



## Avoiding Those Painful Splits: Incipient Case head Separations, The .303 British and Lee Collet Dies

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### Warning

This article addresses issues that deal with reloading firearm cartridges. The information presented is a result of careful experimentation and experience. We offer no guarantee or warranty of any kind on the information presented and you should proceed with caution if you choose to try the techniques or products that we present. Reloading is not an exact science; we have no control over what you do or what you use. Therefore, you assume any and all risk involved.

In our article "Fine Tuning Brass Resizing", Ted and I discussed brass cartridge cases and techniques for getting maximum life from brass cartridge cases.

I recently began working with a [British SMLE, No. 1 MK III\\*](#), a desirable Australian "Lithgow" version.

The SMLE is in caliber [.303 British](#), a rimmed bottleneck cartridge. I confess a fondness for rimmed cartridges. Headspace is set on the rim, as it provides a positive stop. The cases forward movement into the chamber, once struck by the firing pin is arrested by the forward part of the rim engaging the cut in chamber. For the full story on headspace see Jamie's article "Measuring Headspace".

Shooters of the so-called "Belted" cartridges, such as the 7mm Magnum, 338 Winchester

Magnum etc are used to short brass life **if** they full length size their brass each time. The rumor is the belt makes the case stronger. Let's stop that one cold! The belts *only* function is for the cartridge to headspace on. The belt functions the same as a rim, except it allows cartridges to be stacked in a magazine with ease. Interestingly enough, the belted case is also a British development. Rimmed cases were much favored by the British; however, it takes a special staggered magazine to load rimmed cartridges in a Mauser type bolt gun. The belted case allows a standard magazine, yet provides a positive [headspacing](#) device.

Unfortunately, the reamers used to chamber belted cartridges tend to be somewhat casual as to where they put the case shoulder in the chamber. Usually, there is quite a bit of space between the brass cartridge shoulder and the matching area in the chamber. The thinking is; since the case headspaces on the belt, the shoulder placement in the chamber isn't critical. As far as headspacing goes this is correct. If a case is used *one time* and discarded, then there's no issue. It's when that case will be reused again and again that brass separations can occur if more attention isn't paid to chamber dimensions and die adjustment.

The SMLE has a reputation for being hard on brass. This isn't a design fault of the SMLE. A rifle designed for military use doesn't take handloading into consideration. To a government, a cartridge is to be used one time only. Not so with the likes of the dedicated Mil-Surp shooter / reloader. We see a boxer-primed case in the same light as a family heirloom!

At the same time I acquired the SMLE, I also bought a box of PMC .303 ammo. I've been favorably impressed with the Centerfire ammo PMC has made in both the United States and South Korea.

Upon firing the US made PMC ammo, the shoulder moved forward from the factory position. The shape of the shoulder in the chamber is somewhat different from the factory round. (See *fig. I*) This means the chamber; at least the portion near the shoulder is a bit deeper than the PMC brass. This doesn't necessarily mean the chamber is too deep or the brass too small. Factory loaded ammo must safely fit in **all** chambers of that caliber. It behooves the manufacturer of ammunition to make the case small enough so it easily chambers in all rifles. Considering the number of rifles made and the thousands of reamers used, this is no small task! Once again our old friend tolerance comes into play. A chamber at maximum tolerance and brass at minimum tolerance are still within specifications, even though there may be .0020 clearance! I also acquired some new bulk Winchester .303 brass. The unfired Winchester brass is much closer to the chamber shape than PMC, yet it fits the chamber with no problem. (See *fig. II*)



**Fig 1 Unfired PMC brass & fired PMC brass. Notice the factory shoulder shape bears little resemblance to the fired cases shoulder.**



**Fig II Unfired Winchester brass & fired Winchester brass. Winchester factory shoulder shape is closer to chamber shape than PMC. But, there is still quite a bit of space between the shoulder and the chamber.**

When a case assumes the shape of a chamber the brass is said to flow. The supply of metal in a cartridge case is finite. When brass flows from one area of the case to another, then the supplying area must get thinner. This isn't a big problem unless firing and subsequent full-length sizing are constantly pushing the brass back and forth an excessive amount. This sequence of events can cause a thin spot just ahead of the cases web it to a point where it cracks. The reason separations occur just ahead of the web is the thinner case walls expand and pressure holds them to the chamber walls. The head and web area being thicker resist expansion and move backward; therefore the area just ahead of the web is where breakdown occurs. What then are our options?

Of course, one *could* send 3 cases that were fired in their rifle to a maker of custom dies. The shop will make a set of dies tailored to that specific chamber. This option is somewhat expensive; however, considering the dies will be totally handmade, the price isn't out of line for custom work. Partial full length resizing is the option we covered in "[Fine Tuning Brass Resizing](#)". Another technique to minimize brass flow is neck sizing. For those willing to spend just a few dollars more, Lee, [www.leeprecision.com](http://www.leeprecision.com) has just the ticket.

When I got the SMLE; I placed an order for the brass and a set of Lee Deluxe Dies from Graff & Sons, [www.grafs.com](http://www.grafs.com). The deluxe set has a shell holder, full length (FL) resizing die, seater die, and also a collet type neck-sizing (NS) die. Delivered, the Deluxe dies were \$33.34, only \$ 8.60 more then the Pacesetter die set.



Fig III Lee Deluxe Die Set, FL die, Collet die and Seater die.

The Lee Collet NS Die squeezes the case neck around a mandrel. It **does not** move the case shoulder or change case body dimensions.

Let's look at nominal brass specifications and see how they compare with PMC factory ammo and with PMC cases fired in the SMLE.

Type	A	B	C
Nominal Specs.	2.222 - .020	1.7901	1.8900
Unfired Case, PMC	2.2175	1.775	1.8900
Fired Case, PMC	2.222	1.821	1.8900
	Neck Sized	Neck Sized	Neck Sized
	Collet Die	Collet Die	Collet Die

Initial Stretch	.0045	.046	.000
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A: Over All Length, (OAL) of brass

B: Rim of case to base of shoulder

C: Rim of case to top of shoulder

Note: taking measurements from a case body, shoulder and neck joint with a caliper isn't easy! Getting a perfect measurement is difficult. The lines are not *exactly* demarcated. However, I took the average from many readings, and the most important thing is the differences between factory and fired sizes.

We see the case stretched 4 ½ thousands to assume the OAL of the chamber. Actually it stretched 1 or 2 additional thousands. Brass will spring back that much after pressure decreases. The spring back allows the case to be removed from the chamber, so far, so good. Now, if the case were to be FL sized constantly, the shoulder would be set back .031 each time. This is where excessive sizing will weaken brass; eventually it will split.

Now let's look at nominal brass specifications and see how they compare with new Winchester brass and with Winchester cases fired in the SMLE.

Type	A	B	C
Nominal Specs.	2.222 - .020	1.7901	1.8900
Unfired Case, Win	2.213	1.803	1.8900
Fired Case, Win.	2.2175	1.821	1.8900
	Neck Sized	Neck Sized	Neck Sized
	Collet Die	Collet Die	Collet Die

Initial Stretch	.0045	.018	.000
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A: Over All Length, (OAL) of brass

B: Rim of case to base of shoulder

C: Rim of case to top of shoulder

Because the Winchester cases were dimensionally closer to the actual chamber size than PMC, they had to stretch less to fill the chamber. The most important thing is; after that initial stretch, the cases haven't changed because the Collet die only squeezes the neck around a mandrel!

Many sources recommend brass used in SMLE's and rifles set up for belted cases should be discarded after just 3 or 4 firings. It is said the danger of incipient head separations becomes too great after that time. *If a FL die is used exclusively, this may be true.* I have not found it to be true when using the Lee Collet NS die. So far I've only used the NS die on brass **fired in my rifle**. Since the cases were now custom fitted to my SMLE's chamber, brass flow will be held to the absolute minimum by using the NS die. After quite a few firings, I've found **no evidence** of stretching or thinning. If any of my cases start to get hard to chamber, then a trip through the FL die will reset them to factory size.

I have used the FL die on several berdan primed, Mil-Surp cases that I've made into "Dummy Rounds". A dummy round is a brass case, trimmed to length; that contains neither primer nor powder. It contains a seated bullet only. Dummy rounds are used for quick adjustment of a seater die. The brass cases used for dummy rounds are berdan primed Mil-Surp cases discarded by another shooter. Since they were fired in another rifle, it is prudent to FL size them. Of course, before we can FL size berdan primed cases the primer pockets must be drilled out. I used a small pilot drill bit first, then followed up with a ¼ inch drill bit. The ¼ inch drill bit will completely remove the entire primer pocket.



**Fig IV Dummy round & primer pocket drilled completely through.**

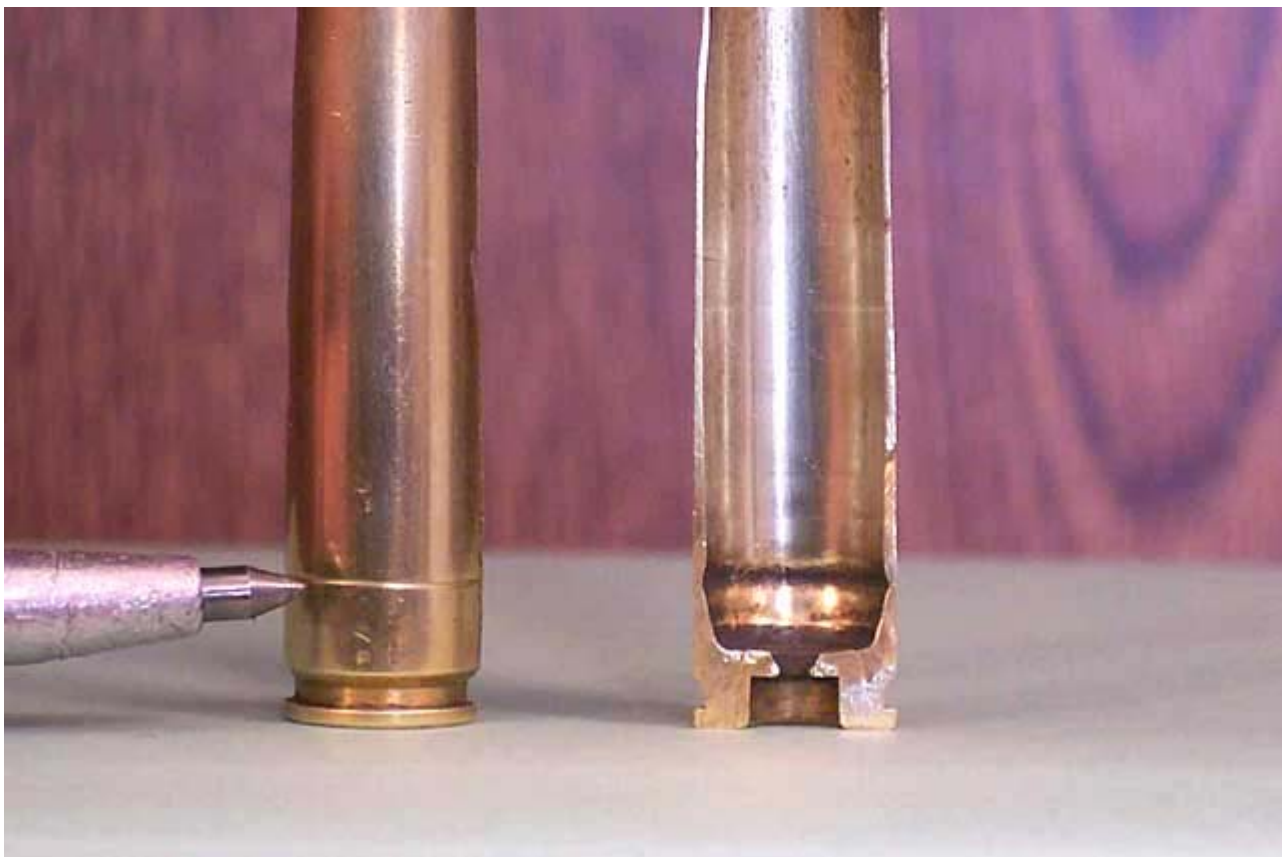
Berdan ammunition is most likely corrosive primed. I had no desire to get potassium chlorate in my new resizing die. Potassium chlorate is hygroscopic and will attract moisture, causing the die to rust. To remove the potassium chlorate coating, I washed the cases well in hot, soapy water before lubing and resizing them.

One may acquire brass with an unknown history. How can it be checked? There is a simple way to check any brass for incipient head separation. Simply bend a large paper clip as shown in fig VII. Use it to feel for a groove where the metal has thinned in a case about to separate. Often the line on the outside of a case won't show, but the metal on the inside is already thinning. Any case found to be defective should have its mouth crushed with locking pliers.

Being a confirmed scrounger/barterer I did acquire a few commercial, once fired .303 cases, that weren't fired in my rifle. Notice I said **once fired** cases. A once fired case will not have been excessively worked and little danger of incipient head separation exists.

But, I still checked them with a bent paper clip. They too were FL sized before being used in my rifle; after that only the Lee Collet NS die has been used on them.

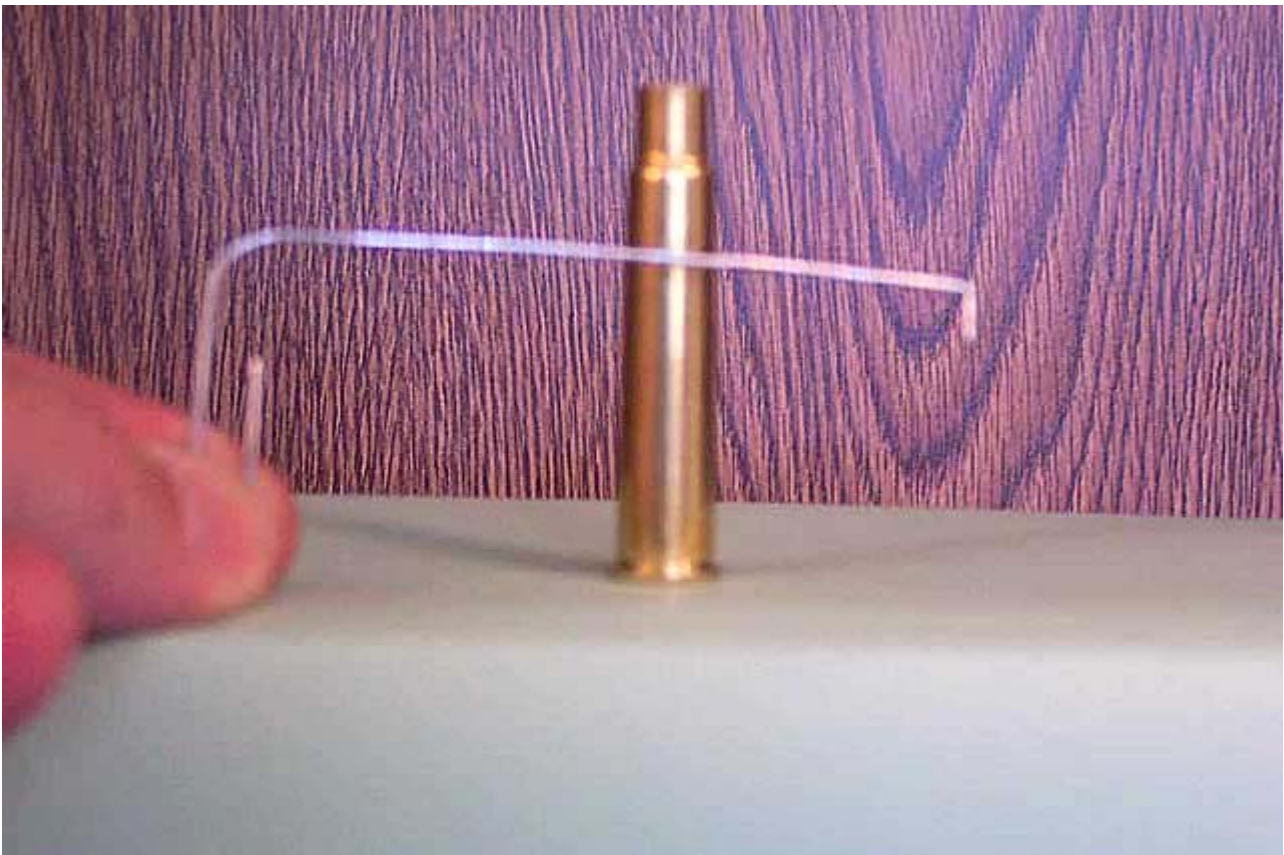
I found a case lying on the range that was ready to separate. No wonder someone tossed it! One more loading and it would have let go! As you can see, this is a rimless case. It was fired many times in a rifle with excessive headspace and constantly FL resized, or there is the possibility the FL die or the shellholder used on this case was incorrectly manufactured, causing the shoulder to be set back an excessive amount during each FL resizing.



**Fig V Notice telltale line on outside of bad case at left.**



**Fig VI Notice groove on inside of bad case at right.**



**Fig VII Hook end of bent paper clip will detect thinning brass as shown  
In figure above.**



**Fig VIII Checking brass for evidence of thin groove.**

It pays to check *all* your brass, no matter what its history. If you have more than one rifle in a caliber; say, 3 rifles in [8 mm Mauser](#), then it's good practice to have a set of brass and dummy rounds for each rifle.

If you have a rifle whose design is known for being hard on brass, or chambered for a belted case; consider Lee Deluxe Dies, the few extra dollars they cost will come back to you again & again through longer brass life.

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