



## Sub-sonic Bullet Design

Sub-sonic velocity (below Mach I, the speed of sound, or about 1130 fps depending on air density) is sometimes used to avoid the loud “crack” of a bullet breaking the sound barrier. Silenced weapons are only silent if the bullet itself does not generate a loud noise in flight. Otherwise the silencer is only effective at hiding the sound of the gas escaping from the muzzle, and not at the loud noise of the bullet itself. Sub-sonic rounds are therefore primarily useful to the military, or to game or pest control officials, or to licensed users of silencers.

However, a sub-sonic bullet must either be very heavy or not carry very much energy, since the energy a bullet can deliver is a product of its mass and the square of its velocity. Reducing velocity greatly reduces energy, and this in turn decreases the ability of a normal bullet design to allow expansion, which is usually desirable in order to maximize the amount of damage done to the target. Since air resistance at speeds below Mach I is primarily caused by the base drag (as opposed to super-sonic bullets, which have far higher resistance from the drag of the shock wave, a function of the nose shape), it follows that reducing base drag will have a greater effect on the retained energy than improving the nose shape.

In fact, a rebated boattail base can improve the ballistic co-efficient of a sub-sonic bullet by as much as 40% over a flat base, whereas the RBT design has only 10-15% effect on super-sonic bullet drag. Expansion of a bullet is inversely proportional to the streamlining of the nose shape, so that a blunt nose shape will expand more easily, at lower velocity, than a sharp nose shape.

Adding a hollow point also improves expansion, if the target material does not plug the hollow point cavity on impact and convert the bullet into a solid nose design. Placing a plastic “bullet ball” in the tip of the hollow point cavity traps a column of air under the ball, which acts like a piston when the bullet strikes. The “piston” compresses the air column and pressurizes the hollow cavity, which in turn presses outward on the ogive and helps expand it on impact. But with very low velocity, even the hollow point with ball tip may not provide enough expansion force. Two other techniques help to insure reliable expansion in sub-sonic bullets: the X-cavity and the 6-point serrated ogive.

The X-cavity, or cruciform hollow point, is made by using an X-shaped core seating punch (usually AFTER seating the core with a conventional flat punch that fits deeper than usual, to allow for forward lead flow when making the cavity). This custom core seating punch, or X-punch, is used in the core seating die. It presses against the pre-seated, shorter-than-usual core, and extrudes four columns of lead forward to the tip of the jacket. When the nose is formed in the PF-1 point forming die, the large cruciform cavity will be pressed together, to whatever degree the bullet maker prefers (even to a closed tip, if a ball is not desired in the bullet tip). Lead surfaces quickly (almost instantly) form a light oxide film in Earth’s atmosphere, so that the surfaces do not wish to join even under high pressure. The surfaces of the hollow cavity may appear to become solid again, but they are still physically separate, and will rapidly expand on impact.

A SDD-2 adjustable length ogive serrator die can be used on the seated core and jacket before the ogive is formed. This die is a “crown of thorns” design, with six sharp points that put a thin shallow groove in the jacket surface, which acts as a stress concentration line on impact, helping the bullet peel back evenly with six equal petals. More than six tends to make the petals too narrow so that they break off, less than six tends to make them too strong so that the sub-sonic velocity cannot peel them back reliably. The serrator raises small ridges along the thin furrows, which would interfere with the insertion of the bullet into the next die, so that a bullet draw die may be necessary to restore original precise diameter and avoid sticking in the point forming operation. Thus, the ultimate sub-sonic bullet can use a RBTO-4 1-E (round nose) swage set with a custom X-shape core seat punch added, a SDD-2 serrator die, and a BRD-1 bullet reducer.

