STARTUNED®

Information for the Independent Mercedes-Benz Service Professional

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In This Issue:

Mercedes-Benz

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 vehicles 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.

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. 7112
e-mail: andrew.webb@mbusa.com

Group Publisher
Christopher M. Ayers, Jr.
cayers@automotivedatamedia.com

Editorial Director
Bob Freudenberger
bfreud@automotivedatamedia.com

Contributing Editor
Chip Keen
ckeen@automotivedatamedia.com

Contributing Editor
Kerry Jonsson
kjonnson@automotivedatamedia.com

Contributing Editor
Tom Nash
tnash@automotivedatamedia.com

MBUSA Technical Content Advisor
Donald Rotolo
Donald.Rotolo@mbusa.com

MBUSA Project Manager
Andrew Webb
Andrew.Webb@mbusa.com

Art Director & Circulation Mgr.
Christopher M. Ayers III
ayersc3@automotivedatamedia.com

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.

To locate a Mercedes-Benz dealer near you, go to **www.mbusa.com**.

Habitable Zone

Luxury is more than just Automatic Climate Control. Nowadays, sensors respond to sunlight, humidity, and even air quality. Let's review how these systems function to keep the passengers in the habitable zone.

When we think of luxury, we think of velvet smooth power delivery, compliant suspension, and all the passenger-compartment creature comforts. Where the last is concerned, nothing exceeds a

Here we have an AAC module. You can access self-diagnostics with your SDS scan tool. This unit directly controls blend flap (mode door) operation, but signals SAM modules to control other outputs such as that to the compressor.

Mercedes-Benz vehicle. Whether it is a manual or automatic climate-control system Mercedes-Benz offers a wide variety of operating modes to best cater to the desires of the passengers. Dual and multiple zones allow separate temperatures and modes to be selected.

While manual systems set a general temperature range, they are still electronically controlled, and most have self-diagnostic capabilities. Automatic systems allow you to set a specific temperature, then they monitor changing conditions and make adjustments to temperature and mode door operation. New sensors have been added to enhance performance. While these systems are more sophisticated than they once were, they can also be more time-consuming when it comes to diagnosing a problem.

While manual systems set a general temperature range, they are still electronically controlled, and most have self-diagnostic capabilities. Automatic systems allow you to set a specific temperature, then they monitor changing conditions and make adjustments to temperature and operation flap (more commonly called “blend door” or “mode door”) operation. New sensors have been added to enhance performance. While these systems are

Air Conditioning

Model Year	Sales Designation	Model Designation	Engine Designation	Description
2002-2009				
	G500	463.249	113.962	A/C Compressor
	G55 AMG	463.246	113.982	A/C Compressor
	G55K AMG	463.271	113.993	A/C Compressor
1986-1995	AC Clutch			
	300D Turbo	124.133	603.960	A/C Clutch
	300E	124.030	103.983	A/C Clutch
	260E / 300E 2.6	124.026	103.940	A/C Clutch
	300CE	124.050	103.983	A/C Clutch
	300CE	124.051	104.980	A/C Clutch
	300D 2.5 Turbo	124.128	602.962	A/C Clutch
	300TD Turbo	124.193	603.960	A/C Clutch
	300TE	124.090	103.983	A/C Clutch
	300TE / E320	124.092	104.992	A/C Clutch
	E300 Diesel	124.131	606.910	A/C Clutch
	300E 2.8	124.028	104.942	A/C Clutch

Mercedes-Benz has an extensive remanufactured parts program that includes A/C compressors and clutches. This may offer a cost savings for your customers along with OEM quality.

more sophisticated than they once were, they can also be more time-consuming when it comes to diagnosing a problem.

At the introduction of the ML320 (163 chassis) in 1998, the HVAC system did not have self-diagnostic capabilities, and through 2001 the service literature never refers to this as AAC. The system has two main parts. There is an A/C/Heater switch in the dash that has three round dials (look in the wiring diagram at component S98) that indicate the selected temperature, mode flap position, and blower motor speed to the second, separate part, the A/C pushbutton control unit. This unit is mounted behind the A/C/Heater switch in the dash panel (in the wiring diagram, component N19). It (N19) directly controls the temperature blend flap, and monitors evaporator and interior temperature sensors. If either of these temperature sensors fail, or indicate too-cold temperatures, the compressor will not be commanded on by the module.

A separate All Activity Module (AAM) is located in the under-hood fuse/relay panel. This controls the relays that supply power to the blower motor, auxiliary coolant fans, coolant circulation pump, and compressor. A conventional resistor board drops the voltage for various fan speeds. The AAM is on the CAN, so you can use your SDS software to see if the compressor or cooling fans are commanded on. You can also quickly see the refrigerant pressure sensor reading to determine if there is a proper charge in the system.

In 2002 CAN, additional temperature sensors and computer-controlled mode doors were added to better control cabin temperature, and the Automatic Air Conditioning (AAC) module was introduced. These new sensors are inputs directly into the AAC control unit. An outside temperature sensor is used to calculate compressor operation. If one were to get damaged or ripped off in an accident, an open circuit would suspend compressor operation. The AAC module signals the front SAM to operate the compressor, but not through clutch control. Instead of the traditional fixed-output compressor and electro-magnetic clutch, a variable-displacement

Up to 2002, E-Class vehicles have self-diagnostics built into the control unit. You can access DTCs and clear them. Refer to www.startekinfo.com for code definitions and testing procedures.

compressor is used. Here, the compressor is always spinning (a rubber coupling in the pulley disengages if the unit should seize), but a swash plate inside can be commanded to minimum stroke resulting in little to no output, and vastly reduced parasitic drag.

An A/C Compressor Control Valve determines the position of the swash plate. The AAC tells the SAM module where it wants to position the compressor swash plate, and therefore its output. This AAC unit controls all electric mode doors through its own CAN system referred to as CAN-KLA, and blower speed is now controlled with a module instead of resistors. A rear air conditioning system was also added, but it only has mode and fan speed control. Self-diagnostics also became available to quickly and accurately address problems. The compressor and cooling fans are now controlled by the SAM.

Now that AAC units are on the CAN, you can use SDS, available for purchase from MBUSA, to interrogate the control unit and quickly look for DTCs, observe live data, and command specific outputs to test if they are working properly. This can reduce your diagnostic time and lead to a more accurate repair. However, on 210 chassis up to 2002, dual zone automatic climate controlled systems can display DTCs right through the AAC control panel.

Codes can be pulled by setting the driver's side temperature to "HI" and the passenger's side to "LO". Within 20 seconds, press the "REST" and "EC" buttons together. The display should go blank and you will notice the "recirculation" LED flashing and the letters "diA" will appear in the display. By pushing the passenger's side "Auto" button you can advance through each code. You must display all codes before you can erase them. Hold both "Auto" buttons down until the letter "d" is displayed on the driver's side of the screen, and "FF" is displayed on the passenger's side. The codes are now cleared.

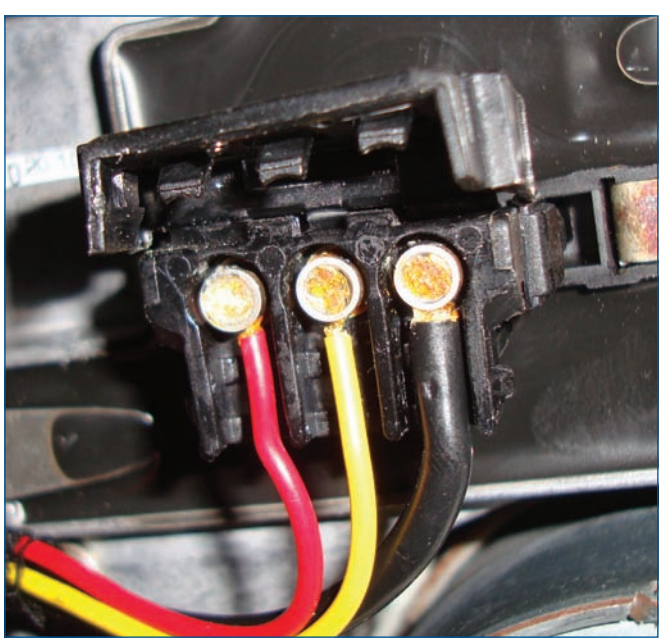
Other chassis, such as the 215 CL Class in 2000, use only the DAS software to communicate with the two-zone Automatic Air Conditioning (AAC) Thermatic, or four-zone Convenience Automatic

Variable displacement compressors do not have clutches. They use a rubber coupling that disengages if the compressor seizes. A compressor control valve changes the output of the compressor depending on the requirements of the AAC or C-AAC control units.

Air Conditioning (C-AAC) Thermotronic systems. Manual systems are two-zone, and do not have an LCD display screen as part of the AAC control panel/unit. The manual two-zone systems have a single dust filter, which should be replaced every two years or 30,000 miles, so make a habit of asking your customers when it was last changed. Four-zone systems use two activated-charcoal filters. If the system detects a failure, and shuts off the compressor, the LED in the "EC" or "A/C Off" pushbutton will blink. Variable displacement compressors are used and are still directly controlled by a SAM. This is usually one of thefront SAMs, but on two-door models such as the 230 chassis it may be the Driver's-side SAM.

Transistorized blower modules allow for multiple fan speeds without additional resistors. These modules can either supply variable positive voltage or ground, so check the wiring diagram first. An analog voltage signal from the AAC control unit is used to command additional voltage or ground to the blower motor. The module also requires its own power and ground supply. On the 210 chassis, the voltage that controls fan speed is almost one volt for low-speed operation, and can go up to 6.5 volts to command high speed. The blower motor itself normally draws about 30 amps at maximum speed. If the amp draw is too high, the module may burn out, so check it.

Aftermarket replacement parts do not necessarily have quality circuitry, so it is not unusual for these parts not to last. Mercedes-Benz offers remanufactured A/C clutches and compressors that meet O.E. standards, so be sure to check with your Mercedes-Benz parts supplier before you're tempted to use something of dubious quality that may end up damaging your reputation.



There are three pins on the blower module. The red and black are power and ground, respectively. The yellow wire carries the blower command. On this 210 chassis, you should see one volt for low speed, and 6.5 volts for high speed.

You should always check the amperage draw of the blower motor when replacing the blower module. Excessive amp draw can damage the new unit. Blower motors typically draw about 30 amps during high-speed operation.

Just Add Water

It's only a matter of time before your state passes legislation mandating the use of water-borne paint in an effort to reduce VOC emissions. What's really involved in managing this change?

In large-volume shops, you may need a more elaborate air filtration system. This one has a large storage tank for the paint booths. Smaller systems are available, but Mercedes-Benz recommends that they have at least three-stages.

Water-borne paint technology is not as new as you may think. During the 1990s the German government required its use in auto body facilities, so its development has been going on for 20 years or so. Typically, paint pigments are suspended in a liquid that can be evenly applied to a surface. As the liquid medium evaporates it leaves the color coat behind. Solvents or VOC (Volatile Organic Compounds) are the most common fluid mediums. Solvents evaporate easier, quicker and at lower temperatures than water. These solvent-based VOCs are not only harmful to your painter, but also to anyone else in your collision repair facility. So, an organization called OTC (Ozone Transport Commission) is working on legislation mandating the use of the water-borne paint application process in several states over the next few years. In addition, water-borne technology has turned out to be a more cost-effective solution when it comes to refinishing.

Due to metal panel oxidation, you still need to use solvent-based coat primers and high-solid clear coats, but using water-borne in the color coat process does help reduce the VOCs in our atmosphere. There are other benefits to water-based paints, too. The application process is slightly different, but there is less over-spray, which makes it easier to control color blending. Also, with a reduction in over-spray it's possible to cut paint costs by up to 30 percent. During the vehicle

production painting process special paints are used where the chemical composition is suited to larger volumes and higher temperatures. In collision-repair paint booths, the conditions are slightly different. That doesn't mean we can't match the color, chip resistance, and gloss. As a matter of fact, Mercedes-Benz has approved four different paint brands produced by three different manufacturers that fulfill all requirements (not all paint brands by these manufacturers are approved). This means your current supplier, or your Mercedes-Benz dealer, should be able to sell you what you need.

The approved brands are:

- Glasurit 90 Series from BASF (for more information on working with 90 Series paints, visit: **www.basfrefinish.com**).
- Permahyd from Dupont's Spies Hecker Division (**www.SpiesHeckerUSA.com**).
- Standohyd from Dupont's Standox Division (**www.standoxna.com**).
- Envirobase from PPG (**www.ppg.com** – look under "Paints & Coatings" for "Automotive Refinish," and you will be directed to the correct website).

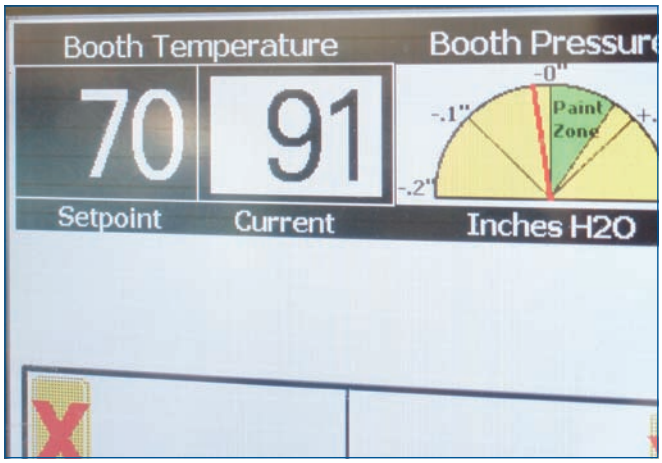
As we said, each of these paints meets or exceeds Mercedes-Benz requirements for color matching, chip resistance, and gloss.

In order to prevent rust contamination as your equipment gets older it's necessary to install aluminum, plastic, or copper piping from you filtration system to your paint booths.

But there's something else you can get from these companies besides excellent paints: Training in how to handle and apply them. As BASF puts it, "At the core of BASF training is an extensive curriculum of classes in product knowledge and use, refinish techniques, troubleshooting, specialty finish repair and color matching. In addition, BASF offers many courses on business management, profitability and productivity enhancement." Pretty much the same can be said for the other two manufacturers. And this training is available both in a traditional classroom, and as e-learning. As PPG says, "Courses are scheduled throughout the year at 16 PPG Business Development Centers across North America. Instructional videos and online courses are also available so you can study on your own time, at your own pace."

The biggest expense when switching to water-based is going to be whatever you decide to do about your paint booth – adapting it, or replacing it. Does your current booth have the ability to flow sufficient air, which results in quick drying times? Another part of the curing process is heat. Heated booths dry paint faster and would work well in high-production shops with this new type of paint. If the investment in a newer high air flow/heated booth is not in your financial future, then you can think about auxiliary systems. You probably already

Air movement is the most important factor in drying water-borne paints. Temperature has less effect. Paint manufacturers have developed paint with improved drying times comparable to solvent-based finishes.



You may have to vary the settings of your paint booth to account for ambient temperature. As you can see here the temperature is set for 70 deg. F., but the actual reading is 90. Use lower temperatures for longer drying times.

have heat lamps, but the more heat the better. You should add auxiliary blowers to help circulate the warm air. Two larger blower units and one handheld unit should be all that you need for most repair jobs. Moving on to the clear coat without proper drying of the color coat could result in "fisheye" or "solvent pop" in the finish. Improvements have been made by the paint manufacturers to improve drying time. That's a big help, but ambient humidity can still have a negative effect.

Another important part of converting to water-borne is your compressor. HVLP (High Volume Low Pressure) means your compressor is going to need to be able to supply more CFM (Cubic Feet per Minute) for your HVLP guns. You may think you already have enough, but if you look at the load created by operating air tools in other parts of the shop you have to ask yourself if your compressor is actually up to the task. And CFM isn't the only issue; dry air is another. You need to remove as much moisture from the air as possible, and that can only be done with a multiple-stage filtration system. Also, you should not be using cast iron piping for your air lines because rust will interfere with the painting process. Copper, aluminum, or plastic are the lines of choice when supplying air to your paint booth.

Now, how are we actually going to apply the paint? First, HVLP guns are needed for water-

Your HVLP gun should be set to between 25 and 35 psi while applying the color coat. The regulator on the gun will allow you to precisely control this pressure. Try to stay away from metal reservoirs as they will corrode over time.

based paints. Even though a high volume of paint is sprayed, less over-spray is created. You may have to change your technique from what you normally do to apply solvent-based paint, but most refinishers have found that once they get the hang of it, it is actually easier to control paint thickness and blending. Very often, if done properly, you only have to apply one and a half to two coats before the flash-off period to finish the job. With water-based paints, stay away from metal cups. Switch to a plastic reservoir for the same reason you shouldn't use cast iron pipe for air. You must keep metal corrosion out of the equation. You need to have two sets of tools to work on steel and aluminum, and, for the same reason you need to have two different guns for applying solvent- and water-based paints. Cross-contamination is verboten and should be avoided at all costs.

Once properly tooled up, you will find that refinishing vehicles with water-borne paints can be a healthy, cost-effective solution that most of us never thought of. Paint manufacturers have addressed the issues with these paints so the transition should be fairly smooth. In this day and age, who couldn't use that!

Special thanks to the staff of Mercedes-Benz of Manhattan for their help with the photography for this article.

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For the kind of color matches that also match your customers' expectations, call your local BASF distributor at **1-800-825-3000** or visit **www.basfrefinish.com**.

Monitoring the Situation

OBD II has been with us for 15 years. Improvements have recently been made, but since we commonly work on older vehicles we may still have problems getting monitors to run. What have we learned?

We've all been working with OBD II for almost a decade and a half. In automotive terms, or in the terms of any modern technology, that's a long time. We've learned how to get results with this system over the years. We know what works, and what does not. These "tips" or "tricks" that we've developed come from our experience diagnosing Mercedes-Benz vehicles. These procedures range from simple to highly questionable. Any Mercedes-Benz is a sophisticated machine with engine management systems communicating with transmission control, electronic shifter, four-wheel drive, etc., on the Drive CAN. This also shares information with the body and chassis CAN systems. Much of this information is used by engine management to determine when non-continuous monitors should run and pass.

Non-Continuous

Non-Continuous monitors do not run all the time, but only when specific conditions are met during a drive cycle. As the vehicle is being driven, engine management exercises these systems outside of their normal operation. The tests are repeated in the next drive cycle when the conditions are again right. If the test fails again, a DTC is set and the MIL (Malfunction Indicator Lamp) is illuminated. If by chance the problem is temporary, then the monitors are run even with the MIL on. In most cases, when drive-cycle conditions are met, the system needs to pass these tests three times to command the MIL off, but the code is still present. SDS is much more capable of detecting faults in the system than the Generic OBD II protocol is, and it is available for purchase from MBUSA. Now, what is meant by the phrase "when the conditions are right?"

Above: One problem you may encounter trying to run monitors is low engine temperature. This can be the result of a thermostat not maintaining engine temperature at speed. Watch the engine temperature in the data stream while driving.

The Time is Right

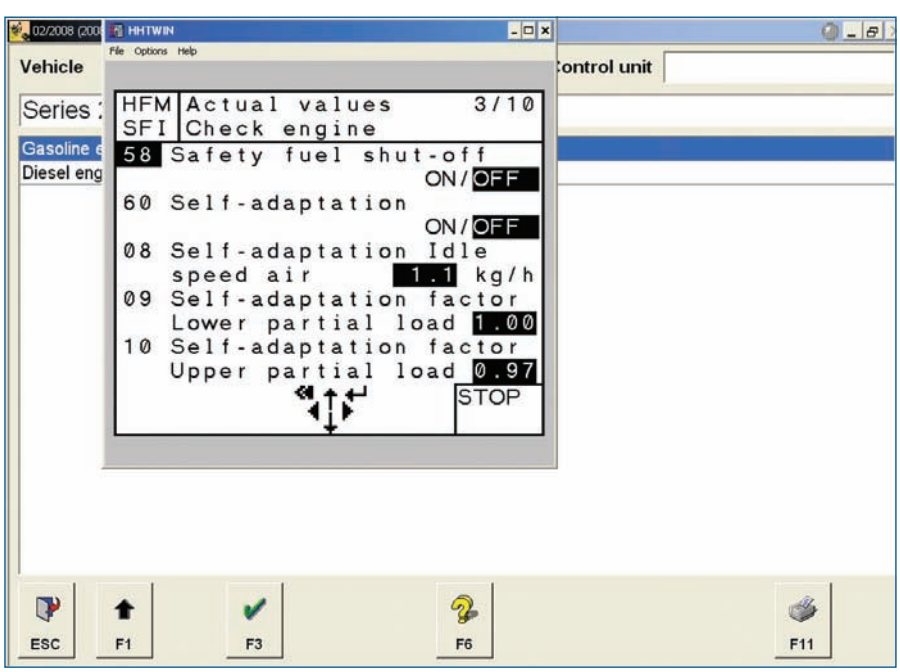
While testing a system's effectiveness, you will need a baseline. If you're going to monitor the switching rate of an oxygen sensor, then you cannot have the engine rapidly accelerating and decelerating. Throttle application should be smooth and steady or the O2 sensor's signal voltages will fluctuate and make testing impossible. You should also be driving on a flat road because going up and

down hills will change engine load (as measured by the MAF) to a point where the monitor will shut off. A drive cycle is meant to mimic the way normal drivers would operate their vehicles.

If a MAF sensor were to become contaminated, fuel trim readings could be commanded one way or the other. Look for additive and multiplicative fuel trim readings coming close to setting a code. This can interfere with running monitors. Another problem can be engine temperature. If this drops below 175 deg. F., the monitor will be shut off. This can be caused by a thermostat not functioning properly. Watch the coolant temperature sensor signal on your scan tool while driving down the road and verify that engine temperature is hot enough.

One key thing to remember is keeping the vehicle speed below 60 mph. Anything over that will shut off most monitors, especially that for the O2 sensor. It's always a good idea to have a driving plan laid out so you can achieve the drive cycle safely.

Another conditions that needs to be met is vehicle speed. It must be kept below 60 mph, or the O2 monitor will shut off. This can prove difficult since Interstate speed limits can be as high as 70, and you might have faster traffic tailgating you. In rural and residential areas, the posted limit may be between 25 and 35mph, which is too slow to monitor 02 sensor function. In other words, the "conditions" have to be correct for the monitor to run. Most Mercedes-Benz vehicles get their speed input reading from the ABS/ASR/ESP chassis CAN. If you have DTCs in these systems, you will need to correct them first. Another sensor reading that can inhibit monitors is that of the air temperature sensor. Verify that it is functioning correctly. This reading often comes from an ambient temperature sensor used by either the AAC, or the instrument cluster.

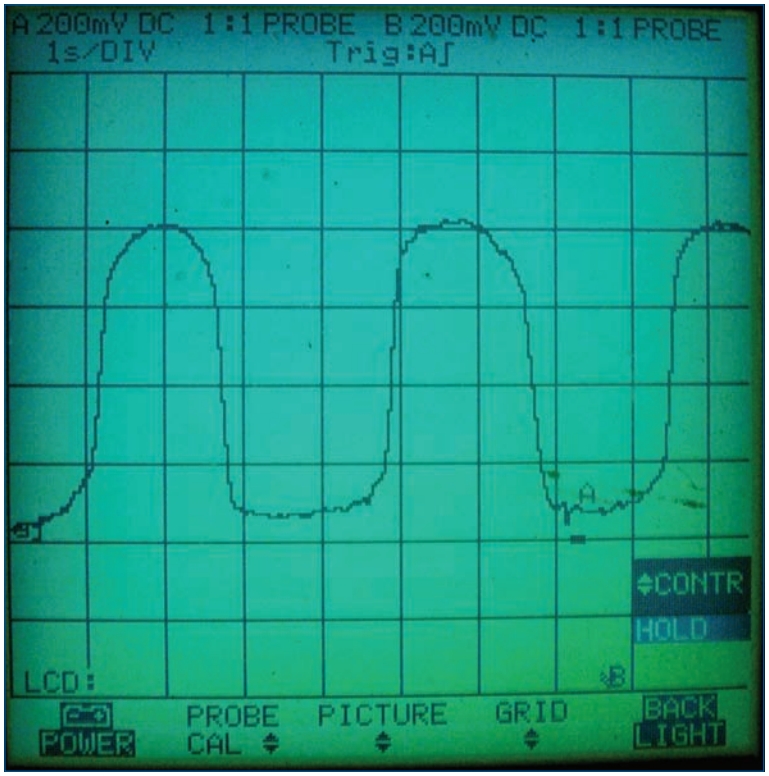


If your fuel trims are approaching their limits, it may be more difficult to run the O2 sensor and catalytic converter monitors. A small vacuum leak or MAF contamination can slow the running of a monitor without being severe enough to set a code.

By The Book

Mercedes-Benz drive-cycle test procedures can be used to help accelerate the process. For example, to help run the O2 heater diagnostics, warm up the engine past 80 deg. Celsius. Shut it off, restart it, and rev to between 2,000 and 2,500 rpm for two minutes. Come back down to idle speed and let it idle for six minutes with all accessories off. To continue with the O2 sensor signal, test drive for three minutes at 43 mph. To move on to the catalyst, drive the vehicle for another three minutes between 48-54 mph. When you are done, do not shut off the engine. The next step is

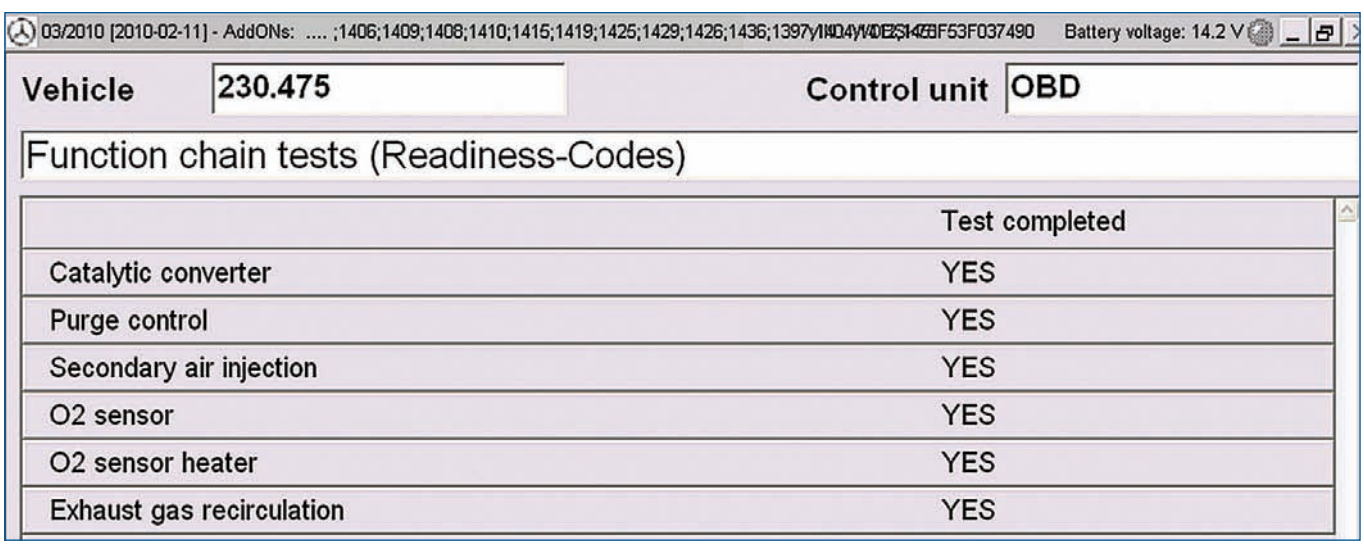
the air/fuel mixture self-adjustment. Simply let the vehicle idle for another three minutes with no accessories on and get ready for the next test, that of the EGR monitor. Drive the vehicle moderately up to 2,000 rpm and release the throttle till engine speed drops to 1,100rpm.



You may have to scope an O2 sensor to look at the activity of the signal. Evaluating its rise time and switch rate will let you determine whether or not the oxygen sensor is responding quickly and accurately.

You should now shut the engine off and repeat the EGR test. At this point, get engine temperature down to below 40 deg C. You can either wait for the engine to cool down, use cooling fans, or connect a sensor simulator to the coolant temperature sensor pigtail. You need to start the air injection diagnostics below 40 deg. C. Start the engine, bring it up to 1,400 rpm, and hold it there until engine temperature is at least 70 deg. C. You can drive the vehicle to achieve this temperature range. Bring it back down to idle for six seconds, then shut it off. You're going to have to repeat this procedure, including the cool-down period.

To run the final EVAP monitor, make sure the fuel tank is between ¼ and ¾ full. Try to keep engine temperature below 100 deg. C., and air temperature below 45 deg. C. Allow the engine to idle for 20 minutes, then drive the vehicle for 20 minutes. Shut off the engine and repeat the process. Each monitor needs to run the test twice for a passing grade. Using your SDS software, you can go into "Actual Values," select "Completed Tests," and review the monitors that have run and passed, and hopefully move on to your next job.



	Test completed
Catalytic converter	YES
Purge control	YES
Secondary air injection	YES
O2 sensor	YES
O2 sensor heater	YES
Exhaust gas recirculation	YES

O2 sensors are checked by watching their signal voltage. The catalytic converter monitor compares the rear sensor signal voltage to that of the front sensor. The EVAP monitor looks at the fuel tank pressure sensor signal, and the EGR monitor looks at MAP sensor voltage with the valve closed, then with it open. You can observe all of these with your SDS software under Completed Tests.

FIRE...

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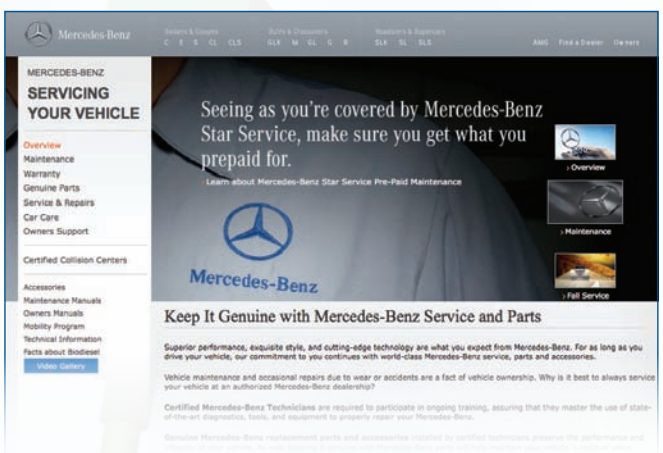

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- ***What's New*** : Accessories tab added for direct access to the items that enhance your Mercedes-Benz vehicle.

- Page with helpful ***parts*** information.

- ***Links*** to other informative sites like the ***Classic Center*** and ***Collision Program***.

- ***Direct link*** to the Electronic Parts Catalog (EPC) to look up parts.

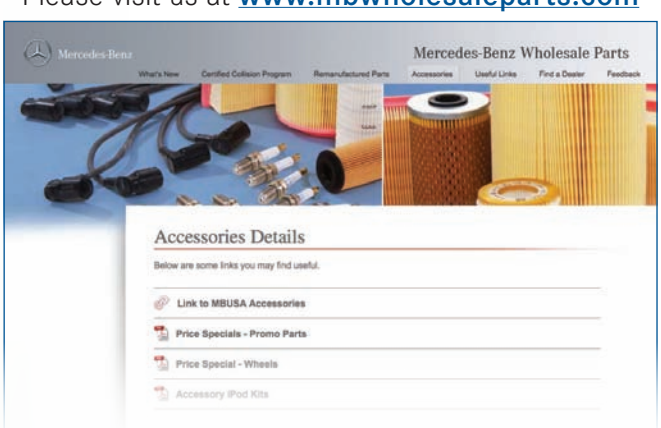
- ***Downloadable*** Remanufactured Parts Catalog and Reman Parts policies.

- User friendly links to tools such as ***STAR Tekinfo*** and ***WIS***.

- ***WebParts online ordering*** information and how-to video tutorial.

- ***Search*** feature to find archived StarTuned Magazine articles & information.

Please visit us at www.mbwholesaleparts.com



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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.

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

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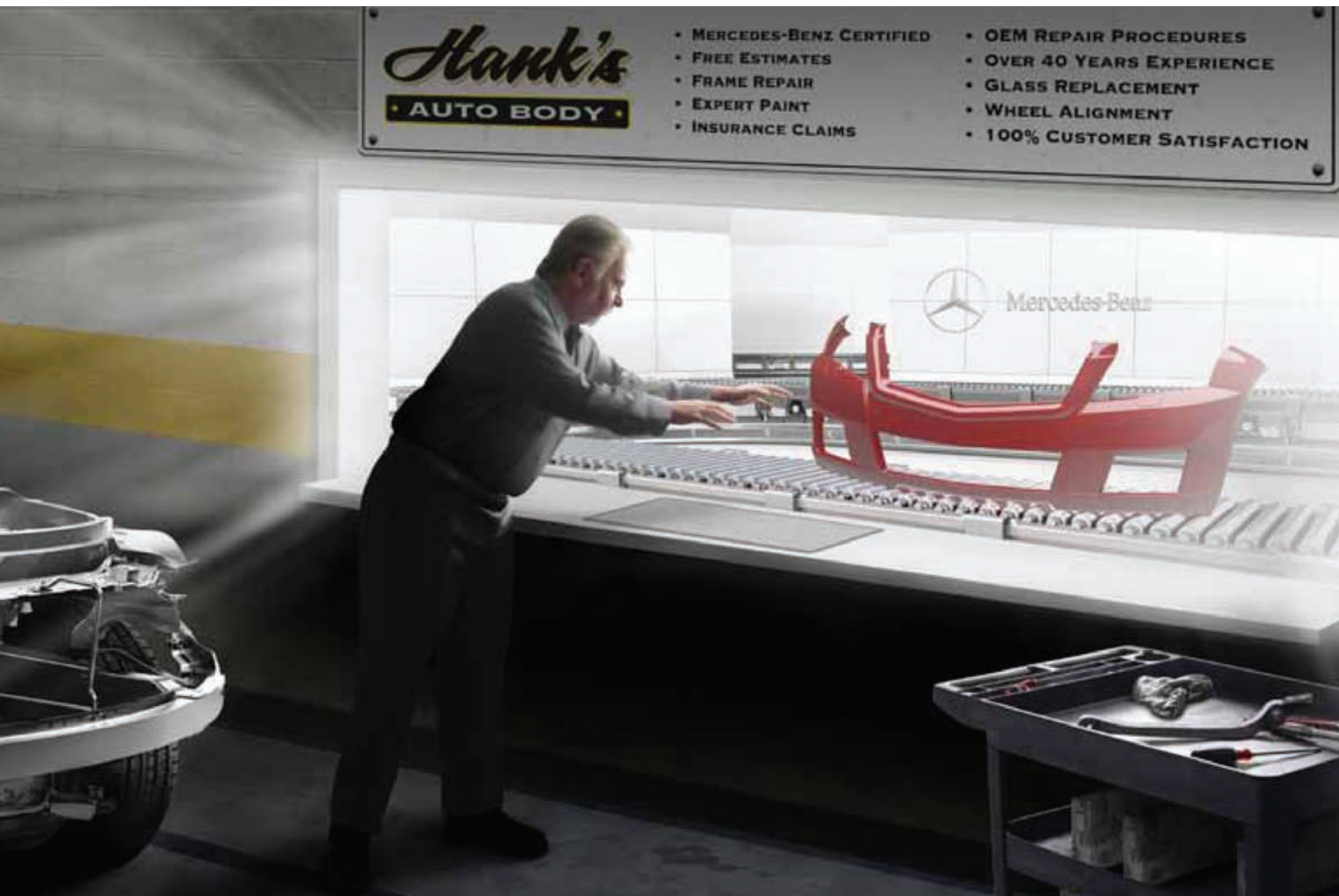

Reach for the parts... the car was built with.

Repairing collision damage with sub-standard, non-OEM or recycled parts of unknown origin and integrity can cause you to lose time, money and even customers. Using Genuine Mercedes-Benz Wholesale Collision Parts offers you precision-engineered, perfect-fit parts that stand up to our strictest vehicle safety standards. If that replacement part doesn't look and fit just right, you'll never see that customer again. Don't let that happen - Genuine Mercedes-Benz Wholesale Collision Parts are readily available, competitively priced, and uncompromising in quality. For more information, contact your local Mercedes-Benz Wholesale Parts Dealer or visit us at **www.mbwholesaleparts.com.**

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