This Document has been adapted from the original FGC-9 MK2 Build guide.

Should you choose to build your own bolt rather than buying one, this document will serve as a comprehensive guide to producing a bolt compatible with your FGC-9 MK2 and/or Stingray firearm.

Making the bolt

The bolt of the FGC-9 will be the most complex part to produce and will be at the heart of the firing mechanism.

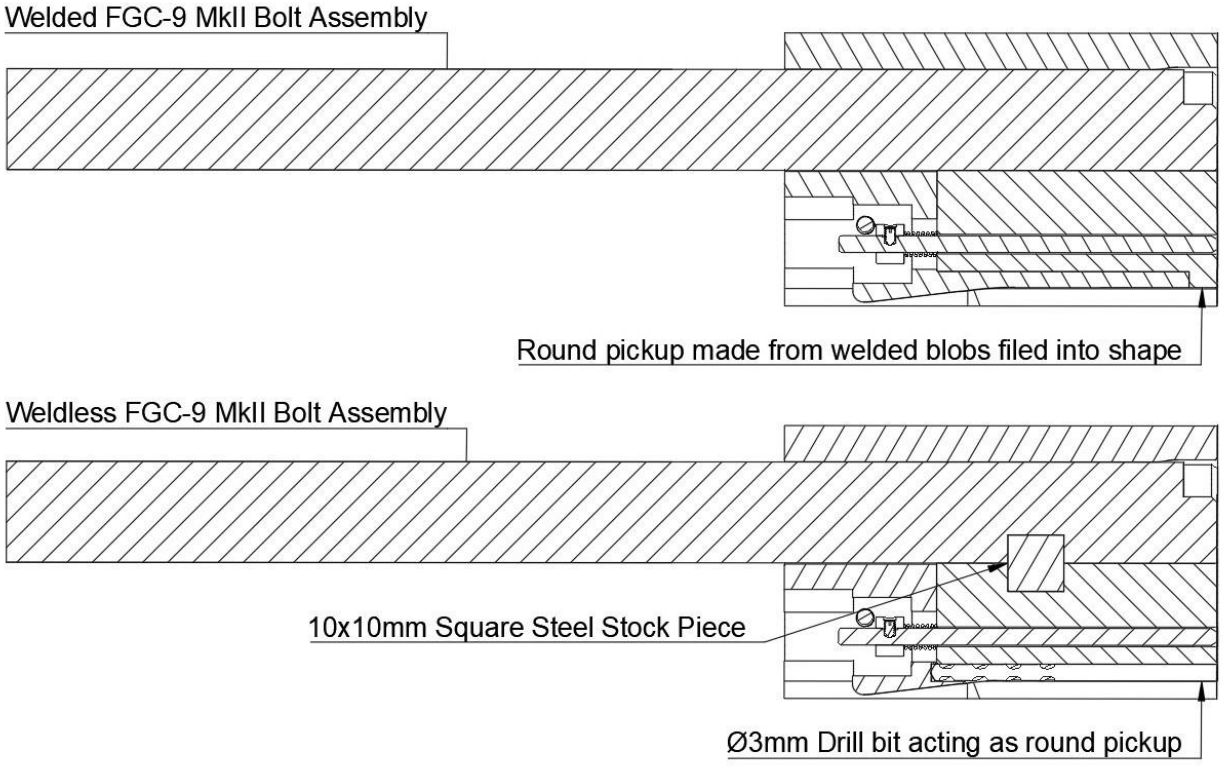
You will have two main ways of attaching the steel stock pieces together that make up the steel portion of the bolt.

Either using a stick welder to attach the two pieces or using JB weld and a piece of square steel stock.

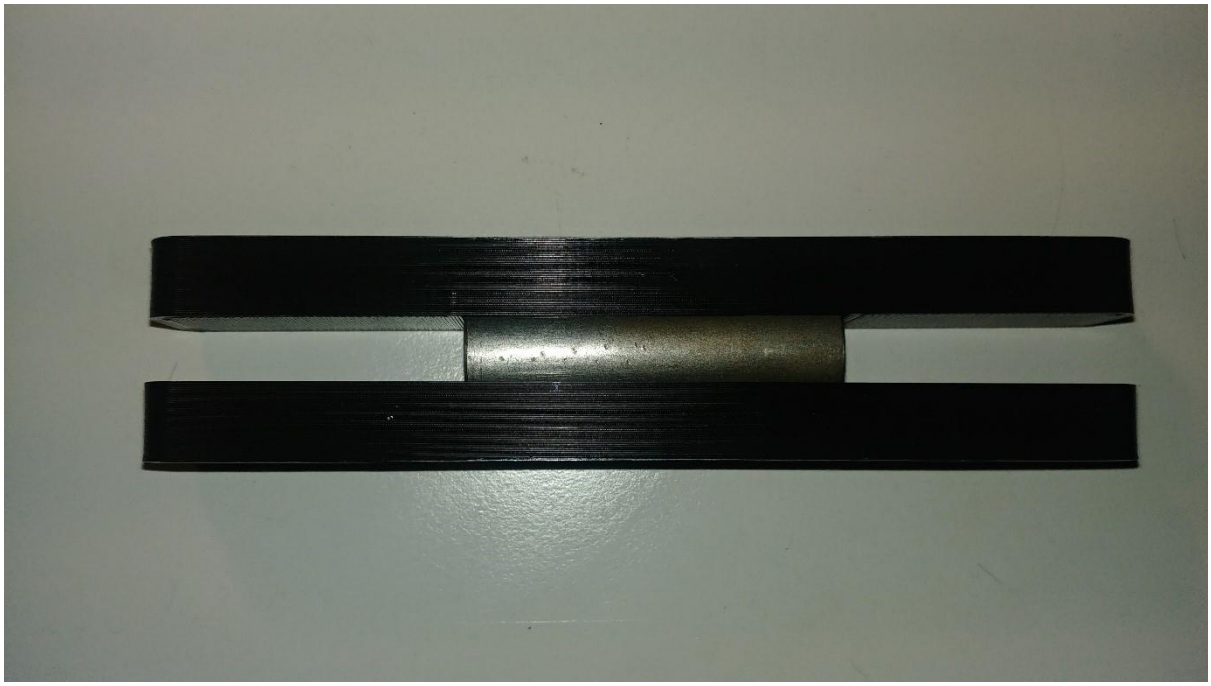
Along with these differences, how the round pickup is added will differ. The rest of the process to build the bolt will be the same. You can choose one or the other depending on your budget and other limitations that have to do with the nature of welding. If you have the tools / environment to go with the option to weld the two steel pieces together and make your bolt that way, it is recommended you do that.

A bolt made with welding will result in a more robust construction that you can have complete confidence in and you will need less manual labor to finish it.

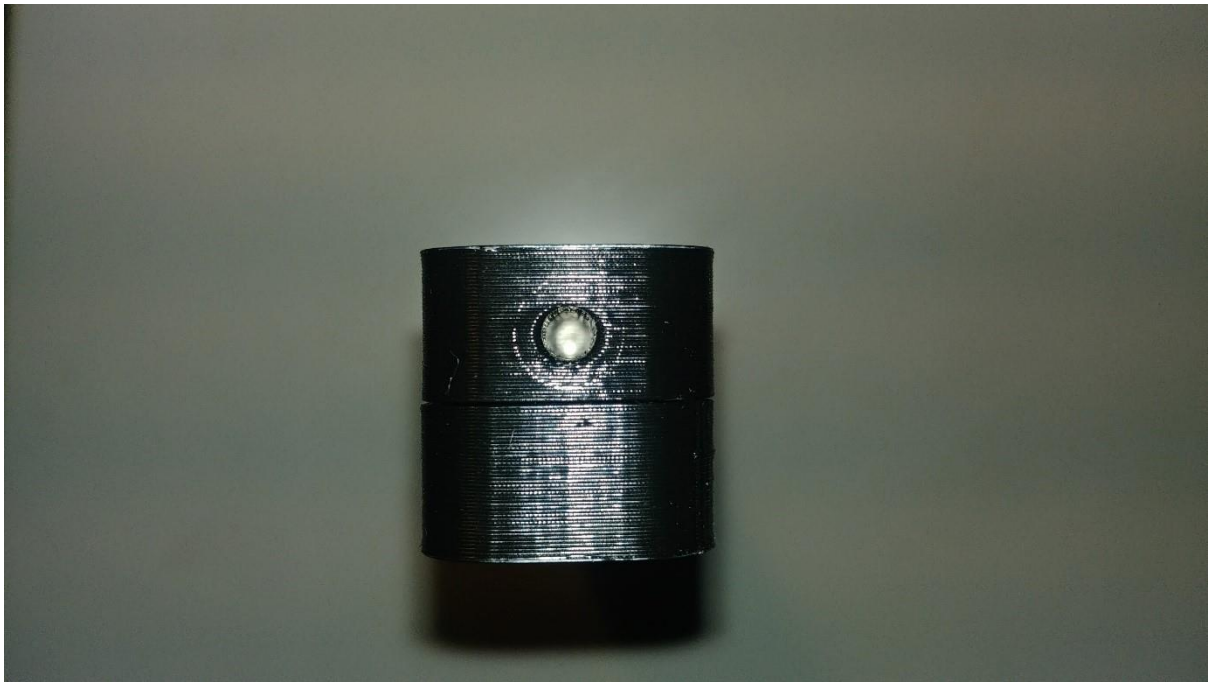
For both paths you will need to begin with drilling the firing pin channel and end with the same recess drilling process. Be sure to read the following pages before starting either process, to get an idea how the options differ.

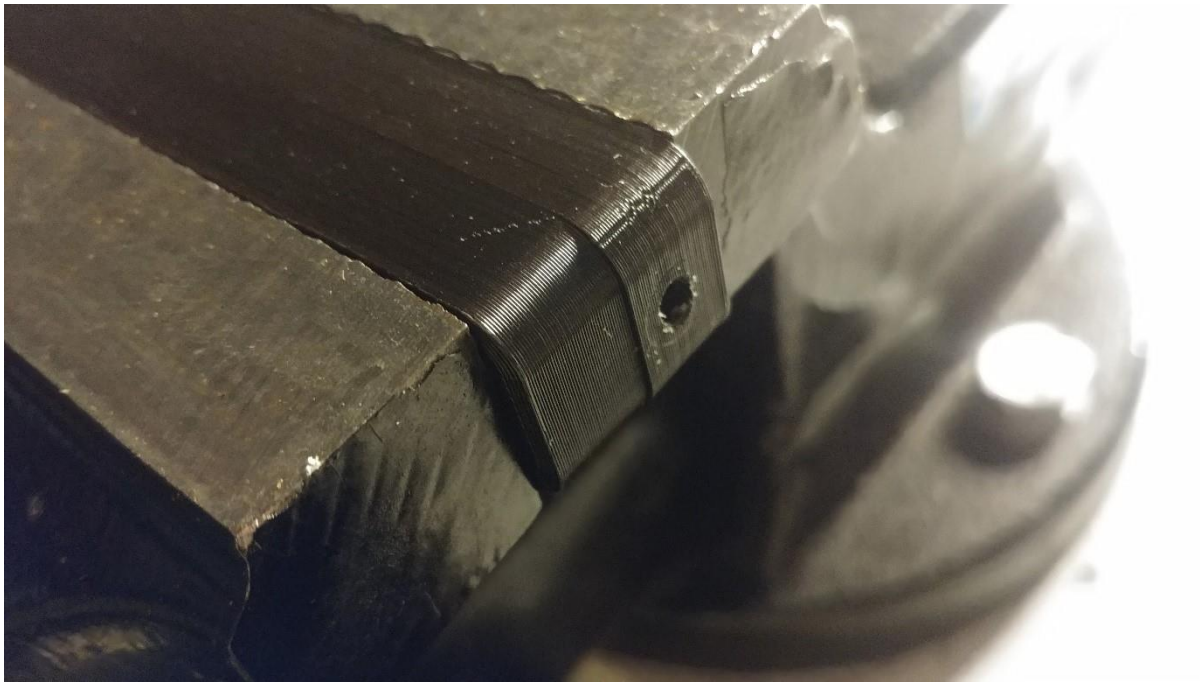


Drilling the lower bolt rod

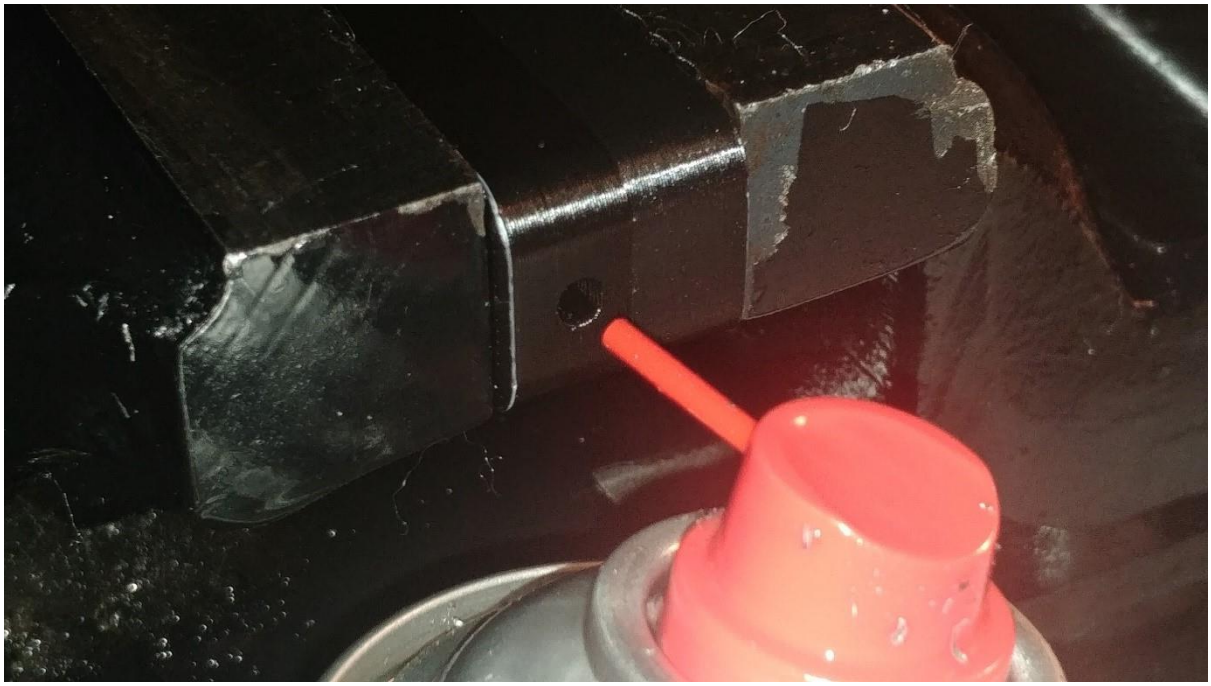


Get your power drill ready with the long 3.5mm diameter drill bit, as well as both drilling jig halves and the 50mm long 18mm bar. Put the short bolt piece (18mm diameter, 50mm long) in between the drilling jig halves.

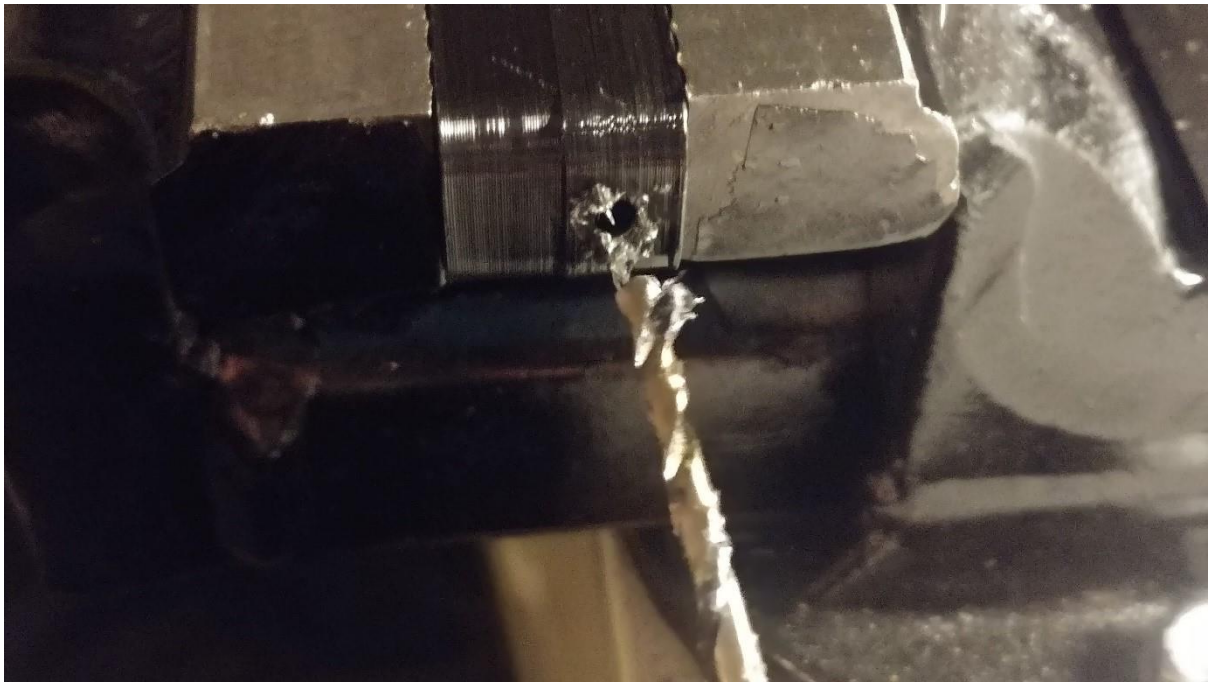


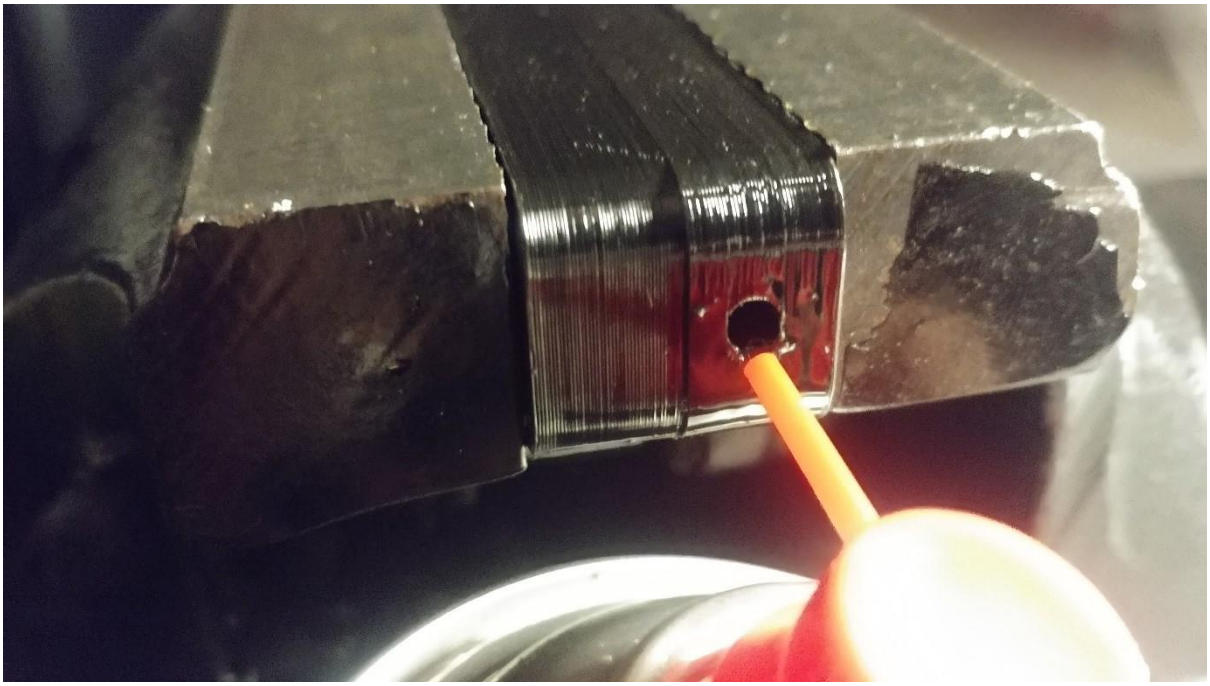


Put the drilling jig with the bolt piece inside, in between the jaws of your table-mounted vise.



Spray cutting fluid into the hole before starting to drill. With ample of forward pressure start drilling into the setup.





Drill a few millimeters into the hole and then remove the steel chips and add new cutting fluid, then drill again. Repeat this until you can feel that you got through the entire bolt piece.

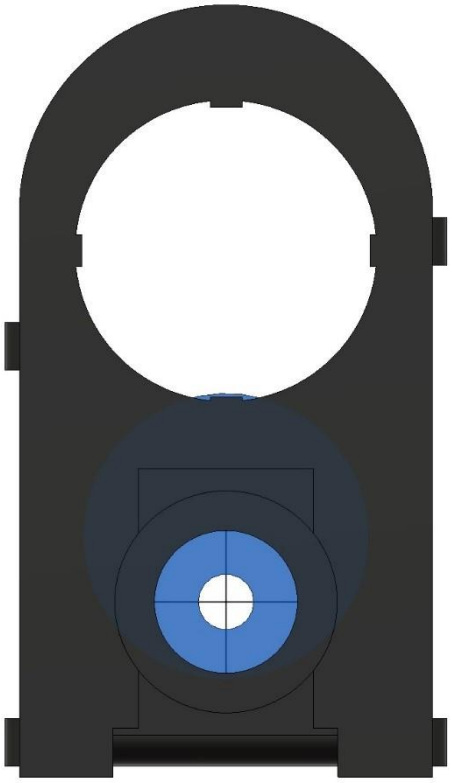
Request for feedback / Help improve the drilling jig:

If you properly followed the instructions using this jig and later on found out that the firing pin indentations are not center but somewhat off-center, note the deviation, by using empty cases and remember in what orientation you inserted the case into the chamber. Then let the firing pin hit the empty case / already struck primer and note whether the off-center indentation is towards the 12 o'clock or more towards the 6 o' clock relative to the center. Measure how far off your indentations are in millimeter and note the relative o'clock position.

Send me your findings via E-Mail: JStark1809@protonmail.com

Welded Bolt Option

Before you continue make sure that your 50mm bolt piece has been drilled correctly. The firing pin channel that you have drilled needs to be straight and in the correct position. To make sure this is the case, take your 50mm bolt piece and put it into the bolt housing.
Rotate it so that the firing pin channel is at the 6'o clock position on the bolt piece.



If on just one side it appears that the hole is at the center, use that side for the bolt face.
Meaning whatever side has the hole at the "correct" spot, have that side be the face end.

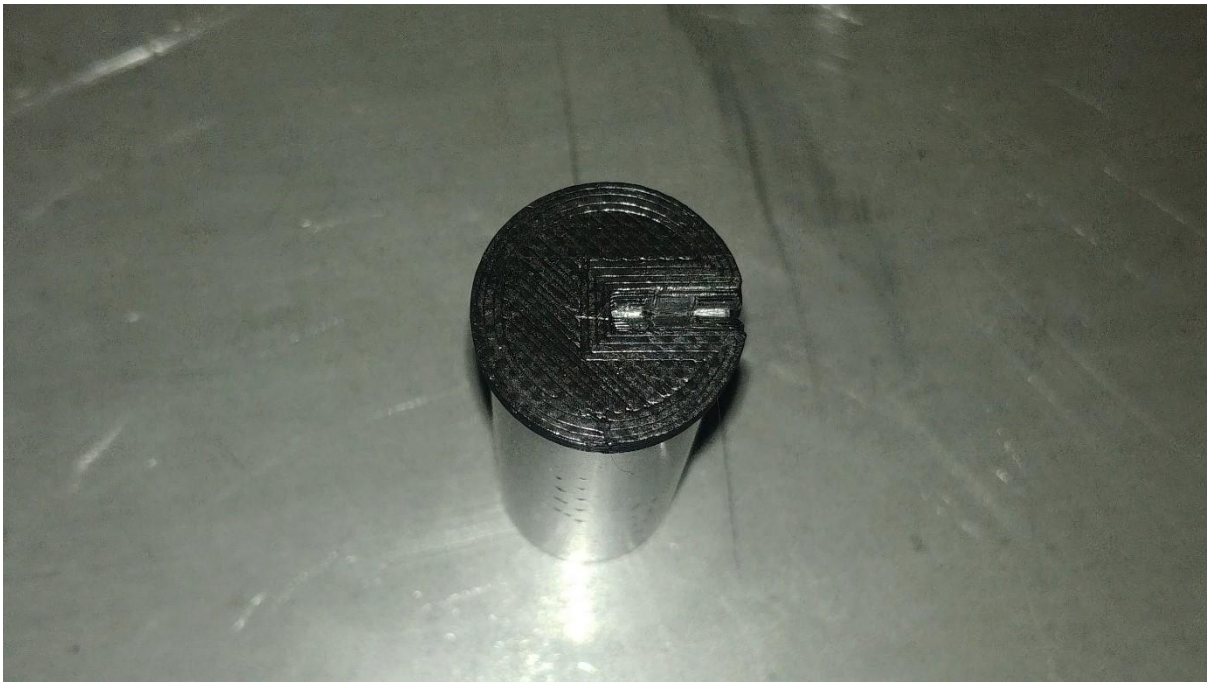
If on both sides of the bolt piece the hole is not at the center of the opening when looking at it from the back of the housing, you need to make a new 50mm bolt piece or rotate it and re-drill it.
You then can later on weld the failed hole shut.

The drilling jig might not work for you, so take the 50mm bolt piece and paint one end of it through the opening of the bolt housing and then mark the center of that circle. This should be the correct spot to drill into.

Getting the firing pin channel to be straight without the drilling jig will be significantly more difficult. Doing it without the jig might be a good alternative only if you are using a drill press.

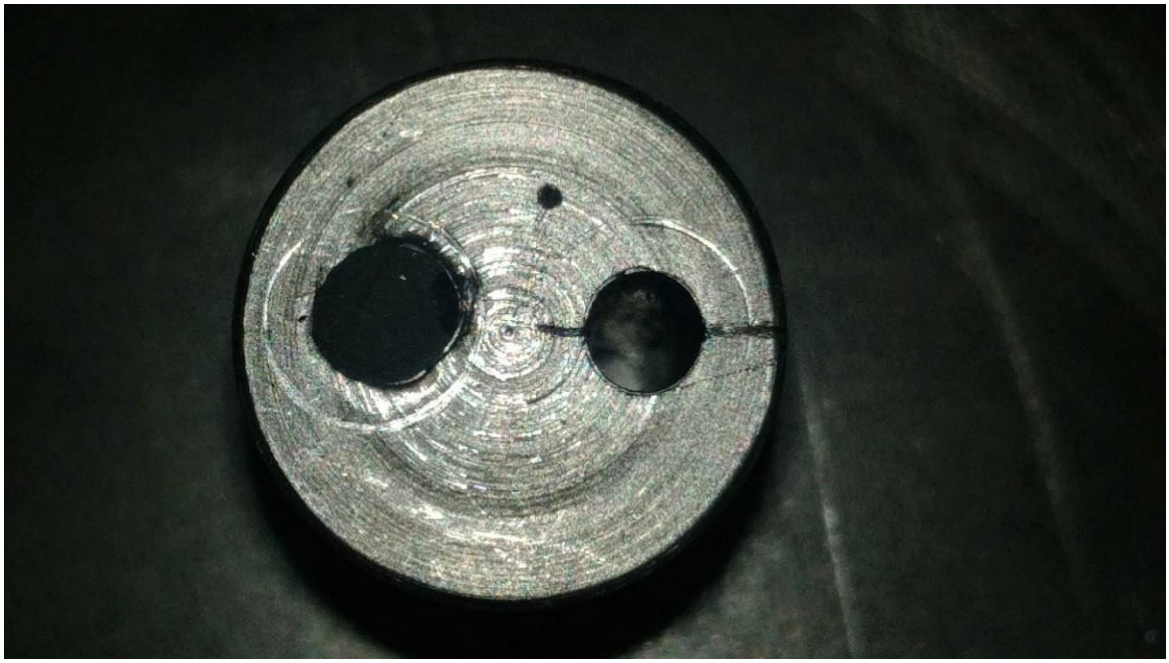
Prepare the tools and materials that you need for the welding process:

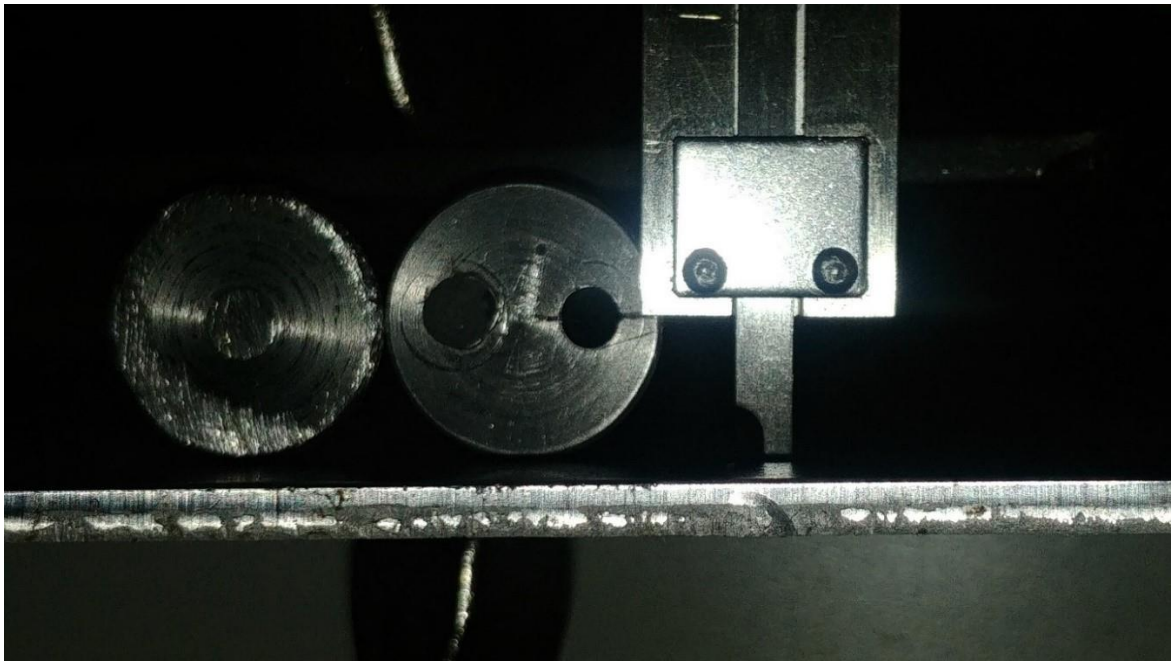
- **1x 50mm long, 18mm diameter steel rod piece**
- **1x 216mm long,18mm diameter steel rod piece**
- **Digital Caliper**
- **Welding table or sheet metal to weld on**
- **Welding helmet, gloves and welding skirt**
- **Welding device powered up and connected**
- **Welding clamp(s)**
- **Welding Jig**



Put the welding jig onto the face end of your 50mm bolt piece where the hole was at the correct position, aligning it via the firing pin channel hole.

Use the bottom corner of your digital caliper or a similar metal device to scratch along the slot of the welding jig.

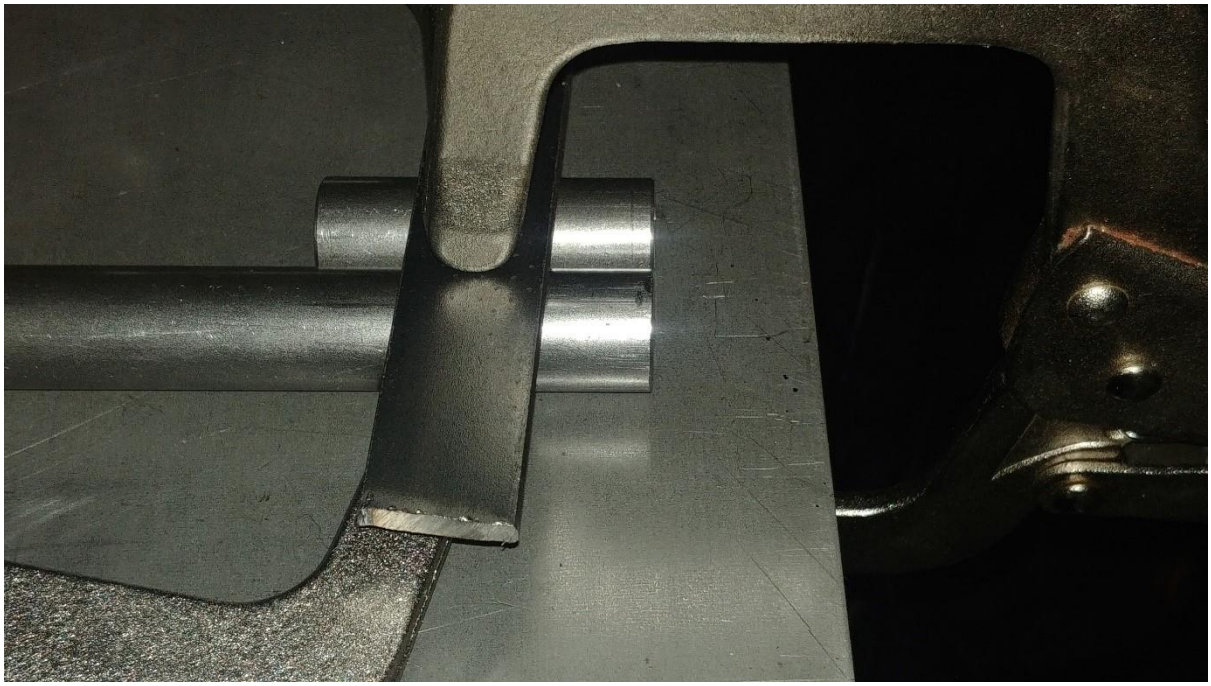


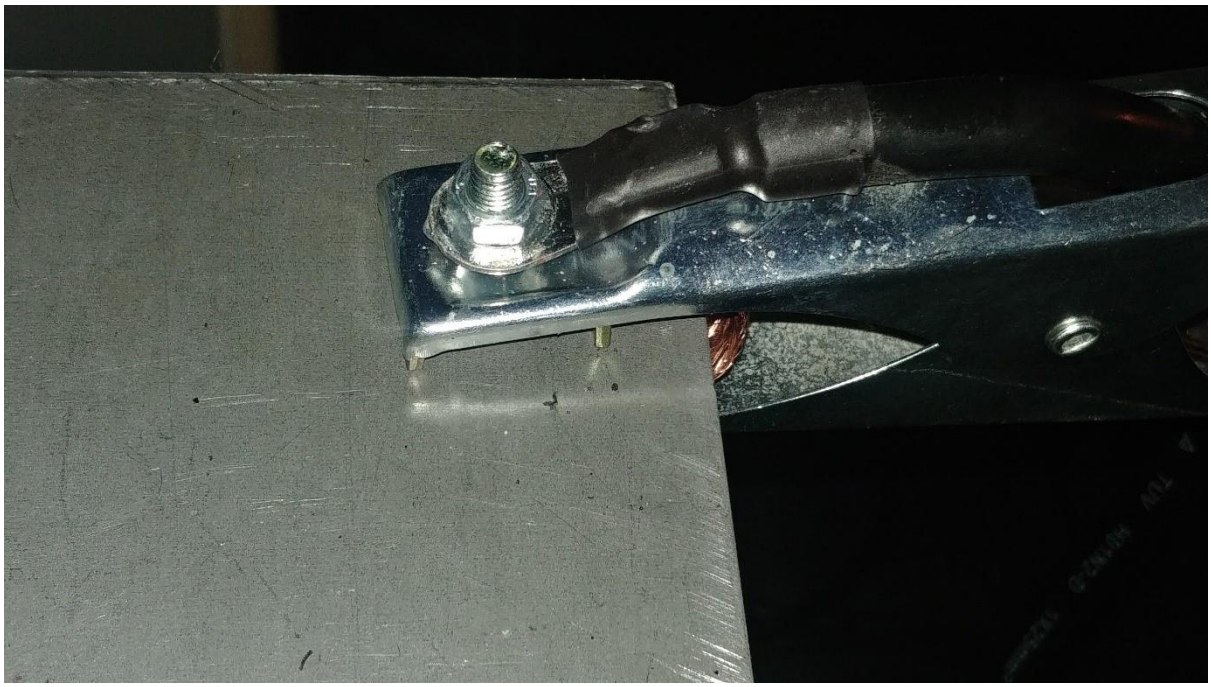


You should now have a clearly visible line on the side of the lower bolt piece that you want to be the bolt face of your bolt.

Now put the 50mm long bolt piece as well as the 216mm long bolt piece and put them next to each other as close and straight as possible.
The firing pin channel should be at the 3 o clock position, while the longer bolt piece should be laid at the 9 o clock side of the shorter bolt piece. Just look at the image to see how it should look like.

Use the depth rod of your digital caliper to align the firing pin hole to be perfectly at the 3 o clock position as you see it in this picture. You do this by measuring the distance of the line to the bottom of the plate you have the bolt piece on. Since the bolt piece has a diameter of 18mm, you need the distance of the scratched line to the bottom to be exactly 9mm.

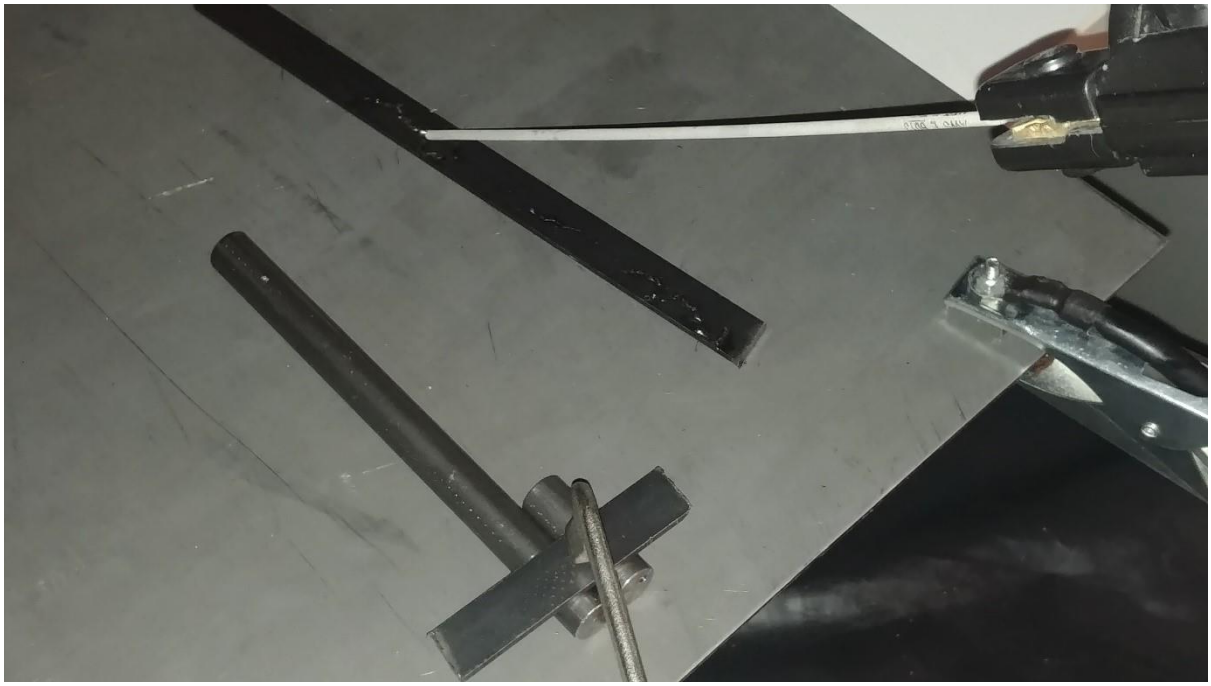




After you have made sure that the drilled hole in the shorter bolt piece is exactly halfway between top and bottom (at the 3 o'clock position) use your welding clamp to fix the two bolt piece perfectly into position as you can see it in the upper picture.

Measure the 9mm distance again to confirm that the firing pin hole is still perfectly at the 3 o' clock position. Make absolutely sure that the front faces/ends of the bolt pieces are absolutely flush.(LOOK AT THE UPPER PICTURE). Meaning on the front/bolt face the ends should be in line and one bolt should not stick out more than the other.

You can now go ahead and connect the contact of your welder to the welder table and turn on your welding device.



Turn on your arc welder and then set the appropriate amperage which you can find on the packaging of the electrode you will be using, for example when using some 2.5mm diameter electrodes you will need to set your arc welder between 65 and 80 amps.

Be sure to wear welding gloves, welding apron and a welding visor before going ahead.

Attach the negative contact from the arc welder to the metal plate on which the bolt pieces are laying.

Hold one of your electrodes with your electrode holder which is plugged into the arc welder device and use some scrap sheet metal strip to try to start a bead, meaning you will have to get the feel to start welding. Imagine what it feels like to strike a match. In a similar fashion you need to strike slowly but fluidly the metal with the tip of the electrode.

After you have successfully got a bead and even a weld line going on a piece of sheet metal, you can go ahead and run the electrode between the two bolt pieces to fill the gap with material.

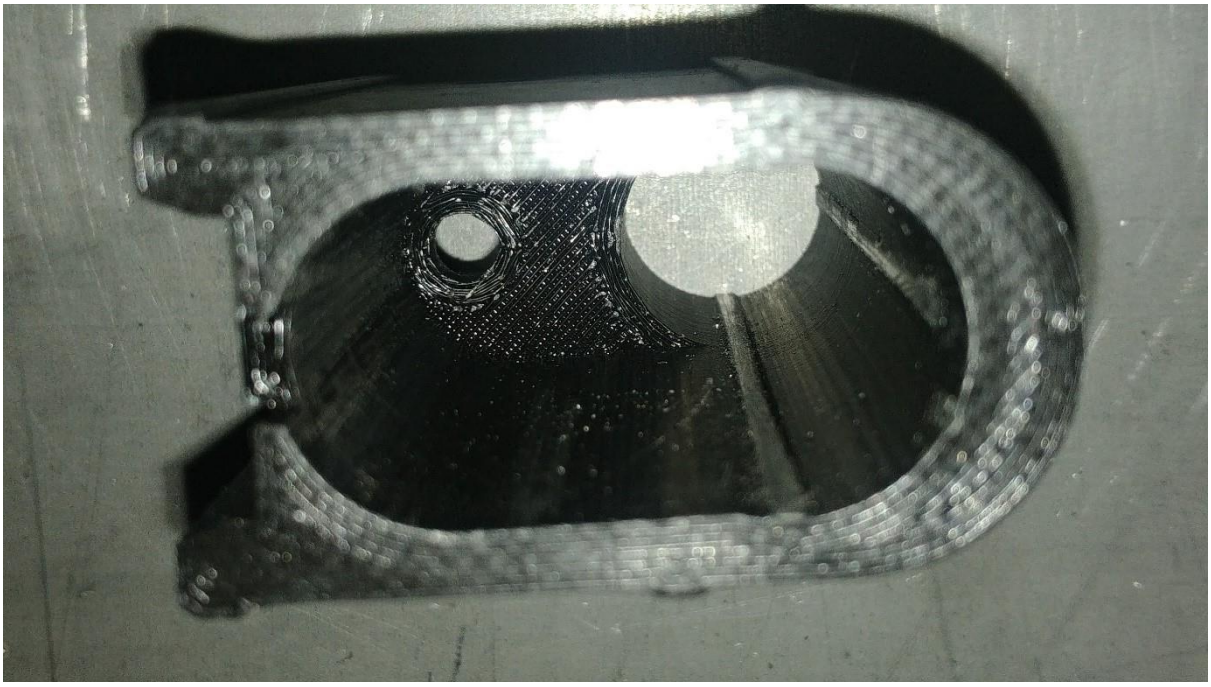
If you can't manage to get a good bead / seam going try to use other kinds of stick welding electrodes, as they might be better suited for the steel you are working with.

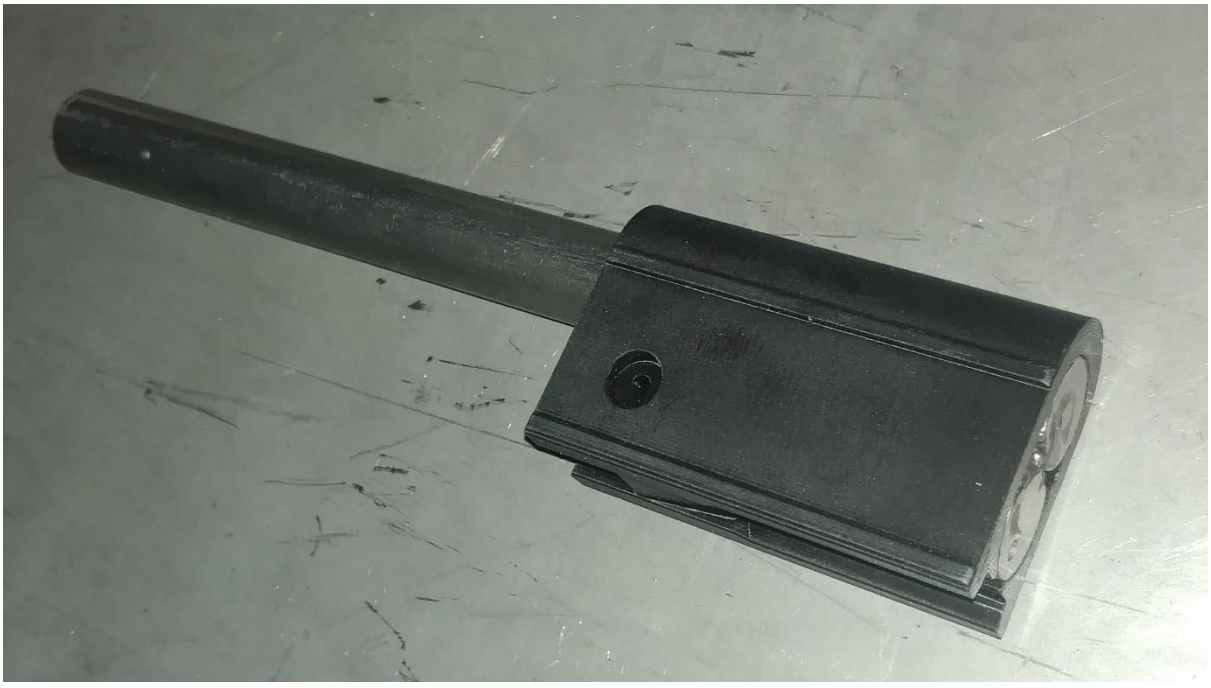
After the first few blobs that you put into the gap, you can remove the clamp and work with the bolt pieces just laying on the metal plate. You will struggle to keep it going consistently but that doesn't matter, keep going at it until the gap on each side looks like in the image.

Once you have filled both gaps on both sides like you see in the picture, use your file to remove as much of the welded material until it can fit into your printed bolt housing.

It will probably take some time until you have filed enough material from the filled gap as well as accidental weld blobs that prevent the bolt from going into the bolt housing.

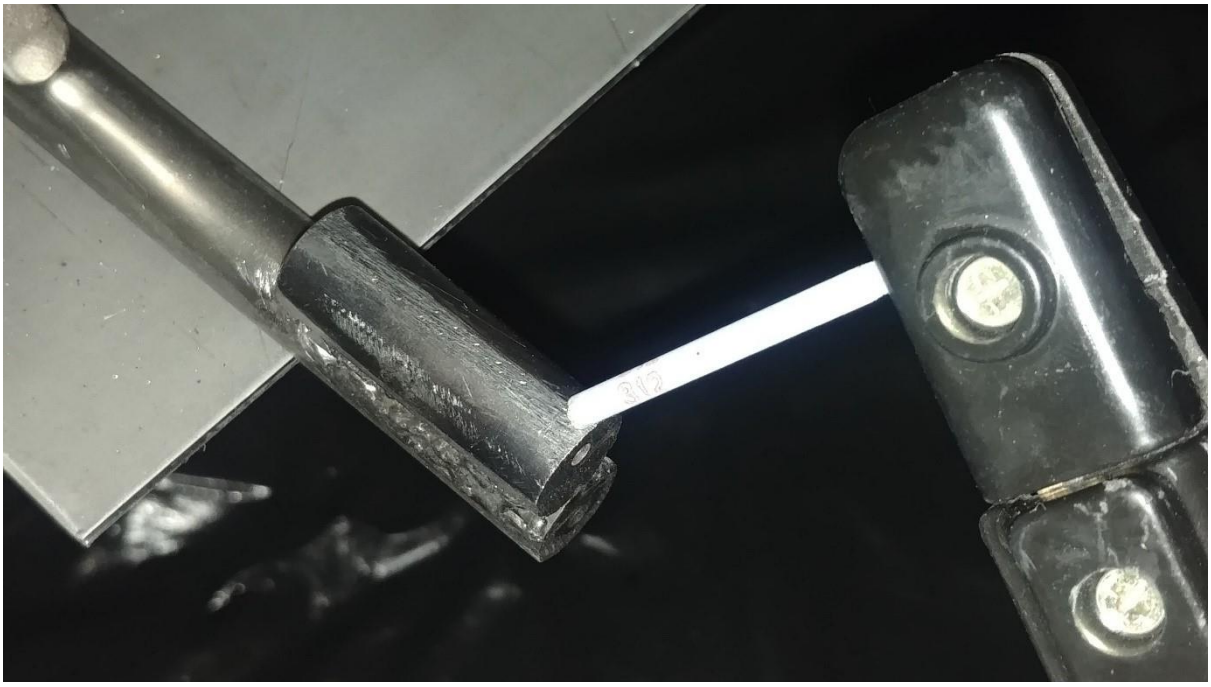
Make extensive use of your metal wire brush and slag hammer to remove as much slag from the welded seam before you spend much of your time using the file.



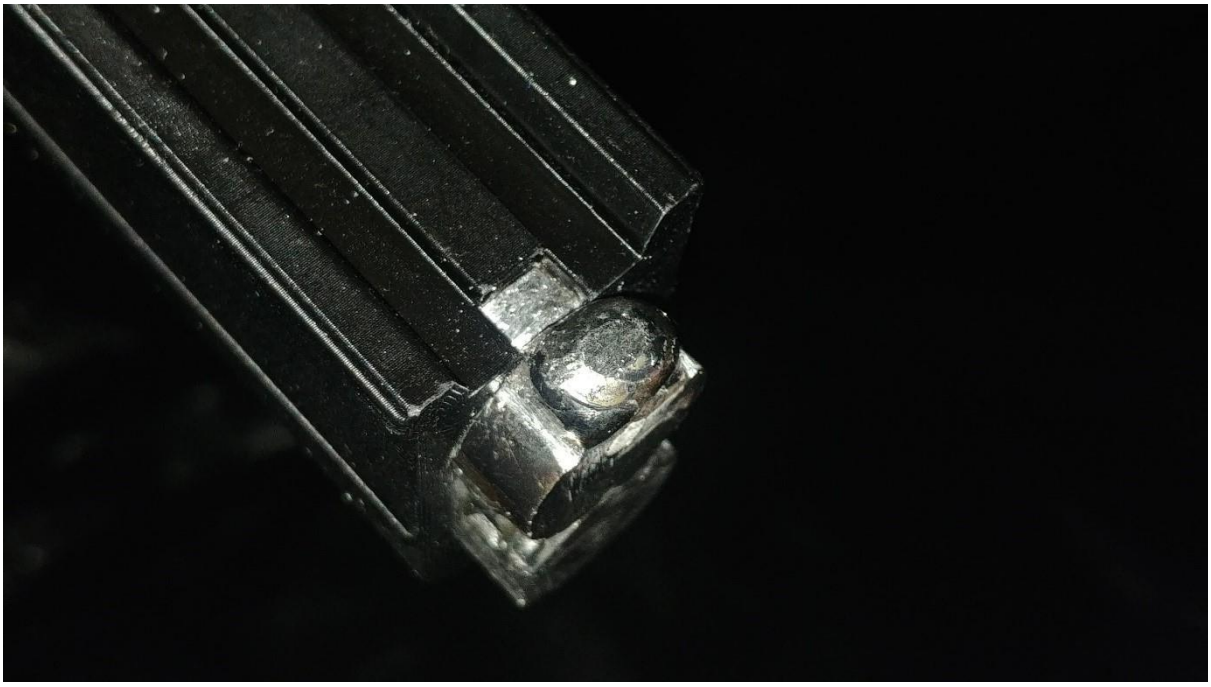


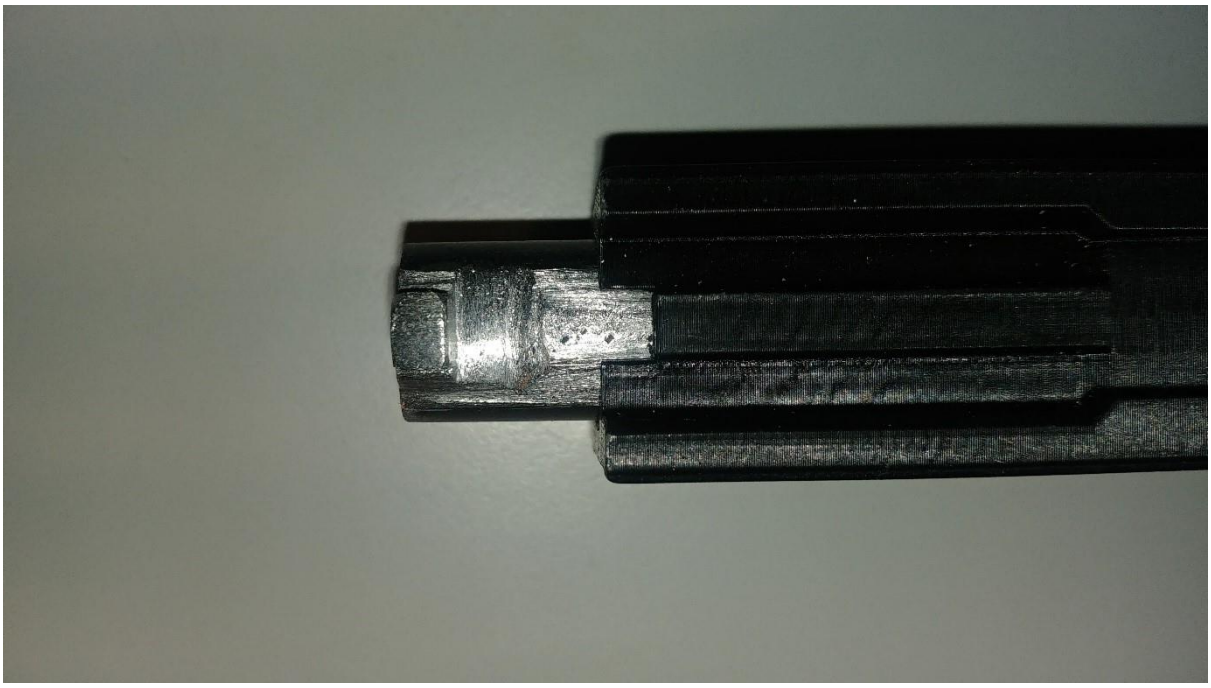
Eventually you should be able to slide the bolt into the bolt housing. Don't try to use too much force getting it in. Try to look meticulously on the bolt for excessive weld material that might prevent the bolt from getting into the housing. You also will probably have to remove material from the steel bolt pieces themselves, especially on the sides to get it to fit in.

Once the welded bolt fits inside the bolt housing use a sharp metal object, a pen or something similar to scratch the outline of the cutout on the bottom of the bolt carrier onto the bottom of the 50mm bolt piece as you can see it in the image.

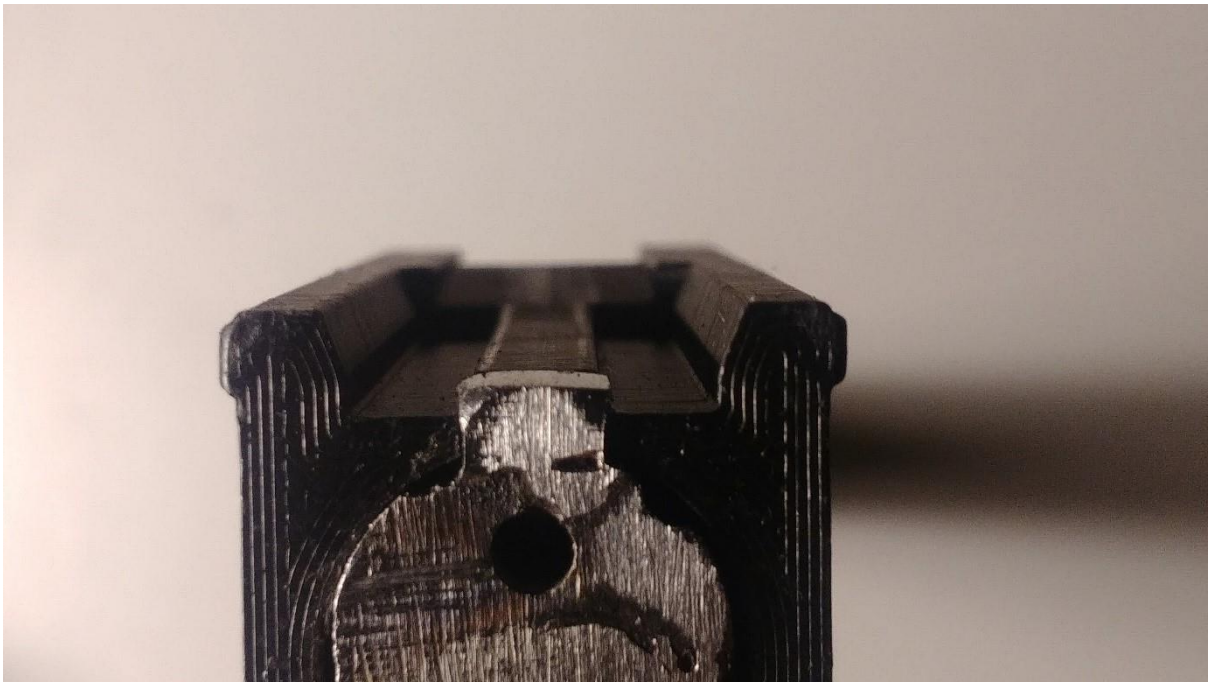


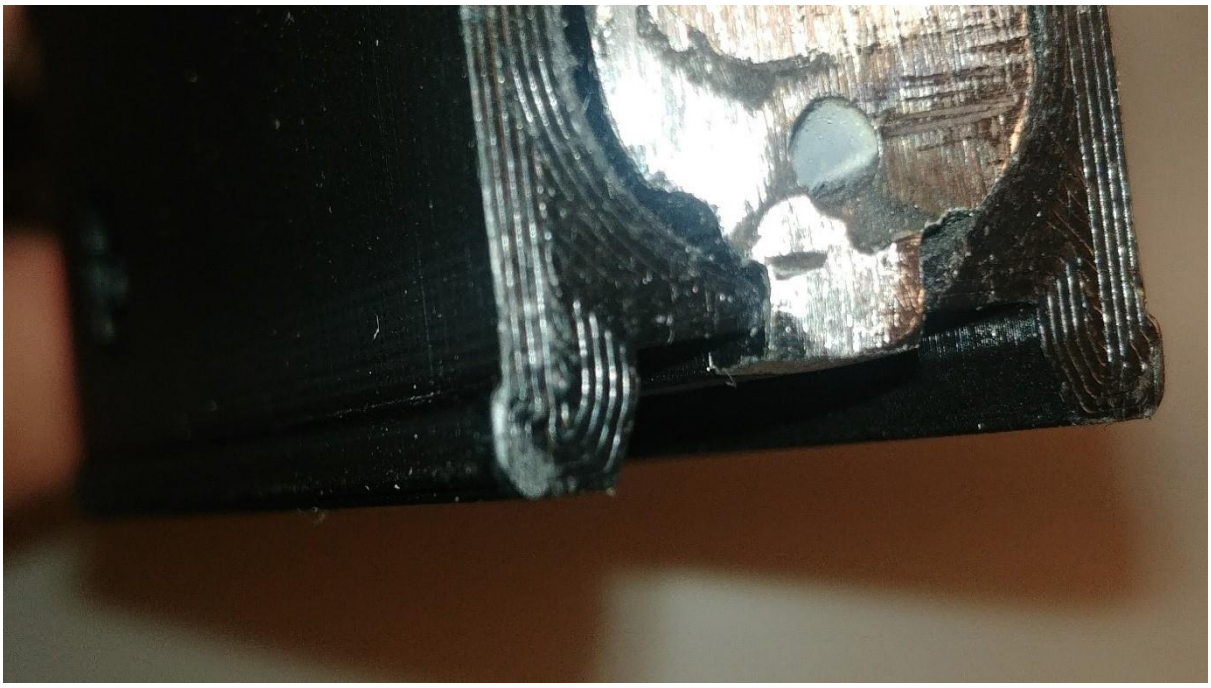
Using one of your partially spent welding sticks that is shorter, add blobs of weld material. Add a blob, let it cool off and then add another blob on top of it until the tower of blobs looks similar to the picture.



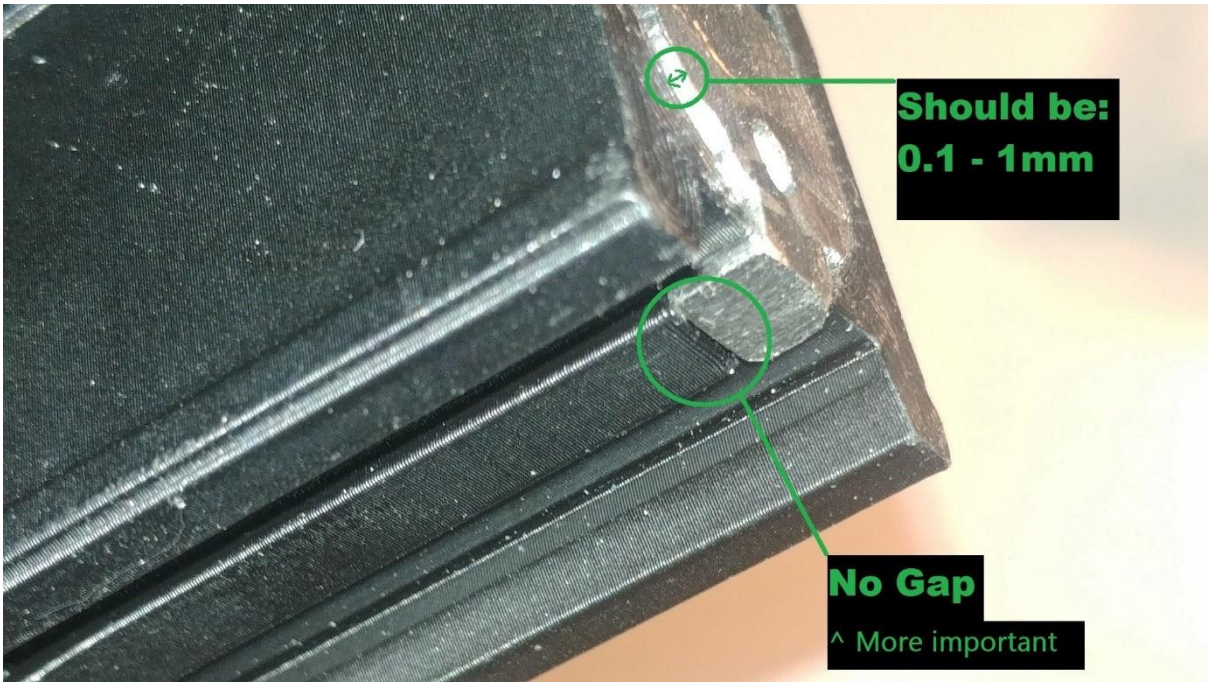


Once your blob tower is high enough and wide enough to cover the cutout you can go ahead and use your metal file to shape it in such a way where it becomes a square that fills out the cutout on the bolt housing.





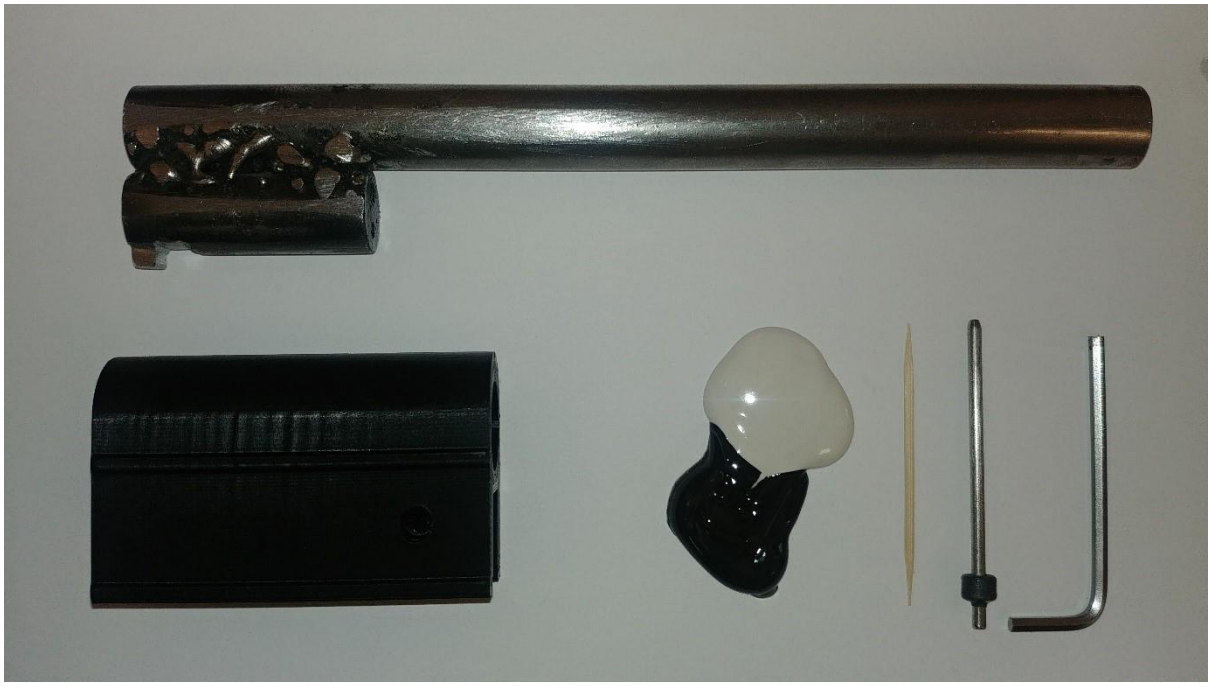
It doesn’t have to be perfect but the sides of the square you are creating should follow the sides of the bottom geometry on the bolt housing as you can see it, in the picture.

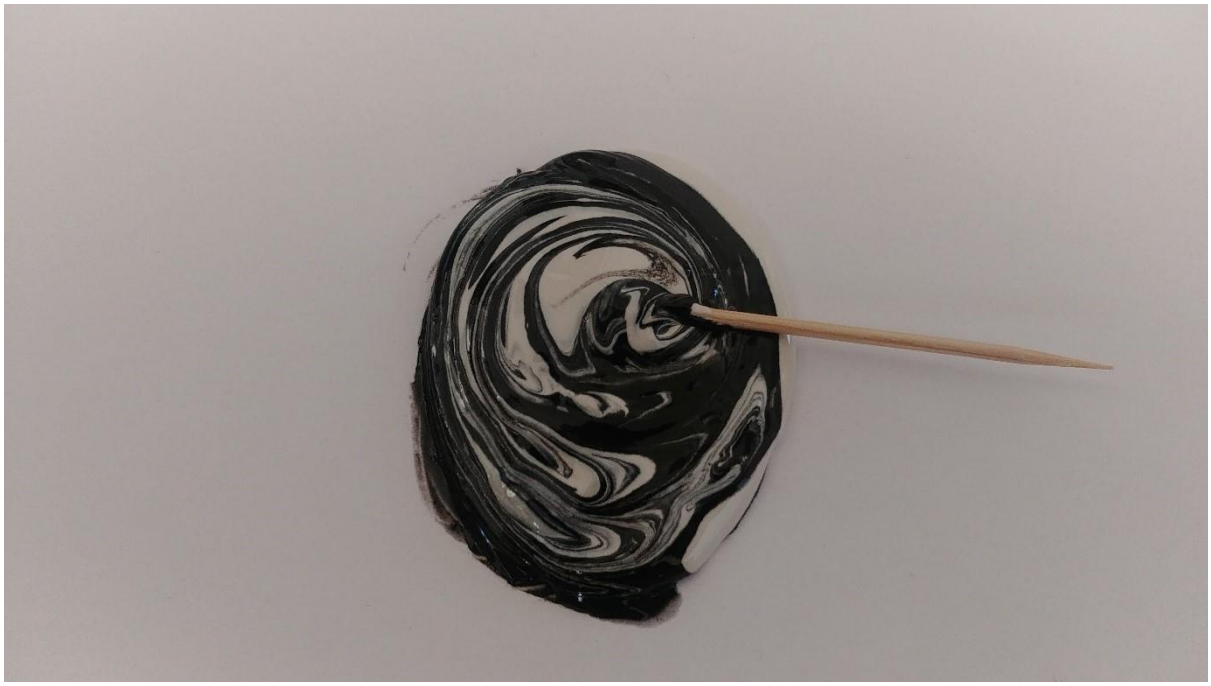


The behind of the square shape will determine how far you can shove the bolt inside the bolt housing. Remove material from the back side of the square shape, so that you can shove the bolt into the bolt housing.

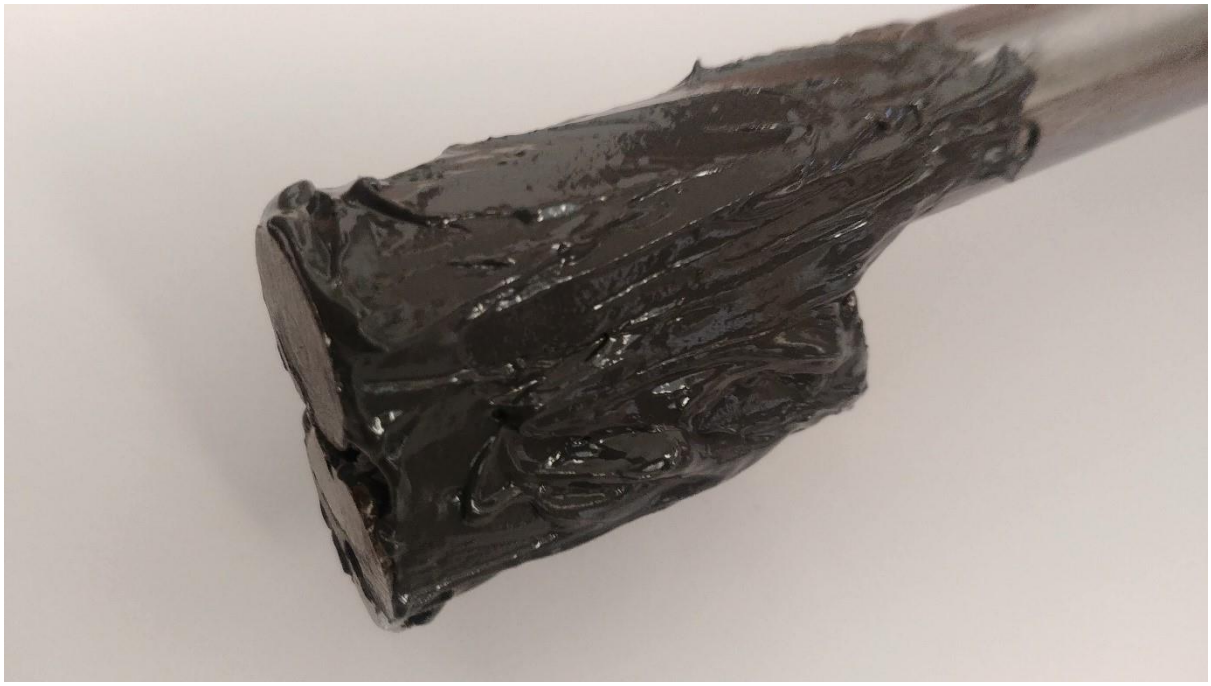
Do not keep removing material from the back side of the square shape, once the bolt face is only sticking 0.1−1mm out, and more importantly when a gap already appears in the circle shown in the bottom of the picture. If the gap has appeared but the front face of the bolt is still sticking out more than 1mm, use sand paper to evenly reduce the protrusion of the steel face.

Once you have managed to file the square into shape so it roughly fills out the cutout on the bottom of the bolt housing and the bolt fits inside the bolt housing well while not sticking out too much, you then can go ahead.

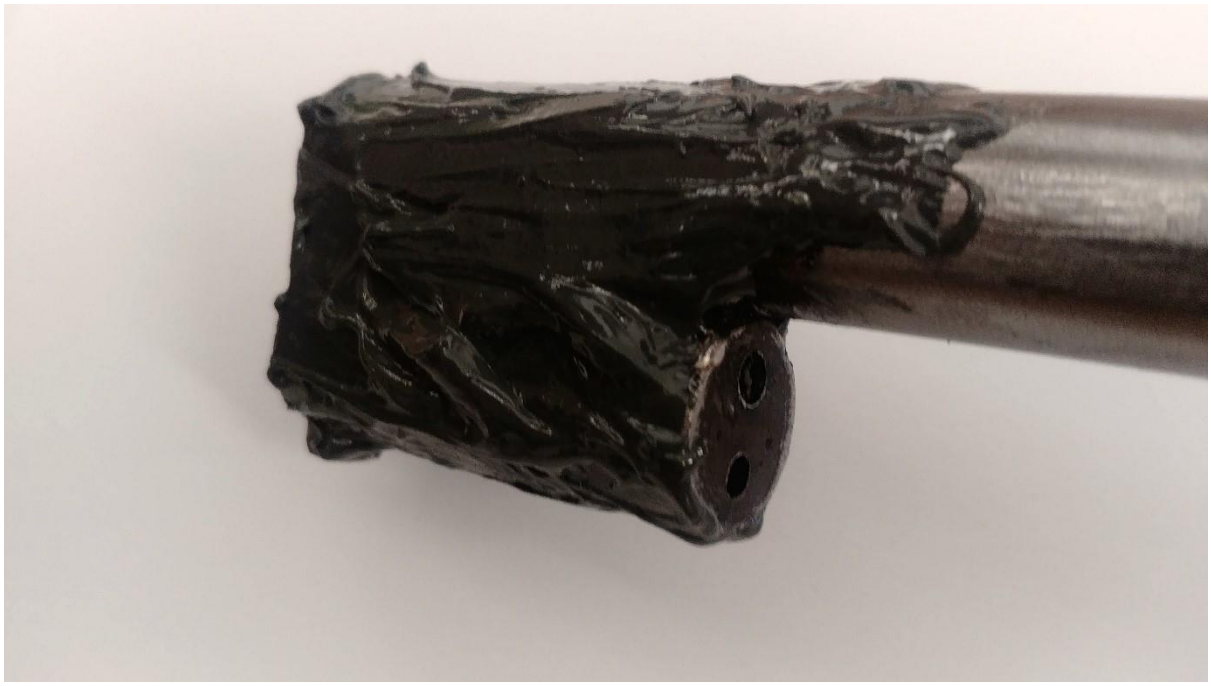


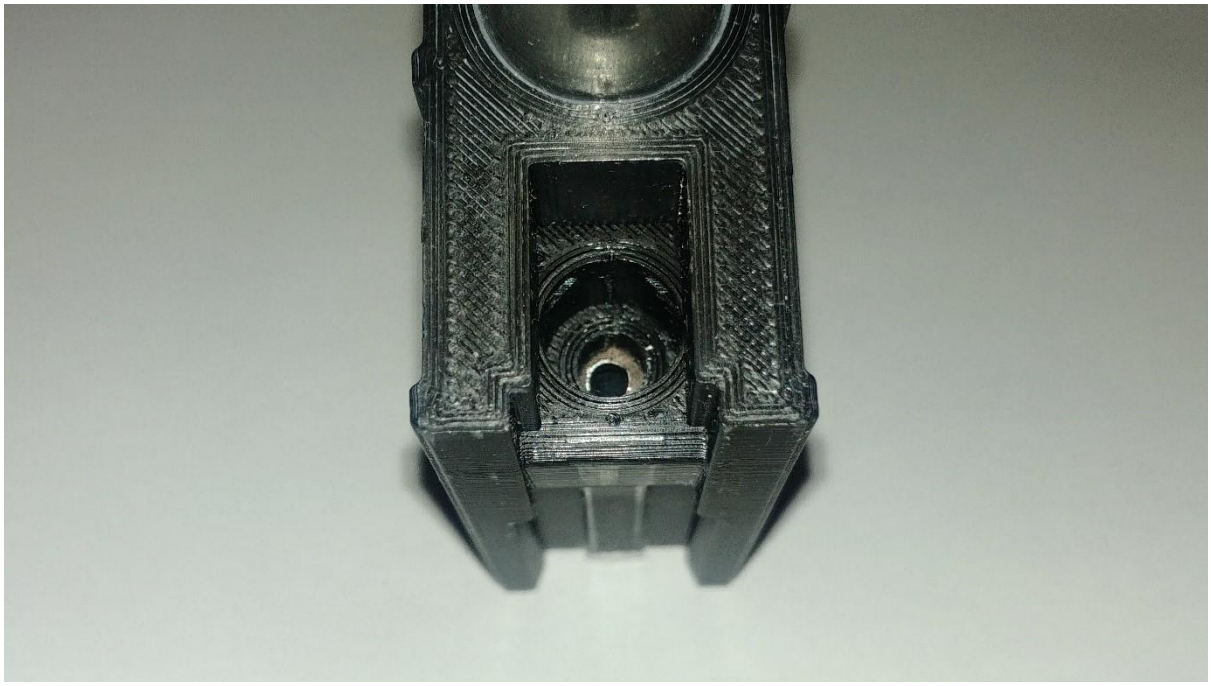


Prepare the steel bolt, the bolt housing, JB weld and the tools to apply it and clean the excessive JB weld off.



Mix the JB weld very well and then apply it to the steel bolt to the extent that you see on the picture.





Push the steel bolt into the bolt housing with the JB weld applied on it.

Make absolutely sure that you don’t have any JB weld on the backside of the lower bolt rod. It has to stay clean!

Be sure to clean the bolt assembly up to the extent you see in the pictures, before letting it dry.

Let the bolt dry for 24 hours before going ahead with the next steps.

Weldless Bolt Option

Text and pictures by IvanTheTroll

Step 1: Prep Work

Remove all supports from your printed parts. Your Bolt Cutting Jigs should have four upright posts that act as integrated supports – use a screwdriver or pliers to remove these four posts, as you don't need them in place. You don't need to be very precise, just get the posts out of the way. It's fine if a little of the post stays stuck to the jig itself.

Jigs before removing posts

Jigs with posts removed.

You will also need to take your 10x10mm bar stock and cut a ~17.75mm long section from it. Use a hacksaw, your grinding tool, or whatever other tool you used to cut your bolt rods to length. The length of bar stock is beneath the bolt rods in the following picture:

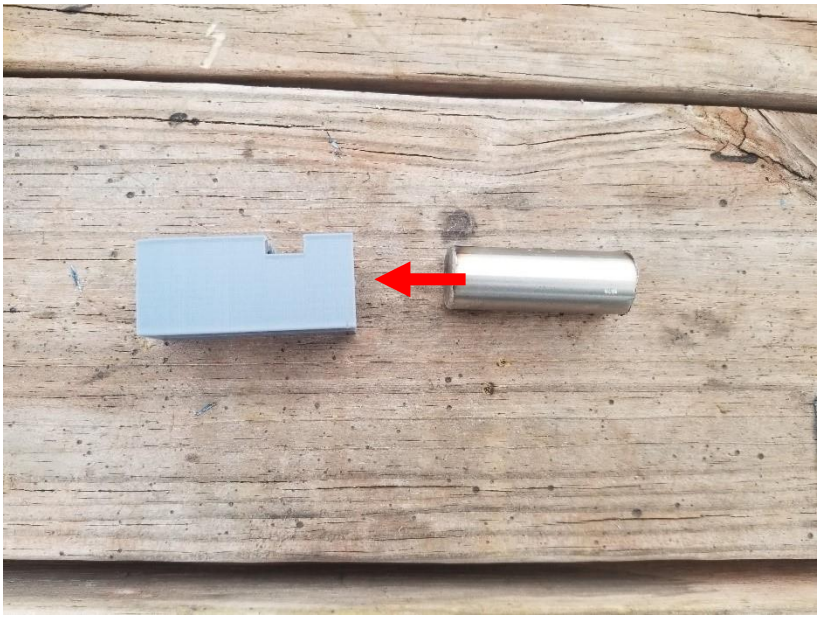
Bolt rods cut to length with bar stock cut to length.

Step 2: Creating Weldless Lower Bolt Rod

For the next step, you will need to make sure you have your bolt rods cut to length (refer to the FGC-9 documentation for this exact length) and your firing pin channel drilled (again, refer to the FGC-9 documentation for the jig and tutorial on how to drill the firing pin channel). I will stress that it is *very* important to get your firing pin channel drilled as straight as you can – It's also a good idea to mark which end of the lower bolt rod you drilled into, as this end of the lower bolt rod should become your breech face. Use a punch or screwdriver to make a small mark on this end of the bolt rod.

Note: I recommend you do these next couple steps outdoors if you are using a power tool to grind. If this is not an option, try and use a room that has tile floor and is easy to sweep in – this process makes a big mess since you are grinding away a lot of metal.

Take your lower bolt rod, one of your cutting jigs, and the same drill bit you used to drill your firing pin channel. Insert the lower bolt rod into the jig BREECH FACE FIRST with the firing pin channel lined up with the larger of the two holes in the front of the cutting jig. It is important that you insert the breech face first to ensure things line up. The breech face is whichever side of the lower bolt rod that you drilled into first when drilling your firing pin channel, or whichever end of the rod lines up the best. If your firing pin channel is too far misaligned and you can't get the firing pin channel to line up with the hole in the jig, make a new lower bolt rod and be more careful when making your firing pin channel.



Insert the lower bolt rod into the jig fully – make sure it is inserted as far as it can go.

Assuming you inserted the lower bolt rod with the firing pin channel aligned, take your drill bit and insert it from the front of the jig. It may be a snug fit, but if you can get it to go in (you can tap it in gently with a hammer if needed) then your firing pin channel is close enough to work correctly.

Insert the drill bit you used into the larger of the two holes – the one that lines up with the firing pin channel.

Double check that the bolt rod is still pushed as far into the jig as it can possibly go – this is very important. After checking this, take your vise grips/clamp/vise and clamp down on the end of the jig – this will lock the bolt rod in place. Make sure this is quite tight – don't worry about deforming the jig, you want to keep the bolt rod totally still. MAKE SURE THAT YOUR DRILL BIT IS STUCK IN FROM THE FRONT OF THE BOLT – you can't see mine in the picture, but you must make sure it is inserted.

Clamp down tight!

Next, you are ready to start removing material. This will get a little messy, and if you are using power tools you should use safety glasses. Safety squinting and looking away won't work here, as you have to closely inspect how much material you have removed. Get your grinding tool ready and find a comfortable way to control both the clamped bolt rod and the grinding tool − I used one hand on the grinder and one hand on the vise grips, but since your set up may vary, take the time to find a way that you can keep the clamped bolt rod and grinding tool under control.

Now you are ready to remove some metal − you will need to use your grinding tool to make a notch in the bolt rod that follows the shape of the cutout in the jig − about 10mm wide, about 5mm deep. Take frequent stops to check how much metal you have removed, but try to work quickly − removing this much metal makes lots of heat, and your jig will start to melt. I've made four of these bolts at time of writing this, and using the grinder pictured I am able to remove the material before the jig gets totally melted. If you are using a Dremel tool, you can take breaks to let everything cool − if you don't ever get the metal red-hot from heat, you can use water to cool it. But if you do get the metal red-hot, DO NOT use water to cool it off − this can cause weird local heat treating to occur, which could lead to a weak bolt.

Be sure to control your tools! Don't lose control of them and grind something you aren't supposed to.

Once you have removed at least 90% of the metal from the slot, you can remove the jig from the bolt rod. If it is getting melty, wear gloves and use a screwdriver to try and pry the jig off. You can also use a punch to drive the bolt rod out of the jig using the small hole in the front of the jig. Because this jig has been overheated, it isn't reusable, so don't be afraid to break it.

Take your 10mm bar stock and test how it fits into the slot. Usually it won't quite fit right away − you can use a Dremel tool or metal file to remove just a little more metal and get the bar to fit. I don't recommend using a grinder, because removing too much metal can ruin your bolt rod. You will want the bar to fit close to snug in the slot, with about half of the bar stock sticking up out of the slot.

Test fit the bar into the slot in the bolt rod.

Use a metal file to square up and fine-tune the slot in the bolt rods. File a little, test fit the bar, file some more, etc.

Step 3: Creating Weldless Upper Bolt Rod

Without going into too much detail, you will make the upper bolt rod just like you did with the lower bolt rod – only you won't need to use a drill bit to align the firing pin hole, since there isn't a firing pin hole on the upper bolt rod.

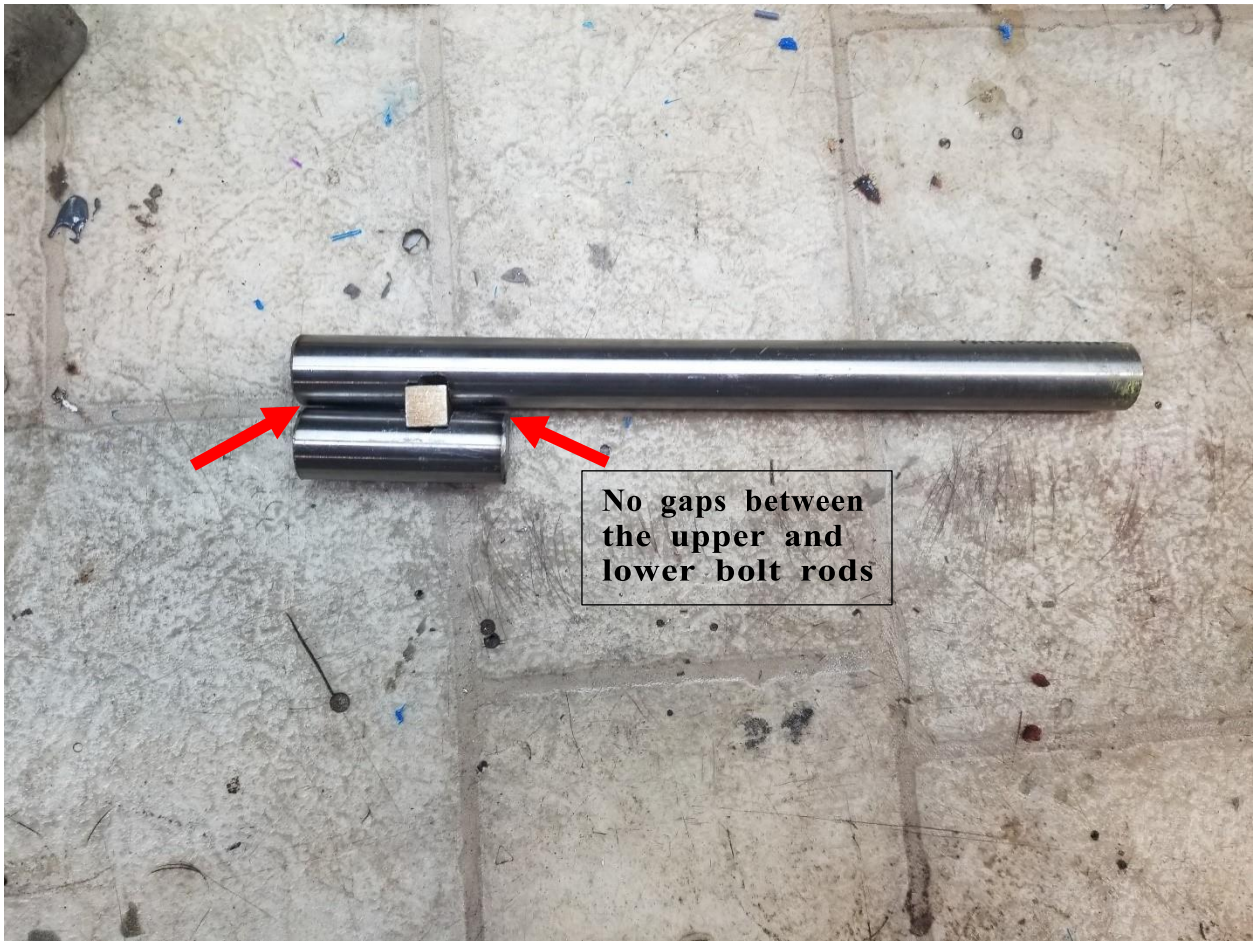
Take your rod, insert it fully into your second cutting jig, clamp it in place, then use your grinding tools to cut the slot into the rod. Follow the same steps as in Step 2 with regards to cleaning up the slot after you have removed most of the metal.

As a reminder, a snug fit on the bar stock is ideal (the less it can wiggle towards either end of the rod the better), and half of the height of the bar stock should be sticking out of the slot when the bar is placed into the slot.

Correct fitment of the bar stock into the slot

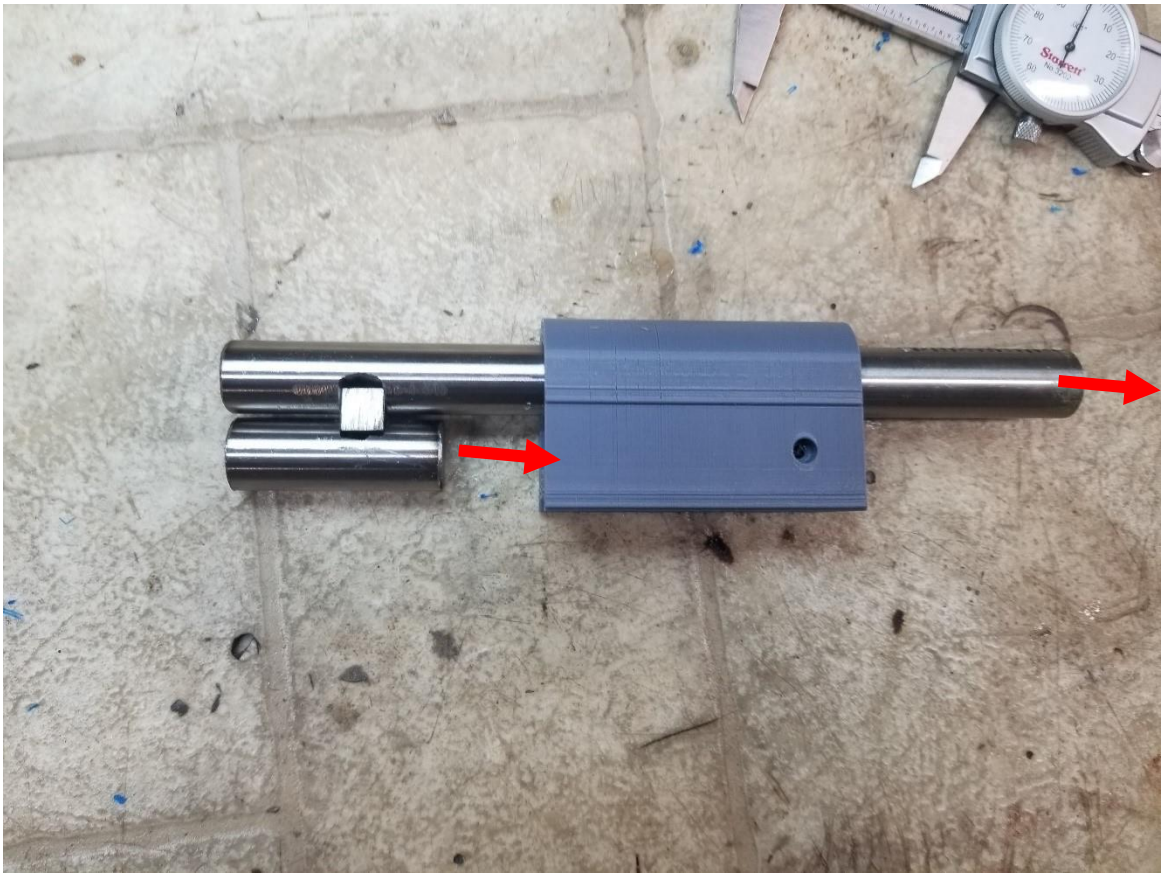
Step 4: Assembling the Bolt

Once you have slotted both bolt rods, take your bar stock and both rods and lay them out like seen in the picture below. Your bar stock might not sit perfectly flat/straight, but so long as the top of the upper bolt rod touches the bottom of the upper bolt rod, then you've cut your slots properly. If the bolt rods have a gap between each other because the bar stock doesn't fit deep enough into the slots, you will need to make the slots a little deeper.



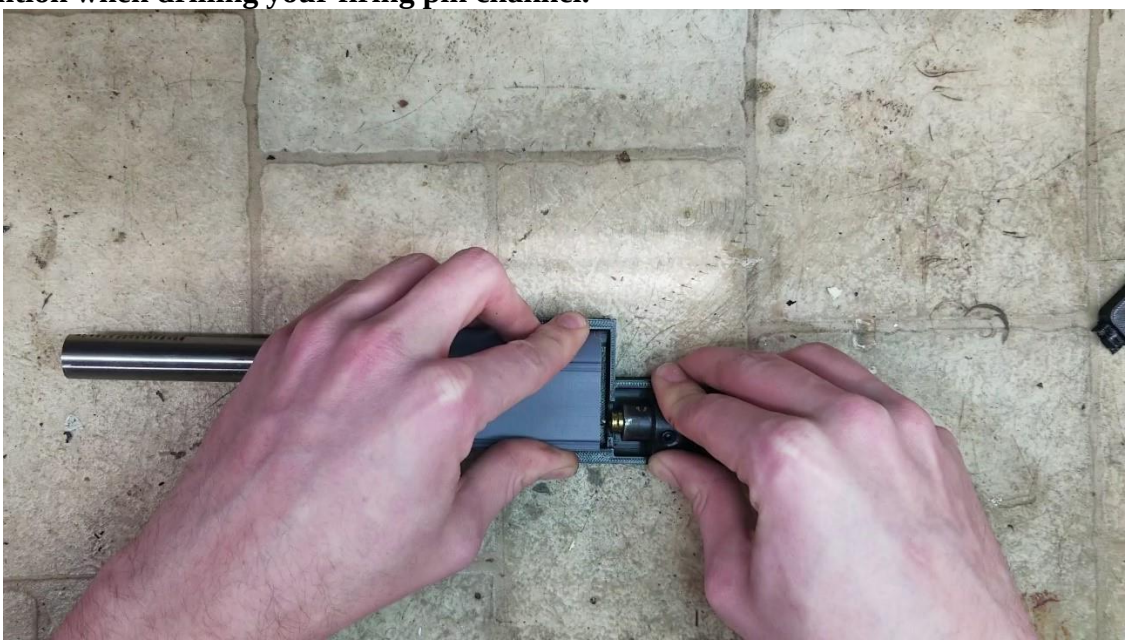
Layout of the weldless bolt. Make sure there is NO gap between the bolt rods. If there is, you need to make the slots deeper.

After ensuring that the bar stock can fit between the bolt rods without any gap between the two bolt rods, you are ready to do a mockup fit of your bolt assembly. Take your metal parts and your bolt housing. Insert the metal parts into the bolt housing as shown in the picture below. Make sure that your bar stock is centered when it passes into the bolt housing. If you didn't make sure that there was zero gap between the top and bottom bolt rods, you won't be able to get the metal parts to fit inside the housing – go back to the previous step and fix this. It may be a little hard to get your metal parts inserted the first time – the bolt housing is intentionally tight to help align the metal parts.

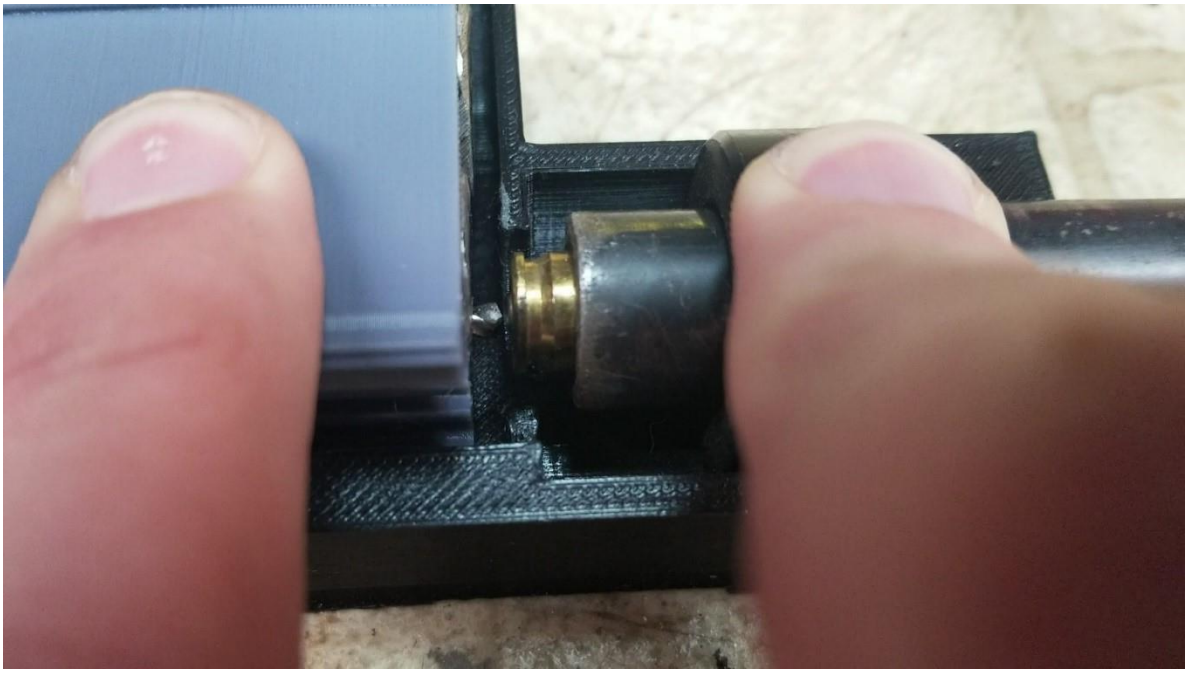


Carefully guide the metal parts into the bolt housing. You might need to tap them in gently with a hammer the first time.

After fully inserting your bolt rods, I recommend you take the drill bit you used to drill the firing pin channel, your FGC-9 headspacing jig (make sure you've read the FGC-9 documentation to understand this tool), and your FGC-9 barrel, as well as a spent/fired cartridge (you can use a live cartridge but be careful). With the cartridge in the chamber and the drill bit sticking out of the firing pin channel, use the headspacing jig to check how the firing pin channel and cartridge/primer align. If the drill bit in the firing pin channel points right at the middle of the primer, you've done well. If it doesn't line up, you will probably have to make a new lower bolt rod − pay close attention when drilling your firing pin channel.



Checking firing pin alignment

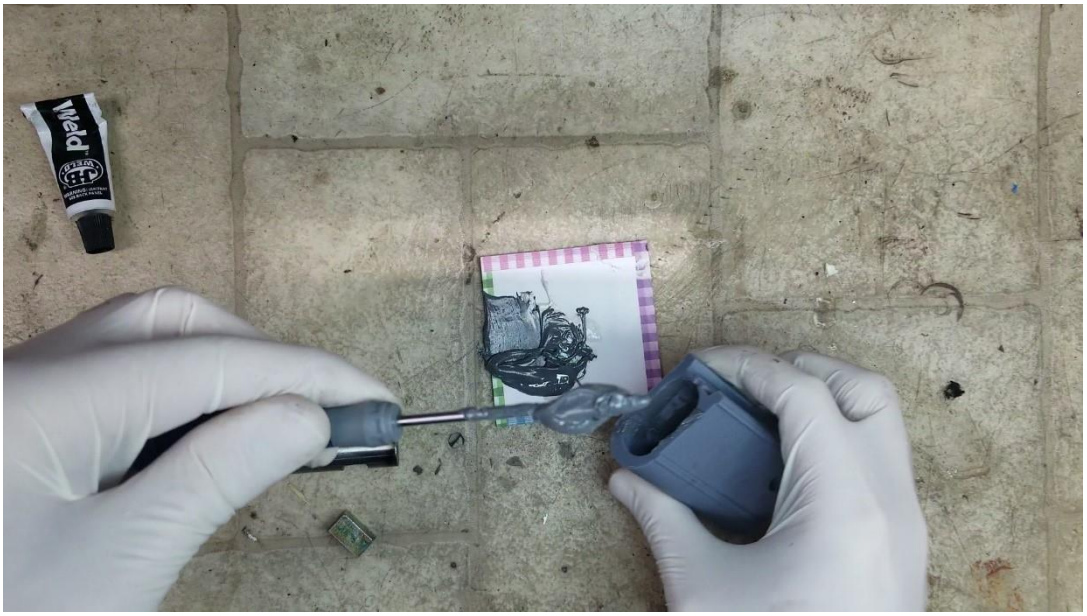


Get up close and check – this firing pin channel is well-placed.

After checking alignment of the firing pin channel, you are ready to JBWeld your bolt assembly into the housing. This step will be messy – don't wear any nice clothes, do not work near carpet, and you may want to wear gloves. Start by mixing a large amount of JBWeld – about 1/3 of each tube should be used for this step. When using large amounts of JBWeld like this, you will need to mix the two parts for about 5 minutes to ensure it is fully mixed.

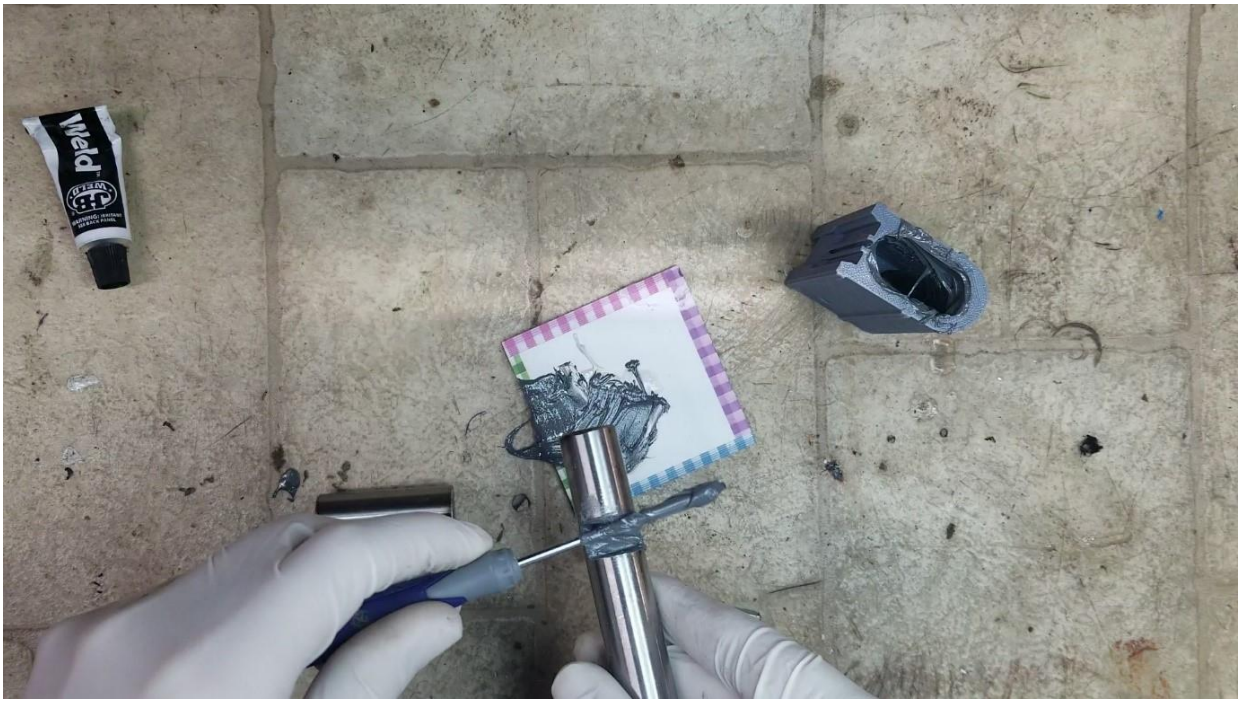
The minimum amount of JBWeld you should use. Mixing more than this amount is a good idea.

After mixing, use a cheap screwdriver, popsicle stick, or other tool to smear JBWeld on the inside of the bolt housing. Apply lots of JBWeld, but try to leave an even coat – you don't want big blobs, you want it spread out on the inside of the housing.



Apply JBWeld to the inside of the housing. Use your tool to spread it out.

Next, I recommend you use brake cleaner/degreaser to clean all the metal parts – this isn't required but will help make a stronger bolt. After cleaning the metal parts, fill the slots in the upper and lower bolt rods with JBWeld. Make a big blob, and ensure the slots have as much JBWeld in them as you can fit.

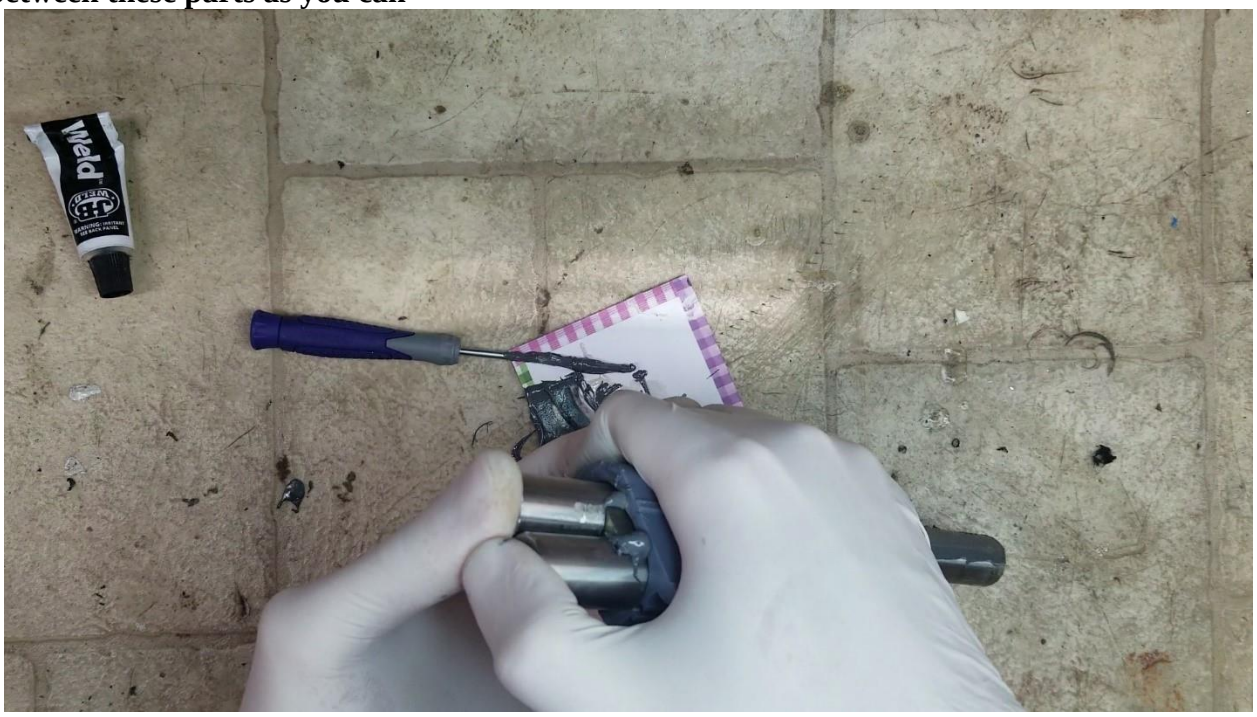


Fill the slots.

Place the bar stock into the lower bolt rod – JBWeld will squish out. Try not to wipe this up – you want to leave it squished out. Squish the lower bolt rod and bar stock into the upper bolt rod – more JBWeld will squish out.

Squish the rods together.

Now, insert the bolt rods into the housing. As JBWeld squishes out, try and guide it into the crevasse between the bolt rods and the housing. You want to cram as much JBWeld between these parts as you can



Smush the bolt rods down into the housing. Smear any JBWeld that squishes out onto the bolt rods and back into the housing.

Push/pull the metal parts until they are fully seated into the bolt housing. Shove any JBWeld that squishes out back into the gaps between the bolt rods and the housing.

Pulling the bolt rods until they are fully seated.

Smearing excess JBWeld back into the gaps.

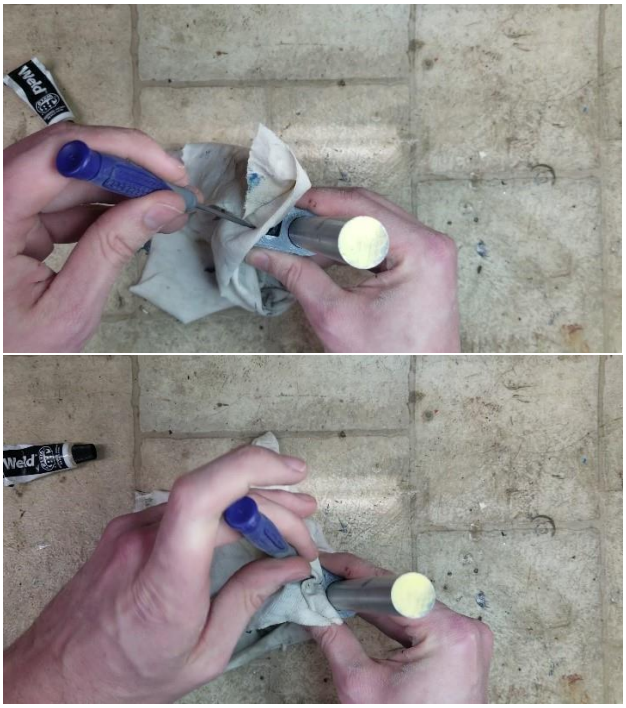
Take your extra 3mm drill bit and coat it in JBWeld – build up lots of JBWeld on the drill bit, fill the flutes with JBWeld. After coating the drill bit, you will insert it into the slot at the bottom of the bolt housing. Insert it until it stops – some of the drill bit will still be sticking out, this is fine for now.

Apply lots of JBWeld!

Smooth out the JBWeld along the bottom of the drill bit/bolt with your finger. Make sure plenty of JBWeld is smeared over the bottom of the drill bit/bolt, as seen in the following picture.

At this point, most of the messy work is over. Use a rag to wipe up any JBWeld on the exposed section of the upper bolt rod. Clean up any JBWeld that you got on the sides of the bolt housing. Finally, you will need to clean out any JBWeld that you got into the firing pin channel/firing pin housing. I usually just use a rag and a screwdriver for this. Use the screwdriver to guide the rag into the rear of the bolt and mop up all the JBWeld that you see. Try and get as much of it out as you can.

This JBWeld needs to be cleaned out.



Mop up all that JBWeld!

You're finally done making messes − set your bolt upright for at least

24 hours to let the JBWeld set up. I recommend you use a clamp on the outside of the bolt housing while the JBWeld sets up (the clamp doesn't need to be very tight, just holding everything steady).

Bolt assembly clamped in place while the JBWeld cures.

After the JBWeld has cured for 24 hours, use a hacksaw or Dremel tool and a file to cut the 3mm drill bit off − you will need to make sure you cut it off perfectly flat with the face of the lower bolt rod. I recommend you cut 90% of the length of the drill bit off with your hacksaw or Dremel tool, then use your metal file to file down the firing pin until it is flush with the face of the bolt. You may also have to take the drill bit you drilled out your firing pin channel with and drill any JBWeld out of the firing pin channel itself.

Dremel off most of the drill bit, then use a file to make it flush with the bolt face.

Drill bit filed flat with the bolt face.

Side view – note that the face of the bolt is flat and the drill bit does not protrude.

With this step complete, your bolt is done. If you are making an FGC-9 MKII, you will need to drill the recess for the charging handle into the upper bolt rod – refer to the main FGC-9 MKII documentation for the process on doing this.

Weldless Bolt FAQ/Troubleshooting

Q: What sort of round counts should I expect? What ends up breaking?

A: While this bolt is by no means stronger than a proper welded bolt, I have put 500 rounds through one and experienced no issues. If I had to guess, either the drill bit will come loose and the bolt will lose it's ability to pick up rounds out of the magazine, or the JBWeld holding the bar stock in place will crack and the bolt rods will become wobbly. If this happens, STOP USING THE BOLT– I'm sure the gun won't feed right if this happened, so if you have a weird malfunction and the bolt feels wiggly, consider the gun out of commission.

Q: What sort of reliability should I expect?

A: Reliability has been great with the bolts I've made – on par with the welded bolts. It's pretty amazing how well the setup itself works, I did not expect it to work as well as it has.

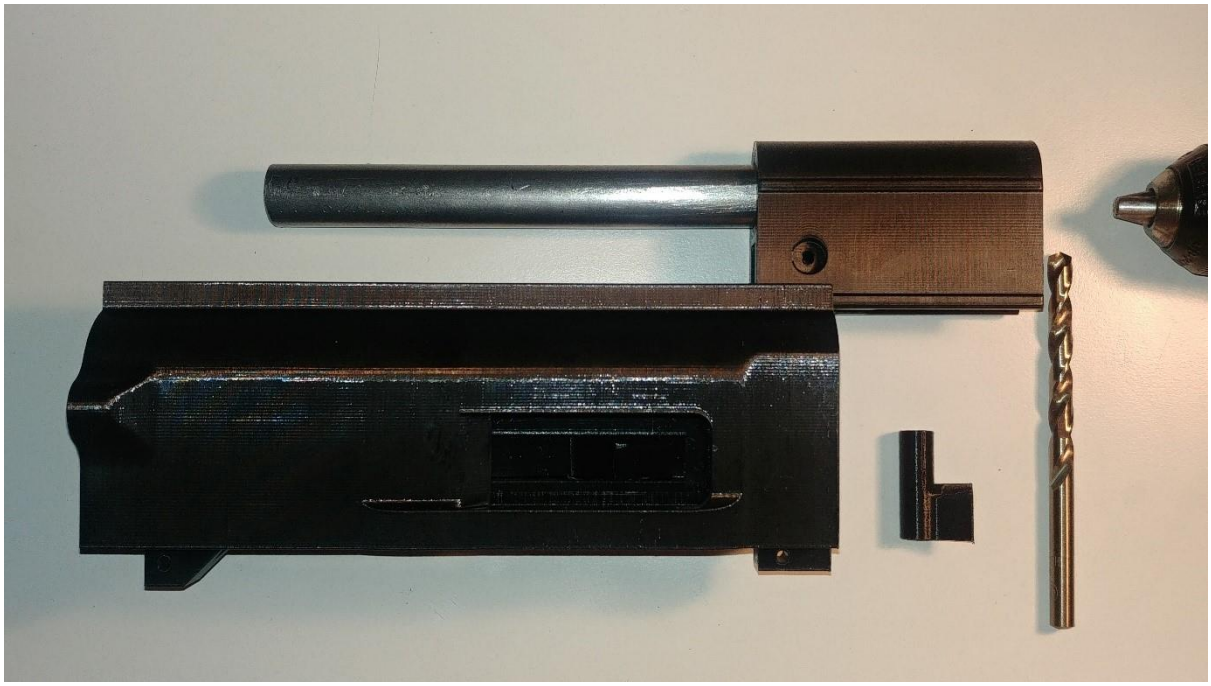
Q: Why am I getting light primer strikes or failures to extract?

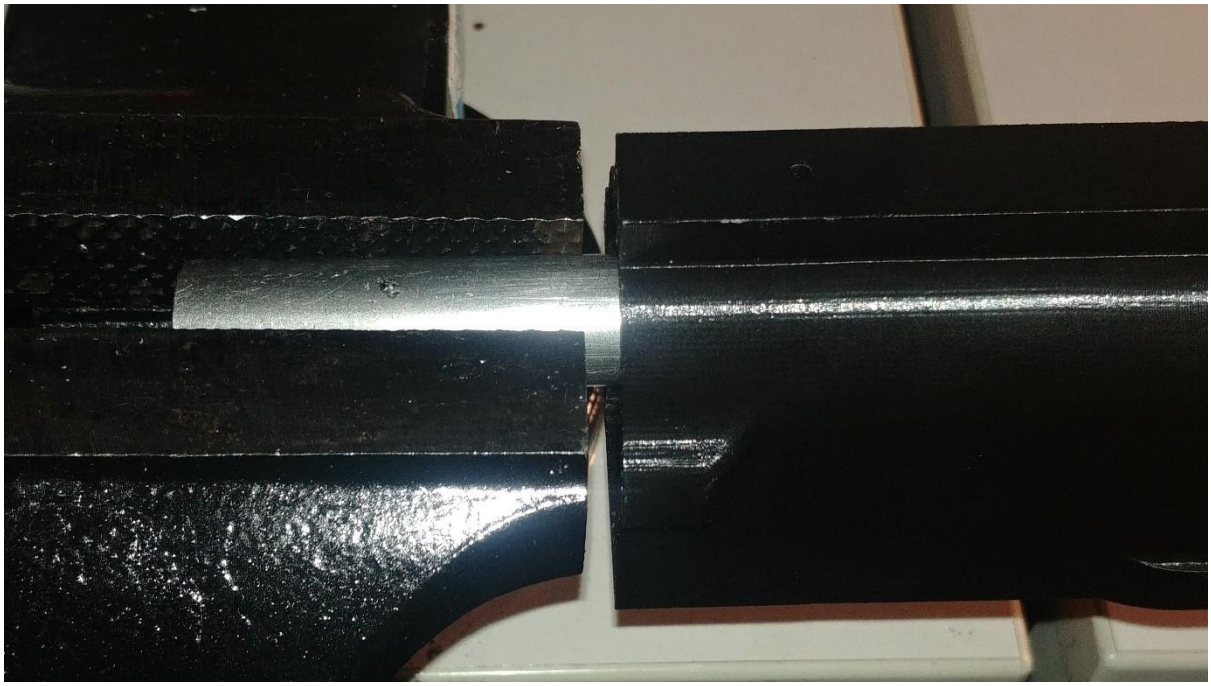
A: Refer to the main FGC-9 MKII documentation/troubleshooting tips for issues like this. It is very important that you headspace weldless bolts per the instructions in the documentation because of the possibility of the two bolt rods not being perfectly aligned when making a weldless bolt.

Q: Can I just use a 3mm rod instead of the 3mm drill bit when JBWelding it into the bottom of the bolt?

A: Maybe, but it will not be as strong as using a drill bit. You can get a set of 10 3mm drill bits for around $5 most places – cheap Chinese ones are fine for this application.

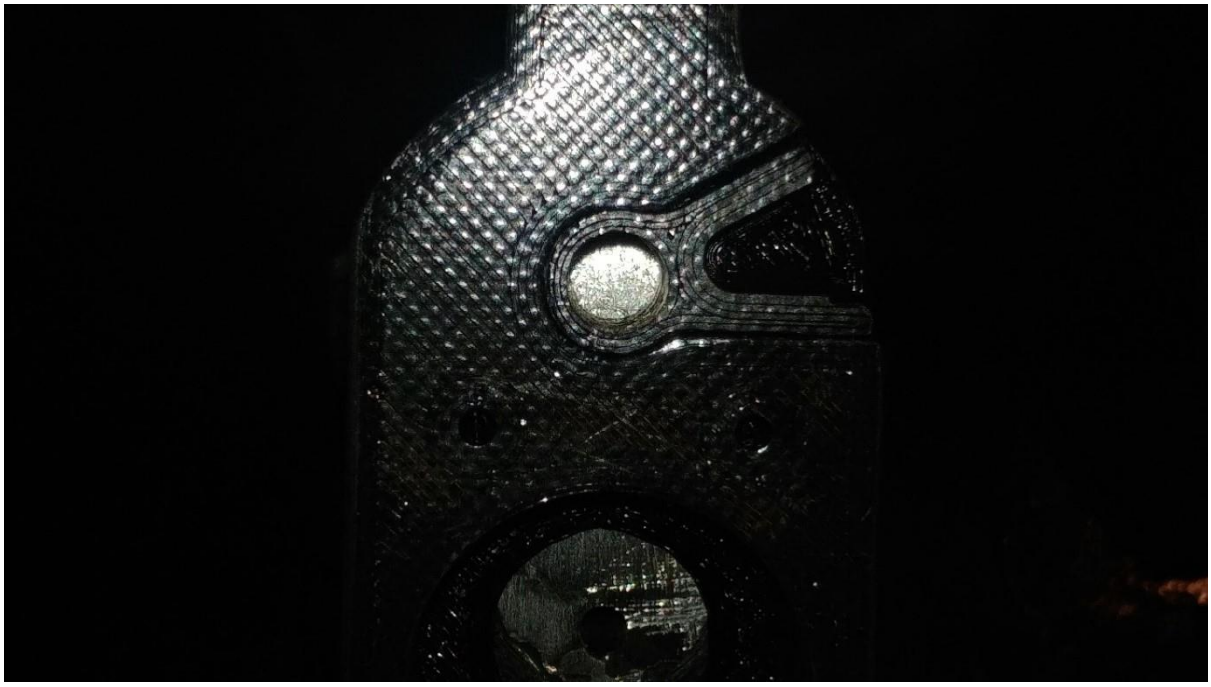
Drilling the charging handle recess





Prepare your power drill, upper receiver, bolt, drill recess jig and a 7mm diameter drill bit. Insert the bolt into the upper receiver.

Insert the drill recess jig into the front of the upper receiver. Making sure the bolt does not fall out, clamp the long bolt steel piece between the jaws of your vise. Have as much as you can of the bolt clamped in the vise while still having the bolt be at the end on the inside of the upper receiver.

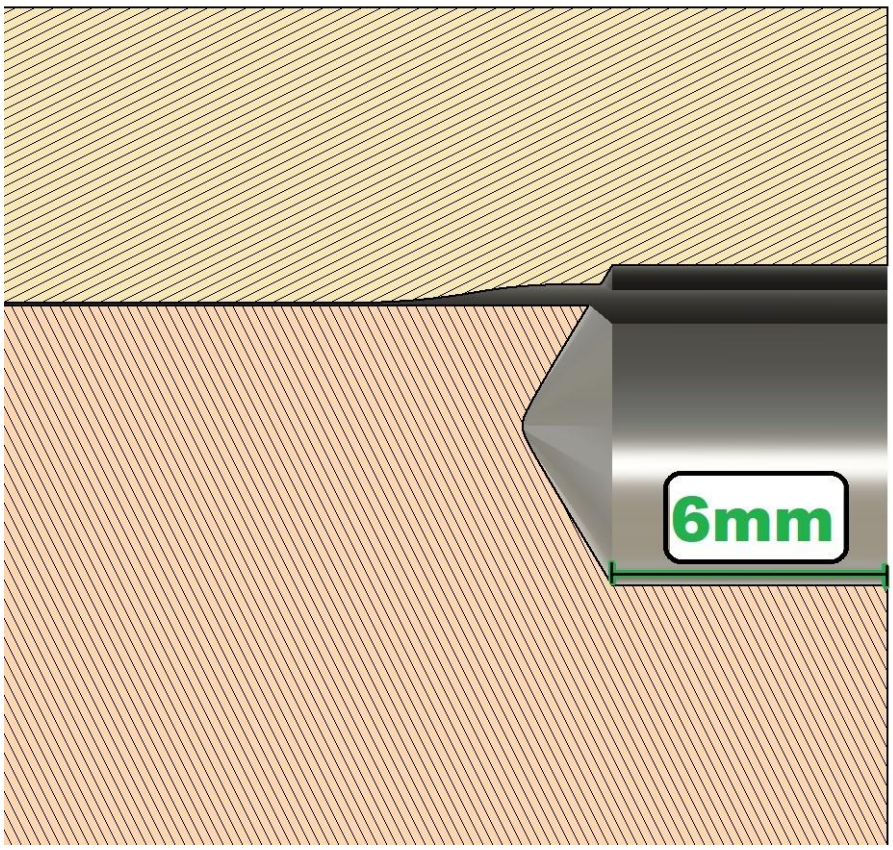


Apply cutting fluid spray and then use your 7mm diameter drill bit to drill into the opening in the recess jig. Push the power drill forward with force trying to drill as straight as possible at the same time.

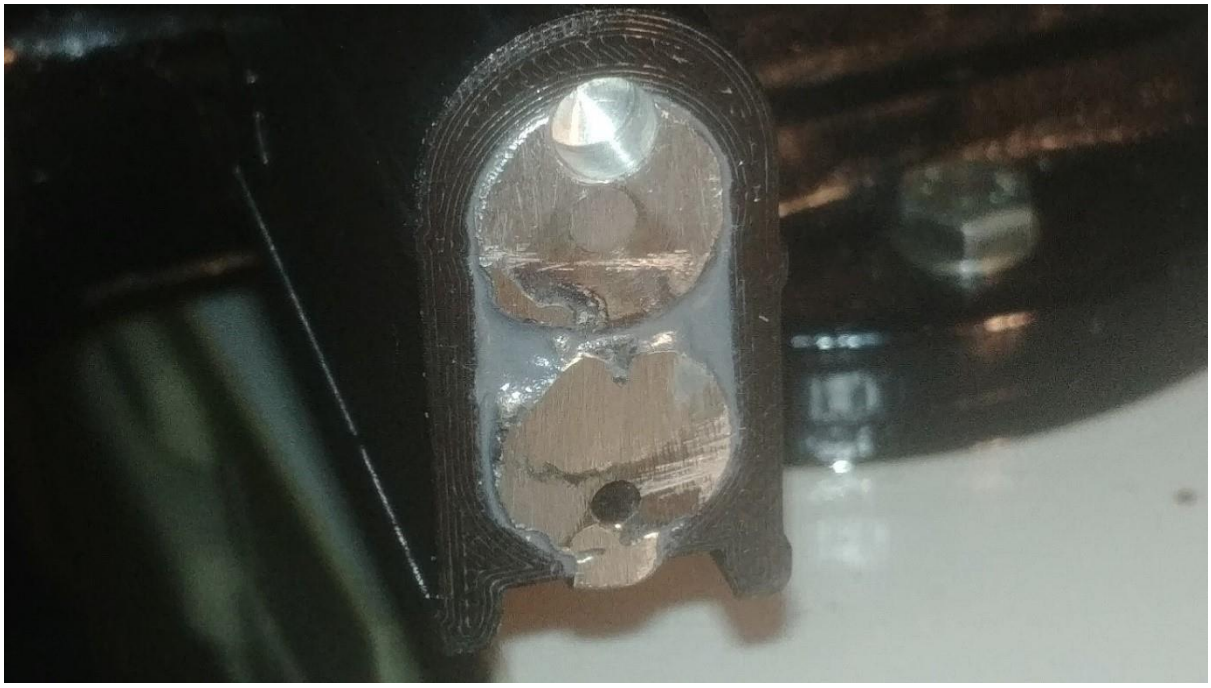
Only drill a millimeter or two at the beginning to get an idea of how fast you are removing material while drilling. Be sure to constantly remove steel shavings with an air spray can or simply use your cutting fluid spray and a brush of some sort.

Your goal is to drill into the bolt face so that you end up with a recess that is 6mm +-1 deep at the EDGE of the bottom of the recess.

Measure this by using the depth rod of your caliper and have the bottom of that rod butt up against the bottom at the edge of the recess. When you measure at the center of the recess you might



measure around 8mm, the reason is that drill bits have a 118° degree tip usually, hence the difference in dimensions center vs edge.



To help the charging handle go into the recess during operation, use sand paper to deburr/ add a radius to the edge of the recess entrance.