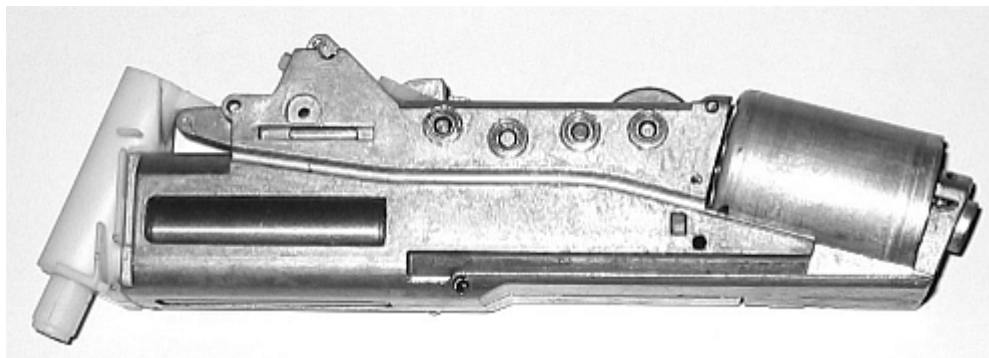


## The rise of the AEPs

Following the successful launch of the Glock 18 AEP, TM is going to roll out a series of AEPs based on the initial AEP mechbox architecture.



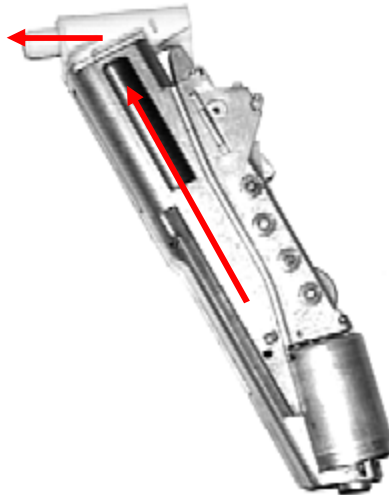
Marui will be carrying the AEP technology over to their upcoming M92F, USP and Desert Eagle!



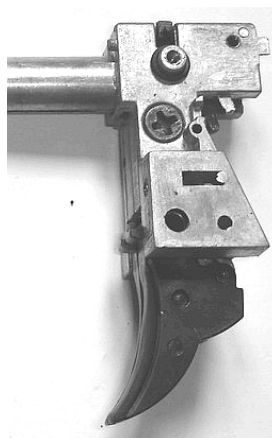
## Advanced AEP Mechbox Guide FULL VERSION



The AEP mechbox has an architecture almost totally different from the “regular” mechboxes. Air flows through a non-linear path and is subject to more “losses” along the way.



*The trigger unit and the barrel are totally separated from the mechbox:*



This guide aims at showing you how to assemble and troubleshoot this new mechbox. Instead of solely focusing on gear shimming, we pay close attention to MANY small and frequently-ignored details (in addition to shimming) that are in fact critical to the smooth operation of your AEP mechbox. We also guide you through the steps required for achieving the best possible air sealing and compression effect.



## **Safety precaution**

Along the process of disassembling/assembling your mechbox, there are chances for unexpected debris to fly out (e.g. when you try to put an upgrade spring into the mechbox, your spring guide may accidentally fly out with strong impact). Therefore:

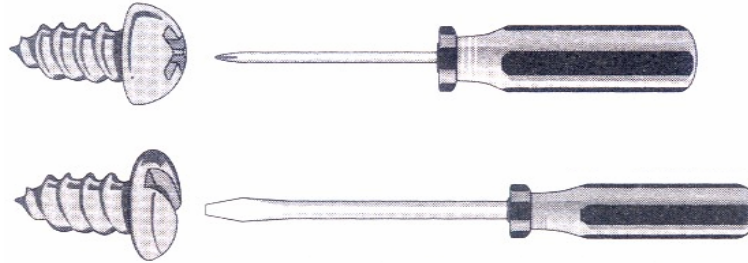
- order your children to stay away from the work area.
- don't work in a location too close to the windows (you don't wanna break the window glass).
- wear safety goggles yourself if you are going to deal with very stiff springs.

Good luck!



## Step 0: Getting the tools you're going to need

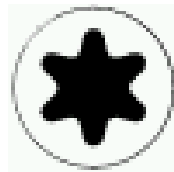
The two basic types of screwdrivers are standard (slot / flat head) screwdrivers and Philips screwdrivers. Make sure you have drivers of different size handy – a whole set of drivers from your local store should cost less than USD\$5 each.



You may come across Torx screws that are pretty small. If you do, instead of getting a Torx driver that fits, you may simply use a small flat head driver. Don't worry, a flat head driver will work just fine with these screws.



*Note: It also doesn't hurt for you to use the regular Philips screws in place of the Torx screws. The Torx screws have nothing special nor unique other than the special screw head layout.*

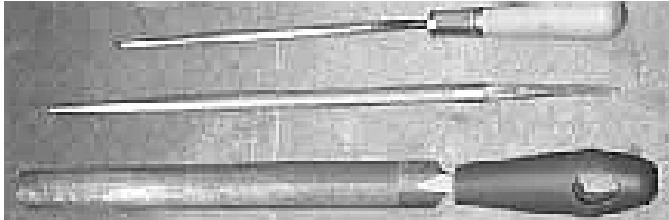


Screws with a centre hole that is hexagonal require the use of Allen wrenches or Hex drivers. To the best of our knowledge, however, no AEP mechbox shall require the use of hex screw. You may find lots of hex screws along the process



of disassembling the gun frame though.

You shall need needle-nosed pliers when handling the smaller mechbox screws and springs. You may also need some assorted files (such as straight edge, rounded and rounded side) for deburring and cleaning the edges of cuts needed for slight modification of certain mechbox parts.

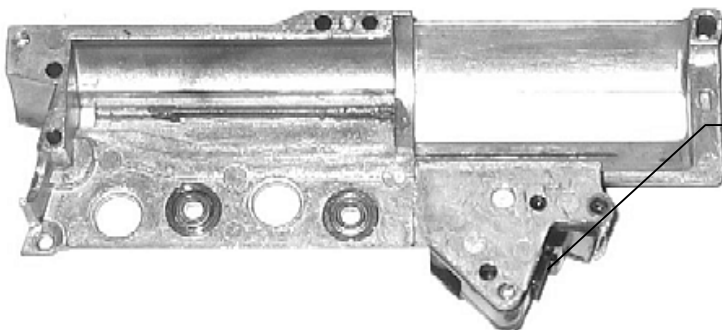
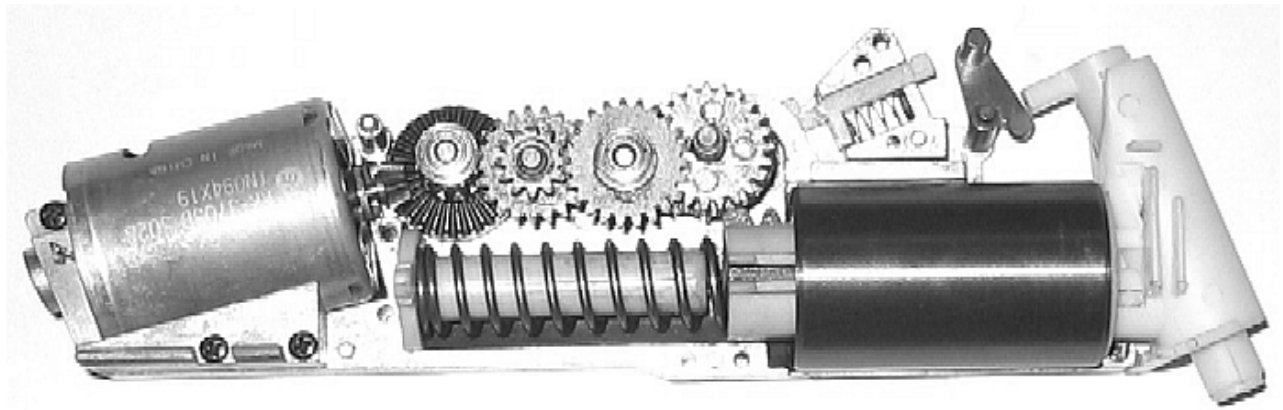
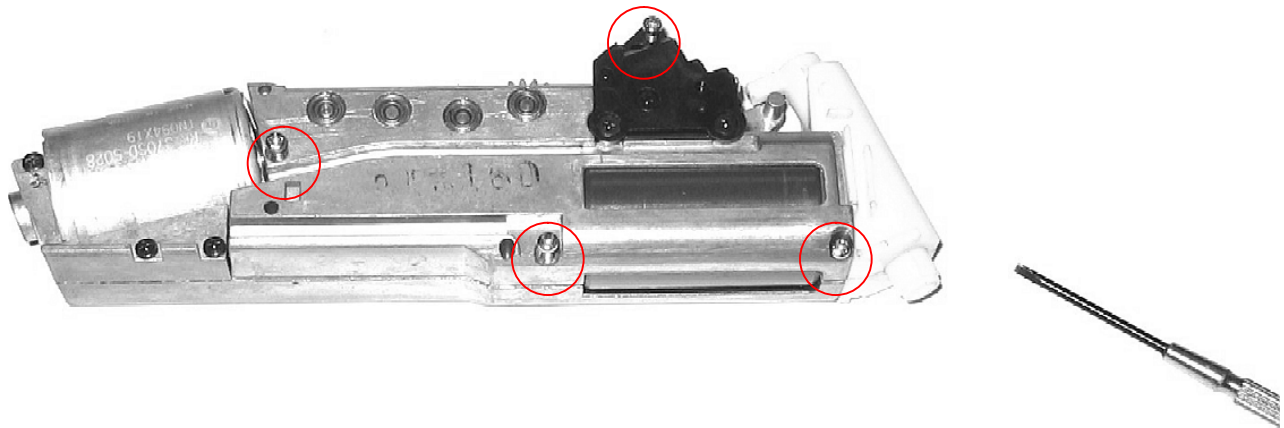


You may need to use a pen shape soldering iron for rewiring the mechbox and the battery connection (especially when you are not happy with the existing wiring or you want to switch to the Deans plugs – the use of Deans plugs as well as proper wiring/soldering techniques are further covered in our **Practical AEG Upgrade** guide). You may also use it to produce small holes on the plastic mechbox parts if an electric drill is not available.



## Step 1: Opening up the mechbox

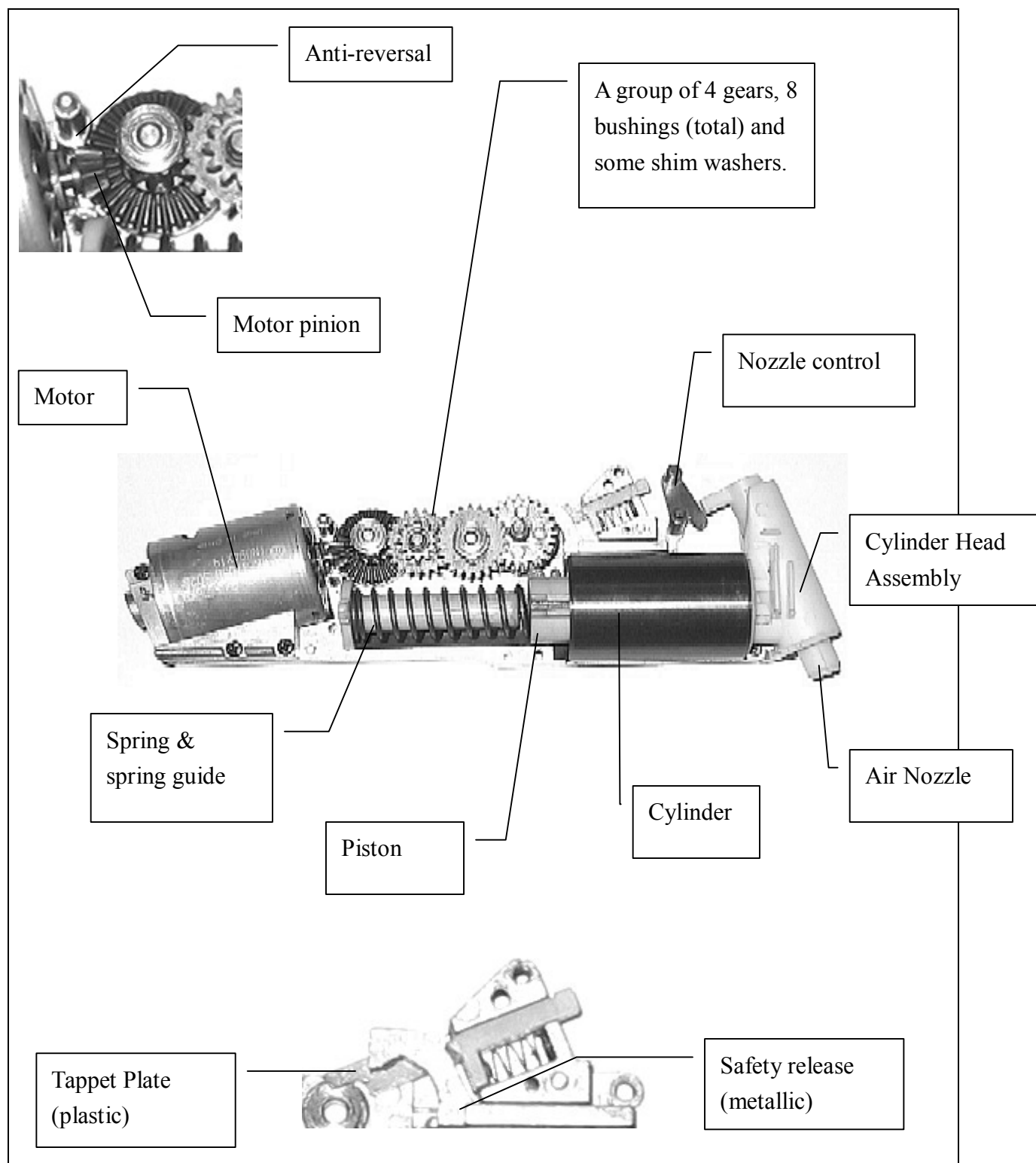
With a small flat head driver of the correct size, remove the 4 screws and then gently open up the shell.



Electric switch box



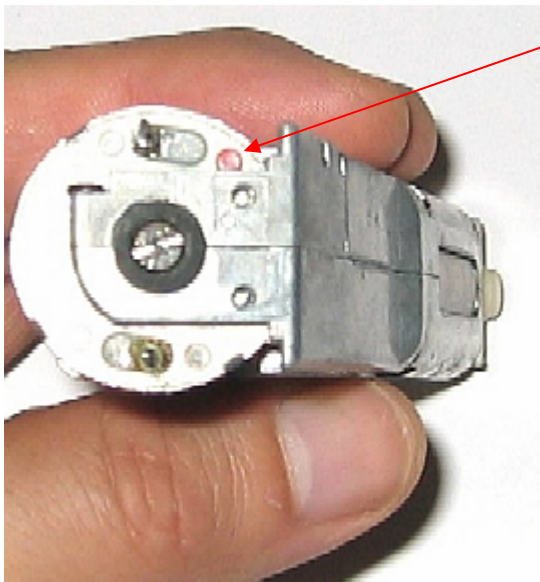




**In case you need to re-route the wires for external battery connection:**

We strongly suggest that you first get all the necessary soldering works and wire connections done before assembling the mechbox. Depending on the gun model and the planned location of your battery, you'll need to plan the length of the wires for battery connection carefully. You must also plan the length of the motor wires – remember, the wires need to be properly routed inside the gun frame before reaching the motor (to avoid getting in the way of any moving parts along the assembly process), therefore it is always preferable to keep the motor wires a little longer than required. Due to the small room inside the gun frame and the relatively low power requirement, you don't really have to use thick wires. AWG 18 wires are fine.

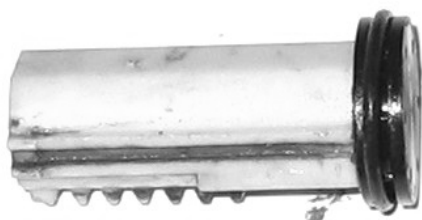
**Warning:** don't mix up the pos / neg wires. Use red wire for pos(+) connection and black wire for neg (-) connection. At the cap of the motor you should see the pos side painted in red.



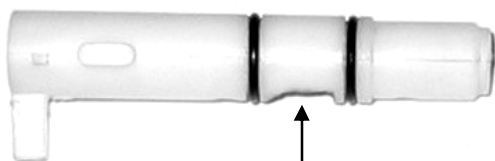


Cylinder, piston, air nozzle, spring guide and spring:

The cylinder set and the piston (the picture shows a Nine Ball upgrade piston head and air seal cylinder):



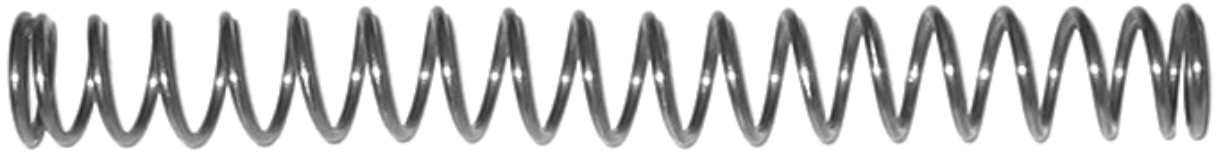
The air nozzle:



Air goes in via this opening.



The stock spring:



*Note that by using the Nine Ball power upgrade spring constantly for full auto firing you may accelerate damage to the cylinder head and the sector gear.*

Spring guide and washer:



You need to pay particular attention to several issues here:

1, Does the air nozzle have a smooth fit with the cylinder head assembly? A loose fitting will fail to seal air, while a tight fitting may lead to nozzle breakage or jamming. The key here is whether the two O Rings have been properly lubed, and whether they have been subjected to excessive wear and tear:



Keep in mind that the AEP mechbox is different from the regular AEG mechbox in that its air nozzle goes **INSIDE** the cylinder head assembly. Therefore, the outside surface of the air nozzle is directly in touch with the inner side of the cylinder head assembly. Improper lubrication coupled with extended use can

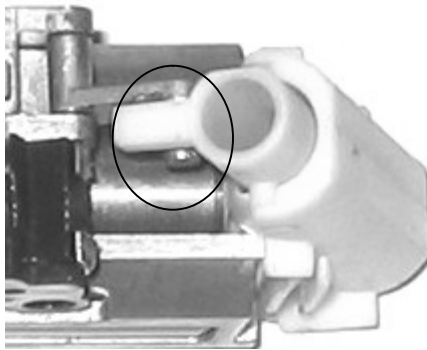


lead to wear and tear on both (as both are made with plastic).

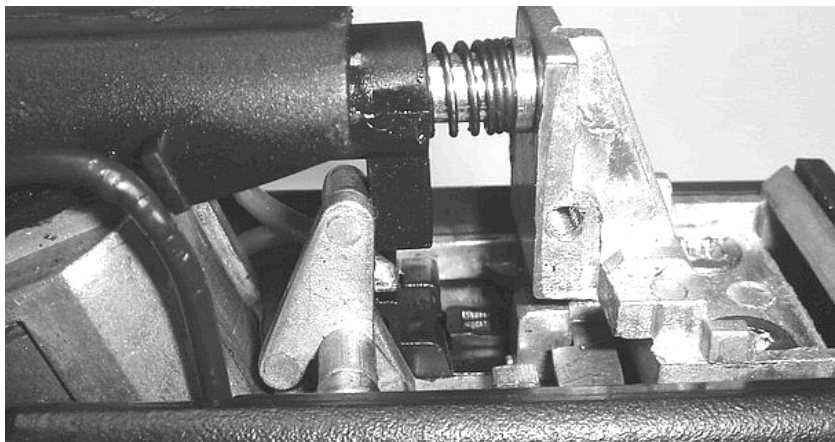
*Having one of them replaced with metallic part may not be desirable as it will accelerate the wear and tear of the plastic part.*

Keep a very thin layer of grease around the air nozzle for lubrication. Re-lube whenever necessary. Do NOT over-grease or some of the grease may block the air passage.

Tip: the back end of the air nozzle has a small plastic tab to be driven by the nozzle control lever. You can always insert the air nozzle into the cylinder head assembly AFTER the mechbox is fully assembled.

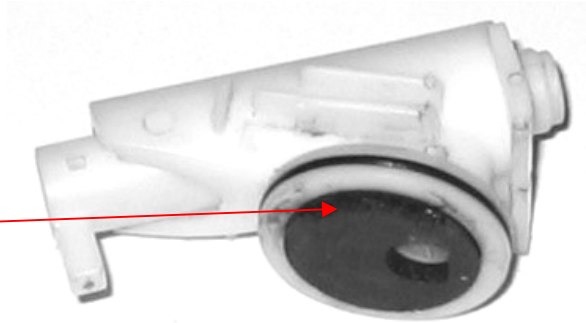


For your reference: This is how the piston works when installed.

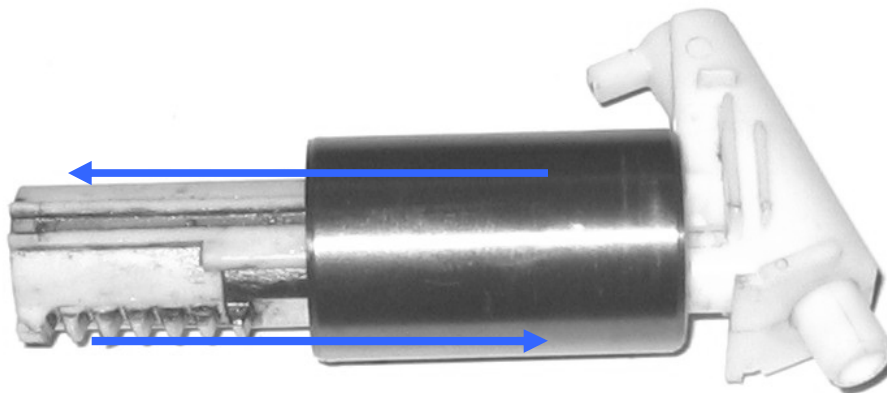


2, Has the cylinder head been damaged (it can happen due to the use of a stiff spring)? If it does, get a replacement before moving on. Also apply some grease evenly around the cylinder head O ring to improve air sealing.

Small damage  
found here.



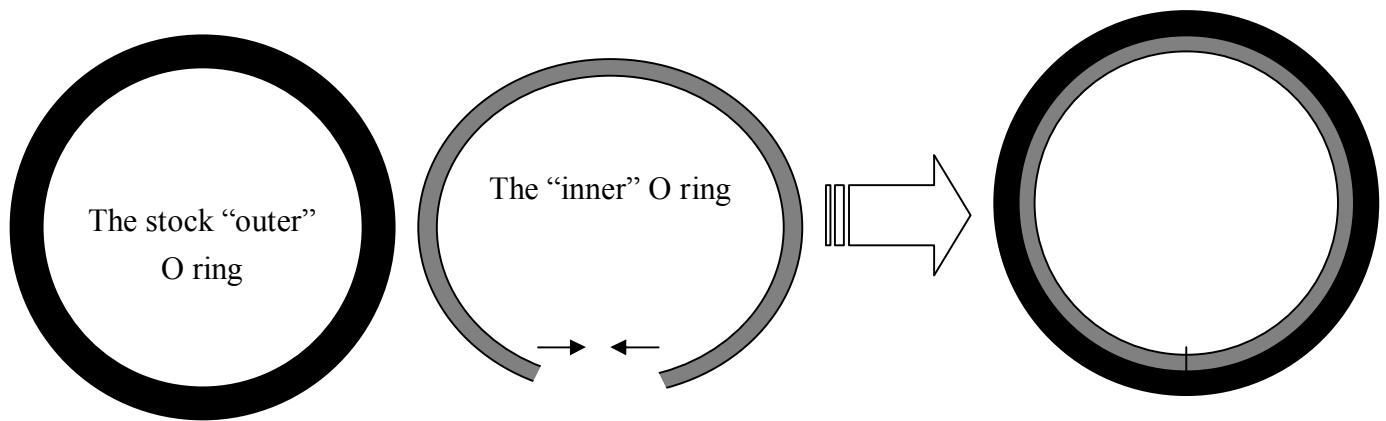
3, Test fit the piston with the cylinder. When you move the piston inside the cylinder you should feel a certain level of resistance. If there is no resistance at all, the piston O'ring is no good (it is allowing too much air leakage, which can result in real serious performance drop). On the other hand, if there is too much resistance, the spring will have a hard time pushing the piston and will lead to both FPS drop and ROF drop. Based on our experience, the stock TM piston is one of the best in terms of air sealing. However, wear and tear is unavoidable and the O ring has to be replaced on a regular basis (per every 30000-shot as a recommendation).



When buying a new piston O ring, by all means take your current cylinder / piston set with you to the hardware store and try things out on the spot. You want an O ring large enough for a slightly tighter fit with the cylinder (so you can improve compression), but at the same time you don't want an O ring that is too large. An over-sized O ring will make it very hard for the piston to move inside the cylinder and will increase the load of the motor and the battery quite significantly.

*\* Remember to also check the inner diameter of your replacement O ring. If it is too large (an inner diameter almost as large as the overall diameter of your piston head is way too large), it may fail to sit inside the "channel" of the piston head during rapid piston movement. If part of it comes off, your mechbox will immediately jam.*

*What if you can't buy a piston head O ring of a suitable size? One little trick is to buy a smaller and thinner O ring, then cut it short a little bit to make it just long enough to wrap around the inside of the piston head.*

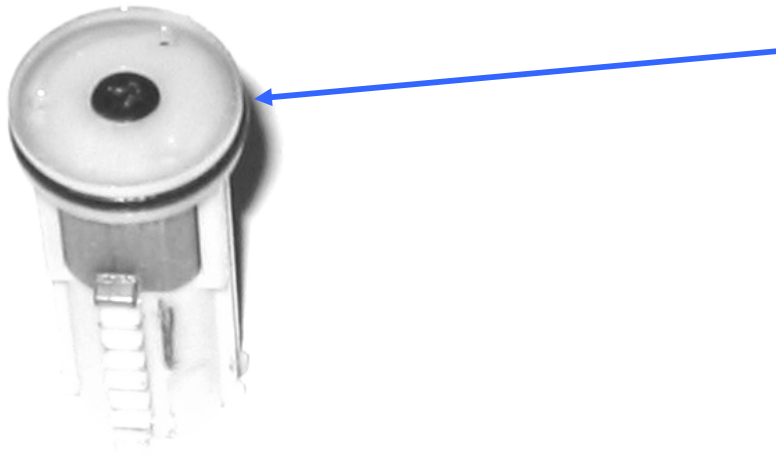


*Put it in first, then put your stock O ring back in (so your stock O ring can wrap around the thinner O ring). This way you can slightly increase the effective dimension of the "outer" O ring (for better compression) and at the same time retain some "flexibilities" without introducing too much friction along piston movement (an oversized O ring can produce too much friction and lead to fast wear and tear on the O ring rubber as well as serious FPS drop).*

Applying grease around the piston head O ring is a measure primarily for ensuring smoother movement – with proper lubing the O ring can have less wear and tear (and can last longer). Most of the time you should not need to replace the O ring unless FPS drop becomes apparent. Do keep in mind, an O ring that fits with the cylinder tightly WILL wear faster due to more friction imposed

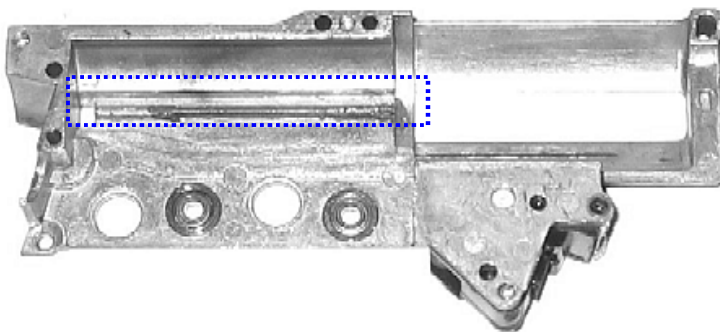


on it during piston movement.



You may also apply grease around the cylinder head for better air sealing. Since the cylinder head does not move, in theory its O ring should not wear out by itself. Still, you may want to regularly check and reapply grease around it if necessary during your regular maintenance effort.

Also pay attention to the side stripes of the piston. Perform test fitting prior to formal assembly. You must be able to get the two halves of the mechbox shell perfectly closed and at the same time allow the piston to slide smoothly. Proper lubrication along the side rail is critical here.



4, If you are using a custom made spring (don't get me wrong, I have nothing against custom made spring), before installation you need to test fit it both sides



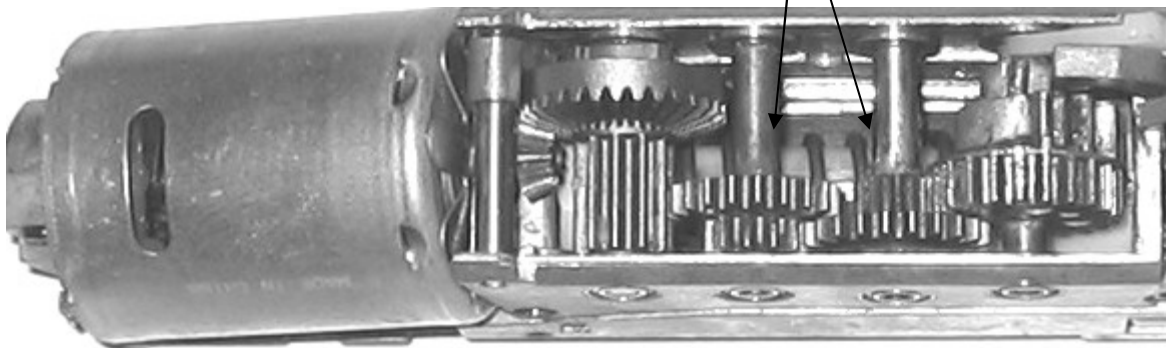


with the spring guide. This is because along spring compression most part of the spring will eventually be in touch with the spring guide and if any part of the spring does not fit with the spring guide your mechbox will get locked up eventually. **Remember, a good fit should allow all parts of the spring to freely rotate along the spring guide (especially when the spring is fully compressed).**

5, After about 20000~25000 shots, check the spring for use by the anti-reversal. You may need a replacement.

### Gears:

The AEP mechbox uses 4 gears (there are 2 spur gears in between the bevel gear and the sector gear).

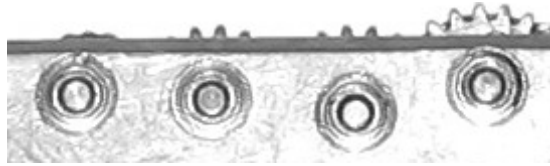


If you are replacing some or all of the stock gears with third party gears, always try to mesh the gears by hand and see if they fit together well. In fact it is always suggested that you buy all four gears from the same manufacturer to ensure the best possible fitting.

### Metal bushings / bearings:

The AEP mechbox uses 8 plastic bushings by default (two for each gear). Our example mechbox uses ball bearings, which require regular lubing (silicon oil spray preferred here):





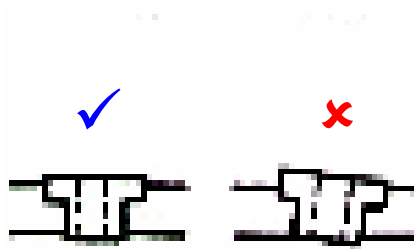
Not all bushings / bearings are of exactly identical dimension. Therefore, you have 2 issues to deal with here:

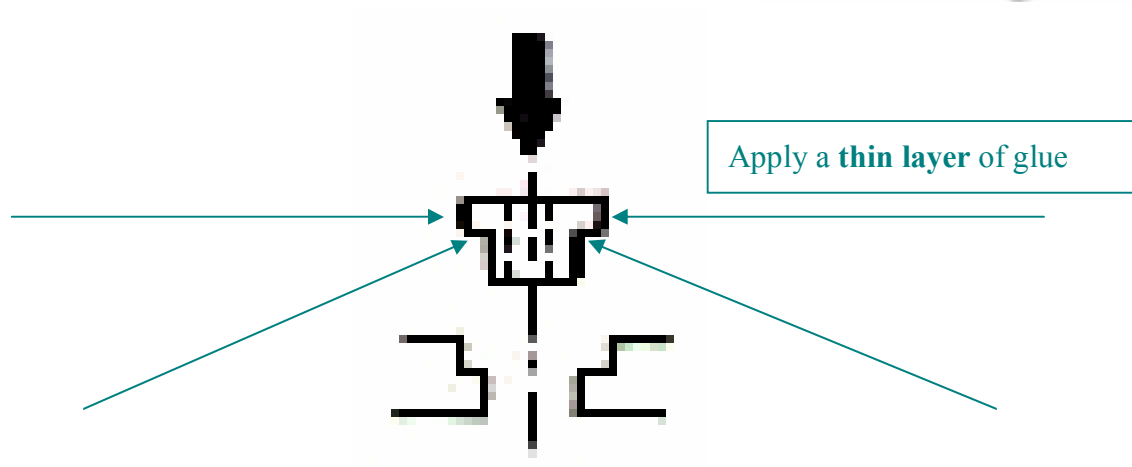
1, Compatibility with the gears: test fit the gears with the bushings/bearings and make sure that the bushings/bearings can comfortably accommodate the gear axles without much "play". This is especially necessary if you are buying ball bearings from the local bearing shop.

2, External compatibility: test fit the bushings/bearings with the mechbox shell. They should NOT be allowed to easily spin on the place holders.

If the bushings/bearings are OK, then let's follow the advice presented in our **Practical AEG Upgrade** and have them firmly inserted into the mechbox shells:

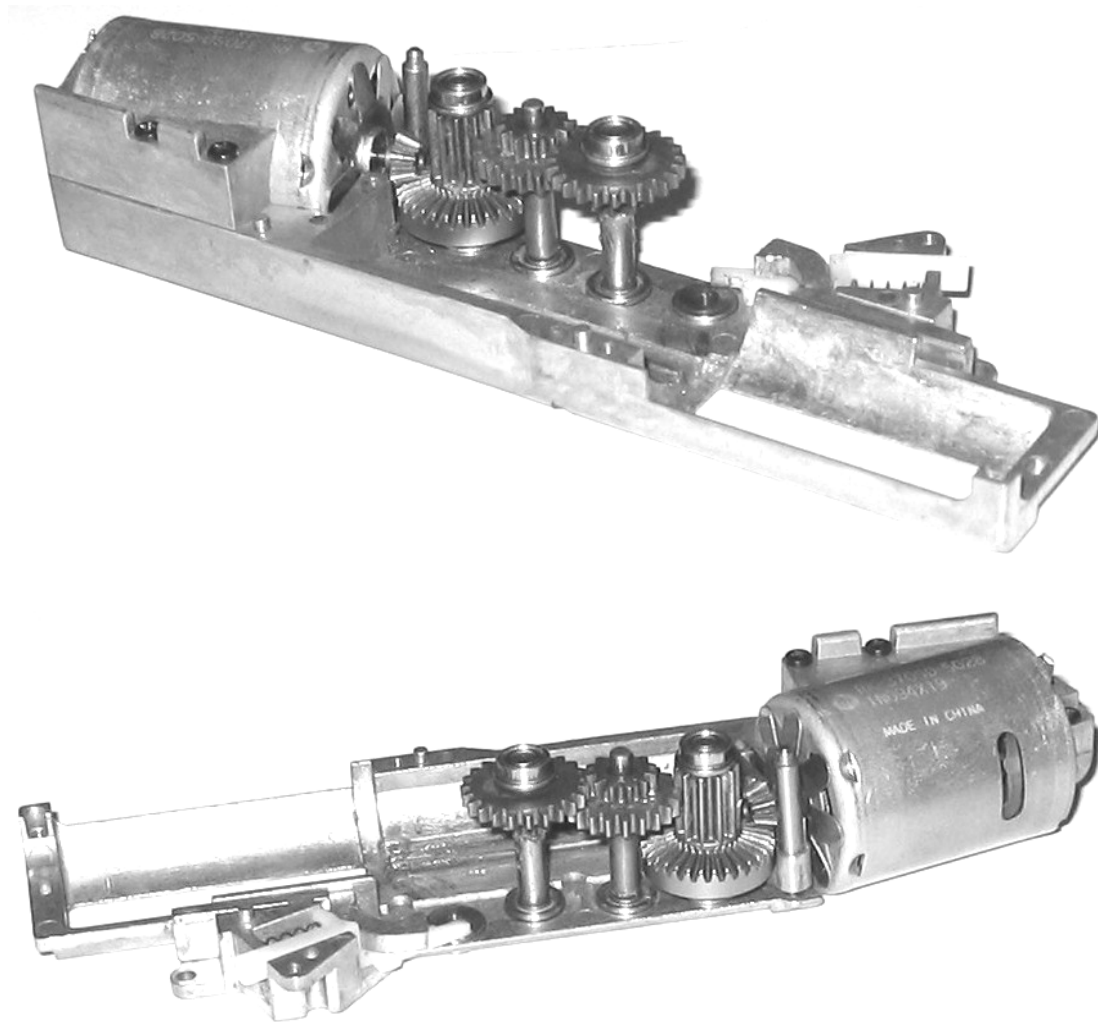
*When installing new bushings, make sure you have them properly aligned with the place holders. Additionally, we recommend that you glue them in place, or otherwise they may go loose and spin together with the gears after prolonged use.*





## Step 2: Shimming

Start by removing everything on the mechbox shell except for the bushings and the safety release/tappet plate. By removing almost everything on the mechbox shell you can focus solely on the insertion and shimming of the gears (and the anti-reversal). An almost empty shell gives you a clearer view of the gears in action.

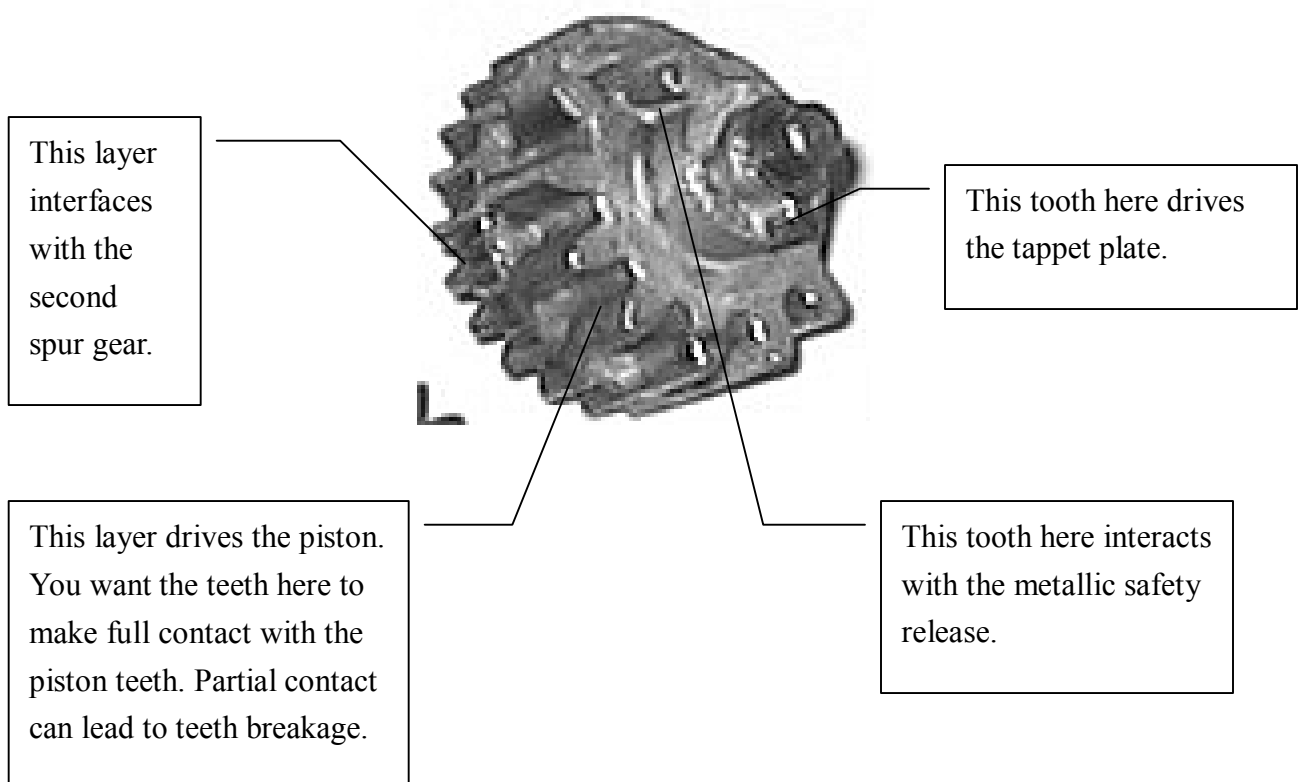


The reason why you need to carefully shim is that different makes of bushings



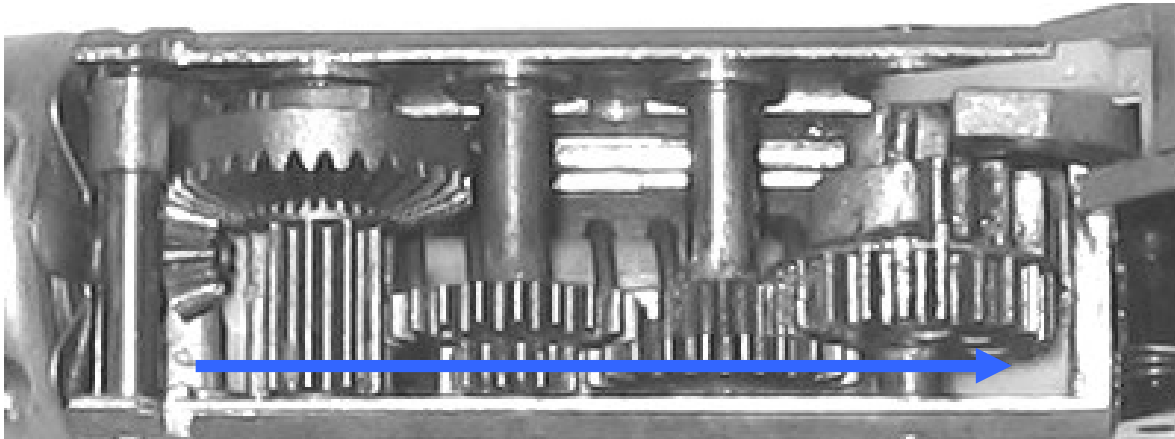
and gears all have small variations in “thickness”. Some gears may require a 0.1mm shim washer on one side while some others may require totally no washer on the top at all.

We recommend that you start shimming from the sector gear because it is the gear that interfaces with most other parts inside the mechbox. The sector gear has 4 layers:



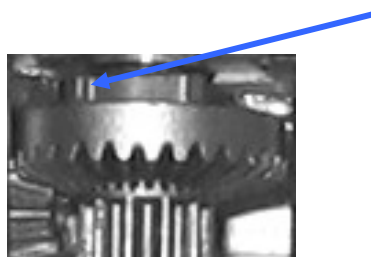
Below shows the gearing sequence (NOT the gear insertion order) of the AEP mechbox:

**motor pinion -> bevel gear -> spur gear 1 -> spur gear 2 -> sector gear**



Be careful when shimming the bevel gear. You must ensure that the anti-reversal latch can maintain proper alignment with it. This issue is often ignored by beginners – a latch with improper alignment can damage or wear out real fast.

*\* The bevel gear interfaces with the anti-reversal right above the bushing:*



Another frequently ignored issue: when you shim the bevel gear pay attention to how many washers (and how thick these washers are) you put at its bottom. Remember, the motor pinion has to get in touch with it in order to turn the other gears. You cannot adjust the vertical alignment of the motor pinion, therefore if





the bevel gear is shimmed too high the contact with the pinion may become too tight for the motor to turn.

When shimming has been initially completed you need to determine if any of the gears have been over-shimmed. As said in our **Practical AEG Upgrade** guide:

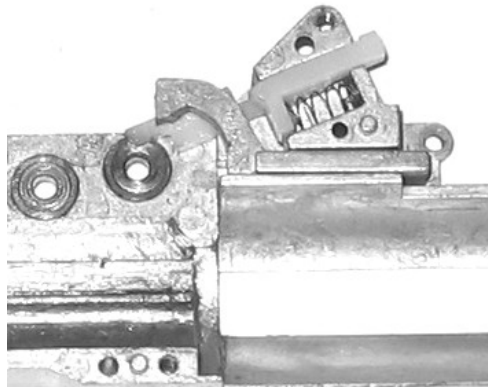
*If you have difficulties putting the two halves of the mechbox back together, chance is that you have put too many shims somewhere. One extra needless shim on either side of any one gear will usually make it impossible for the two halves to perfectly close.*

Hold the 2 halves together tightly and see if the gears still have room to “play” from both sides of the shell. If they are okay initially, then tighten up the mechbox with screws and retry. If they can spin smoothly without much “play”, write down the current setting on a piece of paper, remove the gears and washers and move on to the next step.



## **Step 3: Installing the tappet plate and the cylinder set**

Assuming all bushings/bearings and shim washers are in place and that the motor/bevel gear/anti-reversal are all set (we will talk about gear insertion in the next section), you may now put in the tappet plate (and its spring) and then the safety release.



Note that:

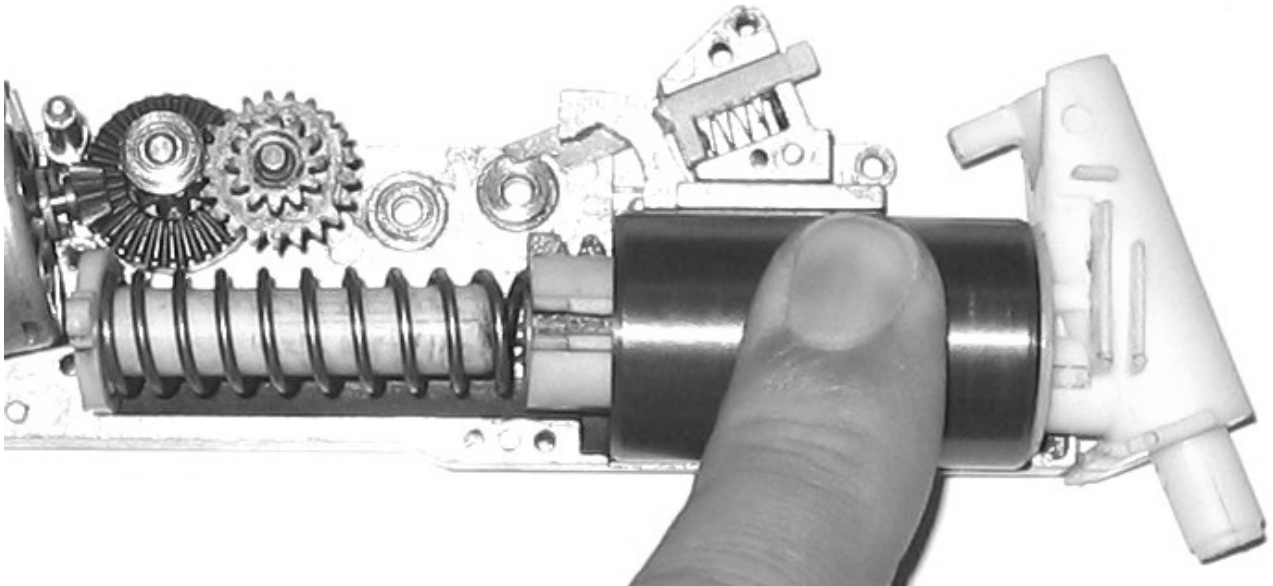
- the tappet plate spring, after prolonged use in full auto mode, can eventually get weakened, which can affect ROF. A stiffer replacement can contribute positively to ROF as the tappet plate can move outward faster, but at the same time it has a slightly greater chance of breakage. Don't use anything significantly stiffer here, and absolutely avoid using one that is softer than the stock one.
- you need to lube both sides of the plastic tappet plate with grease.
- you need to lube both sides of the metallic safety release with grease.

You need to have the tappet plate comfortably sit on the mechbox shell. Test



moving it. Make sure it can slide smoothly.

The next step is to install the cylinder set and the spring / spring guide. It is recommended that you do this prior to inserting the sector gear.



Our **Practical AEG Upgrade** guide covers in-depth the issue of spring, spring guide and piston fitting.

*To minimize the chance of running into problems, when installing a long spring you should remove any spacer on the spring guide (OR inside the piston). While a ball bearing spring guide is a good idea, it itself is also a spacer with significant thickness.*

If you are using a stiff spring like the Nine Ball power spring, then don't add any spacer – the spring is already very strong for the system to sustain...



## Step 4: Installing the gears

The suggested order of gear insertion (assuming you have to install every gear from scratch, and that you have already test-shimmed the gears so you know the proper amount of shim washers to use for each gear):

1. Bevel gear, anti reversal and the first spur gear (the spur gear right next to the bevel gear)
2. Motor and motor pinion

-- setup the tappet plate, the safety release, the cylinder set and the spring guide set

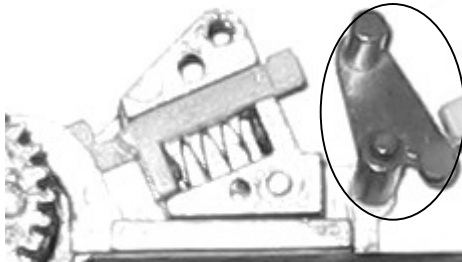
3. Sector gear
4. the second spur gear

\* It is hard to insert the sector gear without first installing the cylinder/tappet plate/piston. It is impossible to insert the second spur gear without first inserting the sector gear.



## Step 5: Completing the installation process

Once all the gears are in place, you may put in the nozzle control lever.



Finally, close the mechbox.

Note that for the AEP mechbox the issue of “one O’clock gear timing” does not really exist. The reason is that at the time you put in the sector gear the first three layers of the sector gear must have interfaced with the tappet plate, the safety release and the piston correctly. You just can’t go wrong with this.

