StarTuned®

Information for the Independent Mercedes-Benz Service Professional

June 2007 U.S. $6.00 € 12.50

Intake Maintenance

Wiring Diagrams

Cooling Systems

Volume 7 Number 2

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:

StarTuned
One Mercedes Drive
Montvale, New Jersey 07645
Phone: 1 800 225 6262, ext. 2647
e-mail: StarTuned@mbusa.com

IN THIS ISSUE

StarTuned®

Information for the Independent Mercedes-Benz Service Professional

Mercedes-Benz

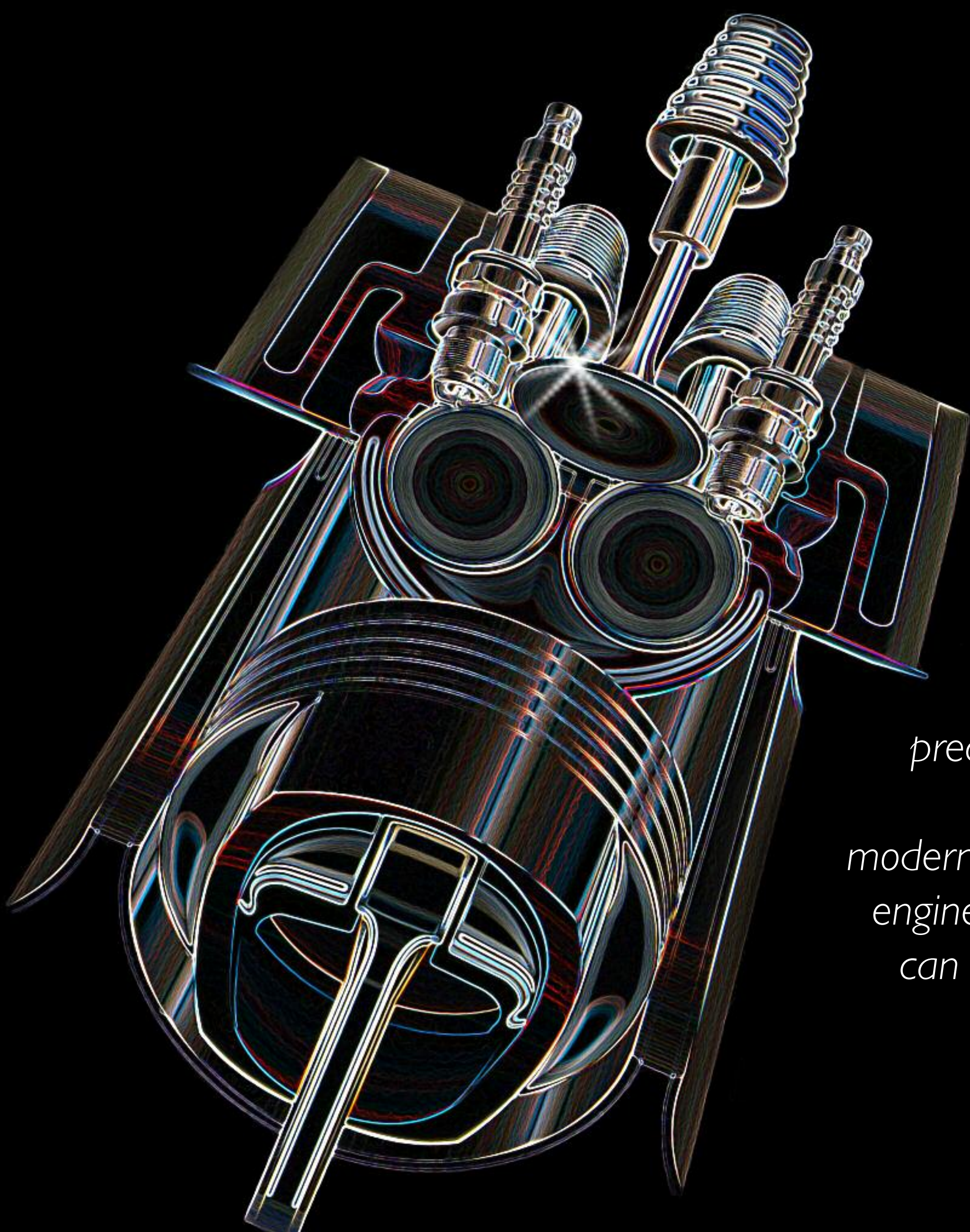
June 2007 U.S. $6.00 € 12.50

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.


Can you purchase a partnership like you can a part?

Keeping the Coast Clear:

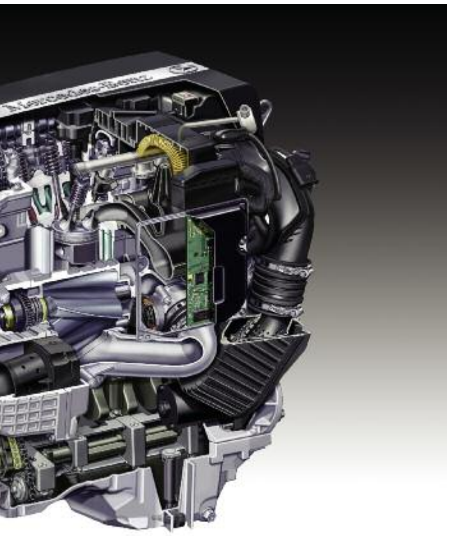
Everything from the air filter housing to the backs of clean if that engine is to perform properly, and live a



The combustion efficiency the precision-engineered intake path of a modern Mercedes-Benz engine makes possible can be thrown off by carbon deposits.

Intake Tract Maintenance

the intake valves must be intact and long life without problems.



Just as the service monitor tells you when to change fluids, it should also remind you that intake tract maintenance is needed.

Carbon is a funny thing. It can coat throttle plates. It can build up on the back of a valve. It can leave the engine in the exhaust, increasing air pollution. Yet it is essential to life as we know it, and to the life of an engine. Since carbon is critical to both combustion and lubrication, we cannot eliminate it. However, too much of it creates problems.

Therefore, it has to be managed. We must maintain an acceptable level so that each component can perform the way it was engineered to perform. How are we going to achieve this? Through proper maintenance of the air intake supply system, we can keep carbon and sludge build-up to minimal levels, which will reduce any adverse effects on engine performance or emissions.

The big picture

The air intake system comprises the air filter housing, intake duct work, throttle body and butterfly, intake manifold and, finally, the intake valves in the cylinder head(s). Accessories attached to the intake system are the PCV (Positive Crankcase Ventilation), EVAP (Evaporative Emissions system), and EGR (Exhaust Gas Recirculation) systems. These contribute to the total air flow into the engine. Because these systems are scavenging or recycling potential pollutants, they are often the first things to look at in order to maintain a clear intake passage.

First, let's look at each component of the air intake system. When air is drawn into an engine (or, more accurately, pushed into the intake by atmospheric pressure), anything that's suspended in the air comes along with it. Everything from airborne dust and dirt, to moisture, to another vehicle's exhaust emissions (cars get pretty close to each another in city traffic) is drawn into the vehicle's intake. Air filters are fitted for this reason. The purpose of an air filter, other than providing a nest for rodents in rural communities, is to filter out airborne dirt and debris. Over time, air filters become clogged, which is why we replace them at regular maintenance intervals.

Some service authorities say that a MAF can be cleaned, while others tell us that replacement is the only cure for the driveability complaints a dirty MAF can cause.

Some Mercedes-Benz owners may even switch their original air filters to a reusable foam type in a quest for more performance. These are saturated with oil to assist in trapping dirt, and holding it in suspension until the air filter is cleaned. One of the benefits claimed for these foam-type air filters is that they increase air flow without sacrificing air filtering ability, which is thought to improve the performance of the engine. Anyone versed in automotive technology, however, knows that not only will these aftermarket filters require an increase in maintenance frequency, they can also cause driveability problems and even set DTCs (Diagnostic Trouble Codes) and turn on the MIL (Malfunction Indicator Lamp). Carbon is usually not a problem at this point in the intake tract, but keeping the air filter clean is important.

Ducting

Next is the air intake duct or tube. On some larger engines, the air filter housing fits right over the throttle body, providing an air-tight seal from one component to the next. On other applications, the air intake duct may be composed of metal, rubber, plastic, or a combination of these materials. The purpose of this tube is to allow flexibility between the chassis-mounted air filter housing and the engine-mounted throttle body. The engine twists and vibrates on its mounts while the air filter housing stays still, so the duct must flex.

In some cases, the air intake duct is used as a connection point for emissions-related components. On a running engine, there is negative pressure in the air intake tube, which can be employed to draw in crankcase blow-by gases and evaporative emissions vapors from the fuel supply system, both of which are then burned in the engine's cylinders. These gases and vapors are hydrocarbons, and may combine with small dust and dirt particles that have made it past the air filter to form deposits. These can build up in the air intake duct. In the duct itself, this will not have a significant impact on performance or emissions. However, any accumulation of deposits on the Mass Airflow Sensor (MAF), which is mounted in the duct, may have dramatic effects on how the engine runs.

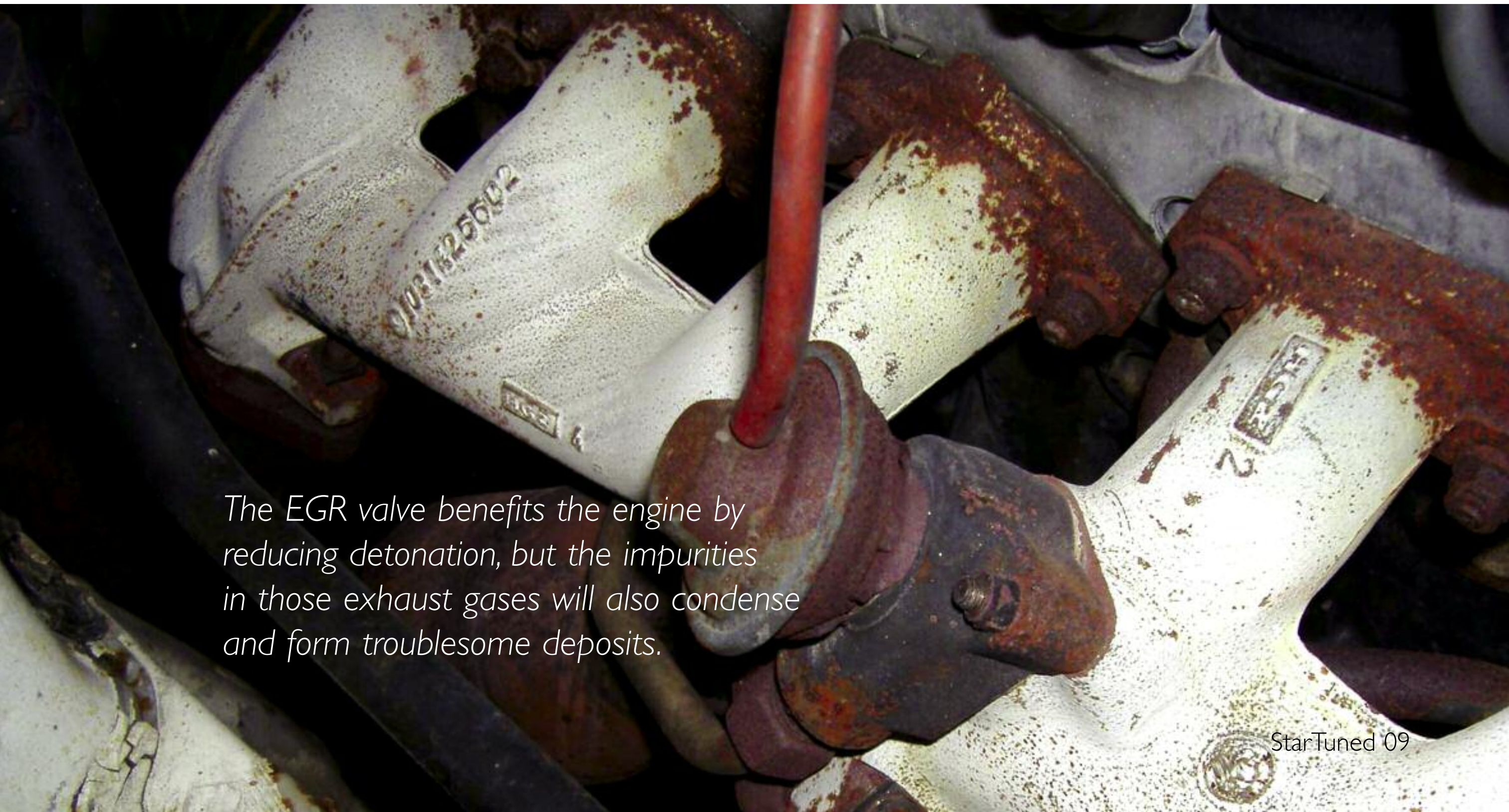
MAF

The job of the MAF is to precisely measure the quantity (by actual mass) of the air entering the engine at any given moment, and send a signal to the ECU. The ECU uses this input to determine ignition timing and fuel injector pulse width. Any contaminants that attach to the MAF sensor element will reduce its accuracy, so must be avoided. This sensor's signals are critical to the ECU's calculations, and can have a large effect on engine performance. MAF sensors are usually mounted very close to the air filter housing, but through resonance effects oil and crankcase gases may come in contact with the sensing element.

The next stop in the air intake stream, which is now carrying hydrocarbons and a small amount of dirt with it, is the inside of the throttle body where the butterfly valve resides. This component is what the driver is actually controlling when he or she presses down on the accelerator pedal. Regardless of whether this is mechanically or electronically controlled, on any gasoline engine rotating the butterfly is how the driver allows more air into the engine, which the ECU senses in order to use its programming to deliver the proper amount of fuel and spark advance.

Idle air control

Either an idle air control valve or the throttle butterfly itself is manipulated by the ECU to provide metered air for idle speed control. Any deposits or debris in these components will have an adverse effect on this function. The air, hydrocarbon mist and dirt mixture mentioned above can build up on the idle speed control motor and the throttle plates. Usually, when the engine has an electronic throttle the idle speed motor is eliminated because the throttle takes over the job of controlling idle speed. With significant oil/dirt build-up in the throttle body throat and on the plates (or, in the passage the idle speed motor controls), idle air flow may be restricted. The module in charge of idle speed



The EGR valve benefits the engine by reducing detonation, but the impurities in those exhaust gases will also condense and form troublesome deposits.

would have to command the passage to open more to compensate for the restriction.

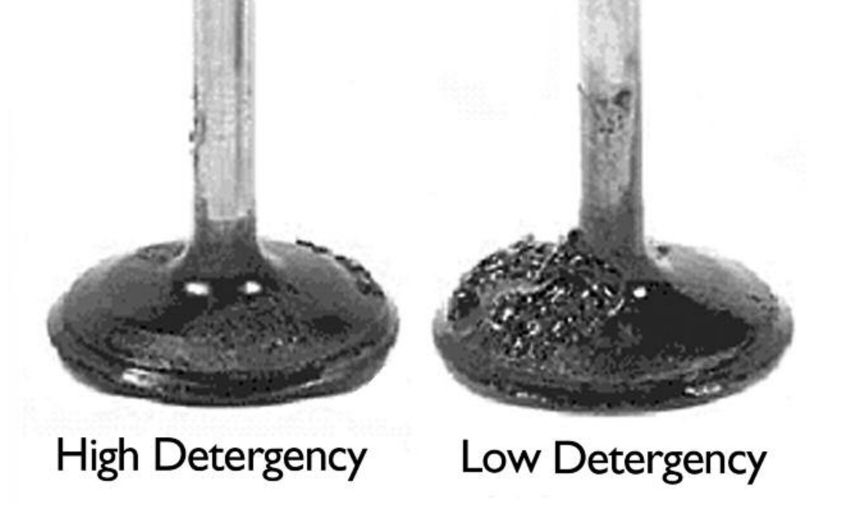
Evaluating scan data is a good way to determine if the ECU is indeed making this compensation. Look at the data PID (parameter identification) that shows adjustments to idle speed control. Any increase in this PID reading would indicate that the computer is making up for restricted idle air flow.

The intake manifold directs air from the throttle body to the intake ports of the cylinder head(s). In older models, this was a fairly simple task. By engineering proper volume and shape, an optimal balance could be achieved between air intake velocity at part throttle and maximum air flow at wide-open throttle. Modern Mercedes-Benz vehicles, however, typically rely on advances in intake manifold design to enhance their already impressive performance. Moveable valves or vanes have been introduced into intake manifold architecture that allow dynamic modifications of the passages to keep air velocity up during mid-range rpm to boost torque, and to effectively shorten the runners at higher rpm to maximize power output. These systems also enhance the swirl and tumble of the air/fuel charge, improving the efficiency of combustion.

You can easily see that deposits in the intake manifold runners will not only interfere with this carefully-engineered flow, but may also keep the valves/vanes from being able to move throughout their full range – or at all.

Exhaust recirculation

In an effort to control peak combustion chamber temperatures, thus reducing the production of NOx and avoiding spark knock or detonation, the EGR system recycles exhaust gases into the intake. These hot, relatively inert gases (which contain some HCs) dilute the air/fuel mixture so that the burn is not as hot as it would be. But, coupled with combustion blow-by through the PCV system and evaporative emissions, these gases will form carbon build-up over time, and the EGR passages themselves may be blocked. The most obvious symptom here is detonation, although a loss of performance may result as the knock sensor circuit retards ignition spark.



These valves make the effect of gasoline additive packages obvious. The valve on the left is from an engine that was run on high-quality "Top Tier" fuel only, the one in the middle received gasoline with the minimum allowable amount of detergent, and the one on the right had straight gasoline with no additives sprayed at it.

Also, carbon deposits may cause the EGR valve to remain open at idle when it should be closed. Depending on how far open the valve is, this will cause rough idling or even stalling.

The manifold runners, the tips of the fuel injectors, and the backs of the valves are the last areas to be bathed by the intake stream before it enters the combustion chamber. The fuel injectors are designed to provide the optimum spray pattern for even and complete combustion. While intake passages are of a fixed dimension, variable valve timing has allowed Mercedes-Benz to adjust the volumetric efficiency of its engines and optimize power and fuel efficiency. Once again, without proper maintenance carbon build-up can adversely affect engine performance and emissions. Short trip, stop-and-go driving, or lower-than-normal engine temperatures (stuck open thermostat, etc.) can all promote these deposits in the intake passages, and, worse, on the backs of the intake valves. Carbon can also accumulate on the valve seat and not allow the valve to fully close, perhaps resulting in roughness and a misfire code, and will act as a sponge until saturated, soaking up gasoline and causing cold driveability problems.

No Additive

Carbon removal

So, excessive carbon build up, particularly in the intake manifold and the cylinder head and combustion chamber, is something to be avoided, or, if already present, removed. There are basically three different methods we can use for this type of service. The most labor-intensive is to physically remove the components and clean them. In the case of “carboned up" EGR passages, or removing sludge from the PCV system, this is fairly easily accomplished. Eliminating excessive intake valve deposits, however, represents a significant amount of disassembly, which the vehicle's owner may not want to pay for.

On the other hand, the air filter housing, intake duct and throttle bore and butterfly are easily serviceable in most cases.

NOTE: With electronic throttles, never spray cleaning solvent on the throttle plates as it may travel down the throttle shaft and into the electronic components of the assembly damaging them. Always spray the cleaning solution on a clean shop rag and wipe out the carbon and sludge build-up. You can verify that this maintenance has been effective by double checking the idle air adaptation PID on your scan tool – look for a reduction in the air adjustment.

There are two other methods that require relatively little labor. You can pour an approved additive into the fuel tank and allow it to be distributed through the fuel injection system. This will react with the carbon deposits, ideally softening them enough that they break up and are pumped out the exhaust. This is effective in de-carbonizing intake valves and the tips of the injectors, but does nothing to help in the intake manifold and throttle body.

This type of deposit removal set-up has become popular. You simply insert the cone at the end of the hose into any convenient centrally-located source of manifold vacuum, then let the solvent compound trickle into the intake stream slowly.

You must be sure that any intake tract cleaning procedure will not damage the air-fuel sensor, O2 sensor, or catalytic converter. Use only Mercedes-Benz approved products.

High-quality brand-name gasolines contain sufficient detergent additives to help keep deposits from forming.

The third method, which has become very popular, is to allow the chemical cleaning solution to be drawn in through the air stream while the engine is running. This allows the chemical to be evenly dispersed throughout the air intake system. It has been demonstrated in the real world that a good deal of carbon can be removed by this procedure, often to the extent that a previously failed emissions test is passed, or a driveability problem is corrected.

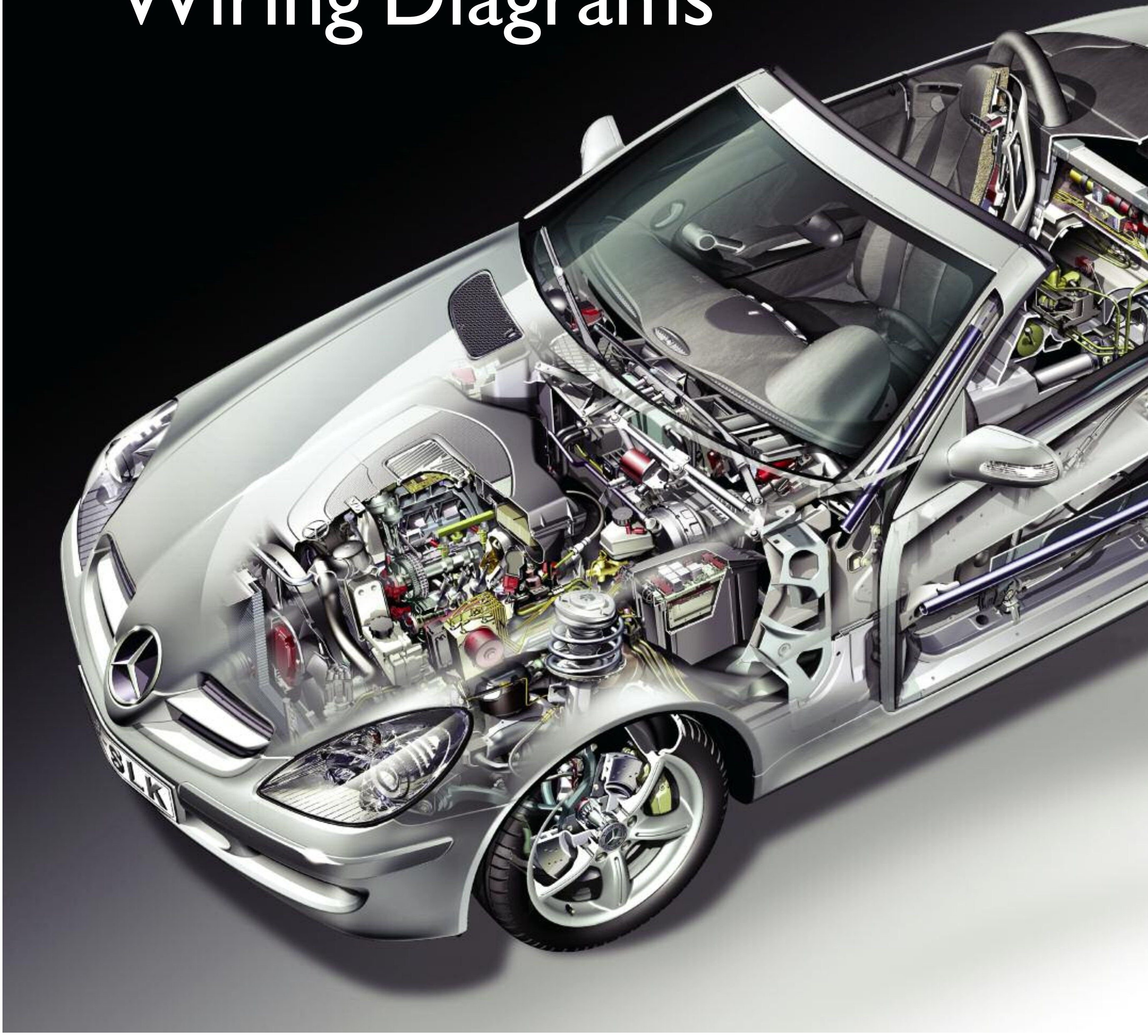
There are some potential drawbacks to these “tune-up in a can” solutions, however. You must be very certain that you are not doing anything that could damage oxygen/air fuel ratio sensors and catalytic converters – you don't want to do more harm than good. As stated in previous issues of StarTuned, Mercedes-Benz does not recommend any aftermarket fuel additives other than what comes in gasoline from the supplier. Mercedes-Benz has its own tank additive, Part # A 000 898 25 45 10. Other additives are continually being tested by the company, so ask your dealer's parts department about it, or watch for any TSBs (Technical Service Bulletins) on the subject.

Finally, advising your customers to buy only quality brand-name gasoline with a strong additive package will go a long way toward avoiding harmful deposits in the first place. Mercedes-Benz owners are a discerning group. Proper maintenance procedures will insure that their vehicles will perform the way the engineers intended them to for years to come. This will give them peace of mind, and you a loyal customer base.

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


www.startekinfo.com
0-60 in a few seconds...
...Mercedes-Benz Technical Information
at Internet Speed...
Where:
www.startekinfo.com
What:
Customer & Service Information including:
Bulletins, Manuals, Repair Instructions,
Approved Workshop Equipment Information,
Special Tool Information, Wiring Diagrams,
Diagnostic Information ...
Why:
A single source for Mercedes-Benz
vehicle technical information
STAR TekInfo
is the official Mercedes-Benz USA, LLC
Customer & Service Information Website
www.mbusa.com
Mercedes-Benz

Information Help:
Interpreting Mercedes-Benz Wiring Diagrams



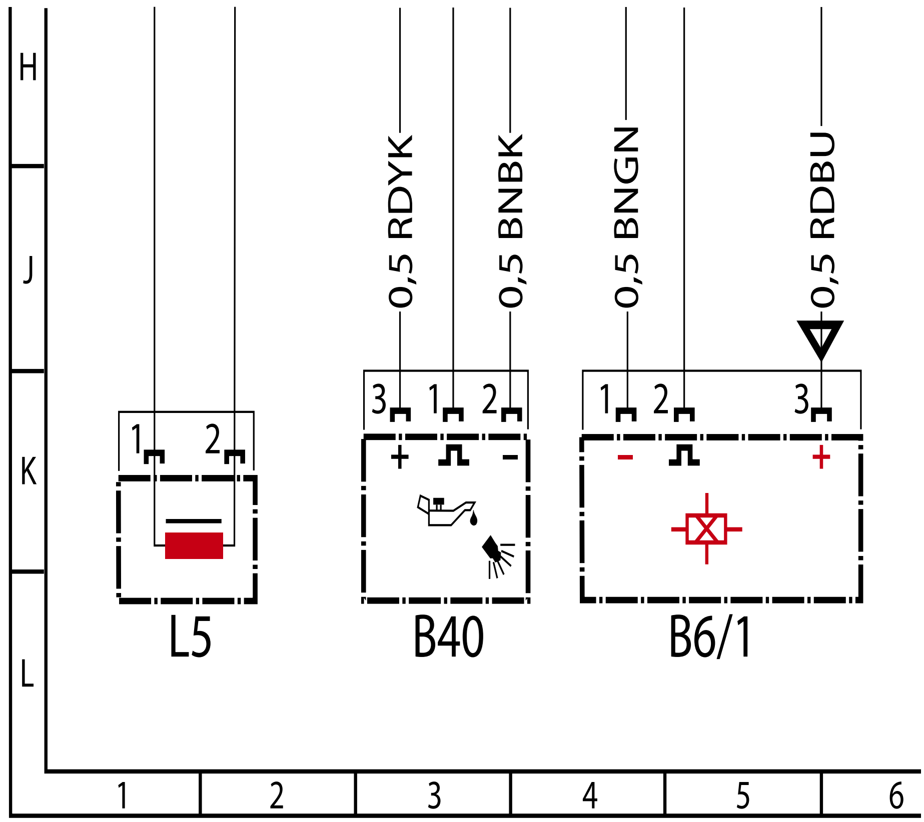
Mercedes-Benz offers the most technologically-advanced vehicles in the world, particularly in the arena of electronics. But technology does not come without a price in the form of complexity. So, you need to know how to read the "electrical road map."

In the old days life was pretty simple. Any time we had an electrical problem to deal with, we could look at a simple wiring diagram. We turned on the ignition to power up the circuits, then we turned on a switch that would either provide a power or ground path to the component we wanted to test. If anything did not work properly, we would check voltage supply, switches and ground paths.

In contrast, what happens today now that we have multiple processors linked together in a CAN network, "resistive multiplexing" and pulse-width modulated outputs? Well, power and ground are still key tests to perform in any electrical diagnosis, but now testing is much more complicated. Systems have become more integrated and therefore trickier to diagnose. Simple on-and-off voltage supplies are still used, but new analog and digital controls have been added to more precisely provide input position and control outputs. With all this computer control added to today's vehicles, we must put down our trusty test light and learn to monitor analog voltage and amperage signals using DMMs, and time-based signals using oscilloscopes. But how will we know what wires to check and where? A wiring diagram is still a critical element to any diagnostic plan.

The price of the extremely high level of technology built into late-model Mercedes-Benz vehicles is increased complexity. Today, you absolutely must know how to read wiring diagrams.

See the three components in this portion of the diagram? Notice that L5 has a coil inside of it and it matches the symbol of an AC pulse-generator/crank sensor. Component B6/1 has three wires going to it, but look inside the component and you will see a + sign, a – sign and a box symbol. These three symbols indicate a power, a ground, and a square-wave signal, respectively. This tells us that the cam sensor (B6/1) is a Hall-Effect type that should be tested using a scope.



Brave New World

Since the early 1990s, Mercedes-Benz has advanced the electronics in its vehicles at an ever-increasing rate. Computer control of engine systems has spread to body controls such as windshield wipers, window motors, power seats, etc. Why all this technology on otherwise fairly simple systems? Adding computer power allows for such advancements as memory power seats, window limit, scan-based diagnostics, and CAN (Controller Area Network) data sharing. When one of these systems needs to be diagnosed for a fault, a scan tool may now be used to access that computer, see if the computer has done any testing and has come up with a fault expressed as a code. On later systems, we can monitor data on the various inputs and outputs. This gives us a tremendous time-saving advantage over checking all the inputs and outputs manually.

At this point, you may want to gamble and just replace the part that the code refers to, but all experienced technicians have found that this does not necessarily repair the problem. At some stage of the diagnostic process, you should actually go to the component in question and check the power, input/output signal and ground. An input/output signal showing no change in the data stream of your scan tool indicates that there is a problem. If this component has no ground path due to a broken wire, corrosion, etc., it cannot change the input/output signal. In this case, you may mistakenly replace a few components before admitting that you must look deeper into the problem.

Locating the component and performing electrical tests is the best way to determine what failed. Finding the component is one step in the process. As an example, suppose the component in question has three wires. Is it a shielded AC pulse generator or a Hall-Effect switch? Knowing which part you are dealing with is required to determine how to test it. You have to set your meter to AC or DC, switch to the proper scale if there is no auto-range function, and, finally, determine if it is a time-based signal, which may require the use of a scope instead.

Once again, evaluating a wiring diagram will allow you to come up with the proper diagnostic plan. By looking at the diagram, you should be able to tell what kind of component you are dealing with – is it an input signal or an output control? The next thing you need to take from the diagram is what wire colors you should be looking for. Finally, you should follow the path of the wiring to other components that may end up being part of the diagnostic process.

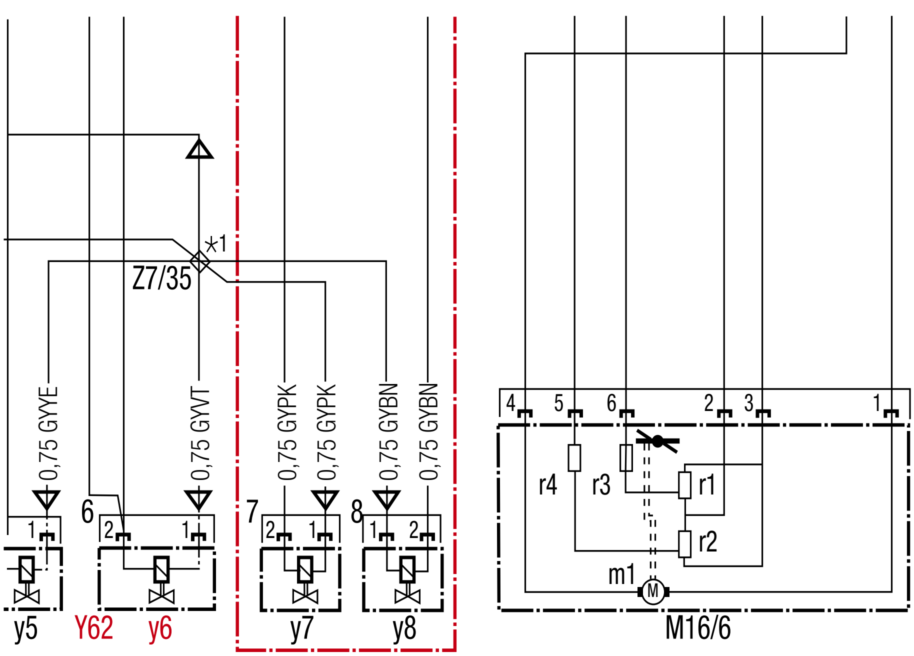
Look at the "Electrical Road Map"

A wiring diagram is like an electrical road map. One will be provided for every electrical system on the car. In the old days, the vehicle's entire electrical system could be put on a single page. Now, we have multiple page fold-outs for each individual system in the vehicle! On a positive note, when you pull up a diagram, you will only view the wires pertaining to the system you are investigating. You will also be informed when a wire goes off the page and what wiring diagram to look for to see where it continues.

Mercedes-Benz has a component identification legend to go along with every wiring diagram. Each component, connector, splice and ground is given an alpha-numeric designation. Grounds will start off with the designation "W", so "W9" represents a ground. You can look in a ground location index to see where "W9" is located. You may see "W9" in more than one diagram indicating that more than one component uses this ground.

In wiring diagrams, two perpendicular lines often represent a ground, not the three lines of decreasing length you may be accustomed to. Splices are represented by the letter "Z," and connectors by the letter "X." In the case of a splice, you will see a wire passing through a diamond with a designation such as "Z3". If you were to look in another section of the diagram and see the same "Z3" designation, you would know that these wires are spliced together. The same goes for an "X" designation. If you see two wires going through the "X7" connector, for example, you would know they are in the same connector. The number in the box refers to the particular pin in the connector that the wire goes to. More on tracing wiring will come later.

All locations can be looked up the same way. Refer to the splice or ground location index and look for a letter/number combination, and you will be given either a written description or a photograph. Components are done much the



Notice the uppercase Y62 and the lowercase y6. If you look for y6 in the component location list you will not find it. If you looked for Y62/y6 instead, it would be identified as the number 6 ignition coil. Also notice the dotted line around y7 and y8. This indicates that these components are only there on V8 models.

(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

 (Continued from page 17)

same way, but since they are so numerous they cannot all use the same letter. The entire alphabet is used to name types of components. For instance, "K" indicates it is some sort of relay, "N" represents control units, and "S" is for switches. Further, "A" is for sub-assemblies such as the instrument cluster, and "B" is for sensors, "F" indicates fuse boxes, "M" stands for motors, and "Y" almost always represents solenoids. Remember, these designations always start with a capital letter, not lower case.

After looking at the capital letter/number symbol you may also see a lower case letter/number symbol. These tell us that there is more than one component incorporated into the main component. For example, on a 2000 Mercedes-Benz 320 sedan with the 112.941 engine, look at the Powertrain wiring diagram. You will see in coordinates 32L and 33L the component "y7" and "y8". Look in the legend and you will not find these components, but look next to "y6" and you see an upper case "Y62." These are the coils of the ignition system. So, looking at the wiring diagram legend you see, from left to right, the alpha-numeric designation, followed by the component name, and finally to the right another alpha-numeric number.

Component* Designation	Component Name	Location**
A1	Instrument cluster	5M
A1p7	Electronic clock/tachometer	6M
F1	Fuse and relay box	
F1-6	Fuse 6, circuit 15	5L
F1-7	Fuse 7, circuit 155	5L
G3/2	O2S 1 (before TWC)	23M
G3/2x1	O2S 1 connectoor (before TWC)	233K
G3/2x2	O2S 1 signal connector	22K
K1/2	Overvoltage protection relay module (87E/87L/30a, 9-pole) (Series K1/1)	2M
K9/1	Auxiliary fan relay module (stage 1)	6M
K10	Auxiliary fan relay module (stage 2)	7M
K27	FP relay module	18M

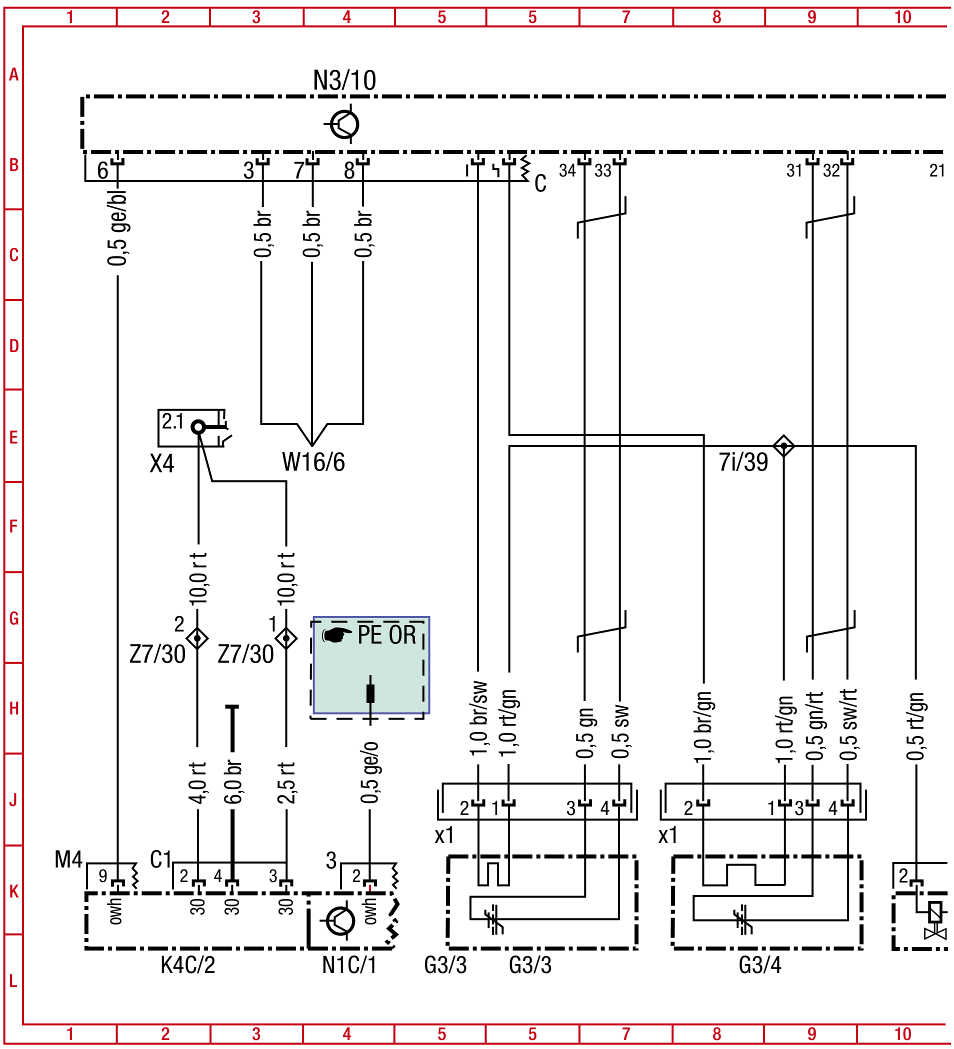
Here is the wiring diagram legend. On the left, you see the component ID designation, followed by a small description, and finally on the right the coordinates indicating where to find it on the diagram.

This letter-number combination is used to indicate where the component is located in the diagram. If you look along the side of a Mercedes-Benz wiring diagram you will see letters starting at the top left hand side working their way down. These letters coupled with numbers along the bottom of the diagram form a grid pattern. By matching the letter and number coordinates of the component on the diagram, as you would "X" and "Y" coordinates on a graph, you should easily find the component you're looking for. Now that you have found are components on the diagram, you can start tracing wires.

Taking the road less traveled

Now that you have identified and located the component, you can start evaluating the wiring. If you look at a Mercedes-Benz wiring diagram, you will notice that control units tend to be at the top. The components for any particular control unit tend to be toward the bottom of the diagram. If you look where a wire enters either a control unit or another component, you will see a long thin rectangle with a letter/number just outside of it. This is the connector name. The rectangle will also have a number inside of it. These are the pin numbers in the connector. Very often, in the component or control unit, adjacent to the wire you will see another number or a brief description of that wire's function. The small description may be something like "PWR," which is obviously power, or "Air Pump," indicating the wire that grounds the air pump relay. You may also see something like "PWM," which stands for Pulse-Width Modulated. This lets us know this is an on/off time-based signal that should be scoped or monitored with a graphing multi-meter. If you see a number, you should know that they follow DIN (Deutsche Industrie Norm) nomenclature. That is, each number represents what is electrically found on the wire. This chart gives some of the more common symbols:

- 30(x) Battery Voltage
- 15(x) Ignition Voltage
- 31 Ground
- 50 Starter Input
- 85 Relay Control Coil Ground Side
- 86 Relay Control Coil Power Side
- 87(x) Relay Output



Control units are at the top and components along the bottom. Along the side, top and bottom of the diagram are the letters and numbers that form the grid for coordinate locations.

So, if you see the number 15 where the wire goes into the control unit, that wire will only have power with the ignition on. While these descriptions are very helpful, you may not see this on all diagrams.

Let's Review

To review what we've covered so far, Mercedes-Benz breaks down its wiring diagrams according to system, therefore everything that system needs to function is in the diagram. Components are indicated by a dotted rectangle. Control units tend to be towards the top of the diagram and their components tend to be toward the bottom. Smaller rectangles come off of the component, and the connector pin and connector name is given. As you follow the wires from the component, you will see letter designations, such as "Z," indicating a splice, "X" indicating a connector, and "W" indicating a ground. Along the wire you will also see the color symbol, such as "BK" for black and "WH" for white, but before that you will see a number like 0.5 or 1.5. This is the cross-section of the wire in square millimeters. The higher the number is the fatter the wire. Here is another chart so you can compare the metric cross-section with the approximate American wire gauge:

- .5 = 20 AWG
- .75 = 18 AWG
- 1.0 = 16 AWG
- 1.5 = 14 AWG
- 2.5 = 12 AWG
- 4.0 = 10 AWG

While tracing the wire in the diagram, you may come across another small rectangle of dotted

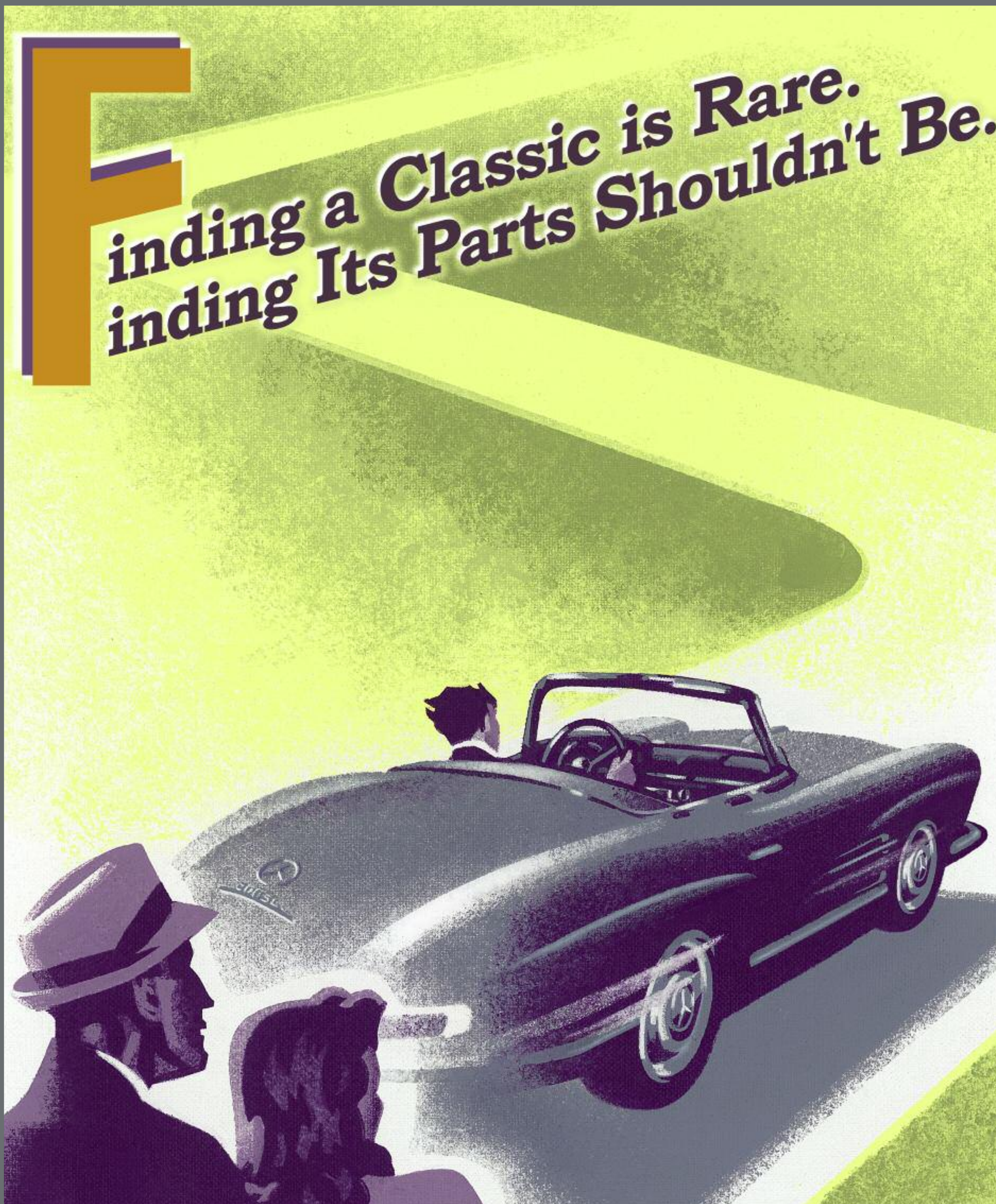
With a subscription to the Star Tek Info website, you can download wiring diagrams and get component locations by entering the Component ID alpha-numeric designation. You get a photo of where the component is located on the car. Keep in mind that these diagrams are big, so a fast computer with a high-speed Internet connection is recommended.

lines with the wire color, size and also another indicator. This is usually a letter "U" followed by a number. This indicates that there are two variations for this wire. For instance, if the car came with a 112 engine, that would be one variation, but if it came with a 113 engine, that would be the other variation. Only one of these wires exists on the car, but both are shown so only one wiring diagram has to be produced. This specific variation description can be found in the alphabetical legend along with wiring diagram location. Where there is a significant change in the wiring from one variation to another, you may see a much larger dotted triangle that runs from the top to the bottom of the diagram. You will find the "U" variation number like "U2" for California vehicles in the upper left hand corner. All that this means is that any wiring found inside the dotted rectangle applies to this variation.

Sometimes you run into variations even before you pick the diagram. You may see the choices PE80.20-2000D, PE80.45-2000A, or even PE80.30-2000C. In this case, it is the central locking system. You would have to know if the car has the Central Locking system (PE80.20-2000D), the Comfort Lock system (PE80.45-2000A), or the Infra-red Remote Locking RCL (PE80.30-2000C). The customer may not be able to help you find this out, but using your scan tool to communicate with the door lock computer should help you identify what system you have. Otherwise, you have to evaluate the diagram and maybe try to match up some components from the diagram to the car.

Preparing the Diagnostic Plan

Since a wiring diagram is a symbolic representation of the vehicle's electrical systems, you should be able to evaluate the diagram and come up with a step-by-step procedure for checking voltage supply, input signal and output ground control. Depending on the problem, you can pull a diagram and lay out the testing process before the vehicle even arrives! Having a plan will help reduce wasted time, inaccurate diagnosis and stress due to comebacks. If we can reduce those problems, everyone will be happy.

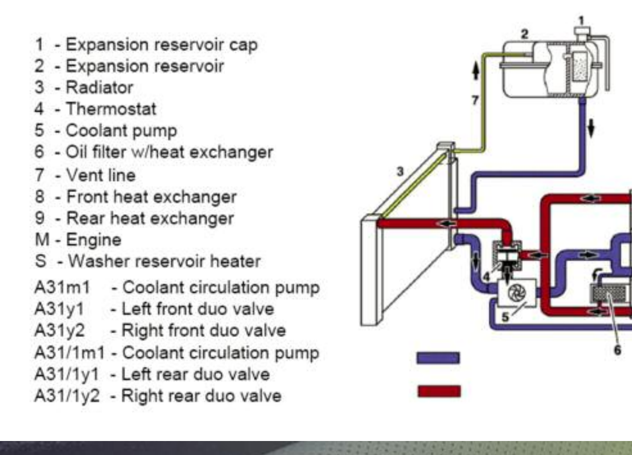


Relive the good ol' days. Mercedes-Benz makes it easier to find classic car parts Call 1-866-MBCLASSIC, and Mercedes works to track down the genuine Mercedes-Benz classic part you need. So you can be sure of one thing: they really do still make 'em like they used to. Visit MBUSA.com/classic. **Genuine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

Mercedes-Benz

Cabin Fe
AuxiliaryCo
Systems

With the advent of dual and multiple zone HVAC, we now have multiple heater cores. So if the water pump is busy pumping coolant through the engine and radiator, what's providing coolant to the heater cores?



ver:
oling

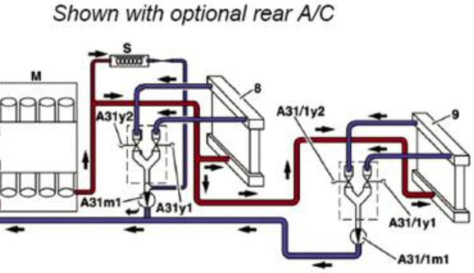
One important part of an HVAC (Heating, Ventilation and Air Conditioning) system is, of course, heating. Passengers naturally like to be able to control the temperature inside the cabin, and during those cold winter days, or even chilly summer nights, keeping warm and driving with a clear windshield has a lot of engineering behind it.

Always keep in mind, though, that a cooling system's main job is to keep the engine from overheating. Heating the inside of the vehicle is just a by-product of this process. But vehicles are subject to a diverse array of driving conditions, perhaps flying down an "Autobahn" at breakneck speeds, or stuck in traffic for hours at a time, so the cooling system must be very flexible. With low engine revolutions and an open thermostat, it may be difficult to supply an adequate volume of hot coolant to the heater core(s). Also, take into account the plumbing that's required and the position of the heater core, which may prove to be a challenge for even the strongest water pump. Consideration must be given to accommodating these extreme conditions.

Consider This!

Since the early 1980s, Mercedes-Benz has used an auxiliary coolant pump to provide an adequate volume of hot liquid to the heater core. With dual- and multiple-zone climate control systems, the volume of the heating system has increased throughout the years. An auxiliary coolant pump was a well thought-out way to manage this additional volume. If you look at a typical Mercedes-Benz heater system (Figure 1), you'll notice that the heated engine block coolant is sent directly into the heater core. In the case of this diagram, this vehicle has rear climate control. Fluid flow is directed through the heater cores, and after it leaves it is passed onto the "Duo-Valve" (A31y1, y2). Its job is to regulate how much coolant is allowed to flow through the heater cores. If the valves are wide open, flow is at maximum. If the valves are commanded closed, no coolant flow will occur. With both dual and rear climate zones, there is a large heater system volume. To deal with this volume, the next stop after the

Figure 1
Coolant Circuit
Shown with optional rear A/C



Duo-Valve is the auxiliary coolant pump (A31m1). This is designed to pull coolant out of the heater core(s) through the Duo-Valve. The more coolant it can pull out of the heater core, the more can enter the heater core. This is important to know when diagnosing "low heat" complaints – more on that later. After leaving the auxiliary coolant pump, coolant is then returned to the engine's water pump for recirculation. And so the process continues.

Who Pulls Who's Chain, and When, and How?

The auxiliary coolant Pump is not required in all situations. It does not alter the temperature of the heater core. It is only activated at or near maximum heat demand conditions. It does not matter what position the air flow mode doors are commanded. So, do not expect to see the pump commanded on all the time. The engine water pump can provide enough coolant flow for smaller heat demands, and during air conditioning operation the Duo-Valves are commanded closed anyway.

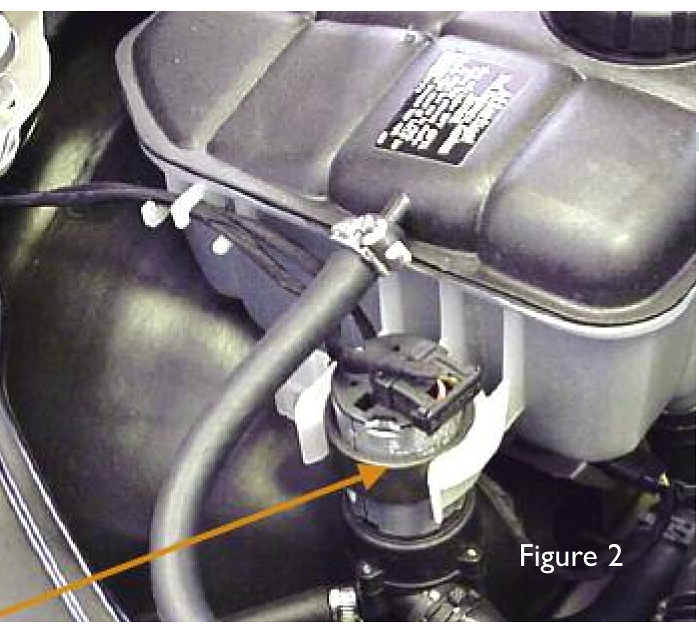


Figure 2

Mercedes-Benz also had a function called "Rest". Pushing this button on the HVAC control panel while the engine is stopped continues to energize the auxiliary coolant pump. Residual heat from the engine coolant cycles through the heater core to maintain cabin temperature even though the engine is off. These are the only times you will see the auxiliary coolant pump operating.

On most vehicles of the 1990s, the pump is controlled by the heater control unit. This provides power to the Switch-over valve block for the mode door control, the Duo-Valve, and the auxiliary coolant pump motor (it supplies the ground to turn the pump on). Pulse-width modulation is not used. The pump is either on or off – there is no variable speed control. After the Front SAM (signal acquisition module) was introduced, it took over control of the auxiliary pump. For example, on a 2001 C280 (203 chassis, Figure 2) you will see a slightly different pump design, but the function is still the same. This pump has two wires. The Front SAM still provides the power supply, but now the pump is directly grounded to the chassis. The command to energize the pump still comes from the climate control unit through the CAN. The HVAC wiring diagram will direct you toward the Front SAM, so remember that you have to look in the SAM wiring diagram to find the auxiliary coolant pump wiring.

The Reason We're All Here

Let's say you get a customer with a low-heat complaint. Now you have to diagnose the problem. This condition can come from a bad water pump, a stuck-open thermostat, a blocked heater core, a stuck Duo-Valve, or a seized auxiliary coolant pump motor. How are you going to decide which part to replace? Without getting in too deep, when diagnosing a stuck-open thermostat it makes sense to let the engine get fully warmed up at idle and monitor coolant temperature, either directly or through the coolant temperature sensor on a scan tool. Then, take the vehicle on a road test and at a steady state cruise see how much the coolant temperature drops. If it drops excessively the thermostat may be stuck open. If the coolant temperature increases, the water pump may be weak.

Check for a blocked heater core by removing the two hoses from the core to the Duo-Valve.

With these lines off and routed into a container, you should see a strong flow of coolant with the engine running. If the Duo-Valve is stuck, very often you will get the complaint of insufficient heat on one side of the cabin. By electrically unplugging the Duo-Valve, it should default to full heat on both sides. Now, how do we check the auxiliary coolant pump motor?

What To Do?

The first step in our test procedure is to determine if the auxiliary coolant pump is being activated. To command the pump on, the temperature should be set to maximum heat and the blower motor set to high speed. If you see a "Rest" button on the climate control panel, you can push that also. Often, you will find a red wire with a tracer and a brown wire with a tracer connected to the pump. The red wire is the voltage supply and the brown wire is the ground command. There should be 12 volts between the power supply and ground with the pump commanded on. If the pump is not commanded on, use a scan tool to communicate with the climate control panel. See if there is a trouble code, or look in data to find out if the PID shows that the pump motor is commanded on. Keep in mind that on '01 and later vehicles the Front SAM is controlling the pump motor, so you may need to access the SAM data to see if the pump request is present through the CAN. If you do have a power supply and ground to the pump, you can now move on to the next step in the diagnostic process.

The Mechanical Side of Things

Now, let's see how the pump is faring. The large hose leaving the pump is the return hose to the engine water pump. By removing it and running another hose into a container, you can determine if sufficient flow is present – just be careful as the coolant may be hot! You may also want to disconnect the hose to the auxiliary pump to make sure there is an adequate coolant supply. This is the large hose coming in from the top of the picture. The small line you see meeting up with the inlet is the return line for the washer bottle heater. Removing the inlet line will also let you know if the heater core or Duo-Valve is blocked. Another item to remember is that you still need to have a good water pump to get proper heat. It does no good to circulate relatively cold water through the heater.

Figure 3

Also, an air-bound system may reduce the auxiliary coolant pump to the status of an auxiliary air pump.

Let's Go a Little Deeper

If there is a heating problem that is temperature or time dependent, or intermittent, then we need to test a little further. After commanding the auxiliary coolant pump on, test the current draw of the pump. A high current reading could indicate the pump is binding up and may soon seize and possibly blow a fuse in the climate control system, or the Front SAM. On the '96 Mercedes-Benz E320 shown, the current draw was .5 amp at cold start-up (Figure 3; on this DMM with its current clamp, 1 mv equals 1 amp). As the engine warmed up, the amp draw increased to as high as 1 amp, but eventually settled down to .8 amp (Figure 4). A low current reading could mean a few things. It could be that the pump is just worn and you would see a relatively low amount of flow once you removed the return hose. However, remember that the auxiliary pump is on the return side from the heater core and the Duo-Valve. If there is a blockage in either of the heater cores or the Duo-Valve, it would lower the coolant supply to the auxiliary pump and therefore reduce its pumping load and its current draw. Figure 5 shows

Figure 4

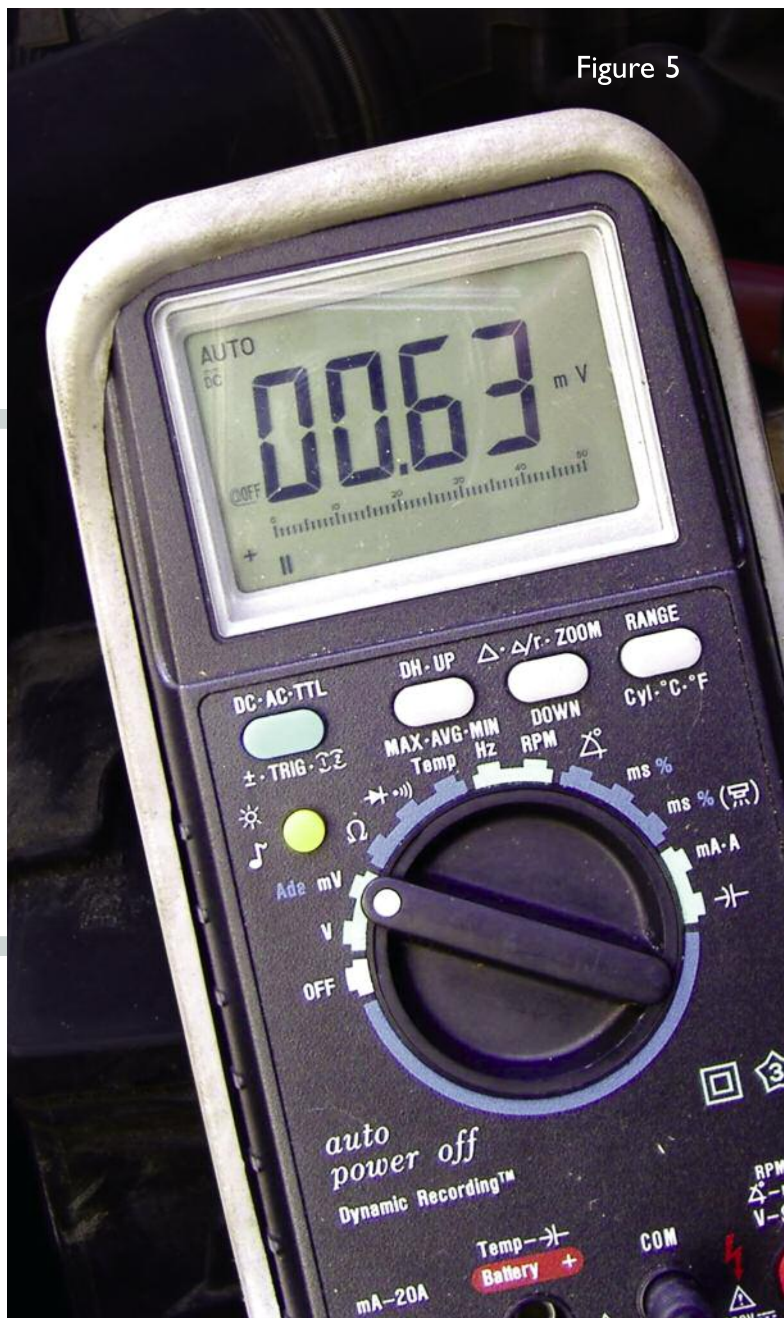


Figure 5

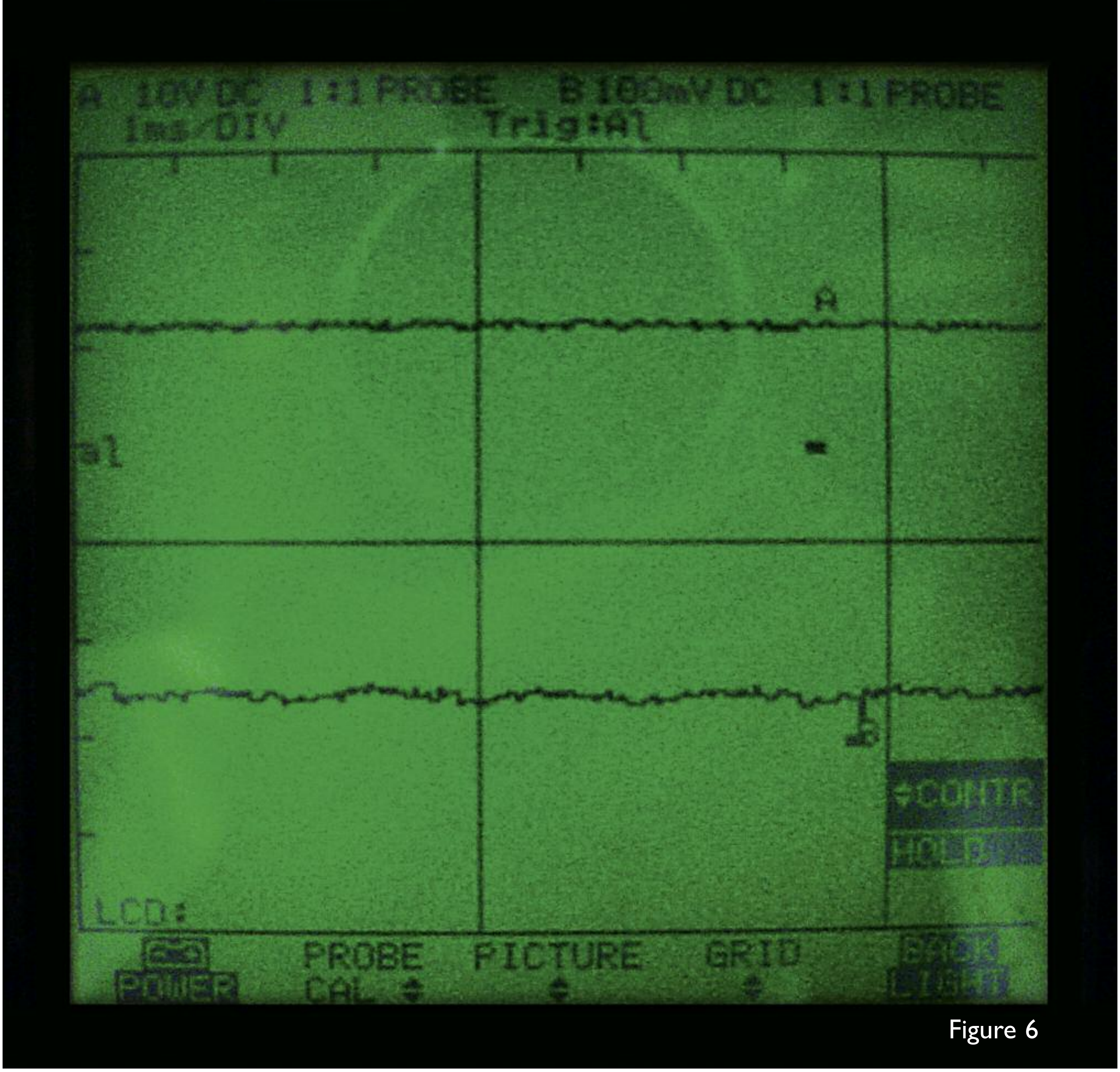


Figure 6

a current draw reading of only .6 amp. This was with both passages of the Duo-Valve stuck closed. So, watch for abnormally low amp draw on a vehicle that has been running for long enough to warm up with the heater on. The amp draw should be closer to .8 to .9 amp.

If you would like to take your diagnosis a step further, look at Figure 6. This is a scope pattern of an auxiliary coolant pump in action. Channel A (upper) is a voltage reading. This is the ground for channel A, and since the scope is set to 10 volt divisions, and the actual waveform is just over one grid block above it, we can determine the voltage is approximately 12V. Channel B (you can see the letter B just below the actual waveform) represents 0 amps. Since the setting is 100mv per amp per division, and the low current probe is set to put out 100mv per amp, you can deduce that the waveform is at about .5 amp, which was the reading when the engine was first started. You also may notice on channel B the slight humps in the current pattern as the brushes pass over the commutator. There are about five visible in this pattern, but for the most part, like the voltage pattern on Channel A, the pattern is fairly steady, meaning that this auxiliary coolant pump is functioning properly.

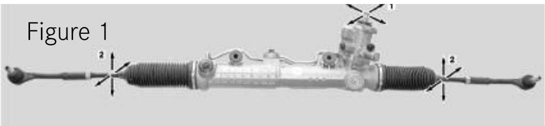
In Closing . . .

Heating systems can be simple to diagnose. Yes, there are the water pumps that are on the verge of not circulating enough coolant and yes, you may have a sticking Duo-Valve to complicate your diagnosis, but after reading this article and following the testing procedures you should be able to find any problem with the auxiliary coolant pump.

Play in the Rack and Pinion Steering System

Models 203, 209, 210, 211, 215, 220, 230

Figure 1



When inspecting the steering system, note that 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, or the driving dynamics of the vehicle. The same applies to radial movement at the rack/tie rod (see Figure 1, 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, which causes supposed play to 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 also due to the steering system's construction and is in no way evidence of play in the system. In order to properly check for play, please note the following requirements:

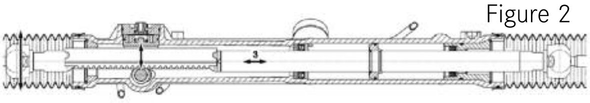
Prerequisite: The steering column and the outer and inner joints of the tie rods must not have any play.

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. The rims must start to move before the steering wheel is turned at most approximately. +/- 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 (which is being measured by the above procedure, see Figure 2.

Figure 2



Repair Kit for Glow Plug Threads in Cylinder Head

Diesel engines

Save that expensive cylinder head! A repair kit is now available for damaged glow plug threads and/or broken off glow plugs. It makes it possible to accurately drill out the glow plug bore and install a threaded insert.

The repair kit can be ordered as a Special Tool (611 589 00 99 00), and costs $650. Also, the wear and tear components of the kit can be individually ordered as needed, along with additional replacement threaded inserts.

GENUINE MERCEDES-BENZ PARTS... NEARBY

Alabama

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
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
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
770-390-0700

Atlanta
Mercedes-Benz of Buckhead
404–846-3500

Augusta
Mercedes-Benz of Augusta
706-860-1111

Columbus
Mercedes-Benz of Columbus
706.256.6100

Duluth
Atlanta Classic Cars
770-279-3600

Macon
Jackson Automotive Group
478-477-4858

Savannah
Critz
912-354-7000

Hawaii

Honolulu
Mercedes-Benz of Honolulu
808-592-5600

Idaho

Boise
Lyle Pearson
208-377-3900

Pocatello
Robert Allen Auto Group
208-232-1062

Illinois

Arlington Heights
Mercedes-Benz of Arlington Heights
847-259-4455

Barrington
Motor Werks of Barrington
847-381-8900

Bourbonnais
Napleton's Autowerks
815-933-8221

Champaign
Sullivan-Parkhill Imports
217-352-4161

Chicago
Mercedes-Benz of Chicago
312-944-0500

Hoffman Estates
Mercedes-Benz of Hoffman Estates
847-885-7000

Lake Bluff
Knauz Continental Autos
847-234-1700

Lincolnwood
Loeber Motors
847-675-1000

Loves Park
Napleton's Autowerks
815- 636-6600

Marion
Foley-Sweitzer Motor Sales
618-997-1313

Naperville
Mercedes-Benz of Naperville
630-305-4560

Normal
Sud's Motor Car
309-454-1101

Northbrook
Autohaus on Edens
847-272-7900

Orland Park
Mercedes-Benz of Orland Park
708-460-0400

Pekin
Sud's of Peoria
309-347-3191

Peru
J.P. Chevrolet GEO Nissan
815-223-7000

Springfield
Isringhausen Imports
217-528-2277

Sycamore
Brian Bemis Imports
815-895-8105

Westmont
Mercedes-Benz of Westmont
630-654-8100

Indiana

Evansville
D-Patrick
812-473-6500

Fort Wayne
Shaver Imports
260-432-7200

Indianapolis
World Wide Motors
317-580-6810 317-924-5321

Lafayette
Mike Raisor Imports
765-448-4582

Mishawaka
Gurley-Leep Motorwerks
574-254-7130

Schererville
Napleton's Auto Werks of Indiana, Inc
219-865-3800

Iowa

Davenport
Lujack's Northpark Auto Plaza
563-388-8610

Des Moines
Mercedes-Benz of Des Moines
515-278-4808

Iowa City
Carousel Motors
319-354-2550

Kansas

Shawnee Mission
Aristocrat Motors
913-677-3300

Wichita
Scholfield Auto Plaza
316-688-5000

Kentucky

Ashland
Giant Auto Group of Ashland
606-329-2288

Bowling Green
Buchanan Imports
270-745-0001

Lexington
James Motor
859-268-1150

Louisville
Tafel Motors
502-896-4411

Louisiana

Alexandria
Walker Automotive
318-445-6421

Baton Rouge
Mercedes-Benz of Baton Rouge
225-490-3101

Lafayette
Moss Motors
337-235-9086

Metairie
Mercedes-Benz of New Orleans
504-456-3727

Shreveport
Holmes European Motors
318-212-1212

Maine

Bangor
Quirk Auto Park of Bangor
207-941-1017

Falmouth
Prime Motor Cars
207-510-2250

Maryland

Annapolis
Mercedes-Benz of Annapolis
410-268-2222

Bethesda
Euro Motorcars
301-986-8800

Cockeysville
Mercedes-Benz of Hunt Valley
410-666-7777

Germantown
Euro Motorcars Germantown, Inc.
240-686-1300

Hagerstown
Mercedes-Benz of Hagerstown
301-733-2301

Owings Mills
R & H Motor Cars
410-363-3900

Salisbury
Mercedes-Benz of Salisbury
410-548-3411

Silver Springs
Herb Gordon Auto Group
301-890-3030

Massachusetts

Boylston
Wagner Motor Sales
508-869-6766

Haverhill
Smith Motor Sales of Haverhill
978-372-2552

Hyannis
Trans-Atlantic Motors
508-775-4526

Lynnfield
Flagship Motorcars
781-596-9700

Natick
Foreign Motors West
508-655-5350

Somerville
Chambers Motorcars of Boston
617-666-4100

West Springfield
Lewbar Imports
413-733-5102

Westwood
Mercedes-Benz of Westwood
781-688-1000

Michigan

Acme
Mercedes-Benz of Traverse City
231-938-3800

Ann Arbor
Mercedes-Benz of Ann Arbor
734-663-3300

Bloomfield Hills
Mercedes-Benz of Bloomfield Hills
248-644-8400

Grand Blanc
Grand Blanc Motorcars
810-695-4400

Grand Rapids
Betten Imports
616-301-2100

Kalamazoo
Orrin B. Hayes
269-345-0167

Novi
Mercedes-Benz of Novi
248-426-9600

Okemos
Lansing Imports
517-853-2600

Rochester
Mercedes-Benz of Rochester
248-652-3800

St.Claire Shores
Mercedes-Benz of St.Claire Shores
734-483-0322

Minnesota

Bloomington
Feldmann Imports
952-837-6300

Maplewood
Maplewood Imports
651-483-2681

Minnetonka
Sears Imported Autos
952-546-5301

Mississippi

Gulfport
Bert Allen Imports
228-864-6622

Jackson
Higginbotham
601-956-4211

Missouri

Columbia
Legend Automotive Group
573-875-5000

Creve Coeur
Plaza Motor
314-301-1715

Ellisville
Tri-Star Imports
636-458-5222

Joplin
Frank Fletcher Imports
417-781-1177

Kansas City
Mercedes-Benz of Kansas City
816-943-7000

Springfield
Elite Automotive Group
417-889-5750

Weldon Spring
Mercedes-Benz of Progress Point
636-300-2277

Montana

Missoula
DeMarois Olds-GMC
406-721-4000

Nebraska

Lincoln
Husker Auto Group
402-479-7600

Omaha
Mercedes-Benz of Omaha
402-384-9999

Nevada

Las Vegas
Fletcher Jones Imports
702-364-2700 702-898-3776

Reno
Mercedes-Benz of Reno
775-326-4000

New Hampshire

Greenland
Dreher-Holloway
603-431-8585

Manchester
Holloway Motor Cars of Manchester
603-669-6788

New Jersey

Bridgewater
Millennium Automotive Group
908-685-0800

Cherry Hill
Mercedes-Benz of Cherry Hill
856-663-3200

Edison
Ray Catena Motor Car
732-549-6600

Englewood
Benzel-Busch Motor Car
201-567-1400

Fairfield
Globe Motor Car
973-227-3600

Freehold
David Michael Motor Car of Freehold
732-462-5300

Lawrenceville
Mercedes-Benz of Princeton
609-771-8040

Little Silver
Contemporary Motor Cars
732-842-5353

Millville
Quality Lincoln Mercury Hyundai
856-327-3000

Morristown
Mercedes-Benz of Morristown
973-267-9200

Newton
Intercar
973-383-8300

Paramus
Prestige Motors
201-265-7800

Union
Ray Catena of Union
908-379.7200

West Atlantic City
Precision Cars of AtlanticCity
609-645-9000

New Mexico

Albuquerque
Mercedes-Benz of Albuquerque
505-821-4000

New York

Amityville
Mercedes-Benz of Massapequa
631-789-1600

Bayside
Helms Brothers
718-631-8181

Binghamton
Empire Motor Car
607-772-0700

Brooklyn
Sovereign Motor Cars
718-258-5100

Fayetteville
Romano Motors
315-637-4500

Goldens Bridge
Estate Motors
914-232-8122

Huntington
Mercedes-Benz of Huntington
631-549-2369

Larchmont
Mercedes-Benz of Larchmont
914-275-4000

Latham
Keeler Motor Car
518-785-4197

Long Island City
Silver Star Motors
718-361-2332

Nanuet
Mercedes-Benz of Nanuet
845-624-1500

New York
Mercedes-Benz Manhattan
212-629-1600

Rochester
Holtz House of Vehicles
716-424-4740

Rockville Centre
Lakeview Auto Sales and Service
516-766-6900

Roslyn
Rallye Motors
516-625-1600

Southampton
Mercedes-Benz of Southampton
631-204-2500

St. James
Mercedes-Benz of Smithtown
631-265-2204

Wappingers Falls
Friendly Motorcars
845-298-0600

White Plains
Mercedes-Benz of White Plains
914-949-4000

Williamsville
Mercedes-Benz of Buffalo
716-633-0088

North Carolina

Ashevillle
Skyland Automotive
828-667-5213

Cary
Mercedes-Benz of Cary
919-380-1800

Charlotte
Beck Imports of the Carolinas
704-535-6400

Fayetteville
Valley Motors
910-487-0000

Greensboro
Mercedes-Benz of Greensboro
336-856-1552

Hickory
Hendrick Motors
828-322-5640

Pineville
Mercedes-Benz of South Charlotte
704-889-4444

Raleigh
Leith
919-876-5432

Wilmington
Bob King Autohaus
910-799-3520

Winston-Salem
Mercedes-Benz of Winston-Salem
336-760-4580

North Dakota

Fargo
Valley Imports
701-277-1777

Ohio

Akron
Ganley Akron
330-733-7511

Bedford
Mercedes-Benz of Bedford
440-439-0100

Canton
Kempthorn Motors
330-452-6511

Centerville
Ross Motor Cars
937-433-0990

Cincinnati
Mercedes-Benz of Cincinnati
513-984-9000

Columbus
Mercedes-Benz of Columbus
614-299-2144

Dublin
Crown Eurocars
614-799-4666

Mansfield
Weidner Motors
419-529-7800

North Olmsted
Mercedes-Benz of North Olmsted
440-716-2700

Sylvania
Vin Devers
419-885-5111

Tiffin
Coppus Motors
419-447-8131

West Chester
Mercedes-Benz of West Chester
513-870-1000

Willoughby
Leikin Motor
440-946-6900

Youngstown
Fred Martin Ford
330-793-2444

Oklahoma

Oklahoma City
Mercedes-Benz of Oklahoma City
405-236-1224

Tulsa
Jackie Cooper Imports
918-249-9393

Oregon

Bend
Mercedes-Benz of Bend
541-749-2500

Eugene
Mercedes-Benz of Eugene
541-687-8888

Medford
Mercedes-Benz of Medford
541-857-8072

Portland
Mercedes-Benz of Portland
503-228-8351

Salem
Valley Motor
503-585-1231

Wilsonville
Mercedes-Benz of Wilsonville
503-454-5000

Pennsylvania

Allentown
Knopf Automotive
610-967-4121

Camp Hill
Sun Motor Cars
717-737-3030

Devon
Mercedes-Benz of Devon
610-687-1500

Doylestown
Keenan Motors
215-348-0800

Erie
Contemporary Motorcar
814-868-8622

Fort Washington
Mercedes-Benz of Fort Washington
215-646-7700

Greensburg
Bud Smail Motorcars
724-838-1200

Lancaster
Mercedes-Benz of Lancaster
717-569-2100

Pittsburgh
Mercedes-Benz of Pittsburgh
412-683-5000

Reading
Tom Masano
610-777-6587

State College
Leitzinger Imports
814-238-2447

Washington
John Sisson Motors
724-206-6000

West Chester
Mercedes-Benz of West Chester
484-313-1100

Wexford
Bobby Rahal Motorcar
724-935-9300

Wilkes-Barre
Motorworld
570-829-3500

Puerto Rico

Carolina
Garage Isla Verde
787-620-1313

Rhode Island

Tiverton
Viti
401-624-6181

Warwick
Inskip Autocenter
401-821-1510

South Carolina

Charleston
Baker Motor of Charleston
843-852-4000

Columbia
Dick Dyer and Associates
803-786-8888

Conway
Fowler Motors
843-347-4271

Florence
Newsome Automotive
843-662-8711

Greenville
Carlton Motorcars
864-213-8000

Hilton Head Island
Modern Classic Motors
843-681-8500

South Dakota

Sioux Falls
Vern Eide Motorcars
605-335-3000

Tennessee

Chattanooga
Long of Chattanooga
423-855-3726

Franklin
Mercedes-Benz of Nashville
615-742-8000

Kingsport
Rick Hill Imports
423-224-2260

Knoxville
Mercedes-Benz of Knoxville
865-777-2222

Memphis
Mercedes-Benz of Memphis
901-345-6211

Texas

Austin
Mercedes-Benz of Austin
512-454-6821

Beaumont
Mike Smith Autoplex German Imports
409-840-2000

Bedford
Park Place Motorcars Mid-Cities
817-359-4700

Boerne
Mercedes-Benz of Boerne
830-981-6000

Corpus Christi
Ed Hicks Imports
361-854-1955

Dallas
Park Place Motorcars
214-526-8701

El Paso
Mercedes-Benz of El Paso
915-778-5341

Fort Worth
Park Place Motorcars of Fort Worth
817-263-3600

Georgetown
Mercedes-Benz of Georgetown
512-868-9711

Harlingen
Cardenas Autoplex
956-425-6000

Houston
Mercedes-Benz of Houston Greenway
713-986-6400

Houston
Mercedes-Benz of Houston North
281–233-6000

Houston
Momentum BMW West
832.772.9100

Houston
Star Motor Cars
713-868-6800

Laredo
Powell Watson Motors
956-722-5182

League City
Alex Rodriguez
281-554-9100

Lubbock
Mercedes-Benz of Lubbock
806-749-2369

Midland
Britt Imports
432-699-7993

Plano
Ewing Autohaus
972-599-0909

San Antonio
Mercedes-Benz of San Antonio
210-366-9600

Sugar Land
Mercedes-Benz of Sugar Land
281-207-1500

Texarkana
Pete Mankins Pontiac-Cadillac
903-793-5661

Tyler
Classic-Tyler Motors
903-581-0600

Waco
Allen Samuels Chevrolet-GEO
254-772-8850

Wichita Falls
Patterson Auto Center
940-766-0293

Utah

Lindon
Mercedes-Benz of Lindon
801-222-4400

Salt Lake City
Ken Garff Imports
801-257-3000

Vermont

Shelburne
The Automaster
802-985-8482

Virginia

Alexandria
Mercedes-Benz of Alexandria
703-341-2100

Arlington
American Service Center
703-525-2100

Charlottesville
Brown European Imports
434-817-3380

Fredericksburg
Noble Cars
540-373-5200

Hampton
Tysinger Motor
757-865-8000

Lynchburg
Kenneth Hammersley Motors
434-385-6226

Midlothian
Mercedes-Benz of Richmond
804-545-9600

Richmond
David R. McGeorge
804-755-9300

Roanoke
Hammersley of Roanoke
540-344-6284

Vienna
Mercedes-Benz of Tysons Corner
703-442-8200

Virginia Beach
Phillips Automotive
757-499-3771

Washington

Bellevue
Mercedes-Benz of Bellevue
425-455-8535

Bellingham
Wilson Toyota
360-676-0600

Fife
Mercedes-Benz of Tacoma
253-922-6820

Lynnwood
Mercedes-Benz of Lynnwood
425-673-0505

Pasco
McCurley Imports
509-547-5555

Seattle
Phil Smart
206-324-5959 206-340-5959

Spokane
Mercedes-Benz of Spokane
509-455-9100

Yakima
Hahn Motor
509-453-9171

West Virginia

Charleston
Smith Company Motor Cars
304-746-0600

Morgantown
University Motors
304-296-4401

Parkersburg
Astorg Motor
304-422-6403

Wisconsin

Appleton
Enterprise Motorcars
920-749-2020

Glendale
Concours Motors
414-290-1400

Madison
Zimbrick European
608-258-4000

Waukesha
Mercedes-Benz of Elmbrook
262-821-5000

Wausau
Rosemurgy International
Auto Mall, Inc.
715-675-7775

West Allis
International Autos
414-543-3000

Advanced Color Management

The COLOR-MAX® system from BASF is the industry-leading tool that revolutionized color matching and can greatly reduce cycle time by delivering a perfect color match—fast. This system features more than 6,700 color formula chips that are sprayed with actual BASF refinish paint. For solid colors, the new COLOR-MAX Mobile is a compact and portable tool that puts the power of COLOR-MAX 2 in the palm of your hand.

For more information, please contact the BASF Call Center at 1-800-825-3000 or visit us online at www.basfrefinish.com.

Helping Make Products Better™

BASF

The Chemical Company

THERE'S NO BETTER PROTECTION FOR YOUR REPUTATION.

There s nothing like trust to keep customers coming back—which is why Mercedes?Benz and AMG rely on Mobil 1. It features anti?wear SuperSyn™ technology that represents the most advanced Mobil 1 engine protection ever. The more heat and friction threaten an engine, the more you can trust Mobil 1. So why give your customers anything less? There s no better way to take care of a Mercedes?Benz or your business. For more information, call 1?800?ASK?MOBIL or visit www.mobiloil.com.

THE MORE YOU KNOW ABOUT MOBIL 1, THE BETTER IT IS FOR YOU, AND YOUR CUSTOMER.

Mobil Command Performance