STARTUNED®

Information for the Independent Mercedes-Benz Service Professional

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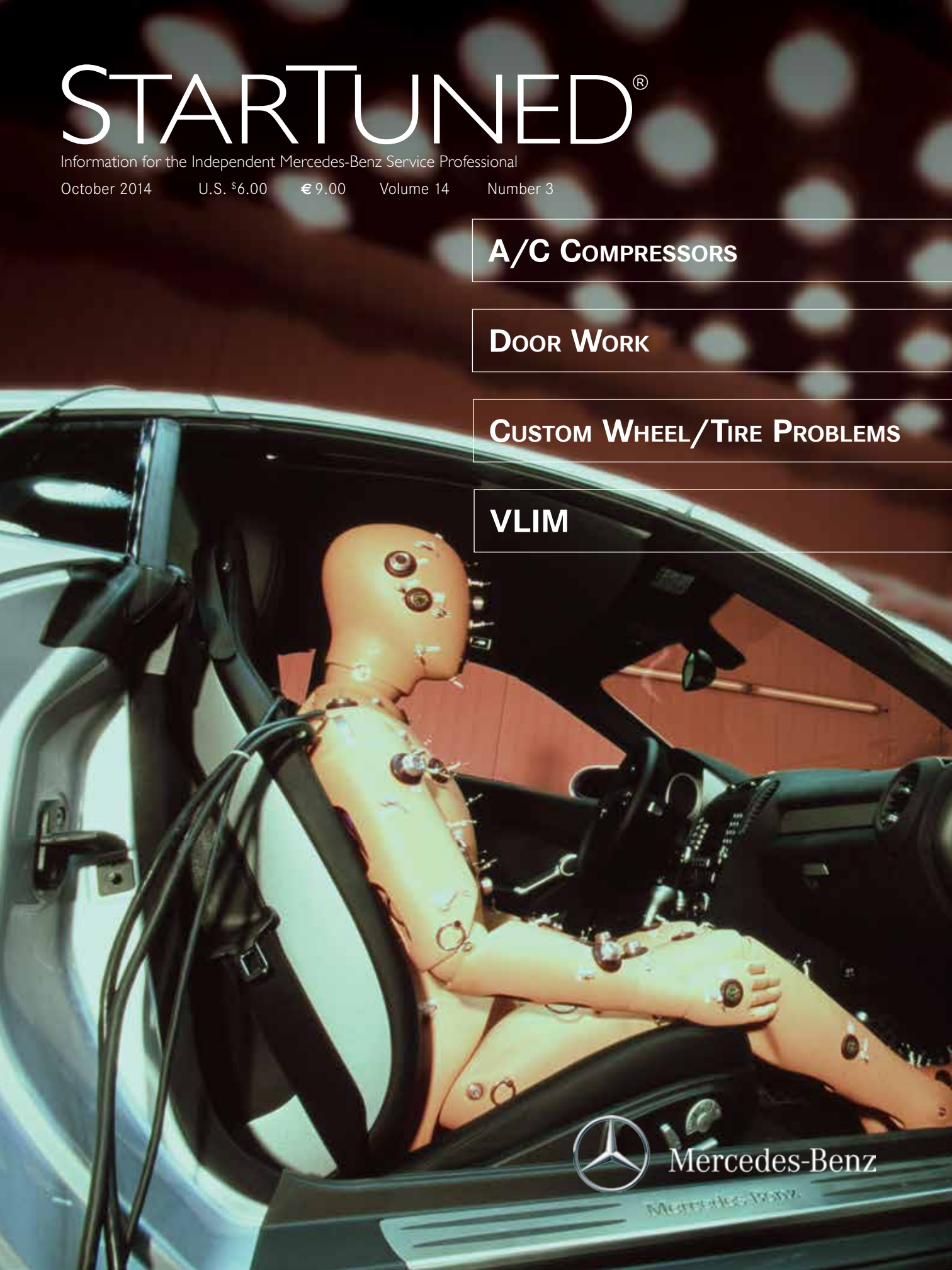
A/C Compressors

Door Work

Custom Wheel/Tire Problems

VLIM



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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.

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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.

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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 to assist you in repairing your customers' Mercedes-Benz vehicles and get 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.

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TO OUR READERS:

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

Mercedes-Benz wants to present the information you need to know to diagnose and repair Mercedes-Benz vehicles accurately, quickly and the first time; text, graphics, on-line and other technical sources combine to make this possible.

Feature articles, derived from approved company sources, focus on being useful and interesting.

Our digest of technical information can help you solve unanticipated problems quickly and expertly.

We want ***STARTUNED*** to be both helpful and informative, so please let us know just what kinds of features and other diagnostic services you'd like to see in it. We'll continue to bring you selected service bulletins from Mercedes-Benz and articles covering the different systems on these vehicles.

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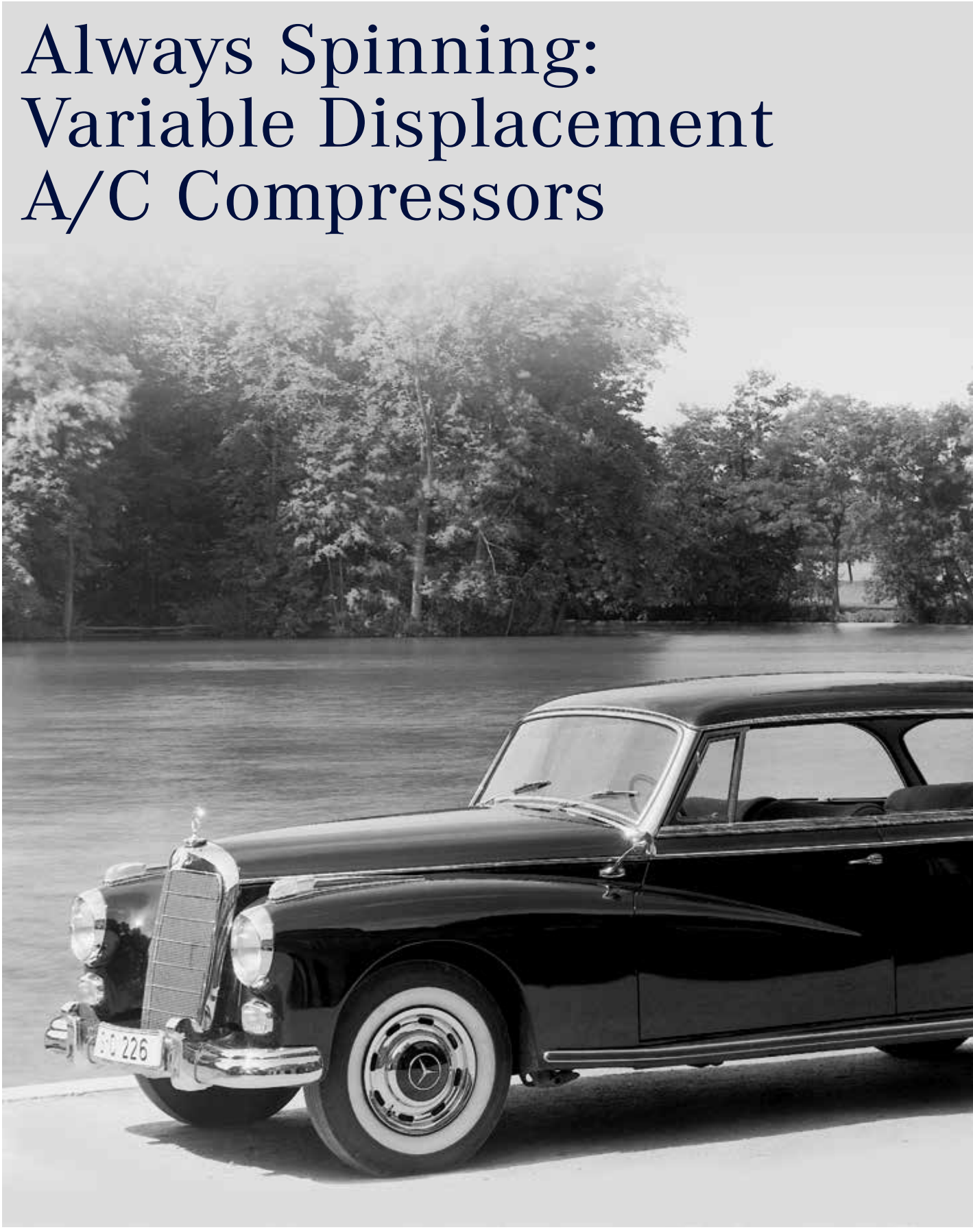
In This Issue

Always Spinning: Variable Displacement A/C Compressors



In 1958, Mercedes-Benz introduced its first fully air conditioned passenger car.

Unlike the traditional cycling-clutch design, a variable displacement compressor spins whenever the vehicle's engine is running. Diagnosing A/C performance complaints in a variable displacement system is similar to the diagnostic process for a traditional compressor. Only after ruling out non-compressor problems can you begin testing the variable displacement compressor itself. Does the swash plate respond differently to different loads? If not, is it a problem with the compressor, sensor inputs, or with the controller?

A traditional compressor pumps the same volume of refrigerant with every stroke of its pistons. If the number of strokes per second is low due to the engine idling, or high due to fast engine rpm, the amount of refrigerant pumped may be too little or too much for the current heat load. With clutch-type compressors, the only way to maintain refrigerant flow within the desired range is to cycle the compressor on and off as needed.

A clutch cycling switch, controlled by sensors measuring A/C system low side pressure and evaporator temperature, turns the compressor on when cooling is needed, and off as soon as the desired temperature is reached.

Cycling the compressor off when the desired temperature is reached conserves fuel. However, turning it back on when needed puts a big load on small engines, and creates a noticeable engine "burp" even on larger engines while at idle or cruising at low speeds.

Changing displacement on the fly

Variable displacement compressors (VDCs) are the solution. Unless there is a serious mechanical problem, the compressor is always spinning, so there is no instant-on high-rpm clutch kick-in to sap engine power, or the potentially-damaging demand that the unit accelerate from zero to several thousand rpm instantly.

VDC designs avoid these drawbacks -- most don't even have a clutch.

Note: Some of the latest Mercedes-Benz models, such as the CLA and 204 with the Eco Start/Stop option, have VDCs with a clutch added, the intention being to eliminate all drag. It's not likely that these will find their way into your shop for years, however, so we will concentrate on pre-clutch VDCs here.

A variable angle swash plate allows the VDC to change refrigerant displacement on the fly. The swash plate sits at an angle around the compressor shaft. It functions much like the lobes on a camshaft. As the swash plate rotates, it pushes each piston up as the high end of the plate approaches the connecting rod, and allows high-side pressure to push them back down as the low end nears.A pulse width modulated (PWM) solenoid valve controls the angle of the swash plate. At the lowest inclination (almost perpendicular to the compressor shaft), swash plate rotation creates only a tiny piston stroke, moves very little refrigerant, and consumes almost no energy. At the maximum angle, the plate moves as much or more refrigerant than a traditional cycling clutch compressor.

Precision control

The control valve can vary the swash plate inclination to any degree between minimum and maximum. Through more precise metering of refrigerant than is possible with the on-off cycling of traditional compressors, Mercedes-Benz is squeezing every little bit of energy out of a gallon of fuel.

The PWM signal is generated by a SignalActivation Module (SAM). The SAM receives its marching orders from the Automatic Air Conditioning (AAC) control unit (Model 164 does not use the SAM; control is handled directly by the AAC). The ACC is the clearing-house of climate-related passenger comfort functions, including interior temperature

A great deal of careful engineering goes into developing the sophisticated, comfortable A/C systems of Mercedes-Benz vehicles. The introduction of the VDC represented a big advance in smoothness and efficiency.

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- Wiring Diagrams
- Technical Bulletins
- Mercedes-Benz Special Tools
- Maintenance Sheets
- Star Diagnosis System (SDS)
- Mercedes-Benz Workshop Equipment

Mercedes-Benz

selection, compressor solenoid valve control, and other a/c component actuation.

The AAC collects driver and passenger inputs through the unit's dash controls. It combines them with inputs from the SAM and various sensors, including ambient, interior, evaporator, and coolant temperatures, plus sensors for refrigerant pressure, solar heat gain, and vehicle speed.

VDC diagnosis the easy way

You don't need to analyze these variables because Mercedes-Benz engineers have programmed it all into the system. Computer algorithms interpret the inputs and make adjustments to the evaporator pressure target in real time.

So, all you need to know to determine whether a variable displacement compressor is the cause of a cooling performance complaint is, one, find out whether or not the compressor is capable of spinning; two, if it is receiving commands from the controller; and, three, if it is responding to the controller by adjusting the angle of the swash plate.

Push the right buttons

Does the driver know how to operate the dash controls? The air conditioning only cools when the "A/C" button is lit or the "A/C Off" button is off. Sometimes it's that simple.

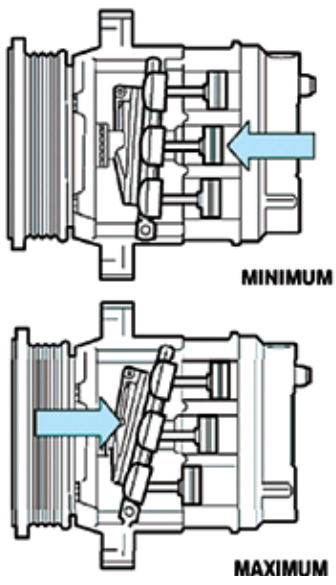
It only takes a second to find out if you're dealing with a VDC -- no clutch!

To the driver's credit, sometimes the system logic may take control away. For example, when sunlight hits the vehicle at an angle, sun sensors in the affected zone may cause extreme differences in outlet air temperatures and blower outputs from side to side, regardless of prior dash temperature settings.

Basics First

Before you begin testing the compressor, you must check basic mechanical functions:

- Make sure the A/C fuse is okay and that the blower motor is working (not seized or jammed).
- Check for proper A/C blend door operation. Switch the A/C temperature quickly from cold to hot and divert it to various passenger compartment outlets. Check to see if temperature changes and sufficient air comes out of each of the dash and other outlets as commanded.
- Is the condenser fan working? If the condenser is unable to dissipate enough heat from the refrigerant, it puts an excessive load on the compressor.
- Are there restrictions anywhere in the system? A plugged expansion valve, obstructed tubing, or possibly the presence



The swash plate in a variable displacement compressor is "hinged" so it can tilt at different angles. The higher tilt creates greater piston movement and higher pumping volume, or displacement, of refrigerant. When the swash plate angle is almost perpendicular to the compressor shaft, it generates almost no refrigerant displacement and consumes negligible energy.

of an A/C sealant additive will reduce refrigerant flow and increase the risk of the compressor seizing due to overheating.

Because it is always spinning whenever the engine is running, a variable displacement compressor needs to be constantly bathed in lubricant. The low lubricant quantity in today's smaller systems puts a VDC at risk if even only a little lubricant is trapped in a restricted A/C component or hose.

Does the compressor spin?

With a variable displacement unit, there is no on-off cycling click sound, because if everything is working properly, the compressor is always spinning. Instead of ear-checking the compressor, you'll have to check pressures. Refer to the Mercedes-Benz specifications in the Workshop Information System (WIS) to see what the pressures should be at current ambient temperatures.

Note: You can always refer to WIS for a more structured diagnosis approach.

Just has been the case for decades, if you have a full refrigerant charge when you first attach gauges without the engine or A/C system running, the psi reading will likely be close to the ambient temperature in Fahrenheit. When in doubt, start with a recover/recharge to make sure that the system contains the correct amount of refrigerant.

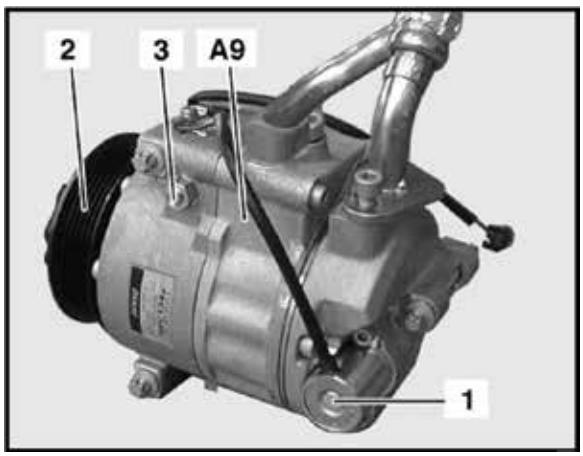
Turn the A/C on and look at your gauges. If you have any pressure differential at all, the compressor is spinning. If you see no or extremely low pressure, loosen and re-torque the compressor bolts, following the torque sequence in the Mercedes-Benz specifications. If the compressor bolts were torqued in an incorrect sequence during a previous field installation, it can cause binding in the internal mechanism. The compressor could hang up intermittently or be unable to adjust its swash plate.

Can we talk?

Another thing to check is whether or not a signal is reaching the compressor control valve from the SAM. Refer to your Mercedes-Benz documentation for how to find out if you have a connector problem between the computer and the control valve. Some control valves rely on grounding through the compressor. The presence of corrosion may insulate this ground causing control problems. Sometimes just loosening and retightening mounting bolts and the ground lug will resolve this.

Does the Swash Plate adjust?

Set the blower to low and rev the engine to high rpm. Note the system pressure. Then change to high blower and regular rpm. You



The control valve, labeled "1," is what actually varies the angle of the swash plate according to the signal from the SAM (Signal Acquisition Module).

The driver's-side SAM generates a pulse width modulated (PWM) signal to tell the compressor control valve what refrigerant displacement level is needed for conditions.

have thus changed the load on the compressor, and you should see substantial changes in pressures. These changes confirm that the swash plate is moving, and the variable displacement function is operating.

If the swash plate isn't adjusting, you have a problem with either the control valve or the internals of the compressor.

Who's in control?

If the compressor is spinning, and the swash plate is adjusting displacement so you see different pressures at different load levels, but the system is still not cooling properly, check the control valve. Cross reference the pressure results you've seen with Mercedes-Benz performance specs at various loads.

If the control valve is not operable, replace the compressor. Currently, the control valve itself is not a serviceable item.

Shear madness

When a VDC compressor seizes up, a shear pin on the pulley breaks off, allowing it to free spin, no longer locked to the compressor shaft. So, the seized compressor won't destroy the accessory belt, and the shear pin breaking off will prevent shutting the engine down and creating a "walk-home" situation for the vehicle owner.

If pin has sheared, you must replace the compressor -- but only after determining what caused it to seize up. Finding the root cause is important for preventing a a quick and unfortunate compressor job comeback.

Compressor seizing is generally due to a lack of lubrication, which commonly means a lack of refrigerant charge. Look for a leak other than at the compressor, or an obstruction somewhere in the system preventing the free flow of lubricant.

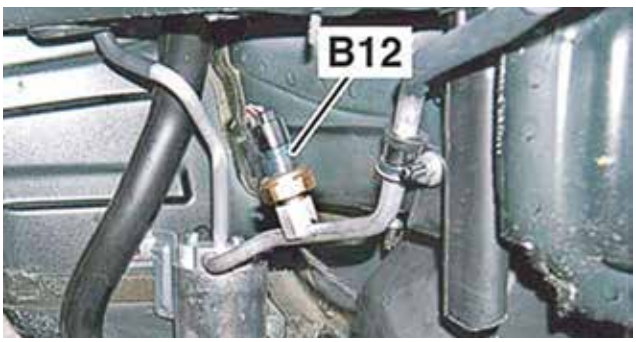
Variable displacement hides the charge level

In an undercharged VDC, the control valve reduces displacement, keeping refrigerant on the low side longer to help maintain the pressure at the desired level. In an overcharged system, the control valve will decrease displacement to try to bring the pressure within specifications.

There are, of course, more diagnostic checks you can perform on temperature and other sensor inputs. The checks we've discussed will let you know if the variable displacement compressor is operating properly.

Even though a variable displacement compressor is different from a traditional unit, air conditioning complaint diagnosis follows a similar path. If there is a problem and you believe it is in the compressor, replace it. If you think it is the control valve, that is an integral part of the compressor, so, again, replace the compressor.

The ACC (NC22/1) combines input from the dash controls with feedback from a variety of onboard sensors, and applies algorithms to make A/C function decisions that help Mercedes-Benz vehicles maintain their fuel-sipping attributes.



Various refrigerant pressure sensors provide input that's used to make the displacement decision.

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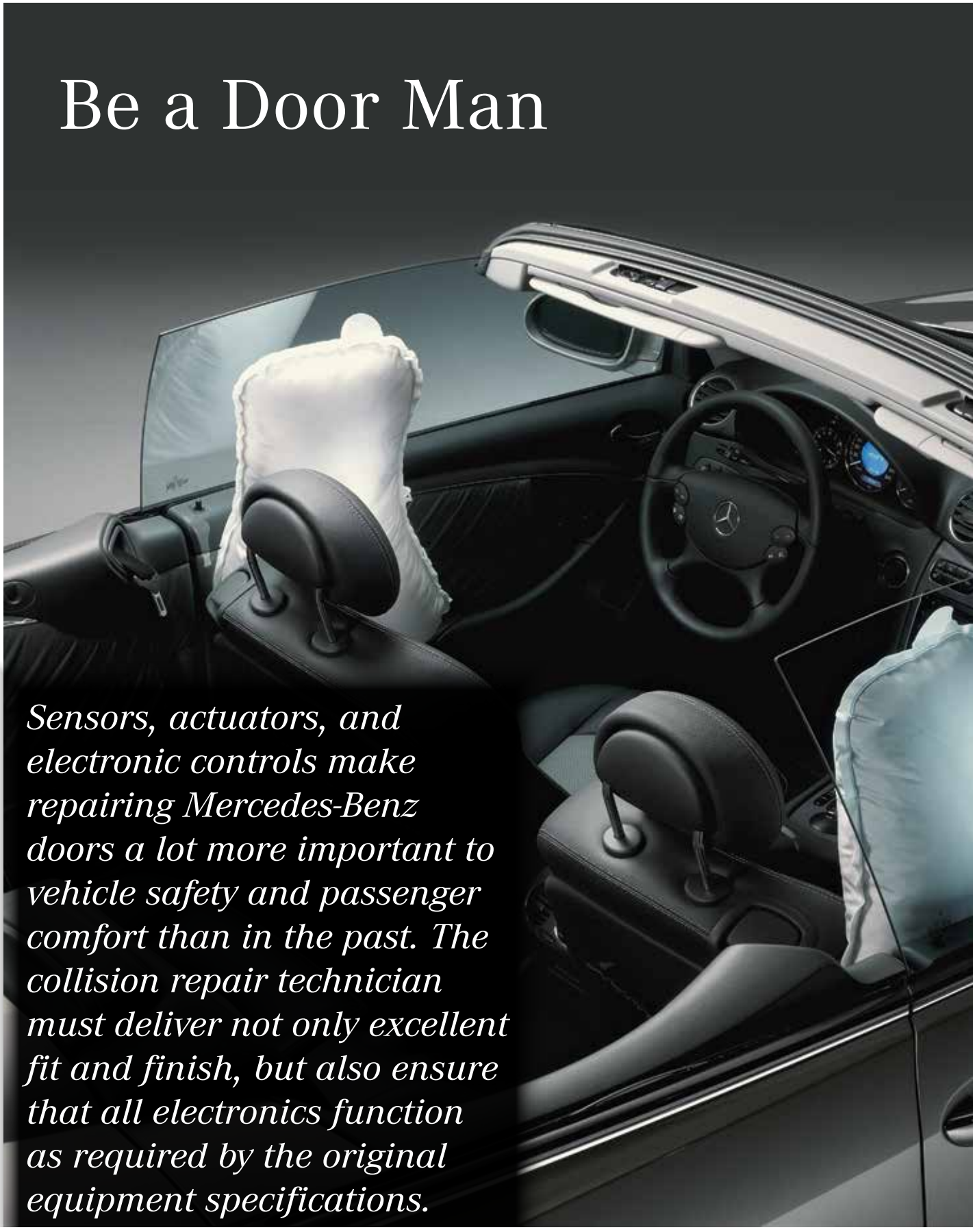

Sensors, actuators, and electronic controls make repairing Mercedes-Benz doors a lot more important to vehicle safety and passenger comfort than in the past. The collision repair technician must deliver not only excellent fit and finish, but also ensure that all electronics function as required by the original equipment specifications.

Mercedes-Benz has always been on the cutting edge of safety technology. These head and thorax air bags were introduced way back in 2001.

There is more to repairing today's doors than just fit and finish, and that Mercedes-Benz sound is still a winner.

There are many sophisticated electronics inside the driver's and other doors in newer Mercedes-Benz vehicles. The most critical may be the side airbag and its sensors and activation controls, all of which are built into the doors on some vehicles.

In addition to these Supplemental Restraint System (SRS) components, there are motors and electronic controls for the windows, door locks and exterior mirrors. There may also be controls for seat comfort settings, air circulation blend doors, the sunroof and other vehicle features. And of course, there are in-door speakers.

Your door repair must take all of these things into account. At minimum, you must test every feature to make sure it works before you invite the customer back to pick up his or her vehicle.

Feel the Pressure

One big fact you should be aware of is that on all Mercedes-Benz vehicles with side air bags, the SRS is activated when a side impact collision causes an increase in air pressure inside the door cavity. An air pressure sensor mounted in the door cavity registers the pressure increase and sends a signal to the SRS control unit to ignite the airbag.

Other sensors also send signals to various control modules to initiate additional safety measures. Depending on the severity of impact and the locations of vehicle occupants, the SRS activates the seat belt Emergency Tensioning Retractor (ETR) to tighten the belt of every occupied seat. Other safety modules unlock doors, shut off the engine and open side windows slightly to allow smoke and gases from the airbag ETRs to quickly disperse from the vehicle.

In appropriately equipped models, safety systems also automatically move the steering

column up to help make it easier for the driver to exit the vehicle, make a call for emergency assistance, turn off the air conditioner and close the fresh air/recirculation door to reduce the entry of hazardous gases to the vehicle interior.

Safety from Simplicity

Older vehicles may have located a side impact sensor in the floor between the frame rails and the seat. Switching to an air pressure sensor and locating it in a sealed door cavity was a Mercedes-Benz engineering "Aha!" moment.

Moving closer to the point of impact helps initiate the airbag response to a side impact a few milliseconds earlier. Shaving a few milliseconds off airbag response time offers potential for significant improvement in passenger protection outcomes, depending on the side impact severity.

Mercedes-Benz engineers accomplished this by sealing every opening in the door with rubber grommets around all bolt holes, gasket receptacles for every clip, and rubber plugs or even tape over any other hole that cannot be permanently sealed.

When your repair is complete, the door cavity must function once again as a sealed unit in order for the replacement side airbags to work. Order a few extra clips and clip gaskets to replace any that break or get lost as you do the repair. Make sure no bolt is installed without a grommet.

For a variety of reasons, some openings were originally covered at the factory with sealing tape instead of a grommet and bolt or clip. So yes, that little piece of tape that fell off while you were disassembling the door had an important safety-related purpose and must be replaced.

In some older Mercedes-Benz models, instead of sealing individual openings with plugs and grommets, plastic sheeting sealed the entire door cavity. The new system of plugs, grommets, clip gaskets and tape make it easier to restore the integrity of the door cavity seal after a side impact accident.

Electrostatic Discharge Caution

Electrostatic discharge (ESD) is harmful to many electronic components, including sensors, airbag components, and the Controller

To ensure that the air pressure sensor mounted in the door cavity can register an increase in pressure that occurs in the event of a side impact collision, every opening must be sealed. Sealing tape was applied at the factory to this small hole in this M-Class SUV rear door, and must be replaced if removed during a door repair.

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Area Network (CAN) bus connections used extensively in automobiles to carry data between sensors, control modules, actuators and devices. Even ESD that is too small to be noticed can cause significant damage to electronic components and control modules.

Every contact with or movement of solids, liquids or even some gases can generate an electrostatic charge. Something as simple as walking on carpet or plastic flooring, or putting on a piece of clothing made with synthetic materials can create a buildup of electrostatic charge.

A few precautions can help minimize potential ESD problems:

1. Use antistatic seat protectors when working inside a vehicle.
2. Leave replacement electronics in their original packaging until ready to use. Cut rather than tearing the package open, as tearing creates more movement that can generate ESD.
3. Avoid contact with materials that can hold a high electrostatic charge, such as polyethylene (PE), polyvinyl chloride (PVC), and Styrofoam. Do not place electronic components removed from a vehicle on PE, PVC, or styrofoam.
4. Touch electronic components on their housing or wiring harness only. Do not touch pins or contacts.
5. Install electronic components before connecting them, so that equalization with the body can occur.

OE Information Makes It Easy

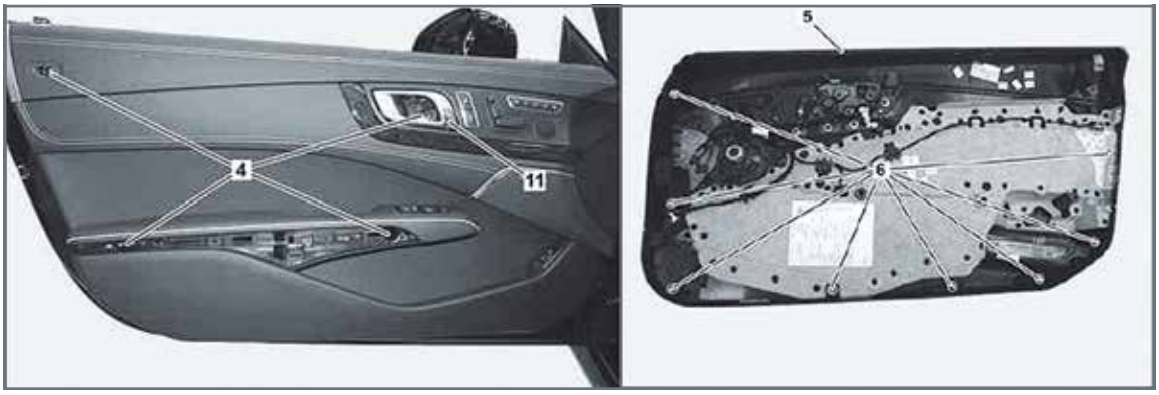
Accessing any of the many components in the door is not difficult. The trick is to know whether the piece you need to remove to get to the desired component is attached using a bolt, clip, or other type of attachment device.

That is where the Mercedes-Benz Workshop Information System (WIS) comes to your rescue. WIS provides the number and location of each bolt, clip, or other attachment device, and the exact sequence of steps so that you don't miss a screw or clip and break a trim panel or mounting bracket.

A combination of bolts and clips typically hold the armrest and control panel to the door.

Two bolts are under a trim piece that is best removed starting at the rear (near the door end that opens), using a plastic wedge that won't scratch the trim or cut into leather, fabric, or plastic interior surfaces as a screwdriver might.

A third bolt is behind the cover of the door handle inset. It is buried in an angled inset opening. Even after the cover is removed, the bolt is difficult to see. If you assumed the panel was held there by a clip, you might pull hard enough to damage the seat for that bolt. That would make the panel unusable, unless you have that extremely rare customer who would



In this SL 400 Roadster driver door, four bolts (4) and eight clips (6) hold the lining (5) to the door.

not mind a vibration noise at the door handle whenever the vehicle is moving.

The fourth bolt is under the airbag badge, and easy to see once the badge is removed from its clip.

After removing all bolts, unclip the door lining from the eight clips by sliding a plastic wedge under the lining and pushing up near each clip. Inspect the lining to make sure that none of the retaining tabs for the clips have been torn out.

Pull off the door lining, being careful not to damage the attached electrical connectors.

That Mercedes-Benz Door Closing Sound

Precision fit is a major part of why the sound of a Mercedes-Benz door closing is one standard of excellence by which other vehicles are often judged. In the C 300, the vertical gap where the door meets the B pillar, A pillar, or front fender is only 4 mm, plus a maximum 1 mm tolerance.

The tight tolerance significantly reduces the likelihood of a door sitting off-kilter and striking too hard against a part of the frame when closing. However, vibration-absorbing insulation may be the greater contributor to that solid "thunk" sound when you close a Mercedes-Benz door.

The Only Good Vibrations

An object tends to vibrate at a rate determined by its size, shape, and material composition. This vibration rate is called the object's natural frequency, or resonance. The object will vibrate when it is in contact with something else that is moving at a frequency equal to or near its natural frequency.

An example of resonance vibration in an automobile would be if a component or piece of trim vibrates only when the car is traveling at a certain speed. The component or trim material has a natural frequency equal to the vibrations of the engine at that speed.

Thanks to this transferability property of resonance, a weak vibration in one object can cause a strong vibration in another. This enables resonance to increase the intensity or loudness of a sound.

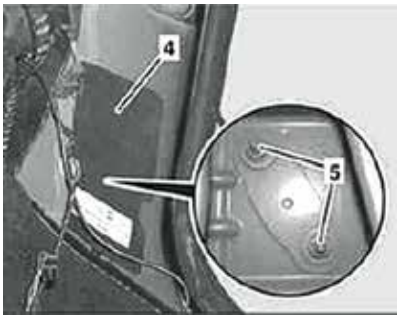
For example, the relatively weak vibrations produced when a pipe organ key is struck cause the air in the related pipe to vibrate in resonance. The air movement causes the metal in the pipe to vibrate. The larger the pipe, the greater the sound increase the vibration produces.

This tendency to pick up vibration from other objects that vibrate at the same natural frequency combined with an ability to magnify the sound from the vibration of another object is a major part of why a vehicle can often present a symphony of noises.

With a healthy respect for the physics of resonance, Mercedes-Benz engineers place a lot of vibration-absorbing insulation throughout their vehicles. It helps make the interior of a Mercedes-Benz as quiet as the library in a Tibetan monastery.

Inside the door, in addition to insulation that blankets large areas, you may find extra insulation strips tacked to small parts of the door where a component presents a high vibration noise risk.

If you had to remove any such insulation pad in order to gain access to a component or area for the repair, you must reinstall or replace the original insulation. |



A small insulation mat (4) covers the area where a component is bolted (5) onto the front door liner panel of this C 300 sedan.

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Potential Consequences of Installing Custom Aftermarket Wheels and Tires

It's a good bet that some of your customers consider their Mercedes-Benz vehicles a fashion statement. Maybe they're wild about some particular wheel and tire combination that's impractical, maybe even unsafe. What do you do?

We've all seen them going down the road and often in the shop: The giant 22-inch or bigger wheels that fill the fender wells from edge to edge. There is no shortage of aftermarket wheels available for just about every make or model. Aftermarket meaning not manufactured by, or specifically for, Mercedes-Benz. Owners seek these out for a number of reasons. Whether it's for flashy looks, sleek style, or perceived performance, oversized rims have become popular in recent years. These large wheels have even reached a mind-boggling 30 inches nowadays. With the flood of new manufacturers and styles hitting the marketplace, the trend shows no signs of slowing.

Looks vs. safety

This is alarming because bigger usually doesn't mean better. With today's Mercedes-Benz vehicles, when it comes to swapping original equipment (O.E.) wheels for aftermarket replacements, there's often more than meets the eye. In most cases, safety is being sacrificed for style as more and more people ignore the unintended consequences of installing these aftermarket wheels. You as an independent service provider (ISP) must be aware of and carefully consider many variables before going down that road. Not only could your reputation as a technician or shop owner be at risk, but also you could be setting yourself up for liability issues. Aside from ride quality, fitment issues, and spectacular repair bills, safety has become a huge legal risk when looking at this type of installation.

Opposite Pages: Wretched excess! This 22-inch aftermarket tire/wheel assembly is just asking for trouble -- harsh ride, compromised safety systems, clearance problems, big repair bills, etc. Simply not practical.

The evolution of electronic controls has such as modern anti-lock braking systems (ABS), Electronic Stability Control (ESP), Brake Assist (BAS), and Distronic Plus (DTR) systems have only added to the list of what potential problems could develop from the use of aftermarket wheels. That's not to say all aftermarket wheels are bad. Wheels manufactured to meet the Society of Automotive Engineers equivalent for safety and staying within the industry standard of + or - 3% of factory size and weight are usually safe. Generally, we have seen minimal issues in the shop. It's those that go beyond that range, however, that we want to take a closer look at.

What we know

Mercedes Benz vehicles were engineered and manufactured to extremely strict standards. Installing larger-than-approved oversized wheels can and does greatly affect many aspects of the vehicle. Deviating from the factory sizes not only affects suspension geometry and handling characteristics, but also increases the cost of ownership in the form of repair bills from abnormal wear and tear. Here are some of the common concerns and problems that show up when dealing with this type of modification:

- A rough and unpleasant ride is a common complaint. Oversized wheels usually have ultra-low-profile tires. The shallower sidewalls have less give and ability to absorb bumps in the road. When engineering the suspension system, Mercedes-Benz factored in the tire profile. The loss of give and shock absorption not only affects the ride, but also can ultimately lead to damage within the vehicle.

- Oversized wheels add weight, as much as three times what's normal for the vehicle. This in turn raises rolling mass and inertia. If you played with a gyroscope as a child, you're familiar with the force involved here. Big wheels want to keep turning; this extra rolling mass can decrease braking system performance. Increased stopping distance and braking effort, premature pad/rotor wear, and, worst-case, brake fade if the system becomes overheated.

These conditions can end up in critical system failure. Added weight stresses lug bolts and wheel bearings, and lug bolt breakage or wheel bearing lock up at speed could be deadly for both the occupants of the vehicle and bystanders alike.

- Oversized wheels can cause power and acceleration loss due to added rotating mass. In addition, the increased diameter will affect the drive gear ratio and speedometer accuracy.

- Heavy wheels add to the unsprung weight of the vehicle (weight not controlled by the springs). This causes stress on ball joints and bushings, and accelerates tire wear.

- Rims that are too tall raise the center of gravity, leading to increased body roll during cornering. Rims that are too wide pose clearance problems, limiting spring travel so that the wheel bottoms out over bumps. Also, we have seen catastrophic tire failures from contact with a

It's just common sense to stay close to the factory-recommended wheel and tire size for any car as built, even more so with a Mercedes-Benz vehicle because of the many integrated safety systems aboard.

suspension component that wears through the sidewall.

Other side effects include rubbing fenders, wheel wells, control arms, and shocks. Increased turning radius, and tie rod wear from excessive tire scrub are also problems.

- Oversized wheels can, and in many cases do, affect suspension geometry, which throws vehicle alignment out of specifications and in many instances beyond the adjustment range built in at the factory. This causes accelerated, uneven tire wear, under- or over-steer, and pulling complaints.

- Mercedes-Benz factory wheels are hub-centric, meaning the center flange of the hub or rotor is used to locate the wheel axially. This type of mounting produces a better-balanced, truer-spinning wheel, and reduces the load on lug bolts. Many aftermarket wheels are manufactured to be universal-fit so the same wheel can be installed on many different automobiles. A universal rim uses a plastic adapter ring to make it hub-centric. Common shop problems with these are where rings are missing, worn away, or wrong sized. This results in the wheels being centered by the lugs only, which commonly causes the vehicle to have steering wheel shake. A shaking wheel can make a vehicle hard to control at speed and dangerous to drive, besides simply being unpleasant.

- Sometimes it's the little things that get you into trouble. Aftermarket lug bolts often present their own gremlins. Over the years, we have seen these cause several problems. Wheels with bolts that are too short may not stay tight, bolts that are too long can damage the parking brake assembly, and, worse yet, bolts with not enough tensile strength for the wheel size can break under the increased load and weight. This is especially true with chrome-plated bolts.

Here you can see tire wear and damage from an oversized wheel -- three inches larger than stock. This W220 also had heavy tie-rod wear/play from the sheer weight of the aftermarket rims.

It's important to remember when making any modifications, proper engineering and component upgrades must be taken into consideration to maintain safety. It's not just the driver that takes the risk when mounting a set of oversized wheels. Passengers and the public at large could be greatly impacted by such actions.

Impact on Electronic Systems

Most of you probably know about the mechanical problems that installing oversized wheels can cause. What's lesser known, however, is the possibly negative influence

on the electronic safety systems. These are the systems that run silently in the background such as the ABS, ESP, and DTR mentioned before. Others include the tire pressure monitoring system (TPMS), Active Body Control (ABC), Airmatic with Active Dampening (ADS), Pre-Safe (SRS), and Attention Assist systems. There has been limited research in this area, but it stands to reason that changing wheels could have an overall negative effect. Mercedes-Benz safety systems were designed to operate with the factory wheels sizes. Being data dependent, these systems need the most accurate information in order to operate correctly. Increased wheel size changes wheel speed, drive ratio, suspension travel, and maneuverability, thus corrupting critical factors the system needs to calculate the appropriate amount of response in an emergency actuation. When milliseconds count, do you want to be the one who compromises active safety by installing oversized wheels? These safety systems were installed for a reason, and some are now being made mandatory standard equipment and should not be altered.

Some of the known conflicts with these systems have come through our shop, such as:

- Missing TPMS sensors. A customer comes in with a TPMS light on wanting diagnosis. After a quick computer check and a hard code “Loss of communication to one or more sensors” present, a quick look at the aftermarket wheels makes the cause become apparent. The wheels were not manufactured to accommodate the factory TPMS sensors. So, the installer had just left them out.
- A vehicle comes in with an ABS/ESP light on above 50 mph. A check of the system reveals a “Wheel speed implausible” codes. Live data shows sensors to be working. In this case, the oversized wheels were the

This GL450 has a damaged aftermarket wheel from hitting a pothole. There was not enough sidewall to absorb the impact. Also, this rim’s construction is inferior with too much offset

culprits. The tires had enough difference in tread depth along with the increased circumference to cause the problem. The system senses that the speeds are too far apart to function properly.

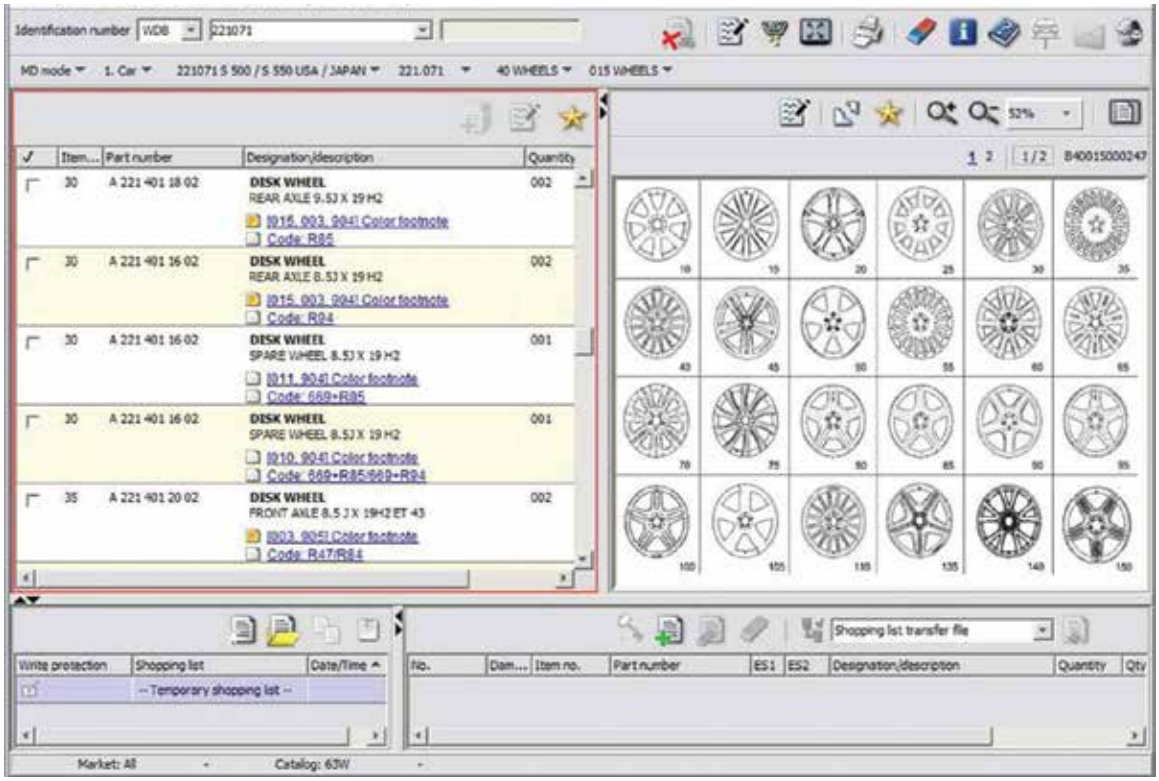
- Countless calls from customers looking to have their Airmatic or ABC system "recalibrated" to accommodate the new ride height of oversized wheels.
- Vehicles needing TPMS pressures parameters changed to match the new operating pressures of the non-stock wheels and tires.

In most cases the ultimate fix is to reinstall the factory Mercedes-Benz wheels and tires. Luckily for most shops, these types of repair orders are few and far between. Over time as popularity increases and systems become more sensitive, the potential for new problems is sure to arise.

A BETTER SOLUTION

How do you as an ISP offer a better option? The answer may be as close as your local Mercedes-Benz dealer's parts counter or the Electronic Parts Catalog (EPC). On most vehicles, there is already a built-in sport or appearance option that was factored in during the design process. A search through the catalog will show all of the approved optional wheels available. Wheels from the Mercedes-Benz performance wing (AMG) are also available for many applications. With numerous size and style options, this is the best overall compromise. The greatest benefit is that the Mercedes-Benz part was manufactured to the highest standard. High-quality parts are designed for a precise fit.

In the end, however, it will always come down to personal preferences. There will always be those who are willing to sacrifice safety for looks. Aftermarket wheels, no matter the consequences, are here to stay. |



Here's a screen shot of the wide range of custom wheels available for the W221 S-Class from Mercedes-Benz. Better choices for safe, trouble-free motoring.

Mercedes-Benz Mobil 1

Product Name	Part Number	Quantity	Product Description	Recommended Consumer Applications
Mercedes-Benz SPEC.				
Mobil 1 Formula M 5W-40	BQ 1 09 0144	Bulk - No Equipment	Fully synthetic formulas designed specifically for gasoline passenger cars	Low SPAsh. Available at most MB dealers
	BQ 1 09 0162	6/1 Quart Cases		
	BQ 1 09 0151	55 Gallon Drum		
Genuine Mercedes-Benz Oil MB 229.5 Specification SAE 5W-40	A0009898301USB6	12x1 Quart Cases	Fully Synthetic formula specifically designed for Mercedes-Benz engines that require the 229.5 Specification	Mercedes-Benz Engines that require 229.5 Specification Oil
	A0009898301USB8	55 Gallon Drum		
	A0009898301USB9	Bulk - No Equipment		
Mobil 1 0W-40	BQ 1 09 0010	Bulk - No Equipment	Fully synthetic formulation designed to meet the requirements of many European vehicles	Porsche A40. Many European vehicles. HT/TS applications.
	BQ 1 09 0015	6/1 Quart Cases		
	BQ 1 09 0016	55 Gallon Drum		
Mobil 1 ESP X1 0W-30	BQ1090184	Bulk - No Equipment	Advanced full synthetic formulas designed specifically for diesel passenger cars that have particulate filters	Low SPAsh. Available at most MB dealers
	BQ1090182	6/1 Quart Cases		
	BQ1090183	55 Gallon Drum		
Genuine Mercedes-Benz Oil MB 229.52Specification SAE 5W-30	A0019893701USA9	Bulk - No Equipment	Fully Synthetic formula specifically designed for Mercedes-Benz engines that require the 229.51 Specification	Mercedes-Benz Engines that require 229.51 Specification Oil
	A0019893701USA6	6x1 Quart Cases		
	A0019893701USA8	55 Gallon Drum		
Mobil 1 5W-50	BQ 1 09 0133	16 Gallon Keg	Higher viscosity, advanced full synthetic formula designed for performance vehicles	Porsche A40. HT/HS applications.
	BQ 1 09 0134	6/1 Quart Cases		
Mobil ATF 134	BQ 1 09 0166	55 Gallon Drum	Extra high performance automatic transmission fluid formulated with selected HVI base oils	Recommended for use in Mercedes-Benz automatic gearboxes
Mobil 1 ESP Formula MB 5W-30	BQ 1 09 0165	12x1 Liter Cases	Advanced full synthetic formulas designed specifically for passenger car diesels that have particulate filters	Low SPAsh. Available at most MB dealers.
AdBlue® ½ Gal.	A 000 583 0107	1/2 Gallon Bottle	Non-toxic solution that transforms harmful Nitrogen Oxide (NOx) emissions from diesel-powered vehicles into harmless water vapor and nitrogen	Recommended for use in Mercedes-Benz, Volkswagen + BMW AdBlue® (DEF) applications
Diesel Exhaust Fluid 55 Gal	BQ 1 47 0002	55 Gallon Drum		
Mobil 1 5W-30	BQ 1 09 0017	6/1 Quart Cases	Advanced full synthetic formulation designed to meet the requirements of many domestic, including GM, and imported vehicles	Vehicles that require 5W-30. Corvette approved.
	BQ 1 09 0018	55 Gallon Drum		
Mobil 1 10W-30	BQ 1 09 0019	6/1 Quart Cases	Advanced full synthetic formula designed for domestics and imports	Vehicles that require 5W-30 or 10W-30
	BQ 1 09 0020	16 Gallon Keg		
	BQ 1 09 0021	55 Gallon Drum		
Mobil 1 5W-20	BQ 1 09 0083	6/1 Quart Cases	Advanced full synthetic formulation designed to meet the requirements of many newer vehicles including Hondas, Fords, Chryslers, and newer Toyotas	Vehicles that require 5W-20
	BQ 1 09 0084	55 Gallon Drum		
Mobil 1 0W-20 AFE	BQ 1 09 0169	6/1 Quart Cases	Advanced full synthetic formulation designed for enhanced fuel economy and cold weather performance	Most vehicles that specify 0W-20 (newer Toyotas and Hondas), 5W-20 and certain hybrids
	BQ 1 09 0168	55 Gallon Drum		
Mobil 1 0W-30 AFE	BQ 1 09 0174	6/1 Quart Cases	Advanced full synthetic formulation designed for enhanced fuel economy and cold weather performance	Most vehicles that specify 5W-30 or 10W-30
Mobil 1 Synthetic ATF	BQ 1 09 0164	6/1 Quart Cases	Multi-vehicle, fully synthetic fluid designed to meet the demanding requirements of modern passenger vehicles	Vehicles that require Dexron III, Ford Mercon and Mercon V performance levels
	BQ 1 09 0163	55 Gallon Drum		
Mobil 1 15W-50	BQ 1 09 0023	55 Gallon Drum	Boosted, higher viscosity, advanced full synthetic formula designed for performance vehicles	HT/HS applications. Racing and Flat tappet applications
Mobil 1 Gear Oil (Mobil 1 Gear Lube 75W-90)	BQ 1 09 0085	12/1 Quart Cases	Exceeds the most severe service requirements in both conventional and limited slip applications	SUITABLE for use in modern high performance automobiles like SUV's, Vans and Light duty trucks requiring API GL-5 level performance

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

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

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

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

Variable Length Intake Manifold Operation & Maintenance

For most of automotive history, the intake manifold was just an inactive lump of iron or aluminum. Not anymore.

The history of the air intake manifold had been largely uneventful. For many decades, the design remained pretty much the same with sparse innovation. It was simply plumbing that made the air/fuel charge available to the combustion chambers willy-nilly with little thought devoted to how far each intake valve was from the typical centrally-located carburetor. The simplest way to understand this function is to think of the internal combustion engine as what it is: an air pump.

As an engine piston moves down on the intake stroke, a vacuum occurs the strength of which depends on atmospheric pressure at that time and location. In a carbureted or throttle-body injected engine, this atmospheric pressure forces the air/fuel mixture through the intake manifold and on into the combustion chamber through the intake ports in the cylinder head, which is burned and pumped out through the exhaust.

Traditional intake manifolds all follow the same basic design, usually consisting of four distinct parts: a mounting flange for an inlet control such as carburetor or throttle valve, a plenum to collect air volume, runners to direct air flow, and an additional mounting flange to couple with the cylinder head.

Saving weight

Early manifolds were simply steel or copper pipes, which were soon supplanted by highly-stable cast iron. To save weight, later versions were made of aluminum alloy. So, you won't see cast iron intakes on newer engines, and even aluminum has been largely phased out. As manufacturing processes and materials evolved, composite plastic manifolds were developed.

Opposite page: The runners of this 1952 300 SLS six prove that science was being applied by Mercedes-Benz engineers over six decades ago. The long runners enhance torque in the low- and mid-rpm ranges.

These offered an advantage beyond light weight in that they have better thermal properties. They can run much cooler than aluminum, improving air charge density, which can be blended with additional fuel to produce more power. In addition, plastics can be molded into more complex shapes than the sand casting of aluminum allows. This gives greater flexibility during the engineering process.

Magnesium alloy is another innovation that is becoming popular in certain applications. Magnesium parts have been around for maybe a century, but recent advances in high-pressure casting have made it a favorable material. The advantages of magnesium are its light weight along with strength and rigidity. Good thermal and acoustic properties are added benefits. Both composite plastic and magnesium manifolds are employed on today's Mercedes-Benz vehicles.

Transitions

The move from carburetion to electronic fuel injection decades ago spurred changes in manifold design. This transition moved the industry away from "wet" manifolds that carried an air/fuel mixture on carbureted or throttle body injected engines. Port-type fuel injection brought us to a new age of "dry" manifolds that only flow the air involved in combustion.

Over the years, more and more attention has been given to "tuning" aspect of manifold design. In today's world, demands for better fuel economy must coincide with demands for maintaining power. The intake manifold has become an integral part of the total engine design process rather than just an afterthought. Constant manifold refinement has added to the engine's ability to produce more power, smoother operation, and vastly improved fuel mileage, and all with lighter, smaller displacement engines compared to those of years past.

The manifold comes alive

Manifolds of the past were "fixed curve," meaning they were designed to only accommodate a general balanced torque curve. In manifold design, plenum size, runner length, and shape are defining factors in how it performs. With a fixed design, the power band or fuel curve cannot easily be changed, so it is an exercise in compromise. It would tune reasonably well at all engine speeds, but excel at none.

In its quest for ever-increasing performance and efficiency, Mercedes-Benz introduced its first version of a two-stage manifold, or Variable Length Intake Manifold (VLIM), in 1994. Basically, VLIM technology allows for intake runners of two different lengths within the same manifold housing with controls that make it an "active" engine component rather than a passive one. This is accomplished by adding an internal flap that can open and shut depending engine speed.

Why is varying the intake length a good thing? It optimizes horsepower, torque, and fuel efficiency by taking advantage of both the venturi effect and pressure waves known as "Helmholtz Resonance." The ultimate goal of the design is to achieve 100% or better volumetric efficiency, which means having the cylinders fill to atmospheric (or greater) pressure as the compression stroke begins. At low speed and engine rpm, high vacuum exists, allowing for

No, that's not a Mercedes-Benz, but this domestic hot-rod engine serves to illustrate a point: Those intake runners are so short, this big V8 can't generate enough power at low rpm "to pull your hat off," as the saying goes.

This early Daimler engine has as basic an intake manifold as possible. No tuning to a particular rpm, just copper plumbing.

combustion chamber filling using the venturi effect. To fill the negative pressure in the chambers, air is sped up by shorter, slightly tapered intake runners. This increased air velocity allows for a more complete air charge.

As the throttle is opened and rpm and load increase, vacuum falls off, so resonance pressure waves are brought into play. When an intake valve shuts, the incoming air "slug" has momentum and is abruptly stopped. This causes a pressure wave to build up behind the closed valve inside the intake runner. By making the intake runner longer, this wave can be harnessed. Stacking the waves of air into the runner raises pressures and the amount of air for charging the cylinder, acting as a kind of low-pressure supercharge. This phenomenon only occurs in the narrow mid-rpm range. At higher revs and speed, dynamic pressure becomes key. This is the outside air being pushed into air inlets as vehicle speed increases. During this stage of operation, high rpm requires less fill time, so a short intake runner is desirable.

On this M272 intake manifold the vacuum actuator for the actuation of the tumble/swirl flaps is located between those for the variable runner flaps.

The mechanics of it

The Mercedes-Benz VLIM uses a spiral design with runners formed around the central internal plenum. This allows for longer intake runner length in a compact area. Each individual runner is typically about 800 mm in length. Individual runners are used to ensure that each cylinder has a sufficient supply of air flow without being affected by pressure waves created by other cylinders. Inside the manifold, resonance flaps were added to the runners. These are what allow the manifold to be variable. The flaps are located about halfway into the length of the runners. They are normally open, allowing air to take a shortcut from the plenum to the cylinder via a shorter runner path. Actuating the flaps closes the midway opening, forcing the air to take a path through the full length of the runner. Every runner has its own flap, but all are interconnected by shafts so that they actuate simultaneously.

Mercedes-Benz uses a vacuum actuator mounted on the manifold to actuate the variable flaps. At idle and low rpm, the internal resonance flaps are in the open position, held by pressure from a spring inside the aneroid. This is the short-runner mode, allowing incoming air to travel the shortest path to take advantage of the venturi effect. During midrange, approximately 1,700 to 3,900 rpm and under load of more than 50%, the flaps close for the long-runner mode. The power of engine vacuum is used in the aneroid to overcome the spring pressure and pull the flaps closed. The vacuum actuator receives vacuum from an internal supply reservoir located inside the manifold. This allows for the capsule to be cycled approximately five times before the reservoir replenishes itself via an internal check valve. Using a storage system ensures actuation during low-vacuum, midrange operation. Vacuum to the capsule is controlled by an electric solenoid

valve. Mounted on the manifold, the valve is triggered by the engine management computer when conditions are right.

Continued refinement

The latest innovation in manifold technology came when Mercedes-Benz introduced the M272/273 engines. Tumble flaps were added to the manifold outlets. These flaps are swung into the intake ports just ahead of the fuel injectors. By partially closing the port, the curved shape of the tumble flaps causes the air charge to speed up and swirl. This helps to blend the mixture for a more homogenous charge. These flaps are actuated by means of a vacuum actuator similar to the one for the resonance flaps, and are held in the recess position by spring pressure until they are vacuum-actuated by engine management at 50% load. Sensors at the end of the tumble flap shaft are used to monitor position. In the event that a flap does not fully open, or fails to open at all, a fault code will be set.

Moving parts can fail

Taking intake manifolds from a completely static component to one with mechanical motion brings a new set of concerns. Older fixed manifolds were almost completely problem-free other than the warpage of aluminum units on inline engines that caused vacuum leaks at the manifold/cylinder head seam. Adding moving parts both internally and externally makes proper maintenance more critical than ever before. Because the internal flaps, pivot bushings, and seals are exposed inside the manifold, anything flowing there has the potential to cause damage. This should lead us

This M272 engine was neglected to the point that the flaps stuck and broke, as did the vacuum actuator rods. Plastic from the flaps was ingested into the cylinders, bending valves.

Performance. Reliability. Success.

With our competitively priced replacement parts, you no longer have to settle for anything less than Mercedes-Benz quality. But that's just part of the story. You see, our hoods, fenders and head lamps all carry a 12-month, no mileage-restriction warranty. So our parts are not only a great deal. They're a great value. Since they're genuine Mercedes-Benz, you can have confidence they'll last, and so will your relationship with your customers.

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

MSRP excludes state and local taxes and freight if applicable. Prices may vary by dealer. See your authorized Mercedes-Benz dealer for additional details or a copy of the Mercedes-Benz parts limited warranty.

Mercedes-Benz

to look at emissions controls that also make use of the intake manifold. First is the exhaust gas recirculation (EGR) system. EGR takes a little spent exhaust gas and returns it to the intake manifold. This process under light engine load dilutes the air/fuel charge to help keep oxides of nitrogen (NOx) from forming during combustion. The potential hazard that arises is coking. Coke is the sticky tar-like substance that can form due to incomplete burning of carbon during the combustion process, and this flows through the intake manifold during EGR operation. The unburned carbon combines with moisture in the incoming air to become this sticky film. Over time, these deposits build up and coat the flaps. If enough coking exists, eventually it can cause part failure. Failure comes in the form of sticking or broken flaps, and premature bushing/seal failure. Symptoms could range from misfires, vacuum leaks, loss of power, to, worst case, broken parts that become free and are ingested into the cylinders causing valve or piston damage.

The tumble/swirl flaps are located directly upstream of the manifold runner/cylinder head intake port interface.

Another system for concern is positive crankcase ventilation (PCV). Crankcase pressure build-up is also routed through the intake manifold. This process poses the same coking hazards as EGR, only in this case the carbon comes in the form of oil vapor.

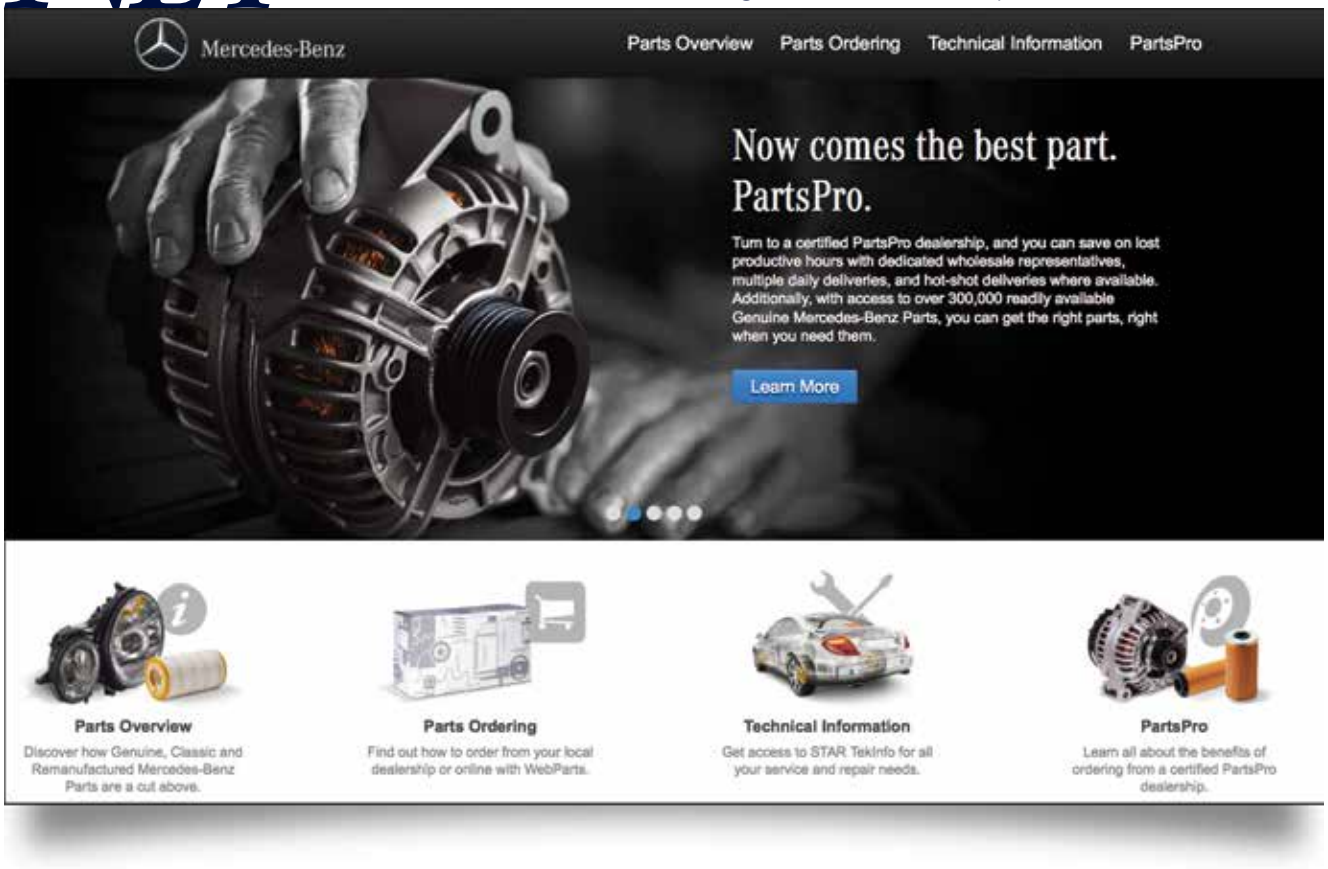
To prevent or minimize these hazards, proper Mercedes-Benz maintenance is highly encouraged. The right fuel grade ("Top Tier"), and recommended air filter and spark plug service intervals optimize combustion, decreasing coking from EGR carbon. Factory-recommended oil and weight at correct mileage or time change interval will reduce coking from oil vapors. Intake tract cleaning has become a popular service, but that will be the subject of a future ***StarTuned*** article.

So, once again, recommending good maintenance services to your customers will likely save them from having to pay for expensive repairs. |

Looking inside this manifold, you can see the coked-up variable flaps, and also the vacuum line at the back coming from the internal reservoir.

the NET

Sourcing Mercedes-Benz Repair and Parts Information



Model Indicator Index provides the ability to find chassis, model year and engine detail from the VIN which assures proper catalog identification of the vehicle when using the EPC.

STARTUNED magazine section with archive search functionality and downloadable articles

Enjoy easy access to technical information and resources.
At STAR TekInfo you'll find all the technical documentation you need on servicing and repairing Mercedes-Benz vehicles.

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

MSRP excludes state and local taxes and freight if applicable. Prices may vary by dealer. See your authorized Mercedes-Benz dealer for additional details or a copy of the Mercedes-Benz parts limited warranty.
*Excludes CORE deposit.

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