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Headspace Gauges And How To Use Them

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A question that gets asked over and over on the Tech Help Line is “What is headspace?” and “How do I check headspace?”. Hopefully, this article will help answer some of those questions and provide some useful information on a very important aspect of gunsmithing.

Headspace is defined as the distance from the bolt or breech face to a measuring point within the chamber forward of the breech. With rimmed cartridges, such as .22 long rifle, 30-30 or .357 Magnum, the measurement is to the front of the rim cut. Straight- walled rimless cartridges, such as .30 Carbine, 9mm Luger or .45 ACP, are measured to the mouth of the chamber. Rimless bottleneck rounds, like .223 or 30-06, are measured to a point on the shoulder at a certain specified diameter. Belted magnums, .300 Win. Mag., or .375 H&H, are measured to the front of the belt cut, essentially like a rimmed case.

Checking headspace should be a part of any job that involves action work, especially if the job will require the gun be test fired. Headspace should be checked before any gunsmithing work is done. That way, if an excessive headspace condition exists, the customer can opt to have it corrected before expensive work is done to a gun that may not be suitable for the intended use. Checking the headspace first helps to protect you, the gunsmith, from firing an unsafe gun or from doing work that you may never be paid for if your customer abandons the gun to your shop.

Headspace gauges are used to check one aspect of a firearm’s suitability for use. If the headspace is less than minimum, factory loaded cartridges may not fully chamber in the firearm, the action may not close fully, and it may not fire. If the gun does fire, you could have excess pressure problems, and in the case of semi-automatic arms, possible serious damage to the locking system. It’s possible, with autoloading guns, to have slam fires due to insufficient headspace. If headspace exceeds the maximum limit, excessive case stretching can occur, even to the point of a case rupture or head separation from the case body. Other problems associated with excessive headspace are: failure to fire, misfires, poor accuracy, and very short case life. With rimfire guns and their thin brass cartridge cases, excessive headspace can lead to ruptures of the case at the rim, or even a complete head separation on firing. The sudden “dumping” of powder gases into the action can wreck an action or stock, and in the case of many rifles, send powder gases back along a bolt body to blast the shooter’s face. For this reason, eye protection when shooting is a must!

Modern headspace gauges are made of heat treated tool steel. Even though the steel is quite hard and tough, you must treat the gauges as though they were made of glass. If they are misused, they can break, cause damage to the gun being checked, or can give false readings on the correctness or incorrectness of a particular gun’s headspace and its suitability for use. Our recommendation is that you use headspace gauges in sets from the same manufacturer. An example of this would be GO and NO-GO gauges from Clymer, and not one from Clymer and the other from Forster. Your results will be more uniform if you stick to this recommendation rather than mixing different brands.

Under normal commercial circumstances, a gun whose bolt closes completely on a NO-GO headspace gauge (even if it does not close on a FIELD gauge) should not be put out for sale or returned to a customer as being suitable for use, until the headspace situation is corrected. Keep in mind that a firearm may have perfect headspace, but may have other chamber problems or action problems that could keep it from being used safely.

Dykem Steel Blue Layout Fluid

There are normally three types of gauges made; GO, NO-GO and FIELD. The GO gauge corresponds to the SAAMI (Sporting Arms & Ammunition Manufacturer's Institute) minimum chamber length, while the FIELD gauge usually matches the maximum chamber depth, or slightly less. NO-GO gauges are an intermediate length between minimum and maximum, that, technically, is a voluntary dimension. A firearm that closes on a NO-GO gauge and does not close on a FIELD gauge may not give good accuracy and may have very short cartridge case life from the ammunition re-loader's standpoint.

Case head separations are a possibility with a gun that closes on a NO-GO gauge. It may also fail to fire or suffer from misfires, depending on the firing pin dimensions. Here's a very thorough list of instructions on how to use headspace gauges to check headspace. It's broken down by type of firearm and type of actions so you can hone in on the kind of firearm that you work on most.

Bolt Action Rifles
The most common usage of headspace gauges is with bottleneck cartridges in bolt action rifles. As with any job, check the chamber and magazine to be certain the rifle is not loaded. Remove the bolt from the action, and strip the bolt as far as practical. This means remove the firing pin assembly and, if possible, the extractor. If the bolt has a spring- loaded plunger in the bolt head as an ejector, remove the ejector. Clean the chamber, the bolt locking lug recesses in the action, the bolt face, locking lugs and the gauge. With some types of bolts, the extractor can't be removed without damage to it or its retainer. For many years, Remington centerfire rifles have used a rivet to retain the extractor. Do not remove the extractor on Remington rifles.

Open and close the stripped bolt on an empty chamber several times to get a feel for the amount of resistance the bolt has to closing. Slip the GO gauge into the chamber and with the pressure of only one finger, attempt to close the bolt. If you are working with a Remington rifle, or any rifle where the extractor cannot be readily removed, slip the rim of the gauge under the extractor on the bolt, and push the bolt and gauge forward to chamber the gauge. Attempt to close the bolt handle. IMPORTANT: If you feel any resistance to closing greater than you had with the chamber empty, stop right there. Don't force the bolt closed. The bolt handle gives you a tremendous amount of leverage, so to avoid damage to the gauge or rifle, use only minimal pressure to close the bolt. If the bolt closes with no feel to the handle with a GO gauge in the chamber, open the bolt, remove the GO gauge, and replace it with a NO-GO gauge. Again, gently attempt to close the bolt. The bolt handle should stop or show resistance to closing at some point before it fully closes. DO NOT force the bolt handle closed. Even if the bolt handle closes 98% before you feel resistance, the headspace is normally considered to be within specs.
If the bolt handle closes fully on the NO-GO gauge, repeat the test with a FIELD gauge. If the bolt does not close completely with this gauge, the headspace is on the long side, but the rifle can usually still be used with factory ammo, if the cases will not be reloaded and there are no other problems present. Never fire a gun that closes on a FIELD gauge. If it is fired, the chances are extremely high that you will get case ruptures.

.22 Rimfire Headspace
Modern .22 Rimfire cartridges fall into two families: .22 long rifle, .22 long, .22 short, BB and CB caps; and .22 Winchester Rimfire and .22 Winchester Rimfire Magnum. The .22 long rifle family shares case body diameters, rim diameters and thickness. The overall cartridge length, bullet shape and weight are the variable factors. The .22 WRF and .22 WRFM differ in body length, and the magnum is loaded to much higher chamber pressures.

Small step at arrow shows amount of headspace (+.005") with a Clymer GO gauge placed in the chamber of a .45 ACP, 1911 Auto barrel

.22 rimfire cartridges present several potential problems to the gunsmith. Most bolt action rifles, as well as lever action rifles, pumps, semi-auto rifles and pistols have a barrel breech that is essentially flat, and use a recess in the bolt head to regulate headspace. Bolt, pump and lever action rifles have a locked breechbolt system, while autoloading guns are usually blowback operated, with the bolt held forward by spring pressure. If you only measure the depth of the bolt face rim cut, you will not get a true picture of the headspace situation, as the bolt on a locked breech system usually has some clearance built into the bolt face to barrel breech face dimension. In addition, autoloading guns will build up dirt, powder fouling and bullet lube on the face of the bolt and the breech end of the barrel, which will temporarily increase headspace by holding the bolt back slightly from the barrel.

Revolver Headspace

The vast majority of revolvers are chambered for rimmed cartridges. They fall into two general types of actions: swing out cylinder and solid frame revolvers. Modern Smith & Wesson revolvers are swing out cylinder types, while Ruger Single Action revolvers have solid frames, where the cylinder pin has to be pulled forward to remove the cylinder for cleaning. In addition, there are two types of cylinders: rebated and non-rebated.

Rebated type cylinders have a recess for the case rim and come almost to the frame at the rear of the cylinder. Non-rebated cylinders, when viewed from the side, leave the entire thickness of the case rim exposed.

When checking revolvers with swing out cylinders, start by cleaning the cylinder, including the chamber, the ejector star and its recess in the cylinder, the front face of the cylinder, the barrel breech and rear of the frame window where the firing pin comes through. On rebated rim swing out cylinders, put a feeler gauge between the cylinder and frame at the top rear of the frame window to check clearance at each chamber. Note these measurements. Open the cylinder and place the GO gauge in a chamber. The GO gauge should be flush or just below flush with the rear face of the cylinder. If it protrudes above the cylinder's rear face, measure how much it sticks up. It should be less than the feeler gauge thickness that you noted earlier. Next, place the NO-GO gauge in each chamber. It should protrude enough that the cylinder cannot be closed with very gentle pressure. **Caution:** Forcing the cylinder closed with a headspace gauge in a chamber may damage the cylinder, the ejector, the revolver's frame or the headspace gauge. The gauge is heat treated harder than any of the gun's components and can break if mistreated.

With a non-rebated cylinder, start by cleaning the gun as detailed above. The cylinder should close easily, with no drag on the gauge, with a GO gauge in the chambers. If the headspace is correct, the cylinder will not close with a NO-GO gauge in each chamber. Do Not force the cylinder closed with any gauge in a chamber.

Single action, solid frame revolvers have their own peculiarities. The area surrounding the firing pin in the frame is usually raised above the surface at the rear of the frame window. With the cleaned revolver on half-cock (or in the case of a current production Ruger, with the loading gate open) slip the GO gauge in the chamber and slowly rotate the cylinder. The gauge should rotate past the raised section with no drag. Next, place the NO-GO gauge in the chamber and repeat the test. The gauge should stop the cylinder's rotation. Carefully back rotate the cylinder as far as possible, remove the cylinder pin from the frame, and remove the cylinder from the frame. Replace the cylinder in the frame and repeat the test on the other chambers.

Match Rifle Headspace Gauges

Shotguns
Bolt action, pump and autoloading shotguns can generally be checked and treated like their centerfire rifle equivalents. Break open guns, whether side by side, over and under, or single shot types, must be checked carefully to avoid damage to the gun. Start by checking the headspace with the barrel off of the action. The back surface of the GO gauge should be level with or drop below the level of the rim recess in the barrel being checked, while the NO-GO gauge should protrude above the level of the recess. After checking with the barrel assembly off of the action, reinstall the barrel assembly. Place the NO-GO gauge in the chamber being checked. Very carefully and slowly attempt to close the barrel. DO NOT “snap” or force the action closed. The barrel assembly on a break open type gun can exert tremendous leverage upon closing. Snapping the barrel closed with a hardened gauge in the chamber can cause damage to the gauge, barrel and action.

This is as complete a rundown on headspace gauges and headspace as I can give you. If you want more information on headspace or on specific chamber dimensions, a great source is SAAMI. They publish a manual of chamber prints that lists headspace and complete dimensions. SAAMI can be contacted at (203) 426-4358. Headspace is one area of gunsmithing it pays to be knowledgeble and cautious about. Remember, headspace is where a very small error can lead to a really big problem.

Tools Used In This Article

#262-100-004	Dykem Layout Fluid
#079-308-000	Brownells .308 Match Rifle Headspace Gauge Kit

Marlin .22 Inside Magazine Tubes

Over the years, magazine tubes for the many different models of Marlin Rimfire Rifles have had subtle design changes that prevent their interchangeability between models. The chart below covers all OEM replacement tubes currently in stock. To find which magazine tube you need to fit your rifle: measure the overall length of your existing tube (minus cap and follower), compare action and follower style, then choose the correct Brownells Stock #.

Brownell's Stock #	Approximate Tube Length	Cap/Pin Design		Marlin Part #	Follower Style	Action
#550-607-222	20-3/8"	Old	Single	607222	Ball	Semi-Auto
#550-507-922	17-3/8"	New	Double	507988	Ball	Semi-Auto
#550-502-522	22-5/16"	New	Single	502522	Cylindrical	Bolt
#550-507-122	10"	Old	Single	507122	Ball	Semi-Auto

#550-502-222	19"	Old	Single	502222	Cylindrical	Bolt
#550-506-122	20¾"	New	Single	506122	Cylindrical	Bolt
#550-502-822	14-7/8"	New	Single	502822	Cylindrical	Bolt
#550-000-500	20-13/16"	New	Single	507522	Ball	Semi-Auto
#550-000-497	10"	New	Single	507422	Ball	Semi-Auto