



PRIMERS AND PRESSURE

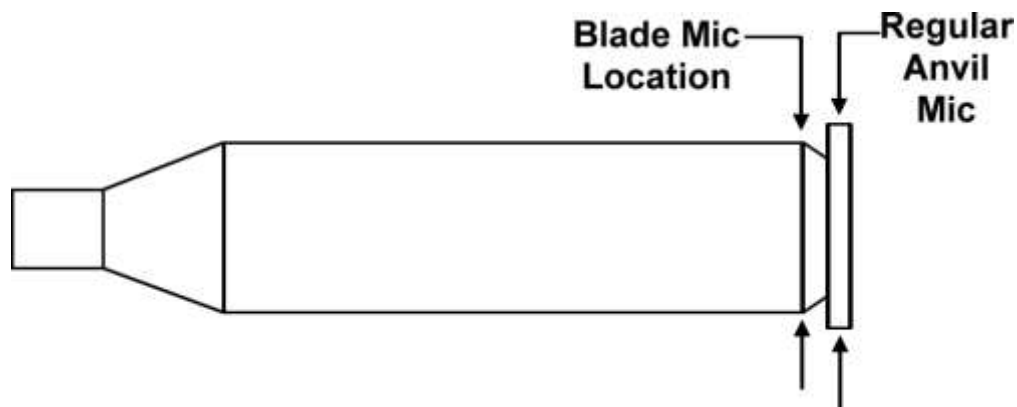
by James Calhoon

(First Printed in *Varmint Hunter* Magazine, October, 1995)

In the course of talking to many shooters, it has become clear to me that the manufacturers of primers have done a less than adequate job of educating reloaders on the application of their primers. Everybody seems to realize that some primers are "hotter" than others and some seem to shoot better for them than others, but few reloaders know that primers have different pressure tolerances.

I ran into this problem myself when loading a 223 to the maximum. The primer I was using was piercing before the case began expanding at the head or reaching maximum pressure. How do you check maximum pressure without a laboratory pressure gun, you ask? To check maximum pressure on a given powder / bullet combination, measure the rim of the cartridge (at a specific point each time of the measurement) before and after firing. Cases don't have to be new, just measured before and after firing.

Discovering Maximum Load By Measuring Case Head Expansion



This method works on bolt actions, but use with caution on falling blocks, like the Ruger #1, as there is no case head protruding from the barrel. In the falling block, the case is fully supported, allowing little expansion in extreme loads. When measuring the case head, readings must be accurately done in ten thousandths of an inch (.0001"). Don't be afraid to check and double check your readings. If the case head grows more than .0001", you are overloading (going beyond the brass yield point) and eventually primer pockets will loosen up. A blade mike is nice, but a regular 0 - 1 mike in .0001" graduation is fine for measuring the rim. When using a blade mike, measure just above the extractor groove, in the same location every time. Use a scribed line as a marker. Take your time measuring. Do it twice to be sure, as .0001" is not much!

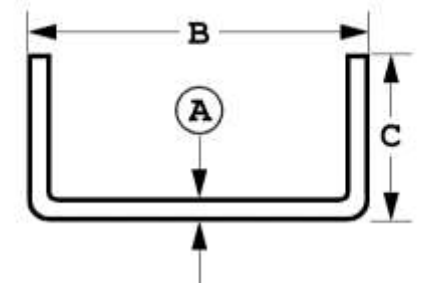
The trick to getting maximum, or at least knowing what maximum is, on your powder / bullet combination, is to reach maximum pressure (going beyond the elastic limit of the metal by only .0001" or .0002") and just back off 3 to 5%. It is best to work up loads in the hottest weather you'll encounter while shooting. Hot weather means higher pressures (especially in the 90 degr. + temperatures). Be careful to work up in small increments when working with small cases, especially in 17's. As a safety precaution, bolt action rifles should have liberal gas ports in their bolts, like the 98 Mauser or 77 Ruger. (See page 78 in the July 1992 issue of The Varmint Hunter Magazine on how to modify the 700 Remington for overload gas relief or see **Gas Off Cure** here.) Wear safety glasses.

When working with maximum loads, keep the bullet off the lands by at least .020". Pressures can really go sky high if the bullet is touching the rifling lands. This is especially the case with the "magnum" cases such as the 17 Rem, 22-250, etc. Roy Weatherby was a pioneer in this area. His big magnums incorporated free bore to remove the "pressure spikes".

Rifle Primer Dimension Chart

Manufacturer	Number	A Cup Thickness	B Cup Diameter	C Cup Height
<u>Small Rifle</u>				
CCI	400	.020"	.1753"	.109"
	450	.025"	.1750"	.113"
	BR4	.025"	.1755"	.109"
Federal	200	.019"	.1757"	.111"
	205M	.0225"	.1744"	.1075"
Remington	6 1/2	.020"	.1753"	.109"
	7 1/2	.025"	.1752"	.110"
Winchester	SR	.021"	.1750"	.109"
<u>Large Rifle</u>				
CCI	200	.027"	.2112"	.118"
	250	.027"	.2113"	.118"
Federal	210	.027"	.2120"	.117"
	215	--	--	--
Remington	9 1/2	.027"	.2100"	.119"
Winchester	LR	.027"	.2114"	.121"

Rifle Primer Dimensions



Mag

.027"

.2114"

.121"

Back to the main topic: *pressure tolerance*. I was getting primer piercing before I reached case overloading. I don't know what prompted me to try CCI 450's instead of the 400's which I had been using, but I did. Presto! No more piercing! Interesting!? A primer that has a hotter ignition and yet withstands more pressure! That's when I decided that it was time to do a dissection of all primers concerned. The chart above shows my results.

By studying the numbers, one can readily see which primers in the small rifle sections will withstand heavy loads. Primer cup diameters are all similar and appear to follow a specification, but check out the cup thickness in the small rifle primers (Dimension "A"). It is obvious that the thicker cups will withstand more pressure. Large rifle primers all appear to have the same cup thickness, no matter what the type. (As a note of interest, small pistol primers are .017" thick and large pistol primers are .020" thick.)

If you are shooting a 22 Cooper, Hornet, or a Bee, the .020" cup will perform admirably. But try using the .020" cup in a 17 Remington and you'll pierce primers, even with moderate loads.

Considering that cup thickness varies in the small rifle primers, it is obvious that primer "flatness" cannot solely be used as a pressure indicator.

Another factor which determines the strength of a primer cup is the work hardened state of the brass used to make the primer cup. They are made with cartridge brass (70% copper, 30% zinc), which can vary from 46,000 psi, soft, to 76,000 psi tensile strength when fully hardened. Manufacturers specify to their brass suppliers the hardness of brass desired. I was not able to test primer hardness, but an educated guess says that a primer manufacturer would choose a harder brass in order to keep material thickness down and reduce costs.

I have not run into primer piercing with large rifle primers. They are all the same thickness and therefore are not subject to the same misapplication problems. Exceptions can be created if too fast a powder is used in a magnum type case. The 22 Cheetah is a primer piercer with fast powders as Barry and I found out!

What does all this mean to the reloader?

- Cases that utilize small rifle primers and operate at moderate pressures(40,000 psi) should use CCI 400, Federal 200, Rem 6 1/2, or Win SR. Such cases include 22 CCM, 22 Hornet and the 218 Bee. These primers are also used in heavy handguns such as the 9mm., 357, etc. Other cases that use the small rifle primer can use the above primers only if moderate loads are used. Keep to the lower end of reloading recommendations.
- Cases that utilize Small Rifle primers and operate at higher pressures (55,000 psi) should use CCI 450, CCI BR4, Fed 205 and Rem 7 1/2.
- With large rifle primers all being the same thickness, choose a primer that makes the most accurate group, is the shiniest, cheapest or whatever, as they all have similar pressure capabilities.

Hope this clears up some primer confusion. If you want more information about primers, priming compounds, or even how to make primers, the NRA sells an excellent book called "Ammunition Making" by George Frost . This book tells it like it is in the ammo making industry.

Any comments call: Jim at James Calhoon Mfg.: 406-395-4079 (Mon. through Fri., 8-2 MST).