

Magazine Checks

Dusting off a few proven techniques for improving accuracy.

by Joe Carlos

When I came on as Armorer for the Army Reserve Marksmanship Program I machine rest tested 135 National Match uppers and only 39 shot MOA. The Reserves didn't previously have an in-house maintenance program and lacked parts so I substituted sweat (mine!) and eventually cut group sizes in half. When I left the Team a decade later all 135 of those uppers shot sub-minute groups with some type of ammo if tested properly. This article is not so much about shrinking groups as getting all of your groups (rifle or pistol) to hit to the same point of impact (POI.)

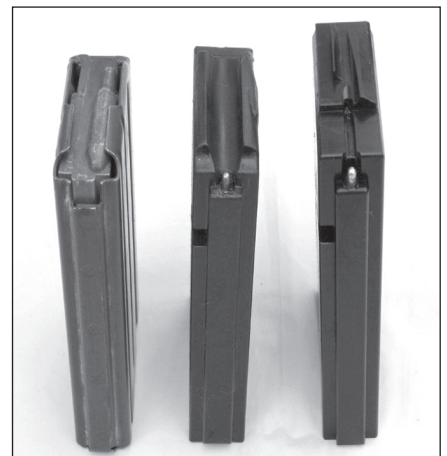
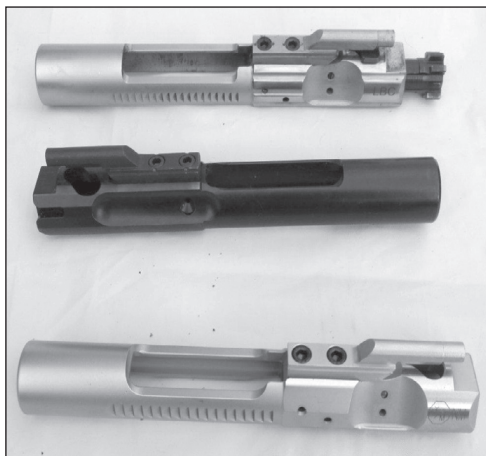
Magazines, integral or detachable, work by using a spring to push a fresh round up in front of a bolt or slide. That cartridge is then pushed into the chamber either manually or by a compressed spring. The magazine under the bolt is exerting upward pressure on it. If one magazine exerts a different pressure on the underside of a bolt or slide it can result in POI changes as compared to other magazines. Most magazines

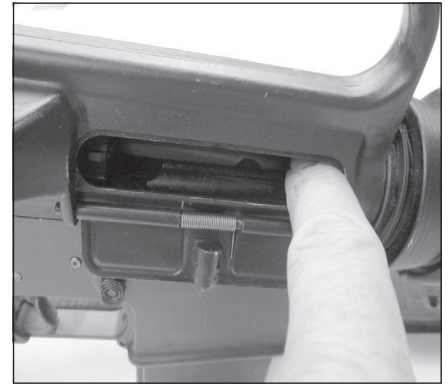
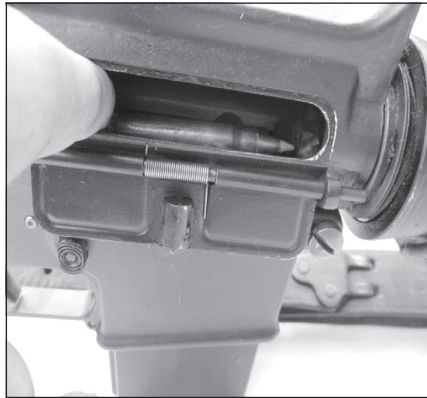
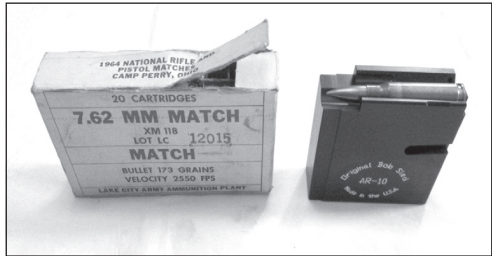
have feed lips, followers, and springs which influence feeding and hence the orientation of the cartridge in the chamber and the pressures that the bolt or breech face, extractors, and ejectors exert on the rims of casings. Those differences can also influence down range bullet impacts. High capacity double stack magazines feeding rounds alternately from right to left at an angle, such as the M1A and AR-15 rifles, likely have the potential to exacerbate differences in orientation and pressures on case heads. There have been firearms that fed from the side. Most of these were military guns that ultimately fell out of favor. I have never heard of this design causing POI problems but many of them have been submachine guns used in relatively close quarters.

I said that magazines work to change down range bullet impact

in part by varying upward pressures that all of them exert on the bottom of the bolt carrier. Locking a charged magazine in an AR-15 with the bolt forward demonstrates this, as you'll notice the carrier move upwards just as the magazine locks in place, compressing the top round downward. When the top round is positioned on the left the carrier will also want to rotate clockwise a bit but it's unlikely you'll be able to see it. When the top round is on the right the rotation will be opposite. You can also perform this test with pistols and see the back of the barrel or the entire slide react. There will be more movement in rack grade pistols as match pistols usually have most visible slop removed by the builder. That doesn't mean that upward pressures can't influence in POI in accurized pistols, however.

Below left: Double stack magazines such as the M14 (left) and AR-15 feed from opposite sides alternately which can result in rounds being oriented differently in the chamber and on the bolt face. The M9 magazine on the right feeds all rounds straight in. **Below center:** True match bolt carriers (from top) from Les Baer, JP Rifles, and Young Manufacturing. **Below right:** From left, standard AR-15 magazine which is spring actuated, single round Bob Sled AR-15 magazine which exerts no upward force on the bottom of the bolt carrier, and a .22LR single round Bob Sled magazine from Compass Lake Engineering for use with their very good dedicated .22LR uppers.





I dealt with match bolt carriers in “AR-15 Upper Quick Fixes: Match Bolt Carriers” (May 2014) and mentioned three match carriers I have used that increase bearing surfaces and give fatter front dimensions. When going through guns currently in my shop and watching for magazine-induced bolt carrier movement, I noticed uppers equipped with match carriers had less upward movement. Since more carrier movement yields greater potential change in POI I would suspect that match carriers may lessen this effect. Unfortunately, when designing my study of match bolt carriers I was short sighted. All I was thinking about at the time was the reduction in group size (8.8% average) and not any positive influence in changes in POI caused by magazines. My bad and what’s done is done.

Or is it? I mentioned at the end of that article that until we can solve the accuracy-robbing problem of bolt carrier in the Stoner platform we’ll never realize full accuracy potential. I’ve been researching potential solutions to this and by observing magazine-induced upward carrier movement I noticed match carriers with anti-tilt pads exhibited much less movement. Experimental anti-tilt pads are already showing 14% average accuracy increases and I’ll begin watching to see if they help with the POI problems as well.

Applying Theories

The magazine test scan (page 15) was a check performed machine rest testing a rack grade Combat Team rifle and three magazines. Note the distance from group one fired with the first magazine and the other groups

Above left: For you grown ups the Bob Sled single round magazine is also available for the AR-10. **Above center:** When shooting single shot slow fire events remember to always push the round up into the chamber with your index finger. **Above right:** Stop pushing the round forward when your index finger comes to rest at the front of the ejection port. This will insure more consistent round positioning and enhanced grouping.

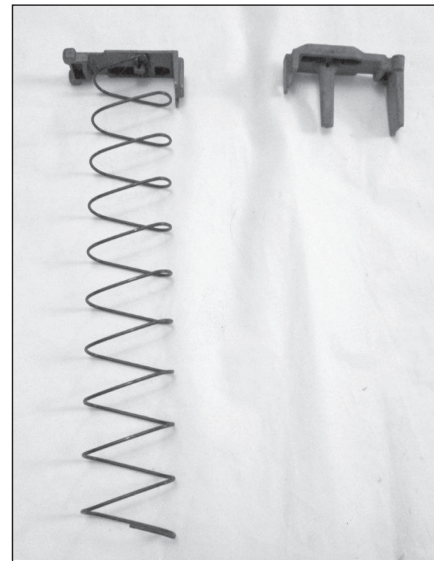
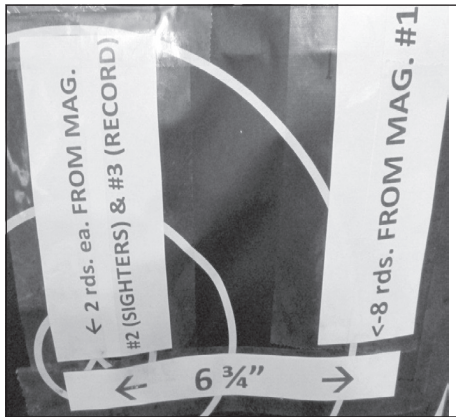
each fired with different mags is 2-1/4" at 100 yards. Many competitive events include reloads and different magazines are needed. To exacerbate matters even further, sighter rounds are offered in some events and some shooters elect to different magazines for that. I recommend taking sighters with a magazine you’ll use when shooting for record. Other stages single feed rounds and many shooters use a “sled” magazine with no spring and follower and exerts no upward pressures on the bolt carrier. I recommend using such a magazine where appropriate because no pressure is always most consistent. When single feeding for slow fire always push the round up into the chamber a consistent distance, then close the bolt. Doing so will give you a net average reduction in group size of 13.8% because rounds will be positioned more uniformly in the chamber. Never use a single shot sled mag for sighters if record shots are fired employing regular magazines with springs.

The target on page 14 illustrates why. The 300-yard SR-3 target has a seven-inch 10 ring. If our unfortunate shooter chooses that second magazine for sighters, mag three for the first two for record, and mag one for the remaining eight rounds, the

POI difference is 2.25 MOA and those eight rounds will be centered on the left edge of the 8 ring. Given the average hold of a Master class shooter I’d expect 12 points to be lost, resulting in an 88. This can really confuse and demoralize any shooter. 3 Gun events involving various pistol, shotgun and rifle stages require rapid reloads with multiple magazines. The more magazines involved the greater the chance for changes in POI caused by one of them.

After Viet Nam I was a drill sergeant for many years before moving on as a small arms instructor, shooting team member, and armorer. During range qualifications troops are issued several magazines for the day’s training only to turn them all in at the end. Soldiers may zero and then qualify with different magazines. Compound possible POI error with M855 “green tip” ball (some of the least accurate ammo I’ve used) and it doesn’t help getting hits at distance. I also spent 28 years in law enforcement and was a firearms instructor during all of it. My department qualification course went back to 50 yards and any POI error could certainly have an effect.

The first group I know performing magazine checks was the bullseye pistol crowd. National Match Course



Above left: 300 yard NMC target center showing misplaced group caused by a magazine. **Above center:** Ransom Rest used to conduct magazine checks for pistols like the M9. **Above right:** Old school spring and metal follower from a vintage 20 round AR-15 magazine. Magazines with newer green plastic replacement followers should not be mixed with older issued magazines.

pistol competitors began testing with the Ransom Rest in the 1970s when the 1911 in .45 ACP was king. While it was somewhat affordable for individuals, gun clubs often bought one and shared it among their members. Most all of the big military and police teams also had them. Machine rest testing verified that different magazines would change the POI. Shooters began numbering their mags and checked them on the machine rest. When the M9 was adopted by the military I used my Ransom Rest to document this with those guns.

When I came to the Army Reserve Service Rifle Team in the 1980s as a shooter I heard rumors that other big military shooting teams used their rifle machine rests to perform magazine checks on M14 National Match Course rifles. The Reserves didn't have a rifle machine rest then and contracted maintenance by paying another competing team to do the work. I questioned that particular bit of logic, wondering how many race car drivers would let a mechanic from a competing team tune their engines. As a Team competitor I tested a number of our M14s and never found one that I felt was capable of anything much better than 2 MOA. I had my own M1As, all double lugged and built

by the best civilian gunsmiths in the country. My personal rifles shot rings around our Team guns. Team policy, however, mandated shooting government guns in competition and my scores declined during my time there. I found this very discouraging and ended up switching to the Combat Team, which used rack grade M16s. The effect of magazines on POI remained nebulous during the M14 era. The one good thing that came of my negative experience with military Team guns was that it fueled my passion to never subject shooters under my care to substandard firearms when I became the Armorer.

During my time with the Combat Team the finicky, high maintenance M14s were dropped (yay!) and replaced by the AR-15. The Reserves were still contracting with a competing team for weapons maintenance, however, and many shooters were still unhappy. I had my own commercially-made rifle machine rest and spent the previous decade working on Combat Team M16s and civilian AR-15s, learning the Stoner platform front to back. I had been performing magazine checks on Combat and civilian AR-15s, M9s, and .45s and was confident this would help the Service Rifle Team.

Performing Magazine Checks

Before we describe the process we need to lay down a few simple ground rules. First, exert only those pressures on the magazine that will be in effect when the gun is actually being fired for record. In general, NRA competitions disallow placing the floor plate of a rifle magazine on the ground for support so it would be inappropriate to do so when testing. Other shooting disciplines do permit using the magazine for support and good shooters take advantage of the extra stability. Many matches and almost all battlefield applications require shooters to fire from multiple positions and may exert no pressure on the magazine in some positions while placing a great deal in others. You will need to test those magazines both ways. I like to use machine rests as much as possible. They speed results and I have faith that I am not committing any errors in application of shooting fundamentals that could corrupt my results. Machine rests do not exert pressures on magazines so in testing a weapon that will be fired both with and without pressures on the magazines requires additional testing from position. Those of you without rifle machine rests would likely test the gun supported by sand bags and then repeat with the magazine resting on the ground.



Above left: Adding oil during range sessions or when testing magazines will help insure consistency in bolt carrier velocity and points of impact. **Above right:** This magazine test scan shows 2.25" distance between group centers.

The results that you get are specific to that gun and magazines only! Magazines tested in one firearm can not be relied upon to be free of inducing changes in POI when employed in a different gun. Test magazines in the firearm(s) they will be used with. The AR-15 can throw a monkey wrench in this as it is quite common for shooters to swap uppers around on different lowers. If you perform a check with a given upper/lower combination and then swap them, repeat the magazine evaluation with the different combination.

Pre-sorting magazines can be helpful but isn't a substitute for firing. Only test magazines that have proven to be 100% reliable in feeding, then sort by brand. Charge the magazines and cull any that present the rounds with a cant different than other magazines. Also, insert charged mags into the firearm with the bolt or slide forward and watch for any noticeable change in feel when they seat in place or observable changes in the way the bolt, bolt carrier, or slide reacts. I would also question magazines whose feed lips look different than the rest of the litter. Many shooters keep a few magazines charged for unexpected "go to war" situations. It is said that doing so can cause compressed magazine springs to "take a set" or be weak and are cautioned to rotate periodically. I would also avoid magazines that have remained charged for

over a year in competition. I have AR mags dating back to Viet Nam that still feed perfectly. Some folks succumb to advertising and want to "fix" unbroken things. Older mags with original springs and followers and others with replaced parts can be identified by different spring resistance if they weren't already marked. I would want my competition magazines to be either 100% with original springs and followers or with all new ones.

Put careful effort into getting the gas tube alignment proper with the bolt carrier key. See "Gas Tube Alignment" (March 2014) on how to do this. These two parts will be locked up during firing and the final stages of chambering. There is room for variation in testing and my way is not necessarily the only right way to perform it. Start with a clean, lubricated firearm and don't hesitate to add oil to slides, bolts, and bolt carriers frequently during testing. Magazines need to be clean as well. Use some type of permanent marker to number mags to keep track. I like to test this using three shot groups but that's mostly due to my military background.

Always chamber the first round by the same method you'll use at a match or elsewhere. This is also a key piece of advice when shooting sighters. Decades ago pistol shooters discovered the first shot out of the magazine chambered manually

is different from self-loaded rounds. This holds equally for rifles as well. If your particular discipline calls for you to insert the magazine with the bolt or slide forward and then rack the first round into the chamber that is the way you should be testing. Conversely, if you will be locking the magazine in place with the slide or bolt locked to the rear then do likewise when testing. Always pay particular attention to where that manually chambered first round goes out of each magazine. Sometimes it helps to fire a fourth shot, triangulating magazine-fed shots two through four and if it differs from the first manually-fed round.

The distance for testing will be determined by a number of variables. For method of observation I use a spotting scope and can see .22 holes reliably at 100 yards but am less confident seeing them at 200 under certain lighting conditions. .30 caliber holes can be seen at 200 yards with good optics. Since the AR-15 is my bread and butter gun I test at 100 yards. It is easy to see .22 and up at either 25 or 50 yards in most spotting scopes so either distance is acceptable for testing. I think that electronic targets like Sius-Ascor units (sometimes called "bullet sensors") would be the ticket for performing magazine checks and would really increase throughput as you can isolate specific shots or groups and the software will locate group centers. Alas, most of the units I've seen price out at five figures so you'll likely have to resort to "old school" methods. Wind is another factor and also why I test rifles at 100 yards. For those of you testing pistols you might want to consider 25 yards on days when wind drift at the 50 could be contaminating your data.

Bookkeeping

There are three ways of keeping track of your test groups that I can think of. If you fail to diligently employ one of them all your hard work will surely turn to chaos.

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Magazine Checks ...

(Continued from page 15)

Mental tracking is what I use. I keep track of the bullet locations and from which magazines they were fired in my head. I can only keep that straight for about three groups before clearing the gun and going down range to sketch in the triangles and label. This takes practice and demands no distractions.

The sketch pad method requires marking each shot on a sketch pad or graph paper as it is fired, then marking each three shot group, triangulating and labeling with the magazine it corresponds to. This calls for periodic cease fires when you go down range and label the actual test target using your sketch as a memory enhancer.

The third is to go down range and label each group as they're fired. This has the dual benefit of giving you the most exercise while affording the least opportunity of error, however, it is slow and you'll spend more time walking than actual test firing.

Eventually you are going to have to tack up a new target. I do it ev-

ery time I go down range after nine shots. I pencil a dot in the middle of the new target paper and then overlay that dot in the center of my previous test groups, not considering any groups fired from rejected mags.

You should test and have faith in the absolute maximum number of magazines you will ever be called upon to fire in a match or the number you intend to carry as your load plan for tactical applications plus a few spares. Once a magazine is checked and found OK it will seldom change your POI of its own volition. This assumes that it is not subjected to some type of abuse. If you suspect that a magazine may have been damaged, furlough it temporarily, rotate in a tested spare, and retest later.

To avoid both function and POI shifts in magazines, keep them clean. For some shooting disciplines this will only mean an annual cleaning. Others will require it more often. Be religious about reassembling magazines during cleaning sessions to ensure that the parts go back together the same as they started. Use whatever bookkeeping method you

prefer in order to ensure that springs and followers go back in the magazine bodies they came out of.

The number one cause of POI shifts following a quick magazine change is shooter error. This usually relates to adopting a slightly altered position after the reload which compromises the natural point of aim. The second most likely cause is probably a change in condition. The wind is blowing harder or the sun comes out from behind a cloud, changing the lighting. Magazines run a distant third but they can't be ignored. If a shooter is only encountering a group shift occasionally it's probably shooter error or conditions changes. If it is happening frequently, test magazines. If you don't have the proper machine rest I recommend shifting responsibility for testing to the shooter as trying to test using sand bags or other support is too time consuming for most gunsmiths. At least now you can provide proper advice to shooters on how to perform magazine checks to determine if they are causing shifts in point of impact. **AG**