Understanding Barrel Bedding

Today's factory rifles shoot better than ever before but that's not to say they can't be improved.

By Jon R. Sundra

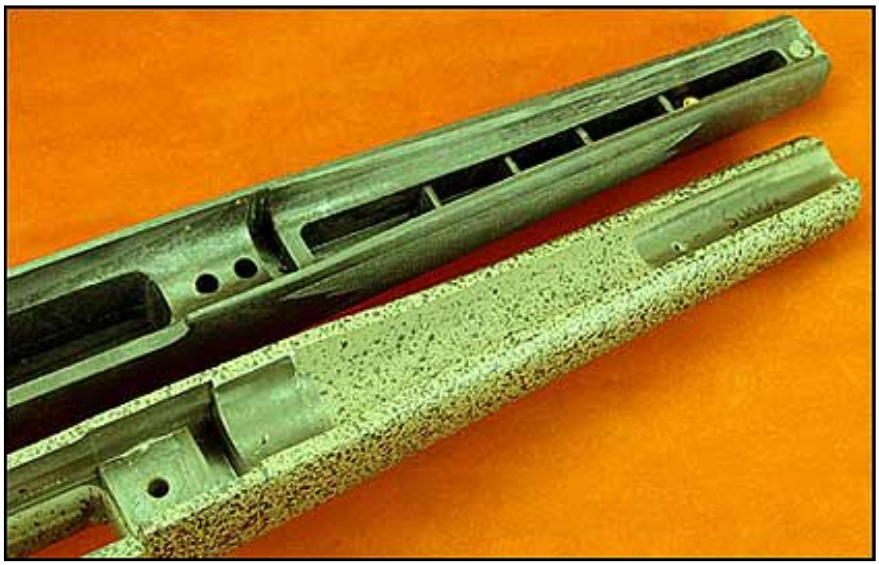
A rifle that is bedded with pressure on the barrel from the forearm tip is likely to shoot to different points of aim if it is rested between shooting sticks or against a tree or if a bipod is attached to the fore-end swivel stud. That's why the author prefers laminates or synthetic stocks and full- or partial-floating barrels.

There are many factors that affect accuracy, but next to the barrel itself, none is more important than the bedding dynamics between the stock and the barreled action.

Actually, "accuracy" can be looked at from two different perspectives: pure grouping ability and a rifle's ability to maintain zero. The two are not the same. The former is the measure of how tight the average group measures, regardless of where on the target it is, while the latter is where our point of impact (POI) is relative to where we expect it to be. In a hunting rifle, consistent POI is more important that pure accuracy, and it's primarily a function of the bedding.

There are a number of ways a bolt-action rifle can be bedded. Bull barrels and heavy varmint/target barrels oscillate less violently than sporter-weight ones as a bullet accelerates down the bore and generally shoot just as well when free-floated as they do when bedded. Some competitive shooters, however, have been known to glass-bed the barrel and leave the action floating while others permanently bond the barreled action and stock together by not using release agent. Most sporter, carbine and ultralight hunting rifles, however, respond better to other bedding dynamics.

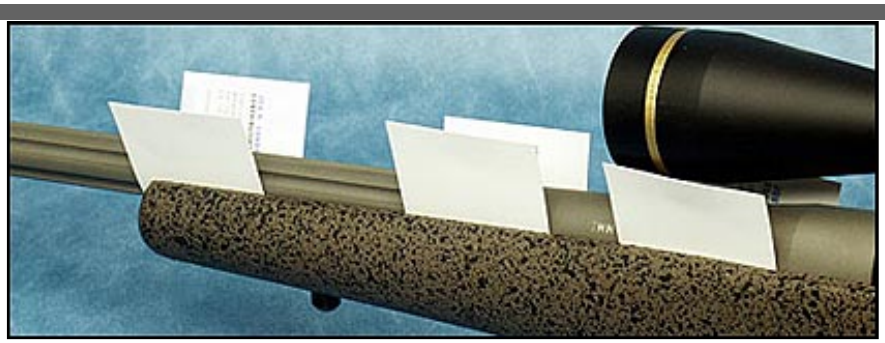
continue article



Injection-molded stocks are unsuitable for glass bedding and generally have hollow fore-ends that further preclude the process. Note the small, circular pressure pad at the tip. Laid-up stocks take to glass bedding well.

Generally speaking, the thinner the barrel, the more likely it is to group best with some dampening pressure being exerted by the stock. The easiest way to produce this dynamic on a production scale is to hog out the bottom of the barrel channel about 1/8 inch deeper than necessary to a point about one inch from the fore-end tip where a raised band of material is left remaining. It is this raised portion of the channel that is the only contact between the barrel and stock. When the forward guard screw is cinched up, the stock is actually bowed inward, and that is what produces the tension against the barrel.

Dampening barrel pressure can also be exerted the entire length of the barrel channel, but to accomplish that you must have perfect surface contact the entire length of the forearm, and that can only be achieved through glass bedding, something no production rifle-maker does. Some, however, do apply epoxy to the recoil-lug area of some select models.

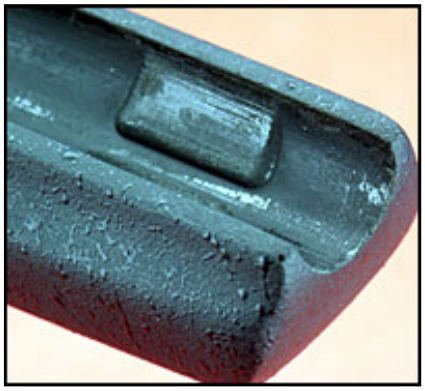


This full-floating barrel will remain perfectly centered in the barrel channel of this laid-up fiberglass stock. Were it a one-piece stock of walnut, the gap between metal and wood would probably change between seasons or if subjected to a drenching.

For a rifle to group its best and maintain zero, the pressure dynamic between the barrel and stock must remain constant, particularly in the case of lightweight barrels that are being dampened only at the fore-end tip. Traditional, one-piece stocks of walnut have proven to be fairly good at keeping this pressure relationship constant, providing the grain structure is properly oriented and the wood is thoroughly sealed not only on the outside but all inletted surfaces as well.

If truth be told, though, it's pretty rare for a one-piece stock to maintain a constant tip pressure against the barrel from season to season or when the rifle is transported to a region where the humidity is vastly different. Then, too, the thinner the barrel, the more POI and accuracy both are affected by where the fore-end is positioned on a sandbag or held in the hand, whether a shooting sling is being used to apply dynamic tension to steady the rifle or if a bipod is attached to the swivel stud.

I know it's difficult for some to believe that a chunk of wood like a rifle stock can swell, contract and warp, but they all do to some degree depending on seasonal humidity or when subjected to drenching rain or wet snow. As to just how much a stock can warp, that can be seen only on a rifle that has a fully floating barrel, i.e., with a visible space along the seam line on both sides of the barrel. I have owned some guns where the barrel would be perfectly centered in the channel during the low-humidity months of winter, and in the summer the fore-end tip would be touching the barrel on one side with a 1/8-inch gap on the other. Depending on the direction of the warp, imagine how much pressure such movement exerts against a barrel, or removes. Believe me when I say there can be as much as 30 pounds of pressure on the barrel at one time of year and zero at another.



Remington's new Model 700 Light Varmint rifle has a laid-up fiberglass stock with a unique tip arrangement whereby two pads on either side of the barrel channel apply dampening pressure while also centering the barrel as would a V-block.

That, of course, is an extreme example, but changes of just a few pounds of tip pressure against or away from the barrel can bring about significant shifts in POI. When I say "significant" I guess it depends on your own personal standard of acceptable performance. If a rifle that groups within 1 1/2 inches of where you want it to on a 100-yard target is acceptable, then it doesn't make much difference how your rifle is bedded. After all, a three-MOA rifle will theoretically keep all its shots inside that 10-inch-diameter vital zone of a deer-size animal out to 300 yards, which probably takes in about 98 percent of all the game harvested in the world.

All I know is that that kind of accuracy isn't good enough for me, not with all the other factors that enter into long-

range shooting like your pulse and breathing, the wind, the uncertainty of distance and the steadiness of your hold. Given the realities of field shooting, I want all the accuracy I can get. I want at least a 1 1/4-MOA rifle, and I want the first shot (and one or two follow-ups if needed) to go exactly where I expect.

Can that best-of-both-worlds scenario be achieved with a one-piece wood stock? Sure, but it's easier with a more stable platform, i.e., a wood laminate or a synthetic, with the barrel either full or partially floated.

Before going further, however, let me again emphasize that slender, lightweight barrels--say, less than .575 inch at the muzzle--do tend to group best when the stock is exerting dampening pressure, but it might be at the expense of a wandering zero and a rifle that's temperamental, so you might have to consider a little compromising. On a hunting rifle, where those first two or three shots go is more important than how tight they group, but obviously the ideal is to have a rifle that shoots its best and at the same time maintains its POI.

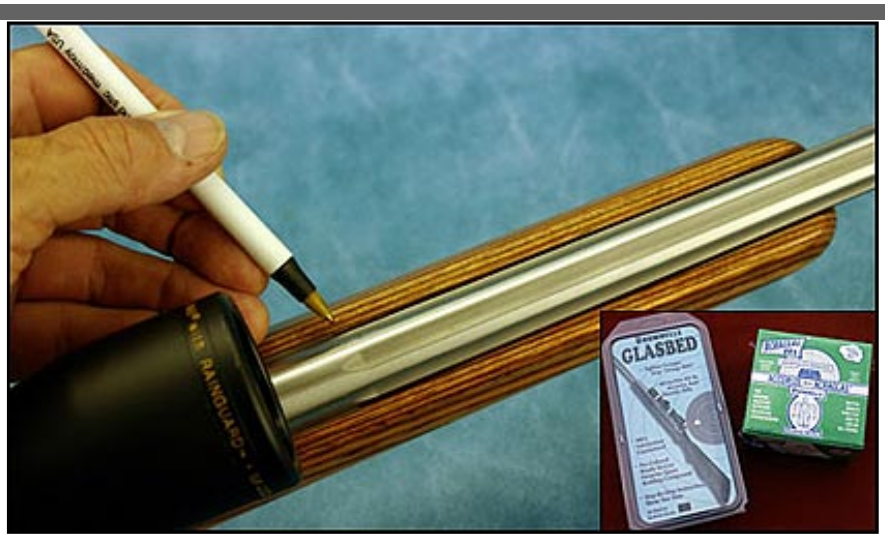
There are some who believe that it's not all that important for a rifle to retain precise zero over extended periods of time because, for one thing, an average hunting trip is but of a few days duration--too short for atmospheric changes to have any significant affect on zero. And because every hunter should check his rifle's zero upon arriving in camp, if there's a shift in zero because of being transported to a different climate or altitude, or from rough treatment by baggage handlers, it's no big thing because the necessary adjustments can be made right there in camp.

Both of the foregoing contentions are true--most of the time. But many's the time I've arrived in camp after dark, and not wanting to lose the first morning waiting for daylight to check my rifle, I've gone hunting with the hope that my rifle is still shooting where I want it to. And what if your rifle gets drenched and you find yourself presented with a long shot? I've seen rifles with one-piece stocks bedded with tip pressure shift POI as much as four inches at 100 yards after being out in an all-day rain.

Most production rifles with one-piece wood stocks are factory bedded using a pressure "band" at the fore-end tip; it's the only contact between forearm and barrel. It can either be filed away to float the barrel or shimmed to apply more pressure.

It should come as no surprise, then, having the experiences I've had, that I prefer laminated wood or synthetic stocks to those carved from a single piece of wood. And of the synthetics, I vastly prefer the ones of laid-up fiberglass to the injection-molded types because they're stiffer and more stable at extreme temperatures, and they can be glass bedded. And yes, I consider glass bedding mandatory in a serious hunting rifle.

It's really a no-brainer--glass bedding, I mean--because no craftsman or CNC machine can inlet with the precision anyone can achieve by simply sinking a barreled action into liquid epoxy. The result is that you have an absolutely perfect, mirror-image bedding surface that provides 100 percent contact with the barrel and receiver--a situation that may or may not prove to be the best bedding dynamic for a given rifle. Only trial and error will determine that.



Glass bedding is a must for the author's rifles. He has bedded more than 60 over the last 40 years. Only trial and error determines the final bedding setup.

As for the actual glass-bedding procedure, that's an article in itself and therefore something we can't go into here. Suffice to say, however, there are three basic beddings we want to try: receiver and barrel fully bedded, receiver and first few inches of barrel bedded or receiver bedded and a full-floating barrel. If you're wondering why I didn't mention the fore-end-tip pressure that's so prevalent in production rifles, it doesn't make sense when you've got the stability of laminated wood or laid-up fiberglass. If dampening pressure proves to be the best scenario for a given rifle, you can achieve it with the more uniform and stable pressure you get with full barrel contact.

In my experience, which takes in the glass bedding of about 60 rifles, I have found that partial bedding of the barrel has worked best for me. By "partial" I mean only the cylindrical, shoulder portion of the barrel immediately ahead of the receiver ring and the coned portion that ends where the straight taper to the muzzle begins. Depending on the specific contour, we're talking the first four or so inches of barrel. What we have, then, is the stiffest, most monolithic portion of the barrel/receiver unit glass bedded with the slender portion of the barrel floated.

The other option is to fully float the barrel, a solution that works better for stouter barrel contours than for wispy ultralights. On paper, at least, this is the ideal solution because no dampening influences whatsoever are exerted on the barrel, which makes for the most stable POI. But again, accuracy may be a bit better with some dampening pressure at the chamber area.

Obviously, these are trial-and-error experiments, and the best way to sample all three conditions is to first fully glass-bed the entire barreled action. If that doesn't produce the kind of accuracy and POI consistency you're after, a Dremel tool will easily remove the bedding material in the barrel channel to affect either a partial- or full-floating barrel.

The author generally floats the thin portion of the barrel starting where the straight taper to the muzzle begins. On this particular rifle he then had a mortise milled into the bottom of the remaining barrel channel to lighten the stock.

Though injection-molded stocks are not suitable for glass bedding, that doesn't mean you can't tweak them. If your rifle is set up with a free-floating barrel, there will still be a solid floor in the barrel channel at the fore-end tip where you can insert a shim(s) until dampening pressure is being exerted. Conversely, if your rifle is set up so that the fore-end tip is exerting dampening pressure, it can be eliminated by either filing or Dremeling the pressure band away or placing shims beneath the receiver ring until the fore-end tip is no longer contacting the barrel. Either way, you will have simulated the desired dynamic.

Clearly, the precise bedding dynamics we've discussed here cannot be achieved on a production basis; that's why your over-the-counter guns are bedded the way they are. As it is, today's factory rifles group tighter and maintain zero better than ever before, but that's not to say they can't be improved.