KEEPING YOUR (case) HEAD!

A brief look at fullbore rifle handloading safety.

Yes, I handload.
Yes, I know what I am doing.
No I don't need to read this.

Well you could be right, but there just might be an odd factor that you had not thought enough about. Please read on – and if you get to the end and think 'well, I knew all that' then that is as it should be. The (thankfully) rare problems that do occur, however, indicate that not everyone is as careful and knowledgeable as you are.

It is perhaps worth pointing out that when shooting a full-bore rifle we are generating something in the region of 50,000 psi within inches of our face. All will be well from a safety point of view if not from the score on the target, if the rifle action and barrel combination is designed to contain that pressure (modern cartridges should only be fired in modern design firearms) and on firing, the cartridge produces pressures that are not in excess of the design limits.

Factory ammunition is pretty safe in this regard. Ammunition manufacturers are pretty alert to the legal implications of their products causing excess pressure to the point of rupturing cases or even firearms. However, there are plenty of reasons not to use factory ammunition (accuracy, cost and bullet choice come to mind) and a large number of shooters reload their own ammunition. This is a perfectly safe pastime and allows many shooters to get additional pleasure from their shooting. When things go wrong on the range, it is more often than not when something has gone awry with handloads and this is either due to operator error (wrong powder choice, or too much powder, for example) or insufficient understanding of all the variables which contribute to a cartridge generating excess pressure.

Incidents are rare but they do occasionally occur and are dangerous. It is important to learn from these events and this article seeks to cover the main areas where handloads can deviate from the safe norm. It is not exhaustive and is not designed to teach the beginner how to reload. It is more of a reminder to handloaders that what they are doing is safe only if they stay within sensible limits.

Let us assume that the cartridge is to be fired in a rifle with a correctly cut chamber for that particular round. An obvious point, but it is possible to do otherwise. It is even possible with one or two cartridge/chamber combinations to fire the wrong round in the rifle. This is not a good idea. Even in ostensibly standard rifles, barrel dimensions, throat dimensions and neck diameter can all affect pressures produced on firing and these were comprehensively explored by the Pressure Trials Consortium and reported in 1998. However these are predominantly gunsmithing issues and we are going to concentrate on handloading in this article.

The reloading process starts with a pile of components and various tools. Firstly, the case. If it is a new case, all should be fine but cases from different manufacturers can have markedly different weights and this translates to different internal volume – the heavier cases will have the smallest volume. Sometimes even different batches from the same manufacturer can have significantly different weights, although this rare. The smaller case volume will increase pressure generated on firing. A maximum load in a large volume case may well generate excess pressure if used in a heavier case. Clearly, mixing cases in a batch of ammunition is not a good starting point. Occasionally, military cases may have

thick walls and relatively thin brass in the head region. Such cases are best avoided for reloading.

Fired cases should be cleaned, not for prettiness but to allow problems with the brass to be seen. Also, if fired cases are not cleaned soon after firing, the burnt powder and primer residue can cause corrosion to occur, especially in the neck area. This is made much worse if the cases get wet after firing. So there really is no excuse for not cleaning your cases.

If cases are fired in large chambers, the resizing process will 'work' the brass more and it will rapidly lose its flexibility and splits and cracks will occur. The case is the only thing between you and the rapidly burning powder and it needs to stay in one piece.

Depending on a number of factors (case shoulder angle and reloading technique among other things) the case neck will elongate during each firing/reloading cycle until it is too long to fit into the space allowed for it in the neck part of the chamber. When a round with an over-long neck is chambered, the end of the neck will be forced inwards pressing it tightly round the bullet. In effect you are providing a crimp to the case in the rifle. However this process will stop the neck expanding readily on firing and letting the bullet go. Pressures will rise dramatically until it is sufficient to force the bullet from the grip of the case.

Cases can also elongate at the base, just above the web (which is the thickest region of the brass next to the extraction groove, or rim depending on the case) and this is likely to be caused by excessive headspace in the rifle or over-enthusiastic full-length resizing. Headspace is the term used to define the correct length of the chamber. In the classical bottle-neck rifle cartridge, it is the length of the gap between the base of the cartridge, or the belt in the case of belted cartridges, and a point on the shoulder. If the chamber is too long or the cartridge is resized too much, then the brass will have to stretch each time on firing and will eventually weaken at the base. This can often be preceded by a bright ring seen around the base of the case just up from the web. If you see this, throw away the whole batch of brass as it is about to let go.

Case showing a split around the base just above the web.

All primers are equal. Not so. Although there is the obvious difference between standard and magnum large rifle primers there is also a difference between primers of different manufacturers. Some are definitely 'hotter' than others and this will affect pressure and velocity. There was an interesting experiment to demonstrate this a few years ago by Mik McPherson in the US. He produced a cartridge case base that could have primers inserted and fired, but the rest of the case was missing. He fired each primer in the dark and photographed the resulting flash, and there were marked differences in the intensity of the flash which he surmised would translate to the rate at which the powder was ignited in a normal load. As ever, this will probably not make a big difference with mild loads but if your loads are nearer the 'hotter' end of the spectrum then a change of primer may well make a notable difference to the result of pulling the trigger. Will it cause catastrophic failure? In itself almost certainly not, but this is as good a place as any to point out that most handloaders do not do any one thing rash enough to blow up a rifle. Problems usually occur when there are a number of factors which in themselves are not extreme but by bad luck or sheer determination on behalf of the handloader to push all the limits, they add together in a concatenation of events resulting in a major problem. A typical example would be everything on the limits under normal conditions but appearing to be OK and then firing this apparently safe load after the rounds have been left in direct hot sun.

Is there a problem with old brass? Not necessarily, but I have recently seen old (10 years +) factory loaded ammunition that when fired holes appeared in the case allowing gas to escape. It had clearly corroded from the inside and so the problem was invisible until it was too late. Likewise primers. Old primers can pierce when fired. This has happened recently so, the moral really is don't use old components.

Old factory loaded case with split allowing gas to escape on firing.

Propellant. This is where the gremlins have the best chance to get to work. The choice of powders is huge and the burning rates vary enormously. Even different batches of the same powder may vary, so it is wise to check when starting a new batch. No-one deliberately loads pistol powder in a rifle cartridge but it has happened. What it boils

down to is if the burning rate and amount of powder loaded into a case are not appropriate for the case capacity, the calibre of the round and the weight of bullet, then things are going to go wrong. Either too much or too little pressure. The only person who should be determining the choice of powder and the load you use (remember it's your head next to the controlled explosion) is you. Information is readily available from the manuals provided by the propellant manufacturers and will give safe starting loads. The place not to go for information is someone on the range who tells you to use x grains of y powder. He may know what he is doing but he may be using much lighter bullets for example. Even worse is the generous person who provides you with some of his handloads. These might (but how do you know?) be fine in his rifle but there is no certainty that they will be OK in yours. I was present some years ago when someone in my club shot the revolver he had purchased from an acquaintance (I hope it was not a friend) who had also kindly provided some loaded ammunition with the revolver. The first shot blew one of the chambers out of the cylinder.

Most handloaders have more than one choice of powder to hand and it is always recommended to have just one can at a time open on the bench. Common sense, of course, but the possibilities for error are endless. Dumping the remaining powder from the powder measure into the wrong container etc. etc. It is also possible to have some of the powder charge from the measure to 'hang' in the measure drop tube so one case gets a short charge whilst the next gets more than its fair share. Recently at Bisley, pulling the bullets from a batch of suspect rounds showed very wide variation in powder charge. The cause was never really identified in this case but the fact is this is not merely speculation - it does happen.

Something to bear in mind when trying the old tub of powder with a bit left from a couple of years ago, is that powder contains moisture and other solvents. Leaving powder open to the air will rapidly change the moisture content and thus its burning rate. If possible, keep powder bottles as full as possible. A near empty bottle risks allowing the powder to dry out into the large air space.

Bullet weight will make a notable difference to pressures generated and if you are trying different bullet weights, make sure the load is appropriate – heavier bullets equals less powder. Bullet seating depth will affect pressures generated. If the bullet is seated into the lands as is common for VLD bullets there will be higher pressures on firing than if the bullet is seated off the lands, and of course a long bullet jump ('freebore') has been used by rifle manufacturers in the past to enable heavier loads to be used without causing excess pressure.

Even bullets of similar weight may behave very differently if the length of the bearing surface (the flat bit on the side of the bullet!) is different. The longer the bearing surface, the more resistance there will be to being 'engraved' by the rifling and therefore the higher the pressure on firing.

That just about covers the components, but things don't end there. Things can go wrong even with the most knowledgeable and experienced handloader. The illustration shows a case head that has been subjected to monumental pressure. Fortunately this occurred in a modern well-designed action. How did it happen? "Competition coming up, pressure of work - no time to test before-hand, new components etc. etc. – the usual load should have been fine". Yes, on paper it really should have been, but somehow, things conspired to make sure this was not so and this case was the result. Fortunately this occurred in a modern strong action.

Seriously stressed primer pocket

Handloading can get addictive and the search for the ultimate in accuracy can lead to greater excess up to and including doing your own gunsmithing. This is a good place to point out that whilst the law does not require proof testing of firearms that are not sold to a third party, the NRA strongly recommends that <u>all</u> firearms are proofed before use.

Let's look on the positive side. One of the most important tools you can have on the reloading bench is the bullet puller. They are cheap and quick to use. When in doubt, pull the bullet from the round and check the powder and the load. Another safety aid is a digital scale. There is nothing wrong with a beam balance but a digital scale is so quick to use it is no problem to check weigh rounds if you suspect you might have given one a double charge for example. Getting a bit more sophisticated, there are computer programmes (e.g. QuickLoad) which allow you to assess powder/cartridge/bullet combinations and their predictions of muzzle velocity are pretty good. That suggests that the information they provide on pressures generated within the chamber are going to be reasonably accurate and this can be a great help when starting to load for a new set of components.

This has been a very basic look at some of the causes of excess pressure in fullbore rifle handloads and was not meant to insult the knowledgeable reader. As stated at the beginning, the aim is to learn from the problems that do occur and hopefully help to avoid them in the future. The focus from the outset was on fullbore rifle handloading as the opportunities for problems can be greater. That is not to say gallery rifles firing pistol cartridges and long barrel revolvers cannot have problems. Giving a case a double powder charge is easier with the small volumes of fast pistol powders used when compared with the slower and bulkier rifle powders. Again, less common with fullbore rifles is getting a bullet left in the barrel from a 'primer special' (primer but no powder), the shooter not noticing and then firing again. Makes an interesting shaped barrel!

To sum up, the key elements are simple: know what you are doing and do it carefully. Easy, really.

Paul Monaghan

MANUFACTURERS' WEBSITES WHICH GIVE USEFUL INFORMATION IN CONNECTION WITH HANDLOADING

Vihtavuori

Website: www.vihtavuori.fi/reloading.html
The complete loading handbook can be viewed and downloaded free of charge. Alternatively the hard copy book may be purchased from Tim Hannam, the Vihtavuori U.K.Agent (Tel: 01977 681 639).

Sierra

Website: www.sierrabullets.com
Details of available manuals and CD rom are given, including an online shop where they may be purchased. The CD rom requires a minimal install of Internet Explorer 5.5 regardless of the version of Windows installed. Sierra's manuals are the most comprehensive, but the majority of information is not available to view on line or to download. Technical help is available in English via their technical help line (approx 6 hrs behind on time).

Other Sources of Loading Information

Norma: Website www.norma.cc (not .com) – There is a useful and downloadable step-by-step guide with pictures.
www.jarheadtop.com This strange but interesting site has a large range of interesting technical snippets of use to the serious hand loader and ammunition/rifle experimenter.
www.amazon.com Do a search for Handloading or Loading. A list of new & used publications may be found with the online shop.
www.amazon.co.uk Same search as above but different publications offered.
www.yahoo.com Search on Handloading or Loading. The Wikipedia site contains some useful information.

Other Powder Information – with limited loading table information.

www.accurate.com The Accurate Powder site.
www.alliantpowder.com The Alliant Powder site.
www.hodgdon.com The Hodgdon Powder site.
www.imrpowder.com The IMR powder site.
www.nobelsport.fr The Vectan Powder site. (French only, although the hard to find loading tables are in English).
www.wwpowder.com The Winchester Powder site.

Other Bullet Makers Information – little or no loading information.

www.bergerbullets.com
www.nosler.com
www.speer-bullets.com