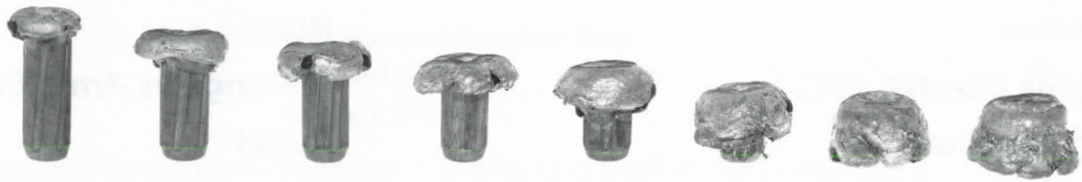
Swift Products

SCIROCCO® II BONDED

Scirocco® II, with the Signature Black Tip™, is a superbly accurate hunting bullet designed for long-range efficiency. It carries velocity and energy better than any of its competitors. Its sleek design and high ballistic coefficient produces the flattest trajectory in downrange hunting, making it a perfect match for long-range cartridges. The Scirocco® II produces positive expansion at minimal velocities as well as controlled expansion and high weight retention at close range. No other tipped bullet offers the terminal range of Scirocco® II.

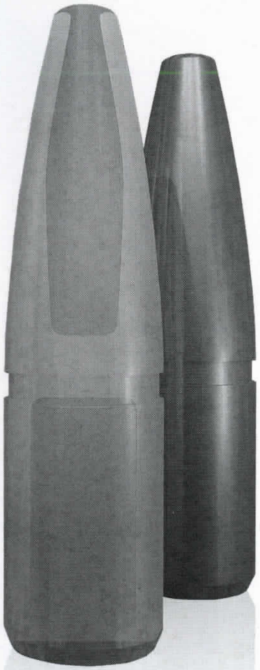


1750 fps	2100 fps	2300 fps	2500 fps	2700 fps	3000 fps	3200 fps	3325 fps
.490 Dia.	.650 Dia.	.675 Dia.	.695 Dia.	.705 Dia.	.710 Dia.	.711 Dia.	.815 Dia.
99% Wt. Ret.	99% Wt. Ret.	97% Wt. Ret.	96% Wt. Ret.	95% Wt. Ret.	84% Wt. Ret.	81% Wt. Ret.	80% Wt. Ret.

The Scirocco® II provides excellent accuracy, controlled expansion of 2.5x its original caliber and 84%+ weight retention. No other tipped bullet is tougher than Scirocco®.

Swift Products

A-FRAME® BONDED



For 30 years A-Frame® rifle bullets have set the standard by which all bonded bullets are measured. With its controlled expansion of 2.2x and 95% weight retention A-Frame® penetrates deep and mushrooms perfectly, making it the choice of hunters for use on any game, anywhere in the world.

1850 fps	**2100 fps**	**2300 fps**	**2500 fps**	**2700 fps**	**3000 fps**	**3200 fps**	**3325 fps**
.402 Dia.	.551 Dia.	.575 Dia.	.580 Dia.	.595 Dia.	.630 Dia.	.630 Dia.	.670 Dia.
99% Wt. Ret.	99% Wt. Ret.	99% Wt. Ret.	98% Wt. Ret.	97% Wt. Ret.	94% Wt. Ret.	91% Wt. Ret.	91% Wt. Ret.

A thick jacket wall, a bonded core and a heavy supporting cross-member all contribute to A-Frame's virtually indestructible design.

Accuracy

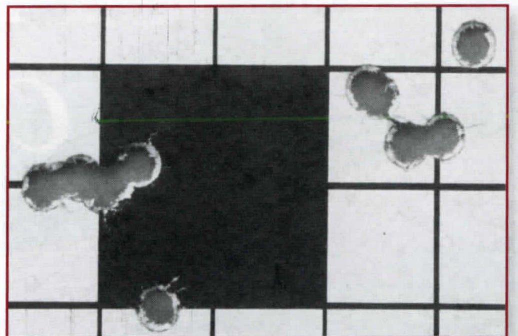
Accuracy by Definition

A major advantage in handloading is that a shooter has the ability to tailor his components specifically to an individual firearm, his intended quarry, the expected hunting conditions, and his hunting style.

There are any number of component combinations that will produce acceptable results, and if a shooter desires, he can simply pick a likely load, sight-in, and go hunting. On the other hand, handloading offers a whole arena for load development, if a person is so inclined. Every firearm is an individual and has its own idiosyncrasies regarding which type of propellant and which charge weight produces the best accuracy. There may be several options in propellant types that produce similar velocities at a given pressure level. However, there may be only one that turns in outstanding results when it comes to accuracy. Only by loading and shooting can the optimum combination be determined.

Use a good bench rest to determine the inherent accuracy of your hunting loads as closely as possible. Always wear eye and ear protection while shooting from the bench rest.

This area of experimentation can be as simple or as involved as a shooter wishes to make it. Some want to get a good load with a minimum expenditure of time and components. Others enjoy experimenting, shooting, and trying different loads. The choice is yours.



Group sizes are measured from the center of one hole to the center of the opposing hole that gives the widest spread.

There are a multitude of factors that go into accuracy, but before talking about what influences accuracy, let's take a look at what is meant by the word "accurate." Different folks have different ideas about what constitutes good accuracy. A competition bench rest shooter is disappointed if his rifle and load are not capable of firing in the "ones" (less than a .2-inch average) for five, five-shot groups at 100 yards. But accuracy of that sort is really irrelevant when it comes to hunting. No hunter could shoot that well with field shooting positions, and even if he could, hunting rifles and ammunition are simply not capable of that sort of accuracy. More than that, a hunter doesn't need that kind of grouping ability. Swift bullets are designed by hunters for hunters, and for our purposes, target or bench rest competition accuracy is not what we're after. What we're concerned with is practical hunting accuracy. But what is practical hunting accuracy?

Most shooters measure accuracy in terms of group size on paper and group size is based on a measurement between the two bullet holes in a group that are the farthest apart. Measurement is from the center of one bullet hole to the center of the opposing hole that gives the widest spread. There has been a lot of talk in recent years about one-inch groups. When conversations center around group size there frequently is no mention of the number of shots or the number of groups. For hunters, it might be a three-shot string or five. Others talk about two-shot groups or ten-shot groups. The number of shots in a group has a great bearing on what should be considered to be a good group. Some quote group size based on the measurement of a single group. Others take the average of three groups or five. Frequently, a hunter reports the measurement of only the best group. There is a world of difference in these comparisons.

The shooting distance also has a great bearing on the expected size of the group. A person has entirely different expectations regarding a group fired at 100 yards than one fired at 300 yards.

The size of a group that is considered to be good is not fixed. For example, one generally expects a custom-built bolt action rifle with an after-market trigger and heavy barrel to shoot better than a short, lightweight lever gun or semi-auto.

For some hunters, group size is of no consequence. Instead, the ability to put the first shot in the desired place the first time and every time is the measure of hunting accuracy.

A lot of qualifiers are necessary whenever accuracy is discussed so that two people have a common ground for comparison. Because these specifications are usually left out, there is often disagreement about what is desired. What is really important is one's ability to place all his shots into the vitals of the game to be hunted at any distance the game is to be shot at. While this is really the core of practical hunting accuracy, it lacks a standard by which loads can be compared. When it comes to handloads, one needs a standard and as we have seen, the standard should be flexible depending on a variety of factors.

What most do agree on is that a rifle's ability to cluster shots into a group, regardless of the group size standards, is a good measure of "accuracy" in developing a handload for hunting. One thing that we can all agree on is that accuracy is something that we can not get too much of. The tighter the group, regardless of the distance, the type of firearm, or the number of shots, the better.

As for the factors that influence group size, there are a lot of them. The shooting conditions, the type of rest, the ability of the shooter, the capability of the rifle, the quality of the sighting equipment, and the condition of the bore are a few of them. Each of those factors is a whole topic in itself. For now, we're concerned about two things, the quality of the ammunition and how handloads can be tailored or "developed" to help us produce tighter groups.

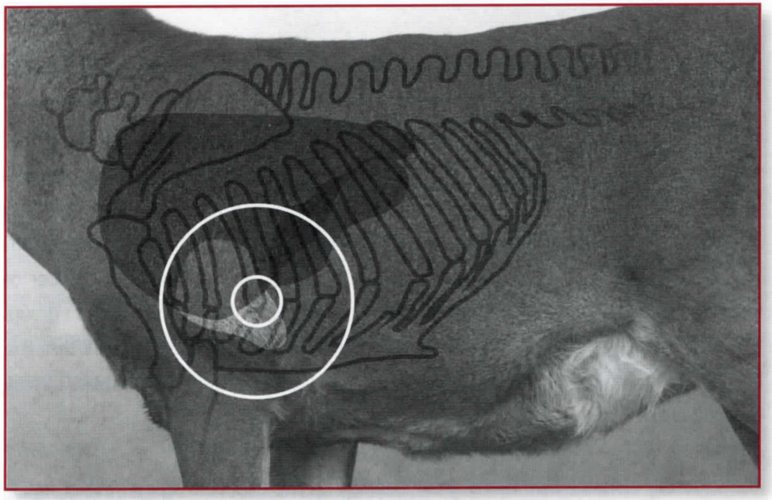
Accuracy expectations from different firearms are different. One does not expect the same accuracy from an iron-sighted lever action firearm as from a heavy-barreled scope-sighted rifle.

Today's factory ammunition is very good, but with it, we have what we get when we buy it. If a rifle doesn't like it and doesn't group well with it, there's not much we can do about it except buy another brand. With handloads, we have a lot of control over ammo performance.

Unlike with factory loads, a handloader has at his disposal almost infinite variables that he can apply to his ammunition that might make it shoot smaller groups. I say "might" because there are no guarantees. The fact is that firearms are individuals. What one rifle might like, another might not like.

Certain propellant types do produce more uniform pressure and velocity results in a given application of cartridge, bullet weight, and barrel length. Certain combinations also produce more uniform results in a variety of temperature, humidity, and other shooting conditions. To this extent, a good load can be developed in and of itself. Such loads tend to shoot well in a lot of rifles. However, there are lots of exceptions to that statement. The fact remains that when it comes to producing a tight-grouping load in a particular firearm, there is no way to predetermine the component combination and bullet seating depth that will do it best. You just have to shoot it to find out. Basically if the load combination produces the right barrel vibrations, you have a good shooting load.

For the most part, it is not difficult to attain hunting accuracy. As a practical matter, first consider the size of the vitals in most game. For example, the vital heart/lung/spine region of a deer is generally considered to be at least eight inches in diameter. Second, consider the accuracy available to the hunter in the field in terms of the available shooting positions and rests. A shot fired offhand in thick cover at a startled moose may not produce nor require a high level of accuracy. On the other hand, if you're shooting prone with a good rest over a glove-padded rock at a mule deer far across a canyon, your accuracy requirement and ability are far different. You must decide what sort of accuracy you need relative to your equipment, the quarry, the hunting conditions, and the type of hunting you do.



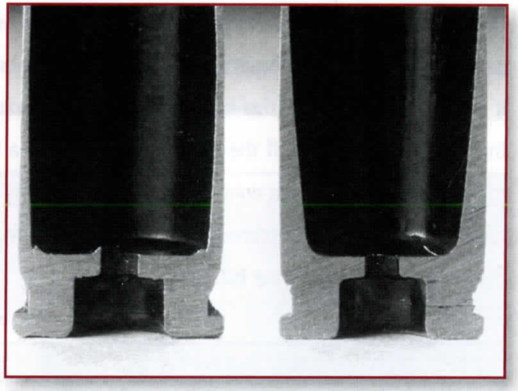
A life-size game target helps to determine shooting potential at various distances. This target has the heart, lungs, and spine marked on it. Practice from hunting positions that you will use in the field.

Reasonable hunting accuracy, for instance, two-inch five-shot groups at 100 yards from a modern bolt action hunting rifle, is not difficult to attain. A lot of loads will do it. One-inch groups are readily possible, but far fewer component combinations and bullet seating depths will turn in a one-inch cluster than a two-inch cluster. A person can spend a minimum of time and effort and get a two-inch load. If he wants a one-inch group average, he might get it the first try, or it might require the expenditure of a lot of time and components to accomplish.

No one can tell you how much time and how many component combinations you should test before you stop trying to get a better group. It's entirely up to you. However, since there are so many variables, it does help to have some sort of a plan or logical approach to this infinite supply of combinations. Otherwise, it is confusing and overwhelming.

Components for Accuracy

As mentioned, if you're simply after a good hunting load, you can usually find it without a lot of trouble. If you're the type who wants to get all the accuracy possible out of his hunting load, and don't mind detailed work to get there, there are a lot of things you can do before assembling components. You might consider the case itself. One of the major factors in shooting tight groups is uniformity in every respect, both in the components and in the assembly of those components. All cases should be of the same brand and lot. Some shooters weigh every case and separate them into sub-lots based upon weight. Primer pockets should be clean so that primers seat to a uniform depth. All cases should be trimmed to the same length. There is often a burr around the flash hole inside cases, and this can be removed with a flash hole chamfering tool to provide additional uniformity here, if desired. Powder charges should be as nearly the same as you can make them. In other words, for the best groups, make all rounds identical in every respect.

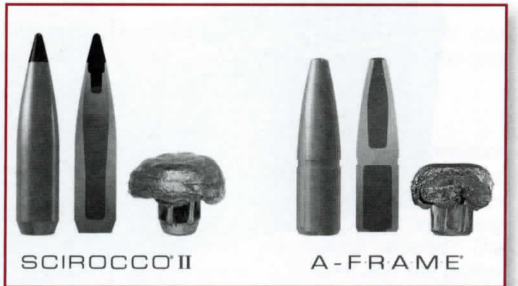


Flash holes often have a burr around the inside that can be removed with a flash hole chamfering tool.

Perhaps the simplest and, possibly, best approach to finding what shoots accurately in your firearm and the approach that requires the smallest inventory of components is to decide on a particular powder, primer, case, and bullet from the outset and use only bullet seating depth as the variable. Deciding on all the components in advance is not as difficult as it might seem.

Choosing a Bullet

When it comes to hunting, the bullet is the most important item to be selected because the bullet, and the bullet alone, is what impacts game. Once that tiny hunk of metal leaves the bore, the success or failure of a hunt rests entirely on it. You have absolutely no further control over a bullet after it leaves the muzzle. When it comes to hunting, so few shots are expended that it makes no sense to purchase bullets based on price. The choice should simply be the best there is. Since you're reading a Swift reloading manual, you've probably also come to that conclusion.

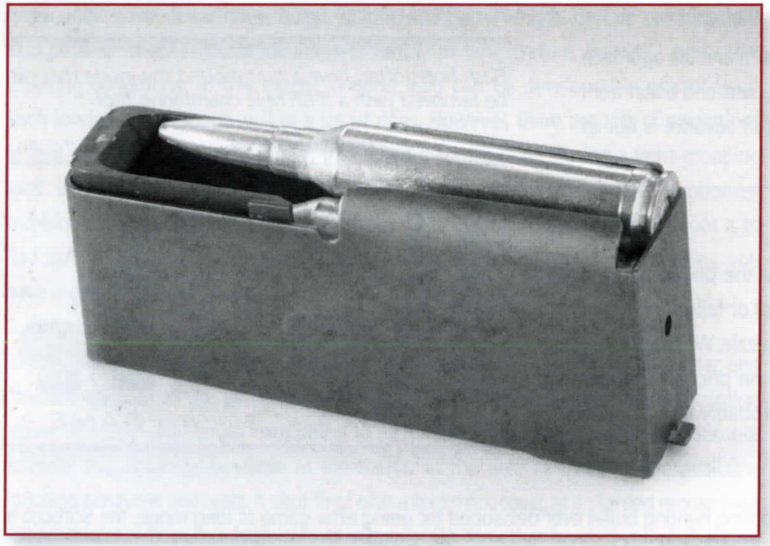


Both the A-Frame™ and Scirocco™ are the ultimate hunting bullets. If you want the flattest-shooting hunting bullet ever developed for going after game at long range, the Scirocco is it. If you want utterly reliable performance and perhaps to be able to seat a bullet a little farther out of a case for more capacity, the A-Frame cannot be beat. The choice is yours.

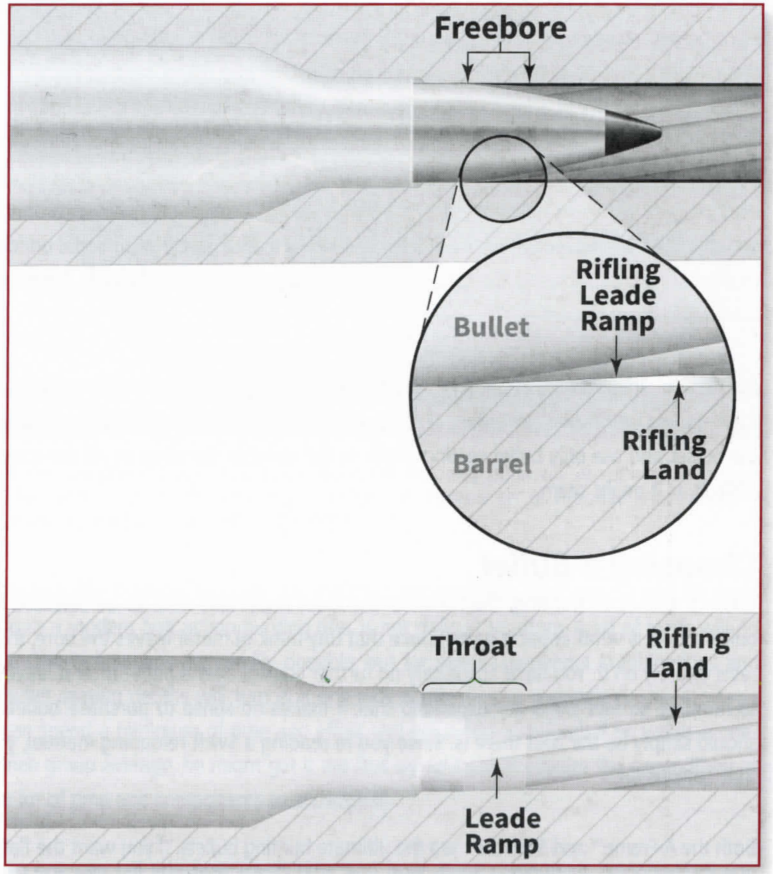
Besides using a bullet of the proper diameter for your cartridge, you need to pick a weight that is compatible with the game you're after. In simple terms, for larger game, use a heavier bullet. Things don't have to get more complicated than that.

Bullet Seating Depth

Decide on a reasonable bullet seating depth for your rifle relative to the magazine box length and the chamber throat length. The bullet must be seated deeply enough that it will fit inside the magazine box, and it must not be jammed into the lands when the round is chambered. If the rifle allows it, seating a bullet a sixteenth inch from touching the lands is about right for starters with hunting ammo. Always use a dummy round without powder or primer for checking function regarding seating depth. Never chamber a live round in your loading area.



Make certain that bullets are not seated so long that cartridges will not fit into or function smoothly from the magazine box.



This illustrates the bullet-to-lands relationship inside a rifle barrel. A bullet can be seated at varying distances from the lands. The length of this distance is referred to as "freebore" because the bullet travels free of the bore for a short distance before engaging the rifling. (The straight section of a rifle chamber forward of the case mouth, if it exists, is also sometimes referred to as "freebore.") It is important not to jam the bullet into the rifling lands. This can raise chamber pressure when the round is fired.

The Other Components

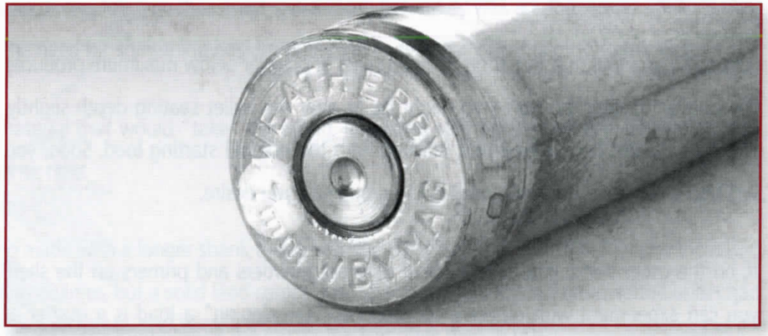
With bullet selection accomplished, you can focus on the rest of the components. A good place to turn at this point is the data in this manual. Simply use the same cases and primers used in development of data for this book. That leaves only the propellant to select. Here, pick a powder that provides top velocity for the bullet weight you've chosen. The data section in this manual presents several of the best powder choices for each application.

Powder Charge

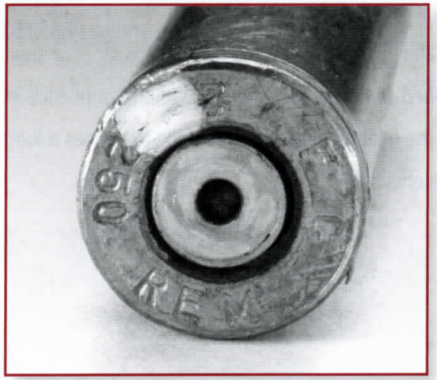
For powder charge weight, start about five to seven percent below the maximum charges. Possible starting points are listed in this manual. Load at least five rounds and then fire them in a group from a good rest. The idea at this point is to see what the load is capable of in the firearm at hand. Shooting practice can come after you've got your load.

Pressure Signs

Immediately after you've fired each shot, pay attention to extraction and check ejected cases carefully for any sign of excess pressure. An excess pressure indication might be slightly more difficult bolt lift or case extraction. It could be a shiny spot on the base of the case where brass flowed into an ejector hole or slot. It could be a dark smudge around the primer indicating that gas leaked around the primer. Excessively flattened primers might be another indicator. If you have no sign of excess pressure, add no more than 2% in powder charge weight, then load and shoot another five rounds. Check again for signs of excess pressure as you go and make note of the group size. You may very well be able to load the maximum listed charge weight in the manual, but at no time should you exceed it. Depending on your rifle and on the pressure signs mentioned above, you may not even be able to exceed the starting load. Published suggested starting loads could prove to be maximum in your firearm.



Look closely for any sign of excessive pressure. Here, a faintly visible circular spot of brass flow into the rifle's bolt face ejector hole indicates a charge that was over maximum pressure. The spot is visible at the eight o'clock position.



This case reveals several pressure signs. Note the shiny spot on the base and the blackened edges of the primer pocket indicating that gas leaked around. The primer is pierced and the primer pocket is enlarged. This was a serious overload. Remember, your rifle might not accept maximum listed loads.

Pressure Signs *(continued)*

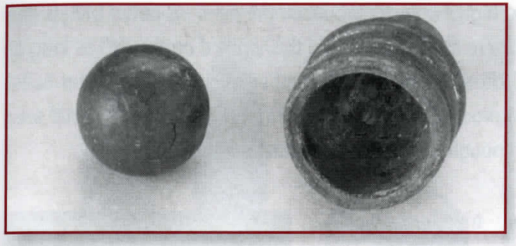
You must be the judge here. If you have a chronograph, you might also make note of velocity, and in no case should the velocity listed for maximum loads be exceeded for a comparable barrel length regardless of the powder charge or lack of pressure signs. (Caution: See warning regarding excessive pressure on page 36.)

Supposing you find that five shots at two grains of powder below maximum produces the smallest group. The next step might be to alter the bullet seating depth slightly, and perform the test series again, starting with the original starting load. Soon, you will find a combination that produces the group size you desire.

If, on the other hand, you have a lot of different powders and primers on the shelf, you can experiment with different components. "Developing" a load is a matter of trying this and trying that but always sticking with published data, always starting with the starting load, and always watching for signs of excessive pressure, then carefully working from there as pressure signs indicate.

It is really enjoyable to experiment and find the load that is accurate by your own standards within the limits of published data. The exercise also builds confidence in your firearm and load. Confidence in the quality of the bullet and the load goes a long way toward your ability to take game effectively.

Bullet Anatomy and Evolution



The patched lead round ball served well in muzzle loading firearms for a long while, then a hollow based projectile with a thin skirt (Minie) was found to be easier and faster to load.

The idea of making a bullet spin during firing was a great improvement. Helical grooves can be seen on this bullet. The grooves were made by corresponding rifling in a barrel.

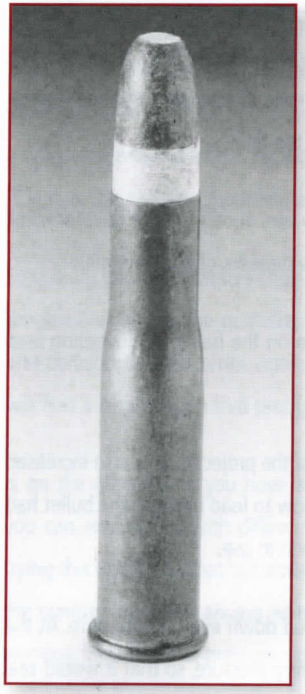
The bullet has come a long way since the advent of gunpowder and firearms. The bullet, as we know it today, began as a simple solid lead sphere used in smoothbore firearms that produced relatively low velocity. There were certainly projectiles of other materials prior to lead, but the density of lead, along with the ease of shaping it to one's desires by molding or swaging, gave it a capability far beyond anything else available at the time.

The idea of making a bullet spin during firing so that it will shoot more accurately was another major advancement in firearms. It also produced the need for something besides pure lead to reap the benefits of this new idea.

It was found that patching material that would "take" the rifling, imparting spin on the ball and preventing lead stripping in the bore at the same time.

Later, a bullet was pointed and made with a longer shank to increase the weight of the projectile. This also increased the momentum and penetrating abilities, but a solid lead conical projectile was slow to load because the bullet had to be engraved when it was shoved down the bore of the muzzleloading rifles then in use.

Along came the Minie with its reduced diameter, so that it could easily be shoved down even a dirty bore. At the same time it had a hollow base and thin skirt that would flare outward under firing pressure, so that it would seal propellant gas behind the bullet and take the rifling.



Paper patching bullets was an attempt to avoid lead fouling. This is a paper patched bullet.

While a pointed bullet was far more effective than a simple round ball, there was still the problem of the soft lead fouling a rifle's bore. The logical solution was to wrap the bullet as a ball had been wrapped. Paper was tried with some degree of success, but it didn't compare to using harder metals, and the idea for today's basic jacketed bullet was born.

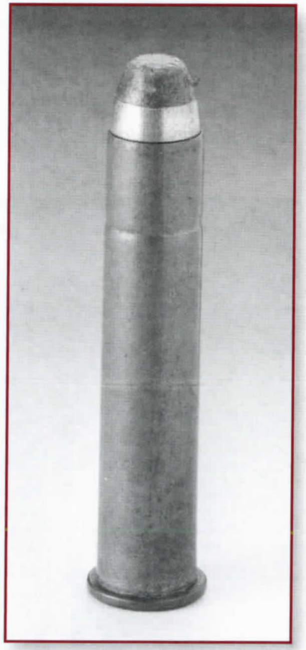
Lead is a wonderful material for bullet making because it is readily available, is relatively easy to mold or press into the desired shape, and provides a lot of weight for a given volume. These qualities, combined with a harder metal jacket, provided the basic bullet design that has been in widespread use for well over a hundred years.

A thin bullet jacket could be punched out and then drawn into shape from a flat sheet of metal while leaving a lead opening in the front end. Not only did this eliminate lead fouling in a rifle barrel, it could be used to reduce bullet deformity somewhat upon impact because the thin and relatively soft metal jacket walls supported the even softer lead to a small degree.

While this basic design has been in widespread use for a long while, it has undergone a vast transition and improvement, and one that has accelerated rapidly during recent years. Comparing a jacketed bullet in use at the turn of the nineteenth century to one being used in the twenty-first century is like comparing a horseless carriage with today's sports cars.

Self-contained cartridges and higher velocity produced the need for better bullets and better bullet jackets. Jackets were made thicker and this worked pretty well as long as velocities were in the 30-30 class. But as velocity climbed ever higher, a better bullet was needed, one that would produce some nose deformation for a blunt frontal area on impact but would retain enough weight for adequate penetration.

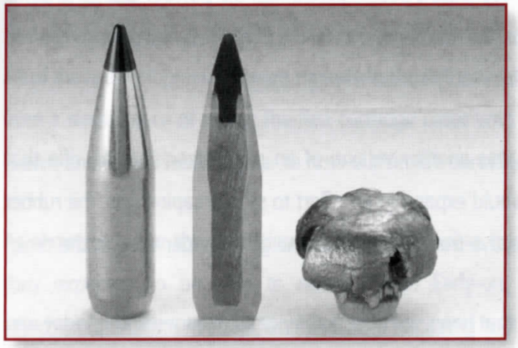
Various bullet designs were tried, usually by altering the jacket but retaining the valuable heavy lead core. Most bullets were made from a flat sheet of metal, cutting or punching out a disk and then drawing it into a cup for lead insertion and point forming. Some bullet jackets were made from metal tubing, and others were made from a solid billet of metal. It was clear that if a bullet retained more weight it penetrated better. At the same time, an enlarged frontal diameter during expansion was the best way to transmit energy to tissue and destroy it. It all adds up to stopping power.



Early bullet jackets were made of cupro nickel. It was better than exposing a bore to lead, but it fouled worse than today's copper or copper/zinc alloys commonly in use.

It could be seen that a wall of metal between front and rear cores would help retain mass by stopping jacket peel-back at the wall and protecting the rear of the bullet. Two cores were used, one inserted at the rear of the bullet and one in the front. The nose was formed around the front core of the bullet, and another core was swaged into the rear.

The Swift™ A-Frame™ bullet has a front core that is bonded to the jacket for ideal mushrooming and high weight retention.



The Swift™ Scirocco™ bullet employs state-of-the-art design with a sleek profile, a polycarbonate tip expansion initiator, and a bonded core for high weight retention.

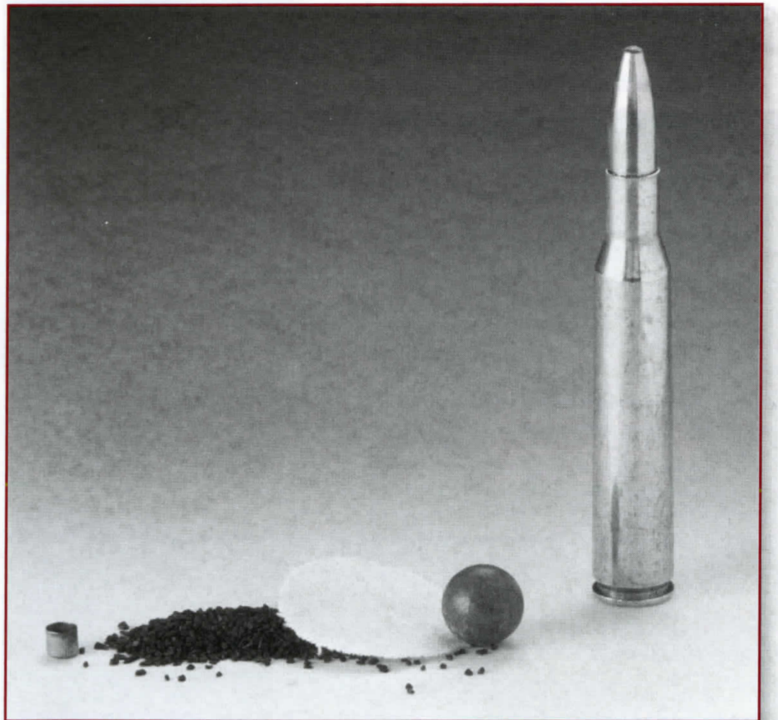
The Swift™ A-Frame™ incorporates this design with the added feature of a front core that is bonded to the jacket, so that most of the frontal weight is retained during impact and penetration. The result is that the bullet expands to a large frontal diameter and yet penetrates to the max.

The Scirocco™ takes bullet making to an even higher level, because, in addition to having a bonded core and heavy jacket, the bullet profile is designed using state-of-the-art technology for the ultimate in long-range performance. Because of this profile, the Scirocco shoots flatter, retains more velocity, and hits harder with more energy downrange. The sharply pointed polycarbonate tip not only enhances bullet profile for improved downrange performance, it serves as an initiator for positive expansion even at extreme range where velocity is low.

The Scirocco is ideal for taking game at extended ranges.

Cartridge Anatomy and Evolution

Ammunition technology has come a long way during the last 150 years. Carrying components separately and loading from the muzzle was time consuming and relatively unreliable. Powder could get damp and ignition systems could fail to ignite. Reloading a rifle, when faced with a charging grizzly, took on a whole different meaning back then than it does today.



Ammunition has come far during the last 150 years. Getting a second shot off fast with a muzzleloader and all its component parts was relatively time consuming. The powder was subject to becoming ineffectual from dampness. Shown here are a percussion cap, a charge of black powder, a patch, and a lead round ball.

One of the first successful breechloading firearms was the Sharps. The rifle has a vertically sliding breechblock with a sharp edge at the top. The breechblock was fitted closely with the rear face of the barrel and depended on this fit to contain powder gases. The rifle used a linen cartridge but was fired by a percussion cap. When the linen cartridge was inserted in the chamber, the breechblock sheared off the rear of the linen case, exposing black powder to the vent for a percussion cap. When the rifle fired, there was some escaping gas between the breechblock and barrel, and with wear and corrosion, the condition gradually got worse.

Another early breechloader was the German Dreyse or "needle gun," a single-shot bolt-action rifle that also used a fabric cartridge but with a primer located in the base of the bullet. When the gun was fired, a needle penetrated the powder charge to strike the primer. As with the Sharps, the rifle depended on the fit of the metal parts to contain gas from the shot, and gas inevitably leaked through the bolt.

The French Chassepot rifle was another version of an early breechloading rifle that utilized a rubber seal that would expand in an effort to stop escaping gas. The rubber seal became hard and ineffective from the sulfur in the gun powder used at the time.

The first centerfire cartridge that bears some resemblance to the ones in use today was the Pottet. The round had a thin metal base with a flange and a body of tightly rolled paper that slipped inside the base. The two were held together by compressing paper in the metal base. It was similar to paper shotshells as we know them and suited only to low pressures.

The Frenchman Lefaucheux developed a gun and a cartridge with a primer inside the cartridge and with an integral firing pin that projected from the cartridge. Ends of chambers were notched for the firing pin, so that the gun's hammer could strike it, driving the pin inside to the primer. The case sealed the rear of the chamber, but if loaded too heavily, gas leaked around the pin. Another problem reported with the design is that the ammunition would sometimes fire if dropped due to the projecting firing pins.

An Englishman developed the centerfire Boxer cartridge, which was made from a thin sheet of brass and paper rolled together with a head of iron. The body and head were held together with a brass band around the base, and the arrangement sealed the rear of the chamber.

All of these developments were a prelude to the day when the cartridge case was made from a single piece of metal. The first cartridge cases with which we're familiar had a drawn and folded head, similar to how our rimfire cartridges are now made.

As shooters made the transition from muzzleloading firearms to cartridge firearms, they expected to be able to reload them. Early-on, major manufacturers like Winchester, Smith & Wesson, and Colt sold reloading tools along with their firearms. Due partly to the problems associated with reloading folded-head cartridges, the solid-head cartridge case was born. This permitted the case to be driven out of a sizing die without deforming it. These rimmed cases were what are now referred to as "balloon head" cartridge cases with a relatively thin base section and with the interior of the case ballooning in around the primer pocket. These cases were fine for black powder charges and the mild pressures that accompanied them. The advent of smokeless propellant and higher operating pressures brought about the need for a stronger case, and so the solid-head case, much like the ones in widespread use today, was developed.

As operating pressures became gradually higher, cases were strengthened. Today's cases have a very thick base and base walls, accompanied by uniform and high-quality cartridge brass that has the proper anneal, grain structure, and hardness in every region.

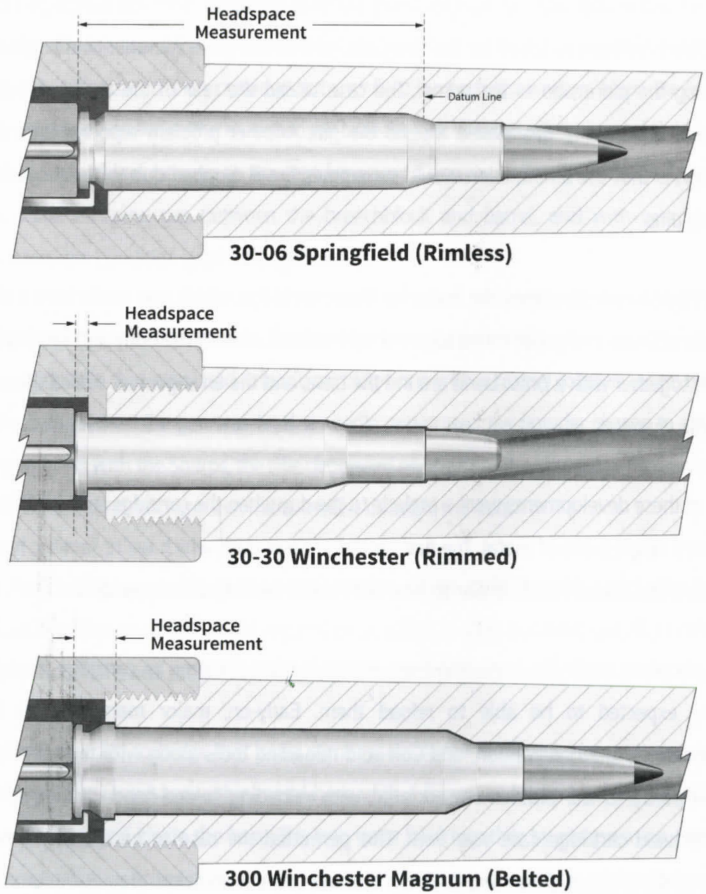
Among brass cartridge cases there has been quite an evolutionary process as well. Most early cartridges in the United States were rimmed and worked well in single shot and tube magazine lever-action firearms of the day. Rimmed cartridges were used almost exclusively in the exceedingly popular Winchester and Marlin lever-action rifles. The rimmed design can be seen in the 45-70 Government and 470 Nitro Express.

Box magazine rifles like the Mauser and Springfield feed more smoothly and work better with rimless cartridges. Rimmed cartridges in these rifles would cause the rims to become interlocked in the magazine unless loaded so that the rounds come out of the magazine box with the rim of each succeeding cartridge forward of the one after it so they do not interlock. Many of our most popular cartridges today are rimless, such as the 25-06 Remington, 270 Winchester, and 30-06 Springfield.

Even with the advent of rimless cartridge cases, some makers continued to favor the short headspace situation of rimmed cases. It was thought that the rimmed cartridge offered a positive resistance to a firing pin blow. This is part of the reason for the semi-rimmed and belted cartridges, efforts to provide the short headspacing advantages of a rimmed cartridge and the feeding advantages of a rimless. The semi-rim design, of which the 444 Marlin is one example, is not popular today.

The true rebated rim, with the rim diameter significantly smaller than the body of the cartridge, can be seen on the 425 Westley Richards cartridge. It is another design that is not particularly popular. The rebated rim results in a portion of the case being unsupported at the rear. Rebated rim cartridges are usually incorporated in bolt-action rifle designs, and there have been complaints of the bolt sliding past the rim of a rebated rim case resulting in failure to chamber a cartridge. While the 284 Winchester is sometimes referred to as a rebated rim cartridge, its rim is not significantly rebated and, consequently, does not have the drawbacks of the true rebated rim design.

These represent various types of cartridge rim designs. From left are the rimmed, rimless, belted, semi-rimmed, and rebated.



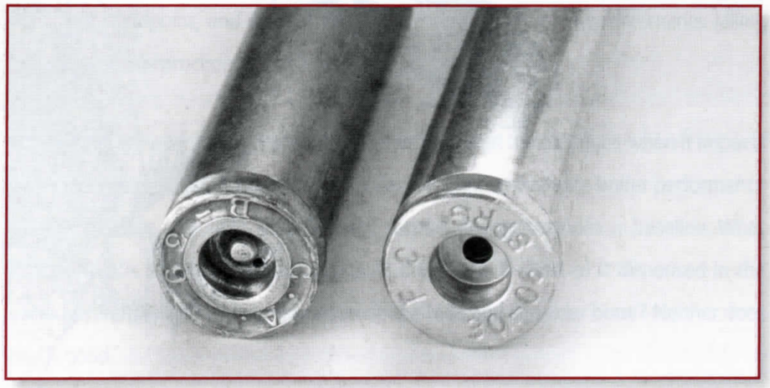
This illustrates the three different types of headspace situations popular among rifle cartridges.

In reality, most popular cartridges today are based on three basic head sizes. The small rimless head size, such as is found on the 17 Remington, 222 Remington, and 223 Remington cartridges, is one. The standard rimless head size, such as the 243 Winchester, 6mm Remington, 25-06 Remington, 270 Winchester, 280 Remington, 30-06 Springfield, 35 Whelen, etc., is the second type. The belted head is the third and is found on the 264 Winchester Magnum, 270 Weatherby Magnum, 7mm Remington Magnum, 338 Winchester Magnum, 458 Winchester Magnum.

Among modern cartridges there are basically two different primer designs. The Boxer is the most popular in America and has a single flash hole with an anvil made as part of the primer cup. The other type is the Berdan, which is popular in Europe and other countries, which has two smaller flash holes with an anvil integral with the cartridge case. Either type works well, but American sizing/decapping dies are designed to be used with American Boxer primers.

Primers, powder, and bullets have all been significantly improved in cartridges through the years. Today the handloader has a vast array of components from which to choose. There are now more than one hundred canister propellants for handloaders. Excellent primers can be had from a half dozen companies and brass cartridge cases are available from many sources. All of these components sold in America are excellent.

Most popular cartridges are based on these three head sizes that originated with these cartridges: From left to right: 222 Remington, 30-06 Springfield, and 375 H&H Magnum.



A Berdan primer type case is shown at left alongside a case intended for a Boxer primer. Note the central anvil in the primer pocket of the Berdan case. There are two tiny flash holes on either side of this anvil projection. The Boxer case has a larger central hole. American cartridges are of the Boxer type, and these are the type that can be reloaded with commonly available equipment. Do not try to size a Berdan-primed case in a conventional sizing die.

Terminal Performance and Stopping Power

Stopping power or killing power is one of those topics discussed around campfires and that brings out differences of opinion. There are disagreements as to how much of a factor kinetic energy, or momentum, is. Some shooters think that bullet weight is more important; others swear by velocity. Some want a large bullet diameter for the path it plows; others want a smaller bullet at high velocity for greater hydrostatic shock. There have been all sorts of formulas presented in an effort to classify cartridges, and many of the formulas bias the classification depending upon what the author deems most important. It is also interesting that many of the formulas omit the most important factor of all, the construction of the bullet itself.

Bullet construction also produces long campfire discussions because of the variables this aspect presents and due in large part to the bullet designs that have been available until recent years. Some shooters want complete bullet penetration on game, while others want the bullet to stop just under the hide on the far side. Still others want a bullet to penetrate only to the heart/lung region.

In practical terms, killing power is simple. When ample damage is done to vital organs, life ceases. It doesn't take a lot of damage to a heart muscle or the brain to cause life to stop. The key is in sufficiently damaging the right vital organs. This is why shot placement is important. A 22 rimfire is considered to be pretty under-powered when it comes to big game, yet a 22 rimfire will cleanly dispatch a 1000-pound steer if the bullet is properly placed.

Making such shots in hunting situations is not practical. There are, in fact, unlimited variables in hunting situations. The shooting distance, the size of the game, the shooting angle, the vegetation the bullet must pass through en route, the thickness of the hide, bones encountered, and other body parts the bullet must pass through are all variables. For these reasons, bullet construction becomes the most important variable of all in killing power. After all, it is the bullet alone that accomplishes the task. It is the bullet, by itself, that not only provides maximum tissue destruction but determines where the tissue destruction is effected.

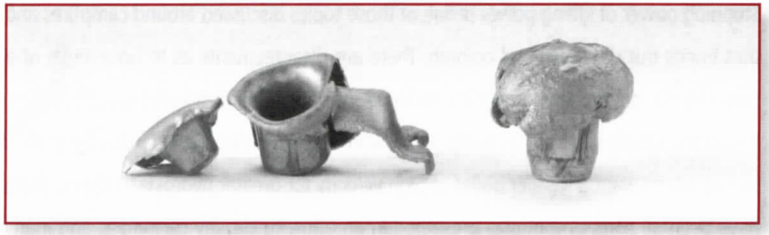
Any two bullets in flight of the same weight and diameter and going the same velocity have identical kinetic energies, regardless of their construction. Yet the two bullets may hold drastically different potentials for killing power. One bullet could produce immediate success and the other, miserable failure, all depending upon construction. From this standpoint, and given a particular cartridge, what really determines killing power is the construction of the bullet.

There really are interrelated factors that determine what a bullet does when it impacts game. There are physical properties that can be used to evaluate bullet performance and to measure a bullet's effectiveness. Kinetic energy provides a baseline. What is important is where the kinetic energy is dispensed. Is most of it dispensed in the earth beyond the game? Is it dispensed on the hide and shoulder bone? Neither does much good.

Generally speaking, there are tradeoffs in bullet performance. A bullet that expands more, penetrates less. A bullet that expands less, penetrates more. But there are other factors at work. A bullet that expands rapidly and offers relatively little support to the core, often loses a lot of weight. Lead smears off the nose, particles separate from the jacket, and sometimes the core is ejected. Here, physical properties of the bullet have been dramatically changed. When a bullet loses weight, it loses energy. That's a simple physical fact. Such a bullet rapidly becomes ineffectual. It stops.

At the other extreme, a bullet might not expand, for whatever reason. In this instance, the bullet does not lose weight, but because of its pointed shape and reduced frontal diameter, it transmits a minimal amount of energy as it slips through tissue and between organs. This brings up another simple physical fact. Energy not transmitted to game is transmitted elsewhere. It is wasted.

Ideally, a bullet expands to a good frontal diameter and then retains weight so that maximum reasonable penetration is achieved. One of the major keys is maximum weight retention. Swift accomplishes this by an expensive and time-consuming method of bonding the lead core to the jacket. The jacket is of a metal composition, hardness, and wall thickness design that serves to provide optimum expansion and at the same time support the lead core during expansion. Most recovered Swift A-Frame bullets retain upward of 90 percent of their weight. The sleek Scirocco retains upward of 70 percent. This is far more than other game bullets in respective categories.



Not all bullets expand the same. In this example, the bullet jacket and core have separated causing significant weight loss and corresponding momentum. The Swift™ Scirocco™ at right retains a good portion of shank.

A person never knows what sort of vegetation a bullet might have to pass through prior to impacting game.

Regardless of the fact that the bullet only has to get to vital organs, penetration is needed for two reasons. First, in a hunting situation, you never know how much brush, hide, bones and nonvital organs your bullet must pass through before reaching vital organs. Secondly, a bullet needs velocity to transmit energy. A bullet that stops in tissue slows down before it stops. The latter portion of the bullet's travel does not transmit much energy to surrounding tissue. From this standpoint, velocity is important in killing power. This is why it is desirable for a bullet to not only get to the vitals in a game animal but to be blasting right through them and, possibly, right through the hide out the other side.

A little extra energy spent on the earth beyond doesn't hurt, and an exit wound produces a better blood trail. While an effective bullet kills quickly, adrenaline, instinct, and muscular reactions can carry an animal some distance even when a heart is completely destroyed, for example. This is why a good blood trail can be important.

The bullet at left is a Swift™ .30 caliber 165-grain A-Frame™ shown unfired, sectioned, and recovered from expansion medium. The bullet at right is a Swift™ .30 caliber 165-grain Scirocco™.

The people at Swift™ understand the intricacies of stopping power and what it takes to produce it. They were hunters long before they were bullet makers, and they worked long and hard to produce the best bullet for the job under the widest variety of hunting conditions.

In a nutshell, Swift bullets expand with a good-size frontal diameter. The diameter is ample for energy transmission but not so large that it is overwhelmed by braking action and instability from a too-large frontal diameter accompanied by loss of weight. As a Swift bullet mushrooms, the jacket walls become a support for the core. In addition, the core is bonded so that it does not separate from the jacket. This why Swift bullets retain so much weight to produce the greatest penetration going for an expanding bullet and, at the same time, provide the maximum energy transmission/tissue destruction along the way.

Exterior Ballistics

"Exterior ballistics" is a fancy sounding name for something not all that complex. Exterior ballistics is simply what a bullet does from the time it leaves the muzzle until it impacts. Exterior ballistics is different from terminal ballistics in that exterior ballistics is a science that has been formulated. There are very precise formulas that really do work for predetermining what a bullet does in flight.

Muzzle Velocity and Ballistic Coefficient

What few people recognize is that there are only two numbers necessary to predetermine what a bullet will do under standard conditions: muzzle velocity and ballistic coefficient. Muzzle velocity is simply the speed of the bullet and is generally measured in feet-per-second (fps). Ballistic coefficient (B.C.) is a numerical value that expresses a bullet's ability to overcome the resistance of air during flight. It is based on the time required for a bullet to travel from point A to point B. In short, a bullet that is pointed and streamlined has a higher B.C. than a bullet that is more blunt. The higher the B.C., the less a bullet drops over a given distance. Things like barometric pressure, humidity, and elevation enter into the picture, but for practical purposes for the hunter, their effect is relatively minor. If you know muzzle velocity and ballistic coefficient, you can calculate downrange drop, energy, and even wind deflection. Even if you throw in the effects of ambient conditions mentioned above, the results can be calculated, and with this information added, the answers are even more precise.

Rather than calculate it, these days there are many computer programs that will do it for you and, in some instances, offer graphics to illustrate the effects of each. If you don't have a computer or don't want to trouble yourself with one, you can get a pretty good idea about the important numbers from looking at trajectory or drop tables published in many sources, including this manual. What computer programs and drop tables do for you is to give you some idea about what to expect. They offer a baseline of reference. They can tell you how to sight-in your rifle to achieve the optimum performance from your cartridge, relative to bullet drop, downrange energy, and the distance you expect to shoot game.

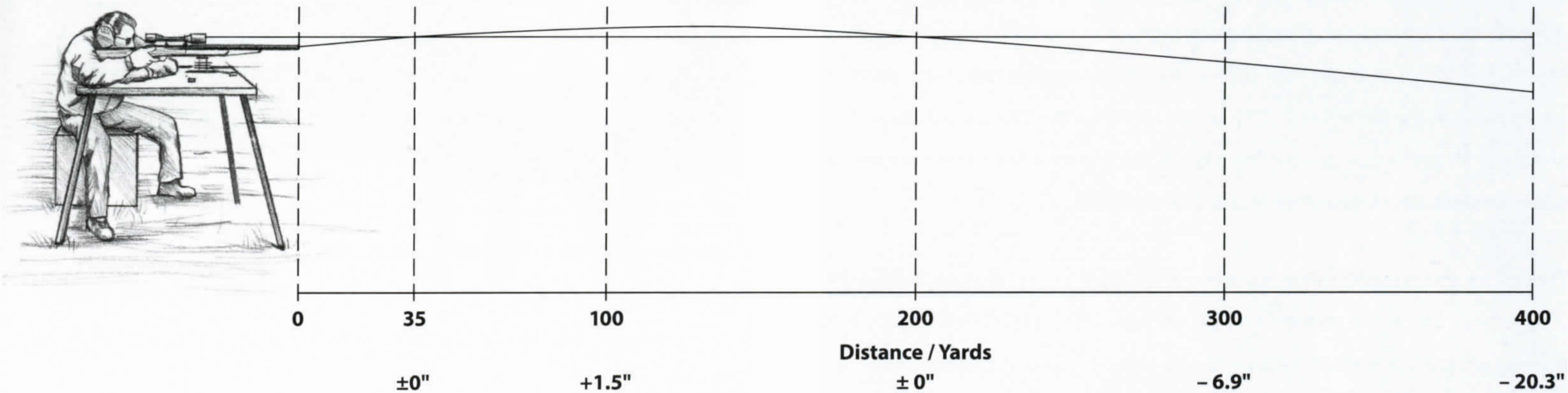
Armed with these details, you can eke out every last bit of theoretical advantage from your firearm and load. I say "theoretical" because you still have to sight-in and try it. It doesn't do you much good to know that a certain sighting-in procedure produces four inches less drop at 400 yards if you're shooting 12-inch groups at that distance. From this standpoint, the hunter who knows his rifle and load from actually shooting it is far better off than the shooter who knows only the theoretical advantages.

When you look at the drop tables, it is important that you know if you're looking at drop from line-of-bore or from line-of-sight. A bullet is acted upon by gravity from the moment it leaves the muzzle. If a barrel is held perfectly parallel to the earth and fired, the bullet falls from the instant it leaves the muzzle. The line-of-sight, unlike a bullet's path, is straight. It does not fall.

Since the line-of-sight is generally above the line-of-bore on a firearm, it is necessary to cant the line-of-bore upward slightly in relation to line-of-sight so that the line of bullet travel and line-of-sight coincide more closely. This has the result of making the bullet appear to shoot "flatter." If both the line-of-sight and line-of-bore were parallel, the bullet's path would become progressively farther from the line-of-sight as the range increased. The two would never cross. What is important to the hunter is the bullet's travel in relation to line-of-sight.

By canting the bore upward slightly, the bullet crosses the line-of-sight at two points. If we examine the bullet's path in relation to line-of-sight from a modern scope-sighted rifle we find that how a rifle is sighted in is decidedly important. For example, supposing the rifle is sighted in dead-on at 100 yards. Remember, the line-of-bore had to be canted upward in relation to line-of-sight to accomplish this. In all instances, the bullet starts out low in relation to line-of-sight. If the scope is 1.5 inches above the bore, the bullet starts out 1.5 inches below the line-of-sight. Supposing the bullet is a thirty caliber 165-grain number that has a high ballistic coefficient of .400 and a muzzle velocity of 3000 feet-per-second. By looking at a computer program for trajectory, we find that the bullet crosses the line-of-sight at about 70 yards so that a rifle zeroed at 100 yards is also zeroed at 70 yards. The bullet will then be 3.1 inches below the line-of-sight at 200 yards, 11.6 inches below at 300 yards, and 26.7 inches below at 400 yards.

If we sight-in at 200 yards instead of 100 yards, the same bullet will first cross the line-of-sight at about 35 yards. It will be 1.6 inches high at 100 yards, dead-on at 200, 7.4 inches low at 300, and 21.8 inches below at 400. Things are looking a little better downrange, even though we're shooting the same bullet and load.



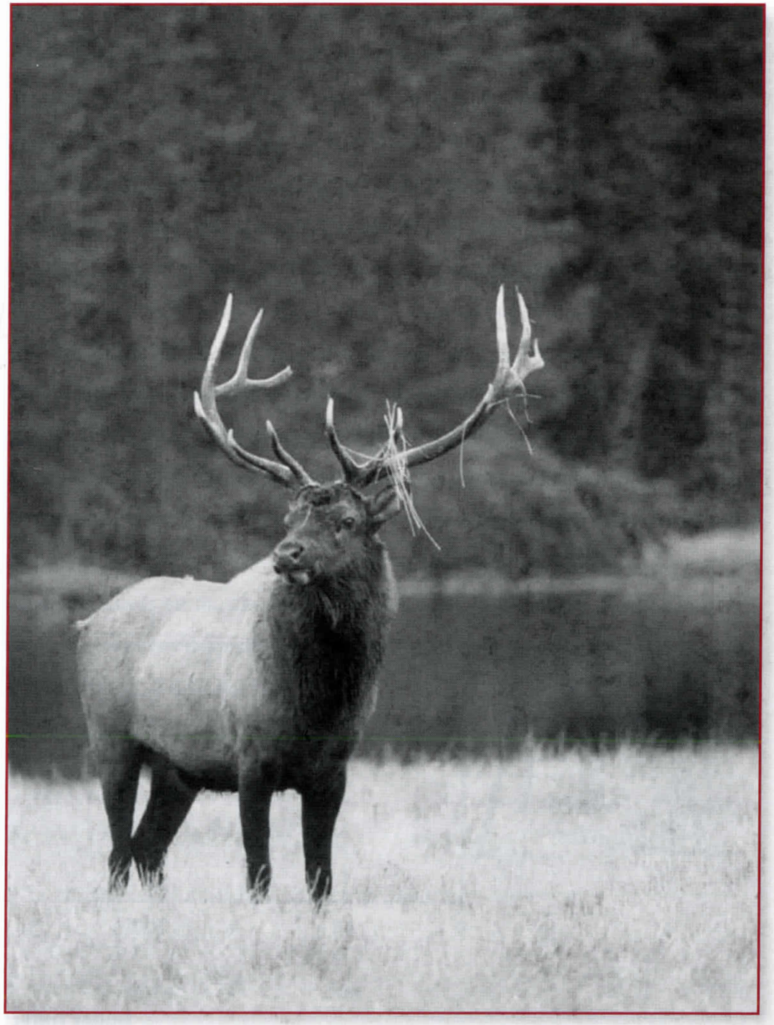
Bullet Trajectory in Relation to Line-of-Sight (200-Yard Zero)

Let's zero even farther out, say at 300 yards. Here, the bullet crosses the line-of-sight on its way "up" at about 20 yards. It is 4.1 inches above the line-of-sight at 100 yards, zeroed at 300, and only 12 inches low at 400. Things are looking better at 400 yards, but that bullet is getting pretty far above the line-of-sight at 100 yards. We can also see from the computer program that this is not the worst of it. The bullet strays a full 5.2 inches above the line-of-sight at about 115 to 120 yards. For a lot of shooters, this is getting pretty far from the line-of-sight for a distance so close. It would be easy to over-shoot at this distance.

As you can see, it is easy to manipulate how "flat" a bullet shoots in relation to line-of-sight simply by changing the sighting-in arrangement. The important thing to remember is that, as you increase the zero distance, the bullet is getting farther from the line-of-sight at midrange distances. For this reason, there is a limit as to how far you can carry this line of thinking.

A hunter can do one of two things. He can decide how much line-of-sight departure he is willing to live with and then sight-in accordingly at some reasonable distance, say 250 yards in the above instance. Or he can memorize the drop and rise above line-of-sight at all distances. The latter really is not practical for a hunter who sometimes must take shots quickly and often at unknown distances.

The best solution is to decide how much line-of-sight departure is acceptable and sight-in to achieve this at the greatest possible distance. Then, a hunter can simply hold dead-on without worry about holdover or hold-under to a certain distance.



This elk is in the wide open and offers a fully exposed kill area so that there is considerable latitude in bullet trajectory.

Partially what is important in this decision is the size of the vital zone on game. For example, an eighteen-inch diameter vital zone is sometimes deemed about right on elk, representing the heart/lung region. Based on this alone, you could live with a nine-inch line-of-sight departure, nine inches above, and nine inches below. But 18 inches is on a broadside-standing elk in the wide open. What if the elk is standing behind a boulder and you can see only the top of his back? What if you have to slip a bullet between two horizontal tree limbs through a three-inch gap? Also, whatever you decide to be your line-of-sight departure is added to your group size. If you decide that a nine-inch line-of-sight departure is acceptable and you're shooting eight-inch groups downrange, the two combine to enlarge your impact zone even more. As you can see, there are practical limits.

For most hunters, the acceptable line-of-sight departure is much less than the nine inches mentioned above, regardless of the large size of game. For most, a four-inch line-of-sight departure is a lot. For some, three inches is all that is acceptable. Whatever the departure you choose, you need to know that you will not be able to place your bullet any closer to the point of aim than the departure you've accepted. If you decide that a four-inch departure is acceptable, you really don't know if your bullet will impact four inches above or four inches below the point of aim. This is an eight-inch window not counting shooter error. With this sighting-in arrangement, not only can you not knock the eye out of a crow, you may not hit the crow. The three-inch line-of-sight departure is something that most hunters can live with, not for shooting crows, but for hunting large game. (By North American game standards and as opposed to small game.)

A good part of this moose's vitals are obscured by brush. Here, the bullet must be precisely placed. If firing from a long distance, trajectory becomes critical.

Point Blank Range

It is important to get a handle on a bullet's trajectory in relation to line-of-sight and your chosen zero if you are to understand what is called "point blank range." It is also important to understand that point blank range is not fixed. It varies not only with the cartridge and load, but with the shooter's sighting-in arrangement.

With today's hunting rifles, a scope is mounted above the line-of-bore so that the line-of-sight is an inch or two higher than the line-of-bore. A bullet is affected by gravity from the moment it leaves the muzzle and if the line-of-bore and line-of-sight were parallel, the bullet would start out an inch or two below the line-of-sight and get progressively farther away as the bullet travels downrange. In most shooting situations during a hunt, say less than 300 yards or so, shooting time can be limited and a shooter does not want or need to think about a trajectory curve. He compensates by sighting-in his rifle beforehand in a manner that makes better use of the bullet's trajectory curve. To do this he angles the rifle's bore line upward slightly so that the bullet crosses the line-of-sight as it rises, then crosses again as it falls, farther downrange.

Most shooters do this by sighting-in somewhat high at the traditional 100 yards (two to three inches) since most ranges have targets at this distance. Others accomplish basically the same thing by zeroing at 200 to 250 yards, depending on the cartridge. For example, if you have a 300 Winchester Magnum or 300 WSM with a 165-grain Scirocco at a muzzle velocity of 3100 fps and sight-in 2.5 inches high at 100 yards, the bullet will be approximately 2.8 inches above the line-of-sight or aiming point at 200 yards and 1.7 inches below at 300. It is a maximum 3.2 inches high at 157 yards (maximum ordinate). This works well for deer-size game.

As you can see, the bullet is not dead-on at any of the above-mentioned distances but it is close enough for hunting deer or antelope. You can hold on the center of the animal's kill area (if he is standing and broadside) and know that the bullet will impact the vitals (not too high and not too low) at less than a certain maximum distance. What is important is where the maximum ordinate of the bullet's trajectory curve occurs downrange and how far the bullet rises above line-of-sight. The reason this is important is that a hunter does not want to over-shoot game at some mid range. This is why this line of thinking can be carried only so far. You should not sight-in too high at 100 yards (or zero too far downrange) or you will over-shoot at some middle distance. With modern flat shooting cartridges, the 2.5-inch-high at 100 yards rule-of-thumb or 250-yard zero works pretty well for deer as was illustrated with the 300 Mags mentioned above. You can hold dead center and not worry about over-shooting or under-shooting out to about 325 yards. This makes for faster shooting when game is spotted because you're not trying to remember (or calculate) the bullet's impact point at various distances.

This maximum distance that you can hold dead center for a vital hit is called "point blank range." Since all game does not come in "deer size," it can be considered an advantage to manipulate the sighting-in arrangement to take maximum advantage of the bullet's trajectory curve relative to the size of the intended target. For example, a coyote is much smaller than a deer and, as in the load mentioned above, the bullet is 3.2 inches above the line-of-sight at 157 yards, you would probably over-shoot a coyote at this distance. The reason is that a coyote measures only about 5" from top to bottom of chest (not counting fluffy hair) and if you hold dead center at this mid-range

157-yard distance, you have only 2.5" of leeway above center to hit the coyote. With the bullet passing 3.2 inches high, you would over-shoot by about .7 inch. For this reason, you would sight-in so that the bullet is closer to the line-of-sight, straying perhaps no more than 1.5 inches at the mid-range distance. This also shortens the maximum point blank range. Conversely, if you're hunting a larger animal like an elk, you can enlarge the allowable bullet departure measurement from the line-of-sight (to perhaps 5 inches), increasing the maximum point blank range. Remember, maximum allowable departure measurement is only for the mid-range distances (a concern about over-shooting). Whatever distance you choose as a maximum allowable bullet departure from line-of-sight at mid range, for example three inches for deer-size game, would be used at the downrange end as well. This is what determines maximum point blank range. Remember, whatever maximum departure from line-of-sight that you choose, it is only half the top-to-bottom measurement of the vital area of whatever you're hunting. If you choose five inches as a maximum allowable departure, the bullet would be five inches high at some mid-range distance and would then be five inches low at the maximum point blank range for a total of 10 inches. The vitals should measure less than 10 inches. I have included drawings to illustrate how a bullet's trajectory in relation to line-of-sight can be manipulated with game of various sizes. I have also included a chart to illustrate how maximum point blank range can vary with the cartridge (muzzle velocity).

Muzzle velocity and bullet shape (ballistic coefficient) are variables inherent in the load that influence the bullet's trajectory and maximum point blank range.

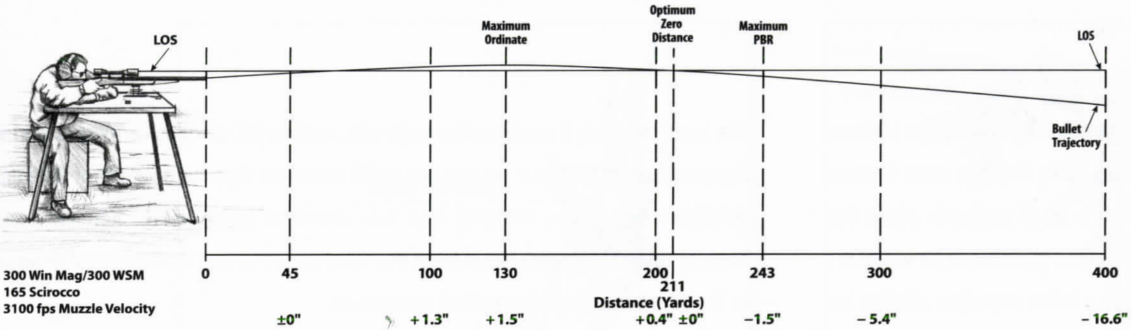
So how does one determine a zero distance or 100-yard sighting-in to maximize point blank range? Supposing you choose 4 inches as the maximum allowable bullet departure, and with a cartridge of a different velocity with a bullet of a different ballistic coefficient. These are a lot of variables. A computer program can simplify the process. Some programs, like QuickLoad and QuickTarget make the process extremely simple. If you do not use a computer, ballistic charts in load or ammunition manuals can give you a pretty good idea though they won't delineate the maximum ordinate of trajectory like a computer program can.

Cartridge	Muzzle Velocity (fps)	Optimum Zero Distance (yds.)	Distance of Maximum Bullet Height (3") From Line-of-Sight (yds.)	100-Yard Impact from Line-of-Sight	Maximum Point Blank Range (yds.)	400-Yard Impact from Line-of-Sight
308 Win.	2750	239	138	+2.6"	278	-19.3"
30-06 Spgfld.	2800	244	140	+2.6"	284	-18.1"
300 Win. Mag./300 WSM	3100	266	154	+2.4"	311	-12.3"
300 Wby. Mag.	3150	270	156	+2.3"	315	-11.5"
300 Rem. Ultra Mag.	3200	274	159	+2.3"	320	-10.8"
30-378 Wby. Mag.	3300	282	164	+2.2"	329	-9.3"

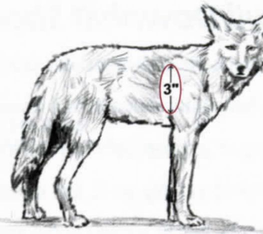
Chart using the 165-Grain Scirocco from various cartridges to illustrate maximum point blank range. Maximum allowable bullet departure from line-of-sight is optional, depending on what the shooter is willing to accept. In this instance, it is three inches above and below the line-of-sight. Maximum point blank range in this instance is the distance at which the bullet drops the chosen maximum three inches below line-of-sight. Beyond this distance, the bullet is dropping increasingly farther from the line-of-sight. Optimum zero distance is the distance at which the rifle is zeroed to achieve this arrangement in trajectory

POINT BLANK RANGE (PBR)

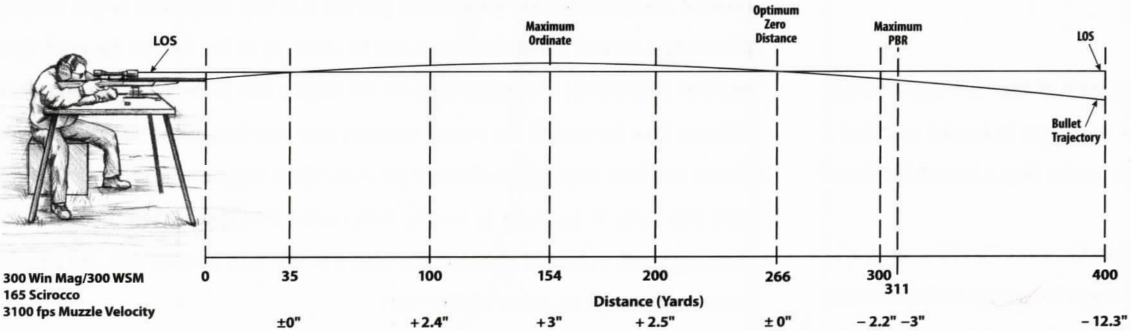
With 1.5" Allowable Bullet Departure from Line-of-Sight (LOS)



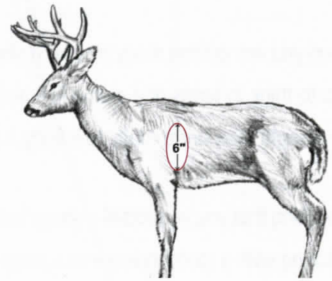
Bullet Trajectory in Relation to Line-of-Sight (211-Yard Zero)



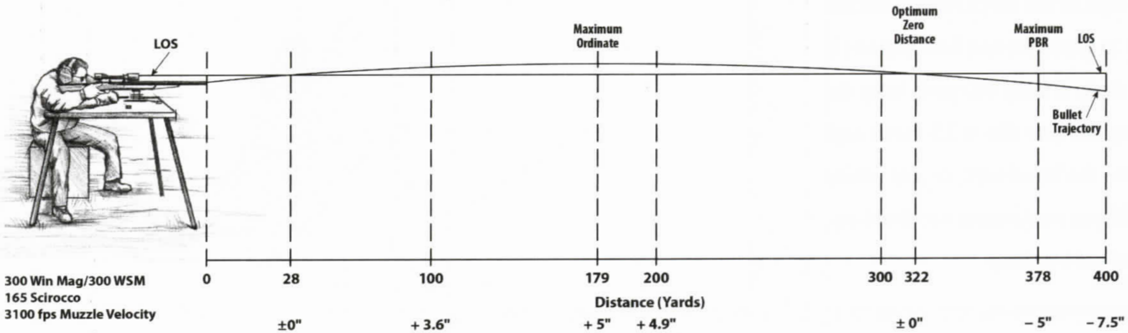
With 3" Allowable Bullet Departure from Line-of-Sight (LOS)



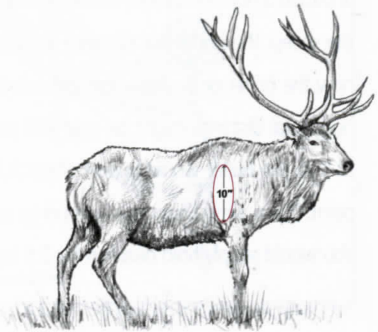
Bullet Trajectory in Relation to Line-of-Sight (266-Yard Zero)



With 5" Allowable Bullet Departure from Line-of-Sight (LOS)



Bullet Trajectory in Relation to Line-of-Sight (322-Yard Zero)



Uphill/Downhill Shooting

The drop charts and computer programs generally give figures based on a distance over a horizontal range. It is a known fact that bullets don't drop the same if you're shooting at a steep uphill or downhill angle. There is a lot of confusion about this, and understandably so. It just doesn't sound like it makes good sense to say that a bullet drops less at a steep uphill angle. The fact is that a bullet drops less whether it is a steep uphill or downhill angle. The reasons and the math behind this can get complex, but it helps to simplify things if you think of a bullet as dropping only over the horizontal distance and not the vertical.

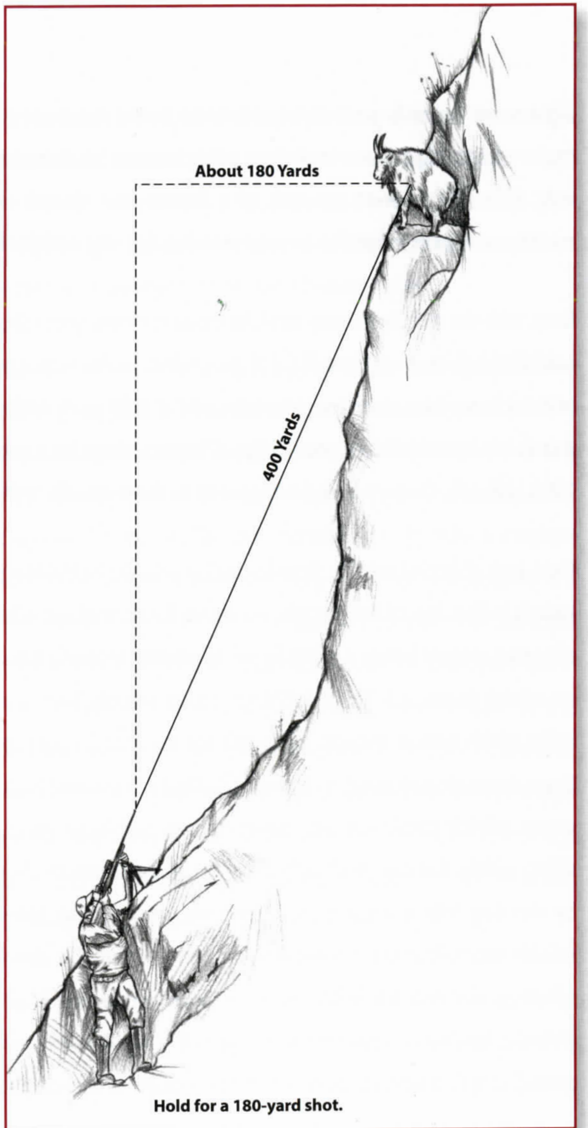
When you are getting ready to take a shot at a steep uphill or downhill angle, it might help to think in terms of a plumb line and a transit. A transit can be leveled to project a line-of-sight view horizontally, to infinity. A plumb line is used to drop a line straight down.

Supposing that you've spotted a sheep bedded on a slope far below the cliff where you're watching with a spotting scope at a steep downward angle. Your range-finding binocular indicates that the sheep is actually 400 yards away on a direct line-of-sight from you to the sheep. Envision sighting from your position straight out over the sheep (as a transit would) and then dropping a plumb line down from the line-of-sight so that the plumb bob touches the sheep. The horizontal distance from your position to where the two lines intersect is how the bullet drop should be calculated. While the sheep is really 400 yards away, the horizontal distance might be only 100 yards. If you sighted your rifle in 2.5 inches high at 100, the bullet would impact about 2.5 inches above the line-of-sight, or your aiming point. If you aimed high (for bullet drop over 400 yards) you would shoot over the sheep. You would simply hold dead-on (or 2.5 inches low) and nail the sheep.

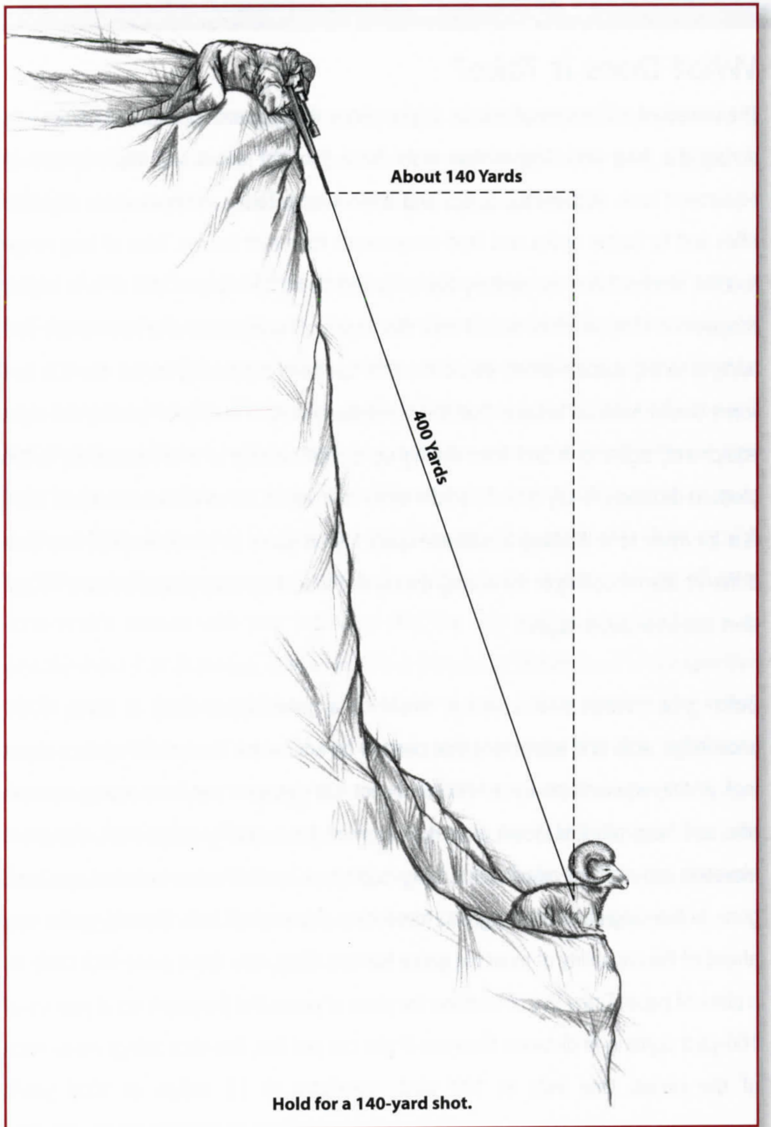
This is not exact but it works well enough with modern flat-shooting cartridges and for big game hunting. There is no way you could memorize drop for a variety of different uphill/downhill angles. However, you can memorize approximate drop for most distances over flat ground. Just think of the bullet dropping over the horizontal distance to the target and forget the vertical component.

The same goes for a steep uphill angle. Say you're thinking of knocking a mountain goat off a ledge about 400 yards above you but at a very steep uphill angle. Envision projecting a vertical (plumb line if it could be done) up to the level of the goat. Then envision a horizontal line projecting from the vertical line to the goat. The horizontal distance from the goat to the vertical line over your own head is the distance that you should calculate drop. In this distance, the bullet drop might be the same as the drop over 100 yards or so, same as for the sheep mentioned above, even though you're shooting uphill instead of downhill. You would simply hold 2 inches low and bag the goat. Watch out so he doesn't fall on you!

Uphill Shooting



Downhill Shooting



Taking Big Game at Long Range

What Does it Take?

The increased military emphasis on snipers since the Vietnam conflict and particularly during the Iraq and Afghanistan wars have brought about an improvement in equipment such as firearms, optics, and ammunition. Today, we have more accurate rifles and far better optics and load components than ever before. Tales of long range success stories from the military have filtered down to hunters and it is a logical progression that shooters would take the improved equipment and knowledge and apply it to big game hunting situations. This has been happening across the U.S. and some would have us believe that it is a relatively simple matter of getting the right equipment, sighting-in and then dialing up a shot nearing or even exceeding 1,000 yards in distance. To say there is a little more to it would be an understatement. There is a lot more to it. Making a humane, quick kill on game at extreme range is a little different than shooting at the enemy during war where a poorly placed or even missed shot can have advantages.

Before you attempt such a feat it would be a good idea to look at some of the knowledge, skills and equipment that need to be addressed. To start, let's take a closer look at the requirements for a 1000-yard shot. Let's assume you have a very accurate rifle and have plunked down almost two grand for a quality scope with consistent elevation and windage adjustments using target-type knobs. You have worked up a load, gone to the range and fired a group measuring about a half inch. Already, you're way ahead of the capability of most big game hunters. Okay, now draw a one-inch circle on a piece of paper. Draw five of them on the piece of paper. Put the paper up at your usual 100-yard sighting-in distance. Now see if you can put five, five-shot strings inside each of the circles. One inch at 100 yards translates to 10 inches at 1000 yards. Eight or ten inches is generally considered to be the maximum size of the heart/chest region of most big game animals for a quick, humane kill. Remember, we're still talking only about the inherent accuracy of a firearm and shooter under relatively ideal conditions at short range (for an accurate rifle), not real-world accuracy at 1000 yards.

Next, with the muzzle velocity carefully measured from your rifle, and armed with the published ballistic coefficient (B.C.) of your bullet, you can use a good ballistic program or chart to see how much energy is delivered at 1000 yards with your load. The rule of thumb has been 1000 foot-pounds (fp) of impact energy for a good deer cartridge and 1500 fp for elk. Does your load measure up to those standards at 1000 yards?

Next, look at impact velocity. How fast will your bullet be traveling at 1000 yards? With today's bullets, lots of hunters take expansion for granted but it takes a certain amount of impact velocity before a bullet begins to expand. Most big game bullets do not open up reliably below a 2,000 or 2,200 fps impact velocity. There's a good chance that a bullet which pencils through game will not transmit ample shock and the resulting tissue destruction required for a clean kill. What is the low velocity level where you can expect reliable expansion and energy transfer from your bullet? Bullet construction differs widely. You can check with the bullet manufacturer or check expansion yourself by shooting into a water-logged newsprint medium. The lowest velocity at which reliable expansion occurs equates to the maximum usable distance for your load. At whatever distance the bullet drops to that velocity level is your maximum usable distance. Here's a tip: given the normal velocity variables with a cartridge, more is to be gained in B.C. (bullet shape) than can be gained in muzzle velocity. Not only bullet shape, but bullet length (weight) is required for a high B.C. Many shooters are unaware that some of the standard twists do not stabilize the longest and heaviest (highest B.C.) bullets particularly well for gilt-edge accuracy. You may have noticed that rifles often shoot mid-weight or lightweight bullets more accurately than the heaviest bullets. As you know, muzzle velocity is another tradeoff for a heavier bullet.

There's a good chance that either velocity or energy, or both, limits your effective hunting range to something less than 1000 yards. Let's put this into perspective. A 300 Winchester Magnum is considered to be an excellent cartridge for long range hunting and plenty potent. A 180-grain bullet is considered plenty heavy for elk and with a very good shape it might have a G-1 B.C. of .500. A reasonable velocity from a magnum length 24-inch barrel is 3,050 feet-per-second depending on the bullet. According to a ballistic program, at 1000 yards with standard temperature and pressure, this bullet has something on the order of 853 foot-pounds (fp) of kinetic energy and 1,461 fps of velocity. Neither of which meet our minimum requirements even for deer at this distance, much less elk. That is not to say that the cartridge will not kill at that distance, but we're looking for something plenty effective, not questionable. You can get a bigger cartridge with more powder and a larger bullet diameter but as you go up in cartridge size, added muzzle blast and recoil make it increasingly difficult to keep those five, five-shot strings inside the one-inch circles.

In sum, you need a load that measures up to the minimums in terms of impact energy, velocity, and expansion at 1000 yards, shoots extremely well, and you can shoot it extremely well, consistently, at the relatively short 100 yards. One bragging group does not count; it should consistently shoot well, all the time. Not only that, but you need to be able to shoot it that well from a position that you can use in the field. A bipod for example, assuming the sagebrush or other vegetation is not too tall.

While all this takes a lot of time chronographing, expansion testing, load workup, ballistics computation, practice, etc., it is doable if you're really dedicated but my guess is that few loads and shooters remain at this point in the qualification process. The next step is to see where the rifle impacts at all distances, not just at 1000 yards. You will find that the published ballistic coefficient and your measured or estimated muzzle velocity do not produce the down range impact points that a computer program or chart suggests, at least not for distances to 1000 yards. They are usually close enough to 500 yards or so to get you in the ballpark, but bullet impact may be off by a considerable amount with your individual rifle. The only way to know for sure is to actually shoot it at all ranges, at least in 100 or 50-yard increments out to our specified 1000 yards. A good rangefinder is a given. You cannot consider taking shots approaching 1000 yards without one. For example, with the 300 Win. Mag. load mentioned above if you misjudge the range by only 20 yards, an error of only two percent, the difference in bullet drop is more than 16 inches at this distance. If you are holding dead center on a deer and miss by "only" a foot from distance misjudgement you will probably under-shoot. With an error of 16 inches you will surely miss.

By this time, with all your shooting at a range with known distances, you have likely found that your actual drop figures do not exactly match those of the ballistics program, as mentioned above. But with all your carefully saved targets you can take this drop information with your rifle and load and work backward with a computer program to derive a ballistic coefficient that fits your bullet's actual trajectory as close as possible. Do you use the G-1, G-7, drag function or some other ballistic coefficient? While one type of ballistic coefficient might fit one bullet, another bullet might require something different.

If you do enough shooting, like a couple thousand shots, you will likely find that you need to hold your rifle with exactly the same cant or angle for every shot, or shots will impact out of the group and increasingly so as distance increases. Maintaining the same cant nearly always requires the use of some sort of leveling device on the firearm, scope or mount because different backgrounds can influence the way you cant your rifle. With the 300 Win. Mag. load mentioned above, if you have your rifle zeroed at 1000 yards but cant the crosshair only three degrees to the right, not noticeable by most shooters, your shot will impact about 19 inches to the right. Cant it only one more degree and your shot will impact about 25 inches right. If you're unfamiliar with this canting error, you will swear that the wind must have moved your shot over. Sometimes it takes a whole lot of shooting to know the difference and to make sure your rifle is zeroed for windage and whether the scope is mounted square on your rifle.

What you will also discover is that an almost insignificant but switching tail wind can significantly move your shots to the left and to the right of the target at 1000 yards. For example, an extremely light two mile-per-hour wind from a 90 degree left angle can move your shot 16 inches to the right. If it switches back the other direction, you've got a 32-inch horizontal spread in shot dispersion. You may find that it is more difficult to keep the shots on an 8-inch bull at 1000 yards than it is to shoot a small group. If the group is to the left or right is it because the wind blew the shots that direction or is it because the rifle is not exactly zeroed for windage, or perhaps the scope is not square on the rifle? Sometimes it takes a lot of shooting to know for sure.

You can practice and become familiar with shooting at a specific range on paper (Paper targets are the only way to know for sure what your shots are doing. Shooting rocks at long range is too imprecise because you do not know the size of the rocks at long distance.) but you still are not even close to knowing how it is to shoot in your hunting area. Temperature, humidity, barometric pressure, elevation and inclination all affect point of impact significantly. How does each of these apply to your load? Temperature of the propellant can affect the powder burning rate which in turn affects bullet velocity and consequently trajectory. In the field you do not know what the wind velocity or even direction are as a bullet travels across a canyon or up a ridge. It is extremely easy to misread the distance, even with a rangefinder because in a hunting situation, the rangefinder can be in error because of brush or a confusing background. On flat terrain it is extremely difficult to get an accurate and repeatable reading at long range.

By now, you are probably getting the picture. There are a whole lot of variables in shooting at 1000 yards that do not show up to a significant degree at 400 or 500 yards. We know that there are shooters taking game at extreme distances like 1000 yards. We also know that there are a lot of misses at this distance. In the tales of shooting prowess from the military, what is usually not known is that it is reported that "military snipers and sharp shooters have a first shot success rate of between 20 and 30 percent at 1000 yards. They usually reach about 70 percent on subsequent shots."

"Walking" shots into the target at distance can be accomplished with a good spotter, but ask yourself if this how you wish to harvest a big game animal. The people at Swift would never say don't do this or that, but at the same time, the people at Swift are very experienced shooters, experienced enough to know how difficult it is to make shots at extreme distance. Shooting at paper targets at long range is truly an enjoyable hobby, so much so that it is addictive and a great way to hone one's shooting skills. It adds a whole new dimension to the sport. Taking game at long range is another story and one would do well to ask himself whether he is up to the task and answer honestly with proven shooting results.

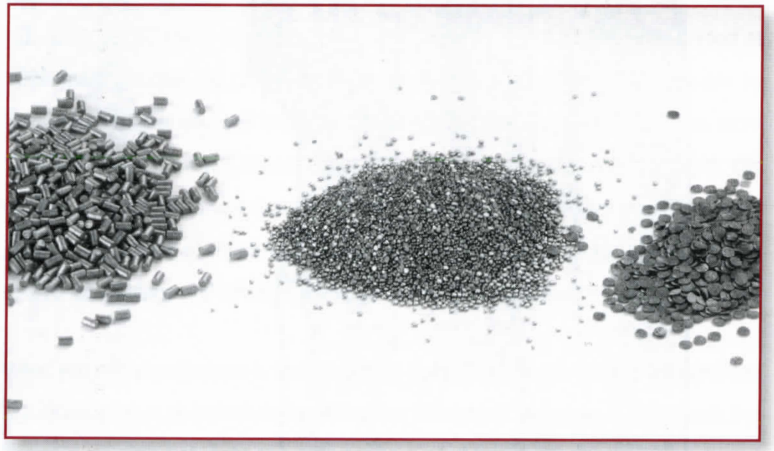
A few years ago, a 400-yard shot was a very long shot on game. With today's equipment and components, and with practice, even a 600-yard shot is very doable. But when it comes to distances greater than that, there are a lot of variables beyond anyone's control. The effects of these elements beyond our control increase with distance to the point that sometimes more luck is involved than skill.

Propellants

Types of propellants can be separated into single-base, double-base and triple-base or multi-base powders. Single-base propellants contain primarily nitrocellulose. Double-base powders contain in addition to nitrocellulose, another essential component, nitroglycerin. Multi-base powders contain a third major ingredient, called nitroguanidine. These technical terms are really not important for the average handloader to memorize.

Handloader propellants can also be classified according to geometry as stick or tubular, flake, and ball or spherical. Each of these names is pretty self-explanatory, if you look closely at individual powder granules.

Burning properties of smokeless propellants are controlled by a variety of means from granule shape and size to perforations, web structure, coatings, and chemical composition.



Today's smokeless powders are of three primary types, shown here, from left, extruded, spherical, and flake.

There are about a hundred canister propellants available to handloaders today from a variety of makers in different countries. In addition, depending on a variety of factors such as bullet weight, case capacity and shape, expansion ratio, temperature, and others, the burning rates of these propellants act differently. Whenever you handload, be sure that you reference exactly the data you want and have on your loading bench only the container of powder that is currently in use. Always be careful to return any unused powder to the proper container from which it came. Never mix propellants. Do not smoke while near propellants, and keep propellants away from any possible spark or flame. It is advised to store propellants in a safe powder magazine.

Propellants for rifle cartridges are primarily extruded, left, and spherical. If you look closely at the granules, you can see the reasons for the designations.

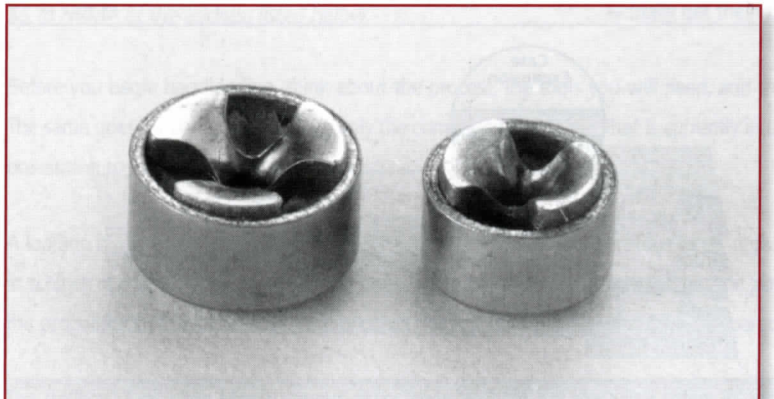
Primers

Make certain that you use the proper primer for the load in question. Generally speaking, when it comes to metallic cartridges, there are large and small rifle primers and large and small pistol primers. Make certain that you have the proper primer size and type for the case you're using.

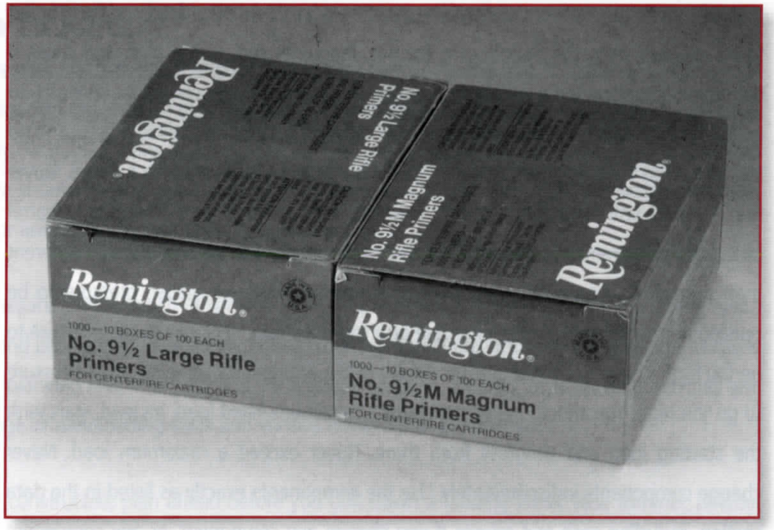
In addition to primer size and rifle or pistol application, there are standard and magnum primers.

Generally speaking, standard primers are used for standard loads. Magnum primers are used for large quantities of slow-burning or difficult-to-ignite propellants.

Primers can and do have an effect on the burning characteristics of propellants. For this reason you should never switch primers indiscriminately.



Primers come in small and large sizes. Make certain you have the proper one.



Primers come in standard and magnum types. Use the proper one for your application.

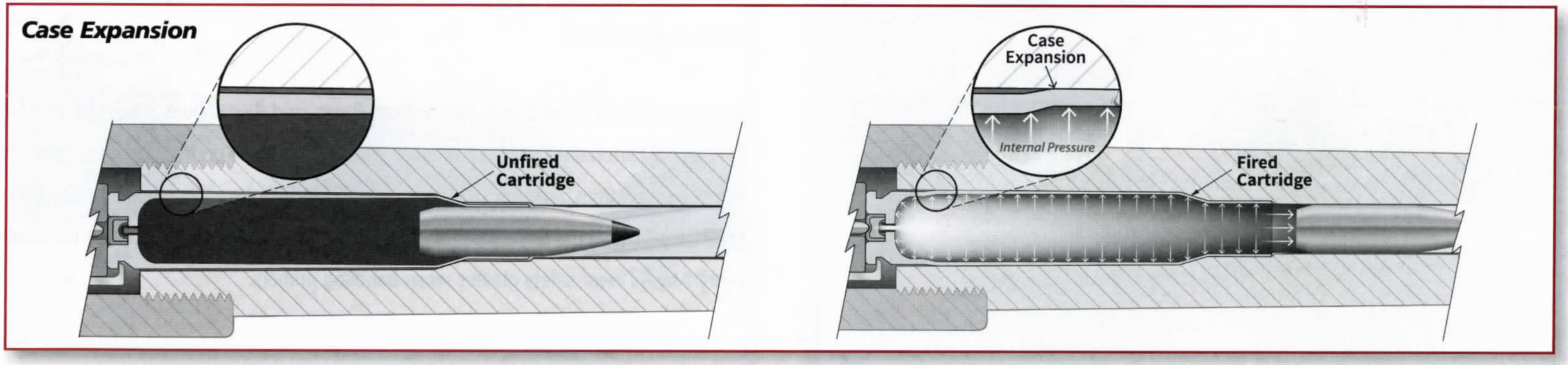
Use the same primers as those listed with published data. All components should be used exactly as listed.

Primers contain a lot of energy for their small size, and they should always be kept in the original carton until used. Never place a quantity of loose primers together. Keep all primers away from children. The force of even a single uncontained primer that explodes can drive the tiny anvil through a hand or into an eye, causing severe personal injury. Always wear safety glasses when handling primers.

Pressure

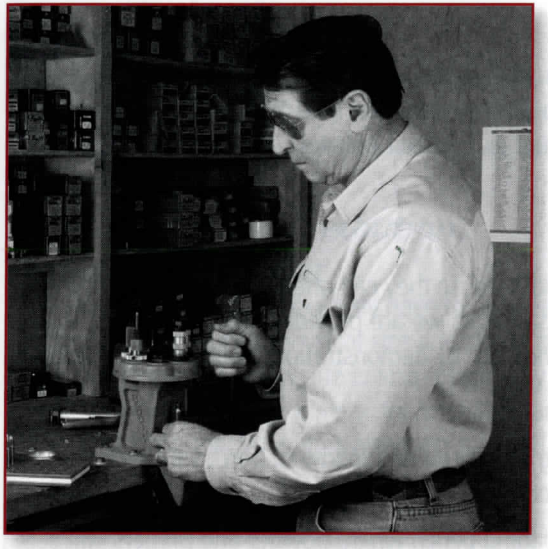
It requires a certain amount of chamber pressure when a round is fired and for a bullet to be expelled from the muzzle of a firearm. Pressures can go too high and cause a dangerous situation for a variety of reasons. Too much powder can cause pressure to go higher than it should. Too little of a slow- burning powder can cause pressure to go too high. (Too little powder can also cause a bullet to become stuck in a barrel. Never fire a round with a bullet stuck in a barrel. Never fire a round with any barrel obstruction.) Extremes of temperature can cause pressure to be considerably different than normal. A change in component or component lots can cause pressure to be outside normal bounds. A too-long case or a too-thick case neck can cause pressure to go too high. Using a bullet that is too heavy or the wrong data can also cause pressure to go too high. You should never start with a maximum listed load. Instead, start with the starting load and progress from there. Never exceed a maximum load. Never change components indiscriminately. Use the components exactly as listed in the data section, including case and primer. If you change any component, or any component lot, start back with the starting load and progress from there as pressure signs indicate.

While the average handloader cannot determine the pressure of his handloads, he can sometimes recognize when pressures are grossly excessive. When you fire a load, first pay attention to the opening of the action. It should open easily without difficulty or resistance. The case should extract and eject smoothly without resistance. There should be no mark on the head of the case. Excessive pressures may cause brass to set back into the firearm's ejector slot or hole in the face of the breechblock or bolt. An enlarged primer pocket is a sure sign of excessive pressure. A black smudge around the primer is another sign of excessive pressure. Excessively flattened primers are yet another indicator. Cratered primers or primers with a hole are another possible sign of excessive pressure. Any enlargement of the solid section of a cartridge case head, as measured with a micrometer, is a sign of excess pressure. It is important to examine fired cases for all these signs. If you see any of these signs of excess pressure, stop what you're doing. Do not fire any more of the loads. Determine what caused the excessive pressures. **WARNING: Excessive pressure can cause damage to your firearm and injury to the shooter and/or bystander.**



Internal chamber pressure causes the case to expand to the supporting steel walls of the rifle's chamber to a point at which the cartridge brass is too thick at the rear of the case to expand under the given chamber pressure. This is sometimes referred to as the "pressure ring" of a fired rifle case. (Not to be confused with the pressure ring on a bullet.) This expansion causes the case to be slightly larger than original. It must then be reduced during reloading/case sizing so that the handloaded case will chamber smoothly and easily on a subsequent firing.

Getting Set Up to Reload



If you have questions about the type of bench you need, you can get plans for a great handloading bench by sending $5 to NRMA at the address listed below.

Before you get set up to reload, make certain that you have an area to work that is free of clutter and distractions. Where you do your handloading depends on your individual circumstances but, wherever it is, make certain that handloading can be safely conducted there. Make certain that the area is clean, dry, and away from any heaters or flame sources. The area should be in a space that precludes any distractions. You must not watch television, carry on a conversation, or answer the phone while handloading.

Most handloading tools require a work bench of some sort. The basic part of any loading bench is a sturdy bench top where loading tools and presses can be securely bolted. Loading operations apply severe leverage forces to a bench so that thick top planking and solid supports are a good choice. In addition, most loading benches also have a provision for storage of handloading tools and various devices that are needed.

Once you get your bench constructed, plan ahead before you bolt down a loading press, case trimmer, powder measure, scale, etc. Understand the loading process so that you can position the tools where they are trouble-free and convenient to use. You can mentally run through the handloading process to organize tools before you actually get them bolted down.

Before you begin handloading, think about the process, the tools you will need, and the components. Have only the tools available on the bench top that are currently being used. The same goes for components. Have only the component container that is currently in use on the bench top. Your work area should be neat and organized, and you should take every precaution to avoid any possibility for error.

A loading block, for example, is a simple item, but it can keep your cartridge cases organized on the bench top. When you load cartridges in batches, as most people do, all the cases in a block can be charged and then the block passed under a good light so that the powder levels in all the cases can be seen. This helps prevent over or under charging or leaving the propellant out of a cartridge case because the propellant levels can all be compared quickly.

The National Reloading Manufacturers Association (NRMA) has reloading safety information, and the Sporting Arms and Ammunition Manufacturers Institute (SAAMI) has powder and primer safety information. These pamphlets can be obtained free by writing: NRMA/SAAMI Safety Folders, One Centerpointe Dr., Suite 300, Lake Oswego, OR 97035.

The Basic Rules for Reloading Safely

The above reloading safety information has been taken from the NRMA (National Reloading Manufacturers Association). For additional information and free safety pamphlets, write: NRMA One Centerpoint Dr., Suite 300, Lake Oswego, OR 97035

Introduction

Most reloaders handload because it is interesting, less expensive than shooting factory loads, and because they can often develop more accurate loads for specific guns. The NRMA and Swift™ Bullet Company want you to enjoy this hobby safely, so we are providing you some basic rules observed by all top-notch reloaders. You are urged to read all available books on reloading. Go to demonstrations; talk to experienced handloaders. Make yourself as knowledgeable as you can.

1. Modern ammunition uses smokeless powder as the energy source. Smokeless powder is much more powerful than black powder or Pyrodex®. Never substitute smokeless powder for black powder or Pyrodex® and never mix it with either.
2. Follow loading recommendations exactly. Don't substitute components for those listed. Start loading with the minimum powder charge in the loads shown.
3. Never exceed manufacturers' reloading data. Excess pressures caused by excessive loads could severely damage a firearm and cause serious injury or death.
4. Understand what you are doing and why it must be done in a specific way.
5. Stay alert when reloading. Don't reload when distracted, disturbed, or tired.
6. Set up a loading procedure and follow it. Don't vary your sequence of operations.
7. Set up your reloading bench where powder and primers will not be exposed to heat, sparks, or flame.
8. DO NOT smoke while reloading.
9. ALWAYS wear safety glasses while reloading.
10. Keep everything out of the reach of small children.
11. Keep your reloading bench clean and uncluttered. Label components and reloads for easy identification.
12. Do not eat while handling lead.
13. NEVER try to dislodge a loaded cartridge that has become stuck in the chamber by impacting it with a cleaning rod. Have a competent gunsmith remove the round.

Handling Lead

Lead, a substance known to cause birth defects, reproductive harm and other serious physical injury, must be handled with extreme care. Handle lead bullets or lead shot only in a well-ventilated area, and ALWAYS wash hands after handling lead and before eating. Discharging firearms in poorly ventilated areas, cleaning firearms, or handling ammunition also may result in exposure to lead. Have adequate ventilation at all times.

Basic Reloading Precautions

Smokeless Powder

All smokeless powders obviously have to burn very fast, but handgun and shotgun powders must burn faster than rifle powders. You will readily note the differences in physical size and shape of various powders, but you cannot see differences in chemical composition that help to control the rate of burning. Burn rate is also affected by pressure. "Hot primers," seating the bullet too deep, overcrimping the case on the bullet, tight gun chambers, oversize bullets, for shotshell, and anything that increases friction or confinement of the powder will increase the pressure. Obviously this hobby requires attention to detail, patience, and meticulousness to ensure the safety and quality of loads produced.

Powder Warnings

1. NEVER mix powders of different kinds.
2. Use the powder ONLY as recommended in manufacturer reloading manuals.
3. Store powder in cool, dry place.
4. If you throw or measure powder charges by volume, check-weigh the charges every time you begin loading, occasionally during loading and when you finish.
5. Pour out only enough powder for the immediate work.
6. NEVER substitute smokeless powder for black powder or Pyrodex®.
7. Don't carry powder in your clothing. Wash your hands thoroughly after handling it.
8. Store powders only in original package. Don't repackage.
9. Keep powder containers tightly closed when not in use.
10. Specific powders are designed for specific uses. Don't use them for other purposes.
11. Smokeless powder is EXTREMELY FLAMMABLE. To dispose of deteriorated powders, follow recommendations in The Properties and Storage of Smokeless Powder SAAMI Reprint #376-2500, which is available from NRMA.
12. Empty the powder measure back into the original powder container when through with a reloading session. DO NOT MIX POWDERS.
13. Clean up spilled powder with brush and dust pan; do not use a vacuum cleaner because fire or explosion may result.

Primer Handling

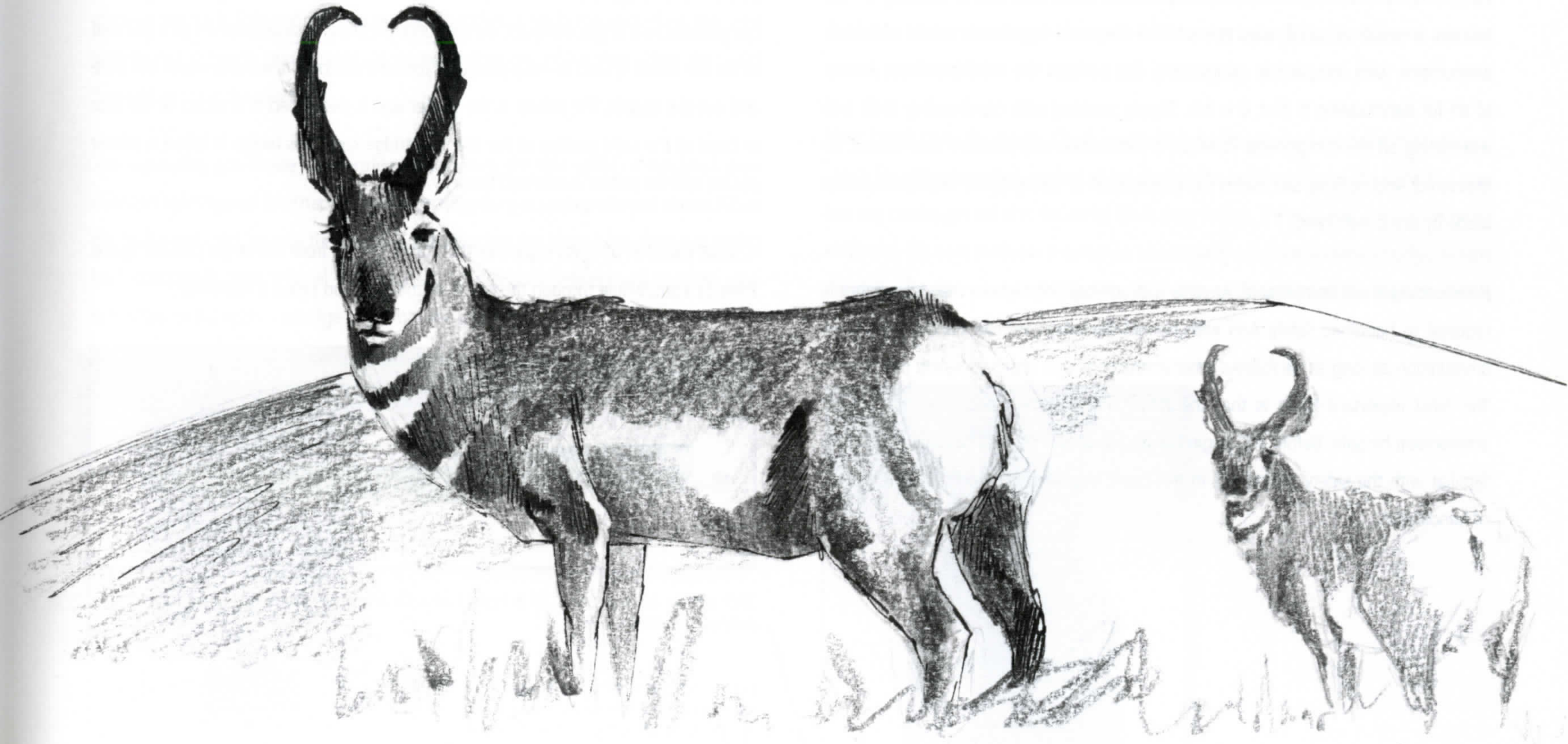
Priming materials differ in brisance (initial explosive force) and in the amount of hot gas produced. Don't mix primers of different makes.

1. Don't decap live primers. Fire them in the appropriate gun—then decap.
2. Don't ream out or enlarge the flash hole in primer pockets. This can increase chamber pressure.
3. Over-ignition creates higher gun pressures. The best results are obtained by using the mildest primer consistent with good ignition.
4. Don't use primers you can't identify. Ask your local police or fire department to dispose of unidentifiable or nonserviceable primers.
5. Keep primers in the original packaging until used. Return unused primers to the same package. Don't dump together and store in bulk. There is a risk of mass detonation if one is ignited.
6. If resistance to seating or feeding of primers is felt, STOP and investigate. DO NOT FORCE PRIMERS.
7. Store primers in a cool, dry place. High temperature, such as in a summer attic, causes them to deteriorate.
8. Don't handle primers with oily or greasy hands. Oil contamination can affect ignitability.
9. There have been instances of "primer dusting" in the tubes of loading tools because of vibration. Clean the machines after each use.
10. Refer to SAAMI reprint "SPORTING AMMUNITION PRIMERS: Properties, Handling & Storage for Handloading." If you don't have one, write NRMA.

Handloading Rifle & Pistol Cartridges

1. Examine cases before loading. Discard any that are not in good condition.
2. Put labels on boxes of loaded cartridges. Identify caliber, primer, powder and charge, bullet and weight, and date of reloading.
3. In handgun cartridges, the seating depth of the bullet is extremely important. Handgun powders must burn very quickly because of the short barrel. They are sensitive to small changes in crimp, bullet hardness, bullet diameter, primer brisance, and especially to bullet seating depth.
4. Check the overall length of the cartridge to be sure the bullet is seated properly.*
5. If you cast your own bullets, remember their hardness, diameter and lubrication affect the ballistics.
6. Plastic cases designed for practice loads (where the bullet is propelled by primer gas only) can't be used for full powder loads.
7. Consult manufacturer regarding disposal of unserviceable ammunition. Ask your local police or fire department to dispose of small quantities.

**Accumulation of lead or grease in the bullet seating tool may force the bullet in too far. If the bullet isn't seated deeply enough, it may engage the lands of the barrel when loaded. This will increase the chamber pressure.*



Reloading Process, Simplified

Handloading–How Does It All Work?

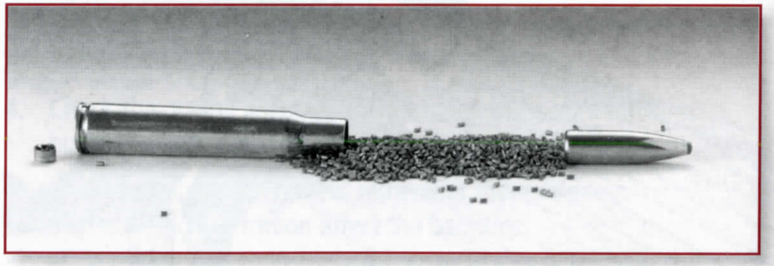
Handloading adds a whole new dimension to shooting. It allows a shooter to tailor components specifically for an individual firearm, the intended quarry, the expected hunting conditions, and even a style of hunting. And by tailoring components to a specific firearm, a handloader has the potential to achieve better accuracy in the process. A round of handloaded ammunition does cost less than a round of factory ammunition with comparable components. But perhaps the most important reason of all for handloading is that it is fun. Simply working with handloading tools and assembling all the components provides a satisfaction and pleasure that cannot be measured. And nothing can match the gratification of taking game with ammunition made by one's own hand.

Handloading is not complicated. Anyone with average intelligence may learn what is required to handload safely. And with normal dexterity, one can handload his own ammunition as long as he follows basic instructions and observes safety procedures. The most important thing is that the handloading process and your handloaded ammunition be safe. Before you begin handloading, you need to become completely familiar with the safety procedures in this book. You need to understand all aspects of handloading.

The Parts of a Metallic Cartridge and How Ammunition Works

All the parts of a round of ammunition comprise a cartridge, and there are four basic parts to a metallic cartridge: 1) cartridge case, 2) primer, 3) propellant or powder, 4) bullet. The cartridge case forms the basis for a round of ammunition by retaining all the components in a single, compact, durable unit. The brass case also serves as a gas seal when the round is fired to keep pressures forward and push the bullet down the bore and out the muzzle. The primer is the igniter and is positioned in a recess at the rear or head of the solid portion of the brass cartridge case. This recess is called a primer pocket and the primer is retained there by a press fit.

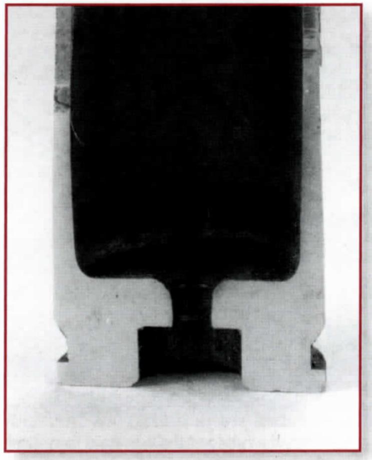
A small partition of brass separates the primer pocket from the larger powder space. There is a small hole through the center of this partition called a flash hole.



This shows all the parts of a round of rifle ammunition, the primer, brass case, propellant, and bullet.

When a round of ammunition is inserted into the chamber of a modern firearm with the same designation and when the breech is locked, the brass cartridge case is surrounded by steel sufficient to contain normal chamber pressure during firing. When the firearm's trigger is pulled a firing pin is rapidly driven forward under spring pressure. The sharp blow from the firing pin detonates the primer and sends a jet of hot gas through the flash hole and into the powder chamber, igniting the propellant. The solid powder burns rapidly and converts to an expanding gas, which then drives the bullet forward and out the muzzle.

The expanding gas inside the cartridge also forces the thin walls of the brass case outward tight against the chamber walls, creating the gas seal mentioned above. When the bullet exits the muzzle the pressure subsides but the brass case does not spring back completely to its original dimensions. It springs back only enough to allow easy extraction of the spent cartridge case from the chamber.



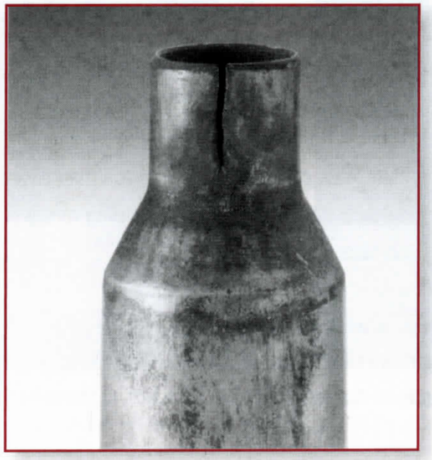
There is a wall of brass between the primer and the powder chamber as can be seen in this sectioned cartridge case. The flash hole passes through this partition to allow powder ignition.

The Reloading Procedure

Case Inspection

A person who shoots only factory ammunition discards the brass case, but a handloader keeps it. This makes sense because the brass case is one of the most expensive parts of a round of ammunition and it can be reused. The first thing to do in preparing any fired case for handloading is to inspect it for foreign material inside. Remove any dirt, gravel, or other debris.

Next, check cases for cracks. Check particularly for longitudinal cracks in the neck and check for circumferential cracks just forward of the solid section of the base. If a case has any cracks, get rid of it. Its useful life is over. In fact, if a case has any sign of being abnormal, it's best to throw it away. An abnormality could be a black smudge around the primer pocket, a bright ring just forward of the solid section of the base, corrosion, or simply a too battered extractor groove and rim.



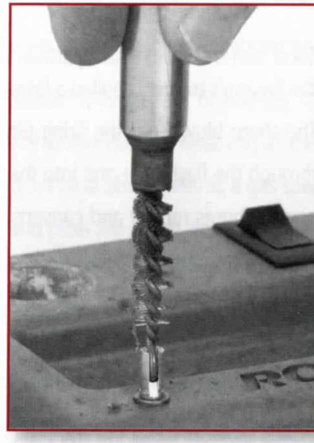
Be sure to check cases for splits as shown in this case neck.

Case Inspection *(continued)*

These cases reveal neck splits and the one at right has an incipient separation near the base. They should all be discarded.

If cases are corroded, throw them away.

Be certain to remove cleaning media grit from the inside of cases. It is important to check flash holes for the grit.

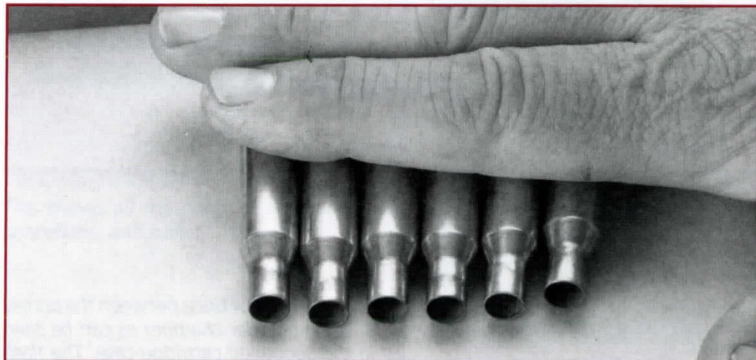


Clean and lubricate the inside of case necks with a dry lube and a brush. This will help reduce expander ball drag and aid in the case pulling off the expander ball of the sizing die.

Case Cleaning

Once cases are visually inspected, now is a good time to clean them in a cartridge case tumbler or vibrator if they need it. A clean case produces less wear on a sizing die, and finished ammunition looks better when brass cases are shiny bright. When cases are removed from the cleaner, look inside each one to see that all cleaning media is removed from the case, including the flash hole.

Once the outside of the case has been polished, clean the inside of the case neck with a brush made for this purpose. A dry lubricant on a brush significantly reduces expander ball drag and screech during sizing later.

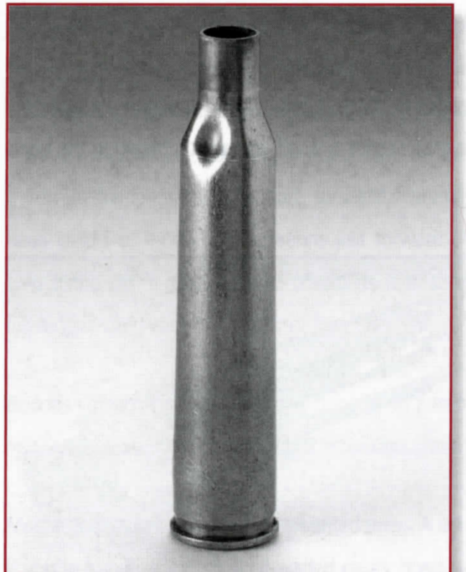


Cases can be lubricated by rolling them across a pad to which case lube has been applied.

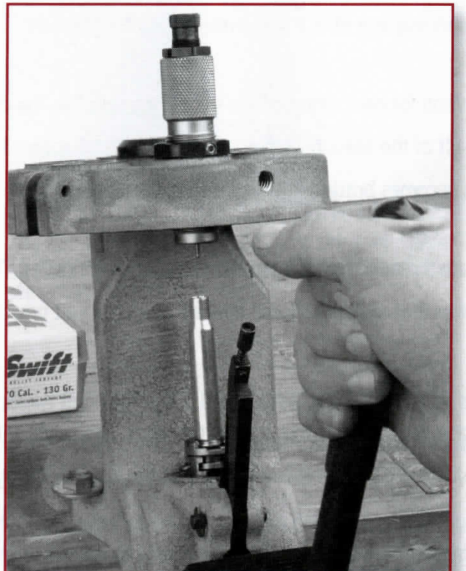
Case Sizing and Decapping

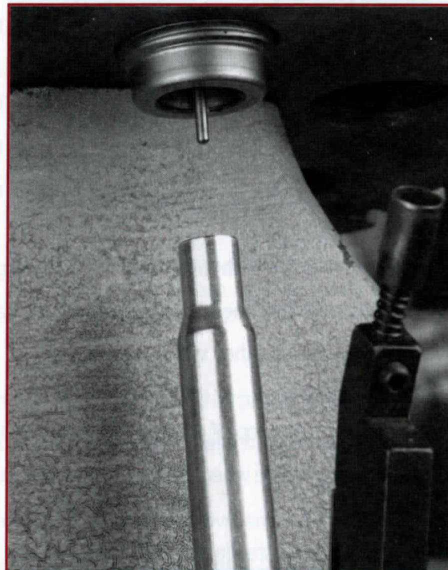
After inspection and cleaning, the case must be lubricated in preparation for sizing, and there are a number of lubricant types and lubrication methods. Rolling cases on a lubricated pad is one method. Simply wiping the cases with lubricant on the fingers is another method. In recent years, spray-on lubricants have gained popularity. The important point is to lubricate the outside of the case so that it won't get stuck in the sizing die. At the same time, don't use too much lubricant. If you do, it will cause dents to form in the shoulder of a case. After you complete the sizing operation, remember that any lubricant must be removed from the case.

Sizing is accomplished by pressing an empty brass case into a die specific to the cartridge being loaded. This die reduces the fired case's exterior dimensions to make the case close to the size it was originally, before firing. Sizing is good policy even on new, unfired brass cases because the necks of new brass cases are often out of round. Sizing is one of the most important aspects in handloading.



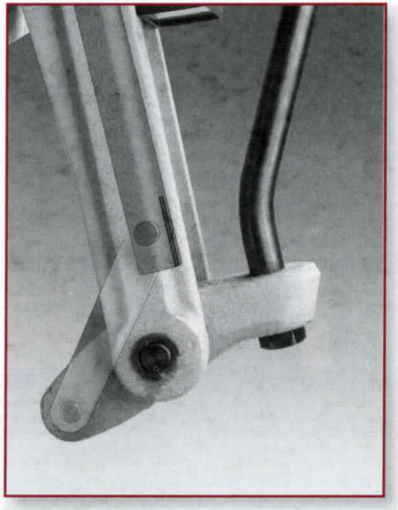
If you apply too much lubricant to the case, the lubricant will pocket at the shoulder during sizing and produce a dent, as shown here.





Here, a cartridge case is inserted in the shell holder at the top of the ram. The case is about to be sized.

Case Sizing and Decapping *(continued)*



Loading presses have a compound linkage to make sizing easier.

In order for a factory round to smoothly enter the chamber of any rifle with a proper designation, each round of factory ammunition must be smaller than the smallest chamber. This means that when a round is chambered there is a small amount of space between the cartridge and the firearm's chamber. Remember, the brass case is pliable and flexes to fill the chamber and seal it when the round is fired.

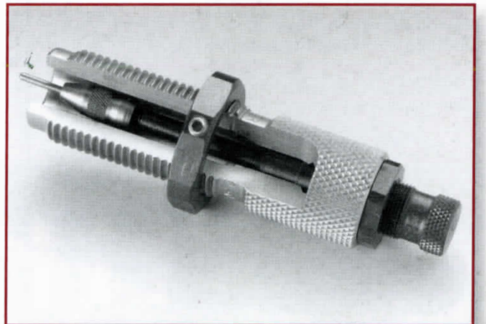
As mentioned, firing a cartridge causes the exterior dimensions of the case to be slightly larger than before the round was fired. A bullet slips easily into the neck of a fired case, for example, with no resistance. Sizing reduces the inside diameter of the case neck so that it will again hold a bullet securely. A case may be sized either full length so that it will chamber in any rifle with the proper cartridge designation, or only the neck may be sized. Neck sizing only means that the case will hold a bullet securely but the round may not fit in the chamber of another firearm.

One reason for neck sizing only is to prolong case life. The cracks mentioned earlier in the section on case inspection are generally the result of the brass becoming work hardened. Repeated firing and sizing a case causes a small amount of flexing in the brass until it becomes brittle to the point that it cracks.

With a conventional bench-mounted press, reloading dies are threaded into the press frame as they're needed. The press operating handle is connected to a compound linkage setup that multiplies force applied to a ram that presses cases into the sizing die and then withdraws them.

A shell holder at the top of the ram interlocks with the case rim, securing the case to the press ram so that it will be withdrawn from the die when the press ram is lowered. Be sure to use the correct shell holder for the cartridge being loaded.

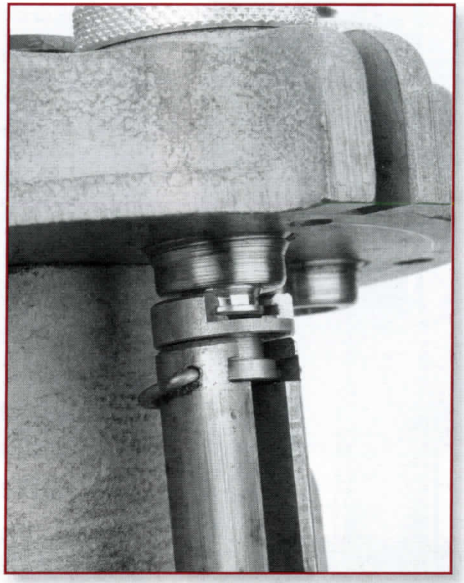
If a sizing die is adjusted in the press frame so that it contacts the shell holder when the ram is at the top of the stroke as some die instructions advise, the maximum amount of sizing is achieved. This brings the case back close to original dimensions so that the case will chamber in any rifle of the proper designation.



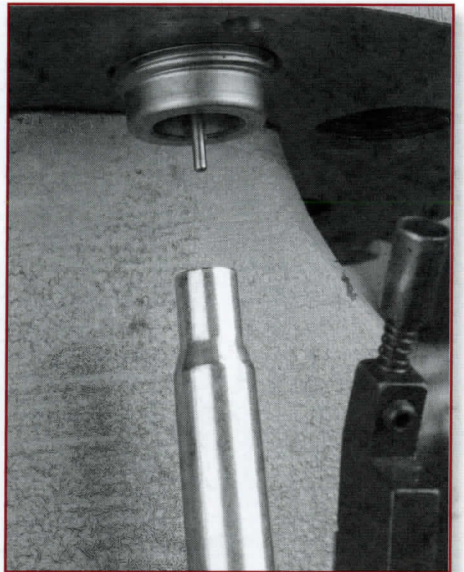
This is a cutaway view of a Redding die to illustrate how it is constructed and how it works.

To minimize work hardening, a handloader may simply size a case only to the degree necessary for smooth chamber entry in his own rifle. The degree of sizing can be controlled with conventional dies simply by backing the die out of the press frame slightly so that it does not contact the shell holder.

As a rule of thumb, full-length size for the smoothest ammunition functioning and where quick operation is essential. Cases for hunting ammunition, for example, would be full-length sized. If you're sizing cases for practice shooting, you can prolong brass life by neck sizing only. As a practical matter, when dealing with popular calibers for which cases are readily available and relatively inexpensive, full-length sizing may be the best bet. If you do full-length size, be sure to watch carefully for case head cracks or incipient separations just forward of the solid web in the case's base. Another possibility is to simply discard full-length-sized cases after four or five loadings.



The rim of the case interlocks with the shell holder so that the case can be extracted from the sizing die when the ram is lowered.

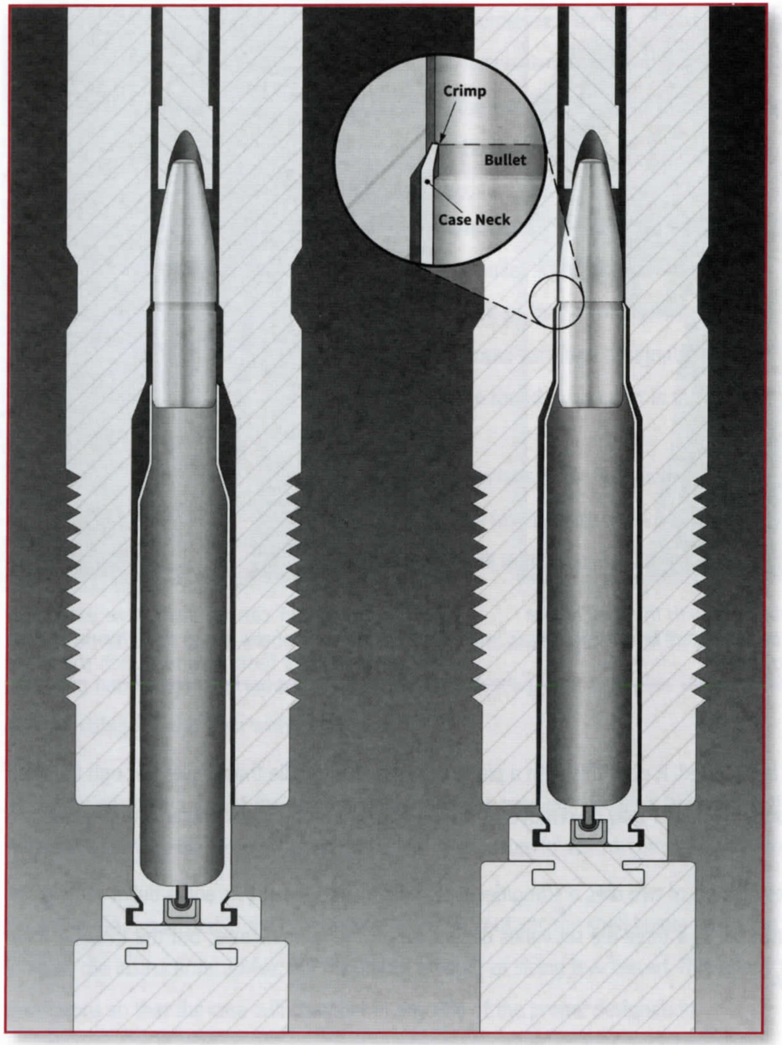


The decapping pin can be seen here extending from the bottom of the sizing die. This must pass through the case's flash hole to punch the spent primer from the primer pocket.

Besides sizing a case, a standard sizing die (in a two-die set) also de-primes the case as it is being sized. It does this with a pin in the center of the die that passes through the flash hole and punches the primer out of its pocket when the case is sized. If you're using hand tools, the primer may be removed in a separate operation. Spent primers are discarded.

Most handloaders use a bench-mounted press. A set of standard dies for bottleneck cartridges consists of two dies, a sizing/decapping die mentioned above, and a bullet seating die. If you're handloading straight-walled cases, there are three dies in a set. The function of each die in a three-die set varies depending on the manufacturer, but the three of them accomplish the same purposes of sizing, decapping, bullet seating, and crimping if necessary.

Case Sizing and Decapping *(continued)*



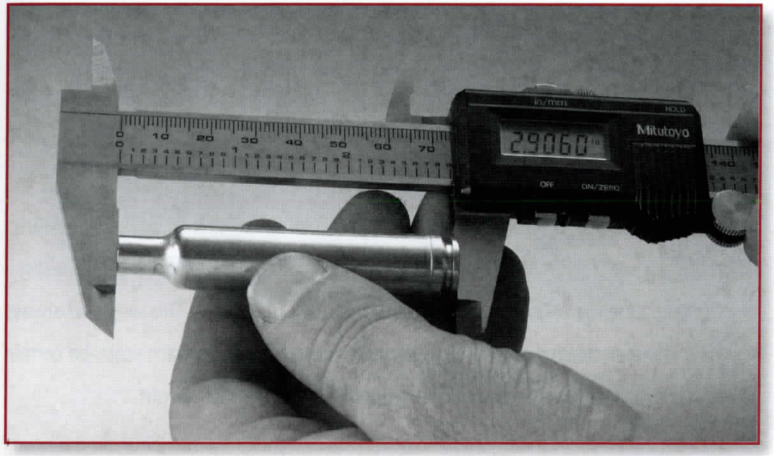
There is a case mouth "ledge" or projection inside the bullet seating die for crimping. Unless there is a specific reason to crimp, such as for a tubular magazine or for a heavy-recoiling cartridge, a crimp is best avoided. A bullet must have a groove for crimping; otherwise the bullet will be distorted during crimping. This drawing illustrates a case mouth being crimped to hold a Swift A-Frame in place. The crimp is positioned just behind the forward edge of the relief groove in the bullet so that the forward edge of the rifle's magazine box will not pound the bullet inside the case under heavy recoil. Most modern loads are not crimped. To avoid crimping, make sure that the die is turned up far enough in the press frame that the case mouth does not contact the crimping ledge.

Case Trim and Prep

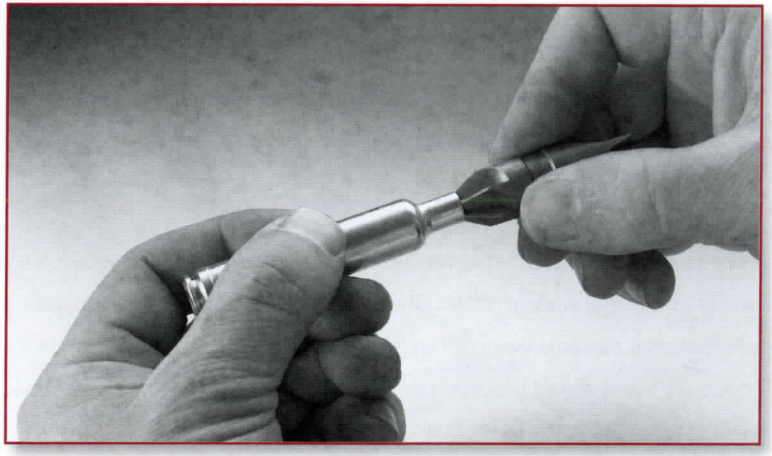
After a case is sized, check its length by using either a simple caliper or a case length gauge designed for the process. The reason to do this is that cases stretch with repeated firing and sizing. Eventually they can get too long to chamber in your firearm. The case should not exceed maximum length. If a case is too long, it must be trimmed to trim-to length. These dimensions are available for each cartridge at the beginning of the load data for each.

Various types of case trimmers are made for the process but the main point is that the mouth be cut to the proper length and square with the case. After trimming, the case mouth must be inside-chamfered and outside-deburred. Inside chamfering is important so that a bullet will enter the mouth smoothly without shaving metal from the bullet.

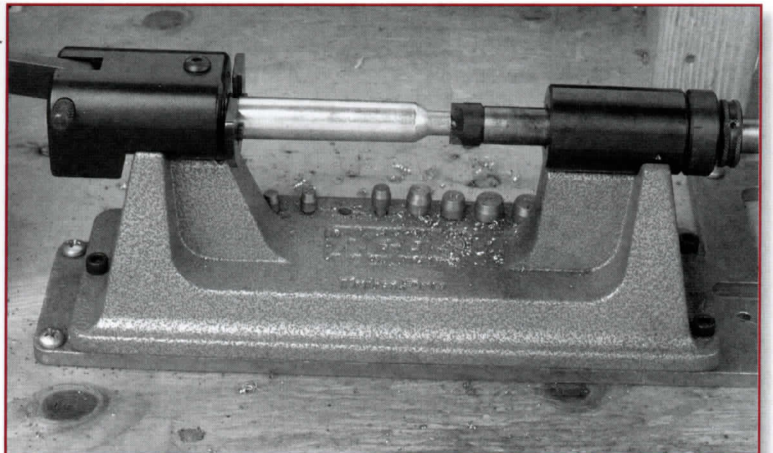
Also check the primer pocket to make certain it is clean. Various primer pocket cleaning devices serve to scrape primer residue from the bottom of the primer pocket. If allowed to accumulate, this residue may prevent a primer from being seated deep enough.



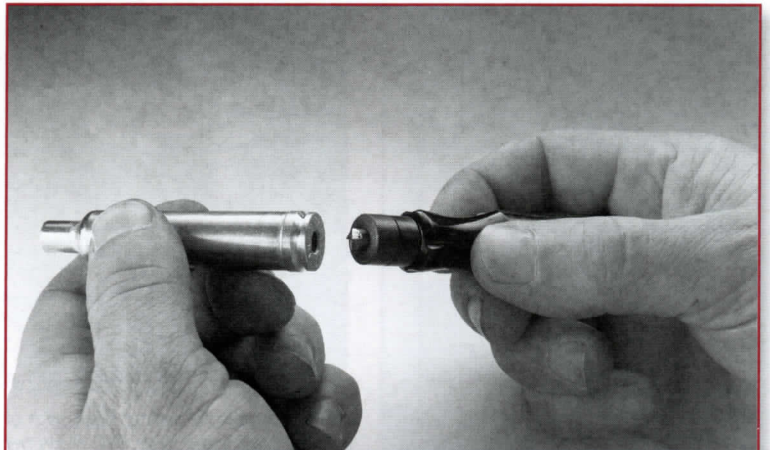
Check case length with a calipers, as shown here, or a case length gauge.



After trimming cases, chamfer the inside of case mouths. This step should also be done on new cases.



This cartridge case is being trimmed in an RCBS case trimmer.

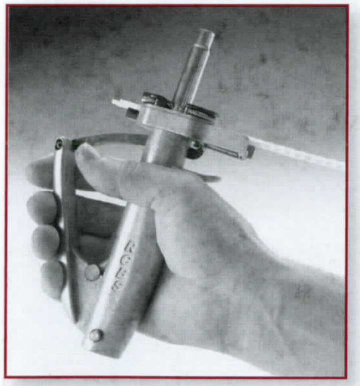


Be sure to clean primer pockets. This tool also uniforms the primer pocket depth.

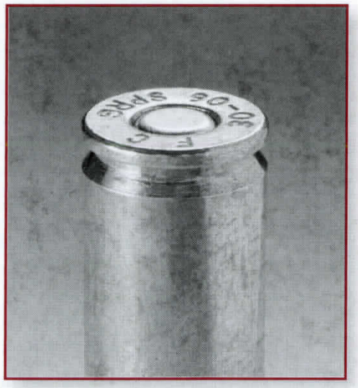
Priming

With the case inspected, cleaned, trimmed, deburred, chamfered, and the primer pocket scraped clean, it is time to assemble components. First comes the primer. The primer should be the proper size and type for the cartridge being loaded. The proper primer size and type is shown at the beginning of the load data for each cartridge. On your loading bench you should have only the primers that you're currently using.

Primers are explosive and must be handled with extreme care. Be certain to use safety glasses whenever handling primers. There are various tools designed for priming cartridge cases that hold the primer square with the case while it is pressed into the pocket. The primer should bottom out on the pocket and the top of the primer should be just slightly below the base of the case. A primer should not protrude above the base of the case.



This is a hand priming tool used to seat new primers in cartridge cases.

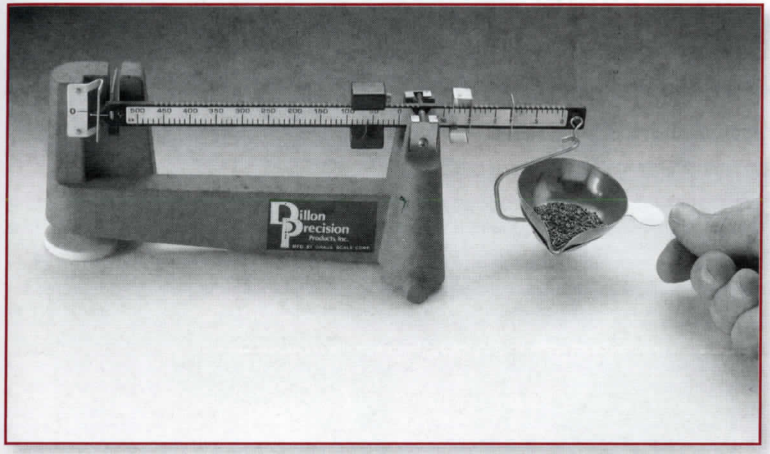


Primers should be seated flush with or slightly below the case rim. A primer should not project from the base of the case.

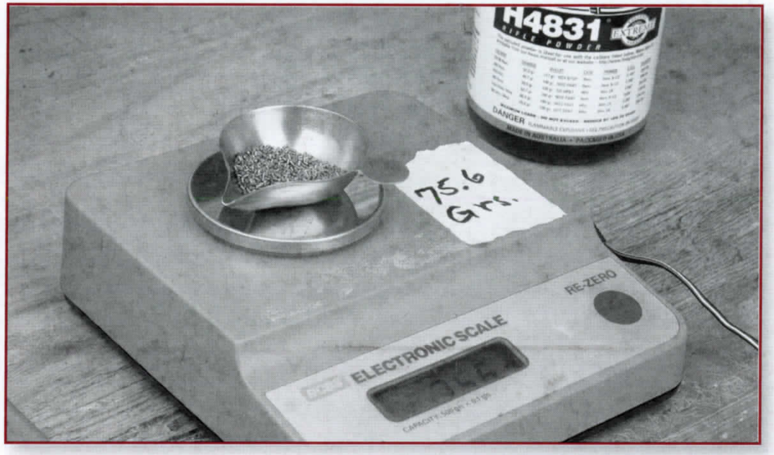
Powder Charging

The next step in handloading is to insert powder into the case. Place on your loading bench only the powder you intend to use. A scale is necessary to make certain you are loading the desired charge of powder. Even if a powder measure is used to dispense charges, a scale is required to check the measure's setting and accuracy. Check the accuracy of your scale with check weights to make sure it is performing properly in the weight range that you intend to work with. It is a good idea to write the desired powder charge weight on masking tape and stick it next to the scale. If you're using a digital scale, tape the charge weight close to the readout window. This way, you always have it for a reference for each charge. If you're using a balance beam scale, be certain that the counterweights are positioned properly for the desired weight.

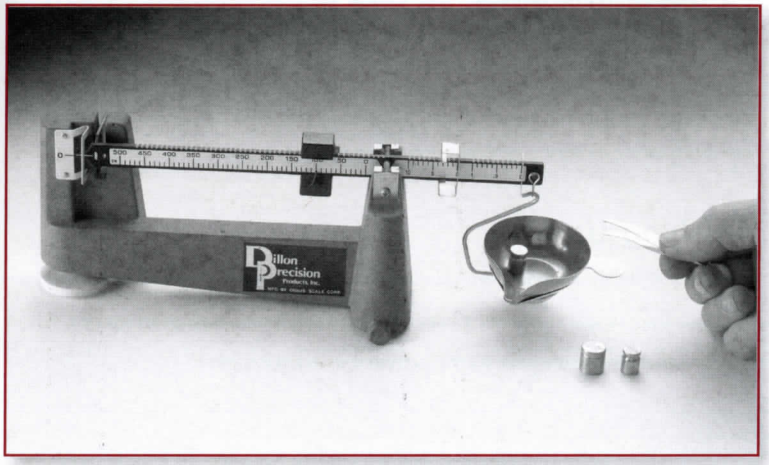
If you're using a measure to dispense powder, try to maintain a consistent measure-operating technique so that powder charges are consistent. Here, a loading block is a good idea. Charge all the cases in the block and then hold the block of charged cases under good light so that powder levels can be seen. If a case is grossly under- or over-charged or if powder is missing, it can be seen at this time.



A conventional and relatively inexpensive balance beam scale works just fine.

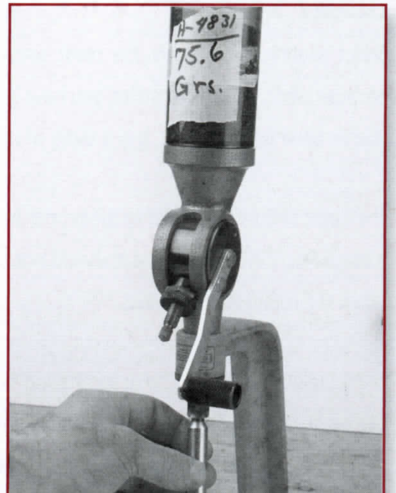


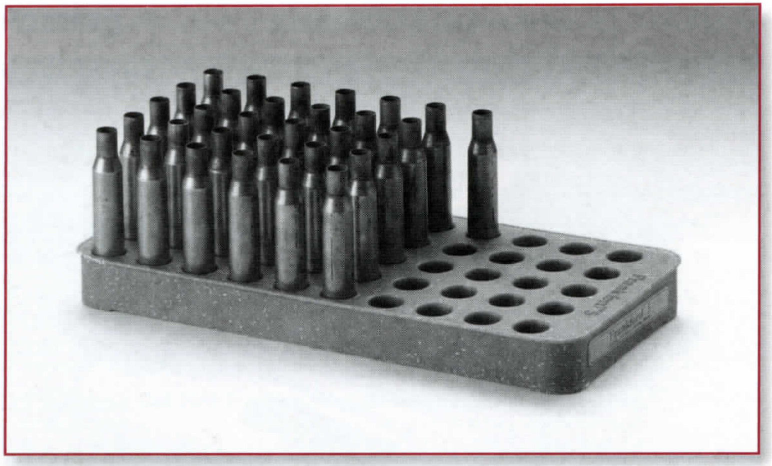
This is an electronic scale. Note the powder charge is written on masking tape applied where it can be readily referenced.



Check weights are being used to verify the scale's accuracy.

A powder measure can be used to dispense charges once it is adjusted with a quality scale. Note the charge weight written on masking tape that is applied to the measure's hopper.





Charge all cases in a loading block, then pass the loading block under good light to view powder charge levels. Any over- or under-charged cases will be readily noticed.

Bullet Seating

Bullet seating is probably the most satisfying aspect of handloading ammunition because when you seat a bullet, you have a completed round of loaded ammunition. If you've done your job well, it is a thing of beauty.

The bullet should be seated to the proper overall length so that it will function through a magazine, if necessary, and it should not be so long that it jams into the rifling lands when the round is chambered.

Most bullet seating dies have a crimping ring inside. If the seating die body is turned too far down into the press frame, the case mouth will contact this rim. Bullets without cannelures or crimping grooves should not have case mouths crimped into them. Simply adjust the die body so that it is just short of contacting the case mouth when the press ram is at the top of the stroke. Bullet seating depth is then adjusted with the central bullet seating stem. To adjust the die for case mouth crimping into a bullet with a cannelure, simply turn the die body down in the press frame until a proper crimp is applied when the ram is raised.

The satisfying results of a well-assembled handload.

Finishing Up

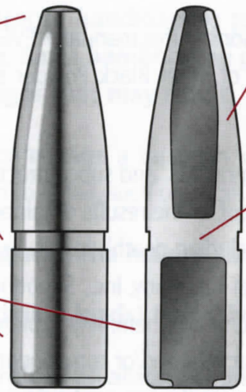
When you've finished loading ammo, clean up the bench. Empty the powder measure back into the original container, remove any loose primers, and clean up any spilled powder. Label your loads with all the pertinent load information.

Swift™ Bullets A-Frame™/Scirocco™

Product Features

A-Frame™

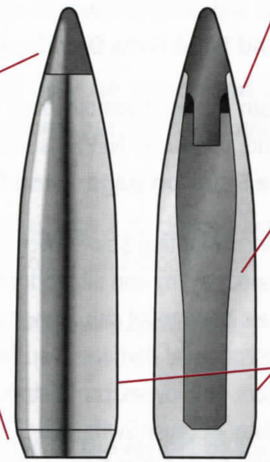
- Swift's bonding process prevents lead core from separating from jacket
- Weight retention of 95% is not unusual for A-Frame bullets
- Pure copper jacket bonded to pure lead core produces maximum strength



- Massive, tappered copper jacket controls expansion as bullet works through thick hides and bones
- Internal cross member stops expansion at optimum diameter
- Protected rear core provides momentum for deep penetration

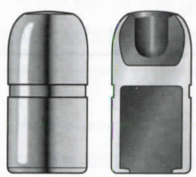
Scirocco™

- Secant ogive nose profile and polycarbonate tip create extremely high ballistic coefficient
- 15-degree boat tail base reduces drag and enhances seating, while retaining an effective, cross-sectional gas-pressure platform



- Mushrooms effectively at velocities as low as 1,440 fps, yet stays together at velocities in excess of 3,000 fps, with over 80% weight retention
- Extra-thick, pure copper jacket to withstand the stresses of energy transfer on game
- Jacket and core bonded together with Swift's proprietary bonding process

The A-Frame, considered by many to be the world's greatest hunting bullet, mushrooms perfectly and penetrates deeply. A precisely designed jacket wall thickness, combined with a bonded core, and a supporting cross-member contribute to upward of 95 percent weight retention. It is the bullet of choice for large and tough game throughout the world.



A-Frame™ Heavy Revolver

The Scirocco is a superbly accurate and sleek hunting bullet designed for long-range efficiency. It carries velocity and energy downrange better than any previous hunting bullet while producing the flattest trajectory. A perfect match for long-range cartridges, the Scirocco produces positive expansion at minimal velocity. The bonded core Scirocco normally retains upward of 80 percent of its weight.

Reloading Safety Tips

- Keep your reloading area organized and clear of clutter.
- Make certain that you're using the proper data for the cartridge at hand.
- Do not use mystery components that are not properly identified.
- Have only the powder on the bench that you're working with at the time.
- Make certain that you have the proper powder for the data you're using.
- Do not start with maximum loads.
- Never exceed maximum listed loads.
- Do not use reduced loads of slow-burning powders.
- Never mix powders.
- Sweep up spilled powder with a broom. Do not allow loose powder to accumulate anywhere.
- Always return unused powder to the proper container so designated on the label. Do it immediately after use.
- Make certain that the data applies to the proper bullet weight.
- Trim cases to the proper length.
- Handle primers carefully and keep them in their original container.
- Always wear protective eyewear when handling primers.
- Redevelop loads when you change any component.
- Do not smoke or allow smoking in your reloading area.
- Do not allow open flame in your loading area.
- Do not handload while under the influence of drugs or alcohol.
- Do not handload when you're tired or mentally sluggish.
- Do not eat or drink while handloading.
- Do not talk, watch television, or become distracted in any way while handloading.
- Never ingest lead.
- Keep components from children.
- Identify your loads by recording details and labeling ammunition.
- Never chamber live ammunition in your loading area.
- Make certain your firearm's bore is unobstructed before you shoot.

Load Data Development—Methodology

None of the velocities listed in the data section were calculated, interpolated, or extrapolated. All were measured. Velocities for maximum loads were verified by firing ten shots for an average; starting loads represent an average of three shots fired.

Pressure and velocity measurements for the accompanying data were accomplished with Oehler equipment, both the System 83 with the Model 57 Infrared screens and the Model 43 PBL with Skyscreen III's and using a strain gauge.

Industry standard reference ammunition was used to establish a reference point for pressure and velocity when available. When reference ammunition was not available, factory ammunition provided a pressure reference.

While the published loads were safe in the test barrels with the components and component lots used under the test conditions, no warranty as to pressure level or safety with other component lots in other firearms under different conditions is expressed or implied.

Propellants were from three manufacturers: Hodgdon, Alliant, and IMR and loading density is based on the water capacity of an unfired case after a bullet is seated relative to the actual powder charge weight for the maximum load. For this reason, some loading densities fill the case to the base of the bullet even though the density is less than 100 percent. Conversely, some loading densities may exceed 100 percent. The reason for this is that the specific gravity of individual propellants is not always equal to that of water, in addition to the fact that there is often considerable air space among the propellant granules, depending on the propellant used.

If you're using the same barrel length as the test barrel used for data development and receive velocity comparable to the velocity listed as maximum, consider your load to be maximum, even though your charge weight may not be listed as maximum. In no instance should you exceed the maximum listed charge weight, regardless of the velocity you receive from your rifle.

The propellants marked with an asterisk (*) indicate those that produced the lowest standard deviations on velocity for ten shots. When two or more propellants produced identical standard deviations, each of those propellants is marked with an asterisk. Sometimes, propellants that produce the lowest standard deviation may be different from another propellant by only one. For example, a propellant marked with an asterisk could have a standard deviation of 20 while another load that is not marked might have a standard deviation of 21. In other instances there is a significant discrepancy with a wider range between the propellants producing the lowest standard deviation and the rest of the propellants.

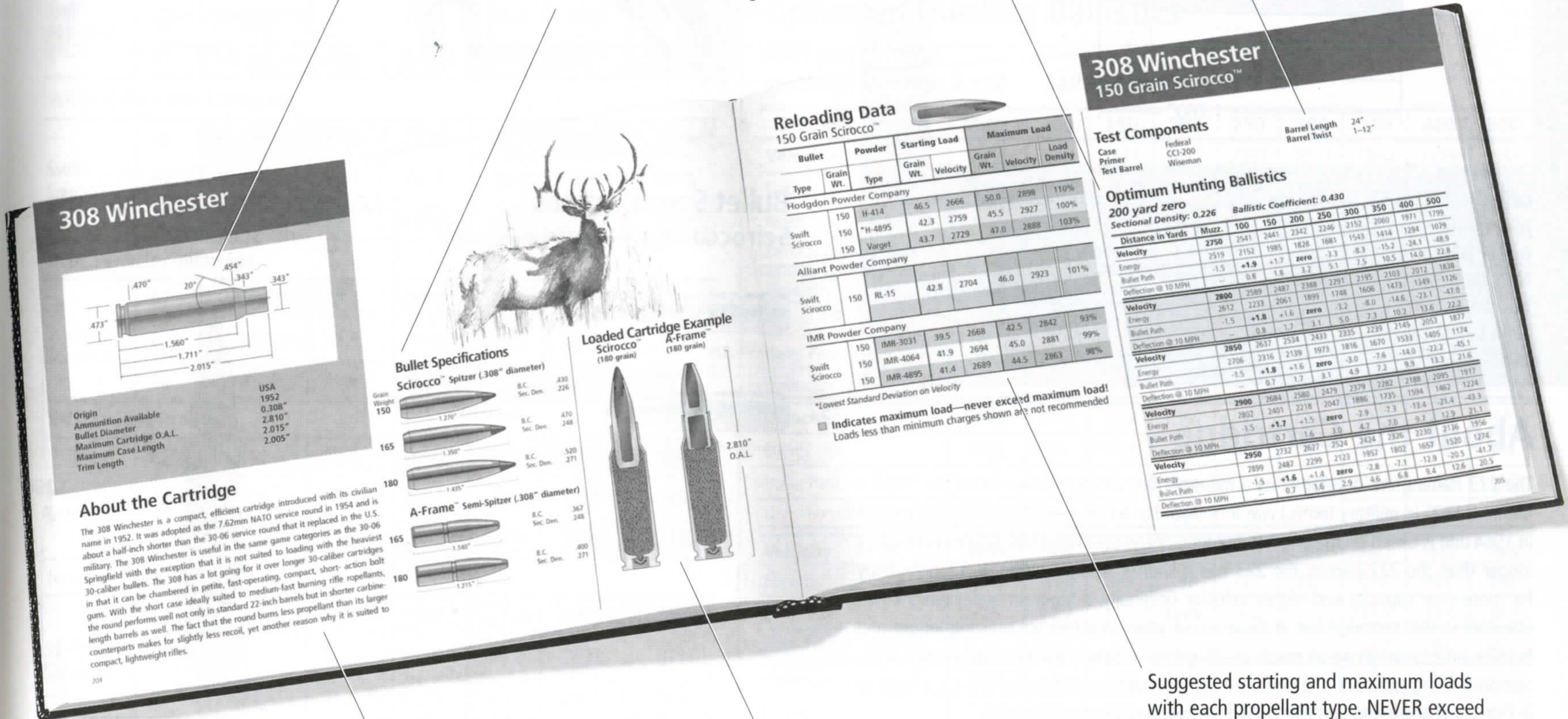
How to Use the Load Data Pages

Nominal specifications for the cartridge along with other pertinent information, including maximum case length and trim-to length.

Swift bullets that are applicable to the cartridge along with important information about them, including bullet weight, sectional density, ballistic coefficient, and bullet length.

The downrange ballistics are keyed to the top velocity with this cartridge and bullet weight, including an optimum sighting-in distance.

Specific information about the test barrel and loading components.



A short history of the cartridge along with the round's attributes.

Illustrates how different bullets affect the powder space capacity with the same overall cartridge length.

Suggested starting and maximum loads with each propellant type. NEVER exceed the charge weight for a maximum load. Asterisk denotes lowest standard deviation on velocity.