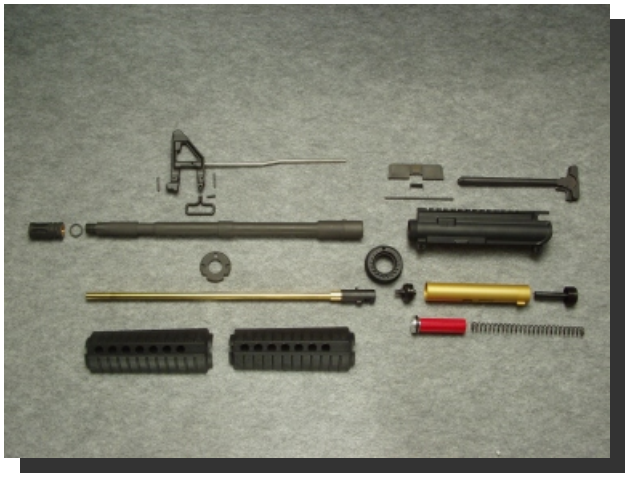
I. Assembly of Upper Reciever

Upper receiver assembly includes the barrel, which controls accuracy. Besides your normal collection of tools, make sure specialized tools such as a vice (or preferably the upper receiver clamp) are available.

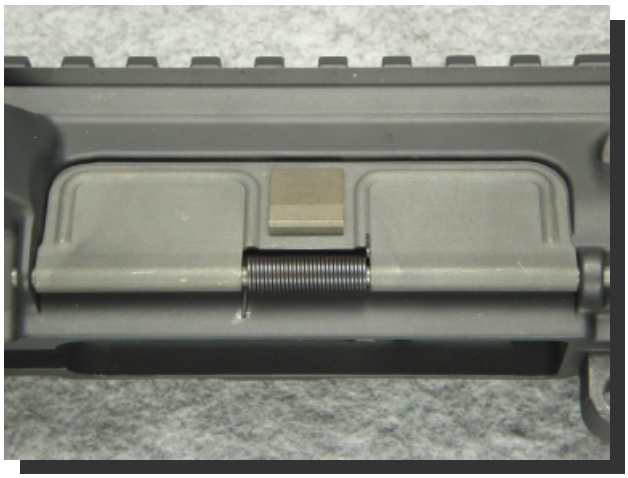


I. Install Dust Cover

First, set E-Clip (UR-005) over groove on Dust Cover Shaft (UR-002).

NOTE

The dust cover's operation is different from the real gun. With the PTW, the dust cover remains closed during firing, and the dust cover spring should be installed so that it will held the dust cover in the "closed" position at all times. Please refer to photo.



Position Dust Cover (UR-003) and Dust-Cover Spring (UR-004) over Upper Receiver (UR-001-M4), then insert Dust Cover Shaft from front end (barrel side) through the upper receiver and dust cover, securing dust cover in place. Note the position of dust cover spring.

---

2. Install Forward Assist Knob

The forward assist knob has no specific function in the P.T.W.

Forward Assist Knob Set Pin (UR-009) is to simply prevent the Forward Assist Knob (UR-006) from springing out.

For assembly, insert Forward Assist Knob Spring (UR-008) into upper receiver, then insert Forward Assist Knob as shown (note the location of groove).

Once the groove is aligned inside the receiver, insert set pin from below the receiver. The pin is easier to install from below with the receiver upside-down because the receiver sits more securely this way.

---

3. Assemble Charging Handle

First insert Charging Handle Stop-Latch Spring (UR-012) and Charging Handle Stop-Latch (UR-011) into Charging Handle (UR-010). While pushing the stop-latch securely against the charging handle, insert the Set-Pin for Charging Handle Stop-Latch (UR-013) by using a pair of Teflon-based pliers.

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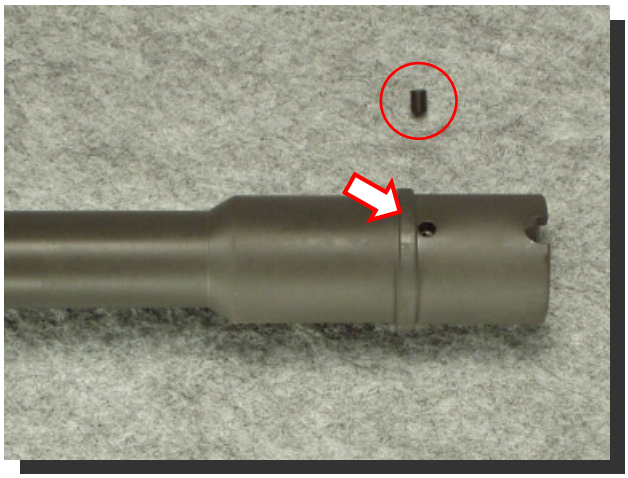
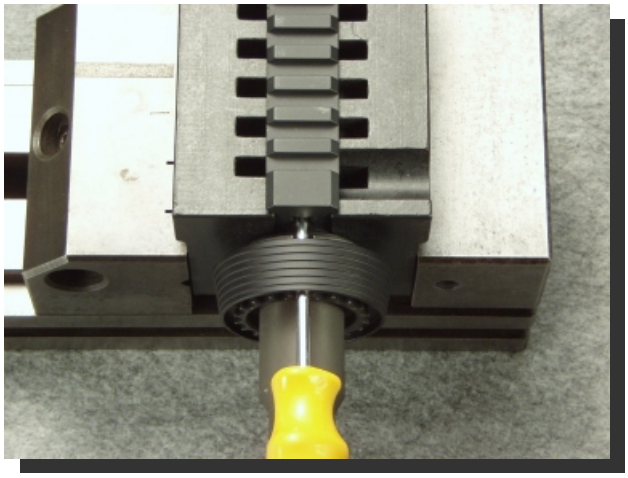
4. Install Outer Barrel

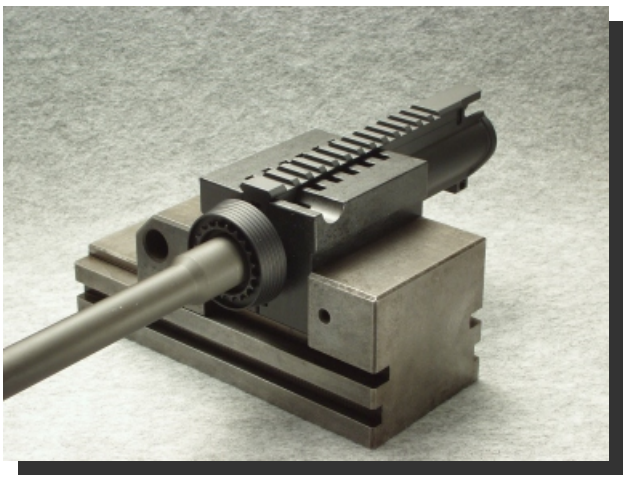
Insert Outer Barrel Knock-Pin (BR-019) to outer barrel, then insert outer barrel to upper receiver.



From the front of the outer barrel, screw in Barrel Nut Assembly (ASS-BR-03). The barrel nut assembly consists of 4 parts (barrel nut, slip ring, weld spring, and e-ring). To properly install the gas pipe later, the notch / holes on these 4 parts and the hole in the upper receiver must align properly. Use a tool such as small screw driver to ensure proper alignment.



Tighten the barrel nut and ensure the holes' alignment in the last step (the path for gas pipe insertion) will remain correct even after the barrel nut is fully tightened. The photo shows the use of a barrel nut wrench. When using such wrench, do not over-tighten as it will be very difficult to remove the nuts later if needed.



TIP

To protect the surface finish, the use of a upper receiver clamp (shown here) is highly recommended. It is a device originally made for real guns, but will fit the PTW quite perfectly.

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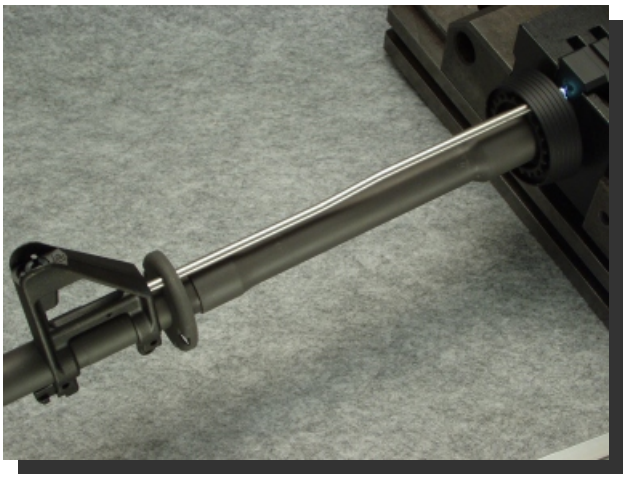
5. Assemble Front-Sight Post

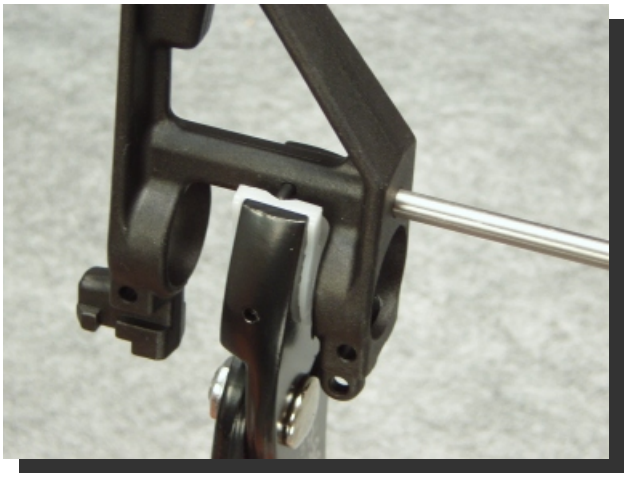
Insert Gas Pipe (BR-014) into Front Sight Post (BR-005), align holes and press-fit Gas-Pipe Retaining Pin (BR-009) using pliers. Then insert Hand-Guard Cap (BR-013) over outer barrel.



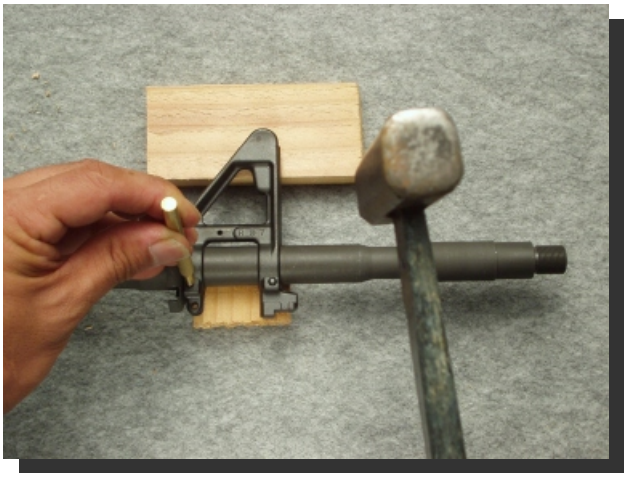
Align front sight post with outer barrel, and insert two Front Sight Post Knock-Pins (BR-010) to secure the front sight post.

TIP

There is a set screw under the front sight post (see next step), you may loosely tighten this screw to position the front sight post, which will help you install the knock pins.



Insert front sight post over barrel. The gas pipe should pass through the corresponding hole in the hand guard cap, barrel nut assembly (hole prepared in last step), and finally into the upper receiver.



Fully tighten the screw under the front site post to secure it in-place.

Fix Front-Sight Post Swivel-Ring (BR-032) and press-fit (or using pin punch) Front-Sight Post Swivel-Ring Pin (BR-011).

---

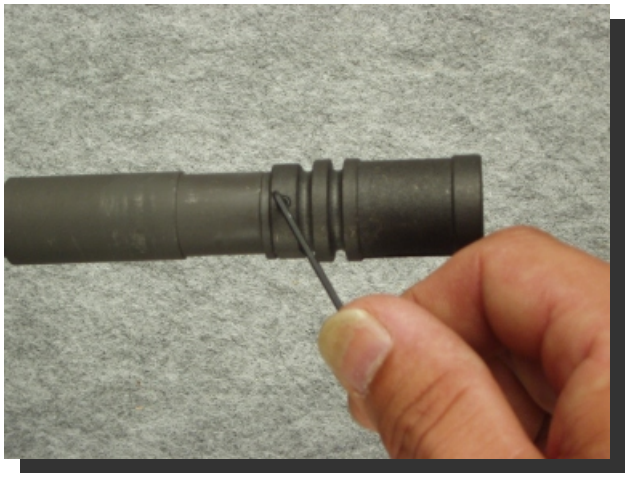
6. Install Hand-Guard

Insert Hand-Guard (BR-032) while pressing down hand-guard slip ring. Be careful not to get your hand caught as tention of the weld-spring is very strong, just like the real gun.

---

7. Install Flash Hider

First, screw Flash Hider Ring (brass sleeve, BR-002) to the threaded tip of Outer Barrel (BR-020). Next, slide Flash Hider (BR-001) over the flash hider ring. While the flash hider is aligned properly (set screw hole facing down, install / tighten Flash Hider Set Screw (BR-004). Loctite "Blue" or other similar removable threading compound should be used to prevent the flash hider set screw from loosening during normal operation.



FINAL CHECK

Install Carrying Handle Assembly (ASS-CH-01) to upper receiver, and visually confirm that the front sight can be seen through the rear sight. If front sight cannot be viewed directly through rear sight, there is a substantial flaw in the front sight post setup or possibly the barrel assembly. The gun will not function properly and the upper receiver assembly procedures should be checked and disassembled / re-assembled if necessary.

II. Assembly of Cylinder Unit

The cylinder is where air is compressed and used to propel the BB (Ball Bullet). The cylinder is also responsible for loading the BB. Note that in this part, much adhesive will be used, and for long-term stability of any adhesive, thorough cleaning / degrasing is critical.

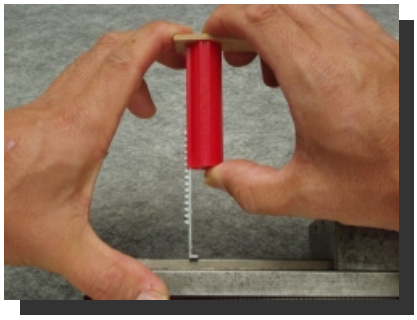
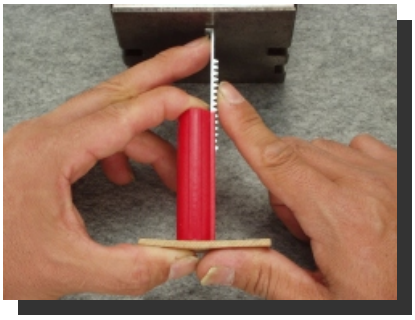
Obviously use of commercial degreasing agent such as break cleaner is the most effective, but even household detergent can be get the job done if rinsed thoroughly.

Finally, it is very important that all parts are dried completely before work begins.

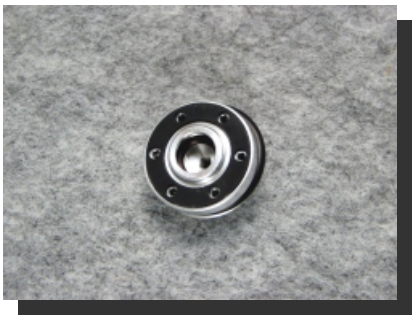
---

1. Installation of Rack Gear

Apply instant-glue (Syanon 722 recommanded) on Piston (CR-012) where Piston Rack-Gear (CU-011) is to be fitted, and press fit together. It is important that the piston is kept perpendicular to the rack gear, and the rack gear is inserted quickly before the adhesive dries.

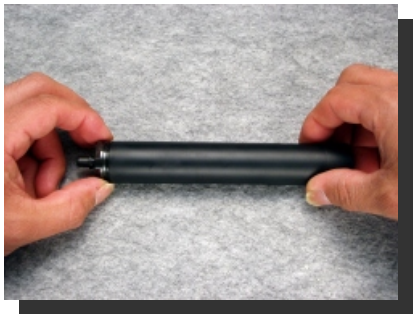
Assemble Piston Head by first gluing Piston Head Bumper (black, flat rubber ring, CU-008) to Piston Head (CU-007) using instant glue. Then install Main O-Ring for Piston Head (CU-010) around the outside of piston head, and Small O-Ring for Piston Head (CU-009) inside the opening in front of the piston head. Refer to photo. Apply sufficient amount of Systema cylinder grease to where small o-ring is fitted.



Place Piston Head Guide Spring (CU-013) over Piston Head Guide (CU-014), and insert the piston head guide through the opening in the piston as shown. While pressing the piston head guide through the opening (the spring should not protrude), apply glue to the thread and tighten piston head onto the piston head guide.


2. Install Piston and Cylinder Head

Apply cylinder grease on inner surface of the Cylinder Case (CU-016). Then insert completed piston assembly as shown. after the piston is approximately 80% inserted into the cylinder case, it must be aligned with the anti-rotation groove inside the cylinder before it can be fully inserted. Use a small tool to guide the piston assembly into the groove from the rear of the cylinder.



Install the Cylinder-Head Assembly (ASS-CU-01) by fastening it onto the front of the cylinder case. Use a special wrench, or a large adjustable wrench, to properly secure the cylinder head assembly.

---

3. Install Main Spring and Spring Guide

Insert Main Spring (CU-017) from the back of the cylinder case, then insert Spring-Guide Assembly (ASS-CU-06) through main spring. Using the spring guide assembly to compress the main spring and screw the spring guide assembly into the cylinder case. Be careful not to allow the spring guide assembly to accidentally loosen and eject itself.

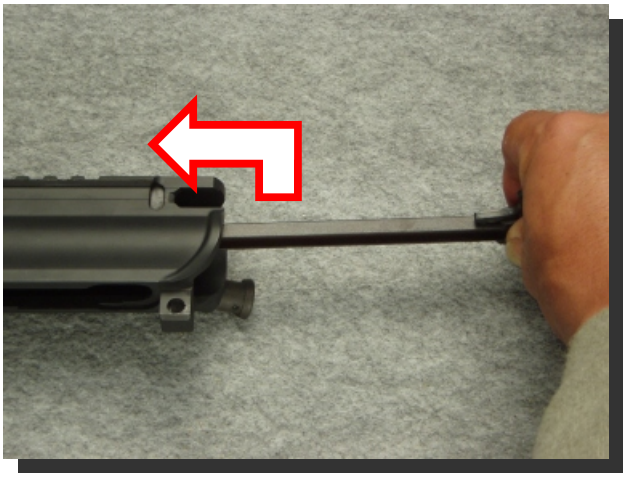
---

4. Installation of Inner-Barrel Assembly

Insert Inner-Barrel Assembly (ASS-BR-04/05) to upper receiver, noting the orientation of the BB feeding opening, as shown.

5. Installation of Charging Handle Assembly

Position charging handle assembly inside the upper receiver, align the notch of the charging handle against the opening of the corresponding slot inside the upper receiver, and push the charging handle into the opening / towards the top of the upper receiver. Then slide the charging handle fully forward and lock it in place.



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6. Installation of Cylinder Unit

Insert completed cylinder unit into upper receiver. Note the orientation and alignment of the cylinder unit, the nozzle (cylinder head) should be facing forward (towards the muzzle), and the notch at the end of the cylinder case must line up and fully seat into the opening in the upper receiver (see photo). It is usually very tight to install the cylinder unit for the first time, however it will slowly develop a proper fit and becomes smoother to insert / remove as the PTW "breaks-in".

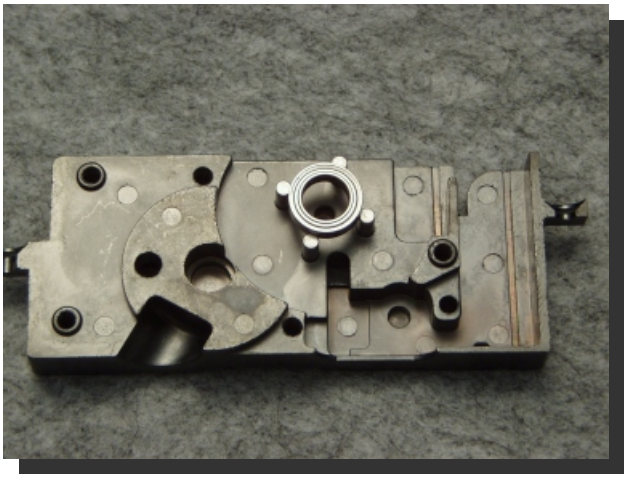
III. Assembly of Gearbox

In this section we will assemble the gearbox. Those who are experienced in building conventional airsoft gearbox may find this completely new and intimidating, but don't be nervous. Components used in the PTW gearbox are manufactured with extreme precision, and if you follow the instruction, anyone can assemble this gearbox correctly. We even eliminsted most of the shims in the system!

---

1. Installation of Planetary Gears

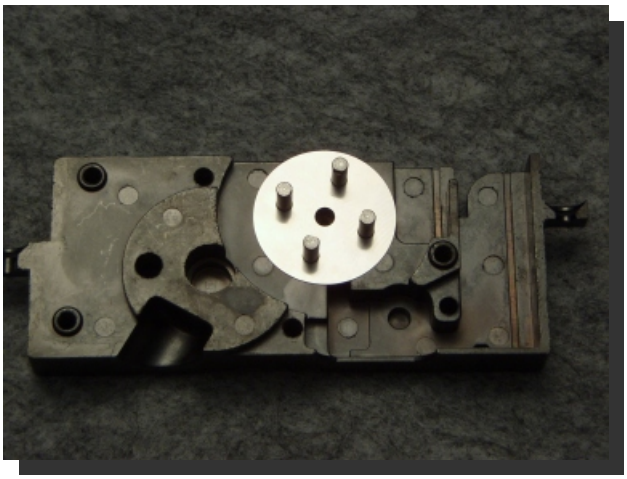
Planetary-Gear Shafts (GB-010, 4x) are pre-installed into the Left Hand Side Gearbox Case (GB-002). There is a D-shaped groove on one end of each planetary gears, properly oriented from the factory. Use the sun gear bearing, as shown, to check their orientation.

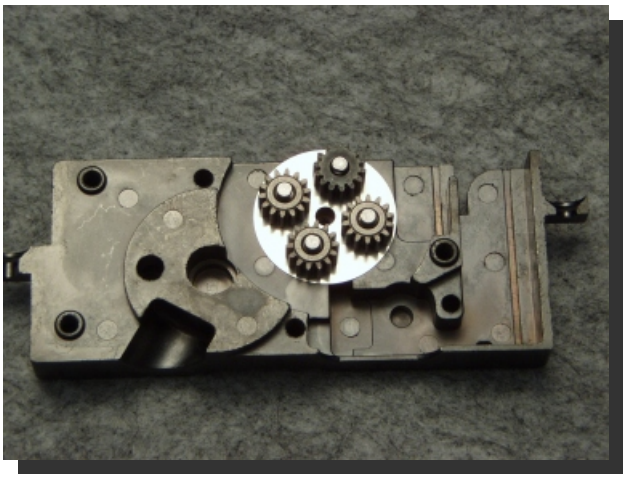


WARNING

The 4 planetary-gear shafts are press-fitted under extremely strict manufacturing control. Never pull out the shaft because you may not be able to re-position them correctly thereafter.

As shown in the right photo, insert Sector Gear Shim (GB-011) over the 4 planetary gear shafts. This shim is used to contain the grease on the sector gear, which helps avoid contamination of other components.



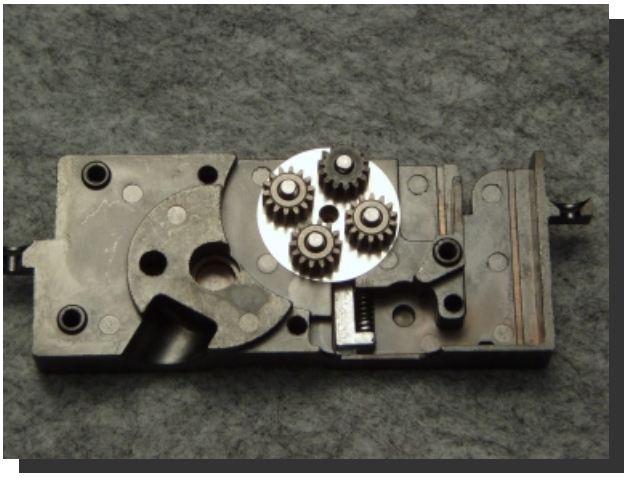


Finally, apply a VERY light amount of grease over the shim and on each shaft, then insert the planetary gears. Note that one of the gear provided are different then the rest (steel-lathed), and they must be arranged according to this photo to avoid possibility of premature failure.

---

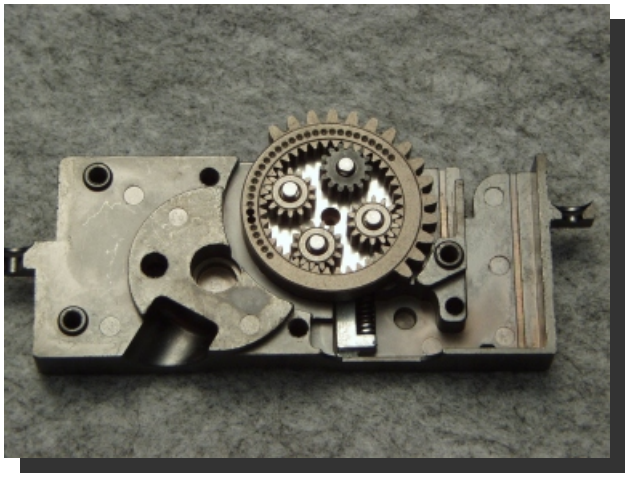
2. Installation of Trigger Lock

Refer to the right photo and install Trigger-Lock (GB-016) and Trigger Lock Spring (GB-017). Apply a slight amount of grease to any contact surface between the trigger lock and the gearbox case.



3. Installation of Internal Sector Gear

Apply a very light amount of grease over the entire Internal Sector Gear (GB-007) - a very thin layer using cotton buds are sufficient - and install the internal sector gear according to the right photo. Pay attention to the orientation of the sector gear, the multiple small holes drilled into the side of the sector gear must be facing up.



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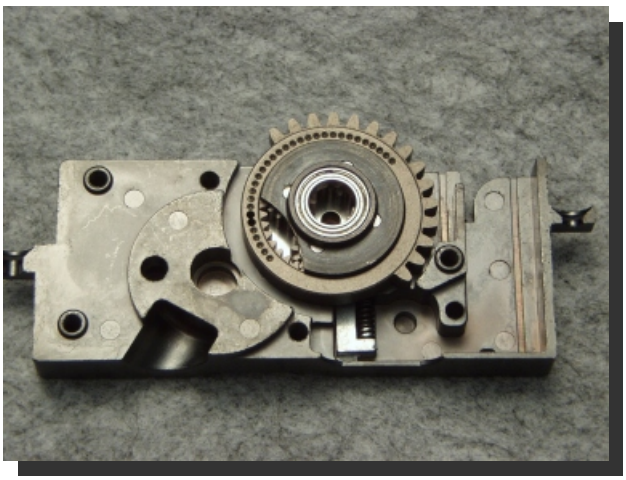
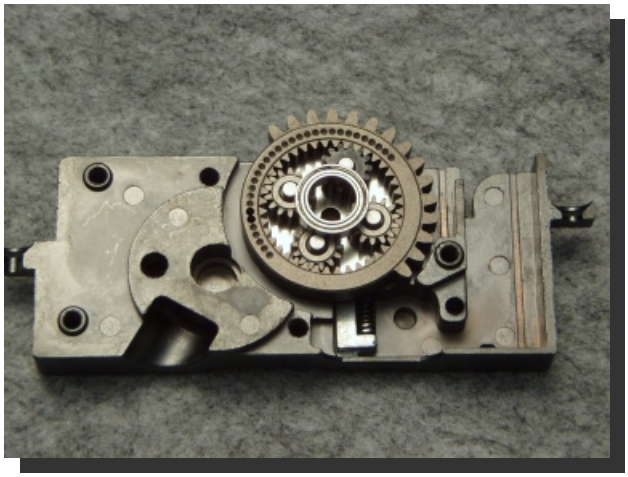
4. Installation of Bearing Plate

Install Bearing Plate (GB-009) and Sun-Gear Bearing (GB-006) by first placing the sun-gear bearing over the top of the planetary gears as shown. It should sit perfectly onto the D-shpaed notch over the planetary gear shafts.





Next, place the bearing plate over the sun gear, with its flat side facing the planetary gears. Each of the 4 planetary gear shafts should seat into the corresponding hole. Also note the orientation of the bearing plate, the cut-out should be facing the 8-o'clock direction as shown.

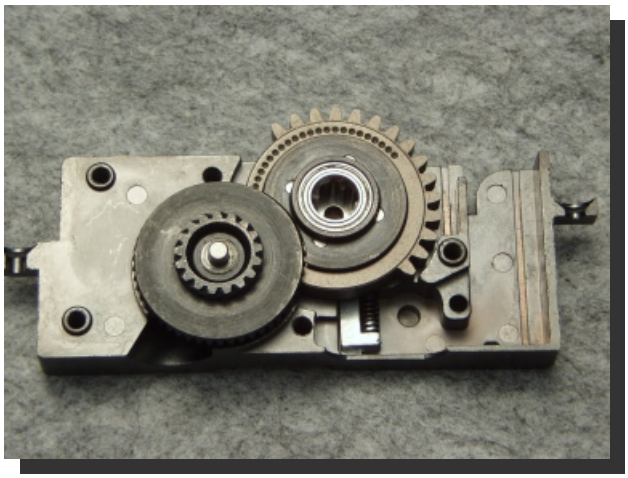
---

5. Assemble Bevel Gear

The Bevel Gear (GB-003) is the only gear that requires Shims (GB-024). First, very lightly coat the entire bevel gear with grease. Next, place one thick shims on both side of the gear, then place an additional thin shim on the "bevel gear" side (where the shaft sticks out longer). Refer to the Technical Diagram if needed.

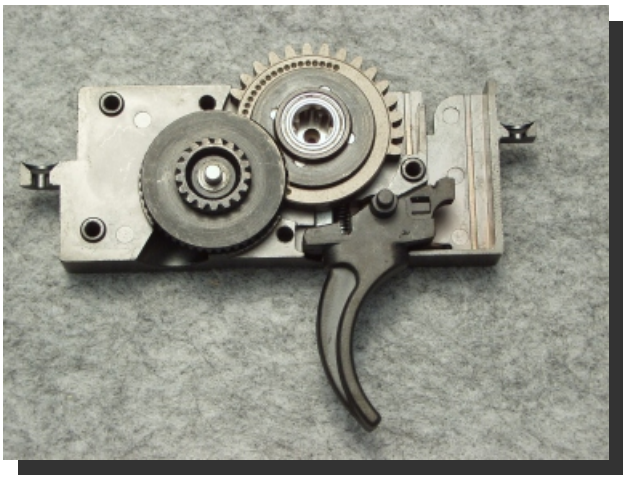
Thereafter, install one Bevel-Gear Bearing (GB-004) to the left side gearbox case with a pin punch. Be careful not to damage the bearing.

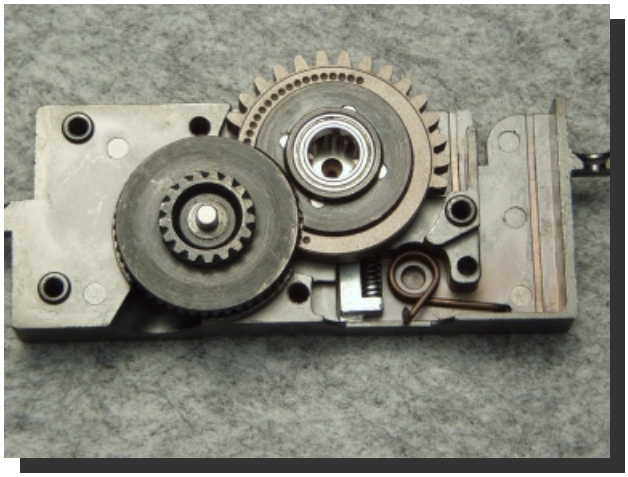
Finally install the bevel gear (with its shims still attached) onto the gearbox as shown.



6. Installation of Trigger

Install Trigger (GB-014) and Trigger Spring (GB-015) according to the following photos.





TIP

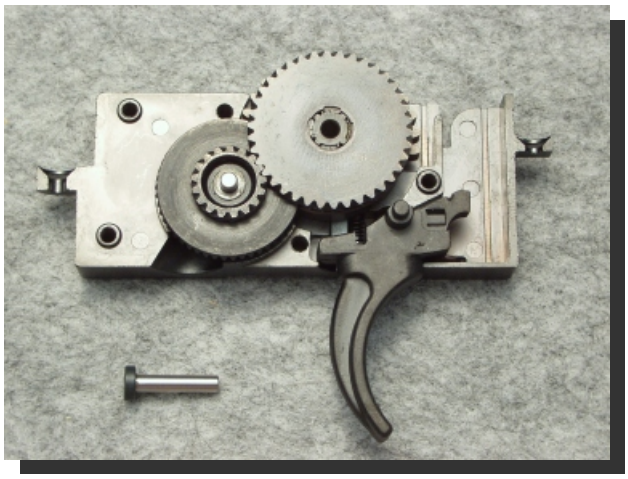
Use a small amount of grease to "stick" the trigger spring to the trigger would make installation easier.

---

7. Install Helical / Sun Gear

First lightly grease both set of teeth on the Helical / Sun Gear (GB-005), as well as the hole in the gear.

Insert the gear through the sun gear bearing and bearing plate as shown. If it does not fit immediately, rotate the internal sector gear by hand while inserting the helical/sun gear.



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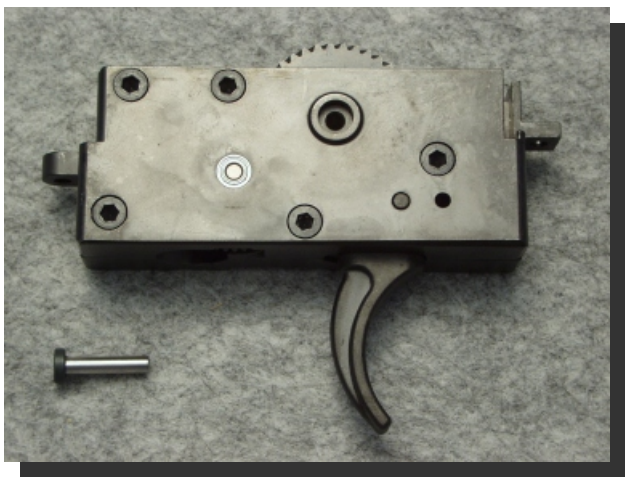
8. Installation of Sun-Gear Shaft

First, thinly grease the Sun-Gear Shaft. The Sun Gear and Sun Gear Bearing (Bushing) are already machine-pressed together.

Then install the bevel gear bearing on the right Right-Side Gearbox Case (GB-001), and then place the right side gearbox case over the gearbox. Loosely fasten the 5 screws to hold the two half together.

Finally place the sun-gear shaft above its appropriate opening, keeping it perpendicular and fully inserting it. You may need to use a small hammer to drive it in, but make sure you only hit it very lightly and drive it in little-by-little to avoid damage to the shaft.



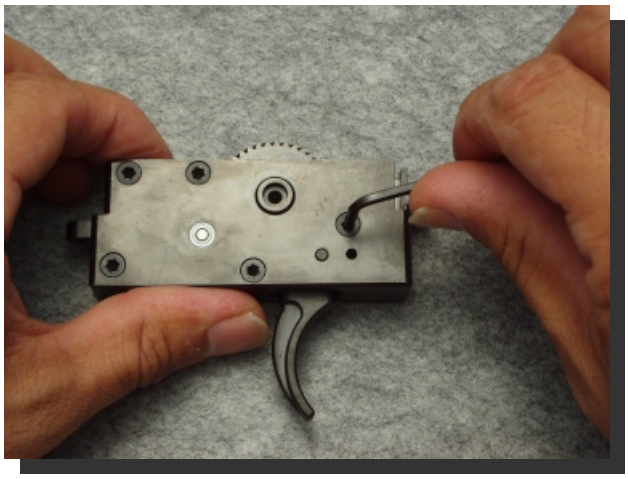
9. Adjustment of Gear Rotation and Installation of Gear-Case Screw

Hold case in hand, and rotate helical/sun gear by hand. If it rotates smoothly, go to (10).

If not, refer to right photo and lightly hammer the lower front part of gear-case left side with plastic hammer. Check gear rotation each time you hammer.

If after repeating the above procedure 5-6 times and gear rotation is still not smooth, try to rotate the internal sector gear by hand. If you feel any "catch" during rotation, disassemble the gearbox, remove the helical/sun gear, rotate it to a different position and re-install the helical/sun gear. Re-assemble gearbox and check rotation smoothness again.

Repeat the above steps until gear rotation becomes smooth. It may be time consuming, but with patient you will eventually find the right position. Thereafter, securely fasten the case screws.



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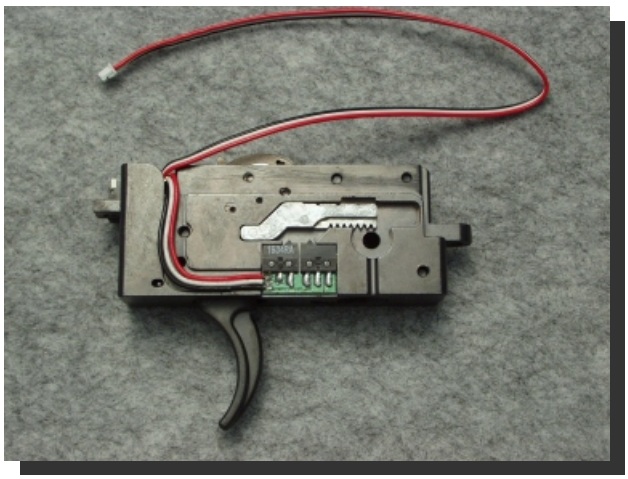
10. Installation of Selector-Rack

Turn gearbox to the left side, and install Selector-Rack (GB-022) to the left-side gear box case as shown. (Your current gearbox won't have the control wires, this photo is just for reference of the rack's positioning). Make sure the selector is at the furthest left of the opening, which is the "SAFE" position.

You have now completely assembled the gearbox.



A Final Word About Greasing

There is always a debate in the factory about how much grease is too much for this gearbox. This subject is particularly interesting because excessive grease will cause binding and decrease operating efficiency, hence resulted in substantially increased motor load. An over-greased gearbox can consume as much as 3-5 extra amp of current! So using the minimum grease required to effectively prevent wear-and-tear is usually the best way to grease this gearbox. Generally speaking, if you can see grease accumulating around the gears as you spin them (i.e. grease getting pushed aside), you've over-greased!