

RIMFIRE BULLET SEATING DEPTHS

BEN PEAL

October is a busy time on Texas shooting ranges. The weather is beginning to cool and deer season is just around the corner. Some hunters may be satisfied with groups of several inches at 100 yards but many, me included, expect accuracy of an inch or less from our deer rifles. Varmint hunters expect even smaller groups. This is where proper seating depths come in to play and experienced reloaders understand its importance. But have you ever thought about seating depths of rimfire bullets? This is something we take for granted. We who shoot rimfire factory rifles from a benchrest expect a tuned rifle to group .200" to .400" at 50 yards. Those who shoot custom rimfire rifles aren't happy unless all bullets go through the same tiny hole.

There are many factors that influence accuracy, case quality, powder type and charge weight, primers, and of course the bullet itself just to name a few. How these blend together determine if bullets print those tiny groups we all strive for or if they print unacceptably large groups. Many reload their centerfire ammunition not only for economy but because good reloads are more accurate than most factory ammunition. Once we choose the right powder and bullet, seating bullets to the optimum depth is the key to smaller groups. Although we seldom think about it and have no control over 22 Long Rifle seating depths, it isn't reasonable to believe the relationship of a rimfire bullets distance from the ogive to the lands is any less important than that of centerfire bullets.

Rimfire cartridges must be loaded by ammunition manufacturers for use in any rifle chambered for that particular cartridge. Chamber throat lengths, freebore if you prefer, vary according to the way different arms manufacturers chamber their barrels and are a case of what you see is what you get. Recognizing that we could only change the seating depth of 22 Long Rifle bullets by pushing them deeper into the case, there is nothing to be gained by trying because doing so would destroy the integrity of the crimp leading to misaligned bullets with the axis of the bore. I wonder if the American Rimfire Association shooters with their custom benchrest rifles, as dedicated as they are to ultimate accuracy, have their chambers throated for a particular cartridge.

I would be remiss in failing to throw in this tidbit. For some time now I have taken the rimfire ammunition manufacturers to task for designating most inexpensive rimfire ammunition as target ammunition. If your target is a DrPepper can at twenty steps then all this ammunition selling for a few dollars a box and carrying a target label is target ammunition. If your target is a bullseye in most complete events it certainly isn't. One thing that always stood out in a business management course I attended was that dollars rule. And as long as the average Joe can hit the DrPepper can, things aren't likely to change. 'Nuff said!

I have spent a lot of time and ammunition looking for ways to improve the accuracy of this kind of ammunition. Weighing cartridges, something I dislike doing, is used by a number of serious competitors in their search for higher scores. Sorting cartridges by lengths and rim thickness to a maximum variance of 0.001" is the best I have found so far. Even so, these fail to address several important factors. Weighing

doesn't take into consideration tiny differences in powder weights which in turn alter velocities and cause hits away from group centers. Overall length does not consider ogive lengths to the lands. And we sometimes find 22 Long Rifle cartridges with a common overall length such as .987" to have a variance of $\pm .004$ ". You can imagine how this must affect seating depths. One would never knowingly fire centerfire cartridges with mixed seating depths and expect to shoot small groups. Why then should we expect really good accuracy from rimfire cartridges with mixed rim base to ogive lengths? This has been my concern for some time but I haven't tried to deal with it, primarily because I haven't had any way to determine this measurement.

An interesting aside to writing for *Precision Shooting* is the feedback we sometimes get from readers with similar interests. One of the calls I received recently was from a fellow who doesn't shoot competitively but apparently is as dedicated as I am in looking for ways to improve 22 Long Rifle cartridges. Gerry Gereg read the September 2012 *Precision Shooting* article, "New From Hornaday", which evaluated Hornaday's rim sorting gauge and ways of improving accuracy. He thought I might be interested in a gauge he is working on to determine lengths from the base of the cartridge rim to the ogive of 22 Long Rifle cartridges as yet another way of improving accuracy. Early results from firing cartridges sorted with his gauge, the G3 MkII PRO, were very encouraging. Gerry makes the G3 rim sorting gauge as well and asked me if I wanted to try these tools. You bet! I could never pass up a chance to try something new.

Gerry sent both the rim sorting and ogive gauges for me to evaluate with no restrictions on the time required or the ammunition selected. Although I haven't previously used the G3 rim sorting gauge, it has been offered by Sinclair International for a number of years. He is considering offering the G3 MkII PRO ogive gauge commercially and wanted another opinion of how its use affected accuracy. When I received the gauges I was immediately impressed with the quality of workmanship. Both are well made and easy to use.

The rim sorting gauge attaches to the blade of a dial caliper and quickly sorts cartridges with a minimum of effort required to feed, read the dial and remove a cartridge. It also comes with a lanyard to guard against accidentally dropping the gauge, possibly causing a cartridge to fire. This is the fastest gauge I have used for rim sorting.

The ogive gauge fits comfortably in the hand while inserting a cartridge in the measuring chamber at the bottom of the tool. Cartridges are pressed gently yet firmly into the measuring chamber until the dial indicator comes to rest. The measuring piston has sharp edges to penetrate the cartridge lube and allow it to contact the ogive of the bullet. This tool is easily cleaned by removing the measuring piston and cleaning with lighter fluid. The piston is indexed to assure its return to the original setting.

Using the ogive gauge, cartridges may be sorted into those of similar measurements, or a narrow range of measurements, allowing us to select cartridges to be chambered with the ogive at or near the same distance from the lands. While we cannot know the actual distance of the ogive to the lands, we can look for rim to ogive lengths that give the best accuracy with that particular lot of ammunition. By sorting our ammunition this way we can selectively fire one lot for competition and another for practice.

Our competitive program has ended for 2012 and finds me with very little ammunition remaining in my shop. I fire many rounds experimenting with different kinds

of rimfire cartridges and probably shoot a lot more during the year than most. I ordered a small quantity of 22 Long Rifle cartridges for trial from Champion Shooters Supply, a source I have used for several years. They not only carry the better brands of rimfire ammunition, they also carry a full line of Anschutz rifles, receiver sights and a good selection of accessories.

In order to make a fair evaluation of the ogive gauge, several brands of 22 Long Rifle cartridges were selected from mid-priced ammunition that carry the target label. I chose mid-priced ammunition because there is usually more difference in lengths, rim thickness and weights than with the more expensive target ammunition. SK Standard Plus is regularly offered as a target round. Federal Champion is a high velocity cartridge. Remington Target has been around for many years and will be included. Eley Target is a round that is used by many clubs for introductory marksmanship and skills development. Most of these cartridges are used by local shooters for both plinking and competition. Retail costs vary from as little as \$2.50 per box for Federal Champion to \$6.00 per box for Eley Target.

Cartridges were to be grouped into two categories for test firing. Group one of each brand would be the cartridges as received with no sorting, measuring, weighing or other attempts at improving accuracy. This represents an accuracy baseline for each particular brand. Group two would be the as received cartridges first sorted by rim thickness and then separated into sub-groups based on rim base to ogive measurements. I included rim thickness to eliminate a controllable variable that could possibly affect accuracy. I wanted the groups from test firing to reflect the influence of rim base to ogive measurements only.

I have very little experience with Eley ammunition, having fired about 100 rounds several months ago. I ordered three bricks of Eley Target from Champion Shooters Supply and measured 200 rounds. I wanted to get some idea of Eley consistency. Rim thickness was measured first, then rim to ogive lengths. Of the 200 rounds I sorted, 121 had rims measuring .039", 68 measured .040" and the remaining 11 rounds were about equally divided at .038" and .041". I used those measuring .039" to check rim to ogive lengths. The first group, 42 rounds, measured .021" to .025", the next group measured .026" to .028" and the last group came in at .029" to .032". Any way you look at, this is consistent ammunition.

Although I haven't tried it, Eley Tenex has a good reputation among American Rimfire Association competitors and is reported to be very accurate. I wonder if accuracy could be further enhanced by rim to ogive sorting. Exploring this may be cost prohibitive because of the quantities of ammunition needed for sorting but could possibly be a project for some time in the future.

Several containers are placed on the work bench to receive cartridges as they are measured. Containers are labeled for cartridges as they are sorted into groups and placed in their respective containers. We are not concerned with cartridge overall lengths, rather rim to ogive lengths. Thus, as an example, cartridges may be sorted into rim to ogive lengths of .015" to .020", .021" to .025" and .026" to .030" as we read where the dial indicator comes to rest. This will vary with the kinds of cartridges you are working with. Test firing will determine the most accurate lot of each brand. You will find some odd lengths, either shorter or longer than the norm, that are likely to print well away from group centers. These would probably become the fliers that ruin an otherwise good score.

Should a lot of some brand be exceptionally poor, we should consider another lot of this brand. Continued poor results with several lots of this brand may lead to eliminating it from further consideration. But before we rule it out completely, remember that rifle barrels may sometimes be very temperamental in the preference for one cartridge over another. And too, sometimes cartridges have hidden variables that we cannot account for or deal with.

Conditions permitting, I wanted to do all shooting on the 50 yard range. A series of five shot groups were to be fired with each brand, followed by another to confirm results. However, our local range is about 35 miles from the windy Gulf of Mexico and trying to evaluate ammunitions and gather reliable data in poor conditions can become an exercise in futility. Wind flags can certainly help but the little 22 bullets are so susceptible to wind changes that I prefer waiting for better conditions. I could use the 25 yard indoor range but experience with my rifle finds so little difference in the size of five shot groups, often .100" at this distance and smaller with good ammunition, that we have difficulty determining which is really best.

The rimfire rifle I will be using is my CZ 452 Varminter. It has a medium heavy barrel and a Weaver 4 X 16 power scope with a fine crosshair. The scope will be set at 16 power for all shooting. I have used this rifle since 2004 and have no idea how many rounds I have put through the barrel. A conservative guess would be somewhere between 50,000 and 60,000 rounds. I don't know what to expect for 22 Long Rifle barrel life. Should accuracy change I would probably opt for a heavy barrel rifle like the newer CZ Model 455 Varmint. It has been my experience with both centerfire and rimfire rifles that the heavier barrels are more accurate than others.

I found a considerable difference between brands as I measured and sorted cartridges. Eley Target and Remington Target had the least variance in rim base to ogive measurements and very little difference in rim thickness. Federal Champion and Standard Plus had the largest percentage of cartridges longer or shorter than the norm and a wider range of rim thickness. Standard Plus turned in the largest average groups before sorting, Eley turned in the smallest. These two brands had near equal small groups after rim to ogive sorting. Some brands formed three groups of rim to ogive lengths, others but two.

Conditions on most days at the 50 yard range were about what I expected with switching winds of 15 to 20 mph. However I was able to find a few better days and shoot for a couple of hours on mornings of light winds. Light winds were scarce and I was about four weeks completing the range work. Early morning temperatures on most days were about 65°.

The ogive gauge taught me a bit about the relationship of ogive distances to the lands and their influence on rimfire accuracy. All brands gave better groups with the longer rim to ogive measurements. Groups became progressively smaller, with one exception. Remington Targets shorter rim to ogive groups were a little larger than the unsorted cartridges. Even so, Remington Targets longer rim to ogive cartridges, like the other brands, gave tighter groups than the base line cartridges. Several repeat firings confirmed this. Apparently this particular lot of cartridges had some hidden quirk causing them to deviate from the established trend. Contrary to my data, the groups fired by Gerry with his Model 52 Winchester were better with the shorter rim to ogive lengths. Again, this goes to show that different rifles sometimes prefer one cartridge over another.

Some rimfire shooters, particularly those with a casual approach to competition, will think this to be a lot of needless work. I don't fault this attitude because after all, we are out to have fun and relax a bit. They may enjoy a match as well as I do. But if you are like me and expect to win now and then you will choose your ammunition carefully before going to the firing line. We have enough problems with wind and mirage without skimping on ammunition.

We all know there is better although more expensive rimfire ammunition available that should require little if any sorting to improve accuracy. But if you have tried the more expensive match ammunition you may have learned that while it is usually very good, it isn't always what you expect. Again, lot numbers are important. That is why most competitors buy small quantities of any ammunition to try at 50 yards before buying in larger quantities. I challenge you who haven't used the more expensive match ammunition to buy a couple of boxes and fire a series of 50 yard groups. Then sort by rim thickness and rim to ogive and fire another series of groups. You may be surprised.

The G3 MKII PRO is not on the market at this time but you may contact Gerry at the reference below for availability. I think you will find it a valuable addition to your rimfire shooting accessories. Either way, you pay your nickel and take your choice so have at it.

50 YARD FIVE SHOT GROUPS
RIM BASE TO OGIVE MEASUREMENTS

<u>SK Standard Plus</u>	<u>Remington Target</u>
As Received=.969"	As Received=.933"
.023"--.025"=.659"	.040"---.044"=.910"
.026"--.028"=.604"	.045"---.047"=.716"
<u>Federal Champion</u>	<u>Eley Target</u>
As Received=.936"	As Received=.653"
.008"--.014"=.838"	.021"--.025"=.630"
.015"--.016"=.740"	.026"--.028"=.628"
.017"--.024"=.723"	.029"--.032"=.608"

I fired a couple of 100 yard groups with the Eley Target sorted .028" to .032" rim to ogive to see how well it would group. With a light 11:00 breeze and 60° range temperature they averaged 1.064".

These targets represent the best of several series I fired with Eley Target. The top row averaged .530" without any sorting and the bottom row averaged .401" sorted rim to ogive at .029" to .032". The overall average for all of the as received groups is .653", those sorted to .029" to .032" averaged .608".

These 10 round targets were fired by Gerry with his Winchester Model 52 and a 20 power scope. I remember back in the forties when a Model 52 Winchester could be bought for about \$100.00.

The CZ Model 452 Varminter used in this project continues to be an accurate rifle after a lot of use over the sandbags.

The G3 rim sorting gauge is the fastest and easiest of the three I have used.

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