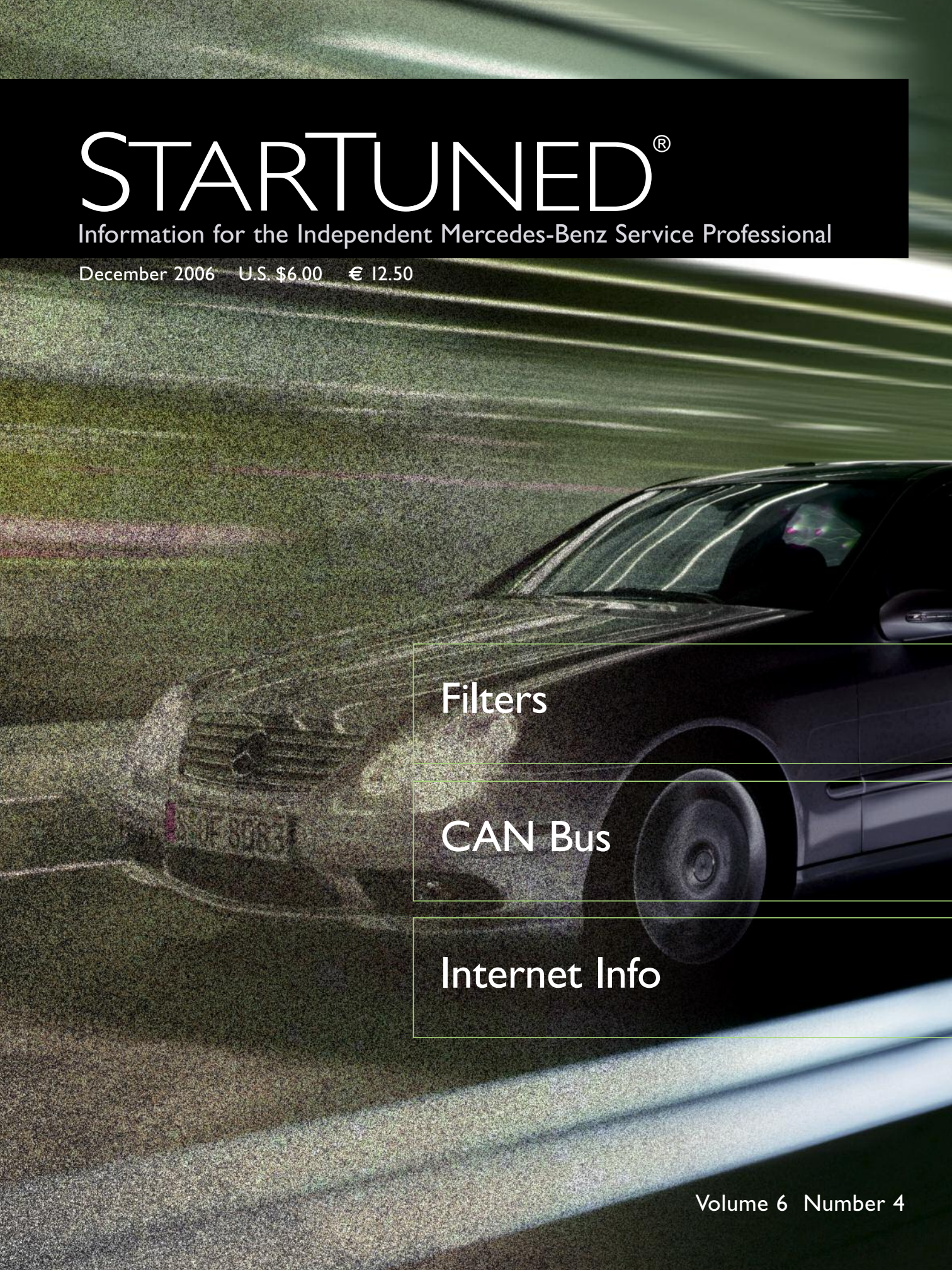

STARTUNED®

Information for the Independent Mercedes-Benz Service Professional

December 2006 U.S. $6.00 € 12.50

Filters

CAN Bus

Internet Info

Volume 6 Number 4

To Our Readers:

- Welcome to *StarTuned*, the magazine for independent service technicians working on Mercedes-Benz vehicles. Your Mercedes-Benz dealer sponsors *StarTuned* and provides the information coming your way in each issue.
- Mercedes-Benz wants to present the information you need to know to diagnose and repair Mercedes-Benz cars accurately, quickly and the first time; text, graphics, 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 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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StarTuned

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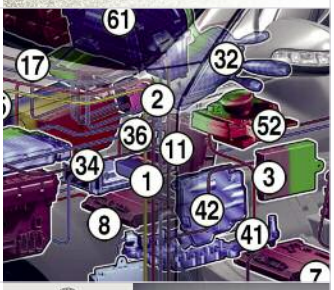

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Can you purchase a partnership like you can a part?

At Mercedes-Benz, we believe in being faithful. Faithful to getting you the parts you want, with all the support you need. And faithful to a partnership that strives to support your business in more and better ways than anyone else. So you, in turn, can be faithful to all those who rely on you. Contact your dealer. **Unlike any other.**

Mercedes-Benz

Blocking The Bad Stuff

Your customers depend on your filter knowledge to keep their vehicles running for a long, long time.

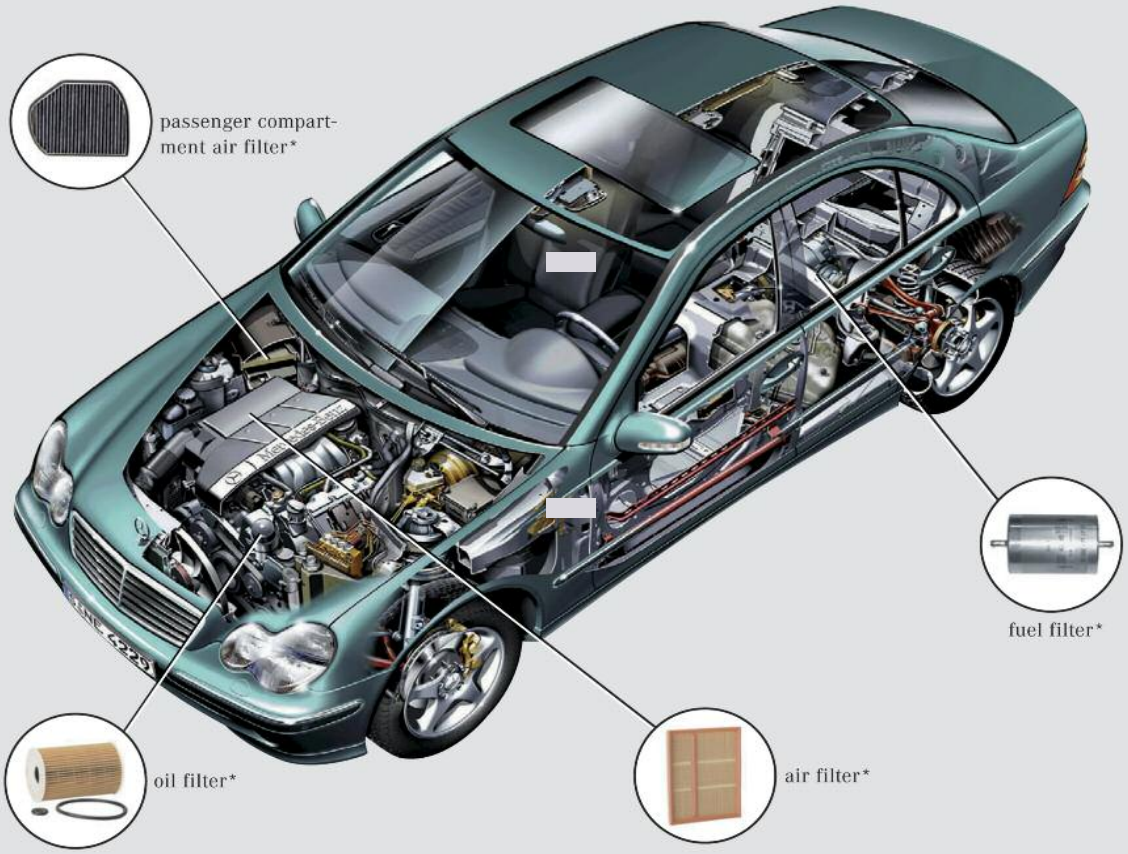
Your customers made a significant investment when they purchased a Mercedes-Benz. Your expertise can help maximize their return on that investment by faithfully following all filter change intervals for the type of driving your customer does and by always using Genuine Mercedes-Benz filters.

Aftermarket filters, with their slightly lower price, may seem like an attractive option to you because you can either save your customers a few dollars, or improve your bottom line a little when you use them. But aftermarket filters cannot compare with the OE quality of Mercedes-Benz filters. All Mercedes-Benz vehicles are carefully designed and engineered down to the last detail. The filters specified by Mercedes-Benz are the only ones designed to work exactly as the engineers intended on a Mercedes-Benz car or SUV.

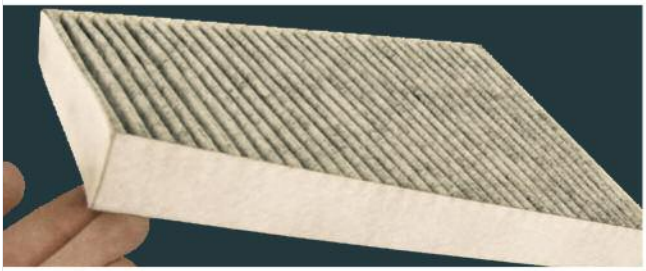
Cheaper filters can also carry a serious risk. All you need is one component failure because the cheap filter didn't do its job and your customer's small savings or your extra profits will more than disappear, along with your reputation for quality work.

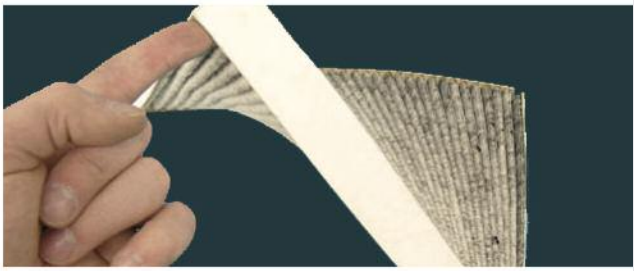
For most technicians, a filter change is just that, pull out the old filter, toss it, and install the replacement. Unless the fluid and filter change is part of a scheduled major service, filter replacement is typically a lower skill task done by a lesser experienced technician.

However, if you add just a few seconds to a filter change to carefully inspect the old filter, you can learn a lot about your customer's driving habits and maintenance needs. You can also pick up warning signs of possible problems, too.



Installing only Genuine Mercedes-Benz filters should be a key part of every maintenance service.





Frame Stability: *The rigid frame of a Genuine Mercedes-Benz filter (left) provides better edge sealing, hence performance than a weak, no-name filter (right).*

Never 100%

Filter design is always a balancing act or trade off between efficiency, protection, and capacity. Think about a one-cylinder engine on a lawn mower, with an air filter mounted over the carburetor. When you remove the air filter and start the engine, air flow would be 100 percent efficient. At full throttle, the engine would draw in the maximum amount of air possible past the venturi. Protection, however, would be zero because nothing would block airborne particles from entering the engine. Service life would plummet as particles scored the piston and cylinder walls.

Plug the carburetor opening completely and you would have 100 percent protection, nothing would get into the engine. But "nothing" also includes the air needed for combustion so the engine would never start or run!

So no filter can be 100 percent effective and still provide 100 percent protection. Genuine Mercedes-Benz filters are designed and manufactured to provide maximum effectiveness and maximum protection. The efficiency and protection numbers for discount, no-name filters can be scary.

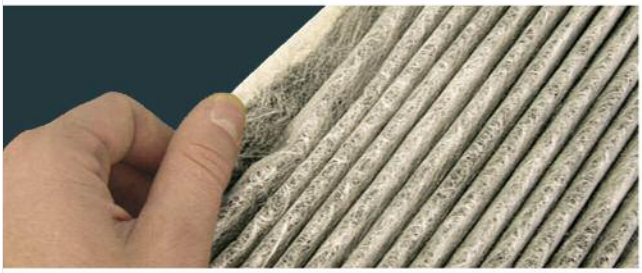
Capacity, the third measure of filter quality, is the volume of contaminants a filter can hold before it becomes full or overloaded and restricts flow. The higher the capacity rating, the longer the filter can be on the car before it must be changed.

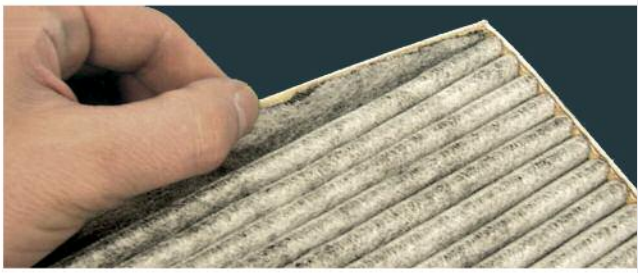
Row Straight: *Evenly spaced, straight filter media rows on a Genuine Mercedes-Benz filter (left) perform better than the inconsistent filter bed of a competitive brand (right).*

Although there are different procedures for changing air, oil, fuel, and passenger compartment filters, you should always follow these steps whenever you replace any filter:

- Verify when the filter was last changed based on either your shop records or the maintenance booklet.

- Inspect the old filter. If the vehicle is at its normally scheduled service interval, based on mileage or time, but the filter is extremely dirty, your customer's driving habits are probably in the "severe" category. Recommend that your customer start follow-





End Seal: Particles can't get past the tight end seal of a Genuine Mercedes-Benz filter (left). Competitive filter end seals (right) can't make the same claim.

ing the shorter "severe" service maintenance intervals to protect his or her car. If your shop has a customer reminder program for schedule maintenance, change the time between notices to the severe duty interval.

- If the filter is very dirty, and the vehicle is overdue for service, stress to your customer the importance of following Mercedes-Benz recommended service intervals to protect the vehicle.
- If the filter shows a normal amount of contamination, but the vehicle is overdue for service based on your records, your customer may be getting service work done elsewhere. If the old filter isn't a Genuine Mercedes-Benz replacement, you know he or she is going somewhere else! Using your best customer relations skills, point out that a shop like yours that only uses Genuine Mercedes-Benz parts is the best place to have any Mercedes-Benz vehicle maintained.

Hardest working filter

All filters work hard, but the air filter has the toughest job based on the volume, or amount of work it does. To burn just one gallon of gasoline requires about 10,000 gallons of air! All 10,000 gallons of that air must be cleaned before entering the engine.

A Mercedes-Benz air filter effectively removes the dust, environmental pollutants, tire particles, and particulate matter that is found wherever vehicles are used. Genuine Mercedes-Benz air filters offer significant advantages compared to other filters:

- Filtering down to the 10 to 20 micron range. Capturing the smallest particles is critical because recent testing has shown that it is the smallest particles, not the larger ones, that cause the fastest engine wear if they are not captured by the filter.

- Maximum capacity. The element used in a Mercedes-Benz air filter has high strength to hold a large amount of contamination. The element is specifically treated to resist breakdown.

- Optimum fold geometry. The complex bends allow a large amount of filter element to be contained in a small space. Increased filter element area boosts capacity and allows extended service intervals.

- Absolute impermeability. Special bonded joints, metal clamping strips between the dirty side and the clean side, optimized seals, profiled joints, and precise foam-molded end plates prevent leaks that allow incoming air to bypass the filter and go straight into the engine.

- Sturdy supportive covers. These perforated stainless steel sheets prevent uncontrolled deformation and temporary leaks.

- Dimensional accuracy. You can count on only a Mercedes-Benz air filter to be properly sized for each application to ensure an

optimal fit inside the air box.

When you replace an air filter, always clean the air box and inspect it for any physical damage. Replace any air box that is dented, distorted, cracked, or otherwise damaged. Install the new filter and secure the air box. The air box fasteners should be snug, but not difficult, to close.

Oil filters

The Mercedes-Benz Flexible Service System (FSS), introduced on some MY '98 models and used through MY '04, monitors time between oil changes and the condition of the oil. A graphic indicator on the dash advises the driver when an oil and filter change is due, based on the vehicle's specific driving history.

The Mercedes-Benz Flexible Service System (FSS) allows service intervals to be extended without danger. That doesn't relieve you of the responsibility of using only the best filters during maintenance.

With FSS, a driver who puts on a lot of miles at highway speed may not see the oil change indicator for up to 20,000 miles, while a stop-and-go, in-town driver may only go 6,000 miles before getting the reminder.

For any Mercedes-Benz without FSS, follow the recommended oil and filter change intervals for the vehicle based on the driver's habits. Any driver who spends most of his or her time in around town or short-trip use will be in the "severe" category and more frequent changes are recommended.

The job of the engine oil is to lubricate, seal, cool, and clean the interior of the engine. The job of the oil filter is to trap the contaminants picked up by the oil as it passes through the engine.

Mercedes-Benz oil filters should be changed at the recommended intervals to ensure maximum engine performance and service life. Filters remove contaminants from the oil, allowing extended maintenance intervals and ensuring long engine life. Filters that are left on too long become overloaded with contaminants. When an oil filter is overloaded, contaminants, instead of being trapped by the filter, circulate throughout the engine, causing premature

Every Mercedes-Benz vehicle deserves the best oil filter available—a Genuine Mercedes-Benz filter.

wear and damage.

Mercedes-Benz is an industry leader in engine technology, not only in design, but also in the use of new alloys that reduce weight without compromising strength. These sophisticated engines require the protection that only premium oil and filters can provide. By using only Genuine Mercedes-Benz oil filters, you, and your customers, are assured of:

- Optimum filtration. Genuine Mercedes-Benz oil filters can trap particles smaller than 0.005 mm. (0.0002 in.).
- High capacity. Genuine Mercedes-Benz filters are designed so the whole available volume of the casing is used to provide a maximum filtering surface and to make longer maintenance intervals possible.
- Correct size. Only a Genuine Mercedes-Benz oil filter is designed to fit exactly for optimum impermeability and effective lubrication.

Whenever you change an oil filter, take a moment to inspect it for any signs of damage or deformity. A distorted filter typically indicates excessive oil pressure, which is usually caused by obstructions in the lubrication system. Test oil pump pressure whenever you have a damaged filter to make sure it is within specifications.

Also, take a look inside the old filter to make sure the filter itself is intact. Any internal damage is a bad sign. Parts of the filter may have broken off and entered the lubrication system. Check oil pressure. An analysis of the old oil may be needed to determine if there is abnormal internal wear.

Always drain the old filter and dispose of it properly, in compliance with all environmental regulations.

Fuel filters

Fuel filters are unique because, unlike air and oil filters, a fuel filter, in theory, should never get dirty. If all service stations sold only clean, uncontaminated gasoline and if fuel system corrosion was never a problem, there would be nothing for a fuel filter to trap! The real world, unfortunately, is much different from the ideal. Gasoline or diesel can be contaminated and fuel systems can become corroded. The fuel filter must trap any particles that could clog or damage the tight tolerances of the fuel injection system.

In addition to protecting the injection system from contamination, the fuel filter's large size serves as a reservoir to dampen fuel pump pulsations with roller cell or gerotor designs (turbine-type pumps don't produce pulsation). Fuel flow is much smoother coming out of the filter than it is going in.

The worst thing about a clogged fuel filter is that it causes the fuel pump to work harder, dramatically shortening its life. If you were to put an ammeter in the fuel pump circuit, you might see up to twice the normal current draw.

If you don't replace filters often enough, you'll be replacing more of these prematurely.

Fuel filters should be changed at least as often as called for in the maintenance schedule. And a really filthy fuel filter is an alert to inspect the entire fuel system.

Eventually, this will cause the brushes and commutator to burn up and wear out.

On top of that, a fuel filter that has been left in service too long can cause a deterioration in performance, including gradual loss of power, stalling, and slow acceleration. A badly clogged filter will shut down an engine because not enough fuel will pass through to the injectors.

If the old filter is loaded with dirt or other contaminants, remember that all the contamination in the filter was first in the tank, and then passed through the fuel pump, before it got to the filter. The discovery of a clogged fuel filter should prompt a more complete inspection and pressure testing of the complete fuel system, including the injectors. It may be wise to remove and clean the fuel tank.

Mercedes-Benz relies on precise metering of fuel for optimal performance and mileage, while also minimizing emissions. Use of a Mercedes-Benz fuel filter is a key part of fuel system maintenance because of:

- Excellent impermeability. Mercedes-Benz filters feature special bonded joints for optimum separation between the clean and dirty side of the filter.
- High quality materials. Genuine Mercedes-Benz fuel filters are resistant to aggressive fuel additives and corrosion.
- High capacity. The quality and workmanship of the filtration media guarantee high fuel purity, long life, low flow resistance, and very good temperature resistance.
- Perfect interaction of all components. Only Genuine Mercedes-Benz replacement filters are designed to work as an integral part of the total fuel system.

Passenger compartment filters

If you don't know your filter history, you might think that passenger compartment air filters are newcomers to the automotive filter world. You would be wrong. The first passenger air filter system appeared in 1939 on what was called the "Weather Eye" system used by the long-defunct Nash.

Unfortunately, passenger compartment air filters didn't catch on at the time. In the late 1980s, however, carmakers realized that with the improvements in engine air filters, and the growing problem of air pollution, engines were breathing cleaner air than people!

Genuine Mercedes-Benz passenger compartment filters trap many pollutant particles in the air including smoke, dust, bacteria, mold, spores, pollens, and some exhaust gas emissions before they enter the passenger area. The cleaner air is not only safer for everyone sitting in a Mercedes-Benz, it also improves the operating of the climate control system and keeps the interior cleaner.

For some unknown reason, cabin filter replacement is a profit opportunity that many shops continue to overlook. Many of your customers may not even realize that their Mercedes-Benz has a passenger compartment air filter. But it shouldn't take much of a sales job to convince them that regular replacement of the filter is good for them and good for their cars. To help you sell passenger compartment filters, put an old, dirty filter in a clear plastic bag, and keep it handy. Show your customers what the filter is protecting them from. If the filter isn't replaced at regular internals, that contamination would be entering the passenger compartment and going into their lungs. Don't miss this money-making opportunity.

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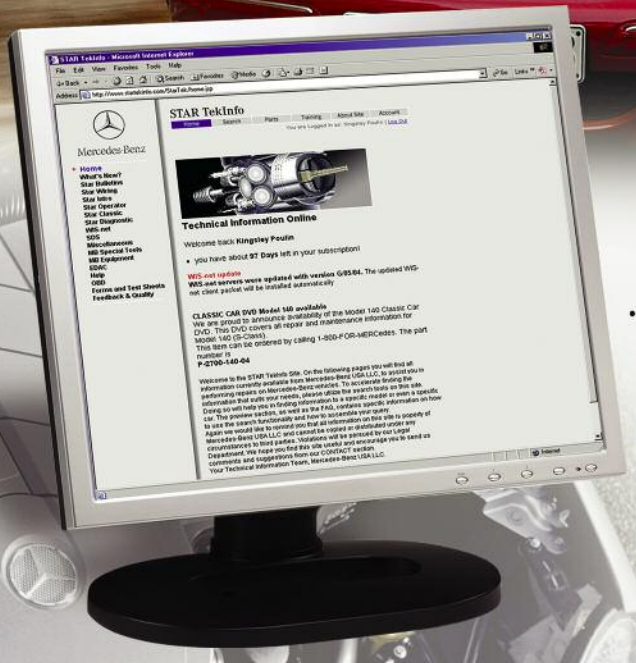

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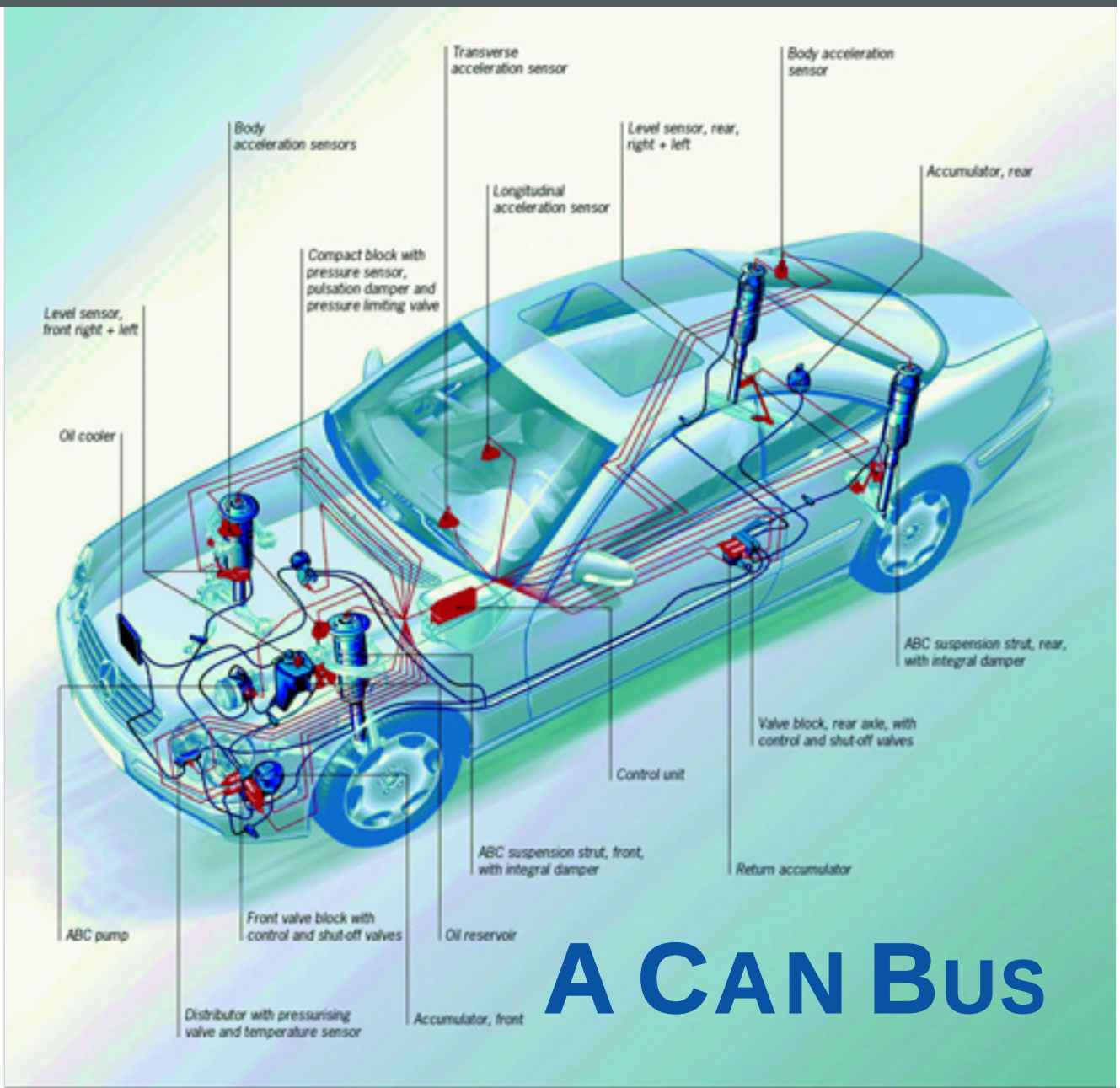


A CAN BUS

IT'S NOT A MODE OF PUBLIC TRANSPORTATION

This technology is essential to bringing Mercedes-Benz vehicles into the future.

In the 1980s, Mercedes-Benz faced a "wire crisis," as indeed did all carmakers. This was because of the demand for more and more onboard electronic devices. Mercedes-Benz was continually adding more sensors, actuators, controllers, and other electronic components to retain its leadership position in automotive technology, to comply with various government regulations for fuel economy, emission control, and safety, and to meet consumer expectations for increasingly sophisticated comfort and convenience features.

Developing the electronic devices was one issue, but a more serious problem was connecting the components so they would work together properly. Old school technology required separate wires to connect every device. Sometimes, multiple wires had to run between two devices. For example, if two sensors reported to a controller, and the controller operated two devices based on sensor inputs, the controller would be the center of a spider web of four to eight wires. The exact number of wires joining the devices would depend upon the circuitry to provide reference voltage and signal voltage between the sensors and the controller and the connections needed for output and feedback between the controller and the actuators. Whenever a new device was added, entire wiring looms would have to be redesigned to accommodate the latest change.

Continuously adding more wires to a vehicle causes many problems:

- Manufacturing costs increase because additional wire means more material and labor are needed to assemble the vehicle. The fact that wire must be uniquely color coded further increases manufacturing cost.
- Finding places to route the wiring gets more difficult as the amount of wiring increases. According to some industry estimates, a mid-size car can have up to three miles of wire!
- More wires means more weight, which hurts performance and fuel economy.
- Fat wiring looms make diagnosis and repair more complex.
- Connecting a bundle of wires, especially at the controllers, becomes more difficult as the number of wires increases.

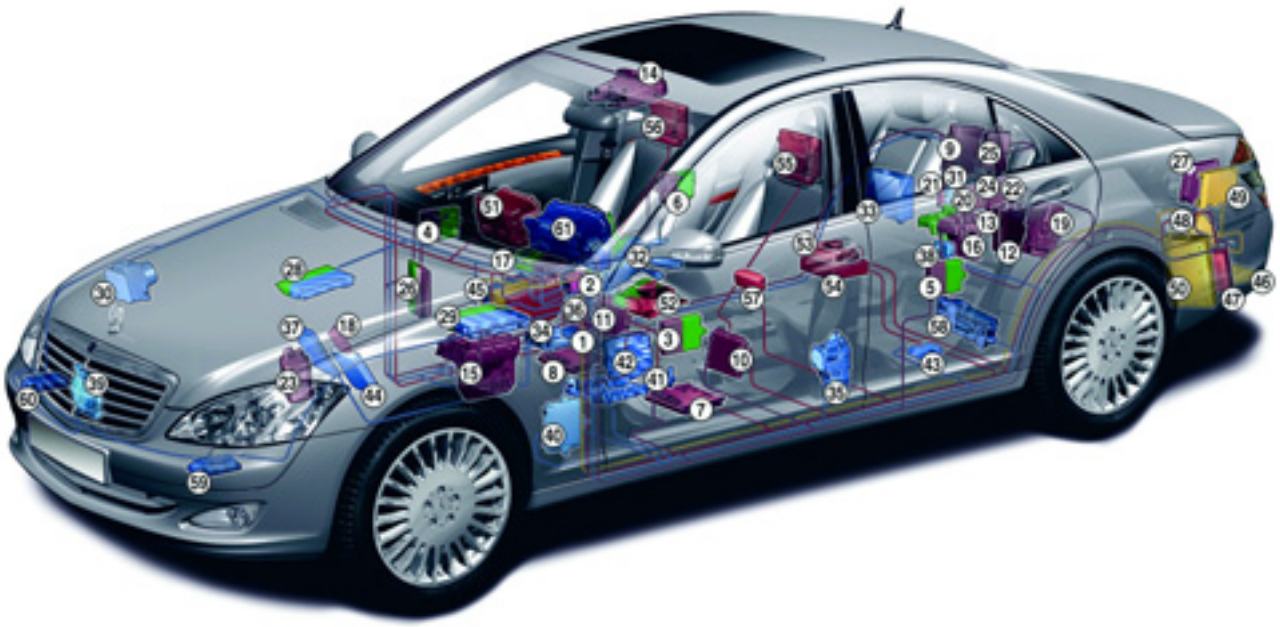
Just Two Wires

The wire crisis was solved by CAN bus technology, which was quickly adopted by Mercedes-Benz and is now used in all its vehicles. CAN stands for "Controller Area Network." "Bus" is an electrical/electronics term for a device or system that links multiple components together.

CAN bus was developed in the late 1980s as a cooperative venture between Intel and Robert Bosch. The two firms realized that the wire crisis was not limited to the automotive industry. Any manufacturer of digital devices faced the same problem—trying to fit more wires in less space as components became increasingly complex and sophisticated. CAN bus technology was so successful at reducing wiring use, it is estimated that literally hundreds of millions of devices are manufactured each year using one or more CAN bus networks.

Mercedes-Benz first used a CAN bus in MY 1992 on the 140 model. Today, every Mercedes-Benz has multiple CAN networks. The current C-Class has three CAN networks, one for the engine electronics, one for diagnostics, and one for the body (there is a fourth CAN, but it supports diagnostics and isn't a factor in service work). The most extensive use of CAN bus is on the current S-Class, which can have up to eight separate CAN networks including the Interior CAN, Drive Train CAN, Diagnostic CAN, Chassis CAN, Front end CAN, Vehicle Dymamics CAN, Telematics CAN, and the Central CAN! Just about any electron that moves on any circuit in the S-Class passes through one or more CAN networks.

According to one Mercedes-Benz service engineer, today's Mercedes-Benz vehicles, with



A new Mercedes-Benz can have more than 60 electronic components linked to eight CAN bus networks.

all of their features and innovations, could not be built without CAN bus technology. It would be impossible to effectively link together all the electronic components and systems that make a Mercedes-Benz vehicle a Mercedes-Benz.

CAN bus replaces the thick bundle of multi-colored wiring with just two wires. One is the “CAN-high” wire, the other is “CAN-low.” The two wires are twisted or braided along their length to limit the amount of electrical "noise" that can enter into the wiring, and both wires are connected to every device on the network.

Two wires are used because, in a CAN bus, signals may be redundantly “pulled up” on one wire or “pulled down” on the other. In electronics engineering, this is known as dominant recessive logic for signal transmission. Because of this setup, CAN bus networks are virtually immune from electrical interference caused by external devices that are not part of the network. Interference can still disrupt a CAN network, but such problems are rare.

In electronic terms, “node” is a generic term for any device on a given CAN bus network. All nodes in an automotive CAN network are capable of both sending and receiving messages. The type of message determines if a node will transmit it or receive it. Although nodes can both send and receive, sensors and other devices that provide input data to a control module mostly transmit. Actuators that respond to signals from a controller are mostly receivers.

Benefits

Mercedes-Benz has quickly adopted CAN bus technology because of its many advantages. CAN bus:

- Replaces thick wiring harnesses with just two wires, saving weight, space, and installation costs.
- Not only reduces the wiring used, but can also reduce the total number of components required. Messages from any component can be sent to any other device on the network. With links between CAN bus networks, a message can be sent from any component to any other location on the vehicle.

Advances of CAN-bus Technology

Lower cost of wiring	Lines from sensors must only be lead to the nearest control unit where the measured values are processed to form a data telegram and are placed on the CAN data bus. Actuators can also receive control signals from a different control unit which receives the data telegram through the CAN bus and then uses this information to calculate a control parameter for the actuator.
Improved electromagnetic compatibility (EMC)	
Fewer plug connections	
Fewer pins on the control units	
Weight saving	
Fewer sensors	Signals from one sensor (e.g. ECT sensor) can be used several times
Better diagnosis	Because signals from one sensor can be received by several receivers, it can be assumed if a fault is displayed by all systems which use a particular signal, that the sensor is defective or that the control unit which processes the signal is faulty. If only one system displays a fault, even though the signal is used several times, the fault is usually at the processing control unit or at the actuator.
Fast transmission rates	Mercedes-Benz uses transfer rates from 83k bits per second (bps) to 500k bps. Faster speeds could be used because CAN-bus will operate at up to 1M bps.
Several messages can be transferred in succession on the same line	

- Is energy efficient. A CAN bus network operates on low voltage – the exact voltage varies from vehicle to vehicle and by the CAN bus type. When no signals are being sent, the network goes into a “sleep” mode, immediately becoming active when a signal is sent.
- Is more reliable because with less wiring and fewer components there aren't as many things that can go wrong. The double twisted wire setup is extremely fault tolerant. Transmission failures or errors are very rare in a CAN bus network.

(Continued on page 20)

Genuine Mercedes-Benz Rema

Why Buy Genuine?

Replace — We replace more parts than aftermarket brands.

Engineered — Designed to meet original OEM drawings.

Manufactured — Made with same OE components as factory parts.

Assembled — Completely assembled from components and not just repaired.

New — Tested to new unit standards.

Quality, Reliability and Value

The quality, reliability and value of the Genuine Mercedes-Benz Remanufactured A/C Compressor wasn't meant to be taken lightly. It is not only an exact replacement for the original unit, it's also remanufactured 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 Mercedes-Benz Remanufactured A/C Compressor and a new one is the price. Which we're sure you'll find quite refreshing.

It's All In the Process

Remanufacturing Process (Genuine Mercedes-Benz)

1. Dismantle core and clean all components.
2. Replace key components 100% with new OE part.
3. Test all other critical components.
4. Replace components that do not meet specs.
5. Assemble, test and box.

Rebuilt Process (Typical Aftermarket)

1. Identify damaged part or parts.
2. Replace damaged part with non-OE part and clean.
3. Re-assemble, test and box.

*See your Mercedes-Benz dealer for details and a copy of the Mercedes-Benz Spare Parts Limited Warranty.

NUFACTURED A/C COMPRESSORS

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Available only through your local Mercedes-Benz Dealer

Mercedes-Benz

(Continued from page 17)

- Is easy to troubleshoot. The system is programmed to identify any node or component that is not operating properly and will set a trouble code.

- Makes adding new devices easy. All that needs to be done is connect the device to the network and reprogram the controller.

Not Multiplexing

Don't confuse a CAN bus with "multiplexing." Although a multiplex network shares the benefits of connecting multiple devices to a single network, the technologies operate differently.

In a multiplex network, a single wire connects all the devices. Each device has a unique "address" on the network. A signal from one device is sent directly to another unit on the network based on the receiving network's unique address. The message skips over or bypasses all other components.

On a CAN bus, all nodes or components send and receive data equally. In theory, a node on a CAN bus could send a signal to all of the other nodes at the same time. But each message that is sent contains an identifier code. The message goes to all components on the network. Each receiving component, "opens" the message and immediately looks for the identifier code. If the code isn't the correct one for the specific node or component, the device "discards" the message.

The distinction between unique addresses in a multiplex system versus unique identifier codes in a CAN bus network might seem to be splitting hairs. But using identifier codes is a key reason why it is easy to add components or modify a CAN bus network. Sending messages to all nodes, but only allowing a node to "open" messages that pertain to its function makes it much easier to program a CAN bus network than a multiplex system with unique addresses.

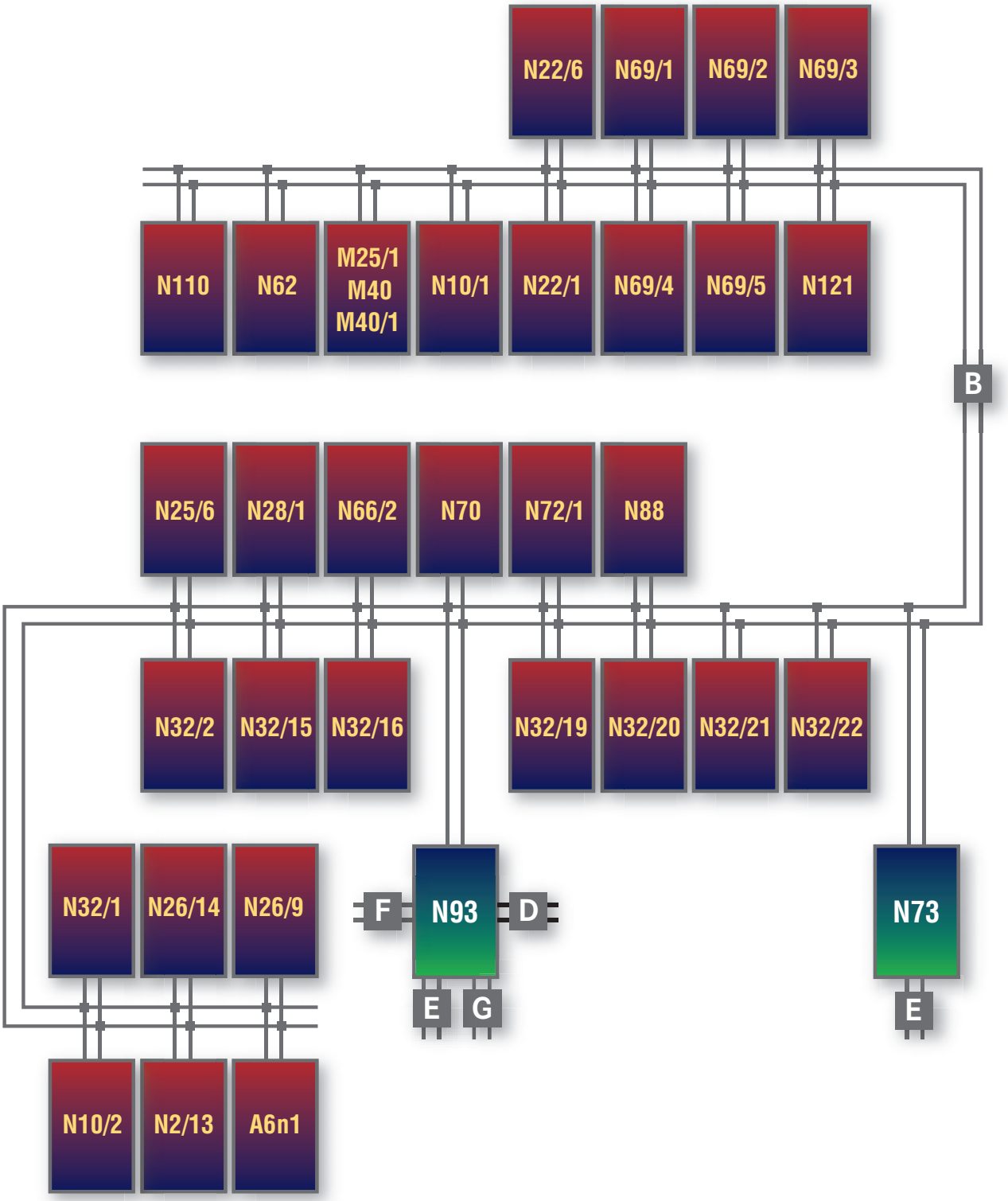
Included with the CAN identifier code is a message priority status, known as the arbitration process. Greatly simplified, arbitration occurs when two messages are being sent to the same node at the same time. As the transmitter node sends a message, it compares the bit sent/transmitted with the bit received back from the network. If the transmitter detects that the received bit and transmited bit are different, then it ceases to transmit, since it knows a message with higher priority is being sent at the same time. The message with a higher priority will be transmitted without interruption. It will try again after an idle time is reached.

In addition to priorities for each node, messages can be ranked by the frequency by which the CAN bus receives them. For example, a signal to initiate the anti-lock brake system would be sent with increased frequency (or at quicker intervals) than a message to the climate control system to adjust the interior temperature.

At maximum speed, a CAN bus network can send signals at speeds of up to 1M (mega) bits per second (bps). A bit is a digital signal for 0 or 1, the basis for all digital communications. Mercedes-Benz does not operate its CAN bus networks at the maximum potential speed. Speed is limited to a balance between what is required for speed and how much noise (interference) the network can tolerate. The faster the network, the more susceptible it is to electronic noise that will interfere with its operation. The fastest any current Mercedes-Benz CAN bus network operates at is 500K (500,000) bps. Some networks operate as slowly as 83K bps.

The 500K bps CAN bus networks are used for drivetrain and other critical systems that require higher throughput. The slower networks are used for various interior systems, which are not as time critical.

The higher and lower priority messages and transmission intervals are in "electronic time" which is measured in milliseconds over a relatively short distance. A human observing the operation of a CAN bus without the use of special test equipment would not be able to sense any difference in priority or speed. To humans, a CAN bus does everything all at one time, and all CAN bus networks are very, very, fast. For example, a single bit transmit time in a 500 Kbps is 2 micro seconds and 83.3 Kbps is 12 micro seconds.



This schematic shows why Mercedes-Benz CAN bus networks are called "linear."

Mercedes-Benz also uses a LIN network that is a slow (19.2K bps) system used for controlling some interior functions. Another network is MOST, a very high-speed network used for the fiber optics that control audio and navigation systems. MOST replaces the older D2B networking technology.

Reliable

CAN bus networks are reliable and getting better. On the latest Mercedes-Benz vehicles, CAN network problems are rare. In fact, when troubleshooting, a problem with the network should be the last thing, not the first thing, that you focus on.

Most of the time, the problem will be with one or more nodes or components on the network. Typically, a component is either not sending out signals or it fails to respond properly to messages that are addressed to it.

If your troubleshooting has eliminated the components on a network, don't begin to check the network itself until you verify that there is normal battery voltage available and the charging system is operating properly. Correct any battery/charging problem before proceeding to test the CAN bus.

Getting the correct voltage reading for a CAN bus only means that necessary voltage is present, not that the network is operating properly.

A visual inspection can spot most of the common physical problems with a CAN bus including:

- Corrosion, which can be caused by water leaks or other moisture sources coming into contact with the wiring.
- Physical breaks in the wiring.
- Shorts to battery voltage or ground, which are usually found using your DMM.
- Damaged connectors.
- Circuits that have been tampered with. If another technician has tried to "fix" a CAN bus by rewiring it, or has added a component that was not originally part of the system, the network won't work properly. Splices, replaced wires, wires that do not have the correct turns per inch in the braiding, etc., will change the length of the wiring, which will interfere with network operation.

With a good quality DMM and lab scope, plus the specific service information for the vehicle you are working on, you can test a network for signal patterns, voltage drop across the components, and system resistance. Make sure all resistance readings are within specifications. A CAN bus may operate with the wrong resistance, but signal problems are more likely when the resistance isn't within limits. This is more critical on the 500 Kbps networks where there are terminating resistors that maintain this balance.

Interference, although rare, can still happen. Interference can confuse you because the problems may mimic a short or communication failure among nodes. A defective alternator is a common cause of interference, which is one reason why you must verify good charging system operation before troubleshooting a CAN bus. Look for a clean signal free of any glitches in the pattern that may indicate transient interference entering the network or control modules that may be sending out errors. If needed, compare the signal of the suspect vehicle with that of a known good vehicle.

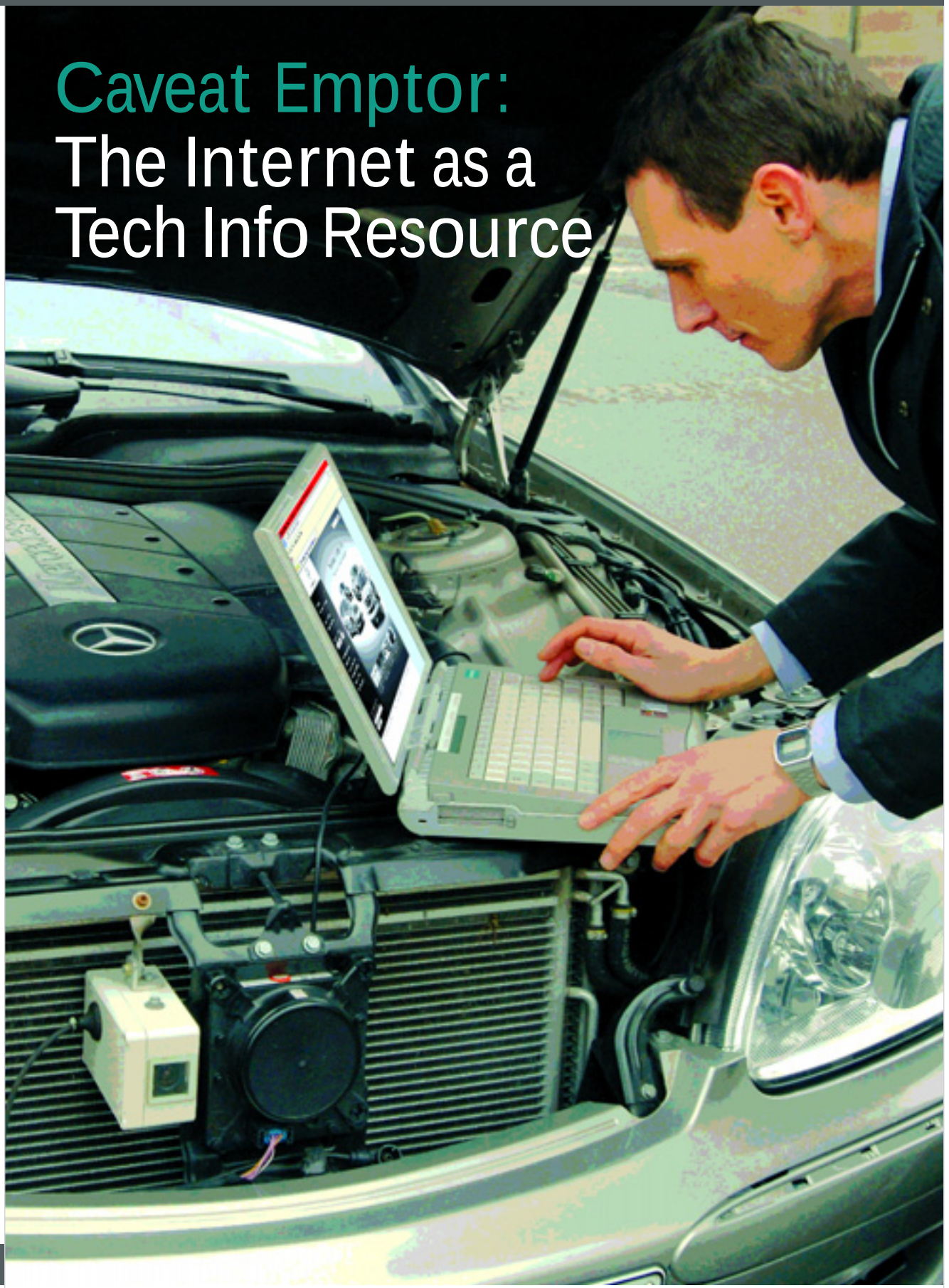
The other major cause of system interference is an aftermarket component that has been improperly installed. You'll have to disconnect each device, one at a time, and check to see if the inference problem is eliminated.

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

Relive the good ol' days. Mercedes-Benz makes it easier to find classic car parts Call 1-866-MBCLASSIC, and Mercedes works to track down the genuine Mercedes-Benz classic part you need. So you can be sure of one thing: they really do still make 'em like they used to. Visit MBUSA.com/classic. **Genuine Mercedes-Benz Parts**

Mercedes-Benz

Caveat Emptor: The Internet as a Tech Info Resource



The Internet has empowered many members of our society, especially those of us who work in technical fields. Just because it's on-line doesn't mean it's true, however.

Is the Internet in your toolbox? Should it be? A smart technician, when he or she runs into a hard-to-solve diagnosis or repair problem, turns to someone for help. For generations, that someone was either a more senior tech in the shop or a technician from another local garage who was known for his expertise on a particular car or system. Today, with the Internet, that helpful technician also exists in cyberspace.

History has shown us that breakthroughs in communications technology make major changes in society. Each one eliminated barriers, making it faster and easier to send and receive messages. The telegraph virtually eliminated time and distance as factors in communications. The telephone eliminated the need for Morse Code. All you had to do was talk and listen. Radio communication eliminated the need for hard wire connections – two people with radios could talk virtually anywhere, anytime. Broadcasting, first with radio and then with television, allowed one transmission to be shared by many millions all at the same time. Fax allowed individuals to transmit images as easily as placing a phone call.

The latest communications breakthrough, the Internet, has outdone the advances of all other breakthroughs. On the "net," people can communicate one-on-one either via email or by instant messaging. One person can communicate with many using a "blog." People with similar interests can join a topic-specific forum or chat room. The Internet supports its own versions of voice, image, and data transmission to rival phone, fax, radio, and TV.

Millions of hits

One of the most important advances created by the Internet was an explosion of information. Never before has so much information been available so quickly and with so little effort. Type literally any word, topic, or question you can think of into a search engine like Google and you will usually get a stunning number of

Star TekInfo Home: Everything at www.startekinfo.com is official service and repair information direct from Mercedes-Benz. For a detailed tour of this website, see the March 2005 issue of StarTuned at www.mbwholesaleparts.com

You should check www.startekinfo.com frequently to get the latest service bulletins.

"hits" or websites related to what you are looking for. Even the most obscure topics will have dozens, if not hundreds of sites. And hits totaling into the hundreds of thousands and even millions are typical.

StarTuned did a search of the Internet to see what was available on servicing Mercedes-Benz vehicles. The results were surprising. A search for "Mercedes-Benz technician" got nearly 300,000 hits. Most sites were "help wanted" ads, or technician's websites promoting their services. A few, however, were related to service and repair work.

Getting 300,000 hits for sites for a relatively limited interest area like "Mercedes-Benz technician" was impressive, but there are a lot more sites in cyberspace related to working on a Mercedes-Benz. In fact, "Mercedes-Benz technician" had the lowest number of hits of our searches.

"Mercedes-Benz repair" returned nearly four million hits! The websites covered just about every model of Mercedes-Benz sold from the late 1950s to present day vehicles. A search for "Mercedes-Benz forum" yielded nearly six million sites, including the official Mercedes-Benz Club of America site (http://www.mbca.org/). Some forums were Mercedes-Benz exclusive, others were general automotive forums with a subsection dedicated to Mercedes-Benz.

Diving deeper, most Mercedes-Benz forums have one or more areas related to service work. Some are further divided into literally dozens of pages, containing a hundred or more different repair discussions for just one model! A few mouse clicks could take you to discussions on just about any service problem for any model Mercedes-Benz you can think of. The discussions ranged from solving difficult intermittent problems to mundane issues like oil change intervals and what brand of coolant is best.

How Good?

Most of the Mercedes-Benz websites are consumer oriented – Mercedes-Benz owners and enthusiasts who enjoy discussing their cars. You will also find a few professional technician sites. The International Automotive Technicians' Network (www.iATN.com) is the best known of the pro sites. iATN boasts some 40,000 members. There are also professional sites among the many discussion groups at msn.com, yahoo.com, etc.

Spending time browsing through a random selection of sites is both interesting and boring. The boredom sets in because almost every site seems to have been set up by the same designer, and very soon all the sites start to look alike. You find an index page listing models and topics. Then you go into the subsection on service, which is further divided by model or system, depending upon the organization of the webpage.

Typically, a question about a Mercedes-Benz repair was posted, followed by anywhere from zero to dozens of responses stretching over several days.

The forums and discussions are interesting because of the incredible range of questions and responses. However, while reading various discussions, we kept recalling the title of an old Clint Eastwood movie, *The Good, The Bad, and The Ugly.* Some responses were good because they solved a problem that had been driving a technician or owner crazy. Other responses were bad because they were wrong or at least weren't to the point. The ugly set in when discussions of different repair techniques degenerated into personal attacks.

One "ask the expert" site advised a Mercedes-Benz owner who was seeking help servicing an older diesel engine model that the best dealership in the country for Mercedes-Benz repair

www.mbca.org is the official website for the official Mercedes-Benz Club of America.

was in New Jersey. The only independent shop the expert could recommend was in upstate New York. We think that reply is an insult to all the good dealerships and independent repair shops, especially *StarTuned* readers, who work hard to provide their customers with the highest level of service possible.

One thing that struck us reading the consumer sites is how seldom anyone responded that a recommended fix actually worked. The discussion all too often just died out with no report on success or failure. On professional technician sites, there were a lot more "thank you, that worked" responses than on the consumer side, but even among the pros, many discussions simply stopped.

One site you can depend on for accuracy is the official Mercedes-Benz technical website, www.startekinfo.com. There are no discussion or forum areas, just access to a vast library of official Mercedes-Benz service information and bulletins. Accurate product information about new Mercedes-Benz vehicles can be found at the general Mercedes-Benz website, www.mbusa.com. There is no repair or service information, but you'll find everything you want to know about features of all the new models.

After the official Mercedes-Benz websites, it is "buyer beware" regarding the value of the repair information you'll find. Even the largest professional site, www.iatn.com makes it clear that you use any information on the site at your own risk. Just part of iATN's disclaimer reads:

DISCLAIMER OF WARRANTIES. YOU EXPRESSLY UNDERSTAND AND AGREE THAT:

Your use of the service is at your sole risk. The service is provided on an "as is" and "as available" basis. iATN expressly disclaims all warranties of any kind, whether expressed or implied, including, but not limited to, the implied warranties of merchantability, fitness for a particular purpose and non-infringement.

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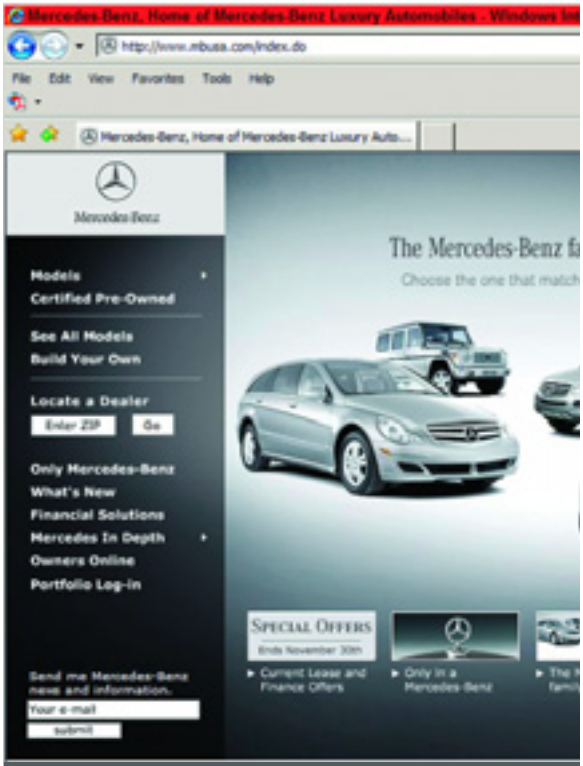

Want the latest on the current Mercedes-Benz line up? The best place to go is www.mbusa.com

you through this network will meet your expectations, and any errors in this network will be corrected. Any material downloaded or otherwise obtained through the use of this network is done at your own discretion and risk and that you will be solely responsible for any damage to your computer system or loss of data that results from the download of any such material. No advice or information, whether oral or written, obtained by you from iATN or through or from this network shall create any warranty not expressly stated in the terms of use.

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How much faith would you put in the advice you get from your buddy at the shop across town if he used the same type of disclaimer?

Don't ignore

You should still use the Internet as a source of service information; just apply some common sense. If you are not on an official Mercedes-Benz website, know who is sponsoring or running the site. Always ask yourself how much you can trust their knowledge and recommendations. Don't just blindly accept anything you read from previous discussions or any responses you get to your questions. Does the answer make sense? How much risk is there in following the advice? Could the recommendation cause harm?

Before you turn to the Internet, have you exhausted other reliable sources for repair information? And are you sure you haven't skipped anything or assumed something in your original troubleshooting and diagnosis?

Although you can obtain an unbelievable amount of information from the web, you still have to factor in your time. You must sort through websites and wade through pages and pages of responses. If you post a question on any of these sites, you have no idea when, if ever, someone will respond.

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.

Erratic A/C Operation Model 163.154/174/175, As of MY 02

If customers complain of erratic A/C operation, running too hot or too cold, the problem may be the sun sensor. First do a basic A/C diagnostic check. DTC B1008 may be set. If no other faults are found, check to be sure the vehicle specifications regarding engine size, body, etc. match the VIN. If everything is normal, check the part number on the sun sensor. If the number is A163 820 73 10, replace the sensor with the new unit, part number A163 820 74 10.

Rack and Pinion Play MODEL 203, 209, 210, 211, 215, 220, 230

When testing for rack and pinion play, radial movement of the steering coupling at the input of the control shaft (Figure 1, Item 1) is not relevant for evaluating play in the steering box. This does not have any influence on the operation of the rack-and-pinion steering system, or the play in the steering system and on the driving dynamics of the vehicle.

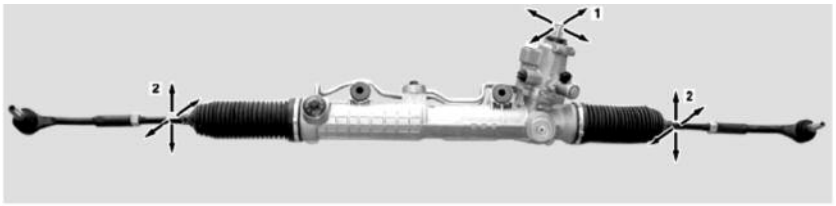

Figure 1, Item 1 and Item 2

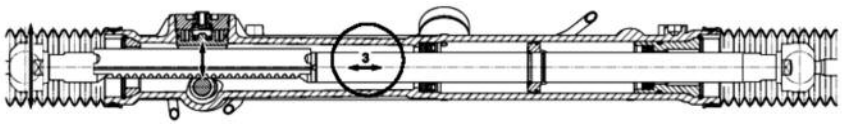

Figure 2, Item 3

The same applies to radial movement at the rack/tie rod (Figure 1, Item 2), especially when the wheels are turned all the way to one side. In this position the rack is extended to one side and acts as a larger lever where supposed play can be felt even more (checking play at the outer and inner joints remains the same). Radial movement when applying pressure when the rack is fully extended to one side or the other is normal and is due to the construction of the steering system.

When quickly turning the steering wheel left/right, especially when the engine is off (no power assist), a loud clunking noise can be heard. This is due to the steering system's construction and is not play in the steering system.

In order to properly check for play, the steering column and the outer and inner joints of the tie rods must not have any play.

The actual check for play in the rack-and-pinion steering system may only be made:

- with vehicle at standstill
- with engine running (power assist of the steering must be ensured)
- with the wheels pointed straight ahead

The steering wheel must be turned slowly while watching the rims move. The rims must start to move before the steering wheel is turned at most approx. +/- 1 degree. During this movement, a steady increase in pressure can be felt in the steering wheel. This delay in reaction is a result of the elasticity of the steering system (steering connections, etc.) and is not a fault. In order to properly evaluate play in the rack-and-pinion steering system, only the axial movement of the rack in relation to the steering box is relevant (Figure 2, Item 3).

(Continued

Glove Box Rattling
Model 203.061/064/065/081 /084/261/264/281 /284/740/747
Model 209.356/365/375/376 /456/465/475/476/477

Customers may complain of a rubbing or rattling noise coming from the glove compartment or the glove compartment lid. Depending on the model, the problem will require either lubing or adjusting the glove compartment lid.

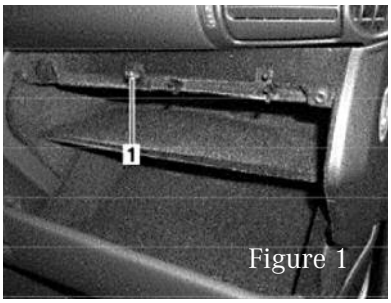

Figure 1

For Model 203 – Up to VIN A113578 or F083917 and 209 – Up to VIN F105129 or T024760, the noise may be caused by the glove box lid rubbing against the striker (Model 203, Figure 1/ Model 209, Figure 2)
To correct the problem, lightly grease the striker with Special Sliding Compound, P/N A000 989 36 60.

For Model 203, Up to VIN A114580 or F098332; and for Model 209 vehicles, the noise

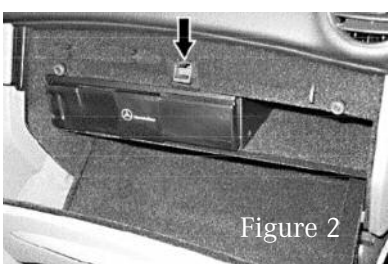
Figure 2

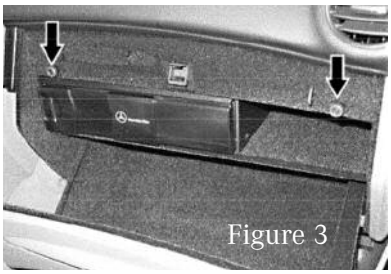
Figure 3

may be caused by insufficient preload for the glove compartment lid. For Model 203 vehicles, increase the preload by moving the striker forward. (#1 in Figure 1). For Model 209 vehicles, increase the preload by adjusting the buffers (Figure 3, arrows). For Model 209 vehicles with a CD changer, also make sure the glove compartment lid is not striking the CD changer.

Cannot Open Fuel Filler Cap
Model 203.040/061/064/065/081 /084/261/264/281/740/747 /764, Up to VIN A687000, F590000 and R155000
Model 209.365/375/376, Up to VIN F128000

If a customer cannot open the fuel filler flap from outside the vehicle, the the locking rod on the actuator motor may be unclipped. A modified bracket for the tank flap lock actuator motor must be installed to correct the problem.

1. Verify the problem by checking that the fuel filler flap will not open from the outside.
2. Remove the bracket for tank flap lock actuator motor as per WIS document AR80.20-P-2300P (203) and AR80.20-P-2300Q (209).
3. Clip the dislodged locking rod into the bracket on the actuator motor.
4. Replace the old bracket (Figure 1) for the tank flap locking actuator with modified bracket P/N A203 820 66 14 (Figure 2).
   Note: Only replace the

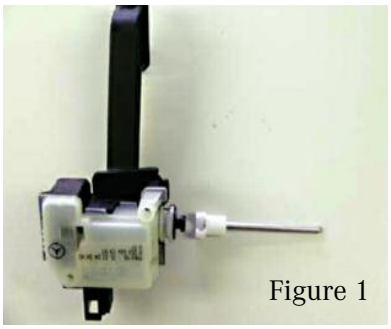
Figure 1

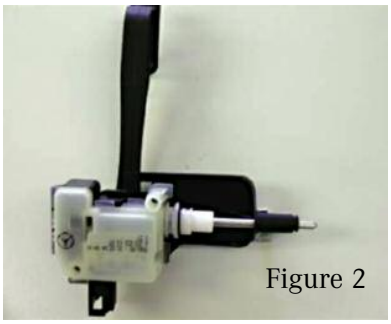
Figure 2

5. Replace existing guide sleeve with new guide sleeve P/N A210 800 00 79.

Note: A new sleeve must be used because the replacement bracket will not fit the existing guide sleeve.

6. Reinstall modified bracket with the actuator as per WIS document AR80.20-P-2300P (203) and AR-80.20-P-2300Q (209).

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Dothan
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
Cook's Import
907-459-7000

Arizona

Chandler
Mercedes-Benz of Chandler
480-403-3400

Phoenix
Phoenix Motor
602-264-4791

Phoenix
Schumacher European
480-991-1155

Tucson
Mercedes-Benz of Tucson
520-886-1311

Arkansas

Fayetteville
Mercedes-Benz of Northwest Arkansas
479-521-7281

Little Rock
Riverside Motors
501-666-9457

California

Anaheim
Mercedes-Benz of Anaheim
714-777-1900

Arcadia
Rusnak/Arcadia
626-447-1117

Bakersfield
Mercedes-Benz of Bakersfield
661-836-3737

Belmont
Autobahn Motors
650-637-2333

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

Buena Park
House of Imports
714-562-1100

Calabasas
Mercedes-Benz of Calabasas
818-591-2377

Carlsbad
Hoehn Motors
760-438-4454

Chico
Courtesy Motors Auto Center
530-893-1300

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

Encino
Mercedes-Benz of Encino
818-788-0234

Escondido
Mercedes-Benz of Escondido
760-745-5000

Fremont
Fletcher Jones Motor Cars
510-623-1111

Fresno
Mercedes-Benz of Fresno
559-438-0300

Glendale
Calstar Motors
818-246-1800

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

La Jolla
Heinz Gietz Autohaus
858-454-7137

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

Manhattan Beach
Carwell
310-303-3500

Modesto
Modesto European
209-522-8100

Montclair
Penske Motorcars
909-568-2600

Monterey
Mercedes-Benz of Monterey
831-375-2456

Newport Beach
Fletcher Jones Motor Cars
949-718-3000

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

Pasadena
Rusnak/Arcadia
626-795-8004

Pleasanton
Mercedes-Benz of Pleasanton
925-463-2525

Riverside
Walter's Auto Sales & Service, Inc.
951-688-3332

Rocklin
Von Housen's Motors
916-630-8877

Sacramento
Mercedes-Benz of Sacramento
916-924-8000

San Diego
Mercedes-Benz of San Diego
858-279-7202

San Francisco
Mercedes-Benz of San Francisco
415-673-2000

San Jose
Beshoff Motorcars
408-239-2300

San Jose
Smythe European
408-983-5200

San Luis Obispo
Kimball Motor
805-543-5752

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

Santa Barbara
Santa Barbara Auto Group
805-682-2000

Santa Clarita
Mercedes-Benz of Valencia
661-753-5555

Santa Monica
W.I. Simonson
310-526-4700

Santa Rosa
Smothers European
707-542-4810

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

Stockton
Berberian European Motors
209-944-5511

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

Torrance
Mercedes-Benz of South Bay
310-534-3333

Van Nuys
Keyes European
818-461-3900

Walnut Creek
Mercedes-Benz of Walnut Creek
925-937-1655

West Covina
Penske Motorcars
626-859-1200

Colorado

Colorado Springs
Mercedes-Benz of Colorado Springs
719-575-7950

Denver
Murray Motor Imports
303-759-3400

Littleton
Mercedes-Benz of Littleton
303-738-7700

Westminster
Mercedes-Benz of Westminster
303-410-7800

Connecticut

Danbury
Mercedes-Benz of Danbury
203-778-6333

Fairfield
Mercedes-Benz of Fairfield
203-368-6725

Greenwich
Mercedes-Benz of Greenwich
203-869-2850

Hartford
New Country Motor Cars
860-278-2000

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
302-995-2211

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

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

Fort Myers
Mercedes-Benz of Fort Myers
239-433-8300

Fort Pierce
Mercedes-Benz of Fort Pierce
772-466-7000

Fort Walton Beach
Quality Imports
850-863-2161

Gainesville
Duval Motorcars
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Jacksonville
Brumos Motor Cars
904-724-1080

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Central Florida Eurocars
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Mercedes-Benz of Orlando
407-645-4222

Melbourne
Mercedes-Benz of Melbourne
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

Pembroke Pines
Mercedes-Benz of Pembroke Pines
954-517-8600

Pensacola
Centennial Imports
850-432-9903

Pompano Beach
Mercedes-Benz of Pompano
954-943-5000

Sarasota
Mercedes-Benz of Sarasota
941-923-3441

St. Petersburg
Crown Eurocars
727-526-3738

Tallahassee
Capital Eurocars
850-574-3777

Tampa
Mercedes-Benz of Tampa
813-870-0010

West Palm Beach
Mercedes-Benz of Palm Beach
561-689-6363

Georgia

Albany
Albany Motorcars
229-883-2040

Athens
Mercedes-Benz of Athens
706-549-6600

Atlanta
Mercedes-Benz of South Atlanta
770-964-1600

Atlanta
RBM of Atlanta
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