StarTuned®

Information for the Independent Mercedes-Benz Service Professional

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Understanding Brakes

SDS Evolves: XENTRY

Let's Get Into Gear

Aluminum: From Bauxite to Beautiful

Mercedes-Benz

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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.

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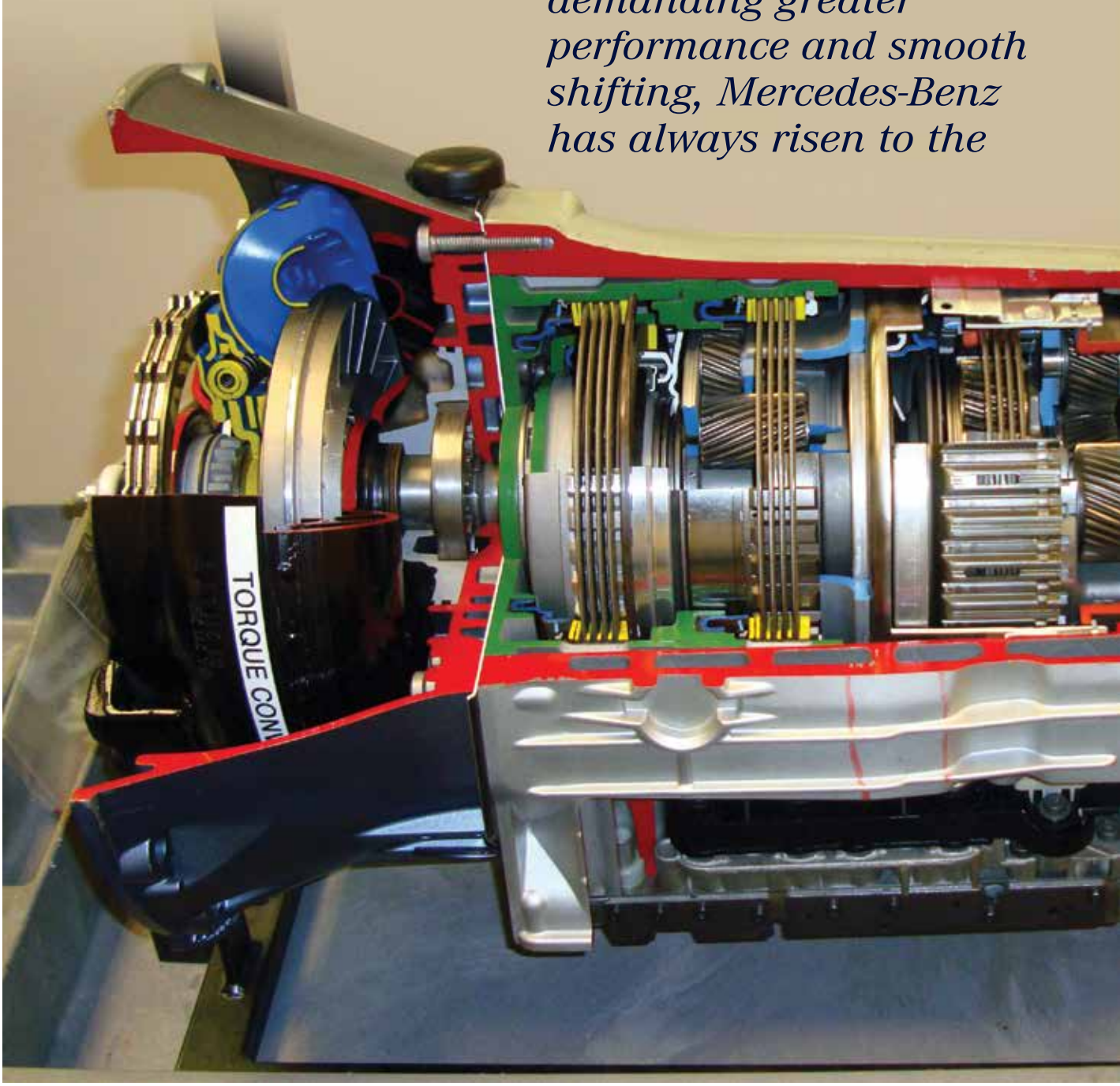
To locate a Mercedes-Benz dealer near you, go to www.mbusa.com.

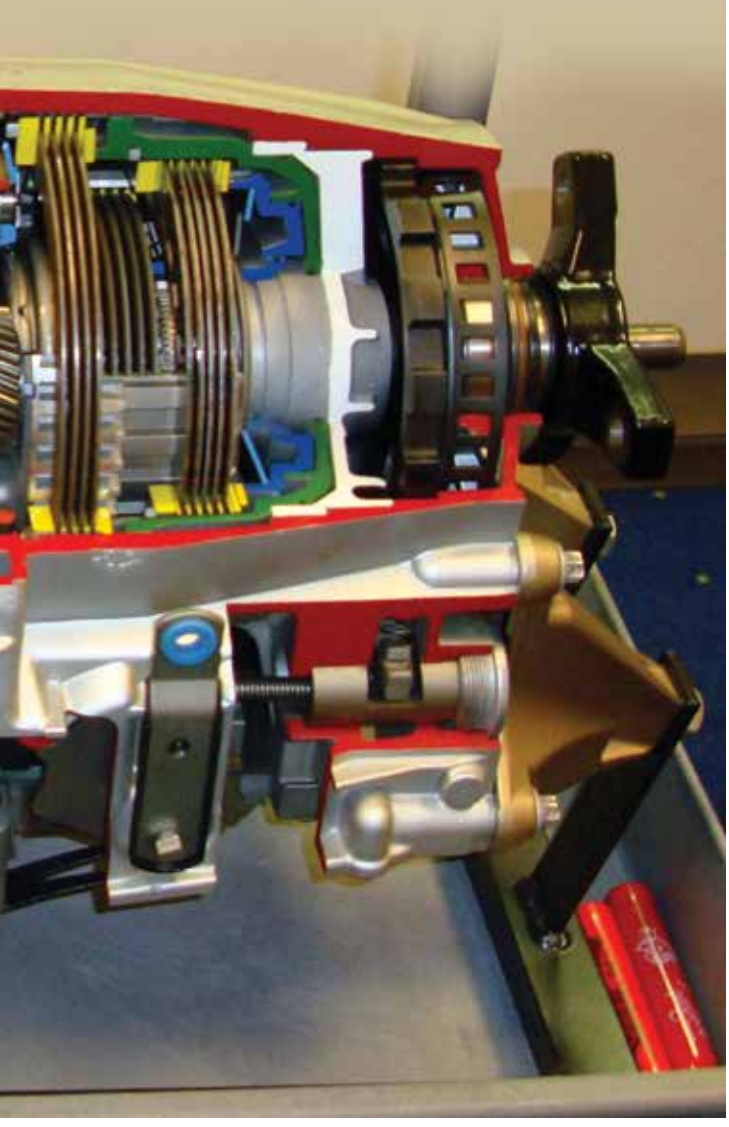
In This Issue

Let's Get Into Gear

Whether it's the government mandating higher fuel economy standards, or customers demanding greater performance and smooth shifting, Mercedes-Benz has always risen to the



challenge. For almost a decade, 7G-Tronic transmissions have been an important part of that response, so they are starting to require service. Here's what you need to know.

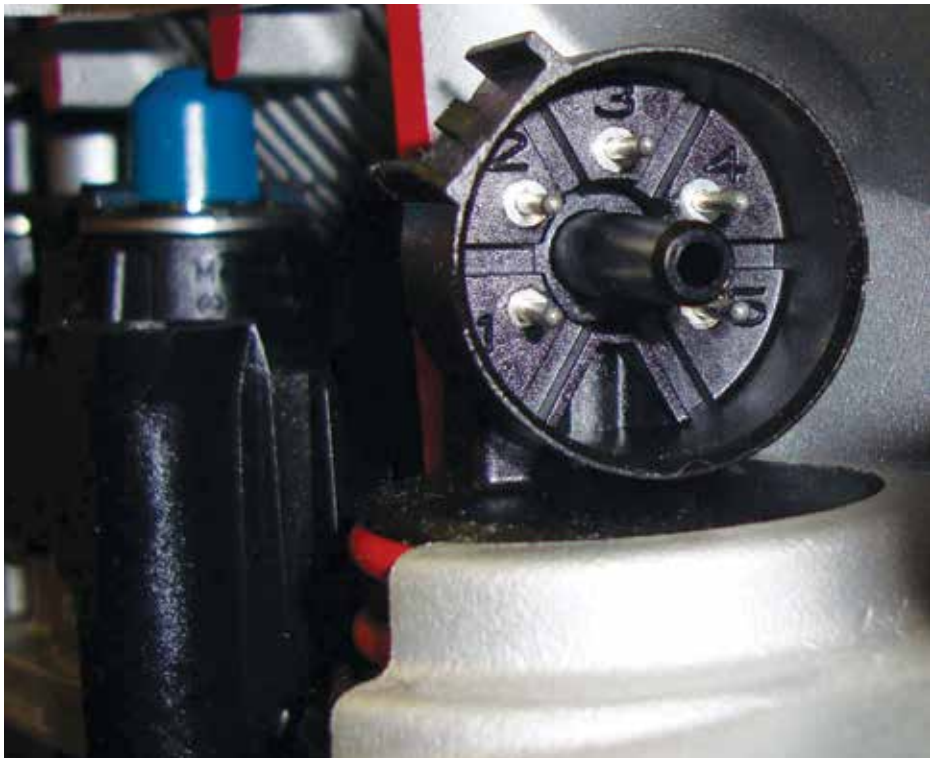


Even though we don't think much about it, the automatic transmission is present in something like 95% of the vehicles sold in the United States. Spirited drivers enjoy being in control of the revs as they go through turns and relish the driving experience, but this was mostly limited to those who knew how to engage a clutch. That is, until sophisticated electronically-controlled automatic gearboxes from Mercedes-Benz arrived, providing the ability to manually shift gears to everyone.

Older automatics lost horsepower through the fluid coupling of the torque converter, which also reduced fuel mileage. Mercedes-Benz engineers made great strides in fuel efficiency and putting power to the ground when they designed the 7 G-Tronic transmission, which made its debut in the 2004 model year and has since been installed in more and more models. They are getting close to 10 years old, and have accumulated some serious mileage. To give them an even longer service life, they are going to need some maintenance, and in this these transmissions are unique. We should all know their special requirements for our customers' good and our profitability.

This new gearbox's service designation is 722.9, which is the next evolution from the earlier and more mechanical 722.6 model transmission. The reason it is called the 7G-Tronic is because it has seven forward gear ratios. This could be achieved because the transmission is completely computer-controlled. While older models (211, 205, etc.) have mechanical linkage that controls the same shift pawl that the ISM does, later versions dispense with this. Instead, the Electronic Selector Module (ESM) sends the gear position signal over the powertrain CAN (CAN-C), and it makes its way to the 7G-Tronic control unit mounted in the transmission valve body. In the case of the 221 Chassis S-Class, the gear position input comes from the Gear Selector Switch mounted in the Steering Column Module. Either way, it is a CAN input to the Electronic Transmission Control unit (ETC) and the Intelligent Servo Module (ISM). The ISM is mounted on the side of the transmission and controls a mechanical motor that moves a shift pawl in the transmission. By having the ETC

control unit mounted inside the valve body, Mercedes-Benz has reduced the number of wires into and out of the transmission, thereby reducing complexity. This, however, prevents a technician from electrical testing of individual components inside the transmission.



With the ETC unit moved inside the transmission, wiring to and from the control unit has been reduced. This connector is for the later 724.2 and 725 transmissions. Pins #1 and #2 are the CAN C lines and voltage is supplied on pin #5. Pin #3 is the wake-up signal from the EIS and lets the ETC unit know the key has been turned on or off.

Being Prepared

As a result of most of the electronics being moved inside the transmission, diagnostics are handled by the Mercedes-Benz scan tool SDS/XENTRY, or equivalent. If you have made the investment in an SDS, you are rewarded with a significant amount of information and control. Before you can view this data, you need to verify communication with the ETC control unit on the C CAN. There is a six-pin connector on the 722.9 transmission connecting the control unit to the harness of the vehicle. The next generation 724.2 and 725 transmissions have a five-pin connector. Only four wires are used to connect the ETC control unit to the rest of the car. This helps reduce wiring complexity and streamlines the diagnostic process. Typically with the 722.9 transmission, pins #1 and #2 are the CAN C wires. The front SAM supplies power to pin #4 of the control unit, and pin #5 provides the ground. The best way to get an accurate wiring diagram for the vehicle you are working on is with a paid subscription to www.startekinfo.com. Verify that the connector is not full of transmission fluid -- it is possible for it to leak. Once you have established communication, you can move on to the next step of the diagnosis.

As you probably know, the self-diagnostic capabilities of Mercedes-Benz control units are comprehensive. You should first look at any self-diagnostic trouble codes or events flagged by the ETC unit. You can also use bi-directional controls such as “Actuations” or “Tests.” If the customer complaint has to do with unusual shifting, you can view “Adaptations.” As the vehicle is driven, the ETC unit monitors the input, intermediate, and output shaft speed sensors. By comparing the three it can determine if the clutches are slipping and make changes to the pressure control to maintain smooth shifting. As the transmission clutches wear, the ETC unit can keep pace with these changes and provide seamless shifting. You can view these changes and see if any severe adjustments are being made. This can let you know if the transmission has reached a point where it is going to require service. As clutch material wears away, it travels throughout the gearbox suspended in the transmission fluid. If this material builds up in the torque converter clutch, shift, or pressure control solenoids it can cause shift concerns. It can also get trapped in the valve body, causing pistons to stick.

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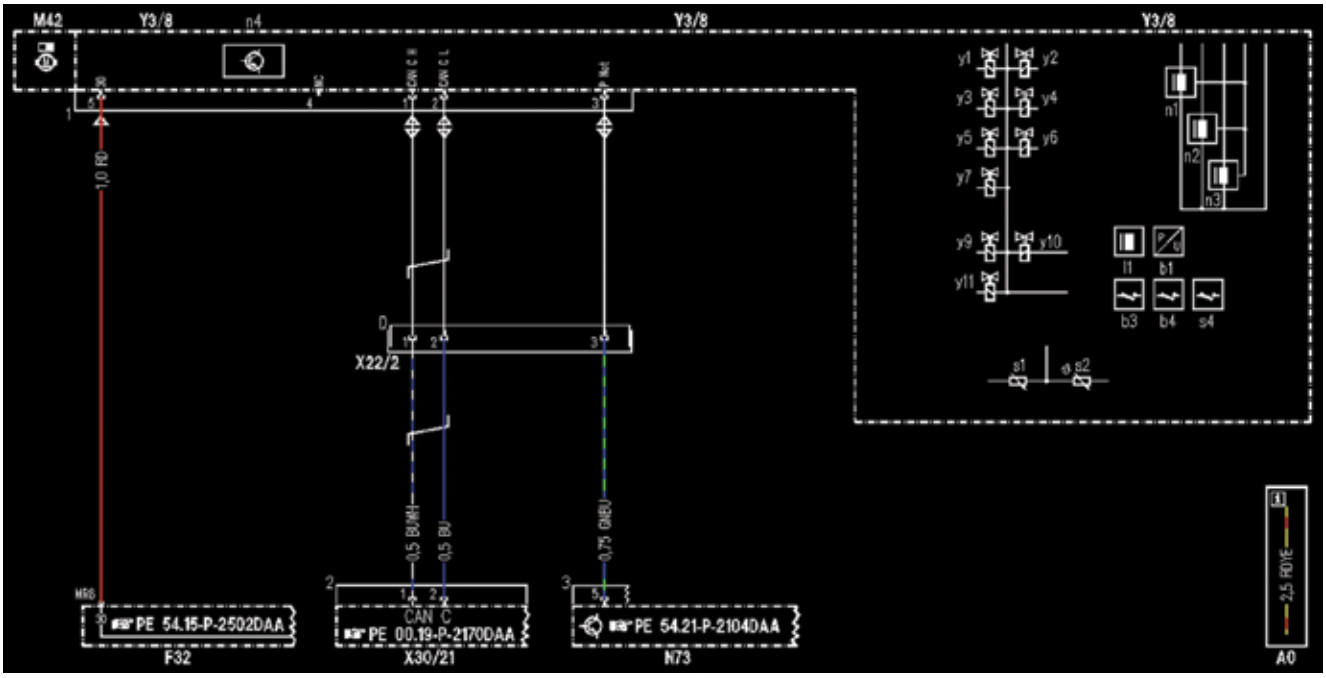
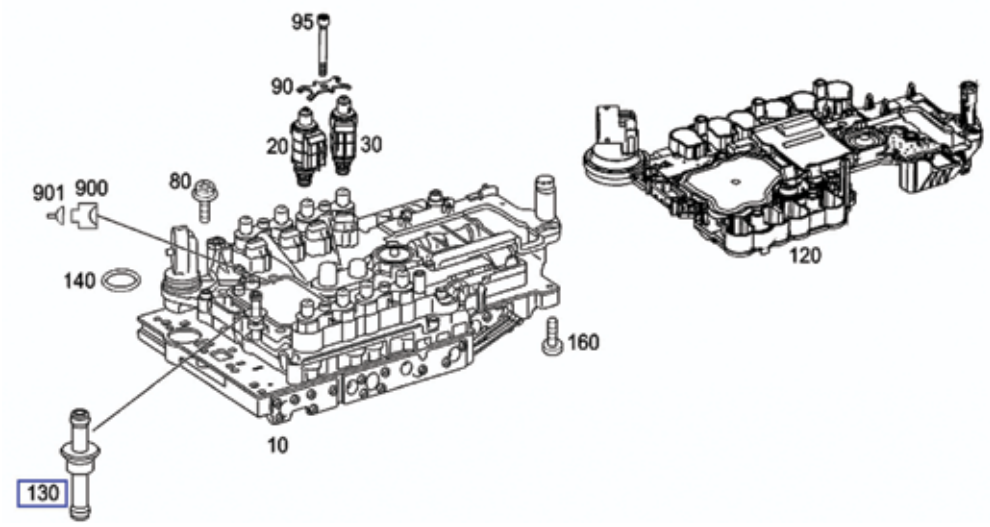


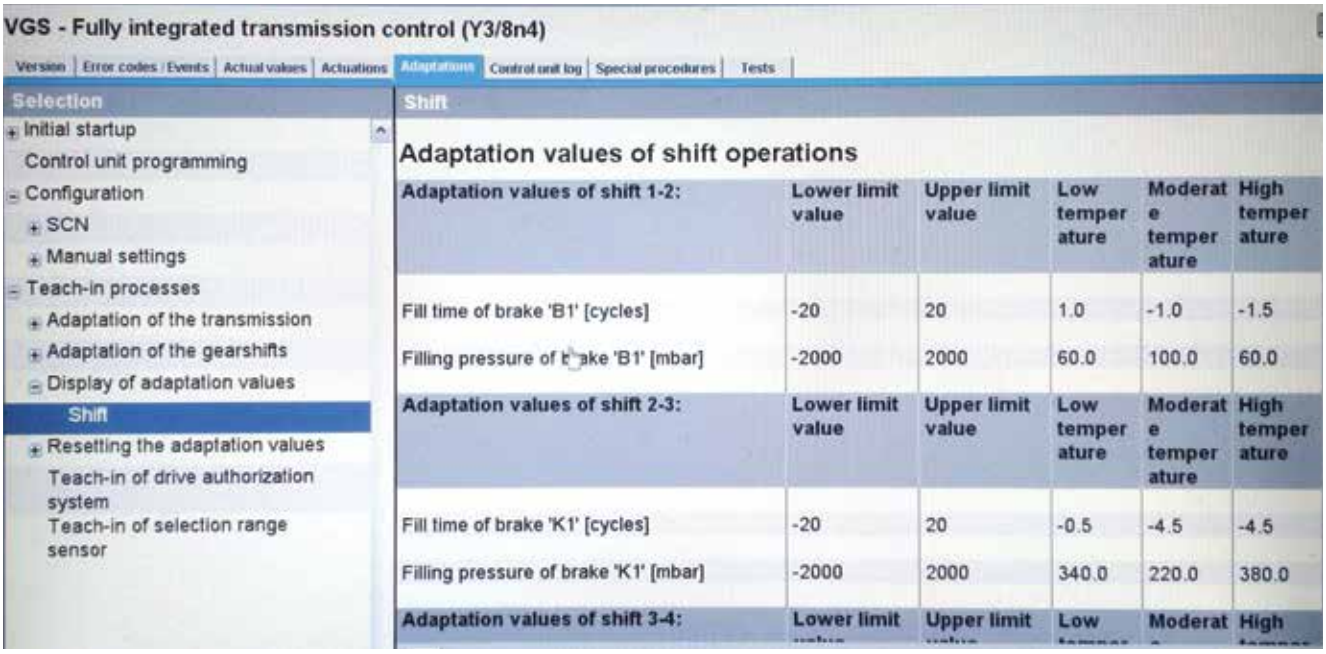
With a paid subscription to www.startekinfo.com, you can view a wiring diagram for the ETC unit. Here we have the 724.2 showing the power supply, CAN C, and wake-up signal. The transmission body itself forms the ground for all the electrical components.

Next Step?

As with any other transmission problem, you should first check the fluid level and look for any obvious leaks. This was typically done with a special tool dipstick on the 722.6 transmission. The procedures for checking the fluid level on the 7G-Tronic is a little different. On these units, the overflow method is used to determine and provide the correct fluid level. The transmission needs to be under certain specific conditions before the fluid can be checked. Since fluid volume will change with temperature, you need to have the transmission between 104 and 113 deg. F. (40 to 45 deg. C), so you are going to have to warm up the vehicle. While it is safer to go on a test drive and run the transmission through all of its gears, you can duplicate this by running the vehicle on the lift or a dynamometer. Either way, this purges the air from all of the channels in the transmission and fills the torque converter.



Looking at Mercedes-Benz EPC will give you an idea of components inside the transmission. Here, we have highlighted the oil guide pipe. It supplies fluid pressure to Brake B3. If there is a leak here, it can cause problems with starting – Neutral, 1st and Reverse all need B3.



By using XENTRY, you can view the adaptations the ETC unit has made to improve shifting for this particular unit. The scale is in millibar (mbar) and shows how much pressure needs to be added to improve the shift. The more pressure that needs to be added means the more there are sticking components or worn clutches.

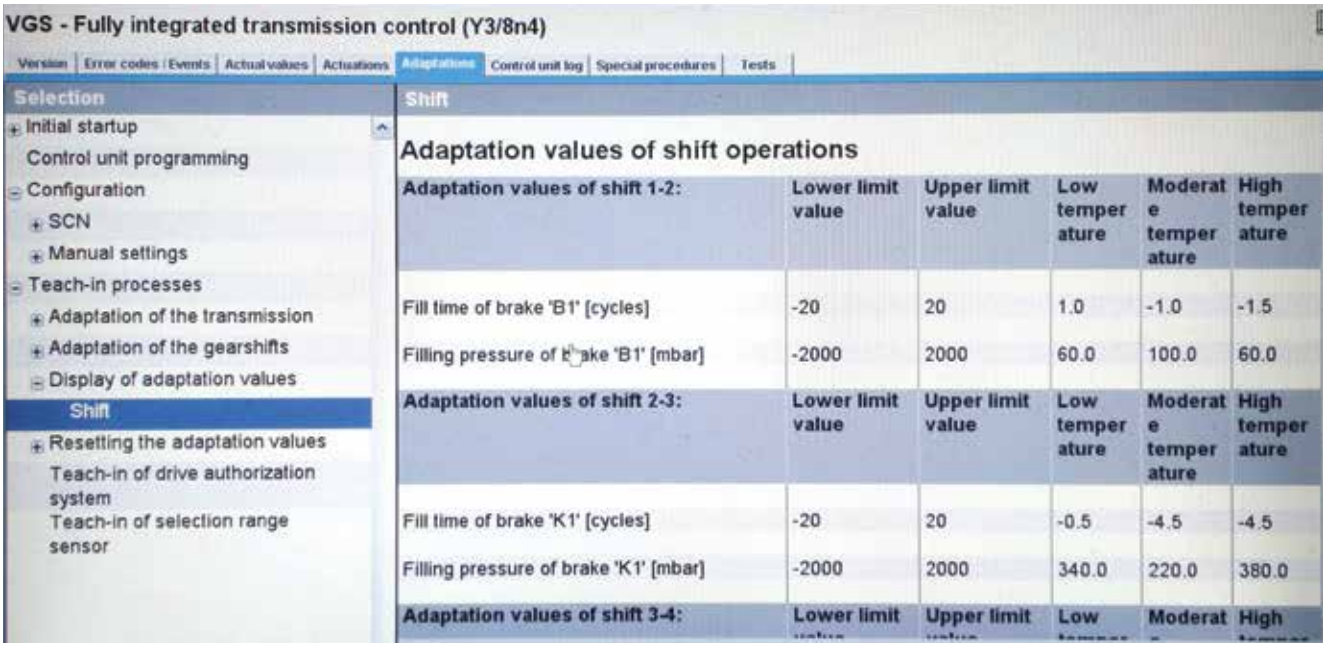
The torque converter will drain back once you stop the engine, so the fluid level is checked with the engine running. There is a standpipe in the transmission pan that has a specific height. When you remove the inner plug of this standpipe, a small amount of fluid should flow out. If not, the level is too low and fluid needs to be added through this opening.

If the transmission fluid looks or smells burned, it should be replaced. While this may correct some overall transmission performance issues, keep in mind that it will not reduce the tens of thousands of miles of use that have caused internal components of the transmission to wear out. Dropping the pan and changing the fluid and filter will only replace between five and six liters. The torque converter and cooler lines by themselves hold between four and five liters, so you are only changing a little over half the fluid. If you have the equipment to perform a fluid exchange, keep in mind that you are going to need approximately 10 liters. It is also recommended that you flush out the cooler lines specifically as clutch material and other debris may have been deposited there and can damage a new or remanufactured transmission.

There are now recommended service intervals for the 722.9 and later transmissions, somewhere around the 70,000-mile mark. This includes the transmission fluid and filter mounted in the pan. Information for the specific vehicle can be obtained from the Maintenance Section of the Owner's Manual, or at www.startekinfo.com. You should also check technical service bulletins to see if there are any changes for the specific model and year you are working on.

Correcting Shifting Concerns

SDS/XENTRY software provides a way to improve shift quality on transmissions that have the proper level of good transmission fluid. Some of us in the aftermarket industry have the notion that we should clear the codes and the adaptations and then go on a road test to see what returns. Clearing the adaptations is what is needed for a new or remanufactured transmission. This erases any shifting strategy that may have been learned from a worn and slipping unit. If you do not clear the adaptations, the fresh transmission will shift as if the old slipping unit is still in place. This can cause premature wear in the new unit, and shift quality will not be smooth. By the same token, if



With XENTRY software, you can force the ETC into learn mode and adapt each shift one at a time to try to correct a shifting problem. You should have someone else drive the vehicle, allowing you to follow the one-screen instructions in a safe manner. Adaptations cannot be performed until the transmission is up to normal operating temperature.

you clear the adaptations with the old unit in the vehicle, the ETC will use a shift pattern as if the transmission clutches are new. This will make the transmission slip even more until the control unit relearns to adapt to the slipping shifts. This could take weeks and will probably cause more damage than good. SDS/XENTRY software has provisions to allow you to adapt each shift. You can go into "Adaptation of the Gearshifts" and select only the gear shift you want to correct.

The ETC control unit will go into a learn mode and quickly learn what it needs to do to correct only the shift you are having a problem with. While in this mode, have someone else drive the vehicle so you can watch the scan tool. Follow the directions, which will direct the driver to stay within driving parameters such as throttle position, vehicle speed, and engine load. Perform these adaptations three to five times. If you have still not corrected the shifting concern, you can try repeating the process again three to five times.

There are software limits within which the ETC unit can correct a shift concern. If you have not fixed the problem at this point, the unit is going to need mechanical service or replacement. You and the customer are going to have to make a value judgment to determine if the problem is only in the ETC/valve body unit, or the mechanical transmission itself, and what course of action you are going to take. You need to look at the overall mileage on the unit to see if it is worthwhile to only replace the valve body/ETC unit, or if it makes sense to install a reman or new transmission. Mercedes-Benz offers a cost-competitive replacement unit. Remember, the torque converter is available separately.

Big Picture

If the customer has decided that he or she is going to invest in a new or remanufactured transmission, you need to know the process in order to complete the job effectively. Number One, aluminum bolts are used to mount the transmission and should not be reused. Purchase new bolts and torque them to specs. You already know you are going to need approximately 10 liters of Mercedes-Benz transmission fluid in order to maintain the warranty. Aftermarket fluid has not been tested by Mercedes-Benz for its lubricity or thermal characteristics and will void the warranty if there is a premature failure.

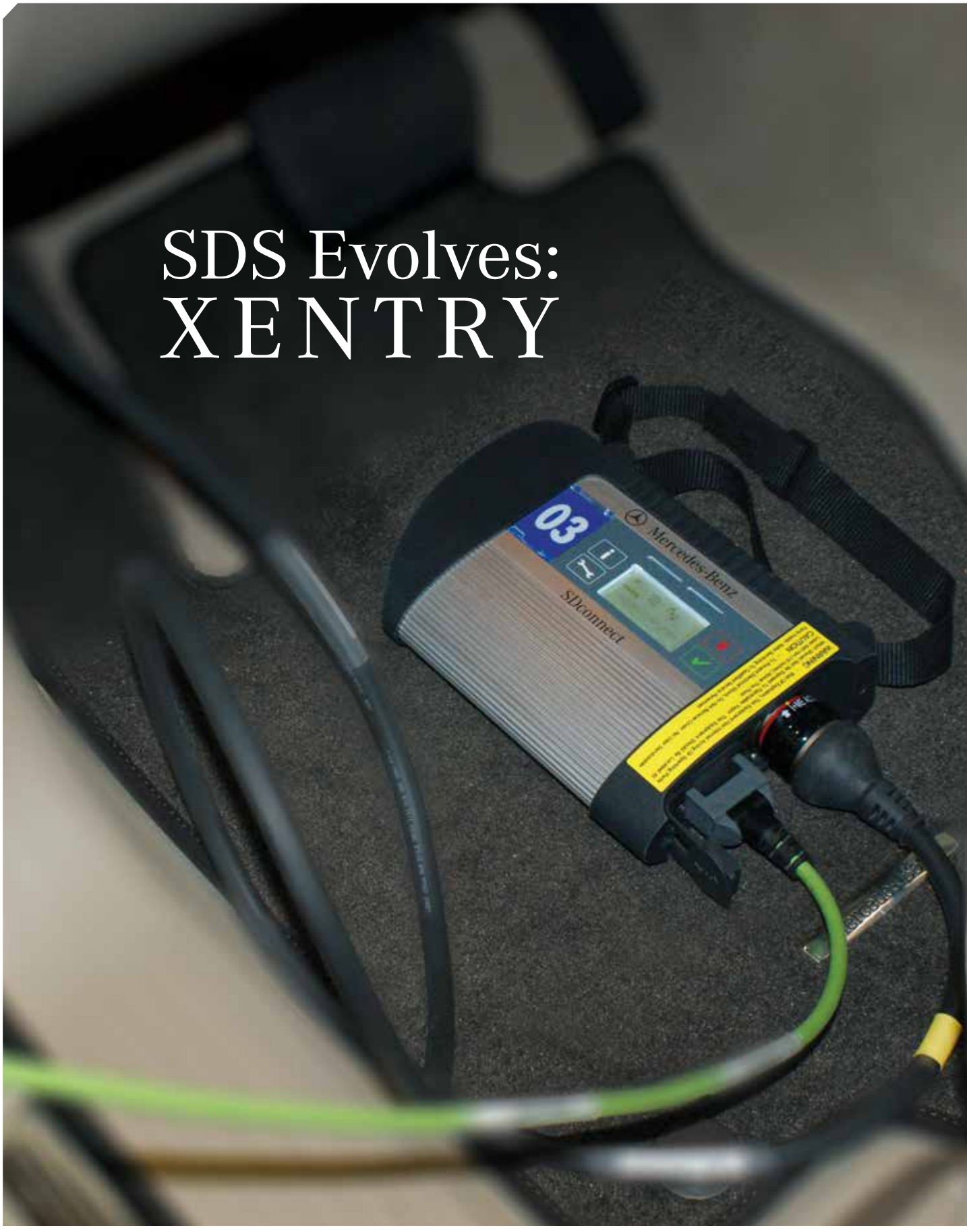
You cannot install a used transmission since the original unit has been programmed to the vehicle, and cannot be programmed to another vehicle. Only a new control unit can be installed and programmed to the vehicle. There are several steps to this process with the factory SDS/XENTRY system. First, you need to program the new ETC control unit to the specifications of the vehicle. With the new software installed, you can then request SCN coding from the Mercedes-Benz service website with XENTRY. XENTRY Connect will return the SCN software coding file, and it will only work on the vehicle for which you have requested it. Once you have installed the SCN coding, you then need to "learn" the control unit to the Drive Authorization System (DAS).

The ETC and ISM modules give current gear position to all of the other control units on the C CAN. This includes those that are a part of the Drive Authorization System (DAS), and, since it is involved in starting the car, it is part of the Theft Related Parts (TRP) program. The owner of the vehicle will need to supply proof of identity and proof of ownership before parts can be purchased.

The new ETC control unit is going to need to be "learned" into the DAS system. Finally, the transmission control unit has a Selection Range Sensor built into it. This gives the gear position to the ETC control unit. This sensor needs to be matched to the ISM to coordinate shift inputs and outputs. They must match or the transmission will remain in limp-home mode. Depending on the type of failure the ETC has picked up, it will go into various limp-home modes. Individual shifts can be bypassed if there is a problem with a single solenoid, but major electrical failures put the transmission into sixth gear allowing it to be driven in for service. Vehicles equipped with this transmission should not be flat towed over 30mph, and it is best to have them flat-bedded to prevent further transmission damage.

Being armed with the proper procedures and factory-backed O.E. replacement parts makes Mercedes-Benz a partner in the service you provide to your customers. How can you get a better partner than that? This relationship helps you provide the level of service that keeps your customers coming back. |

SDS Evolves: XENTRY



Elaborate CAN systems developed by Mercedes-Benz allow for considerable integration of various functions. These give the Mercedes-Benz owner some value-added features not found on other vehicles. When a car owners use the "Convenience Feature" by holding down the unlock button on their remote, they signal the doors to unlock. By continuing to hold down the button, the door modules are signaled by the RFA module to open all of the windows as well (if this feature is turned on). This releases some unwanted hot air from inside the cabin before getting in. Also, the door locks may be programmed to lock once the vehicle is being driven away and exceeds several miles per hour. Here, the Powertrain CAN passes on the vehicle speed signal to a gateway module, whose job it is to transfer information from one CAN to another. From the gateway module, the vehicle speed signal is interpreted by the PSE or door modules and commands all of the doors to lock.

CAN System Features

If the vehicle is a convertible, this same vehicle speed sensor is used to prevent the top from being operated while the vehicle is at speed for obvious safety-related concerns. This elaborate CAN system not only provides these additional features, but it allows for some comprehensive self-diagnostic features as well. Almost all data can be interpreted by the self-diagnostic software, and optional features can be "tailored" to the owner's desires. With all of these options and features present, one of the more difficult tasks will be to properly identify the vehicle and its programmed options. We have all seen that some vehicle owners will change or remove the badging on the rear deck lid that identifies the series and engine. In addition, we all also know that each model or class of vehicle will have a few different chassis designations as the model evolves throughout its lifecycle. For example, the E-Class started off life

Left: While the SDS unit is the main brains of the system, the SDConnect unit is the "pass-thru" device that you may be more familiar with. The unit interprets the vehicle's software language and communicates the information to the SDS unit so you can view it.

as a 124 chassis and evolved into the 210, 211, and now the 212 chassis, but it is still an E-Class. The systems changed with the chassis development, so you cannot use the same communication protocol on a 210 chassis as you would a 212 chassis.

The SDS (Star Diagnosis System) uses the chassis "Baumuster" ("build model") number to more accurately identify the chassis and options of the vehicle. The Baumuster number has been used by Damiler-Benz almost since its inception to identify the entire product line during development and engineering. The first three numbers are always the chassis designation. The next three numbers tell us the major options -- say, if it is a 4Matic model, and what the engine size is. You can also find the last two digits of the Baumuster number as the seventh and eighth characters of the U.S.-specified VIN (Vehicle Identification Number) on all but the latest chassis. This helps you properly identify the vehicle you are working on. It is always best to use the VIN to properly identify the vehicle and, with a free subscription to Mercedes-Benz EPC (you can pay a few dollars and get access to worldwide VINs), you can enter the entire U.S. VIN, and the Baumuster number will be provided for you. You will also have access to the same parts information as your Mercedes-Benz dealer's parts department, as well as completely identifying the vehicle. This can prove invaluable when ordering parts, but always trust the experience of the personnel in your local dealer's parts department.

Introducing XENTRY

XENTRY is the updated version of SDS diagnostic software that helps you identify the vehicle, communicate with it, and perform diagnostic functions. You will see small photographs of the vehicles with their Baumuster number identifying them. This helps the SDS identify the systems and the software protocol that will be used to communicate with the vehicle. You can also simply enter the VIN and this will also identify the vehicle and its specific systems. As you become more familiar with the vehicles, this will not be necessary and you should be able to identify each vehicle yourself. Once the vehicle's chassis designation and options are known, you can advance into self-diagnostic and programming functions. With a fully-functioning SDS with on-line access, you can perform software updates and bring new control units on-line by programming them to the vehicle. Mercedes-Benz is very cautious before releasing its vehicles to the public, making sure that all of the kinks are worked out. Unlike other manufacturers that have you go through a search for upgraded software for each control unit, Mercedes-Benz will only have you reprogram a control unit if there is a specific campaign to solve a specific problem. Software upgrades eliminate these glitches and provide seamless operation of integrated CAN systems.

These software updates may correct some concerns that your customers did not know they had, as well as issues they may be very aware of and want repaired. This one step may save you hours of diagnostic time that in the end you may not be able to bill for. A repair that is not cost-effective is bad for both you and your customer. Typically, the memory of the control unit being updated will be lost, so it is always a good idea to record all of the codes in your "Quick Test" before re-flashing any control unit. If it is required that you update a control unit, you will need to have the ignition key on and the engine off. You cannot do it while the engine is running. The control units will be awake, functioning, and communicating, and this will probably interfere with the reprogramming operation. Ideally, you need all of the other control units on that CAN to be "asleep" and not transmitting data while updating the software on a single control unit. Mercedes-Benz recommends that you have a battery voltage maintainer attached to either the battery or the jumper cable lugs while programming.

XENTRY Abilities

Once software updates have been performed, you will have to road test the vehicle and see if the customer's complaint returns. If it does, you can use the SDS to pull codes, evaluate both "freeze frame" and "live" data, and perform bi-directional control of the system you are working on. This includes features that use more than one control unit to perform a function. Also included in the SDS

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Mercedes-Benz vehicles are electronics-intensive. With the ignition key on for long periods of time, you can discharge the battery. It is always a good idea to have a battery maintainer (commercially available) attached to the lugs on the vehicle. This is particularly important if you are going to code, flash, or program a new control unit since stable voltage needs to be supplied.

operating system is GFF (Guided Fault Finding). This allows the SDS to follow a step-by-step diagnostic procedure for the specific trouble code you are trying to diagnose. Some of the testing can be performed by the SDS and the results will be displayed on the screen so you can interpret them. Some of the tests are electrical that you will have to perform yourself with additional equipment such as a DMM (Digital Multi-Meter). If an electrical test is required, you will be given the pin numbers of various control units and components for checking resistance, amperage, and voltage. You will then be prompted to answer a question with the results of the measurement. This will prompt the next step of the diagnostic process. These are the same diagnostic steps a technician in a dealership may follow. The end of the diagnostic procedure will lead you to the resulting repair.

You do not have to follow the GFF procedures to diagnose a DTC or drivability problem. There are many options you can take other than just pulling codes. Mercedes-Benz strongly suggests that you start each diagnostic procedure with a quick test. In this step, XENTRY will establish communication with each control unit that the vehicle is supposed to have and pull codes. From here you have several options on how to diagnose the problem. The results of the quick test are listed by their respective control unit. In the quick-test view, you will only be shown the control unit hardware numbers, software numbers, and whether or not any codes are present. The control unit electrical wiring diagram (ETM) component designation is also provided to aid in selecting the proper wiring diagram if trouble codes are present. Since some functions require more than one control unit to execute, you can select the next tab and choose the “Function View.” This lists the functions that a customer might complain are not working. It will automatically pull up all of the control units required to execute the function. If you are already familiar with the older SDS layout, you can go to “Control Unit View” and each

You can select the vehicle yourself if you are familiar with the Baumuster number, or you can select the VIN tab to enter the specific VIN. The SDS control unit will automatically query the vehicle for the control unit installed.

control unit will be listed according to its "Drive," "Chassis," "Body," etc.

Once You're Inside the Control Unit...

Once you have selected a control unit or function, you have a few choices aside from pulling codes and following GFF steps. You can start by looking in "Actual Values." Here you can look at live data and view adaptation information that the control unit had "learned." Live data saves you the trouble of having to take a DMM and measure the voltage at each component's signal line. If you see a voltage reading that does not appear correct, you should always support the diagnosis by checking the voltage and the wiring at the actual component. If you want to know if a control unit is capable of controlling an output, you can select "Actuations." Here, you can command the control unit to operate the driver that controls the outputs of the system. This is a simple on-and-off test. You can measure the voltage on the control side of the component and monitor if the control unit is capable of supplying power or ground to the control circuit. Almost all of these functions need to be carried out with the ignition key on and the engine off, so have the battery maintainer attached during testing.

Once you have established that the control unit is capable of manipulating outputs, you can often look at adaptation data. Adaptations are adjustments made by the control unit that occur over time. For instance, if the engine continues to run lean on cylinder bank one at idle, the additive fuel trim will show that the control unit needs to add fuel under idle conditions. This may indicate a vacuum leak. If you were to clear these adaptations, the vehicle may run poorly until the engine control unit learns that bank one is lean

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MODEL YEAR	VEHICLE MODEL	REMAN PART NUMBER
1984-1992	190D2.2	A000230121180
1984-2002	260E, 190D2.5, 300TD, 300D, 300CE, SL500	A000230241180
1986-1991	420SEL, 560SEC/SEL, 560SL	A000230251180
1986-1995	190/300 series, E300D	A000230111180
1986-2002	300E, 300CE, 600SL, SL600	A000230051180
1990-2002	500SL, SL500	A000230061180
1992-1993	500SEL	A119230111180
1992-1999	600SEL, S320, S600, 300SEL	A000230171180
1992-1999	300SE, 600SEC, S600, S320, CL600	A000230221180
1992-2004	CL500, 300/400/500 series, S/SLK/C/CLK/ E-Class	A000230701180
1994-2000	C220, C280, C36 AMG	A000230131180
1998-2005	ML320, ML430, ML55 AMG	A000230681180
1998-2010	ML500, ML350	A001230281180
1998-2010	ML350, ML500, E500, SL500, C/CL/S/G-Class	A000230901180
2000-2006	CL600, CL65 AMG, S65 AMG, S600	A001230011180

MODEL YEAR	VEHICLE MODEL	REMAN PART NUMBER
2000-2009	E320, S350	A000230911180
2002-2007	C32 AMG	A000230781180
2002-2007	C230 CL 1.8	A000230971180
2002-2010	CLK-Class, C55 AMG, SLK55 AMG	A001230191180
2003-2009	CLK500	A001230161180
2003-2010	SL55 AMG	A001230021180
2003-2010	E55 AMG, E320, E500, CLS500	A001230121180
2003-2010	E-Class, CLS55 AMG, CLS550	A001230141180
2003-2010	SL550, C230, C180, C200, CLK200	A001230551180
2005-2010	SLK280, SLK300, SLK350	A001230541180
2006-2010	R350, R500, ML350, ML500, ML550, GL450, GL550	A001230871180
2006-2010	R350, R500, ML350, ML500, ML550, GL450, GL550	A002230521180
2009-2010	C300, C350	A001230501180
2010	GLK350, E250CDI, SLK250,CLS250	A002230311180
2010	E350, E550	A002230381180

*Made with the same OE components as original factory parts

*Assembled to original Mercedes-Benz specifications

*Results: Mercedes-Benz Quality, Reliability and Value

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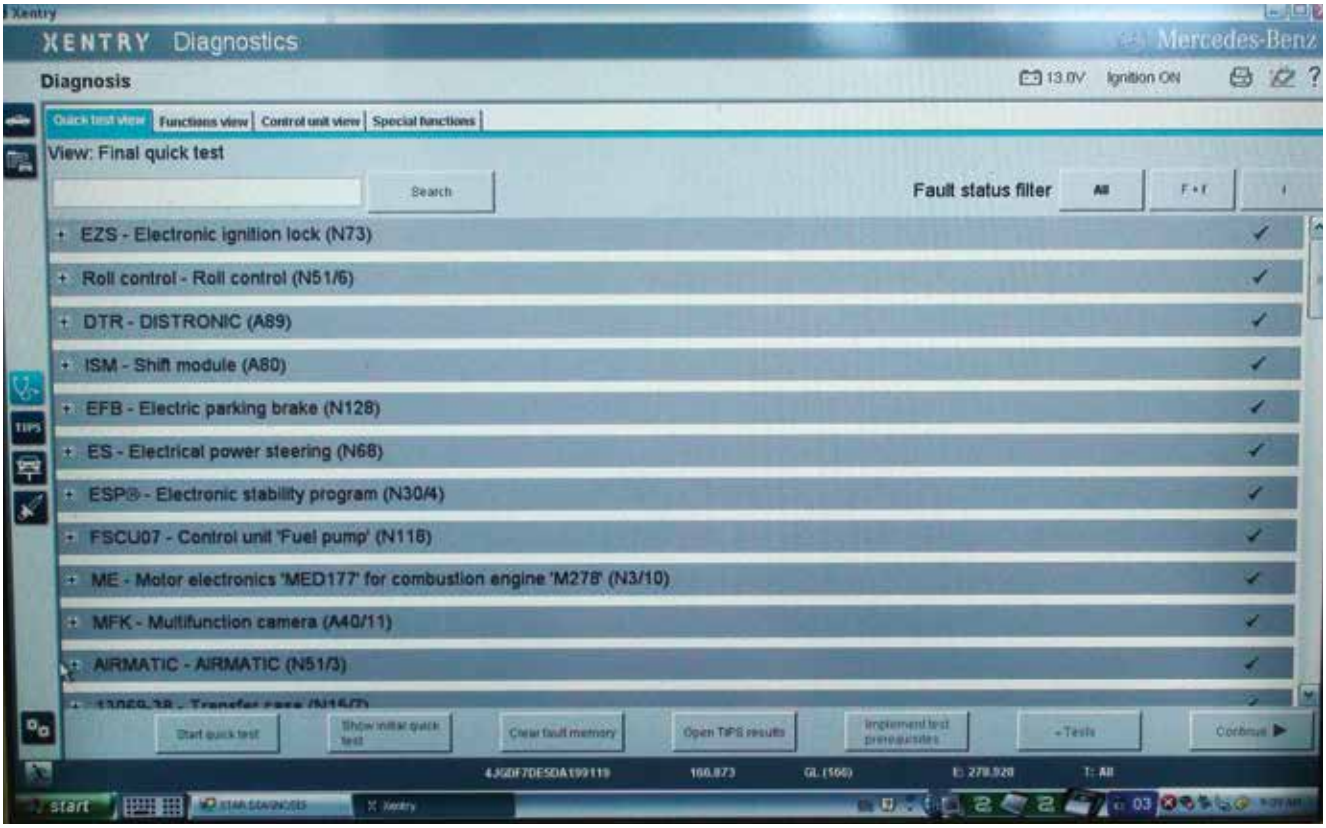
Available only through your local Mercedes-Benz Dealer



Mercedes-Benz strongly recommends that you perform a "Quick Test" of all the vehicle systems. Many features of these vehicles are dependent on a few control units working together. It is a good idea to look at the overall layout of the problem systems. You can select the "Functions View," and the SDS will pull up the control units that have control over the feature you select.

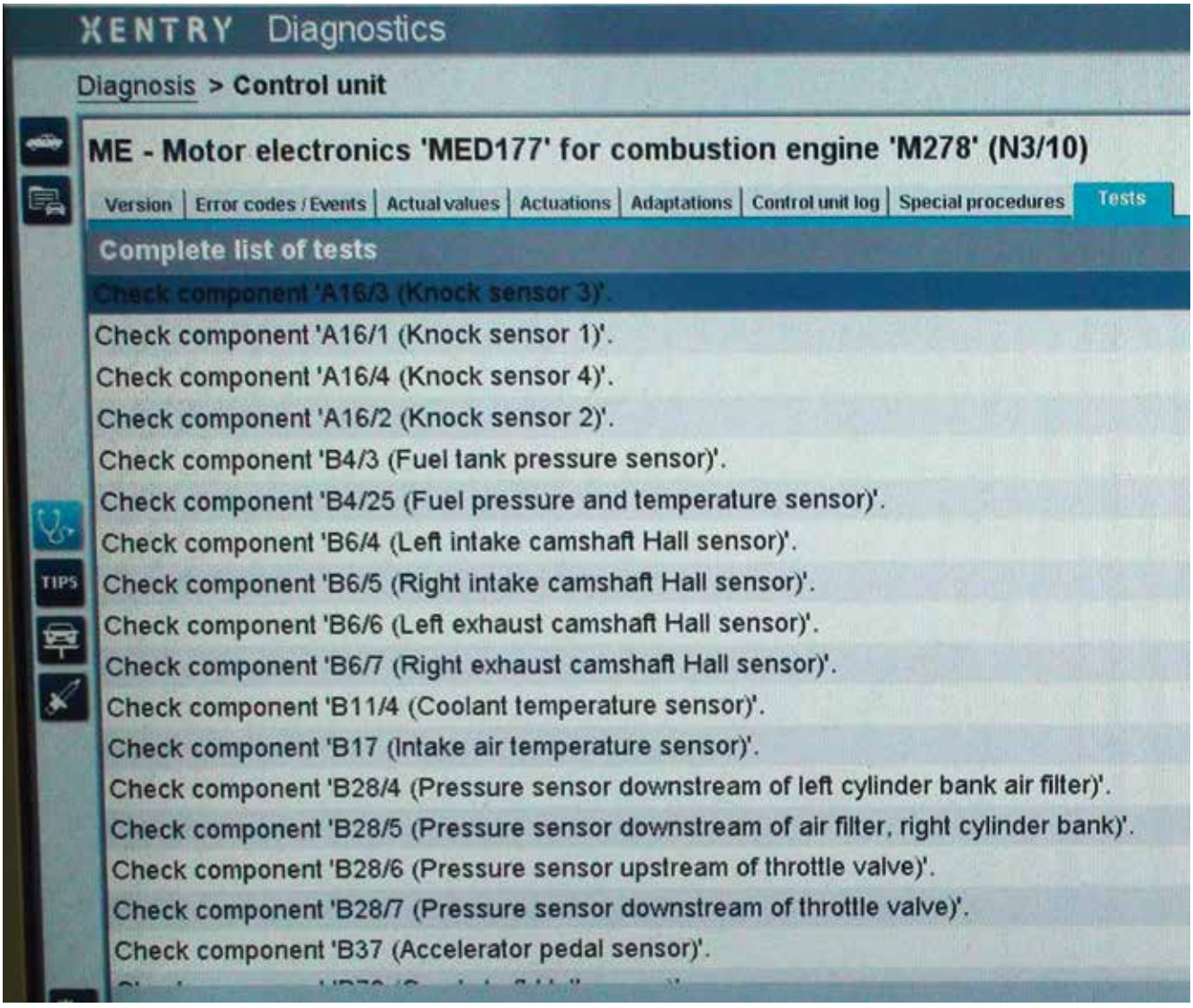
and starts adding fuel again. These learned values are often displayed as a percentage or on the Lambda control. A positive percentage means fuel is being added and a negative reading means fuel is being subtracted. In the Lambda control, the number 1 is the midpoint, above 1 fuel is being added and below 1 fuel is being subtracted.

You may also find adaptation data in the transmission. Here the scales are different. Clutch volume fill times may increase as the control unit applies more pressure to a clutch as the fiber discs wear. Looking at transmission adaptation data can tell you if a particular clutch pack is worn or a shift solenoid is sticking.

Bi-Directional Controls

One change in system is the addition of a "Tests" tab in the diagnostic portion. This is slightly different from "Actuations" in that multiple outputs are activated while the engine is running to simulate the system in operation. The result is an overall system Pass or Fail. Very often you can watch the signal voltage of the system in question as the test is being performed. If you were to attempt this yourself, you would have to graph the signal voltage of the sensor in question, operate the output, and match the conditions of the test. This can be a difficult and time-consuming task. It is made more cost-effective with an SDS scan tool test. Some of these tests were previously found in "Actuations" in the older SDS software. The number of tests have been expanded and given their own tabs in the XENTRY system.

You can purchase your own Mercedes-Benz SDS unit for your independent repair shop. Simply access www.startekinfo.com, and under the "Star Diagnosis/XENTRY" heading select the "Aftermarket" field. You will be prompted to open a PDF document that has all the necessary paperwork needed to purchase a XENTRY unit, as well as instructions on how to fill out the forms and submit them.



XENTRY has added a "Tests" tab that expands on the previous SDS software actuations tab. Here you can perform static and dynamic tests for each system in that particular control unit. Each test will run just as the vehicle self-diagnostic functions would run while the vehicle was being driven.

If your diagnosis leads to a malfunctioning control unit, it is going to have to be replaced.

If this unit is deemed important enough by Mercedes-Benz, it will be assigned a Software Calibration Number (SCN). Each modern Mercedes-Benz vehicle has the VIN and SCN burned into the more important control units to prevent parts theft. The control unit will only work if the VIN and SCN match the vehicle. You cannot swap parts from another vehicle and hope that they will work. When you install a new control unit, you will need to login online to the Mercedes-Benz After Sales portal for the SCN. This number is calculated with the vehicle VIN and the software ID number in the new control unit. After the SCN is calculated, XENTRY will take over and write the vehicle data into the control unit.

By making the investment in a factory XENTRY system, you will now be able to perform more accurate, complete repairs that are both cost-effective and profitable. No more guesswork or worry that the aftermarket scan tool is giving you incorrect information, or that you cannot complete the job when programming and coding are required. This gives you an added advantage over your competition and keeps your customers coming back. Isn't that what we are all striving for? |

Aluminum
From Bauxite to Beautiful

Working with this light metal in collision repair isn't really more difficult than working with steel. It's just different. Learn how to deal with those differences in a professional manner and you'll be ready when an aluminum-intensive Mercedes-Benz rolls into your shop.

Made from plentiful bauxite ore, aluminum weighs approximately one-third as much as steel, but can be combined with other elements to create alloys with strength equal to some High Strength Steels. Ongoing pressure on vehicle manufacturers to increase fuel economy guarantees that body shop technicians will each year for quite some time face a growing need for aluminum repair skills, tools, and equipment.

Current aluminum-intensive vehicles tend to be high-performance or luxury models such as the 2013 Mercedes-Benz SL.

Use of aluminum in some automotive parts however, including doors, hoods, roof, structural components, bumpers, and other body parts, has spread to mid- and even entry-market vehicles, and is increasing at a faster rate each year. When collision damage affects these aluminum components, special repair tools, materials, and techniques are required.

Don't Touch Me, I'm Aluminum

If aluminum is in direct contact with other metals, it needs only a little moisture from the air to create electrolytic action – essentially a battery – in which electrons are exchanged between the two metals. The result is what looks like rust, or, if it is under paint, bubbles that will pop through the finish and ruin your repair.

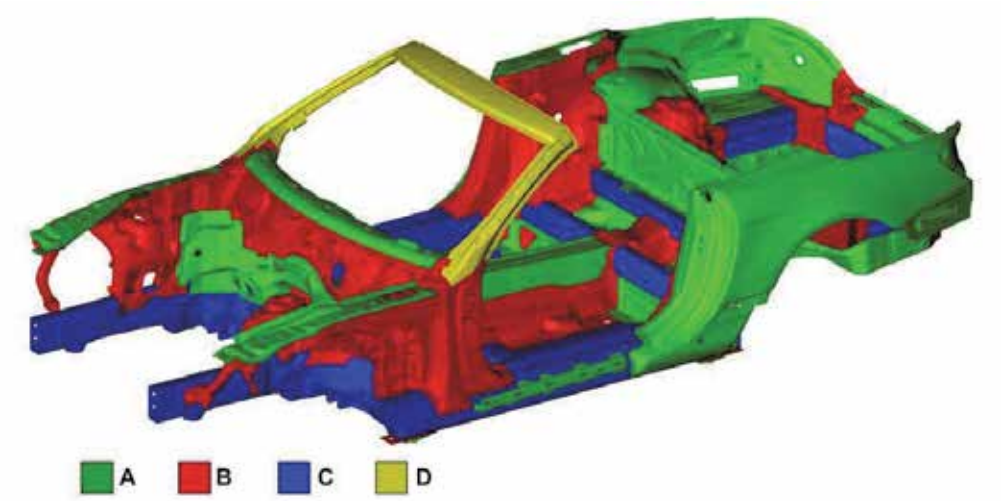
This is more than just a cosmetic issue. Remember in the old days seeing chrome bumpers with one of the bolts corroded through and the bumper sagging on that side? That was galvanic corrosion in action.

At the factory, Mercedes-Benz prevents galvanic corrosion by placing a non-conducting barrier between two dissimilar metals. O.E. repair instructions will tell you how to duplicate this in the repair shop.

Left: The first Mercedes-Benz SL in 1952 combined a lightweight aluminum body, an innovative tubular space frame, and an engine with direct gasoline injection. It won LeMans and the admiration of the entire racing world in its first season. The 2013 SL550 continues the tradition with an all-aluminum structure, innovative engineering, and flowing lines that exude power and grace at the same time.

(Background information about aluminum repair provided by I-CAR)

The only structural component in the Mercedes-Benz 2013 SL550 that is not aluminum is the windshield frame. The SL550 includes aluminum sheet metal (A), cast aluminum parts (B), extruded aluminum parts (C), and sheet steel (D) in the windshield frame.



For example, the Mercedes-Benz recommended bonding adhesive may also function as an anti-corrosion coating. A fastener may have a coating that prevents galvanic corrosion. Pay attention to the installation instructions, as the coating is likely to make this a "one-time use" fastener.

Removing this type of fastener strips off some of the coating and reduces its ability to prevent galvanic corrosion. This weakens the repair, which may have safety implications for the customer, and definitely can harm a shop's reputation.

I Want a Room of My Own

Unfortunately, this galvanic corrosion can also occur even if only a small amount of steel dust comes in contact with an aluminum surface. You need a space dedicated to aluminum work in order to minimize galvanic corrosion potential in a field repair environment.

It should have floor-to-ceiling curtains that close the space off from surrounding bays. This will keep steel dust from other vehicle repairs in the shop from settling on and contaminating your aluminum repair surfaces.

Your "clean room" needs its own air management system, a vacuum evacuation system to remove contaminants from the air and from work surfaces, and separate compressed air lines. A vacuum system offers another important benefit: It removes aluminum dust, which is harmful to breathe and (surprise) explosive in high concentrations, from the air.

You'll need picks, locking pliers, and clamps that are made for working on aluminum. Hammers and dollies should have surfaces that are highly polished so they do not chip or flake easily, or are covered with a non-conductive material such as leather. Wood, plastic, or rubber mallets are good for working out minor dents in aluminum.

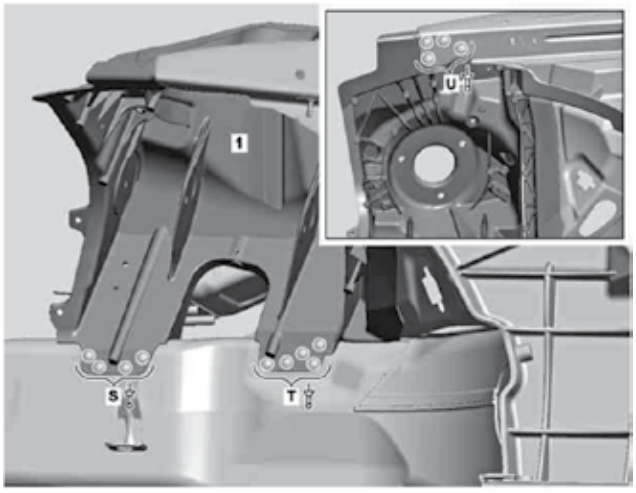
Label these tools so they are used only on aluminum, and store them in a dedicated toolbox so they don't get mixed in with or pick up steel dust from other tools (or from the box).

Because access to the back side of many aluminum parts is restricted, you'll need a weld-on-tab type dent puller. Expect to pay more. Dent pullers made for aluminum must produce more amperage than pullers designed for steel because of the way aluminum conducts current.

You'll need many other tools, including an aluminum welder, spool gun, self-piercing rivet guns, fixture benches, and more. Mercedes-Benz requires specific models of welders that meet Mercedes-Benz requirement and training in aluminum welding procedures and equipment in order to be included in its certified aluminum repair provider network.

Extruded, Cast, or Stamped?

Aluminum automotive components are made in one of three ways: extruding, casting, or stamping. Frame rails once were built by welding inner sections together to create a stronger component. Today, they are made



Mercedes-Benz instructions in WIS recommend replacement of a damaged Suspension Strut Tower – a cast aluminum component – using rivets and two-component adhesive in locations "S" and "U".

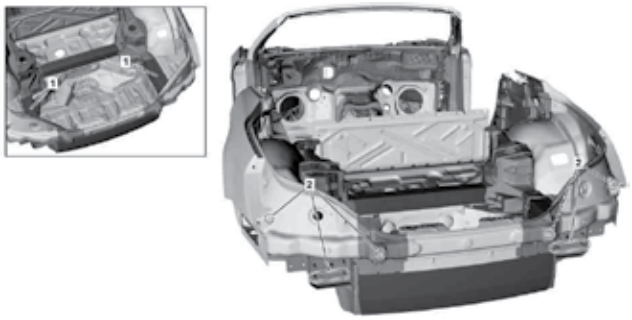
stronger by extrusion -- pressing heated aluminum through complex dies to form multi-celled shapes. Ability to straighten extrusions is extremely limited due to the strength created by their complex internal sections.

Castings are created by pouring molten aluminum into a mold. Strut towers and pillars are made lighter and stronger through casting. Damaged castings MUST be replaced.

Stamped metal parts can include doors, hoods, and fenders. On aluminum-intensive vehicles such as the Mercedes-Benz SL, stampings can also include structural components such as rails, pillars, and crossmembers. Due to their relatively uniform thickness and simpler, non-sectioned design, stamped parts tend to be more readily workable for repair than extrusions or castings.

With This Rivet, I Thee Wed

For extruded or cast components that must be replaced rather than repaired, re-attachment can require bolts, rivets, rivet bonding, or possibly welding. Refer to WIS for recommended replacement procedures. Of course, bolts and rivets must be either aluminum or coated to prevent galvanic corrosion. If the component is mated to a non-aluminum part, instructions will specify parts that include a non-metallic material or coating between the two to help prevent galvanic corrosion.



The floor in the area of the rear longitudinal member (1) is one of the few aluminum structural components on the SL550 for which Mercedes-Benz permits straightening, but only if the deviation from measuring points at "2" in the diagram does not exceed 3 mm.

Use a torque wrench to install threaded fasteners to the recommended torque specification. Stripping threads when installing fasteners on an aluminum part will ruin your day.

Humpty-Dumpty

Aluminum is not more difficult to repair than steel, but it requires different skills, tools, and equipment. Depending on the alloy, aluminum is more heat sensitive and less workable than steel. Technicians therefore have to become very good at judging in advance what can be heat-treated or pulled, and what should be replaced.

Refer to the Mercedes-Benz Workshop Information System (WIS) for the proper repair procedures. The company provides a wealth of information about where the different types of aluminum components are on the vehicle, and what tools and procedures are required to properly repair or replace a given component.

Jump in. Master the skills required for aluminum repair before your competitors get in the game. You'll be a leader in your market, and keep your bays full with referrals from your customers (and from other shops).

Become a Mercedes-Benz certified aluminum repair facility. You'll get extensive aluminum repair training, plus referral business from area Mercedes-Benz dealers that have no in-house collision repair capability. It's a win-win. |

Mercedes-Benz Mobil 1

Product Name	Part Number	Quantity	Product Description	Recommended Consumer Applications
Mercedes-Benz SPEC.				
Mobil 1 Formula M 5W-40	BQ 1 09 0144	Bulk - No Equipment	Fully synthetic formulas designed specifically for gasoline passenger cars	Low SPAsh. Available at most MB dealers
	BQ 1 09 0162	6/1 Quart Cases		
	BQ 1 09 0151	55 Gallon Drum		
Genuine Mercedes-Benz Oil MB 229.5 Specification SAE 5W-30	A0009898301USA6	12x1 Quart Cases	Fully Synthetic formula specifically designed for Mercedes-Benz engines that require the 229.5 Specification	Mercedes-Benz Engines that require 229.5 Specification Oil
	A0009898301USA8	55 Gallon Drum		
	A0009898301USA9	Bulk - No Equipment		
Mobil 1 0W-40	BQ 1 09 0010	Bulk - No Equipment	Fully synthetic formulation designed to meet the requirements of many European vehicles	Porsche A40. Many European vehicles. HT/TS applications.
	BQ 1 09 0015	6/1 Quart Cases		
	BQ 1 09 0016	55 Gallon Drum		
Mobil 1 ESP Formula M 5W-40	BQ 1 09 0135	Bulk - No Equipment	Advanced full synthetic formulas designed specifically for diesel passenger cars that have particulate filters	Low SPAsh. Available at most MB dealers
	BQ 1 09 0142	6/1 Quart Cases		
	BQ 1 09 0143	55 Gallon Drum		
Genuine Mercedes-Benz Oil MB 229.51 Specification SAE 5W-30	A0009899701USA6	12x1 Quart Cases	Fully Synthetic formula specifically designed for Mercedes-Benz engines that require the 229.51 Specification	Mercedes-Benz Engines that require 229.51 Specification Oil
	A0009899701USA8	55 Gallon Drum		
	A0009899701USA9	Bulk - No Equipment		
Mobil 1 5W-50	BQ 1 09 0133	16 Gallon Keg	Higher viscosity, advanced full synthetic formula designed for performance vehicles	Porsche A40. HT/HS applications.
	BQ 1 09 0134	6/1 Quart Cases		
Mobil ATF 134	BQ 1 09 0166	55 Gallon Drum	Extra high performance automatic transmission fluid formulated with selected HVI base oils	Recommended for use in Mercedes-Benz automatic gearboxes
Mobil 1 ESP Formula MB 5W-30	BQ 1 09 0165	12x1 Liter Cases	Advanced full synthetic formulas designed specifically for passenger car diesels that have particulate filters	Low SPAsh. Available at most MB dealers.
AdBlue® ½ Gal.	A 000 583 0107	1/2 Gallon Bottle	Non-toxic solution that transforms harmful Nitrogen Oxide (NOx) emissions from diesel-powered vehicles into harmless water vapor and nitrogen	Recommended for use in Mercedes-Benz, Volkswagen + BMW AdBlue® (DEF) applications
Diesel Exhaust Fluid 55 Gal	BQ 1 47 0002	55 Gallon Drum		
Mobil 1 5W-30	BQ 1 09 0017	6/1 Quart Cases	Advanced full synthetic formulation designed to meet the requirements of many domestic, including GM, and imported vehicles	Vehicles that require 5W-30. Corvette approved.
	BQ 1 09 0018	55 Gallon Drum		
Mobil 1 10W-30	BQ 1 09 0019	6/1 Quart Cases	Advanced full synthetic formula designed for domestics and imports	Vehicles that require 5W-30 or 10W-30
	BQ 1 09 0020	16 Gallon Keg		
	BQ 1 09 0021	55 Gallon Drum		
Mobil 1 5W-20	BQ 1 09 0083	6/1 Quart Cases	Advanced full synthetic formulation designed to meet the requirements of many newer vehicles including Hondas, Fords, Chryslers, and newer Toyotas	Vehicles that require 5W-20
	BQ 1 09 0084	55 Gallon Drum		
Mobil 1 0W-20 AFE	BQ 1 09 0169	6/1 Quart Cases	Advanced full synthetic formulation designed for enhanced fuel economy and cold weather performance	Most vehicles that specify 0W-20 (newer Toyotas and Hondas), 5W-20 and certain hybrids
	BQ 1 09 0168	55 Gallon Drum		
Mobil 1 0W-30 AFE	BQ 1 09 0174	6/1 Quart Cases	Advanced full synthetic formulation designed for enhanced fuel economy and cold weather performance	Most vehicles that specify 5W-30 or 10W-30
Mobil 1 Synthetic ATF	BQ 1 09 0164	6/1 Quart Cases	Multi-vehicle, fully synthetic fluid designed to meet the demanding requirements of modern passenger vehicles	Vehicles that require Dexron III, Ford Mercon and Mercon V performance levels
	BQ 1 09 0163	55 Gallon Drum		
Mobil 1 15W-50	BQ 1 09 0023	55 Gallon Drum	Boosted, higher viscosity, advanced full synthetic formula designed for performance vehicles	HT/HS applications. Racing and Flat tappet applications
Mobil 1 Gear Oil (Mobil 1 Gear Lube 75W-90)	BQ 1 09 0085	12/1 Quart Cases	Exceeds the most severe service requirements in both conventional and limited slip applications	SUITABLE for use in modern high performance automobiles like SUV's, Vans and Light duty trucks requiring API GL-5 level performance

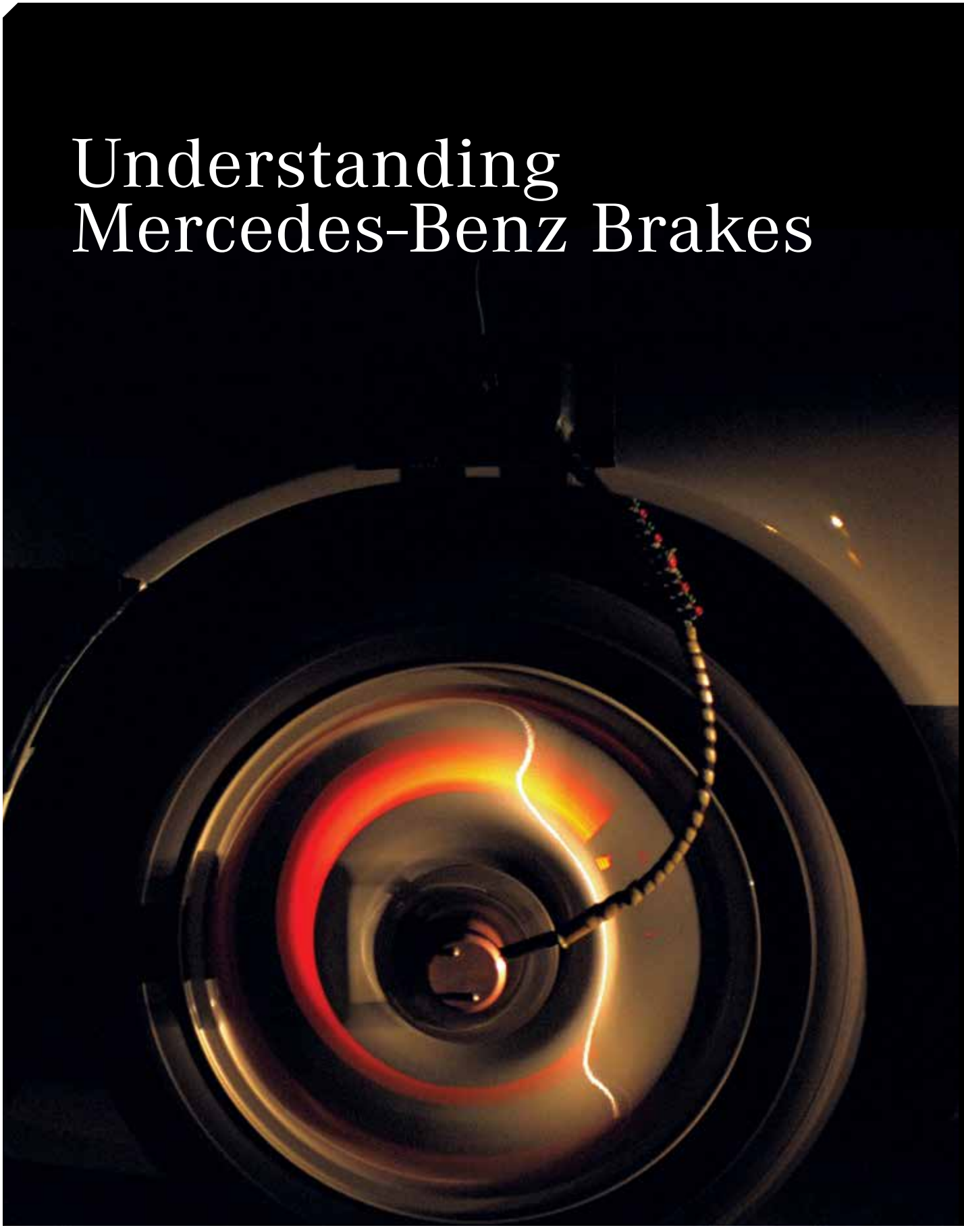
Mercedes-Benz automobiles are designed to perform on the most challenging roads and conditions. Shouldn't the oil used in Mercedes-Benz engines do the same? We think so.

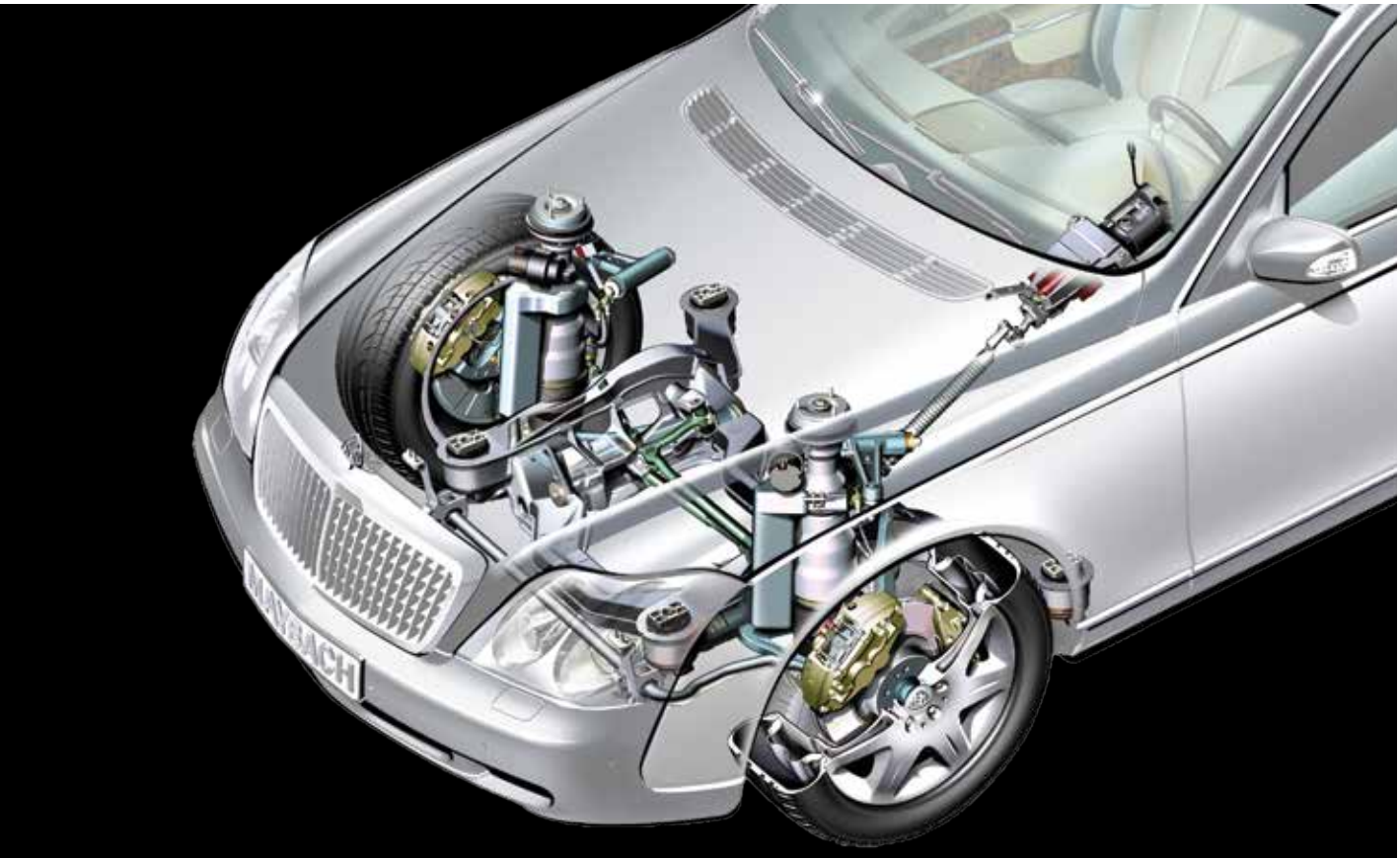
That's why Mercedes-Benz and Mobil 1 have partnered to offer an unbeatable combination of total engine performance and driving luxury.

Please have a look at our oil portfolio which is available through your local Mercedes-Benz dealer. Our dealers are able to offer you a wide variety of oil grades at competitive prices.

Product Name	Part Number	Quantity	Product Description	Recommended Consumer Applications
Mercedes-Benz SPEC.				
Mobil 1 Gear Oil (Mobil 1 Gear Lube 75W-90)	BQ 1 09 0085	12/1 Quart Cases	Exceeds the most severe service requirements in both conventional and limited slip applications	SUITABLE for use in modern high performance automobiles like SUV's, Vans and Light duty trucks requiring API GL-5 level performance
Mobil Special 5W-30	BQ 1 09 002464	Bulk - No Equipment	Formulated from quality base stocks combined with modern performance additives to give the engine the expected protection and performance under a wide variety of operating conditions	Recommended for gasoline fueled automobiles and light duty trucks requiring an API SN/SM/SL/SJ
	BQ 1 09 0171	12/1 Quart Cases		
	BQ 1 09 003064	55 Gallon Drum		
Mobil Special 10W-30	BQ 1 09 003164	Bulk - No Equipment	Formulated from quality base stocks combined with modern performance additives to give the engine the expected protection and performance under a wide variety of operating conditions	Recommended for gasoline fueled automobiles and light duty trucks requiring an API SN/SM/SL/SJ
	BQ 1 09 0172	12/1 Quart Cases		
	BQ 1 09 003764	55 Gallon Drum		
Mobil Special 10W-40	BQ 1 09 003864	Bulk - No Equipment	Formulated from quality base stocks combined with modern performance additives to give the engine the expected protection and performance under a wide variety of operating conditions	Recommended for gasoline fueled automobiles and light duty trucks where a higher viscosity API SN/SMSL/SJ oil is preferred or recommended
	BQ 1 09 0173	12/1 Quart Cases		
	BQ 1 09 004464	55 Gallon Drum		
Mobil Special 5W-20	BQ 1 09 012464	Bulk - No Equipment	Formulated from quality base stocks combined with modern performance additives to give the engine the expected protection and performance under a wide variety of operating conditions	Recommended for gasoline fueled automobiles and light duty trucks requiring an API SN/SM/SL/SJ
	BQ 1 09 0170	12/1 Quart Cases		
	BQ 1 09 013264	55 Gallon Drum		
Mobil Special 20W-50	BQ 1 09 004664	55 Gallon Drum	Formulated from quality base stocks combined with modern performance additives to give the engine the expected protection and performance under a wide variety of operating conditions	Recommended for gasoline fueled automobiles and light duty trucks where a higher viscosity API SN/SMSL/SJ oil is preferred or recommended
Mobil Delvac 1300 Super 15W40	BQ 1 09 0053	Bulk - No Equipment	Extra high performance diesel engine oils that help extend engine life in the most severe on and off-highway applications while delivering outstanding performance in modern, high-output, low-emission engines including those with Exhaust Gas Recirculation (EGR) and Aftertreatment Systems with Diesel Particulate Filters (DPFs) and Diesel Oxidation Catalysts (DOCs)	Specifically recommended for the latest low-emissions, high performance diesel applications equipped with aftertreatment systems using Diesel Particulate Filter (DPF) and Diesel Oxidation Catalyst (DOC) technologies
	BQ 1 09 0058	12/1 Quart Cases		
	BQ 1 09 0059	4/1 Gallon Cases		
	BQ 1 09 0060	55 Gallon Drum		
Mobil Delvac 1300 Super 10W30	BQ 1 09 0086	Bulk - No Equipment		
Mobil Delvac 1 5W40	BQ 1 09 0051	4/1 Gallon Cases	Fully synthetic supreme performance heavy duty diesel engine oil that helps extend engine life while providing long drain capability and fuel economy for modern diesel engines operating in severe applications	Recommended for use in all super high performance diesel applications, including modern low emission engine designs with Exhaust Gas Recirculation (EGR)
	BQ 1 09 0052	55 Gallon Drum		
Mobil Grease XHP 222	BQ 1 09 0078	60/14 oz Cartridge	Formulated to provide excellent high temperature performance with superb adhesion, structural stability and resistance to water contamination	Recommended for industrial and marine applications, chassis components and farm equipment
	BQ 1 09 0079	120 lb Keg		
	BQ 1 09 0080	400 lb Drum		
	BQ 1 09 0098	40/14 oz Cartridge		
Mobil Lube HD Plus 80W90	BQ 1 09 0096	120 lb Keg	Extra high performance, automotive lubricant formulated from select base oils and an advanced additive system specifically for limited-slip differentials	Recommended for use in limited-slip differentials, axles, and final drives requiring API GL-5 level performance
	BQ 1 09 0097	400 lb Drum		

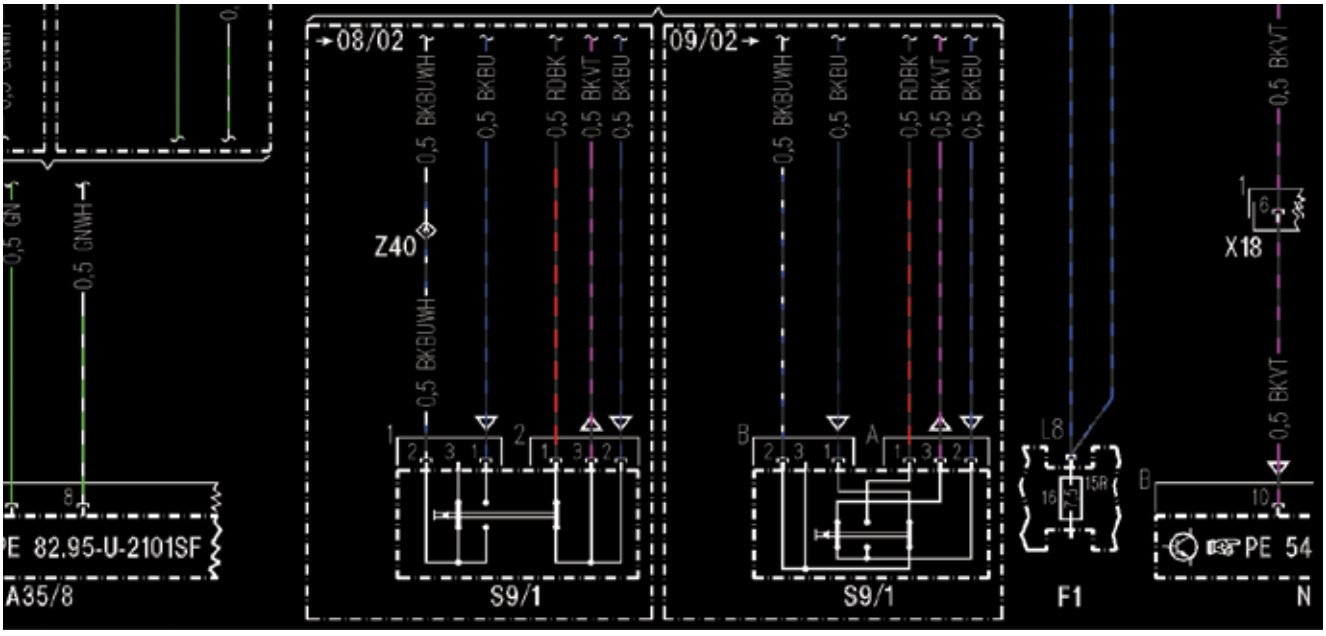
Understanding Mercedes-Benz Brakes





Where safety is concerned, what's more important than brakes? And now, of course, lots of sophisticated electronics are involved in stopping a vehicle. We need to keep up to speed on the systems that help cars slow down, yet not lose sight of the basics.

One of the most common things we do for our customers is brake service. Brakes are probably the most important system on the car -- aside from the powertrain that gets it rolling in the first place. Our customers are very sensitive to their brakes, so it behooves us to be very concerned with them, too. For years, much of their discomfort has been with noisy braking. They seemed to complain more about the squeal from a new set of pads than about any deficiency in how the vehicle actually stopped. But noise is just one of several potential problems in a modern braking system, and service is more than just relining.



The brake switch is a major input. Mercedes-Benz uses a dual switch with opposite contacts. One switch is normally open (NO), and the second is normally closed (NC). Both of these switches change voltage readings when the brakes are applied, as you can see in this diagram.

Much better decel control

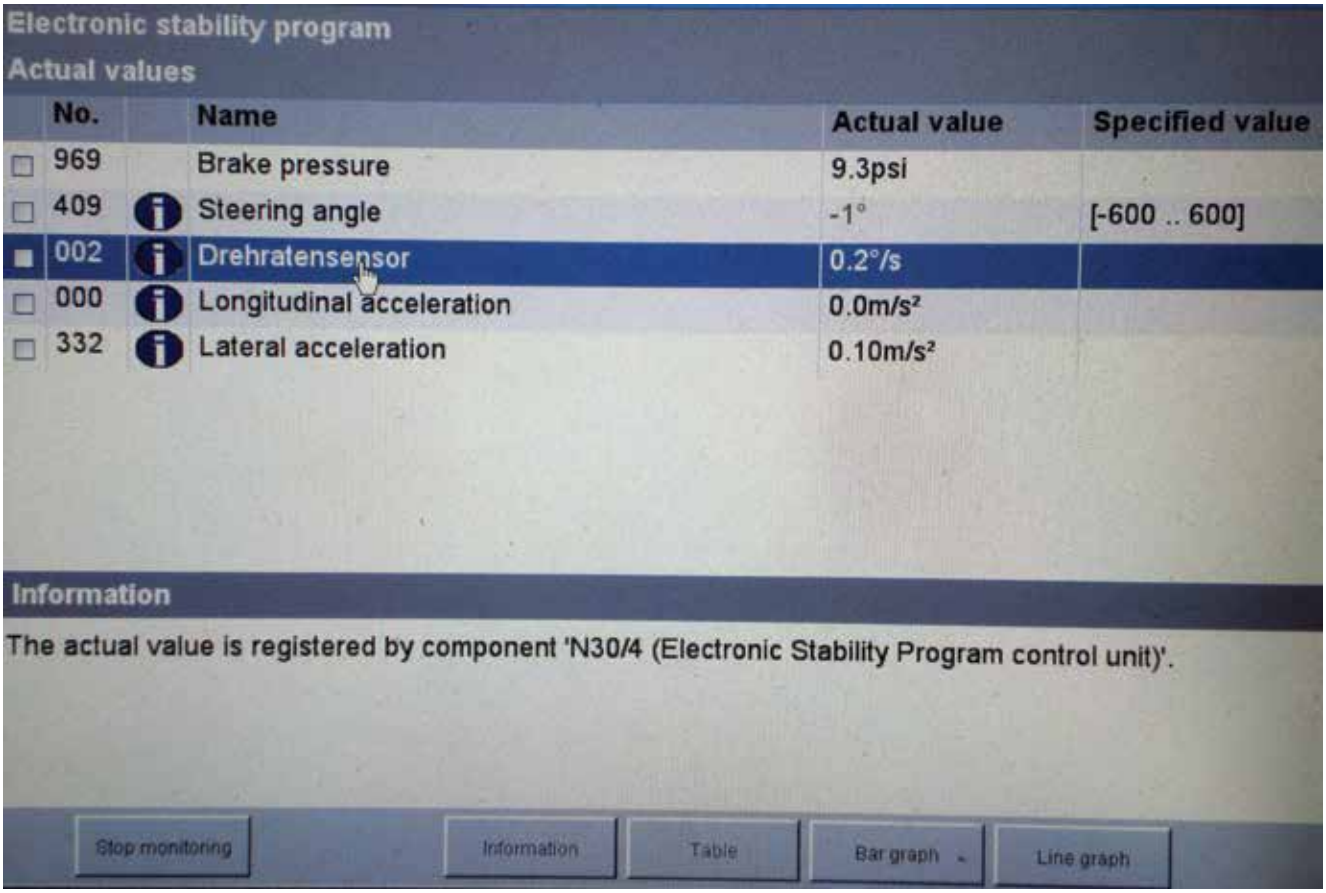
Many years ago before the advent of Anti-Lock Braking Systems (ABS), braking was a fairly simple operation. The driver would step on the pedal, which pushed a piston into a cylinder, which in turn generated hydraulic pressure that was routed to calipers that clamped friction material against rotors, thus converting rotating kinetic energy into heat energy and slowing the car. With such a rudimentary arrangement, panic stops may become a scary issue. If the braking force of any caliper exceeded the grip its tire had on the road, that wheel would lock up and the driver could be in danger of losing control. So, ABS qualifies as perhaps one of the greatest safety advances in automotive history. It, and further improvements in driver control, however, added complexities (especially the electrohydraulic variety) that we in the service business must understand before we can perform proper diagnoses.

ABS made electronic traction and stability control systems possible, and greatly improved the ability of even the best driver to deal with emergency stops and maneuvers, especially in conditions where traction is compromised. ABS took over braking during hard stops, Anti-Slip Reduction (ASR) applied the brakes to a wheel that has lost traction under acceleration (along with "relaxing" the throttle to reduce engine output), and the Electronic Stability Program (ESP) combined ABS and ASR (and in some models, systems that adjusted suspension stiffness, or even offered active suspension intervention) to orchestrate what some drivers have called "the hand of God" effect to help prevent accidents.

Of course, these systems add complexity, making diagnosis a high-tech enterprise when problems crop up. Over the past couple of decades, automotive technicians have had learn how to isolate the cause of a customer complaint: Is it mechanical, or electronic? Self-diagnostics have helped, but the electronic control unit must be able to see the problem for the program to work. Take, for example, a complaint that is familiar to all of us: low-speed ABS activation when traction conditions are normal.

Faulty signal

If no fault codes are present, why is the ABS causing this pulsation? A likely scenario is that as the vehicle slows to a stop, a faulty signal from



You can use your SDS/XENTRY to monitor many inputs, including that for brake pressure. You should know what options the vehicle came with so you can look into the correct control unit. Here we have the brake pressure at 9.3Bar on a vehicle with ESP, so we are looking in the ESP control unit.

a wheel speed sensor (possible causes include high resistance in the sensor or wiring, debris interfering with the magnetic field from the tone ring, etc.) tells the control unit that a wheel is locking up even though it's actually turning normally. Taking the speed signals from the other wheels into account, the control unit merely does what it was designed to do, and takes over the braking of the wheel with the weak signal. No code is flagged because this looks like normal intervention to the electronics.

So, it is our job to find out which signal(s) is/are the problem. Luckily for us, Mercedes-Benz has incorporated one of the most comprehensive diagnostic systems in the industry. With an SDS/XENTRY system, can access DTCs, live data and activations. Something to keep in mind is that ABS, ASR, and ESP are all shut down while in the self-diagnostic mode. So, if you road test the vehicle, do it in a safe place. Remember that it is much safer to have someone else drive while you watch the scan tool. Monitoring the wheel speed sensor readings as interpreted by the ABS/ESP control unit should identify the problem.

All of these electronic controls depend on two other systems operating properly: the friction-producing mechanical components, and the hydraulics that empower them. Some of us technicians (present company included) jump right to the scan tool to look for codes. While this is not a terrible idea, if no codes are present we need to have a diagnostic strategy that will give us the results we want in a cost-effective manner. To be able to diagnose a braking complaint, you should have a complete understanding of the systems involved. Of course, this will depend on the particular systems the vehicle you are working on includes. Most vehicles brought to the

United States have the high-end options, but with so many possible combinations you are going to need to know the differences. Going back to the early '90s, the possibilities are:

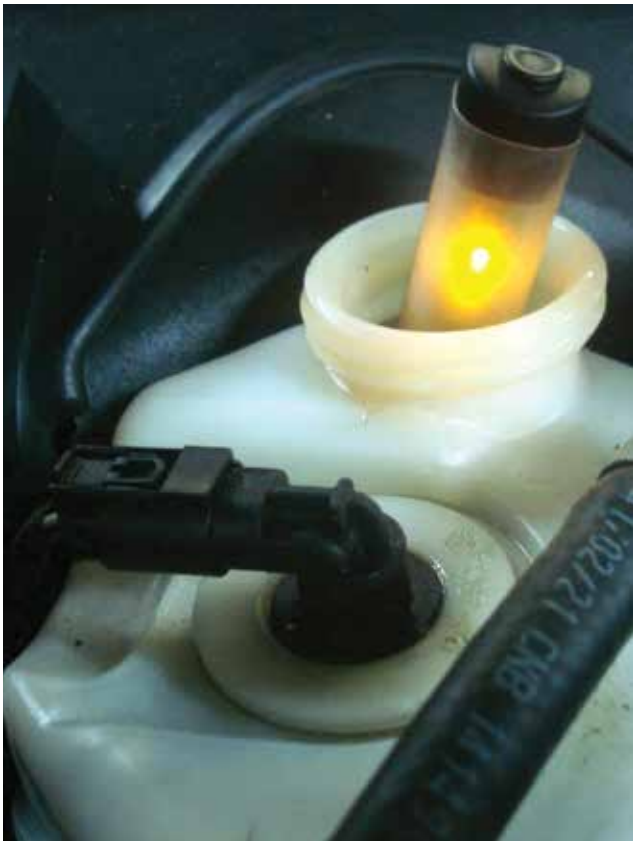
- ABS (Anti-Lock Brake System),
- ASR (Acceleration Slip Reduction),
- ETS (Electronic Traction System),
- ESP (Electronic Stability Program),
- BAS (Brake Assist System),
- 4ETS (4Matic + ETS),
- SBC (Sensotronic Brake Control)

This is not to mention earlier systems, such as ASD (Automatic Locking Differential).

Sound foundation?

Before you jump into any deep diagnostic work, you first should have a look at the basics involved. These include some systems that you might not think of when evaluating a braking problem. Certainly, you should perform a visual inspection of the brake system hydraulic and mechanical components. The master cylinder must supply the necessary fluid pressure (except in the SBC system) through the brake lines to the calipers. The calipers must move freely on their guide sleeves in a floating caliper design. With fixed calipers, the pistons need to move freely or uneven brake pad wear will result, as well as uneven braking at each wheel. These factors are obviously related to braking, but others are not so obvious. As with any other computer-controlled system, stable voltage supply and ground are requirements. This is why you cannot overlook the charging system and battery, although more than likely a control unit will flag DTCs if there's a problem.

One major service procedure (and opportunity!) that is too often overlooked is flushing out the hydraulic system and replacing the brake fluid. Mercedes-Benz maintenance schedules state that this should be done every two years, or 20,000 miles. Brake fluid is hygroscopic, which means it absorbs moisture from the air at any opportunity, particularly in the master cylinder reservoir. A very important characteristic of brake fluid is its ability to handle the heat generated during braking. If there is water in the brake fluid, it will boil at a much lower temperature than the brake fluid itself. While fluids aren't compressible, the steam created in this situation is. So, the driver depresses the pedal, the gas vapors compress, and the pedal hits the floor. Vigorous pumping may be necessary to get enough psi to the calipers to stop the vehicle. Many people would not even know enough to do that, and a very dangerous state of affairs arises.



There are tools available that test the water content in the brake fluid. Here, the amber light indicates the presence of excessive water in the master cylinder reservoir. Mercedes-Benz recommends that you flush the brake fluid every two to three years as important basic maintenance. This will keep the fluid boiling point high to help insure consistent performance under heavy braking, and go a long way in preventing corrosion.

Also, as the seals within the hydraulic braking system wear, debris can become suspended in the brake fluid, or accumulate within areas of the hydraulic circuit. This can cause pistons or valves within the ABS/ESP system to stick or jam. A brake fluid flush removes most of these contaminants, so amounts to cheap insurance against expensive repairs.

The SBC control unit contains the charge pump and accumulator that generate and store the brake fluid pressure used to stop the vehicle. When servicing this unit, or any other component in the brake system, you need to deactivate SBC. This brings fluid pressure low enough so you can open the hydraulics, or simply change the brake pads.

While over the long history of hydraulic brakes numerous means of flushing and bleeding the system have been used, with a conventional brake system (master cylinder, ABS/ASR control unit, and calipers), the only procedure approved by Mercedes-Benz is the use of a pressure bleeding unit installed on the master cylinder reservoir, which keeps the reservoir full while the bleeders are opened.

Unconventional Sensotronic

The Sensotronic Brake Control (SBC) system is easy to identify. It does not have a booster to amplify the force of the driver's leg to the master cylinder. Instead, it has a Brake Operating Unit (BOU). This houses the reservoir, the tandem master cylinder, and a brake pressure simulator. The master cylinder isn't normally in operation, and is only present in case of total SBC failure. The pressure generated in the master cylinder is directed to the two front wheels only. The brake pressure simulator simply gives the driver the feel of a conventional brake pedal for an added level of comfort and familiarity.

Only during an SBC failure is there a limited direct mechanical/hydraulic connection between the brake pedal/master cylinder and the calipers. Normally, a Pedal Value Sensor sends the braking request to the SBC control module. This determines how to match braking request and apply the proper amount of brake pressure to the calipers. The SBC hydraulic unit has a charge pump and accumulator built in to generate and store its own pressure.

A self-check system engages each time the vehicle's CAN systems are "woken-up." This means when the door handle is touched, the ignition key is installed in the EIS, and/or the key is turned on. During the pre-drive check, pressure

is applied to the calipers. If you activate the pre-drive check with the brake pads removed, the pistons may be forced out of the calipers. Therefore, before performing any service work on the brake system, you need to deactivate the SBC system. This can be done with your SDS/XENTRY. Once you have deactivated the SBC and finished the service work, you will need to activate the system (also done with the SDS/XENTRY).

When flushing the brake fluid, you will be replacing over 1.5 liters with an SBC system, less with conventional brakes. Make sure to keep the reservoir fluid full while bleeding. The charge pump runs during the procedure, so make sure the bleeder hose is securely attached.

Since SBC generates its own pressure, the bleeding procedure is not conventional. SDS/XENTRY software is required. Start at the right rear wheel, and continue clockwise to the right front wheel. The charge pump is activated throughout the procedure, so securely attach the special adapter to the bleed screw, or you'll have a slippery puddle on the floor. You will be instructed when to open and close the bleeder screws. You will be replacing approximately 1.5 liters of fluid, so be sure the fluid level in the reservoir of the pressure bleeding unit remains adequate.

BAS muscle

Conventional brake systems require a brake booster to amplify the force applied to the master cylinder. Mercedes-Benz developed BAS (Brake Assist System) to provide additional force during panic stops. In a normal brake booster, the amount of force depends on the volume of engine intake manifold vacuum it contains. For BAS, Mercedes-Benz uses a two-stage booster. With the engine off, barometric pressure bears on both sides of the diaphragm. With the engine running, both sides of the diaphragm are subjected to manifold vacuum. During normal braking, slightly more vacuum is held on the master cylinder side than on the brake pedal side. This difference in pressure applies force to the master cylinder. During a panic stop, manifold vacuum is still applied to the master cylinder side, but the BAS opens a solenoid releasing all the vacuum on the pedal side. This applies even more force to the master cylinder, thus generating greater brake fluid pressure throughout the system. ABS and ESP still monitor wheel lock-up and control the brake fluid pressure accordingly.

By having an in-depth understanding of how Mercedes-Benz systems operate and are integrated, you can provide the proper diagnostic and maintenance services that your customers have come to expect from you. Mercedes-Benz is a partner in this effort, recommending maintenance intervals, supplying accurate information on service procedures, and supplying genuine OEM parts to your local dealer. As a result of this partnership, everyone wins. |

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