

STARTUNED®

Information for the Independent Mercedes-Benz Service Professional

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INSIDE:

ABS UPDATE

ELIMINATING INTAKE TRACT DEPOSITS

ARE YOU A PAD HANGER?

BONDING AND RIVETING

Mercedes-Benz





Yet Another Great Benefit for Independent Repair Shops

It's well-known that the best way to maintain the integrity, safety, and performance of Mercedes-Benz vehicles is by always using Genuine Mercedes-Benz replacement parts. Doing so was recently made an even better business decision with the introduction of the StarParts program, which offers independent repair shops a more cost-competitive line of the most common replacement parts.

And now comes StarRewards, a brand-new program that actually pays you to buy parts from your local Mercedes-Benz dealership's parts department.

StarRewards is an appreciation program for wholesale mechanical and collision customers. It's a rebate program that is based on parts purchases, and there is no cost to enroll. It's a tiered program designed to reward increases in purchases over previous 3-month (quarterly) periods. The more you buy, the more you earn. Rewards are provided in the form of a MasterCard debit card, and can be used for purchases of any kind of products or services from businesses that accept this card.

Virtually all purchases of Genuine Mercedes-Benz parts and accessories qualify for the StarRewards program, including the recently-introduced line of price-competitive StarParts.

Enrolling in the program couldn't be simpler. You simply go online to www.MBStarRewards.com and register. Enrollment is fast and free. Your purchases will automatically be tracked on a quarterly basis, and you can monitor your purchases on your own dashboard at the website.

Once you've enrolled your shop and your credentials have been verified, Mercedes-Benz will use your purchase history to establish quarterly targets for you to reach. As you surpass these targets, you will receive rebates of as much as three percent of your purchases for the quarter. Your purchases will be tracked automatically, and your reloadable gift card will be updated with your new rewards. There's no limit to the dollar value of the rebates you can earn.

It's as simple as that!

And there are not a lot of complex rules to deal with. The StarRewards program is available to single-location independent repair facilities, including both mechanical and collision shops. Only one person per shop may enroll, and purchases must exceed \$200 in a given quarter in order to qualify for StarRewards in the subsequent quarter. While there is the usual legal fine print, there's really not much more you need to know to enroll and participate, and all the details can be found at MBStarRewards.com.

This new StarRewards program is Mercedes-Benz's way of showing its appreciation for your choosing to buy replacement parts from your local dealership's parts department. Mercedes-Benz is committed to building the finest vehicles in the world, and is also committed to supporting the independent service sector with replacement parts of OE quality, fit, and finish. Likewise, Mercedes-Benz is committed to supporting our partners in the independent service sector with products, programs, and incentives that allow ISPs to provide their customers with the highest quality service and repairs possible, while maintaining the profit margins dictated by the nature of small businesses that form the foundation of the independent service sector.

It doesn't stop here. The recent introduction of the StarParts and StarRewards programs represents the creative ways being offered to auto repair and collision repair shops to thank them for their business. Additional programs are already under development to make this partnership an even better business proposition for these important customers in the repair industry. You'll be happy to know that participants in the StarRewards program will automatically be enrolled in future programs developed to enhance the business relationship between Mercedes-Benz dealership parts departments and their valued wholesale customers.

To enroll or to learn more about this exciting new program, just visit MBStarRewards.com.

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, online 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:

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In This Issue

2 Yet Another Great Benefit for IRF

StarRewards, a brand-new program that pays you to buy parts from your local Mercedes-Benz dealership's parts department.

4 ABS Update

This safety essential is changing all the time. Make sure you understand newer systems and how they're integrated with other features.

10 Eliminating Intake Tract Deposits

Especially with direct injection, carbon build-up here is becoming a big issue. What does Mercedes-Benz recommend?

16 Wholesale Team Spotlight: Stefanie Schweigler

Stefanie and her team exist for one purpose — to make it faster, easier, and more profitable for you to buy your replacement parts from your local dealership's parts department.

20 Are You a Pad Hanger?

Hang pads? Most upscale shops have junked their brake lathes, but do you always have to replace those discs during a reline? Mercedes-Benz engineers give us the truth.

26 Adhesive Bonding & Riveting Have Evolved

The latest on materials and procedures

Visit us at our website MBWholesaleParts.com to view a wealth of information on Genuine Mercedes-Benz Parts.

Visit StarTuned.com to access an archive of *StarTuned*® issues, searchable by keyword, vehicle system and publication date.

Mercedes-Benz
The best or nothing.



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ABS Update



The 1978 S-Class (model series 116) was the first production passenger car in the world with ABS.





This safety essential is changing all the time. Make sure you understand newer systems and how they're integrated with other features.

While this 1978 ABS control unit doesn't look all that different from a modern one, it's way less sophisticated.

It's been exactly 40 years since Mercedes-Benz introduced the first commercially-viable antilock braking system to the automotive world. Although no hard statistics exist, presumably it's saved many thousands of lives, and many more serious injuries. On top of that, it set the stage for ESP (Electronic Stability Program), which has kept humankind from more grief. Of less importance to life and limb, there's the benefit of traction control, in which the spinning wheel is automatically braked so torque is sent through the differential to the other side to help keep you from getting stuck in snow or mud. And there are yet more advantages to having ABS components aboard, as we'll see.

Thanks to digital technology, the electronic components of ABS have always been capable of recording, comparing, evaluating, and transforming sensor data into governor pulses for the brakes' solenoid valves within milliseconds. Since 1984, ABS has been standard equipment on all Mercedes-Benz passenger cars. Ten years after the introduction, as many as a million Mercedes-Benz cars with ABS were being operated on the roads throughout the world.

As you'd expect, ABS development hasn't stood still, and many improvements have been made, especially through the collaboration of Mercedes-Benz and Robert Bosch. Here, we'll explain what the latest advances in this technology mean to you, the ISP (Independent Service Provider).

The innovations continue

The complete control system is becoming smaller, more efficient, and more reliable. The initial, typical pulsating of the brake pedal, indicating ABS activation, has largely been eliminated today. However, the system not only safely brakes the vehicle while maintaining perfect steering, it also serves as the basis and pulse generator for the acceleration skid control (ASR) system, the Electronic Stability Program (ESP), the Brake Assist and of course also for the electro-hydraulic brake system, Sensotronic Brake Control (SBCTM).



In Mercedes-Benz passenger cars, the wheel sensor data also serves other functions such as being processed by the electronically-controlled automatic transmission that adjusts to the driver's wishes, the navigation computer, DISTRONIC proximity control, the engine and windshield wiper control, the active suspension control (ABC), and 4MATIC. In short, almost everything in the car that is controlled on the basis of speed is using the wheel speed sensor data.

Adaptive braking

When we talk about Mercedes-Benz ABS, we are really talking about a group of integrated systems that all work together to carry out the function of safe, efficient braking. Adaptive braking (ABR) assists the driver in dangerous situations that occur suddenly, so it's an active safety component. The ESP control unit (N30/4) evaluates data from the following components in order to detect the current driving situation:

1. Yaw rate, lateral and longitudinal acceleration sensor
2. Wheel speed sensors or axle rpm sensors (all four)
3. Steering angle sensor
4. Stop lamp switch

The ABR system is made up of the following sub-functions:

- Electronic stability program (ESP)
- Electronic brake force distribution
- Exhaust test/roller dynamometer mode
- Antilock brake system
- Acceleration skid control (ASR), electronic traction system (ETS)
- Brake Assist System (BAS), or BAS Plus
- Trailer stabilization
- Hill start assist
- Various other functions based on model numbers and option codes.

ESP

ESP prevents the vehicle from breaking away when oversteering or understeering. It helps keep the vehicle from deviating from the course intended by the driver. Brake forces are distributed selectively to the

individual wheels to correct any deviation. In addition, reduction of the drive torque takes place in order to increase directional stability and road adhesion. The ESP control unit processes the following measurement quantities to determine the vehicle's behavior:

1. Yaw velocity
2. Steering wheel angle
3. Brake pressure
4. Engine torque
5. Transmission stage
6. Lateral acceleration

Two types of intervention can take place. In the case of oversteer (fishtailing), brake pressure is built up at the outer front wheel. The resulting reduction in lateral force at this wheel generates a yawing moment which counteracts the tendency of the vehicle to rotate inward. Speed decreases as a result of the brake force at the front wheel, which also enhances stability. In the case of understeer, the maximum possible lateral force at the front axle has been exceeded. In other words, the vehicle pushes via the front axle to the outer edge of the curve. The rear inner wheel is braked to generate a torque to help counteract the "plowing." If the driver presses the accelerator pedal at this time, the drive torque will be reduced first.

SBC brake control

One of the most complex systems involving ABS that you will encounter today is Sensotronic Brake Control (SBC).



The SBC hydraulic unit

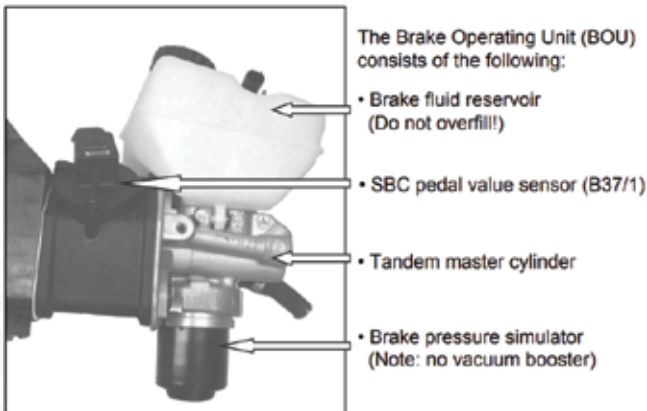
You will probably only see this on S-Class models, some 212 E-Class models, and a few others, but you should be prepared. The SBC assists the driver in dangerous situations that occur suddenly, thus serving as an active safety component. SBC is an electro-hydraulic brake system that controls the braking requests for each wheel individually via “brake-by-wire.”

In normal operation, the hydraulic link between brake pedal and the wheel brakes is interrupted by separation valves. In contrast to conventional pre-ABS brakes, electro-hydraulic control is actuated for each type of braking application. This provides some advantages such as improved metering of the required brake pressure, reduction in stopping distances, and improved vehicle safety dynamics.

The main components of the SBC system include the SBC hydraulic unit (A7/3) with SBC control unit



Brake Operating Unit



The brake pedal sensor with the master unit

(A7/3n1), ESP, SPS, and BAS control units (N47/5), the steering angle sensor (N49), the steering column tube module (N80), the yaw rate and lateral acceleration sensor (B24/15), the SBC pedal value sensor (B37/1), and the wheel speed or rpm sensors.

The SBC hydraulic unit is located at the right front of the engine compartment. The SBC control unit is installed on the SBC hydraulic unit. The SBC control unit has these responsibilities:

- Records the driver’s brake application via the SBC pedal value sensor (B37/1) and the front axle pre-pressure sensor (A7/3b1)
- Supplies the ESP with data about how rapidly the driver wishes to brake, and the pre-pressures at the individual wheels via its own CAN (Controller Area Network)
- Supplies the ESP with the vehicle speed signal directly via its own CAN
 - Carries out all control functions during normal braking
 - Performs all pressure control functions for ABS, ASR, ESP, and BAS control
 - Passes on the brake lights signal to the rear SAM control unit with fuse and relay module (N10/2) to directly actuate the brake lights through the CAN (ESP, SPS, and BAS control unit)

The SBC pedal value sensor’s main task is conveying information on the position of the brake pedal to the SBC control unit (at the right front of the engine compartment) via a Hall sensor. The sensor has a mechanism that converts the vertical movement of the brake pedal into a rotary movement for the sensor.

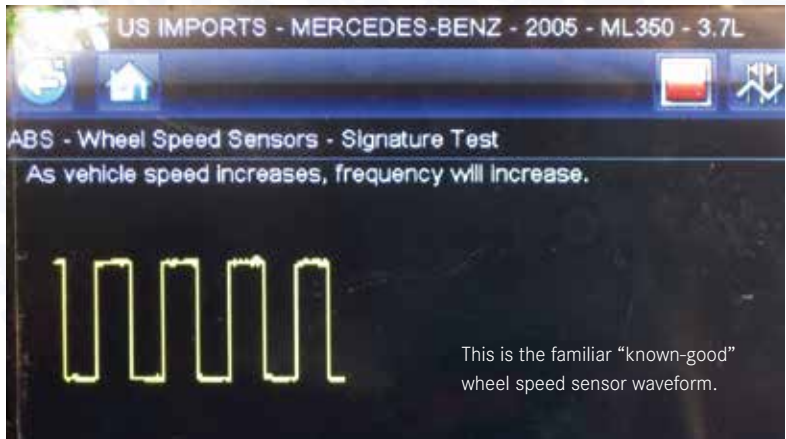
The yaw rate and lateral acceleration sensor is located under the rear SAM control unit. This measures the yaw rate about the vertical axis of the vehicle. The integrated lateral acceleration sensor (AY sensor) measures the lateral acceleration. The integrated longitudinal acceleration sensor reports on the vehicle’s pitching motion. The respective signals from these sensors are read by the ESP, SPS, and BAS control units.

The wheel speed or rpm sensors are located in the front at each steering knuckle, and the left and right rear sensors are mounted on the rear axle wheel carrier. These sensors have not changed much in recent years. They are still the Hall Effect type, which sends data on current wheel speeds to the SBC

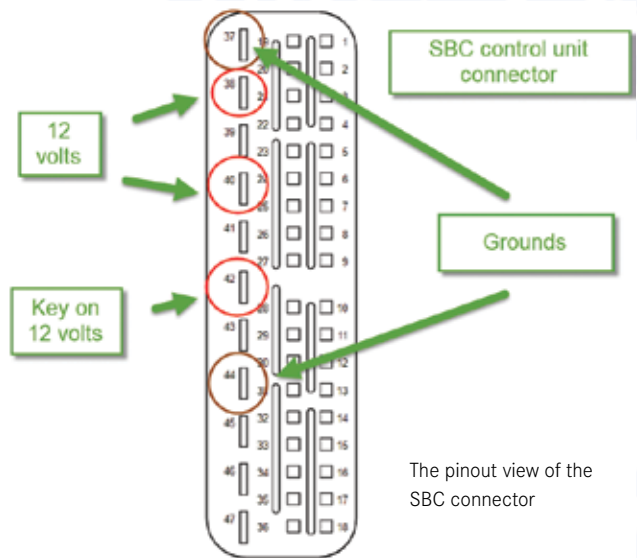
left and right control units. The newer sensors, however, are more sensitive than they once were, and can detect unsatisfactory installation positions and relay this information to the SBC control unit as well. They still produce the square wave form you are used to seeing when you are performing a diagnostic test to see if you have a faulty sensor.

Here's where it is imperative to make sure of a clean installation and proper torqueing of new or replacement units in order to avoid complications with your repair. Use a little high-temperature lubricant in the bore of the housing to ensure a proper seating of the new sensor.

The steering column module is located on the steering column, as you would expect. The module is connected to the engine compartment and interior CANs. Communication between the multi-function steering wheel and the steering column tube module takes place via the LIN network. It's designed to read the sensor switches, buttons, and signals so that the SBC sees all possible driver requests and settings. The steering angle sensor is also integrated into the steering column tube module. The sensor records the current position of the steering wheel and provides the steering column tube module with a voltage signal proportional to the steering lock angle.



This is the familiar "known-good" wheel speed sensor waveform.

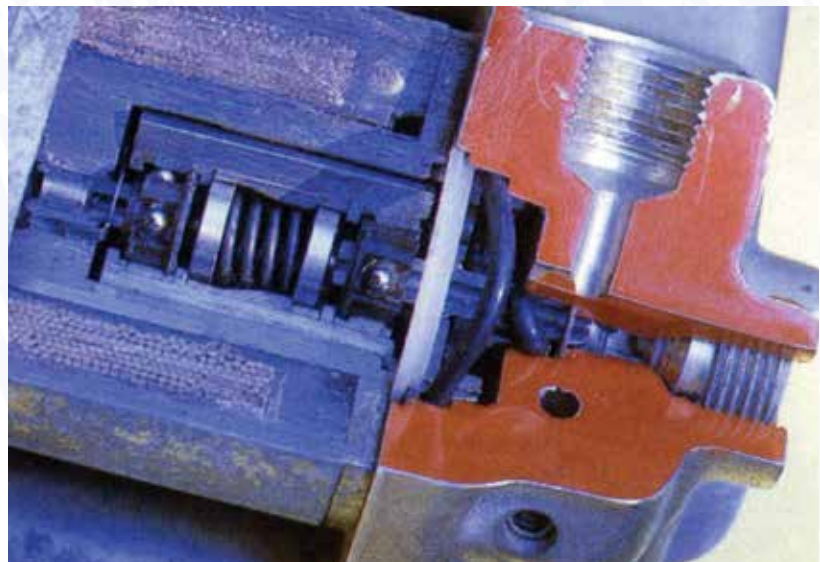


The pinout view of the SBC connector

Troubleshooting

A common symptom scenario: The customer states that the ABS and Sensotronic Brake Control (SBC) warning lights are on. The instrument cluster displays "Service Brakes Visit Workshop." First, find out if any other brake work has been performed on the car. If so, here are some possible items to sleuth out:

1. If a brake flush was not performed with scan tool direction, a battery charger, and a pressure bleeder, air may have been injected into system. Perform another brake flush correctly.
2. If a brake job was performed without using a scan tool, you must



This view of an early Robert Bosch ABS hydraulic unit shows why you don't want dirty old brake fluid in your customers' cars.

connect your scan tool and correctly deactivate and reactivate the brakes. Perform a brake flush.

3. Test the Sensotronic Brake Control (SBC) system for leaks and air with the scan tool.
4. Check the operation of the pressure sensor and reservoir in SBC with the scan tool-guided tests.
5. You may find the scan tool cannot perform guided tests. If so, the SBC unit may have an internal problem such as a damaged diaphragm. Servicing this unit will be a topic for a future *StarTuned* article, but we will include an important safety note here: *Never remove, disassemble, or otherwise tamper with the SBC unit unless you are familiar with the system and the potentially dangerous pressures involved. Always deactivate and depressurize the system according to WIS recommendations before service.*
6. If the fault will not clear with a good reservoir and no air in the system, the pressure sensor in the unit has failed. Replace the Sensotronic Brake Control (SBC).

The system pressure sensor is part of the hydraulic unit and cannot be replaced separately, whereas the pressure accumulator can be replaced separately. Control units will require programming. If the fault code C249F is also set, do not perform testing. Replace the SBC as the operating time of the unit has been exceeded.



Make sure you have the proper pressure bleeding hook up before you start.

If you find yourself starting from scratch with your troubleshooting, follow these steps:

1. Connect a scan tool and check for Diagnostic Trouble Codes (DTCs) in the ESP and Sensotronic Brake Control (SBC) units.
2. With DTCs for hydraulic faults or insufficient pressure supply, inspect for brake fluid leaks or damaged hydraulic lines.
3. Perform a brake flush with a scan tool and pressure bleeder. Follow all listed instructions on the scan tool.
4. If the pump fails to build pressure, or hydraulic faults continue, replacement of the control unit is needed. Replacing this module will require a factory connector and programmer used with a factory or compatible scan tool. Of course, if you have XENTRY, you're all set.
5. Test powers and grounds to the SBC unit before replacement. See the connector pinout view in the photo.

Proper bleeding and equipment

XENTRY or a compatible scan tool with a bleeding system menu is needed for this operation. Also necessary is a battery-maintaining charger to keep the voltage constant, and a power brake bleeder. Here is the procedure from WIS:

1. Deactivate SBC brake system using STAR Diagnosis
2. Connect the battery charger
3. Connect the brake fluid changing equipment (your power bleeder)
4. Connect the scan tool
5. Raise the vehicle and remove the wheels
6. Carry out bleeding operation using STAR Diagnosis menu
7. Check the brake fluid level in the reservoir and correct if necessary

As noted above, trying to service later-model Mercedes-Benz vehicles without the proper equipment and repair information will be futile, and will result in many lost hours of work and damage to your reputation. It should be a given that only Mercedes-Benz approved DOT 4 brake fluid should be used from a clean, sealed container. Remember that brake fluid is hygroscopic and should be replaced on most vehicles every two years. Informing your customers of this need will greatly reduce their chances of future problems in the system. |

Eliminating Intake Tract Deposits



Believe it or not, the first automotive engine to use gasoline direct injection was the 1954 Mercedes-Benz Gullwing. It was a completely mechanical system, of course, and in the era of leaded gasoline, ignition points, and road draft tubes instead of PCV when nobody expected anything like the vehicular longevity we have today, carbon deposits were not considered a pressing problem.

Especially with direct injection, carbon build-up here is becoming a big issue. What does Mercedes-Benz recommend?



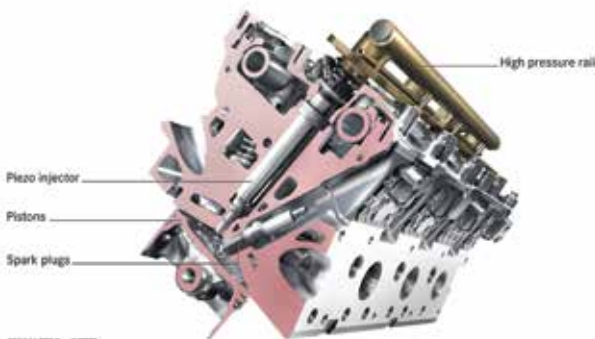
In any discussion of intake, throttle body, and injector cleaning, we should split the conversation into two categories:

1. Conventional port fuel-injected gasoline engines
2. GDI (Gasoline Direct Injection) engines

Due to the different natures of these systems in terms of how the air/fuel mixture is introduced into the engine, they each have their own unique procedures in terms of prevention and cure of intake tract deposits.

As you know, in conventional port fuel-injection the throttle body controls the flow of air into the intake manifold and the injector nozzles are aimed directly at the backs of the intake valves. Over time, the throttle body, the manifold, the ports, and the valves build up a carbon and varnish residue that, if left unchecked, will end up diminishing performance. The reason this happens is twofold. One cause is when an engine shuts down, hot exhaust gases and unburned fuel float to the top of the engine. As the vapors bake in the heat, they form black sooty carbon deposits inside the throttle body and intake. The other cause is the PCV system, which continually introduces oil vapors. These condense on the insides of the throttle body and intake manifold disrupting optimum flow.

Petrol direct injection with spray-guided combustion:
Especially quick and precise piezo injectors spray the fuel directly into the combustion chambers



This cutaway of a late-model Mercedes-Benz cylinder head with GDI shows that injection occurs in the center of the combustion chamber, so continuous cleaning of the swirl chamber and intake valves with a spray of gasoline and its additives isn't possible.



In a GDI engine, the fuel injectors have been moved from a position behind the intake valves to the combustion chambers themselves (hence “direct injection,” as most diesels have today). Since the injectors used to be in the intake runner, close to the intake valve, the gasoline with its additives would act as a cleaning agent that prevented, or at least reduced, the accumulation of oil and carbon deposits on the backs of the intake valves. That is no longer the case with GDI, so the PCV oil vapors condense and collect in the ports and on the valves much more rapidly – the typical timeframe for this to become bad enough to affect performance is 30,000 to 40,000 miles of use.

So what’s the big deal with carbon?

Carbon deposits contribute to abnormal combustion in several ways, but the most dramatic is the “sponge effect.” As the air/fuel mixture in the cylinder is compressed, the carbon has a tendency to absorb both oxygen and fuel. Once the spark fires, the flame front normally spreads through the chamber, consuming the charge. The build-up of carbon, however, has a tendency to extinguish the flame front and stifle combustion. This, combined with the lack of the air and fuel that has been soaked up, results in poor efficiency. This tends to affect performance, particularly during warm-up. A cold engine needs a relatively rich mixture, so absorbed fuel can result in a lean misfire.

When carbon deposits grow large, they can also upset the precisely-engineered pattern of air flow through the ports and in the combustion chamber.

Evolution of the GDI engine

While most conventional engines still use indirect port fuel injection, the world’s first gasoline engine with direct injection was the legendary 1954 Mercedes-Benz 300SL Gullwing. Since then, the company has pioneered direct injection for several high-efficiency European models, including the 2006 CLS350 CGI, powered by the world’s first gasoline engine with piezo-electric direct injection and spray-guided combustion. This advanced engine achieved 10 percent better fuel economy versus the normal V6 with port injection.

A number of 2012 Mercedes-Benz models are powered by engines that feature direct fuel injection. The new four-cylinder and V6 get better fuel economy while producing more pulling power – an impressive feat, considering that increasing either power or fuel economy usually decreases the other.



Carbon build-up can be huge, and very detrimental to performance



The new piezo-ceramic fuel injector operates at seemingly impossible speeds (courtesy Robert Bosch).

The new-generation SLK roadster, the new C-Class coupe, and the redesigned C-Class sedan are all available with a 1.8L inline four-cylinder engine (201 hp, 229 lb.-ft. of torque) that’s fitted with direct fuel injection and a turbocharger.

The recent GLE, the C- and E-Class lines, and the new SLK roadster can all be equipped with a 3.5L normally-aspirated V6 that produces 302 horsepower and 273 lb.-ft. utilizing multi-spark ignition as well as direct injection.

The new direct injection system

The fuel system on the new four-cylinder and V6 engines represents the third generation of modern Mercedes-Benz gasoline direct injection systems. First used on Mercedes-Benz diesels, the electronic fuel injectors spray gasoline directly into the combustion chambers.

In addition, the new V6 makes use of industry-leading electronics technology that features a piezo-ceramic crystalline element in each fuel injector. The piezo

crystal changes shape instantly when electrical current is applied, which makes it possible to design very sensitive and precise injection systems, including the ability to program several small injections with each piston stroke. This is especially impressive, considering that engines idle around 20 strokes per second, and at high speeds run at about 200 strokes per second.

This demonstrates the potential of the internal combustion engine for continued development and refinement. System pressures of electronic direct injection are similar to pre-common rail mechanical diesel injection systems – up to 2,840 psi.

Prevention and a huge maintenance factor

Since a major concern among engine manufacturers is carbon build-up caused by gasoline, Mercedes-Benz recommends the use of only “top tier” premium gasoline containing additives that retard the development of these deposits. This means fuels meeting ASTM standard D439. The octane rating must be at least 91. Spending time educating your customers will help ensure that they enjoy many trouble-free miles.

After an extended period of using fuels without high-quality additives, carbon deposits can lead to such symptoms as:

- Warm up hesitation or misfire
- Unstable idle
- Knocking or pinging
- Power loss

Mercedes-Benz recommends that no aftermarket fuel additives be used as they typically produce no measurable improvement and will only result in higher cost to the consumer.

Then there’s a large factor that’s not often mentioned: motor oil. Both the quality of the lubricant and the frequency of oil changes affect the formation of intake deposits in any engine, but especially in those with GDI. Those PCV vapors we mentioned earlier? They’re the culprit, and the use of only the highest-quality synthetic oil, and adherence to a strict fluid maintenance schedule will go a long way in preventing intake tract deposits.

Liquid methods

Routine cleaning of both types of injection systems and especially the direct-injected models will help prevent the

formation of “hard” carbon deposits, which will be more difficult to remove at a later time. Although there’s really no scheduled interval for cleaning the intake tract, most experienced shops have found that on conventional fuel injected systems a 40K-mile interval is good, whereas with a GDI engine that number drops to 30K – and some say as often as every 20K.

Any good cleaning will start with inspection of the air filter and intake duct, being sure to clean and remove any debris in the air filter housing. Using a good quality chemical made specifically for intake, you can begin with cleaning the throttle body. There are several ways to go about this. One, of course, is to simply use a spray can with a nozzle straw, and scrub with a soft rag or nylon bristle brush. Be careful not to allow too much cleaner to pool inside the intake behind the throttle body, which can cause a hydraulic lock upon startup. Some techs like to place a rag or cloth behind the opening of the throttle to soak up the excess and then fish it out afterwards.

In cases of a really coked-up throttle, you will want to remove it for a more thorough cleaning along with the rest of the intake regardless of whether or not you are working on a conventional EFI or GDI, and you will need some specialized equipment.

The process involves a high-pressure nozzle that sprays a fine mist just ahead of the throttle plates and enters the engine while it’s running. You may be pleasantly surprised at how clean you will find the throttle and intake after the procedure. You can follow up with a fuel additive if the equipment maker recommends it. Using a borescope in the intake before and after can help you to see the results – you may even want the customer to take a look.



A super-fine solvent spray mist can be introduced into the throttle body to clean the intake tract. It’s sensible maintenance.

M272/273 intake flaps

Some of the most common complaints associated with intake tract deposits will be found on the M272 and M273 engines. Excessive build-up in the intake may trigger any of the following codes:

- P2004 – Intake Manifold Runner Control Stuck Open Bank 1
- P2005 – Intake Manifold Runner Control Stuck Open Bank 2
- P2006 – Intake Manifold Runner Control Stuck Closed

The problem is caused by an air flap inside the intake manifold sticking, which causes the actuator arm to break. This results in dramatically deficient performance. There are repair kits with an improved arm, but they don't correct the cause. Again, poor fuel quality and infrequent oil changes lead to the deposit build-up that causes the stuck flap and broken arm. Once the flap is stuck, the only proper repair is replacement of the intake manifold. Prevention with routine intake cleanings can prevent this from occurring and save your customer a large expense.

What about those “hard carbon” deposits?

In cases where the motorist hasn't followed Mercedes-Benz fuel-use and oil-change recommendations, and has gone too long without routine intake tract cleaning, you may encounter deposits that will not come off with conventional chemical cleaning agents. Then, you'll need to physically remove the carbon from the intake, especially the ports and the backs of the intake valves.

One approved process is walnut shell blasting. Walnut media is effective on carbon deposits and other dirt while not damaging the integrity of the substrate materials, especially aluminum. Unlike sand or glass beads, walnut shells are perfectly safe for the engine.

This procedure, however, requires removal of the intake manifold and enough room to attach the nozzle and vacuum hose. If the engine you are working on is too tightly packed for this to be performed in the car, you will have to remove the head and send it to a

qualified machinist for full reconditioning, or see if your local Mercedes-Benz dealer's parts department has a remanufactured head available.

Before you start with walnut shell blasting, you'll still want to clean the “goo” out of the intake manifold. So, the above-mentioned chemical process would be beneficial prior to removing the manifold. Better yet, while the manifold is off you can disassemble it, remove any sensitive parts, and put it in your hot parts washer.



This vehicle has an intermittent p2004 code, meaning the intake runner flap on bank 1 is sticking. The chemical cleaning procedure may be too late.



This photo of the intake manifold runner control set-up shows the plastic levers that operate the flaps. If deposits jam movement, the levers may break.



Here's what you need to perform walnut shell blasting — not a big investment.



Could this look any worse? Driveability and performance down, emissions up.



You may need to modify the adaptor to prevent blow-back of the media.



What a difference!

Walnut shell blasting equipment is available now at a reasonable price, so if you see enough high-mileage vehicles in your shop, you might consider this purchase. You will also need a good shop vacuum — large, and with good filtration to keep dust out of the air. Don't forget to wear eye, hand, hearing, and respiratory protection. Your air compressor needs sufficient capacity to provide a continuous 100 psi.

Begin by opening the port at the top of the blaster canister and adding the media until it's about 3/4 full, thus leaving some space for compressed air (keep your media storage bag sealed up tight as even a little bit of moisture will cause clumping). Refit the canister fill top, and keep all valves closed until you're ready to start the procedure. Also, make sure you've drained any water out of the compressed air supply. Set the tool pressure to about 100psi, then open the air valve. Next, open the lower tank siphon hose and the feed hose valve for the media blasting nozzle.

Place the adaptor into the swirl chamber of the cylinder head (intake side, of course). In some cases, the adapter will be smaller than the port it is being inserted into. If you begin to blast with an air gap around the adapter, a lot of "blow back" will occur. The idea is to seal off the

chamber so the media goes in and not back at you. You may need to make some modifications to the nozzle.

Extremely important! Before you begin blasting, be absolutely certain both valves in the chamber you are working on are closed. Otherwise, you risk filling up the cylinder with walnut shells.

Connect the shop vac, then insert the adapter into the swirl chamber with the nozzle valve still closed. Before you begin blasting, turn on the shop vac and make sure there are no obstructions. The idea is that as you blast the vacuum is constantly removing the media and the carbon deposits with it.

Work in short blasts of 10 to 15 seconds. Move the nozzle in and out and around in a circle to clean as much surface area as possible per blast. Close the nozzle valve and allow the vacuum to run for a few more seconds to clear the swirl chamber.

While this process produces excellent results, it should be obvious that convincing your customers to use top-tier gasoline and to follow Mercedes-Benz's recommendations where oil quality and maintenance are concerned will eventually prove to them that you give excellent advice. |

WHERE DO ALL OF THESE GREAT PROGRAMS COME FROM?

If you're reading this now in *StarTuned*, it's likely that you own, manage, or are otherwise employed at an independent repair shop or collision repair facility that does a large amount of repair and maintenance work on Mercedes-Benz vehicles. If so, you've certainly noticed over the last few years that Mercedes-Benz, in concert with your local dealership, has become very aggressive in implementing programs and services to make it easier and more profitable for you to buy replacement parts from that dealership's parts department.

But where do these ideas come from? Who dreams them up and then takes steps to see that they are implemented in a professional and effective manner?

As you would expect, these ideas come from a dedicated team of experts with a deep understanding of the parts aftermarket and a keen comprehension of the business model typical of independent repair shops.

Heading up this team is Stefanie Schweigler, who carries the title of Program Lead, Wholesale Business Development. Stefanie and her team exist for one purpose — to make it faster, easier, and more profitable for you to buy your replacement parts from your local dealership's parts department.

You've seen the fruits of their labor in the recently-introduced *StarParts*, a price-competitive line of the most commonly-replaced maintenance items in Mercedes-Benz vehicles. And, as you'll read in the pages of this issue of *StarTuned*, Stefanie and her team have just launched Mercedes-Benz *StarRewards*, a program that provides cash rebates for your purchases from your local dealership.

Other programs conceived and implemented by Stefanie and her colleagues include the *PartsPro* dealership wholesale certification program, the *Genuine PartProtection* extended limited parts and labor warranty, and of course *RepairLink* and *CollisionLink*, the advanced online parts ordering systems that speed the placement of parts orders.

So what would qualify a person to head up such an important business unit? If you immediately thought of someone with several decades of experience working within the Mercedes-Benz family and an M.B.A. from a prestigious university, you'd have a good understanding of Stefanie Schweigler. Stefanie has spent most of her

working career with MBUSA, nearly two decades, virtually all of which has involved helping dealerships build relationships with their independent repair shops wholesale business customers.

Her work has involved many tools, initiatives, and programs directly targeting the wholesale business community, including implementation of a particularly user-friendly website, and the development and distribution of technical publications and resources such as the publication you're reading right now.

Stefanie is adamant that the success of MBUSA's wholesale parts initiative is founded on a close working relationship between the Mercedes-Benz dealerships and the independent repair shops, which have a choice as to where to buy their replacement parts. By enhancing the availability of, and access to, OEM parts, Stefanie and her team have a keen understanding of the importance of "Just In Time" delivery to shops that can't afford to tie up service bays for days waiting for parts.

Furthermore, she feels strongly that support of all kinds — technical, marketing, and business management — build a partnership that engenders mutual trust, loyalty, and appreciation of the needs of their business partners.

Just think of all of the support available to you from Mercedes-Benz dealerships — *StarParts*, the newly-introduced *StarRewards* program, dedicated wholesale parts specialists, trainers, outside sales consultants, fast and accurate online ordering if you choose, aggressive pricing structures to keep *Genuine Mercedes-Benz* replacement parts cost-competitive, and customer-driven delivery schedules.

These value-added support services complement the many other reasons to patronize your local dealership's parts department and wholesale parts specialists — all thanks to folks like Stefanie Schweigler, whose full-time job is to make your business more efficient and profitable. |



Stefanie Schweigler

Who's Your *Partner* in Success? Mercedes-Benz's

You've chosen your career as an ISP (Independent Service Provider) because you enjoy maintaining, diagnosing, and repairing motor vehicles. One of the most challenging pieces of your business is parts procurement.

Finding the right parts at the right price and being certain they will arrive when promised can be a challenge.

Wouldn't it be nice if there were a way to get the parts you need without the hassle and uncertainty, so you can get back to the important business of actually fixing cars and taking care of your customers?

With the Mercedes-Benz PartsPro wholesale certification program, now there is!

PartsPro is a rigorous program intended to train Mercedes-Benz dealership parts department personnel on how to better take care of you and ultimately your customers. PartsPro certified dealers have elevated their commitment to supporting the independent repair channel, and will provide you with the highest level of customer service. They focus on the things that matter most to you!

Convenience...Accuracy... Profitability...Delivery

A PartsPro dealer has the tools in place to better meet the needs of their esteemed wholesale customers.

For a dealership to achieve PartsPro Certification, parts department personnel must first undergo intensive "customer-centric" training which teaches personnel how to better help YOU.

There's far more to PartsPro than just customer-service training. The dealership must make specific commitments to provide "Best in Class" service in areas such as logistics, which includes ISP-focused parts availability, regular delivery service, outside sales people to provide you personalized service, as well as a dedicated phone line and "will call" pick up area.

Then there's technical help

On occasion we all need a helping hand. Your PartsPro dealer is there to assist. Whether it means providing diagnostic assistance, information on supplies or special tools, or anything else you may need, your PartsPro dealer is there to assist you in repairing your customers' Mercedes-Benz vehicles and getting them back on the road as fast as possible.

Only those dealerships that meet the stringent certification requirements earn the right to display the "PartsPro" logo. Additionally, they receive ongoing consultation and training to ensure that they are consistently providing the very best support to you, the ISP customer.

We hope you are already receiving industry leading service from your Mercedes-Benz dealer; however, once your dealer is PartsPro Certified, we believe you'll be thrilled with the new "Best in Class" parts-procurement experience!

Of course, you'll continue to have the peace of mind that installing only Genuine Mercedes-Benz parts can provide. |





\$966.00
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Mercedes-Benz

The best or nothing.

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One remanufactured engine pulls the plug on climate-damaging CO₂ and saves 447 days of power for one laptop.



Are You a Pad Hanger?

Hang pads? Most upscale shops have junked their brake lathes, but do you always have to replace those discs during a reline? Mercedes-Benz engineers give us the truth.

From the point of view of easy work and profitability, some of the best jobs we see in the shop involve brakes. Aside from “A” and “B” services, nothing’s better. We’ve sold our customers on the benefits of brake fluid replacement – some only after a caliper froze up – and hanging pads is fast and profitable. Doing it wrong only saves a few minutes compared to doing it right, so let’s look at what it takes to keep our customers able to stop on a dime.

It all starts with brake pads, of course, but there is quite a bit beyond that. Before we start, though, let’s make it clear that we’re going to talk about typical brake systems with ordinary materials: No carbon fiber racing brakes today, sorry.

StarParts

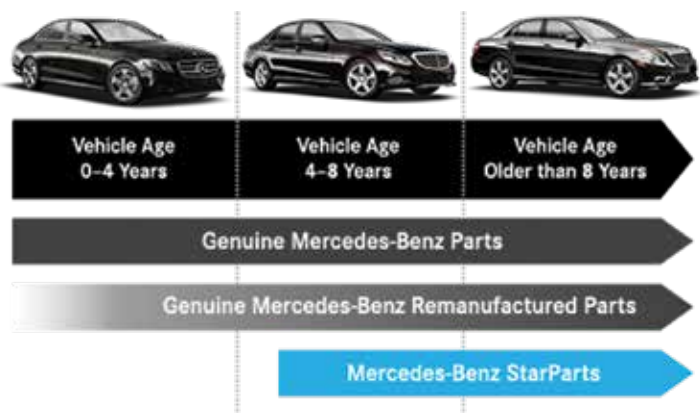
The first step is to make sure you get the right pads. Sure, aftermarket suppliers can offer something that’ll work, maybe even made by the same OE manufacturer, but we’ve found that the genuine Mercedes-Benz pads always fit perfectly, are not likely to exhibit brake squeal, and last longer than the bargain brands. We’re not sure if you’ve heard, but Mercedes-Benz now sells an alternative line of parts, known as StarParts, that costs less, but still delivers

the same performance and proven quality that Mercedes-Benz is known for. Indeed, StarParts might surprise you with its value, so be sure to ask your local Mercedes-Benz dealer’s parts professionals about them. They’re designed for models five years old and older, exactly describing many of the vehicles your customers drive.

According to Mercedes-Benz, StarParts are less expensive because they use alternative materials (such as copper instead of iridium for spark plugs), do away with extra features (such as the wear indicator for wiper blades), and focus on volume by reducing variants so the same part can be used across multiple models. While our shop splits the savings with our customers, this could be a way to offer exceptional discounts while still increasing your profit – a win-win.

Threads

So, once we have the pads in hand, it’s time to evaluate an often-overlooked component of the braking system: fasteners. In the typical brake system, we have several fasteners, most of which are specifically called out in the work instructions to be replaced each time they are loosened. Mercedes-Benz calls these “Single-Use Fasteners,” and has issued specific guidelines for them.



Mercedes-Benz StarParts are value-oriented alternatives for vehicles five years old and older. Parts available include brake pads and discs, wipers, filters, and spark plugs, and carry a one-year parts and labor warranty. Ask your dealer about StarParts.

If we look at a new set of caliper bolts, we always see a little spritz of a plastic material, often blue in color, near the tip of the bolt. You might be tempted to replace this with a dab of blue thread locker, or more often simply ignore it and just retighten the bolts, but this is a grave mistake. First of all, you would probably agree that Mercedes-Benz stands for safety, and those Swabian engineers not only won’t compromise on safety, they also wouldn’t spend an extra “Pfennig” if they can get away with it. That’s true here, too. That blue plastic, Polyamide in this case, has different holding characteristics from liquid thread locker.

Opposite Page: We’ve seen this kind of neglect more than once. NEVER let your customers get to this dangerous point.



Scientific studies over the years have shown that even a properly-torqued fastener can loosen over time (improperly-torqued fasteners are even worse, so why aren't you using a torque wrench already?). To compensate for this, thread-locking systems are used for critical fasteners. In the brake system, three particular fasteners that are designed for single-use only come to mind: The caliper bolts we just mentioned, the small screw that holds the brake disc to the hub, and, for some models, the sliding pins that guide the caliper along the frame.

We are not unaware of the realities of the repair business – it's a rare day when we'll stop a repair because of a fastener that looks nominally okay. But a word to the wise: The legal world is getting tougher every day, and who do you think they're going to come after when there's an accident? We've heard anecdotally of a shop that's out of business now because a caliper bolt loosened and came out several months after the shop did a brake job. The customer survived the accident, but is now a quadriplegic, requiring constant nursing care. Think your insurance policy is big enough to cover that cost for this 34 year old mother-of-three for the rest of her life?

All for the cost of four bolts, under \$10. Studies have shown that customers who have fatal accidents generally do not come back as repeat customers.

Mercedes-Benz policy is that the technician should be able to recognize single-use fasteners (and this goes



Mercedes-Benz uses four basic types of single-use fasteners: A. Locking splines B. Self-locking nuts C. Microencapsulated screws and nuts D. Polyamide coating. Types A, B and C must always be replaced after they have been used. Type D can be re-used if not damaged unless specifically prohibited in WIS. Be sure to review the WIS document AH00.00-N-0001-01A for an explanation of how to recognize and work with these fasteners.

beyond brakes) and replace them every time they are loosened. The Workshop Information System (WIS) document AH00.00-N-0001-01A, partly reproduced here, explains what to look for and how to handle each type of locking system you might encounter. Also, in some cases the work instructions in WIS specifically state to replace a particular fastener.

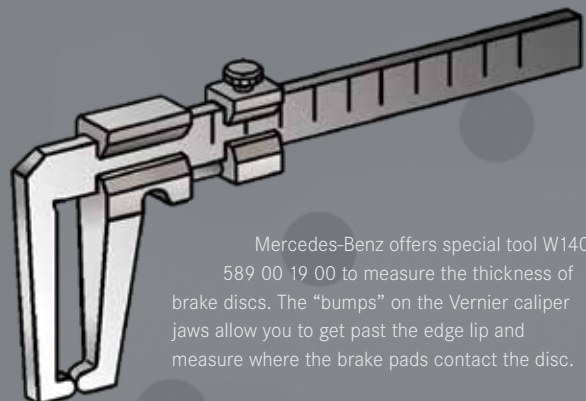
In addition to ensuring the safety and durability of your customer's car, and the good sense of following the manufacturer's recommendations and instructions, the mandatory replacement of single-use fasteners is a source of profit. It might not pay for that safari to Africa, but it'll keep the coffee pot full.

New discs?

Do those brake discs really need to be replaced? The answer to that is easier than you think. If the customer is not complaining about brake pulsation, juddering or other problems, AND the brake disc wear area is above the minimum service thickness, AND there are no cracks, scoring, or corrosion, then no, they don't need replacement. But if you have a customer complaint, Mercedes-Benz does not recommend a brake lathe to "true-up" the discs – just replace them. It's been this way for at least 30 years. As a side note, we've found the cost for a pair of new discs to be about the same as a set of pads, at least for the models we do most of our work on, so cost isn't usually a concern. Also, you get to subtract lathe time from the price.

We doubt that anyone working on cars does not know all about the concept of minimum brake disc thickness, but let's cover it anyway because it's important.

The manufacturer of a brake disc is obligated by law to mark the disc to show the minimum thickness of the wear

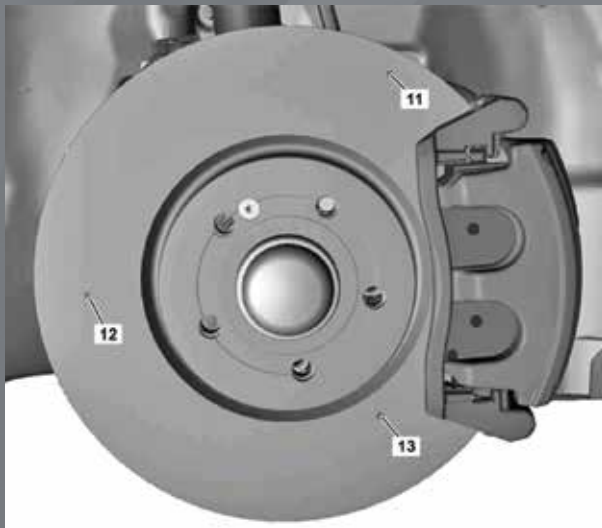


Mercedes-Benz offers special tool W140 589 00 19 00 to measure the thickness of brake discs. The "bumps" on the Vernier caliper jaws allow you to get past the edge lip and measure where the brake pads contact the disc.

surface. Any disc at or below this minimum thickness must be replaced, again by law. There is another measurement, known as the service wear limit, which is thicker than the minimum. This is the thinnest the disc may be during a brake service. This limit accounts for the expected wear of the disc during the life of the pads, so the disc does not fall below the minimum thickness before the next brake service. Too-thin brake discs can fail, by cracking or breaking under load, and lead to an accident.

At every brake service, you always need to measure the brake disc thickness. Mercedes-Benz sells a special tool to help with this, but is not the only source. Always make sure you've zeroed-out the caliper, then measure the wear surface thickness, preferably in a few places. Compare your measurements to the minimum thickness stamped or engraved on the disc "hat," and replace any at or below the minimum. Also check in WIS for the minimum service thickness, which is somewhat thicker than the minimum, and again replace anything that's too thin.

In newer Mercedes-Benz models, specifically Model 205 (C-Class) and onwards, brake discs with wear bores were introduced. Check the three wear bores: If only one wear bore is visible, the disc can still be used with the current brake pads, but new pads may not be installed. If all three wear bores remain visible, the disc may be used and new pads installed (in both cases, as long as it has no other problems, of course).



As of the Model 205 C-Class, Genuine Mercedes-Benz brake discs have three wear bores. The outer (11) and middle (12) indicate wear. As long as both are visible, new pads can be installed (assuming no other problems). The inner bore (13) indicates the absolute wear limit. If visible, the disc can still be used (again assuming no other problems) with the current pads, but new pads may not be installed.

Composite rotors

In practice, we have found brake discs to be okay for two sets of pads. There are exceptions, of course, but most of the time every other brake job needs new discs.

We're all familiar with steel brake discs, and since they were invented they generally came in two types, solid and vented (some of which are cross-drilled), although some exotic types such as ceramics do exist. More recently, Mercedes-Benz has come out with a new type, which is known as the composite brake disc. In composite construction, the wear portion of the disc is the familiar steel or iron casting, while the central "hat" is made of stamped steel. This allows for a much lighter rotor, improving not only unsprung weight (and ride comfort), but also fuel economy and emissions.

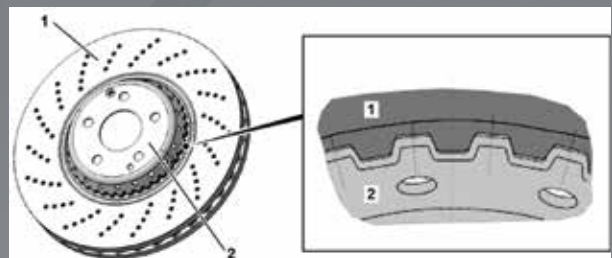
These composite rotors need to be handled with far greater care than the traditional type:

- Never carry them by the hat or central hole, only by the outside rim.
- Always leave them in their packaging box until just before installation.
- Never allow them to be treated roughly, or set down on the hat.
- Protect the anti-corrosion coating of the hat, and avoid impacts or scrapes.
- Avoid shocks or impacts to the brake disc.
- Never use the brake disc to turn the wheels against steering resistance.

Improper handling can damage these discs and make them unusable.

Process and cleanliness

Removing brake pads is usually straightforward, especially if you follow the manufacturer's instructions in WIS.



A composite brake disc consists of the wear plate (1) and a steel "hat" (2). They are joined by a splined connection (inset) that is very strong in the direction of rotation, but which can become disconnected with improper handling such as impact, rough treatment, or trying to turn the steering using the wear plate.

Before we start, we always put on a dust mask. We don't know about you, but we're tired of blowing black gunk from our noses for a day or two after a brake job, and this stuff can't be doing your body any favors. There's no asbestos in brake pads any more, but a dust mask is a small price to pay for comfort. We like the ones that have two elastic straps and carry at least NIOSH N95 rating, but you should research your own Personal Protective Equipment (PPE) needs.

The first step is always making sure the brake fluid reservoir has enough head room to accommodate the brake fluid you'll be pushing back into it, although opening the bleeder and routing the old fluid into a bottle as you push the pistons back will reduce or eliminate that. Depending on the model and brake system, you'll probably remove a spring clip, remove the sliding bolts or caliper bolts (depending on the type of caliper), and retract the piston(s) far enough so that the pads can be slid out. If the outer pad has a brake wear sensor, disconnect that first. Transfer it to the new pads at your workbench if it's in good shape.

Use the Mercedes-Benz brake caliper piston retraction tool to push the piston(s) back into place, flush with the caliper. Be extra careful to avoid pinching the rubber piston bellows with the tool during the process. Avoid using a pair of screwdrivers, big pliers, and other home-grown methods to retract the piston: Just a little extra pressure on one edge or the other can tilt the piston in the bore, ruining it. The tool is relatively inexpensive, lasts forever, and works like a charm.

If the piston is reluctant to retract, it's likely rusted internally and frozen in place. Get a new caliper. Some vehicles allow the replacement of a single caliper, while others mandate that both on the same axle be replaced at the same time. Check WIS.

Also remember to discuss the importance of brake fluid flushes every two years with your customer, because it is the absorbed moisture in the fluid that causes rust on the internal parts of the brake system. Today, it may be the caliper, but eventually those brake lines and other components could fail, especially those expensive ABS components.

Check the brake disc thickness and, if at or below the service wear limit, lift off the caliper, supporting it carefully with mechanic's wire to avoid causing external or hidden internal damage to the brake hose, and remove the worn disc.

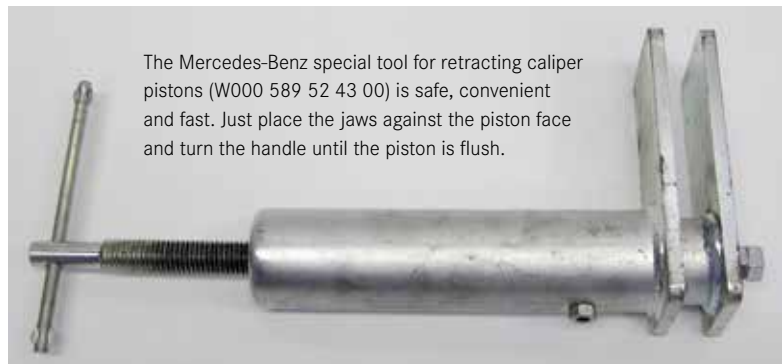
Now is a good time to clean things up, a step we have seen ignored by many shops. With a steel brush and a HEPA vacuum cleaner to help manage the dust, brush away the built-up grime, corrosion, and dust. In an ideal world, the caliper, carrier and surrounding components should be as clean as new when you're done. Of course, be careful to avoid damage to the rubber brake caliper piston boot. With the same brush, scrub the corrosion off the wheel hub to preclude mounting errors that can lead to wobble, and also the inside mating surface of the wheel.

With everything clean, put on a new set of gloves and install the new disc, using a new disc bolt. There's the temptation to re-use the old one – after all, with a wheel mounted it can't come out – but remember that paraplegic mother of three? Cheap insurance for about a buck.

Finish with a flourish

Following the WIS instructions, apply the correct brake grease in the correct locations, then reassemble the caliper and pads to the axle. Don't forget the brake wear sensor, if equipped. When reconnecting the wear sensor, be sure to route the wire correctly. It should not be able to touch any metal parts, especially the rotor, even when the pads are nearly worn out. Take a second to make this right, otherwise your customer will return with a brake wear indicator lamp on when the wire makes contact with something it shouldn't.

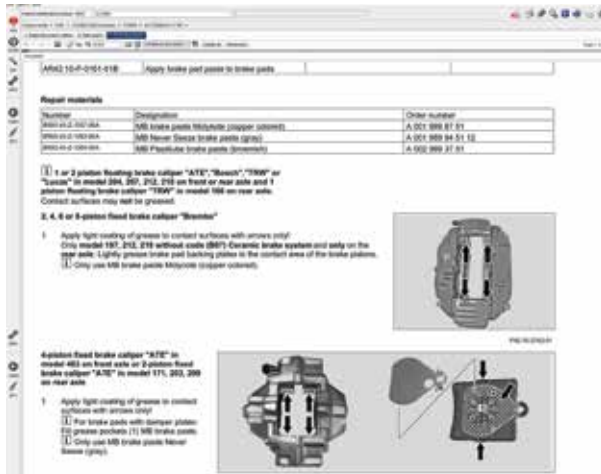
Triple-check your installation, and tighten all the fasteners with a torque wrench. Re-install any dust caps. Before putting the wheels back on, do a quick visual check of the area. Do the tires need to be rotated? Any shock



The Mercedes-Benz special tool for retracting caliper pistons (W000 589 52 43 00) is safe, convenient and fast. Just place the jaws against the piston face and turn the handle until the piston is flush.

absorber damage or leakage? Cuts on the inside of the tire sidewall? Suspension components okay? No damage to the bellows? Remember, your customers are likely not an automotive expert like you, so they count on you to look for anything that might keep their most valuable possession, their car, safe and reliable (some may argue

that your house is your most valuable possession, but your car gets you to work so you can afford that house. In a pinch, you can sleep in your car, but your house can't get you to work. Safe and reliable is why customers come to you, and not the quickie-lube for their work.)



A part of the WIS document explaining the how, where, and what of greasing a caliper. Not all systems use grease, and greasing incorrectly can lead to noise and other troubles down the road.

Reinstall the wheel, starting the screws by hand. In our shop, we run them in with a battery-powered screwdriver and finish the job with a torque wrench. While torque-limiting extension bars might seem like a good thing, and we guess they are better than a plain extension on your impact gun, they can't match the accuracy of a torque wrench. Your customers will appreciate your doing it right if they ever have to change a flat tire.

Anyone can hang pads, and anyone can go above and beyond to do it the right way. In most cases, your customers might never even be able to tell the difference, but writing out the details of what you did (including your inspection of other components, and your findings) on the repair order will make sure they know you took the time and care to do it right. And that kind of service will keep them (and their friends) coming back, again and again.

WHEN SAFETY IS ON THE LINE, THE RIGHT PART IS VITAL

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New Grip
Adhesive Bonding &
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The latest on materials and procedures

In an ongoing quest for fuel economy improvements, Mercedes-Benz vehicles have shed weight by replacing traditional steel with high- and ultra-high strength steel combined with aluminum, magnesium, composites and other lightweight advanced materials. These hybrid structural and non-structural components provide the same or greater strength while being thinner and lower in weight. The lightweighting benefits come with requirements for new joining methods.

Traditional welding does not work when joining dissimilar materials, due in part to their different melting points. Standard pop rivet technology will not work when combining high- and ultra-high strength steels with aluminum and other softer materials. These softer materials can easily become deformed by the force required to punch through the significantly higher strength and stiffness of high- and ultra-high strength steels.



Structural adhesives, rivets, and other fasteners used on Mercedes-Benz vehicles are the result of technological advances and are application-specific. Mercedes-Benz only allows the use of adhesives that are specified in official published repair documents, and only Genuine Mercedes-Benz replacement rivets and other fasteners. ALWAYS refer to WIS.

Opposite Page: New riveting and adhesive bonding techniques and tools give technicians a faster and more effective way to repair advanced high-strength steels, aluminum, and other materials.

The thermal and mechanical joining methods we're used to have had to be updated to work with advanced materials and new multi-material, or hybrid, joints.

Glue is glue, yes? No!

Even for joints that can be bonded using adhesive alone, we now have different products for specific applications. Some adhesive formulas emphasize elasticity, others stiffness and strength. Some may cure at room temperature, while others require heat.

Structural versus panel bonding adhesive

Adhesives were primarily used in repair of non-structural panels until recently. Panel bonding adhesives were not designed to meet the requirements of joining structural parts.

Joining structural components requires greater peel strength, impact strength, and lap shear strength than a panel bonding adhesive offers. To slow the deformation of structural components during a collision, adhesives must also absorb more collision energy. This adds a requirement for increased flexibility properties in the bonded joint.

New impact-resistant structural adhesive (IRSA) products are formulated to offer both strength and elasticity. They are specified to add a "bend, but don't break" (up to a point) capability, especially to structural components that help protect the passenger compartment. In addition to absorbing more energy, impact-resistant structural adhesives offer better high- and low-temperature performance, corrosion protection, and resistance to residual stress.

Impact-resistant adhesive is often recommended for joining thin panels. The flexibility properties help the joint absorb impact force in a collision, where adding fractions of a second longer for a joint to reach its breaking point



may make a huge difference in the ultimate safety of the vehicle. When impact-resistant adhesive is specified, it is absolutely critical to the future reliability of that repair. Never substitute a panel bonding adhesive where an IRSA product is specified.

Refer to your Mercedes-Benz repair information first for adhesive requirements recommendations. Remember that structural repairs have safety consequences. When it comes to adhesives, there is always an approved Mercedes-Benz version. If there is another option, it would also be called out in WIS.

Adhesive science and performance

Adhesives used in structural bonding fall into either the thermosetting, thermoplastic, or elastomeric category. Modern adhesives are often hybrid combinations of thermosetting with either thermoplastic or elastomeric formulations, depending upon which strength, stiffness, temperature resistance, elasticity, and other performance characteristics are desired.

Thermosetting adhesives are synthetic or organic substances that are converted by molecular cross-linking into a permanently hard, solid state. The molecular cross-linking may be initiated by heat, chemical catalysts, or a combination of both. Thermoset adhesives have a higher modulus of elasticity (ability to absorb a higher amount of stress without permanently deforming) and greater resistance to heat and chemicals, but lower toughness than thermoplastics or elastomers. Many thermosetting adhesives feature an epoxy-based formulation.

Thermoplastic adhesives are synthetic or organic substances that harden when cool and soften when heated. They may not be suitable for structural applications, unless specifically designed to have high strength and durability under elevated temperatures. Examples of common thermoplastics include polyvinyls, polyacrylics, and polyethylene.

Elastomeric adhesives are organic substances that after being stretched a great deal can return to their original shape and strength. They are frequently specified for use as sealants. They are also often included as a modifier in thermosetting or thermoplastic adhesive formulas to improve toughness and peel strength for structural applications. Common elastomers include silicone, polyurethane, nitriles, and other natural and synthetic rubber compounds.

In addition to the basic resin, an adhesive may contain solvents, fillers, catalysts, diluents, hardeners, antioxidants, and plasticizers. These may be added to adjust viscosity, temperature resistance, strength reinforcement, and other performance properties, or to activate and control the pace of the curing process.

The increased variety of adhesive types and properties means that you must check the Mercedes-Benz repair information to determine the correct product for your repair application. The risk of using just any crash-durable adhesive is that you don't know what may be different enough about the application to reduce that brand's effectiveness in a Mercedes-Benz vehicle. You have no way of knowing if another adhesive is "equivalent." Mercedes-Benz engineers have tested and validated the adhesive specified for a given repair. By putting its name or endorsement on an adhesive, Mercedes-Benz is providing a shorthand answer to the question of what performance standards that product meets.

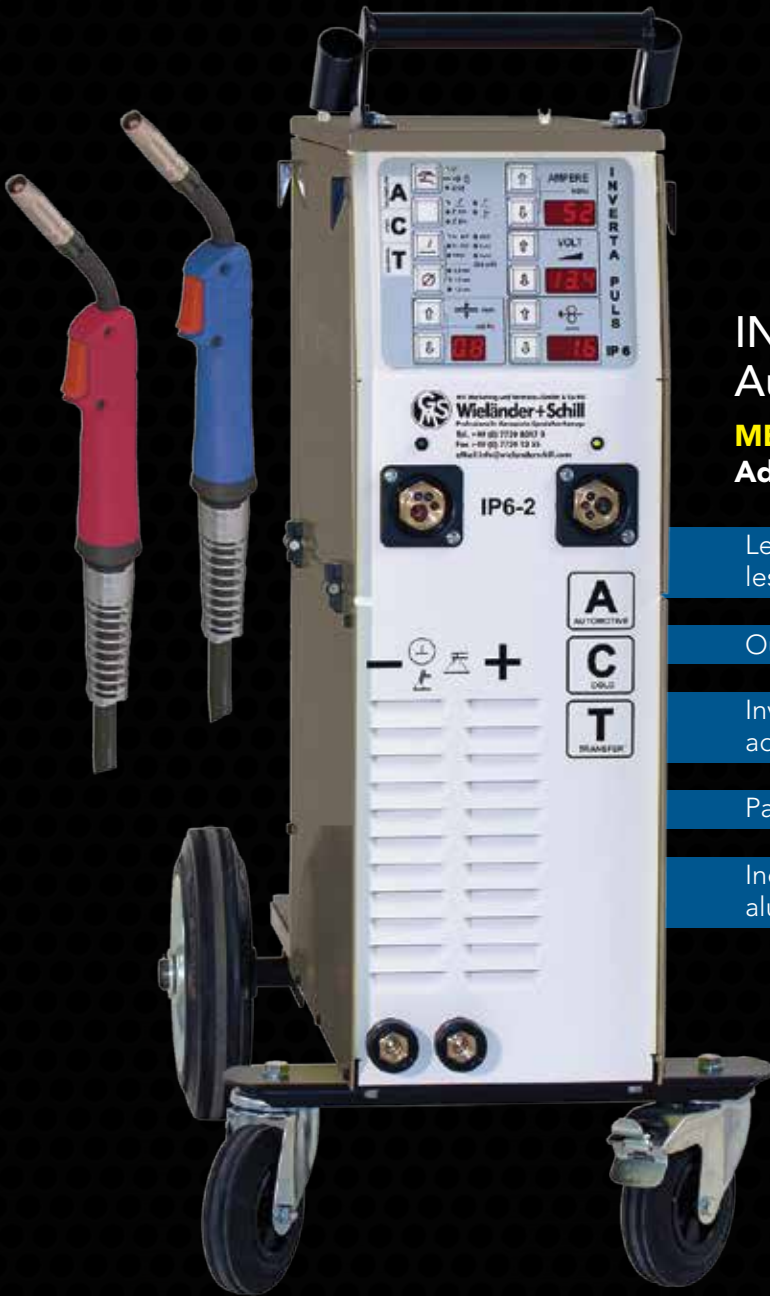
Variety is the spice of...

Dissimilar metals that are being used because they offer strength at lighter weight may have problems with heat, galvanic reaction (corrosion), and kinetic (high impact) joining methods. Traditional joining techniques such as welding and riveting may not be applicable to creating or rebuilding joints in which one or more of the substrates cannot tolerate heat, or is too thin for the kinetic force developed in the spot welding or riveting process.

Adhesives help solve some of the issues associated with joining these finicky materials. For example, adhesives placed between dissimilar metals such as aluminum and steel or magnesium and steel provide a buffer that prevents formation of galvanic corrosion.

Steel, aluminum, magnesium, carbon fiber, and other composites each have different coefficients of linear expansion, which is just a fancy way of saying they expand and contract at different rates. The right adhesive can allow dissimilar materials to expand and contract at different rates without weakening the joint bond. Adhesives also help reduce transmission of vibration-related and kinetic noise through to adjacent panels.

The type and amount of adhesive, and whether it is combined with riveting, welding, or used alone is a function of the required joint strength and stiffness or flexibility, the size of the gap, the expansion and curing



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properties of the adhesive, and other factors. This may be background information that is not included in service manuals, but you can bet that Mercedes-Benz engineers have done a lot of research to develop the correct repair procedure recommendations for you.

Follow Workshop Information System instructions for prepping the mating surfaces of panels to be joined. How the surfaces must be cleaned, whether they are to be perfectly smooth or slightly textured, the temperature of the adhesive and the surfaces, and how quickly you must work after mixing a two-part adhesive or after opening a product are just a few of the factors that, done correctly, provide good adhesion.

If your repair information includes surface preparation steps that are not listed on the adhesive instruction sheet or label, make sure to follow the Mercedes-Benz instructions. The Mercedes-Benz repair instructions may have been updated with information that, due to running model changes, was not available at the time the adhesive label was printed.

Hybrid joining

Mercedes-Benz requires structural adhesives in combination with riveting or spot welding for many repairs. This is called cold joining because it avoids or minimizes the use of heat. The resulting joint is referred to as a hybrid because it combines the strengths of an adhesive and a fastener (rivet or spot weld) to compensate for the individual weaknesses of each method.

Adhesives resist shear forces better than rivets to the extent that they spread any collision force over a wider area of the impacted joint. Mercedes-Benz engineers design structural joint geometry to minimize the likelihood of the joint being sheared apart during a collision. In an abundance of caution, they add rivets, flow drill screws (FDS), spot welds, or other mechanical fasteners to further reinforce many joints against the unlikely event of



Rocker panels, frame rails, floor pans, and other structural components are joined by hybrid adhesive and mechanical fastening technologies on many Mercedes-Benz models.

peel failure. Mechanical fasteners also contribute instant fixturing, so you can continue to work on or around the joint without waiting for adhesive to cure.

Mechanical fasteners better resist pull-out or peel failure; however these types of fasteners have only a small footprint to handle any impact forces. Adding adhesive distributes the stress load over a larger area, increasing overall joint strength. With hybrid joints, two is better than one.

Tip: Do not attempt to substitute an IRSA as an adhesive-only repair where a hybrid (combination adhesive and mechanical bonding) joint is required. If a hybrid joint is required, assume that the joint geometry demands both the extra peel strength offered by a mechanical fastener and the enhanced shear strength of an adhesive. And don't forget to check to make sure the expiration date on the adhesive label has not already passed.

Bolts, flow drill screws, clinching, and riveting are all mechanical methods used with or without adhesives to build and repair vehicles that combine aluminum with steel and other metallic or non-metallic materials.

Vehicle structural components joined by hybrid adhesive and mechanical fastening can include structural parts such as frame rails, rocker panels, strut towers, floor pans, wheel houses, and other areas.

Rivet bonding

Combining rivets and adhesive is a quick and effective method of creating a durable joint between dissimilar materials. Rivet bonding eliminates welding heat as a source of weakening of the metal being joined. Additionally, rivets fit tightly to the joint, creating a seal that, in combination with adhesive acting as a barrier between any dissimilar metals, creates a corrosion-resistant joint.

The new skills a technician must learn are straightforward, but critical to a successful repair. They include how to use the rivet gun, how to select the correct rivet for the application, and which adhesive formulation is appropriate for the repair. Your Mercedes-Benz repair information will tell you the requirements a rivet gun must meet, what rivet is required for a given application, and which adhesive to use.

Riveting story

Pop rivets are pulled by the tool through a pre-drilled hole in the material stack. Pulling the metal shank compresses and breaks the rivet flush with its head. Pop rivets can be used in structural and non-structural applications. They are also known as pull-style or blind rivets. A blind rivet is necessary if there is access to only one side of the joint, or if there is a pre-drilled or pre-punched hole all the way through the material stack.

A self-piercing rivet (SPR) presses the layers together and flares out to form an interlock on the inside of the joint. A die under the bottom panel guides the flaring of the rivet

to create a mechanical interlock. Some Mercedes-Benz dies are application-specific. In high-strength advanced steels, selection of the correct rivet and die is critical to the ability to flare out the rivet without causing the lower substrate to crack.

An SPR should pierce the top, or thinner layer of material and flare in the lower (and typically thicker) layer, without punching all the way through. If your rivet pierces the bottom layer of the material stack, something is wrong. Either you have a rivet that is too long for the application, or your tool pressure setting is incorrect. Selecting the proper rivet part number and installation procedure is critical to creation of a durable joint. SPRs offer lower risk of fatigue failure than spot welding, and SPRs can be used on aluminum, steel, plastics, and other materials.

A clinch rivet is similar to an SPR, except nothing pierces through either the top or bottom layer of the material stack. A solid clinch rivet instead presses all layers down against a die under the bottom layer. As the clinch rivet presses down and flares out, it forces all layers of the material stack to flare out in the same bucktail pattern. Flaring all layers simultaneously adds strength without punching through thinner metals. Work hardening occurs in the top layer as it is pressed around the rivet. This increases the tensile and lap shear strength in the joint area of the otherwise thin top layer.

Flow-form rivets (FFRs) are installed in a pre-punched hole to which adhesive is applied, then the rivet is



Some Mercedes-Benz rivet dies are application-specific. Shown here are dies for 8mm blind rivet insertion and extraction (image courtesy of Reliable Automotive Equipment).

inserted and pressed to pull the layers of the material stack together.

Most rivet installations also include adhesive in the space between rivets. The increased surface area being bonded helps strengthen the joint significantly versus riveting alone. Applying the correct adhesive with the factory-recommended line thickness ensures creation of the desired strength bond.

Although the rivets can be installed through adhesive, there are still differences in the process, depending on which type of rivet you are using. For pop (pull-type) rivets, drill and deburr the holes, apply adhesive and join the substrates before installing the rivet. The process is similar for SPRs, except no pre-drilling of holes is necessary. With flow-form (FFR) rivets, you punch holes after the panels have been joined, then deburr the holes and install the rivets.

Gun control

The proper tool must be used to install each type of rivet. Use of an incorrect tool could deliver either too much force, causing distortion in the workpiece, or not enough clamping force to successfully position and hold the rivet. For example, SPR extraction or insertion in aluminum or thin high-strength metals requires a gun that combines extremely high compression force with precise control over angle and depth of impact.

Fortunately, new modular riveting tool systems are available that can remove and install either pop, SPR, or FFR — three popular types of rivets. The Xpress 800 from Wielander & Shill features different snap-in power unit and insertion or extraction modules that quickly adapt it to the specific rivet type and application.



The Mercedes-Benz-approved XPress 800 modular system includes the XPress 800 Base Power Pack, PushPull pressure cylinder, C-arms, add-on modules, and setting and punching dies for installing and removing almost every type of rivet (image courtesy of Reliable Automotive Equipment).

Weld bonding

Weld bonding replaces welding with adhesive in some portions of a joint. The use of either spot welding or intermittent MIG/MAG welding separated by adhesive over long areas of the joint retains strength while reducing heat stress in thin or heat-sensitive substrates. By gluing the entire length and width of the mating surfaces between spot welds, weld bonding strengthens the joint. The adhesive adds corrosion protection, especially when it separates dissimilar metals. Last, weld bonding helps reduce the effects of vibration and cuts down on noise entering the passenger compartment.

Getting a grip

Mercedes-Benz will specify the correct rivet length, strength, and type of material for creating a strong joint. It will also recommend the best coating for sealing and corrosion resistance, and the adhesive that will offer the strongest protection against shear and peel failures. Everything you need to get a grip on the new adhesive, weld, and rivet bonding techniques is in your Mercedes-Benz service information. |



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Product Name	Part Number	Quantity	Product Description	Recommended Consumer App.
Mercedes-Benz SPEC.				
Mobil 1 Formula M 5W-40	BQ 1 09 0197	Bulk - No Equipment	Fully synthetic formulas designed specifically for gasoline passenger cars	Low SPASh. Available at most M-B dealers
	BQ 1 09 0195	6/1 Quart Cases		
	BQ 1 09 0196	55 Gallon Drum		
Mercedes-Benz GEO 229.5 5W-40	A000989790211BIFU	Liter	Fully Synthetic formula specifically designed for Mercedes-Benz engines that require the 229.5 Specification	Mercedes-Benz Engines that require 229.5 Specification Oil
	A000989790217BIFU	208 Liter		
	A000989790219BIFU	Bulk - No Equipment		
Mercedes-Benz High Performance EO 229.5 0W-40	A000989810211BIBU	Liter 5KG	Fully Synthetic formula specifically designed for Mercedes-Benz AMG engines that require the 229.5 Specification	Mercedes-Benz Engines that require 229.5 Specification Oil
	A000989810217BIBU	208 Liter 15KG		
Mercedes-Benz GEO 229.6 5W-30	A000989820211BJEU	Liter 40KG	Fully Synthetic formula specifically designed for Mercedes-Benz engines that require the 229.6 Specification	Mercedes-Benz Engines that require 229.6 Specification Oil
	A000989800217BJEU	208 Liter 20KG		
Mercedes-Benz GEO 229.71 0W-20	A000989830211BNXU	Liter 35KG	Fully Synthetic formula specifically designed for Mercedes-Benz engines that require the 229.71 Specification	Mercedes-Benz Engines that require 229.71 Specification Oil
	A000989830217BNXU	208 Liter 15KG		
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 X1 0W-30	BQ 1 09 0184	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 0182	6/1 Quart Cases		
	BQ 1 09 0183	55 Gallon Drum		
Mercedes-Benz GEO 229.52 5W30	A000989800219BMEU	Bulk - No Equipment	Fully Synthetic formula specifically designed for Mercedes-Benz engines that require the 229.51 and 229.52 Specification requirements	Mercedes-Benz Engines that require 229.51 Specification Oil
	A000989800211BMEU	Liter 170KG		
	A000989800217BMEU	208 Liter 50KG		
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 0194	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® 1/2 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		

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Product Name	Part Number	Quantity	Product Description	Recommended Consumer App.
Mercedes-Benz SPEC.				
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
	BQ 1 09 0022	6/1 Quart Cases		
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 15W-40	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		
	BQ 1 09 0179	6/1 Quart Cases		
Mobil Delvac 1300 Super 10W-30	BQ 1 09 0086	Bulk - No Equipment		
Mobil Delvac 1 5W-40	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 80W-90	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		



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