

Cartridges: Accuracy Secrets of the .30-06
by Germán A. Salazar

Accuracy Secrets of the .30-06 - Part 1

"The .30-06 just can't beat a .308."

"The .30-06 recoils too much."

"The .30-06 case is too long for real accuracy."

"Everyone knows the military switched from .30-06 to .308 because the .308 is more accurate."

"Snipers use a .308, not a .30-06, that should tell you something."

"The .30-06 is old, out of date, an antique - you can't win matches with it."

I love hearing statements like those, it lets me know that whoever is uttering them is going to be easy pickings in a match because he underestimates the competition and won't be working as hard as he should. The .30-06 vs. .308 debate has been going on since the day the .308 was introduced to the public and probably won't die anytime soon. We've covered the .30-06 vs. .308 debate before ([click here for article](#)) with extensive data from over 6,000 rounds fired in actual rifle matches, not keyboard pounding, so we won't do that again. What we're going to discuss is how to put together a .30-06 for NRA prone, F-Class, tactical or other recreational matches that will be competitive, reliable, long-lasting and moderate in cost.

Amazingly, the .30-06, a cartridge with well over a century of unmitigated success on the range and in the field is rarely seen on the Highpower range these days and is poorly understood by a generation of shooters raised on plastic rifles firing cartridges nearly suitable for rodent control. The .30-06 conquered the 1000 yard ranges from Camp Perry to Quantico, from Camp Pendleton to Fort Benning and all points in between - not to mention the battlefields of Europe in two World Wars where the average firing distance was long and the stakes immeasurable. Yes, history matters, in real life as well as in competitive shooting and the .30-06 is most certainly not a dusty relic of history; it is an accurate, powerful cartridge, capable of exceeding it's many offspring in any measure of ballistic performance. Beating the baby cartridges with the .30-06 doesn't take any voodoo or exotic components, just attention to details and the careful application of a century of accumulated wisdom.

Barrels

There's no getting around this basic fact: you need a top quality barrel to get top quality accuracy. The barrel is the heart of the system and no mass-produced barrel is going to perform on a par with a Krieger, Bartlein, Hart, or other performance barrels made specifically for accuracy. If you're working with a factory or arsenal barrel, the end results will be somewhat limited, but you can still outshoot the .308 and others with similar factory barrels; we'll cover that in a bit more detail further on, for now, let's look at new barrels.

Makers

I use barrels from Krieger, Bartlein and Hart in my rifles with no particular preference, although I find Kriegers usually easier to get as Bruno's keeps the profiles I like in stock (he has Hart and Shilen also). Krieger and Bartlein are made by the cut-rifling process whereas Hart barrels are button-rifled. I have a slight preference for the cut-rifled barrels because I believe the process is more likely to result in perfectly consistent twist rate, but my two main .30-06 rifles have Hart barrels, so this really isn't a big issue. The four items in barrel choice that genuinely matter are internal dimensions, rate of twist, length and weight; let's take a look at each.

Bore & Groove

Although it would barely seem to be worth mentioning, the bore and groove dimensions should be 0.300" x 0.308". Krieger, Bartlein and perhaps other makers offer barrels with slightly smaller internal dimensions, these are intended for chambering in .308 for international Palma shooting where issued ammunition often has bullets slightly smaller than .308" diameter. This is not a concern for the US shooter using match grade bullets and in any event not an issue at all for the .30-06. More importantly, those reduced dimensions may cause excessive pressure with some of the long, heavy bullets we prefer for the .30-06. Stick to the standard 0.300" x 0.308" dimension for your .30-06, that's what it takes.

Twist Rate

The standard rate of twist for factory and arsenal barrels chambered in .30-06 is 1:10". This was established in 1903 with the .30-03 cartridge that used the Krag's 220 gr. round-nose bullet at a very modest muzzle velocity. As the cartridge evolved into the .30-06 with a 150 gr. spitzer bullet, the original rifles had their barrels set back and rechambered with the new short-throat chamber for the lighter bullet, but naturally the rate of twist remained the same. That's ancient history and we don't need to repeat it; what we need is the optimal rate of twist for modern match bullets, and that is the 1:11" twist. This will properly stabilize bullets up to 210 gr. with no concerns and that's as heavy as we're going to consider in this series.

As a fundamental rule, the slower you spin a bullet the more accurate it can be. The reason is simply that bullet jackets aren't perfectly uniform in thickness and a slower rate of spin keeps those tiny variances from altering the bullet's flight. Think of a car tire with a slight imbalance, the faster you go, the more you feel that thumping. The bullet is the same except that because it isn't held by an axle like the tire is, the imbalance will make it wander slightly from its original path. The limitation we face on rate of twist, is that although we want it to be slow for accuracy, we need a certain amount of twist for stability. The 1:11" twist will stabilize all useful match bullets, whereas a 1:12" twist is marginal with some 190 gr. bullets and all of those that are heavier. Accordingly, we can rule out the 1:10" twist as unnecessarily fast, the 1:12" as potentially too slow, and settle on the 1:11" as being just right. Accuracy won't necessarily suffer much with a 1:10", so if you have one, that's fine, if a touch less than optimal. I would avoid the 1:12", however, because it will limit your bullet choices.

Length & Contour

Long and heavy is the rule of thumb for a .30-06 barrel. Let's start with length; I consider 28" to be the ideal length for a 30-06 barrel. This is long enough to take full advantage of the powder charge you're burning. Although a 30" barrel will give slightly higher muzzle velocity (about 25 fps) given the heavy contours that are called for, I prefer to keep the length at 28" to reduce fatigue during a string. If you're shooting F-Class or another form of supported shooting, then a 30" barrel can be worth considering, but nothing longer than that for reasons we'll discuss in a Part 2.

There is no reason to use a short (under 28") barrel on a .30-06 when you have the choice; of course, if you're working with an existing barrel that's a different matter, but you won't get quite the performance level of the right-size barrel. When you burn 53 to 60 grains of relatively slow burning powder, you generate a lot of hot gas ready, willing, and able to push the bullet to a high muzzle velocity, you need to give it room to work and that's what happens as the gas pushes the bullet up the length of the barrel. A .30-06 would see increasing muzzle velocity from a barrel as long as 45"; while that's not practical for a host of reasons, don't cheat yourself of a real ballistic advantage by cutting the barrel off too short - they don't grow back.

When picking a barrel contour, weight is your friend. Yes, the .30-06 generates more recoil than a .308, that's just basic physics; shoot the same bullet at a higher MV with more powder and you get more recoil. If you shoot a heavier bullet, as you should, then you get even more recoil. Now, this additional recoil isn't objectionable, even a tired old desk jockey with a bum shoulder (yours truly) can handle it, but a heavy barrel is one of the ways to make it reasonably comfortable. Normally I use the MTU/AMU profile that all the makers offer (Krieger #9), although I have a couple of heavy Palma barrels (Krieger #14) that work out well also - 6.5 lb. of barrel weight is your friend.

Chambering

You might think that after 106 years there wouldn't be much to say about chambering a .30-06; actually, that's not entirely true, there are some fine points to consider. The first question to ask your gunsmith is whether he has a print for his .30-06 reamer; you really don't want to build a match rifle around an old hunting style .30-06 chamber of unknown dimensions. Even a lot of the old "match .30-06" reamers aren't a good idea because many of them had a 3 degree leade angle which will hurt accuracy compared to the 1.5 degree leade angle used today. Your best bet is definitely to buy a reamer for your project and take good care of it. If you think that 200 gr. is the heaviest bullet you're likely to shoot on a regular basis, then the Pacific Tool & Gauge Serengeti reamer, print no. 9685 is really a great choice. PTG makes great reamers, and this design works very well with bullets from 155 gr. to 200 gr. thanks to the freebore length as well as the case's long neck that gives a lot of flexibility in bullet seating depth. It is also a very good match to Redding sizing dies, another a worthwhile consideration.

If your preference is for heavier bullets like the 210 gr. and 215 gr. models now offered by Berger and Sierra, then I would suggest asking PTG for 0.070" longer freebore. That

will still allow you to use medium weight bullets as well as the heavier ones. At this point, you might as well get a 1:10" twist barrel just for a slight margin of safety with respect to bullet stability in cold temperatures. I think once you go past the 200 gr. bullets, you're out of the "normal zone" with the .30-06 and it becomes a specialized chambering as opposed to an "all-around" shooter which is the .30-06's great strength.

If you want to shoot 230 gr. or 240 gr. bullets, the best bet is to throat the barrel after chambering to place those bullets exactly where you want them in the case neck. That's a more specialized operation, of course, but you'll really be building a single bullet rifle with a very fast twist rate that's beyond our discussion today.

Neck diameter is standardized at 0.340" for the .30-06 and it's a good dimension for an accuracy rifle. Although I turn my case necks to 0.0125" thick, for a loaded round neck diameter of 0.333", I don't consider that to be excessive clearance. Due to their length and taper, .30-06 cases will only last about 11 full-length sizings before you begin to see signs of head separation; therefore, I'm not worried about the 0.007" neck clearance accelerating case neck cracking (which would take at least 20 loadings), and it doesn't hurt accuracy. If you're sure you'll be turning necks, you can go smaller; but consider that unturned Lapua brass will yield a loaded round with a neck diameter between 0.337" and 0.338". That's as tight a clearance as I'm comfortable seeing on unturned brass; the 0.340" chamber neck is an all-around good choice.

Accuracy Secrets of the .30-06 - Part 2 **by Germán A. Salazar**

In [Part 1 of this series](#) we discussed the foundation of an accurate .30-06; that is selecting the right barrel blank and chambering it for best accuracy. In Part 2 we'll detail some specific match proven loads for the only cartridge you really need.

The truest "secret" of great accuracy in the .30-06 is to keep the load close to, but under SAAMI's maximum pressure standard. The loads I've set out for you in this article do just that. As a result, they are accurate, safe, and won't put undue wear on your action or barrel. The .30-06 has plenty of case capacity and will give very good muzzle velocity without exceeding safe pressures. Remember, it isn't a magnum; but it's a lot better than a .308. If you can live in that happy medium ground of .30 caliber ballistic performance, then you'll get a lot of satisfaction from the .30-06.

There are three loads that I shoot regularly in the .30-06 with readily available components. I don't really spend a lot of time working with new powders or bullets because for NRA Highpower Prone shooting, these loads do just about everything I want. I am, however, working on one new load and I'll tell you about that as well; so you'll get three proven loads and one experiment.

I've covered some of these loads previously in our [.30-06 Update article](#), but there are a few refinements, a few more details, and another year of shooting them has shown that they're still good loads. In each case, I'll give you the exact components I use and some acceptable substitutes where applicable.

The Mild Mid-Range Load

One of the fun things about the .30-06 is that you can load it down quite a bit and still retain all of its inherent accuracy. In fact, that's nothing new, as the Frankford Arsenal and Lake City Match and National Match ammo were loaded like this in order to function properly in the M1 Garand without damaging the Garand's somewhat delicate op-rod. This load is really just a duplicate of those old match loads and is extremely accurate. It shouldn't be thought of as a reduced load because the arsenals cranked out millions of rounds just like this and it is a full pressure load, but it's pretty mild in recoil. This is the only load in this article that is suitable for the M1 Garand, or the 1903 Springfield type rifles.

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Brass: Lapua (Lake City or Winchester are acceptable substitutes)

Primer: Federal 210M (PMC, CCI BR2 or Winchester WLR are acceptable substitutes)

Powder: H4895, 47.0 gr. (IMR 4895 and IMR 4064 are acceptable substitutes with minor charge adjustment)

Bullet: Sierra 168 gr. Match King moly (all Sierra or Berger 155 gr. are acceptable substitutes) cut the powder charge 1.0 gr. for bare bullets. Seat the bullet for 0.020" jump to the lands.

Muzzle Velocity: Approximately 2720 fps from a 28" barrel.

This load is extremely accurate despite having a lot of air space in the case and the bullet jump which I normally avoid in my loads. You'll feel slightly less recoil than with a typical .308 Palma load, but don't raise that powder charge; these are fast burning powders and although mild in recoil, you're close to maximum pressure.

The All Purpose Load

On any given weekend here in Phoenix, we might have a match at 300, 500, 600 or 1000 yards. Sometimes I get a bit caught up with daily life and reloading for Saturday gets neglected; that's when this all-purpose load saves the day. I always have a full box (72 rounds) of this on hand and it has allowed me to shoot a match rather than stay home more than once. Of course, if the load weren't accurate at each of those distances, I might as well stay home. Thankfully, it is very accurate and the best example of the .30-06's all-purpose nature that I can think of.

Brass: Lapua (Norma or Winchester are acceptable substitutes)

Primer: PMC (Russian) (F210M or CCI BR2 are acceptable substitutes)

Powder: H4350, 53.5 gr.

Bullet: Sierra 190 gr. Match King moly (Berger 190 gr. VLD is an acceptable substitute) cut the powder charge 1.0 gr. for bare bullets. Seat either bullet for 0.020" jam into the lands.

Muzzle Velocity: 2800 fps from a 28" barrel.

This load is very close to maximum pressure with my lot of H4350 and you should absolutely work up to it because your lot won't be the same; even a change of primers can add 3,000 psi instantly. That goes double if you're using bare bullets because although the indicated 1.0 gr. reduction is a good rule of thumb, being careful and really checking things out is the only prudent approach.

The Long-Range Load

I've been working on this load for some time and am satisfied that I've got just what I need now. This isn't exactly a set of commonly available components, but it isn't too exotic either. Basically, the load was a result of trying to work with H4831sc for long-range because I've always seen excellent accuracy from that powder. However, because of its slow burn rate and low density, the case is full a few grains below what it takes to match the muzzle velocity from H4350. That kept me from trying it at long-range for a while. However, when I brought the super thin Norma brass and the Cauterucio 200 gr. VLD into the picture, it came together perfectly and it's been very good at 1000 yards so far.

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Brass: Norma

Primer: PMC Russian (Federal 210M is an acceptable substitute)

Powder: H4831sc, 57.5 gr.

Bullet: Cauterucio 200 gr. VLD moly (Berger 190 gr. VLD and Sierra 200 gr. Match King are acceptable substitutes). Seat all bullets for 0.020" jam into the lands.

Muzzle Velocity: 2675 fps estimated from a 28" barrel. I haven't chronographed this load, the MV is based on other loads with the same powder. It's a reasonable estimate, but I'll update this when I get a chance to chronograph the actual load.

This load cannot be safely used with other brass. Norma is much lighter than any other brand and allows the safe use of this load. I've shot a few 1000 yard matches with this load and the scores have been in the mid to high 190's with a high stage score of 199-10X. All matches were shot with iron sights from the CSS tubegun with a Hart 1:11" twist barrel, PTG Serengeti chamber as described in Part 1 of this series.

The Experimental Long-Range Load

I really like my current long-range load, but I have a small supply of the 200 gr. VLD Cauteruccio and I haven't tried getting any lately so I don't know how hard or easy it might be. In the meantime, I have a good supply of Berger 185 gr. BTLR and they are a great long-range bullet in my Palma and F-TR rifles, so I am confident that they'll also work great in the .30-06. I haven't done any testing at all with this yet, but I have a solid idea of which components I'll use. During the summer I'll do an initial work-up at 500 yards and then once we get back to 1000 yard shooting in the fall (or maybe in California during the summer) I'll report back on my results.

Brass: Lapua (Norma or Winchester are acceptable substitutes).

Primer: PMC Russian (Federal 210M is an acceptable substitute)

Powder: H4350, no charge weight at this time.

Bullet: Berger 185 gr. BTLR moly (Berger 185 gr. Hybrid is an acceptable alternative).

Muzzle Velocity: unknown at this time

Accuracy Secrets of the .30-06 - Part 3 **by Germán A. Salazar**

Having discussed barrel and chamber reamer choices in [Part 1](#) and a few specific accuracy loads in [Part 2](#), we now move into the final installment of this short series and we'll discuss some reloading tools and techniques for accurate loading of the .30-06. Obviously, good reloading practices are applicable to any cartridge and it isn't my intention to make this an article on how to reload; the purpose of this is to highlight things that are either unique to the .30-06 or of particular importance on the .30-06. I will assume that the reader has a solid knowledge of reloading generally and accuracy reloading specifically, and accordingly, will skip or gloss over many of the basic items that are common to all cartridges.

Brass

One of the great virtues of the .30-06 is the huge variety of brass available for it. One of the real curses of the .30-06 is the huge variety of brass available for it! Huh? Well, it's kind of fun to see all the different headstamps and to try new types of brass, but it can absolutely drive you mad trying to maintain a consistent level of performance. I have .30-06 cases that weigh 176 gr. and I have others that weigh over 200 gr. - and plenty that are in between. Clearly, the load has to be adjusted as you switch from one type of brass to another. Then there's neck thickness; it varies as much as case weight and can also cause problems.

1. **Brand Selection.** The first recommendation regarding brass is to standardize on one brand, or at most two brands, of brass. There will still be some lot to lot variance, but it won't be too much. If I were going to the store tomorrow to buy all new .30-06 brass, it would be Lapua or Norma if the budget allowed it and Winchester as a great alternative. Those choices are based on my observations of brass quality as discussed in item 3

below. However, if you love another brand, or have it already, that's fine and you'll develop your loads around that type.

2. Neck Turning. Because of all the variability in brass, I turn all case necks to the same dimension: 0.0125" thickness. That means I take a lot off of a Lapua case and a little off of a Winchester and kind of in between for a Lake City. But, and this is the critical point, doing so allows me to use the same sizing die setup and obtain the same neck tension on the bullet with any brand of case. [Click here for earlier neck turning article.](#)

3. Case Indexing. The .30-06 case is fairly long, which means that it will more easily develop a thick side and a thin side during the drawing process by which the case is made. The more draws the manufacturer uses in forming the case from the brass cup, the more uniform it will be, but the higher the manufacturing cost will be. Any significant variance in case wall thickness will definitely cause a degradation of accuracy and will make it difficult to get a truly concentric alignment of case and bullet because the case will quickly develop a banana shape. I use the NECO made version of the Creighton Audette tool to check the cases, mark them on the thin side and then insert them into the chamber with the index mark always in the same orientation. Since I began doing this with the .30-06, I've seen a distinct increase in my X count and maybe a couple of points in the aggregate. The effect was not as noticeable with short cases like the 6BR which aren't stretched as much during manufacturing and thus maintain more even wall thickness. To learn more about the process, [read this earlier article.](#)

I think if you do those three things, you've addressed the main concerns with .30-06 brass. Any other form of brass sorting or preparation that you believe to be worthwhile is fine, although I've never been one to weight-sort brass or deburr flash holes. If it makes you feel good, do it, if it doesn't, that's OK as long as you took care of the three big items.

Resizing

1. Sizing Die. I have six or seven .30-06 sizing dies including bushing dies, body dies, neck dies, and conventional full-length dies. However, almost 100% of the time, I use a standard Redding full-length sizing die that I bought used for \$5 from a fellow shooter at the range; I even got a seater for that price. Why? Simply because it is a great match for my chamber. Once I saw how well it sized, I adjusted my neck turning dimension so that this die would give me the neck tension I want without oversizing. When you can just barely feel the expander ball gliding over the inside of the case neck, you've got it right. The great body fit with the standard Redding die is nice, but the Redding bushing dies also have a great body fit and you can adjust the neck to any tension, right? Yes, but there's one more reason to use a standard die over a bushing die: concentricity. A once-piece die that doesn't overwork the neck will almost always give you better concentricity than a bushing die because the bushing has to have some radial clearance for ease of insertion and that thousandth or two of clearance will degrade concentricity. Allowing the bushing to float a tiny bit by not clamping the top down tightly (just back it off a tiny little bit) helps, but a one-piece die is still better.

2. **Headspace.** The longer a case is, and the more tapered it is, the more it will grow each time you resize it; and the more it grows, the sooner you will run into a [case head separation](#). With modern case designs such as the .308 or the 6BR both of which have moderately sharp shoulder angles and straight bodies, you need to set the shoulder back 0.002" or so in order to ensure easy bolt operation and to avoid galling the locking lugs and seats. The .30-06, however, with its mild shoulder angle of 17.5 degrees and it's long, tapered body, works just fine with a 0.000" setback. This isn't the same as neck sizing, because you're still sizing the whole body. However, if you work carefully, you can set your die for 0.000" to 0.001" setback, extend case life a little (I get 11 to 13 firings from most of my brass) and maintain reliable functioning.

Tooling

We've covered all of the basics and there isn't really any tool that's unique to the .30-06, but some take on extra importance with this cartridge.

A good headspace gauge that you can use quickly and easily is essential. I have two that I rely on: a Mo's thimble type gauge ((203) 775-1013) and a Forster case gauge (the Wilson is virtually identical). They do the same thing: give me a shoulder setback reading and allow me to check trim length.

The [NECO](#) Audette tool is critical to me. Without it, I know that my scores would be a little lower and I don't have any room to give up points or X's. I get a lot of peace of mind from checking and indexing my brass with the NECO tool.

The case trimmer is another big item. With a 6BR you might trim every seven or eight firings because that short, straight case seems to never grow - that isn't so with a .30-06! I use a [Giraud case trimmer](#) and trim the cases on every firing. These cases grow quite a bit and I don't take any chances with safety. A manual trimmer takes a long time and I would be tempted to skip this step now and then without the Giraud, so this is a convenience item, but really a safety item.

Conclusion

Our objective is to create ammunition capable of consistent high scores at distances from 300 to 1000 yards under match conditions. That means it might be 40 degrees, or 110 degrees; it might be a calm day or a windy day, it might be raining, it might be blowing dust - in any of these conditions, if the ammunition causes rifle functioning problems, the match is already lost. Careful attention to the tips in this series should allow you to load .30-06 ammunition fully capable of winning matches at any distance against competitors of skill similar to your own.