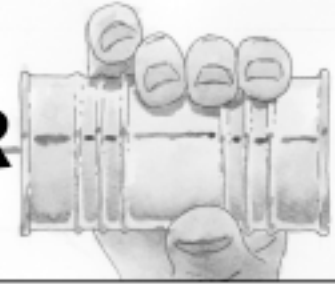


# MEMBER 2 MEMBER



*I think you will agree with me when I categorize Turbo Diesel owners as independent people who are not afraid to try something new. You are an ingenious membership who reinvents and improves a product to make it better serve your needs. You show a strong willingness to share your "Shadetree Solutions." With your input each quarter, we publish the "Member2Member" exchange to give you a forum to tell other members how you solved a problem.*

## BRAKE PAD SELECTION

*In Issue 40 we asked engineer-writer James Walker to adapt his article on brake systems for the TDR audience. I had found James' original in Grassroots Motorsports and was impressed by his common-sense writing style. As an introduction to this issue's "Brake Pad Selection" I'll pull a quote from his Issue 40 article, "modifying our brakes to address the presence of high temperatures (brake pad material and brake fluid composition) should be considered if your thermal concerns cannot be addressed by super-sizing." Super-sizing sounds expensive, so let's hear what James has to say about brake pad selection.*

In Issue 40 we learned that as brake pedal force (how hard the driver is pushing the pedal) is increased, the truck's deceleration rate will also increase (the truck will slow down more) until the point at which the tires run out of traction and lock up (or go into ABS if so equipped). Beyond this point, additional force applied to the brake pedal does nothing more than make the driver's leg sore. Tire-to-road traction was discovered to be the limiting factor for stopping distance, and here in Issue 41 we are back to tell you that fact hasn't changed.

At the same time, we also learned that there were several other benefits to changing brake system characteristics which could benefit the typical TDR reader. Even though race-bred big brake kits are probably beyond the scope of most of the audience, tangible improvements can still be had in the areas of driver tuning, temperature sensitivity, and compliance. Because we don't want this magazine to turn into a 200-page essay on brake system design, for now let's just look at the most common upgrade of all: the brake pads.

## BRAKE PADS 101

One of the single most common brake upgrades is the replacement of factory pads with premium, high-performance, or heavy-duty brake pads. However, because there are no industry standards for what constitutes a "premium," "high-performance," or "heavy-duty" brake pad, the consumer is best advised to do a bit of research beforehand to determine if the four pieces of friction material in the cardboard box (Figure 1) are suitable for their purpose.



Insert Figure 1 – Typical Brake Pads

## Driver Tuning

One of the brake pad's most significant characteristics is its effective coefficient of friction. In general, brake pads from the factory are sold with a relatively low coefficient of friction (typically in the 0.30 to 0.35 range) in order to make the brakes as noise-free as possible. While there are about a bazillion other reasons why this range is so common, let's suffice it to say that in the aftermarket there are not as many restrictions or constraints placed on the friction material performance. It's basically a case of anything goes, and as a result you can buy pads with just about any friction level you desire.

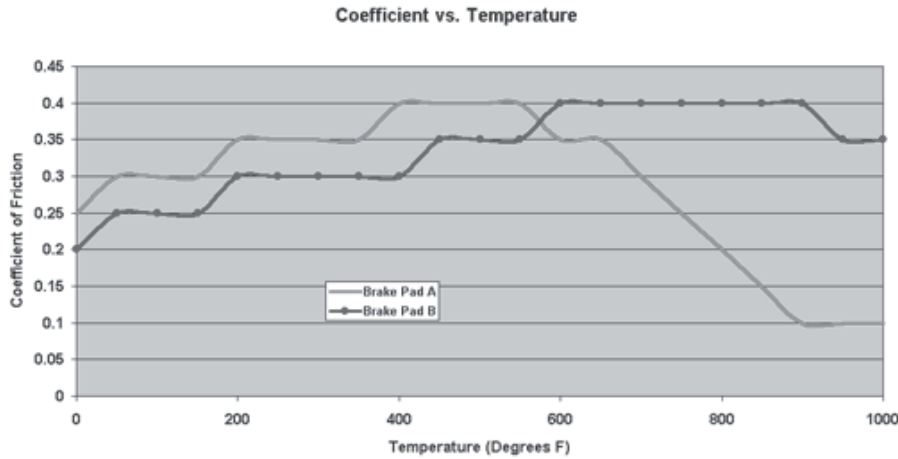
Increasing the coefficient of friction just a small amount can cause the brake system feel to change dramatically. For example, if a factory brake pad with a coefficient of 0.30 was replaced with an aftermarket brake pad with a coefficient of 0.40, the result would be the same as if the driver pressed on the brake pedal 33% harder! Because the relationship of driver force-to-deceleration is generally linear, any change in friction level (on a percentage basis) will directly result in an equal level of increased deceleration. In other words, the driver now has to hit the pedal with less force to achieve the same level of deceleration so the truck feels like it is stopping faster. This is typically regarded as a good thing.

Unfortunately, like most things in life nothing is free. Even though this sounds like a good deal, as soon as the friction level is changed other brake system characteristics can be impacted inadvertently. ABS calibrations, brake balance, noise, wear, dust, and roughness are just some of the possible areas of concern. Buyer beware, the only brake pad which has been certified to work in harmony with your truck is the pad that came from the factory! Increased friction may be on your wish list, but be ready to deal with these side effects should they arise.

**MEMBER2MEMBER . . . . Continued**

**Temperature Sensitivity**

For those owners who do a significant amount of towing or heavy hauling, temperature sensitivity might be the number-one priority. Increased friction levels are great, but if the pad rapidly loses friction as the temperatures go up (a phenomenon known as brake fade), then all of a sudden the truck doesn't want to stop. This is typically regarded as a bad thing. What makes the issue even more complicated is that two brake pads with identical advertised friction levels may have completely different temperature sensitivity profiles (see Figure 2).



Insert Figure 2 – Coefficient vs. Temperature

While the pads from the factory were chosen by the manufacturer to provide a certain amount of resistance to brake pad fade, there are many choices in the aftermarket which can tolerate even higher temperatures before the inevitable drop-off occurs. Keep in mind that like increasing the coefficient of friction, changing brake pad formulation to resist these higher temperatures will come with a penalty in some other area of performance. Compromise is the rule, and typically those pads with higher temperature thresholds will give up noise isolation, pad life, or cold temperature performance as a result. Note that not every high-temperature pad will degrade performance in all of these areas, but be prepared!

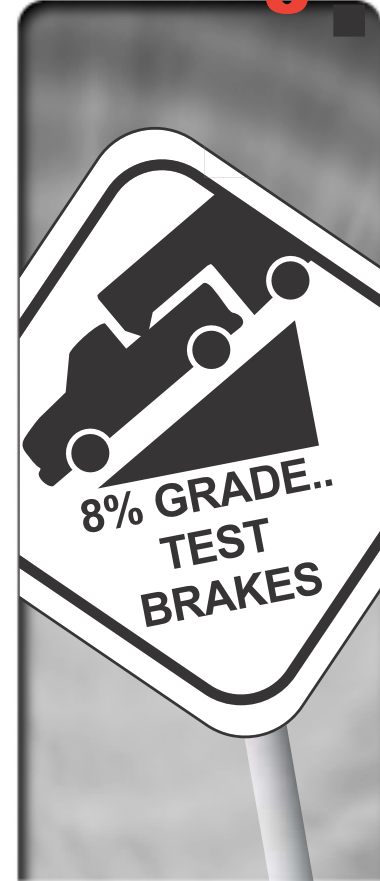
**Compliance**

Believe it or not, brake pads are pretty soft and spongy objects. As a result, every time you step on the brake pedal, part of your leg effort is being used to squish the molecules of the brake pad material closer together instead of generating brake torque. While this is certainly not the most efficient of situations, it simply can not be avoided.

That said, changing from brake pad A to brake pad B for driver tuning (friction level) or temperature sensitivity (fade resistance) can bring with it a change in the lining compressibility, which in turn can change the brake pedal feel. Those brake pads with more compressibility will generally exhibit a softer, spongier pedal while those with low compressibility will typically provide the driver with a more firm brake pedal.

Unfortunately, brake pads with the highest friction levels usually have the highest compressibility, so the pedal feel benefits of the higher friction levels can be masked by the compliance loss of the pad itself. Just the opposite can be true as well, so those brake pads with the lowest friction levels can provide the most firm pedals. Ironic, but that's the harsh reality of the situation.

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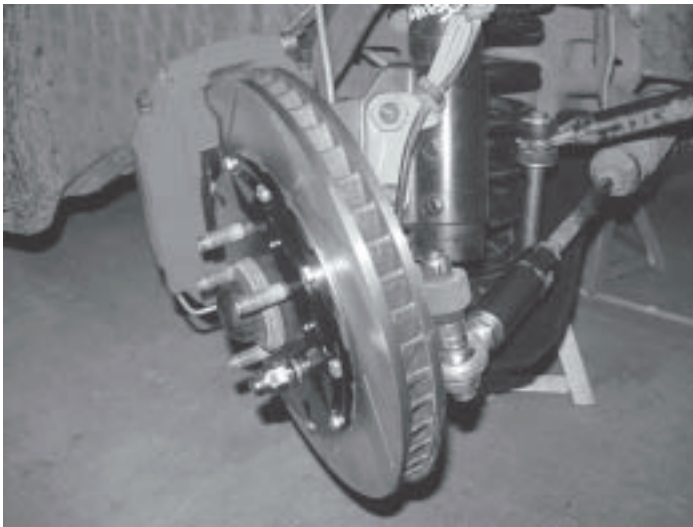
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**All of Those Other Things**

Naturally, in addition to stopping the vehicle, everyone wants a brake pad that doesn't squeal, doesn't create piles of brake dust, doesn't pulsate, and lasts for 100,000 miles. Rest assured that if this miracle brake pad configuration was discovered today, every other brake pad manufacturer would be out of business tomorrow. Sadly this perfect brake pad does not exist, so we are forced to make educated decisions regarding our needs and trade-offs.

What it comes down to is this: your truck came from the factory with a brake pad designed and developed specifically for a certain set of operating conditions. If your vehicle usage is outside of that window, or if you simply want to enhance the OEM performance in some specific way, there are several aftermarket brake pad manufacturers ready to sell you a product to suit your needs.

However, before you spend your hard-earned dollar you should clearly define exactly what you are expecting from your purchase and what negative side effects you are willing to accept. There's no free lunch in brake pad land; but if you are aware of the benefits and trade-offs, you can make the best decision for your application. Make every attempt to find a vendor or manufacturer that can walk you through these decision-making steps, as they will know their product's strengths and weaknesses better than anybody.



How about super-sizing? Check out these StopTech racing brakes.

**Making the Best Decision**

Unlike tire UTQG codes which make an attempt to characterize a tire's performance in several different areas (wet traction, temperature sensitivity, wear rate, and so on), no such information exists from the brake pad manufacturers. Short of a cryptic "edge code" which may or may not be available (and is, frankly, meaningless to the consumer), it's a classic case of buyer beware.

However, there are a few helpful hints and rules of thumb that can go a long way toward helping you make the best choice for your particular application. Note that this list is far from all-encompassing, but should get you well on your way toward making an informed purchase when your truck begins to squeal, shake, and s-s-h-h-u-u-d-d-d-d-e-e-r-r.

1. Stick with a name brand brake pad. While this may sound obvious, there are countless no-name products on the market that could compromise your brake system performance. Nobody can tell how well a brake pad will perform by looking in the box, so rely on the company whose name is printed on the side. In a pinch anything that fits may be able to get you through, but sticking with Performance Friction or Hawk brand pads (there are many more—these are just examples) will most likely result in a more consistent product than a set of \$9.99 Super Stoppers from the local discount auto parts counter.
2. In brake pad land, you still get what you pay for. Brake pad design, formulation, and manufacturing is not rocket science, but there is only so much quality that can be baked into a \$9.99 set of linings, lifetime warranty or not. There is a very good reason that most racing brake pads cost hundreds of dollars—the materials that provide consistent friction at high temperatures cost more than those that fall apart on lap three. These same materials are required in severe use towing and hauling applications, so don't expect to pay any less!
3. Listen to recommendations from people using their trucks the same way you do. Word-of-mouth advertising is still one of the best ways to publicize a product known, and those brake pads with extreme performance, either good or bad, are certainly going to get noticed. Just because everyone is using a set of particular pads doesn't mean it's the best choice for you, but it sure can be a great place to start.
4. Don't be afraid to call the brake pad manufacturer, dealer, or distributor directly to get a pad recommendation. Typically a manufacturer will have several pad compounds to choose from, and the best fit to your application may not be obvious. Share all of your expectations and requirements and see what they have to offer. Naturally you will have to temper their recommendation with the knowledge that they are also trying to sell you their product, but it never hurts to ask.

In closing, beware of the brake pad that claims to do everything well. More often than not, these brake pads are made of snake oil.

Happy stopping!  
**James Walker**  
TDR Writer

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*In brake pad land, you still get what you pay for.*

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