

The Long Range Hunting Series

The Practical Guide To
Long Range Hunting Rifles



Nathan Foster

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Long Range Hunting Rifles**

(1st Edition)

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The Stock

Stock design can make or break a long range hunting rifle. A good stock will enhance accuracy through stability and recoil taming qualities. A bad stock design can not only destroy accuracy through a lack of stability, but through poor ergonomics can also induce flinch to a level where the shooter is put off the sport altogether. So many men have given up hunting due to what they thought was their inability to tolerate 'normal' recoil levels when the culprit was the stock all along.

Stock Materials

Wood is of course the traditional gun stock material; it has been with us since the beginning. We had the club, the spear, the bow, the gun stock and the rolling pin, all deadly tools or weapons in trained hands. Stock makers found out very early in the piece which species of tree were imbued with the ideal qualities of strength, stability and workable traits. Although many species of timber have been used over the centuries, Walnut shone through and became the most common stock making material, a balance of beauty and practical qualities. Today, companies like Remington source Walnut from as far away as New Zealand. Budget manufacturers still occasionally work with Beech, a material that came into focus during the great wars when Walnut supplies were exhausted worldwide. Gun stocks have also been made using Oak, these are somewhat rare. Many other woods have of course been used over the centuries.

The Achilles heel of wood is its tendency, if not treated correctly, to warp with changes in humidity. This can be seen at the forend of the stock, where once the barrel was free floated, changes in temperature and humidity cause the stock material to drift. As a result, the wood touches the barrel, having a negative effect on accuracy. The unseen effects of stock warping can be just as destructive, movement through the area of the action can place great stress on the action, again causing poor accuracy.

Provided the rifle action design is sound and allows for full length bedding, a hefty bedding job with metal filled epoxy combined with stock sealing can eliminate these problems of old. Some rifle action designs are more finicky, allowing for only front and rear bedding (no bedding through the area of the magazine well). In this instance, ensuring that the stock materials are sealed after bedding is of the utmost importance. Teak oil, available from hardware stores in small bottles, is very good for stock sealing and can be layered in several coats.



Tikka rifle stock showing front steel pillar inserted during the bedding process. Heavy walled aluminum pillars (wide diameter) are also common.

Pillar bedding is extremely important when dealing with wood stocks, the steel tubing is used to prevent eventual compression of the wood fibers at the areas of the action screws (king screws). Without pillar bedding, once compression occurs, it can lead to split stocks- and this is not a rare occurrence. That said, as I type this, on the work bench beside me sits a CZ rifle in .223 caliber. The front action screw hole in the wooden stock is located within a hair's breadth of the magazine well. If I were to drill the front king screw hole in the stock to fit a steel pillar, the stock would be weakened, the pillar proving counterproductive. In this case, a hefty bedding job will be an acceptable fix.

Cross bolting is another means of controlling stock fiber compression. On the traditional Sako rifles (Finnbear / AV) as well as the Mauser military rifles, a cross bolt was used to prevent stock compression as well as compression in a rearward direction under recoil. Where a cross bolt is close to the front king screw, no pillar is required at the front of the action unless the operator wishes to be extremely fussy.

Once wood is fully stabilized with steel based epoxy resin bedding, stock compression prevented and the wood sealed from the environment, a wood stock can be practical, effective and of great beauty depending on one's tastes. Key factors of a 'hefty' bedding job include a minimum 1.5mm (60 thou) thickness, extending into the barrel channel for an inch or more where the thickness of the bedding compound should be at least 2.5mm (100 thou) under the barrel and very thick at the 5 and 7 o'clock positions.

The more subtle the bedding, the weaker the wood stock will be. Try to avoid the need for a fine gap between the barrel and forend. While this may look very nice, a larger gap will ensure the barrel remains free floated, preventing the wood from becoming affected by any excessive heat from the barrel. Also, as a good practice, never leave a wood stock separated from its action for more than a few days. If the parts are left separated for weeks and the bedding consists of a front and rear type bedding job, the stock can warp in the area of the magazine well. If you must separate the parts for a period of time, wrap the stock with cling film, put dried rice in the barrel channel.



Laminated gunstocks first appeared during the Second World War if I am not mistaken. I have seen some very fine examples of laminated K98 Mauser rifles. Laminate is a very sturdy material, layers of wood are epoxied together under pressure to create a tough material that resists changes in environmental conditions. Many people find laminate stocks to be as beautiful as they are practical.

On occasion, a laminate stock can suffer compression and split in the bridge area between the trigger and the beginning of the magazine well, much depends on the rifle design and how much stock material is at the tang. Three screw rifle systems (Ruger, M70) can place a good deal of strain on a laminate if the middle action screw is compressed. A hefty bedding job or pillar bedding are key considerations.

The only downside of Laminate is weight, laminate does tend to be heavy, but the differences aren't that great and possibly not worth debating. Boyds are now the leading manufacturer of Laminate stocks which are CNC machined at very low prices. The only weakness of the Boyds stock is the slippery nature of the finished stock. The forend of a Boyds stock can be hard to control and I have seen clients struggle to maintain accuracy due to this single factor. But this is a small issue. If Boyds were to address the stock finish, many folk would not be able to afford a Boyds stock. Therefore, if an increase in stock friction is required, checkering, painting or taping (see tactical section) can all be utilized to overcome this minor limitation. The actual shape of the Boyds stocks are outstanding, featuring wide forends and straight recoiling pitches.

Fiber glass now reigns supreme on long range hunting rifles. It is relatively light and not affected by environmental conditions. Fiberglass stocks generally fall into two categories, those with aluminum chassis (HS Precision and Bell & Carlson) and those without any chassis system.

In past decades, a major problem with glass stocks, was that the glass shell was laid over a foam inner, no different than boat building which is where glass stock design originated from. Glass over foam poses a few problems when used in light layers as opposed to the heavy glass matrix found on boats. If the stock is left to its own devices, it will eventually split under the compression of the king screws. Many of the old glass stocks from the 1970's and 80's including those made by big brands have suffered from this, hence the introduction of aluminum chassis.

Bedding is problematic on glass over foam. If the operator inlets the stock for a hefty bedding job, he will breach the glass and strike foam. If the operator chooses a skim bedding job without any inlet, the bedding itself will be weak and the stock will still remain prone to compression cracks. Pillar bedding may seem the fix, but again, once the stock is inleted, the bedding compound will rest on foam, the pillar is set in foam. The fix, is to inlet down to the bottom of the stock, removing all of the foam in the area of the front of the action and at the tang down to the bottom of the glass shell. Following this, the void can be filled with a lightweight epoxy resin and once this is cured, an overlay of metal filled epoxy resin seals the deal.

McMillan have changed their method of manufacture in recent years but instead of opting for an aluminum chassis, McMillan utilize a solid glass fill throughout the action area. The epoxy used in this area is not however 'indestructible'. If the gun owner is overly heavy handed when tightening action screws, the McMillan stocks can on very rare occasions suffer compression resulting in split stocks. The last one I came across was in 2008. To this end and in lieu of mild torque settings, when ordering a McMillan stock it is wise to order the stock with aluminum pillars - especially seeing as this is an extremely inexpensive option available during the order process. Otherwise, hefty steel bedding jobs and or pillar bedding are the order of the day. I have seen far too many skim bedding jobs on McMillan stocks, operators seem mostly worried about damaging the paint on the top line of the stock. If the paint on the top line of the stock is damaged- too bad. Better to have strong bedding and touch up paint than to have a weak bedding job and untarnished paint. A sturdy, well bedded McMillan stock is a thing of beauty and practicality, regardless of how the top line is finished.

The aluminum chassis solves the problem of fiberglass stock compression entirely. These stocks are incredibly robust, yet simple. It is nevertheless important to understand that aluminum chassis never fit to the shape of a rifle action 100%. In fact the fit is more akin to saddle bars if round bottom rifle action designs are utilized. Ahead of the magazine well, the action will contact the chassis as two thin lines at the 4 and 8 O'clock positions with a small bearing area at the tang contacting the chassis. On flat bottom rifle action designs the exact heights often differ between the action and chassis, riding this time on lateral bars.

Another occurrence with aluminum chassis is the occasional high spot which, once the rifle's king screws are torqued, can effectively bend the action, placing the entire system under a great deal of stress.

Due to the less than ideal fit of aluminum chassis, bedding is near imperative. Often, a rifle of low to moderate power (.223 to .308 Win) can cope with a poorly fitted aluminum chassis, shooting groups

as small as .3MOA. But as cartridge power is increased, accuracy wanes. A rifle capable of shooting .25 to .3 MOA is handicapped, producing 1 MOA. The magic minute is not so magical when one considers that this translates into a 10.5" group at 1000 yards. Add to this a truly finicky bore producing an ES (extreme velocity spread) of 20fps from shot to shot and you're out to 15" at 1000 yards. Add human error from being away from the sand bags and bench, errors in reading wind and thermals and all of a sudden you're out to a 20" group at the very least.



The excellent HS Precision fiberglass stock (M700 Sendero) showing the aluminum chassis and limited points of contact (note rub marks).

Never skim bed an aluminum chassis, make sure the bedding is of a good thickness, about 1.5mm (60 thou) at the sides otherwise the bedding itself will be too brittle. Epoxy resins really need a good layer for optimum strength, regardless of metal fillers.



The HS stock, bedded with our MatchGrade steel based bedding compound.

The Accuracy International chassis is problematic. For those not familiar with this system, owning an Accuracy International stock system immediately gives the shooter the mystical qualities of being ready for arctic warfare. Don't believe me? Good. The AI is very basically a V block chassis. It is most common to use round actions in this V block so the actual contact area between the action and chassis is poor. Many times I have also come across poor recoil lug fit. The AI is difficult to bed because it does not really have side walls, having detachable plastic panels instead. The fix is to epoxy the action to the stock using a syringe type 5 minute epoxy. A release agent is applied to the action, the action is epoxied to the stock, resulting in what I call a rigid mount system, rather than a traditional bedding system which allows the barreled action to recoil and return to battery. Rigid mounting should not be confused with tightly fitted bedded. Tight bedding jobs result in pinched, double grouping rifles.

After the AI and rifle action is rigid mounted, the system works to optimum potential. The only bugbear is that the entire process must be redone if ever the rifle is disassembled. As can be expected, a wooden mallet is required to perform the disassembly process, breaking the barreled action from its epoxy bond by shocking the underside of the barrel as one would do during normal rifle bedding operations.



An Accuracy International stock, plastic panels removed. In this photo, I am applying a basic two pot (double syringe) epoxy to the V block at the tang prior to rigid mounting

Plastic stocks are extremely common now and while plastic is not necessarily the weakest stock material available, it is the most flexible. Flexing under recoil or with changes in forend pressure can greatly hinder accuracy. Several years ago, I designed an epoxy resin to fill the forends and action voids of plastic stocks for optimum rigidity. I call it a stock stabilizer compound. It is expected that the customer will then use our metal filled bedding compound to bed the rifle as is my recommended practice with all stocks. A resin filled, fully reinforced, bedded plastic stock can work very well for hunters on a limited budget. The stabilizer costs around U.S \$15, for a family man on a single income, it's a lot cheaper than a replacement stock and can turn for example, an M700 varmint rifle into a truly reliable tack driver that is ergonomically sound into the bargain.



A bedded and stabilized Remington SPS plastic stock.

When bedding or stabilizing plastic stocks, a key factor is to use a hot knife to burn the stock internals, releasing oils and creating mechanical locks. With proper stock preparation, along with a thick, hefty bedding job, plastic stocks can produce a lifetime of reliable service. We need to exercise some common sense here though, opening up an SPS mountain rifle stock to accept a varmint contour barrel can re-introduce flexing. Another poor practice is fitting full barrel length over barrel suppressors which have become popular in the UK and NZ to plastic stocks- or any rifle for that matter. A quarter inch thick forend that flops around and touches this ridiculous suppressor design with varying pressures depending on shooting positions is a recipe for accuracy disaster.

As plastics go, Ramline tend to make the hardest and toughest plastic stocks using a mixture of both glass fiber and plastic. Sako and Tikka come next, U.S mass produced factory plastic stocks lean towards the soft end of the scale while the rubberized Hogue stock is the softest due to the focus on ergonomics (pleasant to shoot). Hogue also produce aluminum chassis stocks, either can be stabilized and bedded for optimum performance although this can be technically challenging for beginners. I owe a debt of gratitude to Ramline, they make an excellent Swede stock and I have tricked up many a working man's 96 Mauser using these plastic stocks (see grouping in rifle round up section).

The plastic stock of the Tikka T3 deserves special mention. From the factory, most T3 rifles shoot very well out of the box, the plastic stock performing very well. Factory torque settings for the King screws are which is very light. Problems occur if the shooter, after disassembly and cleaning (or trigger adjustments), refits the stock and torques the king screws to 45 lbs and higher. At these higher torque settings, the plastic stock splays, the bedding platform is ruined and loosening the screws does not help as the damage has already been done. At this point, stabilizing and bedding are required to re-align the rifle action to its ideal height. The insertion of pillars is also useful on the T3.

Whatever stock material is selected, you will hopefully now be aware how important epoxy (often called glass) bedding is. If you choose to have your bedding work performed by a gunsmith, be aware that a dollop of resin does not in itself make a bedding job, even if it appears to be a good imprint of the action. Use the MatchGrade bedding compound tutorials to understand not just the critical contact points, but also the critical points of relief that must be obtained in order to prevent pinching and double grouping.

Unfortunately, many skills such as bedding are becoming a dying art amongst gunsmiths worldwide. I have lost count of the number of shooters who, as a last attempt at salvaging a problem rifle, have decided to entertain the possibility that their gunsmith's bedding job was not up to task and to have a go at DIY bedding. The customers re-bed the rifle using our bedding kits along with the instructions I provide, and while their first attempt bedding jobs often don't look as aesthetically pleasing as a smooth operator's, the improved accuracy can be dramatic. So, take great care when considering epoxy bedding. It is critical to have epoxy bedding for optimum accuracy but it is just as critical that the bedding job is not counterproductive as a result of poor implementation.

Summary of Key Points:

1. Fiberglass is currently best practice for long range rifles due to its weight versus strength.
2. Not all fiberglass stocks are equal, be wary of glass over foam.
3. Laminate is an excellent stock material.
4. Wood is an excellent medium when bedded and sealed.
5. Plastic can be bedded and stabilized. Utilize plastic if you are on a limited budget.
6. Ramline utilize glass and plastic and can be ideal for Mausers.
7. All stocks need bedding. There is no magical factory stock. If your rifle is accurate without bedding, it will be even better with bedding.
8. Not all bedding jobs are equal.

Stock Style & Ergonomics

On a long range hunting rifle, a straight recoiling stock is imperative. That is to say, when the rifle recoils, it needs to recoil backwards in as straight a line as possible. The more a rifle recoils upwards or off to each side, the greater the potential loss in accuracy. Be aware that recoil begins upon ignition of the cartridge; recoil does not begin after the bullet leaves the bore. The higher the heel of the butt (top line of the butt) and the squarer the butt is to the line of the bore, the straighter the recoil.

Monte Carlo stocks with large cheek pieces are problematic in that the cheek piece will often slap the shooter in the face, the shooter himself recoiling away from the rifle, taking the rifle off center as he does so. Sako rifles are the worst offenders in this regard. Weatherby have a similar stock design combined with a measure of drop at the heel of the butt which also increases both felt recoil and physical displacement. It is interesting to shoot two identical rifles (barreled actions chambered for the same cartridge) in the two stock styles, a Weatherby factory stock versus a straight recoiling

stock. The differences are obvious. I try to avoid Monte Carlo stocks as much as possible on long range rifles.

I don't believe there is such a thing as the perfect pistol grip. I must have tried just about everything on the market and I still can't find the perfect pistol grip, nor do I want to. Consider this: When you are behind the rifle, which part of your hand receives the greatest focus? The trigger finger. If you are too tense, you have no trigger control. So in this regard, the trigger finger itself is held loosely. OK, try and tense your middle finger without tensing your trigger finger, do it now. You can't do it, can you? OK, press your last three fingers gently against your palm with your index finger pointing forwards. If you have any preschooler boys in the house, they probably already have the draw on you by now and are already blowing black powder residues off their index finger. Where were we? When the hand is formed in this position, you'll see that all we really want is somewhere to hook three fingers and rest a thumb.

A swept open grip (traditional shotgun style pistol grip) used to be considered the fastest handling. Nowadays we have vertical grips as found on the McMillan A series and free grips as found on the Accuracy International. I find that I am comfortable with most designs. In my experience, speed is relative to practice, not design. About the only sin to me is going too short in the pistol grip so that the little finger must rest under the bottom of the grip if straight index finger extension is to be maintained.

Forend design is a major consideration. Nowadays many shooters are using the silly crossed arm shooting position, the forend simply being a place to mount a bipod. The forend is designed to be held, unless the rifle is one of the modern tactical tube rifles. On traditional sporting rifles, the forend can be quite slender, to minimize weight and bulk. This type of forend offers less control, a small surface area to grip. The less grip we have, the less control we have, the more fliers we see. On slender forend mountain rifles, the shooter must be extra vigilant of forehand technique. With the right technique, a light weight mountain rifle can be a great tool. But, where magnum cartridges are employed in lightweight slender rifles - even amongst the most experienced mountaineers - a percentage of shooters cannot get under 1.5MOA with potentially sub MOA capable rifles. In such instances the recoil level is beyond the limits of the shooters ability, the shooter hits a wall that cannot be overcome unless he is willing to quit his job and spend every other day at the range firing hundreds of rounds. The Kimber ultra-light WSM rifles are a good example of this.

For dedicated long range shooting, a beaver tail forend is the ultimate. If the forend is too wide, some shooters will not be able to get their hands around the forend. Fortunately, most manufacturers keep beaver tail forends within usable limits, though some shooters with small hands may have to shop around. With a relatively wide grip, the beaver tail allows the shooter a good level of purchase on the forend which improves accuracy exponentially. I cannot emphasize enough the difference I have seen in client shooting results by simply changing the forend design.

To be honest, I like bush/woods hunting with beaver tail stocked rifles as much as I enjoy using this stock style for long range work. I am also finding that clients want the same, lightweight .308's mated to beaver tail stocks, primarily for bush hunting with added long range capability.

The longer the forend the better. The extra length allows a bipod to be fitted without cutting the knuckles of the fore hand under recoil. A long forend can be rested on a backpack (if a pack is used

instead of a bipod) without allowing the barrel to ride on the pack, ruining barrel harmonics. The longer the forend, the further the front stud can be placed, the lower the carry. With a low carry, the rifle does not stick up above your head too far. This may not seem a big deal, but to a mountain hunter climbing in truly steep terrain a barrel that sits too high when the rifle is shouldered can roll back and outwards. This would shift the hunters balance and can be very dangerous when climbing.

My most favorite aftermarket stocks include the HS-Precision Varmint, the Bell & Carlson #2958 for short action Remingtons, the B&C Medalist 2094 and 2098 tactical stocks for Remingtons, the McMillan A3 which can be ordered and made to fit pretty much anything, and for hunters on a budget the Boyds Laminate stocks; though these lack any texture in the forend in factory form and can be slippery to handle.



The Remington Sendero. The HS Precision stock which Remington use features a long, wide beaver tail forend. The comb of the stock is very high, just allowing the bolt to be extracted from the rifle. The heel is also high; the recoil pad is set almost 90 degrees to the bore. All ideal features.

The Accuracy International stock is not one of my favorite stock designs. It has an overly heavy chassis that is difficult to carry any distance without having a defibrillator handy. The V block is not a good fit for round bottom actions. The AI also has appendages for stock attachments; these are easily caught up on clothing and shrubbery. When shooting the AI, the pistol grip and butt stock is comfortable, the forend is cumbersome. The AI is also the most expensive stock on the market.

I have tricked up a few AI chassis rifles over the years, they can be made into very accurate platforms. The extra weight can be used to great advantage for recoil reduction, shrinking groups to .25 MOA or less. All I can suggest is that the AI is not the be all and end all answer to rifle accuracy, there is work involved. The AI is best suited to F Class type work or hunting from a quad bike and excels in these roles. How its maker managed to push the design onto the military I do not know, it is stupidity to the point of cruelty to expect young impressionable and unknowing snipers to lug such

a massive assemblage of metal work for miles on end. Worse still are the military Majors who continue to push the design, forgetting what it was like when they had to hump it.



Borden action, True-Flite barrel, Accuracy International stock, Nightforce optics, rifle chambered in 7mm Practical. This is a very accurate 'quad bike' long range rifle. It can be hauled on short ridge climbs but is too heavy for backpack hunts. Note the useful adjustable butt pad (length of pull) and cheek piece.

Many long range rifle stocks now come with add-ons. The adjustable comb is a good add on so long as it is not shaped in such a way as to get caught on shrubbery or clothing. The comb can be used to help align your eye with the center of your scope with each shot. In contrast, if your eye is not centered, you may think you have your crosshairs lined up on your target when in fact, you are actually looking through the scope at an angle, the true direction of the bore and point of impact being somewhat different to what you are viewing. So an adjustable comb is a good idea, as are the aftermarket cheek wallets which can be velcroed to the butt stock.



Remington 5R .308 Winchester. This rifle is wearing a Bell and Carlson #2958 stock. Note the cheek wallet attached to the butt of the rifle, used to raise the height of the comb.

The butt hook is about as useful as hemorrhoids. A butt hook (hook shape under the butt stock) is designed for the crossed arm shooting technique for those who like to watch their muzzle jump around like popping corn. Picatinny rails on the sides or underside of the forend are not necessary on long range hunting rifles either. An adjustable length of pull (LOP) can be extremely useful but also a hindrance if it is made in such a way that it can get hooked up on shrubbery etc. McMillan has a good system where they simply use spacers. That to me is common sense.

Length of pull is an important consideration. Too short is OK, too long is a sin. I don't know who first said this but they were right on the money. The longer the reach, the greater the felt recoil, sometimes to the point of both pain and severe flinching. If the LOP is too short, the shooter can end up crowding the scope, resulting in a cut eyebrow which may look pretty cool at work on Monday morning, but will again result in flinching. On the other hand, you can go pretty short if you can get your scope mounted well forwards.

The traditional method of measuring LOP is to crook your forearm at a 90 degree angle to your bicep. Measure from the crook to the middle of the tip of the index finger to determine your LOP in inches. This old method is ideal for open sighted rifles and shotguns. With scoped rifles and the prone positions we use for long range work, it is best to take a half inch off this measurement. This also allows for bulky winter clothing. My measured LOP is 14" but my ideal LOP is 13.5" for an all-around rifle, any position. I can shoot 13" without any problems, though this may have to do with the fact that I have to shoot client rifles weekly and therefore have to cope with a variety of custom

LOP's. At 14" LOP, I begin to feel recoil. At 14.5", I really feel it. On the other side of the coin, if the scope eye relief is short and the LOP is shorter than 14", I go to pieces after a while and start having visions of bourbon to calm frayed nerves. The key is to ditch the scope, not change the LOP.

The recoil pad is a final ergonomic consideration. Pachmayr and Limbsaver recoil pads tend to be very good at reducing felt recoil on magnums. The traditional Sako red rubber pads were pretty jarring. Remington also made a lot of rifles with hard plastic butt plates, as have other makers over the years. The hard pads and plates are often OK on heavy barreled .308's, but in any other configuration can cause discomfort. If your rifle has a hard rubber pad or plastic butt plate, consider replacing it.

Modern factory rifle recoil pads are often sufficient for taming recoil. If you are being bruised, it is of immense importance to address your shooting technique before looking at changing recoil pads. If you are being bruised by a modern factory rifle chambered in 7mm Remington Magnum or a cartridge of less power, technique may well be the problem. As cartridge power is increased above that of the 7mm magnum, combined with reduced rifle weight (mountain rifles), recoil pad design comes more to the fore.

LOP also comes into the recoil pad equation. Be careful not to blame the recoil pad if the LOP is too long and causes discomfort. That said, when altering LOP for optimum fit, use the opportunity to fit a premium aftermarket pad.

Summary of Key Points:

1. Monte Carlo stocks can increase recoil, affecting accuracy (rifle moves off center before bullet leaves bore).
2. Choose straight recoiling stock designs; observe height at heel of recoil pad.
3. A wide forend is useful for long range shooting as well as being useful for general hunting.
4. Consider length of pull, too short is acceptable, too long is a sin.
5. Optics have an effect on length of pull.
6. An adjustable comb or cheek wallet used to raise the comb is useful.
7. You don't need 1000 stock attachments or hemorrhoids.