CHAPTER 12

OilHead GS Wheel Tightening and Truing

Where Nightmares Become Reality

And/Or

Wheel Hurling Is Nominated As An Olympic Event

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Gather round and listen closely while I tell tales of daring do (or maybe that should read daring don't)

I STRONGLY recommend that this entire document be read at least twice (or until it in makes a guest appearance during sleep☺) so that ALL of it has a chance to fully impact on ones head. Proceed at your own risk, do not pass go, do not collect $200, Your results WILL vary, Rated RA (recursive algo-rhythms in force), Do not drive while under its influence... Yada, yada, yada...

Legal-nees Department

First off, lets set the record straight, this procedure is complicated, involved, and requires patience, skill, all of the tools and parts listed, lots of time, intelligence, curiosity, a cool head, and the willingness for me to take responsibility for my own actions. If I royally fuck up my wheel I have no one to blame but myself. This procedural guideline is nothing more nor less than a written description of what is involved with this advanced maintenance. It does not guarantee success nor does it even explain everything I need to know. If I felt that this work is be beyond my ability, then I shouldn't attempt it thinking it will make more sense as I go along, it most likely will take me to places I would rather not experience. In short, I need to be realistic about my own capabilities, talents and ability to know when to call it quits and seek professional help (perhaps for both me and my wheel). The people who have collaborated on this treatise are more than capable of laughing at me while they help me out, **BUT they assume ABSOLUTELY NO RESPONSIBILITY for my attempts at this procedure. I'm completely on my own.**

The single, and highly litigious, issue of liability alone is reason enough to explain why this information has not been readily available and why this paper is for **RECREATIONAL AND INFORMATIONAL PURPOSES ONLY…** It is not intended, nor meant to be used as, a guide in truing your own wheels. If YOU should decide to use this information for purposes other than its intended and stated purpose, realize, you do so at your own risk and expense. It is more than possible that you will turn your perfectly useable wheel into so much junk, requiring many hundreds of dollars to repair.

This paper was written so that I would become familiar with what is involved with the process of truing GS wheels. It was meant to help me determine if my wheels are in need of being trued.

IT WAS NOT WRITTEN SO THAT YOU COULD WORK ON YOUR OWN WHEELS.

There are many reasons BMW recommends **WHEEL REPLACEMENT** NOT **WHEEL SERVICING**, those reasons are still valid and still apply here… Even experienced wheel smiths recommend leaving these wheels alone.

Note, If I found that my rim was out of tolerance and my bike was still under warranty, the most effective path to take would be to have BMW replace the wheel. It would save a

bunch of money and hassle for me and also get the point across to BMW that these wheels need to be right.

Having said all of the aforementioned and keeping in mind that there are people who make their living at performing this task, it doesn't mean that I COULDN'T true up my own wheels. It does mean I need to approach this job with an open mind, have reserve funds available and **PROCEED SLOWLY, DELIBERATLY, and with DELIGENCE and be AWARE WHEN I'VE REACHED MY LIMIT**. This job is more art than science; it takes more feel than measurement, and REQUIRES a full measure of applied grey matter.

There are several themes that I have repeated, over and over again, for a reason. They are an essential element, if I am to have any hope of being successful, to any degree, with knowing if my wheels need adjustment. There are no shortcuts, I don't want to kid myself and assume that just because I wrote this that somehow I'm special (unless I really want to ship my wheel off to someone who IS special by special delivery, just to prove the point).

These procedures are based on what works for wheel smiths who have experience you and I will never know. They have condensed years of practical working knowledge into a few guidelines that (if carefully followed) can result in a properly trued and torqued wheel, nothing more.

At the end of this missive is a list of resources that will be both helpful and potentially wheel saving (that of course assumes that I didn't toss the whole fuc***g wheel across the room). Which introduces the next topic of discussion, that being how good is good enough (or put another way how bad can my rims be and still be useable). Now we are talking about MY wheels here after all, you know, the ones I ride on, down the street and on the freeway… If my wheels fail, I go SPLAT. Wheels are even more fundamental than brakes (and I know, I REALLY don't want to experience brake failure). Same thing here, only much more basic and involved and immediate.

OK, what's going on here,

If I start out with the ASSUMPTION that my rims, spokes, center hubs, tires are all factory perfect, everything should just align up, slick as cow slobber…

Now lets examine that assumption… Have I ever hit a large rock that nicked a rim? Ever run thru a pot hole that could high center one of those lowered 'sports cars'? Ever dropped the bike after hitting something on the ground? etc. etc. get the idea? Any one of these events (and countless others) could have permanent metal shape altering consequences. This means the possibility of having a perfect adjustment, where everything just falls into place, is reduced virtually to nil. Even IF all of the individual parts ARE unaltered (by whatever means) the likely hood that all of them are without flaw or blemish and are perfect, is remote. The point here is the task of truing the wheels can compensate for some imperfection, and in some cases quite a bit of imperfection. But how would I know when the parts are too far gone? That is where BMW's specs come into play, (as well as my own acceptable margin for error).

I also need to keep in mind that once the adjustment process is started there is no turning back. Once that first adjuster has been twisted (unless I'm extremely lucky) I can't reverse even that one action and return to my starting point. I'm committed, I'm in up to my eyeballs etc…. There are however a couple of steps before I reach that point of no return (that only a fool would skip) and from which I can potentially save myself copious quantities of unnecessary grief.

First off however, I need to outline my plan of action so that I will know what is required for the task at hand.

The First Step: INSPECTION Visually inspect the state of my rims, spokes, and hubs while they are still on the bike. This Step can easily save me from untold grief.

The Second Step: SETUP Prepare the wheel for adjustment. This Step (and its counterpart, re-assembly) entails almost all of the hard work. I will need to take the wheels off the bike and remove the tires from the rims. Then the wheel assembly needs to be mounted in a stand or other similar fixture (I've heard that some people can perform this adjustment while on the bike). The front wheel is the easier of the two since I can use the bikes axle to support the wheel. The rear wheel has no axle, so a suitable (and stable) means must be devised to support it.

The Third Step: ADJUSTMENT This will take many hours (I guestimate from 5 to perhaps as many as 10 hours PER WHEEL), so I will strive to make myself as comfortable as possible. Also by minimizing as many distractions as possible I will greatly reduce the level of frustration and potentially avoid a wheel hurling event. Once this Step is completed my wheel should be as good as new (or at least close) and my spokes will be sing'n in the rain once again.

The Fourth Step: RE-ASSEMBLY Remount the tire and balance the wheel. Then mount them back on the bike.

The Fifth Step: FINAL CHECK Lastly, I will check the vertical and horizontal runout of my rims while on the bike (just like Step 1) and verify that nothing drastically changed during Step 4 (this could also be accomplished when I balance my wheels using a balancing stand or similar apparatus).

STEP 1 INSPECTION

This Step is critical. It entails a complete visual, (and auditory) inspection of the rim, spokes and center hub and gives me a rough gauge of how far out of round my wheel is at the very beginning of this job. What am I looking for? Any evidence of physical damage, loose spokes, loose (or missing) set screws, scarred or mangled metal, in short anything that is not 'right'. These details might just be vital in determining if I will proceed further, or to hand the job over to a wheel smith. I will have to make the call (both figuratively and factually).

After visually looking over the rims, spokes, and hubs, I'll next take a screwdriver (or similar tool) and lightly tap the spokes while rotating the tire and listen to them. If they are all tight, the sound I'd hear would be like a bell or 'live metal'. I'll probably hear many that sound of heavily damped thuds and clunks not tings or pings (or most likely a mix of the two). Some might not even ring at all, they will sound completely dead. Those dead spokes might just be broken or are

so loose that they will wiggle if I try and move them with my fingers. These spokes are not carrying their share of the load and can cause other spokes to break due to uneven load sharing. If there are lots of these 'dead and un-carrying' spokes, it would be cause for concern. It usually means that the wheel can't be round and true (especially when under load). Next is to setup and test for the horizontal and vertical runout. Whatzat you say??? I'll use a stick or a pen or similar object that tapers to a point and hold it steady (against a fork leg for instance) and aim the pointy end at the side of the rim and spin the wheel (I'll be sure and not let the tip get caught in the wheel). I'll be looking for the amount of deviation from true, both side to side (horizontal deviation) and up and down (vertical deviation). I'll keep in mind that BMW's specification for these 2 tests are 1.3mm horizontal and vertical MAXIMUM deviation. If my rims show even 1/2 inch (or more) of movement I'll know I have a MAJOR problem. Most likely it will be nowhere near that bad.

Types of defects and what they mean.
Now that I've seen how my rims spin in 3d space I need to re-acquaint myself with the more common types of defects and what they mean. First off, we are dealing with 4 degrees of movement (up/down and left/right) and my goal is when the wheel spins, the rim (and tire) rotate in a perfect circle with very little or no deviation from true. The dance I just saw my rim perform probably wasn't all that close to scribing a circle (unless I'm really lucky). Upon closer scrutiny, the movement of the rim can be described as a series of wiggles or deviations away from (and back to) the perfect circle. Some of the wiggles are fast and occupy a relatively small amount of rim arc while others are slower and involve larger sweeps of arc. Still others look like a divot and are probably associated with an impact point. Flat areas are notable for 2 reasons, if one exists and is the result of an impact (the spokes are loose) the only real solution is to replace the rim (it's wheel smith time). The other type of flatness in the rim is due to excessive spoke tension pulling it flat, this can SOMETIMES be adjusted, depending on the severity of the flat spot.

These various different behaviors all relate to different types of imperfections in the wheel AS IT EXISTS NOW. This means the sum total of all of the forces that have acted on my wheel and has subsequently deformed it, has resulted in the wheel I just observed. Except for major impacts or defects in individual parts, most of the deviations can be adjusted back out. That's the good news, the bad news question is, do I have the 'right stuff' to be able to make the magic happen?

At this point I need to make a decision based on my visual, auditory and out of roundness observations on whether or not I will continue with the procedure or to hand it off to a wheel smith. It's my call, I'll use the resources at the end of this write-up if I have to, but I WILL NOT neglect an unsafe wheel.

STEP 2 SETUP

I won't go into the details of wheel removal, nor tire un-mounting. Nor will I cover supporting the wheel for spoke adjustment, there are just to many different ways of accomplishing this to cover them all. I will cover several guidelines for sidestepping a few pitfalls that can (and should) be avoided. I'll make sure my wheel stand/setup is secure (I don't want to develop a horse voice if it falls over). I'll make sure the axle is level. If my wheel wobbles on the stand

but the axle and the stand are stable I may need to pre-load the bearings in the wheel. If I use dial gauges I'll make sure the readings are repeatable and accurate before I believe them.

I also need to monitor both the horizontal (side to side) and vertical (up and down) portions of the rim. The BMW manual states that the only areas that should be used for this are on the inside of the rim where the tire mounts to it. There are 2 machined surfaces that are suitable for this purpose, these surfaces are why the tire was removed. Can other surfaces be used? Yes, but I can't rely on them to give me the degree of accuracy needed until they are directly correlated to the 2 machined surfaces. This correlation will come in very handy during Step 5.

The easiest means of determining the deviation of my rim will be by using feelers. These are rods or sticks with a pointy end that can be positioned near the surface of the rim to check for out of roundness of the rim at that point. It will be much easier to move a rod around than have to continually re-adjust and reset a dial indicator as the degree of rim deviation varies as I make adjustments. I also would like to use 2 feelers (where possible) for each axis. This provides additional visual clues that can be rather helpful. I'm told, once I see it I'll believe it. Numbers from dial gauges are fine but they don't really tell the whole story of how the rim behaves while spinning. That should prove to be really important in Step 3.

Once I get my feelers (or dial gauges) in place, I'll need to 'map out' the rim. At this time it really needs to be only a cursory, but complete, evaluation of the deviations of my wheels, much like what I did in Step 1. I need to be sure to write down (on either the rim or a sheet of paper or both) the types and number of deviations that I see on the entire rim. This is my next to last chance to fully evaluate how much my rim is out of round. Also I will make another auditory test of the spokes and mark the 'dead' ones as I explained in Step 1.

Up to this point I have not made any irreversible changes to my wheels. In fact what I now have is the perfect opportunity to ship my stripped down wheel to a wheel smith and let *him* qualify for membership in the hair club for men, on my behalf.

STEP 3 ADJUSTMENT

Forward - We have Rules you Know!

First Rule of Thumb, make only small adjustments at a time. Make 1/16th of a turn (about 20 degrees of rotation). I can't emphasize this enough, too much, too fast, will send me off the deep end and turn my brain to mush (and it's my 2nd favorite organ **:-)**
Second Rule of Thumb, go slowly, check where I am after every adjustment. DO NOT assume the adjustment I just made produced the expected results.
Third Rule of Thumb, either lubricate ALL of the adjusters AND set screws or NONE of them. No halfway measures here.
Third Rule of Thumb Subpart 2, torque value readings will be different between lubricated and non-lubricated adjusters and set screws.
Fourth Rule of Thumb, expect the unexpected. These wheels are very strong and also EXTREMELY sensitive to even the slightest change of spoke tension.
Fifth Rule of Thumb, DO NOT OVER TORQUE. The dynamics of stressed structures when suddenly over stressed can be quite impressive.

Backward

I am reminded that once I begin making adjustments I will probably start seeing more pronounced deviations and it might seem as though I'm going backwards and only making the situation worse. All of the defects mentioned in Step 1 could become much more acute and I'll need to begin to correlate how the rim reacts to the adjustments made. Part of this 'making matters worse before they get better' is in part due to making any change in a structure that previously hasn't been adjusted before. The single act of breaking the adjusters loose is enough to throw the entire structure into spasms (which is, in part, why the suggestion is made to lube the spoke adjusters).

This is where the art kicks in. Any out of round deviation is the result of all of the forces that exist in the wheel, not just those that appear to come from the spokes that are nearest the deviation. The forces that pull the rim out of round begin 'before' the deviation and continue 'after' it. In other words a wheel is not a linear structure by any stretch of the imagination. The amount of correction applied to a deviation needs to be made in a progressive and graduated fashion depending on the specific nature and severity of the deviation. This fact will become much more obvious when making adjustments.

Additional thoughts about lubricating the spoke adjusters and set screws.

As a long term preventative solution to known corrosion problems it is usually a 'good thing' to lubricate any threaded adjustable metal to metal parts. Our spoke adjusters and set screws are no exception. They are exposed to all manner of weather conditions and are frequently found to be corroded. Proper lubrication helps keep corrosion at bay. This allows all of the adjusters to move more freely and also insures that the proper torque is set on the spoke adjusters. Besides the specialized spoke prep compound found in bicycle shops any number of lubricants and elixirs will work. WD-40 is NOT recommended, it will in fact, attract water and accelerate corrosive activity once it has dried out and turned into a white crystalline powder like substance.
A penetrating oil with anti corrosive properties (such as Rost-Off) works well as will plumbers penetrating oil (liquid wrench) but they won't last long. Anti-seize (both copper and aluminum based) will last much longer but will require disassembly to apply. Tri-Flow (it has Teflon™ © ®QÐ mixed in) is in the middle between penetrating oil and an anti-seize paste and works well but needs to be worked into the threads. Once I decide to lubricate the spoke adjusters and set screws, then the sooner I do it the better. Whatever I use, it will take time for the lubricant to wick into the threads and do its job. By now it should be evident that I think lubricating the spoke adjusters and set screws is a 'GOOD THING'.

Go Ahead, Be A Deviant (what you need to know first)

And now for the part we've all been waiting for… just how the f*** do I get all of those wobbles and squiggly shimmies and shakes out of my rims???? Well, send only $19.95 and 2 box tops to the address below and we'll rush, by a uniformed representative of the US government our secrets of wobble removal, with no further obligation on anyone's part…. Just kidding!!!!

The procedure is simple, I just need to twist those little 40 torx or 5mm spoke adjusters until the rim is round again!!! Now the hard part… how to know how to twist which adjusters, which way, by how much, and in what order.

These wheels are 'goofy' and EXTREMELY sensitive to small adjustments, the **First Rule of Thumb** is repeated here for a reason, 1/16th of a turn at a time, NO MORE. Why? During the visual inspection I noticed that the spokes not only cross each other, they also cross over to the opposite side of the rim. This 'feature' is quite unusual and explains why these wheels are so sensitive. The amount of leverage the spokes have on the rims is very high. Making an adjustment by adding tension (or lessening it) causes the rim to want to pull from side to side (horizontal movement) far more than vertical. Which means (and also partly explains BMW's claim why no vertical runout compensation is possible) it will be far too easy to shift the rim from side to side. Adjusting the vertical axis will take more finesse.

This job has a mental component that has no equal in terms of usual mechanical skills. The reason this job will take me (I figure) at least 5 hours is due to several reasons. The **First** and **Second Rules of Thumb** means taking small steps, which means I'll wind up taking lots of steps. This approach insures that I won't overload any more of my grey matter than necessary. It also helps to correlate all of the variables involved; spoke tension (or lack of same), rim deviation in 4 directions and on both sides, how all the adjacent spoke tension (or lack of same) affects the rim deviation in 4 directions on both sides etc…. over the entire rim. I know I'm dealing with a stressed structure that is designed to flex, shift and spread complex loads over the entire structure, and all I can do is (thankfully) change one parameter at a time.

The essence of how to change the shape of the rim goes like this. When I add tension to a spoke that attaches to the left side of the rim, it (the rim) will want to move to the right, as does the reverse, less tension, same spoke, moves the rim left. More tension to the spoke on the right rim will move the rim to the left, etc. This type and rate of change of the rim is much higher on these wheels than 'ordinary' ones. This can be considered a good thing IF I MAKE SMALL ADJUSTMENTS see **First Rule of Thumb** AND **Second Rule of Thumb** AND **Fourth Rule of Thumb**. If I really want to hurry it along and ignore the **First** and **Second** and **Fourth Rules of Thumb** I will do so at my own risk (and expense)….

According to BMW, it's not possible to change the vertical runout by adjusting the spokes, we don't agree. BUT, keep in mind it will take much more effort and finesse to move the rim a smaller amount vertically, than is possible side to side AND keep the rims deviation from side to side within acceptable limits. Put another way, making (relatively) large side to side adjustments are easy (perhaps TOO easy) while making vertical adjustments are very much harder and involves a much smaller range of correction.

The Operation (Nurse, hand me the…)

Remember in Step 2 where I examined the rim in a cursory manner? Well now its serious. I need to make a map (on the rim is usually best) of all movement in the 4 directions AND the vertical deviations on BOTH sides of the rim, AND mark which spokes are loose, which are tight and which flop around (dead and uncarrying). This will also help in correlating rim behavior to spoke tension (or lack thereof). Way back in Step 2 we covered the different types of deviations and what they meant, now we will take this knowledge and add it to the map of the rim I just made.

A handy and convenient method of marking the rim is to use the marker and trace on the rim from start to finish all of the long deviations with the max change noted in the sweep of the arc. I'll do this for both the vertical and horizontal deviations. Next I'll mark off the short deviations and lastly mark off the very short 'divots'. If there are none of the divots or the short deviations I can count my blessings, at least for now.
I can use different colors or use arrows or any combination of systematic marking that makes sense and works. I need to keep in mind that the markings will (hopefully) be in a state of constant change and I'll probably (at some point) erase large portions and re-mark the rims just so I can read them, again.

In the center of the 40torx or 5mm allen spoke adjusters are 2mm allen set screws. ALL of these need to be loosened about 2 full turns out (and be lubricated, or not depending on my decision to Rule of Thumb #3) before I can proceed further.

Next I'll use the special torque wrench and measure the existing torque on ALL of the spoke adjusters. If the lubricant has worked itself into the threads these readings MAY be semi meaningful. If no lubricant has been added all I can really tell is which ones are more loose relative to others, with the exception of broken spokes and dead and uncarrying spokes that wiggle by hand.

The BEST method for checking the existing spoke torque is to set the torque wrench at a low setting (below the minimum range set by BMW) say 1 or 2 Nm and check all the spokes. I'll mark those that fall into this range. Then proceed up the scale till I hit the max allowable torque of 5Nm, marking the spokes as I go. I might group them into ranges based on how they measure up but I need to measure ALL of them. If some spokes exceed 5Nm they need to be marked as such…

Now I will shift my grey matter engine into overdrive and correlate the loose spokes with the vertical high spots on the rim. There *should* be a direct relationship between these 2 observations. It should also be apparent that the rims vertical deviation won't necessarily be the same on the left side as on the right side. In other words the left rims vertical deviation and the right rims vertical deviation will most likely be different. This one axis is of primary concern while the side to side deviation is of secondary importance. Remember that moving the rim side to side is FAR easier than moving it vertically (changing the rims radius at that point). In other words the axis that is easy to change is of secondary importance while the more important axis is more difficult to control and change.

As a general rule loose spokes mean that the rim will move up (have a larger radius) and tighter spokes the reverse (smaller radius) with of course the rim wanting to shift right or left.

The finesse (or art) comes into play when I then shift my grey matter from overdrive into hyperdrive and use an incremental and graduated range of adjustments over an area that extends beyond the arc of the deviation. BUT and this is EXTREMELY IMPORTANT, I NEED TO COMPLY WITH the **First** and **Second** and **Fourth Rules of Thumb**. Again, stated another way the ***total*** amount of adjustment applied to each spoke as I sweep thru the arc of deviation will increase as I approach the maximum point of deviation and then decrease as I finish moving thru

the arc. BUT I need to apply **First** and **Second** and **Fourth Rules of Thumb** as I work out the deviation thru the entire arc. This method applies to large arcs as well as the divots and everything in between.
Now to re-cap. I have the wheel setup, the feelers in place, the rim marked, the spoke adjusters and the set screws lubricated, an idea of what I'm looking at and an idea of what to do next. Hold up there bucko, there's still more to consider. What my ideal mental construct should look like is, I want to minimize the horizontal (side to side) movement while controlling the vertical dimension on BOTH sides of the rim and at the same time eliminate all unwanted deviations and bring the rim back into true and wind up with the spokes being torqued within the acceptable range of 3.5 to 5Nm. Simple, No Fuss No Muss…. A child could do it, say, where is that kid when I need him?

Deviant Behavior

One last mental picture that needs to be firmly planted in my head is the dynamics of stressed structural systems. In my mind I'll picture a sandbox where the sand is nice and smooth and level. Then all of a sudden a meteorite comes crashing in from space and impacts the middle of the sand box… Now it's not a huge chunk of space rock, not even large, just about the size of a pea.. After impact and after the dust has settled, I'll see a crater that has been formed. The crater has been defined by a ridge of sand that was thrown up, to the outside edge. In cross section the crater would show a peak of material at the 'start' of the crater then the level would gradually drop down till I was in the center then start back up the other side and peak again at the other side. Ok, nice picture and all but WTF??? This cross section is what the deviation looks like in whole on my rims. Albeit stretched out and laid down on the arc of the rim. The point here is, those peaks at the 'start' and/or 'finish' of the 'impact zone' are where a good deal of the energy went that created the deviation in the first place. In one sense what we are doing is 'moving' material back into place such that the rim is round again. Those peaks need to be relived of the stress they carry and then we 'encourage' the rim to fall back into its normal shape.

Now Here's What To Do

I'll start on one of the long arc problems first 'cause its easier and I'll see better results faster. Find the high spot and loosen the spokes first (whaaa??? That's what I'm supposed to do…) yes, loosen 4 or 5 spokes on either side of the peak of the deviation on both sides of the rim and in a graduated fashion. Then I'll add tension to the peak (on both sides) and taper off the adjustment as I move further away from the center. Did I check the rim using the feelers again? Then repeat, remember **First** and **Second** and **Fourth Rules of Thumb.** Make small incremental adjustments and then check the rim after every change.

I have just passed over the threshold of no return, where sight and sound begin to merge, I have just entered, the twilight zone.

Now, remember those peaks from the impact zone? They need to be loosened and then tightened to help 'encourage' the ends of the deviation to move back into the middle of the arc. Once I begin to make adjustments those peaks might just pop out even more, that's when I go after them and then return to the middle of the deviation and work it back out. I WILL remember to check my work after EVERY adjustment (**Second Rule of Thumb).** After a while I'll be able to fine tune the amount of adjustment in a more beneficial way based on feel and by knowing that the

amount of change needs to be adjusted differently for every spoke, based on where it sits in relation to the rest of the spokes in the arc of deviation.

This loosen then tighten routine ONLY applies when I make a change to a spoke for the first time. The initial loosening lets the spoke 'unfreeze' itself so that the rim and spoke CAN change. The tightening after then IS the adjustment.

Now once the largest arc of deviation is down to a more manageable size I'll move on to the next arc and turn it into an arc of triumph (sorry, I couldn't resist), and so on… Now if only it were just that simple… But once the biggest deviations are down I'll probably start to see interactions between them all. This is where the additive and subtractive effects kick in (I WILL REMEMBER to keep my rim mapping up to date thru all of this). Some 'new' peaks will develop and then disappear as I chase the deviations and reduce them from one area only to have it 'move' to another. As the magnitude of all of the deviations drops and they all start to look the same, they sometimes will overlap each other, and some can cancel each other out. Once the rim is fairly consistent, then its time to begin adding torque so that all of the spokes are within the specified torque range AND keep the rim round (or at least round enough).

And Now For Something Completely Different

As an alternative, there is a FAST TRACK that might apply, if and only if, the rim and spokes are in really good shape and only need to have additional torque added to ALL of the spokes to bring them back into spec. This approach could work if all of the spokes are just under torqued about the same amount (there are no dead and uncarrying spokes).

If the conditions are favorable I might elect to attempt this Fast Track approach thusly… First, I'd back the first spoke adjuster off just enough to unfreeze the spoke as I explained above. Then I'd add tension and tighten the adjuster back to the starting point, and then add a $1/16^{th}$ of a turn (about 20°) of additional torque, AND DO THIS TO ALL THE SPOKES IN 1 BIG STEP. Then I'd check the runout on the rim and see what happened… The rim is either still fairly close to where it was before the BIG STEP or it's gone way sideways on me…. If I chose wisely and the rim is now tighter but still round, I can continue with the Fast Track approach as described next. IF on the other hand I chose poorly and the rim is now a roller coaster, (and my head didn't explode) it's back to re-maping the rim and following Step 3 from the start.

I'll use that special torque wrench and measure the spokes just like I did before, only this time I'll pay attention to minimum and maximum values that I find on the spokes. What's needed is to gradually and slowly add tension uniformly so that the minimum torque is at 3.5Nm while not exceeding 5Nm on the tightest spokes AND keep the rim round. This will take a good deal of time and I may have to take a half a step back and 'reduce' a deviation that pops up. I'll gradually and incrementally increase the torque of the spokes such that the wheel is within spec AND stays round… If I am really lucky and the spoke tension falls within a tighter range than 3.5Nm to 5Nm then I can continue to add torque to all of the spokes and raise the spoke tension up to the max of 5Nm.

Lastly, once the rim is torqued, true, and ready, I will correlate the inside of the rims to the outside. This final bit of grey matter fixation will allow me to tell how true the rim is after the tire is mounted up.

STEP 4 RE-ASSEMBLY

As the repair manual states all too often "Installation is the reverse of the removal procedure". And I shall try not to whack the rim when mounting the tires back on. Note to myself, it is imperative that I re-balance the wheels after the tires have been re-mounted….

STEP 5 FINAL CHECK

Remember that last thing I did in Step 3? That was to correlate the inside readings of the rim to the outside of the rim. Now that the tire is back on (and we no longer have access to those 2 machined surfaces) the only way of checking to see if the rims have significantly changed is to check the outside of the rims.
This is also a further test to see if the rims are truly round with the tires on. This check can be performed while re-balancing the wheels if I do that myself. If not, then I'll use the feeler against the fork trick (Step 1) and spin the wheel to check to see if anything has changed. Knowing the relative roundness of my rims as seen from the outside can be quite useful should I ever suspect a rim after taking a hit and wondering what just happened (on the road for instance).

FINAL TALLY (HOE!!)

Now all of this is fine but what's it going to cost to send the wheel off to a wheel smith and have him work his magic vs. get all setup and do this myself. Well, that depends on two factors; how much equipment I already have, and how much needs to be done to my wheels. For example a straight wheel truing job will run, say in the $2-300 range (perhaps less if the wheel is in really good shape to begin with) PER WHEEL. If the rim needs to be replaced (flat spot or major nick or white rings around an impact point, the rim is beyond a simple truing job and is really only good for playing in the dirt (at best). Which means the rim needs to be replaced, and will cost more, say about $350 to $450 again, PER WHEEL. It should be noted that these numbers are MY guestimation only, there could be a great deal more latitude in the prices based on your particular situation. Use them as a guide.

How much will the equipment for this job run? Well lets assume I have all the 'regular' tools available but I will need the special torque wrench Sears has one (.2 to 4Nm), for $150. Then the rear wheel adapter ($118 or $84) from BMW and a shaft will run either $140 (BMW) or $20-$25 for an after market unit (see Rod Neff in the resources section). Then there is a wheel stand or some such... One possibility is a wheel balancing stand (that would solve 2 needs at once). They can cost about $110 +/- (again see the Rod Neff listing in the Resource section). Plus there is the cost of mounting/unmounting and/or balancing the wheels before and after the truing is done, about $50 to $60 at a M/C shop, or I just might have the means already… So it all adds up to (and the envelope please) from $400 to $500 for the equipment alone (or more if I want really tweeko tools)… In other words it's roughly the same money if I were to have someone do it for me as do it myself (IF I so choose and decide that I can). In either case, experience has shown that I probably won't need to do it again for quite a while (unless I screw up the job). In the worst case my costs would double but at least I would now have all of the tools to try and do it again and some of them are useable for other tasks (the balancing stand for instance).

To put these costs into perspective the cost from BMW for a new wheel is $580 each (F & R). The rims alone are $214 each (F & R). These are prices for the 1150, I would assume the 1100 has similar pricing. Also keep in mind that if I do purchase a new wheel, it too will need its spokes re-tightened once they loosen up after a few K-miles (or sooner).

TOOLS

2mm allen to release the set screws
40T torx for the 1150 - 5mm allen for the 1100 spoke adjusters
really long extension (about 10 inches) to clear the other side of the "spider"
straight handle for VERY easy turning
ratchet for NOT so easy turning.
TORQUE wrench for final turns
soft but rigid feelers
lubricant to make the head turns easier See **Third Rule of Thumb**, and **Third Rule of Thumb Subpart 2**
a temporary (or semi permanent) MARKER

BMW Specifications and Comments

Horizontal & Vertical runout (max allowable)	1.3mm (.05)”
Horizontal runout (max allowed to be reduced to useable limit)	2.0mm (.08)”

Vertical runout cannot be compensated for by centering the rim*

Spoke adjuster torque	3.5 to 5Nm (2.6 to 3.7ft-lbs) or (31 to 44in-lbs)
Set screw	1Nm (.7ft-lb) or (8.8in-lbs)

* This is a direct quote from BMW’s repair manual.
NOTE: The allowable runout amounts are HIGHLY conservative.
These torque values are very small and require an appropriate torque setting tool to be accurate. Also note, your hand can easily generate more than 7ft-lbs of torque.

Terms and definitions

Spoke Adjusters aka spoke nipple, 40torx spoke adjuster, 5mm spoke adjuster
Adjuster Set Screw aka grub screw, spoke lock, 2mm allen set screw

Additional References

Who to Contact After the Wheel Hits the Wall (or when you realize it probably will)
Ricardo Kuhn was instrumental in generating this paper, for more info, see his web site
http://www.motomacondo.com/
He will also have the latest updated version of this paper on his web site for download
contact him (510) 845-9645 or mailto:ricardo@motomacondo.com

Ricardo might be able to help you, contact him only as a last resort. He has for instance made up 21 inch front wheels for the GS. Since he is rather busy his ability to take on any truing job is limited.

Other wheel smiths, if you would like to be listed here, please notify me.

Additional Resources

Rod Neff has a wheel balancer that can also be used to support the wheels during adjustment. He also has additional details of the rear wheel adapter and axle and has a good write up on tire mounting/unmounting. Use the link below for a look at what he has to offer and for his e-mail address to contact him for more info.
Go here http://www.pbase.com/rodneff/2axis_adj_balancer

There are bead breakers and other tools available
Extreme Outback Products has a mondo herker unit the Motorcycle Tyrepliers
http://www.extremeoutback.com/Tire_repair.htm as well as other tools

TireQwik has a bead breaker and tire irons and a balancer as well
http://www.tireqwik.com/tireqwik/breaker.html

Craftsman has a torque screwdriver that almost covers range we need (.2 to 4Nm) for $150 search for part number 00934887000.

Sturtevant Richmont has a variety of torque wrenches and related tools
http://www.srtorque.com/index.html
Their 1 – 6Nm ratchet head wrench P/N 810774 has a price of $174

And of course Snap-On and Mac both have torque wrenches that will work with prices in the $180 and up price range

Last Thoughts

This paper was originally conceived by Ricardo Kuhn as a response to much mis-information that was being offered about the nature and purpose of the spoked wheels we have on our BMW GS's. Since Ricardo's mastery of the English language is somewhat creative, I volunteered to act as translator, editor, and scribe for this information. Ricardo is passionate about doing things correctly and I needed to know what was involved with the entire process, thus it was an ideal linkup, this paper is the result.

I would also like to thank John Macdonald for his technical advice and to help clue me into the tricky bits. The info both Ricky and John shared on the ADVRider forum was the starting point for this little missive (helped along with an extended question and answer session with Ricky Suave himself). I can only add that I KNOW that my wheels need to be torqued and trued, this was the motivation that prompted me to want to explore this in the first place. I knew that the process of writing all of this down would force me to become familiar with the procedure. And since I suspect that I'm not alone in needing to know this procedure, I figured I would 'share the love' as the ADVRiders would put it… If you have any questions or comments they can be passed along to me.

If YOU should decide to contact a wheel smith and ask for his skills to be applied to YOUR wheels, the specifics of what he requires and what work he will perform are based on his experience and knowledge. There are probably very good reasons why he will or will not be willing to provide the exact services you would like him to perform. If his list of services doesn't match your expectations, that isn't his problem, and I would ask that you please don't make it a problem, for either of you.

This is a work in progress, and as such additional input is welcome. Any additional information may (or may not) make it into this paper (with due credit given to the author) but know that all input will be considered… In addition, if you know of some list or forum that would welcome this info please either let them (and/or us) know and so that we can deal with the details. We only ask that should this paper be passed along, that it be complete and un-altered. This work in progress also implies that from time to time we might just update this paper with additional methods, techniques, resources, tools, whatever… Indeed, if you know of anything that would be useful, (wheel smiths that you have used in the past etc.) please feel free to send it to us. Ricardo Kuhn's web site will ALWAYS have the latest revision available. In addition if you would like to be notified of updates we just might be convinced to start a list to notify you of them….

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