

# **DETERRENCE DISPENSED PRESENTS**



**FGC-9**

**DESIGNED BY JSTARK1809**

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Lead tester

Provided ECM-rifled barrel option

Provided 3D-printable FGC-9 compatible magazine

Provided fire control group CAD model

Provided valuable input for design improvements and troubleshooting

3socksandcrops: Provided valuable video footage

Incarbonite: Helped with the airsoft fire control group option

CtrlPew: Provided video showcasing 3D-print supports removal

Special thanks to the following testers:

Sparky8899, 3socksandcrops, Shinto

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# Foreword

The FGC-9 is a 9x19mm pistol caliber carbine that is made mostly out of 3D-printed components, utilizes an AR-15 or airsoft M4 rifle fire control group, is compatible with Glock magazines and offers a truly effective, simple to build and reliable tactical option for self-defense and more.

At the time of this publication, the FGC-9 is without a doubt the most effective and easiest to build homemade semi-automatic firearm design for people with limited access to gunsmithing knowledge and tools.

Frustrated by not being able to acquire and bear firearms because of regulations and tyrannical laws, I embarked on the journey to learn to produce my own firearms. I have had to teach myself how to use 3D-printers and 3D CAD modeling software as well as learn the basics of engineering and gun design. Following the impact of the work by Defense Distributed, for which Cody Wilson was the face, I gained interest in and was intrigued by the topic of modern DIY firearm design. Seeing how the famous very first 3D-printed firearm design, the "Liberator" was very limited in its effectiveness and viability and not seeing any other developments beyond it, I lost sight/interest on the state of the art of modern DIY firearms design for a while.

This was until I found out about the Shuty AP9 by Derwood. The AP9 is a mostly 3D-printed firearm that utilizes off-the-shelf AR-15 components in conjunction with hardware store fasteners. The big issue with the AP9 is that it still relies on commercial Glock barrels and thus is not an option for people outside of the US, as barrels are regulated very strictly outside of the US. Apart from that, the AP9 design has not been developed beyond a prototype stage and effectively can only be built with considerable gunsmithing experience. Additionally the 3D-printed components still have to be worked on after printing and its firing pin needs a lathe to make. I set it my goal to take the AP9 and develop it further, making the most important change the option to be able to use homemade barrels. A very high number of improvements and changes have gone into what now has become the FGC-9 and one of the bigger improvement aspects is the reliance on metric fasteners that are standardized and obtainable globally. The list of changes and improvements is found at the end of this document.

A lot of time, effort, resources, money and nerves have gone into the development of the FGC-9, so if you want to show your gratitude for the work that I put in for the FGC-9 feel free to donate. By donating you are also contributing to further development on a FGC-9 MkII design, as well as other, easy to build, while still effective firearms, such as my next project, the FGC-12, a pump-action box-fed 12 Gauge shotgun.

So consider sending a donation: <http://www.tinyurl.com/JStark1809>

# Outline of the production

## 1. You do not have a 3D-printer or haven't used one extensively?

Check out the 3D-printing guide included in the FGC-9 files and follow it.

Once finished with that you will be ready to continue with this document.

The guide will tell you what 3D-printer to buy, how to assemble it and everything else you need to know to begin 3D-printing.

## 2. You're capable of 3D-printing parts and want to begin building a FGC-9?

You can then go ahead and check out the ECM rifling guide included in the FGC-9 files and follow it. Once finished with it, you will have a rifled barrel that is compatible with the FGC-9.

## 3. Once you have finished producing a barrel in accordance to the guide and it meets the specifications listed on page 56 you can go ahead.

After you have made sure you have a barrel that fits those specifications, check the printing and building phase table on the next pages to plan your next steps. Following that all tools, materials and parts are listed that you will need to build your FGC-9. Before you buy/order any of the tools, materials and parts make sure to read this entire document multiple times to better understand the reason why you will have to get each tool, material and part. That way you can better adjust for limitations that you might face when you can't acquire a certain item for example.

If you decide to use AR-15 pistol grip screws/inch screws instead of the metric option that is listed, you need to use a 6mm drill bit and drill into the mounting hole in the receiver before attempting to install the pistol grip.

Note that if you use the inch pattern secondary buffer spring you need to print the purpose made buffer tube for the inch secondary buffer spring.

If you do not own any Glock magazines you can 3D-print a 25 round magazine designed by IvanTheTroll. The files for that magazine are included in the FGC-9 release files. All information and resources needed to 3D-print reliable FGC-9 compatible 25-round magazines are provided.

Included in the files are oversized versions of the upper receiver and barrel retainer. Make sure to print the barrel retainer first and test the fit of your shaft collars to see if you have to use the oversized versions or not.

## Suggested slicer settings

These are the settings suggested for use with the Cura slicer which is included in the release files. Set Cura settings to "expert" indicated by the three lines symbol to the right of the search settings bar.

Print Orientation: As it is when loaded up in your slicer(Cura)

Quality -> Layer height: 0.16mm

Shell -> Filter Out Tiny Gaps: DEACTIVATED

Infill -> Infill Density: 100%

Material(PLA or PLA+ ) -> Bed Temperature: 60°C

Nozzle Temperature: for PLA 210-215°C,  
for PLA+ 220°C or higher

Support -> Supports: Everywhere      Support Overhang angle: 75°  
Support Pattern: Grid      Support Z Distance: 0.2mm

Build plate adhesion ->Type: Brim      Brim width: At least 2mm  
Brim Only on Outside: ACTIVE

Settings from above for these items:

- Upper Receiver      - Buffer Tube      - Barrel Retainer  
- Bolt Carrier      - Charging Handle      - Magazine Catch Button  
- Bolt Drilling Jig      - Ejector      - Ejector Pivot      - Lower Receiver

Same settings as above for these items but without supports:

- Stock,      - Magazine Catch Bar,      - Magazine Catch Pivot lock,  
- Bolt Welding Jig,      - Upper Receiver Rail,      - Pistol Grip,      - Feed Ramp

After printing each part, make sure to get rid of any edges and artifacts that result out of the nature of 3D-printing. Before you install any 3D-printed components make sure to insert and remove items from their destined place on the receiver multiple times to make sure that they move smoothly if they are intended to do so, which is the case, for example, for the bolt carrier. So if a part does not fit or move in the manner you would expect, try to smoothen the surface of the 3D-printed object and get rid of any squished edges with your craft knife.






For those who own the Creality Ender 3 3D-printer, there are .gcode files for each part provided in the FGC-9 files, that way you can go straight to 3D-printing without having to use a slicer.

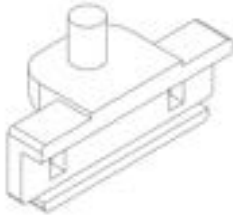





## Printing phase

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*Use this section as a checklist to ensure you've printed all parts you need.*



### Day 1

	Picture	Item	Print Time	Material Used	Notes
1		Magazine Catch Pivot Lock	5 min	1 gram	
2		Bolt Welding Jig	20 min	2 grams	
3		Feed Ramp	20 min	2 grams	
4		Magazine Catch Button	30 min	2 grams	
5		Magazine Catch Bar	50 min	4 grams	


6		Ejector Pivot	50 min	5 grams	
7		Bolt Drilling Jig	1 hour	5 grams	
8		Charging Handle	1 hour	7 grams	
9		Ejector	1 hour	10 grams	
10		Upper Receiver Rail	3 hours	22 grams	
11		Barrel Retainer	7 hours	52 grams	




## Day 2

	Picture	Item	Print Time	Material Used	Notes
12		Bolt Carrier	9 hours	61 grams	
13		Pistol Grip	16 hours	85 grams	


## Day 3

	Picture	Item	Print Time	Material Used	Notes
14		Stock	21 hours	180 grams	

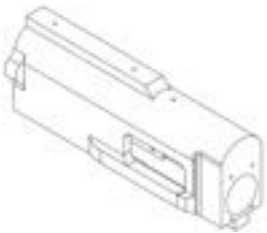
## Day 4

	Picture	Item	Print Time	Material Used	Notes
15		Buffer Tube	1 day 4 hours	220 grams	There are two versions, Metric and Inch

## Day 5

	Picture	Item	Print Time	Material Used	Notes
16		Lower Receiver	1 day 11 hours	203 grams	

## Day 6

	Picture	Item	Print Time	Material Used	Notes
17		Upper Receiver	1 day 15 hours	288 grams	Before printing put a new filament roll on the printer

## Build and assembly phase

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### Day 7

Item		Time needed	Notes
1	Make the firing pin	30 minutes	<i>JB Weld has to cure for 24h afterwards</i>
2	Make the charging handle	5 minutes	<i>JB Weld has to cure for 24h afterwards</i>
3	Melt in the thread inserts	1 minute	
4	Assemble the barrel assembly	1 minute	
5	Assemble the upper	5 minutes	
6	Assemble the lower	5 minutes	
7	Build the bolt	1 hour	<i>JB Weld has to cure for 24h afterwards</i>

### Day 8

Item		Time needed	Notes
8	Drill and tap bolt carrier	5 minutes	
9	Assemble the stock assembly	1 minute	
10	Final assembly	5 minutes	

# Tools, materials and parts

## Tools

### Digital caliper



- A digital caliper that is able to give you accurate measurements

It should be able to display the measurements in millimeters

Recommended source: Amazon, Ebay, Aliexpress, Local hardware store

### Power drill



- A power drill

Ideally it should be made by a good manufacturer and be as powerful as possible

Recommended source: Amazon, Ebay, Aliexpress, Local hardware store

### HSS-Cobalt drill bit set



- HSS-Cobalt drill bit set with sizes:  
1mm, 1.5mm, 2mm, 2.5mm, 3mm, 3.5mm,  
4mm, 4.5mm, 5mm, 5.5mm, 6mm, 6.5mm,  
7mm, 7.5mm, 8mm, 8.5mm, 9mm, 9.5mm,  
10mm

The alloy the drill bits are made out of needs to be:

At least: HSS-Cobalt M35 (5% Cobalt)  
Ideally: HSS-Cobalt M42 (8% Cobalt)

Recommended source: Amazon, Local hardware store

### HSS-Cobalt 4.2mm drill bit



- HSS-Cobalt 4.2mm diameter drill bit

The alloy needs to be:

At least: HSS-Cobalt M35 (5% Cobalt)  
ideally: HSS-Cobalt M42 (8% Cobalt)

Alternative diameter: 11/64"

Recommended source: Amazon, Local hardware store

### Metric socket and bit driver set



- A driver and wrench set that contains metric socket heads and metric hex bits

Recommended source: Amazon, Local hardware store

### M5 tap + tap holder



- You need a M5 threading tap as well as the appropriate tap holder. Ideally you'd just get a metric thread tap and die set

Recommended source: Amazon, Local hardware store

### Stick welding unit



- A cheap and simple stick welding unit that is also known as SMAW(Shielded Metal Arc Welding) or simply arc welding unit

They can cost from anywhere between 50 and 100 USD

Recommended source: Amazon, Ebay, Aliexpress, Local hardware store

### Welding helmet



- A welding helmet is important to have to be able to weld without going blind

Recommended source: Amazon, Ebay, Aliexpress, Local hardware store

### Welding gloves



- Purpose made leather gloves to prevent burning your hands during welding

Recommended source: Amazon, Ebay, Local hardware store

### Welding apron



- An apron to protect you against burning yourself while welding. Made out of leather or leather substitute

Recommended source: Amazon, Ebay, Local hardware store

### Welding clamps



- 1-2x welding clamps to help you during the welding of the bolt. Make sure the welding clamp is of the type you see in the picture

Recommended source: Amazon, Ebay, Aliexpress

### Slag hammer



- Hammer to help you get rid of the slag that forms during the welding process

Recommended source: Amazon, Ebay, Aliexpress

### Metal wire brush



- Brush with metal wires to help you clean welding seams

Recommended source: Amazon, Ebay, Aliexpress

### Metal file



- You need at least one metal file, ideally you'd get a set of files

The metal file should have a 1 or 2 cut ideally

This means it should have a fairly coarse checkering pattern

Recommended source: Amazon, Ebay, Local hardware store, Aliexpress



## Angle grinder



- Vital to make cutting thicker steel stock manageable

Make sure to buy the appropriate metal cutting disc for your angle grinder

Recommended source: Amazon, Local hardware store

## OR -> Dremel tool



- Less than ideal power tool to help you cut steel stock

You have to buy the appropriate Dremel metal cutting disc

Recommended source: Amazon, Local hardware store

## Soldering iron



- Needed to melt the thread inserts into the upper receiver

Any soldering iron will work, ideally you have access to various tips, of which one should work better for the job

Recommended source: Amazon, Ebay, Local hardware store, Aliexpress, Banggood

### Slot screw driver



- Any slot screw driver of small to medium size is appropriate. This will be used to help you remove supports on the 3D-printed parts

Recommended source: Local hardware store

### Craft knife



- This will be used to help you remove supports and print imperfections on the 3D-printed parts

Recommended source: Local arts and craft store, Local hardware store

### Vise



- A smaller or proper full-size vise mounted to a sturdy table

Recommended source: Amazon, Ebay, Local hardware store

# Materials

## PLA filament



- 2x 1kg spools of 1.75mm diameter PLA filament, ideally PLA+ (by eSun)

Choose a PLA or PLA+ filament by a brand that has a good reputation

Use standard black filament as it is produced and used the most, thus the scrutiny in terms of feedback on the quality by the customer is higher on the black PLA of any particular brand

Recommended source: Amazon

## Round steel stock (18mm,3mm)



- 1x 50mm long and 1x 216mm long, 18mm diameter  $\pm 0.1\text{mm}$

(Ideally you'll have multiple of those pieces in case you make mistakes or want to make multiple bolts. You also can buy a round steel stock bar of 18mm diameter that is longer than 300mm and then cut it with your angle grinder or a metal hacksaw)

- 1x 200mm long or longer, 3mm diameter  $\pm 0.01\text{mm}$

IMPORTANT FOR BOTH: The round steel stock has to be non-hardened, so no tool steel for example! Uncoated! Use stainless steel or carbon steel (regular steel)!

Recommended source: Ebay, Local industrial metal supplier

## Sheet metal plates



- 1x 3-5mm thick sheet metal plate, at least 500x500mm big

Put that plate on any regular table to have a table ready to be used for your welding

You will need that sheet metal plate on top of a regular table in case you don't have a welding table that has been specifically made for welding

- 1x 1mm thick sheet metal plate, at least 700x700mm big. Put that plate on the floor around the part of the regular table you will weld to protect the floor.

- 1x 3-5mm thick, 20mm wide sheet metal strip cut to 100mm length to help you align the bolt pieces during welding

NOTE: These sheet metal materials are not necessary but highly recommended if you are new to welding and did not have the facilities and tools to weld.

Recommended source: Ebay, Local industrial metal supplier

## Stick welding electrodes



- 1x package of stick welding electrodes.

Ideally 2.5mm in diameter.

Make sure the electrodes you are using are appropriate for the type of steel which you are welding.

Recommended source: Amazon, Ebay, Local hardware store.

## JB Weld



- 1x package of JB Weld

This is a two-part epoxy that is used to glue materials of all sorts together especially metals. Get the regular JB weld version

If you can't get JB weld try to find a similar product that is a two-part steel bonding epoxy/glue

Recommended source: Amazon, Ebay, Local hardware store,

## Sand paper



- Get at least 1x sheet of coarse to medium grain sand paper

Recommended source: Local hardware store, Amazon, Ebay

## Razor blades



- At least 1x disposable thin razor blade

This is needed to install the 3mm shaft collars that use fairly small slot screws

Recommended source: Local grocery store, Local drug store

## Cutting fluid



- At least 1x spray can or bottle of cutting fluid

It is used to cool and lubricate during drilling, threading and other processes that remove metal

Recommended source: Amazon, Ebay, Local hardware store

## Grease



- 1x small container of grease for mechanical lubrication applications

Recommended source: Amazon, Ebay, Local hardware store

## Tooth picks



- 1x small container of tooth picks

This will be used to mix and apply JB Weld

Recommended source: Grocery store, Local drug store, Local hardware store

# Parts

## AR-15 fire control group



- Fire control group compatible with AR-15/M4/M16 rifles

- You need the following parts:

Trigger  
Hammer  
Disconnect  
Fire selector  
Disconnect spring  
Hammer spring  
Trigger spring  
Fire selector detent  
Fire selector detent spring  
Pins for both hammer and trigger

Recommended source: Brownells,  
AliExpress(All components available on there except trigger and hammer)

## OR -> Airsoft fire control group



- Fire control group compatible with JG/Golden Eagle M4 airsoft rifles.

If you go with this alternative you will need to follow the modification instructions included in the FGC-9 files and buy an AR-15 lower parts/spring kit from Aliexpress.

That lower parts kit should include:  
Trigger spring, Hammer spring,  
Disconnect spring, Fire selector, Fire selector detent, Fire selector detent spring

Recommended source: AsiaAirsoft.com,  
Taken out of a used JG/Golden Eagle M4 airsoft rifle

Recommended source for needed additional parts/springs: Aliexpress

### AR-15/M4 buffer spring



- 1x AR-15/M4 carbine buffer spring

Recommended source: Aliexpress,  
Brownells

### Shaft collars DIN 705



- 3x Shaft collars DIN 705, 16mm  
Inner diameter: 16mm  
Outer diameter: 28mm  
Width: 12mm

- 1x Shaft collar DIN 705, 3mm  
Inner diameter: 3mm  
Outer diameter: 7mm  
Width: 5mm  
(Should include a set screw)

Recommended source: Ebay, Regional  
online fastener supplier

### OR -> Non-DIN Shaft collars



- 3x Ruland MSC-16-F  
Inner diameter: 16mm  
Outer diameter: 28mm  
Width: 12mm

- 1x McMaster Metric shaft collar 3mm  
Inner diameter: 3mm  
Outer diameter: 10mm  
Width: 5mm  
(Should include a set screw)

Recommended source: Fastenal, McMaster



### 3x different compression springs



- 1x Compression spring for the firing pin,  
Outer diameter: 4.5mm  $\pm$ 0.5mm  
Wire thickness: 0.5mm  
Length: 10mm  $\pm$ 2mm

OR

Alternative spring for the firing pin:  
Spring taken out of a ball pen, with a similar outer diameter as above which is then cut to 10mm length  $\pm$ 2mm

- 1x Compression spring for the mag catch taken from a Creality Ender-3 3D-printer  
Outer diameter: 8mm  
Wire thickness: 0.9mm  
Length 20mm

OR

Alternative spring for the mag catch:  
AR-15 magcatch spring cut to 20-25mm length

- 1x Secondary buffer spring:  
Outer diameter: 17mm  
Wire thickness: 2mm  $\pm$ 0.5mm  
Length/Cut to length: 90mm

OR

Alternative Secondary buffer spring:  
Outer diameter: 11/16"  
Wire thickness: 0.070"  
Cut to length: 90mm

Recommended source: Ebay, AliExpress, McMaster

### Hex head screws DIN 933



- 6x Hex Head Screws M3 DIN 933, 40mm
  - 6x Hex Head Screws M3 DIN 933, 20mm
  - 1x Hex Head Screw M5 DIN 933, 40mm
- It has to be a Class 8.8+ screw (Meaning the steel the screw is made out of needs to be hardened)

Recommended source: Ebay, McMaster, Regional online fastener supplier

### Socket head screws DIN 912



- 2x Socket Head Screws M3 DIN 912, 16mm
- 1x Socket Head Screw M3 DIN 912, 20mm
- 1x Socket Head Screw M3 DIN 912, 12mm
- 1x Socket Head Screw M4 DIN 912, 30mm
- 1x Socket Head Screw M6 DIN 912, 25mm

Recommended source: Ebay, McMaster, Regional online fastener supplier

### Cup point set screws DIN 916



- 3x Cup Point Set Screws M6 DIN 916, 6mm

Recommended source: Ebay, McMaster, Regional online fastener supplier

### Washers DIN 125

- 12x Washer M3 DIN 125

Recommended source: Ebay, McMaster,  
Regional online fastener supplier



### Nuts DIN 934

- 3x Nuts M3 DIN 934
- 1x Nut M5 DIN 934

Recommended source: Ebay, McMaster,  
Regional online fastener supplier



### Lock washer DIN 6797

- 1x External-Tooth Lock Washer M6 DIN 6797

Recommended source: Ebay, McMaster,  
Regional online fastener supplier



## Thread inserts



- 4x "Brass Hot Melt Inset Nuts SL" M3  
"M3 X D5.0 X L7.0"

OR

Generic Thread Inserts M3  
(Ideally with diagonal knurling)  
Outer diameter: 5mm  
Width/Length: 5-7mm

Recommended source: Aliexpress

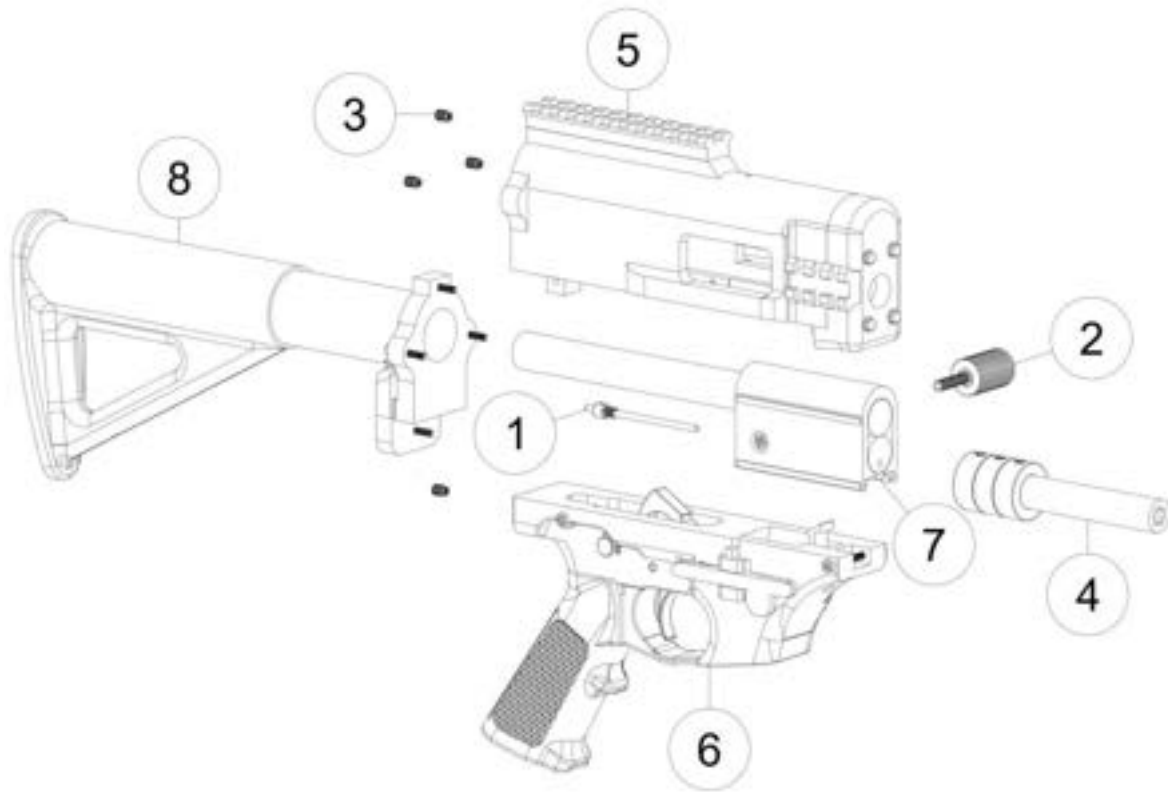
## Shot 9x19mm cartridge case



- 1x 9x19mm case with shot primer

Recommended source: Inert 9x19mm  
cartridge bought from army surplus  
store, Local military training area,  
firing ranges, Regional online firearms  
auction site

## Visual overview of a FGC-9 build



Nr.	Build Step	Page Number
1	Making the firing pin	30
2	Making the charging handle	45
3	Melting in the thread inserts	51
4	Assembling the barrel assembly	55
5	Assembling the upper	58
6	Assembling the lower	62
7	Making the bolt	72
8	Assembling the stock assembly	91
9	Drilling and tapping the bolt carrier	93
10	Final assembly of the FGC-9	98

## Making the firing pin



### Tools needed:

- Small vise
- Digital caliper
- Angle grinder or Dremel tool
- Metal file
- Sand paper
- Steel cutting disc
- Power drill
- Toothpick

### Materials and Parts needed:

- Steel round bar 3mm diameter, at least 70mm long
- Shaft Collar DIN705 ID 3, OD 7mm, Width 5mm
- JB Weld
- Grease
- Razor blade

## Making the firing pin - STEP 1



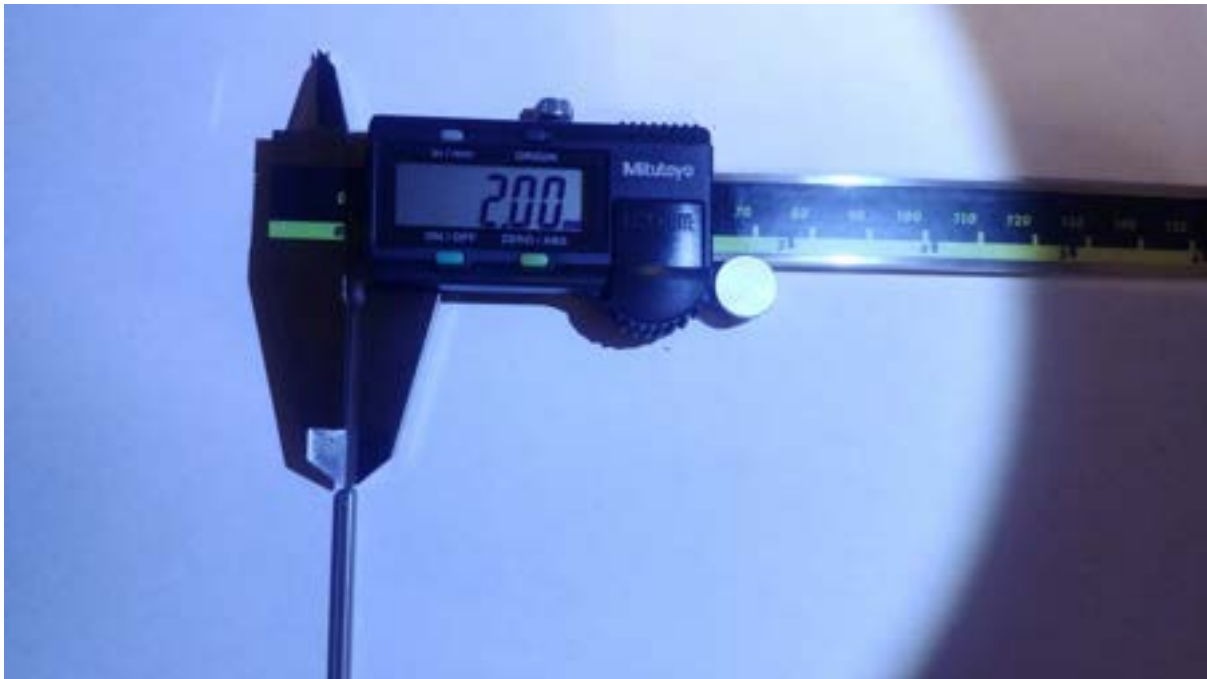
Cut off a 70mm long piece from your 3mm DIA steel bar with a Dremel tool /angle grinder with a steel cutting disc.

Make sure to remove any nasty edges by using sand paper or your metal file before inserting it into the power drill in the next step.

## Making the firing pin - STEP 2







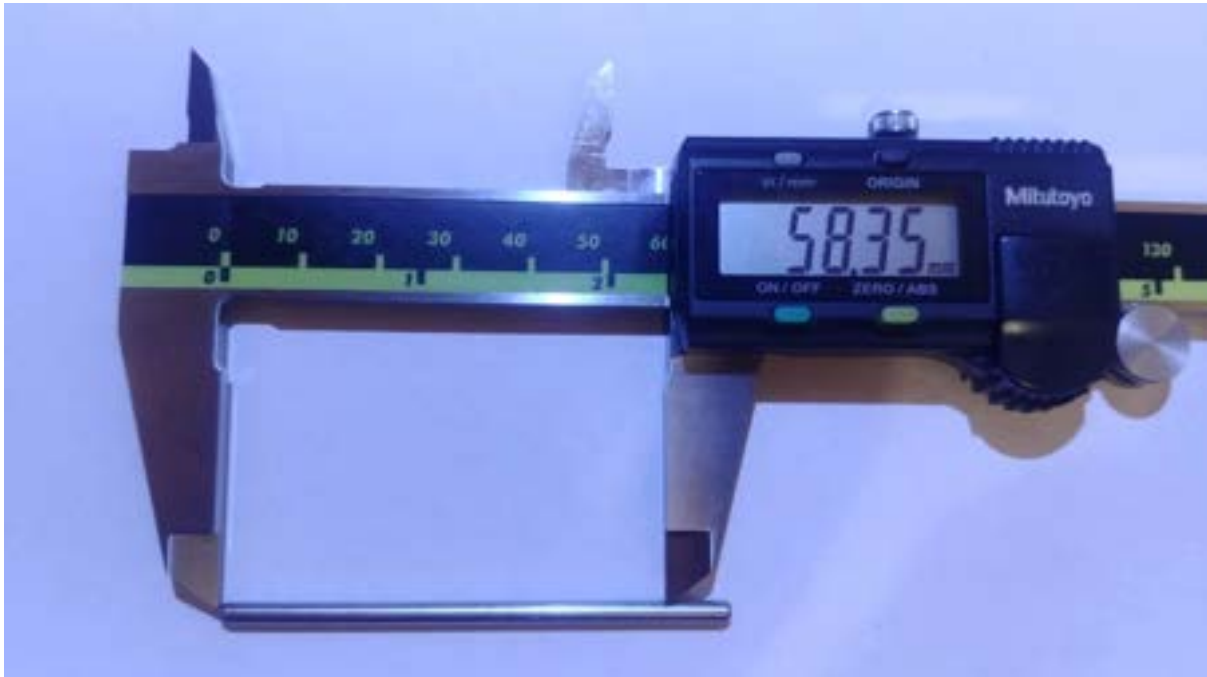
Put the bar into a power drill and rotate it while holding a metal file against it to form a chamfered circle end at the tip that is 2mm in diameter.

Then use sand paper to finish the shape of the tip so that it looks like in the picture.

After you made sure the circle end point is 2mm in diameter, you then can approach to get the circle end point to the final diameter of 1.75mm by carefully grinding the tip against sand paper.

Make sure to hold the bar straight down.

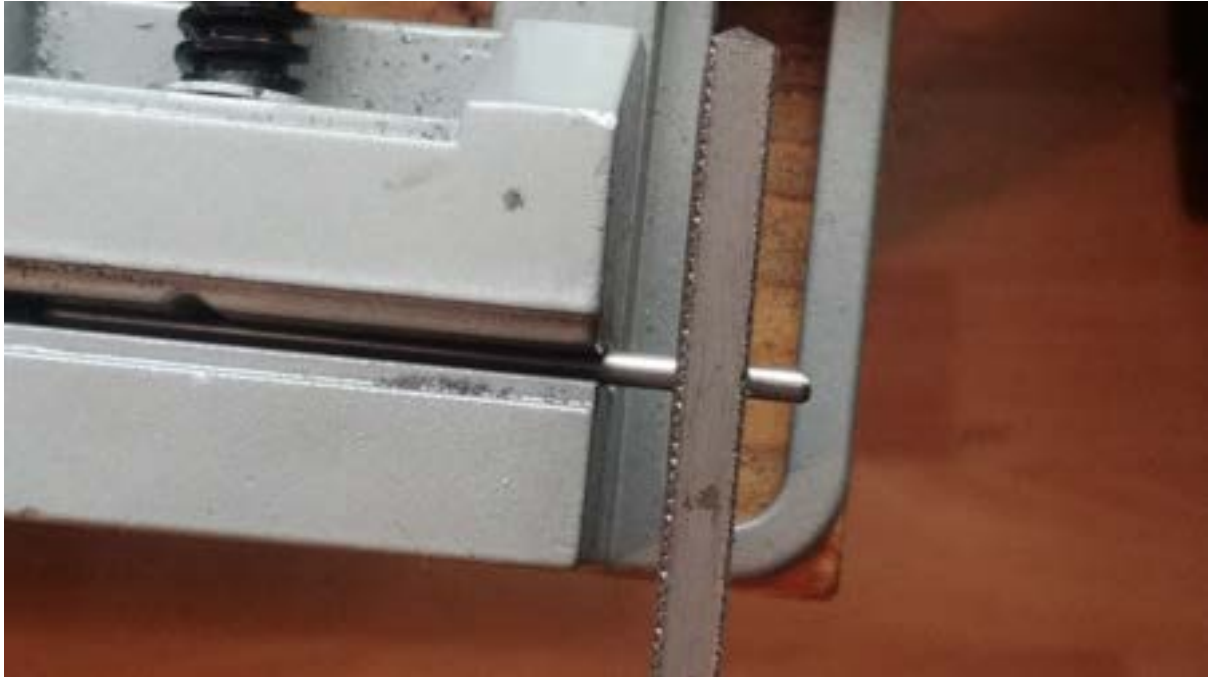
## Making the firing pin - STEP 3



Use your caliper blades to scratch a line around the circumference of the bar at a distance of 58.35mm from the tip.

At that exact distance you will have to drill a divot into the pin later on so make sure you have that spot marked by having a clearly visible belt at the distance of 58.35mm from the tip.

## Making the firing pin - STEP 4



Put the bar into a vise and use the edge of your metal file to create a flat section around the previously marked position.

Only file so much that you have a flat area to drill into for the divot later on.

## Making the firing pin - STEP 5



Use your power drill and a 1mm drill bit and then afterwards go deeper with a 2mm drill bit, to create a divot deep in the bar that is in the center of the flat area you created, that is aligned with the previously created line which is 58.35mm from the tip.

Instead of the 1mm drill bit you can also use a punch and a hammer to mark the spot before using the 2mm drill bit.

Note: The divot is not center in the picture. You should do a better job than that ;)

## Making the firing pin - STEP 6



Remove the grub screw from the shaft collar and put the shaft collar onto the bar aligning the hole of it with the divot to get an idea where the shaft collar should be for the later steps.

## Making the firing pin - STEP 7



Mix up some JB weld with a tooth pick.



## Making the firing pin - STEP 8



Remove the shaft collar and put some JB Weld onto the flat area that you filed and fill up the drilled divot. Then slide the shaft collar to that position and try to line up the hole with a tooth pick through the hole of the shaft collar. Try to remove the JB weld out of the shaft collar screw hole so you can see that the shaft collar hole is centered with the divot.

## Making the firing pin - STEP 9



Once you have made sure the shaft collar screw hole is lined up with the divot you previously created by probing with a toothpick, you can fill the hole with JB weld.

Be careful not to move the shaft collar away from its position at this point.



## Making the firing pin - STEP 10



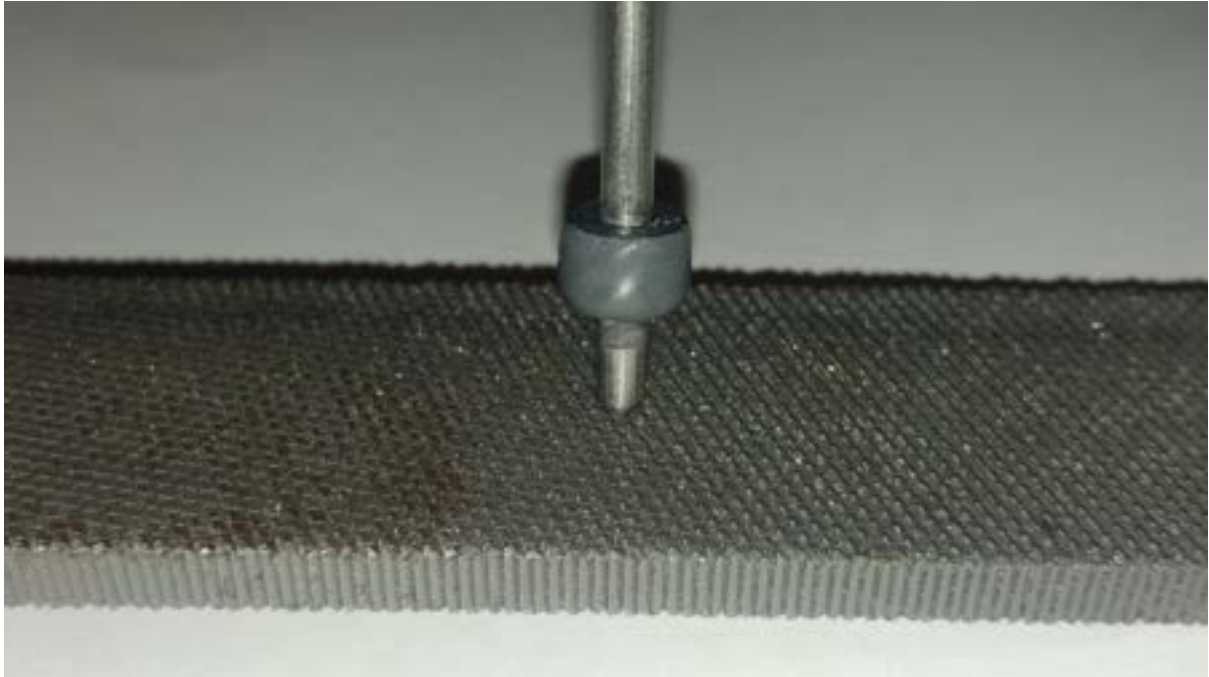
Take a razor blade and apply a drop of grease along the shorter edge of the razor blade to have the grub screw stick to it. Screw the grub screw into the JB Weld-filled shaft collar screw hole. Cover the entire shaft collar and the area behind the shaft collar with JB Weld.

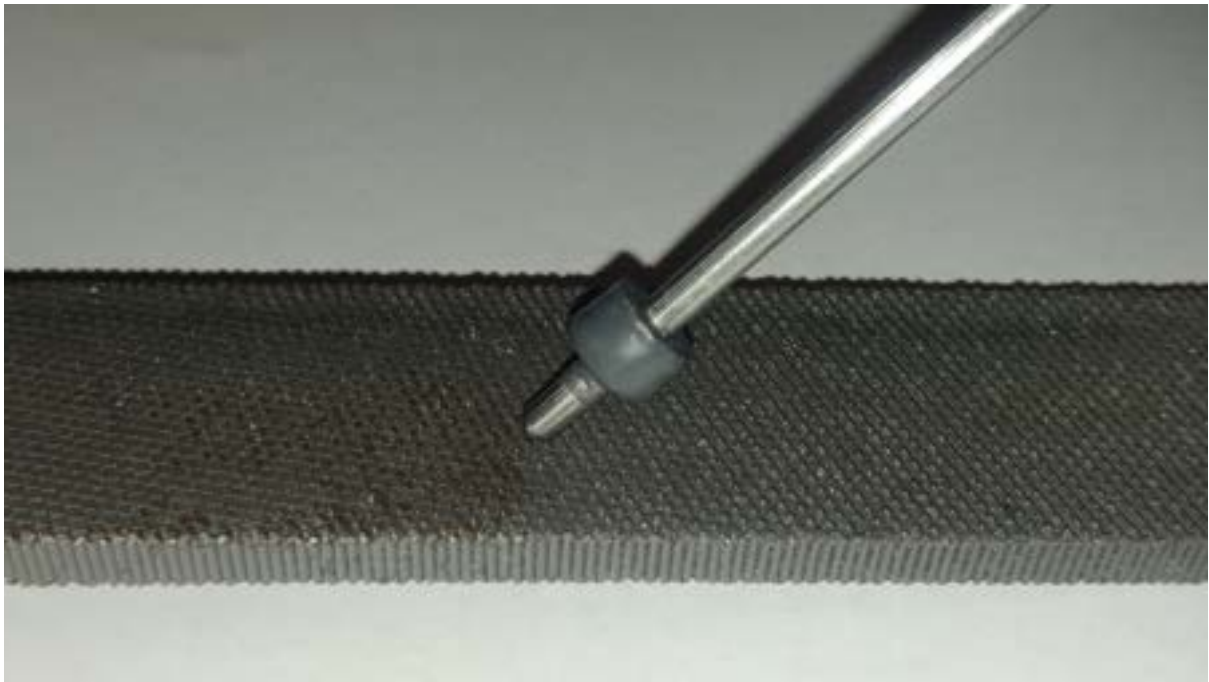
## Making the firing pin - STEP 11



Clean the flat side of the shaft collar that is towards the tip from any JB weld. After you have applied JB weld and cleaned it from the places that should be free of JB weld, as you can see in the picture, let the firing pin cure in a vertical position for at least 24 hours.

## Making the firing pin - STEP 12





Using a metal file shorten the firing pin by grinding the back end of the firing pin to reach an overall length of 67.50mm.

Make sure to do this carefully and measure often during the filing process.

After you reach the final length, chamfer the end of the back a little as you see in the picture.

## Making the charging handle



### Materials and Parts needed:

- JB Weld
- Toothpick
- Hex Head Screw M5 DIN 933 Class 8.8+ 40mm Length
- Nut M5 DIN 934
- 3D-printed FGC-9 charging handle

## Making the charging handle - STEP 1



On a paper set aside the printed charging handle, the screw and the nut.

If you want, you can use sand paper to fillet the edge of the flat side of the charging handle.

## Making the charging handle - STEP 2



Rotate the nut on the screw in such a way that when you drop it into the charging handle cavity, the outward side of the nut is flush with the flat side of the charging handle.



## Making the charging handle - STEP 3



Squeeze an equal amount of both parts of the JB weld compound. Use the toothpick to mix the two parts of the JB weld compound well. After having mixed the JB weld well put it on your toothpick to pick up some JB weld.



## Making the charging handle - STEP 4



Apply a decent amount of JB weld into the charging handle cavity. Make sure that enough JB weld is in the cavity so that excess JB weld will be pushed out when inserting the screw.

## Making the charging handle - STEP 5

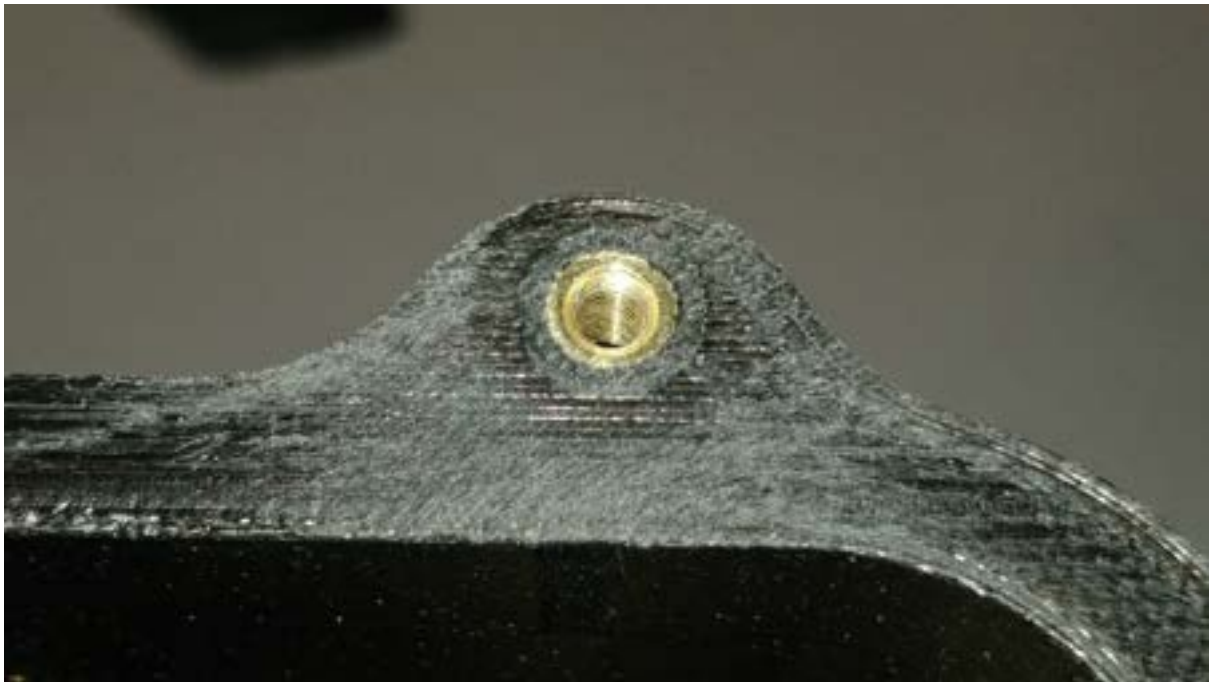


Put the screw with the still attached nut from the state it was in after Step 2, into the charging handle cavity.

Clean up the excess JB weld with soft tissue paper. Make sure to use soft tissue paper and your finger nails in such a way to clean the threads of the screw from any JB weld.

Let the JB weld cure for at least 24 hours before further use of the assembled charging handle.

## Melting in the thread inserts



### Tools needed:

- Soldering Iron

### Materials and Parts needed:

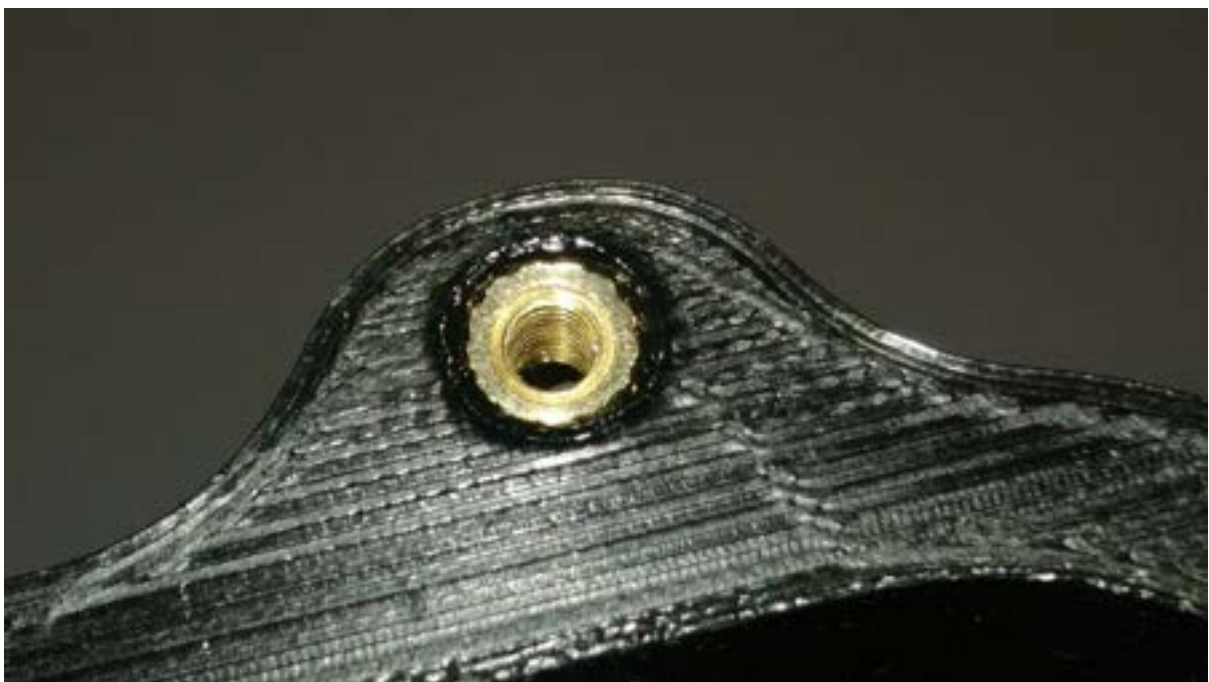
- 4x Thread inserts M3
- 3D-printed FGC-9 upper receiver
- 3D-printed FGC-9 lower receiver
- Sand paper

## Melting in the thread inserts - STEP 1



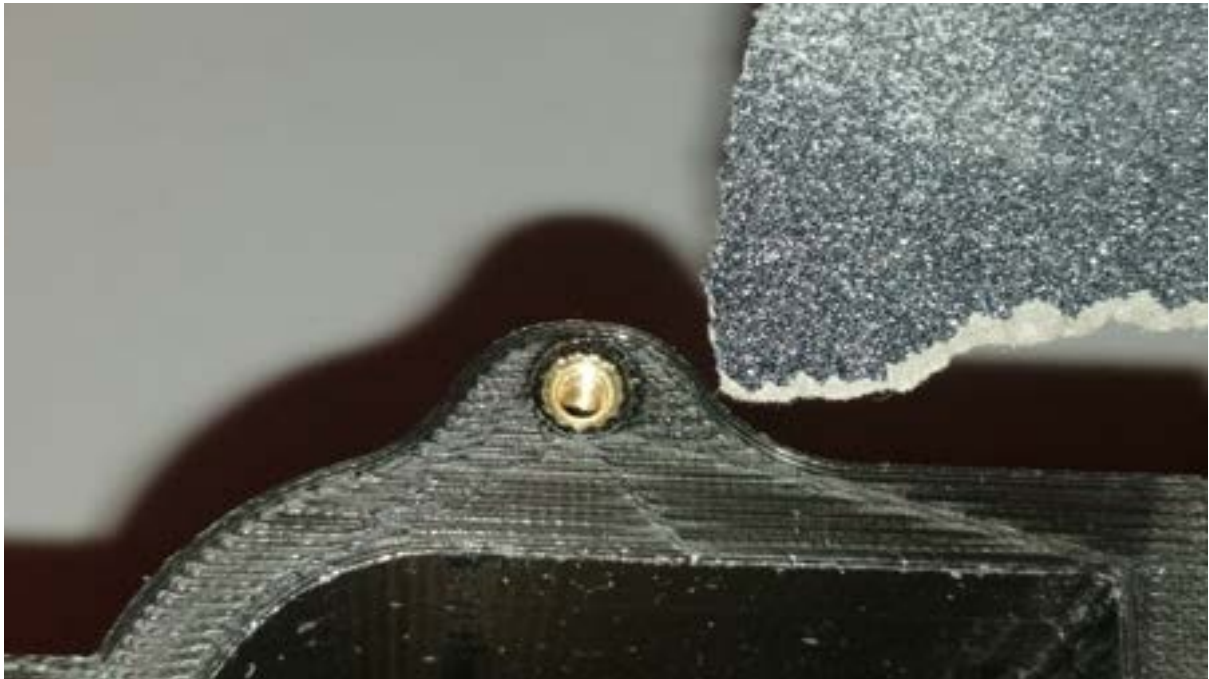
Prepare all four thread inserts as well as the upper receiver and lower receiver. Get your soldering iron and pre-heat it. Put the thread inserts with the tapered side into the holes on the back side of the upper and lower receiver.

## Melting in the thread inserts - STEP 2



Making sure the thread inserts can go down in straight use your soldering iron to push in the thread inserts about 1-2mm past the entrance of the hole. Meaning the thread inserts should not stick out of the hole.

## Melting in the thread inserts - STEP 3



Take sand paper and sand away the uneven surface that was formed by the plastic melting. Make sure to get the surface around the thread insert hole smooth so that the entire back surface is flush.

## Assembling the barrel assembly



Tools needed:

- 3mm hex driver or hex key

Materials and Parts needed:

- 3x Shaft collars DIN705 ID 16, OD 28mm, Width 12mm
- 3x Cup point set screws M6 DIN 916, 6mm
- FGC-9 compatible 9x19mm barrel

## Assembling the barrel assembly - STEP 1



Make sure that your barrel that you will use in your FGC-9 is 114mm long and has an exact outer diameter of 16mm.

Make sure the depth of the chamber of your barrel is at 15.95mm  $\pm$  0.02mm

Prepare your barrel, the shaft collars, the set screws and the hex key then go ahead.



## Assembling the barrel assembly - STEP 2



Slide the three shaft collars onto the chamber end of the barrel and have the face of the barrel on the chamber side be flush with the face of the first shaft collar.

Hold the first shaft collar with one hand onto the barrel so that it is situated as described earlier and screw in a set screw lightly into it.

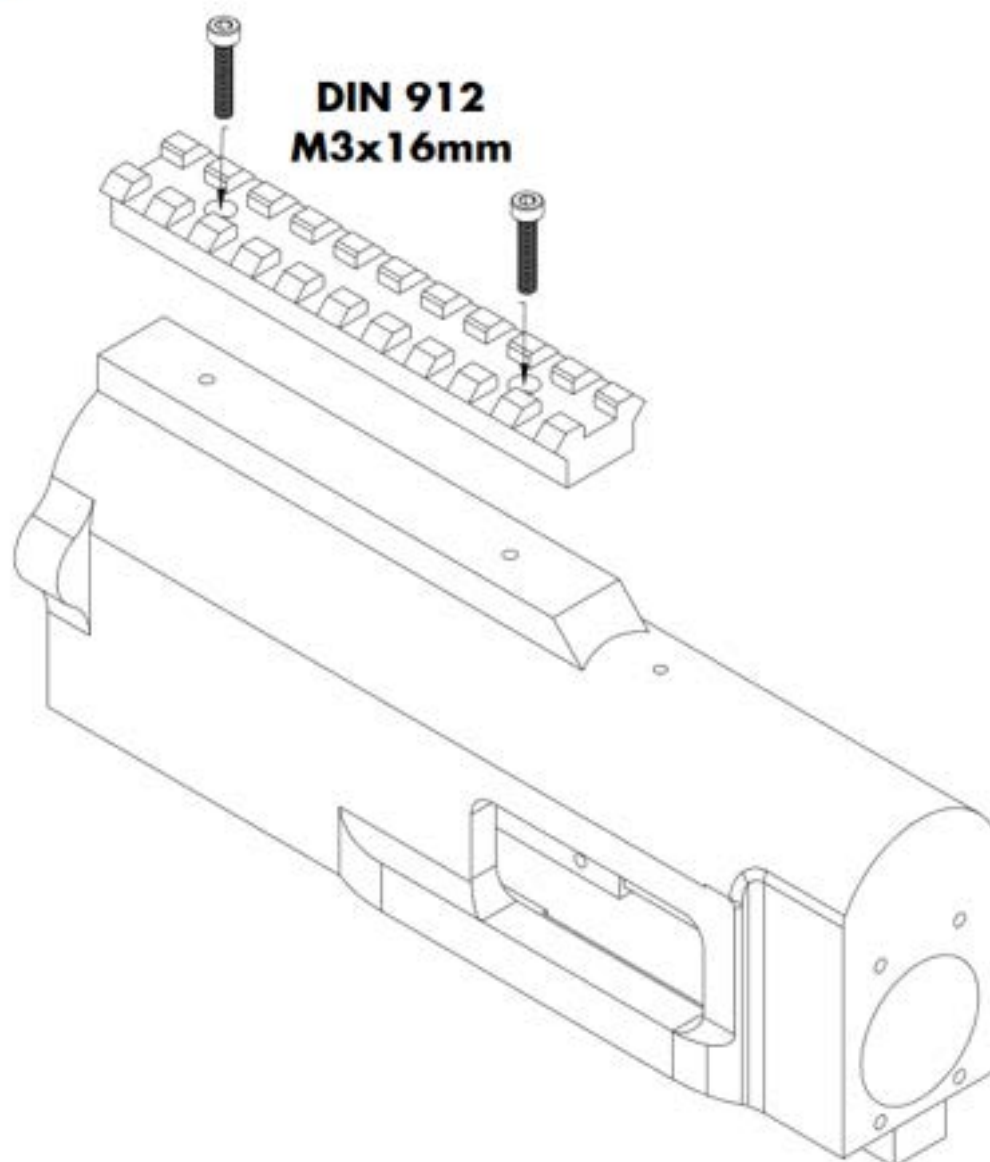
Now that the first shaft collar is in place and the face is flush with the barrel face you can press the second shaft collar against the first shaft collar and screw in the set screw with your hex key as well.

Now do the same with the last shaft collar and the barrel is now ready to be temporarily installed into the upper receiver. Again only lightly screw the set screws in at this point, only so much that the shaft collars do not lose their position easily.

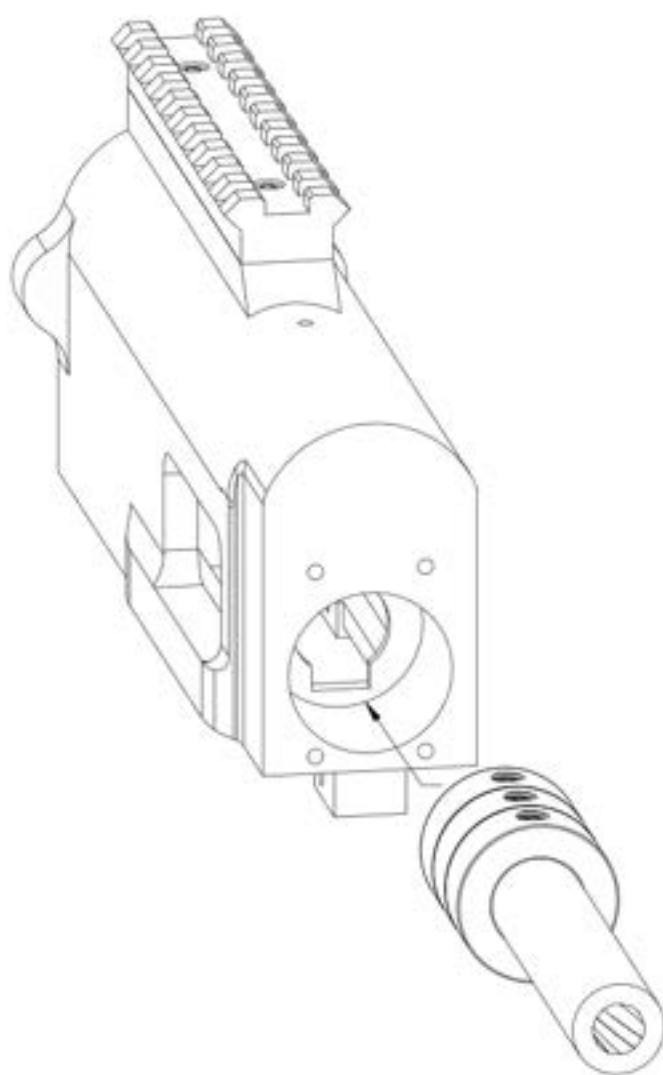
Later you will have to adjust the barrel position relative to your stack of shaft collars in the event that the back of your cartridge cases do not reach into the inside of the upper receiver enough to be pushed against by the bolt face while that cartridge case is chambered.

## Assembling the upper

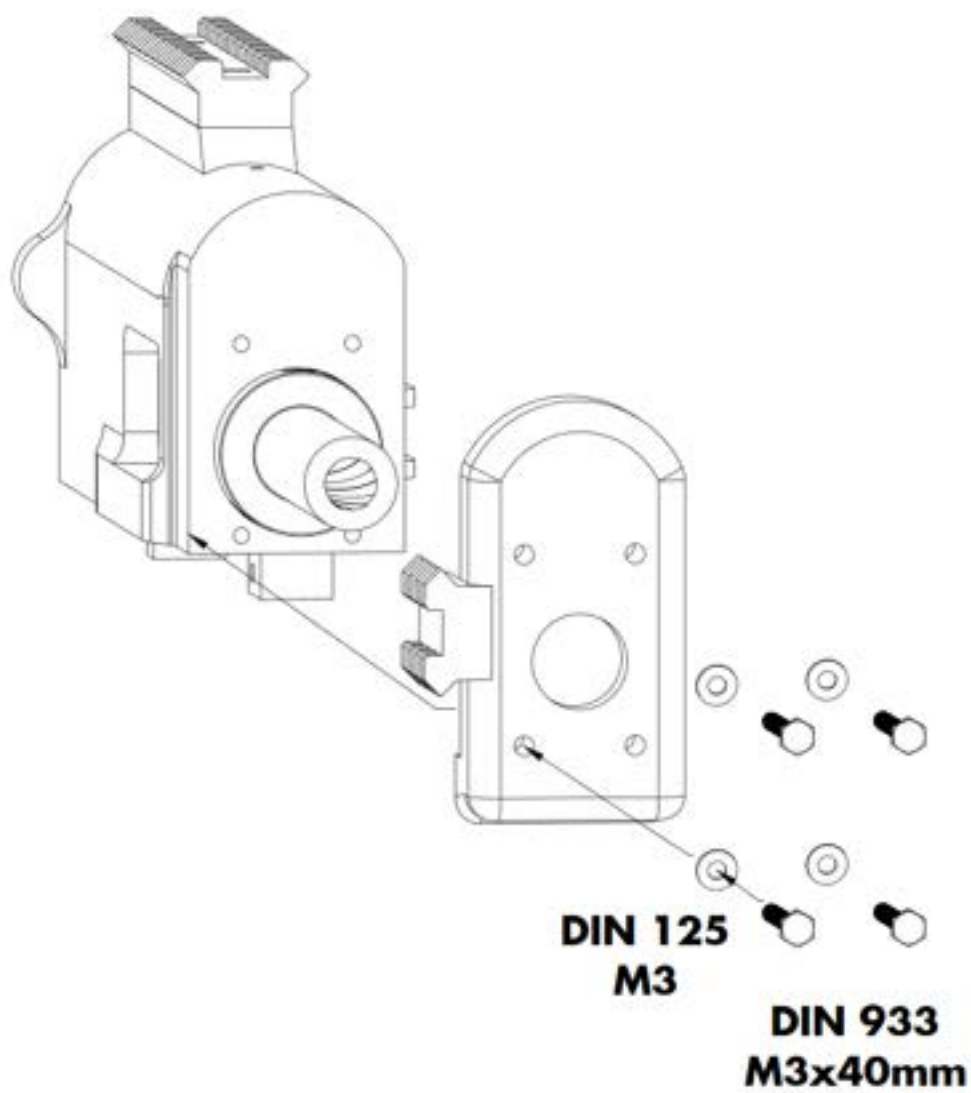
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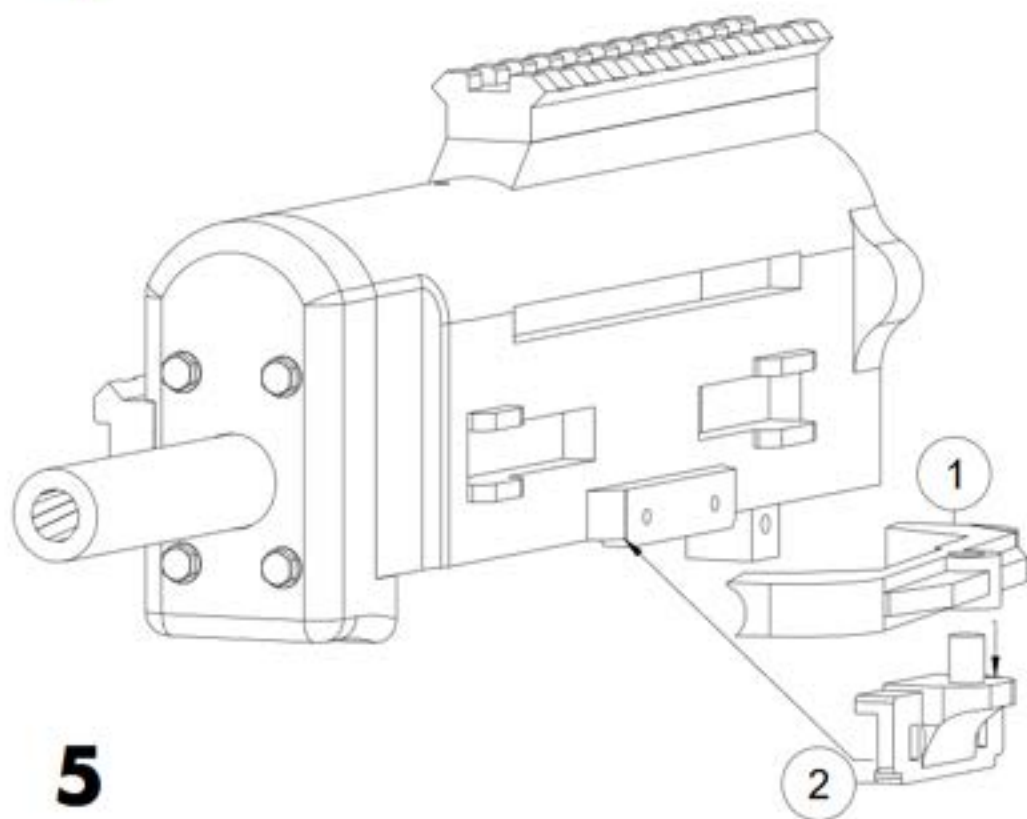
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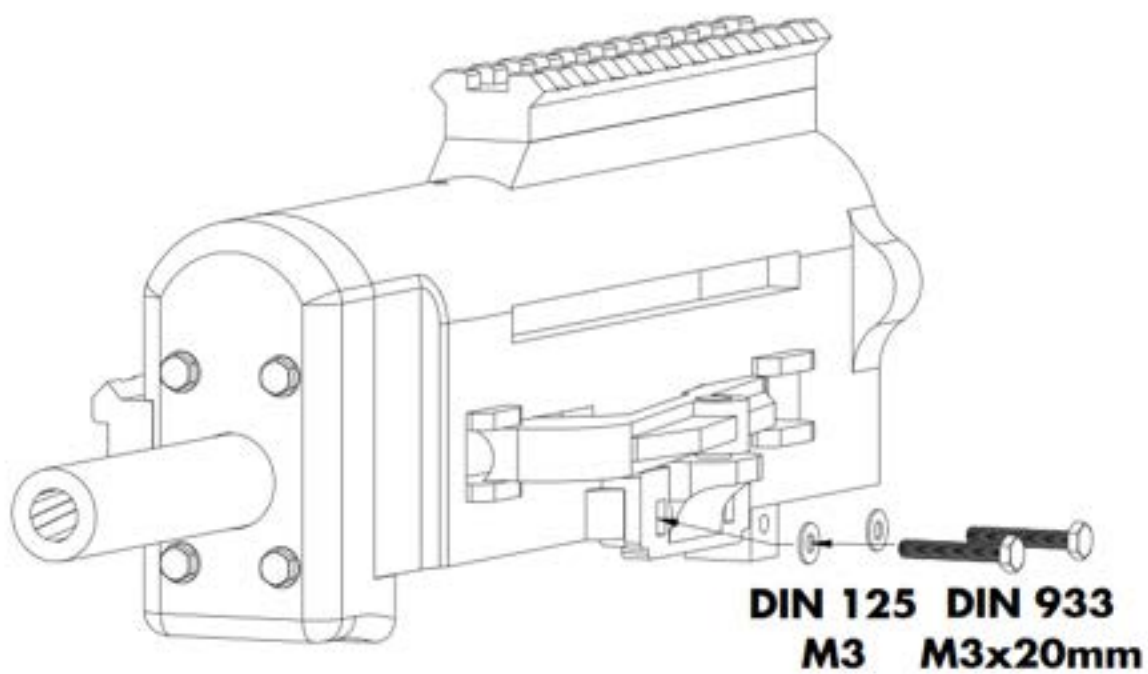
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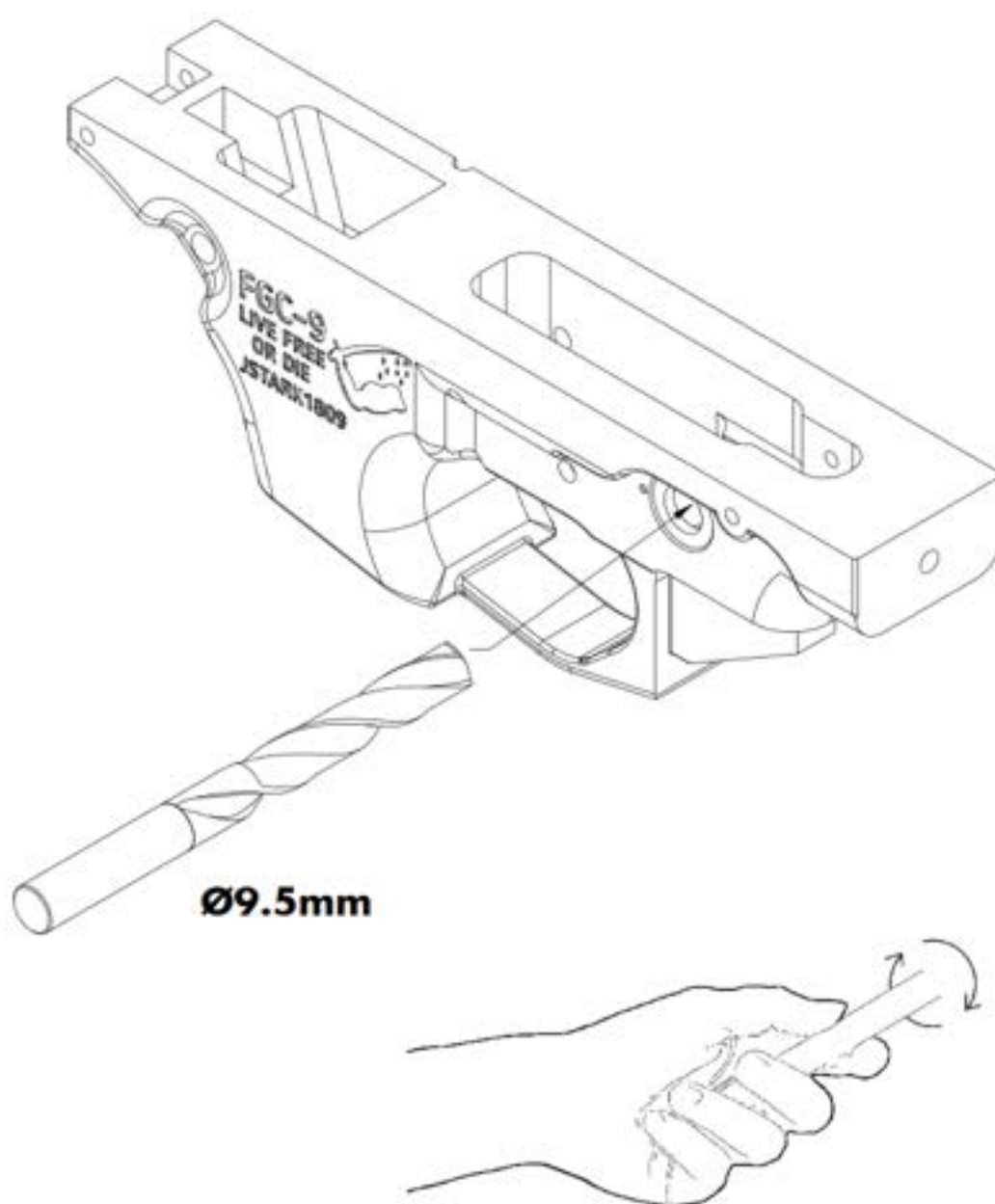


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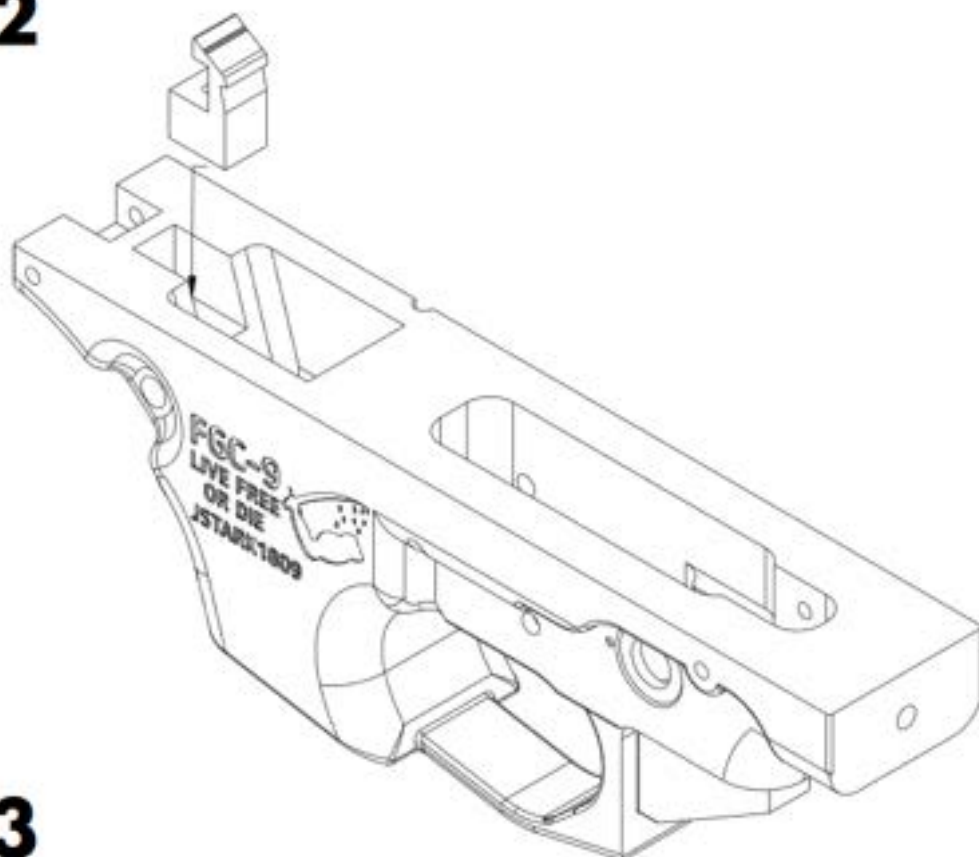


## Assembling the lower

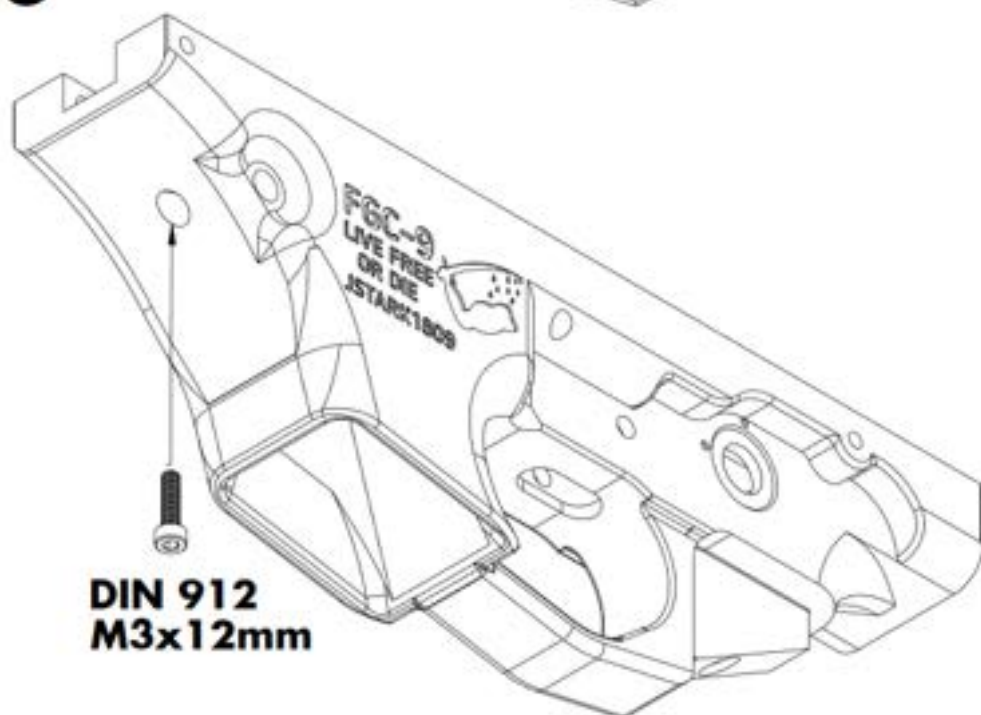
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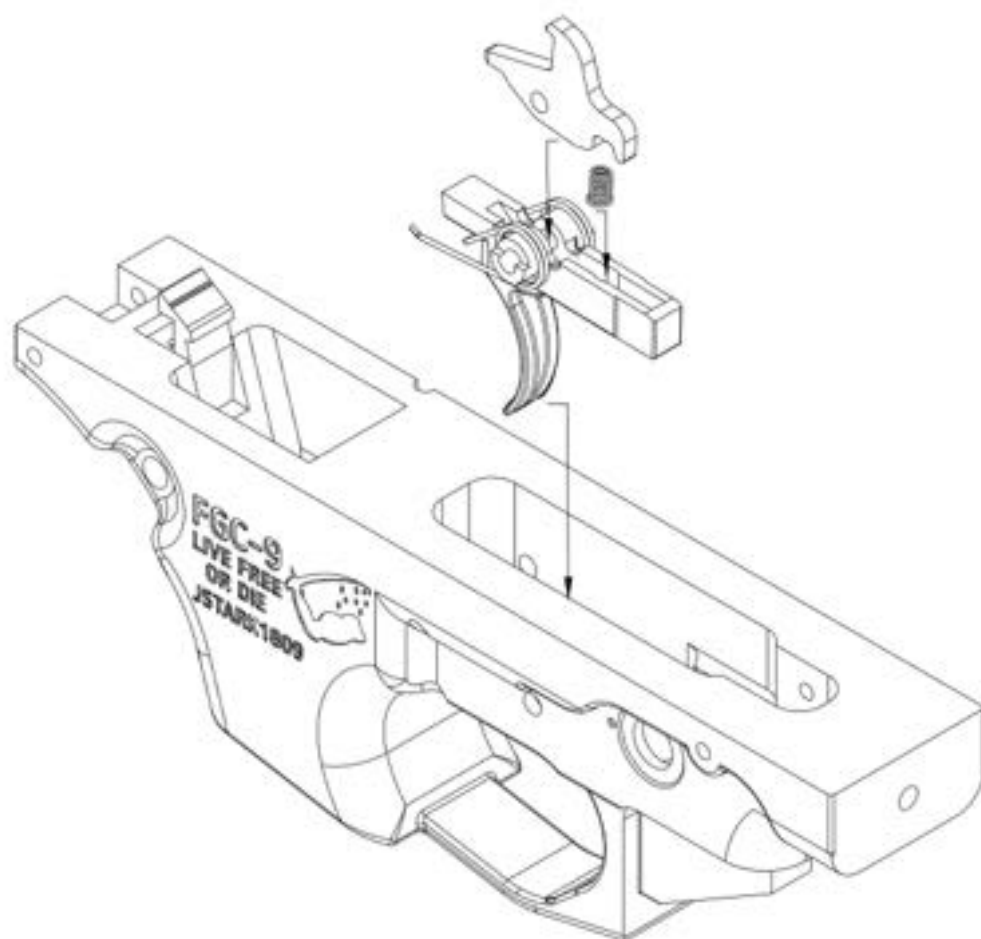
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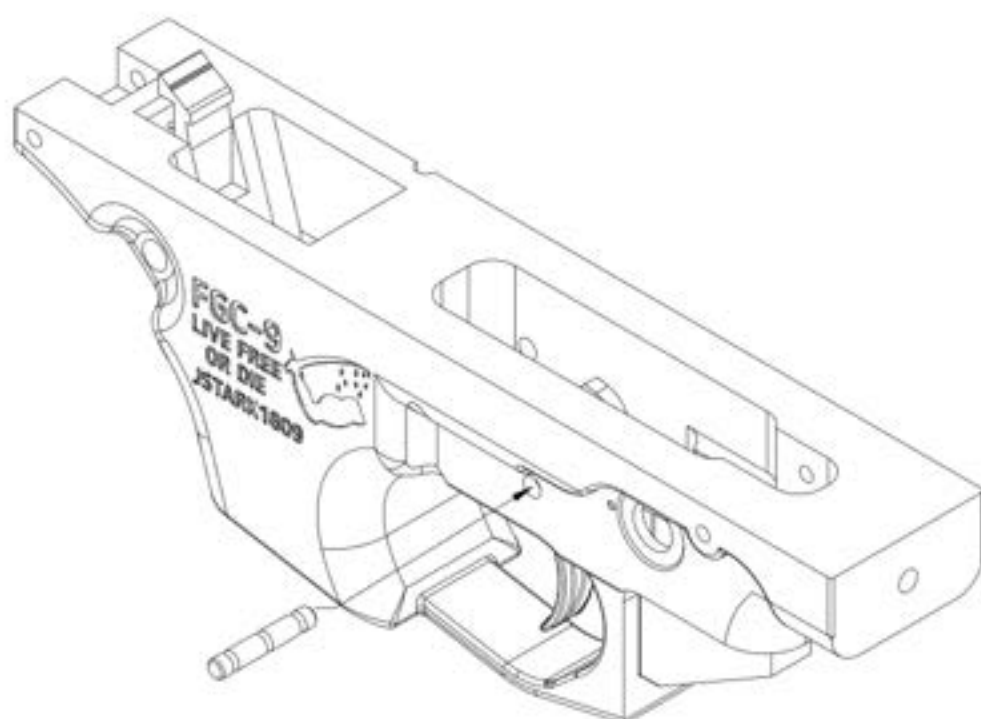


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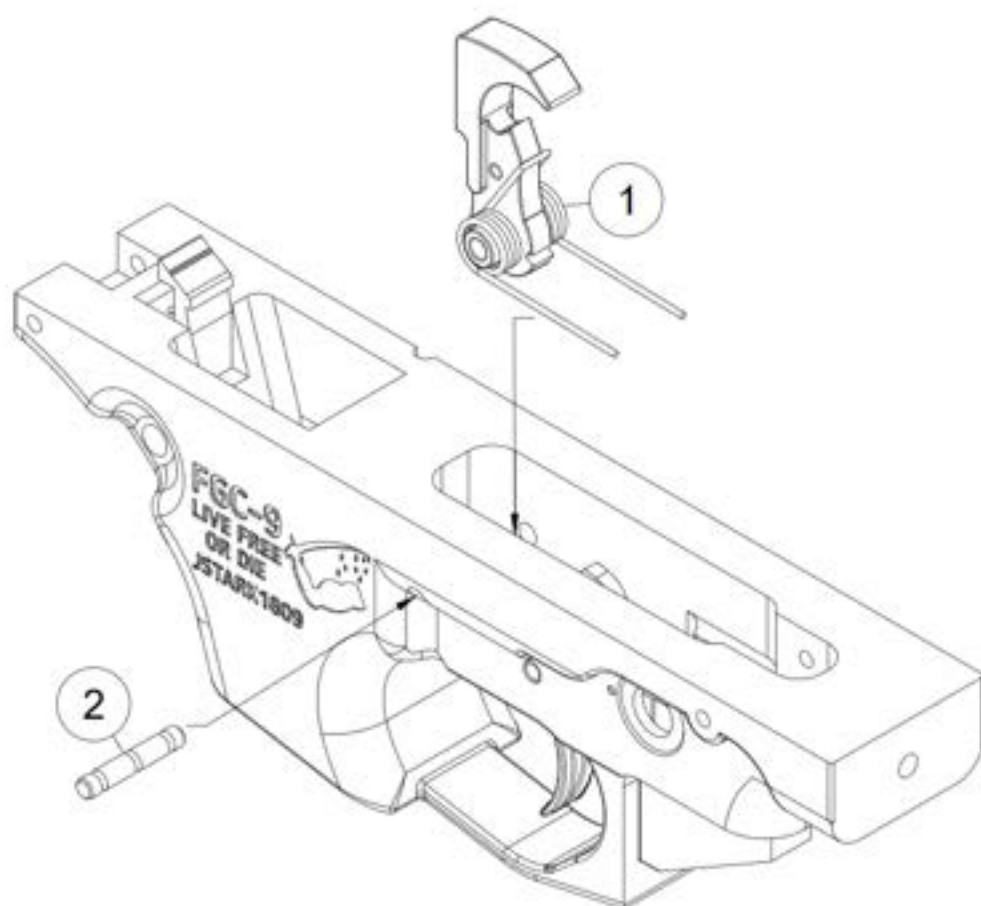




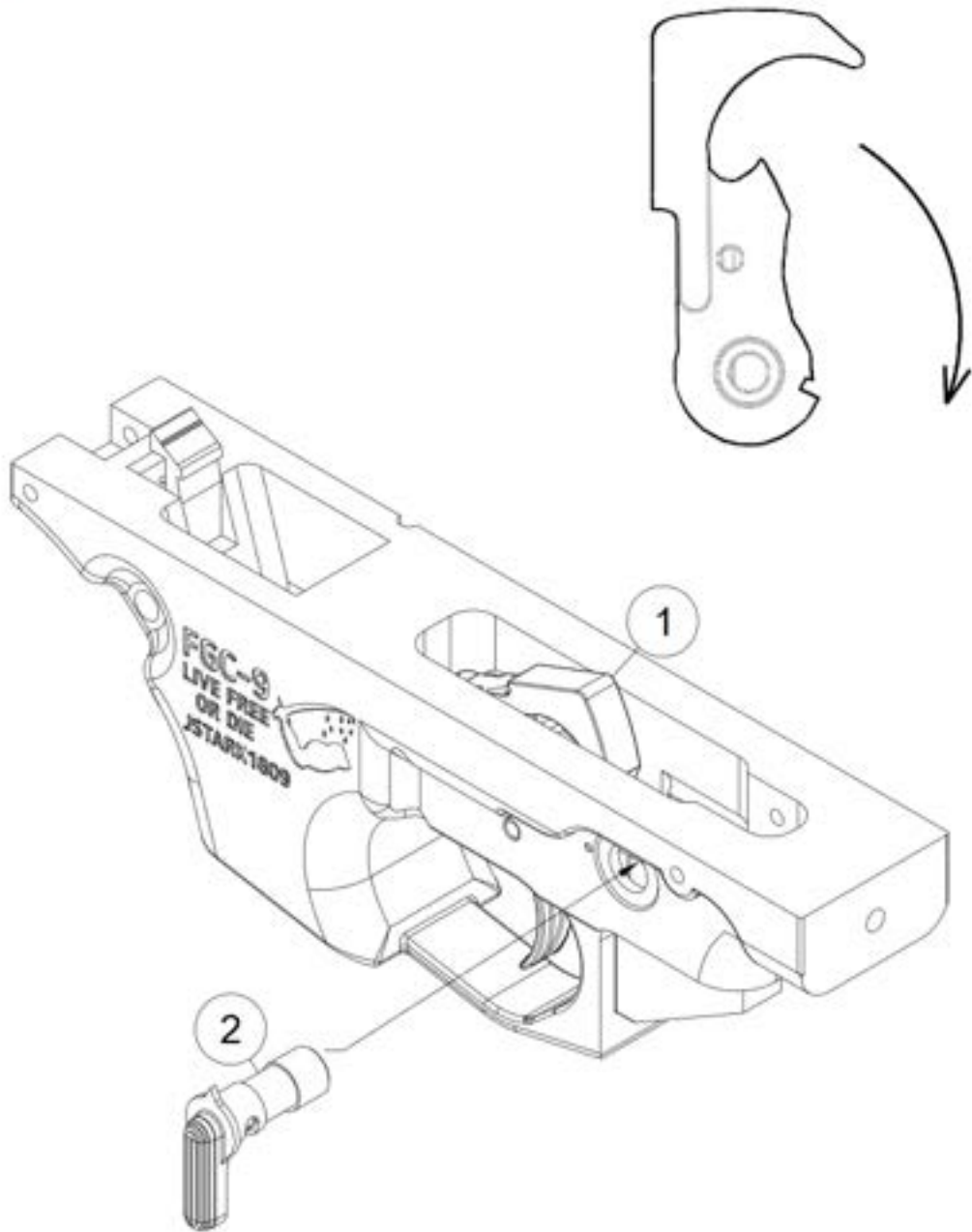
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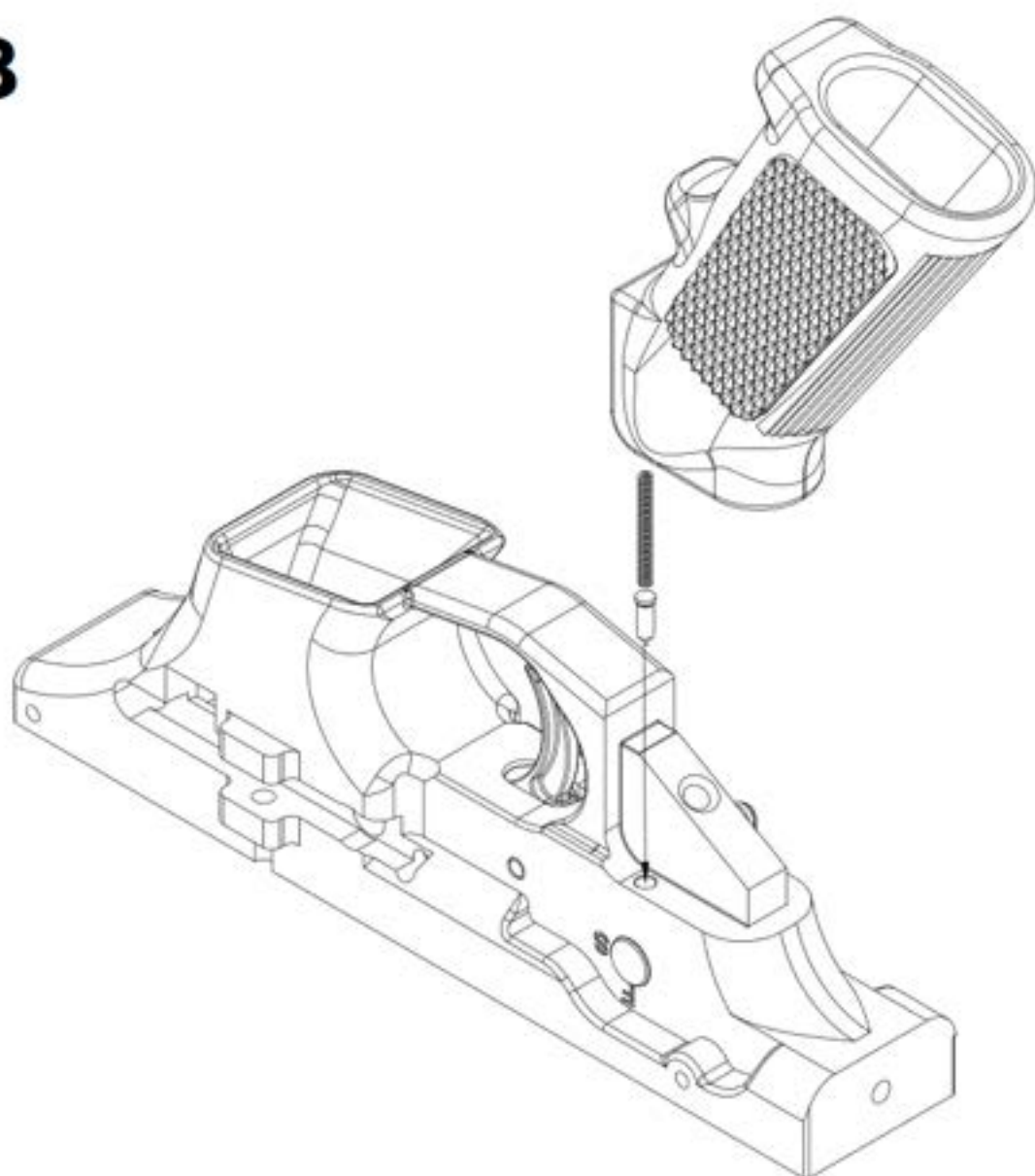
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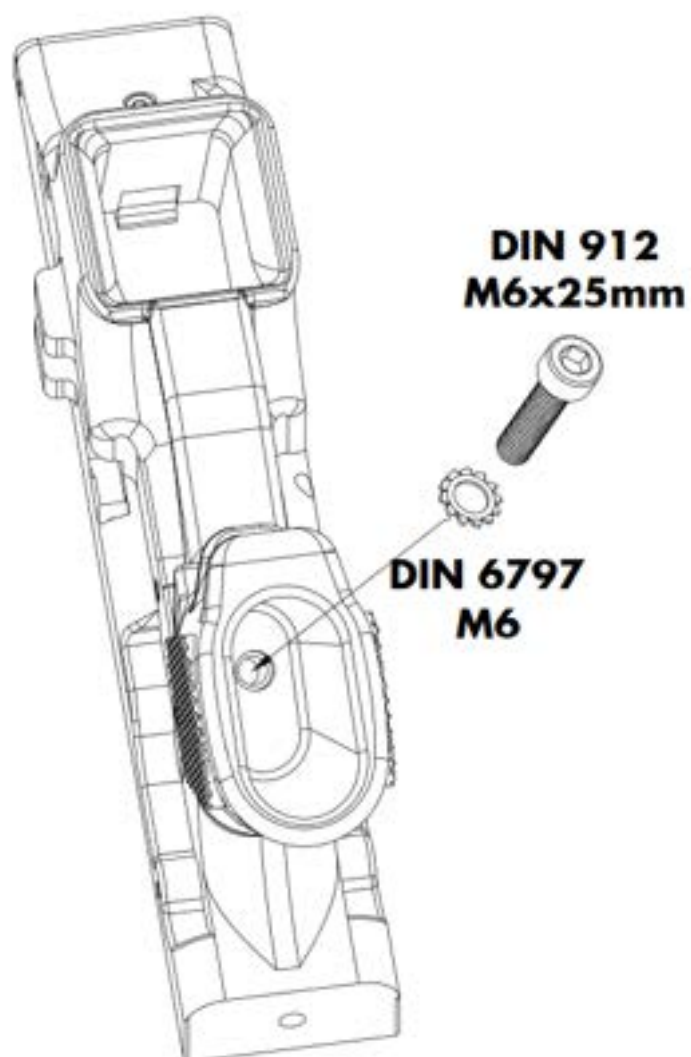
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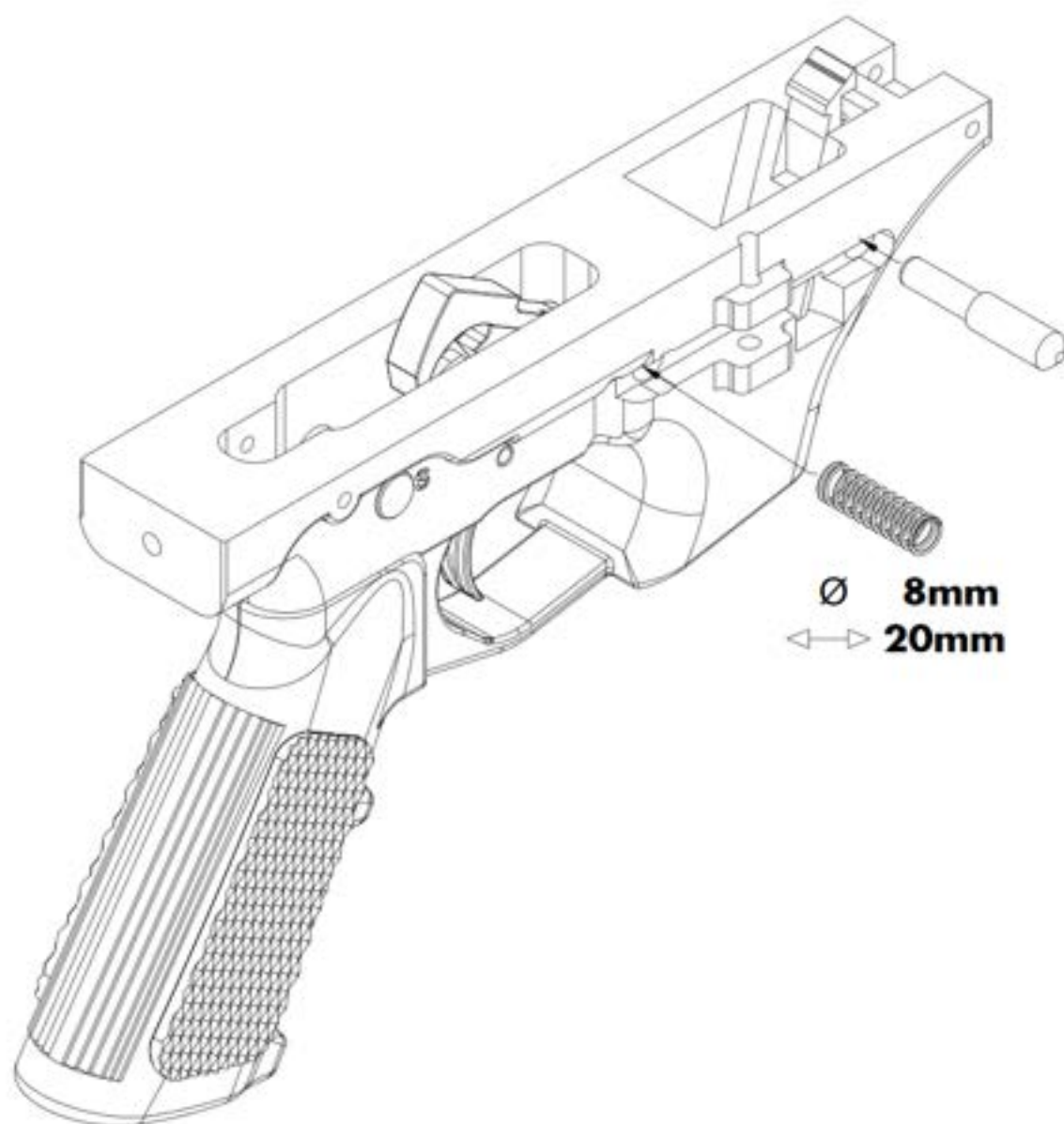
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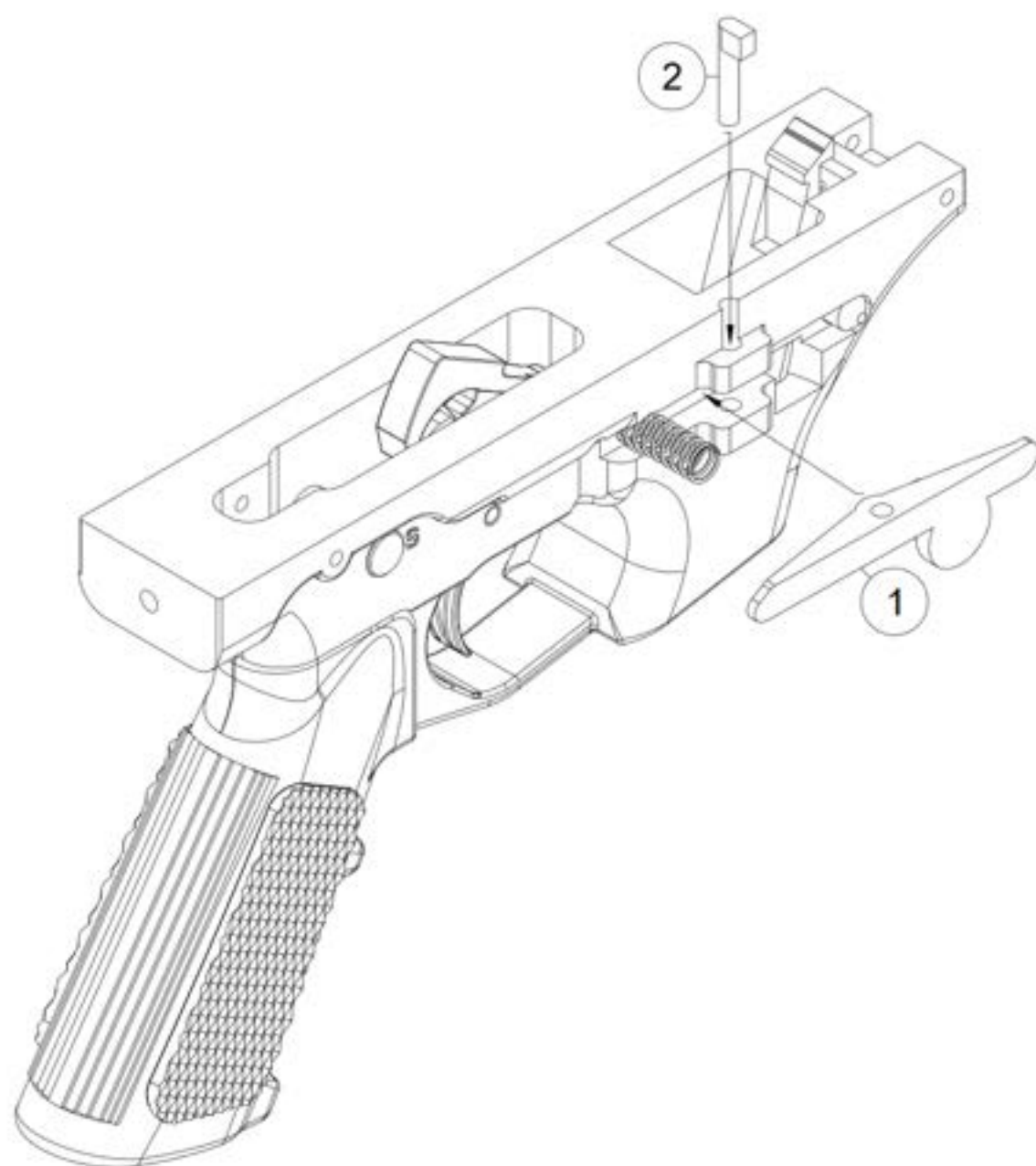
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**10**



**11**



## Making the bolt



### Tools needed:

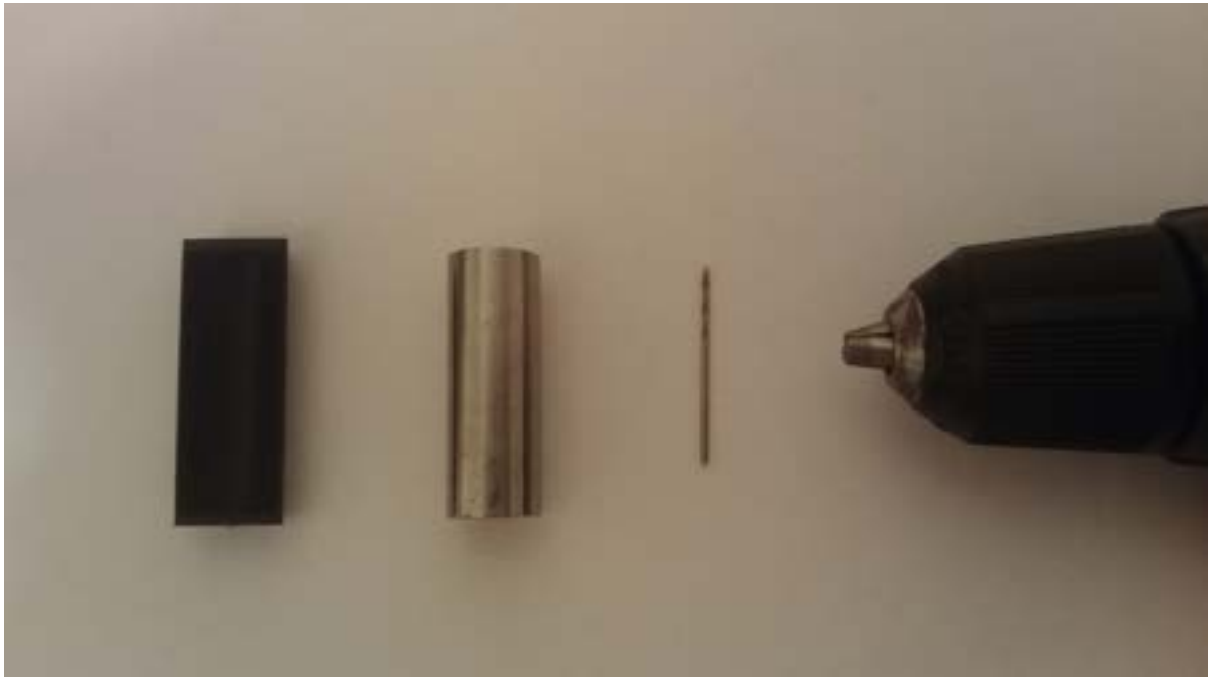
- Electrode welder and all welding related equipment
- 3D-printed FGC-9 bolt drilling jig
- 3D-printed FGC-9 bolt welding jig
- Power drill
- HSS-CO drill bits 1mm, 2mm, 3mm, 3.5mm
- Metal file

### Materials and Parts needed:

- Steel round bar 18mm diameter 50mm long
- Steel round bar 18mm diameter 216mm long
- JB Weld
- Stick welding electrode
- Cutting fluid
- 9x19mm case with used primer
- FGC-9 firing pin
- FGC-9 upper receiver with installed barrel assembly
- 3D-printed FGC-9 bolt carrier



## Making the bolt - STEP 1



Get your power drill ready with a 1 or 1.5mm drill bit as well as the bolt drilling jig and the 50mm long 18mm bar.

Put the short bolt piece (18mm diameter, 50mm long) into the drilling jig.

## Making the bolt - STEP 2



Hold the drilling jig that has the short bolt piece inside and drill into the holes on both sides to mark where you will drill deeper later.

Make sure that both drill spots line up with the jig holes. Make sure to not have the short bolt piece rotate inside the jig while you do this.

## Making the bolt - STEP 3



Remove the short bolt piece out of the drilling jig.

Use a power drill with a 1.5mm, then 2mm and then 3mm drill bit to gradually increase the size of the divot that you created on both sides.

## Making the bolt - STEP 4



After having both divots/shallow holes on both sides to 3.5mm in diameter get cutting fluid and spray some on the drill bit as well as the hole when drilling deeper.

As you drill about halfway through the short bolt piece on one side use ample cutting fluid. Drill halfway through the short bolt piece from the other side as well. In the end you should have a 3.5mm hole going through all the way through the short bolt piece.

## Making the bolt - STEP 5



Get the bolt welding jig and sand/file any potentially squished and flat edges so they are rounded.

Assuming you don't have a welding table, get any table and put a sheet metal plate on it. Ideally it would be bigger than 500x500mm and around 3-5mm in thickness.

Put both the short and long bolt piece near the edge of the metal plate and clamp them together with one welding clamp, then get the 20mm wide sheet metal strip if you have it and use it with another welding clamp to make sure both bolt pieces are fixed on the metal plate properly.

## Making the bolt - STEP 6



Get your bolt welding jig and a 3.5mm drill bit and use them to make sure that the hole you drilled in the shorter bolt piece is exactly at 3 o'clock.

Additionally or alternatively you can use your digital caliper to make sure that the drilled hole is exactly at the height halfway between bottom and top of the bolt when looking at it the way it is depicted in the picture.

## Making the bolt - STEP 7



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) you can remove the bolt jig and the drill bit. Remove the clamp that pressed the bolt pieces against the table and more importantly make absolutely sure that the front ends of the bolt pieces are absolutely flush. Meaning on the front/bolt face the ends should be in line and one bolt should not stick out more than the other.

## Making the bolt - STEP 8



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 how 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.

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.



## Making the bolt - STEP 9



After letting the probably very hot bolt cool off, hold the bolt like in the image while having the bolt always having contact with the metal plate and then put blobs of welding material on the underside near the bolt face of the shorter bolt piece.

You should put weld blob on top of each other so that it is high and wide enough for you to file it into shape to conform to the gap that exists at the front of the bolt carrier as shown in the next image.

## Making the bolt - STEP 10



Keep adding blobs until you get enough material to start filing the blob tower into shape. Always take a close look at the bolt carrier and the bolt to see if you need to add more welding material.

The shape that you created is going to be used to push the cartridges into the chamber of the barrel. It is called a cartridge pick-up.

Clean the bolt of any and all weld splatter that could have stuck to the bolt as this could misalign the bolt in the carrier.

Also when first putting the bolt into the carrier check to see if any of the welds from joining the two parts together are sticking above the rods and thus contacting the carrier. If there is weld contacting the carrier this could misalign it in the carrier. So file or grind this weld to be flush with the bolt so as to make the diameters of the rods the only thing in contact with the carrier.

## Making the bolt - STEP 11



Start filing from the back of the added material and always make sure that you are removing material evenly on both sides so that the blob becomes a rectangular shape, with the middle in line with the middle of the bolt piece. It is very important that you insert the bolt into the bolt carrier every now and then during the removal of material to make sure that the rectangular shape that you made fits perfectly into the gap in the bolt carrier and that you stop removing material from the back of the welded shape before the bolt face goes behind the face of the bolt carrier front.

## Making the bolt - STEP 12



Make sure the bolt sticks out by at least 0.2mm out of the carrier after you are done with all your filing and sanding on the bolt pieces.

Meaning, when you look at the bolt carrier with the bolt pieces inside, the two steel rods should stick out a little bit and you should still see them when you look at the silhouette of the front of the bolt carrier. When you are at the very end of the build process you can use sand paper to make sure that the bolt pieces only stick out by about around 0.2-0.5mm.

## Making the bolt - STEP 13



Put the bolt into the bolt carrier without using anything to fix it in place yet, and then put the bolt carrier with the bolt inside into the upper receiver. Turn the upper receiver upside down and look into it from the bottom.

Now put an already fired 9x19mm cartridge case into the chamber of the barrel and put your firing pin into the bolt carrier. Attach your lower and temporarily fix it to the upper by simply putting a M3 screw into one of the two takedown holes. Before you attach the lower cock the hammer (push the hammer down into the inside of the lower).

Now make sure the bolt butts up against the cartridge case and pull the trigger. Slide the bolt carrier away from the cartridge case and look at the indent the firing pin left in the primer of the case. If the indent is not perfectly in the middle of the primer you need to go back and potentially add weld material to the pick-up and file it again so that you can shift the position of the firing pin channel a little bit more to the left or right depending on where your firing pin left the indentation.

## Making the bolt - STEP 14



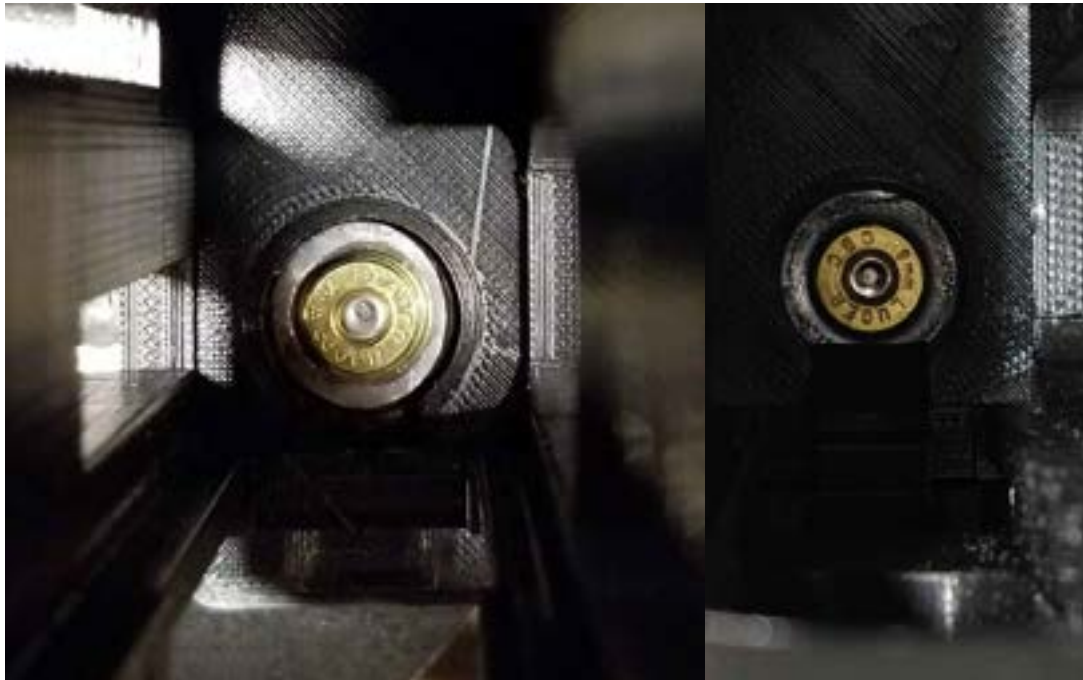
You can look into the muzzle end of the barrel and have the bolt be close to the chamber to make out if the firing pin channel hole is centered with the center of the barrel. In this picture for example the firing pin channel is not centered with the barrel.

Adjust the way the bolt sits inside the bolt carrier to make sure the indent of the firing pin is perfectly in the center of the primer of the cartridge case. It is absolutely important that this is right.

If you see that the cartridge case butt does not reach inside the upper receiver cavity you might need to unscrew the set screw of the shaft collars and shift the barrel closer into the upper receiver and then screw the set screws back very tightly into the barrel to have the cartridge case butt not be past the end of the inside of the upper receiver.

The idea is that you need the bolt face to butt up against the cartridge case. When this happens the cartridge case does not move at all and is basically stuck between the bolt face and the chamber of the barrel.





On the left you can see how the indent on the primer is off-center and basically at the 12'o clock position. This is NOT how it should be.

On the right you can see how the indent on the primer is closer to center. This is how it should be.

Try to get the firing pin indent as centered as possible.

## Making the bolt - STEP 15



After you have been able to properly file the bolt pick-up into shape and at the same time have the firing pin leave indents into the primer of the cartridge case perfectly in the center you can start mixing up JB weld and applying it as you can see in the photo.

Make sure you do not apply any JB-Weld near the openings of the firing pin channel in the lower bolt piece. It is absolutely essential that no JB Weld gets into it.

Now you can slide the bolt into the bolt carrier.



## Making the bolt - STEP 16



Now that you have slid the bolt, with JB weld applied to it, into the bolt carrier make sure with your firing pin that the firing pin hole is perfectly free of any JB-weld. If you see any JB-weld on the firing pin after having shoved it into the firing pin channel, use soft paper napkins or even better, alcohol wipes, to clean the firing pin and sticking it in again until the firing pin channel is absolutely clean of any JB Weld. You can use an L-shaped long hex-key as well. Make sure that the firing pin can freely slide in and out of the channel with no issues.

## Making the bolt - STEP 17

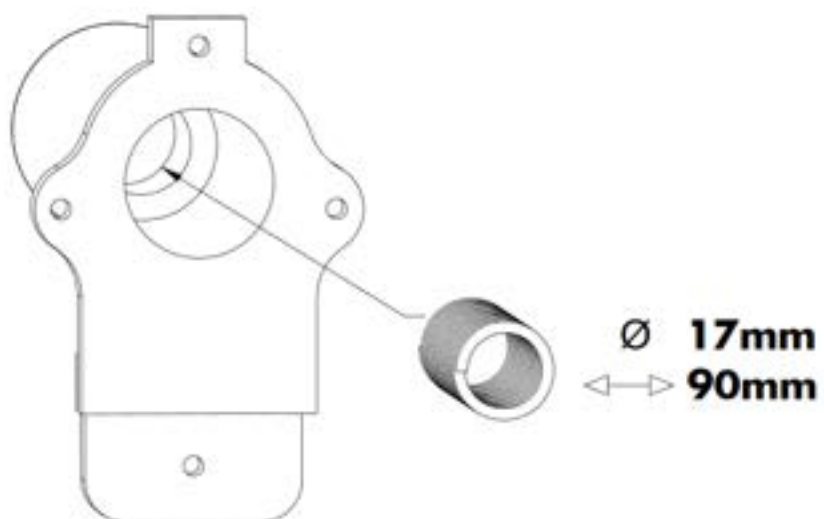


Fill up any gaps and crevices on the bolt face side that is between the inside of the carrier and the bolt, as you can see in the picture and then put the bolt somewhere so that the JB Weld can cure for 24 hours. Make sure that you use something that is appropriate to prop up the longer bolt piece that is sticking out of the bolt carrier to prevent the longer bolt piece from being canted.

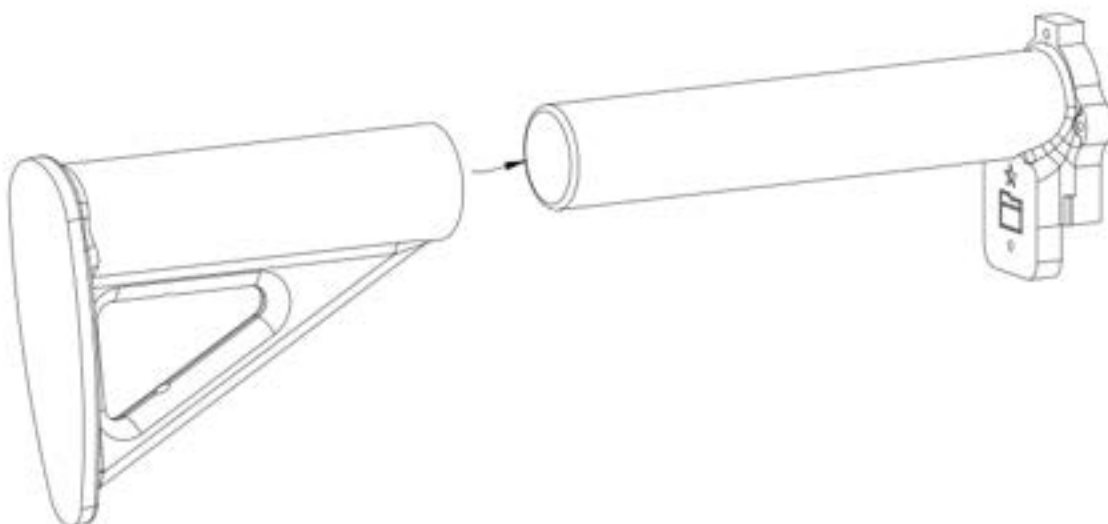
It has to be sitting straight inside the bolt carrier. If you have seen that your firing pin impacts were too high, you should make sure the longer bolt piece is pressed up against the "roof" of the bolt carrier as it cures so that the firing pin channel hole on the bolt face is situated lower to mitigate the high firing pin impact that you saw. If they were perfectly in the middle, just have the longer bolt piece stay perfectly straight and in case the firing pin indents were too low you can let the longer bolt piece slouch a little, but make sure that it is not canted too much to the bottom. After the JB weld has cured, see that the firing pin strikes are still centered, then screw the set screws that hold the barrel to the shaft collar very tight.

## Assembling the stock assembly

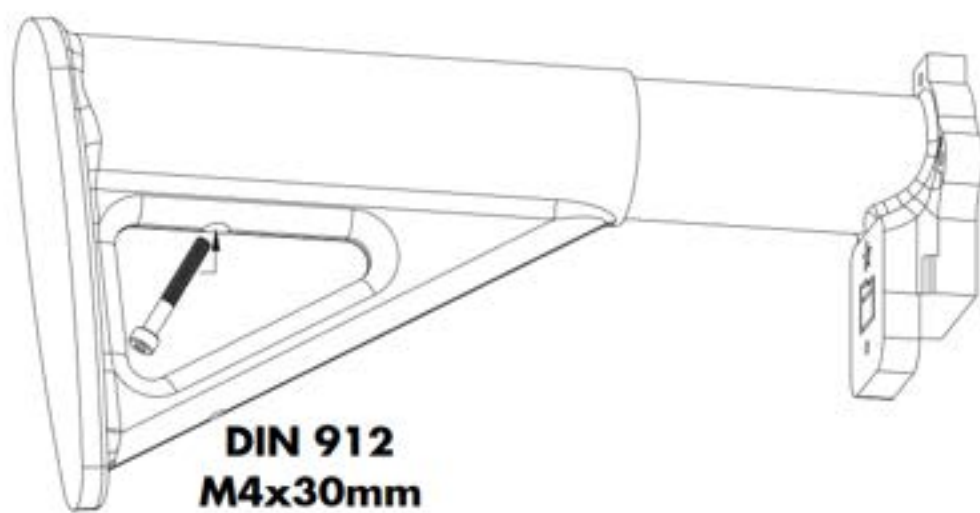
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## Drilling and tapping the bolt carrier



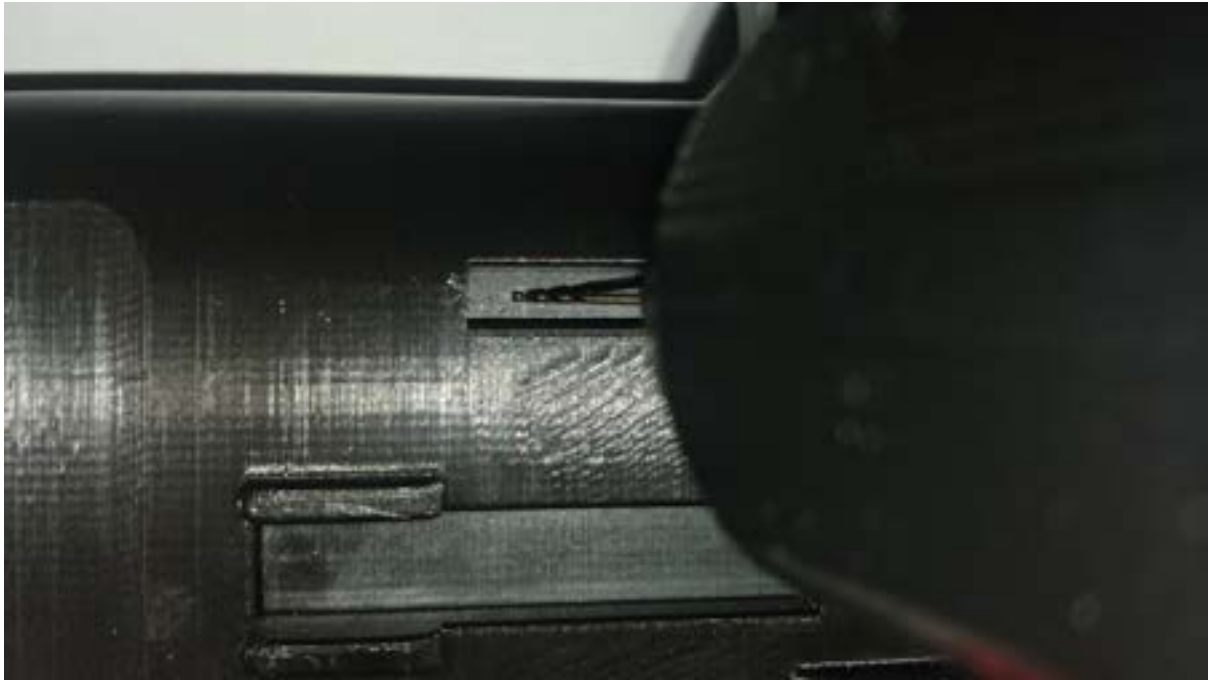
### Tools needed:

- Power drill
- Digital caliper
- HSS-CO 4.2mm or 11/64" drill bit
- HSS-CO metric drill bit set
- Tap holder
- M5 tap

### Materials and Parts needed:

- Cutting fluid
- FGC-9 bolt with the bolt steel pieces JB welded in.

## Drilling+tapping the bolt carrier - STEP 1



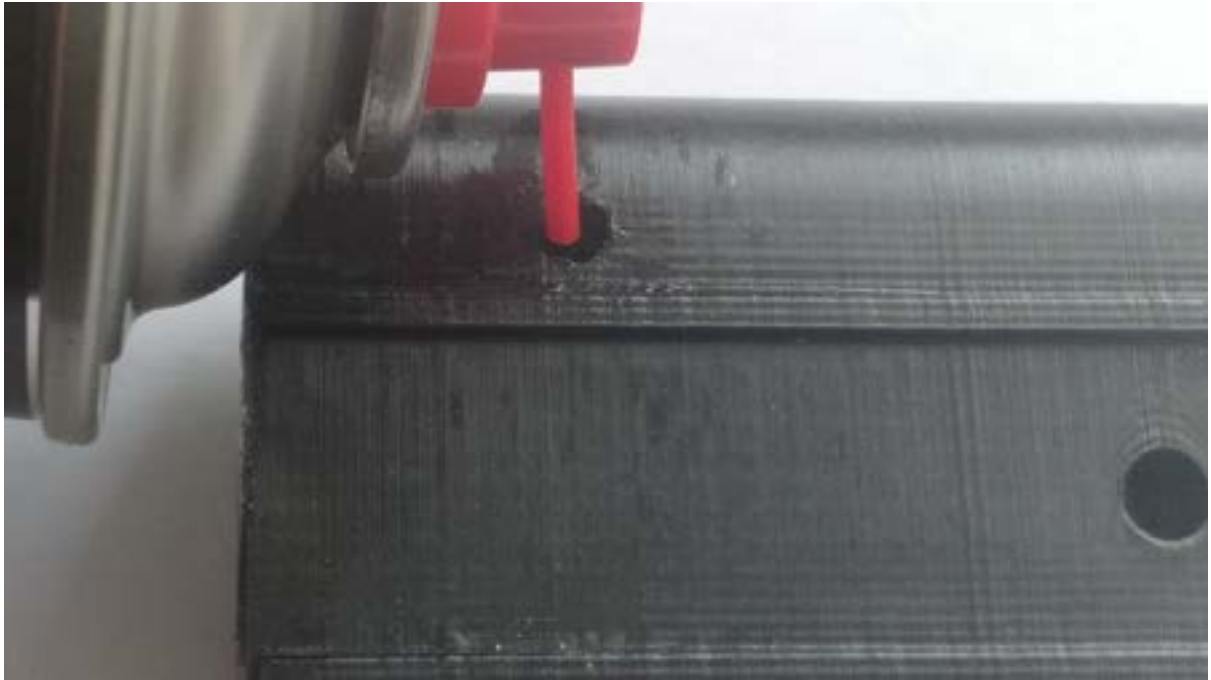
Put your bolt into the upper receiver and drop/push it to all the way to the front. Take a digital caliper and mark a spot at least 8mm from the end of the charging handle slot at the front of the upper receiver with the point of the caliper blades. Take your power drill with a small drill bit of 1-2mm in diameter and mark a spot on the bolt carrier through the charging handle slot where you previously scratched into and exactly between the top and bottom of the charging handle slot. Really do make sure you got the marked spot perfectly half-way between the top and bottom of the charging handle slot.

## Drilling+tapping the bolt carrier - STEP 2



Now put your 4.2mm drill bit in the power drill and try to enlarge that marked spot through the charging handle slot while making sure that the enlarged spot is again between the top and bottom of the charging handle slot. You can now remove the bolt carrier from the upper and drill into the marked spot you created, trying to stay as straight as possible while you drill into the bolt. Make sure you do not cant the drill bit in any way.

## Drilling+tapping the bolt carrier - STEP 3



Get cutting fluid into the hole as you start to reach the steel bolt piece inside the carrier while drilling.

Use an ample amount of cutting fluid.

Your goal is to drill 15mm into the bolt.

You can go deeper but absolutely make sure you do NOT drill through the steel piece completely.



## Drilling+tapping the bolt carrier - STEP 4



Take your M5 thread tap and secure it into your tap holder properly and start to cut the threads into the hole you just drilled.

Again make sure to use an ample amount of cutting fluid while turning the tap and after each full turn back out the threading tap half a turn.

It is also wise to stop after a few turns and clean out the hole of material and then get more cutting fluid into the hole.

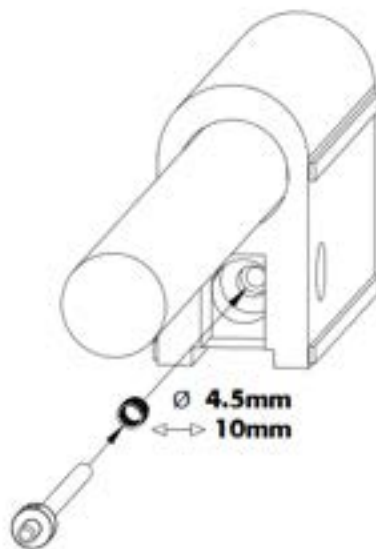
Once you feel significant resistance that means you probably reached the end of the hole and any further turns will most likely break your tap and it will be stuck inside your bolt.

So be very careful. Throughout this process make absolutely sure you do not cant the threading tap so try to hold the tap holder as straight as possible.

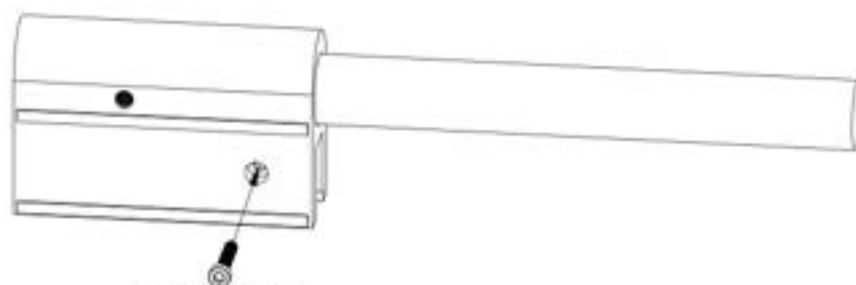
If you mess up at any stage during the drilling or tapping process, you can always use JB weld to fill up any holes, let it cure for 24 hours and then start again.

## Final assembly of the FGC-9

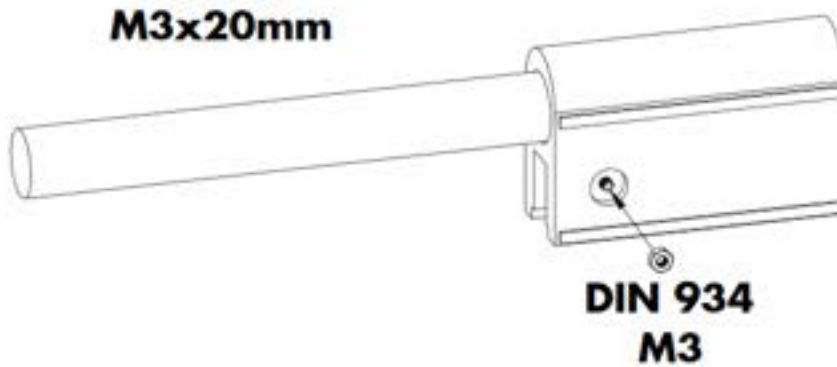
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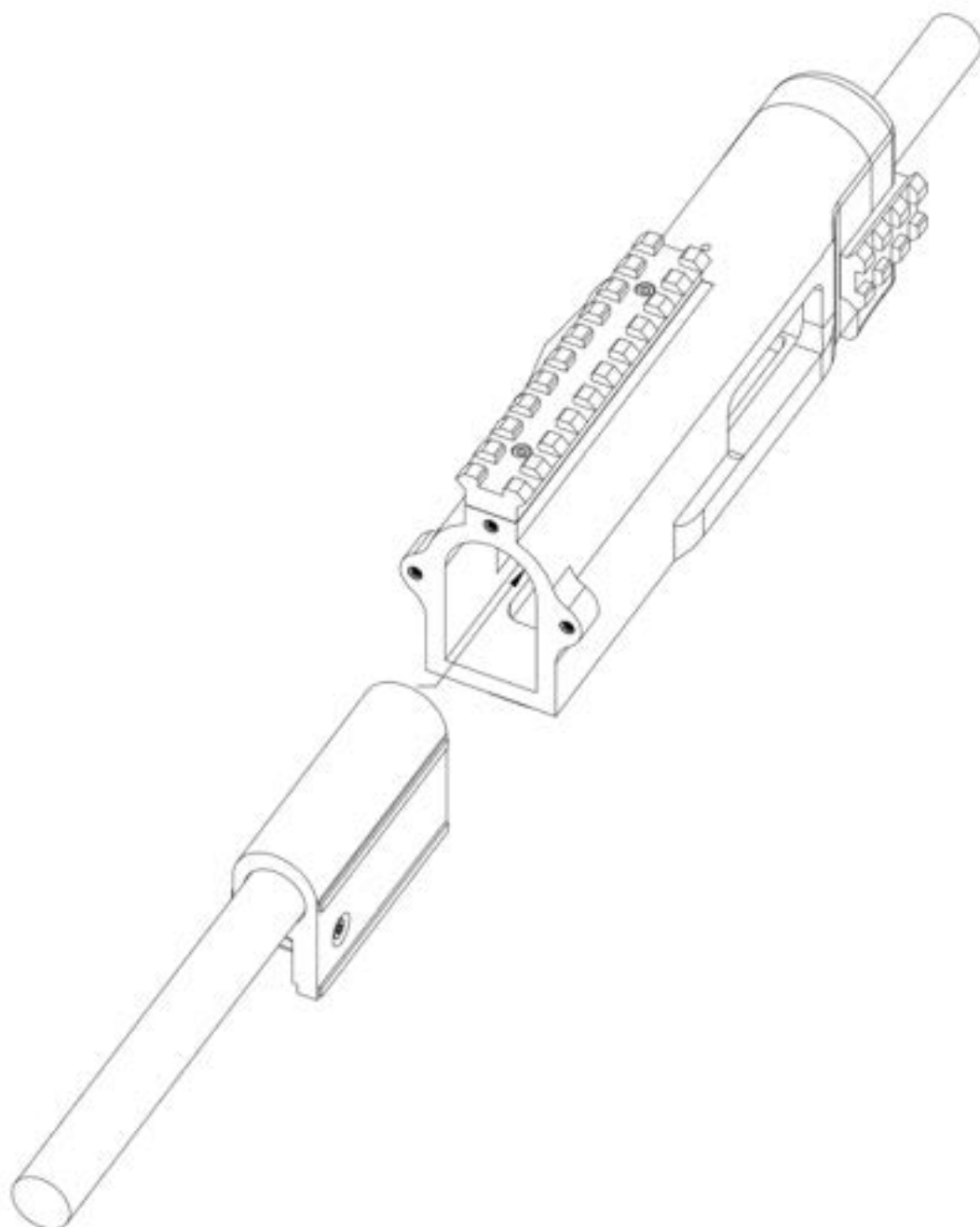
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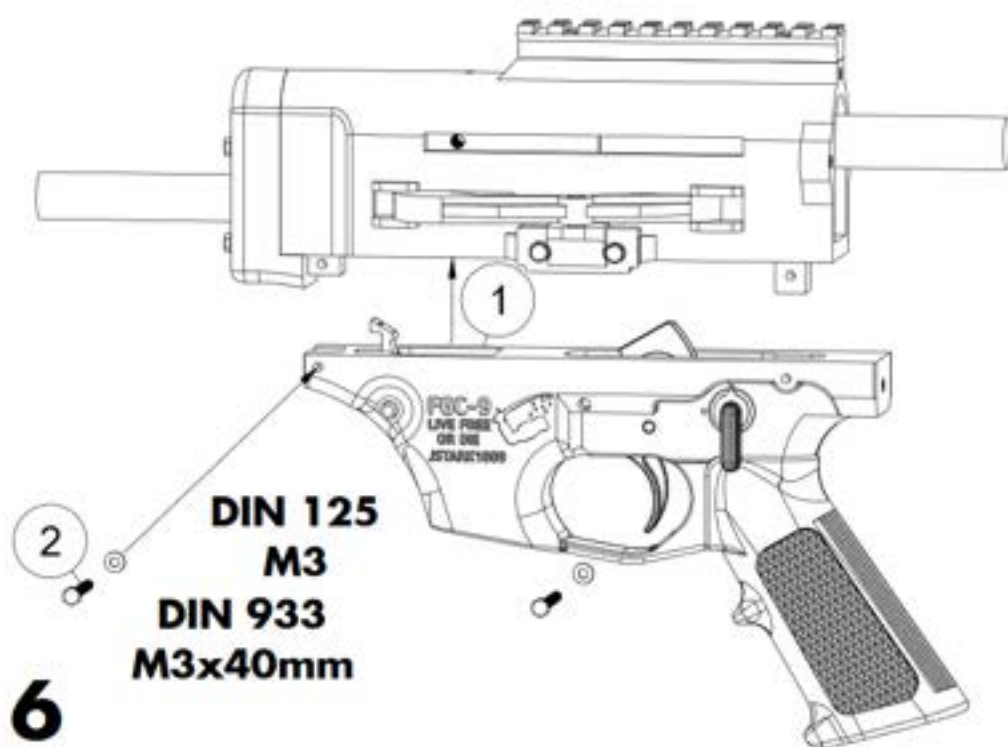
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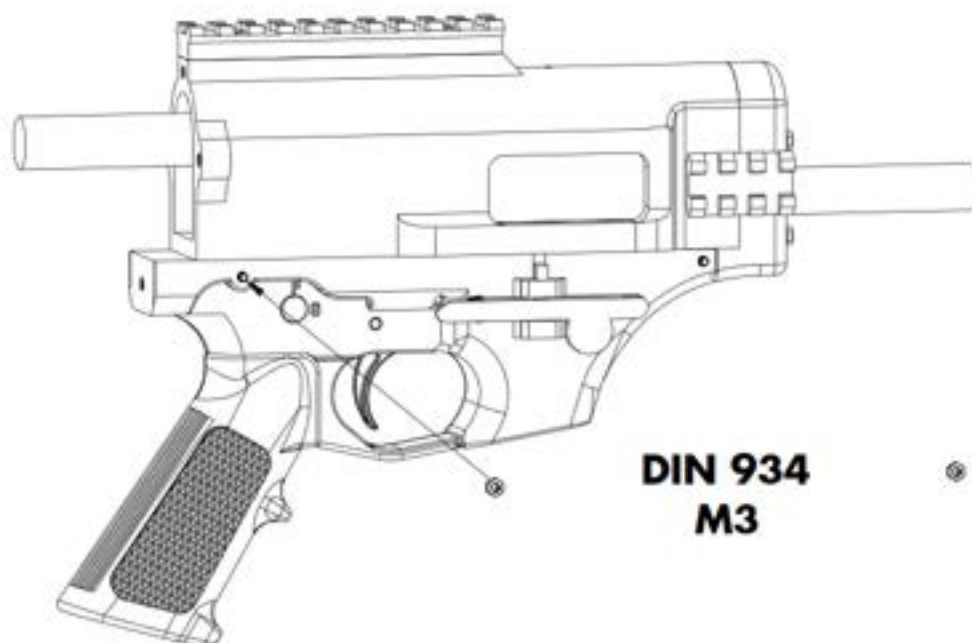
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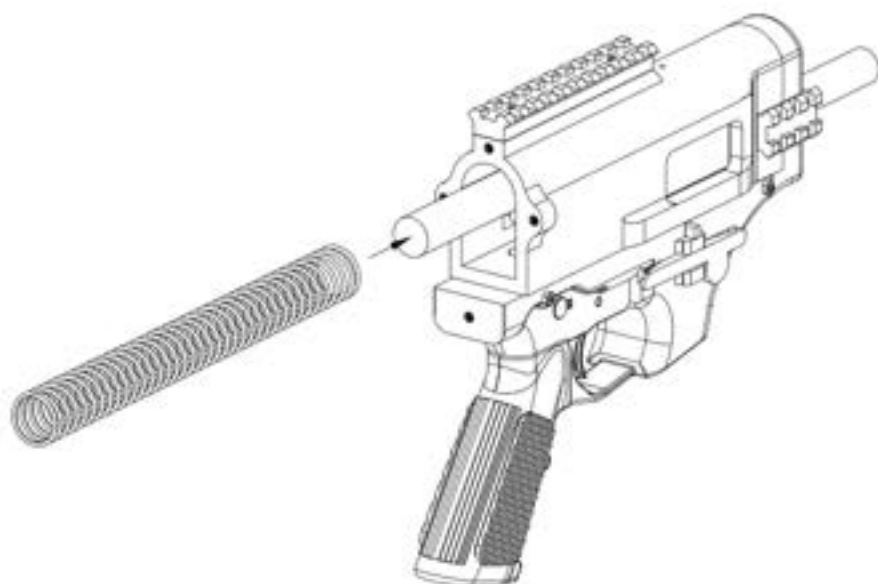
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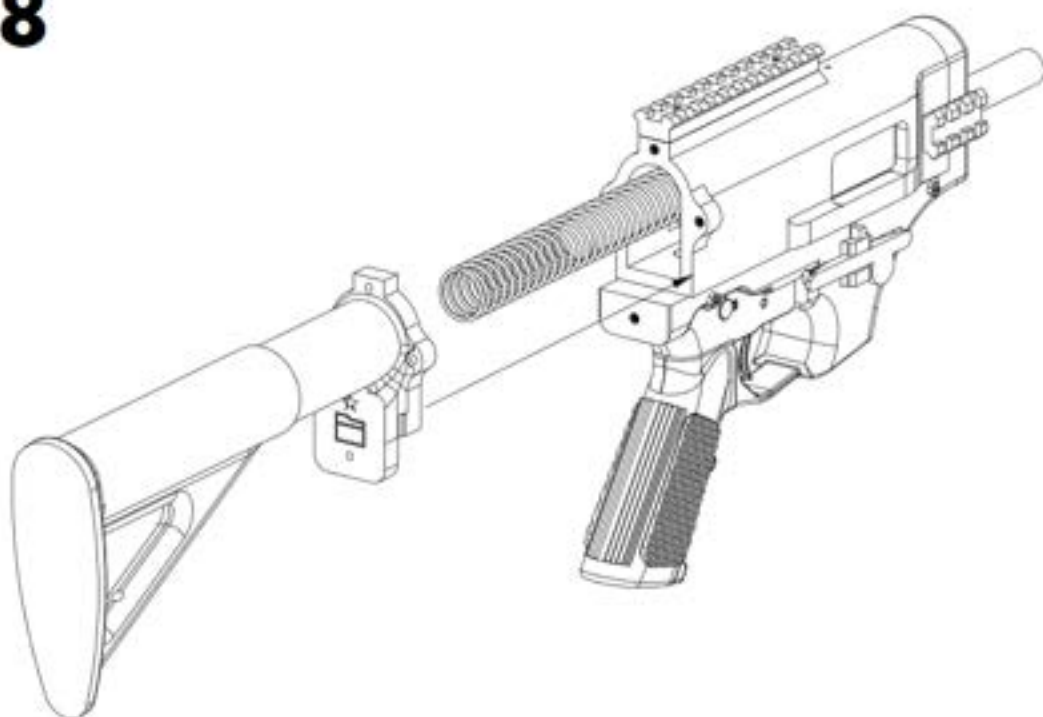
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## Test firing

One of the questions you will ask yourself once you have completed assembly is where you will fire the first dozen shots to test your FGC-9 build.

Ideally you have a patch of land, a building, garage or the like that is very far from inhabited areas.

If you do not have access to a remote firing area you can use a basement.

The next question will be what you will shoot into. This becomes especially tricky when firing in a basement.

One needs to fire into a so called bullet trap in that case.

A fairly portable and easy to build solution is the following:

Take a 60-liter plastic barrel and fill it with around 25kg of rubber mulch.

Before the rubber mulch is poured into the barrel you can JB weld a steel disc that has the appropriate diameter down at the bottom inside the barrel to guarantee that no pistol caliber projectile can leave the bullet trap.

Use a barrel that has a plastic lid so that you can simply use strips of electrical tape to cover the bullet hole entrances.

For the first few test shots I recommend you wear gloves and ballistic eyewear or a welding helmet.

Only load one cartridge for the very first test shot.

Make sure to check that the bullet has left the FGC-9 barrel and check that there are no cracks or damage of any form on the gun after each of the first dozen shots. Inspect the firearm very closely after each shot.

If you encounter any issues while testing the firearm or later down the line refer to the troubleshooting page.



## Closing remarks

I hope this document has helped you successfully build your means to defend yourself and not be a victim to unjust firearm legislation any longer.

This project has consumed a lot of resources, was a huge risk for me to undertake and took me a lot of time which I hope you'll appreciate.

By partaking in the DIY firearm community with the knowledge you have or will attain down the line you can give back and further help our cause.

If you can't contribute via direct development and design of DIY firearms and related technologies, at least support those that do in various ways.

One way you can do this is via donations, making sure that further versions of the FGC-9 can be developed as well as other firearms of similar design philosophy such as a mostly 3D-printed box magazine-fed pump-action shotgun design I am working on next, called the FGC-12.

So please consider donating: <http://www.tinyurl.com/JStark1809>

Direct Link:

<https://btcpayjungle.com/apps/3FZ5eiQz2WCFihdr6KZKFeKmrblz/pos>

I hope that the FGC-9 will kick-start a new era for modern DIY firearms. This document and the general design of the FGC-9 shall serve as a benchmark for future DIY firearm designers. You should always make sure to make things as easy as possible for people that want to build your designs.

The release of the FGC-9 does not represent the end in the fight against tyrannical gun control as the question of homemade 9x19mm ammo for example, has not been properly solved at this point.

Search for Deterrence Dispensed on the internet and find like-minded people with the same goal of fighting against tyrannical gun laws by advancing DIY firearms technology.

We together can defeat for good the infringement that is taking place on our natural born right to bear arms, defend ourselves and rise up against tyranny at any time.

**"Live free or die: Death is not the worst of evils."**  
*John Stark, 1809*

# Troubleshooting

## Cartridge case stays inside chamber after a shot

This issue can be caused by a number of factors, but two are more likely to cause it than the rest. The two most common issues are having a poorly cut chamber/throat and/or having a firing pin with a too pointy tip.

In order to troubleshoot these issues, start with checking the firing pin, making sure that the end is flat, not pointy and is made according to the instructions. If your firing pin is too pointy or has too much extension (was cut too long) the firing pin will stick to the primer and cause a failure to extract.

If the firing pin is in order, next check the chamber/throat. Can you insert a round, tap it into the chamber and still easily remove it? If not, you may need to cut your chamber and throat a little wider.

If you pass the above test, next take a look at the case of a round that failed to extract. Does it have a lip on the case mouth? If so, your throat was cut too loose and the case is shoving past the chamber seat and into the throat (which isn't good). This is what a fired casing that shoved into the throat looks like, note the angled crimp at the mouth of the case:



To fix this issue, before resorting to making a new barrel you can adjust the so called headspace of your FGC-9 barrel to stop the case from being shoved too far into the throat.

To do this, demount your barrel assembly and loosen your shaft collars.

They will have staked themselves in place during assembly, so you'll have to loosen the set screws and twist them to get them to unlock.

With the shaft collars loosened, tap or press the barrel FORWARD in the collars by about 0.2-0.4mm, then retighten the collars, remount the barrel, and test-fire again.

If the first 0.2-0.4mm fixes your issue, you're all set. If not, you can repeat the process to move the barrel forward another 0.2mm to a total of 0.6mm, but do not move the barrel any further forward than that, as you may risk out-of-battery detonations.

Side Note: it seems using cartridges that have 124grain heavy projectiles or heavier ones helps prevent the failures to extract. This is something to pay attention to if you have an easy choice between 115grain projectile cartridges and 124grain projectile cartridges.

## Light or no firing pin strikes on the back of the primer

Light strikes can happen for a number of reasons on the FGC-9, most common are out of alignment firing pins, sticky firing pin channels, or out of spec firing pins.

Take a look at the primer strike on a round that had a light firing pin strike. Where is the center of the firing pin hitting? If it is hitting on the case itself even a little, you will have issues.

If you would like to try reducing the diameter of the head of the firing pin by a little in an attempt to get all of the firing pin on the primer, you may do so within reason - but for seriously misaligned pins, you will need to make a new bolt.

For firing pin channels that are sticky, first try and find where there is excessive resistance - take the firing pin and insert it from the FRONT of the bolt - does it insert easily? If yes, your firing pin channel is good, and your resistance is in the bolt housing. If no, you need to drill out your firing pin channel just a bit more - your firing pin should be a loose fit that can fall out with gravity.

If the firing pin seems to be hanging up in the bolt housing, ensure you don't have any excess JB Weld buildup from when you cemented the firing pin together or from when you assembled the bolt itself.

If the firing pin is hitting the internal recess of the bolt carrier, take a dremel tool or a drill and add some space to that recess to allow the pin to move freely.

Finally, if there is no resistance in moving the pin and the pin is aligned, your firing pin may be out of spec in terms of length or collar placement.

Double check all of your dimensions on the firing pin - especially the distance from the collar to the rear end (where the hammer hits). If that distance is too long or too short, the hammer won't get a good, square hit on the firing pin.

If the cartridge sits loosely inside the chamber and you see none or just light firing strikes, you can try to move the barrel slightly towards the back by loosening the set screws, moving the barrel and screwing tight again.

## Cartridges not feeding into the chamber consistently or at all

The most common feeding issues on the FGC-9 stem from magazines. Original factory Glock magazines work very well while Magpul PMAGs and various versions of 3D-printed Glock magazines might not work. Included in the FGC-9 files is a FGC-9 purpose-made 3D-printed 25-round magazine that works very well.

So either use factory Glock magazines or use the provided 25-round printed magazine. Monitor the state of your 3D-printed magazines, as they may wear out after a few hundred rounds.

Another source of feeding issues can be a misshapen chamber mouth, misshapen pickup on the bolt, or a poorly installed feed ramp.

Your chamber mouth should have a small radius on it as a result of the ECM chambering - this radius works wonders for aiding feeding. If you ground this radius off, it may cause feeding issues.

The pickup (which you shaped from a weldblob when making your bolt) needs to be perfectly flat with the face of the bolt, not sticking out nor undercut.

The feed ramp should be sitting all the way at the bottom of its pocket in the FGC-9 lower. If it isn't all the way down in the pocket, you will have feeding issues. Ensure it is seated and not damaged (if your round pickup on the bolt is shaped poorly it can damage the feed ramp, causing feeding issues).

# Changelog

Changes from Shutty AP9 base design:

- 16mm OD barrel with shaft collars used instead of a Glock 17 barrel
- Changed bolt stock piece diameter to 18mm OD
- Changed shape of upper receiver significantly
- Changed shape of lower receiver significantly
- Changed barrel retainer significantly
- Added newly designed firing pin that doesn't need a lathe to manufacture, designed to be made with basic hand tools.
- Completely cleaned up every single model of the components that were taken over from the AP9. (Cleaned up as in removing all the amateur-tier weird modeling mistakes/artifacts on the CAD model components)
- Completely changed all fastening components to European based DIN components (screws, washers, collars, nuts ...)
- Changed design to utilize steel materials with metric dimensions
- Added stock designed completely from scratch
- Added completely new feed ramp
- Changed the magwell entirely
- Changed mag catch
- Changed mag catch button
- Changed mag catch button canal
- Changed fire control group pocket to spec, cleaned the pocket
- Changed springs used, now using only metric springs except the AR-15 carbine buffer spring
- Changed top rail slightly and extended it
- Changed side rail slightly and extended it
- Cleaned up pistol grip install area
- Cutout near fire selector hole for more ergonomic fire selector switch interaction
- Changed position and diameter of all screw holes
- Completely changed the way upper and lower attach
- Changed mag catch attachment
- Changed pin holes and all other holes to eliminate need for post processing such as sanding, reaming etc.
- Completely designed new charging handle from scratch that is easier to build and more ergonomic
- Significantly changed and cleaned bolt carrier
- Added fire selector indicators on both sides
- Added thread inserts to enable disassembly without ruining the gun
- Added purpose made pistol grip
- Changed buffer tube