Reloading: Seating Die Runout

Seating Die Induced Runout - A Comparison

by Germán A. Salazar

This article describes a brief but useful test of bullet seating dies with an eye towards the runout or eccentricity introduced into the loaded cartridge by the seating die. We'll check the runout at the bullet ogive of cartridges loaded with five different seating dies: RCBS, Hornady, Redding, Vickerman and Wilson.
The Hornady and Vickerman dies are universal .30 caliber, the rest are specific to the .30-06. We'll measure case neck runout of each case prior to bullet seating and measure bullet runout at the ogive after seating. Ten cases will be loaded with each die. The brass is neck turned Lake City 63 NM. We will calculate average neck runout on each set of ten cases and compare that to average bullet runout on that same set. The difference will show us the seating die induced runout and we'll rank the dies accordingly. The presses used are an RCBS Rockchucker for the threaded dies and an arbor press for the Wilson. Read this article for what it is: a brief test using the dies that I happened to have and which shows a way to test rather than producing any absolute results. This is a limited, hobby time test which I conducted for my own information an entertainment. Enjoy!

RCBS - Hornady - Redding - Vickerman - Wilson

As I mentioned above, the brass used for the test is Lake City 63 NM which was previously neck turned to a uniform thickness of 0.0125" and has been fired four times since the neck turning. It was resized with Redding bushing dies in two steps, first a full-length die with a 0.335" bushing, then a neck die with a 0.331" bushing. In my experience, this is the best way to minimize case neck runout if you have to reduce the as-fired diameter by more than 0.004". My chamber has a 0.340" neck

diameter and loaded bras is 0.333" diameter, so there is a fair amount of work to be done in sizing and necks do not maintain perfect concentricty through the process.

I first checked every case on the Sinclair concentricity tool. The tip of the indicator was set 0.125" in from the case mouth to avoid any irregularities which might exist right at the mouth. Every case was marked with a black marker at its point of greatest eccentricity. They ranged from 0.0005" to 0.0035" (half a thousandth to three and a half thousandths). I was comfortable splitting thousandths on the dial but didn't try for more precision than half a thousandth; it would just be guessing if I had. In addition to marking the case, I made a table with each case indicated by number

and runout.

The next step was to sort the cases by runout and assign an approximately equal number of each runout to each seating die. I didn't know how much influence the initial runout might have on the seating die's performance, therefore, by equalizing the range of runout that each seater would face, I believe we maintained the integrity of the test procedure.

All of the seating dies were set to give the same overall length as measured at the ogive with the Sinclair hex nut comparator. When setting the seating stem at it's final location on each die, a loaded cartridge was fully inserted to put the stem's threads under tension before locking them in place. This procedure loads the stem upward in the threads and minimizes any possibility that a stem cocked in its threads might increase runout. This doesn't apply to the Redding since it uses a non-locking micrometer adjustment.
I loaded a known good lot of Sierra 168 gr. International bullets in the cases. Since I'll fire these at 200 yards in a subsequent portion of this test in a few weeks, there was no sense in loading the 185 or 190 grain bullets I normally use for 500 and 600 yards. My practice load with 168's and IMR 4320 is accurate and should show us the extent to which the runout differences affect accuracy at moderate ranges.

Once the bullets were seated, I reset the concentricity tool to measure runout right at the ogive of the bullet. I think this is the critical point as it will contact the rifling first and will determine the bullet's initial squareness to the bore.
I marked each case with the bullet runout, this time in red and again made the mark at the point of greatest eccentricity. Generally speaking, the maximum bullet runout occured at the same orientation as did the maximum case neck runout. This indicates that while the seating die may contribute to runout through its own imperfections, the bullet is largely following the established eccentricity in th9e neck.
On my table, I wrote the bullet runout next to the neck runout and subtracted to determine how much additional runout was induced by the seating die. In most cases there was a little more runout when measuring the bullet. However, many remained unchanged and more than a few improved, especially with the best die - this was a real surprise. I was also surprised by the finishing order of the dies. You might be surprised too. I will say, though, that all were acceptable for general reloading and Highpower match use.

The Rankings

And now, the moment you've been waiting for...

#1 - Redding Competition Seating Die (sliding sleeve type, threaded die)

The Redding, which I expected to finish high, did what I thought couldn't be done - it produced rounds with an average runout that was less than the average case neck runout of the brass used. In none of the ten rounds loaded did the Redding increase the runout; it either held exactly the same or it decreased. The **Redding**, with an **Average Runout Change of -0.0003"** is the winner. The negative sign, of course, indicates a reduction in runout.

However, it's important to note that we're using a mathematical calculation that gives a result that is smaller than the precision with which we can measure runout, so take the numbers as what they are - smaller than we can reliably guarantee and more of a ranking indicator than an exact measure of probable runout results. This applies to all the dies.

#2 - Wilson (chamber type, for arbor press)
I expected the Wilson to come out on top, given it's long-standing reputation as the best seating die and its near universal use in Benchrest shooting. It didn't quite work out that way, but the Wilson was very good, with only three rounds increasing runout and an equal number decreasing, the remainder were zero-change. **Wilson Average Runout Change: +0.00015".**
#3 - RCBS Standard Die (standard threaded die)
I expected the RCBS to be dead last, maybe by a big margin; was I ever wrong! I was really surprised, quite pleasantly, by the RCBS die's performance. Three runout increases, an equal number of decreases and four zero-change made for a very creditable score. **RCBS Average Runout Change: +0.00025".**
#4 - Vickerman and Hornady (tie) (both partial sliding sleeve, neck only, threaded dies)
These dies share a lot in common, being of universal use for a given caliber, in this case, .30 caliber. You can seat bullets in anything from a .300 Savage to a .300 Winchester Magnum with these dies as they just capture the neck of the case in order

to align it with the bullet. However, as your Economics professor taught you, there is no free lunch. That universality of application reduces precision, though certainly not to a level that would render them useless. With more increases in runout than decreases, the Hornady lost ground. The Vickerman had a lot of zero-change rounds, but increased 0.002" on a couple and that really hurt it's average performance. So, the **Hornady and Vickerman** with an **Average Runout Change of +0.0006",** bring up the rear - very much to my surprise. These are very useful dies, however and let's keep some perspective, with an ARC of about half a thousandth, I wouldn't be concerned about using them for Highpower match loading.

Update - November 7, 2009

Below is a picture of the targets fired with the ammo loaded for this article (it only took two months to find a free day for this!). All firing was done at 100 yards, prone, iron sights with the CSS RT10 Tubegun. All targets have 10 shots, the same 10 that were in the runout test for each die. I shot the Hornady die ammo first and the group was a bit low, so I made a small elevation change for the remainder. The RCBS die ammo certainly looks like the worst, and the Redding the best, but I suspect things might shift around a bit on a rerun of the test. Conditions were ideal for this testing and I'm satisfied enough with the way I shot that I don't plan to repeat it. I think all groups were fired in a consistent manner, none being better ot worse than the others in terms of overall execution. You can click the picture to enlarge it for more detail. The targets is the NRA 100 yard Smallbore target, with a center X ring that is 1" in diameter and the 10 ring is 2" in diameter. I shot on the full target and just cut out the centers for the picture.

I hope you enjoyed reading this and remember, this is just something I did for fun and amusement on a Saturday morning with what I had on hand. Do your own testing and come to your own conclusions.