

## Benelli .22 Pistol Extractor Tuning

Benellis are wonderful target pistols, and CAN be extremely reliable. However, the extractor mechanism can be prone to problems without some tuning. I own two MP90S's, and maintain over 20 Benellis for a college team, so I've had the opportunity to learn a lot over the last 20 years. I've tried to distill what I've learned below. In addition to the shape of the extractor tip, there are several other areas that may need attention to get the maximum reliability from your pistol.

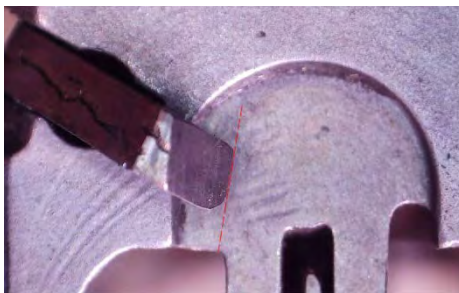
**Extractor Tip Grinding:** Here is a photo of three different brand new extractors, showing the variation in the shape of the nose you can run into. The edge of the top one has no angle to speak of, and will push the rounds down off the bolt face. The next one has a bit of an angle, but it's not big, and may have problems. The last one has a nice large angle ground on it that should hold the round against the side of the recess on the bolt face.



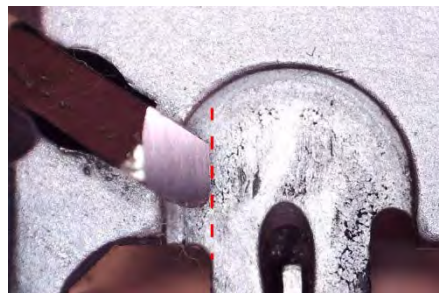
Even if there is a good angle on the nose, it helps if the portion of the edge that contacts the case is sharp so it can dig into the brass a bit. In part because of the plating, none of the extractors shown are very sharp. Because there is plenty of over travel in the design, you can stone the nose back quite a bit without affecting anything. You do NOT want to sharpen the hook by grinding the underside, which would allow the cases to slip further forward. You don't want to remove any more metal than is absolutely necessary. A fine hard Arkansas stone is good for minor adjustments. You may find that you have to remove quite a bit of metal, in which case a fine or even medium grit India (aluminum oxide) stone will be more efficient.

Before getting into sharpening the edge, you want to double check the angle, because adjusting that can require stoning the same edge, and once you done that, further sharpening isn't necessary. Because the extractor swings down at an angle, the geometry of the edge where it contacts the case is critical.

The direction the extractor edge wants to push a case can be described in terms of a negative, neutral or positive angle.



"Negative" Extractor Angle



"Neutral" Extractor Angle

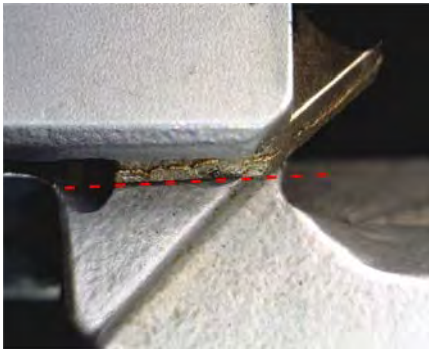


"Positive" Extractor Angle

Having run into extractors with an extreme "negative" angle that actually pushed the rounds down off the bolt face, I was initially concerned with avoiding that. A positive extractor angle will help to hold the case up into the rim pocket, and I

experimented with that. However, in the Benellis, there is another factor at work that turns out to be far more important than whether you have a slight negative angle on the tip.

The extractor system is built so the extractor tip will usually contact the inside of the extractor slot in the barrel, deflecting the extractor tip off the case. The photos below show an extreme amount of deflection when the bolt is closed.



Extractor w/o case (bolt open)



Extractor with fired case (bolt open)



Extractor deflected by barrel slot

How far the extractor gets deflected depends on how well the angle of the extractor tip matches the angle of the inside of the slot in the barrel. On one of my Benellis, this corresponds to an extractor angle of about  $-4^{\circ}$ .



As best I can tell, the factory extractor angles tend to run slightly more negative than this, at about  $-10^{\circ}$ . Apparently there is enough friction between the case and the bolt face that this doesn't cause problems of pushing rounds down off the bolt.

An extractor I installed in my Benelli last year had been ground to give a positive angle of  $\sim 7.4^{\circ}$ . About 300 rounds after a thorough chamber cleaning, I started to get extraction failures. The extractor was letting go of the case when it was only part way out of the chamber:



Because of the angled extractor design, actually measuring the deflection is tricky. It also turns out that the extractor gets pushed to the rear slightly before it begins to deflect sideways. I came up with an approach using a dial indicator magnetically attached to the bolt that (with care) can give fairly repeatable results. I measured the extractor deflection on a fired case and got 0.31 mm (0.0122"). That is about half the width of the rim. If the extractor can't swing back into



position quickly enough, it could be trying to hang onto just the rounded edge of the rim. When I reground the extractor to match the  $-4^\circ$  angle of the slot in the barrel, the deflection dropped by over a factor of three to 0.09 mm (0.0035"). Here's what the tip looks like by itself, and holding onto a case:



There are two important things to notice:

- 1) The case is not all the way at the top of the rim pocket. Depending on the fit of the slide to the frame, there is no guarantee that there won't be a significant gap above the rim when the case comes out of the chamber.
- 2) In part because of that gap, the point where the extractor contacts the case can be well below the center line of the extractor. Most of the factory extractors have a large radius ground on the lower corner to help a case push the extractor aside when a round is sliding up into the bolt face. When regrounding an extractor, the edge has to be ground back far enough so that the contact point with the case is above what remains of that radius. Otherwise, the deflection will be increased, and the effective angle at the point of contact will be overly negative. The good news is that grinding the extractor tip reduces how far the round has to push it aside, and very little radius is actually required to ensure reliable feeding. The rounds will tend to roll up into position without having to push the extractor sideways by sliding.

Without cleaning the chamber, I reassembled the pistol with the  $-4^\circ$  angle extractor, and the failures disappeared. I've fired over 480 additional rounds with the reground extractor with no malfunctions.

The factory angle of  $\sim -10^\circ$  clearly works OK, but if you do the math, the  $6^\circ$  difference is enough to contribute about 0.2 mm (0.008") of additional deflection when the slide closes. If you aren't experiencing extraction failures, I wouldn't worry about modifying the extractor angle unless you want to squeeze every last bit of performance out of things. I'd also check the angle of the slot in the barrel to make sure they didn't change the design or tooling at some point. I'm working on a sample of one at this point, but I will be trying this modification on several other pistols in the future.

**Plating & Stamping Defects:** Many of the extractors are nickel plated, and the plating quality on them can vary considerably. It's not at all uncommon to find some plating chipping off an extractor, which can interfere with smooth operation. Using a sharp tool, try to pry off any loose plating that you can, and then stone the sides so they are reasonably smooth. Trying to remove all the plating isn't necessary, and will thin the extractor enough that it will loosen the fit in the slot.

The Benelli extractors are stamped from sheet stock, and the process leaves the edges rough, often with a ragged groove running around the perimeter. Depending on the shape of the extractor tip and how high the cases sit in the bolt pocket, the stamping defects can land right where the tip hits the cases. This doesn't seem to cause problems directly, but I have encountered an extractor where the edge was weakened and chipped right where it hits the case.

**Extractor Hole Burrs:** Some bolts have machining burrs left in the hole for the extractor spring & pin. The extractor should swing back & forth smoothly under thumb pressure. If you detect any roughness in the action, start by giving it a good cleaning, but while you have it apart, check the hole for burrs.

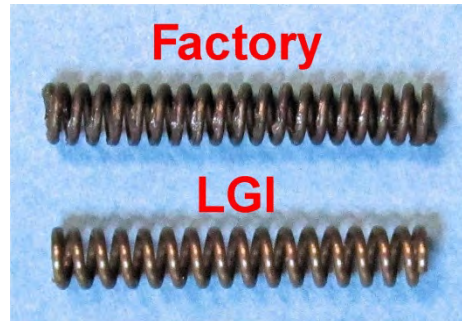
The hole is  $\sim 2.6$  mm (0.1024"). The shank of a new #38 drill bit (0.1015") should slide into the hole smoothly. If you feel any roughness, you will need to fix that. I had one that was bad enough that I had to start with a #39 drill bit (0.0995") to get it all the way in. You can use a #38 drill bit by hand to clean out the worst of the burrs. After that, I lap

the inside of the hole with a fine lapping compound. I use TimeSaver #111 non-embedding compound using the shank of the #38 drill as the lap. Make sure you clean out all residual lapping compound before reassembly. I find that pipe cleaners work well for cleaning the extractor spring hole. Some vintages of Benellis have vertical holes drilled in the underside of the bolts that intersect the extractor holes, and you can use an aerosol cleaner on those to flush out the hole.

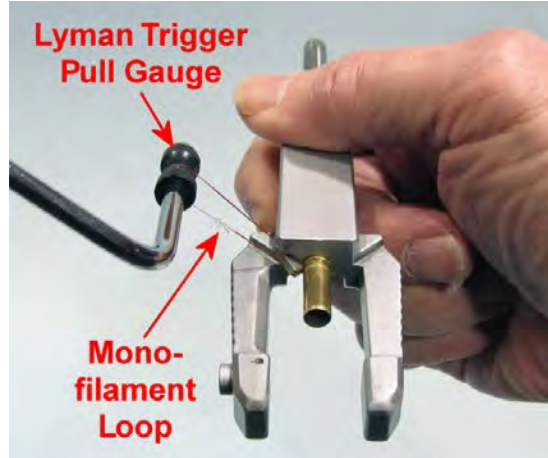
**Extractor Springs:** Larry Carter Larry of Larry's Guns, Inc. (LGI) found that the reliability of the Benelli extractor system could be improved considerably with a stronger spring. Here is a comparison of the Benelli factory extractor springs and the LGI springs:

Benelli: 2.43 mm OD, Wire is 0.041 mm dia, OAL = 14.66 mm, 18 turns

LGI: 2.41 mm OD, Wire is 0.043 mm dia, OAL = 14.40 mm, 15 turns. Wire is shinier than factory.



You can measure the extractor force by using a loop of thin fishing line and a trigger pull gauge (I like the Lyman digital model). Holding the bolt horizontally with a fired case held by the extractor, you pull on the extractor with the loop until the case is JUST released. With an LGI spring, this tends to be around 0.75 kg (~ 1 lb. 10 oz.) of force. The Benelli factory springs run closer to half a kilogram (~ 1 lb. 2 oz.) or less.



Over time, the extractor springs can wear, or get compressed and lose a bit of force. The stronger springs give plenty of margin to ensure reliable operation for many years.

Another thing to watch out for is that Benelli has made small changes to the extractor design over time. The depth of the hole has varied a bit, and apparently the newest extractor pins are longer than they used to be. I suspect this was done to increase the extractor force while using the original spring design. Some people have also tried to increase the spring force by putting a ball bearing in the bottom of the hole. My Benelli has one of the shallower holes, and trying this with an LGI spring wouldn't allow the pin to go in far enough to install the extractor.