Brake Tech #05

Brake upgrades for track day use

With track days growing in popularity world-wide, many people are learning the hard way just how punishing these events can be on brake system components. The fact is that standard (OEM) brake components (pads, discs, hoses, fluid and even calipers in some cases) will not stand up to track day use....period. Standard suspension and even decent high-performance road tyres will do surprisingly well under entry level track day use but your brakes will fade, wear extremely quickly and possibly be permanently damaged. Unfortunately, many enthusiasts who are just starting to experiment with track days find themselves at the beginning of an expensive and often frustrating learning curve when it comes to brakes and track day use.

The fact is that many enthusiasts initially try to avoid making the investment required to correctly setup their brakes for track day use. This is a short sighted approach though. Proper track pad compounds, discs (rotors) that can handle track temps, s/steel braided brake lines, high-temp brake fluids and big brake kits are expensive but worth every cent in the long run in terms of on-track performance and wear life. Too many people try to get away with running high-performance street pads on standard OEM discs and end up learning the hard way that this will result in poor (sometimes dangerous) on-track brake performance, extreme pad wear and damaged (cracked, distorted) discs. In the long run, most enthusiasts that are just getting into track days will go through this learning curve and end up spending more money replacing damaged pads and discs over time than they would have if they had invested in the correct components in the first place.

Many people phone us up and say that they cannot understand why they are having such major issues with their brakes because they see themselves as entry-level track users and not "race car drivers". We need to be very clear on this next point: Track day users are often harder on brakes than professional race teams.

With braking excessive heat is the enemy. Consider that the same amount of heat that gets generated by an engine to get a car to 100kph (62.5mph) in 6 seconds gets dumped into four fairly small brake discs (with far less mass than your entire engine, cooling and exhaust system) in about 3 seconds when braking from 100kph (62.5mph) - 0. That's a lot thermal energy that your discs need to deal with in a very short period of time, during a single stop.

Now consider that under track use you have a compounding effect due to heavy, repetitive use of the brakes. Let's say you produce front disc temps of 90 deg C (194 deg F) while braking for the first corner of a track but the front discs only cool to say 60 deg C (140 deg F) by the next corner, so you exit that corner with disc temps of let's say 140 deg C (285 deg F) etc. This buildup continues until at lap 6 or 7 your front discs are sitting at 700 deg C (1300 deg F) at which point the standard cast-iron grades used for most OEM discs can be permanently altered (damaged). At these temperatures high-performance street pad compounds and most crossover pad compounds will be fading severely and smearing friction material unevenly on the disc surface, which can lead to vibration and localised high points that run hotter than the rest of the disc leading to further damage. It's a downward spiral from there on.

Let's look at some key factors that directly influence brake temperatures. The two most influential factors are: 1) The weight of your car and 2) The speed at which you start braking from. If you double the weight of the vehicle - you double the amount of heat produced by your brakes. If you double the speed - you produce four times the amount of heat. If you double weight and speed - you produce eight times as much heat. So, even small differences in speed and weight make BIG differences in terms of brake temperatures. Another factor that substantially influences brake temperatures is: 3) The amount of cooling that is supplied to the brakes. Standard road cars have very little in terms of proper brake ducting / cooling and this seriously limits the brake system's ability to handle continuous, heavy repetitive braking as experienced under track conditions. When taking into account the above points, it quickly starts to become clear why track day users often have worse brake issues than race teams.

Consider the following regarding the brakes on race cars: 1) Production-based race cars are normally completely stripped down and often weigh up to 400kg's (880lbs) less than the street version of the same car, 2) Professional race car drivers generally carry far more corner speed than your average track day enthusiast, meaning that they have to slow the car less before each corner, therefore producing far less brake temperature, 3) Race teams typically run proper ducting from high-pressure areas on the front of their cars that directly feed cool, pressurized air to key areas around the front (and sometimes rear) brakes and 4) Race teams spend a lot more time optimizing front/rear brake bias, resulting in the rear brakes doing their optimal share of the work when slowing the car. This helps to balance the chassis under braking as well as reduce front brake temperatures, when compared to a car which is heavily front biased, which so many track day cars are. (More about this later).

Frequency of track days

It is important to note that whether you take part in track day events once a year or every weekend, you will experience sub-standard brake performance and are likely to damage your brake components if you try and use standard discs and street pads on track. These issues have more to do with the extreme brake temperatures (experienced under even a single session on a track day) than they do with the frequency of your track day events. We highly recommend that you invest in the correct brake components even if you plan to do only a limited number of track days.

Definitions

- We would define entry-level track day use as: Up to 6 laps per session in a standard (unmodified) road car of light–medium weight, running on street tyres.
- We would define intermediate track day use as: Up to 10 laps per session in a moderately tuned road car of light-medium weight, running high performance street or semi-slick tyres.
- We would define advanced track day use as: More than 10 laps per session in a substantially modified (or particularly heavy) road car running on semi-slick tyres.

Standard diameter upgrade vs. Big brake kit

So where do you start when setting up your brakes correctly for track day use? Of course there are endless variables to consider including: vehicle weight and power output, size and efficiency of OE discs and calipers, type of tyres being used, circuit layout, driver experience, number of laps to be done per session etc. We will cover these variables in a bit more detail later but to start with, there are essentially two basic directions to follow.

The first would be to fit a Big Brake Kit (BBK). The second would be to fit discs and pads that can operate at higher temps before fading / failing. The big brake kit is generally the optimum solution for track day use. Although 4-wheel BBK's are available for certain applications, most track day users will get away with a front only BBK. These kits include larger diameter front discs with far more efficient cooling vane designs that can store more heat and flow substantially more air. Also included are multi-piston aluminium calipers, s/steel braided brake lines and all necessary mounting hardware etc. We could write a ten page article on all the reasons why a quality BBK is the way to go for track day use but we won't get into that kind of detail in this overview. Basically, BBK's provide improved ability to store and dissipate heat, hereby resulting in lower operating temperatures and more consistent brake performance under the extreme braking conditions encountered under track day use.

Some other benefits to be had from a quality BBK include: less caliper deflection, firmer brake pedal, reduced weight, less disc distortion (with properly designed floating discs), improved disc and pad life and optimized brake balance (if proper consideration has been given to matching caliper piston size to the vehicle platform in question). There are numerous very good BBK's on the world market as well as some very, very bad ones. We suggest opting for a BBK from a reputable manufacturer who's products have been proven under race conditions. Properly designed BBK's are perfectly suitable for double-duty (street and track day) use as long as due consideration is given to pad compound selection. Decent BBK's are fairly expensive but if you're going to be taking part in track days they are a very good investment. You'll end up saving yourself a lot of money in the long run and you'll be able to enjoy your track events without the constant brake issues that are so commonly associated with track day use.

For detailed information on Powerbrake's range of big brake kits – click here

The second option would be to fit upgraded standard diameter discs and pads. This option was really brought about originally by Production Car / Group N style racing in which the series rules often specify that no big brake kits are allowed. Often these race series specify that OE calipers and standard diameter discs must be used but leave the disc design/material as well as the choice of pad compounds free. The irony being that generally these rules are designed to keep costs down but this is a highly debatable point as the larger discs and pads featured in big brake kits would last far better than the standard diameter discs and pads, often off-setting the purchase price of the BBK over a period of just a single season. Nevertheless, these rules have forced disc and pad manufacturers to come up with disc alloys and competition pad compounds that can run to extreme temps without fading / failing.

For example - Powerbrake can supply standard diameter disc / pad combinations for many cars that will run to temperatures in excess of 750 deg C (1380 deg C) without fading or failing but there are trade-offs. 1) You cannot run most race pads on the street as they will become abrasive to discs at low temps and will run very noisy in terms of brake squeal etc. This means that you need to run a two-pad strategy, where you fit proper competition pads for your track day events and switch back to your high-performance street pads for daily use. 2) Eventually other components around the brakes (caliper seals, caliper guide bolt bushes, brake fluid, ABS sensors etc) will start being affected by the extreme brake temps encountered under track conditions.

Regardless of whether you opt to fit upgraded standard diameter discs and pads or a big brake kit up front, we highly recommend upgrading the rear pad compound as well to ensure optimal brake bias. This will not only result in a far more balanced vehicle attitude under braking but will also help to keep front brake temperatures to within acceptable levels. Generally you can get away with running the upgraded rear pads on the OEM rear discs without a hassle.

Brake fluid

Brake fluid is the 'life-blood' of your brake system. One of the common problems experienced by enthusiasts just getting into track day events is an increase in brake pedal travel throughout a track session and in some cases a pedal that goes straight to the floor with little or no brake effect at all. This occurs when the brake fluid behind the pistons in your calipers reaches its boiling point and evaporates, turning

from a liquid into a gas. Gas is far more compressible than liquid, so your brake pedal gets longer and longer, eventually going straight to the floor. In the brake industry, this is referred to as “vapor lock”.

The scary thing about vapor lock is that when you’re actually on the brakes, you are pressurising your brake fluid, which temporarily raises the boiling point of the fluid. Your brake fluid is therefore most likely to boil in the instant that you come off the brakes (when the brakes are still extremely hot but the system pressure is reduced, hereby lowering the brake fluid to its normal boiling point). In this example, you will only realise that your fluid has boiled when you get to the next corner and hit the brakes only to discover that your pedal goes straight to the floor with very little brake effect. Anyone who has experienced vapor lock will tell you, it is not something you want to experience first hand! At Powerbrake we feel that you MUST use a decent high-temperature brake fluid for any form of track day use. This is a safety critical point and should not be overlooked.

Good brake fluid choices would be Motul RBF600 or Endless S-Four for entry-level and intermediate track day use and Motul RBF660 or Endless RF650 for advanced track day use. These glycol based fluids are fully compatible with the seals in all modern brake systems. They will offer substantially improved boiling points and reduced compressibility, which leads to a firmer, more consistent pedal feel and vastly improved on track safety. Do not use any form of silicone based brake fluid!

The table below provides a comparison between the wet and dry boiling points of standard DOT 4 fluids and some of the high-temperature brake fluids that Powerbrake stocks. What the table does not show is the differences in compressibility between the different fluids. If you are looking for the absolute best brake fluid on the world market at the moment in terms of reduced compressibility and optimal wet and dry boiling points, Powerbrake recommends that you use Endless RF-650.

Fluid	**Dry boiling point (when new)**	**Wet boiling point (once fluid has absorbed 3% water by volume)**
DOT 4 requirements	230 deg C	155 deg C
Endless S-Four	295 deg C	187 deg C
Endless RF-650	323 deg C	218 deg C
Motul RBF600	312 deg C	216 deg C
Motul RBF660	325 deg C	204 deg C

Stainless steel braided brake hoses

From the factory, most cars are fitted with flexible rubber brake hoses that connect the hard brake lines (attached to the car’s bodywork or chassis) to the calipers (or wheel cylinders in the case of drum brakes). The rubber brake hoses are made up of an inner lining that is resistant to brake fluid, followed by one or two layers of material braid and a final outer rubber protective coating. While rubber hoses provide the flexibility necessary for wheel articulation, they do expand considerably under heavy braking resulting in an unwanted long, spongy brake pedal. Rubber brake hoses also have a limited max operating temperature and we have seen rubber brake hoses literally melt out of their end fittings (on the ends that attach to the front brake calipers) under serious track use.

Professional race teams have specified stainless steel braided brake hoses for decades due to the vastly improved pedal feel, quicker system response time, improved temperature resistance and increased durability of these assemblies. When it comes to braking, any sponginess or compliance in the system is bad because it reduces the driver's ability to modulate their braking and avoid unwanted wheel lockup. Some very interesting research has been conducted into the fact that the human brain can modulate pressure variations far better than movement. So, the bottom line is that you want your brake pedal movement to be as short and firm as possible, as opposed to traveling excessively under hard braking. Powerbrake highly recommends the use of stainless steel braided brake hoses for anything above entry-level track day use.

For more information on Powerbrake's DuraLine s/steel braided brake lines – click here

Summary of fundamentals

To summarise then, we recommend that entry-level and intermediate track day users fit our GT Series standard diameter front discs matched to a decent high-performance street pad up front for street use. The GT discs will handle fast-road and a fair amount of track use (they are the exact same discs that we supply to production car race teams in cases where they are not allowed to upgrade to BBK's). For track day events you MUST switch from your high-performance street pads up front to proper competition pads (such as Endless CCRg, Cobalt XR-Series, Carbotech XP-series, Hawk DTC-series etc) and then switch back to your fast-road pads for daily driving again.

This strategy can work very well and we have many customers both in our domestic and export markets that have taken our advice on this two-pad strategy with great success. For optimum brake balance, we recommend upgrading your rear pads as well. Normally OEM rear discs can be retained as long as they are within wear limits. At Powerbrake we feel that upgrading to a decent high-temperature brake fluid is safety critical and is a MUST for any form of track day use. Fitting stainless steel braided brake hoses is highly recommended for intermediate and advanced track day use.

For advanced track day users or enthusiasts with particularly powerful / heavy cars we recommend fitting one of our big brake kits up front with a pad compound correctly selected to suite your vehicle and driving style. Rear pads should be upgraded to optimize brake balance and contain front brake temperatures. Stainless steel braided brake hoses and high temperature brake fluid should be considered a NON-NEGOTIABLE safety upgrade for all advanced track day users.

Pad compound selection

Once you have the foundation brake components such as discs, calipers, hoses and fluid sorted out, the next step is to select front and rear brake pad compounds that are going to suite your intended use, vehicle weight, tyre choice and personal preferences. The pad compounds that you select will determine the 'personality' or 'characteristic' of your brake package. Friction material engineering is an incredibly complex science and by switching brake pad compounds you can dramatically alter the braking characteristics of your car. The differences can literally be 'day and night'. Pad compound selection will determine the amount of initial 'bite' you experience, whether the brakes are linear or progressive in nature, how soon fade sets in under track use as well as disc and pad wear life and more.

Many disc, caliper or big brake kit manufacturers either have their own branded pad lines or represent and stock a certain brand of pads. The result is that they try to encourage a specific pad brand to customers that buy their discs or BBK's. At Powerbrake we take a different approach to pad compound selection. As a foundation brake component manufacturer that dedicates an enormous amount of time to R&D, we have developed very good working relationships with a number of the world's top specialty brake pad manufacturers.

The result is that we have a very well established database of test data on a very wide variety of pad compounds. In fact we have access to over 70 high performance street, crossover and competition pad compounds from six of the world's leading pad manufacturers. Of course we do not stock all of these materials but we do carry substantial pad stocks in-house for immediate delivery and can usually deliver any specialized, non-stock pad compounds on a special order basis within about 4 weeks.

While all specialty pad compounds have a unique blend of characteristics, we can broadly categorise them into three groups.

Category	Application	Examples
High performance street pads	Street use only. **Not** to be used for track day use in front calipers under any circumstances. Can be used in rear calipers for track days in some cases.	Bendix Ultimate, Endless SSY
Crossover pads	Can be used for high performance street and entry-level track day use in the front calipers of light cars and fitted at the rear for intermediate and advanced track day use in a wide variety of cars.	Carbotech XP8, Endless MX72, Hawk DTC30
Competition pads	Intended for track use only. Many competition pads can be safely used to drive to and from a track day event but should not be left in for daily street use due to: possible reduced friction levels at low temps, increased disc abrasion at low temps, high levels of brake dust and excessive brake noise.	Carbotech XP10/12/16, Cobalt XR series, Hawk DTC60/70, Endless race compounds.

Before going any further, we need to be very clear on the following:

No form of street pad (OEM or high performance) should ever be used for any level of track day application. Doing so can be dangerous and will result in brake fade and almost certain damage to front discs and pads. Running any form of street pads for track days is a complete miss-application of the product!

Assuming that you are clear on the above statement, we will not discuss street pads any further in terms of track day use. Moving on then - the most common mistake that we see people make when they start getting into track days is to try and run a crossover pad that they can use for both daily road as well as weekend track day use. While there are some compounds on the market that can be forced into this double-duty role, you will always be compromising both ways. Under street use the crossover pads will typically run noisy and be more abrasive to discs than high performance street pads. Under track use the crossover pads will not come near to the performance levels, heat range and wear life of proper competition pads. The end result is that you end up being disappointed with both on-road and on-track performance.

The fitment of a big brake kit can extend the scope of crossover pads because the larger brakes will reduce brake temperatures and possibly allow the crossover pads to cope better under track conditions but you will still have to live with many of the negatives listed above including: abrasive, noisy pads under road conditions.

As mentioned previously, we highly recommend a two pad strategy for track day enthusiasts that use their cars as daily drivers as well. This way, when running your high performance street pads you will enjoy smooth, quiet, responsive braking and friction levels that are well suited to street tyres. The street pads will not be abrading away your discs at the lower temperatures associated with daily road use either. When you switch to your competition pads for track days you will be getting uncompromising brake performance, heat range and wear life. The higher friction co-efficient of the competition pads will also be better suited to make the most of the improved grip provided by the semi-slick tyres that most intermediate and advanced track day users run. By running a two pad strategy you will optimize both disc and pad life with both your street and track day pads.

It is important to understand that if you run pads over their maximum operating temperature on track, the pads will start to transfer friction material erratically to the surface on the brake discs. This uneven friction material transfer leads to disc thickness variation, brake vibration and uneven heating of the disc surface (as the high points run hotter than the rest of the discs). Ultimately you can permanently damage your discs in a very short period of time (one track day), which will then need replacing. Disc skimming (turning) may not solve the problem as the cast-iron in the areas that overheated (typically the areas between the cooling vanes) has likely changed to a harder material. If you skim (turn) the discs, the vibration will disappear for a short period of time until the disc starts to wear slightly, at which point the harder areas will not wear at the same rate as the softer areas and the brake vibration will return. If you had run a two pad strategy with competition pads that have the correct temp range, you may have saved yourself the cost of a new set of discs.

Selection of a particular competition pad compound really boils down to personal preference. Some drivers prefer a pad compound with very strong initial bite, while others prefer a smoother initial bite. Likewise, some prefer a compound that offers a very flat torque curve, while others prefer a torque curve that rises during a brake application. Some drivers prefer a pad with a very high friction co-efficient that requires less pedal pressure, while others prefer a pad with a slightly lower friction co-efficient that requires firmer pedal pressure. Different vehicle platforms and suspension setups will also react differently to different competition pad compounds and these vehicle specific points may influence pad compound choice. In the long run you may end up trying a few different competition pad compounds before settling on the material that best suites your vehicle and driving style but at Powerbrake we are in a very good position to make a

well qualified initial recommendation and then work with you to fine tune brake characteristics to meet your preferences over time.

The second most common mistake that we see people make is to upgrade only their front pads. This brings us to our next point for consideration, which is the front/rear pad split. It is common for car manufacturers to lean towards an overly front biased brake setup. In simplified terms: If the optimum brake bias for a particular vehicle is say 65% front / 35% rear, you may find a vehicle manufacturer opting for a 70/30 front/rear split. This is done to ensure that if the vehicle owner fits a lower friction front aftermarket replacement pad (bear in mind that front pads often wear out before the rears do) that the car will not end up with too much rear brake bias, which is an unstable and potentially dangerous situation.

So, the bottom line is that many cars are in fact setup from the factory with a bit too much front brake bias as a safety net. Now consider that so many track day enthusiasts only invest in high friction front pads because they are thinking that the front brakes do the majority of the work and the result is that the brake bias is now moved even further forward to say: an 80/20 front/rear split. This can result in a number of negatives including: premature front wheel lockup, excessive front brake temps, excessive front disc and pad wear and poor vehicle dynamics under braking (e.g. a car that pitches its weight violently forward to the front axle under braking, rather than 'squatting' and composing itself early in the brake application, before transitioning its weight forward in a more controlled manner).

For this reason we recommend upgrading rear pads at the same time as the front to maintain correct brake bias. In fact, it is often possible to increase the rear friction co-efficient slightly more than the front in percentage terms in order to really optimise brake bias. Some of our customers in fact run the same competition compound front and rear for optimum bias. This will differ from car to car and is also influenced by suspension setup. Generally speaking, the firmer the setup - the more rear brake bias can be used. So, a car with a very rigid chassis, a firm suspension setup and good weight distribution may be able to run the same competition pad compound front and rear, while a car with a softer setup (i.e. most standard road cars) would do better with a slightly stronger front pad than rear pad. Typical front/rear splits for track day applications would include: Carbotech XP12 front / XP10 rear, Hawk DTC70 front / DTC60 rear, Endless CCRg front / MX72 rear, Cobalt CSR front / XR5 rear.

A word of caution here though - There is a definite 'tipping point' beyond which a car with too much rear brake bias will become very unstable under braking. You need to approach this point cautiously if you are experimenting with moving brake bias rearwards to squeeze the maximum brake performance from your car on track. If in doubt, stick to the OE front/rear split and increase pad friction levels in equal percentages front and rear. Again we would be happy to make recommendations on front/rear pad splits based on your vehicle platform and setup.

The last point for discussion with regards to pad compound selection is how corrosive the brake dust is that is given off by different competition pad compounds. The brake dust that you see deposited on your wheels after either street or track use is combination of brake disc material and carbonised pad material. Most brake pad compounds (street or competition) contain some ferrous content and brake discs are obviously manufactured from ferrous materials as well. Therefore if your car gets wet/damp and is not cleaned regularly, brake dust can corrode (rust) and damage the finish on your wheels as well as the paint on your car in the area behind the wheels. In some cases this is more prominent with competition pad compounds, which may have higher ferrous content than many street pads. As a general rule we recommend that you wash your car thoroughly immediately after returning from track day events. If you take part in very regular track days, it is not a bad idea to have 3M vehicle protection film (VPS) applied to the area behind your wheels to avoid any paint damage.

For detailed info on the various brake pad compounds that Powerbrake can supply – click here

Brake cooling (ducting)

Ducting cool air to the inboard, inside diameter of your front brake discs will substantially reduce front brake temps. This in turn results in reduced brake fade, improved brake consistency, increased front disc and pad life and the ability to stay out on track for longer sessions. You will notice that in professional race circles, proper brake cooling is the norm. Although this modification has enormous technical benefits, the reality is that very few track day enthusiasts will fit proper ducting. The reason is that the ducting is normally taken from high-pressure points somewhere on the vehicle's front bumper (fender). This normally requires some fairly serious modifications to the vehicle's bodywork and enthusiasts that use their cars for daily use as well as track days are often hesitant to make these modifications. We therefore tend to see this level of modification on dedicated track day vehicles that are not used as daily drivers. Having said that, you cannot downplay the substantial technical benefits of proper brake cooling. Brake duct kits are available from many aftermarket sources around the world for popular track day cars.

Budget considerations

Please do not make the all too common mistake of increasing the horsepower of your track day car and fitting semi-slick tyres with far higher grip levels than street tyres and then try to save money when it comes to your brakes. Remember that increased horsepower will mean that you will be arriving at corners at higher speeds and this exponentially increases brake temperatures. High-grip tyres will also result in your brake components being taxed far more severely.

Upgrading to brake components that are designed to operate at the temperatures associated with track day use should be considered a safety critical upgrade. Nobody wants to damage their car or injure

themselves due to a brake failure on track. In fact, it would make logical sense to first invest in decent track tyres and upgraded brake components before spending any money increasing horsepower. If your car is a dedicated track day car then we highly recommend reducing weight before increasing horsepower.

The second consideration in terms of budget is that if you try to save money when selecting brake components for your track day car, you are simply going to end up continuously damaging discs and pads, which will require constant replacing. The result being that you will very quickly end up spending the same amount of money that the correct brake components would have cost you in the first place. Our advice is to invest in the right brake components up front and then enjoy improving your driving skills safely, without the constant frustration of brake fade, vibration and high disc and pad wear rates.

That said we have provided a table below that lists possible brake upgrades for track day use in order of increasing cost, while covering the pro's and con's of each.

Upgrade	**Comments**
Fit front crossover pads only.	This is the most common upgrade carried out by people just getting into track days. The up side is that this is a cost effective option. The down side is that most crossover pads will run very noisy on the street as well as being abrasive to discs under road use. On track performance will be mediocre and inexperienced drivers may well overheat the crossover pads leading to disc and pad damage and costly replacement bills. OE discs should be carefully checked to ensure that they are within their wear limits because the higher friction crossover pads are going to dump more heat into the discs, which will need to handle the increased thermal loads. This upgrade will also result in the brake bias moving forward substantially affecting brake balance negatively.
Fit front crossover pads and replace standard brake fluid with a decent high-temperature fluid.	Decent brake fluids are not that expensive and should be considered an essential safety upgrade for anybody starting to use their car for track days. This is even more important if you are only upgrading your front pads as the resulting overly front-biased system is going to lead to very high front brake temperatures due to the fact that the rear brakes are trailing behind and not contributing as much brake effort as they should be. This can quickly lead to boiling brake fluid in the front calipers.
Fit front crossover pads as well as upgraded standard diameter front discs and replace standard brake fluid with a high-temp fluid.	The addition of front brake discs that are machined (in many cases to tighter tolerances) from cast-iron alloys that can handle far higher brake temperatures without distortion and cracking makes a lot of sense. Discs that feature moderate slot patterns will offer further benefits in terms of de-glazing pads and venting away friction gasses and debris. Stay away from cross-drilled discs completely for track day use. Cross-drilling reduces disc mass (and therefore the thermal storage capacity of the disc) as well as substantially increasing the chances of disc cracking around the drilling sites. We recommend high quality discs with moderate slot patterns. The very best discs on the market will have undergone

	various forms of stress-relieving, which result in a very stable disc casting and maximum resistance to distortion and cracking. The bottom line is that higher friction pads will slow your car quicker, meaning that your discs will have more heat dumped into them in a shorter space of time. This is hard on discs and it makes sense to upgrade to higher grade discs that can better handle this increased thermal shock.
Fit upgraded front standard diameter discs and run a two pad strategy up front, running high performance street pads for daily use and switching to proper competition pads for track days. Replace standard brake fluid with high-temp fluid.	The two pad strategy is an excellent choice for a car that is used for both daily driving as well as weekend track days. This strategy will ensure optimum on-road and on-track performance with fewer compromises. Front disc and pad life will be optimized under both road and track day use.
Fit upgraded front standard diameter discs and run a two pad strategy up front, running high performance street pads for daily use and switching to proper competition pads for track days. Replace standard brake fluid with high-temp fluid. Fit s/steel braided brake hoses.	The addition of the s/steel braided brake lines is a good decision from a safety point of view as they will handle far higher temps than OE rubber lines. Pedal travel will also be substantially reduced and brake feel, feedback and modulation improved.
Fit upgraded front standard diameter discs. Run a two pad strategy up front, running high performance street pads for daily use and switching to proper competition pads for track days. Replace standard brake fluid with high-temp fluid. Fit s/steel braided brake hoses. Fit upgraded rear pads.	By upgrading your rear pads you can optimize front/rear brake bias, resulting in a far more balanced platform under braking. Front brake temperatures will be reduced as a result, leading to improved front disc and pad life. From a technical point of view the addition of upgraded rear pads really is the right way to go. Far too many enthusiasts ignore rear pads as a cost cutting measure, which is a mistake. This setup is the optimum option for a car that does double duty as a daily driver and weekend track day car - before stepping up to a big brake kit.
Fit a big brake kit up front with a crossover pad compound, matched to upgraded rear pads. Most big brake kits will include front s/steel braided brake lines and decent brake fluid.	Although expensive, a quality big brake kit is a very wise investment on any car that will be used track days. The sooner you make the investment the better. We cannot tell you how many times we have watched customers pouring money into regular replacement of standard diameter discs and pads as they get more and more into their track days. Eventually when they get tired of constantly replacing standard diameter brake components, they make the investment in a big brake kit in the long run anyway. The question to raise then is how much money they could have saved themselves by buying the big brake kit earlier on? We do not feel that the crossover pads are the right way to go but

	the big brake kit will result in lower front brake temperatures, which may allow you get away with running a single pad compound for both street and track day use. Keep an eye on disc abrasion under street use though. Brake noise may also be an issue on-road.
Fit a big brake kit and run a two pad strategy up front and run matched upgraded rear pads. In other words you will have the front BBK with a set of front street and a set of dedicated front competition pads, upgraded rear pads, braided brake lines and decent brake fluid.	A superb setup that will actually save a track day enthusiast money in the long run. Brake performance under both street and track conditions should be excellent and hassle free.
Fit a big brake kit and run a two pad strategy up front and run matched upgraded rear pads. You will have the front BBK with a set of street and a set of dedicated competition pads, upgraded rear pads, braided brake lines and decent brake fluid. Add proper air ducts to feed cool air to the inboard, inner diameter of your front discs.	This is the ultimate track day brake setup. Fitting the air ducts may require modification to the car's front bumper (fender) although there are air duct kits on the market for various cars that scoop air from underneath the car meaning that no modifications are required to the front fender. Ducting cool air to the front brakes will substantially reduce front brake temperatures. However in reality, only a handful of serious track day enthusiasts will take this step as it may require some permanent modifications to the car. Proper ducting is often only carried out on dedicated track day cars and not daily drivers. The technical benefits of proper air ducting are substantial and should not be underestimated. At this point you have race-level brake setup on your track day car. Enjoy hassle free track days….

Conclusion

The purpose of this article is to provide track day enthusiasts with the basic knowledge required to make informed decisions regarding the upgrading of their brakes. Time and time again we have watched as enthusiasts that are just starting to get involved in track days try to get away with spending as little as possible on brake upgrades. The inevitable result is continuous brake issues, including severe brake fade, extreme disc and pad wear and even complete brake failures on-track. Large sums of money end up being spent over time on constant disc and pad replacements.

Eventually the person in question comes to the realization that they will have to invest in doing the job properly and they end up spending money on the correct products anyway. Had they invested in the correct brake upgrades initially, they would have saved themselves all the money that was wasted along the way as well as being able to enjoy their track days and improve their on-track driving skills without the frustration of constant brake issues, which reduce driver confidence as well.

Above all this though, should be the safety considerations. Nobody wants to damage their car or injure themselves because they simply did not have the correct brake equipment on their vehicle for the intended application. We sincerely hope that the information provided in this article will guide you to make an informed decision regarding the correct brake upgrades for your track day car.

POWERBRAKE

Email:	sales@powerbrake.co.za	Phone:	+27 12 998-0214
Mobile:	+27 84 374-6296	Fax:	+27 12 993-1221
Address:	P O Box 38205, Garsfontein East, 0060 Pretoria, South Africa		