STARTUNED®

Information for the Independent Mercedes-Benz Service Professional

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Fuel Pump

HFO-1234yf

Matte Finish

Power Seats

Mercedes-Benz

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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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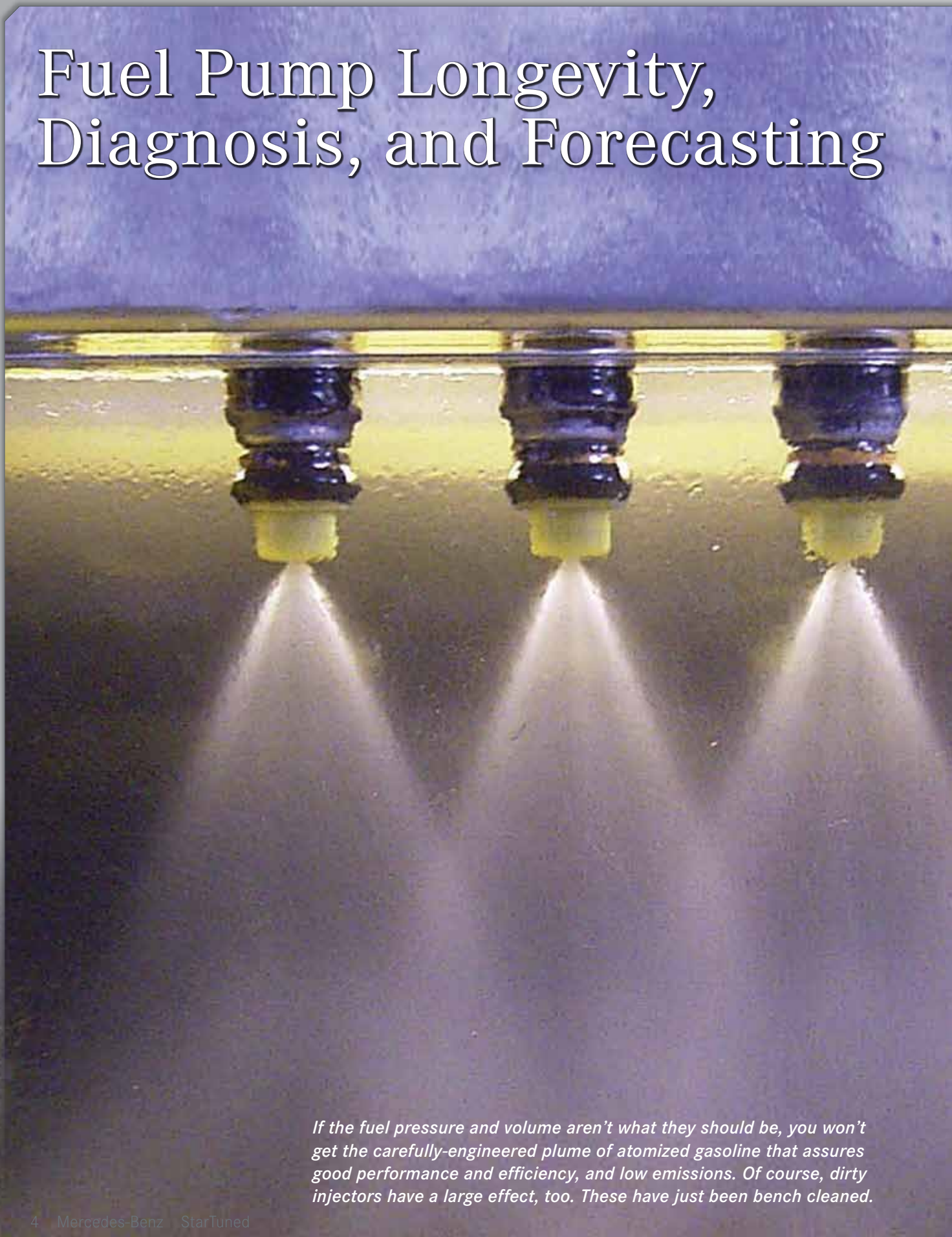
In This Issue

Fuel Pump Longevity, Diagnosis, and Forecasting



If the fuel pressure and volume aren't what they should be, you won't get the carefully-engineered plume of atomized gasoline that assures good performance and efficiency, and low emissions. Of course, dirty injectors have a large effect, too. These have just been bench cleaned.

The electric fuel pumps Mercedes-Benz vehicles have used for many decades have evolved and improved immensely. Given their continuous duty and the junk they often have to ingest, however, replacement is still a common job.

Whenever you're presented with an engine that won't start, or runs poorly, the conventional diagnostic wisdom is that you should check the condition of the internal parts that make compression before you embark on sophisticated electronics troubleshooting. Ditto for fuel pumps. Perhaps that pump is simply worn-out, or maybe the filter is clogged. Even if it's not quite ready to fail, can you predict how long it might keep working?

Improper psi can cause all kinds of troubles that often get blamed on something else. Symptoms include bucking on the highway, momentary cutting out, hesitation, low power, stalling (typically, it'll fire up again after it's cooled off), and, of course, no-starts and hard starting.

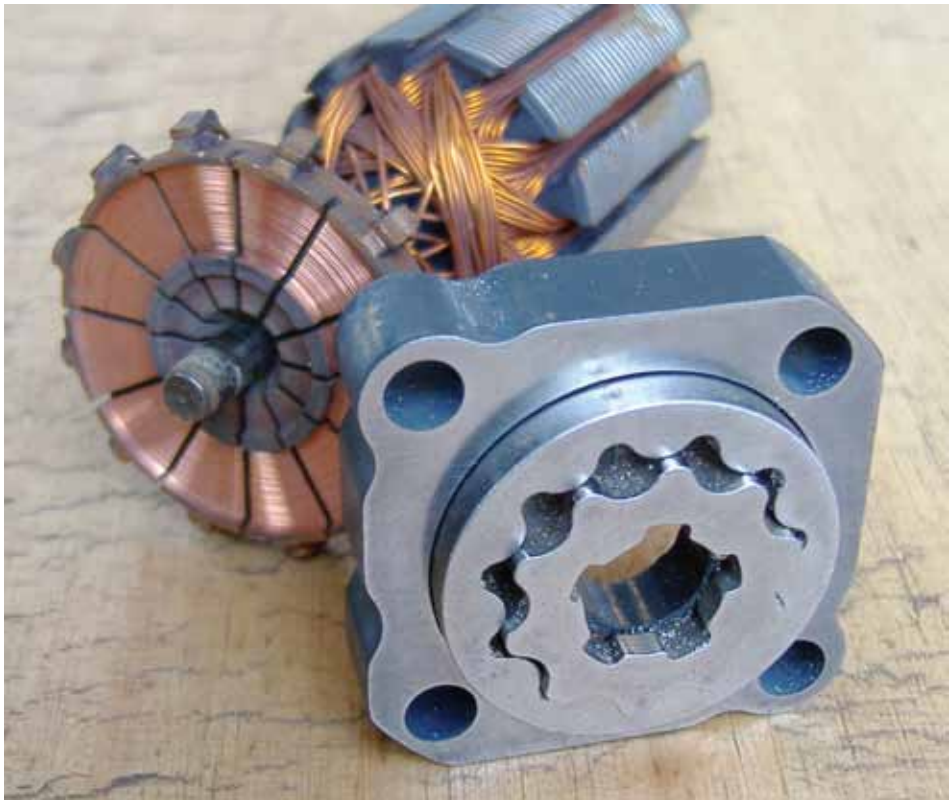
History, basics, and lifespan

Even before the advent of EFI, Mercedes-Benz vehicles had the Robert Bosch K-Jetronic continuous injection system, which got its pressurized gasoline by means of a roller-cell pump mounted outside of the tank (its electrical ground was sometimes tenuous, leading to intermittent operation). Then came L-Jetronic, LH-Jetronic, Motronic, etc., all of which had in-tank pumps. Another phase of this evolution was the introduction of "returnless" fuel systems, wherein the pressure regulator is also in the gas tank, and the pump has a three-phase, duty cycle-controllable motor (that it doesn't always run full-blast should increase its longevity). Now, we're seeing gasoline direct-injection systems with up to 3,000 psi (200 Bar) of pressure, but they're going to be the subject of a future StarTuned article.

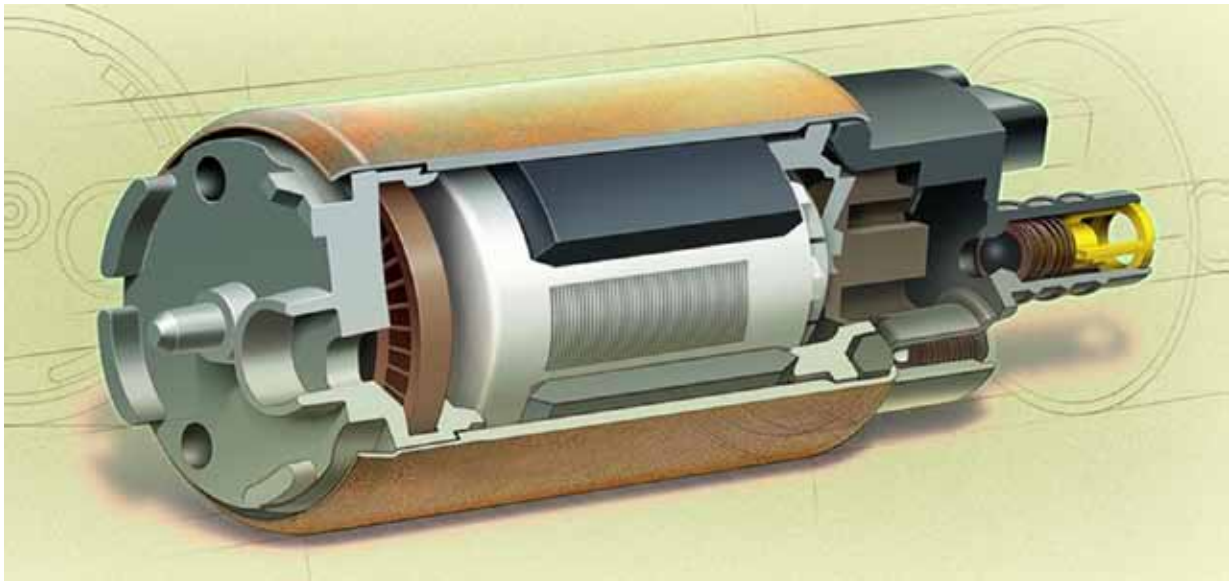
Over the years, high-pressure electric pumps have come in three varieties: roller cell, gerotor or internal-gear, and turbine. The first type, which appeared at the outset of the fuel injection era and continued for years and years, uses rollers in a notched rotor to catch gasoline and force it into a small-volume area of the housing. It has lots of moving parts and can be noisy. Gerotors use a different principle. Similar to an oil pump, they squeeze liquid by means of the eccentric action between a star-shaped rotor and a matching element that surrounds it. The turbine type first

showed up almost 20 years ago, and you'll find both single- and dual-stage versions in most late models (certain applications still used gerotors up into the last decade). Its main advantages are fewer parts, no internal friction, and less noise. They're not always perfectly silent, though -- since they spin so fast, you can sometimes get a high-pitched whine. One drawback to the design is that it isn't capable of grinding up any debris, so it requires a very efficient pick-up strainer/screen/sock.

The question of pump lifespan is interesting. Engineers have told us that early designs had a target longevity of 10,000 hours (roughly 300K to 400K miles), then improvements such as lower amperage draw, better-balanced armatures, and more compatible materials in the brushes and commutator made it possible for them to go even farther.

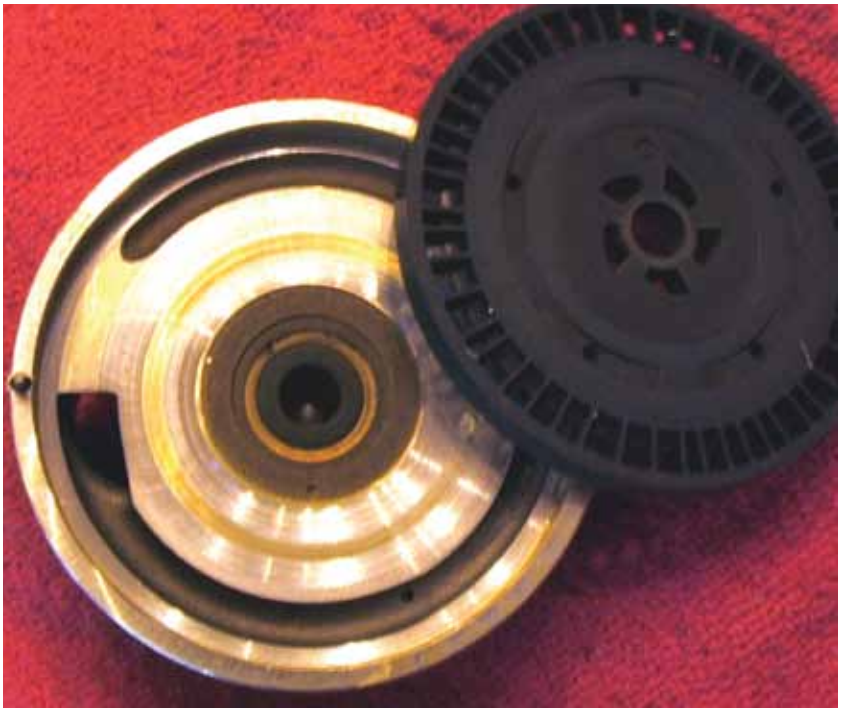


The gerotor/internal gear-type fuel pump has been used up until recently. In this older example, notice how different the commutator is compared to that of later models.



Just about all fuel pumps today are of the turbine type, which are relatively quiet. They don't do well at swallowing debris, though. (Courtesy Robert Bosch.)

Those enhancements may be very admirable, but every technician knows that in the real world fuel pumps often don't last for the life of the vehicle (which is typically very long indeed in the case of Mercedes-Benz). What can cause the demise of such a highly-engineered component?



Turbine pumps use centrifugal force to generate pressure. The moving parts don't actually touch, so there's no wear. That is, except in the electric motor.

If you want to do some research into what's killing pumps among your customers, you can use an exhaust pipe cutter to slice through the aluminum housing and pull out the internal components. It's easy and interesting.

Two things: dirt, and restricted filters. You may have noticed that many of the fuel filters you replace are so thoroughly clogged that you can't blow through them. If you had checked the pump's amperage draw before removing the old filter, you might have seen up to twice the expected number -- say, eight or ten instead of four to six. It shouldn't take much of an intellectual leap to realize that a plugged fuel filter will make a pump work harder, and all that extra electricity will wipe out the brushes and groove the commutator, killing the pump prematurely. Increased backpressure in the system equals more arcing, heat, and wear.

Sucking silt

Filters are one thing, but bear in mind that whatever you might find in one has already been eaten by the poor pump. That's why it's so important that you install the strainer/sock/screen pickup carefully so that there's a perfect seal. Pump manufacturers have told us that the biggest cause of premature failure with replacement units is a mistake here. With the gerotor type, noise may become noticeable early on as the contaminants scuff the gears and they drag against each other, and the turbine type won't tolerate dirt at all. Of course, if you buy the whole pre-assembled Genuine Mercedes-Benz fuel pump module that's available for most late models, there's no risk of unstrained gasoline making its way into the internals.

In an ideal world, the gas tank would be dropped and thoroughly emptied and cleaned, preferably with steam. Even if you have to pump or siphon out a considerable quantity of gasoline, don't even think of putting it back into the car.

Late model Mercedes-Benz replacement pumps come assembled in a module, such as this M-Class specimen. That relieves you of the responsibility of putting all the parts back together so that there are no leaks past the strainer, and there's no unwanted contact between parts that can cause noise.

The silty contaminants tend to stay in suspension, so dispose of the old stuff one way or the other -- maybe you could run your lawnmower on it.

This isn't an issue with certain late models such as C300 California-spec TZEVs because you can't just replace the pump. The tank, pump, and sending unit come as a complete assembly.

While it's hard to prove that running on empty damages a fuel pump, it certainly can't be doing it any good. Aside from less cooling action, contaminants will be more concentrated.

When a pump motor's commutator gets rough like this from contaminants, heat, and the excessive electrical load caused by a restricted filter, the brushes wear out and bounce to the point of failure.

Besides dirt, another factor that damages pumps is motorists who drive with their tanks nearly empty. Gasoline is what cools the pump, and the silt mentioned above is going to be a lot more concentrated in three gallons than in 15. Suggest to your customers that they try not to run on the last dregs of gasoline in their tanks.

Except for a total internal jam-up, the ultimate failure of a pump's ability to force fuel forward will be electrical. If the commutator becomes rough from contaminants or overheating, the brushes start to bounce. This oscillates the wires that connect to the brushes, and eventually one of them breaks. In older models, the tiny brush spring ends up carrying the current, a job it's certainly not up to, and it quickly burns out. Newer units have nylon brush carriers, so when the wire breaks there's not even this much to fall back on.

Symptoms and testing

What are the symptoms of a failing pump, exactly? One fuel system authority says, "Typically, no-start after shut-down. You usually have some warning on the highway." A veteran diagnostician and shop owner tells us, "The problems we see are mostly intermittent failures on the road. The car cuts out, bucks, then stalls. But it'll often start again once it's cooled off."

Everybody in this business should know by now that checking fuel pressure is one of the requisite basics of performance troubleshooting, but we keep hearing that many of you out there don't bother to do it. Get with it and customer complaints become more comprehensible. As one seasoned veteran says, "If you don't check pressure, you might start replacing sensors or the computer to fix the problem when the pump or a clogged filter or screen might be the real trouble."

We should mention some troubleshooting tips we've learned over the years:

- You should see violent needle swings between dead-head (return line clamped) and running pressures. A slow rise means trouble.
- Pull the pressure regulator's vacuum hose and you should see a rise.
- Once you're sure the hose to your gauge has all the air bled out of it, you should see that needle spring to attention almost instantly when you switch the key on. A slow pressure build points to a problem.
- Low pressure suggests not only a weak pump, but also a clogged filter or pick-up sock, a crimped line, or resistance in the pump electrical circuit.
- Too many psi may be due to a restricted return line.

Excessive oscillations of the brushes can cause their leads to break from fatigue. If the springs are grounded, they'll complete the circuit, but not for long. In later versions, the brush holders are all nylon, so there's no path to ground through them.

- Just because you've got specified pressure doesn't mean there's sufficient flow. Total system volume at the Schrader of one liter in 35 seconds is a common "nominal value" in StarTekInfo. You'll find cases where just opening the valve on your gauge will kill the engine, yet the psi reading was fine.

- On a conventional fuel delivery system, a dirty inline filter will reduce fuel volume and fuel pump rpm, and increase fuel pump current. This is because the plugged or restricted filter acts like a dead-head. On a returnless system, the restricted filter will have no effect on fuel pump speed or current, since these systems are always dead-headed anyway.

- A dirty pick-up screen will reduce fuel volume, possibly increase fuel pump speed, and decrease fuel pump current, since it will cause pump cavitation. Either a conventional or a returnless system will react the same way since there's no essential difference on the "suction" side.

Good pressure doesn't necessarily mean sufficient volume. In some cases, just opening your gauge valve will kill the engine. Better do a volume test.

Where's the juice?

No or low pressure may mean the pump's circuit is faulty. A bad control relay is a possibility, but check for poor connections before you think about new parts. Test for the presence of battery voltage at the pump's positive terminal or wire, and keep in mind that a bad ground is a common cause of both no-starts and performance problems.

Voltage-drop testing is the best way to locate high resistance. With the circuit powered up, use an accurate voltmeter to see if you get a reading across connections and lengths of wire. Anything more than about .2 volt (or, 200 millivolts) is too much.

If the pump won't run at all, it's natural to check the fuse. If it's blown, and the car starts after you replace it, you should still find out how many amps it's being forced to carry. Fixing high draw now may head off a future breakdown.

You'll need either a low-reading analog ammeter or a DMM (Digital Multi-Meter) with sufficient current-carrying capacity. As we hope you know, amperage testing is done either by hooking up the meter in series with the load, or with an inductive pickup that you clamp around the wire. The latter works best with big current flow, such as you'd find in the starter circuit, so we prefer the former for diagnosing fuel pumps. That means you've got to break into the circuit. Connect one of the ammeter's leads to the positive battery post and the other to the pump's hot wire. Look this up in WIS. The same goes for the draw specs, but we will say that if you see anything over six amps with a mid-pressure system (45 psi), or seven amps with a high-pressure version (60 psi +), you've got a problem.

Leaker

The fuel pressure regulator is a pretty simple device, but that's no reason to overlook it. Whenever you see high emissions, some experts say to pull the vacuum hose off the fuel pressure regulator and look for gasoline. Diaphragms have been known to rupture.

System leak-down can cause hard starting, among other things. If psi won't hold, pinch off the supply line. No change? Then the check ball in the pump isn't the culprit. In cases where leak-down disappears when the return line is pinched, the problem is a perforated diaphragm in the pressure regulator. If that doesn't make a difference, you've got seepage through an injector.

It's fairly unusual to find a blockage in a line, whether from a crimp, dent, or a big piece of debris, but it does happen. Identifying such a situation requires looking around underneath with a good light and an inspection mirror.

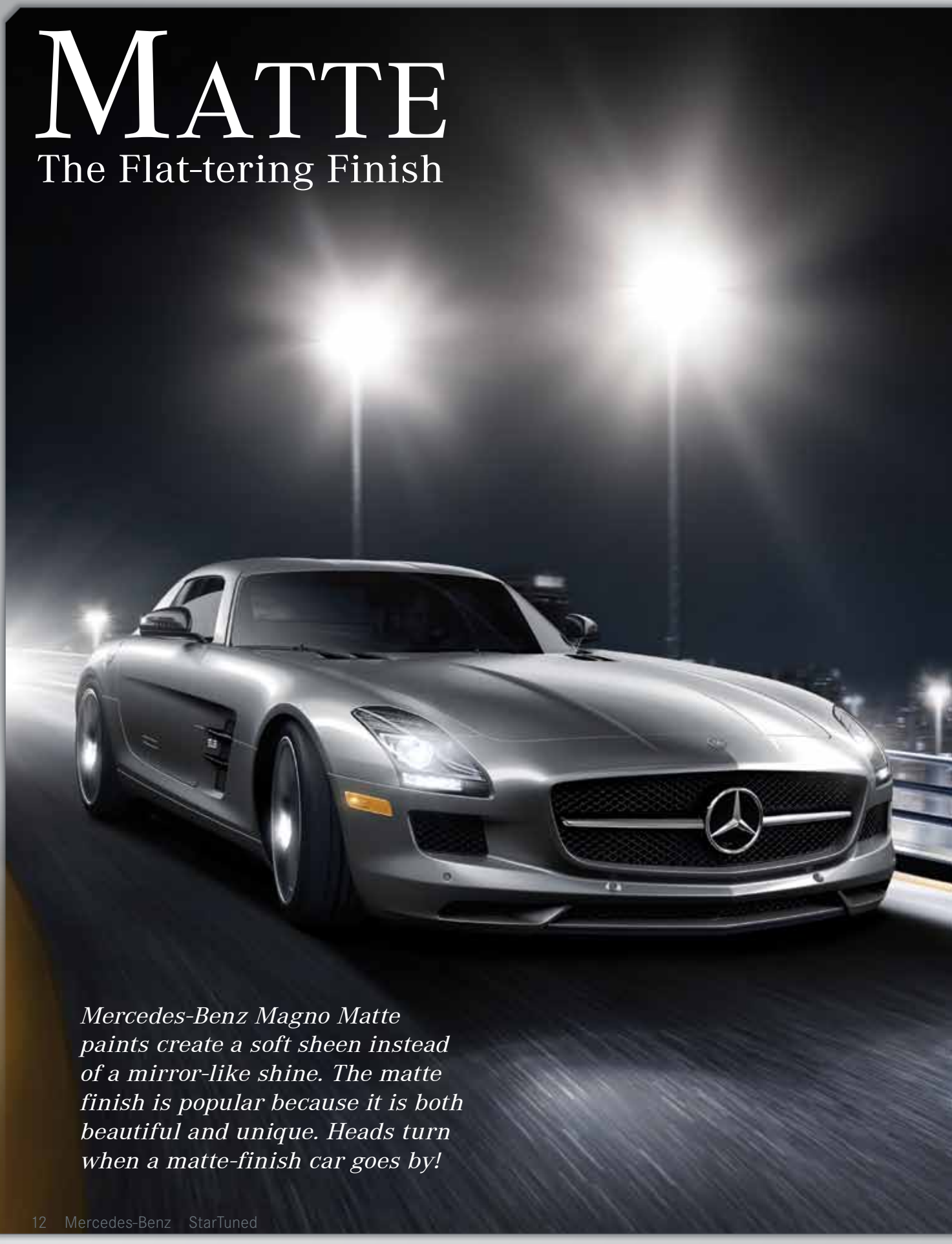
Speaking of lights, we should mention that more shops burn from droplight accidents than from anything else. Whenever you're working around fuel, use only the LED or enclosed fluorescent type.

Ramping

Taking a good look at the waveforms the electric motor generates can help you predict how much life that pump has left in it, but the "current ramping" idea isn't cut and dried. It's easy enough to tap into the circuit with a lab scope or graphing multi-meter so that you can actually see the waveform, but interpretation is subjective. You really need to use exactly the same piece of equipment in exactly the same way over and over to collect a database before you can be sure of what you're looking at. Still, with a little comparative experience, it'll help you nail down those elusive intermittents. |

You can use a lab scope or a graphing multi-meter to observe the waveforms the pump's motor is generating. With experience and experimentation, this will help you predict how much life is left in it.

Matte
The Flat-tering Finish



Mercedes-Benz Magno Matte paints create a soft sheen instead of a mirror-like shine. The matte finish is popular because it is both beautiful and unique. Heads turn when a matte-finish car goes by!

As more and more people are wowed by that stylish Mercedes-Benz matte finish, it's logical to assume that you'll soon be seeing this type of paint in your collision shop. Here's what you need to know to maintain that distinctive appearance when repairing this type of finish.

To begin with, regular gloss paint reflects 90% or more of the light that hits it. The reflection is uniform and mirror-like. Matte finishes reflect only 20% of the light. The remaining 80% is so diffused that the reflection of an object is not recognizable on a matte-finished surface.

In the clear

Don't let the dramatically-different appearance of the Mercedes-Benz matte finish intimidate you. You'll be happy to hear that the matte effect is entirely in the clearcoat, and that the other paint layers are similar to those of traditional gloss finishes. The low sheen is obtained by the use of different hardeners, reducers, application methods, film thickness, and drying options. Polishing a flat finish results in significant differences in luster compared to non-polished areas, so any final coat errors cannot be buffed out. Dirt in the application of the clearcoat, mottling or striping due to improper spray technique, variations in film thickness, and other visible defects require complete repainting of the final topcoat. For this reason, Mercedes-Benz strongly encourages the use of the procedures and materials recommended by matte paint system manufacturers.

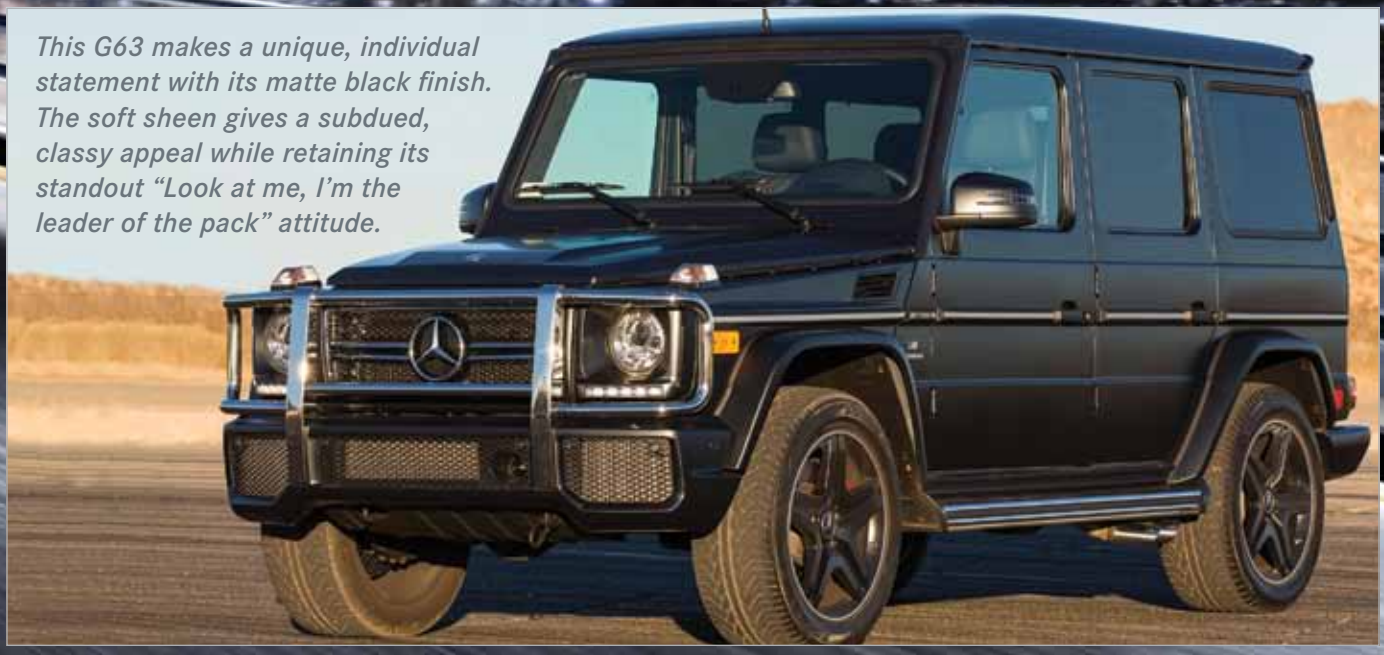
Matching: More than just a formula

Of course, the paint manufacturer's recommended mixing formula is important. Even minor deviations from the recommended ratio of hardener and reducer to the clearcoat paint itself will lead to significant changes in the level of "matting" (gloss reduction).

But matching a matte finish is more than just formula numbers. It requires careful visual inspection. You must pay attention to both color and gloss level. Different areas of the vehicle body may require different gloss levels. Film build can cause a color shift if painting over OE clearcoat.

Additionally, the gloss level for the vehicle being painted may have changed due to its age and cleaning history. This may, for example, necessitate painting the entire side of a vehicle instead of just the damaged panel in order to produce a matched gloss appearance on that side.

Other factors affecting the degree of gloss in your finished job include whether the hardener and reducer are slow- or fast-acting, whether you



This G63 makes a unique, individual statement with its matte black finish. The soft sheen gives a subdued, classy appeal while retaining its standout "Look at me, I'm the leader of the pack" attitude.

Procedural photos courtesy DuPont Performance Coatings

Color test panels are absolutely critical to match both color and gloss level to the vehicle being painted. Prepare several test panels, each featuring different mixing ratios of matting agent and clearcoat, and different wet/dry spraying methods.

use a relatively dry or wet spray method, dry film thickness, ambient temperature, flash-off time, and drying method. Different combinations of these factors can alter gloss level by up to 20%.

This variability makes color/gloss test panels mandatory. After looking up the color formula recommended by the matte paint system manufacturer, spray at least three test cards with different ratios of matting agent (flattener) and clearcoat.

After drying (colors will appear significantly darker when dry), compare each test card to the vehicle, and evaluate both color and gloss level. Check in natural daylight. Hold the card against the vehicle surface to ensure that your viewing angle and light source are the same as for the area being repaired.

Spray consistency is key

"Mottling" describes a finish that looks streaked, spotty, or striped. It is often the result of an unbalanced spray pattern, or not observing the proper flash time between basecoat and clearcoat.

Preparation is your quality assurance

Paint will not stick to dirt or oil-based contaminants. Before and after sanding and between undercoats and topcoats, pre-clean the surface with wax and grease remover.

Proper preparation for a matte refinish is necessary to the success (and efficiency) of your paint job. Because you cannot sand or polish a matte finish, removal of any dirt or imperfections in the topcoat requires a complete re-do.

Even before you start sanding to level and prepping the surface for paint adhesion, you must remove any oil-based contaminants by wiping the surface with the wax and grease remover recommended by the approved matte paint system manufacturer. Do not substitute thinner or reducer in place of the wax and grease remover as this is likely to cause fisheyes when you apply the paint.

After sanding, remove any dust and residue with the cleaning agent recommended by your matte paint system manufacturer.

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For example, if one pass is heavier than the others, that area may appear glossier after curing. Try to spray so that you maintain a wet edge, but that no one pass is heavier than the others.

Tilting the spray gun can place more paint at the top or bottom of the pattern, making film thickness uneven in that area. If you paint while too tired (don't expect sympathy from the boss), you may inadvertently allow your arm to drop while spraying. This tilts the spray fan up, resulting in more paint being deposited on the bottom portion of the pass than at the top, and, bingo, you've created a horizontal stripe in your finish.

Experiment with overlap. If a 50% overlap leaves light streaks between passes, try 75%. Be sure to maintain consistency with each pass.

To further reduce the appearance of striping, spray in two different directions in the same coat. After you've completely covered the panel with horizontal passes, cover again in that same wet coat using vertical strokes.

You can also help prevent mottling by using the correct spray gun settings (needle/nozzle/pressure), holding the gun perpendicular to the surface being sprayed, and following the matte paint system's recommended flash and dry times.

Spot repairs? Polishing? Not with matte paint!

All manufacturers of matte paint systems recommend edge-to-edge application of matte clearcoat on panels being repaired. Differences in film build, paint age, cleaning history and other factors make a spot repair likely to reflect light differently from surrounding areas. The blended section stands out, which is by definition unsatisfactory with matte or flat finishes.

There can be no de-nibbling or polishing of matte or flat finish topcoats. Any rubbing or polishing to eliminate imperfections will increase the gloss level in the area where mechanical pressure is applied.

Dirt can be removed at the basecoat stage, or after the first coat of clear has flashed off.

Evaluate test panels on the surface to be painted. Try to judge the test panel's color and gloss level at the same light angle and intensity as the finish on the vehicle.

Matte clearcoats flash off faster than traditional gloss paint, so you must maintain a wet edge as you spray. Experiment with the amount of overlap in each spray pass.

If inspection reveals any dirt in the final clearcoat, the job must be re-prepared, and the full repair area clearcoated again.

Lovin' from the oven

Matte finishes are often baked or air dried. Oven-dried finishes may have slightly more gloss than those that are air-dried, so be sure to follow the paint manufacturer's drying recommendations. Never use infrared (IR) drying as it does not allow the proper solvent die-back. For the same reason that you don't like die-back in a traditional paint job – it flattens color by reducing gloss – you want it in a matte or flat finish.

Similarly, be careful not to spray your clearcoat too wet. A heavy spray may leave too much solvent remaining during the curing process, which prevents gloss die-back to the proper level for the desired soft matte sheen.

You won't be able to tell if you have too much gloss until curing is complete. The clearcoat goes on glossy as normal and dries flat. By then, if you notice too much gloss it is too late for anything but a removal and re-spray of the last clearcoat application.

Pay attention to the paint manufacturer's recommended flash-off and drying times. These companies invest a lot in research and field testing to make sure that their recommended mixing, spraying, and curing techniques produce the best finish.

Mercedes-Benz Approved Matte Paint System Manufacturers

- Glasurit
- R-M
- Standox
- Spies Hecker
- PPG Refinish
- Henkel (Teroson)

Refer to the After-sales Paint Technology Guide at https://portal.aftersales.i.daimler.com for further details about approved matte paint systems.

Factors Affecting Degree of Gloss

- HIGHER GLOSS LEVEL
- LOWER GLOSS LEVEL
- Hardener with higher solids content
- Hardener with lower solids content
- Slower hardener
- Faster hardener
- Slower reducer
- Faster reducer
- Higher application viscosity
- Lower application viscosity
- Thicker dry film
- Thinner dry film
- More flash-off time
- Less flash-off time
- Force drying
- Air drying

(Source: Adjusting the Degree of Gloss of Permasolid 2K Clearcoats, Spies Hecker)

Passing inspection

The final matte finish should have a uniformly low gloss. The surface may appear on close inspection to have small patterns and a slight texture, but these are normal matte-finish characteristics.

Looking down on the hood and then across the roof from the same standing position, the gloss level of the two different surfaces will appear different even if they are not. Viewing the surface at approximately 60 degrees reveals less gloss than at a flatter angle. To judge gloss level, try to view an entire side of the vehicle at a consistent angle. Do the same for all horizontal surfaces. When you get it right, seeing that classy matte finish you just applied is very satisfying.

Finally, it is important before embarking on this new procedure (or any other, for that matter) that you carefully read everything about it in WIS, the ultimate authority. |

Matte painting requires edge-to-edge application on the panel being repaired. A blended section would reflect light differently compared to surrounding areas, making the repair unsatisfactory.

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GENUINE MERCEDES-BENZ REMAN A/C COMPRESSORS

MODEL YEAR	VEHICLE MODEL	REMAN PART NUMBER
1984-1992	190D2.2	A000230121180
1984-2002	260E, 190D2.5, 300TD, 300D, 300CE, SL500	A000230241180
1986-1991	420SEL, 560SEC/SEL, 560SL	A000230251180
1986-1995	190/300 series, E300D	A000230111180
1986-2002	300E, 300CE, 600SL, SL600	A000230051180
1990-2002	500SL, SL500	A000230061180
1992-1993	500SEL	A119230111180
1992-1995	400SE, 400SEL, 500SEC, S420, S500	A119230001180
1992-1999	600SEL, S320, S600, 300SEL	A000230171180
1992-1999	300SE, 600SEC, S600, S320, CL600	A000230221180
1992-2004	CL500, 300/400/500 series, S/SLK/C/CLK/ E-Class	A000230701180
1994-2000	C220, C280, C36 AMG	A000230131180
1998-2005	ML320, ML430, ML55 AMG	A000230681180
1998-2010	ML500, ML350	A001230281180
1998-2010	ML350, ML500, E500, SL500, C/CL/S/G-Class	A000230901180

MODEL YEAR	VEHICLE MODEL	REMAN PART NUMBER
2000-2006	CL600, CL65 AMG, S65 AMG, S600	A001230011180
2000-2009	E320, S350	A000230911180
2002-2007	C32 AMG	A000230781180
2002-2007	C230 CL 1.8	A000230971180
2002-2010	CLK-Class, C55 AMG, SLK55 AMG	A001230191180
2003-2009	CLK500	A001230161180
2003-2010	SL55 AMG	A001230021180
2003-2010	E55 AMG, E320, E500, CLS500	A001230121180
2003-2010	E-Class, CLS55 AMG, CLS550	A001230141180
2003-2010	SL550	A001230551180
2005-2010	SLK280, SLK300, SLK350	A001230541180
2006-2010	R350, R500, ML350, ML500, ML550, GL450, GL550	A001230871180
2006-2010	R350, R500, ML350, ML500, ML550, GL450, GL550	A002230521180
2009-2010	C300, C350	A001230501180
2010	GLK350	A002230311180
2010	E350, E550	A002230381180

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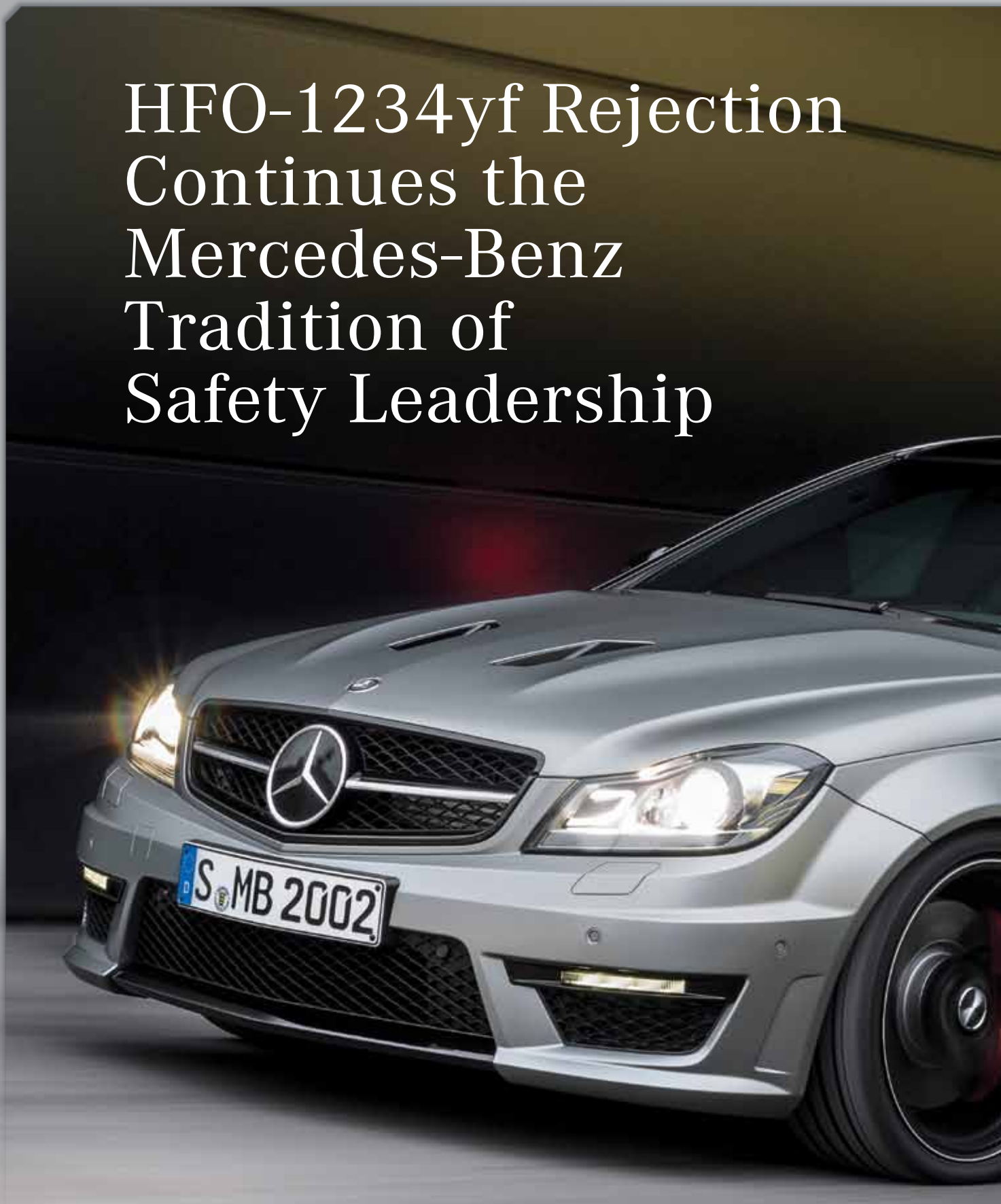
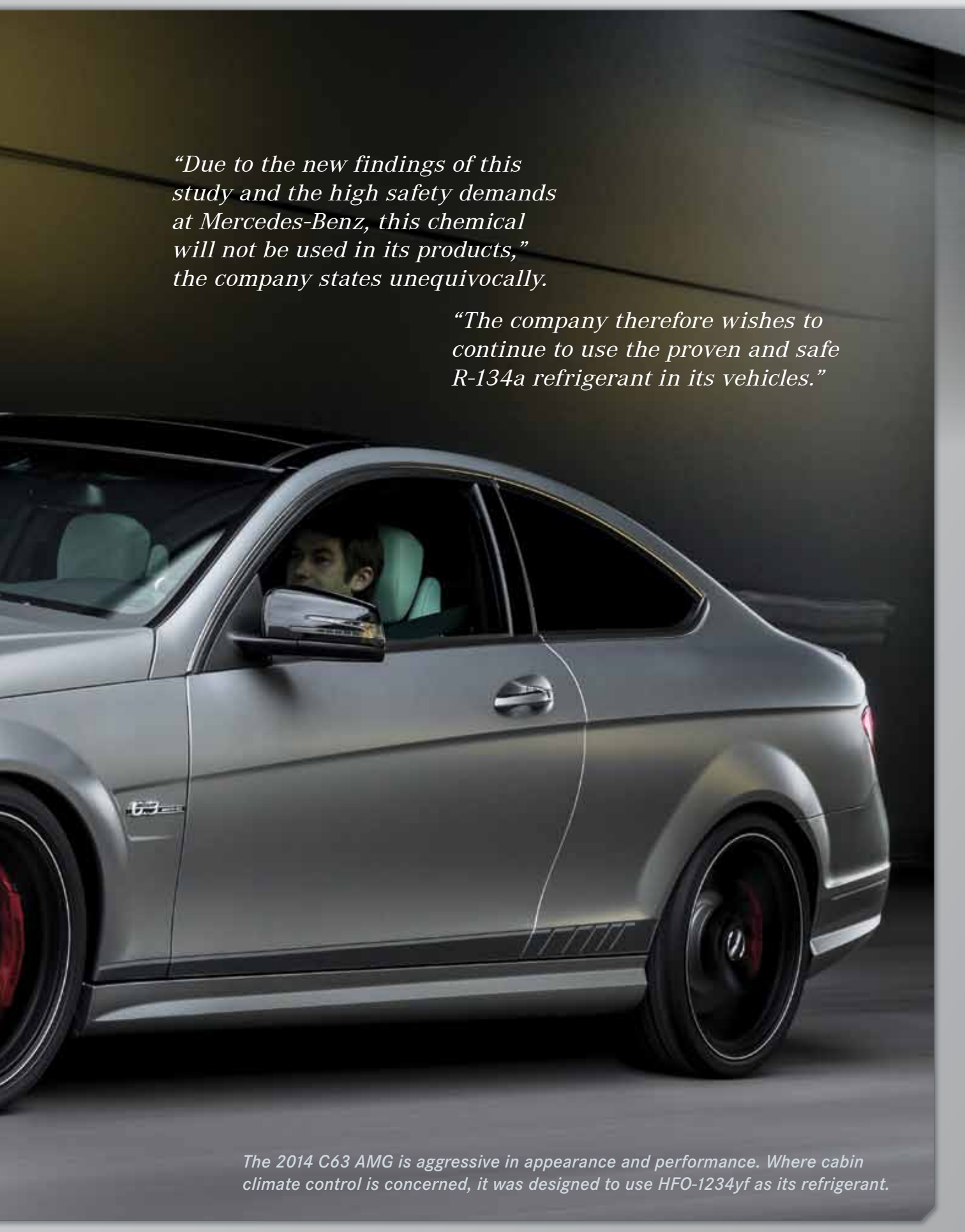
HFO-1234yf Rejection Continues the Mercedes-Benz Tradition of Safety Leadership



"Due to the new findings of this study and the high safety demands at Mercedes-Benz, this chemical will not be used in its products," the company states unequivocally.

"The company therefore wishes to continue to use the proven and safe R-134a refrigerant in its vehicles."



The 2014 C63 AMG is aggressive in appearance and performance. Where cabin climate control is concerned, it was designed to use HFO-1234yf as its refrigerant.

Mercedes-Benz has an unrivaled history of safety innovation that goes back more than 60 years. In 1951, the company introduced the first reinforced passenger compartment with front and rear crumple zones. It was also the first to use anti-lock brakes in 1978, traction control in 1986, air bags in the North American market in 1988, electronic stability control in 1995, side curtain airbags in 1998, adaptive high beams in 2009, among many other safety innovations.

So it should come as no surprise that, after extensive research has shown a flammability risk in vehicles using the European Union-mandated refrigerant HFO-1234yf, Mercedes-Benz was the first to reject its use. In a statement released in September, 2012, Mercedes-Benz manufacturer Daimler announced that it would not use HFO-1234yf in its vehicle A/C systems.

HFO-1234yf is a low global-warming potential (GWP) refrigerant that is a leading candidate to replace HFC-134a, the factory-installed refrigerant in use in most vehicles built in the past two decades. HFC-134a is being phased out worldwide in an effort to reduce the direct greenhouse gas emissions related to refrigerant use, and the indirect (CO2) emissions resulting from the increased fuel consumption required to operate mobile air conditioning compared to certain alternatives, such as CO2.

In addition to rejecting the use of HFO-1234yf in future vehicles, Daimler has begun retrofitting to HFC-134a its Mercedes-Benz vehicles that had already been produced with HFO-1234yf A/C systems and refrigerant. A company spokesperson said that such retrofitting is a temporary measure until safer and more environment-friendly refrigerants and mobile air conditioning technologies become available.

How we got here

Carbon dioxide (CO2) is the gas that is the largest single contributor to the "greenhouse effect," which many believe causes global

The AMG's A/C service ports are visible on the right. While not compatible with those for R-134a, they don't look that much different, and a retrofit can easily be made.

warming. For comparison purposes, the global warming impact of CO2 is pegged at 1, and the GWP of any other gas is measured in multiples of CO2. Using the CO2 yardstick, HFC-134a has a GWP of 1,430, meaning it is 1430 times more harmful to the atmosphere. The proposed new refrigerant HFO-1234yf has a GWP of 4.

The European Union's European Commission (EC) in 2006 issued a Mobile Air Conditioning (MAC) Directive limiting passenger car refrigerant GWP to below 150 for any new types of vehicles manufactured beginning in 2011, and for all new vehicles registered in Europe beginning in 2017. The MAC Directive effectively bans HFC-134a from passenger car use.

U.S. refrigerant manufacturers DuPont and Honeywell co-developed HFO-1234yf, a fluorinated gas that meets the EC GWP requirements. The manufacturers claim that HFO-1234yf is a near drop-in replacement for HFC-134a. Its cooling capacity and COP (a ratio of cooling output to the compressor power required to generate that temperature change) are each within 5% of that of HFC-134a. Use of HFO-1234yf requires new vehicle manufacturers to make only minor A/C system design modifications, including new service fittings and a more substantial evaporator.

HFO-1234yf has a mild flammability risk that, according to Honeywell and DuPont, is contained with minimally modified A/C technology. Those modifications include routing A/C hoses away from high heat sources, as vehicle manufacturers do with fuel and hydraulic lines.

European companies including Daimler are less relaxed about flammability. They cite research showing that when burned, HFC-1234yf produces hydrogen fluoride (hydrofluoric acid), a highly toxic and corrosive gas. Daimler and other German carmakers lobbied for consideration of alternative refrigerants. The case for delay of MAC Directive enforcement was helped when Honeywell and DuPont reported they would not reach full production capability of HFC-1234yf until the fourth quarter of 2012 at the earliest. The European Commission delayed MAC Directive implementation until 2013 to build refrigerant production capacity and to allow manufacturers time to explore potential alternative MAC technologies.

Beyond laboratory tests

On three separate occasions in recent years, the Society of Automotive Engineers (SAE) International has organized Cooperative Research Projects (CRP) to investigate whether HFO-1234yf or some alternate refrigerant better meets mobile A/C safety and global warming standards. American, European, and Asian vehicle manufacturers, including Daimler, participated. HFO-1234yf passed the SAE cooperative research project testing. It met industry safety standards including those set by the U.S. EPA and the German Automotive Association.

Although Daimler participated in the SAE cooperative research project studies, the company saw a need to go beyond laboratory tests. It simulated a head-on collision by crashing a vehicle against a wall on a safety test track. The resulting refrigerant fire shows that there is a higher flammability risk than seen in lab tests, according to Daimler.

The hydrogen fluoride gas that's produced when "twelve thirty-four" burns in the engine compartment quickly infiltrates the cabin. It's so corrosive it etched this test car's windows to the point of opacity. This photo is from UBA, the German Federal Environment Agency.

The company reports its test proves that in "a serious head-on collision in which the refrigerant line is severed... the refrigerant, which is otherwise difficult to ignite under laboratory conditions, can indeed prove to be flammable in a hot engine compartment. Similar tests of the current HFC-134a refrigerant did not result in ignition."

In the Daimler test, the HFO-1234yf refrigerant ignited within two seconds, and produced hydrogen fluoride. The corrosive gas penetrated the passenger compartment in high-enough quantity and potency to etch the windshield, turning it milky white. Hydrogen fluoride poses a serious health risk for passengers who may become exposed during a refrigerant fire in the aftermath of an automobile accident. Breathing hydrogen fluoride can burn lung tissue and cause swelling and fluid accumulation in the lungs, according to the U.S. Centers for Disease Control (CDC). Skin contact with hydrogen fluoride may cause severe burns.

Germany's Federal Institute for Materials Research & Testing (BAM) conducted tests that support the Daimler findings. It set up release of HFO-1234yf in real cars and in high heat conditions that would encourage ignition. In its "Final Test Report on Ignition Behavior of HFO-1234yf," BAM concluded that "in nearly all tests in which the refrigerant was released at specified test conditions the detected hydrogen fluoride amounts exceeded critical amounts for human health."

Concerns about potential skin burns and lung damage raised by its own and the BAM tests justified Daimler's decision not to use HFO-1234yf in the A/C systems of its Mercedes-Benz vehicles. Daimler has made the results of its tests available to the SAE cooperative research project and to key automotive manufacturers and associations, and is actively encouraging the industry to explore alternatives to HFO-1234yf.

Wiggle room

In response to Daimler's September 2012 announcement of its intent to continue using HFC-134a, the European Commission Technical Committee – Motor Vehicles (TCMV) announced in December that the MAC Directive would be enforced as planned beginning January 2013.

A European Commission "Framework Directive" issued in 2007 established legal guidelines for the vehicle "Type" approval process. However, the law is a bit vague about when a vehicle is considered a "new" type and must therefore meet the Type requirements of the Framework Directive. By simply not labeling their HFC-134a systems as part of a new vehicle "Type", manufacturers could continue using the existing refrigerant in 2013.

This uncertainty left room for Daimler and other interested parties to delay the launch of HFO-1234yf A/C systems in their 2013 vehicles. They have instead continued lobbying for MAC Directive approval of alternatives to HFO-1234yf.

The German Association of the Automotive Industry (VDA) said it may take at least half of a year "to quantify the risks further and develop appropriate countermeasures." Options being considered include modifying the A/C system to enhance HFO-1234yf safety, re-formulating the refrigerant, or switching to a different refrigerant altogether. At least one other major German vehicle manufacturer has, since the Daimler announcement, publicly encouraged consideration of R744 (CO2).

Take another look

Although HFO-1234yf has been approved by previous SAE International CRP studies, Daimler's 2012 rejection of the refrigerant led SAE to establish a new CRP team to update its review. The team includes thirteen global OEM members and is studying new data from several that completed HFO-1234yf tests after the prior CRP studies were finalized.

The CRP is also reviewing the design and safety requirements for potential use of R744 in mobile A/C systems. Systems must contain the higher operating pressures of R744 (up to 3,000 psi, or 200 Bar!), which is likely to drive vehicle production costs up. The design must also prevent release of CO2 into the passenger compartment, where it can impair the driver's response to road conditions. If this containment requires

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underhood R744 heat reduction to be transmitted to another medium that travels through a "secondary loop" into the passenger compartment, system cost will increase and cooling efficiency will decrease. Publication of the CRP findings is planned for the second quarter of 2013.

HFO-1234yf and R744 Get U.S. SNAP Approval

The U.S. EPA Significant New Alternatives Policy (SNAP) program in 2012 listed both HFO-1234yf and R744 as acceptable substitutes for ozone-depleting refrigerants in mobile air conditioning systems. EPA made SNAP approval of R744 systems subject to the following conditions:

1. CO2 levels in the passenger compartment must not exceed a short-term exposure level (STEL) of 3%, or 30,000 ppm, over a 15 minute period, and must not exceed an absolute limit of 4%, or 40,000 ppm. Vehicle manufacturers must test periodically and document over the first three years of a new CO2 system design that gas levels in the passenger compartment do not exceed these limits.
2. The system must include a high-pressure cut-off switch and a high-pressure warning label to alert technicians of potential danger during service.
3. Low- and high-side service ports must have fittings that differ in outside diameter from those of non-CO2 MAC systems.

Technician certification is necessary

SAE International has published new guidelines specifying what training a technician needs in order to properly diagnose and repair an A/C system that uses either HFO-1234yf, or R744. Technicians may be trained in either or both refrigerants. SAE standard J2845 requires that technicians be trained to correctly recognize which refrigerant a given vehicle or piece of

Tool and equipment makers have been busy engineering products for this dubious new refrigerant, such as this highly-sensitive identifier. If the industry ends up leap-frogging to CO2 (also known as R-744) systems because of the anti-HFO-1234yf movement led by Mercedes-Benz, all that work may represent a dead end. (Courtesy Neutronics.)

equipment contains, and to understand how to handle the refrigerant safely and without release into the atmosphere. They must also have access to the relevant service procedure information and the equipment and tools that are required by law to be used with each refrigerant.

The Mobile Air Conditioning Society (MACS) Worldwide announced in September, 2012 that it has developed the first program to meet SAE J2845 training requirements. The MACS program trains technicians on the proper servicing of HFO-1234yf A/C systems.

The U.S. EPA has yet to announce any changes to its Section 609 technician certification requirements. However, the mild flammability of HFO-1234yf and the higher pressures and driver impairment potential of R744 suggest that the agency will make the training specified in SAE J2845 mandatory.

The lure of easy money

HFO-1234yf may cost as much as ten times more per ounce than HFC-134a. Environmental groups complain that the price differential is a major temptation to re-charge an HFO-1234yf system with HFC-134a. The fact that both refrigerants are compatible with most components of the newer system makes it easy to substitute HFC-134a during a repair.

If a shop gives the customer the choice, many will take the lower cost option. An unscrupulous shop can simply add the lower-cost HFC-134a, charge the HFO-1234yf price, and pocket the difference. Either way, the likelihood that the vehicle gets HFC-134a is high, and the claimed environmental benefit of the switch to HFO-1234yf is lost.

High stakes

The Daimler rejection of HFO-1234yf has the mobile air conditioning industry holding its collective breath. A/C system developers, vehicle manufacturers, tool and equipment makers, and service providers have all invested significantly in HFO-1234yf. Only a few vehicles have so far entered the U.S. market with HFO-1234yf installed. Some carmakers have said they plan to introduce HFO-1234yf into their lines over the next few years, and others have been testing and tooling up for their entries.

For the time being, there's no reason for you to worry about anything beyond your supply of trusty and much less expensive R-134a.

As far as you, the independent auto service specialist, are concerned, the most important thing to understand from this complicated, politically-fraught situation is that you should hold off on purchasing dedicated HFO-1234yf service equipment, or attending training on this refrigerant for the time being. Daimler's safety innovations have changed the automotive landscape many times before. With this leadership stance against HFO-1234yf, it may do so again. |

Mercedes-Benz Mobil1

Product Name	Part Number	Quantity	Product Description	Recommended Consumer Applications
Mercedes-Benz SPEC.				
Mobil 1 Formula M 5W-40	BtQ 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		
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 Formula M 5W-40	BQ 1 09 0135	Bulk - No Equipment	Advanced full synthetic formulas designed specifically for diesel passenger cars that have particulate filters	Low SPAsh. Available at most MB dealers
	BQ 1 09 0142	6/1 Quart Cases		
	BQ 1 09 0143	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® 1/2 Gal.	A 000 583 0107	1/2 Gallon Bottle	Non-toxic solution that transforms harmful Nitrogen Oxide (NOx) emissions from diesel-powered vehicles into harmless water vapor and nitrogen	Recommended for use in Mercedes-Benz, Volkswagen + BMW AdBlue® (DEF) applications
Diesel Exhaust Fluid 55 Gal	BQ 1 47 0002	55 Gallon Drum		
Mobil 1 5W-30	BQ 1 09 0017	6/1 Quart Cases	Advanced full synthetic formulation designed to meet the requirements of many domestic, including GM, and imported vehicles	Vehicles that require 5W-30. Corvette approved.
	BQ 1 09 0018	55 Gallon Drum		
Mobil 1 10W-30	BQ 1 09 0019	6/1 Quart Cases	Advanced full synthetic formula designed for domestics and imports	Vehicles that require 5W-30 or 10W-30
	BQ 1 09 0020	16 Gallon Keg		
	BQ 1 09 0021	55 Gallon Drum		
Mobil 1 5W-20	BQ 1 09 0083	6/1 Quart Cases	Advanced full synthetic formulation designed to meet the requirements of many newer vehicles including Hondas, Fords, Chryslers, and newer Toyotas	Vehicles that require 5W-20
	BQ 1 09 0084	55 Gallon Drum		
Mobil 1 0W-20 AFE	BQ 1 09 0169	6/1 Quart Cases	Advanced full synthetic formulation designed for enhanced fuel economy and cold weather performance	Most vehicles that specify 0W-20 (newer Toyotas and Hondas), 5W-20 and certain hybrids
	BQ 1 09 0168	55 Gallon Drum		
Mobil 1 0W-30 AFE	BQ 1 09 0174	6/1 Quart Cases	Advanced full synthetic formulation designed for enhanced fuel economy and cold weather performance	Most vehicles that specify 5W-30 or 10W-30
Mobil 1 Synthetic ATF	BQ 1 09 0164	6/1 Quart Cases	Multi-vehicle, fully synthetic fluid designed to meet the demanding requirements of modern passenger vehicles	Vehicles that require Dexron III, Ford Mercon and Mercon V performance levels
	BQ 1 09 0163	55 Gallon Drum		
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
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		

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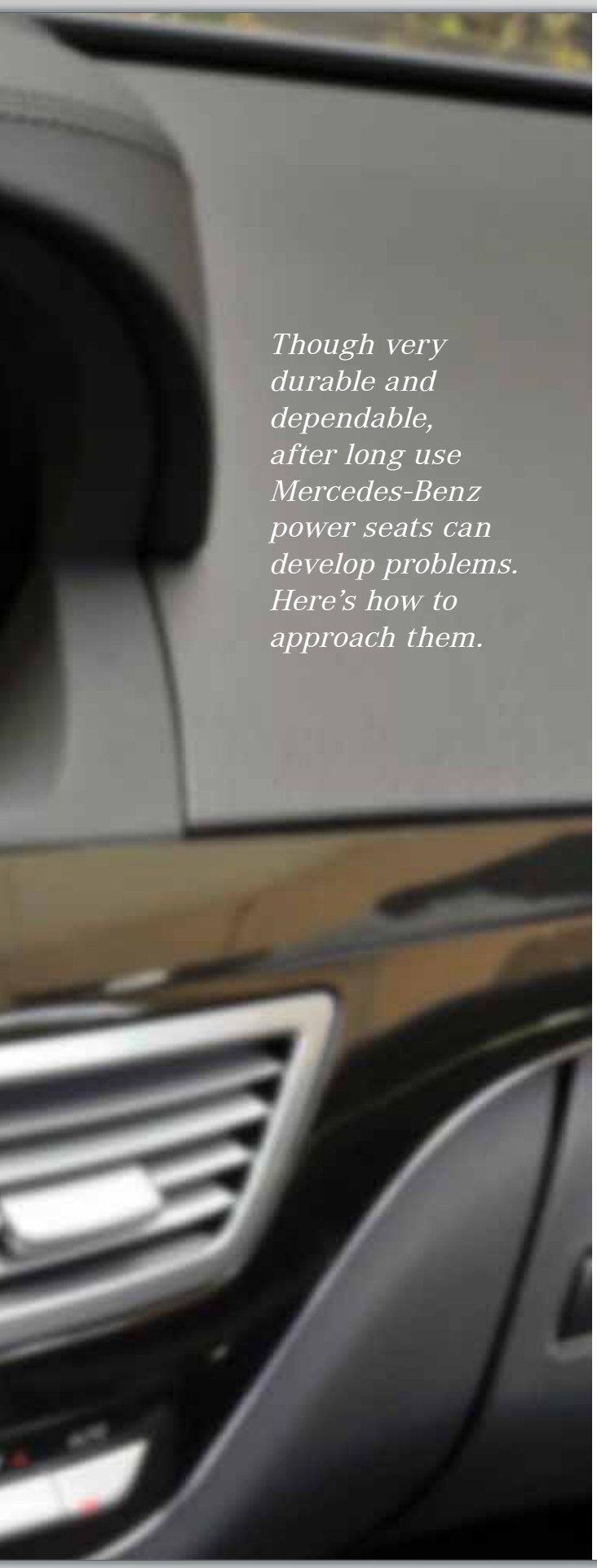
Product Name	Part Number	Quantity	Product Description	Recommended Consumer Applications
Mercedes-Benz SPEC.				
Mobil Special 10W-30	BQ 1 09 003164	Bulk - No Equipment	Formulated from quality base stocks combined with modern performance additives to give the engine the expected protection and performance 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
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		
Delvac 1300 Super 10W30	BQ 1 09 0086	Bulk - No Equipment		
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		

Diagnosing Power Seats



Though very durable and dependable, after long use Mercedes-Benz power seats can develop problems. Here's how to approach them.

Remember the days when you had to use leg power to move a seat forward or back? There was a lever underneath the seat between your ankles that had to be pulled, then you would slide the seat back and forth manually (footly?). What a hassle! Also, if you lacked the necessary coordination and power it could get comical, especially on hills. Thankfully, somebody had the great idea to electrically power seats in a way that allowed anyone to work a switch to move the seat to where you wanted it -- to a position that gave you safe control. As the years went on, engineers incorporated more everyday conveniences into the automotive seat. A modern Mercedes-Benz vehicle can be ordered with seats that are heated and ventilated, and with adjustable bladders that massage and support your back and sides. Ah, the comfort. Nobody wants to give that up. So, let's talk diagnosis.

Orthopedic dream

Power adjustable seats in the Mercedes-Benz world can be deceptively complex. How difficult can it possibly be to diagnose a defective power adjustable seat? Well, it can be tricky, but is much easier when you have SDS to help you find the problem. Our test subject will be a 2007 Mercedes Benz S550. At its launch, the seats of the W221 chassis were recognized by the European Orthopedic Society as having the best design of all automobiles. Not bad, and it shows that extensive engineering went into the design of this seat to make it more comfortable while meeting the extremely high safety standards of all Mercedes-Benz vehicles.

How does it work? The frame bottom, back and headrests are adjusted via electric motors bolted to the track and frame. For lumbar support and the massage function it uses several bladders that are independently inflated/deflated to adjust the size and stiffness of the cushions. These same bladders are used in the Dynamic Seat function. Dynamic Seat uses steering sensor input to instantly inflate the outside cushions, relative to the direction you are turning, to help hold the driver in a more upright and stable position. The heated surface feature is achieved through an electric element with high resistance that

converts 12V electrical energy into heat. This element sits between the cushioning foam and the leather covers. The ventilation of the seat works by means of small fans embedded in the cushions, pulling air through the perforated leather covers.

What goes wrong? The most common problem with the seats is when they stop moving. If this happens, the first thing you have to do is an operational check. What exactly doesn't work? Does the seat move forward, but not back? Does it recline? Do the headrests work? By doing this you can narrow down what the probable source of the problem is. If only one motor fails, you can rule out a problem with rest of the system. If nothing works, then you know there is a larger issue. So, the second thing you should do is a short test to search for any fault codes.

If SDS can communicate with the seat control module, then that is a good sign -- it means the module is probably okay. Often, what you see is what's shown in Figure 1.

What does this mean? "No normalizing" means that the seat control module does not know the location of the seat track in a given position. The module likes to know where each electric adjusting motor is on its path of travel. How far away is the end stop? It needs this information to make a map of how far back the seat is, how high it is, the inclination of the backrest, and the height of the headrest. That way, when the driver adjusts the seat back, the headrest automatically rises to accommodate a taller driver in the seat.

If the module has faulty information, bad things can happen. For instance, the seat may move in the opposite direction desired, or clearance issues with the headrest and headliner may occur.

First, you should check actual values in the seat control module (Figure 2).

How do we resolve this? SDS has a function in the "Adaptation" menu for normalizing the seat automatically. Select this function and let it run, you will get a report (Figure 3).

If the procedure fails, the program will alert you as to which motor didn't normalize. This will help you narrow down the source of the fault. The motors have built-in Hall-effect sensors. If you get a fault code for the sensor of a given motor, it means the motor is defective. A caveat: If there are any obstructions on the track, such as a coin or soda can, the seat will not normalize properly.

How does the module lose this data in the first place? Almost always, it is a case of low battery voltage. If the car has a weak battery and the voltage drops below 11.0V, the module

The Dynamic Seat function uses steering sensor input to instantly inflate the side cushions in tight turns to keep your body more stable.

Vehicle 221.177 Control unit ESA-FL

Event memory

Checked fault codes

Unchecked fault codes

Reading cycle

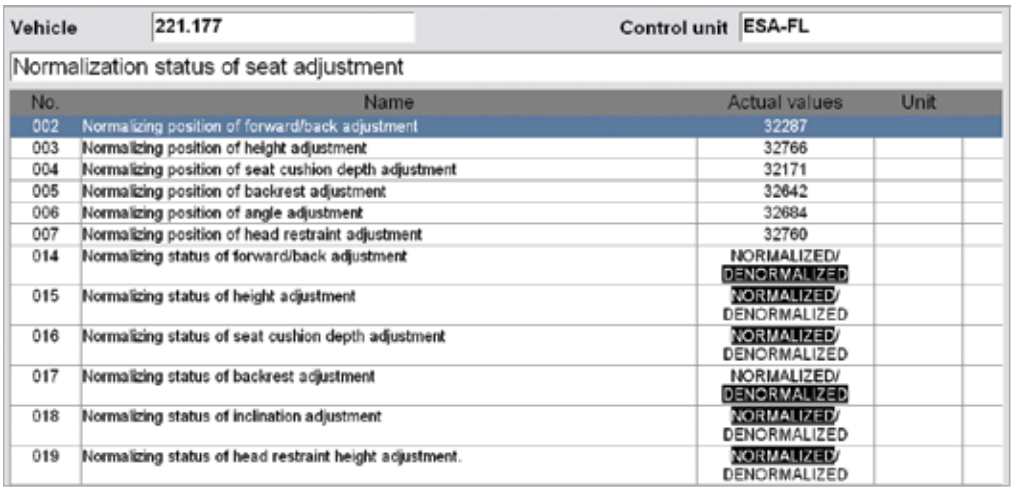
Code	Text	No.	Status
9060	No normalizing of forward/back adjustment.	0	Event CURRENT and STORED
9061	No normalizing of inclination adjustment.	0	Event STORED
9067	No normalizing of seat cushion depth adjustment.	0	Event STORED
9064	No normalizing of backrest adjustment.	0	Event CURRENT and STORED
9099	Initial startup is not yet completed.	0	Event CURRENT and STORED
9062	No normalizing of height adjustment.	0	Event STORED
9063	No normalizing of head restraint adjustment.	0	Event STORED

Figure 1

might "forget" the normalization data. Fix the battery issue, then re-normalize all the seats, and recheck. If the problem persists, either an individual motor (which would throw a fault code), or the module is at fault.

Seat heat?

What to do when the seat heater doesn't work? The first thing is to verify that the red LED indicators in the seat heater switch come on when the button is pressed (engine running). If that is the case, then the problem resides in the seat itself. If the LEDs do not come on, perform a short test with the SDS and process the faults. To check the circuit, look for the heated seat connector underneath the cushion. You will see a four-pin connector that splits into two separate two-pin connectors. This is the junction where the seat bottom cushion and seat back cushion heaters get their power. If you are getting power at this connector, check to find out whether or not there is an open in the seat side. To do this, disconnect and split the connector and ohm out the heater elements separately. An open indicates a defective element, which means the cushion must be replaced.

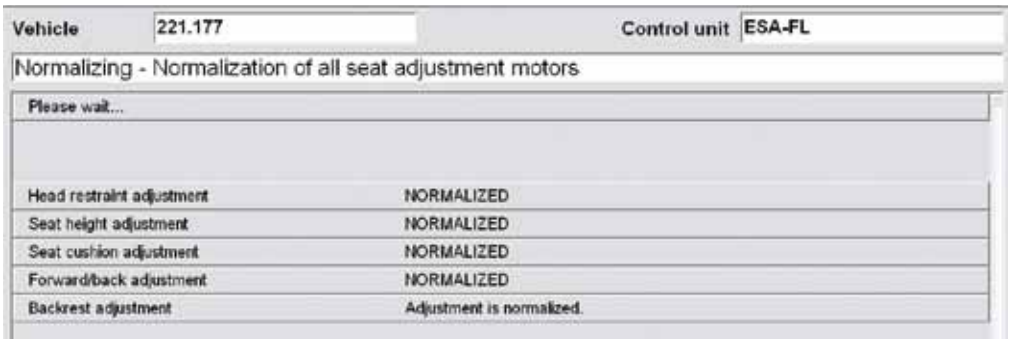


Vehicle 221.177 Control unit ESA-FL

Normalization status of seat adjustment

No.	Name	Actual values	Unit
002	Normalizing position of forward/back adjustment	32287	
003	Normalizing position of height adjustment	32766	
004	Normalizing position of seat cushion depth adjustment	32171	
005	Normalizing position of backrest adjustment	32642	
006	Normalizing position of angle adjustment	32684	
007	Normalizing position of head restraint adjustment	32760	
014	Normalizing status of forward/back adjustment	NORMALIZED/ DENORMALIZED	
015	Normalizing status of height adjustment	NORMALIZED/ DENORMALIZED	
016	Normalizing status of seat cushion depth adjustment	NORMALIZED/ DENORMALIZED	
017	Normalizing status of backrest adjustment	NORMALIZED/ DENORMALIZED	
018	Normalizing status of inclination adjustment	NORMALIZED/ DENORMALIZED	
019	Normalizing status of head restraint height adjustment.	NORMALIZED/ DENORMALIZED	

Figure 2



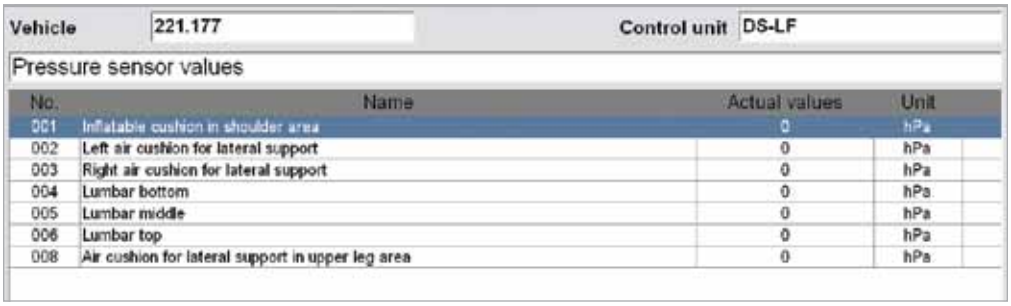
Vehicle 221.177 Control unit ESA-FL

Normalizing - Normalization of all seat adjustment motors

Please wait...

Head restraint adjustment	NORMALIZED
Seat height adjustment	NORMALIZED
Seat cushion adjustment	NORMALIZED
Forward/back adjustment	NORMALIZED
Backrest adjustment	Adjustment is normalized.

Figure 3



Vehicle 221.177 Control unit DS-LF

Pressure sensor values

No.	Name	Actual values	Unit
001	Inflatable cushion in shoulder area	0	hPa
002	Left air cushion for lateral support	0	hPa
003	Right air cushion for lateral support	0	hPa
004	Lumbar bottom	0	hPa
005	Lumbar middle	0	hPa
006	Lumbar top	0	hPa
008	Air cushion for lateral support in upper leg area	0	hPa

Figure 4

The seat ventilation is checked in a similar manner. The fans are either running when the blue LED in the switch is on, or it is not. But beware: The effect is very subtle and might be hard to feel. Use a sheet of paper to check if it's working. If the sheet is sucked to the seat, then the fans are running. If the fans are not running, check the wiring.

Dynamic Seat Function

Now comes the more complicated part: What if the Dynamic Seat function doesn't work? For this you almost certainly need SDS. The first step, as always, is to perform a short test. Also, search for any available software updates for the Dynamic Seat Control. If there is a code for a steering angle sensor, address that first. If you have fault codes for a leak in the system, SDS will help you find it. As mentioned before, the bladders are inflated with air individually. This is regulated by a control module and air distribution center called a Module Carrier. A pump supplies the needed air. The first thing to do is check the pressures in the bladders using SDS. Under "Actuations," you'll have the ability to inflate the cushions (Figure 4).

Using this screen, you can check whether or not the pump is working, and also check for leaks. If one or more cushions does not inflate, find the location of the leak. Is it a line? Is it a bladder? Usually, you can listen for this, or use a smoke machine. If the bladder leaks, then the entire bladder package has to be changed. This is a bit of work since you basically have to take the leather cover off to replace the bladder. All this can also be used to find a fault with the massage function.

If you don't have SDS handy, you can enlist the built-in functions of the vehicle to do a quick leakage check. Use the Command Controller in the center console to select the "Seat" menu in the Command screen. Here, you can select all the individual cushions and inflate them. If one or more do not inflate or deflate right away, you have a leak.

At times, you will get codes for a defect in the module itself. There are a series of 'Guided Tests' in SDS that will help you find the problem (Figure 5).

Process these in order to find the problem. We mentioned software updates earlier. Before you get too crazy, flash the control module using SDS and clear the codes. Remember that battery voltage is critical -- low voltage can trigger phantom fault codes.

Vehicle	221.177	Control unit	DS-LF
Complete list of guided tests			
Check power supply of component N32/19.			
Test CAN wiring for Short circuit or open circuit.			
Check alternator.			
Check of 220-V supply to module carrier for seat cushion			
Check of 220-V supply to module carrier for seat backrest			
Check of 220-V supply for module carrier for massage function			
5 V supply			
Test plug connection 3.			
Test plug connection 2.			
Test plug connection 4.			
Module carrier for backrest			
Module carrier for seat cushion			
Module carrier for massage function			
Interior CAN check			
CAN test between control units DS-LF and SCM [MRM]			
CAN test between control units DS-LF and ESP			
CAN test between control units DS-LF and DSP			

Figure 5

Squeaks, Creaks, and Rattles

Let's talk about a very common and very annoying problem: noise, as in squeaks, creaks, and rattles. No matter how well engineered and built a seat is, there's always the possibility of noises occurring. With leather, plastic, and metal all interacting with each other, chances are somewhere a squeal will develop. What to do? Mercedes-Benz sells a kit (Part #000-580-0350) to treat this. The kit includes different types of lubricants and felt tape. Whether it's the leather seat bottom rubbing against the plastic seat trim, or a plastic guide sliding on metal rails, or wherever else two types of materials meet, there is a lubricant in the kit to address it. Think of the noises as vibrations. When the leather rubs against the plastic, it makes a noise. Adding the right lubricant between them will reduce the friction, and, therefore, the vibration. No vibration, no noise. Felt tape can be used where seat covers go over the frame, or where the air bladders contact the seat covers.

Lastly, what to do when the seat refuses to move and you can't get to all the bolts to remove the seat? Before you break out the power tools and hammers, try this: If one of the motors is detached from the rail, try to reach under and reattach it temporarily to move the seat. You can also try powering up motors individually using a battery pack. Just make sure to isolate the motor from the rest of the car and be sure to use a fused connection. |

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