

# Precision Shooting

- RELOADING GUIDE -



*The Precision Shooting Reloading Guide . . . .*  
*For Those Individuals Concerned With . . . .*  
*“Extreme Rifle Accuracy” . . . . In The Various Disciplines*

Highpower/Rate Gun

Highpower/Gas Gun

Point

my bench a long time ago; they still work well so there is no reason to change.

### Random Observations

**Velocity:** On the face of it, more velocity is better than less velocity. This is reinforced by the profound philosophy, "if some's good, more's better". Well, why is more velocity better? The knee-jerk response is that the bullet bucks the wind better. As the example earlier in this chapter showed, it takes a lot of extra velocity to make much difference in wind deflection; more extra velocity than can reasonably be extracted from a load that is already approaching the upper end of the pressure curve.

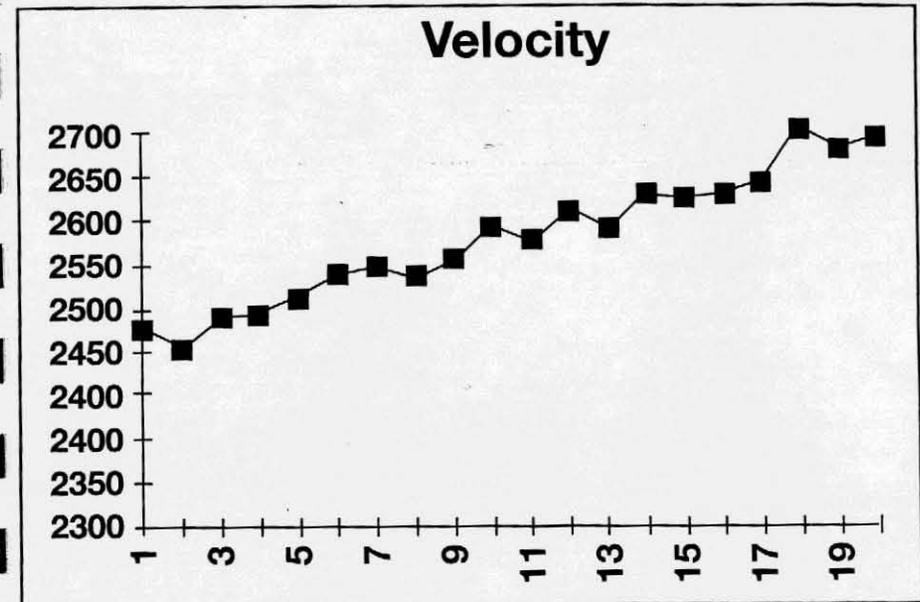
For years Mid Tompkins and others have said that the 190 grain Sierra Matchking shot best out of the typical .308 Winchester NRA Match Rifle when loaded to around 2,525 fps. Can it be made to go faster? Sure. There are a number of loads that will drive the 190 grain Sierra at 2,600 fps without overtaxing the system. Do I load to 2,600 fps? No. The loads that seem to be the most accurate (group best day in and day out) hover around 2,500 to 2,525 fps. There is a "sweet spot" for lack of a better term, when all of the component parts (including the rifle) seem to work best together.

This is not solely dependent on one component. The same 190 grain bullet shoots very well out of the .300 Winchester Magnum at around 2,900 fps. In other words, it is not that the bullet alone cares so much about a particular velocity. It is the sum of the parts that function well together at a particular velocity.

There may be more than one "sweet spot" for a given set of components. To take advantage of a particular cartridge's potential, it might make sense to pick the one that is nearer the upper end of the pressure-velocity curve, rather than one nearer the lower end of the curve. Having found this happy confluence of stable or linear pressure and velocity curves, it does not make sense to try and produce additional velocity even though it may be possible to do so and remain within the safe operating pressure limits of the rifle and cartridge.

Creighton Audette set up a test to observe this. Holding everything but the amount of powder constant, he fired a series of 20 rounds starting with the least amount of powder, working up to the greatest amount in constant increments. He fired the series at a 300 yard target. As one would expect, the rounds with the least amount of powder struck lower on the target and those with more powder struck higher on the target. However, the points of impact did not form a linear, vertical line of holes, evenly spaced from low to high. There were several areas where the holes clustered together. In other words in certain areas a small increase in powder charge did not necessarily produce a corresponding rise in the point of impact on the target.

Curious to know whether this was a result of the rifle being sensitive to a



*Audette Style 20 round string*

particular pressure-velocity combination or if the ammunition would behave differently within certain portions of the overall curve, I tried an experiment similar to Mr. Audette's. A series of 20 rounds was loaded in 0.2 grain powder increments and fired over a chronograph, starting with the least amount of powder and ending with the most.

As you can see, there are two areas where the velocity curve levels out, even though the powder charge continues to be increased. Shots 6 through 9 and 14 through 17 show a pronounced "flattening" of the curve. On the other hand, the difference in velocity between shots 17 and 18 is 57 fps. If one were to select a powder charge between those used for shots 17 and 18, the chances are that extreme spread and standard deviation would not come out too well. It should be pointed out that the heaviest powder charge used in this series was well below the maximum in reloading manuals.

This graph relates to two comments made earlier:

1. If ambient temperature increases, pressure increases. Though I keep saying "velocity", velocity is a function of pressure. If we look at the range of powder charge weights within these flat spots in the velocity vs powder charge curve, it is not very great. Presumably, the range of pressure is not that great either. The point is that it would not take much of a change in pressure, caused by a change in charge weight or temperature (or bullet touching the lands one time and not the next) to push the load out of the nice flat portion of the curve into a more erratic portion of the curve. "Erratic" being relative

and not having to do with safe operating limits in this case, but rather finding the most stable operating section of the curve.

2. Operating well inside the performance envelope. Whatever cartridge and load we chose, it makes sense to operate in a stable area that is at a level below the maximum allowed by safety considerations. The issue here is that pressure-velocity can get mildly erratic before it gets dangerously erratic. There are other areas well below "maximum" that are mildly erratic too, as shown between shots 11 and 14. In any event, it makes more sense to operate in an area of the curve that is most stable. If that area is difficult to locate, then perhaps a change in a component, such as powder, is indicated.

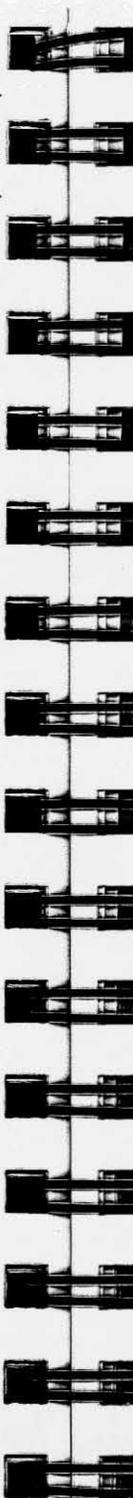
Some of the above conclusions are based on assumptions that may sound like adding two plus two and getting five. However, my experience does not run contrary to these observations.

This is not a sure-fire way to find the best load, but it does offer a place to start looking. If one were to take the time to combine shooting a similar series for "group" while chronographing at the same time, the results might be even more enlightening; especially if there were "flat" sections of the velocity curve that matched identifiable clusters of impacts on the target.

For the most part, I still test new loads by practicing with them. This serves several purposes. It enables me to practice and I need the practice more than the rifle and chronograph do. Further, the conditions are more like the match environment in terms of the sequence and number of rounds fired. This also offers the opportunity to get zeros for the new load, should it be selected for use in a match. There is the side benefit of consuming barrel life while accomplishing two objectives instead of just one.

One last observation about velocity. Earlier in this section I commented that the natural response to why more velocity was better than less velocity is because the bullets are not affected as much by the wind. While that is true, there is another reason.

Everything else being equal, there is less vertical change in point of impact per foot-per-second at higher velocities than there is at lower velocities. While this does not make much difference at short range, and is therefore harder to detect, it is noticeable at long range. Like trying to improve resistance to wind deflection, not much is accomplished by squeezing another 100 fps out of an existing load. But if a .308 Winchester and .300 Winchester Magnum both shooting the same 190 grain Sierra Matchking bullet are compared, the benefit of the magnum's higher velocity is more obvious. A 50 fps spread in velocity at .308 Winchester speeds (2,500-2,550 fps) equates to a 19 inch vertical spread in point of impact on the 1,000 yard target. The same 50 fps spread at .300 Winchester Magnum speeds (2,900-2,950) results in a 13 inch vertical impact dispersion.



What this says is that velocity extreme spread and standard deviation are significantly more critical with cartridges like the .308 when used at long range; and even more so with cartridges like the .223. It also means that extreme spread is just as important as standard deviation for ammo to be used in long range shooting, particularly at 1,000 yards. Since the 1,000 yard 10 ring is a circle (20 inches in diameter), any movement from the center in a horizontal direction reduces the vertical dimension and vice versa. A good, solid mid-ring ten at 3 or 9 o'clock brings the edge of the 10 ring to within about 6.5 inches, vertically, of the horizontal line through the center of the target. In other words the 10 ring is only about 13 inches tall, at that point. The less vertical dispersion in the group, the more 10 ring is available to accommodate changes in wind and wind reading errors.

That is why 1,000 yard, highpower shooters will often cite "elevation" as the measure of a load, rather than overall group size, as in: "Yeah, this baby held better 'n X-ring elevation during that match." The reason is that "elevation" is more a measure of the hardware and windage is more a measure of the shooter's wind reading ability.

Having watched thousands of rounds go down range in 1,000 yard matches, I am convinced that more points are dropped by mid level shooters due to elevation errors than because of the wind. In part, this is due to the fact that most of us do not get to shoot at 1,000 yards on a regular basis. Most mid-to-high level highpower competitors hold well enough to shoot clean scores at 1,000 yards. After all, the 1,000 yard ten ring is no more difficult in terms of minutes of angle than the 600 yard ten ring, both being roughly 2 minutes across. The vertical dispersion due to variations in velocity are almost cut in half at 600 yards compared to 1,000 yards, *expressed in minutes of angle.* In other words, a rifle-ammo systems that holds X-ring elevation at 600 yards may not hold 10-ring elevation at 1,000 yards, even though the respective X and 10 rings are of the same relative or angular size.

Less experienced 1,000 yard shooters will often blame their hold or the wind for a shot that landed somewhere outside the 10 ring. In many cases it is simply a rifle-ammo system that is not delivering consistent velocities over an extended string of shots.

Up to this point, the tone of this chapter has been to emphasize that Pretty Good Accuracy is good enough to shoot competitive scores in highpower. That remains true at 1,000 yards. However, for 1,000 yard shooting we must pay particular attention to consistency of ammunition characteristics, like velocity, that may go unnoticed at the shorter ranges. Stated another way, it is much better to shoot 2,500 fps ammunition with a standard deviation of 8 and an extreme spread of 20 than 2,600 fps ammunition with a standard deviation of 12 and an extreme spread of 35.