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"Expander Ball Tips and Information"

By Jason Giglio – Ballistic Tools, Inc.

Foreword

This "Tips" file is the result of a suggestion sent to me by Jason Giglio of Ballistic Tools, Inc. After bouncing the email back and forth a few times, I ultimately convinced Jason to author it as "Guest" Tips file. As a commercial brass processor and converter of military and civilian cartridge brass, Jason possesses intimate knowledge on the subject. — Lee Love

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Expander Ball Tips and Information

In a full length sizing rifle die, the neck section of the die is cut so that the neck is squeezed down to an inner diameter that is much smaller than is necessary to hold a projectile. This is because brass varies in thickness and the sizing die can only size the outer diameter of the neck. With thinner brass, the inner diameter will be larger, so the designer must pick a conservative size that will reduce the inner diameter of all types of brass below the size of the bullet to ensure that there will be an interference fit that will grip the bullet.

This is where the expander assembly comes into the picture. The expander enters the neck of the not-yet-sized brass freely, and stretches the neck to the required inner diameter on its way out. You can feel this as a "catching" on a hand-pulled reloading press as the brass is removed from the die.

Shoulder Distortion

If the neck portion of the die is tight, and the brass soft, it is possible for the action of the expander ball to distort the shoulder, pulling it forward, altering the headspace of the cartridge, which is the length from the middle of the shoulder to the base. Excessive headspace when sizing brass can cause rounds that are difficult to chamber and extract, or may not fully chamber at all. It also may not pull the shoulder evenly, causing a distortion that can affect accuracy. This effect is worse on cartridges with a long flat shoulder, such as 6mm PPC.

Avoiding Shoulder Distortion

To avoid shoulder distortion, there are a few options. The most precision way is to use a collet neck sizing die, that is adjustable to size the neck of the brass just enough based on the outer diameter of the brass. Because this sizes only the neck, if the brass is to be used in a different firearm than the one that fired it, a special body sizing die must be used to size the body and bump the shoulder of the brass.

Another option is to lubricate the inside of the neck. There are powdered lubricants that can be brushed into the neck and left in place with no harmful effects on the powder. If a liquid lubricant is used, an excessive amount could contaminate the powder. It's generally recommended that the cases be tumbled in dry media after sizing but before loading if a liquid lubricant is used inside the case.

TIP: Dry Neck Lubes include powdered graphite, moly and mica. The products listed below are readily available. *

- Forster White Motor Mica (mica)
- Frankford Arsenal® (mica)
- Imperial® Dry Neck Lube (graphite)
- Neco Super Deluxe Dry Neck Lube Kit (moly)

* This list is taken from the Tips file, "Cartridge Case Lubrication".

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It is possible when using spray lubricants to aim the spray such that only a very minute amount enters the necks. If the use is sparing enough, the small amount of lubricant will not affect the powder. Using the "bag method" of lubrication, where brass is put into a Ziploc® bag and shaken with lubrication will also allow only a small amount of lubricant to reach the necks.

TIP: The key is to spray the wall of the bag sparingly. Don't direct spray onto the brass in the bag, or some pieces will get an excessive amount of lubricant inside of them.

A carbide expander ball (sometimes called a "button") is, by far, the easiest solution to reduce neck expansion friction. Because carbide is extremely hard and the carbide expanders are ground to a very fine surface finish, friction is reduced without lubrication.

Types of Expander Balls

Cylindrical Steel Mandrel

Cylindrical steel mandrel sizers, that some rifle dies use, are the most basic type of neck expander. They pull hard compared to the other types (which can change the shoulder) and can get brass or nickel coated onto them (which changes their size and makes them even more sticky).

Steel Ball/Elliptical

Elliptical and ball shaped steel sizers are much better since they only contact one point at a time, which reduces friction. Steel balls have a tendency to wear and shrink over time faster than other types of expander, increasing neck tension slowly, especially if your brass isn't perfectly clean. Often a new ball from the factory will give 0.001" to 0.003" of neck tension. A well-used one may give 0.005" or more of neck tension. These assemblies are often only hardened on the surface, so occasionally you may find that an expander ball shrinks a large amount in a short time. This is either a sign that the hard layer has completely worn off, that there is something abrasive in the necks of your brass, or both.

Carbide Button

Carbide buttons solve most of the issues that other types of expander have, with excellent wear resistance from the ultra hard carbide, and the lowest friction to avoid distorting necks. They do tend to cost a little more than the other types, and most dies do not come with them included, so they must be purchased as an accessory. It is a worthwhile purchase to avoid all the potential pitfalls of the other types of expander.

TIP: Just go ahead and purchase a carbide button at the same time you purchase the die and save all the trouble of upgrading later.

There are some carbide buttons that are not rounded, but rather flat with two tapered edges. A design that is all rounded such as Redding Reloading's carbide size button is superior, as it only contacts on one point at a time.

Monitoring Your Expander Ball

Because non-carbide expander balls can wear, it's important to monitor your neck tension when preparing brass. There is also quite a bit of manufacturing variation in non-carbide expander assemblies. Two identical die sets from the same manufacturer can vary by up to 0.001" to 0.002" in expander ball size.

It is difficult to measure neck inner diameter with calipers. The brass will tend to stretch as the calipers are adjusted, and it is nearly impossible to get the calipers inserted perfectly parallel to the neck and perfectly centered to measure a diameter. Neck diameter is somewhat critical and a few thousandths is all that separates good from bad. Because of this, using ordinary calibers to measure neck inner diameter is not recommended.

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NOTE: Yes, there are calipers and micrometers specially designed for measuring inside diameters. But they still require a lot of skill to obtain accurate measurements. They also tend to be expensive and difficult to find in versions that can measure inside small caliber case mouths.

The Ballistic Tools Case Mouth and Neck Tension Gauge for .308 and .224 diameter calibers is one way to reliably gauge neck inner diameter. The gauge has steps every 0.003" of neck tension, with the final step the same diameter as the projectile. If the gauge inserts fully, then the brass does not have sufficient neck tension to hold a bullet. If there is more than 0.006" (two steps) of neck tension, it can cause difficulty when seating bullets.

Ideal Neck Diameter, Brass Elasticity and Anneal State

Ideal neck diameter is between 0.003" and 0.006" below the projectile size, for most calibers. A size smaller than this may cause problems with shoulders or necks collapsing when the bullet is seated, and difficulty getting flat base bullets seated.

Tension in excess of 0.003" does not add additional grip to the projectile, as the brass will stretch as the bullet is inserted. The amount of tension is limited by the elasticity of the brass. Freshly annealed brass will have less elasticity. Brass that has been fired many times will have more elasticity, but is also more likely to crack if neck tension is excessive. This crack may happen immediately or after the loaded rounds have been stored for some time.

This same elastic effect happens when brass is sized. With the same expander, two otherwise identical pieces of brass with different anneal state (i.e. number of firings) will spring back a different amount. Using the Ballistic Tools Case Mouth and Neck Tension Gauge will allow you to measure this to ensure that all your brass is getting sufficient neck tension.

Don't Lose Your Ball

A thing to watch out for is losing your expander ball. Some die designs are more prone to this than others. If the expander ball comes loose, it is a major hassle. It will be trapped inside a piece of brass with a very tight neck, and if you don't notice it immediately when prepping brass, all the subsequent brass will have an unusably tight neck.

Retrieving A Lost Ball

Retrieving a lost ball usually requires carefully cutting open the piece of brass that it came off in. If it came off at some point and you aren't sure what piece of brass it's in, a magnet generally works well for finding the piece that contains it. If you are doing bulk brass preparation, check periodically that your expander assembly is tight.

NOTE: A loose expander assembly also makes decap pin breakage more likely.

TIP: If you don't have a magnet, you can weigh the cartridges on your powder scale. But using a magnet is much faster.

TIP: If you happen to have a Tapered Size Button (normally used for reforming case necks up to a larger caliber) you can use it to expand the case neck just enough to recover the lost expander ball. It is less messy than using a hacksaw.

Stuck Case

Another way to trap an expander ball in a case happens when attempting to remove a stuck case from a sizing die. The expander ball can't be removed from the brass until the brass is extracted from the die. If you attempt to unscrew the decap assembly and knock the brass out from the top with a rod, damage to the expander ball is unavoidable.

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TIP: The Redding Stuck Case Remover Kit (#2200) is highly recommended for extracting brass stuck in a reloading die while avoiding damage to the expander ball within it. It is a tool that should be on every reloading bench.

Closing Thoughts

The expander assembly in a sizing die seems like a simple device but, as you can see, there are a lot of subtle issues that can crop up. There are many aspects of reloading that are easy to remain blissfully ignorant of, until they cause a problem. With a little care, knowledge, and planning, you can avoid these problems, or at minimum, recognize quickly when they are happening. Pulling apart hundreds of bad reloads is never any fun.

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About the Author

Jason Giglio is the founder of Ballistic Tools, Inc and inventor of the Swage Gage™ and Case Mouth/Neck Tension gauge. He is a commercial brass processor and converter of military and civilian cartridge brass, and an active participant in online reloading help forums. He was introduced to reloading in 1992 by his father who is a competitive shooter and gunsmith.

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