StarTuned®

Information for the Independent Mercedes-Benz Service Professional

March 2019
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TPMS Service
No-Crank
ISPPI
Wheel Bearings & Seals
Hybrids of Different Steels and Aluminum

Mercedes-Benz

Who's Your *Part*ner in Success? Mercedes-Benz's PartsPro

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.

StarTuned®

March 2019

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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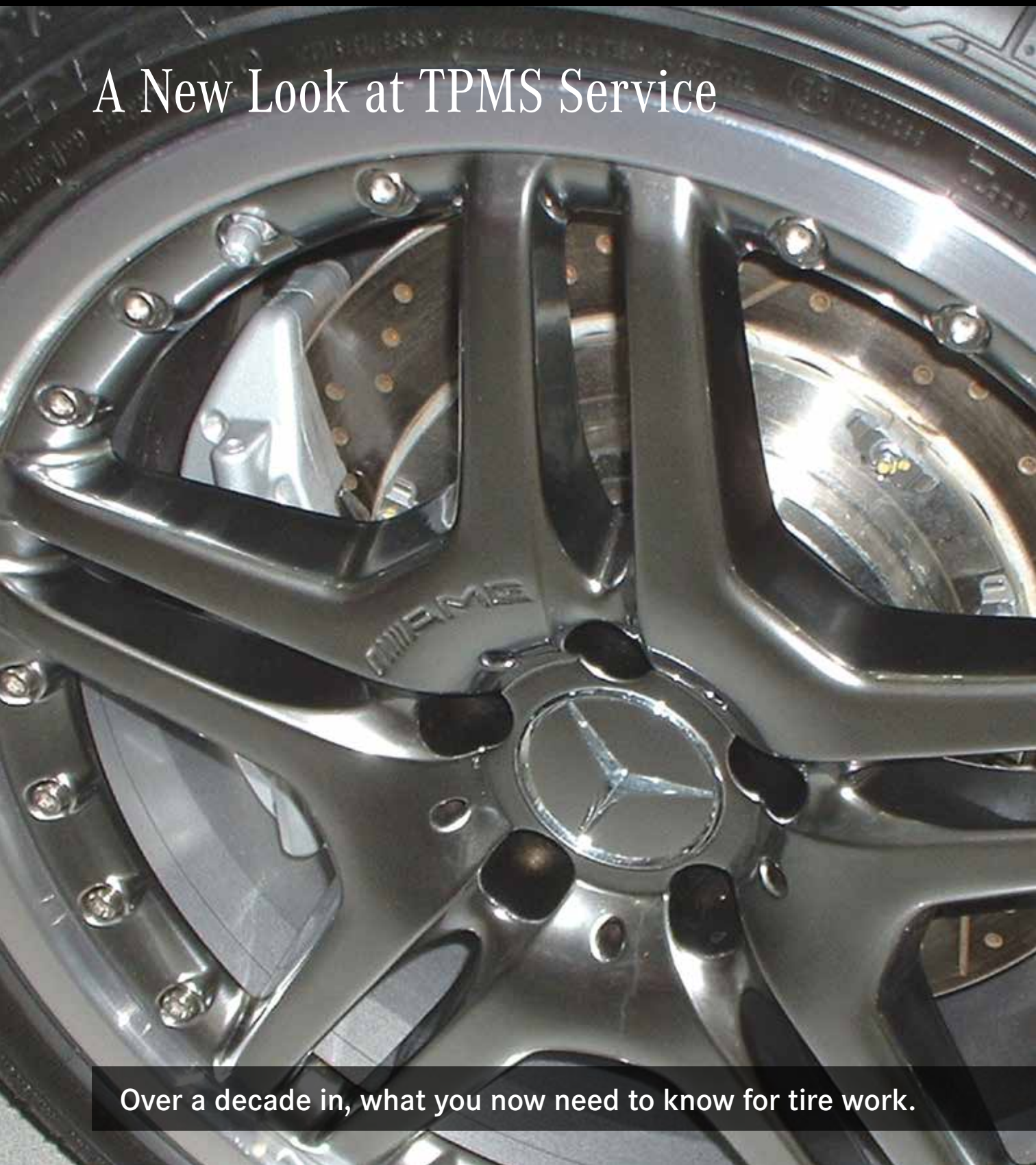
Mercedes-Benz
The best or nothing.

A New Look at TPMS Service



Over a decade in, what you now need to know for tire work.

Mercedes-Benz

Wise men tell us that if we want to know where we're going we need to look at where we've been. Tire pressure monitoring (TPMS) is a relatively new technology to the automotive industry. It's really a harmonious fusion between the automotive industry and the tire industry. Tire technology has made many advancements from radial tires to run flats. But there is one item that always needs attention: inflation pressure.

Why do tires lose air?

Even a perfectly good-looking tire with no obvious defects or visible punctures will lose air over time. This is due to osmosis. Osmosis or permeation is the ability of air to pass through the structure of the tire rubber. It exits the tire sometimes at the rate of 1-3 psi per month. The exact air loss is usually determined by the model and make of the tire. Different rubber blends provide different rates of permeation.

Nitrogen has been a buzz word in tire inflation as well. The racing industry figured out pretty quickly that tires filled with nitrogen rather than air also exhibit less pressure change with temperature swings. That means more consistent inflation pressures during a race as the tires heat up. The molecules of nitrogen are bigger, so they penetrate the rubber at a slower rate. However, there are pros and cons to using nitrogen.

A change in thinking

In the fall of 2000, following several fatal accidents involving underinflated tire failure and vehicle rollover, Congress signed into law the Transportation Recall, Enhancement, Accountability and Documentation Act (TREAD). Many lawsuits initiated this action. Arguments on both sides pointed to issues from improper posted inflation pressures to faulty vehicle design. CBS news reported NHTSA links to 148 deaths and more than 525 injuries in the United States due to separations, blowouts, and other tread problems in a certain manufacturer's tires, many made at one particular plant, 6.5 million of which were recalled during the summer. One factor caused by low air pressure is an increase in the running temperature of the tires, which contributes to decreased belt adhesion.

This law mandates the use of a suitable TPMS technology to alert drivers to a severe under-inflation condition of their tires. The law requires that all new vehicles produced for the U.S. market after September 2007 have TPMS. This action not only provides a safety factor, but also peace of mind. Generally, drivers are not aware that they have a low tire until it's too late, at which point the tire usually cannot be saved and further risk to life and limb due to possible blowouts ensues.

There are basically two types of monitoring systems that have been developed to keep an eye on tire pressures, and Mercedes-Benz has used both technologies. Most of the vehicles you service will have one or the other of these systems, either indirect or direct.

In indirect systems, the pressure is monitored using the wheel speed sensors . The ABS control unit detects the pressure loss of a tire by means of the different rolling circumference. A tire with a low air pressure effectively has a smaller diameter, so has to make more revolutions than one with the correct air pressure. However, this system is not as precise as the direct measurement type, and requires a pressure loss of approximately 30% before a warning message is displayed. The advantage is the relatively low price as numerous vehicle components already in place can be used. The only things required are adapted ABS software and an additional display in the instrument panel.

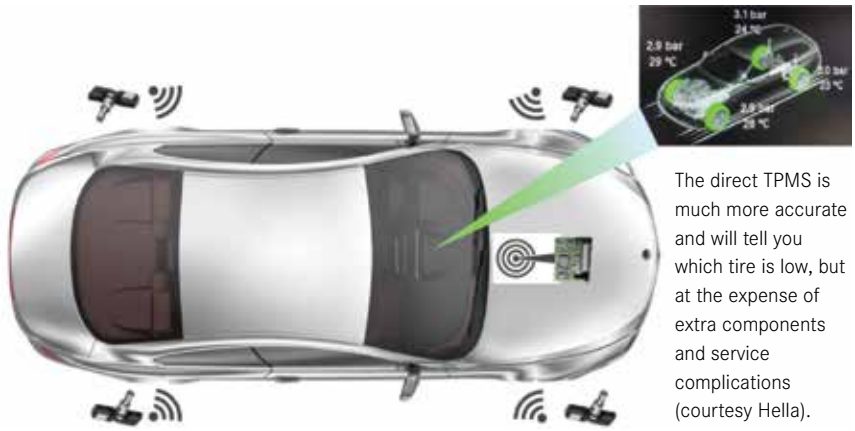
Direct measurement systems are considerably more precise, but involve additional components (and service complications), and are therefore more expensive. In this system, a battery-powered sensor is located in each wheel. These measure the temperature and the pressure of the tire, and transfer the measured values wirelessly to the TPMS control unit and/or display unit. Tire stem antennas transmit the radio signal.

This 2006 AMG has an indirect system. Note the ordinary valve stem. Not as accurate as the later direct type, but less expensive and no service complications.

Direct systems compare the tire pressure with a reference value stored in the tire pressure monitoring system control unit. This has the advantage that pressure losses of several tires can be detected at the same time. One disadvantage of the direct measuring systems is that the batteries will fail after approximately five to 10 years. Whenever you determine through diagnosis that there are one or more weak batteries in a vehicle, you should replace the sensor(s).

Early indirect systems relied on existing hardware: wheel speed sensors. When a tire gets low, its diameter is reduced so it takes more revolutions to cover the same distance. TPMS electronics can detect the difference and signal the driver (courtesy Hella).

Changing out the sensors requires removal of the tire from the rim. Mercedes-Benz recommends that you follow the tire machine manufacturer's instructions regarding dismounting and mounting the tire, paying particular attention to the area where the valve stem is mounted. Be sure to check the sensor for damage or improper torque. Should you change the sensor each time you replace a tire? Most of the time you will want to if the sensor is over five years old. This will save your customer time in the long run.

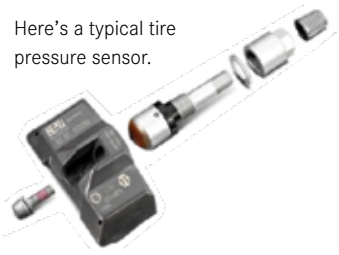


The direct TPMS is much more accurate and will tell you which tire is low, but at the expense of extra components and service complications (courtesy Hella).

What your customers need to know

There are a few factors that could cause the tire pressure warning to illuminate, one of which is a leaking tire. As mentioned previously, it's normal for even a good, undamaged tire to lose air pressure over time. A tire can typically lose 1-2 psi of pressure for every 10-degree F. drop in ambient temperature. When the tires are warm, whether from driving or being in the sun, their pressure will be significantly higher than after the vehicle has been parked outside on a cold winter day. This change alone could trigger the TPMS warning lamp.

The recommended inflation pressure listed in the Operator's Manual or on the label inside the fuel door is a "cold" pressure, meaning the car has been parked outside in ambient temperature conditions for at least an hour. Mercedes-Benz recommends that you check tire pressures with a high-quality gauge (accurate to one psi) at least once per month and not to wait for the TPMS indicator to illuminate. Advise your customers to refer to the Operator's Manual for information about resetting the vehicle's TPMS after correcting pressures, rotating, or replacing the tires.



Here's a typical tire pressure sensor.

We've found many times that our customers are misinformed about what the TPMS system is designed to do, so you as a technician and your service advisors will be ahead of the game if you take the time to explain the subject to them. A typical conversation with a customer

often starts out like this: "My tire pressure warning light is on. I know something's wrong with the system because I looked at my tires and they look fine." Nine times out of 10 we will first check the tire pressures with an accurate gauge and find that they are out of spec. Mercedes-Benz has produced a short video to help your customers understand the system better. Give them this link and have them watch it to help them become better informed: https://bit.ly/2tmae2M.

Let's take a look at one of the more common vehicles you may service

C-Class vehicles can be equipped with either of the two types of tire pressure monitors depending on the model year. Later models all use the direct type with tire pressure sensors mounted in all four the wheels.

Then there's the TPMS control unit. The tire pressure sensors measures the pressure and temperature and send this data to the control unit every 60 seconds. Information on tire pressures can be seen in the multifunction display. After a few minutes of driving, the current pressure is shown in the service menu of the multifunction display. The TPMS will be restarted when you have adjusted the inflation pressure to a new level, perhaps for different load or driving conditions. The TPMS is then recalibrated to the current tire inflation pressures.

If the tire pressure monitor detects a significant pressure loss in one or more tires, a warning message is sent to the multifunction display. A warning tone also sounds and the tire pressure warning lamp lights up in the instrument cluster. If the pressure of at least one tire is continuously below the warning threshold for 12 minutes during a trip, a warning signal is set and stored in the memory of the control unit and displayed in the instrument cluster at the end of the trip. If the customer complains of this message in the display, your first course of action should always be to do a thorough tire inspection, set the tires to the recommended inflation, and drive the vehicle for 10 minutes to ensure the problem has been corrected. If the warning message still appears or comes back, then there is a malfunction in the TPM system. Further diagnosis with your XENTRY or compatible scan tool is in order.

Wheel mounted sensors

Most direct TPMS sensors use ultra-high frequency (UHF) radio in one of the "unlicensed" ISM bands (industrial, scientific, and medical) for transmitting the data, usually around 434 MHz in Europe and 315 MHz in much of the rest of the world. Currently, there are more than 150 SKUs of tire sensors fitted to North American vehicles. Mercedes-Benz uses several different makes of sensors, such as the common one made by Schrader.

Early sensors were found to have been replaced without need due to the wrong tire valve caps. A TSB shows a detailed analysis of the valves and states that corrosion was causing an issue due to different metallic materials in their makeup. In order to avoid corrosion, only plastic valve caps should be used on vehicles with tire pressure monitoring systems.

Every TPMS sensor must be "relearned" to the vehicle following the prescribed OE relearn procedure after replacement, regardless of whether it is genuine OE or aftermarket. The relearn procedure is mandatory to ensure that not only the replacement sensor works properly, but also that the vehicle's complete TPMS functions properly as well.

Some aftermarket sensors require special programming to meet the vehicle's application specifications prior to installation and relearn. These may include "programmable," "universal," or "cloneable" sensors. In addition to this extra step, technicians may need to invest in specialized tools, training, and software to complete the process. Even if a shop has the specialized programming tool, it may need to be updated to provide the latest application or software changes in order to meet the specifications of a particular vehicle. We highly recommend that you stick with genuine Mercedes-Benz-supplied sensors to avoid the issues sometimes associated with aftermarket products.

This Schrader unit is one of the more modern TPMS sensors on many Mercedes-Benz vehicles.

On any direct system, check the valve stem caps. TPMS sensors should have plastic caps to avoid corrosion-related problems.

Other components

The following are other components and systems that are involved in the direct-type TPMS in a model 204 with a code 470 system. Other models will be similar, but be sure to consult WIS or XENTRY for the layout of the model you're working on:

- The instrument cluster, which displays the warning and pressure readings
- The outside temperature sensor
- Front SAM control unit
- The tire pressure monitor control unit
- The steering column tube module control unit

The Brains of the Outfit

Beyond the pressure sensor in each wheel, the most important component listed above is the Tire Pressure Monitor Control Unit, which is located in the left trunk area. It's responsible for the following tasks:

- Reading sensor signals
- Evaluation of input factors
- Actuation of components

Reading the input factors involves both one-way radio (the radio frequency signals mentioned previously), and interior CAN B.

The signals from all the tire pressure sensors are read via the two-way radio signal. The CAN bus reads the following signals: vehicle speed, outside temperature, and the odometer. The input factors that have been read in are evaluated by the integrated microprocessor and the relevant components are then actuated via the CAN B as well as the instrument cluster display for warnings, tire pressure readings, and messages.

Indirect systems

In older indirect monitor systems, the rolling circumference changes based on air pressure, and the existing wheel speed sensors send info on individual wheel rpm to the control unit. This data is evaluated by means of a comparison of the rpm in the ESP and BAS control unit. The ESP and BAS control unit compares the FL and RR wheel rpm, and the FR and RL wheel rpm. Also incorporated into the equation are the:

- Lateral acceleration
- Yaw rate
- Wheel torque

The vehicle needs to be driven at a speed of at least 12mph for a few minutes to read properly. This type of system will set a warning without stating a position and will be inactive when braking.

Resets

Resetting or performing the relearn procedure after a wheel change can be done using the controls on the steering wheel:

1. Adjust tire inflation on cold tires to the recommended pressures listed on the gas filler flap.
2. With the ignition switch "on," use the left/right arrow buttons on the steering wheel to select "Service".
3. Press the up/down arrow buttons to select "Tire Pressure," and press "OK." "Tire Pressure Monitor Active" is now displayed.
4. Press the down arrow button and "Use Current Pressures as New Reference Values Press 'OK' to Confirm" will be displayed.
5. Press the "OK" button to Confirm. After driving a few miles, the set pressure values will be stored as the base setting.
6. If the TPMS light comes back on, or the instrument cluster states "TPMS Malfunction," diagnose for faults in the Tire Pressure Control Module.

There may be times when you need to connect the scan tool to relearn the system or to diagnose the faults if you cannot get it to relearn.

Check the Bulletins!

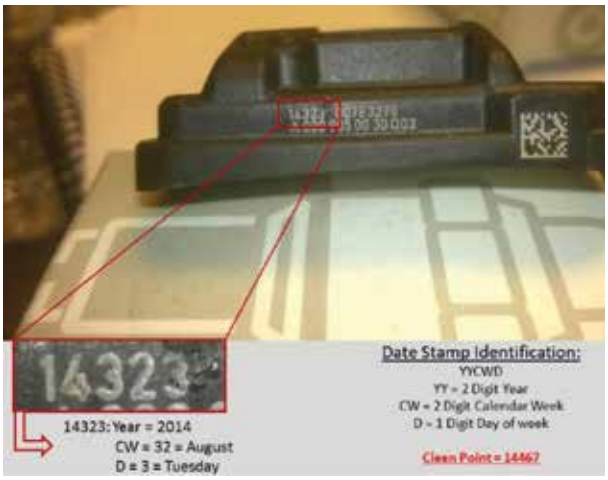
It should be noted that there are several TSBs concerning certain TPMS faults. TSB - LI40.15-P-046651 in particular is one where if you receive customer reports in the above model vehicles of the instrument cluster displaying "Tire Pressure Monitor Inoperative," and there is a corresponding stored fault code of 5581 (front or rear

sensor localization failed), this is because the difference in the signal strength between the front and rear axle may not be enough for the wheel assignments to be accurately made. The bulletin will go on to explain that the remedy involves a hardware modification as well as some software updates or resets when the repairs are completed.

The latest

The batteries in TPMS sensors naturally wear down eventually, and replacement costs money and labor. Now there are prototypes in the works of "battery-less" sensors. Also in coming technology, the Companion App, developed by Mercedes-Benz Research and Development, provides vehicle information and door-to-door navigation instructions using the customer's Apple iPhone or Android device. Depending upon the model, you may be able to check your tire pressures with your smart phone!

Toggle through the menu on the steering wheel controls to get the tire pressure readings.



Always consult Mercedes-Benz TSBs for concerns with a TPMS. This one notes a problem with a certain numbered batch.

No-Crank?

Battery, grounds, security, or...?

As long as your muscles and back were up to it, there was nothing to stop you from cranking the engine of this 1902 Simplex. Today, there are numerous possible impediments. (Courtesy Mercedes-Benz.)

Everyone has encountered this complaint on a work order that reads something like this: "Customer states vehicle does not start, will not crank." There was a time when this entailed a fairly simple diagnosis and repair – nine times out of 10 simply a battery issue – but now with anti-theft packages and complicated wiring schemes there's more here to diagnose than meets the eye.

While there are indeed multiple complicated possible faults that may cause your customer's distress, it's best practice to not jump to the most difficult diagnoses, but start simple.

Strategy-Based Diagnostics

Most of you with some experience and training under your belt are aware of this term. This is the process whereby a good technician knows how to combine experience, service information in terms of manufacturer's specifications, scan data and test results, as well as their own individual test results to arrive at a theory of what's wrong with the vehicle. At that point, you use established techniques and equipment to prove your theory, then you make the repair.

Most authorities will agree that the first step in any diagnostic procedure is to verify the customer's concern. You've all had this happen: You're brought a no crank/no start, you put the key in the ignition or hit the start button, and, bam, the car starts right up. This is a perfect opportunity for your service adviser to communicate with the customer about what's going on with the car. Is this the first time this has happened? Most likely you're dealing with an intermittent fault. Gathering as much information as possible from your customer will give you more ammunition to shoot at the problem. Let's assume now, however, that you verify the customer concern and the vehicle indeed has a no crank condition.

Differential Diagnostics

Differential diagnostics is the process of differentiating between among multiple conditions that exhibit similar symptoms, which is common practice in the medical profession. You compile a list of possible causes of the symptoms, then perform observations and tests to rule each possibility in or out. Let's make a list of possible causes for this case:

- Battery
- Fuses
- Starter
- Wiring
- Security/anti-theft
- Control modules and relays

Voltage

All cars need sufficient voltage to crank, of course, but also enough amperage delivered to the right places to facilitate the operation. We don't even plug in a scan tool if the initial voltage is below 12.6, or we get a huge drop in voltage under load. You may get many under-voltage or false codes, so it's best to address the battery first before performing a scan.

Batteries

A Mercedes-Benz battery may be either AGM (Absorbed Glass Mat) or traditional lead acid. It may also be located in various places depending on the model. Some are in the trunk, some are under the hood, and some are under the seats. Also, some models have two batteries for different purposes. One is the starting battery, and the other is the auxiliary battery. You will want to check them both using a high-quality battery tester.

NOTE: If it is deemed necessary to charge the on-board accessory electrical system battery (G1/7), then the starter battery must also be charged.

On vehicles with more than one battery, the ground leads should be disconnected from the others while one is being charged or tested. Check the battery voltage of the on-board electrical system battery via the instrument cluster or a multimeter, as described in the WIS document AR54.10-P-1132A. A battery should be charged when the measured voltage drops below 12.2 V. A good tester will tell you if the battery needs to be charged and

retested. Some testers have a mode of diagnostic charge. This mode charges and tests the battery at the same time to give a very accurate analysis of its condition. If the vehicle has been inactive for six months or longer, the batteries must be charged prior to putting the vehicle back into service to counteract any self-discharge.

NOTE: The instrument cluster displays a white battery symbol with the text, "Visit Workshop," if the auxiliary/additional battery voltage is < 11.5V. If the auxiliary/additional battery is between 6.0 V and 11.5V, it will be charged by the front SAM (N10/1) at a rate of 150 mA when the engine is running, or STAR Diagnosis is left connected and set to charge the auxiliary battery. If the measured voltage of the auxiliary/additional battery is below 6.0V, it should be replaced.

Upon finding a faulty battery, replace it and verify the repair. It's important in some models to register the battery. After you have indeed solved the problem by replacing the battery, be sure to conduct a full system scan to be sure there are no underlying issues concerning the no start. Why did the battery fail? Just due to age, or is there perhaps a draw on the system? Is the charging system operating properly? Let's move on with the assumption that the battery tests "good" and has been eliminated as a cause.

to the no-crank condition, but try only to pay attention to those related to the symptom at this time. Many non-factory scan tools will not communicate with car if the message from the Electronic Ignition Switch for "Key On" is not working.

If the key turns in the ignition switch, but no warning lights come on in the instrument cluster, try to turn on hazard or dome lights to allow scan tool communication and check for fault memory in the Electronic Ignition Switch (EIS). Continue when a fault code is set for

Note the amp hour rating and the IBS at the negative cable of this Mercedes-Benz battery.

Fuses

This seems so simple, but in complex modern vehicles this step is often overlooked. Before moving on to scanning the vehicle, you should check all the vehicle's fuses. Sometimes there will be three or more different fuse blocks, and you might be tempted to check only those that seem related to starting the vehicle. But experience has taught us that fuse descriptions can be misunderstood. You will be quite frustrated to find out that the cause of your concern was simply a fuse that you thought was unrelated.

Quick Test

Perform a quick test on the vehicle and record, diagnose, and erase codes. Many unrelated codes may pop up due

Avoid frustration and embarrassment by checking all the fuses early on!

Electronic Steering Lock (ESL). Even if you have some anti-theft or ESL codes, it would still be prudent to verify the signals at the starter itself before going into more complicated EIS issues.

Starter Issues

As mentioned, the starter needs the proper voltage delivered at the right amperage in order to crank the engine over. A voltage drop test to the main connections and the signal wire to the solenoid are in order next.

Looking at our symptoms, check the signal wire first. Consult the wiring diagram if needed, but this should be the smaller wire at the starter solenoid connection. Check for a good signal when trying to crank the vehicle. If you have a good signal (>10.5V), connect your multimeter in parallel with the positive battery terminal and the heavy positive lead of the starter connection. In the DC volts mode, you should have no more than .2V per connection voltage drop when the circuit is loaded. In other words, turn the key to the crank position or hit the starter button. Do the same with the ground side of the circuit. Typically, .6V is the most you want to see for a voltage drop. If it is greater, proceed with checking and cleaning connections. If the starter has a good solenoid signal, and the main cables are sound as revealed by your voltage drop test, you can now deduce that the starter itself is faulty. One step that can be helpful at this stage is to give the starter a tap with a small hammer while a helper turns the key to the start position. If the engine now cranks, the starter has an armature issue and it's time to replace it.

Complete the Vehicle Test

Having eliminated the battery, fuses, starter wiring and starter, now you can address possible EIS faults. With the symptom: "No crank/no start/ESL and IC do not respond to key input," you should refer to topic number LI80.57-P-051521 for some troubleshooting tips.

Here's the procedure outlined in this particular tip, which is quite common, starting with the complaint:

1. No crank/no start/intermittent no crank.
2. Communication via SDS to Electronic Ignition Switch N73 (EIS/EZS), and or short test may or may not be possible at time of fault.
3. Scenario:
   - When accessing the passenger compartment, the message center in the ICM will illuminate (eventually the message center will time out and shut down, and will not illuminate until the CAN is activated via the interior lock/unlock switch).
   - The key will turn in EIS N73.
   - The ESL N26/5 does not activate/respond (or the steering wheel remains unlocked at all times).
   - The warning icons in the ICM will not illuminate.

Cause:
Internal issue with the Electronic Steering Lock N26/5 (part number A 204 545 57 32)

Remedy:
First, perform a complete guided test of the drive authorization system, and transmitter key via the "Tests" menu in the EZS control unit. Fault codes A25408 and A25464 in the Electronic Ignition Lock N73 (EIS/EZS) direct you to replace the Electronic Steering Lock N26/5.

NOTE: If no fault codes are stored, do not replace any parts!

Check the part number on the Electronic Steering Lock N26/5. If it is A204 545 57 32, please replace with part number A 204 545 81 32 using WIS instructions AR46.10-P-0910CW.

NOTE: It is possible to corrupt the Electronic Ignition Switch N73 if it is replaced prior to replacement of the suspect ESL. Also, insure that the CAN does not time out before the programming of the ESL with the workshop key is completed. If replacing both units, make sure to plug in the new ESL first.

Replacement of the ESL will require a programming workshop key to perform initial startup. After replacement of the ESL, insert the workshop key into the Electronic Ignition Switch (EIS). Once the light in the workshop key turns off, remove the workshop key and insert the ignition key. After a couple of seconds, you will be able to turn the ignition key, allowing the car to start. Replacement of the Electronic Ignition Switch (EIS) is the same, but you will need to program the VIN into the Electronic Ignition Switch (EIS) with scan tool functions. Be aware that these parts are on the Mercedes-Benz Theft-Relevant Parts (TRP) list. See the factory website for further details.

Function and Task of ESL and EIS

The electric steering lock control unit, located on the steering column, processes information from the electronic ignition switch control unit (N73) and is connected to it by a bi-directional serial data line.

XENTRY

Electronic ignition lock/steering lock / Overall vehicle / Does not receive turn authorization / Drive authorization system DAS / Safety and locking system /

Electronic ignition lock/steering lock / Overall vehicle / Drive authorization system DAS / Malfunction / Safety and locking system /

Overall vehicle / Drive authorization system DAS / Safety and locking system / DAS function / Malfunction /

Power generation / Engine management / Starter motor / Starter Function / Does not turn /

Overall vehicle / Drive authorization system DAS / Safety and locking system / Key receives no turn authorization / DAS function /

Engine start/stop / Power generation / Engine management / Does not start /

Control unit/fault code

Control unit	Fault code	Fault text
EZS - Electronic ignition lock (N73) (E/S_204)	A25408	The electric steering lock has a malfunction. There is a signal fault or the message is faulty.
EZS - Electronic ignition lock (N73) (E/S_204)	A25464	The electric steering lock has a malfunction. There is an implausible signal.

Parts

Part number	Ind-Par-tEs1	Ind-Par-tEs2	Designation	Quantity	Note	EPC	Non-EPC
A 204 545 81 32			Electronic Steering Lock	1		X	

Work units

Op. no.	Operation text	Time	Damage code	Note
			46202 73	

This is a possible readout during a scan of a no-crank issue (Source: LI80.57-P-051521).

After the unlocking operation, the power to the locking component is switched off to avoid unintentional locking.

The following is the scope of the ESL:

- Calculation of Hash value
- If the Hash value is incorrect and the unlocking position is not reached or not recognized, an error message is transmitted to the electronic ignition switch control unit.

NOTE: Hash values can be thought of as fingerprints for files. The contents of a file is processed through a cryptographic algorithm, and a unique numerical value – the hash value – is produced that identifies the contents of the file. If the contents is modified in any way, the value of the hash will also change significantly. Two algorithms are currently widely used to produce hash values: the MD5 and SHA1 algorithms.

- Position monitoring of locking bolt via two hall sensors
- Switching on integrated motor via alternating relay for locking and unlocking bolt
- Locking steering column with locking bolt

Inputs:

- Circuit 30
- Circuit 31
- Serial data line to electronic ignition lock control unit

Output:

- Serial data line to electronic ignition switch control unit

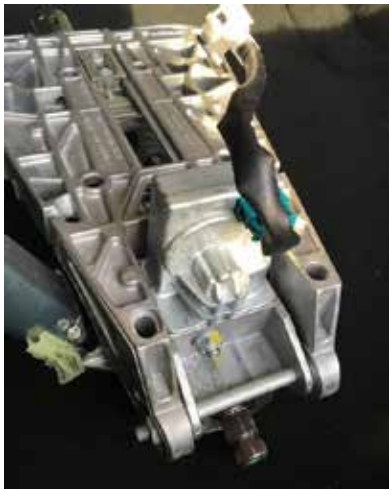
The electronic ignition switch control unit is located on the right next to the steering column (204 models).

The EIS is the master control unit for the following functions:

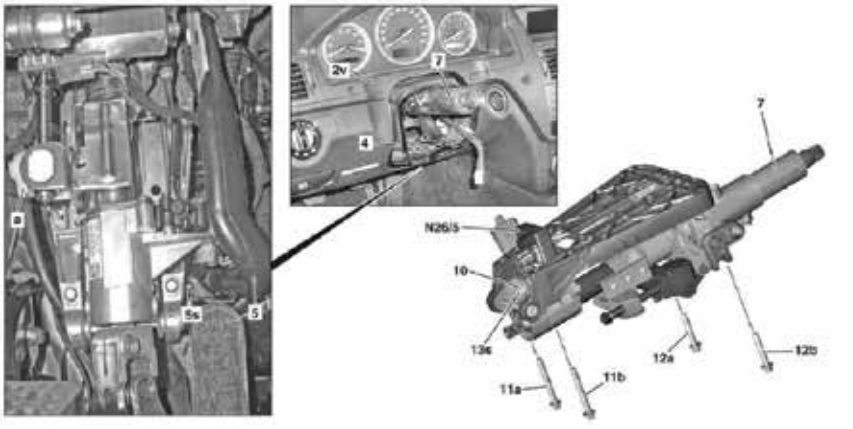
- Drive authorization stage 3 (DAS3)
- Central locking (CL[ZV])

Scope of tasks for EIS:

- Communication with transmitter key when transmitter key (A8/1) is inserted, via infrared signals and inductive energy transmission.
- Encrypted data exchange according to Hash method for key identification with transmitter key
- Transmitting hash code
- Rotary-angle-dependent activation of circuit 15R, circuit 15 and circuit 50 after identification of transmitter key
- Mechanically locking transmitter key in turned positon and mechanical rest between start and drive position
- Mechanical reception and read-in of KEYLESS GO start/



The electronic steering lock is attached at the steering column.



Here's the steering lock breakdown from WIS document AR46.10-P-0910CW.

stop button (S2/3) via additional contact switch in EIS

Inputs:

- Circuit 30
- Circuit 31

Outputs:

- Circuit 30 to ESL
- Serial data line to ESL

It should be noted that the EIS and ESL are participants of the interior CAN and chassis CAN, and are not a gateway.

A typical EIS assembly

Drive Authorization System – DAS

The drive authorization system is a combination of the EIS, ESL, ME-SFI, and electronic transmission control units all communicating together to start the vehicle.

The encrypted data is exchanged between the transmitter key and the EIS via an infrared signal. The code is then computed in dialog between the key and EIS using the above-mentioned Hash method. The corresponding value of the key is transmitted to the other control units by the EIS. Check, release, and feedback are performed separately by each control unit.

When the transmitter key is inserted in the EIS, it is inductively supplied with power so that even when the key's battery is dead the vehicle can still be started. You will, however, have a message in the cluster display if the key battery is dead. Asking your customer if he or she has another key is always a wise part of the diagnostic platform in the event that the first key is defective.

As you can see, we've gone from simple to complex. Using proven methods, diagnostic strategies, and proper equipment, you should be able to diagnose even the most difficult no-crank concerns.

Independent Service Provider Parts Information - ISPPI

Daimler AG recently switched from its Electronic Parts Catalog EPCnet to a new system, ISPPI (Independent Service Provider Parts Information). This new system contains exactly the same parts information available to Mercedes-Benz dealers worldwide.

After nearly 15 years, EPCnet was showing its age. While several years of optimization had EPCnet running smooth and fast, the core Java technology has nearly reached the limits of what is needed to support modern vehicles. Hosted in Europe by Daimler, ISPPI uses the latest web page standard, HTML5, doing away with the constant Java compatibility issues that plagued EPCnet, and offering several new advantages.

The biggest advantage is a live connection to a database of vehicle data cards of every nearly vehicle built since the mid-1980s. The advantage here is that changes to the vehicle's configuration – a different engine installed, retrofitted option codes, and so on – are all managed in real time, instead of being stored in a static file set. This offers greater accuracy when looking up parts. Daimler will add the data cards for older vehicles in stages over the coming year, ensuring support for the classics.

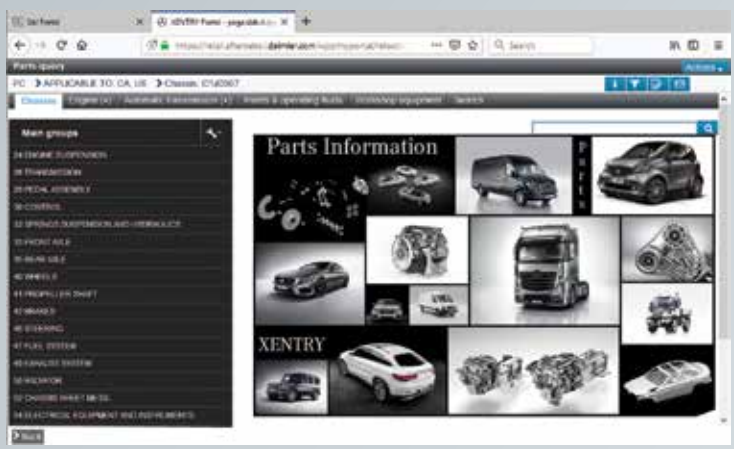
The new user interface offers several possibilities for customization, changing the way the system looks and feels according to each user's preferences. An extensive user guide is available for download to help with understanding all the possibilities.

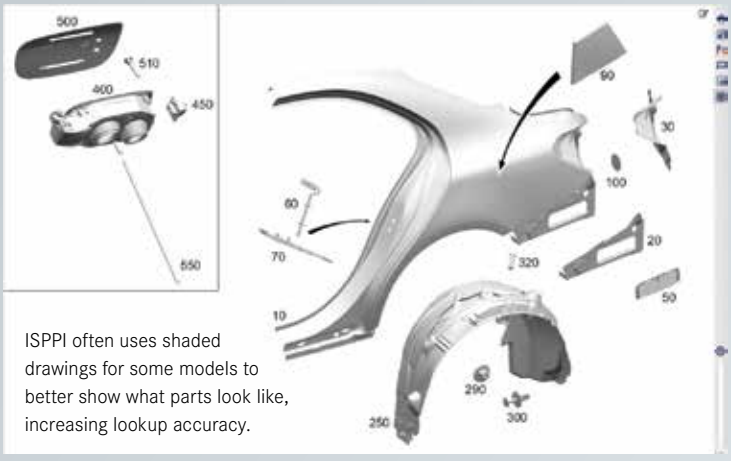
The workflow to find a part is somewhat improved, but still uses the familiar group and sub-group system known from as far back as the parts microfiche era. As with EPCnet, start with the VIN to ensure the vehicle-specific filters are enabled, then pick the group and subgroup. Finally, pick the part(s) you need by clicking the parts on the illustration.

As before, ISPPI also has separate catalogs for paints and operating fluids as well as for Mercedes-Benz special workshop tools. Also as before, a parts search can be started with either the model designation (Baumuster), or using the pull-down menu of all vehicles and models to pick what you need. Of course, without a VIN the parts filters are unavailable.

All EPCnet subscribers in the United States were migrated to ISPPI in mid-December, 2018. New subscribers can visit the website https://epc.startekinfo.com to subscribe. Select the "Subscribe" link, complete the simple three-step process, and a User ID and temporary password will be assigned within a few days – unlike EPCnet, subscriptions are not processed instantly. A subscription includes not only passenger cars, but (subject to change) all Daimler vehicles worldwide such as buses, trucks, and the Unimog, as well as Sprinter vans and Smart models. A subscription costs $75 per year, the same as EPCnet.

StarTuned plans to cover ISPPI in greater detail in the next issue, so stay tuned!





ISPPI often uses shaded drawings for some models to better show what parts look like, increasing lookup accuracy.

Yet Another Great Benefit for Independent Repair Shops

Mercedes-Benz STAR REWARDS

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 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.

Performance. Reliability. Success.

With our competitively priced Genuine Remanufactured Parts, you no longer have to settle for anything less than Mercedes-Benz quality. But that's just part of the story. You see, our AIRMATIC® struts, catalytic converters, turbochargers and steering racks all carry a 24-month, no mileage-restriction warranty. So our parts are not only a great deal. They're a great value. And since they're genuine Mercedes-Benz, you can have confidence they'll last, and so will your relationship with your customers.

Mercedes-Benz

The best or nothing.

*MSRP excludes state and local taxes, and freight if applicable. Price excludes core deposit. Price valid as of March 2017. Prices may vary by dealer. See your authorized Mercedes-Benz dealer for additional details or a copy of the Mercedes-Benz parts limited warranty.

Contact an authorized Mercedes-Benz dealer
or learn more at www.mbwholesaleparts.com

One remanufactured engine pulls the plug on climate-damaging CO_2 and saves 447 days of power for one laptop.

Loaded

Wheel Bearings & Seals

You may think of them as ho-hum mechanical parts, but they still need attention, especially with wheel speed sensors.

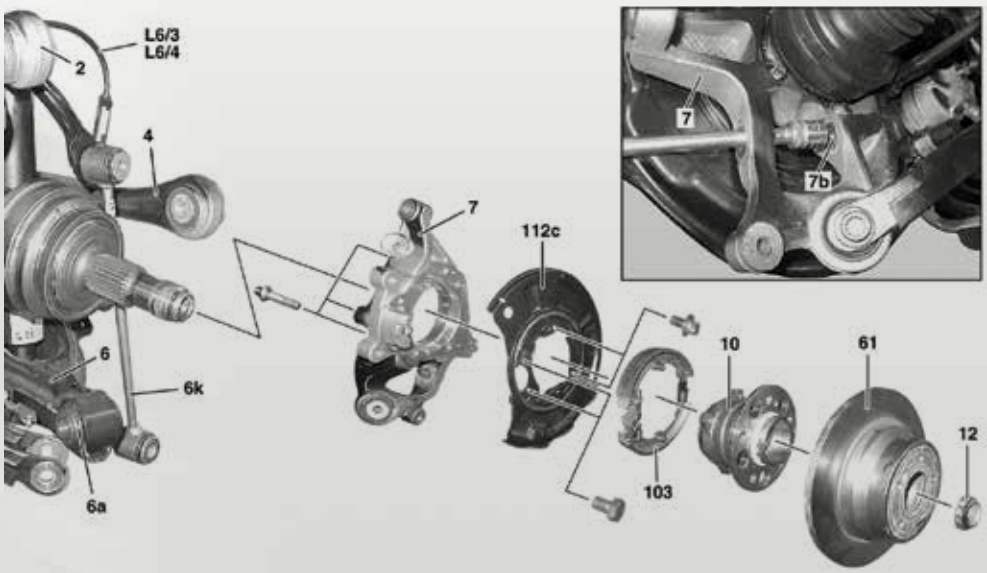
There's more to wheel bearings than meets the eye. Since even the earliest uses of the wheel, a means of reducing the friction where the moving hub meets the non-moving axle has been used, but we've come a long way since wooden bushings soaked in paraffin.

Modern cars have been using roller bearings almost as far back as anyone alive can remember, and the technology involved hasn't changed much in a lifetime. But that doesn't mean there's nothing new under the sun.

Here, we'll take a close look at wheel bearings, along with how they're related to the wheel speed sensors used for modern ABS, traction management, and stability control.

Let's start with the easy stuff. Rear wheel bearings in rear-wheel drive cars have to support the drive axle shafts, so they're always non-adjustable bearing assemblies. Some are pressed onto the end of the rear axle shaft, but more recently they're bolted to the wheel carrier or hub in a holder.

The same goes for the front wheel bearings in front-wheel drive cars, as well as all four wheel bearings in 4MATIC models. In all these cases, replacing wheel bearings is a fairly simple operation: Take the old one off, install the new one. The details do vary from model to model, and in some cases the procedures needed to get at the bearings can be somewhat labor-intensive: When there's an axle involved, it generally needs to be removed to access the bearings. But the bottom line in these situations is that the Mercedes-Benz Workshop Information System (WIS) will supply all the finer details of the procedures, because even though they don't usually vary much, they do vary.



A non-adjustable rear wheel bearing integrated with the hub (10). Installation is a simple bolt-on operation once the carrier (7) is accessed.

Left: A bearing that failed the normal way, from metal fatigue after a long life. Notice the pitting on the tapered rollers: This is from tiny flakes of metal falling off the surface after billons of compression cycles.

Mercedes-Benz requires wheel bearings to be replaced in pairs, meaning both left and right sides need to be replaced at the same time. Much like brake discs, you'd never replace just one, even if the other seems fine. This is also not a bad time to recommend brake discs and pads, even if there's still some meat on the old ones, because there is virtually no extra labor involved. Naturally, we don't want to cheat our customers, but in our shop if the pads and/or discs have less than about 10K miles left on them, we'll explain the situation to the customer – including our estimate on how much pad and rotor life remains - and ask if they want to replace them anyway, since they really only have to cover the parts cost. Some of our customers consistently decline, but most of them are happy that we can save them some money by doing this.

We also take the time to check all the steering and suspension parts. Wheel bearings are not likely to fail on newer cars, so by the time this job is needed the vehicle has seen quite a few miles. Checking everything out carefully takes only about 15 minutes, and we always write on the work order what we did and what we found. Most of the cars we get are regulars, so we've been keeping an eye on things over the years, but we find that our customers keep coming back because they can see we're looking out for them and their cars.

Then we come to the front wheel bearings that need adjustment. While most technicians working for even just a few years have done this job before, let's walk through it carefully, closely following the WIS work instructions. Taking the E-Class as an example, this basic procedure has remained unchanged from before the 123 model to at least the 212 model. Really new cars, like to 213 and 205 C-Class, are different, but we'll get to that in just a moment.

The theory of wheel bearing adjustment is that a constant pressure on the bearing rollers allows for a more consistent lifespan. Too little pressure, a result of too much bearing clearance, and the wheel can "rattle" the bearings. This allows shock forces on the bearing rollers and races to actually put microscopic dents into the bearing system. Roll over the tiny imperfection often enough, and the bearing will fail. Likewise, too much pressure from too little clearance and the excessive compression forces cause the bearing to overheat, and hot metal doesn't have the durability of cool metal. In other words, faulty adjustment is bad for the bearing.

Bearings of all types have distinct ways of failing. While a mechanical engineer can explain and even predict these failures using advanced math, let's just get at the basics. Even a correctly installed, clean, well-lubricated, and properly-loaded bearing will fail by fatigue, from the stresses of repeated contact. Just like bending a coat hanger wire enough times eventually causes it to break, compressing the surface of the bearing races and rollers (or balls, needles, whatever) bends the metal at the surface just a tiny bit, and after very large number of cycles, the molecular bonds start to break, just like that coat hanger. This causes very thin flakes of the surface metal to break free, contaminating the bearing and leaving rough spots behind. Once this failure mode, known as "spalling," begins, the process accelerates due to the small metal particles now added to the contact points, similar to how beach sand might affect a bearing. This, by the way, is the normal failure mode when bearings "wear out."

A typical wheel might rotate 600 times per mile, so each point on the race of a bearing with (for example) 25 rollers will see 25X600 = 15,000 compression/decompression cycles pressing on it each mile. So when that E320 comes in with 100K on the clock and doesn't have a noisy front bearing complaint (hardly any do at that mileage), we express amazement at the fact that those bearings have experienced over 1.5 billion bending cycles and are still going strong.

Ah, but sometimes they don't last that long. There are a few causes for early bearing failure, but they almost always come down to one of two things: heat or shock. Heat comes from the excess friction caused by a too-tight bearing, contamination, lack of lubrication, or an outside influence (think acetylene torch). Shock comes from excessive bearing clearance, an accident, or a careless technician with a hammer.

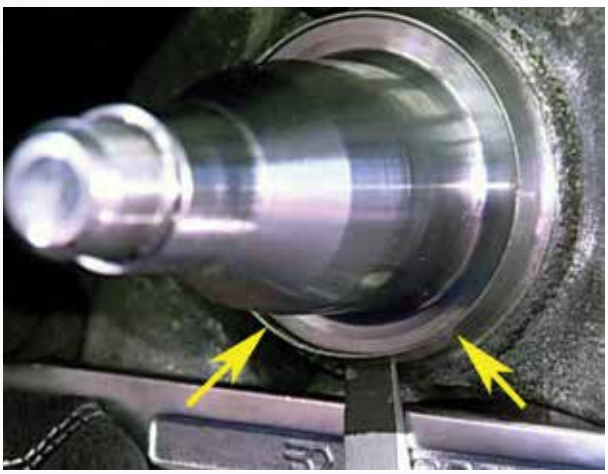
Here's the procedure that works for just about every Mercedes-Benz model we've ever seen (but as always, WIS has the details):

We start by removing the front wheels, brake calipers and discs. If you have a SBC-equipped model, be sure to deactivate the system first. Using our trusty hub cap remover, the center cap comes off. Resist the urge to pry it out with a chisel or screwdriver – bending one (even a little) will ruin it, and grease will eventually leak out onto your customer's shiny alloy wheels.

With a hex wrench, loosen the clamping screw on the axle nut and unscrew the nut from the spindle. In some models, there's a bronze spring and contact at the end of the spindle. Be sure to save this for re-use, unless you bought a new set. Shake the hub a little to pop out the covering washer and outer bearing, and remove them. This is a good time to note the condition of the wheel bearing grease: Is it still green, as original, or is it black? Does it contain "glitter" (the tiny flakes from a failed bearing) in it? Be sure to save some for the customer's inspection.

Pull the hub straight out off the spindle, and bring it to the press. If the hub is stuck, there's a slide-hammer-type puller that will pop it right off. In older models – late 1990s and earlier – the speed sensor tone wheel (also known as a pulse wheel or generator) is a series of grooves or splines machined into the hub. In later models, the tone wheel is a separate slotted disc at the back of the hub, while in still newer models it is part of either the inner seal or bearing assembly. No matter the technology, take pains to avoid damaging it unless it's being replaced. Note that in some models have you remove the speed sensor to avoid damage.

Our Mercedes-Benz special tool, W116 589 22 33 00, sees a lot of action in the shop. It is used to remove and reinstall the cap on the wheel hub. The wheel turns to open and close the jaws, and the slide hammer makes quick work of even the most recalcitrant hub cap.

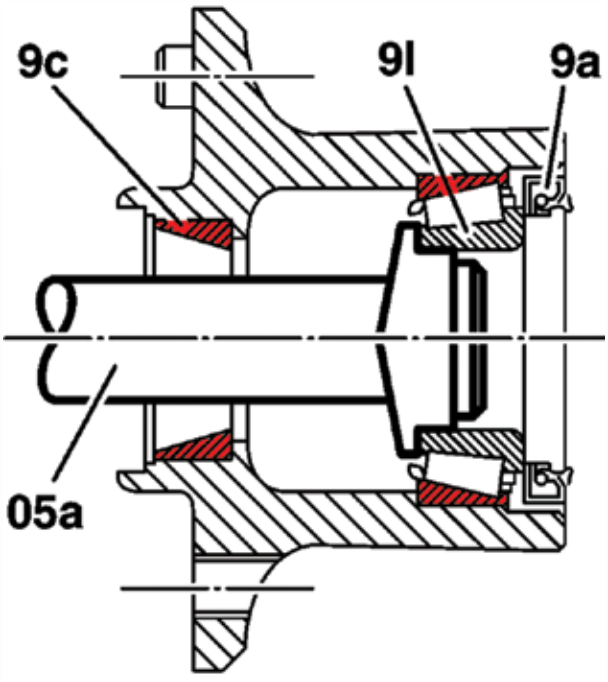


In some models, the metal carrier (arrows) of the inner bearing seal can remain on the spindle after the hub is removed. Check carefully and be sure to remove it before installing the new seal, which has its own metal carrier. The carrier cannot be re-used.

Using the seal removal tool or a brass drift, pop out the inner seal, pull out the inner bearing, and use the bearing race tool to drive out both outer races of the outer and inner bearings. Clean and carefully inspect the hub, and if anything is damaged, replace it.

On the spindle, of particular importance is the surface that the inner seal rides upon, which needs to be smooth and shiny. Also inspect the spindle bearing surfaces, and if discolored from heat it also needs to be replaced. In some models, a thin metal seal carrier from the old seal might remain on the spindle. Check for it carefully and, if found, pry it off before installing a new seal with carrier. In the accompanying photo, an arrow points to the metal carrier. Then start reassembling.

First, install the inner races of the inside and outside bearings using the installation tool. Then pack both bearing cages full of the Mercedes-Benz green high-



The components of a typical front hub. The inner seal (9a) is removed when the drift tool (05a) presses out the inner wheel bearing (9l). A similar drift is then used to press out the inner races remaining in the hub (color). The specific drift to use depends on the model, so check in WIS for the details.

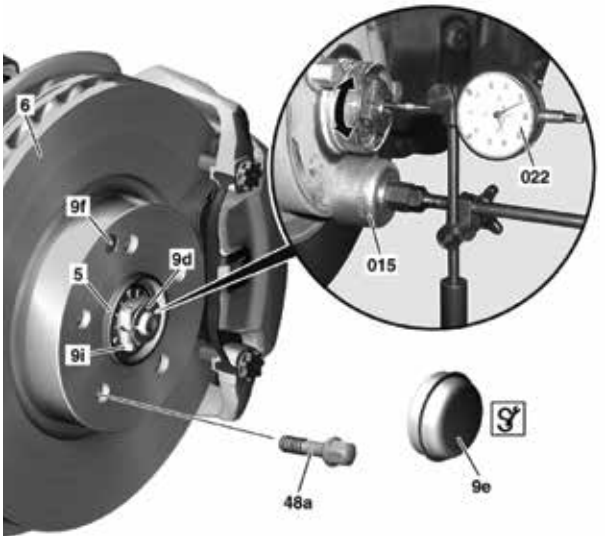
temperature bearing grease (A002 989 00 51). Remember, everything has to be super clean, since even a small amount of debris will cause premature failure. Install the inner bearing and then the inner seal, and pack the specified amount of grease into the hub. For a 204 model, for example, 60 grams (just under half a tube) gets placed inside the hub in the space between the inner and outer bearings. Lightly grease the spindle and the inner seal lip, and gently install the hub onto the spindle. Be sure to avoid cocking the spindle off-axis even a little, otherwise the seal can be damaged. Push the outer bearing onto the spindle and into the hub, then install the spacer washer and spindle nut. Hand-tighten it.

While continuously spinning the hub, tighten the spindle nut with a wrench tightly, until the hub starts getting noticeably more difficult to turn. This sets the bearings and makes sure the races are installed flat. Loosen the nut and re-tighten it barely finger tight. Lightly grease the hub faces that will contact the brake disc – just a little to prevent seizing later on.

At this point, all the greasy parts are done, so we take a few minutes to clean up, change gloves, and check everything. Install the brake disc, remembering that the brake disc safety screw is a single-use fastener. Always replace it after it has been loosened. Tighten the new safety screw to spec (usually 9 Nm).

Now comes the tricky part: the actual adjustment. Keep the brake disc from wobbling by fastening it to the hub. Use a wheel bolt, opposite the safety bolt, to hold both sides of the disc tightly to the hub. Attach the magnetic base of a dial indicator to the brake disc, with the indicator tip on the spindle nose – see the image. Push and pull the brake disc/hub assembly in and out with a fair amount of force, but absolutely in line with the spindle, and measure the free play. Specification is 0.01 to 0.02 mm (0.0004 to 0.0008 in.) of free play. Tighten or loosen the spindle nut in very small increments until the spec is reached.

In a practical sense, we find it easiest to loosen the nut until Iwe can actually feel some play. The hub/disc assembly makes a kind of clicking sound when pushed and pulled. Check the adjustment – probably quite a bit loose – and very slowly tighten the spindle nut, maybe a 20th of a turn at a time. This might take a few tries to get just right, and experienced hands can feel the right point. There is definite and audible movement (it might



The spindle nut (9d) is turned to adjust the wheel bearing clearance, which is measured with a dial indicator (022) and magnetic base (015). A wheel bolt (48a) is used to fasten the brake disc (6) to the hub, since the safety screw (9f) is not enough to keep the disc from moving in and out, causing incorrect clearance measurement, which is less than 0.001 inch. The locking screw (9i) locks the adjustment in place.

take a quiet shop), but not much. Once you have it right, tighten the hex locking screw to 11 Nm, and re-check the adjustment. Repeat until it's right.

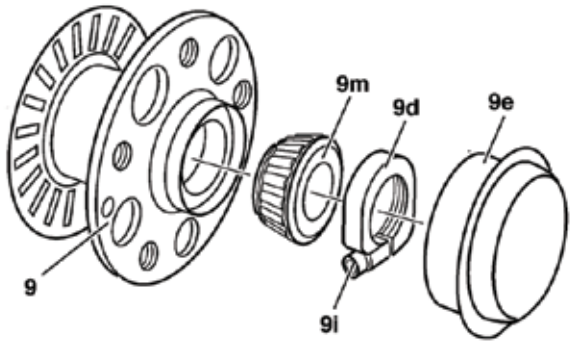
When pushing and pulling, don't use so much force that you move the steering or have the brake disc moving relative to the hub. The best we can describe the force is about as much as it takes to push a flat brick across unpainted concrete.

After the clearance is adjusted, put 15 grams of grease into the hub cap, and, using the slide hammer to avoid damage, pop it back on. When the wheel hub gets up to temperature, the grease is partly liquefied and will flow out of the tiniest gap on the wheel hub cap, staining your customer's wheels. If in doubt as to its condition, replace it.

For newer models like the 205 C-Class and 213 E-Class, the bearing is an assembly that bolts onto the wheel carrier, no adjustments needed. Four bolts, tightened quite a lot (see WIS for the specs), hold the bearing and carrier in place. Kind of an anticlimactic letdown after all that work on the earlier models.

Then, there are the tone or pulse wheels. In early ABS vehicles, there were three: one on each front wheel, and a third at the rear differential. The analog sensors of the era detected the "splines" machined into the hub or on a special wheel attached to the pinion shaft at the

The rear axle pulse wheel (5) must be pressed on to the axle (4) and never hammered, or it can be damaged.



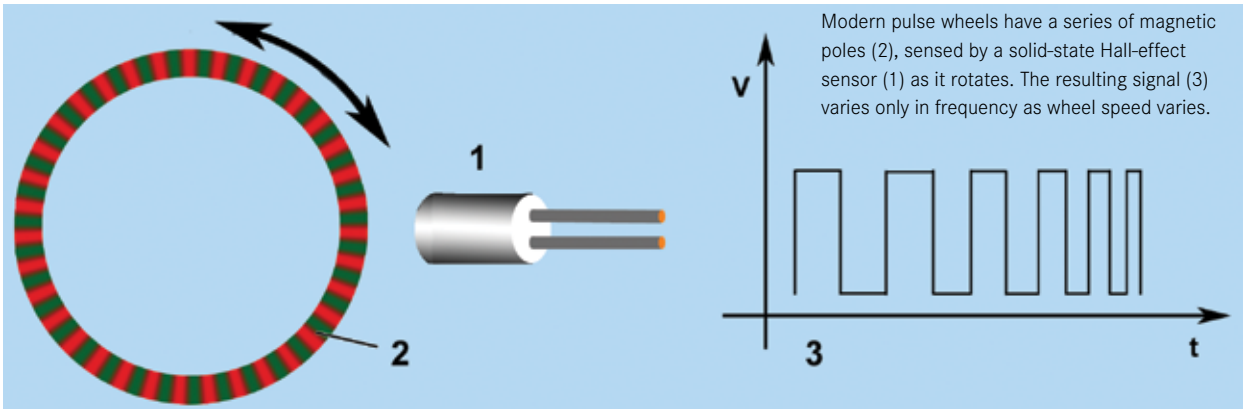
The wheel hub (9) incorporates a slotted disc (left) for the traction control system's wheel speed sensor. Also shown are the outer bearing (9m), spindle nut (9d), locking screw (9i), and hub cap (9e).

differential. The introduction of ASR required each wheel to have its own sensor, so in the rear the machined hub design was used. Sometimes, these splines got dirty and caused problems. A wire brush and a careful inspection was the usual cure.

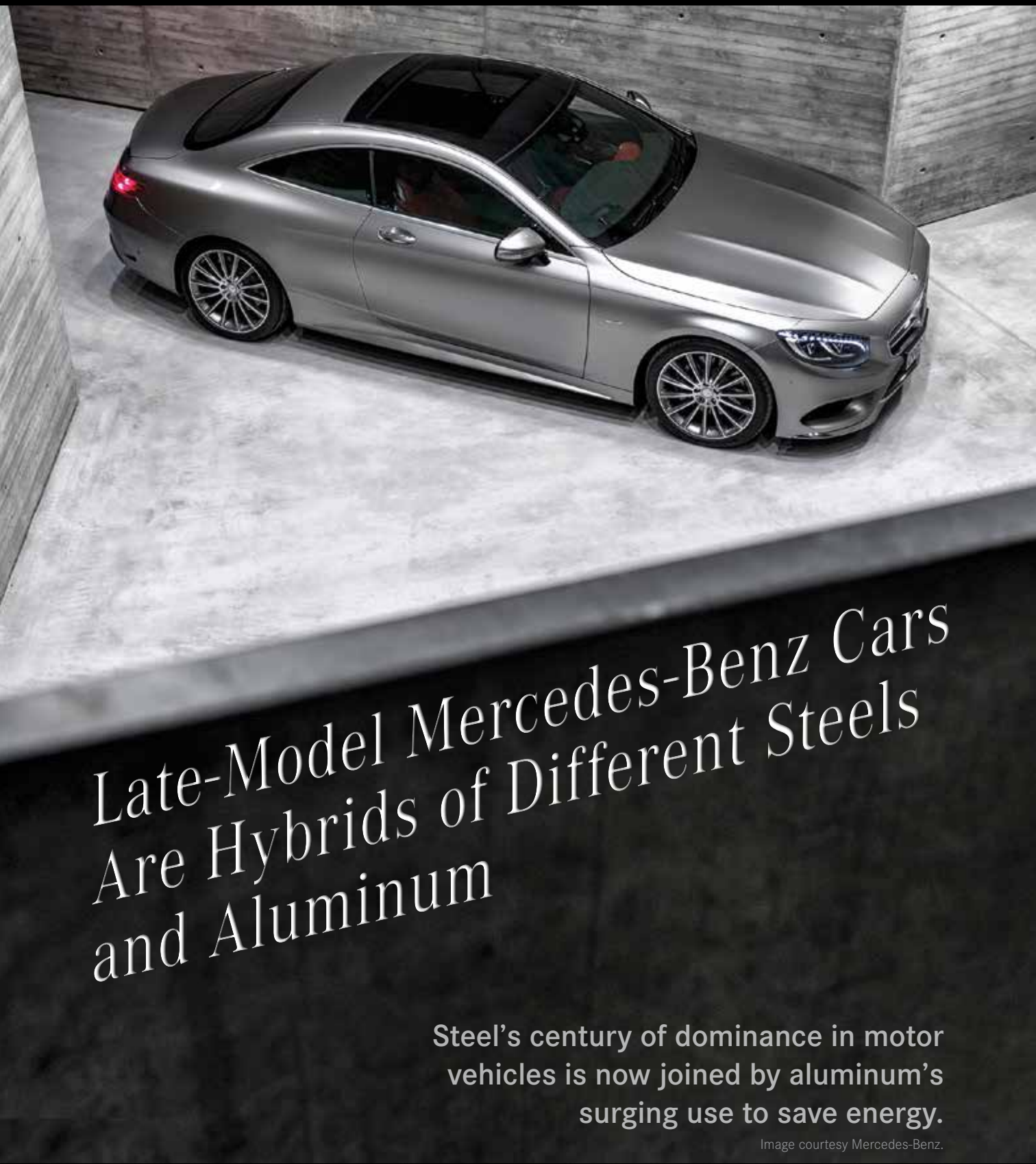
Not long after, active digital sensors were introduced, which use the Hall-effect to sense magnetic pole "lines" invisibly embedded into an object. At the rear axle, a magnetic tone ring is pressed onto the axle shaft. Taking the old ring off can be done with a drift and hammer, but the new one must be pressed onto the axle. Hammering it even a little can crack or demagnetize it.

In the front, at first the machined splines gave way to a slotted disc. Then, a magnetic pattern was embedded into the inner seal, or in later cars with non-adjustable bearings, the rubberized edge seal of the bearing itself. With these magnetized components, it's important that you don't accidently demagnetize them. Using a magnet near them (duh!), or striking them will cause damage, as can strong vibrations such as from a near-by hammer blow.

An important implication of these magnetized tone wheels is that if the traction control system is acting strangely, or there's a DTC related to wheel speed or wheel speed sensors, remember that the cause can include the tone wheel. Your best bet is to use an oscilloscope to monitor the speed sensor's signal output, ideally using the Mercedes-Benz breakout box and correct test cable. The Hall-effect sensors need power and ground to function, and remember that they switch on and off to produce pulses that are grounded. So, measuring from output signal to ground won't give you a reading. You have to measure from output signal to power! Spin the wheel at about one revolution per second and look for missing, too-long or too-short pulses, which are indications of tone wheel troubles.



Modern pulse wheels have a series of magnetic poles (2), sensed by a solid-state Hall-effect sensor (1) as it rotates. The resulting signal (3) varies only in frequency as wheel speed varies.



Late-Model Mercedes-Benz Cars Are Hybrids of Different Steels and Aluminum

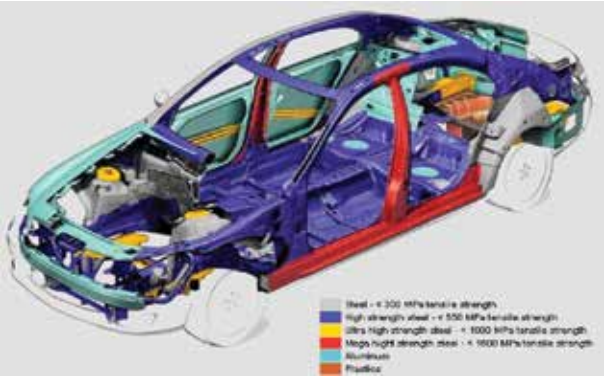
Steel's century of dominance in motor vehicles is now joined by aluminum's surging use to save energy.

Image courtesy Mercedes-Benz.

Mercedes-Benz

For a century after Karl Benz's Patent Motor Wagen appeared in 1886, cars were made primarily of steel and iron. Aluminum occasionally crept into vehicles, but only minimally.

Then came the past 40 years, with a profound need to conserve energy and a strong emphasis on passenger safety. With those imperatives came the surging inclusion of aluminum as an integral part of the modern car. Instead of being nearly 100 percent steel or iron, today's cars are roughly 65 percent steel and 30 percent aluminum – and aluminum increases its percentage with each new model year and vehicle refinement.



Several types of steel from mild cold-rolled to Advanded High Strength Steel (AHSS) make up about 60-70 percent of Mercedes-Benz vehicle bodies, blended together with aluminum components to create a super-strong, advanced, and highly-appealing motor car.

Electronic catalogs simplify selecting the correct part or component when replacent is needed.

One of the main reasons for this is to shrink the "energy footprint" the automobile leaves on the environment. Recent independent studies claim that aluminum in automobiles has a 20 percent smaller life-cycle CO2 footprint than steel, and that aluminum vehicles prevent 44 million tons of CO2 emissions when compared to steel vehicles.

Steel Still King, Bolstered by Aluminum

Most steel employed in Mercedes-Benz vehicle bodies is low-carbon annealed cold-rolled, or simple mild steel. Low carbon content and annealing makes this steel soft and malleable, suitable for undergoing the severe deformation required for forming complex shapes. The body and chassis make up over half the weight of the average vehicle, and the tensile strength of steel is significantly stronger than that of the strongest aluminum alloys.

This means that aluminum parts need substantially increased thickness compared to steel to meet strength and safety standards, and newly-developed high-strength steel (AHSS) can reduce steel's weight by being thinner and still meeting requirements.

Still, aluminum yields weight savings of up to 50 percent compared with the traditional mild steel structure, while being equal in strength.

However, advanced high-strength steels with different properties compared to conventional carbon steels offer advantages comparable to aluminum in weight savings. Also, ferrous metals are easier to weld. Mechanical fastening is about the same for steel or aluminum in terms of complexity, although galvanic corrosion is an issue if aluminum must be joined to a steel substructure.

Aluminum is lighter, and can be formed from relatively thick sheets, but high-strength steels can match aluminum parts through redesign and thinner gauge sheet. Steel and aluminum are both 100 percent recyclable, although steel is somewhat easier to handle.

Mild Steel Bolstered by HSLA Bodies Ruled 20th Century

For the latter part of the 20th Century, Mercedes-Benz vehicles for the most part were made with variations of mild cold rolled steel strengthened and somewhat lightened by extensive use of HSLA (High Strength Low Alloy) steels. Also included were occasional but growing additions of aluminum, plus magnesium and more and more plastics.

But the extreme pressures of the past few years have brought significant changes to steel. Still representing roughly 60-65 percent of the vehicle body and chassis, newly developed AHSS (Advanced High Strength Steel) is beginning to replace HSLA as the steel of choice to add significant strength and lower weight in the vehicle. While most StarTuned readers are repairing vehicles with extensive use of HSLA, some vehicles introduced in the past few years are going big time in using AHSS.

Meeting the fuel economy and lower footprint challenges with less steel at a lighter weight, these steels feature improved formability and crash-worthiness. They can be manufactured at very thin gauges while maintaining the strength of mild steel, and better than conventional steel of a couple of decades ago. This allows using AHSS in the same amount of packaging space as conventional steels – less material used and a lot of mass saved.

Steels with higher tensile elongation have better cold formability for stamping and more automotive energy absorbing capacity, and first-generation AHSS normally gets its formability from ferrite microstructure and its strength from "martensite" microstructures. Second-generation AHSS uses induced plasticity effects, and is the key to the Transformation Induced Plasticity (TRIP) effect. When austenite is deformed, it transforms into martensite and thus gets stronger, delaying sheet metal forming fracture. Their formability is significantly better than that of other first-generation steels.

For the moment, we'll concentrate on the use of conventional or mild steel augmented by HSLA steels.

Avoid Prolonged High Temperature with HSLA Welds

Heat treatment can be time-consuming and costly, and can affect the strength and toughness of a welded joint, its corrosion resistance, and the joint's residual stress level. But it is also a mandatory operation required in many welding application codes and standards.

Great welds make solid repairs that usually are at least as strong as the sheet metal around them.

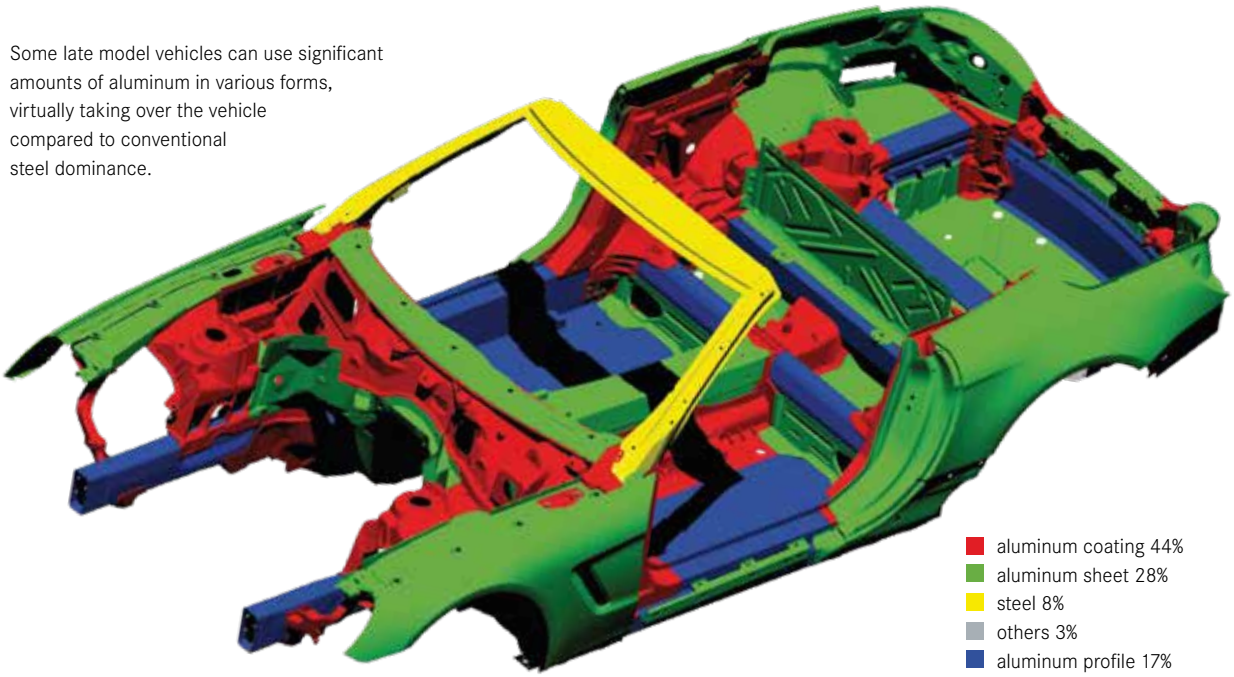
The welded joints of steel, including HSLA, usually require post -weld heat treatment (PWHT) to reduce residual stress and improve the weld's performance. If the PWHT is conducted at an appropriate temperature and time, the welded joint gains favorable mechanical properties, but if the PWHT temperature is too low, the weld metal exhibits inadequate toughness due to insufficient tempering effect.

CAUTION: If the PWHT temperature is too high, however, the tensile strength at ambient and elevated temperatures is reduced from the excessive tempering effect. PWHT involves heating the metal to a high temperature, where re-crystallization and/or a phase transformation take place, and then cooling slowly to soften the metal after it has been hardened. Normal repair facility welding procedures involving HSLA steel are fine, but avoid overheating or "cooking" the weld to make sure it takes.

Initial PWHT temperatures should be brought down and held at about 600 deg. C, then finally cool the weld down to avoid modifying the mechanical characteristics of the metals involved. If temperature remains too high and is then brought down suddenly, this can actually weaken the weld rather than strengthen it. This camn potentially cause later weld failure and require re-welding.

In cases where the PWHT hold temperature exceeds the transformation point of the weld metal, the weld metal undergoes reverse transformation, which results in a microstructure containing fresh "martensite," a substance that generates high strength, but low

Some late model vehicles can use significant amounts of aluminum in various forms, virtually taking over the vehicle compared to conventional steel dominance.



toughness. This deteriorates the overall welded joint performance. The PWHT temperature should be carefully controlled to avoid this problem.

Crash Worthiness is a Strong Aluminum Advantage

Aluminum absorbs about twice as much crash-induced energy as does the same weight in steel, another strong advantage for aluminum use in a passenger car. But, and this could be highly important, the higher cost of aluminum versus steel could add to the cost of the vehicle. Aluminum materials are generally two to three times more expensive per pound than steel.

MIG Welding Aluminum Generally Used

Aluminum has a much lower melting point – half that of steel – and higher thermal conductivity – as much as five time that of steel – and the heat in the aluminum dissipates very quickly. Aluminum must be treated with care compared to welding straight steel, and welding aluminum requires different techniques and possibly different – or expanded – equipment. However, MIG welding or Gas Metal Arc Welding (GMAW) of aluminum are very important aluminum welding methods used in most Mercedes-Benz collision centers, and basic MIG is relatively straightforward to perform.

Aluminum thermal conductivity is double that of steel, aluminum heat dissipates quickly and welding currents and voltages must be higher than for steel. *But keep track of correct temperatures and don't overheat aluminum welds! Basically, you cannot overheat an aluminum joint and achieve a successful weld.*

When welding:

- Turn up the wire feed speed for out-of-position joints to avoid a fused tip or weld that does not take.
- Push the wire into the joint.
- Avoid pre-heating to prevent degrading the aluminum's mechanical properties.
- Keep track of and control the welding "puddle."

Gas-shielded flux core welding (FCAW) may be an option rather than MIG for indoor out-of-position applications. This system avoids producing spatter, delivers high deposition rates, and requires very little material pre-cleaning. FCAW filler metals allow higher heat inputs and deposition rates, and perhaps double deposition rates for out-of-position (overhead, upright, or otherwise not flat) welding with excellent bead quality. Some consider FCAW wires more forgiving and easier to use, especially with applications requiring a lot of welding.

It is possible to use the same welding parameters for in-position (flat or horizontal) welding as for out-of-position welding due to FCAW's wide parameter window.

Tips on MIG Welding

Aluminum welds very well with MIG, and this is best used on thicker materials that are in a flat position. Thinner and out-of-position materials are basically for highly-skilled and experienced aluminum MIG welders. In many cases, even experienced welders find this difficult to learn because of the way the welding puddle looks and the fast travel speeds used to weld out-of-position.

Gas Metal Arc Welding Aluminum (GMAW)/MIG

- Good for most welds
- Creates fast weld deposits
- Welds in every position
- Yields x-ray quality welds
- But pay attention!
- *Take great care with temperature in out-of-position welds – do not overheat!*
- Needs real skill, appropriate equipment
- Difficulties welding thin aluminum

MIG welding aluminum machine settings are similar for all positions, normally needing about 20 to 24 volts to achieve arc spray transfer. Welding out-of-position, which may account for most collision center applications, however, requires increasing wire feed speed to keep the weld full of metal, with the wire feed pushing the wire into the joint. If feed speed becomes too slow, a fused tip or a weld that does not take might be the result. In other words, turn up the wire feed speed for out-of-position joints.

The thickness of the material to be welded determines some of the techniques. The base material must be thick enough to handle the heat.

Generally Limit or Avoid Preheating

While a little preheat is okay to clear up moisture, limit preheating to avoid degrading the aluminum's mechanical properties. The maximum heat treatment for heat-treatable alloys is 400 degrees F. (204 degrees C), but if the aluminum is preheated to 350 degrees F. (177 degrees C) and holds the temperature in that range while welding, the aluminum's mechanical properties are changed, and not necessarily for the better. For non-heat-treatable alloys such as 5000 series aluminum, holding the temperature even as low as 200 degrees F. (93 degrees C) can sensitize the material and make it prone to stress corrosion cracking.

Keep the temperature within correct settings when welding aluminum joints, and don't overheat mistakenly attempting to ensure the best weld. You cannot overheat an aluminum joint and achieve a successful weld.

Compared to steel's 2,600 degrees F (1427 degrees C), aluminum's low 1200 degrees F. (649 degrees C) melting point does not mean that light-duty equipment is okay for welding aluminum. With thermal conductivity more than double that of steel, aluminum heat dissipates quickly and welding currents and voltages for welding aluminum must be higher than for steel.

Machining to remove the material tends to distort and create dimensional instability. *This is different from steel welding, where stress-relieving is performed by heating the material hot enough to allow movement of the atoms.* The stress-relieving temperature with steel is about 1,100 degrees F. (566 degrees C), but the post-weld stress-relief temperature for aluminum (650 degrees F/343 degrees C) is so high, the mechanical properties of the alloy are lost – basically a no-no.

CAUTION: Do Not Overheat Aluminum Joints!

When setting up MIG welding machinery, the operator will need to utilize machine speed to react to the temperature of the aluminum. If welding cold aluminum or spot/tack welding, machine settings are standard, but if welding joints, temperature becomes quite important. When welding a cold joint it may appear that the machine heat is too low; however, heat settings will seem too high as the weld progresses, so be careful.

Overheating may cause the entire joint to turn semi-liquid and fall apart, without real warning. This affects all types of aluminum welding using an arc or flame to melt the metal. When the joint is overheating the molten puddle almost appears to be the base metal. Experience and "feel" are required to determine whether the temperature

is correct or too hot, and a heat stick marking next to the weld can help - and basically you cannot overheat an aluminum joint and achieve a successful weld.

Out-of-Position MIG Welding

If welding in-position (flat or horizontal), there's room for changes if needed because there's time to react and correct if the weld is going awry, but it's basically just a feeling with out-of-position welding (overhead, upright, or otherwise not flat). The liquid weld pool tends to drip or sag, and generally welding slower and with lower welding parameters or heat input will reduce the fluid weld pool. Out-of-position welding requires a fast whipping or steady motion concentrating on staying ahead of the puddle. When MIG welding aluminum, the technique used is always forehand and pushing the puddle.

Welding thicker aluminum out-of-position has to be accomplished as a matter of course when appropriate at the collision facility, but the weld appearance can be ugly. The process demands moving fast while preventing the puddle from "rolling over."

Aluminum MIG or Aluminum TIG?

Choosing welding processes depends on thickness of the material. MIG welding is great on anything that is 1/8 of an inch or thicker and is in-position. TIG welding works best on thinner stuff and pipe. TIG welding, which stands for "Tungsten Inert Gas Welding," is the slang term widely used for this system, although TIG welding's proper name is "Gas Tungsten Arc Welding," or "GTAW."

TIG welding as we know it today was introduced in the 1940s using helium, with "heliarc welding" being the common term for it. It is now a registered trademark "GENUINE HELIARC," and older welders often refer to TIG welding as "heliarc." But "TIG welding" and "heliarc welding" are one and the same.

What will the future hold for automotive bodies? Probably more aluminum and less steel. Aluminum offers higher MPG and a lower carbon footprint, and is known as the heart of aircraft and space vehicles, as well as exotic performance and specialty vehicles. This metal virtually exudes "21st Century normal" – but with comparatively limited use due to higher costs as well as greater forming requirements. Its greater utilization for auto bodies may be a combination of engineering and fuel saving advantages and subtle marketing.

Mercedes-Benz Certified Collision Centers Offer Timely, Convenient, Top-Quality Collision Repair

Familiar with the Mercedes-Benz Certified Collision Center program? This growing program is a customer-focused network of Mercedes-Benz Certified Collision Centers allied with Mercedes-Benz dealerships. The Mercedes-Benz Certified Collision Program was developed with one goal in mind: to provide valued Mercedes-Benz customers with a seamless and satisfying after-collision repair experience. Employing skilled, thoroughly-trained technicians and appropriate equipment, Certified Collision Centers are adept at bringing a Mercedes-Benz car or SUV back to before-collision condition.

These fully-equipped and professionally-staffed centers are either stand alone facilities, or are located at a dealership.

Centers Meet Stringent Requirements

To become a Mercedes-Benz Certified Collision Center, MBUSA analyzes the recommending dealer's Area of Influence (AOI) and Units in Operations (UIO), and determines the business need for a Certified Collision Center in the area. If the application is approved, MBUSA's audit partner will conduct an on-site visit.

If the collision center passes the on-site certification audit and meets all program standards, it will be officially certified as a Mercedes-Benz Certified Collision Center for two years, contingent on dealership sponsorship and meeting continuing training requirements.

"Training is what really makes the Collision Center certified," notes Benito Cid, Collision Business Manager, Mercedes-Benz USA. "A shop needs

to utilize the available collision courses – and continue to do so – to keep the title of being Mercedes-Benz Certified." To maintain certification, a shop needs to have at least two hands-on training sessions annually, and four e-learning courses per year, per facility, beginning with the calendar year of certification. Should a facility not be able to meet requirements by the end of the second year following certification, the shop will be temporarily suspended from the Mercedes-Benz Collision Program, and can be listed again as a Certified Collision Center once the facility can show proof of completing all classes.

Training requirements are per shop, not per technician. If the shop employs five technicians, one technician may complete a course, a second technician in the facility may take another course, and so on. In addition to training, requirements for getting and maintaining certification are utilizing the recommended tools and equipment. These include:

- Resistance welders that meet Daimler global specifications
- Welders tested for power supply and duty cycle for all markets, for use on boron steel, and that will not change alloy structure during welding
- Special aluminum rooms separated from steel work in the shop that must have a separate dedicated tool set and prevent contamination from steel dust, and dust extractors used if sanding aluminum with #400 or finer paper to avoid explosion risk
- Vehicle benches and jigs to ensure proper positioning and structural accuracy
- Electronic body measurement devices including vehicle-specific Celette and universal Car Bench
- During a post-accident alignment check, measurement results will be compared to the original Mercedes-Benz specified values, when available

Left: Technician care in installing highly-visible components as well as internal repairs underscores shop commitment to quality work and strong customer service. Don's corrections

Recertification Ensures that Centers Remain on Track

Every two years, Certified Collision Centers are evaluated for recertification, and undergo an on-site audit. If the collision center meets requirements, the Mercedes-Benz Collision Team will extend the collision center's certification as a Mercedes-Benz Certified Collision Center for an additional two years. Important Collision Center features include:

- Mercedes-Benz Roadside Assistance will tow any Mercedes-Benz vehicle to a Certified Collision Center or dealership free of charge after a collision
- Certified Collision Centers have total accessibility to training courses and proper repair procedures, including STAR TekInfo, CV TekInfo and WIS (Workshop Information System) that ensure that the centers accurately repair all Mercedes-Benz vehicles according to Mercedes-Benz standards
- Priority handling and appointment scheduling for Mercedes-Benz customers
- Car wash outside and cleaning inside prior to customer delivery
- Test drives of completed vehicle available on request.

Customers and insurance companies can easily find the closest Certified Collision Center by using the locater on mbusa.com, or mbcollisioncenters.com. Those wishing to sign up to become a Mercedes-Benz Certified Collision Center should check out the procedures summed up below.

The Mercedes-Benz Certified Collision Program

With a range of approved tools, equipment, and repair methods, a Mercedes-Benz Certified Collision Center has what it takes to bring a Mercedes-Benz vehicle back to its pre-collision condition. Mercedes-Benz Certified Collision Repair Facilities exist to ensure that a Mercedes-Benz vehicle owner or driver receives the safety and craftsmanship that he or she has come to expect.

The program utilizes three tiers:

Base. Authorized to perform all collision repairs on all Mercedes-Benz passenger vehicles with the exception of aluminum structural repairs;

Elite. Authorized to perform all collision repairs on all Mercedes-Benz passenger vehicles including aluminum structural repairs;

Commercial Vehicle. Authorized to perform structural and cosmetic repairs on Sprinter and Metris Vehicles.

Benefits of participating in the Mercedes-Benz Certified Collision Program include Profitability, Exclusivity, Convenience, Accessibility, Visibility and Assurance that Mercedes-Benz Roadside Assistance will tow any Mercedes-Benz vehicle when needed. Enrolling in the Mercedes-Benz Certified Collision Program starts when the collision center and a sponsoring dealer fill out an online application (at mbcollisioncenters.com) indicating the dealer and collision center understand the expectations and mutual benefits of the program. The application will be forwarded to the MBUSA field staff for their signatures of approval, then to the Mercedes-Benz Collision Team for final evaluation.

More information on standards, requirements, program fees and greater detail on the complete program for either Dealer Owned Collision Centers or Dealer Sponsored Collision Centers is at mbcollisioncenters.com.

Mercedes-Benz Mobil 1

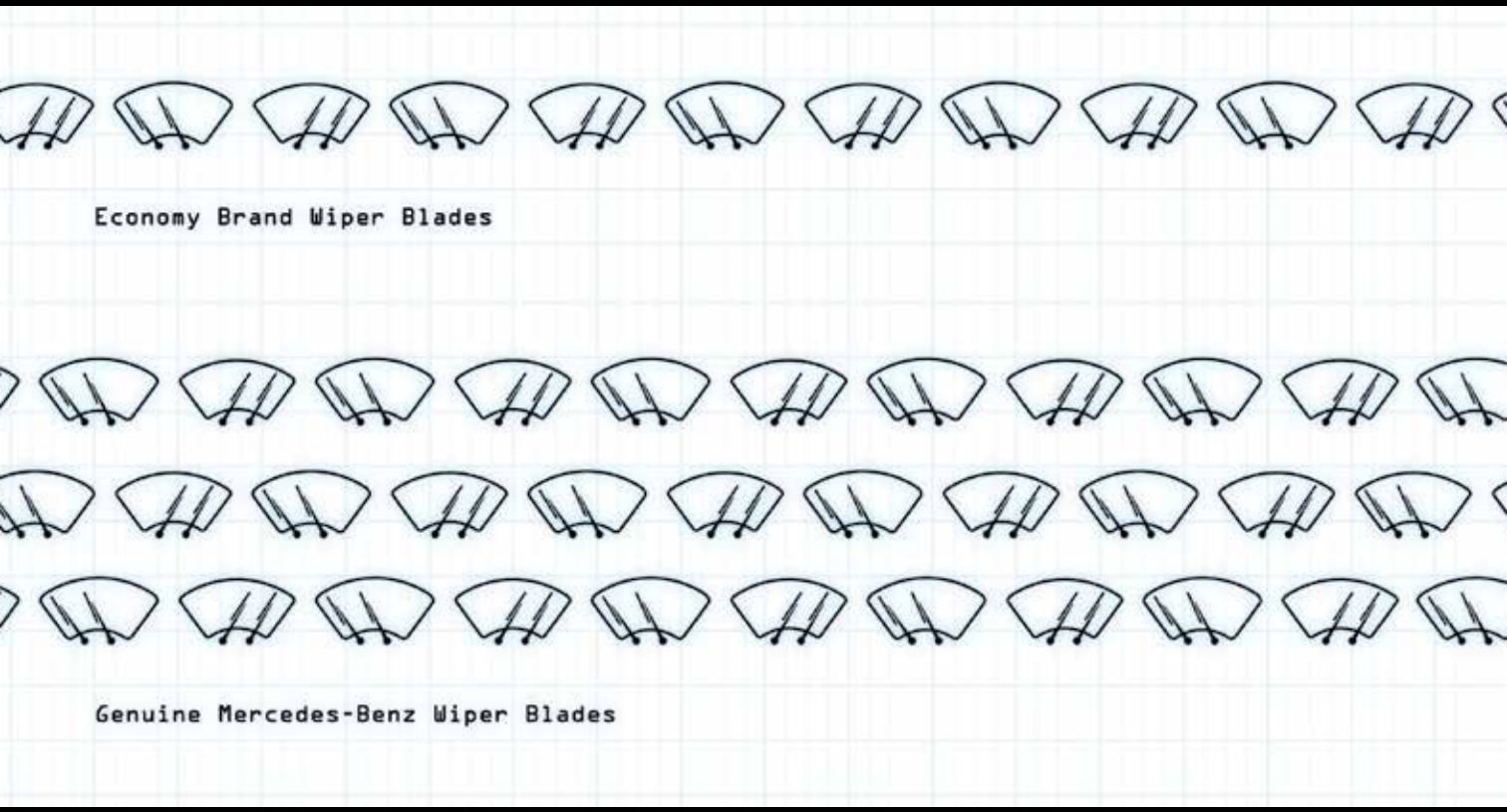
Product Name	Part Number	Quantity	Product Description	Recommended Consumer App.
Mercedes-Benz SPEC.				
Mobil 1 Formula M 5W-40	BQ 1 09 0197	Bulk - No Equipment	Fully synthetic formulas designed specifically for gasoline passenger cars	Low SPAsh. Available at most M-B dealers
	BQ 1 09 0195	6/1 Quart 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		

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 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		



Some think all wiper blades are the same. This will make it clear.

Genuine Mercedes-Benz Wiper Blades can provide up to 800,000 more wiping cycles than ordinary blades*. Not to mention that every blade has a precise curvature unique to each model, and most have a maintenance indicator on the tip that shows when replacement is necessary. A clear advantage – at a competitive price. This is why you should choose Genuine Mercedes-Benz Wiper Blades. **Contact an authorized Mercedes-Benz dealer or learn more at www.mbwholesaleparts.com.**

MSRP
$63
Part #
A 212 820 19 00

*As compared to economy wiper blades using durability test #PN 103713, which tests wiper durability through 1.5 million wiping cycles.

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