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Precision Scope Mounting: By, Charley Robertson

Long range rifle shooting is more popular than ever. This is evident by the growing number of products marketed specifically for long range shooting. Today every scope manufacturer has a product line of long range scopes enabling the average rifleman to accomplish what only a few years ago could only be accomplished by a few very elite, highly trained individuals with equipment so expensive only a government agency could afford to possess it. These scopes, fitted with target knobs and ranging reticles can only be an asset to your rifle if they are properly mounted. Mounting a long range tactical scope sounds on the surface to be an easy enough task but in reality nothing can be further from the truth. Having built hundreds of custom rifles and mounted thousands of scopes, I did not give the job enough **serious** analytical attention until I started shooting long range tactical matches and building long range tactical rifles for some of the country's top shooters. While shooting at various matches, I noticed several inconsistencies among very talented shooters. A typical conversation between three competitors all shooting 308s at 800 yards might go as follows:

(#1) *"Man there must be more wind out there than I can see. I held ¼ MIL right and I still hit left.*

(#2) *"No kidding? I only held ½ a MIL right. I hit, but it was almost too much."*

(#3) *"Really, I held right on and smacked them all right in the middle."*

How can three talented shooters have such a wide range of results? I thought it was condition changes that occur from shooter to shooter that could not be seen. Or, maybe it's the way each scope is set up on the rifle. What if the scope is mounted on a rifle in such a way that the vertical cross hair is not in perfect plumb to the rifle? Or a problem even harder to detect, what if when turning the target knobs to dial in the correct amount of elevation, the center of the cross hairs moving up and down are not exactly perfectly plumb? How far off do things have to be before it matters? This concept of keeping everything perfectly straight is not new, I've been doing that for years. I vise up on a rifle and place a good Starrett bench level on the receiver rails and make sure the cross hairs follow a line I have drawn on my shop wall. I needed these questions answered, so on a no wind day (for New Mexico that is a 3 to 5 mph wind) I experimented. I had two rifles chambered for the new 6.5 Creedmoor. Our shop built both rifles and they were identical set ups both having their scopes mounted in the conventional manner. There was a minor difference between the two in that one had a Leupold Mark 4, 6.5x20 FFP with a TMR reticule and the other had a Leupold Mark 4, 8.5x25 FFP with a TMR reticule. Both rifles had a good 100 yard zero. Shooting at a 12"x10" steel plate at 755 yards with a 3 mph wind from 3 o'clock, using a center hold, The shot from the first rifle hit just off of the left edge exactly where it should have and the shot from the second rifle hit ¼ of a mil to the right. At the range, I loosened the rings and rotated the scope on the rifle that was shooting too far right, so minutely that it was almost imperceptible in fact I wasn't sure I even rotated it. Shooting again at 755 yards the point of impact moved about ½ a MIL left, and hit just off of the right edge. With a 3 mph wind from 3 o'clock using a center hold, it should have been just off of the left edge. I rotated the scope again in the same direction, and it moved another ¾ MIL in the same direction. Now it is shooting too far left. The other rifle that I left alone did not change point of impact proving that conditions were consistent. Simple fact, scope mounting matters, a lot! My next question was how can I make sure I attain the "perfect scope mounting job". I can't take every long rang rifle

to the shooting range and mount and remount scopes until everything works right. I MUST have a reliable method to perfectly mount a scope in the shop and know without question that it will function 100% correctly in the field. I set forth to design and implement a system that would do just that.

The new system must secure the barreled action (with the scope mounted) in such a way that the centerline of the scope and the centerline of the rifle's bore are both exactly in the same vertical plane. Then, dial the elevation knob through it's entire range while looking through the scope making sure the cross hair's center never leaves a perfectly vertical plumb line. Rigidity is the key. It is absolutely imperative that operating the target turrets over and over again causes no detectable movement in the assembly. To make a long story short, we designed a carriage assembly very similar to that of a rail gun. That carriage rigidly holds the barreled action and scope perfectly plumb enabling the operator to simultaneously operate the elevation turret through its complete range and view its movement over the perfectly plumb line. I obtained a perfectly plumb vertical line using a laser level on my neighbors building 35 yards from the shop. This eventually evolved into a grid with MOA and MIL marks accurately drawn on it so that scopes could be evaluated as far as their true movements, but that is another story.

Using the new system the scope on the problem rifle was rotated in the rings so that it accurately tracked on the laser line. Another trip to the range. I use a software program on a PDA called *Field Firing Solutions* from www.precisionworkbench.com. After verifying a 100 yard zero the target at 755 yards was engaged. With a 7 mph wind from 135 degrees my software called for and I dialed in, 17 ¾ MOA of elevation and a hold of .4 MIL right. I got a center hit with both rifles. This was a great success.

Conclusion:

I have always taken great care mounting scopes. The techniques I had been using were perfectly correct in theory. I simply wasn't getting the degree of accuracy required. Originally both rifles went through the same process. I got lucky on one, not so lucky on the other. The difference between right and wrong was imperceptible using our old system in the shop environment. I could not get satisfactory results until I built a very elaborate fixture that could rigidly hold a barreled action with the scope mounted in such a way that the vertical centerline of the bore and the vertical centerline of the scope had no more variation than one thousandth (.001) of an inch in six inches.



Some rifles are just good shooters and they make it easy for a good shooter to shine. The performance of some rifles defies logic, and makes it impossible for the shooter to excel. The shooter questions their ability to dope wind. They get frustrated and filled with self doubt when in reality they might just need to have their scope properly mounted.

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