

## BRAKE UPGRADE INFORMATION & PRICE LIST

STOP PRESS!! We now have the HSV and FPV Performance brake kits available for VT upwards Commodores and AUII upwards Falcons, including BA (and yes, they stop the BA brake shudder). They include larger directional slotted rotors, larger red calipers with pads and braided hoses along with all bracketing, bolts etc required to complete the job. The kits do all four wheels. Prices are \$2900 - \$3000 plus gst depending on application or \$3300 - \$3400 fitted and the car does NOT need to be certified as the kits have ADR approval.

AND!! AP Racing kits for the same animals starting at \$4900 plus gst for a 4 pot front/4 pot rear, through to \$6000 plus gst for 6 pot front/4 pot rears.

Thankfully most of us these days realize that there is a lot more to preparing a competitive car than providing it with endless reserves of horsepower and torque. What a lot of people don't realize are the performance and safety gains that can be made to the vehicle by inexpensively spec'ing up their existing road brake system with proper race compounds and fluids. This does not mean using road oriented metallic or kevlar pads or "DOT 5" fluid. Although these will be better than a set of standard cardboard pads, they really should not be let anywhere near a race car or track

RACEBRAKES 0800BRAKES, as well as supplying race calipers and race rotors, also specialize in setting up race brake systems for competitors on a budget or where the rules of a race control class prohibit the use of anything other than the standard original equipment foundation brake system. The GT and Production Muscle Car class (500+hp, 16-1700kg, 270kph) and the HQ's being examples of these. Most standard brake systems, once equipped to handle the heat generated under racing conditions, are more than adequate for events like the Dunlop Targa and other club racing duties.

If we think of the brake system as a chain that is only as strong as its weakest link, and heat as its enemy, we find that the weakest link in a road brake system is the friction materials. A good quality standard road compound will have a maximum c.w.t (continuous working temperature) of around 300 degrees C. An Aussie V8 Supercar generates around 650 degrees C at the end of Conrod. What we need to do is put proper race compounds into our road calipers, as the smaller road brake system is not as good at dissipating heat as the larger brake systems and can generate temperatures equivalent to larger race cars.

The problem you may come across when looking for proper race compounds for your road calipers is that the manufacturers of the race compounds will generally only manufacture pads for recognized race calipers such as Brembo, AP, Alcon etc or homologated road calipers such as the early EVO and WRX calipers. They are just not interested in tooling up to produce a run of '73 Mercedes 280E pads on the off chance that someone (like Ken Williams) wants to take one racing.

RACEBRAKES 0800BRAKES are able to supply or manufacture race pads for any type of caliper with race compounds that will handle temperatures of at least 700 degrees C. Some compounds will handle much more. **These compounds perform from dead cold and make a blindingly good street pad regardless of their racing abilities.** Don't panic if your vehicle is equipped with drum brakes as we carry a German Pagid drum brake compound for these applications. We even have the old Ferodo DS11 compound available if you wanted to spec up your GT Falcon, Monaro, Charger or Torana for authenticity's sake to the Bathurst compounds of the sixties and seventies. This material, for you aficionados out there, "was introduced in the late fifties and was almost universally used in Formula One

right up until cast iron discs were superseded by carbonfibre reinforced carbon (carbon-carbon) discs and pads in the eighties. According to Federal-Mogul's records (Ferodo Racing's parent company), between 1961 and 1981, 265 of 267 Grand Prix victories were scored using DS11 pads". (Article entitled From DS11 to DS3000 by Ian Bamsey, Racetech magazine) Two decades of dominance. Let's see if Ferrari or HRT can match that.

Interestingly enough, speaking of dominance, Ferodo's replacement for the DS11 compound called DS3000 was used by every manufacturer except Mitsubishi (who we believe used Raybestos) in the 2002 World Rally Championship (and no, it is not a control pad). DS3000 was used by Peugeot to win Rally of New Zealand 2003 and by Subaru to win Rally New Zealand 2004 with Petter Solburg. Mark Skaife and HRT used it for their 2001 & 2002 Australian V8 Supercar titles and other recent local success by DS3000 includes 1<sup>st</sup> Superpole, Yellow Pages 500, October 2002, 1<sup>st</sup> overall Dunlop Targa 2002 and 1<sup>st</sup> overall NZ V8 Tourer Championship 2003.

For the record, Ferodo's DS11 compound had a coefficient of friction (which denotes how "grabby" a disc pad is) or mu rating of .31. Low by today's standards compared with DS3000 Plus 03 compound at .72. A metallic road pad, (not to be confused with carbon metallics), which most of you have used before, also has a low coefficient of friction rating, again of around .3. This lack of power in a road metallic pad and DS11's poor cold performance do NOT make them desirable as modern race compounds. DS11 did however have a "recommended maximum temperature of 750 degrees C but is commonly used at temperatures in excess of 1000 degrees C" (Ferodo International Technical News F16, July 1980). Impressive numbers sure, (a Bendix Metal King Plus has a maximum c.w.t of 400 degrees C) but if your brake assembly is being asked to cope with those sorts of temperatures, you are going to be having extra problems over and above brake fade.

Compare Mintex's new M1177 material at .61 (dropping off a little after 500 degrees C but still holding a massive .55 c.o.f at 700 degrees C), Mintex M1166 sprint compound at .47, Ferodo DS2500 at .5, Ferodo TS2000 at .46, Mintex M1155 targa/endurance compound at .43 and Mintex M1144 (Formula Ford compound) at .45. EBC, on the other hand, doesn't seem to know where they are as they claim up to three different friction levels for some of its compounds, Red Stuff .33, .4, and .45, Yellow Stuff .34, .4, and .42, and Blue Stuff .38, and .4 depending on which brochure you pick up or which web site you visit. This proves the importance of obtaining an industry standard C.O.F/temperature graph, which should be available from any reputable supplier of friction materials, to determine how a disc pad material performs at any given temperature. The claim made for Green Stuff is .46 but as it is only recommended for road use or 4X4's and since even Mintex's baby compound (M1144) outperforms it in both road and race applications we struggle to take it too seriously. To obtain graphs on above mentioned products plus Pagid, Wilwood Polymatrix, SBS, but excluding EBC, please contact us at RACEBRAKES 0800 BRAKES. We can, however, provide the brochures of the conflicting claims made by EBC.

Which brings us to the next weakest link in the chain. The Brake Fluid.

There is no point having materials sitting in the wheels able to handle 700+ degrees C if your brake fluid is going to boil as soon as you put them to the test. First let us dispel a few common misconceptions. You do NOT want to use a DOT 5 brake fluid. DOT 5 is the rating given to silicone brake fluid (more correctly called Silicone Basal Brake Fluids or SBBF's) We must also not confuse "silicone" fluids with "synthetic" fluids. Silicone fluids are not miscible (mixable) with conventional fluids however synthetic race fluids can be mixed with conventional road fluids. Very handy if you have rolled the car in the back of beyond, tipped all your race fluid out of the reservoir, but the car will still be driveable if only you can top up your master cylinder. Remember, mixing standard brake fluid with your race fluid will proportionally dilute the properties of your race fluid.

Now back to the DOT rating. All brake fluid, apart from silicone fluids, are hygroscopic which means that they will absorb moisture. Some people use the term hydroscopic. The higher the DOT rating, the less hygroscopic they are. In other words, the less moisture they will absorb over a given period. Over time this will contribute to a brake fluids "wet boiling point". Using a high DOT rating in a road car theoretically means that you will not have to change your fluid as often as you would if you were using a lower DOT rated fluid. This however does not apply to a race car as a race cars brake system produces so much moisture and debris that the road car laws of longevity are not really relevant.

Silicone fluids are NOT hygroscopic, meaning that they will not absorb moisture. This however is their downfall. All brake systems produce moisture. Particularly race brake systems as it is the extreme temperature changes that cause excessive moisture build up. As the brake system produces moisture, a conventional brake fluid will absorb it but a silicone fluid won't. The moisture is still in the system but instead of absorbing into the brake fluid (admittedly reducing its boiling point), it just sits there in little water pockets waiting for the brake system to get hot so that it can vaporise. Even a well soaked brake fluid will have a higher boiling point than water. We must also be reminded here that the boiling point of a liquid goes up with pressure. That is why your pedal may hang in there during repeated heavy braking, but disappears entirely, after a brief acceleration run, on your next application. You would have thought that it may have even recovered slightly while you were off the brakes, but when you got off them and released the pressure, that's when the fluid boiled.

RACEBRAKES 0800BRAKES handy hint: Avoid the risk of vaporizing your brake fluid at all costs. The results of a brake pedal going to the floor can be extremely hazardous to your health. Replace your silicone or road fluid with a proper race fluid. We have found ELF's HTX115 to be very good value for money. We know that silicone fluid is kind to your paintwork if you spill it, but what are your priorities?

Keeping in mind that a DOT 5 is a silicone fluid, the highest DOT rating generally available for a conventional or synthetic fluid is a DOT 5.1 (notice the point one and we also note that there are DOT 6 fluids out there) So while a DOT rating has its place, what we are really looking for in a race fluid is a high dry boiling point. Interestingly, two of the best race fluids on the planet today, Brembo's LCF600 Plus (this is the stuff that they tip into the Ferrari F1 cars and is available from RACEBRAKES 0800BRAKES in 500ml bottles) and Castrol's SRF are both rated as DOT4+.

Incidentally, the minimum dry boiling point requirements of a DOT 4 fluid is 230 degrees C, DOT 5 (silicone) is 250 degrees C and DOT 5.1 has a minimum dry boiling point requirement of 260 degrees C. Admittedly, most off the shelf DOT4 road fluids will exceed the minimum requirements. In comparison, Brembo's LCF600 Plus has a dry boiling point of 316 degrees C and Castrol's SRF has a dry boiling point of 310 degrees C.

The other (and some would argue most important) advantage of a proper race fluid is that it is a lot less compressible than standard road fluids. In other words, they are less squashy. The less compressible race fluids help eliminate a lot of your spongy pedal and long pedal travel problems. It really is a shame when people spend hundreds of dollars outfitting their vehicles with braided hoses to firm up the pedal, then go and put a road fluid (or even worse, a silicone fluid which is highly compressible) into their car to save themselves a few dollars??

Now that we have our fluids sussed, the third weak link in the chain now becomes the rotors.

RACEBRAKES 0800BRAKES can of course supply 2 piece race rotors. However, once the price of manufacturing hats to make them fit your vehicle is taken into account, it seems almost churlish to wrap your standard road calipers back around them so we go shopping for a pretty set of four pots and there goes the budget.

As this discussion is centered around a “bang fer yer buck” makeover of a standard road brake system, we will be concentrating on what to do with your standard road rotors.

Firstly, RACEBRAKES 0800BRAKES and the manufacturers of road rotors do NOT officially recommend the use of non race rotors for motorsport use. However, RACEBRAKES 0800BRAKES are more than happy to supply quality road rotors for these purposes if it suits the clients budget or is mandatory because of control class rulings. The reality is that a lot of people go racing very successfully on road rotors.

The minimum requirement for racing on road rotors is... Make sure they are above the minimum thickness as specified by the rotor or vehicle manufacturer. The thinner a rotor gets, the less its ability to dissipate heat, which will increase the risk of it warping or cracking.

RACEBRAKES 0800BRAKES handy hint: Proper race pads are of course designed to dissipate heat efficiently. If we had a dollar for every client that suffered continual warping problems while racing on road oriented “performance pads” who then found that their warping problems were eliminated by using a proper racing friction material.....

Cross drilled and Slotted Rotors.

As a general rule of thumb, we at RACEBRAKES 0800BRAKES will try to steer you away from cross drilled rotors. The main advantage of cross drilled rotors is unsprung weight which is of course extremely critical on very light weight cars. However, having all those holes drilled through them makes them a bit of a “grenade” rotor, prone to warping and cracking when used on heavier vehicles that generate a lot of heat under braking. A very light weight car will, of course, not generate as much heat under braking therefore cross drilled rotors may not be such an issue.

The other advantage of cross drilled rotors is their ability to de-gas and continually de-glaze the disc pads. These processes, without the disadvantages of cross drilling, are to be found in “slotted only” disc rotors. No point in having the flash, powerful race pads in the car if they glaze up and lose their efficiency. However, slotted rotor upgrades are NOT an absolute necessity if you are running modern, high coefficient race materials that perform from dead cold in your road calipers.

RACEBRAKES 0800BRAKES will surprise you with their range of “slotted only” rotors. If, like the Mercedes 280E rotors, they are not available off the shelf, we can source them in about a week.

Summary.

For around the five hundred dollar mark, RACEBRAKES 0800BRAKES can set up your existing brake system to a point where we can guarantee that you will not outdrive your brakes on the road or on the track. This is what we call a Package 4 upgrade and consists of a front and rear friction and fluid upgrade.

While we cannot guarantee mileage on friction materials and always recommend taking a spare set of pads (even if these are just road pads as hole fillers if necessary), most of our clients used to get through prologue and the Dunlop Targa on one set of endurance pads, however, we now advise taking at least two sets of fronts due to the weight and distance increases of recent events.

If because of excessive weight, horsepower or speed you are able to outdrive 700+ degree materials, we would advise spending a couple of hundred dollars on brake ducting to cool everything down.

At the end of the day, we must remember that a brake system is only as good as the vehicles tyres and that a properly set up big race brake system will always beat a properly set up smaller road brake system. But that is a different story for different budgets.

For further information, specification sheets, or an accurate quote for your vehicle, please feel free to phone Steve or John at RACEBRAKES 0800BRAKES (0800 272537) or visit our web site at [www.racebrakes.co.nz](http://www.racebrakes.co.nz) . Our e-mail address is info@racebrakes.co.nz. and we are situated at 351 New North Road, Eden Terrace, Auckland, New Zealand.

## **RACEBRAKES 0800BRAKES**

### **APPROXIMATE BRAKE UPGRADE PRICE LIST**

Package 1	Front friction upgrade	\$250 - \$350
Package 2	Front friction and fluid upgrade	\$300 - \$400
Package 3	Front and rear friction upgrade	\$400 - \$500
Package 4	Front and rear friction and fluid upgrade	\$450 - \$600
Package 5	Front rotor and front friction upgrade	\$650 - \$800
Package 6	Front rotor, front friction and fluid upgrade	\$700 - \$850
Package 7	Front rotor and front and rear friction upgrade	\$800 - \$950
Package 8	Front rotor, front and rear friction and fluid upgrade	\$850 - \$1000
Package 9	Front and rear rotor and front and rear friction upgrade	\$1200 - \$1350
Package 10	Front and rear rotor, front and rear friction and fluid upgrade	\$1250 - \$1400

Braided hose upgrades can be added on top of these packages at an average cost of \$80 per hose.

These prices are based around cars with medium sized brakes such as 323 DOHC Turbo or Lancer GSR using the Mintex M1166 friction compounds and the ELF HTX115 race fluid.

For larger brake systems such as those fitted to EVO's, Skylines, Aussies etc add approximately 10%. Keep in mind that an EVO 1 or a V-tec Prelude have much larger front disc pads than the VS HSV clubbies that didn't opt for the big brake kit.

For vehicles with smaller brake systems such as Starlets and older Civics etc deduct approximately 10%.

For an accurate quote please phone 0800BRAKES (0800 272537).

As long as the vehicle weighs under 1800kg and is not an 800hp monster the following rule of thumb applies.....

Package 1 will not be outdriven on the road and we will guarantee that with Package 2 or Package 4.

For club racing or track days, Package 2 is the minimum but you will really appreciate Package 4 which we can then guarantee will not be outdriven on the road or the track.

You will need a really good reason not to do the fluid upgrade, and if that is your choice we recommend at least putting fresh road fluid in. Caliper upgrades are not usually necessary (or allowed in a lot of race classes) but if you are after the look of a big red Brembo you will need to budget around \$1000 per caliper.

Update: One of the most commonly asked questions is.... "How long are my race pads going to last under road conditions?"

Our best attempt at answering that question goes like this..... While we cannot guarantee mileage on a set of race pads, we can give you some indication as to what to expect. As a general rule, 500 race k's is considered good mileage out of a set of race pads. However this is where we should be pointing out that we need to be comparing apples with apples. If you were only going to get 500 road k's out of your \$200 race pads, this would not be considered a good investment in terms of dollars per kilometre as most people would be going through a set of pads every 1-2 weeks. If we use 40,000km as an average mileage (some people get more, some people get less, but everybody is happy with this as an average) for a set of road pads under **normal road conditions** and we fit our race pads and **drive the car exactly the same way as we did on the road pads**, we would expect to get higher mileage from them as they are of a denser material composition. What we find in reality however, is this. The race pads are fitted and the car is now driven in an entirely different manner than it was before. The braking points become later, the pedal pressure is applied more vigorously, and the car is taken to track days etc. Why, because you can. (heat, therefore track work, is one of the big killers of pad life). This usually results in the vehicle getting less mileage (say 20-30,000km) on the race pads than the road pads because it is now being driven in a **totally different way**.

For people who are only doing 5000km a year in their cars, 20-30,000km will equate to 4-6 years motoring. To prove the theory that race pads will last longer than road pads when driven in **exactly the same way** as each other, ask yourself this question..... If 500 race kilometres is considered good mileage out of a set of race pads, on a V8 Tourer for example, how many race kilometres would a V8 Tourer get out of a set of standard road pads?

De-gassing. What is it and how will it benefit me? (By Steve Borg, Disc Brakes Australia DBA)

As we know normal brake discs have a smooth, flat surface. Holes and slots in the face of the disc have a number of purposes. Firstly, removing gasses from the face of the disc, these gasses greatly reduce the coefficient of friction. Disc pads, when hot, expel gasses. These gasses form a cushion between the face of the disc and the pad.

It takes a tenth of a second to squeeze these gasses out on normal rotors. Now this does not sound like a very long time, but consider this. When a vehicle is travelling at 100km/h, it is moving at a rate of 30 metres per second, therefore a tenth of a second is three metres. So in essence, when the brakes are applied, the vehicle travels for three metres squeezing out gasses and not creating friction to slow the vehicle. (Race Brakes 0800 Brakes comment: This is probably not a big issue at city speeds but consider the lap time savings of a 300 km/h race car with 6 braking points per lap. This could add up to a saving of half a second per lap which could mean the difference between 1<sup>st</sup> or 14<sup>th</sup> in an Aussie V8 Supercar grid.) Another problem that occurs (which we touched on briefly earlier in this article) when the build up of gasses is not released, is that the pad material becomes hardened and glazed, greatly reducing the grip between the pad and disc. Cross drilling (see earlier comments) and slotting allow these gasses to be removed immediately, also helps to deglaze the pads, increasing the grip between the pad and disc, hence shortening the braking distance. Cross drilling and slotting makes the disc surface uneven so water and dust cannot develop into a thin layer that becomes a smooth, glass like surface and can greatly reduce the coefficient of friction. (Race Brakes 0800 Brakes comment: This ability to keep the disc pads continually deglazed is their main justification for using them as road rotors) Cross drilling and slotting work effectively to reduce the main problems that occur in brake systems. But there are some trade offs, such as a shorter pad life of approximately 10% so if you're getting 40,000km from a set of pads (NB: He uses this figure too) this can be reduced to 36,000km, a small price to pay for better braking performance. Also, the cross drilled rotors are more prone to cracking under extreme conditions, such as racing.

**Both the cross drilled and slotted and just slotted discs have the same performance qualities.**

So the question is, do I fit cross drilled and slotted or just slotted discs?

This question has to be asked of the driver, what is the main use of the vehicle?

Is the vehicle used for racing, or driven extremely hard?

Does the vehicle go off road? (circuit or strip work I presume)

If the answer is yes to either of these questions, slotted only discs should be recommended.

Other stuff that you will probably need to know: (Back to Steve Currie from Race Brakes)

As mentioned previously, most race pad manufacturers do not make pads for road calipers. Do not despair as we are able to manufacture these for you although it will take approximately 3 – 4 working days.

We need templates to build them from which cost on average \$20 - \$30 per axle set for us to supply new ones which will give you spares for next time. Alternatively, we can build them using your old disc pads which will save you this outlay.

As we are component manufacturers/suppliers only, we are unable to work on your actual car – although most upgrades are as simple as pad, fluid, rotor and hose swaps and this can be done by any competent workshop.

Bedding-in procedures for race pads and new rotors: In the road pad world, bedding-in of new pads is done very slowly and carefully along with new rotors or freshly machined ones. Race pads however are a different kettle of fish. Official bedding-in (conditioning) procedures for race componentry advises bedding-in (conditioning) of new pads on old rotors, and bedding-in (conditioning) new rotors with old pads. This ensures that the high temperatures involved in bedding-in race pads doesn't hurt the "green" (non-work hardened) new rotors. Most people cannot afford the luxury of fitting a set of pads, bedding them in and then pulling the car apart again to fit the new rotors. What we advise in road car instances is to fit the new rotors and pads at the same time and drive the car normally for about a week thus getting some non-severe heat cycles through your new non-work hardened rotors. Once this is achieved, it will then be appropriate to do the high heat cycling conditioning procedures necessary to bleed the gasses and resins out of your new race pads. This will cause an initial pre-fade as it happens but once it is out of the way, fade will not re-appear. Performance and longevity will also be enhanced. Be aware, most race pads will fade the first time that they get up to racing temperatures as the conditioning process takes place. We advise doing this pre-fade/conditioning/bedding-in procedure (call it what you will) in a controlled environment. Make sure that you get a set of bedding-in instructions for your particular brew of race pads when you receive them.

The blurb on braided hoses: Short answers. Yes, they are legal for road use as long as they meet a required standard. Yes, we can build them for you if you provide us a sample hose or a very, very clear set of instructions. No, you won't need to certify the car.

For a long time, virtually any type of braided brake hose was O.K, but they needed to be signed off by a low volume vehicle certifier, which meant that the car had to have a low volume certificate. Now the LTSA requires the braided hose itself to meet an approved standard, which is marked on the hose so the testing station guys can pass them, and does away with the need to certify the vehicle.

So now, the only disadvantage over rubber hoses is the extra cost of the hose – typically around \$50 a piece more expensive.

The advantages though, may make this extra investment well worthwhile. For starters, braided hoses don't swell and expand like rubber can, greatly improving pedal feel and response. They are less prone to exterior damage, very important in gravel events, and are less likely to suffer internal wall collapse which can act as a check valve and hold your brakes on – not a good look as far as heat build up and pad wear are concerned. A collapsed inner wall on a brake hose can also be very tricky to diagnose and is generally only thought of after the pads have been blamed as a bad batch and wearing out too fast, along with the calipers having been overhauled in case they were sticking. Possibly a lot of needless expense. Braided hoses also weigh less than rubber lines – not by a lot, but it does all add up and it is unsprung weight as well.

Predominantly, there are 3 types of braided hose.

The first is a properly swaged type like Goodridge, the acknowledged Rolls-Royce of braided brake hoses. These are manufactured like a rubber hose with proper braided hose swaged fittings at each end, i.e. a minimum amount of joins which translates into lighter weight and less chance of having any connection problems.

The second is of a type which has fittings screwed into swaged ends. Not ideal, because of the extra connections involved, but certainly a better option than the third type.....

Which is the Brake Quip style that uses large diameter rubber hose fittings swaged onto small diameter braided hose. To overcome the diameter differences, a packer is used between the hose and the fittings. Not a good look and quite a number of reported failures lately as the hose just pulls out of the fitting. Check with Eugene at Trade Parts and Lyall at Hi-Tech Brake and Clutch for confirmation as we have not sold any of these ourselves.

Below are Low Volume Vehicle Technical Association comments by Tony Johnson as published in New Zealand Performance Car, Issue 95, November 2004.

Q. I am in the middle of turbocharging my Honda Civic and have a question for you guys regarding brake upgrades. Basically, is there a point where they must be upgraded, or does it just come down to them being tested when I do the cert? The car was originally a Vti model before I put the B16A DOHC VTEC engine in, so it only comes with the disc brake on the front and drums on the rear. From previous experience though, I have found that upgrading the front pads to something half decent usually makes a pretty good difference, but I'm wondering if that will be enough in my case? I don't really want to go to the hassle of doing a rear disc conversion, as I don't think it will make that much difference to the cars stopping power. I'm aiming for around 250hp, which is almost double the 120hp the Vti came with. Kind Regards, Michael.

A. Good question. No, there isn't a cut-off point that says bigger brakes have to be fitted. As you can imagine the number of potential vehicles/conversions is almost infinite, so it would be near impossible to regulate. Add to that the fact that some cars come out from the factory with useless brakes (VN Commodore for example), while others have such awesome braking systems you can throw gobs more power at them and they're still just fine (Honda VtiR/SiRs etc). As you rightly mention, decent performance brake pads on the front can make a huge difference (cures the Commodores). Likewise, direct brake rotor replacements from an after market supplier like DBA can give a great improvement (through better material composition). Neither of these two mods require an LVV cert. So to answer your question, whether or not your brakes are man enough for their new job is a decision for the LVV certifier as part of his inspection process. In the case of a power upgrade, he doesn't carry out just a one-off performance test, but a cyclic brake-resistance fade test. This slows the car from 100kph to 0kph several times in immediate succession, ensuring that after repeated applications (simulating a hard twisty and hilly road work-out) you're not going to run out of stoppers. The LVV certifiers often find that brakes are good once, maybe twice, but often on the third or fourth application the pedal's gone rock hard and car just keeps going.

**Steve from RACE BRAKES 0800BRAKES butting in here, I wonder how many non-modified cars would pass the LVV cert brake test?** The best advice for those of you doing an engine upgrade or conversion and wanting to retain the standard brakes is before you take your car in for its cert, make sure the brakes are all in good condition (fresh, good quality fluid etc), and secondly, exactly what Michael suggests – talk to a specialist and fit a good quality set of aftermarket pads to the front. A final word of caution here; don't go too wild on the pads. The pads serious race cars use require a lot of heat to build them up to a point where they work properly (some pads will need one or two hard-out laps around Pukekohe before they're fully in business).

These are not suitable for road-going performance cars, they can be dangerous. Tony Johnson, Old Hoon, Low Volume Vehicle Technical Association Inc.

For those of you who choose to ignore all of the above and insist on grafting larger brakes on to your vehicle for increased cooling, which will decrease the wear rate of your consumables, and/or to fill up the wheels, keep in mind that you will still have to do the friction materials and fluid even on your bigger brakes. Since a well set up small brake system will run rings around a standard spec big brake system, a properly set up big brake system will obviously be better than a well set up small one.

There are two ways of fitting bigger brakes to a car. The least common route for most people is the fitment of proper aftermarket race calipers and two-piece race rotors. This way, while generally being the most expensive option because of the necessity of making 'hats' to get the rotor to fit the car, ensures that you get the maximum brake size inside your given wheel diameter.

The most popular way for us Kiwi's to fit a larger brake to our cars is to graft something on from a larger donor car, usually (but not exclusively so) from the same family of manufacturer. Examples of this would be Skyline 4 pot calipers onto Pulsars or VT Commodore parts onto VB – VS.

As RACEBRAKES 0800 BRAKES is not a dismantling yard or a multi make franchise dealer, we cannot supply Toyota, Nissan, Ford etc calipers or advise whether or not a Nissan 4 pot caliper, or the like, will "bolt straight on" to a Starlet etc. The same applies to rotors. We can't tell you if a Honda Legend rotor is going to "bolt straight on" to your Civic. You will need to work that out for yourself. A simple piece of advice here if you choose to take this route – rather than re-inventing the wheel, find someone who has done it before and see what they have used.

The truth is, some people elect to use certain donor cars because they just happen to have a destroyed one sitting in their backyard with a supply of free parts, or alternatively, have done their homework and have seen what has been used successfully before in similar conversions, thus eliminating that re-inventing the wheel thing. We can, of course, supply rotors off the shelf for most cars and should be able to supply you standard or sports versions of those Supra/300ZX/Legend etc rotors when you have decided what you are going to use.

It is O.K to use a mix of componentry. For example, you may have large enough rotors already and just want to fit some larger aftermarket calipers. Phone us with your rotor diameter and width and we will let you know what is available, keeping in mind that the chances of replacement calipers "bolting straight up" is virtually non-existent and will need mounting brackets made and the vehicle certified.

The same principle applies the other way. For example, you may have scored a couple of decent calipers off "Trade Me" but can't seem to find any vehicle that has been built with a 300mm rotor diameter and the correct offset and stud pattern to suit your 4 stud car. Why? Because not too many 4 stud cars were ever made with rotors that big. In fact, not too many road cars at all are made with rotors over 300mm. And the ones that have been, are not usually found at "Pick A Part". Rotor manufacturers do not tool up to make rotors of 300mm diameter with ? offset and ? stud pattern and ? centre bore just on the off-chance that a Kiwi modifier will want a pair some day. Your most helpful website for sizing listings is the DBA website at [www.dba.com.au](http://www.dba.com.au). If what you want isn't made, this is where the two piece rotors come into play – name your diameter and thickness, to suit your wheel diameter and caliper size, and get a pair of alloy hats made for them to give you the rest of your custom dimensions. A bit pricier sure, but nice and light and you only have to make the hats once. If your rotors wear out, you just need to replace the worn part.

A lot of people also go looking for disc brake conversions for their drum brake rear cars. No problem with that, but again, the same grafting rules apply and before you do anything, ask yourself these three questions, “Where am I going to get a handbrake from?” and “How much is it going to cost me to upgrade the end of the car that only does 20 – 30% of the work (and will in all probability lock up under heavy braking anyway when the rear wheels lift off the ground if the suspension isn’t sorted)?” along with “Would I be better off spending the \$500/1000/2000? dollars on the front brakes instead, since they do 70 – 80% of the work?”

Brake squeal:

Here is where the “black art of the brake guys” stuff comes in, and I’ll try to explain it in such a way that you won’t need a physics degree to understand it. Those people reading this with a physics degree will probably pick holes in the explanation, but I’ve got broad shoulders and I would appreciate your feedback if you have an improved or more accurate way of presenting it.

Brake squeal is one of those things that can drive you crazy on a road car, is irrelevant on a race car, and is a bit like the chicken and the egg question. For example, the friction materials don’t cause brake squeal, but by changing them, sometimes the squeal goes away which causes the uninformed to refer to the previous “squealing set” as “faulty”.

However, brake squeal is caused predominantly by a harmonic frequency, which is the frequency at which something vibrates, found in the relation between the steering/braking/suspension systems of most cars to one degree or another.

In simple terms, think of a bell. When you hit it, it vibrates and makes a noise. If you were to put your hand over the outside of it and hold it tight, then throw the little inner ball against the inside of it, you would only get a “dook” (like book) sound, not the usual dinnnnngggggg (like a bell) sound. This is because you have eliminated the bell’s vibrations and changed the frequency.

This vibration elimination is also what we need to achieve with your car to get rid of the squeal/ringing sounds by changing/eliminating the pitch/frequency of the vibration through a damping effect.

You will probably have noticed that brake squeal is predominant under light check braking and goes away when you give the brakes a good workout. This is because you are putting a lot of pressure on the pad/caliper combination under hard use which is stopping things from vibrating, moving and chattering. It will in all likelihood also be de-glazing disc pads which, in some instances, can be another contributor to brake squeal.

Soft standard cardboard pads are generally a lot more forgiving to vehicle harmonics than the race compounds as they will absorb and dampen the vibration instead of “chattering” like the denser race pads. To prove that it isn’t pad compounds *causing* the squeal, one only needs to look at cars with standard pads that are also squealing to realize that there is more to it than just disc pad compounds. Admittedly, now that we understand why, it is easy to see how changing friction materials can sometimes get rid of the noise, but it doesn’t necessarily get rid of the harmonic vibrations. But as these harmonic vibrations aren’t a safety issue, just getting rid of the noise is all we care about.

So how do we get rid of the vibrations from our race pads, because we don’t really want to put standard road pads back in?

Since most vibrations come from the disc pad contact areas in the caliper, we need to make sure that we have some good aftermarket anti-squeal shims fitted between the caliper pistons and the back of the pad. Yes, those steel shims that you threw away, were factory fitted anti-squeal shims. These were O.K for soft forgiving standard pads, but not really that absorbent as they were made of steel, and usually had to last through a number of pad changes because most people don’t buy O:E pads with new shim kits. The aftermarket anti squeal shims are a bit like a gasket material with a sticky backing on one side which you

attach to the back of the pad. The piston goes up against it and the shim absorbs any vibration. These aftermarket shims are around \$15 for an axle set. You can also get spray on anti-squeal compounds for the back of the disc pad, but these tend to be less permanent than the shim arrangement.

You will also need to make sure that any areas on the side of the pad that come in contact with the caliper are coated with copper grease or something similar. This is to eliminate the pad “hanging up” and vibrating on the caliper body. Don’t ignore pins and slides where appropriate for the same reasons and never put oil or grease onto the friction material surface of the pad.

For the record, the larger the brake diameter, the more prone it is to harmonic frequency. This is why vehicles such as Evo’s, with 320mm diameter Brembo brakes on the front of them etc, have more squealing issues than Grandma’s Corolla with the smaller diameter brakes .

If the generally effective and cheap fixes listed above don’t work, you may need to look at rotor compositions. Not a common problem, and not guaranteed to cure the problem if you change them, but an incompatible rotor/pad combination is known to be an issue in some instances. Obviously you would not start to cure brake squeal by changing disc rotors as your first option as the “process of elimination” should always start with the cheap cures.

If you find yourself getting down to some of the old timers remedies of pad chamfering and slotting, I would suggest that you are probably on a hiding to nowhere.

And yes, I do know of cars that could never get rid of squealing problems, so the owner got rid of the car.

To be continued when new common questions are found that aren’t answered so far.....