***How to Use a Borescope***

By **Gordy Gritters**

*Published in Varmint Hunter Magazine – April, 2010*

I thought it might be interesting to discuss the various ways to use a borescope, which is a wonderful tool that is being used by gunsmiths and many shooters/gunowners all over the world. Gone are the days when the very top gunsmiths were the only people owning and using a borescope. Nowadays, many gunowners and competitive shooters own their own borescope to be able to keep an eye on erosion and fouling as well as look for cleaning rod wear and other damage inside the bores of their rifles.

This one tool has revolutionized the gun industry in significant ways because everyone can now see exactly what is going on inside their barrels. It has changed the way people clean their barrels and helps people determine when a barrel is eroded badly enough to warrant replacing it with a fresh one.

Speaking for myself, I first saw the Hawkeye borescopes being demonstrated years ago at the Varmint Hunter Jamboree and I realized right away how valuable a borescope would be for me as a gunsmith and knew I had to have one. They were being demonstrated by Ken Harrington of Gradient Lens Corp, who is a big supporter of the Varmint Hunter. You will have met Ken if you’ve ever been to a Varmint Hunter Jamboree since he rarely misses one.

When I first got my Hawkeye borescope, I immediately found out I was not getting barrels nearly as clean as I thought I was. I had been a professional gunsmith for a number of years already by that time and really thought I knew what I was doing getting rifle bores clean – boy was I wrong! I would “clean” a barrel, then look at it with a borescope and still see all kinds of fouling in the bore. So I’d go back and clean some more until I finally did get it clean. This definitely helped me find out which were the better solvents to use, what brushes worked best, and most of all what techniques worked best to get the job done quickly and well.

One big reason for having a borescope is to be able to see throat erosion and bore damage, such as pitting, scratches, and wear caused by improper use of cleaning rods. A bore must be very clean to really be able to tell much since copper and power fouling coating the surface of a bore hides so much detail. But when the bore is clean, it is easy to use the borescope to check for any damage or rust pitting, and to see how much erosion is present in a bore.

When I first started to use my borescope in my gunsmithing shop, while inspecting bores after chambering a barrel I would occasionally find that the lands right in front of the throat would have scrapes and metal damage to the tops of the lands. I soon realized that this was being caused by the sharp edges of the reamer bushing scraping and digging into the tops of the lands if the bushing was too tight in the bore or if the bore wasn’t real straight. I learned I could eliminate this problem if I would radius and polish the sharp edges of all my reamer bushings, and I have never had this problem since. Until I saw this with my borescope, I had no idea it was happening since it was sure not visible to the naked eye by looking in the end of the barrel.

One major thing I discovered was something that has completely revolutionized how I set up and dial in barrels up in a lathe for the chambering and crowning processes. What I started to see in my borescope while chambering barrels was something that really bothered me because it should not be there and at the time I didn’t understand what was going on. When I chambered a barrel, I would look and sometimes see that the throat appeared to be crooked and not perfectly concentric like it should have been even though I always made sure the barrel was “perfectly dialed in” by conventional methods.

This really bothered me, and over several years and much experimentation I finally figured out that the crooked throats I could see, and verify by careful measuring, were caused by curvature in rifle bores. When I dialed a bore in at the throat and at the crown like I was doing at the time, the barrels that had significant curvature between those two points would have a throat that did not always appear to be as perfect as they should be. When I finished chambering a barrel and saw what appeared to be a slightly crooked throat, I would measure the runout in the chamber itself at zero, the neck runout would be zero, and the throat runout would be zero – all like it should be - but the bore immediately ahead of the throat would have a little runout which meant it was not running true at that point. Then when I measured a little farther up the bore it would show even more runout, meaning it was running even less true the farther forward I measured. Finally a light bulb came on and I figured out the bores curvature was causing this problem.

It was quite a process figuring out how to overcome this problem reliably, which led to my developing the methods I use today. I explain this method in great detail in the “Chambering a Championship Match Barrel” DVD I did with Grizzly Industrial several years ago, and I also teach it in my Extreme Accuracy Institute precision gunsmithing classes that I conduct at my shop.

To this day, I rely heavily on my borescope and use it multiple times a day to inspect almost every barrel I work on. I use it to inspect new barrels to make sure they are visibly OK inside. I inspect every chamber I cut multiple times during the chambering process to make sure there are no visible defects in the chamber itself, to make sure the throat is cut clean and true, and to make sure there are no visible markings on top of the lands in front of the throat. I use it to inspect crowns for burrs and other defects. I use it when cleaning bores to make sure they are really clean. I use it when evaluating rifles for accuracy problems by inspecting the bores for throat erosion and anything else that can be detracting from that rifle’s accuracy.

When I recently started my “Extreme Accuracy Series” of precision gunsmithing DVD’s, Ken Harrington from Gradient Lens, makers of the Hawkeye borescopes, loaned me a video borescope to use during the filming of a couple of these videos. I thought I could see a lot with my regular borescope, but when you magnify this onto a computer monitor or TV screen, it is amazing just how much more you can see.

Gradient Lens later loaned me a fixture along with the whole video system when I was a featured speaker at the 2009 IBS 1000 Yard National Championships evening symposium. This fixture holds the barrel in a set of v-blocks, and the borescope is fixed solidly to a sliding track on this fixture so it can be slid in and out of the bore for perfect motion-free viewing. I used this fixture several months after I completed filming the DVD footage, but I wish I had used it during the filming since it is simply amazing how much better it is to view things without all the movement I have when holding the borescope by hand.

During this presentation I used the borescope hooked through my computer to a projector which projected the image up onto a big screen on the stage in front of the auditorium. I know this presentation would not have been nearly as clear if I had been hand-holding the borescope. I could just place the borescope on a certain feature I was trying to show and leave it there. Then I would walk up to the screen and point out what I was trying to show - an off-center throat from crooked chambering, a big burr on the side of a land in the throat caused by a dull chambering reamer, throat erosion, different types of fouling left after a barrel was supposedly “cleaned”, a dinged up and worn crown, etc. It worked great!

Another use for a borescope is to inspect the bolt lug seats in the action, especially if you think you might have galled the bolt lugs by running them without sufficient lube or by using the wrong lube. This is a common problem and although you can smooth any built-up galling off the bolt lugs very carefully with a stone or fine file, you have to remove the barrel to get a look at the lug seats in the action. I just put the 90 degree mirror tube on the borescope and by angling the borescope just right you can see the lug seats quite well. Ditto for checking the lug seats after pillar bedding a stock to make sure you didn’t get any epoxy on the lug seats if you had some bedding epoxy squeeze up through the front action screw hole.

I have found this is a great tool to use for a number of other things also – really anytime you need to see inside of something. You can look inside a threaded hole to see how bad someone (not you, of course :) has damaged a thread when not starting a screw properly, you can look inside a cartridge case to see if the case head is starting to separate from the case body, and you can inspect the inside of your loading dies to make sure they are clean and not damaged. This is really useful if you think a die is causing scratches on your brass.

It also is a great tool to take along whenever you’re going to buy a rifle. You can use it to inspect the bore to see if it’s really “had less than a box of shells fired through it” like is so often claimed. It is not uncommon at all, especially in a varmint or target rifle, to have a gun look almost brand new on the outside, but on the inside have the throat be completely shot out. I know from experience that a rifle barrel can be shot out in just one awesome 3-day prairie dog hunt, because I’ve done it back in my early days. Boy, did I have a great time, but my 223 was never even close to being accurate again after that hunt!!

Finally, I think you might find it interesting to learn a little history on borescopes in general and the Hawkeye borescope in particular. According to Ken, borescopes were first developed to look inside of cannon barrels. Other uses nowadays for this technology are as endoscopes to look inside cadavers, and highly refined versions are used in medical and surgical fields. They are used in criminal forensic labs to inspect the inside of gun barrels for the presence of “blood blowback” after a shooting has occurred. Military, automotive, aerospace, metal working and other specialized industries use borescopes to inspect the insides of engines and other parts.

Gradient Lens Corporation, a small company in upstate New York, perfected the manufacturing process that dramatically reduced the cost of the borescopes, which run about one third the cost of the high end borescopes that are generally made in Germany. They designed the Hawkeye borescope specifically for the shooting industry, and introduced it to the world at the SHOT Show in 1996. Since then the Hawkeye borescope has become the standard by which all other borescopes are judged.

One of the big features they incorporated into the Hawkeye is a 90 degree mirror tube, which allows you to look directly at the sides of a bore, throat, and chamber as you insert the borescope into it. You can see so much more detail this way than you can by just looking straight ahead without the 90 degree mirror tube. It is available in several different lengths and thicknesses, with the 17” Classic Slim version being the most popular for gun owners. It is long enough and slender enough to use end to end in almost every gun barrel 17 caliber and larger.

I had them upgrade my Hawkeye recently to their new “Green Eyecup” version that I immediately noticed was a significant upgrade that produced noticeably sharper images even than their standard version always has. They also have produced a new borescope mirror that has technology that protects it from the harsh chemicals often present in gun barrels. Gradient Lens has information available on all their borescopes and options on their website, which is posted at the end of this article.

Thank you to Gradient Lens for this wonderful tool – I truly could not get by without it!

Credits:

**Gradient Lens Corp** 207 Tremont Street, Rochester, NY 14608 1-800-536-0790 [www.gradientlens.com](http://www.gradientlens.com)

**Gordy Gritters / Gordy’s Precision** [www.ExtremeAccuracyInstitute.com](http://www.ExtremeAccuracyInstitute.com) / [www.GordysPrecision.com](http://www.GordysPrecision.com)