Cartridge case prep techniques and why?

OK, here's a quick summary of cartridge case preparations that are useful to improving the overall uniformity of your loaded rounds (usually) which may help you decide the costs : benefits for your own applications.
Costs = money and time.
Benefits = potential reloading and rifle accuracy improvements

So what is the object or aim here? To have ammunition that is likely to deliver repeatable, very accurate performance to suit your need.
What do you need? Well that depends on many things like budget and what is actually possible accuracy wise to squeeze out of any rifle / ammo combination.
Many factors contribute to this and quality handloaded cartridges play a big part.
Then again, for example there is little point doing all this simply for pig shooting.

So let's look at a list here if you do want to attempt to achieve that extra accuracy potential
1) you need good components (brass cases, bullets, powder, primers etc)
2) you need to check and improve the consistency of each cartridge case (which holds these all these componments together).
3) you need tools that you use to assemble that ammunition ACCURATELY
4) you need more tools to check the above.

So let's look at number 2) in more detail. Cartridge cases are made of brass and the quality varies some. Also the manufacturing process varies some. These items are mass produced. There are some tasks that can be done to improve their consistency and uniformity from case to case that will help deliver better performance.
Some of these we might list as:
1) uniforming the primer pockets
2) uniforming the flash holes and deburring the inside of that flash hole
3) outside neck turning (by machining) the case necks
4) correct and repeatable case length trimming (a normal reloading practice anyway)
5) deburring inside and out of case mouth. Some of the inside deburr tools help with bullet seating (eg the K&M VLD deburrer)
6) weight sorting of the cases.
7) using quality resizing dies and bullet seating dies (and procedures) that are likely to keep all things straight and uniform.

So that is it in a nutshell. Of course this discussion does not include the other issues apart from the ammunition like the rifle and its condition, shooting method, components like bullets and powders, primers etc and the load tuning that is required anyway to achieve the best possible.

So how much does case prep actually deliver in achieving this overall aim? That is hard to quantify. It varies from cartridge to cartridge and from rifle outfit and shooting needs but the basic idea should need no explanation. We try to make each and every cartridge case as close to exactly the same as each other. Why? Well the case is the container which holds together all the other components and it is the one component which is used over and over again. So within reason if you put in some work on the cases at the beginning you should not need to do them again as you reload over and over again. So you can concentrate then on some of the other issues.

Now tools to do case prep stuff. That's where we come in. There is lots of stuff out there on the market and most of it is crap. Over the years with our experience we have learned about what tools work, mainly for competition, but also we use the same for our regular varmint shooting guns. Since we happen to know these product manufacturers personally our business is dealing primarily in with these. Our whole product range is like this. It is specialised but not actually directed at benchrest competition only. These quality tools are usually not any more expensive than what might be available as a line through the regular gunshop.
So the case prep tools generally which I am talking about are LE Wilson and K&M products and some of the Forster products. Wilson for trimmers and reloading dies etc, K&M for neck turning tools, priming tools, flash hole and primer pocket and inside deburring tools etc. A simple digital scales to weight sort cases is all that is then required. Then a concentricity gage tool is helpful in determining what your results are and also for culling some “odd” ones. Sinclair or Forster are an example.

Now one area of case prep that gets a lot of discussion is outside neck turning. Is this necessary? Yes and no. It depends on the level of work (and money) you want to invest and also it depends on what type of reloading dies you are going to use.
In general terms if you intend to use resizing dies that use an expander ball system on the decapping rod there is probably not much to be gained from outside turning cases as the limits of what can be achieved are dictated by this die design. The exception might be the Lee Collet die.
The aim of outside neck turning is to machine the brass thickness around the neck area to achieve uniformity. No cases, including the Lapua cases, are uniform in thickness.
So why do this?
Well with a uniform neck thickness (all the way round) you have a much higher chance of achieving bullet grip (or neck tension) that is close to exactly the same for each and every cartridge. That is important. Also you are more likely to have a loaded round that will keep the bullet straight in relation to the cartridge axis. Two very important benefits.
Bullet seating dies do also have a big impact upon this but NO BULLET SEATING DIES can straighten up a crooked case. Many people assume that simply by getting good design bullet seating dies fixes all problems. Not quite, as we see here.
Outside neck turning is particularly useful when using the bushing style neck sizing dies. These dies operate by having an interchangeable neck size bushing to control the amount of bullet grip (neck tension). They do not use and an internal expander which is on regular sizing dies. This internal expander so often causes problems where cases are often bent at the neck area. After a bullet is seated the result is a bent cartridge. Not good for accuracy.

So for these “bushing” style dies to deliver their benefits of uniform neck tension (either tight or loose) we need for each and every cartridge case to have close to the same thickness of material around their necks. That is because, in this system, the resizing occurs by squeezing from the outside. Pretty simple and basic when you think about it.
So what sort of outside neck turning? There are two (2) types actually. Stuff done by benchrest shooters and others where the cases are usually heavily neck turned removing a lot of material to suit the special design chambers in their rifles. These chambers usually have what is known as "tight neck dimensions".
The other type of neck turning is by removing the smallest amount of brass possible to achieve material uniformity WITHOUT increasing the clearance to the standard or factory chamber in the neck area. In other words for rifles with standard or factory chambers a case without neck turning will easily fit into these chambers, so if we remove too much material by machining a lot away from the necks we will create another issue by having too much clearance.

Lets look at an actual example, Lapua 308 brass, if measured around each neck for thickness, by using a quality accurate instrument (Mitutoyo thickness micrometer) will have thicknesses that will vary from .0140" to .0150" on most of the cases. Then the odd case will be thinner in one area, maybe down to .0138" and others will have a thicker part up to .0154". This sounds like a lot but these are actually regarded as the best quality cases. So the aim is to improve overall thickness uniformity and at the same time to not reduce that overall clearance of the loaded round by too much. In other words, it’s a compromise. So I would pick a thickness of .0142” to set the neck turner tool cutter.
Notice I am talking of measurements here to the ten (10) thousandths of an inch. (0.0001”)
What this means is we will remove material from all cases, some will have material removed 100% of the way round and others will have patches where the cutter will not touch because they are thinner in one area. This may at first appear odd. Some might say why not set the cutter so each case is turned to a thickness of .0137” for example and this will ensure that each and every case is machined 100% of the way around each neck. Well that is true but this will mean that our clearance has been reduced for the rifle chamber maybe too far. With a neck thickness of an extra ½ a thousandths and when the cartridge is loaded we measure across the neck area and find that is one thousandths smaller than my choice where I machined to a thickness of .0142” . This is because included in the measurement here is the neck thickness on both sides. So in other words a reasonable compromise needs to be found and one that in practice finds us improving the overall concentricity by about 80%. That is significant enough for the purpose in a standard or factory chamber size.

The tools used to do this job need to be quality “hand neck turners” and not attachments onto case length trimmers. If you need to neck turn, you need quality tools to achieve a desired result. It is not a very easy job but must be done properly. That is why we sell the K&K range of neck turners. These tools can be used with the aid of a cordless drill to drive the case but their definition is still a “hand neck turner”.
If we also use quality reloading dies, possibly with an interchangeable neck size bushing system (LE Wilson, Redding, Forster etc) then by choosing different bushing we can control the neck tension and whatever we choose (tight or loose) will be the same for each and every cartridge case.

So without running a whole course here on Advanced Reloading the essence is that if we have prepared our cases properly, we seat a primer properly with proper tools (eg K&M hand priming tool) and that will seat each primer to the same depth as we will have machined the bottom of the primer pockets, the cases will have a uniformed flash hole and also deburred that flash hole inside and equal depth (not like other brand flash hole tools do). The resized cases will all deliver the same neck tension because we outside neck turned them and as we are seating the projectiles using quality “in line” seating dies (eg, Wilson, Redding competition and Forster competition) the end result will be straight cartridges with bullet tension the same and each case should be close to same shape and dimensions as each other. The result is obvious. Overall accuracy though is dependant on the other factors previously listed (rifle, projectiles, load, shooter). Still it’s an example of we can undertake to eliminate some of the errors.

If you were going Formula 1 motor racing you would not consider making sure that each and everyone of your tyres were exactly the same, would you? Well even if you are not Formula 1 racing, maybe a cheaper formula, you still want best possible performance. Ensuring you can “tick as many boxes as possible” IT IS SOMETHING THAT YOU CAN DO.

I hope this helps explain a little.

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2011.

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