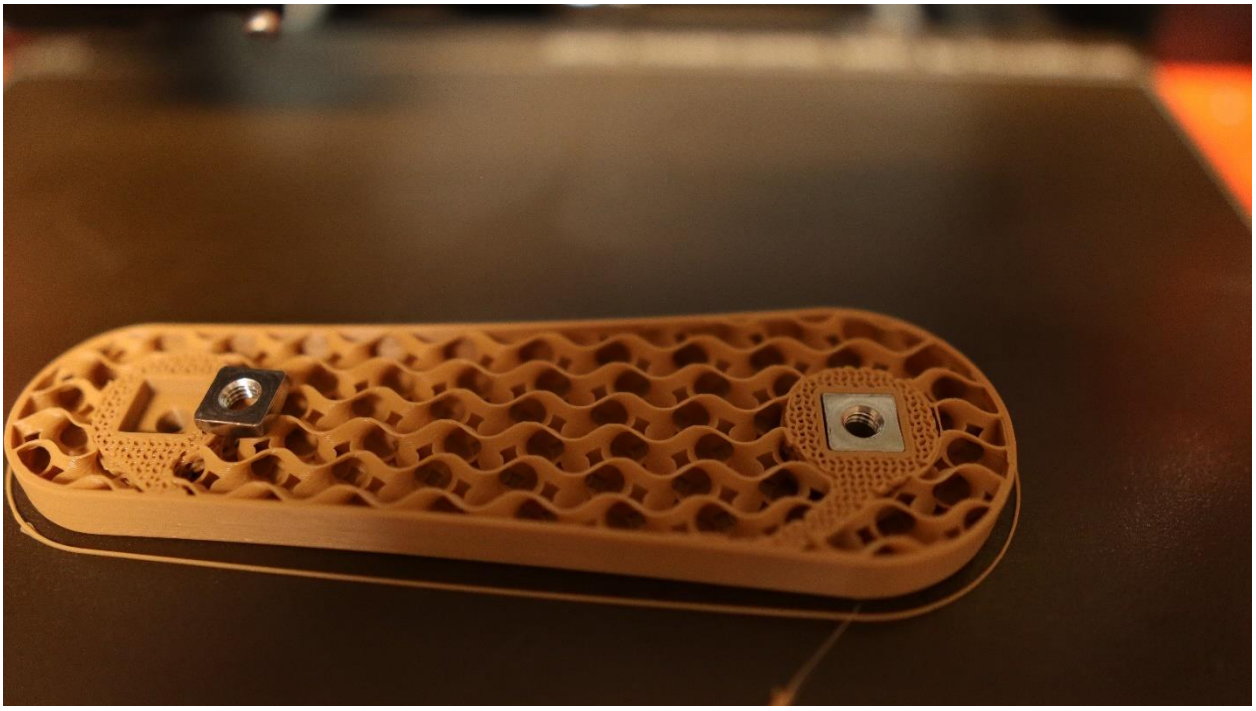

*Figure 6 Square nuts are dropped into their pockets during the print pause.*

In order to insert the square nuts into their pockets, you will need to pause the print at the correct layer. This can be a challenge on cheaper printers like the Ender 3, but it is doable.

In Prusa slicer, move to the layer you want to pause at, normally the layer below the layer that covers the pocket, and right click on the color change icon on the layer slider. Then select “add print pause (M601)”. You will need to reslice the print, and then confirm that the paused layer is in the right place.

Try completing this operation with the block first, as it is a short print and mistakes will be less wasteful.

The printer should now automatically pause at the correct layer. The square nuts should drop into place, curved side down. If the nut gets caught at an angle, carefully lift it out and try again.

You will need to add two nuts to the stock and one to the block.

## 4.7 Filament Changes

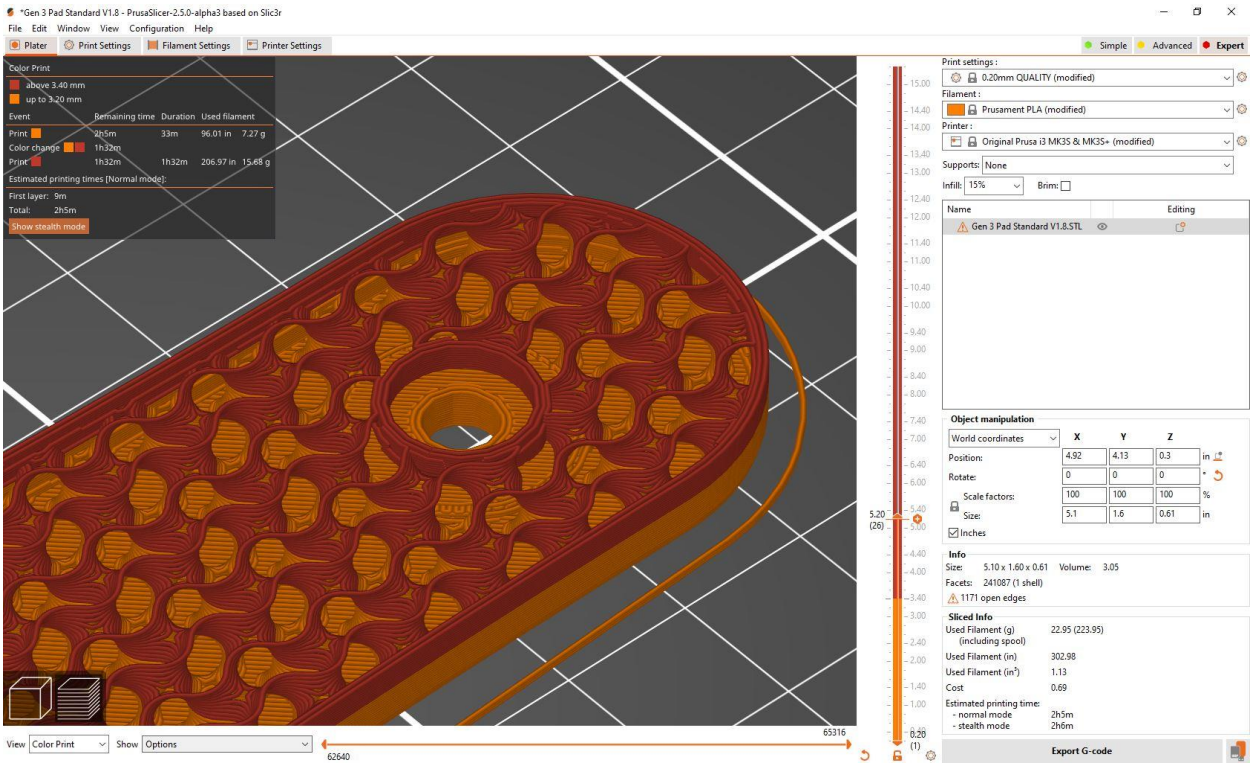


*Figure 7 Filament change placed above the area the screw will rest on.*

When printing the butt pad in TPU, the first few layers up until the screw head should be printed in PLA+, and the remainder should be printed in the TPU. This ensures a ridged base for the flexible filament to adhere to.

Adding filament changes in Prusa slicer is easy, just move the layer slider to the correct position, and click the “add color change” icon. You should position the filament change so that the screws are clamping against PLA+ only, start the TPU the layer above the shelf where the screw head will rest.

Because PLA+ and TPU have different print temperatures, you will need to add a custom G-Code at the layer below the filament change.

Right click on the color change icon and select “custom G-Code”. Add the following:

**M104 S240**

M104 tells the printer to set the nozzle temperature to the new value. S240 is the new value, 240 C in this case. Your TPU may use a different temperature, in which case you should change the 240 to the correct value.

On the filaments page you should adjust the nozzle temperature and bed temperature for the PLA+ you are using. These are the settings the printer will use until it meets your custom G-Code.

If you are going to print the pad from PLA+ without TPU, ignore this step.

## 4.8 Slicing the Parts

Before proceeding make sure that you read “Scaling to Fit” and that you know how much to scale each part before committing to a long print.

You should print the butt, adapter, pad, block, and plate first. It’s recommended to print the large parts alone, and then print the plate and block together.

Then assemble the retention mechanism and install the pad onto the butt. Once this is done, you can install the adapter and butt onto the buffer tube and adjust the length of pull. See the Assembly chapter.

Once the butt is where you want it, ensure the adapter is pressed against the buffer tower, and measure the distance between the butt and the adapter. This is the length that the neck should be. You will use the scaling tool in the slicer to print a custom neck of exactly the right length.

*If you have the stock in its shortest configuration, you may not need to print the neck at all.*

Keep this process in mind as you go.

A few tips while slicing and printing:

- Do not forget to add the print pauses. Double check. Forgetting to add the nuts is not much fun. The butt and the block are the two parts requiring pauses and nuts.
- Do not run your bed temp too high. If you print the larger parts from PLA+ with the bed at 65 C, you will have issues, 45 C for all but the first layer is a must. Same goes for any filament, but temperatures will vary.
- Use random seams or paint on seams, otherwise you will get an ugly scar down the side of your stock.
- Use the modifiers. The butt and adapter are the two parts that require modifiers. Infill in the modifier should be 50%.
- Print the plate and block together, this will help each layer on these small parts have enough time to cool and will prevent warping.

## 4.9 Measuring for the Neck Length

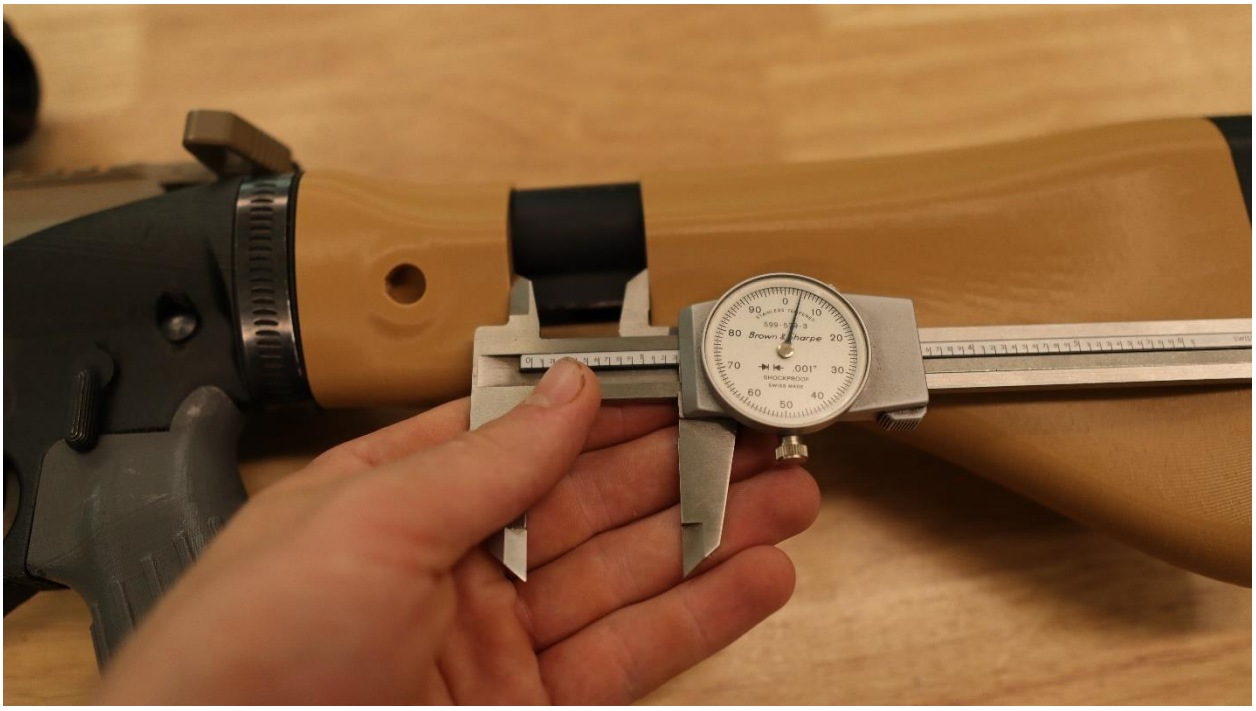


*Figure 8 Measuring for the length of the neck.*

This is why you need those calipers, though a fine ruler will also work.

Press the adapter firmly against the buffer tower and then install the stock. Be sure to pull the stock away from the lower as you tighten the block, this ensures that any slack in the retention mechanism is taken up, and the stock cannot move any further back later.

Holding the calipers square to the buffer tube, measure the gap between the butt and the adapter. Use this value in the slicer to scale the neck.

In Prusa Slicer you can only enter a precision of two decimal places, round your result down to two places.

# 5 Assembly

Assembly is the simplest part, though installing the stock onto the buffer tube can require some care so as not to over torque the screw and damage the butt.

## 5.1 Retention Mechanism

The retention mechanism consists of five parts; The butt, block, plate, screw, and nut.

The block should already have the nut embedded internally during the print.

Start by threading the screw into the bottom of the block, there will be some resistance as the block is designed to grab the threads much like a lock nut, and prevent the screw from backing out over time.

The screw head should be about 0.2” from the bottom of the block.

Slide the block into the buffer hole on the butt and drop it into the retention-well screw head down. If the block tilts sideways in the well, shake it back out and try again. The block should slide smoothly into the well and remain properly aligned. Push the block down until it is fully seated in the well.

Once the block is fully seated in the well, you can slide the plate into its slot on the front of the butt, it should slide in all the way until flush.

The screw head should now be fully captured, take your Allen key and use it to push up on the screw head through the access hole, if the block pops out you will need to repeat this process, but be careful to ensure that the block is not tilted and is fully seated before the plate is installed.

The plate can be easily removed with a pair of pliers, if needed.

To test the retention mechanism, turn the screw with the Allen key, the block should move in and out depending on the direction you turn the screw.

### 5.1.1 Steps

*Figure 9 Parts needed for the retention mechanism.*

*Figure 10 How the block interacts with the buffer tube.*

*Figure 11 Installing the screw into the block.*

*Figure 12 If the block tilts and jams, then retry.*

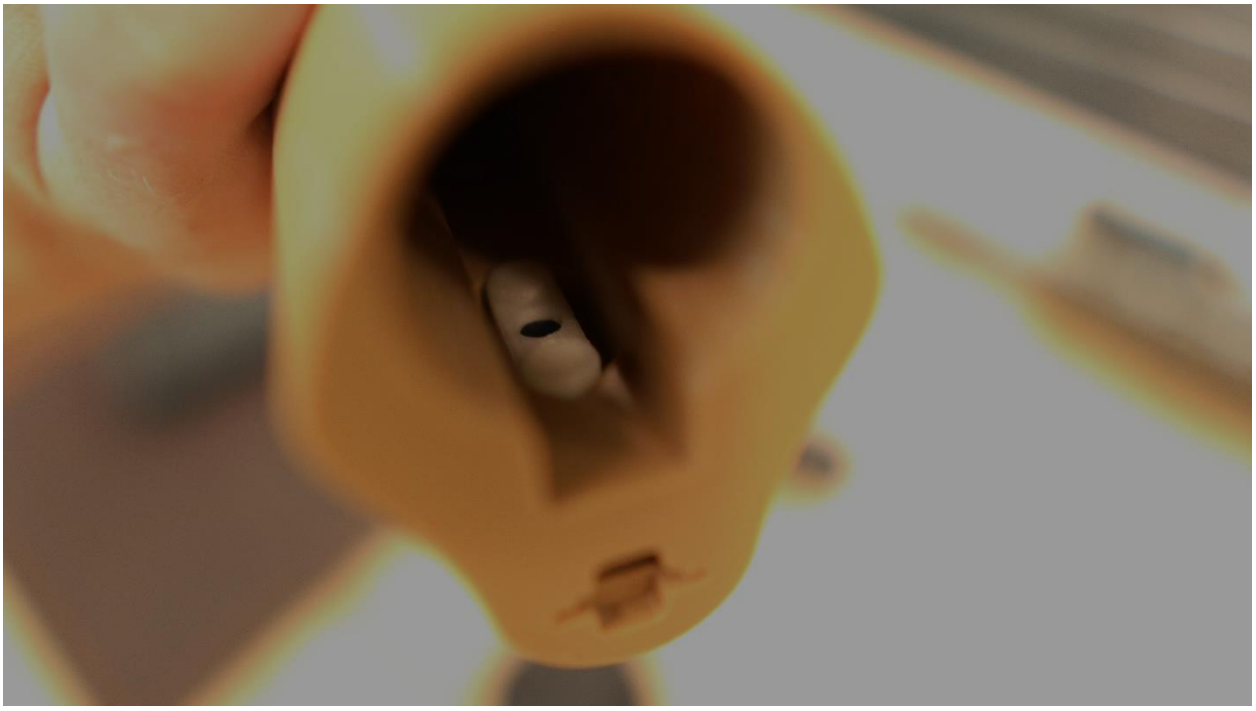

*Figure 13 Block should drop into its pocket like this. Push it all the way down.*

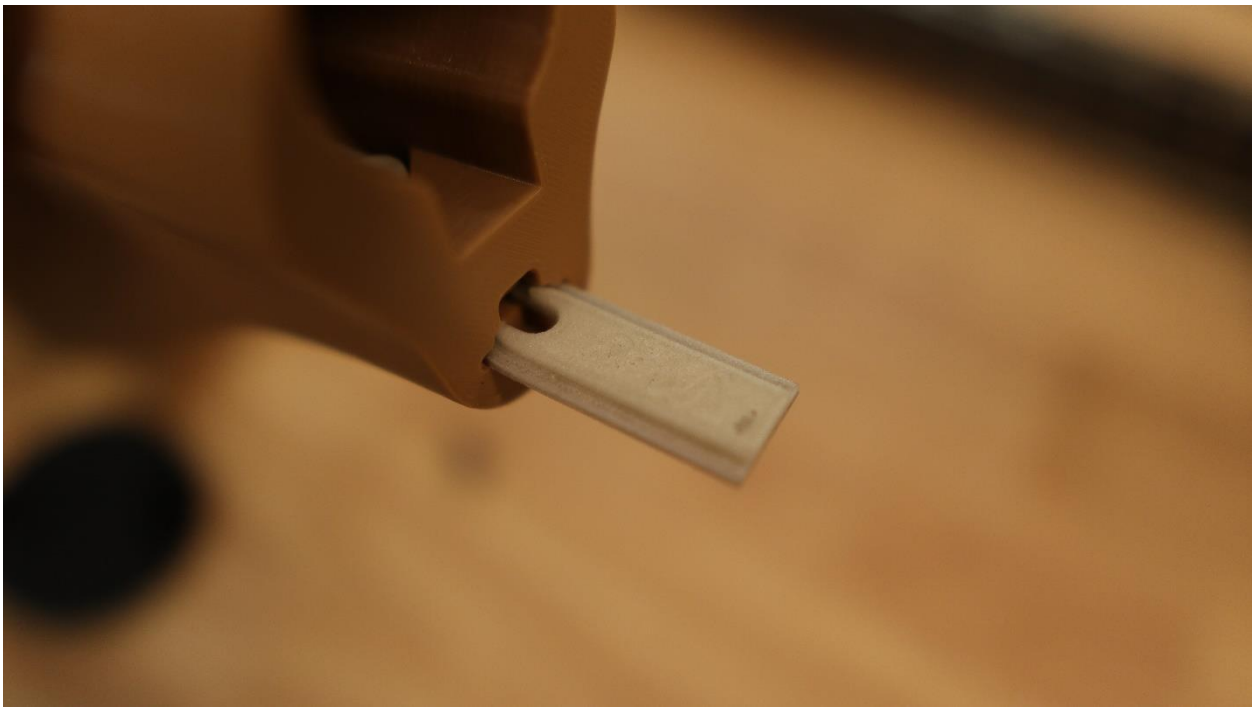

*Figure 14 Slide the plate in from the front. It should slide over the screw head and capture the screw.*

*Figure 15 Plate sitting flush.*

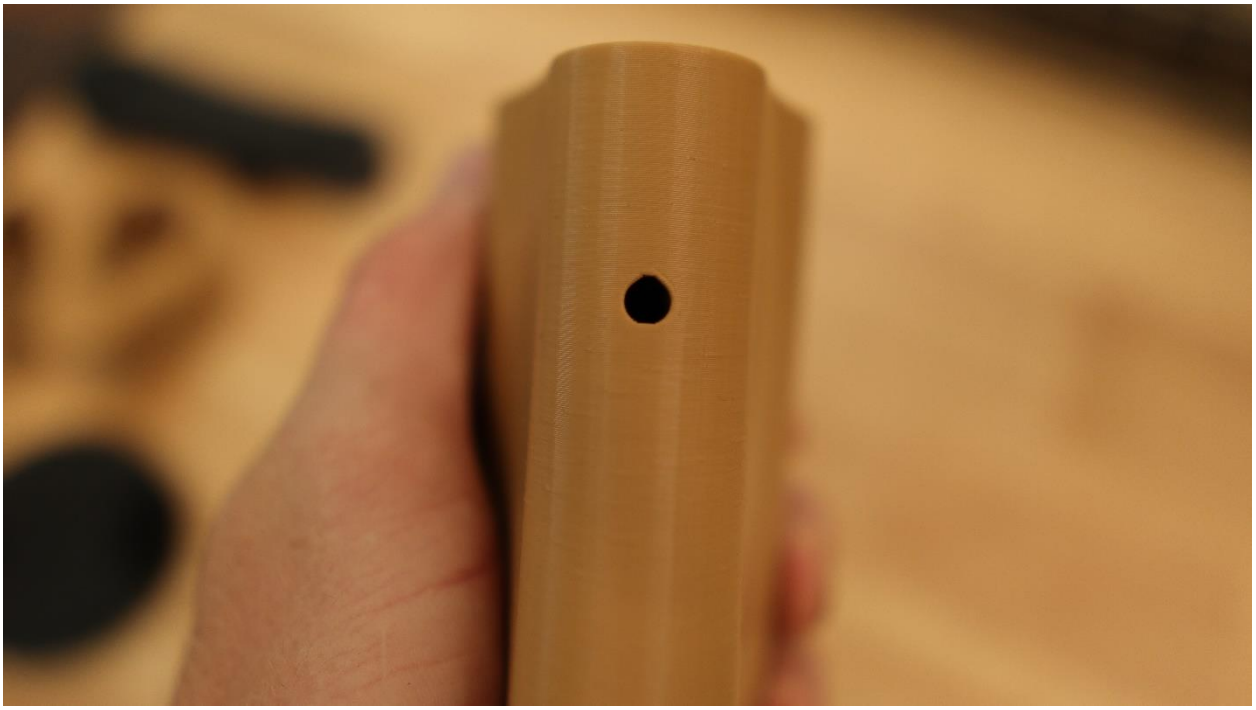

*Figure 16 Screw head access hole.*

*Figure 17 Checking for function.*

## 5.2 Pad

The pad is attached to the butt with a pair of screws and square nuts. The nuts should have already been installed in the butt when it was printed.

Press one screw through the pad and thread it onto the butt, don’t tighten it fully though. Wait until you install the next screw before you lightly torque the screws down.

Expect some resistance as you thread the screws into the butt, the printed holes are designed to bite into the screw threads and prevent them from backing out.

**Torque Spec: 10 IN/LB**

### 5.2.1 Steps

*Figure 18 Parts needed to install the pad.*

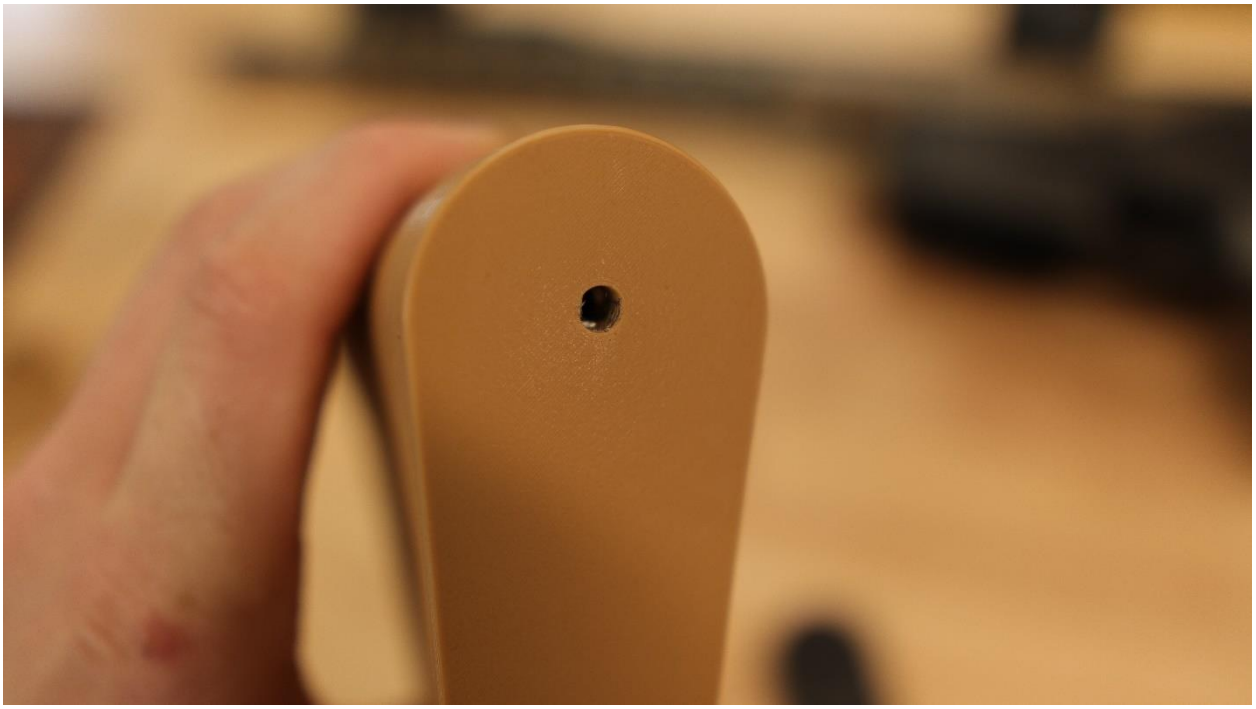

*Figure 19 The holes have flats on each side, this is to act as a lock nut and prevent screws from backing out.*

*Figure 20 Push the screw through the plate, and then fasten it to the stock.*

*Figure 21 Add one screw and then the other.*

*Figure 22 Fully tighten the screws together to the specified value.*

## 5.3 Installation

Installing the adapter and neck is easy. Simply slide them over the buffer tube in the proper orientation.

Before you install the butt, ensure that the retention mechanism is pulled all the way in. Do this by turning the screw clockwise until you meet resistance.

If you have already printed the neck to the proper length, then it is as simple as sliding the butt up to the neck and turning the screw counterclockwise to the proper torque spec.

If you are installing the stock for the first time without the neck, then you will need to align the bosses on the block with the holes on the buffer tube.

Slide the stock onto the buffer tube until it stops, and then pull it back an inch or so. You can now carefully turn the screw counterclockwise until you feel the slightest resistance, slide the stock back and forth and you should feal the block engaging with the holes in the tube.

Once you have the stock aligned with the holes where you want it, tighten the block a little more and wiggle the stock to ensure that the block is engaging in the holes. Once it's engaged, you can fully tighten the block. While tightening, make sure you pull the stock away from the lower, this ensures that a gap will not form later. You can now measure for the neck.

Do not over tighten the screw. ¼ turn after you meet resistance or the torque spec is all that is required.

**Torque Spec: 10 IN/LB**

### 5.3.1 Steps

*Figure 23 The adapter is slid into place.*

*Figure 24 The stock is slid to the mid position.*

*Figure 25 Feeling for the detents by sliding the butt back and forth while tightening the block.*

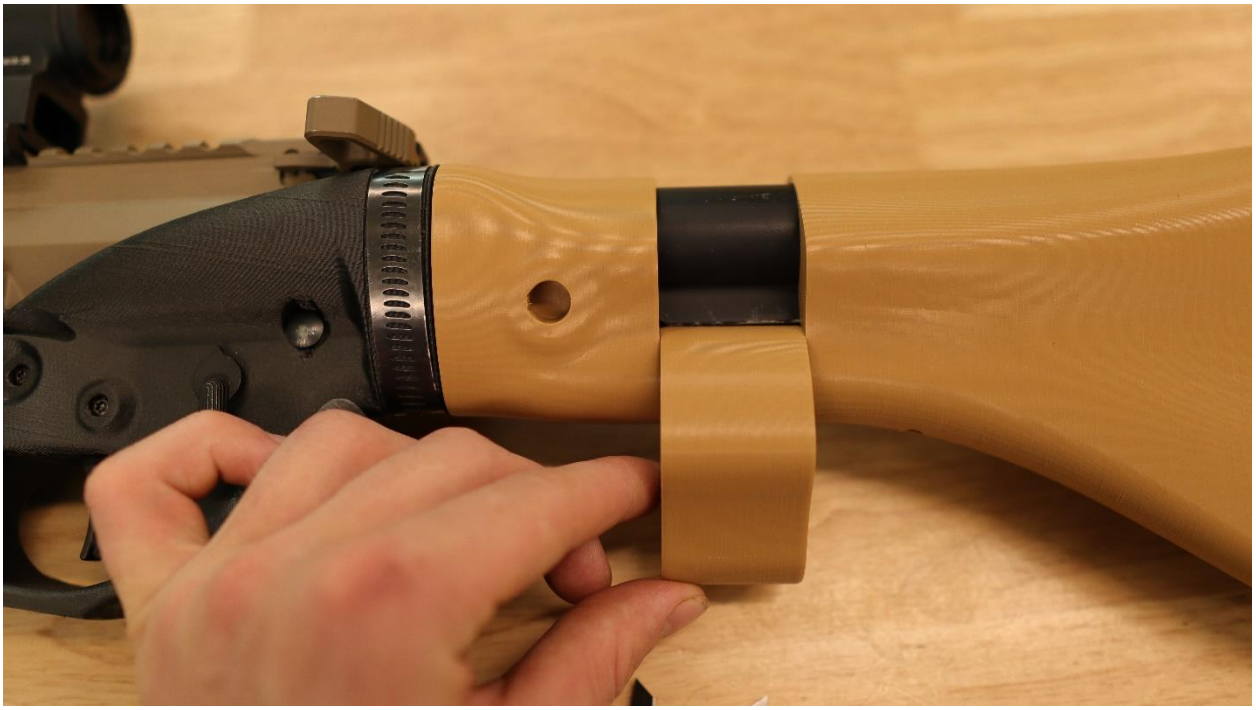

*Figure 26 If you have already printed the neck, simply slide the stock up to the neck and torque the screw.*


*Figure 27 Done!*

# 6 Wall Hanger (Experimental)

The wall hanger attaches to the wall via a pair of bugle head deck screws. This is experimental and is provided for your amusement.

Five walls and 25% infill is recommended for the main part, and 70% infill is recommended for the modifier.

Us screws of sufficient length to engage into the backing surface. Using a wood block that is fastened through the drywall to a stud would not be a bad idea.

# 7 Trouble Shooting

Problems can always crop up.

## 7.1 Parts Too Tight Over Buffer Tube

This is commonly caused by one of a couple different issues. Incorrect scaling, or slumping. Use the neck piece to fine tune your scaling, and use a lower bed temperature when printing to prevent slumping.

## 7.2 Plate Won't Fit in Slot

This can be caused by over extrusion or other print defects, sanding the plate until it fits is the fastest solution. Never force the plate in, if it becomes jammed your stock will be difficult to complete.

## 7.3 Screw Holes in Pad Won't Align with Square Nuts In Butt

Probably caused by the scaling of the pad not matching the scaling of the butt. It's important to scale all the large parts by the same amount in the X and Y axis.