

WHITE PAPER REPORT REGARDING BRASS CASING UNIFORMITY

Accuracy and precision are two very important objectives of all serious shooters. To meet these objectives, we must develop goals for ourselves and measure our performance against these goals. When we fall short of our goals we must understand the factors that influence accuracy and precision if we are to make improvements that will ultimately allow us to achieve our goals.

Accuracy is a fairly easy objective to understand. We simply want our bullet to strike a target in the location we choose. To develop a goal statement --something measurable-- we could say that we want our firearm to shoot 3" at 100 yards. This can be accomplished readily with a good barrel and scope configuration, though it may take some trial and error on the shooters part.

Precision is a much more elusive objective. Technically, precision statements are a measure of repeatability. What we are really saying is that we want multiple shots to strike the target in the same place. Notice this goal does not state that the bullets are striking the target where we want them to (that's accuracy) but rather that a series of bullets group closely together (ideally, they all go through the same hole). More realistically however, we might seek a 0.5" group of 3-shots fired from the bunch at 100 yards.

When our precision goal eludes us we may be faced with a very difficult task. To begin, we should probably re-evaluate our precision goal. In other words, is a 0.5" group obtainable, maybe not? Perhaps a 1.0" group at 100 yards is more realistic. If however, we are having difficulties attaining a precision goal that is realistic, then what?

Now it gets nitty-gritty. You see many, many factors influence precision. Some factors fall under the realm of interior ballistics while others fall under exterior ballistics. Let's begin by discussing the latter briefly first.

The term exterior ballistics describes everything that happens to the bullet once it leaves the muzzle of the firearm. Gyrostatic instability and environmental conditions are two important factors influencing precision. If you are pushing a bullet at too great a velocity you may not be achieving stability and hence, are seeing erratic bullet placement at range. Stable environmental conditions are not a factor concerning precision, but differential conditions are a major problem. In simpler terms, varying crosswinds are the bane of serious shooters.

The term interior ballistics describes everything that happens to your bullet before it leaves the muzzle of the firearm. This includes the construction and uniformity of the individual bullet, casing, primer, and powder, and the synergistic interaction of the assembled components. You see if we take two slightly heavy bullets --our 168gr bullet is actually 168.4gr-- and fire one in a case that is slightly heavy and the other in a case that is a bit light the rounds will almost certainly group poorly even if all other factors remain the same. The interaction of bullet and case will be enough to influence round placement relative to one another. So improving precision is going to end up being a game where we eliminate as many factors as we can and seek uniformity of factors that we cannot control. This idea is not new. I recall gun author Bob Milek saying something quite similar.

What factors can we eliminate? For starters try using powder and primers of the same manufacturing lot. Next consider your bullet. If accuracy and precision are your game and your target is not expected to be any more tenacious than paper, consider match grade bullets. On the other hand, if you are like me, and target shooting is done in preparation for days afield, then

bullet selection must be more a consideration of terminal ballistics than accuracy or precision. Terminal ballistics describes everything that happens to a bullet (and target) upon impact. As sportsmen we must first consider the bullets ability to kill cleanly.

So that leaves us with environmental conditions and cases. Cases are more important and complicated than one might think. First, the metal must be thin and flexible enough at the mouth to release the bullet without cracking or splitting while the head of the case must be thicker and strong enough to insure safety. In more technical terms, the mouth of the case must have high yield strength while the head of the case must have high tensile strength.

Cases vary in several important ways. First the weight of the case varies, as does the capacity of the case. Lastly, the depth of the primer hole can and does vary as well. To assess case quality I measured .338 Winchester Magnum case weight using a standard high-quality RCBS reloading scale. All measurements were made to the nearest 0.1-grain. Eighty cases were weighed, 20 from each manufacturer (Remington-Peters, Federal, Frontier, and Winchester-Western). The results are shown in the graph below.

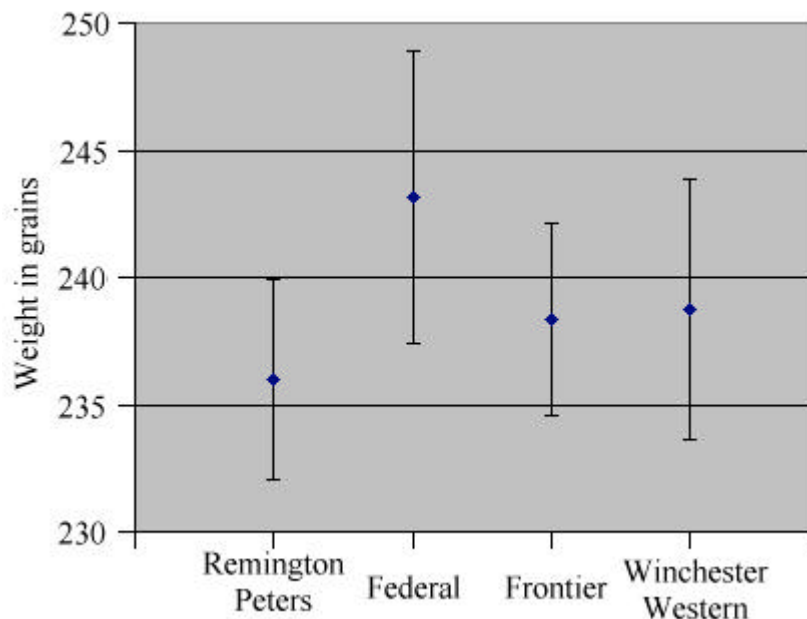


Figure 1. Case weight comparison. The point indicates the mean or average value while error bars indicate variation (n = 80).

I also measured .338 Winchester Magnum case capacity by filling each case with alcohol and weighing the volume of alcohol that was contained by each case using the same RCBS scale. Sixty cases were weighed, using 20 from each manufacturer (Remington-Peters, Frontier, and Winchester-Western). The results are shown in the graph below.

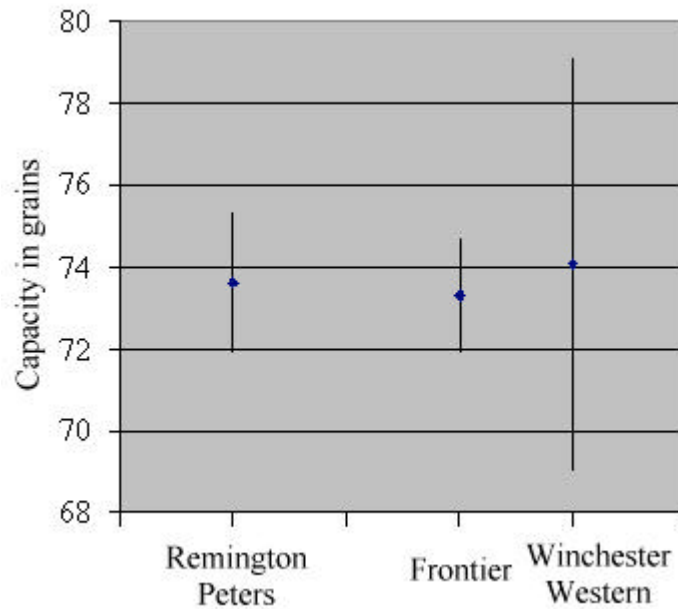


Figure 2. Case capacity weight comparison measured in grains of alcohol. The point indicates the mean or average value while error bars indicate variation (n = 60).

Sampling 20 cases from each manufacturer certainly does not give us a definitive conclusion regarding case quality. However, this simple experiment does reveal some very interesting trends. First, when viewing the graphs, bear in mind that we are not necessarily seeking the heaviest case or the one with the highest average case capacity or volume. I for one am quite willing to pass these by in return for cases that are most uniform. So what we are looking for in these graphs, is the shortest error bar length regardless of where the average dot is placed. For both case weight and capacity Frontier is the best, followed closely by Remington-Peters. Uniformity will improve our precision.