

CHAPTER THREE

rear-Brakes For Dummies

Where Our Ham Fisted Hero Taunts DEATH Itself & Learns To Tell About It.

- Or -

Brakes?, BRAKES! We don't need no stink'n BRAKES! ! !

Javarilla
JohnJen
Marc

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Rear Brake Pad Maintenance For Dummies

Welcome Back...

What? Didn't get enough abuse the first time?

Ok, we've a fresh tome of typographical horrors and technical misdirection for your amusement.

Find yourself a couple hours, grab your wrenches and let's see if you can learn to inspect and do routine maintenance on your rear brake pads.

But first, A LITTLE MELODRAMA...

Welcome to the edge of the abyss. Last time we focused on "go". This time we focus on "stop".

As much as we all like 'go' it's way more important to be able to 'stop.' If you venture much further into this document, you're wrenching in the realm of death.

We'll lighten up here in a minute, but right now, you need to know that you WILL be diddling with THE SINGLE MOST IMPORTANT SAFETY MECHANISM on your bike.

So, pay attention, maggot meal, or we'll be buying parts from your widow.

Fortunately, BMW made this a pretty easy thing to do, and, despite some odd photos, and weird spatial-linguistic challenges, this isn't all that hard to do, and it doesn't take but an hour once you've got the process down.

And it's a great thing to know how to do, particularly if you ride hard and want to make sure that things are in good order. Hell, if you ride like JohnJen or Javarilla, you go through rears like butter – every trail braking dive, every overcooked wheelie, every rear wheel slide through a switchback – not to mention riding in the goddamn rain day after day after day.

So, getting good at this might actually save your ass – it will definitely save shop time and spondoolies.

BUT – HERE'S THE BIG CAVEAT...

OK, right off the bat we are going to be dealing with a few procedures and circumstances that range from being potentially destructive to plain old dangerous to men and machine. For this reason (and a few others) it is STRONGLY recommended that you read this entire chapter AT LEAST ONCE, BEFORE you proceed.

If normal common sense is ignored and/or these instructions aren't followed with an eye on safety and proper situational awareness, any number of 'bad things' could happen.

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We could make an extensive list of possible dire consequences ranging from breaking (or at least severely hurting) yourself, your bike, or any number of other people, places, and things.

We ARE NOT responsible for your actions, lack of same, nor the consequences (unless they're all good, in which case we will all bask in the limelight). We are providing you with a set of our experiences and procedures with the aim of helping YOU maintain the brakes on YOUR bike. As such YOU are the one performing this maintenance procedure and it's YOUR job to make sure that these procedures are performed properly. We are only providing the basic details of how we perform this maintenance function.

This chapter does not and can not be complete in every detail nor does it try to be. It assumes that you are familiar with many things concerning your bike and your ability to operate it and maintain it correctly.

If you have questions regarding, or are confused by, ANY of the material presented here, get them answered BEFORE you begin!

In short KNOW what you will be doing BEFORE you make the attempt.

It is YOUR RESPONSIBILITY to get all of this right!¹

Again. **Nobody** should be using this document to inspect or do maintenance on their rear brakes – or anyone else's rear brakes.

We do NOT accept any liability or responsibility for what you're about to read. This document was written purely for our own entertainment, despite the pains we taken to be as thorough as possible on the technical issues.

If you choose to work on your brakes using this document, and you have no prior experience with brakes, you should hook up with a master for a hands-on walkthrough.

If you choose to ignore all of this advice and proceed.

Be very careful!

Read very carefully!

If it is NOT CLEAR what to do, put down the beer and back away from the wrenches.

This particular document targets the R1150GS. R1100GS and R1150GS Adventure riders will be able to follow along with only minor differences. For example: many 1100's don't have ABS, so the whole sensor thing isn't an issue. For Adventure riders this procedure is pretty much the same, it's just that the caliper assembly looks a little bit different.

¹ Alright. We all know that the red print in the bible means something *really* important is being said. Well, the red print here isn't exactly God speaking to you, but you'd better listen up. Got it? Good.

Okay, with that outta the way, let's get started with the rear brakes!

Why Start with the Rear Brake Pads?

Well, we're ass men, and...

No, seriously, we start with the rear brakes because you can't fuck yourself up as badly if you hose it. Also, the rear brake assembly is actually quite a bit more complex than the fronts – so it's a good test of your tolerance for mechanical anxiety and our writing style. Finally, you probably chew up rears way faster than fronts – at least, if you ride fast and hard through the twisties.

But, we promise, if you get the rears right, we'll move on to the fronts where you have a MUCH greater chance to bring your life, and not the bike, to a screeching halt.

Getting Started...

The best way to get started is to plan to do this NEXT weekend.

Why? To give you time to face your mortality. A week gives you time to:

- Contact your lawyer and get your affairs in order.
- Get drunk.
- Rump the receptionist one last time.
- Get the parts and lubricants and such in your grubby little mortal mitts...

Then, when you get to the shop Saturday morning, we're all assured that you're prepared to meet your maker.

The Parts List...

You're gonna need to get your hands on the following...

Sintered Rear Brake Pads. BMW, EBC, etc...

Sintered pads provide better braking performance because the embedded metal bits provides better braking performance. The downside is that they'll wear your rotor a tad quicker. But we like to stop when we need to (and sometimes we really, really need to), so stopping performance is our priority. Besides, Tad is just a yuppie anyway.

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BMW's Rear Brake Caliper Repair Kit.

This is a three piece kit consisting of a brake pad guide pin, a pin clip and an anti-chatter clip.



You'll also need to acquire the following Tools...

1. Brake Cleaner (not pictured)
2. 220-grit wet/dry sandpaper
3. Rear caliper repair kit BMW p/n 34 21 2 330 313
4. Couple 6 inch zip ties
5. Sintered rear brake pads (In this case, from der fodderlund)
6. Small (1/4" to 1/8") flat blade screwdriver
7. High temperature anti-seize or suitable brake grease for the brake components. (Yes, I know – when I first heard that, I thought “Brake Grease! We’re gonna GREASE our BRAKES! What the HELL! This guy is a MORON!” But it all makes sense. Play along a bit.)
8. Small 1/4" drive ratchet wrench with suitable bits
9. Silicon Grease appropriate for use on rubber materials (Heavy, silicon grease! For motorcycle parts! Now go put your daughter’s KY Jelly back between her mattresses!)
10. A couple more ratchet wrenches in the 3/8 size range
11. A couple of toothbrushes (for cleaning)
12. Torque wrench
13. A smallish, 3/8" to 1/2" inch thick block of wood or plastic
14. Mallet – to lightly punch out caliper guide pins.
15. A punch – not more than 1/4 in diameter.
16. A small 1/8" Punch – to lightly punch out caliper guide pins.

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17. Diagonal cutters – for the zipties.
18. Bunches of rags – to make your casket more comfortable.
19. Fancy Wire – used for holding the caliper out of the way. It needs to be stiff but relatively easy to twist the ends together and hold the weight of the caliper. We recommend either bailing wire or heavy safety wire, about 12” should be enough.

Oh – it’s a touch more pleasant to do this in the right environment. A lift saves some wear and tear on the back. Some girlie calendars add a certain flavor. Easy access to an aebelskeever maker is also a VERY good thing... This is JohnJen style.

Javarilla style requires a stool, hip-hop music, christmas lights, a skeletal audience and as many large breasted mermaids as you can bribe to hang around the garage/studio.

Are You Ready?

You’ve got all the stuff?

You’ve got your affairs in order?

The receptionist is out shopping with your gold card?

Great!

Let’s wrench, coffin stuffing.

First, Clean the Bike Loser.

Cheese-n-rice! Look at that. We’ll wait over here while you clean the bike!



Because, like your sex partners, we ain’t gonna touch it until it’s clean.



Pull the ABS Sensor

Pull the rear ABS sensor wire and rubber grommet from its cable anchor plate. It should just pop out with a little back and forth finger action. You're going to be wrenching around there and, very shortly, you'll be removing the cradle, so it's good to get the cable out of the way now. If it won't come loose then you will need to loosen the front caliper bolt first. You should not have to remove the bolt and when the sensor wire and grommet have been separated from the anchor plate tighten the bolt back down. You don't need to re-torque it because you'll be removing it later anyway.

MechAnnoyance

We suggest pulling the ABS sensor because we want to minimize stress on the sensor cable. You can sorta do this without wrenching on the sensor, but it's not a good idea. You'll be waving the brake assembly around in the air soon, you'll see why.



Next, you'll pull the ABS sensor, because you're gonna be waving that whole brake assembly around in the air in a minute...



Unbolt the ABS sensor – but don't start pulling it out just yet...



So now the ABS sensor is unbolted... Now, before you go any further...

MechAlert

BEFORE you start working the ABS sensor out – keep in mind the sensor is probably shimmed. Those shims rest **on top** of the sensor, and are held in place with the bolt you just removed. Once that bolt is pulled, there is nothing other than friction holding those shims in place. If you start twisting that sensor you could drop, damage or lose those shims.

This is NOT something you want to do - they calibrate your ABS sensor to your ABS sensor ring – you lose ‘em, your ABS may not work properly, and Javarilla gets cheap laughs at your expense.

Note: at most all that will happen is you’ll end up chewing up the end of the sensor and have to replace it, all the while not having ABS function because it faulted due to sensor failure.

Ok, so now your anxiety level is up and it’s almost inevitable that you are gonna’ munge your shims, so let’s do it...

Gently work the ABS sensor out by turning it slightly, maybe 20 degrees, clockwise, then slightly counter-clockwise. (For the Europeans and the sad-ass copy-cat Canadians – that’s countre-clockwise.) Repeat as necessary until you’ve worked it out a half inch or so...



Then get a hold of those shims...



MechASuggestion

Be careful here – you need to keep track of these shims, and not damage them.

Count them! Depending upon your setup, you may have none to 4 (or more), in Javarilla's case, 3 of these little suckers. The shims range from 'thick' to 'tissue-paper'. Be careful when handling and cleaning those thin ones. You'd hate to mess up your ABS alignment and meet your maker the next time you stomp down on a big hunk o' back brake on those rain-slick elevated steel bridges!

S'alright. Now work the ABS sensor out and you're safe!



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Now, take a minute and trace the ABS sensor wire back along the brake line. Depending upon how the ABS cable is routed down the brake line, you might find you need to clip the zip ties that hold the ABS cable to the brake line. This is no biggie – you'll be able to tell in a minute when you unbolt the assembly and start waving it around.

Loosen the Brake Pad Guide Pin

Now is a good time to loosen the guide pin for the brake pads. The key word here is 'loosen.' (For the Europeans and those SACCC, that's 'loosne'...)

MechAdmonishment

You do NOT want to remove this pin completely or things will start falling out of the assembly. Then we'll have to sit here listening to you grunting and puffing while we try to avoid the disturbing sight of that sweat sluicing off your fatback and down the crack of your ass as you snuffle around lookin' for brake bits on the floor of that pigsty you call a shop. Believe me, NOBODY here wants ANY part of that...

BTW::Did we mention that all of ADVRider has decided it's time for your ass crack intervention. Buy some suspenders, you gawd-damned walrus!

So here's the trick....

While the brake assembly is still bolted to the bike, let's remove the guide pin's retaining clip.



Now, this little clip is a springy bit. You go pokin' your tool in there and wankin' around and this clip is going to spring free and, our guess, it enters orbit – because we lose them all the time, and we never find them in the workshop. (That's actually bullshit, but we'd say anything to keep you from slingin' ass crack again!) This isn't a problem if you have the full rear brake pad replacement kit on hand – because it contains a new clip – but it is a problem if you're cheap like we are, and you're going to try to reuse parts...

So, with your screwdriver, maneuver the little clip around on the pin so that it's oriented so you can remove it by levering upward...

Then, put your finger on it...

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And gently work it free.



Ok, now, grab your thinnest and wimpiest hammer and the 1/8" punch...



And tap the pin just hard enough to make it move...



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You're only going to punch it through a centimeter or so... You stop when you can clearly see this expansion ring poke out the opposite side of the assembly...



That little expansion ring is all you need to see. If you push the pin further, you'll create a mess for yourself and make us blind. So stop, already.

Unbolt Rear Brake Assembly

Ok – so now you can unbolt the rear brake assembly... There are GREAT instructions on how to do this in your bike's manual, but here's the quick pic to keep you rolling...

First the back bolt...It does have a plain flat washer



Then the front bolt...It has the ABS cable anchor plate that also serves as a washer



Now, I'm sure we don't need to say this, but we're gonna say it anyway...

Clean the bolts!



MechaCleanlinessIsNextToMechaGodliness:

Push your fingernail into a **clean** rag, then into the threads and spin the bolt to get as much junk out as possible. You want the bolt clean enough to eat off – although, what you'd eat with a bolt remains unanswered and possible fodder for a federal grant...

[Javarilla Note: JohnJen is a real bastard about clean bolts, the least you can do is live my pain... What you get out of the exercise is this – humility (and judging from your posts to AdvRider, man, do you need some humility) and a certain perverse satisfaction that even if you NEVER wash your bike, you're ridin' one of the slickest, well-maintained machines on the road.)

Remove Rear Brake Assembly

Now let's remove the brake assembly. You don't want to just pull the assembly off the bike because, well you *might* scratch your rotor, but mostly it won't come off easy. The more worn your rotor, the more difficult this can be. So....

First create some clearance at the pads so you can lift the assembly off without forcing it off.

Get a good hold on the brake caliper assembly and tilt it into the bike... Here we're pushing into the bike at the top of the caliper with our palm, and pulling outward away from the bike with our thumb. We're NOT trying to lift the assembly straight up – there should NOT be any vertical or horizontal movement..

This twists the assembly around it's front to back axis, creating pressure on the caliper pucks and causing them to open up a bit. And we all like a wider spread. Cue: Everyone looks to the Girlie photo on JohnJen's Wurth calendar. (Javarilla Note: OutKast's 'Spread for Me' is a good tune for this little exercise.)

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Then reverse the motion and tilt the brake assembly back the other way... Here we're pushing in with the thumb and pulling towards us with the fingers.



Gently try to lift the caliper assembly straight up. And, at some point you can **easily** lift the caliper assembly off the rotor and away from the bike. If it doesn't lift without friction, keep rocking the assembly until it does...

Things

Now you've got the brake assembly off the bike, it's a good time to talk about how it works. The rear brake assembly is a pretty interesting piece of work, with lots of moving bits and odd dynamics.

Lets start by naming names...

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This is the rear brake assembly or caliper...



This slivery bit is the caliper carrier. This is the only bit that actually bolts to the bike. Everything else is free floating on this carrier.



This is one of the caliper carrier guide pins – it's under the rubber gaiter...



Everything else in the assembly floats free on these caliper carrier guide pins.

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We'll be paying quite a bit of attention to the caliper carrier guide pins under these gaiters – because if they're heavily scored or damaged, your rear brakes aren't gonna work for shit. This is the caliper assembly... This whole black cast assembly – note how it spans both sides of the rotor – is what squeezes the rotor.



Do **NOT** press brake pedal, OK? This would be bad.

Now here's the kicker – we love this part – this black caliper is the piece that does all the work, it's what promotes the slow, yet, it is **NOT** bolted to the bike. This thing floats free – riding only on the caliper carrier guide pins!

MechAmusings

Every time I get into the rear caliper assembly, the design of the rear brakes never ceases to amaze me. It amuses me to see how virtually every part that moves is only tangentially attached to the bike, yet virtually every part that transfers braking force is directly affixed to the bike. It all seems so elegantly kludged.

So we'll describe the dynamics of this whole assembly in sort of a backwards fashion then fast-forward to explain how it really works...

This piece contains the hydraulic pistons. Those pistons extend when you mash the rear brake. But, note how there are pistons on only this one side. Those pistons are in the bits that are **NOT** bolted to the bike. Hold on a minute – it gets weirder.



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As you mash the brake pedal, the pistons push the near side (or 'active') pad...



As the active pad makes contact with the rotor, the pistons continue pushing on the active pad – but, now, because the pad has made contact with the rotor, the pistons begin pushing the entire caliper assembly outward, away from the rotor. This is where the carrier guide pins come in - as the assembly continues to be pushed away from the rotor, it's riding on the carrier guide pins. (This bit here...)



As the pushing continues, the pad on the backside gets pulled toward, and eventually makes contact with, the rotor, et voila – both pads are engaged – and, slowing ensues. And here is where it is so weird that Javarilla freaks everytime he thinks about it – nothing supplying the slow is bolted to the bike. It's all just slidin' around like an excited dog on linoleum on those carrier pins.

This is the bad on the 'other side,' it is the inactive or 'fixed' brake pad...



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The backside or 'fixed' pad (and thus the entire caliper assembly) doesn't move much at all, mostly because when you let up on the pedal all that lets go and opens up (just a tiny bit) are the pistons and the 'active' pad. This is why the 'fixed' pad wears out faster. It doesn't get pulled away from the rotor, and if the caliper carrier guide pins are 'stuck or sticky' it can force the fixed pad into the rotor thus wearing it out even faster.

With all this sliding around, the brake pad guide pin takes some abuse, too...



If it incurs too much wear, it will adversely affect your brakes. In fact, it's possible for you to experience diminished rear braking just because of the wear on this pin. That's why the BMW rear caliper repair kit contains a replacement pin.

Take another look at the inactive or 'fixed' brake pad...



Note how it rests against the backside of the brake caliper assembly. That's why we say it is 'fixed' in place. This pad doesn't move much, in fact it shouldn't move at all (with respect to the caliper assembly). It is simply pulled onto the rotor as the 'active' pad is pushed into the rotor by the pistons.. Sounds easy, huh?

Well what really is happening is the fixed pad stays put (more or less) and as the pistons push on the active pad, which in turn pulls the caliper and fixed pad into the rotor and active pad. Then as you let off the pedal the pistons retract (ever so slightly), the active pad and caliper open up slightly and let the rotor spin freely. This also means that in effect it's the caliper that needs to move at least half of the total movement back and forth and it rides on the carrier guide pins, which if they get mucked up is why the fixed pads wear out so much faster. If the carrier guide pins (and the pad guide pin) won't allow the

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caliper to move freely then the fixed pads apply stopping force ALL THE TIME, and they wear out faster and suck down your fuel mileage.

MechaMortality Warning

This is important - we'll mention this several times throughout...

We're going to tell you to rotate the brake assembly. Be careful **not to kink** your brake hose when you manipulate the rear brake assembly. Kink has it's place, but it's place is on the internet and with strangers in distant bars. You do not want it near your brake hoses. You'll be twisting and manipulating this hose quite a bit, and it should provide plenty of feedback when you're twisting it too much – but be on the look out.

BEWARE - Breaking or mangling this hose can yield unspeakable pain and infinite silence...

Ok, now let's rotate the brake so we can look at the other side...

Do **NOT KINK** the hose! What? Did you forget **ALREADY!?!?**

REPEAT AFTER ME

“UNSPEAKABLE PAIN”

“INFINITE SILENCE”

“**DO NOT KINK THE HOSE!**”



Here's another carrier guide pin and rubber gaiter...

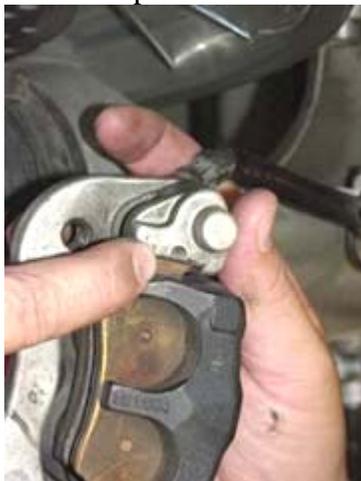
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Now carefully rotate the carrier in space so you can look at the brake pad's 'heel'..



And the 'heel' clip...



MechaMusing

If you ever wondered where all the force from the rear brake pads was absorbed – you're looking at it.

As the pads engage the rotor, the rotational force jams the brake pad heels into the heel clip at the 'front' end of the pads, and pulls on the brake pad guide pin at the other. That heel clip transfers the energy into the carrier, and from there, onto the rear paralever assembly. Little bits of metal doing Herculean things. Pretty insane, huh?

We'll pay a lot more attention to that heel clip later.

Not only does it take the brunt of the braking, but it also incurs some lateral movement of the brake pads as they're squeezed into the rotor and as the pads wear.

These bits ARE bolted to the bike. Thank god, someone at BMW remembered to bolt SOMETHING to the bike!

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Remove Brake Pad Guide Pin

Now, the brake assembly is free of the bike with the exception of the brake hose. Ok, now for the really fun part, let's start disassembling the rear brake caliper assembly. Remember that guide pin you punched part way out?



Well, we need to monkey with it – so, maneuver the brake assembly in space until you're holding it like so...



And push/pull the pin out.



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If you didn't turn the brake assembly upside down as shown, bend over and pick up all the pieces that just fell on the floor. (Psst, the rest of you - while he's down there, will someone please kick his ass?)

Remove Brake Pads

Oh, now grab yourself a little pad – in this case, we're grabbing the 'fixed' pad...



And whip it out...



And repeat for the other pad.

NOTE: it may help to slide the carrier back to open up the gap and expose more of the pad so that the pad can be removed easier.

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Remove Anti-Chatter Clip

Great. Now remove the anti-chatter clip. This little clip keeps the pads from banging around in the caliper assembly by creating some down force on the pads.



Too bad women don't come with an Anti-Chatter Clip, eh?



Breaking Down the Caliper Assembly

Ok, now lets break down the caliper assembly.

Break Carrier Guide Gaiter Seals

Rotate the brake assembly in space until you can look at it like this, and check out the little rubber gaiters. There is one for each carrier guide pin.



These gaiters protect the carrier guide pins from accumulation of spooge.

Grab a smallish screwdriver and gently work the gaiters off their seats. No. Put away the pocket knife, you don't want to slice up or poke a hole in the gaiter.



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Then rotate the brake assembly in space and do the other gaiter...



Separate Carrier and Caliper

Great – once you've eased the gaiters off of their seats, you're ready to pry the carrier away from the caliper.

With fingers on the caliper assembly (the big black bit) and thumbs on the carrier (the silver bit) you should be able to separate them. If not, you need to pay a lot of attention to the carrier guide pins.

These 2 parts should slide apart easily but only when keeping them in parallel. If they stick or bind during their separation phase then either there is major grunge or corroded metal or your trying to pull them apart while not keeping the 2 parts parallel. Don't force them apart as they should slide apart with ease, but if they just aren't cooperating then work at sliding the 2 pieces back and forth a little bit at a time until they learn who is the master... At this point examine the pins to see if you can see what caused them to grab so tightly. This will be important later.



And there it is... You've broken it all down.

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If you'd like to know how to put it all back together, order BFD Volume II for only \$39.95 (plus S&H). Be sure to have your credit card ready! Operators are standing by!

Just kidding...

Now, instead of a rear brake, you have a caliper assembly:



And a carrier assembly...



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Let's break this thing down even further, starting with the caliper.

Remove Caliper Gaiter

First, let's remove the rubber gaiter.

Take the accordion end of the gaiter between your thumb and forefinger and gently fold it inward on itself, then gently push and pull the accordion end through the caliper.



Work it out assertively, but gently. You DO NOT want to damage these gaiters



Now clean the gaiter VERY thoroughly – inside and out. Q-tips are handy here, but be sure that you DO NOT leave any cotton behind.



Caliper Preparation

Now, let's clean the caliper thoroughly.

Mecha-Mortality Warning

No bullshit, dude. We're talking life and death here!

You've probably heard your Mother, bless her, say that "cleanliness is next to godliness," well, in this case, it's just a lowdown dirty lie. The cleaner you get that caliper, the longer you'll be down here rolling on tarmac and rubbing shoulders with Satan.

Leaving your caliper DIRTY can get you a LOT closer to godliness a LOT sooner than you might like.

So you go tell your mother we said she's fulla shit – bet we don't see you 'round here no more.

Cleaning Caliper Pistons

So, one more time – clean the caliper piston edges thoroughly so we can shove them in, and get them out of the way.



Clean them outside and in. How clean do they need to be – well, if it were MY LIFE...

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Why are we being so fussy here? Well, when we push those pistons back in we DO NOT WANT any grunge to be pushed in with the piston into or past the seals. These seals are inside the caliper and are the ONLY thing that keeps the hydraulic fluid pressure in and allows the pistons to move out... In other words these seals are what lets the brakes work, at all. We do not want to contaminate them or make their lives any more complicated than they already are. So clean away...



And clean EVERYTHING else on the caliper...



Caliper Piston Compression

Clean? Good. Now we need to push the pistons almost completely in so we can clean the remainder of the caliper.

MechaMessAvoidance

CAUTION:: When you do this next step, keep in mind that you'll be pushing brake fluid back into the reservoir.

Depending upon how worn your pads are, you might force TOO MUCH FLUID back into the reservoir, so you need to keep an eye on this – you may need to open the reservoir and remove some fluid.

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You can wick fluid with paper towels or rags, or remove some with a small spoon, dipper or syringe.

NOT DO NOT CONTAMINATE the fluid. If it's already turned yellow now would be a good time to plan on flushing the old hydraulic fluid out and replacing it with new. Stay tuned for Motorcycle Fluids for Dummies.

So, keeping an eye on the fluid reservoir – let's get those pistons out of the way.

Using a small block of wood, push the piston back into the caliper. **NOT ALL THE WAY.** (Leave maybe half a centimeter, [for you Europeans or SACCCs, that's centimeter] or about an 1/8 inch, exposed – this will make things easier when lubricating, and when remounting the pads.)

Push on both caliper pucks at the same time – don't try to divide and conquer. It'll take some thumb squeezing, and possibly a small 'C'-clamp.

The Opposable Thumbs method – preferred by homo simians everywhere...



The C clamp method – for the more mechanically minded...



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And what you'll end up with is this...



Note that we did NOT push them completely in. There's just a smidge of puck extended making them just a bit easier to lubricate.

Now you can complete your cleaning...



Get it cleaner, casket-boy! EVERY NOOK AND CRANNY!



Mechacademics

Functional description time... (Somebody turn up the M.C. Hammer CD!)

The rear brake is a single action type brake. This means it pushes with only one pair of pistons. In order to squeeze the rotor (disc) equally from both sides, the caliper body 'floats' on a carrier which allows the entire caliper assembly to slide

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back and forth, so that the single set of pistons can squeeze the rotor from both sides even though in actuality they are only pushing from one side.

This is accomplished by ‘fixing’ one rear pad in place (with respect to the entire caliper itself) and allowing the entire caliper assembly to slide back and forth enough that the pistons push on the moveable pad which then pushes the whole caliper assembly into the ‘fixed’ rear pad. It’s actually ONLY the **carrier** that is bolted to the frame and thus into a set position, not the caliper (unlike the front calipers).

The carrier allows the entire caliper to move back and forth and it holds the calipers in all other dimensions so that the braking force can be transfer to the frame and thus slow us down.

Put another way the caliper assembly, when squeezing the rotor, actually slides back and forth on the carrier guide pins so that the pads squeeze equally on the rotor.

Why go to all this trouble? Well, mostly to reduce the amount of braking force available at the rear tire, since the vast majority of our stopping power comes from the front tire and we don’t want to just skid the rear tire. Instead we want to be able to ‘feel’ the amount of braking power we are applying to the rear tire. Using a single action brake greatly reduces the amount of available power. So does reducing the diameter of the rotor and also reducing the contact area that the pads and rotor sweep thru, but we are limited due to the size of the final drive and other physical variables.

Because of this we have a few more parts that require some special attention. Single action calipers are very common, so the procedures to maintain them are well known.

There are ‘clips’ and ‘pins’ and ‘heels’ that need to be paid attention to in order to have smooth and predictable braking power with even wear and minimal surprises down the road. The parts that wear (out) are the pads, the rotors, the locating pin, the heel receiver, and the anti-rattle clip.

Cleaning the Carrier Bits

Removing the Carrier Gaiter

Remove the gaiter from the carrier. This gaiter has a small flange that holds it in the carrier – in the photo below, you can almost see the flange near the tip of my thumb. You should be able to squeeze the gaiter and gently pull it from the carrier. Before you put the gaiter down (or drop it), take a look at how the carrier is indexed and the gaiter is flanged.



Remove Brake Pad Heel Clip

Now, let's remove the brake pad heel clip.



This is an interesting little piece, here. This is where the heel of the brake pad sits. When you're braking, tremendous force is projected into this little surface. Not only that, but this surface also incurs some lateral movement as the pads squeeze and retreat from the rotor. We want to treat this little guy with the respect he deserves.

This clip has some spring tension in it – when you remove it, take care you don't send it across the workshop into the twilight zone. You will **NOT** complete the reassembly if you lose this. You do **NOT** get a replacement clip with the various BMW repair kits.

This clip's primary job is to minimize the wear of the brake pad's heel on the carrier, as such, if it isn't re-installed, the entire carrier will need to be replaced in very short order.

Ready? Ok. First, note where I've positioned my thumb to prevent the spring action. Now, grab a small screwdriver and lightly pry and push.



And you've gotten it off...



Clean it All, Again

Clean every imaginable surface of the carrier and all of its parts. Twice! Why? Because we know how you clean, you decaying chunk of mortician bait.

Clean all threads with Brake-Clean.

Thread a rag with Brake-Clean through the female threads.

Use a dental pick if you need to clean nasty stuff outta the threads.

Clean every nook and cranny.

These are YOUR brakes. Make sure they're going to work.

Inspection

Rotor Inspection

First, let's check your rotor. If it's heavily grooved, you might want to change pads a couple times in short order to grind down the high ridges. If it's too worn or rutted, you need to consider replacing it.

The BMW repair manual lists the minimum allowable thickness for the rotor. We can list it but without the proper tools and understanding of where and how to measure the rotor... Suffice it to say, if in doubt, have it measured at a shop.

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Use your fingernail and trace over the surface, if you feel deep grooves then haul out your micrometers and measure the thickness of the swept portion of the rotor (not the outside edge or the inside where the pads don't squeeze the disc). Don't have micrometers? Find someone who does or take your wheel to a shop or dealership and have them measure the rotor(s). Unless you're a manic stoppy practitioner or you just gotta slide your rear tire into every corner you see, your rotors should be good for at LEAST 60-80K miles

Run your fingernail across both of the faces of the disc rotor from the inside to the outside. What you want to feel for are 'large' ridges or grooves that can 'catch' your finger nail. Slight or minor undulations in the surface are 'ok' it's the 'big ones' that are of concern here.



On this rotor, at 23,000 miles, there is no significant scoring, so this disc is in fine shape - we'll just move right along.

Carrier Guide Pin and Hole Shaft Inspection

Check the health of the carrier guide pins. There are two - one on the carrier, one on the caliper assembly. And conversely there are 2 hole shafts on the opposite end of each assembly. Remember the rubber gaiters? That be the hole shafts.

With your fingernail again, feel for scoring and look at the surface condition for major wear and discoloration along the whole length of the shaft. What is important here are low spots, ridges, (which can be 'long' and 'deep') or any other surface anomalies.

If you can feel any sharp edges or other surface irregularities these need to be removed, or the guides replaced or other remedial action taken. Remember these are sliders, we need to have the calipers slide easily along these guides, UNDER BRAKING, which introduces heavy additional forces. Remember when you pulled the carrier off the caliper? And perhaps it didn't cooperate? Now is the time to really examine these guide pins AND their mating holes for WHY they were sticking and grabbing... Use a flashlight if you have to. The hole shafts should appear smooth and round. With little or no pitting. How much is too much? Well if the 'fixed' brake pad is wearing out MUCH faster than the 'active' pad, pitting and wear on the guide pins and hole shafts is most likely why.



In this photo you can see the slider guide has some discoloration. In living color, you'd see the lighter areas as 'silver' and the smooth areas as 'gold.' The 'gold' is the good, or original, surface. The light areas indicate this guide has some wear – nothing too significant for 23,000 miles. Nothing we're going to do anything about this time, but, we're going to keep an eye on this.

Mechacademics...

Your rear brakes uses these guides to maintain alignment AND transfer braking forces. You want your caliper assembly to slide on these guides as easily as possible, so smooth guides are important. A tiny bit of surface irregularity isn't bad because these guides are riding in grease and have a 'large' surface area, but, too much is not good.

Smooth slider action is also key to even brake wear. If you haven't got smooth sliders, you may notice the pads will wear unevenly. In our case, the pads are wearing evenly – so Javarilla got lucky, but his sliders are starting to wear, we'll see how the pads fare this next time.

The front slider guide, the guide on the caliper, will show the most wear. It transfers most of the force, and thus incurs the greatest degree of wear. The guides can be replaced – notice the hex heads in both. Replacement isn't discussed further in this doc.

If you feel you've got too much scoring, you may want to either smooth the guides, or go get new guides. If most of the original gold coloring is worn off AND if the guide pin surfaces are heavily pitted and thus the contact area between the guide pin and it's receiver is significantly reduced, it's time for new guide pin(s). Grab thy wallet and get thee to the certified mechanic.

You can smooth the scoring with Scotchbrite, or with very fine grain sandpaper (400 grit or higher), but you have to weigh the smoothing of the guides against the amount of gold colored surface treatment you want to shave off – shaving off the gold is not a good thing – it's your protective barrier and wear indicator.

Brake Pad Guide Pin Inspection

Now let's inspect the pin. This is the pin you removed earlier with the punch and hammer.



Notice the markings on the pin. That's scoring from the brake pads.

The brake pads sit on this pin, kinda like this:



The pin incurs a lot of the braking force when the pads are engaged, and there is a fair amount of sliding force across the pin as the pads are engaged, and released. The wear occurs in different places as the pads are consumed. A lot of wear on this pin can influence brake wear, and it may indicate other problems.

It's a very good idea to replace this pin, and it's part of the rear caliper repair kit.

Chatter Clip Inspection

Let's look at the anti chatter clip.

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This little clip sits up inside the brake caliper and on ‘top’ of the pads and applies downward pressure on the pads. This keeps the pads from rattling, or chattering, in the caliper assembly when the pads are both engaged and resting free. Let’s make sure there are no oddities in the clip – check to see if it’s broken, if tabs are sheared or especially if it has noticeable wear anywhere.

If the clip is questionable at all, replace it with the new one in the brake kit.

Rotor Preparation

We like to break up the glaze on the rotor when new pads are installed. It helps all parts seat quicker. To do this, you need to give the disk a slight sanding.

Move the brake assembly up and out of the way and secure it with your fancy wire. The frame near the rear foot pegs works well.

Use a 220 or 180 (up to 360 or 400, if need be) grade wet/dry paper.

Then, applying slight thumb pressure, and bracing your hand against the final drive...



...and rotate the wheel.

Get a rotation in, and change the position of your thumb. After perhaps 5 rotations of the wheel you’ve probably covered enough of the surface.

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Do the opposite side of the rotor, too. Same drill – a rotation per finger position, maybe up to 5 rotations – and you're done.



Reassembly

Let's crack open the rear caliper repair kit ...



And you should have a new pin guide, pin guide clip, and anti-chatter clip.



Let's apply some high-temperature anti-seize grease to the wear component of the brake assembly.

Mecha-Mortality Warning

Yes, we are applying anti-seize (grease) to **SOME** of the parts in the brake caliper assembly, but we are NOT SLINGING grease.

You need to be very careful and very conservative in your use of grease – you do NOT want it getting onto the rotor or the pads.

When you grease something, grease only that thing, at the particular spot where we tell you to, and **nothing** else.

Then immediately clean your fingers. If you accidentally get your fingers greasy, DO NOT assume that you can work around it. Stop and clean yourself, you slob.

When you grease some parts (like the anti-chatter clip) you want all metal surfaces to have a LIGHT coating of grease on them. We use our fingers and work the grease into all of the convoluted surfaces and nooks and crannies.

Other parts (ie. pads) only the metal backing is to be LIGHTLY coated and only on the back side where the pistons contact the pads. NOT on the sides (with the exception of the heel and the hole that the pin runs thru, as these are heavy wear areas).

A light coating of grease means that there is enough grease to help protect the metal parts from corrosion etc. But not SO much that it could get on the pads or rotors and mess with the necessary stopping friction

The use of grease on certain parts is important for smooth and quiet operation but too much grease can (and in the wrong places) will turn your brakes into heat and smoke generators with greatly undesirable braking performance...

MechaChemical Break

High temperature anti-seize. (up to 1200 degrees C) . Copper works best. Aluminum based will work, but not as well. Aluminum based anti-seize dries up, and forms something of a sticky hard paste like glue, which ends up serving the wrong purpose.

Wurth CU800 is a preferred grease, however, any anti-seize that is good for lubricating the BACK side of brake pads will work. Permatex copper based anti-seize will also work

Wurth CU1100 supports up to 2000 degrees C – so, for you folks out on the track with the white hot brakes...

We will grease the insides of the gaiters using a VERY light rubber friendly grease. Silicone grease is best because it doesn't eat rubber. Wurth Silicon

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lubricating compound paste is the shtznitz. Any light grease that is good for rubber gaskets, window channels, lubricating brake parts. Not pads! Parts.

Lubricate Piston Contact Areas

First, lets hit just the area of the caliper pistons that will touch the back of the active brake pad.



You are going to put just the finest sheen of copper anti-seize grease on the pressing surface of those pistons...



You're **NOT** going to stuff grease into every nook corner or cranny, or all over the edges of everything in sight – all you want is just a very light coating of copper anti-seize on the contact area between the pistons and the brake pads.

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Lubricate 'Fixed' Pad, Rear Surface Contact Areas

Now let's apply a thin sheen of anti-seize to the fixed side of the caliper assembly where it makes contact with the back of the 'fixed' brake pad.



Cover the surface areas, like so...



Notice how we just greased **ONLY** that one surface.

Lubricate Back Surfaces of Brake Pads

Now, **lightly** lube the **back** of the brake pads. This is the metal surface where the pad contacts the caliper or the caliper pistons.



Lubricate Heel of Brake Pad

Lightly lube the edge of heel of each pad, where the heel touches the heel clip.



Wipe off the excess anti-seize from the edges of the pads

Mecha-Mortality Warning

DO NOT GET GREASE on the brake pad itself.

Keep your hands clean.

That grease is sneaky and it gets around. IF IT GETS ON THE PAD clean the pad with Brake-Clean. Grease on the friction surfaces (pads and rotors) will severely reduce the amount of braking available and generally won't 'burn off' until much damage has resulted.

Lubricate Brake Pad Guide Pin

Lightly lubricate the guide pin with the high temp anti-seize. Get it all over. Get it under the rotating head. Leave no metal exposed.



Mount Brake Pad Heel Clip

Next, place the brake pad heel clip back into the carrier.



Then, just to make sure this clip has plenty of slide juice, lube it lightly.



Insert the gaiters back into their proper seats.

Assemble Caliper Gaiter

Grab the longer gaiter, pinch the accordion end, slip it into the caliper, and gently work it back through...



Until you can pull the accordion end of the gaiter through to the other side, leaving only the knob exposed. Take joy in this. It's one of the few times you can leave your knob exposed on purpose.



Assemble Carrier Gaiter

And here's the gaiter going back into the carrier. The flanged end of the shorter gaiter goes into the carrier.



And, here it is fully inserted. [Make your own clever remark, here. Pretend you weren't prompted.]



Lubricate Gaiters

Stuff the silicon grease into both of the gaiters and guide pin hole shafts.



Lube the guides with the silicon grease. First the caliper guide...



Then the carrier guide...



Reassemble Carrier and Caliper

Assemble the carrier and the caliper by fitting guides to gaiters...



And gently align the caliper and carrier together...



And slide them together...



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Pushing until they 'click' and the gaiters seat.



Wipe off any extra grease on both gaiters.



Seal your silicon grease before you drop it, step on it and splurt it all over the workshop.

Lubricate and Assemble Anti-Rattle Clip

LIGHTLY lubricate the anti-rattle clip with the high temp anti-seize. Leave no metal exposed. Use your fingers if you have to, to get the grease on ALL of the surfaces (be sure and clean your hands afterwards).



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Insert the anti-rattle clip. It goes next to the guide pin (which is the back of the brake.) Pay attention to the arrow – it must be pointing forward. Take a minute to get oriented in space – remember you’ve got the brake upside down when you’re working on it.



Assemble Brake Pads

Insert the active brake pad – the one whose back rests against the caliper pistons. Angle the assembly in your hand so the pad will “fall” into place, rather than “fall” on the floor.



Align the heel of the pad to the heel pad base clip. Then drop the pin side of the pad, then push the pad in so that it rests on the caliper pistons. You may find that it helps to slide the carrier ‘back’ to allow more room for the pad to drop onto the pistons.

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Insert the fixed pad in the caliper.



Align the heel pad to the heel pad base clip. Then drop in...



Insert Brake Pad Guide Pin

Insert the guide pin, (it only goes in one way) and push the pin through both of the brake pads, and through the other side of the caliper.



Give the head of the pin a light tap or two with the mallet to seat the pin.



Slide the clip onto the end of the pin's groove – shoulder side in... If the groove of the pin doesn't 'stick out' far enough for the clip then the pin hasn't fully seated yet.



Put circlip back on.

Gently Pry The Pads Apart

Now we need to make space between the pads so the assembly will fit over the rotor.

Carefully, pry the brake pads apart with a small screw driver.



Mount Brake Assembly Over Rotor

Put the brake assembly back into position on the bike.

Gently put the assembly over the rotor and move side to side to create enough gap to allow the caliper to drop down onto the rotor.

Bolt Brake Assembly

Apply anti-seize to your caliper mounting bolts...



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Hand tighten the bolt in place.

Front bolt with ABS cable anchor needs to be oriented properly. It has a notch that matches up with a ridge on the final drive housing.



Rear bolt...



Serve up 40 fresh nm of torque...



And, you're almost reassembled.



Test Brake Assembly

Great, now lets give all this work a little test.

Push down on the rear brake lever.

You'll probably notice that the brake lever pushed all the way down before ANY real brake power was applied.

Release the lever and push again, and again until the lever feels 'firm'.

Now, slip the transmission into neutral, and, standing on the right side of the bike, give the rear tire a spin, and use the rear brake lever to stop the rear wheel.

Hold the rear brake on, and try to spin the tire.

If you're not hearing ungodly crunching, or LOUD ugly metal scraping noises and if you're feeling the brakes work, you're probably in good shape to continue. There will be new noises and if you're using the sintered brake pads it will sound like metal to metal scraping, but it won't be LOUD.

Next check the level of the fluid in your rear reservoir and make sure it sits between the min and max marks. Note, if you are planning on bleeding this system and don't want to fill the reservoir at this time be sure and do it before riding the bike...

Reassemble ABS

Lightly grease ABS sensor with grease (not the end!) – light on the inner portion – just so it slips in without being dry. Slightly heavier on the cable exit portion because that's where the o-ring is. Give the o-ring a light slop of grease.

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Insert the ABS sensor into the final drive.



Gently rotate the ABS sensor clockwise and counter-clockwise (countre-clockwise) until it begins to insert. Work it in, rotating and wiggling, just like with the old lady, until there is only the last ¼ inch or so to go, then stop...



So you can insert the shims and put anti-seize on the ABS sensor bolt.

Prep the shims in order, if you can, of thick, thin, thick.

Mount them on the ABS sensor, and insert the bolt through the abs sensor through the shims, into the final drive.

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Get the bolt started by hand, then push the abs sensor the rest of the way in.



Tighten with a sneerk. Put the rubber grommet (and ABS sensor cable) into the holder and secure the ABS sensor cable to the hydraulic hose with one or two ty-rap(s)

And the final product should look like this...



Now, step back and congratulate yourself, because you started with this...



Final Exam

So now it's time for a really meaningful test.

Take the bike off the stand. Roll the bike around slowly using the rear brake to stop. Again, listen for any unusual sound, and feel for stopping power.

Remember, these are new brake pads and they will take some time to properly seat to your rotor (and vice versa).

You **will not** have the same amount of braking power you had before this procedure – you'll need to fully break in the pads before you're running at full rear stopping power again.

But, if you have no scary noises, and you have braking power, you should be ready to mount up, power up and 'brake' those new pad in.

If you live, next time, we'll mess with the front brakes. Until then, learn the words to "Nearer My God to Me."

The Racers Edge Technique For Breaking In New Rear Pads

Accelerate the bike up to 15 to 20mph or so and then fairly quickly brake down to 5mph or so, repeat this 15 times. Then park the bike and wait for the rotors to cool down to the touch WITHOUT GETTING BURNED... On the last run they will be WAY TO HOT TO TOUCH - so don't even try. It might take upwards of an hour for them to cool all the way down, depending on ambient temperature... Once cool, your done... enjoy your new brakes...

NOTE: You may notice the rotors or calipers get hot enough to smoke. This is residue burning off the new pads and/or rotors. This isn't unusual. If the pedal gets mushy

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during the break in, stop and let everything cool down. It is also advisable to change your hydraulic fluid after the break in is completed as well.

If you have also changed out the front pads and are breaking them in as well, accelerate up to 30mph and brake down to 5mph, 30 times in a row, then park it and let everything cool down.

Cheerio from JenLabs.

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Editors note: This chapter isn't as polished as we would normally like to make it before release. It was my opinion/decision that it would be of value nonetheless and so I pushed to get it done... These tomes take a tremendous amount of time and effort and our primary author just couldn't devote enough of his spare time to finish this chapter with the same degree of panache as his previous efforts. To that end I take responsibility for any errors and confusion that exists. We do hope to make revisions which will put the finishing touches in all the right places... Of course any and all suggestions are welcome.