Chamber Dimensions

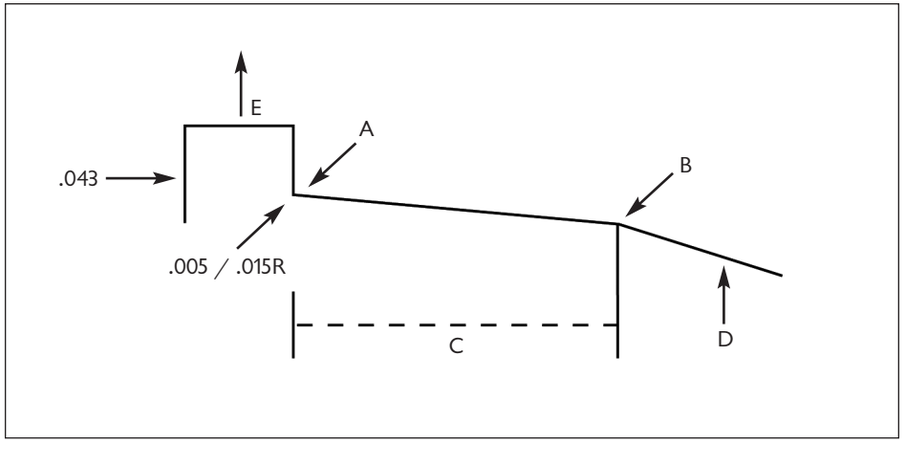
As previously stated, the chamber will have a major impact on the accuracy of a rifle. To understand what a chamber is and its influence, it's best to become familiar with the rimfire chamber. The illustration below is a reproduction of a chart provided by PTG that depicts the critical dimensions and aspects of a chamber. At first glance, it easy to see why there are so many different results with the same ammunition between different rimfire rifles.

The first dimensions to consider are "A" and "B".

A and B — Chamber Diameters

The A and B measurements represent the major internal diameters for each end of the chamber. The measured diameter of A is slightly larger than B, creating a bit of a taper inside the chamber. This taper matches the taper on the rimfire case and makes loading and unloading much easier than if the case walls were perfectly straight. These two diameters also dictate if a loaded round will actually fit into a chamber. This is the part of the chamber where the brass casing of the round rests.

If the loaded round is greater in diameter than either of these two internal diameters, it will not fit and should not be forced. Forcing a loaded round into an undersized chamber will



compress the brass, forcing it to clamp down harder than intended on the bullet and deform the case and bullet. Tight chambers can also shear off lead from the bullet as it's being chambered and cause the case to become stuck halfway inside from the lead shavings building up around the case and chamber wall.

If there is excessive space between the outside of the case and the inside of the chamber wall, two distinct problems will arise. First, is that the loaded round will sit at a slight angle inside the chamber, with the rear of the case resting on the bottom of the chamber and the bullet at a slight angle in the barrel throat. Upon ignition of the round, the bullet will enter the bore of the barrel off-center and the soft lead will deform under pressure and travel down the bore crooked. Contrary to myth, if a bullet starts crooked or off-center in the bore, it will not straighten itself out as it travels down the bore. This is basically the path of least resistance for

the bullet. Ideally, the round has minimal space between the chamber walls and sits in as perfect of alignment as possible to the bore. This is a big step towards attaining better accuracy.

The second problem with excessive space between case body and chamber walls is severe brass deformity and possible failure. An important point to consider is that the brass case serves two functions — to contain the primer, bullet, and powder, and also to serve as a high-pressure gasket between the bolt face and the bullet. When the round is ignited, the primer explodes with a sharp and intense flame, instantly igniting the gun powder. The gunpowder flashes and the resulting pressure forces the case to expand and seal the back of the chamber at the same time that it releases its grip on the bullet. The bullet is launched forward and out of the barrel, and the brass slightly retracts, also known as spring-back, and then is ready to be removed from the chamber. The empty rimfire case is discarded, and the next round can be loaded.

The brass protects the bolt face from the hot flames and it protects the shooter from venting gasses through any seams or ports in the action. If there is substantial space inside the chamber, the brass may not be able to stretch completely to fill the case, and some of the gases vent back past the case mouth, leaving soot marks along the case walls. Normally, this is a minor leak and causes no safety concern, but it destroys a rifle's accuracy. Gas leaks around the case mouth cause tremendous velocity deviations and also harmonic vibrations through the rifle.

Chamber Mismatch

These two .17 caliber rimfire cases were fired in the same rifle, and the results were very different. The case on the right is a CCI Mach 2 rimfire round, and the rifle was chambered for this particular ammunition. You can see the shoulder of the case has moved slightly forward, but the body of the case is clean, showing no soot lines from gas leaks or case failure. The case on the left is the .17 Aguila, a substantially different case design, with the shoulder set much further back. The fired case is lined with black streaks of soot, and the shoulder is bulged unevenly out to the left side. The groups from this round were very poor with a 120fps velocity deviation.

C — Chamber Length

Looking back at the PTG illustration, measurement "C" is the actual chamber length, excluding the rim thickness, and this is important in that it dictates how long the brass case can be for it to fit in the chamber. Interestingly, not all .22 rimfire cases are the same length. The majority of the rimfire cases are similar in length, but some of the sporting cases are longer, such as the CCI Stinger. Within this measurement, there is some room to work with various types of ammunition, but it is mostly trial and error. Trying to force a case or loaded round that