

M14.ca Blackfeather® “RS” Engineering and Design Considerations of the M14.CA Tension Adjustable Op Rod Guide

The theory behind “free floating” a rifle barrel to improve accuracy seems simple ... *“If nothing touches the barrel when it oscillates through the vibration cycle immediately after a shot has been fired [aka **barrel harmonics**] a free floated barrel **should** be more consistent in returning to the same orientation for the next shot.”* And, as demonstrated on the firing range, *with improved consistency in barrel harmonics, improved accuracy often does occur.* A rifle with the receiver properly bedded and held solidly to the stock, with the barrel “free floated” will often shoot better than it did with some contact between the barrel and the fore end. This simple theory is well proven in single shot and bolt action rifles.

However, free floating an M14 barrel is not quite as simple. The gas and spring operated semi-automatic M14 rifle has a very heavy reciprocating mass consisting of the op rod, bolt, spring, and cartridge all frantically thrashing around under the barrel and inside the receiver. This heavy reciprocating mass can and usually does have a significant impact on M14 barrel harmonics. And because this heavy reciprocating mass is working on the barrel to receiver joint, true *full length* free floating of an M14 barrel could cause extra flexing, inaccuracy, and potentially even early failures of the receiver. So, the M14 design is better off if the barrel is only *partially* “free floated,” and at some point supported rigidly in line with the receiver .

In a *conventional* wood or fiberglass M14 stock, the point chosen to connect the barrel to the forearm is at the stock ferrule/barrel band, right behind the gas assembly, at the very tip of the forearm. Bedding the receiver with *precise vertical tension* of the tip of the stock forearm to the gas assembly and barrel band, is the well proven classic method of getting the M14 barrel to vibrate more consistently. Creating more consistent barrel harmonics through *unitizing* [minimizing play] the gas assembly, and achieving *precise* upwards forearm to barrel tension, works ... and it works well ... but this is more of an art form, done by experienced M14 craftsmen on an individual basis on each individual rifle. This method is not suitable for modern mass production methods.

In theory, solidly connecting the M14 barrel to the forearm closer to the receiver by using a larger, reinforced, rigidly held, heavy duty op rod guide [aka “*partially free floating the M14 barrel*”] should be a viable way to minimize M14 barrel oscillations, and/or possibly make the barrel harmonics more consistent and repeatable. The KISS principle is applied here by eliminating all the many variables and built in play inherent to using the complicated gas assembly/ barrel band/stock ferrule interface.

Where the new M14.ca op rod guide design differs from other “free floated” M14 op rod guide designs is that the M14.ca guide is *adjustable*, to allow for perfect fit with civilian M14 clones. It has the largest surface bearing area of any ORG. It offers a self-lubricating feature found in no other ORG with special relief cuts at the front and rear for packing grease. The ORG is quad-locked and is buttressed inside

the Blackfeather “RS” stock like no other and it uses 5 set screws. 3 of these 5 set screws allow you to maintain the vertical alignment of the ORG prior to installation and the other 2 set screws lock the large, vertical adjustment screw used for barrel tensioning and accurizing the M14. Our ORG is also pinned using a tensioned, coiled, stainless spring pin for extra strength. The ORG is seated on a large steel bedding surface embedded inside the Blackfeather “RS” stock to account for wear in this location.

Note that US GI M14 receivers are held to incredibly tight external dimensions, and will usually fit the also incredibly precise CNC machined alloy bedding surfaces consistently and properly. But many of the civilian M14 clones may have receivers that are slightly off from true GI M14 dimensions. With the M14.ca **adjustable tension** design, there is no longer any need to shim at the front or the back of the receiver to stock bedding surfaces to achieve perfect vertical alignment and proper barrel to forearm tension. Vertical/tension adjustment is now built right in to the new op rod guide.

When adjusted with the standard tension settings recommended, the M14.ca op rod guide has demonstrated a noticeable improvement in AVERAGE accuracy shot by the same rifle in M14 conventional type stocks ... with average calculated over groups fired with several different brands and weights of .308 WIN and 7.62 NATO spec ammunition. This standard setting uses the adjustability built in to the op rod guide to adjust vertical alignment of barrel to forearm precisely, even with slightly out of spec receivers, and then to add some *slight DOWNwards tension to preload and stabilize the barrel/forearm connection*. This slight vertical pre-tension is precisely adjustable, and *adjustments are repeatable*, to achieve the best **average** accuracy with most loads.

Once adjusted properly, the pre-tension can be locked in, and if necessary the barreled action can quickly be removed and replaced in the stock. This quick removal and replacement feature is unique to the M14.ca design, and allows multiple **“upper”** barreled receiver assemblies to be swapped into the same stock, with minimal disruption to zero.

For those who want to experiment further, barrel to forearm vertical tension is now *adjustable*, so that *the system can be fine tuned for best accuracy with an individual load*. Like the Browning Boss muzzle weight device, the M14.ca adjustable op rod guide can be fine tuned to create more consistent barrel oscillation and return to zero *for a specific load*. But unlike the boss, which is attached at the muzzle, the M14.ca op rod guide works further back on the M14 barrel. With either system barrel harmonics can be made more consistent for that one specific load, and accuracy with that specific load can improve significantly.

The M14.ca Blackfeather “RS” alloy stock was designed to tremendously improve the balance, fast handling and ergonomics of the M14 rifle. Because we have no control over the all too many variables in INDIVIDUAL M14 rifles, we can make no accuracy guarantees for the Blackfeather stock. However, in high round count range testing, we demonstrated that a near standard M14 clone [tested in five different conventional stocks] went from a best group of 1 3/8”, to a best group of 7/8” after fitting and tuning in the BF stock.

And these were FIVE shot 100 yd groups.

The new Blackfeather “RS” op rod guide (ORG) is thicker, wider, and protrudes down further than a standard M14 ORG. Both sides of the ORG and the insides of the alloy locating bosses inside the forearm are precision fit and finely finished. They are designed to minimize rotation ... but to still allow for easy removal and replacement of the barreled M14 action into the Blackfeather stock, and also still allow smooth, precisely adjustable vertical travel for tension tuning.

The thickness has been increased to provide *maximum linear bearing length* against the approximately 5/8" long barrel boss on a standard weight M14 barrel. This increased linear bearing, combined with the precisely sized .802" ID hole in the ORG [which fits snugly around the .800" OD of an in spec barrel boss] minimizes any potential wobble brought about by the back and forth motion of the op rod inside the guide.

The ORG width has also been increased significantly, and has been precisely matched to the two massive alloy locating bosses inside the fore arm of the Blackfeather stock. The interface between these oversized parts is loose enough to allow smooth and precise vertical adjustment and the quick removal and replacement of the barreled receiver into the Blackfeather stock, while still large enough and tight enough to minimise rotation of the ORG around the barrel...which is an all too common accuracy robbing condition with many M14 type rifles.

FITTING AND ADJUSTING TENSION WITH THE M14.ca BLACKFEATHER "RS" ADJUSTABLE OP ROD GUIDE

FITTING:

PLEASE READ THE FOLLOWING INSTRUCTIONS ON FITTING AND TENSION ADJUSTING COMPLETELY BEFORE STARTING THESE PROCEDURES AS PROPER INITIAL ROTATIONAL AND LINEAR FITTING AND TENSION ADJUSTING MUST BE DONE IN COMPLEMENTARY STEPS WHICH MAY REQUIRE MOVING BACK AND FORTH SEVERAL TIMES BETWEEN EACH INDIVIDUAL CORRECTION!

CORRECT LINEAR LOCATION ON THE BARREL -- In the book, "The U.S. .30 Caliber Gas Operated Service Rifles: A Shop Manual, Volumes I & II" the author Jerry Kuhnhausen gives the correct distance from the **center** of a standard 1/2" thick op rod guide to front of receiver as 6.825" +/- .003".

1.] The new thicker BFOG is .750" thick so the proper distance from the **back** of the new BFOG to the front of the receiver is 6.45" +/- .003" [or if using a ruler, *approximately between 6 7/16" – 6 15/32"*].

2.] A length of alloy tubing is included with your BF stock for use as a convenient OP Rod Guide installation device. This tubing fits over the front of a stripped barrel, and can be hammered back lightly to push the ORG back, to achieve correct linear location on the barrel boss. The recommended procedure for installing the new op rod guide on the barrel is to first mount the receiver in a vise. Use short pieces of aluminum angle iron as no mar vise pads, and do NOT squeeze the receiver TIGHTLY ENOUGH TO DEFORM IT.

3.] Remove the three ORG locking set screws, and put them aside for later. The ORG should fit around the barrel boss fairly snug, *yet still be loose enough for some rotation and some linear travel to achieve perfect vertical and fore and aft alignment with the receiver.* The OD for a standard contour barrel boss should be .800", and most barrels will hold to this dimension very closely.

4.] The top hole in the ORG is precision sized to .802"ID. If barrel boss is undersize and the ORG is **too loose, stipple lightly around the barrel boss with a self striking machinest center punch.** Two rows of stippling, at the front and back of the barrel boss, will tighten up the fit here. The loctite can be heavily applied to fill in any gaps here.

5.] **If the ORG is too tight on the barrel boss, do not force it on.** Included with the BF stock is a couple of lengths of emery cloth. This emery cloth can be used to polish the outside of the barrel boss, or the inside of the ORG. This will most likely be required only with a barrel boss that has been modified to increase OD (outside dimension) by peening, stippling, or checkering, or if some chemical adhesives are still on the barrel boss. Holding both ends of the emery cloth as if you were polishing a boot, clean off any old adhesives on the barrel boss, and also work down any raised tool marks. You can also wrap the emery cloth around the M14 issue cleaning rod handle/combo tool, to polish the inside of the ORG. Go slowly here and test for fit often...a minute of polishing can make a big difference.

6.] Once the ORG slips *snugly* part way on to the barrel boss, *and still rotates with proper motivation from a large wrench with padded jaws [do not use a hammer]* you are ready to push the ORG back into proper linear alignment. The alloy tube installation device works only as a *push* tool, so go carefully and check often for proper alignment. If you go too far back, you will have a tough job trying to pull the ORG forward.

7.] The hole in the bottom of the forearm is **precisely** located to give perfect fore and aft alignment with the ORG when the ORG is properly located on the barrel. . In this way, the actual BF stock and a 1/4" hex wrench can be used as a gage to measure perfect linear adjustment ... *... but should be not used as a tool to force the op rod guide back and forth.*

8.] *Do not be overly concerned if the cross pin slot in the barrel does not line up perfectly with the cross pin holes in the ORG, as with this new ORG design the cross pin is optional.*

9.] With the ORG on the barrel but not yet locked in place, test the barreled receiver for initial fit in the BF stock. Make sure the ORG is as close to vertical zero as possible, as indicated by the fit within the alloy bosses inside the BF stock forearm. A bit of grease here will aid assembly/disassembly and minimize any marring from a slightly angled ORG.

10.] The hole in the BF stock forearm is exactly the right size to allow a 1/4" hex wrench to fit into the large TENSION ADJUSTING SCREW at the bottom of the ORG. When the M14 barreled receiver has the ORG properly aligned fore and aft and vertically, a 1/4 hex wrench fits easily into the screw hex socket. Check again the distance from the back of ORG to the front of receiver. The correct dimension here should be ***6 7/16" – 6 15/32"***.

11.] Install the trigger guard assembly. Install the 1/4" castle head ORG retaining bolt, and hand tight with a short handled 3/8" inch wrench. (Do not use the m14 cleaning rod handle here as it can easily mar the anodised surface around the retaining bolt). *Ensure that the 1/4" bolt tip does not protrude into the op rod guide hole.* This can be done by visually inspecting the assembly from the front, through the op rod hole in the ORG.

12.] Remove 1/4" ORG retaining bolt. Remove the barreled assembly with ORG now set for proper fore and aft location, and start fitting for *precise* vertical/rotational alignment.

PRECISE VERTICAL ZERO

– some slight rotation may still be required!

- 1.] The ORG should fit around the barrel boss fairly snug, *yet still be loose enough for some rotation to achieve perfect vertical alignment with the receiver.* When rotating the ORG on the barrel for fit, make sure you rotate the ORG in a way that does not mar the outside of the ORG or the inside of the alloy locating bosses in the stock forearm.
- 2.] The recommended procedure here is to use electrical tape to pad the jaws of a large adjustable wrench [crescent wrench type] . This can then be used to rotate the ORG with some measure of control and consistency, and also with no marring of the finish.
- 3.] Precise rotational alignment of the ORG with the receiver can be measured using the straight edge of the vertical flats at the side of the ORG and indexed by eyeball against the straight edge on the vertical flats of the M14 receiver. If you can't see well enough with this method, use a pair of longer straight edges clamped on to the ORG and the receiver. If you have a precision digital level [or a level program for your Android cell phone or Iphone] you can also use the bottom of the M14 receiver and 90 degrees from that reading as the correct index for the ORG sides.
- 4.] When you have perfect vertical alignment, the M14 barreled receiver with the ORG should now slip smoothly in and out of the forearm. The alloy bosses in the BF forearm can be used as a gage to determine when perfect vertical alignment is achieved ... but should be not used as a tool to force the op rod guide to rotate. If you check between the ORG sides and the alloy bosses with thin feeler gages, any minor variations should be apparent.
- 5.] Remove the barreled receiver assembly with ORG from the BF stock. Test op rod travel and alignment by installing the op rod and the bolt, **without** installing the op rod spring or op rod spring guide. Tilt the barreled receiver with op rod and bolt installed up and down at a 45 degree angle, and ensure the op rod and bolt move smoothly and completely through their travel. This known as "**The Tilt Test**".
- 6.] Reassemble the barreled receiver with op rod and bolt into the BF stock. Lock the trigger guard into place, and with the hammer cocked, confirm the op rod and bolt still move smoothly with no interference from the stock. NOTE: there will be some interruption in travel as the bolt passes over the hammer and forces it down slightly.
- 7.] Install the 1/4" castle head ORG retaining bolt, and hand tight with a short handled 3/8" inch wrench. Do not use the M14 cleaning rod handle here as it can easily mar the anodized surface around the retaining bolt. *Ensure that the 1/4" bolt does not protrude into the op rod guide hole*, by performing the tilt test again. There should be no extra friction or binding than the last time tested.

LOCKING THE ORG IN PLACE

- *With the precisely CNC machined new ORG and BF stock, achieving a proper ORG fit should require minimal effort ... for most unmodified barrels and in spec receivers.*

1.] Once proper fore and aft alignment and perfect vertical alignment have been achieved, the ORG should be secured in place. This installation should be considered semi-permanent, as removing the new ORG or re-adjusting it will be difficult once the loctite sets, and the lock screws mar up the surfaces of the barrel boss. ***Take your time and get it right the first time!***

2.] With the barreled receiver installed in the BF stock, with the trigger guard installed and the ¼” ORG retaining screw torqued down, and with the op rod/bolt assembly sliding smoothly in the tilt test, linear and rotational fit of the new ORG to the barrel is confirmed as correct.

3.] Remove the ¼” ORG retaining screw . Confirm there is proper clearance between the bottom of the tension adjusting screw and the inside surface of the forearm. To confirm this adjustment, back out the tension adjusting screw until it just touches the inside of the forearm, then adjust back in 2/6 of a turn [two sides of an allen wrench]. If you can not feel precisely when the tension screw contacts the fore arm, watch carefully at the forearm tip to see if the forearm flexes out and in. Once again, adjust the tension screw out to first contact, then back in 1/3 of a turn.

4.] Re-install the ¼” castle head ORG retaining bolt, and tighten with a short handled 3/8” inch wrench. Confirm with a tilt test that the op rod/bolt assembly still slides smoothly.

5.] The initial fitting of the ORG is now complete, and the ORG can now be secured to the barrel with the three locking set screws, with loctite, and with the optional heavy duty cross pin.

6.] Put a drop of loctite in each locking set screw hole. Reinstall the set screws tightly. The screws will force the loctite between the ORG and the barrel boss. Remove any excess loctite from the exterior of the installation.

7.] Leave the loctite to set for at least 4 hours.

8.] Remove the barreled receiver from the BF stock. The front and back should fit tightly, but still be removable without *excess* force. A rubber mallet or a block of wood pushed through the mag well from the bottom, or some thin tapered SOFT wedges may be helpful. **Do not attempt to pry between the front or back of the stock and the barreled action with anything hard!**

9.] Look at the cross pin holes in the ORG and confirm the cross pin slot in the barrel boss lines up. If the slot does not line up with the holes, it means your barrel has the cross pin slot cut located incorrectly. This is common with Chinese M14 clones, and is NOT critical.

10.] If the slot and the holes line up, you may choose to install the optional new heavy duty spiral cross pin. If installing the cross pin, put a few drops of loctite in the cross pin holes, support the far side of the ORG against a non-marring surface, and being careful not to mar the close side of the ORG with the punch, or twist the ORG out of alignment, drive the cross pin in. Ensure that the cross pin does not protrude outside the ORG surfaces. Recheck that the pin did not force the ORG out of proper alignment, either fore and aft or by rotation from true vertical.

11.] If not using the cross pin, at each side, deep into the holes for the cross pin you can add another few drops of loctite.

12.] A fine coating of grease may be applied to the ORG sides to ease vertical adjustment, and removal and replacement of the barreled action from the stock.

13.] The enlarged hole sections at the front and back of the ORG, which fit around the op rod, may be filled with extra grease. These will act as a convenient reservoir, so greasing the op rod will not be required as often.

14.] Re-install the barrel ferrule and the gas assembly on to the barrel. Check how the tip of the op rod guide lines up with the tail of the piston. Any mis-alignment here is a symptom of an out of index barrel, a bent op rod, or a gas cylinder bored out of true to the bore. Perfect piston tail/ op rod tip alignment is desirable for best accuracy and long term wear, however proper vertical alignment of the new ORG to the receiver and stock is much more important.

15.] Some mis-alignment of the piston tail / op rod tip can be corrected by proper procedures ...straightening or bending the op rod ... replacing the gas cylinder with one that is true, etc.

16.] If the barrel is mis-aligned [out of index] with the receiver, more serious work by a serious M14 gunsmith is required. If the mis-alignment is not too much just ignore it ... most rack grade M14 type rifles have loose op rod guides with considerable play here, and they usually shoot and function quite well. However, if maximum accuracy is the goal, or if the barrel is off index quite a bit, it is best to correct this issue. Otherwise accuracy can suffer slightly, and op rod drag, op rod tab wear, and op rod jumping out of the receiver slot can become an issue.

ADJUSTING TENSION

Recommended Standard Setting for Best Average Accuracy, and Experimenting for Best Accuracy with Individual Loads.

In a 1000 rd trial, using several different types of ammunition, three different M14 type rifles and two different Blackfeather “RS” alloy stocks, the best **average** accuracy was achieved with the recommended starting tension adjustment of 1/3 turn **draw** between barrel and forearm. Every individual M14 can have distinct individual preferences, and your M14 type rifle might prefer different tension settings all together. Therefore, we can make no guarantees regarding accuracy with your individual M14 type rifle. Adjusting the tension settings to best suit your individual M14, and confirming that adequate accuracy is achieved, is the responsibility of the individual owner.

However, one piece of advice here ...while experimenting with tension settings to find the **perfect** setting for your M14 can be rewarding, it can also be frustrating, and the more experimenting you do, the more *expensive* it gets. So unless absolute best accuracy is required, know when to stop and know when the point of diminishing returns is reached.

Once the tension adjustment has been verified on the range as accurate enough, the tension adjusting screw may be locked in place semi-permanently, to ensure this accuracy setting does not shift. Removing and replacing the M14.ca adjustable ORG equipped barrel and receiver assembly should not significantly affect zero or accuracy. In fact, one of the design goals of the Blackfeather stock was to make the lower stock assembly interchangeable with various M14.ca ORG equipped “upper assemblies”, with minimum change in zero or accuracy.

1.] The starting point for tension adjustment is 1/3 turn [two sides of the HEX wrench] UP = DRAW from neutral/initial contact between the bottom of the new ORG tension adjusting screw and the top of the steel wear reduction plate embedded in the forearm. If range testing shows that accuracy with this setting is acceptable, you can now remove the M14 barreled receiver assembly and lock the tension adjusting screw in place with the provided locking set screw.

2.] You can also choose to experiment further with the tension adjustment by adjusting the tension adjusting screw up or down till you find best accuracy. **Small** adjustments here can make significant differences in point of impact and in group size. Use a six sided hex wrench as an indexing device, and adjust one wrench flat at a time [1/6 of a turn]. When range testing shows that accuracy with this setting is acceptable, you can remove the M14 barreled receiver assembly and lock the tension adjusting screw in place with the provided locking set screw.

3.] POI and group size may vary with different ammunition. If you have one **specific** load that you prefer, the tension adjustments and range testing should be done to achieve best accuracy with this particular ammunition

Copyright ©2012 The Upgrade Path Inc. for M14.ca, All Rights Reserved