

# The Nutty Professor's Service Manual

## Basic Servicing Part (5) – Brake Shoes & Wheel Cylinders

Right, following on from last month's "servicing and adjusting your brakes" article, this month's jaunt into the fun filled world of do it yourself mechanics, or "Lego for grown ups" as I like to call it, is the replacement of brake shoes and brake cylinders.

We will also be covering bleeding the braking system, as this is necessary after replacing wheel brake cylinders.

Once again, as per previous articles, this article is based on Kirsty's 1976 1300 air-cooled VW beetle, but most VW's are very similar.

### Braking System – Renewal of brake shoes & wheel cylinder

**Difficulty Rating:** If you can program a video recorder to tape "Top Gear", and not accidentally record "The Top One Hundred Crap Songs Performed by Belgian Nuns at New York Bar Mitzvah Parties" or other such shit, on one of the other 800 channels that manage to fill 24 hrs a day with nothing but utter crap, then you can do this.

**Approximate Cost:** Brake shoes for four wheels = £30 (approx), Brake shoe fitting kit = £3.50, Wheel cylinder = £5 each, brake fluid = £15 (approx), four spilt pins = £1.

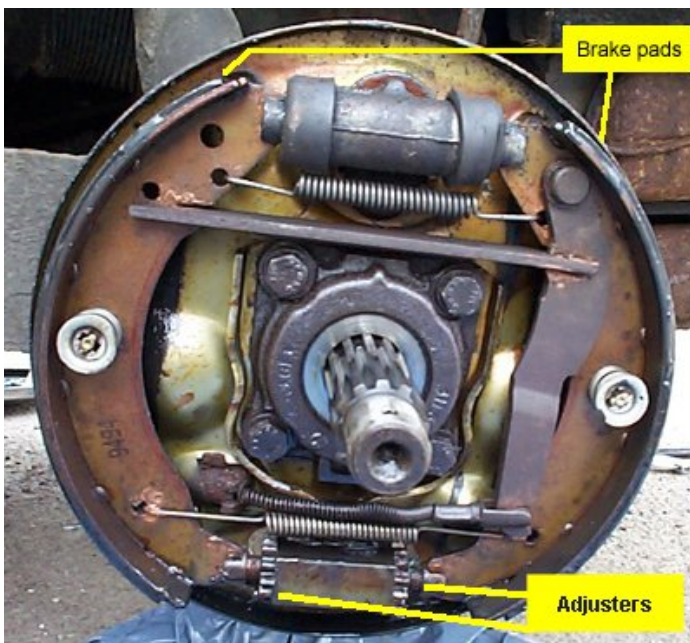
**Tools Needed:** *Large flat head screw driver, a trolley jack, axles stands, wheel brace, brake bleeding kit, 8mm allen key, 36mm socket and braker bar, 10mm socket and spanner, 7mm spanner, pair of pliers, gentle adjuster(hammer), tub of copper grease.*

**A foreword:** Firstly, before you go speeding off to your local VW part supplier to get yourself the brake shoes and other bits that you need, A Word of Warning! There are so many combinations and sizes of brake shoes and wheel cylinder used by VW, that you will never buy the right ones. You've got more chance of convincing a 14 year old that life before Play stations, X-box's and mobile phones was fun, and kids have not always been pork bellied, albino TV addicts. The best way to get the exact parts you need is to take the parts off your vehicle and then take them with you to the parts supplier. That way you'll save yourself time and money. Secondly, and this is important! Messing with the braking components on a vehicle is not like adjusting your fan belt. If you get this wrong, the consequences are a little more severe than just an over heating engine. So with this in mind, if at any point you are unsure of anything, don't just guess! Call myself or someone else in the VW club for advice. We won't mind. Honest! And the golden rule when looking at your braking components is "If in doubt, get a new one". It's not worth the risk of using old or questionable components in your braking system.

Right, lets throw caution to the wind and start fucking with the brakes. Firstly park your vehicle on a level hard surface. Starting with the rear left hand wheel, undo the wheel nuts a tiny bit so they are easy to undo when the vehicle is jacked up. Jack up the vehicle so the wheel is about an inch clear of the ground and support the vehicle with an axle stand. Put a couple of bricks under the front tyres to stop the vehicle from moving. Remove the wheel and get into the habit of putting the wheel under the vehicle, so in the event of the axle stand or jack breaking, the wheel will hold the vehicle off the ground. Now you will see the brake drum. The drum is held in place by the large 36mm nut in the middle. To remove this, firstly use your pliers to bend the split pin so it is straight and pull it out. It might need a tap with the gentle adjuster (hammer). Now get your 36mm socket and braker bar and undo the nut. (Tip: make sure the hand brake is on hard and the vehicle is in reverse gear). If the drum just turns and does not undo, just adjust up the brake shoes (last months article) as much as you can so the wheel will not turn. Then undo the nut. If

it still won't budge and you have stock wheels, or other wheels that enable you to see the centre nut without removing the wheel, you can try undoing the nut before you jack up the vehicle and take off the wheel. If the wheel simply spins (slipping on the ground), get your local rugby team (or lard arse person) to sit in the back seat for extra weight and have another go.

Once you have the stupidly big nut off, it's time to remove the drum. Now in theory, you should be able to take off the hand brake and simply slide the drum off. But in reality, there is no way this will ever happen, particularly if the last time the brakes were looked at, Margaret Thatcher was Priminister. If you imagine the inside of the drum, you have two brake shoe that have been pushing outward onto the inside of the metal of the drum since Adam and the Ants were in the charts. This will have created a groove in the metal that the shoes are sitting in. This creates a ridge on the back edge of the drum, which prevents you from pulling it off. To get the drum off, you have to back the brake shoes off as far as they will go. To do this, use a flat head screw driver to adjust the star adjusters through the inspection/adjustment hole in the drum (this may be in the front, but probably the back of the drum). View last month's article for more on adjusting brakes. Once both brake shoes are backed off as far as possible, the drum should slide off. If you are still having difficulties, use your gentle adjuster (hammer) to tap around the edge of the drum to loosen the grip. Wobble it from side to side and up and down and eventually it will come off. The longer the vehicle has been left without the brakes being renewed, the harder it will be to free the drum. So if the drum was last taken off by your great uncle Bolgaria, the chances are you're going be swearing a lot over the next hour!



With the drum finally removed, it should look something like the picture. The brake cylinder is at the top, the adjusters are at the bottom and the brake shoes are on either side. You will also notice the handbrake cable coming in through the bottom and hooking onto a lever on the right hand side. You might find that it is a good idea to take a picture (if you have a digital camera) of the layout, so you can refer to it when putting it all back together. To remove the brake shoes, firstly remove the spring clamps that are in the middle of each shoe. Use your pliers to twist the centre, while pressing down the outer spring so the clip pops off, and pull the pin out through the back of the backing

plate. Use your pliers again to remove the two springs that hold the two shoes together, one at the top and one at the bottom. Once they are removed, the left hand brake shoe should come out of it's slots at the top (in the brake cylinder) and at the bottom (in the star adjuster). Now use your pliers to unhook the handbrake cable off it's lever and the right hand shoe will come out, complete with the hand brake lever mechanism. Make sure you make a note of which way around the lever mechanism goes.

Now examine the brake cylinder. If there is any sign of leakage around it, or the rubber seals on each side are split or perishing, it will need replacing. For the sake of this article, we are assuming it will need replacing. To remove the cylinder, you will firstly need to disconnect the brake pipe from the back, and that's the messy bit. Get yourself a little jar

or vessel of some description to catch any brake fluid (preferably not your wife's favourite vase or the cat's food bowl) and a rag to wipe up any mess. **IMPORTANT....!!** Do not get any brake fluid on your paintwork! Brake fluid acts like paint stripper and will ruin your paintwork. If you get any brake fluid on your hands make sure you wash them well before even considering touching your paintwork. If I see any hand shaped paint stripped areas on your vehicle, I'll be pointing and laughing at you!

Grab an open ended spanner (either 8, 9 or 10mm, the size varies) and as gently as possible undo the pipe going into the back of the brake cylinder. Now the possibility that this pipe will break when you try to undo it is very likely particularly if it appears rusty and past it's best. But don't worry, replacing the pipe is easy and doesn't make a lot of difference in the grand scheme of things. In fact it will only benefit you in the long run. You may even prefer to replace the pipes anyway, to save doing it at a later date. At least that way you know you've only got to bleed the brakes once.

Once you have undone the nut on the end of the brake pipe, it should pop out of the brake cylinder. If you are not replacing it, do not pull it out and bend it. Just leave it in place and it will come out when you remove the cylinder.

To remove the cylinder, undo the bolt securing it in place, just below where the brake pipe enters the cylinder, with a 13mm spanner. Once undone the brake cylinder should come out from the front of the backing plate. However, the cylinder has probably been stuck in the backing plate since the car rolled off the production line and so is likely to be rusted in place. Use a bit of WD40 to soak the area around the cylinder and penetrate the rust. From the front, try twisting the cylinder clockwise and anti-clockwise, and possible a couple of taps with the gentle adjuster to free it. If you bust it, Who cares. You're replacing it anyway! But be careful not to bend the backing plate, or you'll be replacing that as well, and they can be as hard to find as rocking horse shit, depending on your particular vehicle.

With the brake cylinder and brake shoes removed, you can now take them with you to get some new ones. Don't forget to get a brake pipe set if you are replacing any pipes and the brake shoe fitting kit (which consists of new springs, etc) and new split pins to secure the large centre nut on. But before you go pootling off to the parts supplier, remove one of your front wheels as well, following the same procedure.

On the front left wheel you will have the speedo cable held in the centre of the little dome cap. Pull off the little circlip (if it has one), and pull off the domed centre cap. Giving it a tap from side to side with the gentle adjuster should loosen it. The only difference with the front is instead of a large nut in the middle of the wheel, you have a clamp which is secured by a bolt. Simply loosen the bolt with an 8mm allen key and unscrew the clamp off the centre spindle. (NOTE. It has a reverse thread on the left hand front wheel, so you turn it clockwise to unscrew it.) Behind the clamp is a large washer (the thrust washer), behind which is the wheel bearing. This should all fall out easily with a little pull of the drum. It may well be messy, as it will all be covered in grease. Make sure you re-grease it all when putting it back together. Also you don't have a hand brake mechanism to worry about in the front wheels.

Once you have the shoes and cylinder off the front you can and get everything you need, safe in the knowledge that you'll be getting the right stuff, cos you can compare it with the old when you buy it. Don't forget to buy some new brake fluid!

Reassembling the shoes, cylinder and drums is simply putting it all back in reverse order to how you took it all apart. Nothing to it really! But the one thing you must do first, is pull out the star adjusters (you'll get new one's in the brake fitting kit. When putting the new ones in, put plenty of copper grease all over them, and this will ensure they don't seize up and will make for easy adjustment in the future. Also put copper grease on all the parts

where metal makes contact. i.e on the ends of the shoes where they slot into the cylinder and the star adjusters, and the hand brake lever hinge, and where the actual handbrake cable hooks on. But NOT on any part of the actual brake shoes where they come into contact with the brake drum. Greasing up your actual brake pads would be like installing an accelerator pedal in place of your brake pedal! Also, when handling your new brake shoes, do not get your greasy mits on the pads, or they'll end up looking like your (by now) grease covered face, and be less affective than using a hairdryer to power the new airbus A380.

Once you have all your braking components installed, including installing and connecting up your brake pipes, it's time to bleed the brakes. Bleed the brakes before you adjust the brakes, as without brake fluid in the system you'll just spend hours wondering why your new brakes aren't working. Like pushing shit up a gravel hill with a pair of tweezers, it's frustrating and a waist of time.

The purpose of bleeding your brakes is to fill up all the pipes and cylinders with brake fluid and expel any air from the system. Brake fluid will not compress by air will. When you have spongy brakes, this is generally because there is air in the system, which can compress. When there is no air, there is nothing to compress and thus the brakes should feel firm. To bleed the brakes you will need a brake bleeding kit. This basically consists of a pipe with a one way valve on one end. You can bleed your brakes without this, but it becomes a pain in the arse and you'll need an assistant and a lot of patients. You will also need a jar or vessel of some description to catch the excess fluid.

Firstly fill your brake fluid reservoir with fresh brake fluid (never put old fluid back into the system). The reservoir can be found under the bonnet on the left hand side of the car (in a Beetle or Type 3) or just under the driver seat (in a bay window camper) , or **under the dashboard** (in a split). Leave the top off the reservoir, as you will be topping it up as you go. If you are sure you have connected up all the pipes correctly, get in the drivers seat and press the brake pedal to the floor a couple of times. It will probably feel very weird (spongy, or go straight to the floor). Now check the reservoir and top it up if needed. Now get under the vehicle at the back left wheel, and put a 7mm ring spanner on the bleed nipple which is on the back of the brake cylinder you installed. With the spanner in place, connect your brake-bleeding pipe to the bleed nipple and put the other end into a vessel to catch the brake fluid. Now turn the spanner to undo the bleed nipple (usually about half a turn) to allow fluid to come out. Now get in the drivers seat and operate the brake pedal three or four times. Now check the reservoir level and top up if needed. Now check the fluid coming out of the rear cylinder bleed nipple. You may have to do this a few times before any fluid comes out, particularly if you have replaced any pipes, as the fluid will have to make its way from the front of the car to the back wheels.

I should point out that this is so much easier if you have an assistant to sit in the vehicle and operate the brake pedal, while you lie underneath checking the fluid as it comes out. What you are looking for is the fluid to come through without any bubbles in it what so ever. Keep going, operating the brake pedal and topping up the reservoir in between until the fluid runs clear of bubbles. Your pipe of your brake bleeding kit will be clear so you will be able to see any bubble in the fluid. Once there are no bubbles, close the bleed nipple with the spanner and move on to the other back wheel, then the left front wheel and finally the right front wheel. Make sure you do them in that order (starting with the furthest away first). As you progress you should find the brake pedal begins to get progressively firmer. Don't worry if this is not the case, as you have not adjusted up your brakes yet. So once

you've bled all the wheels adjust up the brakes as per last months article. Once adjusted your brake should begin to feel better.

If you find you are bleeding the brakes and cannot seem to get rid of the bubbles, firstly check all the brake pipe connections, to ensure they are tight and no air is getting in the system and then try again. If there are still fine bubbles in the system, here's a little trick from a guy who used to bleed pneumatic systems on submarines. I don't know why it works, but it does! Make sure all bleed nipples are closed and all connections are tight. Pump the brake pedal until it becomes hard and then use a piece of wood or metal bar to wedge the pedal down (i.e. pushed on) and leave it for 24hrs. When you return bleed each wheel in the same order, and all the bubbles will be gone. I know it sounds mad, but it works. I've used this method many times myself, and it really works.

Once you are confident your brakes are bled and adjusted correctly, it's time for a test drive. Make sure your brake fluid reservoir is filled correctly (there should be a level marked on the reservoir), and the cap is on, and go for a drive.

Please be very careful when test-driving your vehicle for the first time. Do not go steaming off down the road thinking you have the best brakes in the world. Be very tentative in testing the brakes. Start with soft braking and build up to an emergency stop. If at any point they do not feel right, STOP and re-check everything. Ending up in your neighbour's front garden and reducing their prize winning garden gnome collection to rubble may be funny, and possibly intentional, but it won't do your vehicle any good and definitely won't win you any brownie points with the neighbours.

If your test drive is successful, the first thing to do when you stop is get underneath the vehicle again and look for any signs of leaking brake fluid at any of the wheels, or any other points where you have replaced or adjusted etc. If all is well, just make a mental note to check for leaks again in a week or so, just in case. And that's it. You're done. Congratulations you just saved yourself several hundred pounds worth of garage bills, and the knowledge that your braking system has not been put together by some 16 year old apprentice, while chatting to his mates on his new mobile phone about why he can't come out drinking and hanging around the streets tonight as his recently acquired ASBO and the electronic tag on his ankle won't let him.

Until next time.

Drive safely my VW chums.

Regards,

Simon (aka Nutty Professor)