STARTUNED®

Information for the Independent Mercedes-Benz Service Professional

June 2019
U.S. $6.00 | €5.36
Volume 19 | Number 2

INSIDE:

- BRAKES
- CAN DIAGNOSIS
- ELECTRIC VEHICLES
- WATER CORROSION

Mercedes-Benz
The best or nothing.

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®

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

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

In This Issue

Mercedes-Benz
The best or nothing.

Friction 2019

New pads and rotors with brake sensors will result in a happy customer every time.

How and why Mercedes-Benz brake lining recipes have evolved, and why you should install only the genuine article

The invention of the wheel, what an amazing discovery and revelation that must have been in its day! A way to power and leverage larger objects and move them in an easier fashion. Now that you've got things rolling, the question arises: How do we stop this thing? That's where friction comes in.

If we're to understand the chemistry and engineering behind Mercedes' latest friction materials then we need a short course on exactly what friction is and how it comes into play in the modern automobile. We see friction in action constantly when we examine how the automobile functions. Friction is used when the tire grips the road to accelerate and when the brake pads squeeze the rotors to slow things down.

Friction is defined as the resistance that one surface or object encounters when moving over another. For the purposes of this article we will be looking at two types of friction:

Static friction is a force between two surfaces that prevents those surfaces from sliding or slipping across each other. This friction allows a car to accelerate forward – the rubber compound in the tire can grip the road and push backward, which causes the ground to push forward on the tire. If there were no static friction between an automobile's tire and the ground, you would be unable to propel the car forward when accelerating and would simply end up spinning the wheels.

Kinetic friction is the force when two materials slide across each other. It always opposes any sliding or slipping motion and tries to reduce the speed at which the surfaces slide across each other. For example, a baseball player sliding into third base plate uses kinetic friction to slow down. If there were no kinetic friction, the baseball player would just continue sliding right past the base.

Both types of friction come into play in the braking of the modern automobile. Static friction will come into play when your customer parks their car on a hill. The force of the parking brake shoes (or pads, depending on the system) squeezing against the parking drum will keep it from sliding down the hill. Kinetic friction comes into play when your customer applies the brakes to slow down. The force of the brake pads against the rotors will oppose the sliding motion and begin to reduce the speed at which those two items slide against each other.

The higher a brake pad's coefficient of friction (expressed by the Greek letter mu (μ), pronounced *myoo*) the more aggressive the pad and the greater its stopping potential (the same amount of pedal force provides more stopping power). In theory, μ ranges from 0 (full lubricity, no friction at all) to 1.0 (solid, no slippage possible). Fifteen to 20 years ago, most production brake pads were lucky to see the high 0.20s. Today, OEM pads are well into the 0.30s, top-tier performance street pads in the 0.40 to 0.45 range, and some race cars in the high 0.60s.

A pad's friction is not constant, varying due to changes in temperature, humidity, moisture, wear, age, and many other factors. Brake pad designers strive to develop highly stable pad compounds that maintain friction consistency over a wide range of operating conditions. But as compounds become more exotic, they also become more expensive. And more aggressive (higher μ) compounds tend to increase rotor wear. Mercedes-Benz engineers strive to find just the right balance in these factoring equations.

When the brakes are actuated, the kinetic energy of the vehicle is converted into heat. The temperature of the brake discs can then rise to as much as about 700 degrees Celsius (1,300 degrees F), more than hot enough to glow. High-quality materials and workmanship on

Friction Coefficient	Code
Up to 0.15 µ	C
Over 0.15 µ up to 0.25 µ	D
Over 0.25 µ up to 0.35 µ	E
Over 0.35 µ up to 0.45 µ	F
Over 0.45 µ up to 0.55 µ	G
Over 0.55 µ	H
Unclassified	Z

Here's a friction coefficient chart showing performance at various temperatures

Note the FF designation on these pads for an AMG model

Typical raw materials found in brake pads. Photo courtesy of Akebono.

Mercedes-Benz genuine brake discs ensure that they can handle the temperature extremes while maintaining structural and dimensional stability so that the vehicle quickly comes to a standstill when needed, helping ensure a short stopping distance.

The frictional performance of brake pads intended for typical street usage is classified under SAE Standard J866, expressed as a two-letter code: The first letter designates the low-temperature (0 to 200 degrees F) friction performance, and the second letter the high-temperature (200 to 600 degrees F) performance. The letters generally appear on the backing plate as a prefix or suffix to the part number. If the first letter is lower than the second, the pad works better at high temperatures and needs a warm-up; if the second letter is lower than the first, the pad may fade at high temperatures. The best street pads have good friction at both high and low temperatures (ideally, both letters would be the same, as in FF). Most pads will have this designation code printed on the back or edge, but not always: Some manufacturers may choose to use proprietary numbering or coding systems on their pads.

Early friction materials

The earliest automotive brake friction materials were credited to Bertha Benz, business partner and wife of automobile inventor Karl Benz. She is also known as the first person to take an automobile long distance, thus promoting the automobile as the modern alternative to the horse and carriage. In the course of her journey the wooden brakes failed and Mrs. Benz visited a cobbler to install a leather covering, making the world's first lined brake shoe. Since that time engineers have spent years and countless hours developing the proper friction materials to provide the ultimate braking performance. In 1961 the 220 SE model was the first Mercedes-Benz to be fitted with four wheel disc brakes, ahead of the 300 SL which had to wait a few additional weeks to have discs fitted.

Modern brake pads are constructed of various materials, chosen for their characteristics. The materials used, and the relative amount of these ingredients in the friction material, as well as the fabrication methodology, strongly affect the braking efficiency, wear resistance, and propensity of a brake pad towards brake-induced noise, vibration, and harshness (NVH).

Vehicles have different braking requirements, depending on the way the vehicle is expected to be used. Different friction materials offer application-specific formulas and designs. Brake pads with a higher coefficient of friction provide good braking with a lower brake pedal pressure requirement, but tend to lose efficiency at higher temperatures and suffer from faster wear. Brake pads with a smaller and more constant coefficient of friction might not lose efficiency or stability at higher temperatures, but generally require higher brake pedal force.

Brake pads were originally made with asbestos because its properties allowed it to deal with both the heat and drag that braking exerts on the pads. However, as the serious health-related hazards of asbestos became apparent, other materials had to be found.

Beyond Asbestos

Today, brake pad materials are classified into one of four principal categories, as follows:

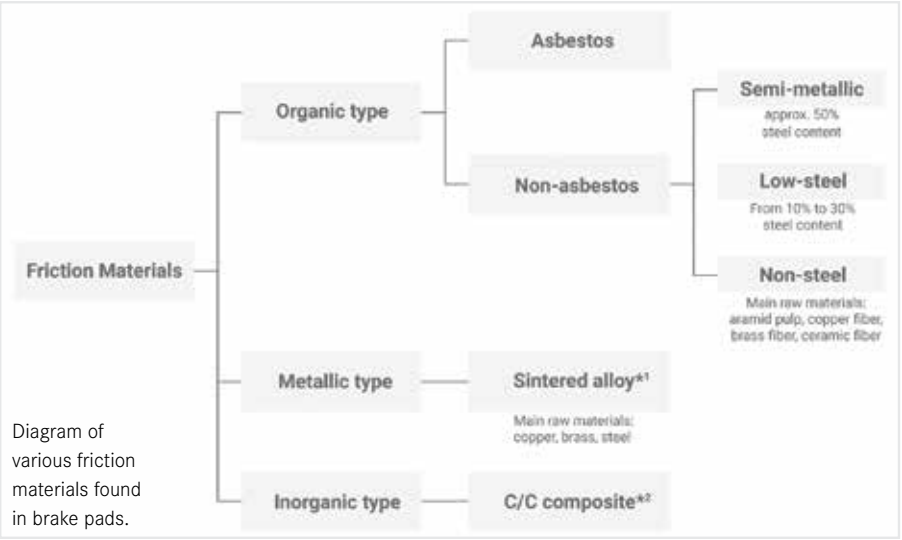


Diagram of various friction materials found in brake pads.

Non-metallic or organic materials – these are made from a combination of various synthetic substances bonded into a composite, principally in the form of cellulose, aramid, Polyacrylonitrile (PAN), and sintered glass. They are gentle on rotors, but produce a fair amount of dust, thus having a short service life.

Semi-metallic materials – synthetics mixed with varying proportions of flaked metals. These are harder than non-metallic pads, more fade-resistant and longer-lasting, but at the cost of increased wear to the rotors which then must be replaced sooner. They also require more actuating force than non-metallic pads in order to generate braking torque.

Fully metallic materials – these pads are used only in racing vehicles, and are composed of sintered steel without any synthetic or organic additives. They are very long-lasting, but require more force to slow a vehicle while wearing the rotors faster. They also tend to be very loud.

Ceramic materials – Composed of clay and porcelain bonded with copper flakes and filaments, these are a good compromise between the durability of the metal pads, and the grip and fade-resistance of the synthetic variety. Their principal drawback, however, is that unlike the previous three types (and despite the presence of the copper, which has a high thermal conductivity) ceramic pads generally do not dissipate heat well. Phenol formaldehyde resin is frequently used as a binding agent. Graphite can serve as a friction material as well as binding agent. Ceramic brake pads are exceptionally quiet, because the ceramic materials cause the braking sound frequencies to be elevated beyond that of human hearing.

Of primary concern of course is the noise factor. Probably the number one complaint after brake service is noise. Consider the ringing sound when rubbing a finger around the rim of a wine glass: The harmonic vibrations that result are similar to the noise that can be generated by the brake pads contacting the rotors. The installation of aftermarket brake pads, instead of the genuine Mercedes-Benz offerings, will have your customers complaining about noise and wondering about the quality of the work.

There are environmental factors that govern the selection of brake pad materials. For example, the bill SSB 6557 adopted in Washington state in 2010, along with a similar bill in California, limits the amount of copper that is allowed to be used in friction materials. This will be eventually phased out to only trace amounts, due to the negative impact of high copper levels on aquatic life. As the brake pad manufacturers see this trend continue they have decided to make the reduction for all brake pads sold in the future.

What about the rotors?

Brake rotors are made of several materials.

1. Cast Iron
   The oldest material when it comes to a brake rotor. It's one or two pieces and gets the job done. It used to be the most common material for brake rotors. However, it's also the heaviest option, which affects unsprung weight, the overall weight of the car and its handling.
2. Steel
   Steel has been the racer's choice for years, because a steel brake rotor is thinner (thus weighing less than cast iron) while still handling heat better. The downside: Steel rotors aren't as durable as some others, and warped rotors can cause noise and a pulsating pedal when braking.

3. Layered Steel
   Layering sheets of steel together and laminating them makes them resistant to the warping you might find in a straight steel brake rotor. It's a favorite of racers who don't want frequent brake rotor replacement and repair, but manufacturers are currently targeting only professional racers. Production is limited, so it's not terribly common in passenger vehicle applications.
4. Aluminum
   Aluminum brake rotors dissipate heat quickly, but they also melt at a lower temperature than other options. Aluminum is a favorite for motorcycles, which weigh far less than a car or truck. Although aluminum doesn't have the wear-resistance of ferrous metals, the lighter motorcycle doesn't tax the brake rotors as much as a heavier car, truck or SUV.
5. High Carbon
   These are iron, but with a lot of carbon mixed in. They can take a lot of heat and dissipate it quickly. The metallic content helps the rotor avoid cracking under high stress, and brake noise and vibration are reduced as well.
6. Ceramic
   They offer the highest heat capacity (85 percent higher than cast iron) and superior dissipation, and they maintain a more consistent force and pressure as the temperature of the rotors rises. Ceramic is the highest-performance brake rotor available today, but it is also the most expensive.

On several Mercedes-Benz models, such as the GT (190), C-Class (205), S-Class (222), CLS (217) and GLC (253), you'll find a composite rotor, which is a two piece design consisting of the brake rotor surface and a steel casing 'hat' where the rotor mounts to the hub. These rotors have built in corrosion protection. The steel casing is galvanized with a zinc-nickel coating and the disc is also painted with zinc dust paint. These composite rotors need to be handled with far greater care than the traditional rotors, as we explained in our article in our article *Hang Pads*, in the September 2018 issue of *StarTuned*.

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

Improper handling can damage these disks and make them unusable.

The optimum braking result can only be achieved with brake discs precisely tailored to the brake pad. It is this philosophy that has also made Mercedes-Benz engineers into experts, in terms of the right "friction partner" for their brake pads. The genuine Mercedes-Benz brake disc range is manufactured in strict engineering tolerances and meets the ECE R90 requirements for quality and performance. Would you expect anything less?

Genuine Mercedes-Benz brake pads are perfectly designed and engineered for genuine Mercedes-Benz brake discs. The optimum friction pairing helps ensure high braking power, short stopping distances, reduced wear and tear, and prevents brake noises from occurring. This is how Mercedes-Benz genuine brake linings contribute to accident-free driving. If customer satisfaction is your goal, installing the original friction materials the vehicle came with will result in happy customers and no comebacks.

New composite rotor from an AMG model.

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.

This new StarRewards program is one way Mercedes-Benz shows its appreciation 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. |

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® ½ Gal.	A 000 583 0107	1/2 Gallon Bottle	Non-toxic solution that transforms harmful Nitrogen Oxide (NOx) emissions from diesel-powered vehicles into harmless water vapor and nitrogen	Recommended for use in Mercedes-Benz, Volkswagen + BMW AdBlue® (DEF) applications
Diesel Exhaust Fluid 55 Gal	BQ 1 47 0002	55 Gallon Drum		
Mobil 1 5W-30	BQ 1 09 0017	6/1 Quart Cases	Advanced full synthetic formulation designed to meet the requirements of many domestic, including GM, and imported vehicles	Vehicles that require 5W-30. Corvette approved.
	BQ 1 09 0018	55 Gallon Drum		
Mobil 1 10W-30	BQ 1 09 0019	6/1 Quart Cases	Advanced full synthetic formula designed for domestics and imports	Vehicles that require 5W-30 or 10W-30
	BQ 1 09 0020	16 Gallon Keg		
	BQ 1 09 0021	55 Gallon Drum		
Mobil 1 5W-20	BQ 1 09 0083	6/1 Quart Cases	Advanced full synthetic formulation designed to meet the requirements of many newer vehicles including Hondas, Fords, Chryslers, and newer Toyotas	Vehicles that require 5W-20
	BQ 1 09 0084	55 Gallon Drum		
Mobil 1 0W-20 AFE	BQ 1 09 0169	6/1 Quart Cases	Advanced full synthetic formulation designed for enhanced fuel economy and cold weather performance	Most vehicles that specify 0W-20 (newer Toyotas and Hondas), 5W-20 and certain hybrids
	BQ 1 09 0168	55 Gallon Drum		
Mobil 1 0W-30 AFE	BQ 1 09 0174	6/1 Quart Cases	Advanced full synthetic formulation designed for enhanced fuel economy and cold weather performance	Most vehicles that specify 5W-30 or 10W-30
Mobil 1 Synthetic ATF	BQ 1 09 0164	6/1 Quart Cases	Multi-vehicle, fully synthetic fluid designed to meet the demanding requirements of modern passenger vehicles	Vehicles that require Dexron III, Ford Mercon and Mercon V performance levels
	BQ 1 09 0163	55 Gallon Drum		

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		

Stress-Free CAN Diagnosis

Make sure you have a clear overall picture of what's actually happening using function diagrams and flow charts, then zero-in with a process of elimination and XENTRY.

Test leads that come with the XENTRY Diagnostics Kit 3 make it easy to check can bus at the diagnostic link connector (DLC).

Putting stress-free and controller area network diagnosis in one sentence may seem to some as a bit of an oxymoron but honestly, the answers are there. The challenge is to master a process for running through a diagnostic routine and developing a surefire technique for troubleshooting. Developed in 1983 by Robert Bosch and installed in 1991, the first production vehicle to feature a CAN-based multiplex wiring system was the Mercedes-Benz W140. Since that time hundreds of articles have been devoted to CAN bus diagnostics and development, including many good *StarTuned* articles. We will try not to repeat too much redundant information and focus on some of the latest strategies and especially using the newest version of XENTRY Diagnostics Kit 3.

A Multiple CAN Network

Keep in mind Mercedes-Benz also uses several different bus speeds on their vehicles. Depending on the application, there may be a high-speed 500 Kbps CAN-C bus for the powertrain, transmission and ABS modules, and a slower-speed 83 Kbps CAN-B bus for the body control functions. On some Mercedes-Benz cars, there may be as many as 30 modules on the CAN-B bus. Up to model year 2002, all communication between the CAN-C and CAN-B bus went through the electronic ignition switch (EIS) module. After 2002, a new "gateway" module handles the inter-bus communications as well as onboard diagnostics via a CAN-D bus. Now you may find CAN-G, CAN-H as well as MOST (Media Oriented Systems Transport). MOST is a high-speed multimedia network technology optimized by the automotive industry. It can be used for applications inside or outside the car. The serial MOST bus uses a daisy-chain topology or ring topology and synchronous data communication to transport audio, video, voice and data signals via optical fiber. More on that later. In addition to these you may have a LIN bus and a K line. LIN (Local Interconnect Network) is a serial network protocol used for communication between components in vehicles. The need for a low-cost serial network arose as the technologies and the facilities implemented in the car grew, while the CAN bus was too expensive to implement for every component in the car. The K-line is a single-wire connection and thus a serial interface, which is directed via a data strand and has a ground connection. Accordingly, in practice the K-line has two physical conductor connections being used. Power supply and control of transmission and reception are the main tasks of these technical components.

The XENTRY Diagnostics Kit 3 at work

Steps to CAN diagnosis

The independent service provider is usually working on vehicles that may have more age and mileage on them that what the dealer may see. Many of the factory repairs have been done while the car was under warranty. Belonging to a network that has a database of vehicles similar to the ones in which you are working on in which to compare can be very helpful at times. That said, too many technicians fail to develop good diagnostic strategies and rely on the network for their diagnostic work. Here is a good strategy to implement in CAN diagnostics:

1. Verify the customer's concern and develop a general direction to follow.
2. Do some research. You may find you need to purchase a subscription to startekinfo.com to get workshop information. Check TSBs. Understand the problem, the components and the systems possibly involved in the complaint .
3. Form a theory of the cause through testing and then test to see if you are correct.

4. Perform the required repairs and verify the customer concern has been taken care of.

If the vehicle is roadworthy a test drive and verification of the complaint may be the first order of business. After you have verified the customer concern the first step is to connect your scanner (XENTRY) and perform a quick test. Although a good aftermarket scan tool may be able to perform this test, I'll be honest here, you won't get very far in your diagnosis after that. Beyond reading codes and data, you won't be able to see if version coding is up to date or correct. See previous article in *StarTuned* "Why you need XENTRY".

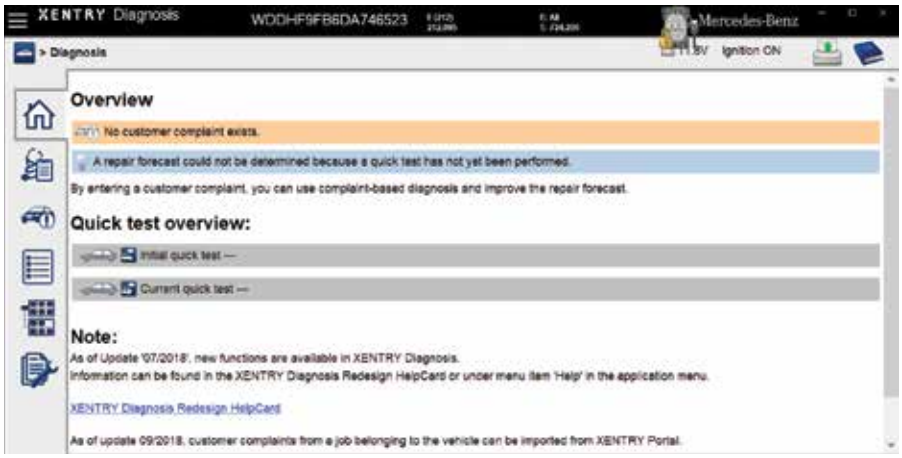
Be sure to connect a battery maintainer on the vehicle and plug in the scan tool to an 110V outlet. XENTRY Diagnostics Kit 3 will have different menus when you open diagnosis depending upon which year vehicle you are working on. Newer vehicles will have the six button cells on the left after you have selected the proper vehicle. Usually 2008 models and newer will have auto detect and will communicate with the vehicle to select the proper VIN and variant. Although sometimes you will be asked to choose some variants. The six cells are:

- The home screen which has notes, the quick test cell, and the current quick test cell. It should be noted that there is an option to choose a customer complaint but XENTRY will only allow it after a quick test.
- The next cell looks like a doctor's stethoscope with a notepad and choosing it will list all the components fitted to the vehicle.
- The cell with the car with an exclamation mark is the customer complaint screen. Again XENTRY will ask you to perform a quick test first.
- The bullet point tab will give you the control unit view.
- The next tab is very handy. It looks like a diagnosis tree and it's a tree of all the CAN networks on the model you are working on. This will be very helpful for communications problems when trying to find which components are off line or shorted.
- The last tab on the left of the main menu screen is a picture of manuals with a wrench. This window opens up a special functions tab which may have various items in it such as but not limited to: Stored control unit logs, Entry for retrofits and modifications, and System information.

Start your initial quick test, the XENTRY will drop down to the next cell and give an option to start the test. The XENTRY and some aftermarket enhanced scan tools automatically poll or ping the modules or perform a "health check" to confirm that all modules are online. If your scan tool indicates "no communication" with a specific module, then you must diagnose the reason for the non-communication.

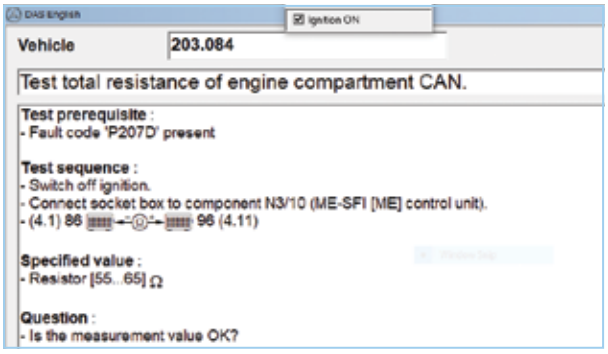
The full module scan or quick test is important because it will show a good general picture of what modules are on line, any communication faults. A printout of this test is good to have on hand for verification purposes. Sometimes at this point a good look under the hood or even an under the vehicle inspection may turn up some items you will notice may have been damaged or tampered with, thereby causing your symptoms.

Each module after the initial quick test will have either a green check mark, an F for fail or an I for "more information" available. Many times at this stage you may often have multiple codes in several modules. Remember to go back to your original strategy, "What is my customers concern and what are the most likely places to find fault that relates to that complaint." Many codes may be stored from previous events and are completely unrelated. This is why it's good to have a printed report for the customer. Although the stored codes may not have relevancy to the vehicle concern, it's prudent to advise



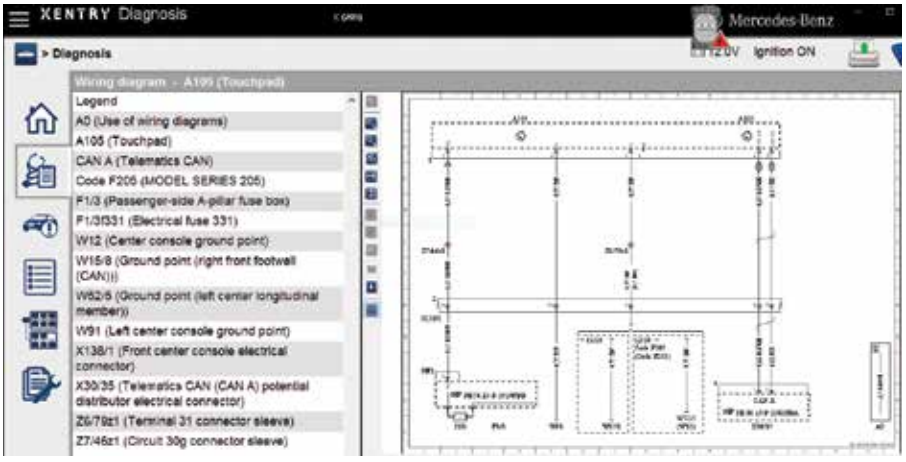
Here is the menu you will see on later models.

them that there may be other possible problems with the vehicle that they may want to direct their attention to. Now that you have selected the control units and codes that relate to the problem you are trying to solve, you can open each one up individually. A further menu will open that has each individual fault in the control unit itemized. A further drop down menu for each one will give you supplemental information regarding the occurrence of the event. This is your "freeze frame" data and it can be quite extensive and give you much information that will help in your diagnosis. You will also be informed as to whether it is a current fault or intermittent.



Example of a CAN fault and the recommended test sequence.


Clear and precise pictures aid in testing the right connectors and pins.



Wiring diagrams related to the concern are a huge help.

At this point you have the option of clearing the codes and rechecking for hard faults or proceeding on with tests of the failed components. Unless you are certain you have a hard fault I would advise against erasing the fault memory. In doing so if the fault does not occur again right away, you won't have the availability of the tests tab on the XENTRY to zero in on the most probable causes. If you click on each of the faults individually you will find a "tests" tab located at the bottom screen. One or more tests will pop up in the field in which XENTRY will instruct you to perform certain tasks and report on the outcome in a YES/NO format. These tests may involve checking voltages at various pins and using a lab scope to record a wave form on a crank position sensor, to using bi directional controls to see if the actual data on the scan tool show whether or not the component you are activating is working or not. Continue on with each command, the menu will sometimes give you the exact cause, sometimes the most probable or possible cause and other time the problem may not repeat.

Dependent upon the flow chart you will be able to pull up WIS/ASRA, TIPS, wiring diagrams, connector assignments etc. in another menu window. Again, having a clear overall understanding of the complaint coupled with TSBs and history of similar vehicles will help you to formulate and accurate diagnosis.

General Notes

Some general guidelines to follow in CAN diagnostics are common sense but worth a reminder. Your XENTRY unit will also remind you of these items:

- Use only a cable with a fuse to bridge connections.
- Each time after replacing a component, always carry out a component test.
- This will assure you that the component is functioning properly, connections are good and coding of the component is correct.
- When processing a fault code, the instructions to follow may generate a test step which will be interrogated by a YES/NO cell. Please note that this test sequence may generate other fault codes which must be ignored. This is why it's important to print out or

have a list of your original fault codes so that you understand which codes you generated in your testing.

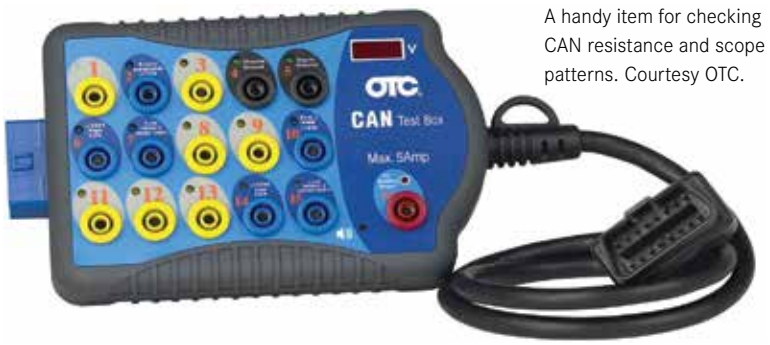
- Only generate a counter fault by short circuiting or open if this is expressly requested in the diagnosis tree.

XENTRY Measurement Technology HMS 990

Optional with the purchase of the XENTRY is the HMS 990. This devise coupled with the XENTRY Diagnostics Kit 3 give the technician extensive measuring options. Service technicians can carry out a wide range of measurements on the vehicle's electrical system. Various voltages, ignition and dwell angles – all the essential values can be checked. The equipment can even be used to check all the alternator values. The multimeter provides the opportunity to accurately check the basic electrical parameters such as voltage, current, resistance, frequency, temperature, and pressure.

HMS 990 USB Measurement Technology also makes it possible to check the duration of combustion by analyzing individual cylinders. Compression and rotational speed are also always in check. The service technician is immediately notified of deviations from the specified values.

Note the labeling of the test leads making it easy to connect to your lab scope for diagnosis.



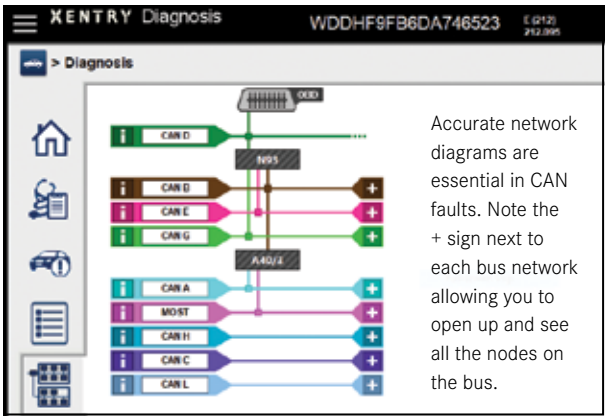
A handy item for checking CAN resistance and scope patterns. Courtesy OTC.

Also incorporated is the use of a universal oscilloscope and the 12-channel oscilloscope to measure various signals such as those from the crankshaft position sensor or the camshaft Hall sensor. Recordings over the long term are also possible. You can also store the measurements taken with the recorder function and retrieve them at a later point.

As you work through your fault diagnosis the test sequence as we mentioned earlier may ask you to use a lab scope to say, graph a crank or cam sensor signal. You can do this perfectly well with your lab scope and check voltage signals with a high quality multimeter. The HMS 990 just incorporates these tools and makes the job more convenient.

Other Specialty Tools

One item worth having is a DLC connector breakout box. When diagnosing a CAN communications problem, you can use this device at times to diagnose which items are off line. If your fault codes indicates a bus problem that is connected to the DLC you can do a resistance test at that point. There are two 120 ohm termination resistors connected in parallel so the resistance should be 60 ohms. If the resistance is incorrect you will need to start isolating which node on the bus may be the problem. Here is where the CAN bus tree diagram comes in handy. A lab scope comes in handy here as well. By viewing the data packets being transferred between controllers you can look for clean lines without noise or interference which might indicate a problem with one of the



Accurate network diagrams are essential in CAN faults. Note the + sign next to each bus network allowing you to open up and see all the nodes on the bus.

A must have for your tool box, this loop can bypass a suspect MOST component.

controllers. Voltages are important too, if you see your voltage drop to zero, that's going to indicate a ground issue in the line or one of the modules on the line. Conversely if you see voltage up to 5 volts or even 12 volts then the indication would be that you are shorted to power and you can start tracing things from there.

MOST

We mentioned the use of the MOST technology in CAN diagnostics. In diagnosing a MOST equipped vehicle the test sequence may have you remove the device from the loop. In order to do this since it is an optical network, measuring terminating voltages isn't relevant. A very handy tool is a MOST loop tool. You simply unplug the suspect controller, plug in the loop which essentially by-passes the unit and if your communication is restored you've found the culprit. A must have tool to have if you get these vehicles in your shop.

See, no sweat! Have a clear cut strategy in place, understand the vehicle and its components that you are servicing. Work through a methodical approach using the steps and information that XENTRY supplies you with and you are well on your way to solving problems.

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

Tips for Corrosion Prevention in Wiring Repair

Corrosion is a major cause of poor performance of electrical circuits. Here are a few proven measures for limiting post-repair corrosion potential.

Corrosion is the enemy of performance of almost every system in today's vehicles. Corroded electrical connections and wiring reduce the ability to send power to actuate devices. It also scrambles digital data and prevents clear, timely communication with the software that adjusts vehicle response to driving load and road conditions. As an interrupter of the delivery of power and data, corrosion reduces the safety, handling, comfort, fuel economy, and other metrics that are key to vehicle operation.

Automotive engineers now design many connectors with watertight or moisture-resistant housing construction. If you find a sealed connector, you can bet that it is going into a water-challenged location on the vehicle, defined by Mercedes-Benz as anywhere that isn't in the vehicle interior or trunk. Use whatever connector the parts catalog specifies. It may list a part number without explicitly stating that the part is waterproof and seals the connection when properly installed. Failing to use a non-waterproof connector where one is called for only creates an opportunity for moisture to cause corrosion or otherwise weaken performance of your repair, and we all know customers hate comebacks more than you do.

Corrosion on an electrical contact or connection point is one cause of resistance buildup in that circuit. When your checks show excessive resistance compared to the OEM specification for a given circuit you should, in addition to looking for loose connections or frayed wiring, keep an eye out for evidence of corrosion. If you find corrosion in any connector or wire, you'll need to eliminate the corrosion and protect that contact point from future moisture ingress.

Corrosion on wires – that blue stuff so often seen in flood cars – is fatal for the harness. It cannot be repaired, the correction will only get worse, so replace the affected harness.

They're everywhere!

Examples of applications for which waterproof connector housings are used include virtually all engine sensors and connections, steering sensors and contacts, headlight connectors, exterior mirror harnesses, windshield wipers, and other components that are either safety-critical or exposed to the elements.

Examples of applications that are protected by the placement of a gasket or seal between the connector and potential moisture sources include door electronics,

These SLK2.8 style contact have single-wire seals to keep moisture away from the electrical contacts. The contact wings are specially-shaped to accommodate the seals.

This gorgeous 2019 AMG C63 S sedan contains many electrical connections that you'll need to ensure remain as moisture-resistant after your repairs as they were the day they left the factory.

engine control units, electronic water pumps, tail lamps, and cameras and radar sensors mounted in bumpers, grilles, and deck lids.

Wiring harness repair versus replacement

Wiring harnesses are repaired as an alternative when replacement cost is high. When repaired using procedures and materials specified in the Mercedes-Benz Workshop Information System (WIS), the repaired wiring harness function is equal to that of a new part. Note that a badly-damaged or safety-related harness should be replaced and not repaired.

Insulation faults

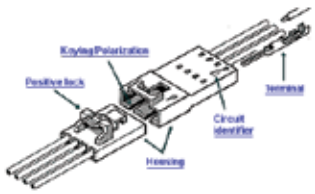
When the tubing or insulation protecting the wire strands is damaged, any moisture present can cause corrosion. Repair damaged cable tubing, then rewind the exposed area using PVC tape, except orange high-voltage wiring which always must be replaced for safety. If the wire insulation is damaged but no wire strands are severed, it may also be repaired with PVC tape. If the insulation is damaged and any wire strands are severed, cut the wire and re-join it using a Raychem connector.

Connector housing faults

Faults in the connector housing increase the risk of moisture contamination affecting the wiring. These include a housing that is cracked, loose, deformed or not able to close completely. Most connector housings are available as spare parts, and they are not expensive. Most have a part number on them if you look closely. Always replace a cracked or damaged housing, as well as any missing, damaged, or incorrectly mounted seals or grommets.

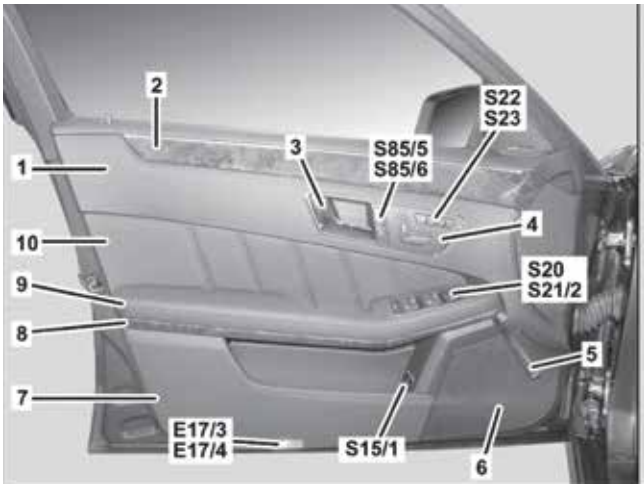
Contacts and housings

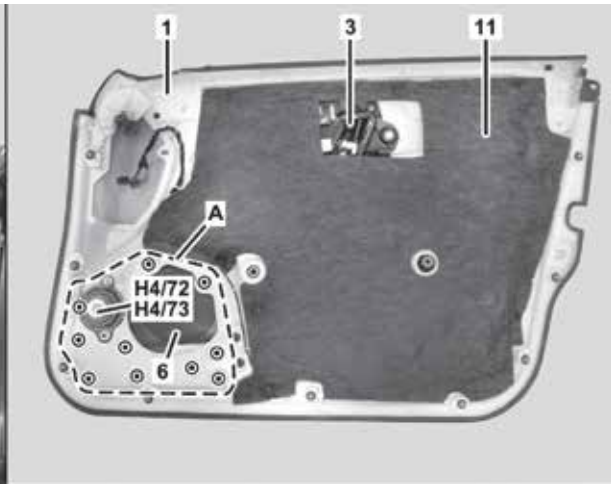
Electrical contacts used by Mercedes-Benz come in a variety of types. Some components have wires soldered to them, ending in a connector. The type of locking or coupling mechanism, the size, shape, material and current rating of the contacts, and whether the housing is watertight or not are just a few of the things that differentiate one connector type from another. Some of the more common contact types have names like MQS, SLK2.8 and JPT. In



Most electrical connectors use positive locking systems to ensure they don't come loose, as well as keying to help prevent incorrect connections.

Exterior mirror motor and lamp connections are just one of the many electrical connections that are in moisture-challenged locations on the vehicle.





You'll find a large number of connections for electronics inside the driver's door. On many 2013 and newer E-Class (model 212, pictured) Mercedes-Benz vehicles, this includes the front door locking switches (S85/5 & S85/6), power window and outside mirror adjustment switch group (S20 & S21/2), seat adjustment/memory switch group (S22 & S23), trunk release button (S15/1), front door exit warning lamps (E17/3 & E17/4), and the speakers (H4/72 & H4/73).

Group 00.19 of the Workshop Information System, there are hundreds of pages of resources to help you identify and repair these contacts correctly.

Mercedes-Benz connector housings generally use "keys", which are teeth, lugs or other special protrusions into the housings to make them unique. Only housings with the correct keying pattern are able to mate with each other, to help prevent incorrect connections. Some are also color-coded to aid in the identification of correct pairings.

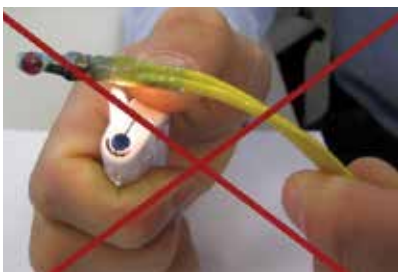
Coating types

Electrical contacts feature a tin, silver or gold coating. The coating is not only important for contact reliability but for corrosion-resistance. Tin is used in dry environments, while silver and gold are used where moisture can be a concern, and for safety-related systems such as airbags or traction control systems. Gold offers the highest resistance to harmful corrosion, followed closely by silver.

Male and female contact must each have the same type of coating as the other in order to establish the best connection. When replacing contacts, always use parts that feature the same coating type on the contacts as the original part.

Single-wire seals for watertight connections and gold or silver contact coatings for corrosion resistance may not be offered by knockoff brand wiring and connectors. To ensure that your repair gets the performance capabilities required, use only Mercedes-Benz original replacement parts.

And don't assume that because an electrical connector housing looks familiar that it contains the same type of internal contacts as one you've seen before. Mercedes-Benz often uses connector housings that have a similar appearance but use a different contact type inside. Always refer to the parts catalog for the exact part numbers when replacing electrical connectors.



Oh my goodness, no! Any uncontrolled heat source will damage the Raychem connector. A temperature-controlled heat gun like the Steinel HL 1910 E is the best choice.

Do not repair list

Some lines and connectors must be replaced if damaged. The 'do not repair' list includes safety-related or sensitive items such all connectors for the Supplemental Restraint System (SRS) and Electronic Stability Program (ESP) system, any high-voltage wiring (including power inverters for the MAGIC-SKY roof, 110 VAC supplies and Hybrid or Electric Vehicle components) and all network (CAN, FlexRay) cables. Coaxial cables used for antennas and high-speed video data cannot be repaired successfully and must also be replaced. The optical fibers used in D2B and MOST networks are not wires at all, but optical fibers, and cannot be repaired. Any aluminum wiring as well as all wires 6 mm^2 or larger in cross-section are also unrepairable. Look for the complete list in WIS document AH00.19-1000-08A.

A notable exception to this list is the SRS squib (ignitor) connectors for certain airbag, pyrofuse squib and seat-belt tensioner connections: Special pigtail wiring harnesses are available which can be spliced into the existing harness (between 100 and 1000 mm from the connector) using Raychem connectors. Look in the parts catalog or ask your dealer: These repair harnesses, where available, are clearly marked on the same picture as the component it connects to.

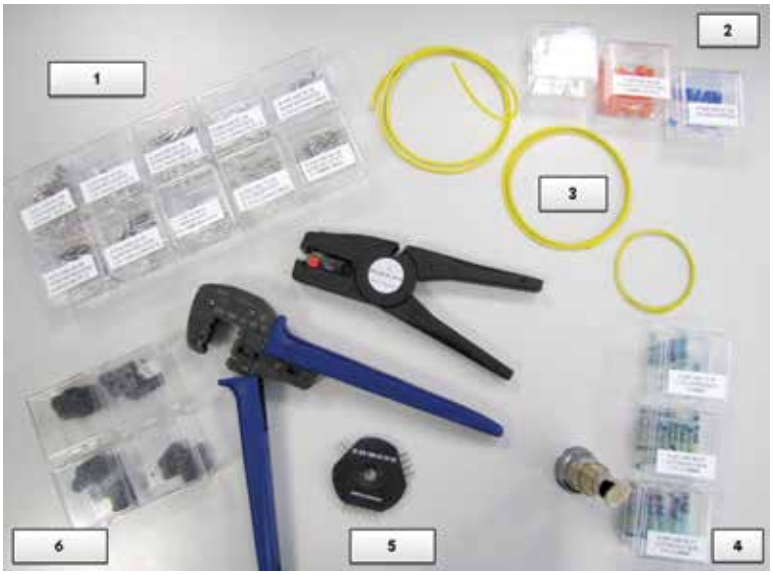
While new contacts may be crimped to wire ends in quantity, you must take extra care when processing more than a small few to ensure the contacts are re-pinned into the correct housing cavities. Large connectors, with more than a few dozen contacts, require even more diligent care, to prevent malfunctions or worse.

When repairing damage by splicing wires, if more than 10 conductors in a bundle are affected, the harness must be replaced instead. When using Raychem splices, stagger their location so they don't create an overly large 'lump' in the harness. Twist-on Raychem connectors are used to join more than two wires, or wires of different cross-sections, while in-line Raychem connectors are used to join two wires of the same size.

Mercedes-Benz offers several wiring harness repair kits for various repairs. Although these require a considerable investment, any other methods or tools could compromise the performance, longevity or safety of the vehicle. The most common kits are the basic kit (W000 589 13 99 00) and the passenger supplement kit (W220 589 04 99 00), which covers almost everything you

might encounter. The kits include contact removal, wire preparation, crimping, and sealing tools and materials. WIS has all the detailed procedures on using this equipment properly. A flat-wire repair kit (W211 589 01 99 00) is also offered. Ask your local Mercedes-Benz dealer if they might loan you their tool set to perform a proper repair.

If just a few contacts need to be replaced, most contact types are sold as 'cable tail' sets. These contacts are pre-crimped onto a specified wire size. It is a worthwhile idea to keep a couple of each contact type of these in stock, since all that's needed is a Raychem connector, hot air blower and a stripping tool.



Some of the contents of the Mercedes-Benz wiring repair kit. Contacts (1), seals (2), repair wire (3), Raychem connectors (4), an example of an unpinning tool (5) and crimping pliers with contact-specific die sets (6) are shown, with a wire stripper in the center.

Note: Be careful when pulling or pushing wiring to rule out a short circuit or loose contact: Pulling too hard can cause damage to the contact or seal.

Approved wiring harness repair methods

There are seven different harness repair methods approved by Mercedes-Benz. Some include special parts to make the job easier and more effective. See WIS document AH00.19-1000-04A to learn which repair options and replacement parts offer the best solution to your problem. WIS document AR00.19-P-1000-05A will guide you through a damage assessment.

1. Crimping, using the correct crimping tools
2. Radial solder connection (Raychem)
3. Axial solder connection (Raychem)
4. Combination of Raychem and Cable Tail
5. Conventional soldering for solder-type contacts
6. Rapid connection technology
7. Flat conductor repair

Each repair type is covered in detail in WIS. The index for wiring repairs is WIS document AR00.19-P-0100A. Here is a summary:

Repair methods

A crimping handle with various crimping dies, each for a specific type of contact, are found in the Mercedes-Benz wiring repair kit. Follow the instructions for the manual crimper carefully. It is important to select the correct crimping die set, and to use it properly. A correctly-crimped contact has better electrical properties than a soldered contact. Resist the urge to fold over the contact's wings with pliers and solder the wire in place: This significantly reduces a contact's reliability and performance. After crimping, tug the wire to verify a good crimp: You want it to fail now, not later.


Raychem connectors – here, an in-line Axial version is shown – have solder, flux, and hot melt glue surrounded by a heat-shrink casing to ensure a permanent, water-tight splice. Always use a temperature-controlled hot air blower to install them, as other heat sources like a cigarette lighter or painter's heat gun will cause damage.

Raychem connectors have a little dab of solder and flux, surrounded by a heat-shrink casing filled with hot-melt glue. Twist the wires together and heat the Raychem connector with a temperature-controlled hot air blower (and not a cigarette lighter!) to ensure a permanent, watertight connection. Cable tails are attached the same way, to replace a contact instead of simply joining a wire.

Older models use solder-type contacts, often round 2.5 mm and 4 mm is diameter. In classic models these are used almost everywhere. Heat the contact and wire, then apply solder to the wire and contact – don't apply

solder to the soldering iron, as the contact and wire may not be hot enough to ensure a correct contact.

Rapid Connection Technology (RCT) is an insulation-displacement system, used to connect smaller single wires together. You simply lay the wires into the slots and squeeze the connector body closed to make the splice. These can only be used in dry locations, and must be wrapped in felt tape to prevent rattling.

Flat wire repairs are tricky, but with the flat-wire repair kit you can crimp new contacts onto the end of the flat wiring used in roof and some door harnesses. We recommend you speak to your dealer about this, as the harnesses are ore likely better to be replaced.

Avoid the temptation to strip wires with pliers, a knife, your teeth, or anything other than a nick-proof wire stripper. Damage to the wire strands is just asking for trouble, for you and your customer.

Ignore any of these steps and you could end up with a variety of problems. Too short a section of stripped wire or an improperly mounted crimp contact may result in either the single-strand insulation or the connector seal being pinched. This could allow any moisture in the area to penetrate the connection and cause contact corrosion. If the stripped section of strands is too long it may position the single strand insulation outside of the crimping arms, resulting in insulation that is not crimped at all.

After repairs, use fabric tape to protect a wiring repair against chafing and to create a neat appearance. In the engine compartment and other high load areas, heat shrink tubing or corrugated hose combined with insulation tape are preferred for their better moisture resistance.

Uncoupling a connector

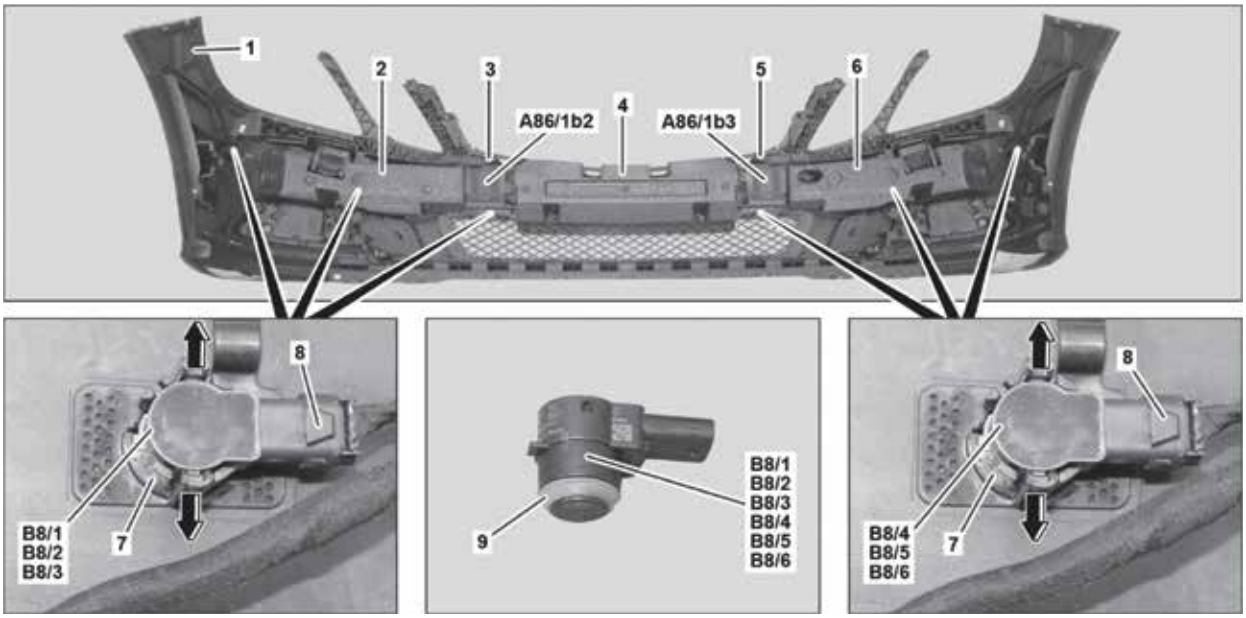
Each connector type has its own method and tool for unpinning. All of the needed unpinning tools are included in the wiring repair kit, and specific and detailed instructions are found in WIS. Resist the urge to use a pick, paper clip or other tool to unpin a contact, as you are very likely to not only damage the contact but the connector housing as well. Some contact housings have secondary locks that must be released before you unpin them.

A properly seated door gasket is critical to preventing moisture from entering and causing corrosion of connectors, switches, and controllers for door-mounted electronics.

Seals and gaskets

As mentioned, connectors subject to moisture are generally sealed. Larger connectors, where the number of wires makes individual wire seals prohibitive, have sealed backs and edges. Smaller

Even within a category of harness types there are variations, such as how the connector is secured, or whether it uses male or female connectors. These structural variations require different uncoupling and removal procedures. For example, the left version in this image features a slide-type locking mechanism, while the right shows a simpler clip style.



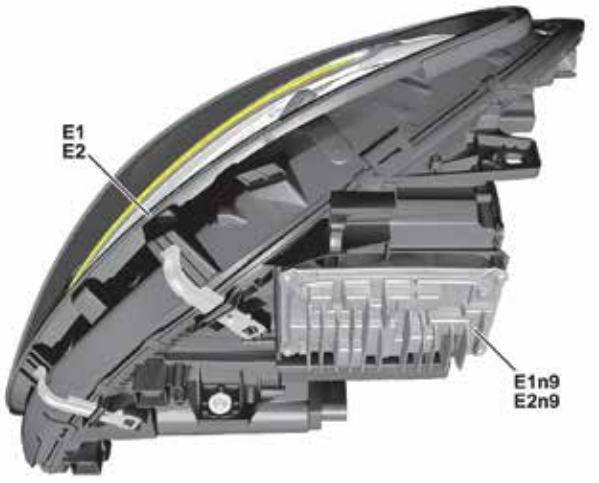
There are six PARKTRONIC sensors (B8/1, B8/2, B8/3, B8/4, B8/5, B8/6) in the front bumper of the Mercedes-Benz E-Class. Each has a sealing ring (9) that if scratched or gouged can allow moisture to seep around to the electrical connector and cause performance-robbing corrosion.

connectors generally use single-wire seals. Be sure to identify what kind of seals are in use, and inspect them carefully before allowing them to remain in the vehicle – especially if you think they're leaking. Single-wire seals are crimped onto the wire ends just like non-sealed contacts, but using different crimp dies and special contacts of course. The seals are readily available. The different colors are only to help in identifying what you have in your hand, because they are too small to have part numbers on them.

Look for sealed connectors and contacts in the doors, behind the bumpers at PARKTRONIC sensors and lighting units large and small. Engine parts, wheel sensors, fuel system components and cameras also all use seals. Nicks and scratches allow moisture to migrate through capillary action to where it can cause performance-robbing corrosion, so not only inspect them carefully, but handle them carefully too. Don't forget the possibility of water entry through failed gaskets, for example at the tail lamps.

Downhill flow

A connector that is positioned below a potential water source that develops a leak is vulnerable to corrosion. When an electrical circuit begins acting fishy, a quick visual inspection may save you a lot of diagnostic time. If you find corrosion on or in any of the connectors on that circuit, suspect condensation from an air conditioning unit, a plugged drain from the evaporator, a deteriorating radiator or water pump hose, or any other upstream moisture source as potential culprits. Once you locate and eliminate the moisture source, you can replace or repair the electrical connector and consider rerouting the cable away from potential future leaks.



The headlamp control units in 2016 and newer CLA (C117) models are screwed to the underside of the headlamp housings. If the gasket around the headlamp housing is damaged or fitted incorrectly, or the housing is damaged, moisture may enter the wiring harness connectors for the control units. The resulting corrosion can cause a failure of the Intelligent Light System.

Winning

With attention to these sometimes odd sources of moisture, you can beat wiring repair corrosion.

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Servicing Mercedes-Benz vehicles with Genuine Mercedes-Benz Parts, StarParts, Remanufactured Parts and Accessories demonstrates your commitment to using only the highest-quality parts for your customers. To show our appreciation, we invite you to join the Mercedes-Benz StarRewards program. Now, each time you make a purchase through your Mercedes-Benz dealership, you can earn a cash rewards on a reloadable card that you can spend on whatever you desire. Simply sign up and start getting cash rewards for parts you're already installing.

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Mercedes-Benz STAR☆REWARDS

Mercedes-Benz Electric Vehicles Ready for the Road!

The compact, all wheel drive EQC uses front and rear motors to best advantage for each driving situation.

The scenario is real: Mercedes-Benz electric vehicles are on the scene, prepared for travel and headed your way for repair and service.

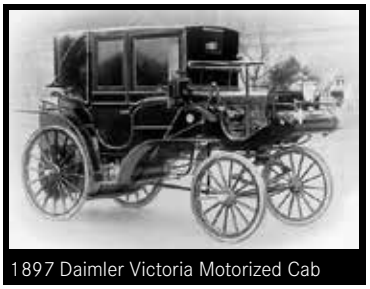
After developing the first automobile in 1886, Karl Benz and, separately, Gottlieb Daimler steadily refined and upgraded their pioneering internal combustion engine powered vehicles. But they also went extensively into the emerging electric vehicle surge, which saw electric vehicles become quite popular throughout the 1890s and into the first two decades of the 20th Century.

Strong, steady development of gasoline engines and widespread road development demanded greater range of movement that electric vehicles, with their battery power limitations, could not equal. This caused electric vehicles to lose favor and largely vanished from the scene by about 1920.

Mercedes-Benz has jumped into the Electric Vehicle (EV) fray in a big way with the introduction of a carefully developed complete range of electric vehicles and supporting systems called EQ. The first electric vehicle out of the gate is the highly important EQC crossover, set for introduction beginning in 2019 and full bore in 2020.

Popular Even Before They Are Built!

The market for these vehicles appears to be red hot, with Mercedes-Benz indicating the EQC is "sold out for 2019 and probably for 2020 as well," according to Mercedes-Benz CEO Dieter Zetsche, speaking of the situation in Europe. Mercedes-Benz plans to have 10 electric vehicle models in the market by 2022, and has pledged multi-billion dollar investments to battery suppliers in the United States to support its vehicles. Increased lithium ion battery capacity and range, combined with electric motor and control system advances will play a significant role in the growing success of Mercedes-Benz vehicles.



1897 Daimler Victoria Motorized Cab

1908 Mercedes-Benz EV 'Berlin Taxi'

Nearly 125 years of heritage connects earliest Daimler and Benz electric vehicles to today's highly advanced Mercedes-Benz EQC.

Motor of Daimler electric taxi

A relatively small electric motor beneath the seats powered the Daimler electric taxi.

1905 Daimler EV Taxi

The EQC setup features compact electric motors at the front and rear axles, configured differently to reduce power consumption and provide different output. The front electric motor is optimized for best possible efficiency in the low to medium load range, while the rear motor adds sportiness under full throttle. Together, the motors generate 402 horsepower and a maximum torque of 564 lb-ft. The motors draw power from latest-generation lithium ion batteries consisting of 384 cells in a modular design. The battery pack groups together two modules with 48 cells each and four clusters with 72 cells each, and is located beneath the floor, between the two axles, saving room inside the cabin and enhancing a low center of gravity.

The EQC also features an ECO Assist system that notifies the driver that he or she can lift off the accelerator pedal and coast ('sailing') to save battery. The system works in conjunction with data from navigation, traffic sign recognition, and info from the intelligent safety assist systems.

The 1835-pound battery pack is cooled by a water-cooling system which can also warm the battery in cold weather. Cooling is supplemented by airflow through the front grille. The battery, located beneath the floor, is protected by a strong girder frame to prevent damage from side impact.

The EQC's front electric motor provides highly efficient driving, while the rear motor offers added punch when called for – and makes this a four wheel drive vehicle.

Already sold out in Europe for first two years of production, the dramatic EQC features front and rear electric motors and more than 400 hp for all wheel driving.

The EQC cabin gives great view of what's ahead and what's going on in the vehicle.

In addition to Comfort, Eco and Sport driving modes, a Max Range setting indicates about 250-280 miles in the EQC, with the 7.4kW on-board, water-cooled charger ready to boost battery charge. The Mercedes-Benz EQC is set up to use a Level 3 DC Fast Charger, which offers a 40-minute charge.

The End of Oil Changes

Many of us – well, some of us anyway – revel in the time when we were best friends with a spark plug wrench, could set timing right on the button for best performance, and loved the sound of that tuned engine roaring to life. Maintaining a Mercedes-Benz electric vehicle (EV), however, involves one major difference from those "good old days" – there is no internal combustion engine (ICE).

The EQC's charging port (European version shown) accepts available charging connectors from various charging stations or home charging from household outlets. The two contacts at the bottom are for quick-charging.

Beneath the floor, the high voltage lithium ion battery pack gives the EQC about a 200 mile range and provides for all the power needs of the vehicle.

Instead we have two very powerful high voltage electric motors that should be treated with careful respect, but require no routine maintenance. No oil changes, for instance, nor spark plugs, camshafts, fuel pumps or fuel tank. Plus long-lasting brakes that regenerate the kinetic energy from braking back into the batteries means the brake pads can last longer too.

The new EQC electric vehicle operates with well-coordinated powertrain components that produce strong, quiet performance, including:

- The high-voltage battery pack
- Voltage Inverter/Converter
- Motor Controllers
- Two powerful electric drive motors

The high-voltage battery pack, consisting of several individual lithium ion cells, requires thermal management – cooling and/or heating – to attain maximum life and capacity. Water cooling is supplemented with air flow from the grille, and uses supplemental heat when required in cold weather. These large and heavy battery packs need special equipment if they need to be removed safely from the vehicle. Note that handling HV components, like the battery pack or wiring, can be fatal unless proper equipment and precautions are used. Please consider having your local dealer handle these complex jobs, since one false move could be your last.

The inverter takes direct current energy from the high-voltage battery pack and supplies it as alternating current energy to drive the vehicle's traction motors. The traction motors are called Electric Machines, to differentiate them from small DC motors used for things like the window lifters, for example. Sophisicated electronics convert large amounts of DC current into AC to drive the electric machines. The inverter also works in reverse: AC power (from a charging station, or generated by the electric machines) is converted back to DC to store in the HV battery, or to charge the 12-volt system battery.

The EQC's electric vehicle motor (EVM) controller is a sophisticated device that delivers variable-frequency energy to the electric machine by modifying the energy flow from the battery. Essentially it produces variable-frequency 3-phase AC, which causes the electric machine to spin at the desired speed in response to throttle inputs from the driver. Each electric machine has its own motor controller and (at least for now) they are integrated with the electric machines and cannot be replaced separately.

The electric machines are mounted using stout rubber bushings and a very strong frame, with the frame mounted with another series of rubber bushings to the chassis. This anchors the electric machines and prevents motor noise and vibrations from intruding into the passenger compartment.

Testing HV components isn't a matter of breaking out the multimeter or oscilloscope. When you are dealing with hundreds of volts, there are a few things that are forbidden if you want to continue living: Never pierce the insulation to test voltage. Use HV-rated protective equipment and work procedures as provided by the manufacturer. And don't even think of working on the high voltage parts without proper training. Instead, you need to use XENTRY Diagnostics or some other testing tool to question the component as to its condition. Mercedes-Benz engineers designed extensive self-diagnostic and monitoring systems into these components just so the average techjnician doesn't have to expose themselves to potentially fatal voltages.

Brakes should last much longer due to regenerative braking. The driver can influence the amount of 'no throttle' braking effect from almost nothing to a really aggressive level, where the driver may never actually use the brake pads. Nonetheless, the conventional brakes do need occasional attention from time to time, as they do see some use and will eventually wear out. Mercedes-Benz recommends a check of the brake pads and system at a 50k service, although owners might want to consider an annual brake service to clean and verify the brake system's condition to ensure proper brake operation.

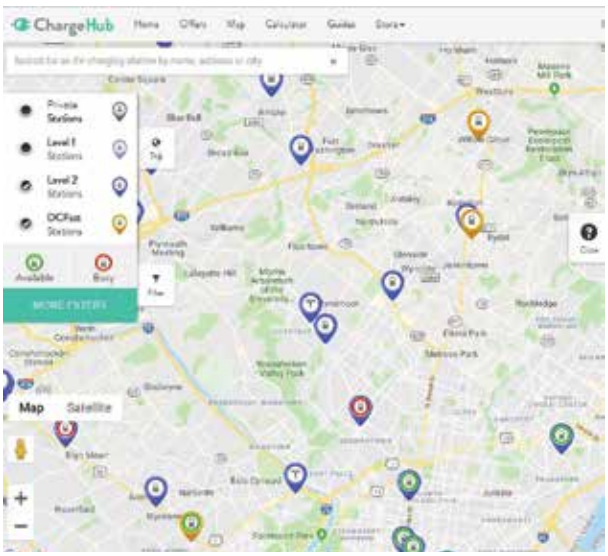
Under the hood is the powerful front electric machine that provides most of the propulsion, while the rear electric machine gives added power when appropriate. These traction motors are anchored to a strong frame with robust rubber bushings that keep electric motor hum isolated from passengers. Be careful with the orange cables, which indicate high voltage. They must not be cut or damaged!

Thousands of charging stations nationwide utilize Level 2 connectors for quick charging on the road or around the corner.

Service Considerations

With EVs there are some new considerations for the service shop. In some cases you should consider farming out specific jobs – like locking out and disabling the HV system – to your local Mercedes-Benz dealer. When working with a Certified Collision Center, be sure they also understand these considerations. Some tips include:

- Safety First: To ensure safety for technicians and your vehicle, the service facility should set up and make mandatory the "Lock-out-Tag-out" (LOTO) – or similar procedure – forbidding work on any electric vehicle until making absolutely certain that the vehicle electric system is LOCKED OFF. The vehicle can only be turned back on by the individual who locked it off and who holds the (only) key, after all repair work is done. This is a national industry safety standard for work on any electric machinery, and in most workplaces failure to abide by this rule results in immediate termination of employment.
- Schedule service to recognize that a vehicle sitting in the facility for an extended time waiting for repairs could lose enough charge to require recharging before work can begin.
- Anticipate longer repair times if removal of the vehicle's 80 kWh lithium ion battery pack needs attention, especially with heavy side impact and severity of a collision, in case the battery is damaged, or in the way of structural repair. Located under the floor of Mercedes-Benz electric vehicles, the battery pack will need special equipment to move.



Local maps on networks such as ChargeHub and ChargePoint provide great detail on charging station availability, showing mostly Level 2 stations and where they are.

- You should consider getting an EV charger installed at your facility, if you don't already have one. This will position your facility as "Mercedes-Benz EV Ready", encouraging service business just by making the charger accessible to Mercedes-Benz drivers. Of course, if you are thinking of getting a DC Fast Charger installed, you'll need to verify that the electrical panel is up to the task. A standard charger might use several amps at 220 volts, while the Fast Charger uses much more.

Traveling with the New Breed of EVs

Get the GPS ready, electric vehicles are here and already on the streets of America. Mercedes-Benz anticipates electric vehicles (EV) eventually making up a quarter of vehicles sold worldwide and is promoting its superior EQ vehicles as the finest electric vehicles on the road. Here is some information about the various charging options for the Mercedes-Benz EQC:

- All Mercedes-Benz electric vehicles — including the Plug-In Hybrids and the all-electric B-Class and smart models – are delivered with a Level 1 charger for use with standard 110-volt household current, and can connect to a standard Level 2 (SAE J1772) charger for faster charging (three to five times faster than Level 1). The Mercedes-Benz EQC also is equipped with a Level 3 (SAE Combo CCS) connector.
- Level 2, the most common connector, normally charges the vehicle in about 3 to 8 hours, while a Level 3 connection, when available, can charge the vehicle in in about 40 minutes. Level 2 connectors are widely available in the United States, while Level 3 chargers are somewhat less common. The number of both types are growing daily throughout the country.

Charging The Battery

Charging stations around the country use one of three basic financial models to deliver EV charging. These are:

- Pay-as-you-go – you set up an account with the charge provider, and they deduct the cost from your account as you use the charger.
- Subscriptions – a flat rate to charge, or a monthly fee for reduced-price charging.
- Free to use – many businesses offer free charging as an inducement to visit.

EV drivers can charge for free when available, although some operators allow only a short period of charging. Most networks involve some payment arrangements to be able to charge, such as a credit card on file. You can join more than one network if you like, or arrange your travel to avoid non-free public charging unless you're nearly out of charge.

The cost per hour to charge basically depends on the power capabilities of the vehicle's onboard charger as well as, of course, the hourly rate for the charge. A typical 'fill-up' is only a few dollars, far less than a gasoline vehicle for the same range. According to the US Department of Energy website, there are about 28,000 public locations (representing nearly 80,000 charging outlets, or about three per location average) to charge an EV, and from experience we've found that about one-third of these are free.

Quick Recommendations for Travel

For those planning a lengthy trip, here are some tips:

- A vehicle with only a Level 1 or Level 2 charger capability might not be the best choice for a long trip. Charge times are a few hours, and you're limited by the vehicle's range. The EQC has Level 3 charging capabilities, making longer trips practical.
- ChargePoint is the largest charging network, but there are several networks in the United States and Canada. Research on the Internet to see which is best for you. It's not unusual to have several network 'memberships.'
- Study your anticipated routes and destinations, and possibly use PlugShare (plugshare.com) or another station-finding tool to see which charging networks are along the way. Be ready to use any of them that are convenient on your schedule.
- Mercedes-Benz USA anticipates offering a smartphone app, much like the EQ Ready app available today in Germany. It can be used to assist planning and scheduling a trip, including finding correct routes to arrive where you want to go. Visit mercedes-benz.com/en/eq/about-eq/eq-ready to get a preview of what's coming.

When charging at a commercial charging station, be careful to watch for slow charging speeds, and as a courtesy to others, disconnect and move the EV after you're done charging. If you drive an ICE (Internal Combustion Engine) vehicle, again be courteous and don't block an EV charger: You can get fuel most anywhere, but an EV can only charge in a few locations.

The new Mercedes-Benz EQC: The Mercedes-Benz of electric vehicles, indeed.

Classic Parts

While most of your business likely comes from newer vehicles, perhaps just a few years old, you almost certainly have a few long-time customers with a classic Mercedes-Benz. It isn't just that Mercedes-Benz vehicles tend to last longer than most other marques, nor is it that the timeless designs are still fresh today, or that Mercedes-Benz owners show a genuine love for their vehicles, but that these and other factors combine with the Mercedes-Benz commitment to astounding parts availability several decades after production has ended.

The Mercedes-Benz Classic Center, located in Irvine, California, is ready, willing and able to support you for all your classic car needs. A classic in the Mercedes-Benz world is any vehicle more than 15 years out of production: A 163 M-Class, last built in Model Year 2004, is a classic, while a W220 S-Class is just a year away from that status. Customers and service shops contact the Classic Center every day looking for parts, and in most cases what is needed is available... But sometimes, some parts aren't in production any more.

In these cases, if the Classic Center can register enough interest, the original blueprints are dragged out and the parts are manufactured again in a small batch. Some recent examples include some classic rubber trunk mats for the R113 SL models (A113 684 01 01) and the W108 models (A108 684 01 05), which haven't been available for a couple of years.

The friendly team that the Classic Center can sell you classic parts directly, or refer you to a local dealer who can procure the parts for you. They are also a wealth of knowledge on these vehicles, having been there and done that, so they can make your life easier. For example, the crankshaft bearings for a Gullwing engine, unlike modern engine parts, need to be fitted to the block. They are delivered a little bit long so they can be trimmed to fit perfectly. If you didn't know that, just bolting them in could result in engine damage, which, when dealing with literally priceless and rare engines or vehicles, might be a disaster.

The parts they sell carry the same parts warranty as any Mercedes-Benz parts: 24 months with unlimited mileage for most parts, with selected parts (engines, certain accessories like trailer hitches and step bars) warranted for 48 months or 50,000 miles. You can see the full terms of the Mercedes-Benz Vehicle Service Parts and Accessories Limited Warranty at www.mbusa.com/en/owners/service-maintenance.

So, if you have a customer who wants a genuine Mercedes-Benz part for his or her classic, be sure to give the Mercedes-Benz Classic Center in Irvine a toll-free call at (866) MB CLASSIC (622-5277) between 8 am and 4 pm Pacific time, Monday through Friday, or email them at classicparts@mbusa.com. Even if the part really is out of production, your call might be the one that 'tips the scales' towards commissioning a new production run. Parts availability is dynamic, so stay in touch with the Classic Center for the latest information. Follow along on social media (@MBClassicCenter on Facebook, Twitter or Instagram) for the latest official news.

While the chances of a classic like this 500K Cabriolet B coming into your shop for an oil change are almost zero, all those 560SL drivers are just as passionate about their cars. Most any part, for most any car, is available from the Mercedes-Benz Classic Center – and if not, they might be able to get it for you. Image courtesy Wikimedia Commons.

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