Rifle Barrel Twist vs Bullet Weights

A few rifling-twist guidelines and tips to ensure you don't take a wrong turn with your gun or ammo bullet weight.

March 26, 2021 By Craig Boddington

Yeah, I know I'm supposed to know everything about sporting rifles. I acquired a nice 1899 takedown in .250 Savage from my buddy Joe Bishop's widow—clean, in great shape, flip-up aperture. Between my eyesight and the irons, I'll never know how well it really shoots, but it grouped just fine with 100-grain Hornady InterLocks.

Thing is, I wanted to use it on the Central Coast, but there are no California-legal unleaded factory loads in .250. I have dies, so I loaded a few 90-grain GMX, but if the bullets hit paper at all, they hit sideways.

I should have known that before 1920 all .250 Savage rifles were barreled with a slow 1:14 twist for the initial 87-grain load. My friend Kyler Hamman directed me to Hammer Bullets in Idaho, which makes a 67-grain 0.257-inch copper bullet intended for the old 1:14 twist. Yep, it's light for caliber, but it stabilized, and I'm able to push it to almost 3,200 fps with no pressure signs.

Rifling twist imparts gyroscopic stability to a projectile, enabling much greater accuracy than a smooth bore. The formula for determining a proper stabilizing twist considers the length, weight, and shape of a projectile. Of these, projectile length, or at least the bearing surface that contacts the rifling, is critical.

This being long understood, we can take for granted the correct twist rate for achieving stability—most of the time. Rifling twist is expressed as a complete rotation per inches of rifling, as in 1:10 (one turn in 10 inches). Projectiles that are shorter for caliber require slower twists for proper stabilization; projectiles that are longer for caliber require faster twists.

Roundnose bullets are shorter for weight than sharp-pointed, spitzer bullets. So a 1:12 twist is traditional for the .30-30, while most .30 caliber cartridges designed for longer bullets have a 1:10 twist. Slow twists are uncommon today, but they still exist. The .45-70 is standard with a 1:20 twist because the most common projectiles are relatively short and light for caliber.

Generally, there is a range of suitable projectiles, not an abrupt precipice like I encountered with that .250 Savage. If the rate is too slow for the projectile, accuracy will typically deteriorate gradually until a breaking point is reached. Then bullets may tumble end over end after exiting the barrel.

In my experience, keyholing is more common with twists that are too slow to stabilize the bullet. Twists that are too fast seem more likely to simply yield poor groups. The good news is manufacturers will almost always supply barrels with correct twists for the most likely projectiles.

The best-known exception is the situation between the .243 Win. and .244 Rem., both introduced in 1955. According to legend, Remington saw the .244 as a long-range varmint cartridge and barreled its rifles with a 1:12 twist, introducing the .244 with a 90-grain load. Winchester apparently saw its .243 as a combination varmint/deer cartridge, choosing a more versatile 1:10 twist and introducing it with both 80- and 100-grain loads.

The original .244 Rem. with 1:12 twist was unable to provide good accuracy with bullets over 90 grains. With a faster 1:10 twist, the .243 Win. shoots well with both light varmint bullets and heavier hunting bullets.
In 1958 Remington changed the twist to a faster 1:9. By then the .243 had caught on, while the .244 never would. In 1963 the .244 was renamed 6mm Rem., retaining the 1:9 twist, but the damage was done. It can be argued that the 6mm Rem. is a “better” cartridge than the.243, but it has never caught up.

The difference between 1:10 and 1:12 doesn’t sound like much, and it isn’t. In .30 caliber, a 1:10 twist will stabilize a wide range of bullet weights. 7mm bullets tend to be longer for caliber than .30 caliber bullets. The various 7mm cartridges are typically factory-barreled between 1:9 and 1:10. Any twist within this range will stabilize the most common 7mm bullets.

However—as we shall see with the .223/5.56 NATO—the smaller the bore diameter the more critical correct twist becomes, especially as projectiles continue to develop. In 6mm, the difference between 1:10 and 1:12 proved a deal-breaker. In 1920, with the introduction of a 100-grain .250 Savage load, Arthur Savage changed to 1:10, still the standard twist for most .25 caliber cartridges, stabilizing almost all .25 caliber projectiles.

Over time, standard projectiles have become longer, and stabilizing rifling twists have gotten faster. However, standardized rifling twists will provide good accuracy for most projectiles available within a given bullet diameter.

There are exceptions. Standard .30 caliber bullets range from 110 to 220 grains, and there are .308-inch bullets from 100 grains to 250 grains. It is not reasonable to expect a .30-06 with a 1:10 twist to provide equal accuracy across this range. For instance, in years gone by I’ve experimented with extra-heavy 250-grain .30 caliber hunting bullets, but with the standard 1:10 twist I’ve never gotten great accuracy.

Although extra-heavy bullets are often touted for dangerous game cartridges, I've had similar accuracy issues with 350-grain .375 bullets and 450-grain .416 bullets. Most .375 barrels have 1:12 twist; most .416s have 1:14 twists. If you're serious about extra-heavy bullets, you might consider rebarreling to a faster twist.

The opposite can also apply. The fast, light-recoiling 110-grain .30 caliber bullets are interesting for practice and varmints, but in most rifles with 1:10 twists, bragging-size groups are uncommon. You could, of course, rebarrel to a 1:12 or 1:14 twist for light bullets, but you might have accuracy issues with heavier hunting or match bullets.

Just recently I spent some range time with a Wilson Combat carbine in .300 BLK, a marvelous AR. It was barreled with a 1:7 twist, probably ideal for the heavy-bullet subsonic loads essential to the Blackout's intended mission.

Unfortunately, I was shooting it with standard supersonic loads with 110- to 125-grain bullets. Accuracy was okay for the .300 BLK's range, but this twist is too fast for such short bullets. Better would be the standard .30 caliber 1:10; ideal would probably be 1:14, but accuracy with 220-grain subsonic loads might be abysmal.

Increasingly, with some of today's specialized cartridges and bullets, we need to start asking about rifling twist and thinking about our exact purposes. At the extremes, one spin has never fit all, but today there are more situations where standard rifling twists may not suit your needs.

Increased interest in extreme-range shooting is probably the second-most common example. Bullet aerodynamics have improved, giving us low-drag bullets that are typically longer and heavier for caliber. The .243's 1:10 twist and the 6mm Rem.'s 1:9 twist are versatile, but neither is quite right for the 108- to 112-grain match bullets recently developed. Ruger puts a faster 1:7.7 twist on its Precision Rifle in 6mm Creedmoor.

Because 6.5mm cartridges were developed early in the smokeless era, twists were fast to stabilize heavy-for-caliber military bullets. Standard for the 6.5x55 was 1:7.5, ideally suited to today's longer 6.5mm bullets. The .260 Rem. was initially barreled at 1:10, not fast enough to properly stabilize today's low-drag bullets. Some manufacturers have shifted to 1:9; but 1:8 twist is most common with the 6.5mm Creedmoor. If you're buying or building any 6.5mm rifle and intend to use high ballistic-coefficient bullets from 140 grains up, a 1:9 twist is minimal and 1:8 is better.

The .30 calibers are not necessarily more cooperative, but most .30 caliber cartridges were designed for bullets up to 220 grains. The 1:10 twist standard to most .30 caliber cartridges will stabilize even long match bullets up to about 230 grains. Heavier .30 caliber slugs exist, but a slightly faster twist will yield better results.

Interestingly, the .308 Win. is most commonly barreled with a 1:12 twist. This is probably because use of long, heavy bullets was not envisioned in shorter actions. However, in .30 caliber, even a 1:12 twist is versatile and can usually stabilize 190-grain match bullets and 200-grain hunting bullets.

Proponents of the 7mm argue that typical 7mm bullets are longer with higher sectional density than .30 caliber bullets. Thus, 7mms have traditionally been barreled with slightly faster twists.

The 7x57 Mauser, designed for 173-grain bullets, was originally barreled at 1:9. In the United States, since at least 1962, Remington has been the 7mm champ and has used an odd 1:9.25 twist for its several 7mm cartridges. Winchester used a 1:9.5 twist for the 7mm WSM. Interestingly, Roy Weatherby used a 1:10 twist for his 7mm Wby. Mag. Whatever, the 7mm is also quite flexible, within limits.

As bullets become more aerodynamic and inexorably longer, ideal twists must change. Bullet makers give us clues. But while we can change barrels, we cannot change twists. Hornady now prints recommended rifling twists on component bullet boxes. Its 7mm 162-grain ELD-X suggests 1:9.5. Berger prints "minimum" and "optimal" twist rates on its bullet boxes. Berger's 195-grain Elite Hunter 7mm bullet suggests a minimum of 1:9 and optimal of 1:8.3.

My buddy Derek Barnes, a serious long-range shooter, is messing with a .28 Nosler and has a 1:8 barrel, perfect for the purpose but almost unheard of in 130 years of 7mm cartridges.

TWIST RATES FOR VARIOUS BULLET WEIGHTS

Bullet Diameter	Twist Turn: Inch	Weight Range (grs.)
.172	1:9	20-25
.204	1:12	24-45
.224	1:7	68-80
.224	1:12	35-60
.224	1:14	35-55
.243	1:10	55-100
.243	1:7.7	100+
.257	1:10	60-120
.264	1:8	95-160
.277	1:10	100-160
.284	1:9	120-195
.308	1:7	168+
.308	1:10	150-230
.308	1:12	110-190
.338	1:10	185-285
.375	1:12	225-300
.416	1:14	350-400
.416	1:12	400+
.458	1:20	250-400
.458	1:14	300-600

Notes: Bullet grain weights are approximate guidelines. Barrels vary. Twists used with poorly matching bullets will usually show gradual accuracy deterioration. Bullets tumbling or "keyholing" and hitting the target sideways indicate gross mismatch.

See Photo Gallery

The .22 centerfires, especially the .223 Rem./5.56 NATO, have caused the greatest changes in rifling twist. As our standard military cartridge for 50 years and the hottest-selling commercial centerfire, the .223 has an interesting history. It was introduced with a 1:14 twist, soon changed to a more versatile 1:12 twist, which usually works okay for bullets from 40 to 60 grains.

Then the military wanted long-range performance, and hunters started using .223s with heavy bullets for deer. Military 5.56 rifles currently have a fast twist of 1:7, while 1:12 remains common for many .223s intended for varmint shooting. This is one of few situations where a given cartridge has multiple "standard" twist rates, so let the buyer beware.

I have a 1980s Kimber .223, a favorite varmint rifle with 1:12 twist. For this article, I shot a 50-yard test group with the 55-grain V-Max, all shots touching. I knew this rifle doesn't shoot heavy bullets,

but I didn't know the limit. I went to 69-grain bullets, and the first two shots touched. Nice, but surprising. The third bullet hit the target sideways high and right. Clearly, I was past the bullet weight limit for this barrel. For fun, I tried a 73-grain ELD-X. It was hopeless. All bullets keyholed, scattering all over the target.

I also have an older AR with 1:12 twist. With lighter bullets I've used it for prairie dogs, and I've taken a few whitetails with it, mostly with 60- to 62-grain bullets. At that weight, groups are not as tight as with lighter varmint bullets, but there is no keyholing. Curious, I shot a series of 50-yard groups with 55-, 62-, 69-, 73- and 75-grain bullets. As expected, the 55-grain bullet grouped best. The other groups opened up, but there was no tumbling. So barrels differ, but I know from past experience this barrel's accuracy limit is about 60 grains.

In the United States, the Sporting Arms and Ammunition Manufacturers' Institute establishes and maintains standard specifications for factory cartridges, including the rifling twist intended for the cartridge. As noted, this can change over time, but bullet makers are obligated to develop bullets that will work in standard rifling twists.

"We consider twist rate all the time," Hornady engineer Joe Thielen told me. "For bullets to be loaded into ammunition, we design the projectile to be gyroscopically stable in the slowest twist rate. A case in point is the 178-grain ELD-X to be loaded in .308 Win. where the standard twist rate is 1:12. Another good example is the 90-grain ELD-X 6mm bullet; the standard .243 Win. twist is 1:10."

Thielen went on to say that if engineers didn't have to worry about loading bullets in factory ammo, they could design a bullet for maximum aerodynamic efficiency. However, they still need to consider the fact that the bullets will likely be shot from commonly used twist rates.

"Examples are the 6.5mm Creedmoor and 6.5mm PRC, where most factory and custom barrels are 1:8 twist," he said. "We could design and build a 180-grain 6.5mm bullet and shoot it from a 1:5 twist barrel, but velocity would be anemic and getting it to shoot well would be difficult.

"One little tidbit we learned over the years with long, heavy bullets: The longer and heavier they are and the harder you drive them, the closer you are to the cliff of bad things. One little step further and you fall off. Stuff goes to hell in a hurry. The long, heavy bullets are awesome on paper and in the field, but everything from equipment to the bullet itself must be perfect to get them to work well."

In the early '90s, my old friend Randy Brooks of Barnes Bullets gave us the first expanding homogeneous alloy hunting bullets: the Barnes X. Prior to the X, Barnes was known for extra-heavy bullets like the 225- and 250-grain .30-caliber and the 350-grain .375.

In developing the Barnes X, Randy told me that he had to constantly consider rifling twists because a copper bullet is longer than a lead core bullet of the same weight.

"Ultimately, the bullets had to work," he said, but because of high weight retention, he came to realize they could use a bullet of less weight to achieve the same performance. This, of course, translated to higher velocity and less recoil without stabilization issues.

One last thing on spin. Just the other day I was on the range with John Lazzeroni, another old friend, checking zero before going pig hunting. I shot a nice group with John's 7.21 (.284) Tomahawk, noting it was a bit to the left.

“Oh, yeah,” he said. “I always zero a bit left for spin drift.”

Most of us mere mortals don’t worry about spin drift, but it’s a real effect that long-range shooters must consider. Rifling with the most common right-hand twist drifts to the right; left-hand twist is the opposite.

Amount of spin drift depends on bullet shape and velocity and also the rate of twist. The faster the twist, the greater the effect, and you can figure a minimum of eight inches at 1,000 yards. I wasn’t thinking about 1,000-yard shooting; I was thinking about a 100-yard head shot on a pig. I removed John’s spin drift allowance.