Ruger Blackhawks & Cylinder Throat Dimensions

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INTRODUCTION

After fifteen years of building Ruger cylinders, my dad and I have a much better understanding of what it takes to make an accurate revolver. Like most pistolsmiths, we've come to appreciate and place a lot of emphasis on critical dimensions and part alignment. For example, we use a modified form of line boring to ensure proper cylinder to barrel arrangement. Throats are always cut to match the bullet diameter and cylinder stops are machined a half-thousandth over the bolt's width to ensure tight lock-up. While none of these steps guarantee excellent performance, they certainly don't hurt. I've always been curious though to know the impact of these features on accuracy. In other words, to what extent does accuracy decrease when cylinder fit is compromised or cylinder-to-barrel alignment is slightly off? Fortunately, we don't build guns out-of-spec from the get go, so I have no way of conducting a before and after study. A lot has been written about throat dimensions however, and this is a characteristic that's easily tested thanks to Sturm Ruger. While it seems obvious that cylinder throats should be matched to the bullet diameter, this isn't always the case with certain Blackhawk and Vaquero chamberings. For years, Ruger shooters have had to overcome tight throats by reaming or honing the bores to the correct dimension. Usually, it's ideal to have the throats be at or 0.0005" over the diameter of the bullet. This extra half-thousandth allows the bullet to enter the gap without upward or downward sizing. Rugers on the otherhand can be undersized by as much as 0.005". In fact, .45 Colts usually mic between 0.448"

and 0.450", while their old .44-40 Vaqueros were as small a 0.424". The latter was especially awkward when mated to a 0.430" barrel. Even the limited edition .38-40/.40 S&W convertibles as sold through Davidsons had throats undersized at 0.395". As one might expect, incorrect cylinder bores can be problematic. Take the .38-40 Vaquero for example. The round shoots a 0.400" bullet that when fired is squeezed down to 0.395". After jumping the cylinder gap and engaging the forcing cone, the bullet is then re-expanded by a few thousandths in order to seal against the barrel's lands and grooves. Thus, the slug changes diameter three times before it exits the barrel. How much, if any, does accuracy suffer when a bullet goes from 0.400" to 0.395" and then back to 0.400" prior to leaving the gun? This trial will attempt to quantify this by testing the 25 yard accuracy of a Ruger Blackhawk in which: 1) The throats are undersized from the factory, and 2) The throats are corrected to match bullet diameter.

ACCURACY

What makes a revolver accurate? A simple question, but one to which there's no set answer. If you study the work of men like Elmer Keith, John Linebaugh, and Hamilton Bowen, you'll at least understand what factors contribute to accuracy. In my own way of thinking, these factors can be categorized into two classes. The first of which includes critical dimensions and part alignment. The second class is comprised of non-mechanical characteristics, many of which aren't inherent to the revolver itself. While I'm not going to suggest that one class is unequivocally more important than the other, most revolvers don't shoot well if they lack mechanical integrity. Before I move on to the cylinder throat trial, I'd like to further discuss these two classes.

I believe that revolver accuracy starts with sound cylinder-to-bore alignment. Specifically, if the bullet's path is allowed or forced to alter when leaving the throat, accuracy will suffer. Two major factors to consider include the alignment of each throat to the barrel's bore and the action's rigidity. Line-boring can achieve the former in that it allows the cylinder bores to be cut while centered to the barrel. Most often, this involves cutting the bores while the cylinder is locked in the gun using a frame mounted shank. Our method also uses a frame mounted shank to mark the bore's centerline as the cylinder is in battery. Unlike the conventional line-boring techinique however, we drill the bores with the cylinder being outside of the frame. Secondly, if the cylinder is allowed to rotate as the round is fired, the bullet's path can be changed as it

crosses the barrel gap. If either, or both of the abovementioned are present, the bullet will engage the forcing cone off center. Now firm cylinder lock-up can be bad if the bore and barrel are slightly misaligned. In such instances, the cylinder is not allowed to correct for the misalignment by rotating in the direction of the barrel's centerline. When this occurs, the bullet slams into the forcing cone and is deformed (lead shaving is often the result). Other critical factors include chamber and throat dimensions, especially with regard to uniformity. Chamber specs are important for reasons that go beyond accuracy however. For one, tight chambers lessen case expansion, thus reducing the degree to which the brass is worked. This in turn lowers the effect of chamber pressure in that the shell doesn't get a run before encountering the cylinder walls.

The line the bullet travels within the gun is extremely important and often overlooked. While it's essential to have proper barrel-to-cylinder alignment, the bullet's path within each component is critical. Cylinder throats should be sized to allow the bullet to pass without altering its diameter; usually a throat that's 0.0005" over the bullet will suffice. Throats that are too large can be just as unfavorable as those that are undersized in that they cause the bullet to over-expand. Again, the goal is to have the bullet maintain it's initial diameter before it engages the barrel. Secondly, the barrel and forcing cone need to be concentric, while the rifling must be consistent. Barrel consistency is only half the battle however, in that the bullet must be properly aligned before it meets the rifling. Free-boring the barrel is one way to achieve such alignment. The first time I had heard of this practice was in the early 1980s when Rod Sward of Interarms started to free bore the Virginian Dragoon silhouette models by a half inch (or slighty greater than the caliber). Initial tests showed that this not only improved accuracy, but had a negligle effect on velocity. The Taylor throating method is a similar free-boring step and entails a free bore that's slightly larger than the groove diameter. Lastly, the forcing cone must be concentric and not too steep; as with many pistolsmiths, we cut our cones to 11 degrees.

Other aspects of revolver accuracy include trigger pull, sight pattern, cartridge components (bullet, powder type, primer, crimping, charge weight, etc), and of course, raw skill. All too often we're quick to blame the gun for being inaccurate, when in truth, the shooter has as much to do with performance as mechnical integrity. Take the Freedom Arms Model 83 for example. They're in fact some of the most accurate revolvers ever built, but many can't master them due to the sharp recoil of rounds like the .454 Casull.

THE TRIAL

So why am I discussing the attributes of an accurate revolver? I'm doing so in part to illustrate that throat dimensions are only one of many critical factors. In spite of this, the only variable considered here will be throat diameter.

The gun I chose to test was an Accusport Bisley in .45 Colt. Though this is not a standard catalog item, Ruger did produce a few thousand stainless .45 Bisleys for Accusport distribution (1,000 were also produced in .41 & .44 Magnum). My experience with these guns is that their quality is no better or no worse than standard Ruger Blackhawks. Cylinder fit was decent and didn't exhibit end-shake, though a slight amount of side play was present. Pin gauges were used to measure throat dimensions, and the following was found: Two were 0.448", three were 0.449", and one measured 0.450". Obviously, all were undersized for 0.452" bullets.

Before any tests were conducted, the gun was slightly altered. First, a Belt Moutain base pin was installed and the grips were upgraded to a set of black laminate. Secondly, a spring kit was added with the resulting trigger pull equalling ~2lbs. The Bisley was also dry fired 1,500 times to help break-in or "smooth" the action. Once complete, accuracy, or should I say precision, was tested at 25 yards off the bench. Undersized throats and all, the gun performed as follows:

BRASS	PRIMER	BULLET TYPE	BULLET WT	POWDER	CHARGE	GROUP SIZE (INCHES)
Winchester	Win-LPM	D&J Hard Cast	300	W296	21.0	2 3/4"
Winchester	Win-LPM	D&J Hard Cast	300	W296	22.0	2 1/2"
Winchester	Win-LPM	Hunters Supply - Cast	270	2400	16.0	2 3/8"
Winchester	Win-LPM	Hunters Supply - Cast	270	2400	18.0	2 1/4"
Winchester	Win-LPM	Hunters Supply - Cast	270	H110	25.0	2 1/8"
Winchester	Win-LPM	Penn Bullets - Cast	255	H4227	18.0	3"
Winchester	Win-LPM	Penn Bullets - Cast	255	H4227	19.0	3 1/4
Starline	Federal 155	Hornady XTP	300	W231	7.0	2 7/8"
Starline	Federal 155	Hornady XTP	300	Unique	9.5	2 3/8"
Starline	Federal 155	Sierra Sports Master	300	2400	16.0	2 3/4"
Starline	Federal 155	Sierra Sports Master	300	H110	21.0	3"
Starline	Federal 155	Sierra Sports Master	240	H110	26.0	3 3/8"
Starline	Federal 155	Sierra Sports Master	240	H110	27.0	3 1/4"
Starline	Federal 155	Cast Performance LBT	335	W296	19.0	2 1/4"
Starline	Federal 155	Cast Performance LBT	335	W296	20.0	2 1/2"

Each load was assessed by firing four 5-shot groups at 25 yards; noted group size is the average of the four. As you can see, multiple bullets, powder types, and charge weights were tried. Considering the degree of throat variance, these groups were respectable.

After the gun had seen 1,000+ rounds, the throats were enlarged to 0.4525" using a Sunnen Hone. The same loads were reassessed, and a reduction in average group size was observed:

BRASS	PRIMER	BULLET TYPE	BULLET WT	POWDER	CHARGE	GROUP SIZE (INCHES)
Winchester	Win-LPM	D&J Hard Cast	300	W296	21.0	2 3/8"
Winchester	Win-LPM	D&J Hard Cast	300	W296	22.0	2 1/4"
Winchester	Win-LPM	Hunters Supply - Cast	270	2400	16.0	2"
Winchester	Win-LPM	Hunters Supply - Cast	270	2400	18.0	1 1/2"
Winchester	Win-LPM	Hunters Supply - Cast	270	H110	25.0	2 1/4"
Winchester	Win-LPM	Penn Bullets - Cast	255	H4227	18.0	2"
Winchester	Win-LPM	Penn Bullets - Cast	255	H4227	19.0	2 1/8"
Starline	Federal 155	Hornady XTP	300	W231	7.0	1 3/4"
Starline	Federal 155	Hornady XTP	300	Unique	9.5	2"
Starline	Federal 155	Sierra Sports Master	300	2400	16.0	1 7/8"
Starline	Federal 155	Sierra Sports Master	300	H110	21.0	2 3/4"
Starline	Federal 155	Sierra Sports Master	240	H110	26.0	3"
Starline	Federal 155	Sierra Sports Master	240	H110	27.0	2 3/4"
Starline	Federal 155	Cast Performance LBT	335	W296	19.0	1 1/2"
Starline	Federal 155	Cast Performance LBT	335	W296	20.0	1 7/8"

It's been said that correcting throat dimensions won't guarantee improved accuracy. It's also been said that it almost never hurts. This trial supports the claim, in that group size was decreased by 6/10" on average. Now is 6/10" that material? Many may say that it's not, and to that end I agree. What tight throats will do however is increase chamber pressure. Squeezing a bullet through a throat that's undersized by 0.004" – 0.005" definitely causes a pressure spike. This isn't as much of a problem with mild .45 Colt loads, but should be a concern with high end 30,000 psi loadings.

The impact of throat dimensions on revolver accuracy has been studied for years. In fact, Elmer Keith wrote about the subject decades ago. This trial is just another illustration of how Blackhawk performance is effected by correcting undersized throats.

If you have any questions or comments, please feel free to write me at:
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Accusport Bisley in .45 Colt. Typical 25 yard group before throating (left). Five-shot group using the same load after throating (right). On average, correct throats reduced group size by 0.6”.