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by Larry Carley
Technical Editor

FRICTION MATERIALS: SELLING PREMIUM VS. STANDARD LININGS

When a customer asks for a box of brake pads or shoes for a vehicle, what do you recommend? The most expensive premium linings? Standard replacement linings? Or the least expensive, economy grade linings? Or do you show your customer the options and let him or her decide?

Many aftermarket friction suppliers

today offer a premium line, a standard line and, in many cases, an economy line of replacement brake linings. The least expensive brake linings are typically offered in a “value line” and are targeted primarily at the retail, do-it-yourself market. The standard and premium grade linings, by comparison, are aimed primarily at professional in-

stallers or DIYers who want the very best and are willing to pay top dollar for a better product. Most professional technicians won't even consider an economy grade of replacement lining because they don't want to risk having an unhappy customer if the customer isn't satisfied with the way the brakes feel or perform.



VALUE LININGS

Although brake suppliers insist their value grade linings are as “safe” as standard grade linings, don’t expect the life or stopping power of the cheapest brake linings to be on par with the more expensive linings. Value linings are exactly what the name implies: an inexpensive fix that is adequate for the job but not much more.

Value linings may be an economical choice for a customer who will be selling or trading his or her vehicle soon, but needs the brakes to be in decent working condition before he or she can get rid of it. Value linings may serve the purpose for a vehicle that isn’t driven a lot or is not subjected to hard use. Stop-and-go driving in heavy city traffic is hard on the brakes, but highway cruising hardly uses the brakes at all. So for a customer who’s relatively easy on his or her brakes, value linings may be all he or she needs. But the customer will have to live and maybe die with this decision.

STANDARD REPLACEMENT LININGS

The next step up are “standard grade” or “OEM equivalent” replacement linings. Such linings generally offer similar braking performance and service life as the original equipment linings on the vehicle. The goal is to usually restore “like-new” feel and performance with friction materials that are identical or very similar to the OEM brake linings.

In recent years, though, the distinction between standard and premium grade linings has blurred as brake manufacturers have introduced new friction materials and new pad designs. There has been an ongoing effort to continually upgrade brake performance, noise control and pad life.

A few years ago, the buzzwords “application specific” and “application engineered” were applied to many linings whose friction characteristics were customized to more closely match the performance characteristics of the OEM brakes on specific vehicle applications. Instead of having one or a few basic friction materials that could be used on a wide range of vehicle applications, friction

formulas were tweaked to make linings much more vehicle specific.

One leading brake supplier told us it now uses about 40 different friction compounds in its various product lines to achieve application specific coverage. Another supplier said it currently has 25 different compounds in its line and will be adding more as needed to keep pace with new models.

The widespread use of antilock brake systems has also played a role

in the development of more application-specific brake materials. The threshold at which the wheels start to lock up depends on vehicle weight, speed, traction and the coefficient of friction of the brake linings themselves. Because the ABS control electronics are calibrated to the OEM brakes, aftermarket replacement linings should closely match the friction characteristics of the OEM linings — which, in most cases, requires the

Possible Causes of Mid-Life NVH Problems on Brake Pads

If you’re seeing an increasing number of noisy brake pads that require replacement before they reach the middle of their duty cycle, the root cause may be lift (partial delamination) of either the friction material or shim from the backing plate.

We all know that brakes are subject to significant wear and tear during normal operation, but with a number of today’s drivers either overloading or over-driving their vehicles, brakes are often experiencing heat and shear loads that are well beyond what the OEM predicted. This type of overheating degrades the brake pad — not necessarily the material strength of the friction material or the shim, but the bond between shim and plate or friction material and plate.

This is usually obvious on brake pads that undergo rapid heat/quench cycles. The rapid expansion and contraction of the plate can flex the plate in relation to the friction material and “break” the bond. Once the bond is broken, it allows the plate and friction material to resonate at different frequencies, creating noise. Typically, this vibration and delamination process will continue.

In these cases, you can easily observe the “edge lift” and see the progressive delamination, starting typically from the “leading edge” of the brake pad, and you can easily slip a feeler gauge into the gap. But in many cases, the edge lift — or delamination — is not easily visible.

The buildup of debris or surface corrosion at the joint between friction material and plate can mask a delaminated edge, but any degradation of the bond will cause the NVH characteristics of the pad to change, usually resulting in noise.

The same situation can arise with shims. Excessive loading and/or excessive heat will degrade either the shim materials or their attachment to the plate, reducing or removing their ability to control/mitigate the NVH/frequency characteristic of the pad and caliper assembly. Again, this is obvious in extreme cases; however, you need to check carefully to determine the actual state of the shim and the integrity of its bond.

In both cases, you need to consider upgrading the friction material you’re installing to match a level of vehicle use that is obviously beyond what the OEM considers to be “average.” Look at products that are designed for heavier loads, or perhaps just heavier feet.

— Tech tip courtesy of
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Today's most popular brake pad types, semi-metallic and ceramic, have characteristic strengths and weaknesses. But well-formulated pads can make non-issues of the typical negatives; professionally-installed premium pads will satisfy choosy customers. For example, though ceramic pads are not intended for high performance applications, top-quality aftermarket ceramics deliver clean, quiet stops with excellent performance equal to or better than OE. Premium semi-metallics deliver great stopping performance and resist fade quietly, with a minimum of perceptible wheel dust.

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A premium brake pad will include all of the hardware like shims and clips in the box.



use of application-specific materials. That's one reason why a growing number of aftermarket brake suppliers now "certify" that their brake linings perform at the same level of performance as the OEM linings they replace.

All OEM original brake linings on new vehicles must meet government safety standards. The Department of Transportation standards require vehicles to stop within a certain distance, and the latest FMVSS 135 rules require an even shorter stopping distance. Consequently, some OEMs have had to upgrade their brakes and go to more aggressive linings to meet these standards.

Yet there are no equivalent standards for aftermarket brake linings or any other aftermarket brake parts. The safest course of action for aftermarket brake suppliers, therefore, is to use friction materials that are the same or closely match the OEM brakes — and to voluntarily certify their compliance.

Most premium grade linings are now application specific, but so are many mid-range or standard grade linings. What's more, many brake suppliers have introduced new product lines specially designed for trucks, SUVs and import vehicles. Most of these are what we'd call premium grade linings because of their performance and price.

PREMIUM LININGS

Premium grade linings are the best the aftermarket has to offer. They typically equal or exceed OEM performance in all categories: stopping power, feel, fade resistance, noise control and lining life. Some have

"low dust" formulas that reduce the accumulation or visibility of dust on alloy wheels. Some have exotic ingredients such as ceramics instead of metallic fibers, while others have exotic coatings such as copper and titanium. Special coatings help seat the pads on the rotors, dampen noise and/or eliminate the need for special break-in procedures.

The word "ceramics" is often associated with premium linings, and many ceramic brake linings are indeed higher priced, upgrade replacement linings. But ceramic formulas vary a great deal, and the ceramic linings from one brake supplier may be entirely different from those from another supplier in terms of braking effectiveness, heat dissipation, noise suppression and wear resistance. So just because a set of pads has the word "ceramic" on the box doesn't necessarily make it a premium-grade product.

Ceramic linings are usually a good upgrade over standard non-asbestos organic (NAO) linings, but are usu-



Low dusting pads can reduce brake dust buildup on some wheels.

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BRAKE FADE

Brake fade is something nobody wants to experience. When you step down on the brake pedal with a certain amount of force, the vehicle should slow predictably. But when the brakes get too hot and start to fade, it takes more and more pedal effort to get the same amount of braking force. Eventually, the point is reached where the vehicle won't stop no matter how hard you stand on the brakes.

The brakes on most vehicles that are driven normally in everyday traffic never get hot enough to experience brake fade. But when driving down a steep mountain, prolonged braking may cause the brakes to get too hot and fade. The brakes may also overheat and fade if the pads or shoes are dragging because of a mechanical or hydraulic problem in the brake system.

On a rear-wheel drive car or truck, repeated high-speed braking can push the front brake temperatures to 300 degrees F or higher. On a front-wheel drive car, the front pads and rotors work even harder and may see temperatures of 600 degrees F or more with repeated braking. The brakes on a race car, by comparison, may experience temperatures of 800 to 1,100 degrees or higher, causing the rotors to glow bright orange and give off sparks when the brakes are applied.

The secret to preventing brake fade is managing heat with friction materials that are designed to operate

ally not recommended to replace semi-metallic linings on larger, heavier trucks or SUVs.

PREMIUM PAD FEATURES

Most premium pads incorporate such features as chamfers, slots and built-in shims to control noise and vibrations. Chamfers and slots change the loading on the surface of the pads and the frequency at which they vibrate to reduce noise. Shims on the backs of the pads, or that are molded inside the pads, also dampen vibrations and noise. Some manufacturers, when they mold their pads, also use a "layered" construction with different friction materials sandwiched together to control noise and performance.

Some premium pads are also "pre-burnished" to eliminate many of the problems that can occur if they're not broken in properly. When brake linings are manufactured, the resins that bind the ingredients together are not fully cured. When the linings are later installed on a vehicle, the heat produced by normal braking bakes the linings and cooks out the residual

chemicals from the resins to improve the lining's friction characteristics. If the brakes get too hot before the linings are fully cured, the heat can "glaze" the linings, causing noise and braking problems. So to eliminate the need for a break-in period, some brake suppliers are now adding an extra manufacturing step to fully heat-cure (burnish) the linings.

PRICE

Because of the special ingredients and extra manufacturing steps that go into premium grade linings, they cost more than standard linings. The cost isn't that much higher and, when you consider that the cost of the linings is actually only a small percentage of a complete brake job, price should not be a major issue when it comes to recommending the benefits of premium pads. After all, you usually get what you pay for — and when a customer realizes premium pads will feel better, brake better and run quieter than a cheap set of pads, he or she will usually go for the more expensive linings. ●

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