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Information for the Independent Mercedes-Benz Service Professional

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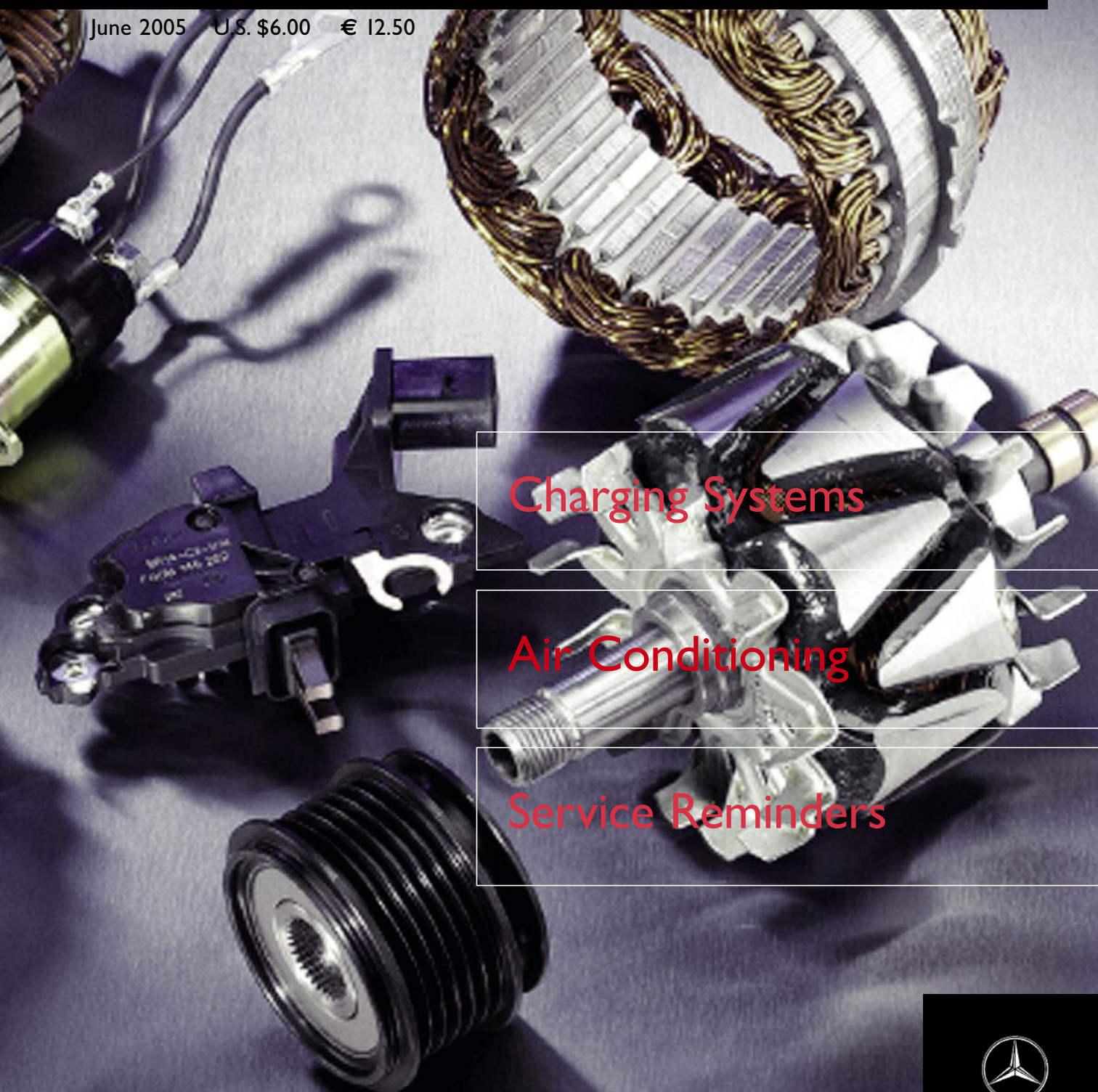

Charging Systems

Air Conditioning

Service Reminders

Volume 5 Number 2

Mercedes-Benz

To Our Readers:

Welcome to *StarTuned*, the magazine for independent service technicians working on Mercedes-Benz vehicles. Mercedes-Benz sponsors *StarTuned* and provides the information coming your way in each issue.

Mercedes-Benz wants to present what you need to know to diagnose and repair Mercedes-Benz cars accurately, quickly and the first time. Text, graphic, on-line and other technical sources combine to make this possible.

Feature articles, derived from approved company sources, focus on being useful and interesting. Our digest of technical information can help you solve unanticipated problems quickly and expertly. Our list of Mercedes-Benz dealers can help you find original, Genuine Mercedes-Benz Parts.

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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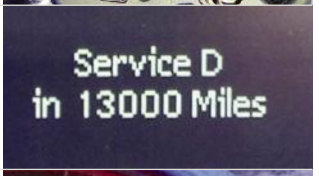

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Visit us at our new website **www.MBWholesaleParts.com** to view this issue and all past issues of StarTuned, along with a wealth of information on Genuine Mercedes-Benz Parts.

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Charging System
ISSUES & EVOLUTION

Are you taking it for granted that you have a solid understanding of the system that keeps the battery up? Keep reading, or risk damaging expensive components and arriving at faulty diagnoses

Once upon a time, any technician with even a little experience knew almost everything there was to know about automotive starting and charging systems. There was a battery, alternator (or, if we go back far enough, a D.C. generator), starter and an ignition switch and solenoid set-up, and that was about it. Five minutes with a test light and a screwdriver would get you to the root of the problem, and everyone lived in harmony.

While the basics haven't changed much, the details sure have. Dual-battery systems, 220-amp alternators, AGM batteries and intelligent load management have all been introduced since the last time you studied the topic, so we'll present a refresher course to bring everyone up to speed.

We don't have the space to deal with starting systems today. With the advent of electronic starting systems like Keyless Go, to cover the topic adequately would take a whole article in itself. StarTuned will do that, but in a future issue.

Square one

Let's start with the most basic basics. You need a battery to store power, so it can supply power while the engine is not running (and power to get it running). You also need an energy source to keep the battery topped up and to supply power to the vehicle while the engine is running, usually in the form of an alternator.

Although we all know that cars run on a 12 volt system, that's a "nominal" voltage. A fully-charged lead-acid battery has a terminal voltage of about 12.65 volts. To charge this battery, we'd need a voltage around 13.8 to 14.2 volts depending upon temperature – high enough to charge the battery fairly quickly, but not so high that it reaches the "gassing voltage", which is about 14.4 volts. Exceed that voltage, and the water breaks down into free oxygen and hydrogen very rapidly, and the battery "boils" dry. In addition, the released H_2 is explosive.

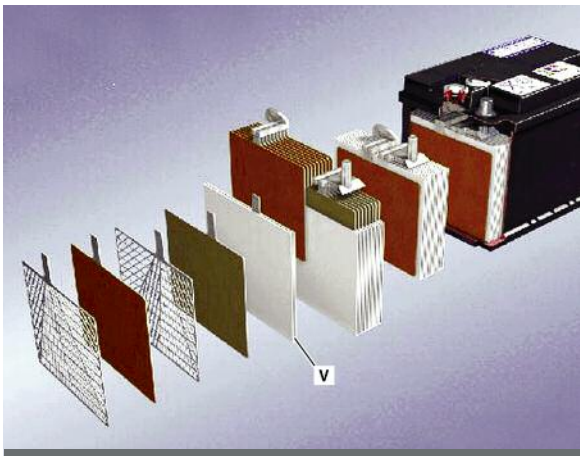
Without all these parts working together to produce the amperage a modern vehicle requires, driving trips would have to be short indeed.

Charging a battery at high current also hurts it. Ideally, you should never charge at more than five amps, but to maintain realistic charging times we commonly bump that up to 20 amps.

Soaked up

The latest thing on the market is the Absorbed Glass Mat (AGM) battery. This adds glass matting, or 'fleece' (think attic insulation), to the inside of the battery. The fleece absorbs all of the sulfuric acid like a paper towel while allowing it to circulate enough for the chemical activity necessary. The advantages of an AGM battery are increased service life, ability to withstand a deep discharge, and – most importantly – they are non-spillable.

By non-spillable, we mean that the normally liquid acid is captured inside the battery. One of the tests for the 'non-spillable' rating is to drill



In this cutaway of an AGM battery, you can see the fine white fiberglass mats (V) that hold the electrolyte.

a series of 6 mm holes in the bottom of the battery case – yes, with the acid in there – and to place it onto a sheet of blotter paper for 15 minutes. If any acid leaks out, the test is failed.

Don't confuse AGM batteries with the older gelled-electrolyte batteries commonly used for low current applications. This type of battery is not suited to supplying the high currents for, say, starting an engine, while the AGM will happily act as the source of hundreds of amperes.

Although the sulfuric acid is said to be diluted, it's still plenty powerful, and therefore dangerous. Ask anyone who has spilled some on his or her skin, or, heaven forbid, splashed some into his or her eyes. Acid contacting you anywhere is a medical emergency, calling for lots and lots of water and, in many cases, a precautionary trip to the Emergency Room. Don't discount the seriousness of battery acid – it keeps on eating away at your flesh for hours after exposure.

Considering the sobering nature of battery acid, you can easily understand how much safer an AGM battery can be for all involved. In modern vehicles, where tight spaces have moved batteries into the trunk and passenger compartments, it becomes absolutely critical to replace the battery with the proper type.

Suitable equipment

It's very important to adhere to the 20 Amp limit with AGM batteries, since they're more easily damaged by rapid charging. A special 20-ampere fully-automatic charger is the only Mercedes-Benz approved way to recharge an AGM battery (Part Number 110-9420).

This MB-approved electronic battery tester takes you way beyond the traditional means of diagnosis, and it gives you a definitive answer in a minute or so without applying a load.

Battery diagnosis has gone beyond the hydrometers and carbon piles of the past. Today, Mercedes-Benz recommends the use of a no-load battery tester, specifically the Midtronics MCR717, available as a special tool through MBUSA (Part number W900 589 09 21 00). It provides a definitive answer on battery condition in about a minute – Good, Bad, or Charge & Retest. Of course, a load test can still be performed, but the new AGM batteries do not lend themselves to a specific gravity measurement, making an accurate diagnosis difficult with a traditional VAT.

If you find that the battery is marginal or dead, the best bet for both you and your customer is a Genuine Mercedes-Benz replacement. You may be surprised to learn that the prices are competitive with the local parts store, and the quality and warrantee are top notch. Not to mention that it will always fit.

Before installing that new battery, you need to find out why the old one died. Did it just fail because of age? Is excessive rest current draining the battery? Did the customer leave the lights on? Is the alternator doing its job? Is the accessory drive belt slipping? Does the car get driven enough to keep the battery charged? Is there something else causing the problem? Finding the answer isn't always easy, but it's the right way to fix the complaint. Remember, if it happens again, you can be sure the customer will be right back in your shop, and a lot less happy.

Two batteries, no waiting

Now let's have a look at some of the new things under the sun. The first is a dual-battery system, introduced with the SL-Class (230 chassis) in model year 2003, and also installed in the E-Class (211 chassis) and subsequent models. This system uses a relatively large starting battery, located in the trunk, coupled with a small battery for lighter electrical loads. These two batteries are connected through a Battery Control Module, which regulates the charging and discharging of the two batteries, as well as handling load management.

The battery control module measures the load capacity of the main battery, actual current flow to loads, and can take active measures to stabilize the electrical system. These measures include bumping up idle speed, connecting the auxiliary battery to the system via a relay, or shutting off non-essential consumers through the CAN Bus.

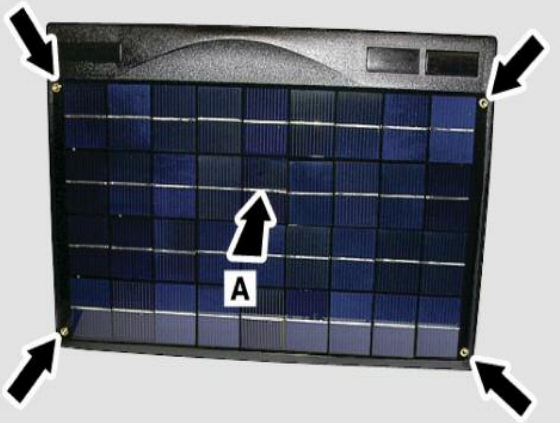
This means that, under certain electrical conditions, some electrical features may not work, while at other times they function normally. While it is beyond the scope of this article to get into the gory details for each model, just remember that all of this and more is available 24/7 in the MB Workshop Information System (WIS), online at www.startekinfo.com.

Jump-starting a dual battery system must be performed exactly as described in the owner's manual, or damage to the battery control module or other components could result. Connecting jumper cables to the wrong battery might turn into an expensive lesson.

Trickle-down theory

If the car sits around a lot – not unusual for an older vehicle, particularly a sports car that isn't a daily driver – the battery might need more charge than the alternator is able to provide in the abbreviated opportunities it has. This is especially true if the vehicle is driven mainly on short trips, where the battery has to start the engine frequently, without enough running time for recharging.

MB sells a fully-automatic trickle charger exactly suited for cases like this (Part Number B67542024). Connected either by means of alligator clips directly to the battery, or through a socket that you install in a convenient location for the customer, the trickle charger is left connected the whole time the car is parked. Priced around $100, it'll ensure the battery is kept in tip-top condition. As a bonus, it can also be used to keep the motorcycle or lawn tractor battery happy.



Attach this solar panel to a south-facing window to maintain the battery of a car that's not driven often. The arrows indicate the location of the suction cups.

If the car is kept outside, another possibility is the solar panel (Special Tool Number W900 589 02 6300) that you mount on a suitable window with suction cups. While its ability to produce current is small, it should be enough to prevent the battery from running down even if the car isn't driven for long periods.

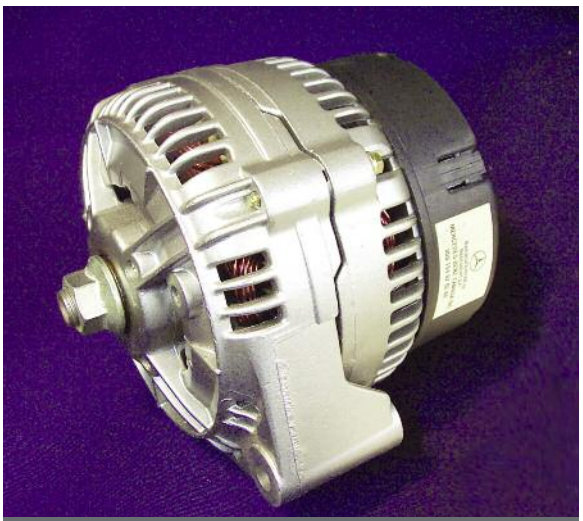
Draw poker

Testing the rest current draw in a dual-battery system is different from what's done with ordinary systems. As a matter of fact, testing the rest current draw in cars equipped with a Controller Area Network (CAN) bus (most MB models from 1998) is fairly complex – you have to wait for the bus to go to sleep (usually 15 minutes, but sometimes up to 65 minutes) before the rest current drops to normal.

Normal rest current should be under 60 mA (0.060 Amps) – with older cars, far below that. You'll always have some rest current – for the clock, the alarm system, and a few other always-on systems – but locating a larger draw can get frustrating. Although it's beyond the scope of this article to provide specifics, the general procedure is to isolate and measure. Once the CAN bus goes to sleep, start removing fuses to locate the general area of the excessive current draw. Keep reducing the search area until you find a promising candidate. Then, restore the whole system and work down the path just identified.

Alt or Gen?

Alternators are also new and old. A basic alternator is a self-exciting AC generator, producing three-phase alternating current, which is converted to direct current (DC) and electronically regulated to a nominal 12 volts for supplying vehicle systems and keeping the battery charged.



Is this an alternator or a generator? It's all a matter of semantics, but we believe the term "alternator" makes a useful distinction.

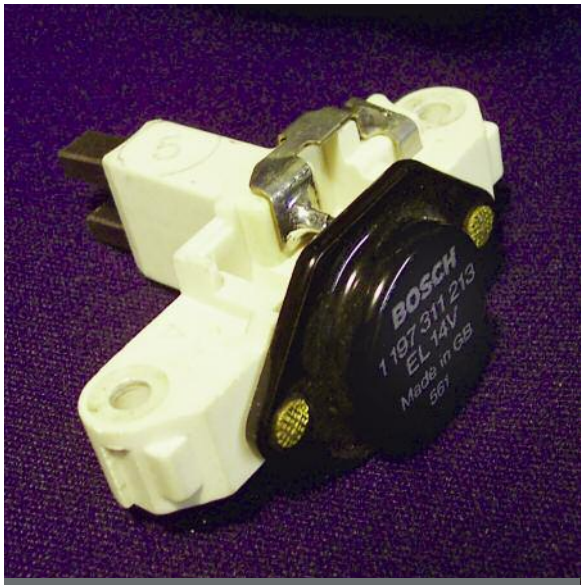
Even though the terms generator and alternator are often used interchangeably, the difference is that a generator produces DC and an alternator produces AC. So, even though the car's alternator produces AC, it gets converted to DC by means of diodes, so the technically correct term would be generator. At least, that's what the Society of Automotive Engineers (SAE) has determined. But, we need to differentiate between actual generators, which use permanent magnets and a commutator to generate only DC (not seen on new cars for four decades), and the modern generators which use electromagnets to generate a magnetic field and convert their AC to DC. Many technicians call the modern version an alternator, a convention we will follow, although all automobile manufacturers are obligated to use the term "generator" since the EPA accepts the SAE definitions.

The old-style generators had heavy armatures, and because of that could not be allowed to spin as fast as an alternator, lest they fly apart. The lower speeds limited the amount of current they could deliver at idle. An alternator is much lighter, and can be spun at two to three times engine speed right up to redline. So, it has a much flatter charging curve, delivering a substantial amount of energy even at engine idle.

Field work

A self-exciting alternator has nothing to do with alleviating boredom; instead, it means that coils of wire are used to generate the magnetic field, through which other coils of wire are moved to generate electricity. But, an alternator cannot start producing electricity until it can build up a magnetic field, and it can't build up a magnetic field until there is electricity – a Catch-22. The solution is to use the vehicle battery for the so-called bootstrap current.

A small amount of electrical current is allowed to flow through the spinning electrical coils, which, once a certain shaft rpm is reached (about 1,400 or so), rapidly increases until the magnetic field builds up to full strength.



The solid-state voltage regulator is integral with the assembly that holds the carbon brushes.

Carbon brushes carry the current to the spinning coils, and these brushes are usually a part of the voltage regulator assembly. The voltage regulator works by limiting the current through the brushes to the coils, modulating the magnetic field to maintain a constant output voltage despite varying loads, speeds and temperatures. The regulator assembly is also available separately as a spare part – no need to replace the whole alternator.

Details

With the newer alternators, expect current capacities well in excess of 150 Amperes. This means that wiring and electrical connections become much more critical. For example, a tenth of an ohm (0.1) might not seem like much, but at 200 amps that means a power loss (into heat) of 4,000 watts – enough to heat a room. Thankfully, modern wiring methods help avoid such cases of high resistance, but cleanliness (and tightness) still count.

Some newer alternators are water-cooled. It's easy to spot the coolant lines, but if you've never heard of the concept, having anti-freeze pour out of an alternator may be disconcerting. While still not commonplace, it's not unheard of, either.

As in the old days, a burned out charge lamp in the instrument cluster will prevent the alternator from self-exciting: The initial current we spoke about earlier flows backwards though the light bulb from the battery. In most cases, there is a resistor in parallel with the indicator lamp to ensure that enough current flows – a 1.2-watt light bulb just isn't large enough. Suspect an issue with this circuit if the alternator never excites itself.

A very noisy alternator can be caused by a bad bearing – unlikely unless the car has high miles – or a blown diode. A shorted or open diode puts an unbalanced mechanical load on the alternator shaft, causing it to vibrate. Modern testers can identify a bad diode in a few seconds by picking up ripple voltage. You can't test the diodes individually unless you open the alternator, which is not advised unless you have no other choice.

We'll sum up with a list of tips:

- **Good grounds are always important, and the central ground in any vehicle is the back half of the alternator.**
- **Replace batteries with the same size and type only. The wrong battery could fail prematurely, or become a safety hazard in a crash.**
- **Be sure to install the vent tube and vent plug from the old battery into the new battery. Battery gases are explosive, and must be vented properly. If unsure, consult a dealer.**
- **Follow all safety precautions when working with batteries. An exploding battery can ruin your day – or your life. If you're not familiar with all of the many safety procedures necessary for working on and around batteries and charging systems, find experienced help.**
- **If the vehicle battery is discharged, find out why before you replace it, or you'll just end up with a comeback.**

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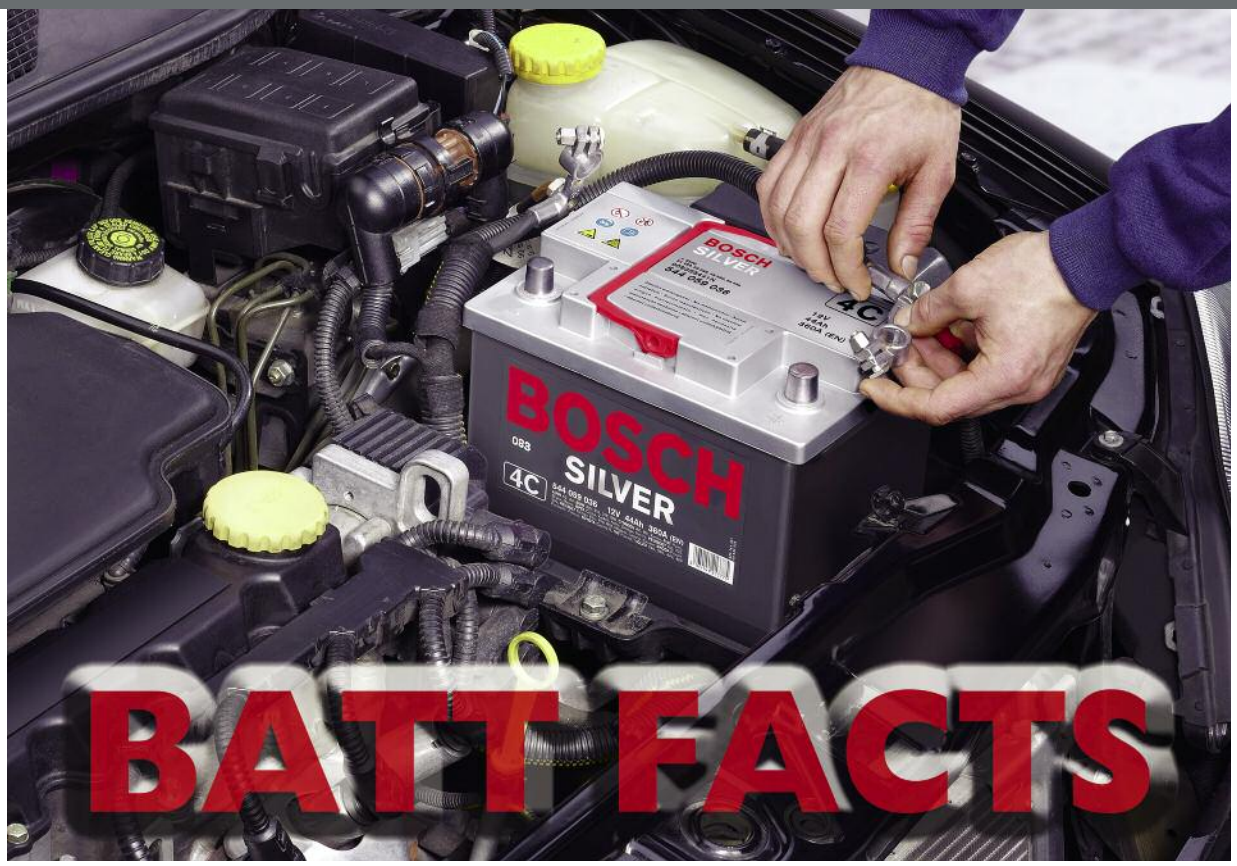


BATT FACTS

Everybody who remembers high school chemistry, raise your hand. No? Well, that's not really surprising since knowledge of most of the principles involved isn't used very often in the course of normal life.

That is, except for the chemical reaction that allows a lead-acid wet cell do what it does. This has been understood for a long, long time. In fact, the ancestor of the modern automotive battery predates the automobile itself. Gaston Plante, a French inventor, produced the first practical and rechargeable lead-acid battery in 1859 – that's 27 years before the first real automobile (the Benz Patent Motorwagen of 1886). While Plante would surely recognize the modern battery, every aspect of performance has been studied and improved upon.

A quick recap of battery theory and anatomy will help you understand the changes that are going on. If two dissimilar metals are placed in an electrolyte that can attack them, voltage potential is created. Electrons will flow if a connection is made between the metals, and that's what electricity is.

In a wet cell, the metals are sponge lead (Pb) and lead peroxide (PbO_2), and the electrolyte is dilute sulfuric acid (H_2SO_4). The reaction begins as sulfate (SO_4) breaks away from the acid and unites with the lead of both the positive and negative plates to form lead sulfate ($PbSO_4$). The oxygen (O_2) is thereby liberated from the lead peroxide and joins with the hydrogen (H_2 what's left over after the sulfate left the acid) to produce ordinary water (H_2O), which dilutes the electrolyte. Eventually, both the plates turn into lead sulfate, the electrolyte becomes very weak, and current stops flowing.

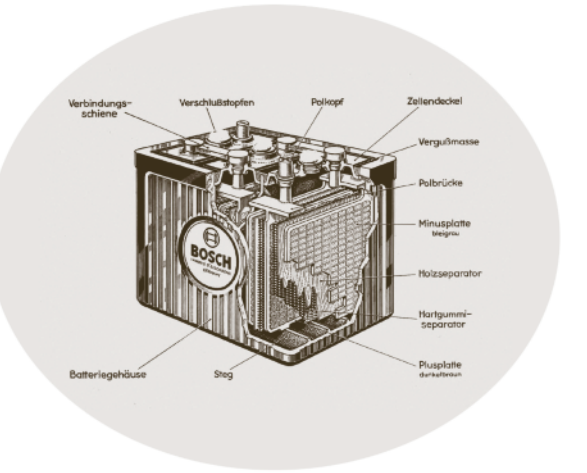
But reversibility is the wet cell's most important characteristic. When an outside power source pushes electrons through the cell in the opposite direction to that of discharge, sulfate separates from both plates to rejoin the hydrogen in the water, forming a new batch of sulfuric acid. The oxygen goes back to the positive plate to recreate lead peroxide, and the electrical potential is restored. If charging continues after all the sulfate has gone into the electrolyte, the water starts to decompose, releasing free hydrogen and oxygen, an explosive couple.

The traditional automotive battery has plates made of a combination of lead and antimony impregnated with the metals involved in the reaction. The positive plates are separated from the negatives by sheets of porous material that insulates them electrically from each other, but allows the electrolyte to pass (although such things as balsa wood have been used, sealing the positive plates in plastic envelopes is commonly done today to keep the active material in place that had previously been allowed to drop piece by piece into the space under the elements, lowering the cell's capacity and sometimes shorting out the plates). Numerous plates of each metal are interlaced within one cell, but whether two or a dozen are used the cell produces a "pressure" of 2.1 volts. Six cells are connected in series to give the 12.6 volts almost all cars have needed since the fifties.

Computer designed radial grids, thinner plates, and other refinements greatly increase the energy density of modern batteries. To illustrate, a typical old fashioned unit could deliver maybe ten cold cranking amps per pound, whereas a more highly evolved specimen might produce 18.

A big change we'll be seeing in the relatively near future is the adoption of 42-volt systems (that number refers to alternator output, but they can also be seen as 36-volt systems because they use 18 two-volt cells), something the Europeans are especially hot about.

Why tamper with a standard that's been around for half a century? Lots of reasons. First, those flywheel-mounted combination starters/alternators you may have heard about



While the principles of the lead-acid wet cell battery have been known since 1859, designs and materials have sure changed. This old battery actually used porous wood for the plate separators.

allow such quick, quiet starting that the engine can be shut down any time you come to a stop, which will save gas and cut pollution (no more idling in traffic jams), but they need plenty of voltage to do their job efficiently. Then there's the idea of using electric motors to drive such things as A/C compressors and rack & pinion steering gears, and that'll draw lots of power. Instead of resorting to gigantic cables to deliver sufficient amperage, increased voltage can be enlisted. Another possibility is solenoid-actuated engine valves, which concept will also require more moxie than 12 volts can offer. Of course, this will put a whole new spin on service safety. Nobody ever minded a 12 volt shock very much, but 42 will be another story.

Finally, are there any new combinations of active materials (called "couples" in the industry) that show promise as a practical replacement for lead acid? In a word, no. As one of the battery engineers we interviewed for this section puts it, ***"I don't think we'll see a switch from lead acid. Its cost is low relative to any other couple, nicad for instance. And lead acid is eminently recyclable."***

Ramifications of the Mercedes-Benz Intelligent Service Reminder System

Extended service intervals? How about an average of approximately 12K between oil changes? What's it all mean for our business?

Depending on how the car is driven, it might be a long, long time before the FSS lets that motorist know it's time for service. That's a convenience for the Mercedes-Benz owner, but may present a business challenge to the independent M-B service shop.

Over five years ago, Mercedes-Benz introduced its Flexible Service System, a computerized maintenance reminder that takes numerous factors into account before alerting the driver to the need for an oil and filter change. Although the idea had been tried before with varying degrees of success, from all reports this is actually working as intended. Back in '99, it became standard equipment on E320, E430, C280, C43, CLK320, CLK430, SL500, and ML320/430 models powered by the 3.2L V6 and 4.3L and 5.0L V8.

The key to FSS is a dielectric sensor in the oil pan that sends the computer information on the amount and type of contaminants in the liquid lubricant. It does this by calculating the dielectric constant of the oil - its ability to insulate - by measuring the electrical capacitance of the oil. Contaminants cause a gradual shift in the dielectric constant. The logic also takes into account input on rpm, throttle position, vacuum, and oil and coolant temperatures.

There's also an integrated oil level sensor, which not only reports if the crankcase is either low or overfilled, but also lets the FSS module know when and how much oil you've added. This information goes into the service calculation (also known as the Bonus System), extending the change interval because now some of the oil is fresh.

The result of all this computing is an instrument panel readout that gives the motorist plenty of time to work an LOF appointment into his or her crammed schedule. In fact, the main justification for FSS is customer convenience – he or she won't have to make as many service visits.

How long to spoil the oil?

This has been an interesting development, not just because of those sensors and unique programming, but also because the oil-change intervals the system gives you are from – get this – 10,000 to a maximum of 20,000 miles, depending on usage (time limitations also apply).

This sophisticated dielectric sensor resides in the oil pan and actually has the ability to report on the types and amounts of contaminants in the engine oil. This input goes into the electronic hopper with other info so that the computer can calculate the optimum oil/filter change interval.

Why do the Stuttgart engineers believe you should subject your beloved and expensive conveyance to what we veteran technicians would call dangerous oil change intervals? Lots of reasons. To begin with, that crazy-sounding 20K-mile maximum is only in cases where the FSS sees nothing but open-road cruising at light throttle and moderate temperatures. There are also the evolutionary improvements in oils (229.3 or 229.5 specs synthetic oil required) and filters that benefit all automobiles, as does a precisely-controlled air/fuel mixture that won't wash lube off the cylinder walls or contaminate the crankcase with raw gas.

For its own products, M-B cites sophisticated engine design carried out using the best available materials. This includes such things as cast-in silicon-aluminum cylinder sleeves with a low-friction surface that allows piston ring spring tension to be reduced by 50%. Combined with other friction-reducing measures, overall internal parasitic losses are down an impressive 45%, and that means less stress on the oil.

Another factor is the super-accurate electronic engine management system, starting with the Robert Bosch Motronic ME 2.0 and its successors, which allows these engines to meet National Low Emissions Vehicle (NLEV) standards. This leaves little chance for an overly-rich mix to ever occur, or its attendant gasoline dilution of the critical lubricant. Of course, it doesn't hurt that the oil capacity of current M-B models ranges from eight to a truly-abundant 13 quarts.

Do the math

Suppose for the sake of argument that all cars you work on have similar features and the same recommended oil change intervals within 10 years. Combined with 100,000-mile spark plug, coolant, and belt life, will our business be decimated?

In a word, no. Or, at least not for a long time.

The U.S. vehicle population is tremendous. Even given the growth in sales for Mercedes-Benz models, those already on our roads aren't going to be replaced all that soon. In our own shop, we've recently worked on an older SL with almost a quarter of a million miles on it, and several diesels that have gone even farther, yet are still in great shape.

Also, people are keeping their cars just about forever – roughly 10 years is the average age of cars and light trucks in the national fleet today, but it's much longer with Mercedes-Benz models, and going nowhere but up. It's just so costly to buy a new vehicle that motorists are hanging on to existing cars until they get every last bit of use out of them. They're also driving more and more miles per year, taking better care of their cars than they did in the neglectorama past, and more willing to have expensive repairs done instead of dumping their dependable old friends.

Another positive factor for your service business is that sooner or later all these aging Mercedes-Benz vehicles will need repairs, advanced technology and terrific durability notwithstanding. Brakes are a good example. For many reasons, they need more work today than they did in the past. Eventually, every Mercedes will need a water pump, too. Then there are all the other components that high mileage will eventually wear down or otherwise destroy: CV boots and joints, clutches, suspension and steering parts, exhaust systems, radiators, hoses, and belts, batteries, starters, and alternators, A/C compressors, condensers, and evaporators, internal engine parts, etc.

Not only is most of this work more labor-intensive than it was in the old days, but the parts are vastly more expensive, meaning your profit on parts will be higher. So, even as the number of jobs your customers require is going down, the size of the ticket is going up.

All of this is not to say that the automotive service business will not decline. It will. Face it: All cars, and especially M-B models, are simply getting better and better. But you've got at least another decade of prosperous dollar volume ahead of you, maybe 15 good years. Beyond that, all bets are off. Never listen to people who want to tell you what's going to happen 20 years into the future.

Traditionally, service shop technicians have used oil and filter changes as an opportunity to give the car a careful examination and perhaps uncover the need for repairs, or other maintenance. Now, with the longer LOF intervals the Flexible Service System permits, you'll have to make the most of each visit by being extra vigilant and disciplined in your inspection.

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to view this article and all past issues of StarTuned,
along with a wealth of information on
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The Genuine Mercedes-Benz will blow

Mercedes-Benz Quality and Reliability at a Great Value.

The quality, reliability and value of the Genuine Mercedes-Benz Remanufactured A/C Compressor wasn't meant to be taken lightly. The A/C Compressor is not only an exact replacement for the original unit, it's also re-manufactured and tested to meet the same strict specifications as the original, so it performs just as well. And like all remanufactured parts, it's covered by the Mercedes-Benz limited parts warranty.* In fact, the only detectable difference you'll find between a Genuine Remanufactured A/C Compressor and a new one, is the price. Which we're sure you'll find quite refreshing.

Remanufactured for Mercedes-Benz using the same factory standards as new parts.

- Fits like new parts
- Meets original specifications
- Performs like new parts
- Backed by same warranty as new parts

Remanufactured to Genuine New Specifications

Cylinder Block & Front/Rear Housing
Cleaned, inspected, gauged, and honed to OEM specifications or replaced with new components as needed.

Discharge Reed Valve
Cleaned, polished, and inspected.
Replaced with new components as needed.

Steel Gasket
Replaced 100% with new components.

Oil
Replaced 100% with R134a-compatible oil.

O-Rings & Seals
Replaced 100% with O-Rings compatible with both R12 & R134a refrigerant.

Pistons
Cleaned and inspected. Replaced with new, if the treated surface is scratched.

Shaft & Swash Plate
Cleaned, polished, and inspected.
Replaced with new components as needed.

Shaft Keys
Replaced 100% with new components.

Shoes
Sized, cleaned, polished, & inspected.
Replaced with new components as needed.

Snap Rings
Replaced 100% with new components.

Suction Reed Valve
Cleaned, polished, and inspected.
Replaced with new components as needed.

Thrust Bearing
Cleaned, polished, and inspected.
Replaced with new components as needed.

Valve Plates
Cleaned, polished, and inspected.
Replaced with new components as needed.

*See your Mercedes-Benz dealer for details and a copy of the Mercedes-Benz Spare Parts Limited Warranty

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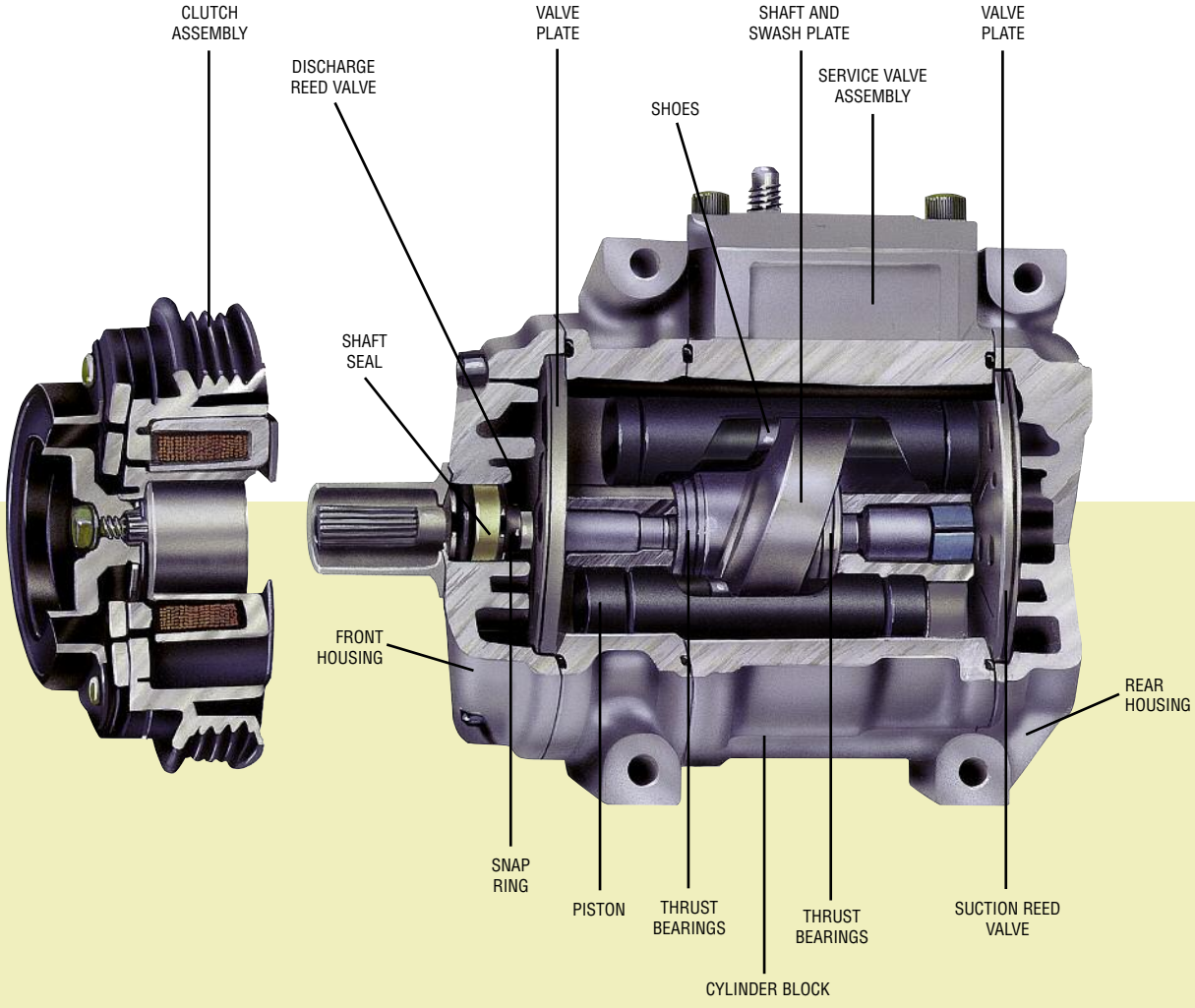
Remanufactured A/C Compressor you away.

Genuine Mercedes-Benz Remanufactured A/C Compressor



For more information about Genuine Mercedes-Benz Remanufactured A/C Compressors, contact your Mercedes-Benz dealer.

Mercedes-Benz

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Mercedes-Benz Genuine Remanufactured Parts

Remanufactured for Mercedes-Benz by DENSO

STEP BY STEP

A/C Refrigeration System Diagnosis

A streamlined approach to finding out what's wrong

Suppose your customer is no longer getting that refreshing arctic blast at the dash vents of which he or she had become so fond. Perhaps the air is barely cool, or presents no evidence of refrigeration whatsoever.

Ask some questions. Has the condition developed gradually or occurred suddenly? Has any work been done on the system? If so, what and when? The customer won't be able to remember exactly, but maybe he or she can find receipts.

A performance check is certainly in order. Now, doing this with the utmost accuracy is a complicated subject involving temperature, humidity, factory procedures, etc., but mostly you'll know what to do next simply by measuring the duct temperature. Remember, though, that the humidity level can affect output by as much as 15 deg. F.

You may have noticed that we at StarTuned are always harping on the importance of checking the basics, so look for obvious external problems. Is the compressor belt loose? Has the condenser collected any airflow-blocking leaves, fast-food wrappers, etc? Is the heater stuck on? Can you feel a draft of outside air at the vents while driving? Is the engine running hot? Is that declutching fan permanently declutched, or is that electrical air mover never coming on?

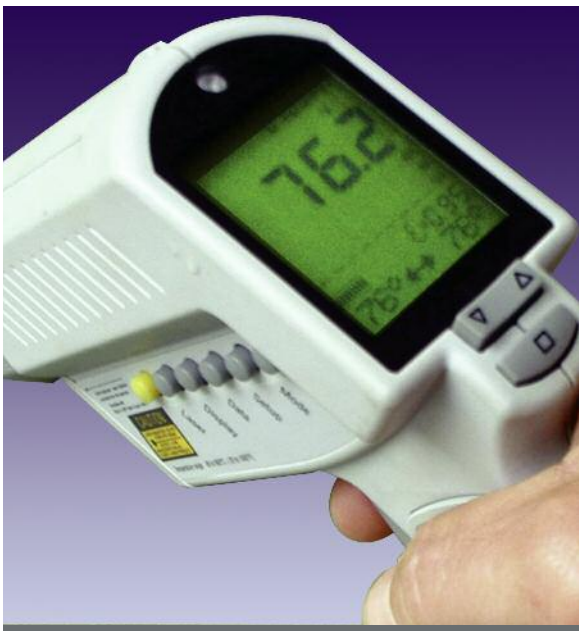
Next, look at the compressor clutch with the controls switched on. If it's engaged, the basic system is working and there's at least a moderate amount of refrigerant present because if there weren't, the lost charge safety device used in the clutch energization circuit would have tripped. Providing there are no external problems, weak cooling is probably due to a low charge, moisture and/or air in the circuit, a restriction, or a problem with the heater controls. Suspect that last item if clamping off the heater hoses brings duct temp down by more than about five degrees.

In cases where the compressor is indeed turning, let the system stabilize for 10 minutes on Max at fast idle, then feel the hoses near the compressor. If there's a reasonable charge, the high side/discharge line will be warm and the low side/inlet line cool. No significant difference points to an insufficient amount of refrigerant.

No engagement?

A clutch that's not engaging is an impediment to further investigation. Look for voltage and/or ground at the terminals if the circuit's not complete, either the safety set up is protecting the compressor, or there's a control problem. With old Freon R-12 systems, you could use a tire gauge type A/C pressure tester to do a quick check of the charge. Anything over about 50 psi meant there was enough refrigerant present to keep the protection device from opening the circuit, so there would have to have been another reason the clutch isn't working.

If there's a sight glass in the system, it can tell you quite a bit providing you've got good eyes and sufficient light. A clear stream or just a few stray bubbles indicates a decent charge, although the glass could be clear in cases where all of the refrigerant has been lost.



The first step in diagnosis is finding out if the A/C output is indeed below what can reasonably be expected on a hot, humid day. Perhaps that motorist wants more than can be achieved.

Although electronic leak detectors can be useful, they're not as positive as the UV light and dye method.

There's a subtlety you may never have heard of: Undercharge bubbles are strung together and surrounded by froth. Those caused by the presence of air are separate and aren't accompanied by foam.

Bogus gases?

In this era of confusion, you've got to have a refrigerant identifier. Not only are there plenty of systems out there that have had R-134a added to replenish a R-12 charge (or even vice versa, for some reason), but we've actually seen cars running around with their air conditioners full of explosive propane. Also, if you want to destroy a mobile A/C system, you could hardly do better than to charge it with R-22, but that's exactly what some misguided do-it-yourselfers, and even some technicians, have done, presumably because they think it'll save them some money compared to using R-12 or retrofitting to R-134a. Talk about false economy!

But once you've identified a refrigerant cocktail, what do you do with it? Well, you could just give the customer your condolences and send him out the door, but that doesn't fit in very well with your hard-won reputation as a person who offers helpful solutions to tough problems. Some shops have a dedicated "garbage" recovery machine, which might be an old unit or something intended for the purpose. They collect the stuff, send it off to a facility that will either destroy it or reclaim it, and charge their patrons for that service.

Gauging

Now you can attach your equipment. With the engine off and cool, a pressure reading somewhere around the ambient temperature indicates a pretty good charge with either R-12 or R-134a. But that's about the only rule of thumb that's valid anymore. Today, proper high side/low side and engage/disengage pressures vary all over the map. You've got to look up specs and procedures on WIS (www.startekinfo.com), and interpret readings in context.

If both gauges read within the specified range, the no cool condition may be due to moisture contamination. Very low pressure or a vacuum on the suction side points to a lack of refrigerant. There are numerous possible causes of excessive head pressure ranging from a lazy fan or blocked condenser fins to a flooded expansion valve, too much refrigerant, air in the system, restriction, or engine overheating.

A drastic reduction in cooling when the car slows down from cruising speed could be due to a compressor that's going bad. Another damning symptom for the pump is a combination of high suction and low discharge pressures.

Years ago, you could do a nice, straightforward diagnosis of the compressor by clamping off the suction side and watching for a vacuum of at least 18 in. Hg. within two minutes, but those days are pretty much gone because you'd crush the impermeable liner of modern barrier hose. You can still test the output side by putting a piece of cardboard over the condenser. Growing fluctuation as the pressure rises means the discharge valve is leaky. A big swing on a regular basis indicates a bad cylinder.

It leaks!

There's never justification for recharging until you've found and repaired any leaks that

may be present. Do a visual inspection first expect an accumulation of oil and dirt at a seepage point.

Many technicians have a love/hate relationship with electronic leak detectors because they require a lot of patience and can trick you. That's one reason the nearly-foolproof ultraviolet light and dye method has become so popular. Pass that UV lamp over all the components, hoses, and connections and leaks will show up in bright yellow.

Another good way to find out if a leak exists is to draw a deep vacuum and see if it holds (where it's located is another matter). The reading shouldn't drop more than two inches in five minutes. Or, you can use one of those new electronic vacuum gauges for much faster findings.

Water retention

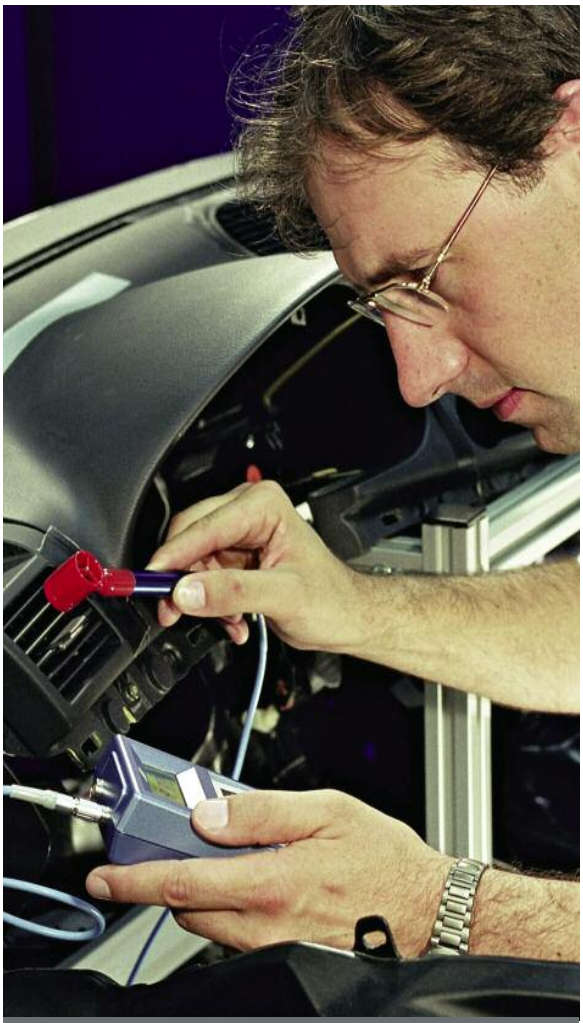
Should you always replace the receiver/drier or accumulator when doing a full A/C service? The answer is yes, and for many good reasons. In the first place, water is the archenemy of the system. Not only does it interfere with refrigeration, it also promotes the formation of hydrochloric and hydrofluoric acids, which can eat through the evaporator. Then there's the desiccant. If it starts to break down and gets through its bag, it'll clog everything in sight. Just drawing down the system won't boil much moisture out of the desiccant, and certainly won't eliminate those particles.

Retrofit?

Since many Mercedes-Benz owners keep their cars much longer than is customary with other makes, chances are you've still got some customers driving cars whose A/C systems are charged with R-12. MB and other authorities say you should keep systems designed for R-12 running on R-12 as long as that's economically feasible. Making whatever repair is necessary, then recharging with R-12 will assure like-new performance and keep labor costs down. As of this writing, that is. The next time the A/C blows its charge R-12 may be fabulously expensive or perhaps not available at all at any cost.

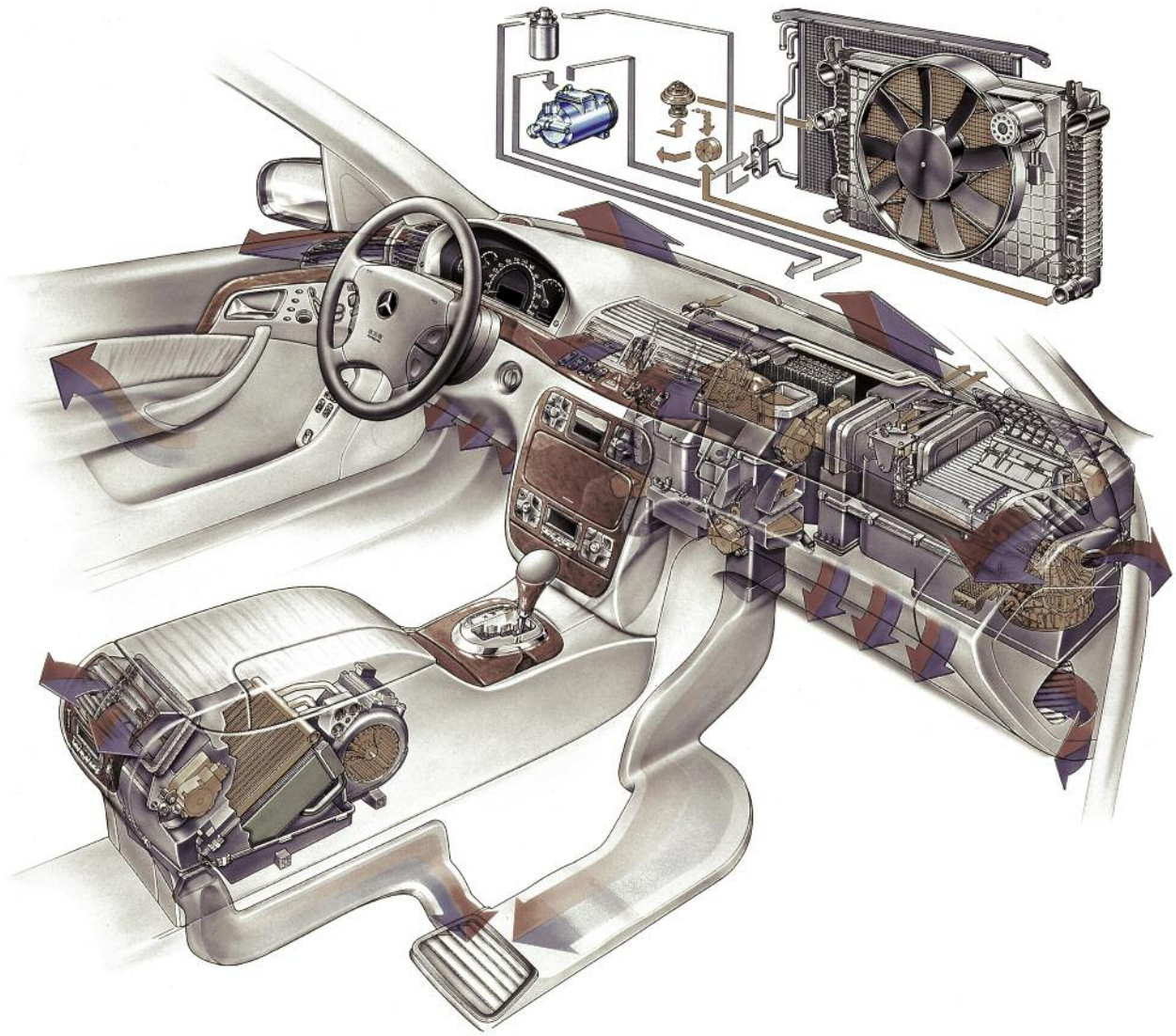
Going to R-134a, on the other hand, is done all the time and the results are usually fine provided you do it right. After retrofit, future repairs will be relatively inexpensive because R-134a will be the standard for as long as we care to speculate (CO_2 refrigerant will be a while in coming), assuring a plentiful supply, and you can be certain everybody else in the service business will have the equipment and knowledge to handle it.

One caveat: You should realize that while R-134a gives satisfactory performance in most cases, there's a good chance you'll notice that the system won't cool down as fast or feel as ice-cold as it did on R-12.



This MB engineer is checking duct temperature in the HVAC development lab in much the same way as you do out there in the real world.

The Compressor's Hard Life



While the pump may not be very sophisticated compared to many other components of a modern Mercedes-Benz ATC A/C system, it sure works the hardest.

When it comes right down to it, there aren't all that many things that can go wrong with air conditioning system when compared to, say, electronic engine management. There are leaks, of course, but other than that and occasional failure of the expansion device, the only other weak link is the compressor itself, with good reason. It's in operation most of the year – in defrost in winter if it's not locked out by a low ambient switch, and in the heat of summer, trying to overcome the increased heat load on newer models that have what the design guys call more "greenhouse" (lots of glass – comedian Steve Martin even has a routine about a home solar heating system that uses car seats as collectors).

So, what causes a compressor to come apart? Lots of things, from insufficient lubrication to shock loading, to a piece of debris in the system. Here we'll discuss some of the conditions that can turn an expensive compressor into scrap metal.

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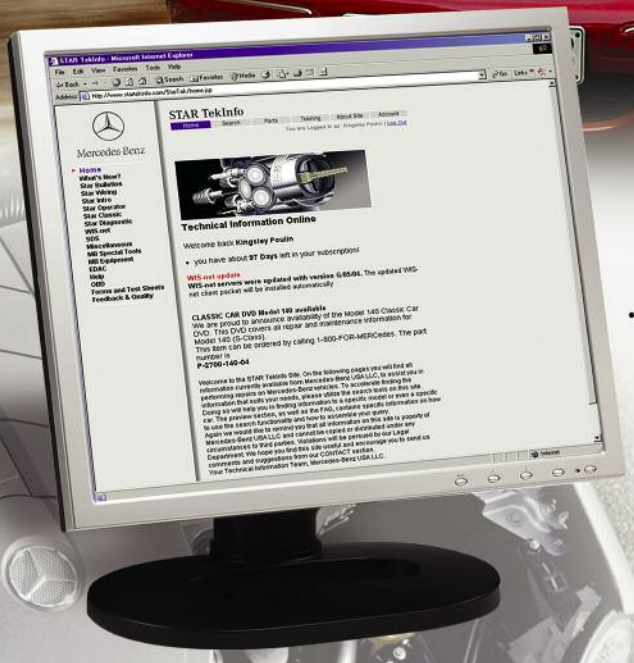

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Where:
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Serious acceleration

If you look at relative pulley sizes, you'll see that nearly all compressors are slightly overdriven. Starting a compressor up against any head pressure with engine speeds at, say, 1,800 rpm (multiplied by the overdrive ratio) is a surefire recipe for making our little refrigerant squeezer into a core for the rebuilder.

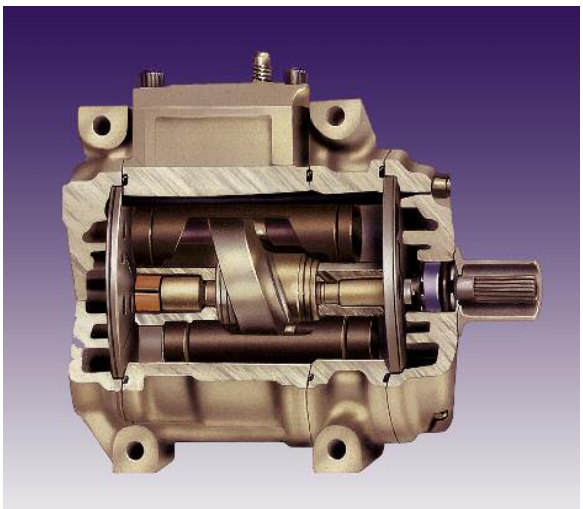
Now, let's mount the compressor down low, where oil might run back into the suction side, and we can add liquid slugging to the list of suspects. Liquids are, for all intents and purposes, non-compressible (well, okay, to be precise they'll compress about one-half of 1% of their volume). Trying to squeeze liquid with a piece of gear designed to squeeze vapor is guaranteed to break the compressor, often tossing internal pieces right through the side. Over charging is another possibility. To add to the challenge, let's cut back on the weight and strength of a typical modern compressor, and it's pretty easy to see why compressor life might be a bit of a concern.

Shrapnel

While we're on a roll, we can talk about short-lived replacements due to poor cleanup from the last failure. System flushing has become more expensive and difficult than ever before; you can't just sweep it with R-11 as you used to, can you? MB, as most car makers, tells us not to do solvent flushing because they're afraid you'll leave something in the system that will ruin the lubricating properties of the refrigerant oil – they've found everything from brake cleaners and gasoline to turpentine and lacquer thinner. Personally, we believe flushing is not the way to go, and that it's difficult to get good results given the convolutions and tiny passages inside many late-model condensers. If the compressor has disintegrated, better think about springing for some new parts such as a condenser and any hoses that contain a muffler. It's imperative to replace that receiver-drier or accumulator, too.

Slippery stuff

Then there are lubrication issues. First, naturally, is the possibility of oil starvation. We've seen compressors lock up because they were dry as a bone. This typically occurs from a refrigerant leak, which takes the oil with it and causes the car's owner to top up the system over and over (people seem blind to that ugly accumulation of gunk and dust that will be found at the site of the seepage).



Too little oil will cause a compressor to burn up, but too much can break it.

How about choosing the right kind of oil? As we hope all of you know by now, R-134a simply can't transport droplets of mineral oil, so a synthetic lubricant is an absolute must. While POE (polyol ester, commonly called "ester") has been the most popular lube in the aftermarket, the carmakers and compressor manufacturers/remanufacturers are adamant and unanimous in recommending PAG (polyalkyline glycol). As one reman exec puts it, "PAG oils should be your choice. They provide superior lubrication properties. With R-134a and PAG, we have fewer compressor returns than with R-12 and mineral oil." An O.E. guy simply says, "We don't warrant compressors not using the approved lubricant or refrigerant." Just make sure you get the right viscosity.

By the way, compressor suppliers have told us that in cases where they ship units dry, they often get them back as returns STILL dry. Take the time to read and follow the oiling recommendations that come with the pump.

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Mercedes-Benz

All the fantastic engineering efforts intended to keep you cool can be defeated by a tiny piece of shrapnel, too little (or the wrong) oil, or several other low-tech problems that can disable the compressor.

Sooner, or later

Given enough time and neglect, any compressor will fail, but just a little maintenance can extend a pump's life. Cleaning the condenser fins regularly and testing cooling fan operation periodically (particularly on variable or multi-speed fan systems) can make a big difference by keeping head pressures down.

Careful charging is also important. You need to make absolutely sure that you introduce no air into the system. Air tends to migrate to the condenser, effectively reducing its size. Air will cut system capacity and raise high-side pressures, further stressing the compressor. The incidence of air getting into A/C systems during service has escalated with recycling. In some cases, there are specific procedures used to purge recovered air from the equipment that aren't being followed in the crush of daily business. Now is a good time to re-read your equipment's operating manual. Make sure the proper purge process is followed or you might be creating a problem during routine service.

No shop doing A/C work can be without a refrigerant identifier these days. There are people out there using blends, illegal refrigerants, and even propane. It's pretty obvious what the misuse or misapplication of refrigerants might do to a system or the compressor, not to mention your recovery equipment. Recovery without identification is like playing Russian roulette.

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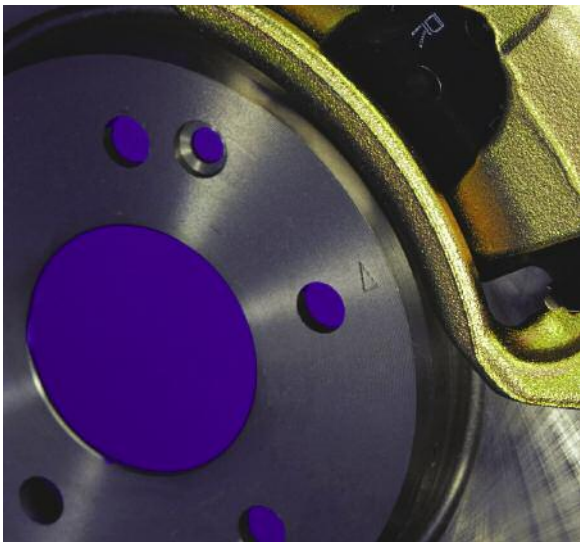
STARTUNED

PARTS NEWS

ROTOR PUZZLE AND SOLUTION

A come-back! The very thing you do everything in your considerable power to avoid. Yet, it's happened, and in the area of brakes, no less. A recurrence of a pedal-pulsation problem is embarrassing and damaging to your reputation, especially since the ticket for the work you did on the original visit was pretty substantial. That previously loyal customer isn't all that happy with you.



You remember doing the job. The well-kept Mercedes-Benz had covered a substantial number of miles in its few short years of life, and had developed the bumpy brake feel that's indicative of disc thickness variation (also called non-parallelism). The underlying cause of this condition is rotor runout and warpage, which causes certain spots on the disc to contact the friction material every revolution, so they wear more than the other areas.

You're well aware of this cause-and-effect situation, so you studiously avoid doing anything that could possibly contribute to rotor runout on every single brake job. You mark the location of discs that are going to be reinstalled, and carefully clean all the rust off the hub mounting surface. You also use a torque wrench and the proper star pattern to tighten the lugs, never your impact gun. Finally, you always take the time to give the new brakes an initial break-in with at least half a dozen gentle stops.

So, what went wrong in this unfortunate case? As you recall, the original rotors were worn pretty thin. In fact, you could see they'd need to be replaced as soon as you pulled the wheels, which you confirmed with your mic. You've recognized that the installation of new rotors during reline is becoming a trend – some of your colleagues say that their brake lathes are gathering dust.

You called your regular parts jobber, and he sent over brand-name aftermarket rotors at a good price. They looked fine, and after you'd applied your craftsman-like procedure to the brake job, you were confident in the results. In fact, the car was stopping smoothly when you sent it out the door. Back again in a matter of months, though.

You're mystified. That is, until you mention the situation to a friend, another shop owner who specializes in upscale European makes. He was thrilled to be able to enlighten you. It seems that he'd been having the same kind of problems, so he did a little research. He got brand-new Genuine Mercedes-Benz O.E. rotors and aftermarket "equivalents," and weighed them. Lo and behold, the aftermarket parts generally weighed a pound or two less than the real thing. Without that extra meat, they're more prone to warpage.

So, you saved the customer a few dollars, but you ended up with a come-back, stress and some loss of sleep. Wasn't worth it, was it?

STARTUNED

FACTORY SERVICE BULLETINS

These suggestions and solutions for technical problems come from service bulletins and other technical information published by Mercedes-Benz, selected and rewritten for independent repair shops.

Electronic Ignition Switch DTC B1000 Model 203

Due to an error in the DTC software, it is possible that the Diagnostic Trouble Code (DTC) B1000 may be saved in the Electronic Ignition Switch (EIS, N73). If this fault is present, but not current, the DTC may be ignored and the DTC memory erased. Do not replace the EIS for this condition.

Hard Starting, Won't Run, or Poor Performance (possible DTC and inaccurate fuel level reading) All 2001 C-Class

There's a good chance that what's happening here is the fuel pump check valve binding in the open position resulting in a reduction of fuel flow to the engine and to the fuel transfer pump in the fuel tank (i.e. no fuel transfer from one side of the fuel tank to the other). Possible DTCs are P201B – 016 to 128, and P201C – 016 to 128. Replace the fuel pump, Part Number 203 470 1394, production date 00T277 (277th day of 2000) or later.

Harmonic Balancer Trouble 1998 through 2000 Models 163, 202, 208 & 210 with 112 engine, Models 129, 163, 202, 208, 210, 215 & 220 with 113 engine, & 2001 Model 170 with 112 engine

MBUSA has determined that the harmonic balancer pulley in the above vehicles may, depending upon use and under-hood temperatures, deteriorate to the point of affecting performance and drivability, preceded by driver warnings such as noticeable engine vibration. Approximately 368,836 vehicles are affected.

First, check the part number of the balancer. ONLY these two part numbers require replacement:

- A112 035 00 00
- A112 035 06 00

Refer to the proper WIS procedures, such as AR61.20-P-1105GH, AR20.40-P-5660C, AR13.22-P-1202B, WF58.50-P-0330-02A, GF03.30-P-1600-01C, AR20.40-P-5000GH, etc.

NOTE: Torque the harmonic balancer pulley bolt in two stages: First, to 200 Nm, then turn bolt an additional 95 degrees of rotation.

MILs Illuminated Only Briefly After Ignition Switched On Models 202 and 210

If certain Malfunction Indicator Lamps (MILs) and other warning lamps in the instrument cluster (A1) light only briefly after switching the ignition ON (bulb check), this is an indication that the connection between the instrument cluster and the generator (G2, a.k.a. alternator) circuit 61 (D+) is open. The generator warning lamp does not come on for this condition. In these cases, check the wiring between the generator and the instrument cluster for an open circuit, as well as the generator itself. Correction for this condition DOES NOT require instrument cluster replacement.

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Mike Schmitz Automotive
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Crown Automobile
205-985-4200

Huntsville
Mercedes-Benz of Huntsville
256-837-5752

Mobile
McConnell Automotive
251-476-4141

Montgomery
Jack Ingram Motors
334-277-5700

Tuscaloosa
Leigh Automotive
205-556-1111

Alaska

Anchorage
Mercedes-Benz of Anchorage
907-277-3383

Fairbanks
Cook's Import
907-459-7070

Arizona

Chandler
Mercedes-Benz of Chandler
480-403-3444

Phoenix
Phoenix Motor
602-264-4791

Phoenix
Schumacher European
480-991-1155

Tucson
Mercedes-Benz of Tucson
888-505-0244

Arkansas

Fayetteville
Jones Motorcars
479-521-7281

Little Rock
Riverside Motors
501-666-9457

California

Anaheim
Caliber Motors
714-777-1900

Arcadia
Rusnak/Arcadia
626-447-1117

Bakersfield
Mercedes-Benz of Bakersfield
661-836-3737

Belmont
Autobahn Motors
650-637-2333

Beverly Hills
Mercedes-Benz of Beverly Hills
310-659-2980

Buena Park
House of Imports
714-562-1100

Calabasas
Calabasas Motorcars
818-591-2377

Carlsbad
Hoehn Motors
760-438-4454

Chico
Courtesy Motors Auto Center
530-893-1300

Claremont
Penske Motorcars
909-568-2600

El Dorado Hills
Mercedes-Benz of Eldorado Hills
916-567-5100

Encino
Auto Stiegler
818-788-0234

Escondido
Mercedes-Benz of Escondido
760-745-5000

Fremont
Claridge's
510-623-1111

Fresno
Mercedes-Benz of Fresno
559-438-0300

Glendale
Calstar Motors
818-246-1800

Laguna Niguel
Mercedes-Benz of Laguna Niguel
949-347-3700

La Jolla
Heinz Gietz Autohaus
858-454-7137

Long Beach
Mercedes-Benz of Long Beach
562-988-8300

Los Angeles
Downtown L.A. Motors
213-748-8951

Modesto
Modesto European
209-522-8100

Monterey
Mercedes-Benz of Monterey
831-375-2456

Newport Beach
Fletcher Jones Motor Cars
949-718-3000

Oakland
Mercedes-Benz of Oakland
510-832-6030

Palm Springs
Mercedes-Benz of Palm Springs
760-328-6525

Palo Alto
Park Avenue Motors
650-494-0311

Pasadena
Rusnak Pasadena
626-792-0226

Pleasanton
Mercedes-Benz of Pleasanton
925-463-2525

Riverside
Walter's Auto Sales & Service, Inc.
951-688-3332

Rocklin
Von Housen Motors
916-924-8000

Sacramento
Mercedes-Benz of Sacramento
916-924-8000

San Diego
Mercedes-Benz of San Diego
858-279-7202

San Francisco
Mercedes-Benz of San Francisco
415-673-2000

San Jose
Beshoff
408-239-2300

San Jose
Smythe European
408-983-5200

San Luis Obispo
Kimball Motor
805-543-5752

San Rafael
R.A.B. Motors
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