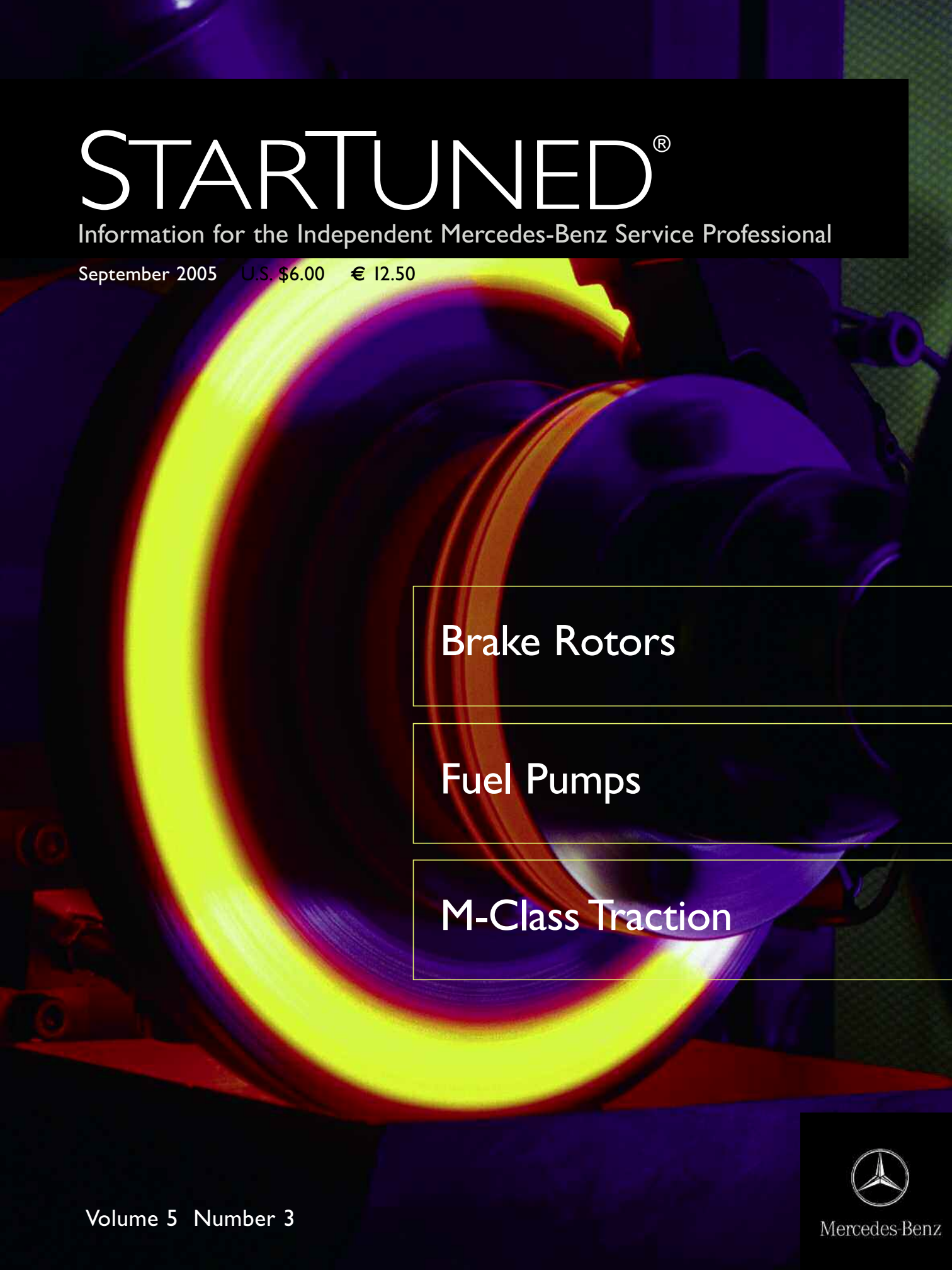

STARTUNED®

Information for the Independent Mercedes-Benz Service Professional

September 2005 U.S. $6.00 € 12.50

Brake Rotors

Fuel Pumps

M-Class Traction

Volume 5 Number 3

Mercedes-Benz

To Our Readers:

Welcome to *StarTuned*, the magazine for independent service technicians working on Mercedes-Benz vehicles. Mercedes-Benz sponsors *StarTuned* and provides the information coming your way in each issue.

Mercedes-Benz wants to present what you need to know to diagnose and repair Mercedes-Benz cars accurately, quickly and the first time. Text, graphic, on-line and other technical sources combine to make this possible.

Feature articles, derived from approved company sources, focus on being useful and interesting. Our digest of technical information can help you solve unanticipated problems quickly and expertly. Our list of Mercedes-Benz dealers can help you find original, Genuine Mercedes-Benz Parts.

We want *StarTuned* to be both helpful and informative, so please let us know just what kinds of features and other diagnostic services you'd like to see in it. We'll continue to bring you selected service bulletins from Mercedes-Benz and articles covering the different systems on these vehicles.

Send your suggestions, questions or comments to us at:

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Visit us at our website **www.MBWholesaleParts.com** to view this issue and all past issues of StarTuned, along with a wealth of information on Genuine Mercedes-Benz Parts.

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Can you purchase a partnership like you can a part?

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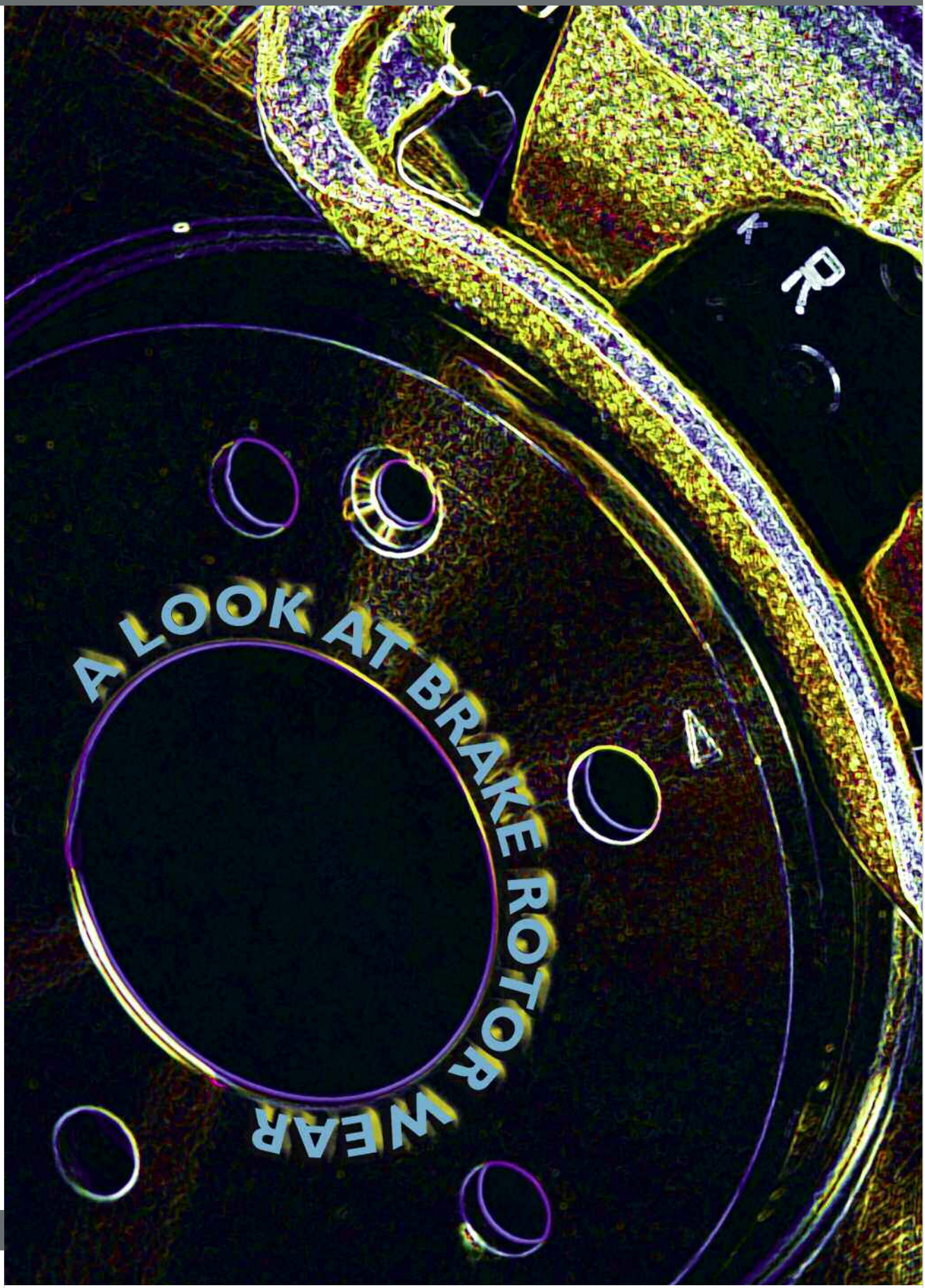

A LOOK AT BRAKE ROTOR WEAR

We've all seen it: Rotors down to throw-away thickness at relatively low mileage. Why it happens, what you can do to mitigate it, how it's related to pedal pulsation, and why you should buy O.E. Also, a profoundly basic trend that flies in the face of traditional auto service practices

This is the kind of super high-performance brake you'll be seeing from Mercedes-Benz in the future. You won't be putting that futuristic rotor on your nasty old lathe, will you?

While most systems of modern automobiles are becoming more dependable and durable every year, brakes are still giving us as many opportunities for service and repair as ever. More, actually, because of numerous evolutionary factors, which we'll explain.

Genesis

The whole thing started back in the 1970s with the energy crises, which pushed automotive engineers into ambitious weight-reduction programs. Eliminating drag, both mechanical and aerodynamic, was another hotly-pursued quest – we got overdrive and streamlining, among other things.

So, we went from heavily-built, boxy cars that slowed down when you took your foot off the gas to lithe, aerodynamic vehicles that not only coasted forever, but also blocked air flow to the brakes. Throw in 70-mph speed limits and you can see that we've got what amounts to a continuing challenge.

Compare the brakes on a twenty-something-year-old car to those of a recent specimen, any of which (especially a Mercedes-Benz) would certainly be considered a high-performance vehicle by older standards. The vintage model used asbestos pads against massive well-ventilated discs with a large friction area and average surface temperatures of maybe 175 deg. C. (350 deg. F.), while the newer one has abrasive semi-metallic, NAO, or ceramic linings against thin rotors that reach twice that temperature at the slightest provocation. Aggressive friction recipes and all that heat in a slender little rotor can obviously contribute to wear and warpage. Why light rotors? Two reasons: To dissipate heat

It would be foolish to use outmoded service procedures on something as highly-evolved as this AMG disc brake and wheel assembly. Your policy should be quality and careful craftsmanship above all other considerations.

efficiently instead of holding it in a mass of iron like a Dutch oven, and to reduce unsprung weight, thus improving handling and ride.

If you've tended to blame accelerated wear on modern friction materials and have wondered why we can't go back to asbestos, you can stop now. By law, the carmakers had to quit using asbestos in '93 – nobody wanted to have that dangerous fibrous mineral around, either in a manufacturing plant or a service shop. But with smaller brakes doing more work, a new friction material was badly needed anyway, regulations aside. Asbestos had done a pretty good job for about 80 years – it was durable, cheap, and quiet. But it had a couple of drawbacks that were to spell its eventual demise. One, its use in certain circumstanses is linked to some forms of lung disease.

Friction materials have evolved to the point that they're far superior to early semi-mets. This M-B O.E. recipe is the ultimate combination of performance, noise reduction and good wear characteristics.

Two, its friction characteristics degrade in really severe service resulting in the scary phenomenon you probably know of as "fade."

So, we got semi mets. Initially, these were steel wool, iron powder, and other metal particles molded together with a phenolic resin binder, which handled heat well, and in most cases gave quite long service. Early semi met recipes, however, had big problems with noise and tended to eat rotors. But today's formulas, especially those so painstakingly researched by Mercedes-Benz engineers, are vastly improved in every aspect. To achieve high-performance braking, the friction material and the metallurgy of the disc must be matched to the application. The trick is in balancing lining and rotor wear against stopping power and pedal feel, and compromises come at the expense of wear, which is just as it should be. Still, there's no denying that modern friction materials do take a toll of discs more severe than asbestos would.

Bye bye brake lathe

Now for the earthshaking trend we mentioned in the opening paragraph. A lot of editorial space in trade magazines has been devoted to the proper methods of achieving the smoothest possible disc surface on a brake lathe. You were supposed to use premium carbide bits, keep them well dressed and use a slow feed rate. Also, you were admonished to use abrasives to knock down the relatively rough directional finish that's left by the lathe to achieve a 40 60 RMS/36-55 RA (for those of you used to the Roughness Average scale, the conversion is RMS = RA X 1.11) non-directional swirl.

Guess what? None of that matters anymore -- you can just put it all out of your mind to make room for something else. As one M-B service manager says, "Our brake lathe went into the trash." Yup, fewer and fewer professionals in the auto service business are machining discs. They've sworn it off in favor of buying new ones. Now that's a profound change considering that it wasn't that long ago when it was standard operating procedure to

automatically turn rotors on a lathe during a reline (providing they weren't down to their legal throw-away thickness). A successful Mercedes-Benz specialist puts it this way, "We've gotten rid of our brake lathe. The tolerances on late models are so close, any appreciable wear demands that the rotors be replaced." Also, new discs will be extra insurance against a recurrence of a pulsation complaint simply because they haven't been cut, so are thicker.

So replacement is becoming the rule. Besides being fast, it amounts to a profitable parts sale for the shop. But how do you choose among the available options? Do you try to save the customer a few dollars, or would you rather feel confident that the job won't come back to haunt you?

Diplomacy

Here, we bump into a delicate diplomatic situation. Suppose you replaced a regular customer's rotors with the proper O.E. units at the last reline. Now, he's been driving a lot and he's worn out his pads in a relatively short period of time. You've wisely adopted the no-cut policy, but there's still plenty of meat left on the existing discs to assure they won't wear past the throwaway-thickness in the next cycle. You can't help but feel that selling this loyal patron another new set of rotors after just, say, 40,000 miles might be perceived as excessive, even if he or she trusts you enough to bite the bullet. That, of course, puts an even heavier responsibility on you to do the right thing in this particular case. So, if there's no evidence of pulsation, you might opt to just install new linings. While the notion of "hanging pads" might be offensive to your sense of craftsmanship, there are cases where it's the only reasonable route. Just make sure you do it right so that you don't generate a comeback.

Regardless of these occasional exceptions, the simple fact is that rotors aren't as meaty as they once were, so you'll be replacing them much more often than you used to.

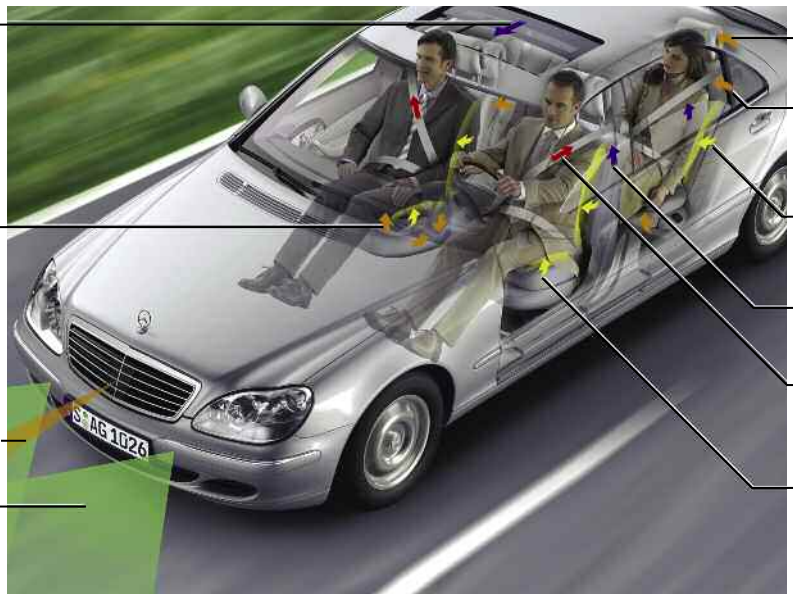
Pulsation frustration

A topic intimately related to rotor wear is pedal pulsation, a condition that seems to continue to grow. It tends to repeat, too. The car may go out of your shop with nice, smooth braking action, but in a distressingly high percentage of cases, it shows up at your door again within a couple of months, and there's a good chance its owner will have lost faith in your work.

There's no doubt that, whether mild or violent, pulsation takes the fun out of driving an otherwise fine vehicle. Nobody likes bumpy braking, but you have got to understand it before you can cure it.

Not that many years ago, every shop in the galaxy turned rotors as S.O.P. at reline. Not anymore. As one M-B service manager says, "Our brake lathe went into the trash." Replacement is becoming the rule.

(Continued on page 11)



Mercedes-Benz S-Class to Debut PRE-SAFE Radar

Accident avoidance system has been shown in M-B studies to potentially reduce rear-enders by 75 percent

When the next-generation Mercedes-Benz S-Class goes on sale in Europe this fall, the flagship sedan will be the first to feature a new version of PRE-SAFE, a revolutionary new safety system shown in Mercedes-Benz studies to potentially reduce rear-end collisions by up to 75%. The next evolution of Mercedes-Benz accident avoidance, PRE-SAFE uses two complementary radar frequencies to detect vehicles up ahead, warn of a likely impact and prime the braking system for faster response when the driver brakes the car.

In addition, the front seat belts are tightened during the valuable time just before a possible impact, and the seats move to positions that can provide better protection – two measures that have been part of the current S-Class PRE-SAFE system since its debut in 2002. The latest version also closes the side windows to provide better support for the curtain air bags, and can inflate special front seat cushions that provide greater lateral support for occupants and help the side air bags provide even greater protection.

The new PRE-SAFE is tightly integrated with the optional Distronic Plus system, which includes an enhanced version of the Mercedes-Benz Brake Assist system. Not only does it supply full-power braking assist in emergencies based on the speed by which the driver applies the brake pedal, as previously; Brake Assist Plus continuously measures the distance to the vehicle ahead and precisely modulates brake pressure if the driver doesn't brake hard enough to come to a stop behind a decelerating vehicle at the available distance. During extensive testing, data recorders and video cameras documented more than 250,000 real-world miles covered by 200 drivers in the U.S. and Europe. 100 drivers participated in intense testing on the DaimlerChrysler driving simulator in Berlin, where rear end collisions were reduced by 75% in three different traffic scenarios with dense traffic.

The newest PRE-SAFE system uses two different radar beams to scan traffic in front of the car. Newly developed short-range radar with a frequency of 24 gigahertz sweeps the first 33 yards in a fan-shaped 80-degree pattern, working in tandem with a narrower nine-degree beam of longer-range 77-gigahertz radar (already used for the car's optional Distronic cruise control feature). The two radar frequencies complement each other to provide a full range of over 160 yards – more than one and a half football fields. The system can identify when the car is gaining too quickly to maintain the driver's set following distance to vehicles with the Distronic system, and it decides whether or not to sound a warning, ready the brakes and trigger other PRE-SAFE measures.

(Continued from page 9)

Nothing beats a genuine Mercedes-Benz O.E. rotor for avoiding comebacks and keeping your customers satisfied. By the way, don't bother removing that gray anti-corrosion coating.

One expert gave us a theory about why pulsation problems increased when semi-metallics supplanted asbestos. He believes it is related to what happens when you stop at a light. By their very nature, semi-metallics conduct heat away from the rotor, whereas asbestos is nothing if not a good insulator. This was intended, but it has an unintended consequence: The area of the disc that is gripped by the pads cools faster than the metal around it, causing warpage. Another authority says, "A fundamental fact that many technicians do not realize is that semi metallics are designed primarily to get the heat out of the rotor."

So, heat is the enemy and such things as sluggish pistons that don't retract properly help keep that temperature up.

Thickness variation out of wobble

The direct cause of pulsation is DTV (Disc Thickness Variation), which can also be seen as a lack of parallelism between the two sides of a rotor. Wobble causes the rotor to wear unevenly

as it hits those abrasive pads in one spot on each side every revolution of the wheel, and the contact areas will end up thinner than the rest of the disc. Some authorities claim that .002 in. of runout can cause about .0004 in. of DTV in 3,000 to 5,000 miles. Typically, thickness variation should be held to .0002 in., although we know brake exerts who say it'll take .0004 to generate a complaint. Either way, you're going to have to take your time checking for discrepancies this tiny – measure thickness at eight evenly-spaced points around the disc.

As a diagnostic preliminary, make sure the condition is indeed due to the friction components and not the result of a malfunctioning ABS. The module could misinterpret a bad signal from a damaged or contaminated wheel speed sensor to be a skidding tire, so may pulse the hydraulics. If you take the time to carefully experience the condition, however, your technician's instincts should allow you to differentiate between the two.

Next, you've got to determine whether the pulses are coming from the front or the rear (or both). Commonly, DTV in the front will cause the steering wheel to rock or shudder on light brake applications at low speeds. You'll feel the side-to-side movement if you hold the wheel with just a few fingers. If you work on vintage Mercedes with rear drum brakes, you can find out if the rears are at fault by finding an uncrowded street, coasting in neutral at about 20-25 mph, and applying the parking brake gradually. Out-of-round drums will typically produce a heavy bumping and hitching during this test.

Get the car safely up in the air, but don't pull the wheels yet. Instead, measure runout on the inside of the rotor with the wheel installed and the lugs torqued, if possible. This will tip you off to real-world runout.

Not so flat

Besides ordinary runout, there's disc flatness, the kind of warpage that makes the rotor resemble a potato chip. With your dial indicator, check for this at points 90 deg. apart and close to the outer edge of the wear surface. Find the high point and mark it "1," rotate the disc one-quarter turn, mark it "2" and record the reading. Do the same thing twice more to establish points "3" and "4." The difference between "1" and "3" will be max runout, whereas the biggest deviation from flatness will be between "1" and "2," "2" and "3," "3" and "4," or "1" and "4."

In the past we were told we could check for flatness with a straightedge and feeler gauges, but most authorities today say that's apt to be inaccurate and misleading.

Everything we've mentioned so far applies to both front and rear discs. Since rears only account for 40% or less of stopping power, however, they won't be the cause of as many complaints.

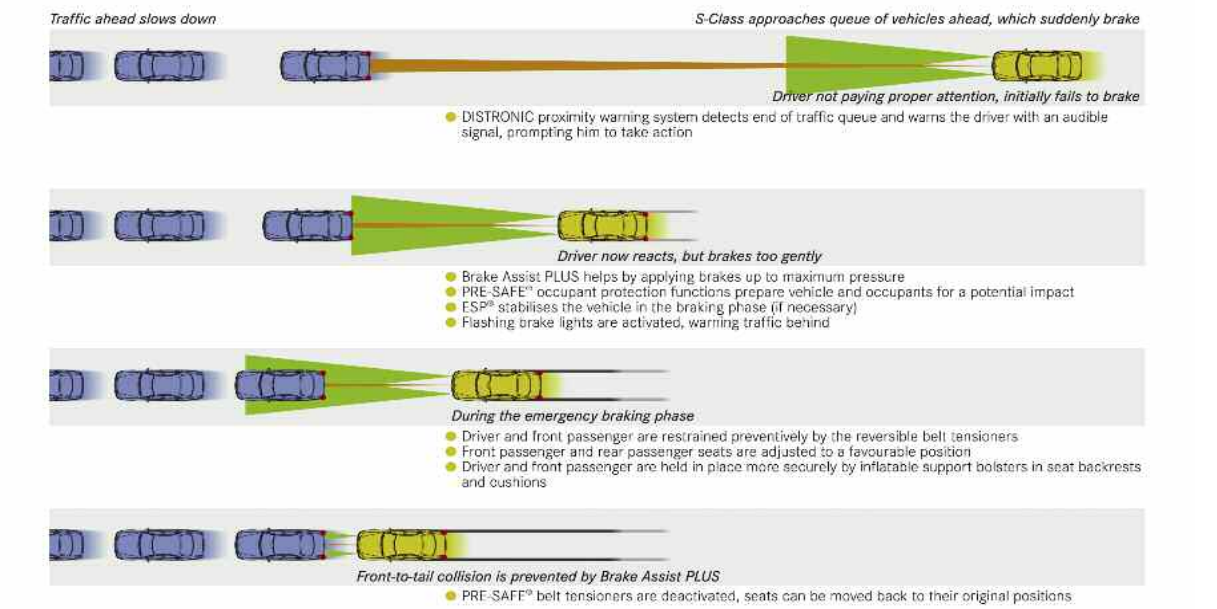
Don't be a troublemaker

Sure, today's brake systems are prone to problems for all the reasons stated earlier, but that doesn't mean you shouldn't do whatever you can to avoid aggravating the situation. In other words, don't cause trouble.

If you buy new O.E. discs, you won't have to worry about getting the mounting surface perfectly clean. The hub is a different story, however. Take your time removing all corrosion so that the rotor will run as true as possible.

(Continued on page 14)

Brake Assist Can Stop in 45% Less Distance



Mercedes-Benz was the first automaker to make standard an electronic brake-assist system that can recognize emergency braking and automatically apply full-power brake force for shorter stopping distances. Called Brake Assist, the system is activated only in emergency braking situations and doesn't affect normal brake operation. Brake Assist made its debut in model year 1998 on most Mercedes-Benz models.

In tests on driving simulators and on the track, Mercedes-Benz safety researchers discovered that even experienced drivers may not apply full braking force in emergency situations. Although the reasons for this are unclear, the solution is relatively simple: use technology to design a system which can recognize emergency braking (whenever the pedal is being depressed very quickly), then react with split-second electronic speed to apply full brake assist force automatically.

Tests showed that 99 percent of drivers were slow in applying the brakes, or only applied full brake pressure when it was too late. Mercedes-Benz researchers found that the new brake assist system can provide 45% shorter stopping distances for many drivers, and even most skilled drivers find about a 15% improvement.

Most drivers during testing took 239 feet to stop a car from about 60 miles per hour, while cars equipped with the new Mercedes-Benz brake assist system came to a halt in just 131 feet. Even when drivers applied the brakes very late in an emergency, stopping distance was reduced by nearly 20 feet – more than a car length. The new Mercedes-Benz brake assist system can provide the critical difference between an accident and a close call because the electronic system can react far faster than any human can.

Brake assist is a driver-adaptive system that learns each driver's braking habits by using electronic sensors to monitor every movement of the brake pedal and feed information to a mini-computer. As a result, the system can instantly recognize when the driver pushes the brake pedal more quickly than normal.

If it ever reads pedal speed signals that clearly mean an emergency, the computer instantly applies an electronic valve on the brake booster system for full braking assist. The Brake Assist system takes advantage of the benefits of the standard ABS, which prevents the wheels from locking up under braking. As soon as the driver eases up on the brake pedal, normal brake control resumes.

To exchange important data at lightning speeds, the Mercedes-Benz brake assist system networks with other in-car micro-computers for ABS brakes, ASR traction control or ESP stability control, and the engine/transmission electronics. The system even processes information about vehicle speed, so it is definitely a fully in- tegrated system.

(Continued from page 12)

For lugs, nix on the 1/2-inch impact, and affirmative on the torque wrench.

This begins with what should be the simple matter of tightening the wheel lugs. This should always be done with a torque wrench, but we all know that just about everybody out there in the trenches of auto repair does it with a 1/2-inch-drive impact gun. Speed, you know. Shops that use a torque wrench typically have fewer comebacks for pedal pulsation (of course, they employ other careful procedures, too, which we'll mention later).

As one veteran brake expert explains it, "What happens is you tighten the first lug to 90 ft. lbs., and that cocks the wheel. Then, you may tighten the second to 90 also, but the wedge effect makes the other one actually closer to 130, which puts an uneven strain on the rotor. After a couple of months, or 1,500 to 4,000 miles, the iron relaxes to match the stress, and you've got a pulsation problem. You can avoid this by installing the wheel and tightening the lugs while the car's on the lift, lowering it, backing them each off half a turn, then torquing them."

Good point, and we'll add that you should use the proper tightening pattern, either star or criss-cross, depending on the number of lugs. Even more important, though, is anything that interferes with the trueness of the rotor mounting. For example, corrosion on the hub or axle flange that keeps the disc from seating properly, hence introducing runout. In our shop, we use our "whizzer" with abrasive discs and various powered wire brushes to get those flanges as clean as possible before mounting the rotor. If there was no pulsation problem and the disc is to be reused, we index a lug and the rotor "hat" with punch marks or paint so we can be sure to put it back in the same position.

It's a worthwhile precaution to check runout whenever a new rotor is installed. If it's less than .002 in., send the car out. If it's anything more, remove the rotor, rotate it one lug, remount it, and check again. Keep doing this until you arrive at the position with the least wobble.

Break 'em in, don't burn 'em up

Some authorities say overlooking proper lining break-in is the Number One cause of noise and hard pedal complaints. As one brake expert tells us, "It's not unusual to see a perfectly good brake job ruined in the first five minutes by improper break-in." The ideal way to start new linings off is to make 30 slow stops (spaced two minutes apart) from about 30 mph using light to moderate pressure.

Obviously, no working tech is going to take that much time. But you'd be foolish not to make at least 10 moderate stops at 30 second intervals (you should be able to feel the action smooth out), then caution your patron to avoid heavy braking for the first 200 miles.

Miscellaneous

We'll conclude with some random, but important, points:

- That gray anti-corrosion coating on new M-B O.E. rotors? You don't have to waste any time removing it. It'll disappear after just a few light stops during lining break-in, and leaves no harmful residue.
- Following the "no turn 'em" philosophy doesn't relieve you of the responsibility of repacking wheel bearings and replacing the grease seal when a rotor is reused.

- Mercedes-Benz has made special "cleaning pads" available to improve the wear surface of rotors that are to be reused without taking a lot of meat off. You drive no more than 300 meters at 30 kph (roughly 300 yards at 20 mph) while repeatedly applying the brakes moderately.
- While Torque Sticks are a big improvement over just blowing those lugs on with your thermonuclear gun, a torque wrench is still superior.
- In that vein, some shops are using a 3/8-inch-drive air gun turned low to run the lugs up lightly, which won't produce enough torque to cause warpage, then finishing with a torque wrench.
- It's been found that overly hard friction material can amplify any variation in a disc to the point of unacceptable vibration. So, use only the best, meaning O.E., to avoid complaints.
- An Mercedes-Benz-approved brake paste applied to the hub and the mounting surface of the rotor will go a long way to prevent corrosion, and will also help heat dissipation.
- Dragging brakes will obviously result in overheated rotors. One cause is sluggish caliper pistons, another a clogged hose that lets psi into the cylinders under that substantial pedal pressure, but not out from the wimpy return force of the piston seal. Regular brake fluid changes can head off both.
- Never use aerosol brake cleaner to wash rotors or pad surfaces. We mean it. The thing that works best here (and is cheapest, too) is detergent and water applied with a scrub brush. That floats metal particles and other hard contaminants out of the pores. Thin, volatile solvents just make the iron absorb them.

Mercedes-Benz Brake Safety Landmarks

Where stopping safely is concerned, Mercedes-Benz is no Johnny-come-lately. Although there were important brake innovations that vastly improved the safety of the marque as early as the first decade of the 20th century, this summary of what M-B has done in this area during the last 67 years should prove the point that this company is serious about protecting the people who drive, or just ride in, its vehicles.

1938 – **self-adjusting brakes**

1959 – **first test car built**

1961 – **servo-assisted disc brakes**

1969 – **systematic investigation and analysis of traffic accidents (in Germany) involving Mercedes cars**

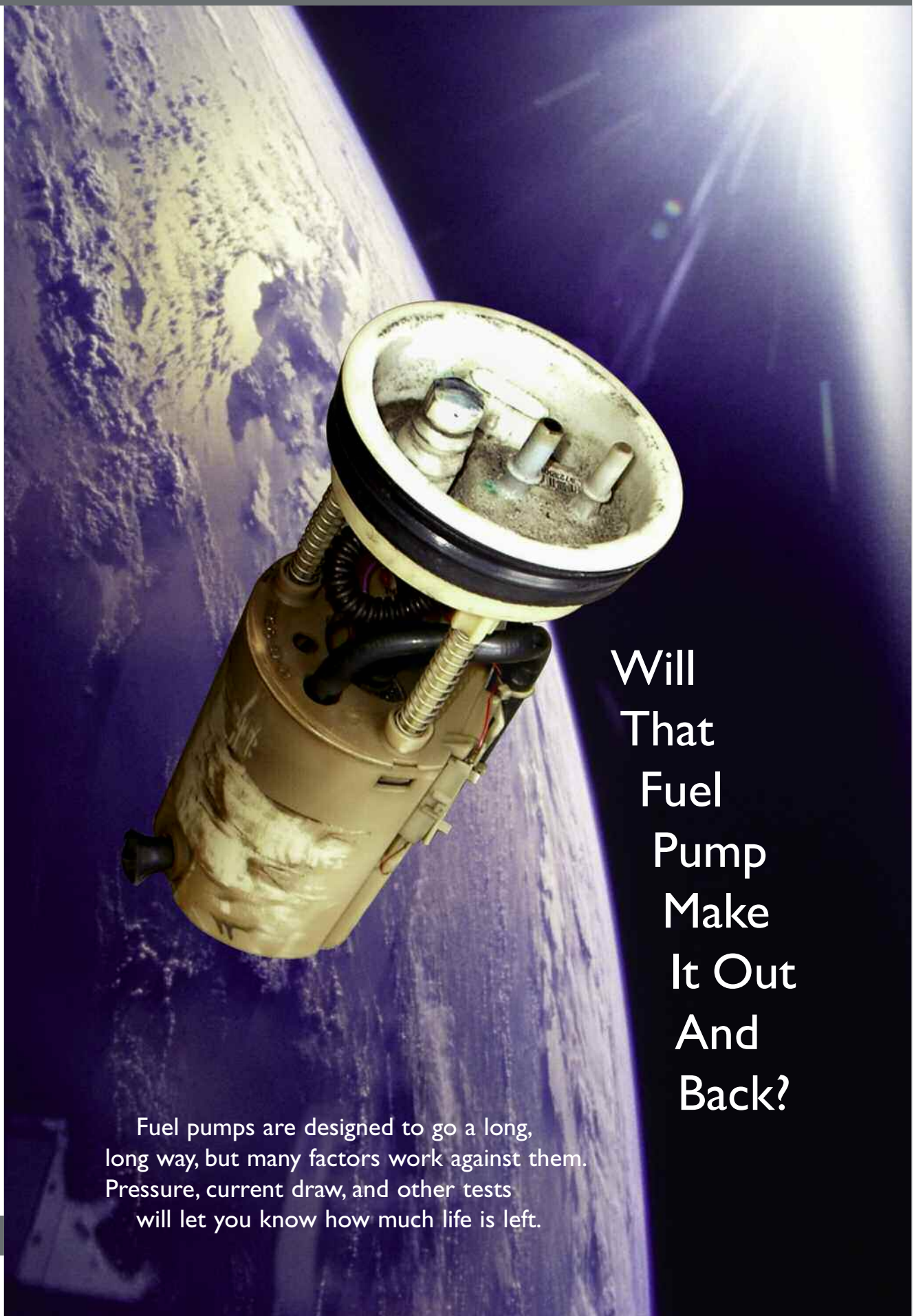
1978 – **electronic anti-lock brake system (ABS)**

1992 – **G-force brake proportioning system (model year 1993 S-Class)**

1997 – **Brake Assist system**

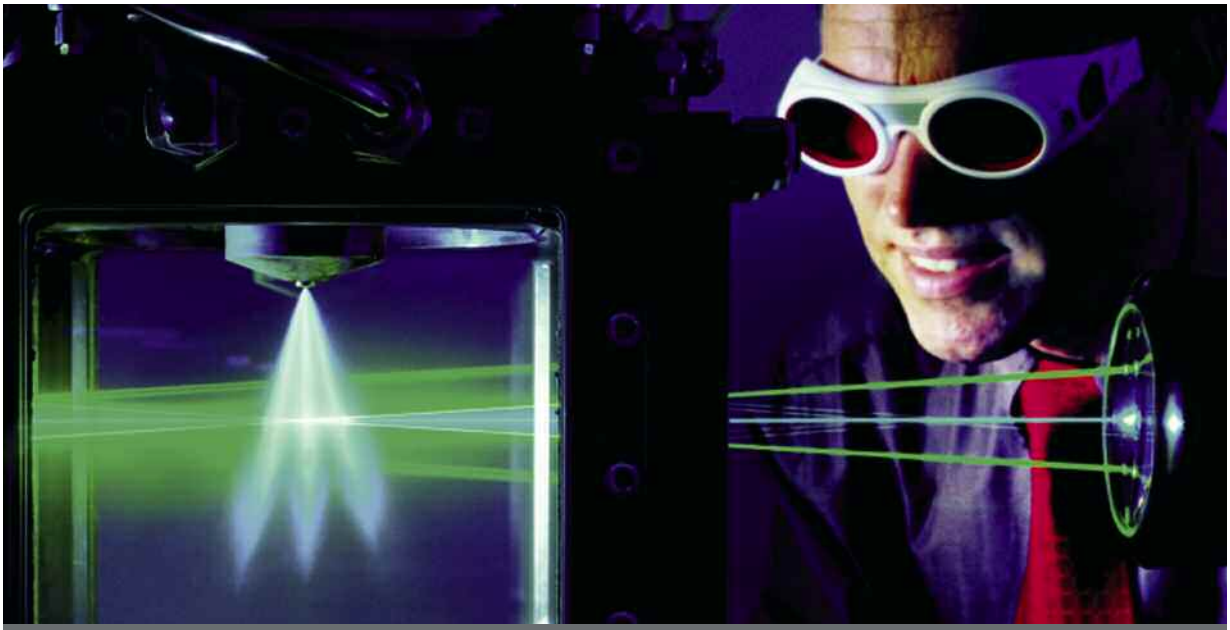
2002 – **electronic braking system (model year 2003 SL coupe/roadster, model year 2003 E-Class sedans)**

2005 – **Enhanced PRE-SAFE system uses radar to prime the braking system for faster response (model year 2006 S-Class)**



Will That Fuel Pump Make It Out And Back?

Fuel pumps are designed to go a long, long way, but many factors work against them. Pressure, current draw, and other tests will let you know how much life is left.



If the fuel pressure isn't what it should be, you won't get the carefully-engineered plume of atomized gasoline that assures high performance and low emissions (courtesy Bosch).

Unless you work on antiques, you haven't seen a Mercedes-Benz with a carburetor and mechanical fuel pump for decades. That's because the Stuttgart engineers had the foresight and intestinal fortitude to switch to fuel injection way back in the 1970s when that might've been considered a risky decision. With society's growing environmental consciousness and worries over energy crises, however, that really was the right direction. So, Robert Bosch K-Jetronic continuous injection was adopted early on (at a local M-B specialist's shop, we were just admiring a 1970 V8 coupe so equipped), followed in short order by L-Jetronic, LH-Jetronic and Motronic.

Regardless of the generation of fuel injection system involved, all use an electric fuel pump. Although it may seem hard to believe, we've heard people ask why we can't have simple, old-fashioned mechanical pumps with fuel injection. While it wouldn't be beyond mankind's abilities to build a cam-driven pump that could produce sufficient pressure and volume, such a unit would take up valuable room under the hood and interfere with the design of the engine. And, unlike the situation with a carburetor and its built-in reservoir, injectors can't supply any gasoline until the pressure's up, so you'd have to crank for a while before the powerplant got enough fuel to start. There'd be no possibility of controlling it electronically, either.

In the days of carburetors, there was nothing subtle about fuel pressure. You either had enough to keep the bowl filled or not, period. No mysterious driveability issues were involved. Not anymore. Improper psi can cause all kinds of troubles that often get blamed on something else, much to the consternation of everybody involved. Symptoms include bucking on the highway, momentary cutting out, hesitation, low power, stalling at inopportune moments (typically, it'll fire up again after it's cooled off), and, of course, no-starts and hard starting.

Prelims

High-pressure electric pumps come in three varieties: roller cell, gerotor, and turbine. The first type, which appeared at the outset of the era of fuel injection and continued for years and years, uses rollers in a notched rotor to catch gasoline and force it into a small-volume area of the housing. It has lots of moving parts and can be noisy. Gerotors use a different principle. Similar to an oil pump, they squeeze liquid by means of the eccentric action between a star-

(Continued on page 20)

The Genuine Mercedes-Benz will blow

Mercedes-Benz Quality and Reliability at a Great Value.

The quality, reliability and value of the Genuine Mercedes-Benz Remanufactured A/C Compressor wasn't meant to be taken lightly. The A/C Compressor is not only an exact replacement for the original unit, it's also re-manufactured and tested to meet the same strict specifications as the original, so it performs just as well. And like all remanufactured parts, it's covered by the Mercedes-Benz limited parts warranty.* In fact, the only detectable difference you'll find between a Genuine Remanufactured A/C Compressor and a new one, is the price. Which we're sure you'll find quite refreshing.

Remanufactured for Mercedes-Benz using the same factory standards as new parts.

- Fits like new parts
- Meets original specifications
- Performs like new parts
- Backed by same warranty as new parts

Remanufactured to Genuine New Specifications

Cylinder Block & Front/Rear Housing
Cleaned, inspected, gauged, and honed to OEM specifications or replaced with new components as needed.

Discharge Reed Valve
Cleaned, polished, and inspected.
Replaced with new components as needed.

Steel Gasket
Replaced 100% with new components.

Oil
Replaced 100% with R134a-compatible oil.

O-Rings & Seals
Replaced 100% with O-Rings compatible with both R12 & R134a refrigerant.

Pistons
Cleaned and inspected. Replaced with new, if the treated surface is scratched.

Shaft & Swash Plate
Cleaned, polished, and inspected.
Replaced with new components as needed.

Shaft Keys
Replaced 100% with new components.

Shoes
Sized, cleaned, polished, & inspected.
Replaced with new components as needed.

Snap Rings
Replaced 100% with new components.

Suction Reed Valve
Cleaned, polished, and inspected.
Replaced with new components as needed.

Thrust Bearing
Cleaned, polished, and inspected.
Replaced with new components as needed.

Valve Plates
Cleaned, polished, and inspected.
Replaced with new components as needed.

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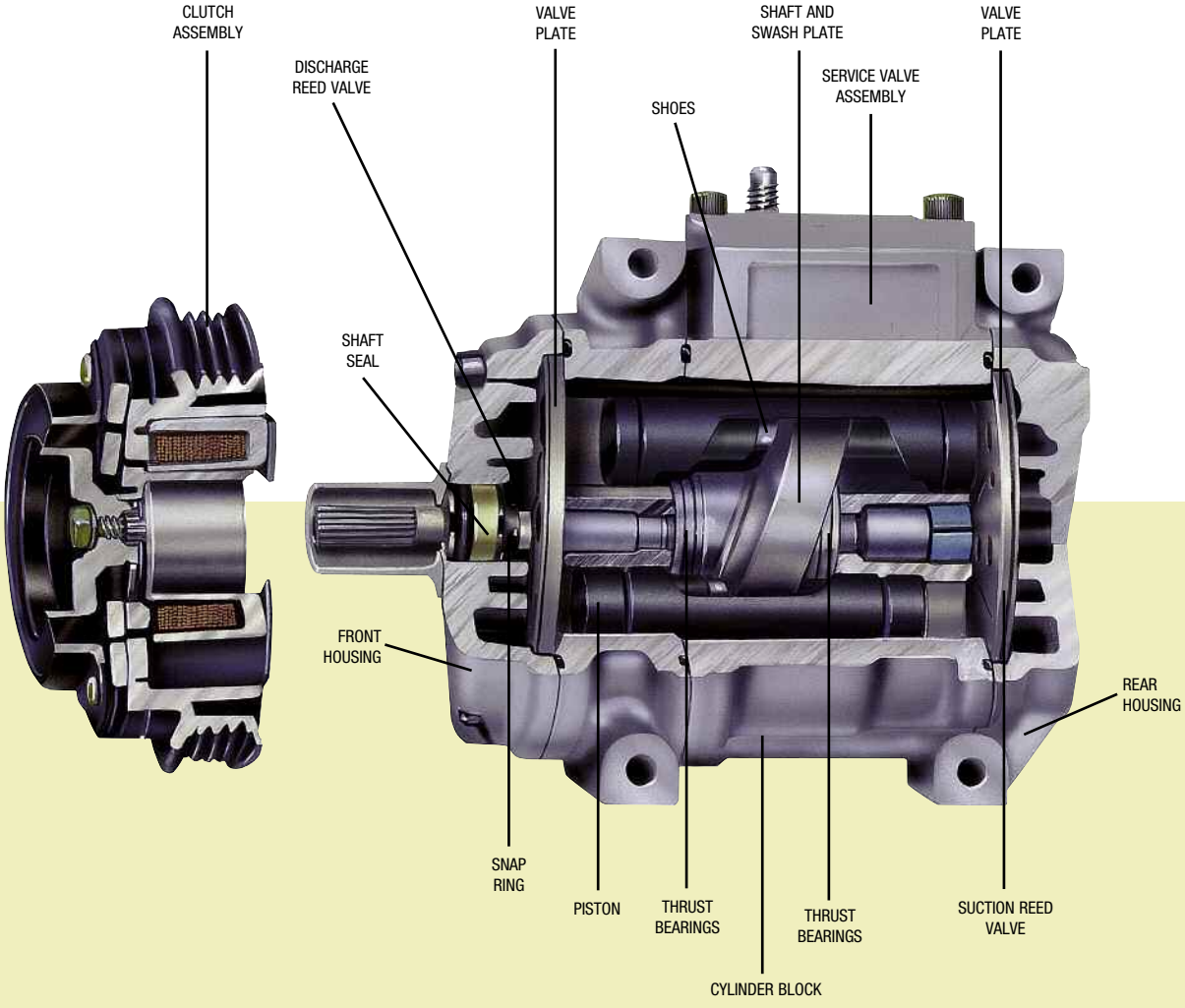

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Remanufactured for Mercedes-Benz by DENSO

(Continued from page 17)

shaped rotor and a matching element that surrounds it. As for turbines, an engineer tells us, "The trend is toward the turbine-type fuel pump, both single- and dual-stage, mainly because there's less noise. But there can be a noise complaint about turbines, too: Since they turn a lot faster, you could get a high-pitched whine." They're not good at handling any debris, by the way.

Regardless of the type, how long should we expect electric pumps to last? The engineer tells us, "We've been looking for a pump life of 10,000 hours [say, 400,000 miles]. That's been our bogey. Now, we've been asked for life-of-car longevity. We're building pumps with lower amperage draw, well-balanced armatures, and more compatible materials in the brushes and commutator to increase life."

What, exactly, is being pumped into that tank? Certainly, there are some impurities, but some of the intentional additives may cause trouble, too.

Well, that's all admirable, but every technician knows that they simply don't last anywhere near that long in most cases. In fact, we commonly see failures sometime before 150,000 miles, certainly not an especially long distance for a typical Mercedes-Benz to travel before retirement. What's happening?

In a word, crud. You may have noticed that many of the fuel filters you replace are so jammed up you can't blow through them. And if you checked the pump's amperage draw (typically, this is easy to do at the relay) before removing the old filter, you might have seen up to twice the expected number – say, eight or ten instead of four to six. It shouldn't take much of an intellectual leap to realize that a plugged fuel filter will make a pump work harder, and all that extra electricity will wipe out the brushes and groove the commutator, killing the pump prematurely. As the engineer put it, "Any time you add backpressure to the system, there's going to be more arcing, heat, and wear."

And here's a suggestion that should help with customer relations: After you've replaced a fuel filter, it's a good idea to open it up with a pipe cutter (a hacksaw will throw too many filings into the equation) and take a look at what's inside. If you find lots of rust or other contamination, you can protect your standing with this patron by showing him or her the evidence, then recommending that the tank be removed and cleaned and the lines blown out. If he or she declines, make a big note on the repair order, and express the caution that filter replacement should be done regularly.

It goes in first

The idea that clogged filters ruin pumps may not come as a revelation to you, but a related statement from one fuel system service expert came as one to us: "Remember, whatever you find inside the fuel filter, the pump's already had to eat." Of course! But we'd just never thought of it that way.

Do replacement pumps have problems, too? "Contamination is the biggest killer of fuel pumps, original or replacement," says the engineer. "On replacements, typically because the strainer wasn't properly installed so there's no seal, leaving a pathway for debris to get in. Whenever you're replacing a pump, be extremely careful of how the parts go together -- read that instruction sheet."

Another fuel system authority tells us, "The most common call I get is, 'That new pump I installed is getting noisy.' This is usually with-

in three or four weeks. What's happening is dirt and contamination are getting into the pump. On the gerotor type, it scuffs up the gears so they drag on each other causing vibration and noise. The turbine type won't tolerate dirt at all.

"We have a lab guy who tests returned pumps, and he says that the biggest problem is strainers that aren't installed properly. They're either not pressed on all the way, or they're crooked. This lets unstrained gasoline into the pump."

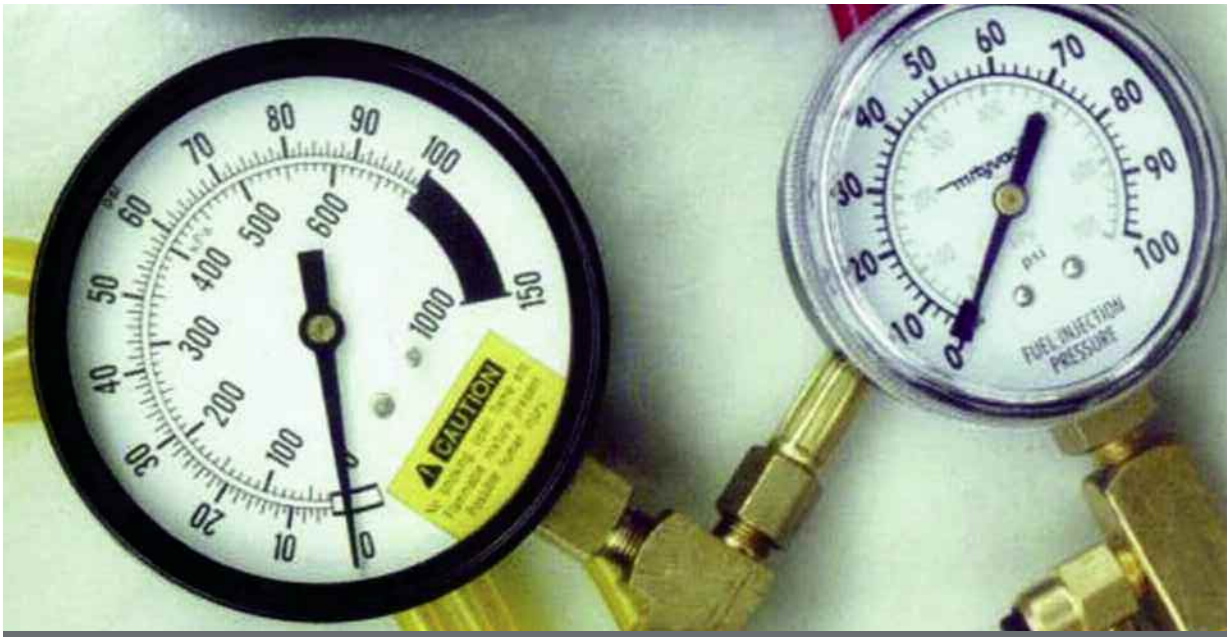
Late model Mercedes-Benz replacement pumps come assembled in a module, such as this M-Class specimen. That relieves you of the responsibility of putting all the parts back together so that there are no leaks past the strainer, and no unwanted contact between parts that can cause noise.

This isn't an issue with many late models because you have to buy the whole assembly or fuel pump module already put together. It costs more, but it'll be much faster and easier to install, and there will be less chance of a comeback.

But there's more to this situation, such as the question of whether or not the tank needs to be removed and cleaned any time a pump is replaced. On this, our expert says, "I try to educate technicians that every time you replace a pump you should drop the tank and clean it out thoroughly (some people use steam). Put in fresh fuel. Dispose of the old stuff even if you have to take it home and use it in the lawn mower, but don't put it back in the car because fine, silty stuff tends to stay in suspension." What, exactly, is this troublesome debris? "I'm no chemist, but I suspect corrosive additives that clean injectors. What's it doing to the rest of the system?" he tells us.

While it's hard to prove that running on empty damages a fuel pump, it certainly can't be doing it any good.

Dirt's not the only reason pumps burn out, however. Immersion in gasoline is necessary for cooling, yet people run around on "E." Although some engineers we've talked to dispute this, an expert who's done a lot of real-world research on the subject has pretty much proved its truth to us. We don't know if this is due to increased temperatures in the tank – after all, in a typical system (not the returnless type) the gasoline is circulated up and around that hot engine, and the more there is, the smaller the rise in degrees. Also, the silt mentioned above is going to be a lot more concentrated in three gallons than in 15. Suggest to



Nothing can tell you more about that pump as simply as reading the pressure it produces. How fast those psi come up is another telling factor.

your customers that they try to keep their tanks at least half full.

One pump specialist sums up the most common reasons pumps go away as follows: "The failures we see are brush wear, gerotor lock up from contamination, and check valve leak down." The expert who did the research mentioned above sees it a little differently, saying, "The commutator becomes rough, which makes the brushes bounce. This oscillates the braided copper wires to the brushes, and eventually one of them breaks. So, that tiny little brush spring ends up carrying the current, a job it's certainly not up to, and it quickly turns to charcoal. Thus, that becomes a dead spot. I've seen that burned up spring 99 times out of 100 failures."

Symptoms and testing

What are the symptoms of a failing pump, exactly? One fuel system authority says, "Typically, no-start after shut-down. You usually have some warning on the highway." A veteran diagnostician and shop owner tells us, "The problems we see are mostly intermittent failures on the road. The car cuts out, bucks, then stalls. But it'll often start again once it's cooled off."

Everybody in this business should know by now that checking fuel pressure is one of the requisite basics of performance troubleshooting, but we keep hearing that many of you out there don't bother to do it for some inscrutable reason. Get with it and your life will suddenly become easier as customer complaints become more comprehensible. As one seasoned veteran says, "If you don't check pressure, you might start replacing sensors or the computer to fix the problem when the pump or a clogged filter or screen might be the real trouble."

This is the ideal place to mention some troubleshooting reminders we've learned over the years:

- Take the time to check pressure accurately – a reading just a little below specs can cause driveability and power problems.

- You should see violent needle swings between dead head (return line clamped) and running pressures. A slow rise means trouble.

- Pull the pressure regulator's vacuum hose and you should see a rise.

- Once you're sure the hose to your gauge has all the air bled out of it, you should see that needle spring to attention almost instantly when you switch the key on. Once again, a slow pressure build points to a problem.

- Low pressure suggests not only a weak pump, but also a clogged filter or pick up sock, a crimped line, or resistance in the pump electrical circuit.

- Too many psi may be due to a restricted return line.

- Just because you've got specified pressure doesn't mean there's sufficient flow. Total system volume at the Schrader of one pint in 20 seconds will run any car. You'll find cases where just opening your gauge set will kill the engine, yet the psi reading was fine.

- System leak down can cause hard starting, among other things. If psi won't hold, pinch off the supply line. No change? Then the check ball in the pump isn't the culprit. In cases where leak down disappears when the return line is pinched, the problem is a perforated diaphragm in the pressure regulator. If that doesn't make a difference, you've got seepage through an injector.

- On a conventional fuel delivery system, a dirty inline filter will reduce fuel volume, reduce fuel pump rpm, and increase fuel pump current. This is because the plugged or restricted filter acts like a dead-head. On a returnless system, the restricted filter will have no effect on fuel pump speed or current, since these systems are always dead-headed anyway.

- A dirty pick up screen will reduce fuel volume, possibly increase fuel pump speed, and decrease fuel pump current, since it will cause pump cavitation. Either a conventional or a returnless system will react the same way since there's no essential difference on the "suction" side.

Electrical issues

No or low pressure may mean the pump's circuit is faulty. A bad control relay is a possibility, but check for poor connections before you think about new parts. Test for the presence of battery voltage at the pump's positive terminal or wire, and keep in mind that a bad ground is a common cause of both no-starts and performance problems. As a pump engineer tells us, "A local shop had a car that ran intermittently. It would stop, then you could slam the door and it would start up again. That was a bad pump ground."

Voltage-drop testing is the best way to locate high resistance. With the circuit powered up, use an accurate voltmeter to see if you get a reading across connections and lengths of wire. Anything more than about .2 volt (or, 200 millivolts) is too much.

If the pump won't run at all, it's natural to check the fuse or the fusible link. If it's blown, and the car starts after you replace it, you should still find out how many amps it's being forced to carry. Fixing high draw now may head off a future breakdown.

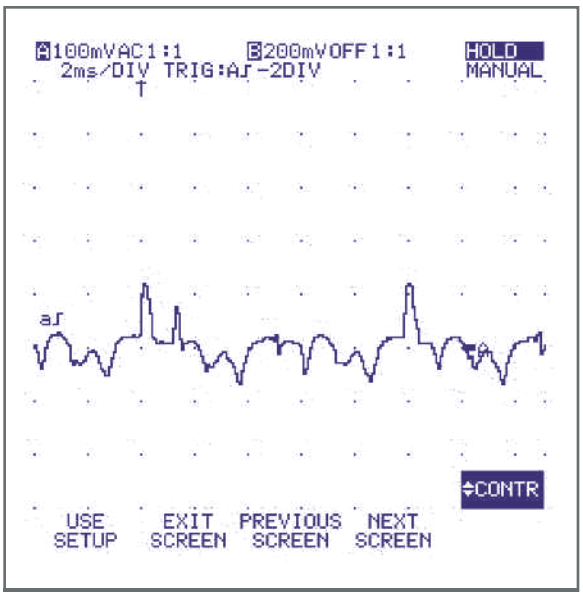
You'll need either a low-reading analog ammeter or a DMM (Digital Multi-Meter) with sufficient current-carrying capacity. As we hope you know, amperage testing is done either by hooking up the meter in series with the load, or with an inductive pickup that you clamp around the wire. The latter works best with big current flow, such as you'd find in the starter circuit, so we prefer the former for diagnosing fuel pumps. That means you've got to break into the circuit. Connect one of the ammeter's leads to the positive battery post and the other to the pump's hot wire. Look this up in WIS (Workshop Information System, available at www.startekinfo.com). Ditto for the draw specs, but we will say that if you see anything over six amps with a mid-pressure system (45 psi), or 7 amps with a high-pressure version (60 psi) you've got a problem.

Leakorama

The fuel pressure regulator is a pretty simple device, but that's no reason to overlook it. Whenever you see high emissions, some experts say to pull the vacuum hose off the

fuel pressure regulator and look for gasoline. Diaphragms have been known to rupture – "I've had them come in with gas running out of the tailpipe!" one shop owner tells us. Although we've never seen it, we've heard that a diaphragm can rupture badly enough to fill cylinders with gasoline and cause hydraulic lock.

You can use a graphing multi-meter to observe the waveform the pump's motor is generating.



A lab scope will also display pump waveforms. No matter which you use, it takes some experience and experimentation to make the most of the current ramping procedure.

It's fairly unusual to find a blockage in a line, whether from a crimp, dent, or big piece of debris, but it does happen. Identifying such a situation requires patience and lots of crawling around underneath with a good light and an inspection mirror. Speaking of lights, we should mention that more shops burn from droplight accidents than from anything else. Whenever you're working around fuel, use only the fluorescent type.

Can you predict the future with current ramping?

When we first heard that the concept of current ramping was being used as a way of judging the health of a fuel pump, we though it was going to be the next big thing in diagnostics. Just think of it: By taking a good look at the waveforms the electric motor generates, you can predict how much life that pump has left in it.

Well, not exactly. It turns out the reality isn't so simple. Sure, it's easy enough to tap into the circuit with a graphing multi-meter or a lab scope so that you can actually see the waveform, but interpreting it usually isn't cut and dried. You really need to use exactly the same piece of equipment in exactly the same way over and over to collect a database, mental or otherwise, before you can be sure of what you're looking at. Still, with a little comparative experience, it'll help you nail down those elusive intermittents.

We'll conclude with a safety note: Don't even think about working on an electric fuel pump until you've disconnected the negative battery cable.

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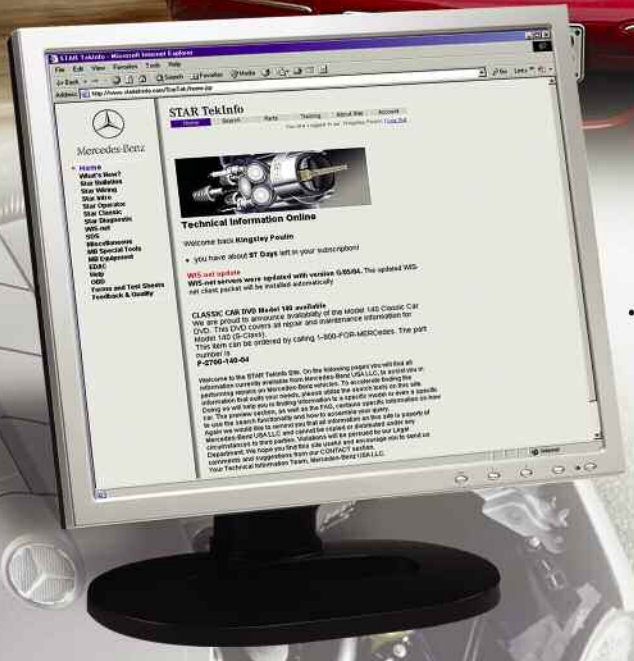

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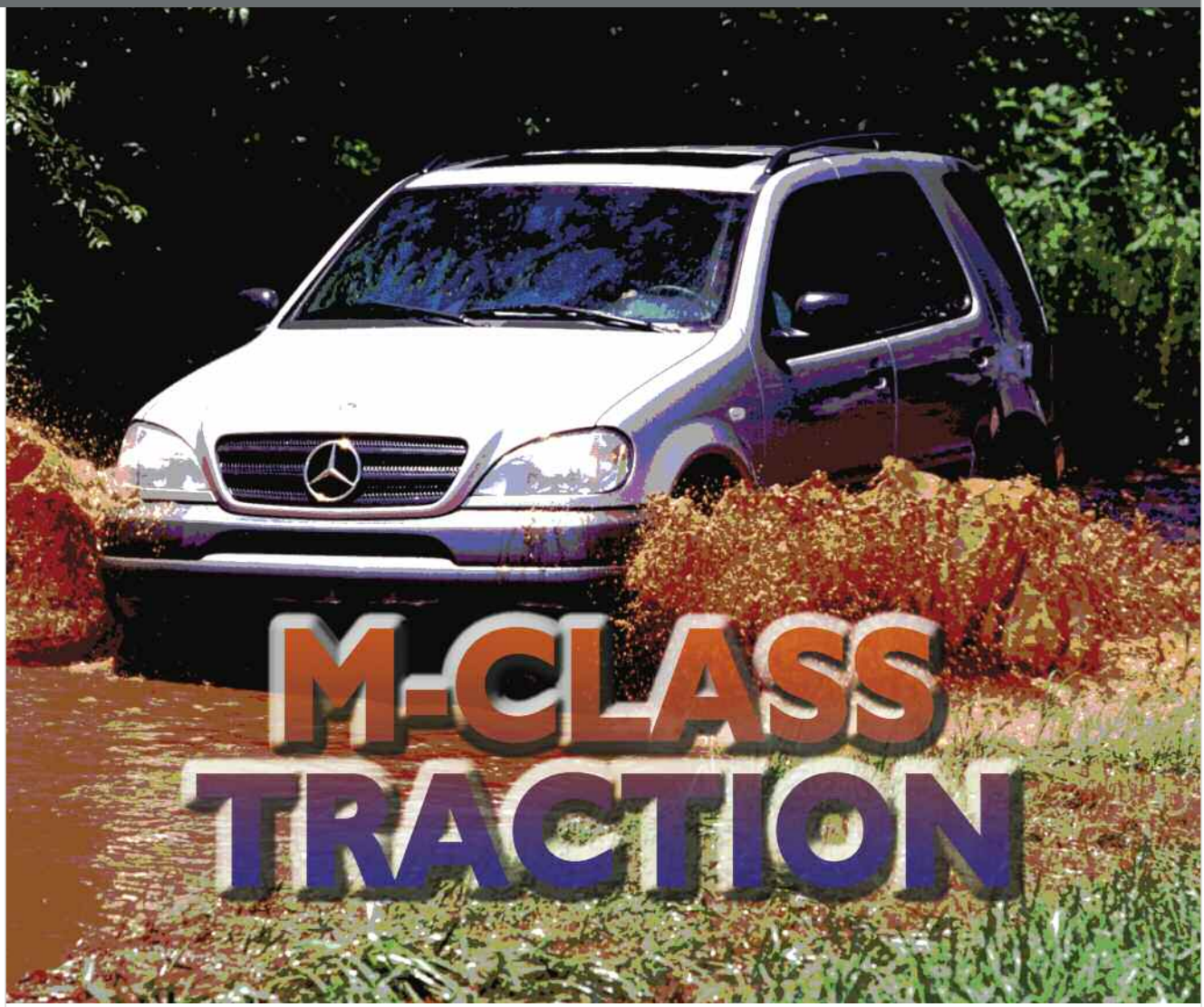


M-CLASS TRACTION

This early M-Class enlists the capabilities of the ABS to achieve excellent traction.

In the movie *The Lost World: Jurassic Park,* a hungry tyrannosaurus rex tears a Mercedes-Benz M-Class SUV apart to get at its tasty human contents. Pardon us, Mr. Spielberg, but we don't think so. A convertible, sure. Maybe even a flimsy little hardtop, but decidedly not this rugged and extremely well-built 4,321 lb. conveyance with its reinforced steel body cage.

So, it's a solid vehicle, but how does it get the power of its efficient, high-tech V6 or V8 to the ground in a manner that allows it to navigate off-road sites, perhaps in an effort to evade gigantic reptilian predators? We've noticed in conversations that most people out there don't have a clue about the clever engineering M-B used to achieve that capability, so here's the story.

In most cases, the terms "four-wheel drive" and "4X4" have been misnomers. There's a differential at both ends and one in the middle, right? So in slippery conditions you've still only got a 4X2. This brings up the old saying, "Four-wheel drive won't keep you from getting stuck, it'll just get you 50 feet deeper into trouble."

Mercedes-Benz didn't believe its customers would take kindly to ending up in that unfortunate situation, so its engineers designed a drive system for the M-Class that goes as far as any we've seen to avoid it, and does so elegantly without the mechanical clutter of differential locks or viscous couplings.

Picture a full-time, dual-range set-up with three open differentials and a 50-50 torque split front to rear. Nothing unusual or troublesome

about that. Also no traction and no forward progress if both a front and a rear wheel are in icy troughs.

So, how is four-wheel drive achieved? Aha, there's a trick to it, and the trick is only possible because ABS provides the basis of the 4-ETS (Electronic Traction control System). If you're familiar with farm tractors, you know they typically have separate rear wheel brakes. If one of those big lug tires starts spinning, you just apply the pedal for that side and torque flows to the other, which will usually keep you rolling. Same thing here, only we're talking both ends, and no intervention from the driver, who's probably a mechanically-oblivious soccer mom or an intellectually-preoccupied exec, is required. Instantaneous, too.

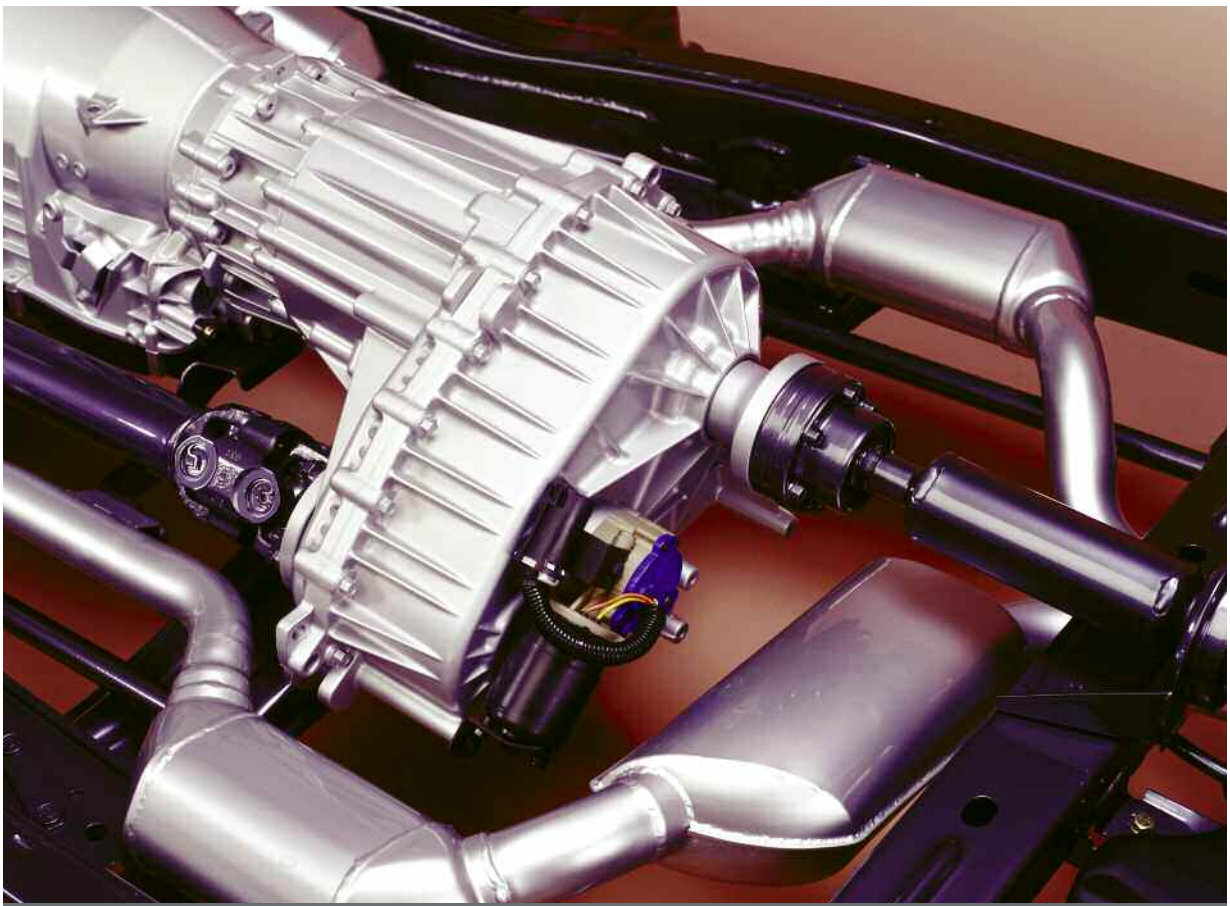
Here's the action: Whenever a wheel speed sensor tells the control unit that a tire is spinning, it orders the ABS hydraulic unit to use its servo pump and accumulators to brake that corner until the differential starts sending power to the opposite side. This works even if three tires are on slick surfaces. If conditions are even worse than that, just be careful.

A few service notes:

- Want to do a dyno test? Then you'd better have a four-wheel unit or you're going through the wall.

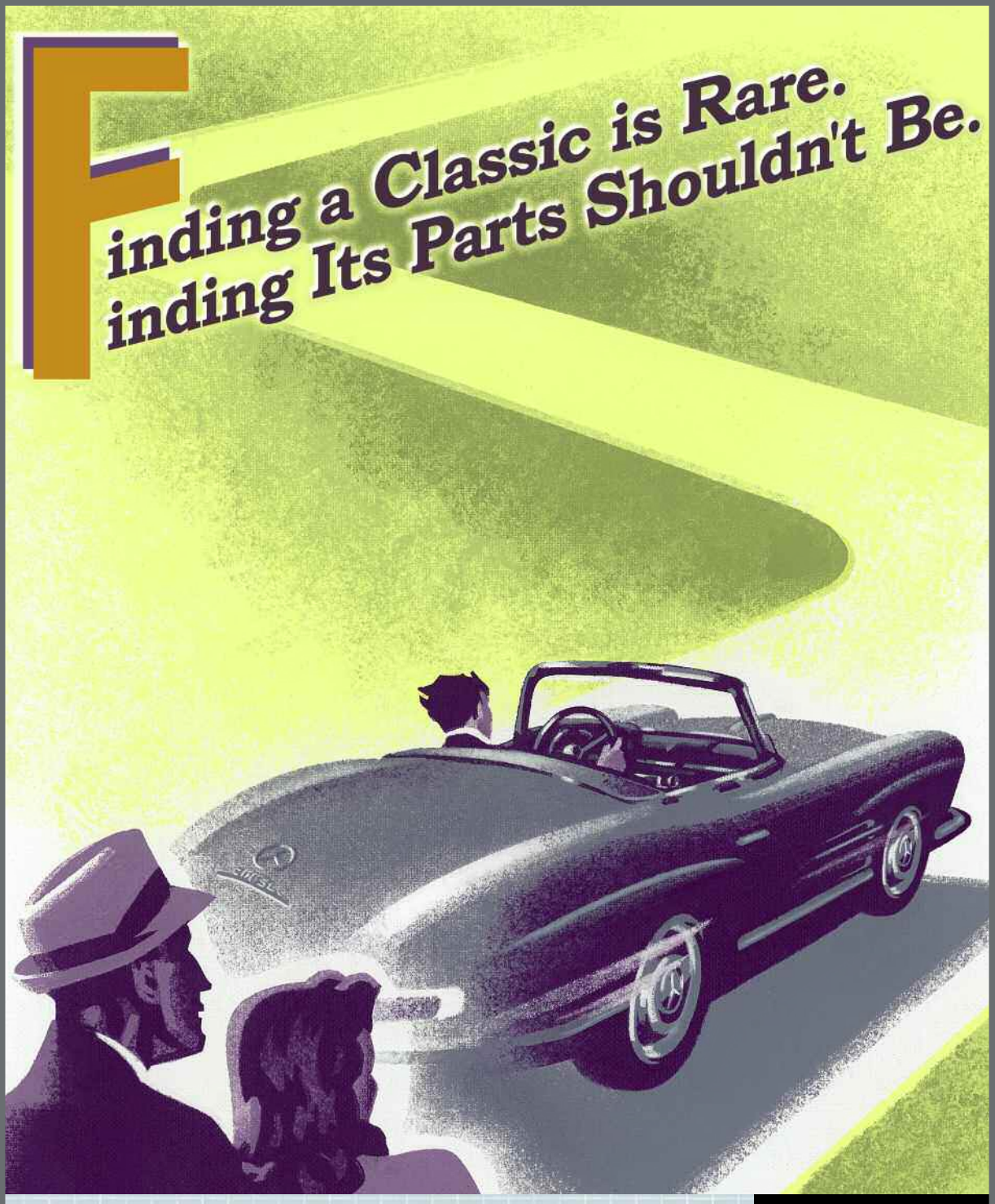
- You can tow an M-Class, but all four wheels must be on the road and you can't go more than 30 miles at a speed of 30 mph or less. If you have to go farther and faster than that, either disconnect the battery and both driveshafts, or use a flatbed.

- The shift linkage must be adjusted with the vehicle's weight on all four wheels and the selector in "D."



There's nothing unusual about the transfer case. It's the intervention of electronics and ABS that makes the difference.

Finding a Classic is Rare. Finding Its Parts Shouldn't Be.



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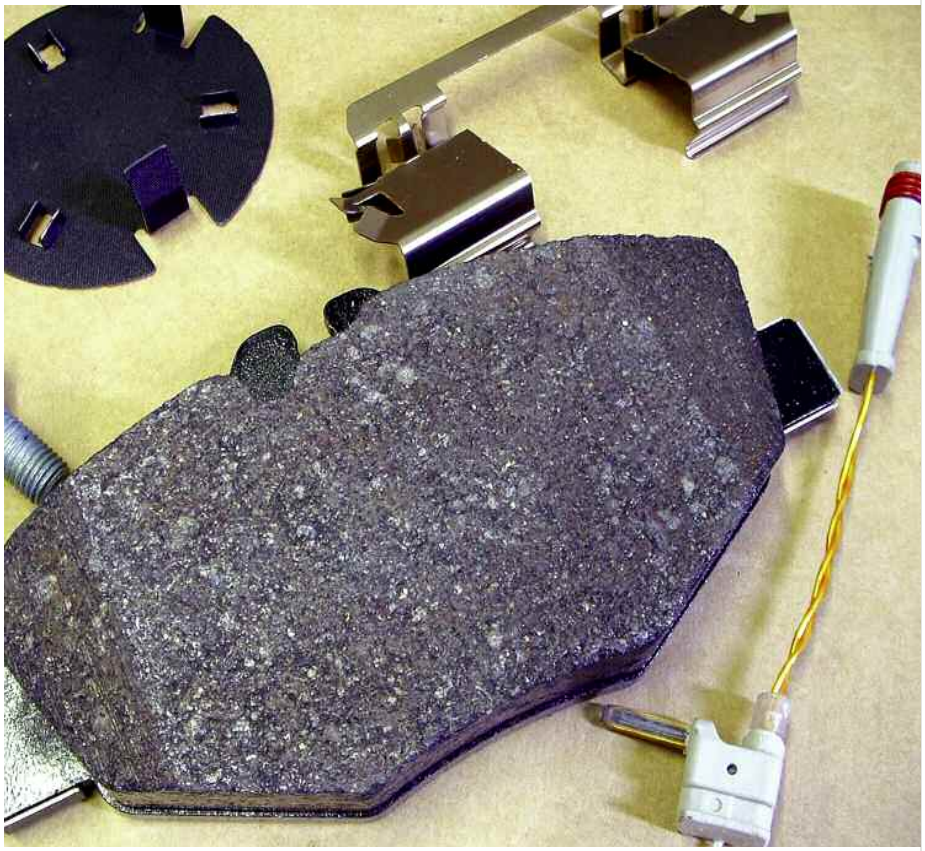
Parts News

Lost S.O.S.?



We well remember a couple of decades ago when we first stumbled upon the Mercedes-Benz pad wear indicator system – we hadn't been aware that such a thing had even been invented. Wow, a warning lamp on the dash goes on when it's time for new linings, and it's so simple. Just have a ground pin on the pad that contacts the rotor when the friction material gets thin. Much more elegant than the noise-generating steel tab used by other makes -- no matter how little the motorist knows, or cares, about things mechanical, he or she can read, so will know this actually concerns brakes, whereas just hearing a high-pitched squeal will just alarm him or her without pointing in any particular diagnostic direction.

Fine, but working as an independent at the time, we quickly found out a distressing fact: The aftermarket pads we normally bought didn't have any facility for attaching the old ground pin assembly – and certainly no new assembly. In other words, installing non-O.E. pads absolutely defeated this useful feature.

With a genuine Mercedes-Benz O.E. pad set, on the other hand, you get everything you need for proper assembly. Not only pads that'll accept the ground pin, but also the whole assembly and connector. That means the pad wear system will be completely renewed, and you can expect it to work just as it did on the first reline cycle.

There's more, though. You also get the proper pad shims, spring clips, hardware, etc. to bring that disc brake caliper assembly back up to like-new condition. Even more important, you can rest assured that the friction recipe is ideal for the application. It'll go a long way in preventing comebacks. Plus, it won't hurt that you'll be able to advertise that your brake jobs are done using genuine Mercedes-Benz parts exclusively.

STARTUNED

FACTORY SERVICE BULLETINS

These suggestions and solutions for technical problems come from service bulletins and other technical information published by Mercedes-Benz, selected and rewritten for independent repair shops.

Anti-Corrosion Coating on New Brake Discs

All models

If you've been buying new O.E. rotors from your local Mercedes-Benz dealer's parts department, you've noticed that they're covered with a flat gray anti-corrosion coating. It seems that some technicians are worried that this may cause braking problems, and perhaps contaminate the new pads, so they spend time removing the coating with various solvents, mild abrasives, and even steam.

This is an entirely unnecessary waste of time. True, the old protective coating used over a decade ago (a blue glaze) did need to be eliminated before the rotor was installed, but the present day coating is effectively removed during the first brake application and will not affect the performance of the brakes.

However, you may notice the following conditions immediately after these new discs are installed:

- Braking-related noise during the first few brake applications.
- Parking brake squeal (parking brake not applied) with moving vehicle until the brake shoes are seated.
- Odors related to the first time the brakes are used with substantial force.

These conditions will disappear after applying the brakes several times. Therefore, a thorough test drive by the technician before delivery to the customer is recommended to avoid unnecessary complaints.

Steering Wheel Twitch During Brake Application

Models 211 and 230, 2003 through 2005

If your customer complains that the steering wheel twitches during slow speed brake applications, replace the hydro-mount, or partially hollow rubber style torque strut bushings with solid rubber bushings. Reference the following WIS documents: AR33.15-P-0160R (torque strut removal/installation) and AR33.15-P-0160-02T (torque strut bushing removal/installation). The originally-equipped torque strut bushings can deform under braking applications, resulting in left or right steering wheel rotation. The solid rubber bushings have more resistance to deformation.

Note: Do not replace the torque strut assemblies.

The steering wheel twitch can usually be maximized during slow-speed repetitive brake applications, such as those encountered during stop-and-go traffic, or when approaching a toll booth. It may occur during brake pedal application and/or release. Since ambient temperature may influence the condition, it is important to check for it when the engine is at normal operating temperature.

Note: It is imperative that the condition be verified on a smooth, flat and level road surface. Failure to observe the aforementioned conditions may result in needless replacement of the torque strut bushings.

The solid rubber torque strut bushings carry Part Number A211 333 11 14.

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Mike Schmitz Automotive
334-794-6716

Hoover
Crown Automobile
205-985-4200

Huntsville
Mercedes-Benz of Huntsville
256-837-5752

Mobile
McConnell Automotive
251-476-4141

Montgomery
Jack Ingram Motors
334-277-5700

Tuscaloosa
Leigh Automotive
205-556-1111

Alaska

Anchorage
Mercedes-Benz of Anchorage
907-277-3383

Fairbanks
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907-459-7070

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Mercedes-Benz of Chandler
480-403-3444

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Phoenix Motor
602-264-4791

Phoenix
Schumacher European
480-991-1155

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Fayetteville
Jones Motorcars
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Riverside Motors
501-666-9457

California

Anaheim
Caliber Motors
714-777-1900

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Rusnak/Arcadia
626-447-1117

Bakersfield
Mercedes-Benz of Bakersfield
661-836-3737

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Autobahn Motors
650-637-2333

Beverly Hills
Mercedes-Benz of Beverly Hills
310-659-2980

Buena Park
House of Imports
714-562-1100

Calabasas
Calabasas Motorcars
818-591-2377

Carlsbad
Hoehn Motors
760-438-4454

Chico
Courtesy Motors Auto Center
530-893-1300

Claremont
Penske Motorcars
909-568-2600

El Dorado Hills
Mercedes-Benz of Eldorado Hills
916-567-5100

Encino
Auto Stiegler
818-788-0234

Escondido
Mercedes-Benz of Escondido
760-745-5000

Fremont
Claridge's
510-623-1111

Fresno
Mercedes-Benz of Fresno
559-438-0300

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Calstar Motors
818-246-1800

Laguna Niguel
Mercedes-Benz of Laguna Niguel
949-347-3700

La Jolla
Heinz Gietz Autohaus
858-454-7137

Long Beach
Mercedes-Benz of Long Beach
562-988-8300

Los Angeles
Downtown L.A. Motors
213-748-8951

Modesto
Modesto European
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Monterey
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831-375-2456

Newport Beach
Fletcher Jones Motor Cars
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Oakland
Mercedes-Benz of Oakland
510-832-6030

Palm Springs
Mercedes-Benz of Palm Springs
760-328-6525

Palo Alto
Park Avenue Motors
650-494-0311

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Rusnak Pasadena
626-792-0226

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Mercedes-Benz of Pleasanton
925-463-2525

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Walter's Auto Sales & Service, Inc.
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Rocklin
Von Housen Motors
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858-279-7202

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Beshoff
408-239-2300

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Smythe European
408-983-5200

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Kimball Motor
805-543-5752

San Rafael
R.A.B. Motors
415-454-0582

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310-829-4511

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707-542-4810

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Berberian European Motors
209-944-5511

Thousand Oaks
Silver Star A.G.
805-371-5400

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310-303-3500

Van Nuys
Keyes European
818-461-3900

Walnut Creek
Stead Motors of Walnut Creek
925-937-1655

West Covina
Penske Motorcars
626-859-1200

Colorado

Colorado Springs
Mercedes-Benz of Colorado Springs
719-575-7930

Denver
Murray Motor Imports
303-759-3400

Littleton
Mercedes-Benz of Littleton
303-738-7700

Connecticut

Danbury
Mercedes-Benz of Danbury
203-778-6333

Fairfield
Mercedes-Benz of Fairfield
203-368-6725

Greenwich
Mercedes-Benz of Greenwich
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Hartford
New Country Motor Cars
866-346-2369

New London
Carriage House of New London
860-447-3361

North Haven
Mercedes-Benz of North Haven
203-239-1313

Delaware

Milford
I.G. Burton
302-424-3042

Wilmington
Mercedes-Benz of Wilmington
800-800-1949

Florida

Clearwater
Lokey Motor
727-530-1661

Coral Gables
Bill Ussery Motors
305-445-8593

Daytona Beach
Mercedes-Benz of Daytona Beach
386-274-4775

Ft. Lauderdale
Mercedes-Benz of Fort Lauderdale
954-462-4381

Ft. Pierce
Coggin Motor Mall
772-466-7000

Ft. Walton Beach
Quality Imports
850-863-2161

Gainesville
Duval Motorcars
352-332-7571

Jacksonville
Brumos Motor Cars
904-724-1080

Lakeland
Central Florida Eurocars
863-688-8111

Maitland
Mercedes-Benz of Orlando
407-645-4222

Melbourne
Continental Motorcars
321-956-0600

Miami
Mercedes-Benz of Miami
305-919-8000

Naples
Mercedes-Benz of Naples
239-643-5006

Orlando
Mercedes-Benz of South Orlando
407-367-2700

Pensacola
Centennial Imports
850-432-9903

Pompano Beach
Autohaus Pompano
954-943-5000

Sarasota
AN Luxury Imports
941-923-3441

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Crown Eurocars
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Capital Eurocars
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Hentschel Motorcars
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RBM of Atlanta
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