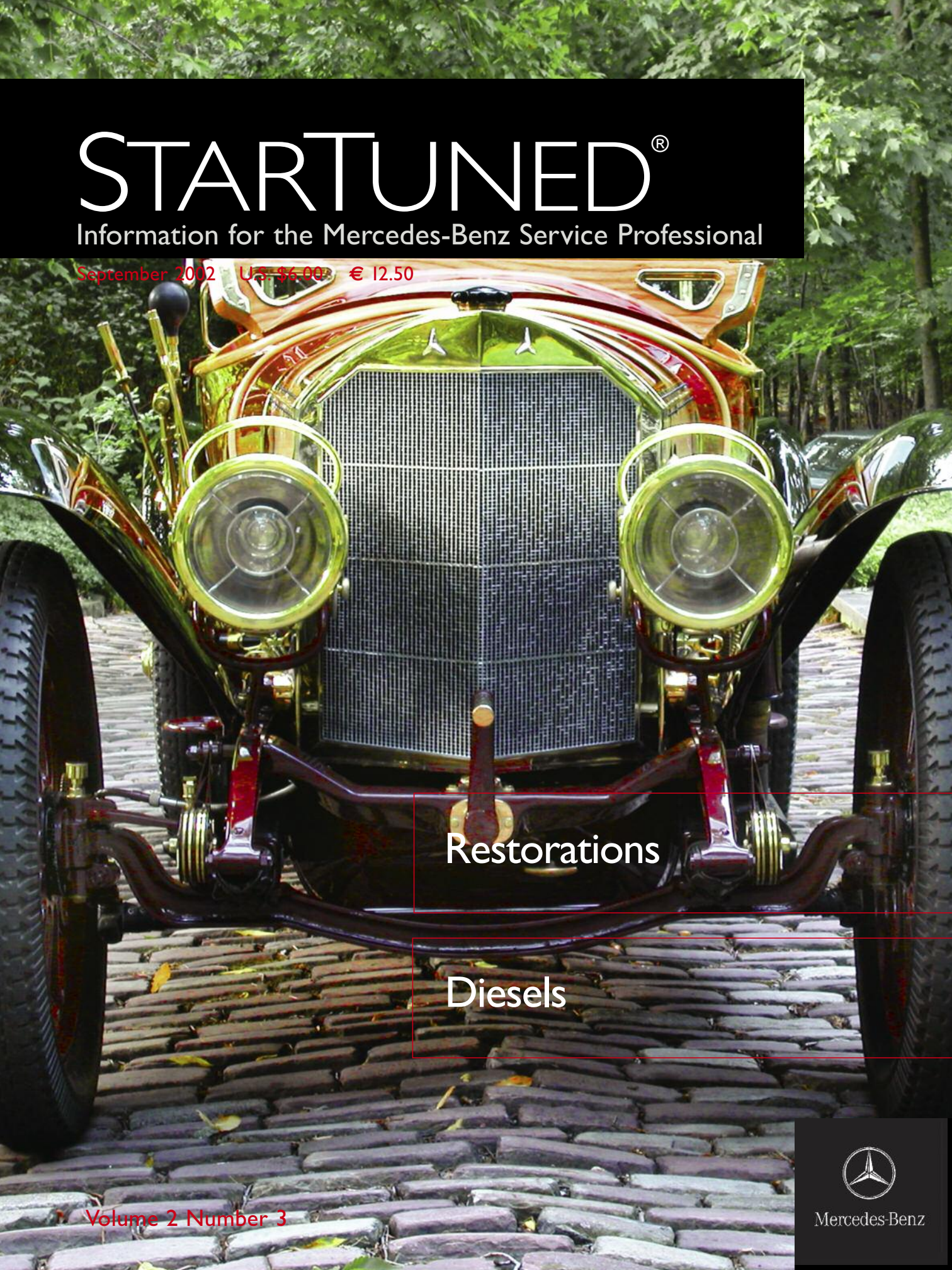
STARTUNED®

Information for the Mercedes-Benz Service Professional

September 2002 US $6.00 € 12.50



Restorations

Diesels

Volume 2 Number 3

Mercedes-Benz

StarTuned Corrections

The sure way to avoid making mistakes is by not taking chances, by not saying anything interesting. Guess we could take that safe course and pad *StarTuned* out with articles about how to market performance tires to retired people, but that would be even more boring to write than to read. We have made some mistakes in past issues, and we expect to make more in future ones. So here, rather than write about marketing tires, are corrections for the goofs we know about:

- Karl Benz' original *Patentwagen* did not have hot-tube ignition, as we wrote in June this year, but an early version of spark ignition, at the very technological forefront of developments back in 1886. Gottlob Daimler's earliest engines *did* use the hot tube, and that's how we made this mistake.
- In the March 2002 issue we mentioned solving a problem with a speedometer cable. That solution is accurate, but we slipped and called it an "accelerator cable" in one place. Hope you didn't swap one for the other!
- In the June 2002 issue, our photo shows the 119 engine in a 140 and the spark plug recesses where, under overvigorous engine compartment cleaning, it is possible to puddle water and short out that cylinder. In the text/caption, however, we mistakenly identified the car as a 126. What can I say? Momentary brainfade. Won't make that boner again, will make some other.
- Catch a mistake in our pages? Tell us. We want to know, and we want to correct it. E-mail us at novaks@mbusa.com or write us at *StarTuned*, Mercedes-Benz, Montvale NJ. And thanks!

StarTuned®

Information for the Independent Mercedes-Benz Service Professional

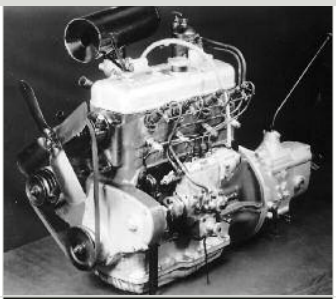
September 2002 U.S. $6.00 € 12.50

Feature Articles

04

The 'Oil Motor'

Mercedes-Benz introduced the first Diesel car in 1936, and the company is still pioneering compression-ignition technology.



10

Revivals!

Few cars make better restoration projects than a Mercedes-Benz, and few factories can provide such detailed assistance, in parts and in information. Should your shop conduct revivals?

Departments

18

Parts News

Whether for vehicles long out of production or for modern ones, your best source for Mercedes-Benz parts is Mercedes-Benz.

24

Factory Service Bulletins

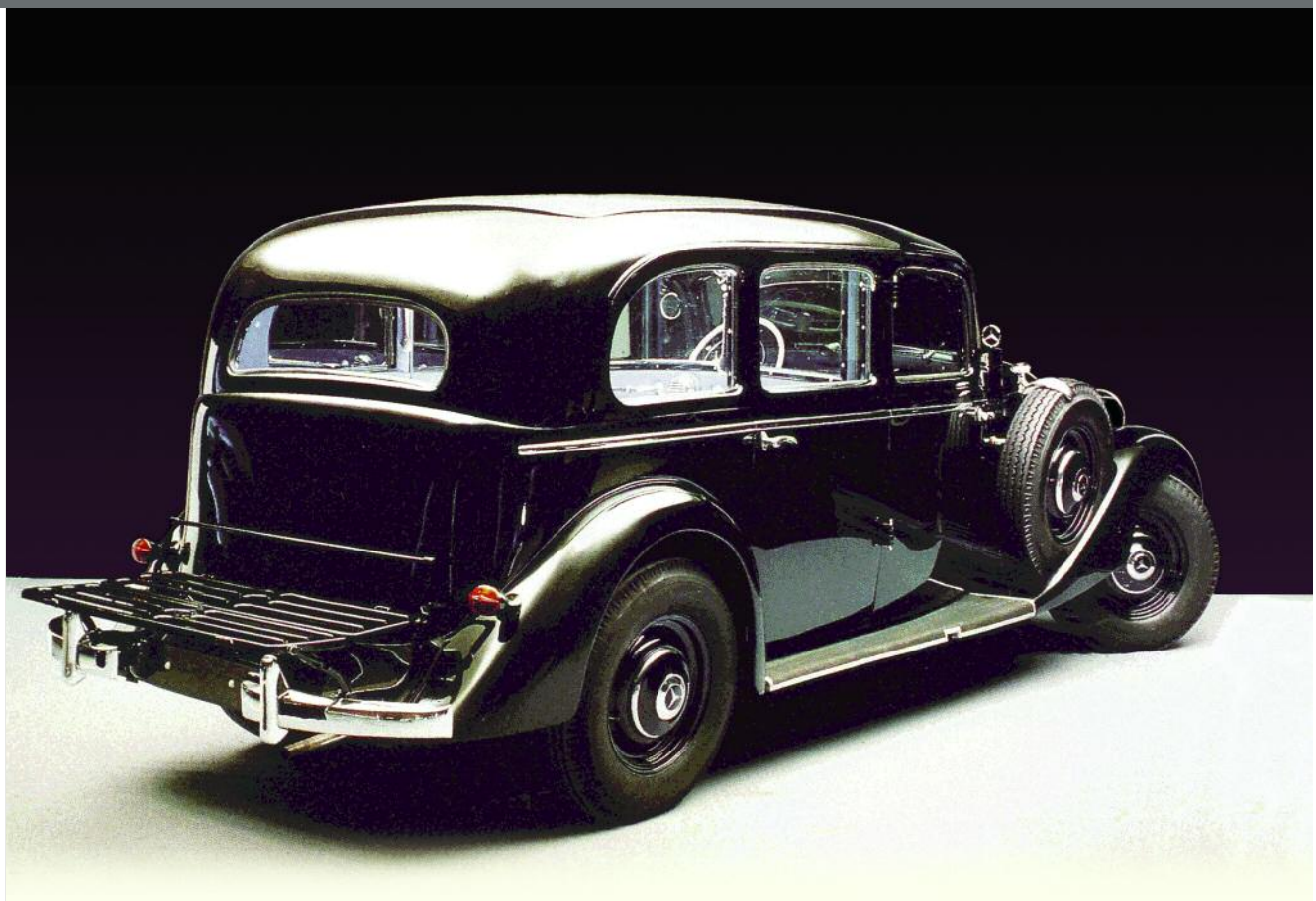
These suggestions and solutions for technical problems are from service bulletins published by Mercedes-Benz, selected and adapted for independent repair shops.

27

Mercedes-Benz Parts... nearby

Wherever you are in the United States, there's a nearby source of genuine factory parts for your customers' Mercedes-Benz vehicles.

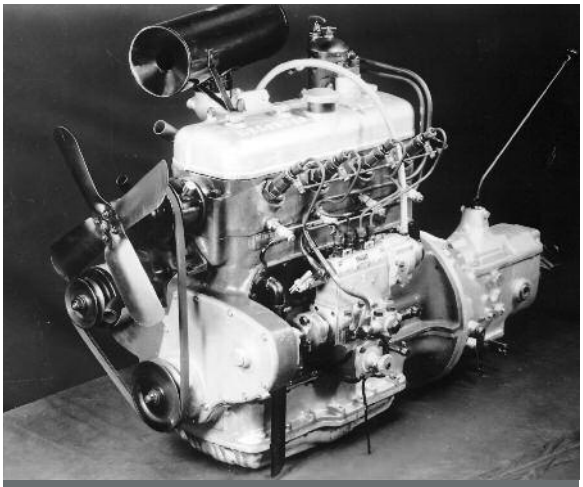
Mercedes-Benz



THE 'OIL MOTOR'

MERCEDES-BENZ DIESELS

The names *Mercedes-Benz* and *Diesel* fall together so naturally it's a surprise to learn the company's first Diesel car, the four-cylinder 260 D, was not built until 1936, comparatively late in the firm's history, after they'd built gasoline-fueled automobiles for 50 years. The 260 D found favor as a taxicab, as Mercedes-Benz Diesels have throughout Europe since. Earlier both the Benz and the Daimler companies (they merged in the late 1920's) had separately produced Diesel engines for trucks, for agricultural and marine use; but they had not previously applied the Diesel advantages of durability and fuel economy to passenger cars.



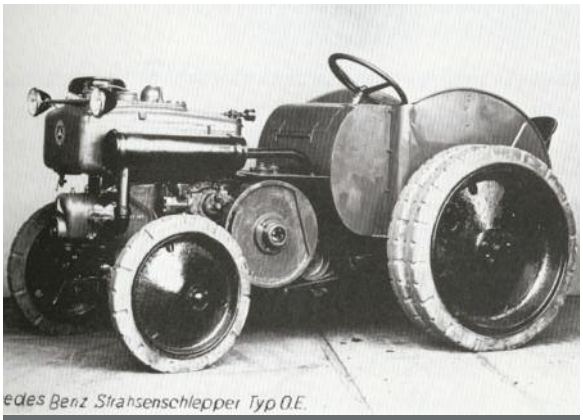
The 260 D engine, though a cam-in-block, is strikingly similar to later Mercedes-Benz prechamber Diesels. It's also much like the Diesel engine they built for many years for refrigeration units, lacking only a four-gallon oilpan.

Rudolph Diesel, a French engineer of German ancestry, patented his first compression-ignition engine in 1892. Employed as industrial and marine powerplants for the first 15 years or so, Diesel's engines worked pumping water from coalmines, generating municipal electricity and chugging around Hamburg harbor in tugboats. At the turn of that century, there was as yet no industry-standard technology to get a fuel mixture burning dependably in the combustion chamber for every power stroke. A few engines used newfangled, then-high-tech ignition magnetos, or coils, vibrators and spark plugs, but most others used such contraptions as glow-plugs or gas-heated tubes to light the fire. Every engine designer sought a reliable ignition system.

When you're trying to achieve something everyone else finds very difficult, sometimes the best solution is to do something very different, something everyone else is *not* trying to do, something that avoids that recalcitrant problem altogether. Diesel avoided the ignition problem by basic gas physics: If you rapidly compress a gas, it gets hotter just as rapidly, roughly in proportion to the degree you compress it. Compress the air enough, and its temperature exceeds the flashpoint of your fuel. When the injector sprays oil into the combustion chamber as finely atomized droplets, each one immediately starts burning, raising the cylinder pressure and temperature still more. So Diesel didn't need an ignition system. Incidentally, he didn't need a carburetor, either.

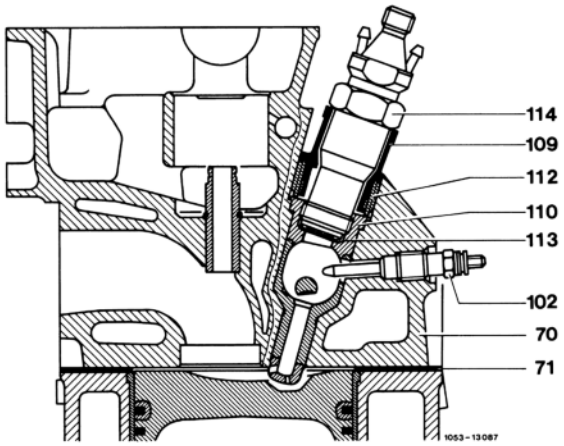
What he and later designers of compression-ignition engines did need was a hydraulic pump and injector system capable of delivering the fuel in exactly the right quantity and at exactly the right moment, maintaining that fine atomization and spray pattern regardless of engine speed or load.

Benz Prechamber Diesels



Daimler or Benz have built Diesel tractors for longer than they've built Diesel cars.

Prosper L'Orange, a German engineer of French ancestry (evidently in the Nineteenth Century European boundaries moved around more frequently than European families did), was chief designer of the prechamber Diesel engines used in early Benz tractor and truck engines and in Mercedes-Benz car engines until recently. A prechamber design makes



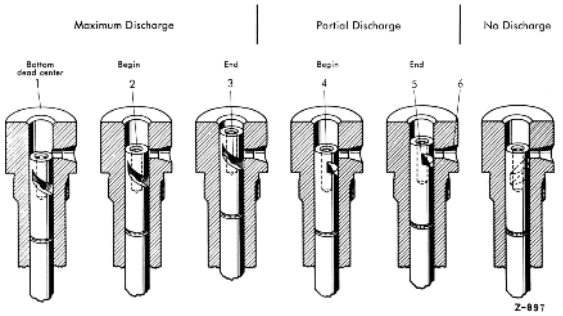
70	Cylinder head	112	Threaded ring
71	Cylinder head gasket	113	Heat shield
109	Sleeve	114	Nozzle holder
110	Prechamber		

The prechamber Diesel houses injector, glowplug and diffuser pin all in a small chamber above the cylinder. Once combustion begins, the burning air-fuel mixture blows through apertures at the bottom of the prechamber into the main cylinder area.

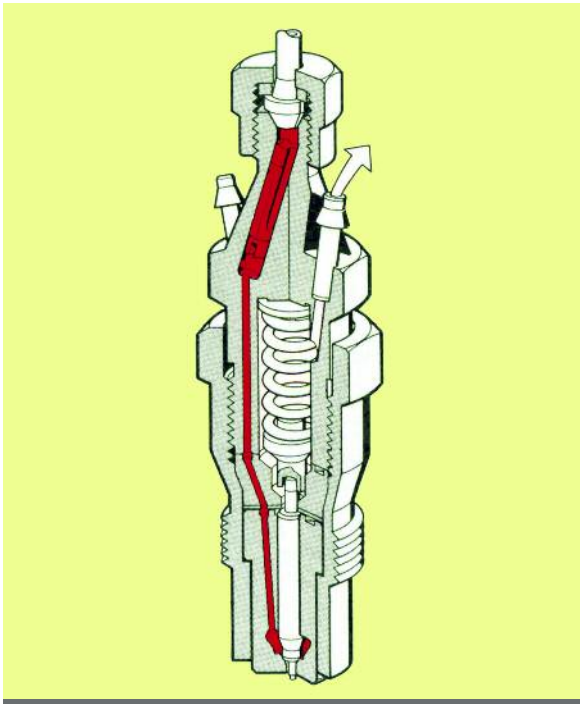
it easier to machine each combustion chamber to identical size (since the cylinder head can be dead flat) and lends itself to somewhat higher engine speeds, allowing use of common or similar transmissions and differentials for vehicles available with either Diesel or gasoline engines. Note that the Mercedes-Benz prechamber uses shaped-top pistons and multiple exit holes from the prechamber through which the mixture of burning fuel oil and air enter the combustion chamber proper. This is different from a Ricardo- or swirl-prechamber, which uses a single larger aperture and works by spinning the air in the chamber before and during the fuel injection. The Mercedes-Benz prechamber uses diffuser pin and the multiple flame holes to turbulate the combustion.

Mercedes-Benz car Diesels up to the late 1990's use the prechamber design. The injector nozzle and the business end of the glowplug share a small chamber above the main combustion chamber and connected to it through a series of metering orifices. In most Mercedes-Benz automotive Diesels, the third inhabitant of the prechamber is a diffuser pin, straddling the prechamber, deflecting and scattering the injected fuel spray. The diffuser pin also helps vaporize the fuel once the engine is running at operating temperature, using residual heat from the previous power strokes of the engine.

On rare occasions, a diffuser pin breaks loose in the prechamber, usually hammering away at the prechamber walls, too. This is a fairly hard problem to diagnose the first time because it's not something you suspect. But there is a characteristic noise the engine makes with this problem, and once you hear it you'll know a loose diffuser pin if you ever hear another one. You remove the prechamber — no need to pull the head unless there's other damage — to replace the pin.



The plungers make a full stroke for each rotation of the pump camshaft, but the amount of fuel injected depends on their rotational position, as determined by the toothed control rod.



In the traditional Diesel injector, pressurized fuel from the pump enters at the top, follows the internal high-pressure passage to the injector tip, lifts the pintle and injects the fuel. What does not enter the combustion chamber passes around the pintle, around the spring and into the return line.

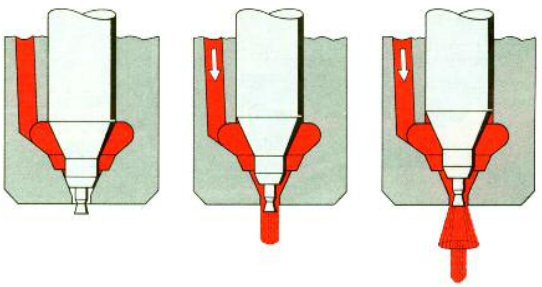
The injection pump plungers make a full stroke for each injection, but the accelerator and governor determine the injected quantity by moving the control rod, a toothed rack that rotates the plungers — just the opposite of a steering mechanism, this is a driving rack turning driven pinions. Depending on the rotation position, a plunger's shaped control edge uncovers the control port after the proper fuel volume sprays and returns unused fuel to the supply reservoir.

As engine speed increases, the centrifugal advance moves injection-start farther ahead of TDC, but there is no retard with load since the combustion flame can propagate only as fuel is injected. It can't burn prematurely if it's still in the injector, yet to be injected.

Starting in the 1980's, an Electronic Diesel System (EDS) replaced the all-mechanical governor. The EDS actuator changes idle speed in response to coolant temperature and the state of the A/C compressor clutch. The control unit works the actuator through the A/C relay. The actuator is duty-cycled, but you can power it briefly to confirm idle speed control. Just don't leave your jumpers connected for more than three seconds, or you can damage the internal wiring. An electronic governor system, unlike the

centrifugal version, can anticipate the A/C compressor's load and begin to increase idle rpm just before the electromagnetic clutch engages. Later EDS variations add more sensors and actuators, like an intake air mass sensor and the EGR actuator.

The fine tip of the injector separates the fuel into minuscule, easily burned droplets. The only way to turn oil into finely atomized droplets, practically into fog particles, yet hold them in a consistent cone shape against the turbulence of the combustion chamber air, is to force the fuel through a very narrow passage under very high pressure and at very high speed, 150 bar/2250 psi. – gun barrel pressures and bullet speeds. So never let an injector spray in the open air. Up close, the oil can slice right through clothing, skin or eyes.



To make the combustion a bit smoother and quieter, as well as to stretch out the power stroke for better torque, most engines use one variety or another of 'throttling' injector. These injectors spray at an initial rapid rate to start the fire, and then continue the volume more slowly to sustain the burn over time.

Most injectors work by an initial fast squirt that initiates the combustion flame and a subsequent more diffused and extended spray that delivers the bulk of the fuel more gradually for that power stroke. The purpose is to 'soften' the initial combustion and spread out the combustion pressure over the power stroke. Such a design is often called a "throttling injector" since it throttles fuel delivery during part of the injection.

That narrow passage around the pintle and through the injector tip accounts for why good filtration of the fuel is so important on a Diesel engine – the slightest grit can clog an injector, jam it open or skew its spray cone pattern. That also accounts for why it is so important to machine the injectors so precisely. Otherwise they'll never seal against the residual pressure or won't open at the right time – to say nothing of lasting a reasonable useful life with their tips exposed to the high temperatures and pressures of the combustion chamber.

The high working pressure also shows why you don't want to let a Diesel engine run out of fuel: It can be difficult to bleed all the air out, and you don't need much of a bubble to soak up all that hydraulic pressure.

Such high pressure is also necessary because for much of the time the engine is running injection must continue while the piston approaches and passes TDC and during the power stroke, after early fuel combustion has raised the pressure in the chamber very high. After all, injection pressure must be considerably greater than the combustion pressure to force fuel in against it.

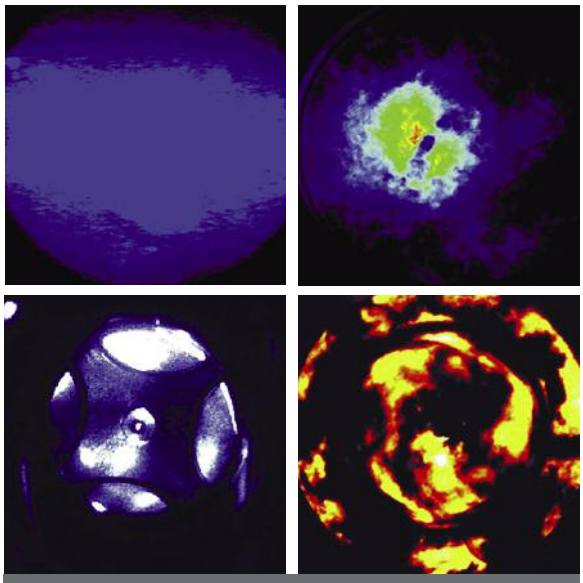
Diesel Detonation

Many people think they hear 'engine knock' when a Diesel engine is idling nearby. That's not what they're hearing. The idle rattle is not combustion knock but the mechanical sounds of the fuel pump when the engine is cold, the lobes of the pump cam clicking the tappets to their injection work. The fuel pressure pulses convey the clicking sounds to the injectors at the ends of the fuel lines. It takes a bit more fuel to keep the engine idling cold than idling warm, so the pump does a bit more work even before its parts have begun to expand to their operating size. Engine idle speed – momentary crankshaft speed, that is – also varies more cold than it will warm, further contributing to the rattle. That 'engine knock' almost goes away as the engine warms, unlike the real thing, detonation. But what is "the real thing"?

Detonation or knock means somewhat different things in Diesel and gasoline engines. In the gas engine, the entire fuel charge for the next power stroke is in the cylinder at the instant the intake valve closes, ready to burn. At the corresponding point in the Diesel cycle, there's nothing flammable in the cylinder at all, just air.

In the gas engine, you have detonation anytime the fuel-air charge 'Diesels,' that is, when the mixture or any significant pocket of it crosses the autoignition temperature/pressure threshold and burns explosively, all at once. Usually, but not always, this occurs if a hotspot in the combustion chamber triggers a flame before the spark occurs. It also occurs if the motorist uses fuel of such low octane the knock sensor/timing retard system can't correct for it.

The premature flame causes a rapid buildup of pressure and heat, reaching a pressure maximum before TDC. The engine has to use part of its torque output to overcome that early pressure peak, so there's a reduction of available power. Before long



The engineers at Mercedes-Benz built several engines with glass cylinder heads to photograph combustion inside, using special high-speed cameras. Top left is a normal, ideal gas engine combustion, with a blue flame consuming most of the fuel. Top right is inhomogeneous combustion, combustion with local detonation. The red, yellow and green flame indicates incomplete, perhaps explosive fuel-air burn. Bottom left is normal, ideal Diesel combustion, with very good atomization of the fuel through the multiple nozzles of the latest injectors. Again the blue flame indicates complete combustion. Bottom right is inhomogeneous Diesel combustion, with poor fuel atomization, incorrect timing, poor distribution and/or fuel of the wrong cetane rating. Again the yellow and red flame indicates incomplete combustion. This engine would produce substantial smoke.

carbon starts to form deposits on the combustion chamber surfaces because the premature combustion was incomplete. That carbon occupies space and thus raises the effective compression ratio of that cylinder.

Now the cylinder is vulnerable to detonation. Detonation occurs when all or part of the fuel-air charge in the cylinder reaches its autoignition threshold before TDC, exploding at once rather than burning sequentially. Now instead of a rapid buildup of pressure, we have a pressure spike, which outside the engine we hear as a 'clink' or a 'plink.' Inside, it's the sound of metal destruction, of microscopic metallic flaking. There's more carbon buildup, more compression ratio increase, more detonation. If this continues, of course, the damage gets more dramatic, with staved-in pistons and valves hammered back into the cylinder head.

Since the charge explodes all at once rather than burning gradually, the combustion temperature also spikes. This is a bit surprising since the combustion is incomplete, but makes sense when you think of the amount of heat produced per unit of time. Another thing that makes sense is the sudden spike of NOx with detonation. The temperature went over the nitrogen-burning threshold, so NOx goes over the wall.

Shop magazines used to occasionally show a wacky series of drawings, explaining detonation and preignition by reference to colliding flame-fronts. There are, under some preignition circumstances, colliding flame-fronts, but they're waves; they interpenetrate just like waves in water or air; they don't collide. They're events, not objects. They don't clink or clank or clonk when they meet and pass through one another.

The fuel in a Diesel engine also autoignites, but not all of it at once and not explosively for the simple reason that most of it is still in the injector, waiting in line to get to work. Of course, there can be knock if the injection timing is set wrong or if one of the injectors is defective, leaking fuel in too early or failing to properly atomize the fuel it does inject. Diesel detonation can also occur if the vehicle is misfueled with something that ignites improperly. Finally, detonation occurs during a 'runaway' Diesel episode, as we'll explain in Part Two, next issue. The destructive effects can be identical to those on gasoline engines.

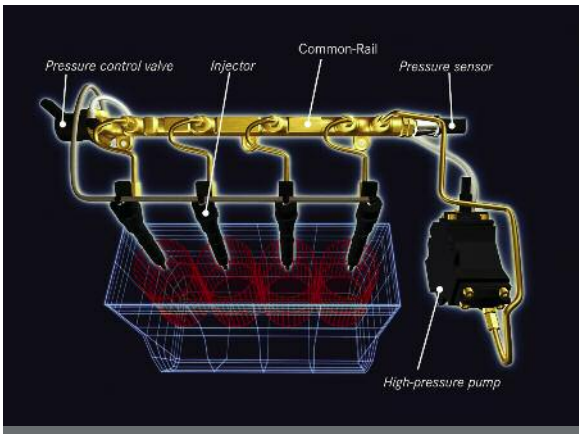
One interesting aspect to the glass-engine photos is something faint they show about fuel efficiency. Even in the gasoline combustion chamber without detonation, the one with the smooth, homogeneous burn, you can see, all around the cylinder just at the mechanical surface of the bore, a slight reddish pink halo where the hot, gas-blue flame burns cooler and goes out as it approaches the surface. This happens in the gasoline engine because the fuel-air mixture fills the chamber uniformly, right up to the surfaces. But the surfaces, though at the operating temperature of the engine, are well below the ignition (burning) threshold of the mixture. The fire can never burn all the fuel charge. This consequence is greater in a real engine, with temperature-conductive metal surfaces.

Now look at the good Diesel burn. You don't see the flame reaching to the surfaces because the fuel doesn't. The flame reaches only as far as the fuel spray has traveled but it stays hot gas-flame blue all the way. It isn't really mixed as homogeneously, just blown into the center of the chamber's pocket of air. The Diesel combustion occurs inside an envelope of air. That air certainly gets plenty hot as it undergoes compression and 'packages' the com-

bustion. But it insulates the fuel from the (relatively) cooling cylinder walls. There's no red rim of quenched flame in the Diesel combustion chamber. All the Diesel oil can burn.

For years Diesel engines have had what some people call a 'Diesel catalyst.' It is, however, not really a catalyst but a ceramic exhaust filter, a particulate trap. When it captures enough waste hydrocarbons, either the temperature of the backpressure-enhanced exhaust or an electric heater ignite and burn off the captured particulates. If something goes wrong with the particulate, it clogs up, reducing the air through the engine and the power it can produce.

Industrial Diesel engines are usually direct-injection designs. The fuel injector sprays fuel directly into the combustion chamber, just above the piston or even into a pocket cast into the piston face. Direct injection provides greater manufacturing simplicity and about 18 percent better fuel economy (you don't lose heat through the prechamber if you don't have a prechamber).



The newest Mercedes-Benz Diesels use a common fuel rail, not unlike gasoline injection systems. Much unlike the gas system, however, is the enormous hydraulic pressure, as much as 2000 bar – 28,000 psi! Actuation of the injectors is electrical rather than mechanical. Special Piezo-electric injectors pulse the high pressure fuel into the center of each combustion chamber. A Piezo-electric injector is, in a way, the conceptual mirror-image of the knock sensor, using an electric pulse to cause a pressure pulse.

Mercedes-Benz has not sold Diesel cars in the United States for several years, but they have continued development and manufacture of them in Germany. The new four-valve engines are direct injection, not prechamber designs (there were a few four-valve prechambers in the late 1990s). No longer are the injection systems predominantly mechanical (they have been at least partially computerized since the earliest versions of the Electronic Diesel System in the late 1980's), but now use electrically pulsed Piezo-injectors. Pressure still comes from a mechanically driven pump, however, into a very high-pressure version of the common rail fuel system seen on gasoline fuel injection systems. Timing is electronic, not mechanical. High pressure (almost 2000 bar!) is available even at idle, so they can use injectors with multiple very tiny nozzle holes instead of one. This allows even finer fuel atomization and approaches a more homogeneous mixture, avoiding those pockets of rich mixture (black smoke) and lean mixture (NOx). Since pressure is constant, there's no 'Diesel noise' as cam lobes tap plungers – there are neither injection pump lobes nor plungers.

Will the new Mercedes-Benz Diesels show up in this country? Nobody's saying for now, but it's likely the emissions regulations for Diesel engines will have to settle before the company decides that.

A major problem right now is that the new direct-injection Mercedes-Benz Diesels use the new NOx-reducing exhaust catalyst incompatible with sulfur in the fuel. European fuel sources are relatively low-sulfur, while those for North America have more of the unsought element. Perhaps economical means will unfold for removing the sulfur, perhaps they'll find some way to modify the catalyst system, or perhaps they'll figure out an economical way to make sulfur-free synthetic Diesel fuel from natural gas. Stay tuned.

As there's more emphasis on a reduction of CO_2 because of 'greenhouse-gas' concerns, the return of the Diesels seems assured. The enormous improvement in fuel economy, and the corresponding enormous reduction in carbon dioxide emissions, will leave no alternative. Add to it the reasonable prospect of clean synthetic Diesel fuel, derived from local sources, and the future of the Diesel is also assured. In the long run, it may be the gas engine that's imperiled.

NEXT ISSUE
Part Two
MERCEDES-BENZ DIESELS
Batteries and Glowplugs,
Turbochargers and
Superchargers and the
'Runaway' Diesel!

The Genuine Mercedes-Benz will blow

Mercedes-Benz Quality and Reliability at a Great Value.

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

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

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

Remanufactured to Genuine New Specifications

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

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

Steel Gasket
Replaced 100% with new components.

Oil
Replaced 100% with R134a-compatible oil.

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

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

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

Shaft Keys
Replaced 100% with new components.

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

Snap Rings
Replaced 100% with new components.

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

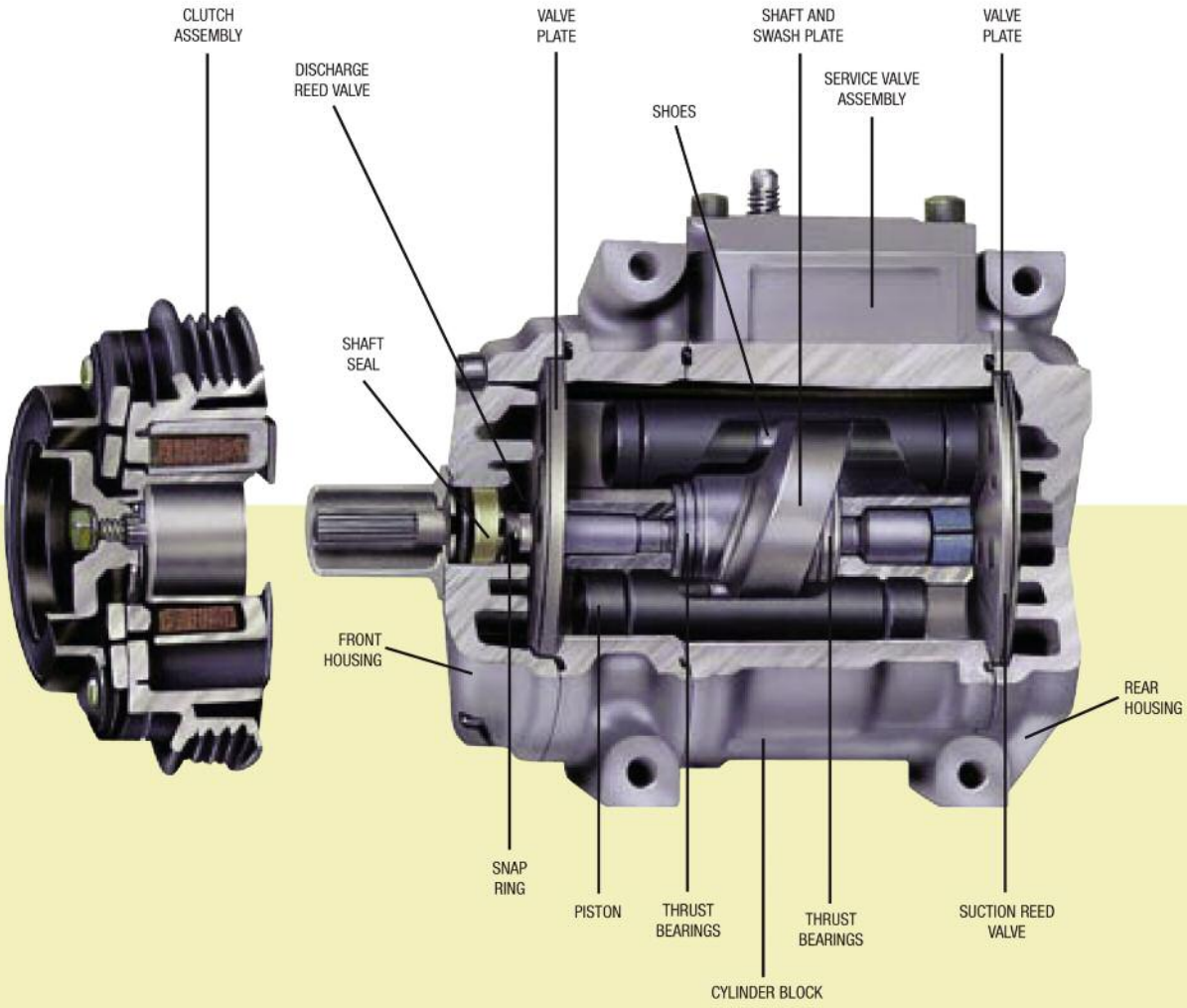
Thrust Bearing
Cleaned, polished, and inspected.
Replaced with new components as needed.

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

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

Remanufactured A/C Compressor you away.

Genuine Mercedes-Benz Remanufactured A/C Compressor



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

Mercedes-Benz

Mercedes-Benz Genuine Remanufactured Parts

DENSO

Remanufactured for Mercedes-Benz by DENSO

Revivals!

'Gimme that ole' time automotion,
Gimme that ole' time automotion….'

It's odd how we like lapstrake wooden sailboats with creaking Manila lines slapping against gnarly masts, how we like ragwing biplanes with slow-growling radial engines, how we like coal-black, coal-fired locomotives chuffing smoke and roaring steam, and – more in our line here – how we like old cars from across a wide ocean and from a distant time. Cars with hand cranks and flathead, sidevalve engines; cars with radiators, headlights and fenders all proudly separate one from another; cars with split hoods that hinge up along each side; sports cars from the 1950's, still fast on those skinny spoked wheels with the knockoff hubs.

Many a classic Mercedes-Benz fits those nostalgic tastes, and many people are happy to spend considerable time and money restoring one. Perhaps you've considered offering that kind of work at your shop or even restoring a classic for yourself now or for sale later. A safer way to get your feet wet in the restoration business is to focus first on restoring someone else's prospective treasure, letting the customer bet the vehicle will be worth the money at completion. You won't get rich restoring that first car, and you might decide never to do another. Or you might find you like the work a lot and expand your restoration services into new areas nobody else has.

A diamond in the rough, or just rough? It takes background knowledge of the market as well as careful technical inspection of a potential restoration vehicle to tell which you've got. Don't go for the first example of any car you find, even if it means missing a sale or making a long road trip twice. The restoration will take much longer than it would take to drive to China.

There are several advantages to choosing a Benz for the work: First, the company is still around, so information and parts are much easier to come by than if you set out to revive, say, a Stutz Bearcat, a Harmon V-16 or a Studebaker. Second, while nobody can predict how much a restored vehicle will be worth when you're done, historically classic Benzes have held their value, just as modern Benzes do. Third (though this is a deep secret just between us, so don't blab it around), Mercedes-Benz' mechanic-friendly design means the cars are easier to work on than many other makes.

Mercedes-Benz has a classic restoration service, itself. Right now they're doing restorations only in Fellbach, a small town near the factory at Untertuerkheim in Germany. Presumably most of the output from the Fellbach workshop will go into the Daimler-Benz Museum on the factory grounds and to other company displays, but they expect to do other work, perhaps including some private work, as well. They'll probably open a second restoration shop in California in the medium future. Official Mercedes-Benz factory restoration shops will probably restore only a very few vehicles. However, not many carmakers can claim their factory can still put a fifty-year-old car in showroom condition using factory parts, factory tools and factory personnel. Mercedes-Benz can. It's not likely, of course, the streets will be choked with their restorations, even in Fellbach.

There's more involved in restoration work than you might suppose, I discovered visiting and conversing with independent shops focusing on Mercedes-Benz classics. I talked with Dave Polson of Autowerkes in Broadview Heights, Ohio; with Pieter van Rossum of Silver Star Restorations in Topton, North Carolina; and with Scott Grundfor of Scott Grundfor Co. in Arroyo Grande, California.

All of our independent restoration informants were at some pains to emphasize their opinions are their own. They use OEM information and parts when possible and available but improvise within their experience and knowledge of the factory's traditions for cars earlier than 1947 for which information and parts are more limited or unavailable. Here are a few things to keep in mind if you're considering expanding your own shop's specialties to include restoration projects.

What is a 'Restoration'?

Sometimes people just want a running example of a classic – not showroom-perfect, merely something to put-put down Main Street in Fourth of July parades, to chug along at old car shows or to tool

It's radiator star may tilt, but this early 1970's SEL was once the top of the Mercedes-Benz line. Not only did it sport hydropneumatic suspension and many other advanced technical features, with its high-revving 6.3-liter V8 engine (see below), it could leave any 'Vette of the time in the dust, even with six passengers aboard. Most parts are still available for this car, should someone restore it.

around town on beautiful summer days when everyone else is gone so the roads are empty. But they want the real McCoy, not an 'exotic' plastic replicar bolted atop some more mundane running gear. Other people want to go all out for one of the major restoration competitions, like the Pebble Beach *Concours d'Elegance*. They want to restore a rare car to showroom condition or better, but all original.

Preparing a car for occasional hobby use and less-than-perfectly-original restoration can be much easier and can even result in a better, safer vehicle. Nobody would use electrical wires with the old woven fabric insulation for any reason other than historic accuracy, not when you can get good, high-impedance, color-coded, plastic-insulated wires for much less than nostalgia-tech conductors. Even though the wiring system on an old car may be simpler than what you have in your kitchen toaster today, an antique automotive wiring harness does carry enough current to blow fuses or start fires. Similarly, nobody would use ancient fuel lines when safer modern tubing is available, and far more reasonably. But if the restored car is to compete for factory-condition, you'll have to go with the horse-and-buggy-era materials. That is, after all, what the competitions are for. If someone wants the restoration for occasional driving around, however, you can use better supplies. Many classic cars have been converted to 12-volt systems just for the simplification that brings to everything electrical (you can use readily available batteries, lamps and an alternator, for example). *Concours d'Elegance* traditionalists will say 'tut-tut,' but that's what traditionalists say, anyway.

There are two large worlds between these extremes, one world of time and another world of money. The different levels of vehicle restoration range from merely pounding out the dents and getting the engine running (which we won't consider here), to making from an old car something that is much like it once was but with sensible modern compromise upgrades like a 12-volt electric system, or finally to fielding the winner at the *Concours d'Elegance.* Some cars could never reach that state of exalted elegance merely because of the cars they are and the times we live in. Restore a 240D Model 123 to flawless showroom condition, and you have a fine, useful, roadworthy car, old enough for antique plates in many states, but you don't have a conveyance to wow the plutocratic swells at the country club. Good a car as it is, nobody with Roman numerals after his name dons his tweed driving cap, wraps on a monogrammed silk scarf and laces up his stringback ostrich-skin driving gloves to slide behind the wheel of a 123.

Dave Polson's second piece of advice to a shop considering restoration work (right after 'don't do it – it's too much work') was, if it's your money, find a convertible (or a "cabriolet" or a "roadster" – Mercedes-Benz uses the three terms for three distinct ways of putting the top down or taking it off) for any car you buy and restore yourself. Nothing else carries the same restoration demand or resale value. Pieter van Rossum agreed, "If the top comes down, the price goes up." As a person of automotive technical savvy, you probably know that even the stiffest, girder-frame convertible will twist and flex and lift one squealing wheel or another off the ground in a braking turn, even though a torsionally stiffer coupe or sedan could handle the same curve with quiet, competent serenity. That doesn't matter. If competitors had a completely free hand to use any kind of machine to blast around left-handed circles as fast as possible, the USAF could quite literally blow the doors off everything on the NASCAR circuit.

What counts in many restorations is The Look. Neither utilitarian nor technically superior transportation is the story. Classic car fans are after the classic look and the classic sound – and seeing themselves framed in that classic look and sound.

It takes about the same amount of work to restore one make of car as another of the same era, but certain automotive marques hold a resale value others do not. Guess which!

Time and Money

Most people who want to restore a classic car expect it will be expensive, but they don't know how expensive. But nobody knows how long it will take, either, and that may challenge people more. Restoration projects not only require patience and money from the customer, but patience, skill, storage space and time from the shop doing the work. If somebody has to have a classical car restored by a certain imminent date, let him do the work himself.

At the top restoration level, where our correspondents work, they're largely in control of things. Want to have one of their shops restore your car? OK, they will. But on their terms. None of them can start earlier than nine months to a year from now. None of them will give you a completion date certain or an all-up price. They do say it takes at least 18 months to two years once work starts, maybe longer, and costs much more than you expect or they can estimate. They may accept a maximum price contract – after which work stops wherever the restoration stands. These are certainly not the arrangements we make for ordinary car service!

Not only is there no restoration flatrate book, there isn't even a wild-guess, ballpark-estimate book. No two restoration jobs are similar enough to extrapolate one from the other, and the more experience someone has restoring classic cars the less likely he is to get specific about time or money. If you had two original cars in exactly identical condition and restored them to exactly identical condition, the price and completion date for each would nonetheless be different because the work time and parts prices would be different. Given the scarcity of cars worth restoring, there's no way this can be otherwise.

It's understandable a potential customer might find this uncomfortable. You probably would, too. But don't start out to restore a car until you work these issues out with your customer. A restored classic car is a hobby for someone relatively flush with money and time, but as Scott Grundfor explained, while some of his customers have been worth hundreds of millions of dollars, they – at least the ones he did business with – didn't get that money by tossing it around. "Nobody ever told me, 'cost is no object,'" Grundfor recalls. Likewise, many of these people are used to hard-bargaining business negotiations, probably much more used to it than you are.

Our cover and center pages show what has to be the most spectacular car restoration ever. This 1911 Daimler Mercedes (*not* a Mercedes-Benz! The companies were many years from their merger when it was built) has a steam-bent mahogany strip body with ribs of ash, called a "skiff-body" because of its similarity to boat construction. The original was built on a Daimler chassis by Jean-Henri Labourette of Paris, and the car's first owner was Henry Stetson – he of cowboy-hat fame. When the average American household income was $500, Stetson paid $18,000 for this car, the only one of its type. You're looking at the profits from a lot of cowboy hats.

The engine is a ten-liter (that's 600 c.i.d.) four-cylinder with two exhaust and one intake valve per cylinder, arranged in sequential banks of two. The Daimler MotorenGesellschaft rated the engine at 90 hp at 1300 rpm. The car's top speed is between 75 and 100 mph – you'll understand that nobody is going to check on that. The car weighs a bit over two tons.

StarTuned most sincerely thanks Scott Isquick, just the second owner of the car, for showing it to us and driving it under its own considerable power. Mr. Isquick is the patron who supported the restoration, and it is the jewel of his antique car collection, of course. The work was done over several years with 12,600 man-hours of highly skilled work. If we weren't too slack-jawed with astonishment to manage it, we'd tip our editorial hat to the man who did the job and his associates, to Dale Adams. If he tells you anything that conflicts with anything we've written here, obviously he's right.

1911 Daimler Mercedes

Polson restored this beautiful silver 300 SL for a client who uses the car as his daily driver, at least in good weather. The 'civilian' 300 SL was very similar to the Gullwing, but Polson notes that few parts are actually interchangeable, even though their appearance is quite similar. The Gullwing is somewhat smaller and much more of an all-out racing machine than this car. It remains, nonetheless, a splendidly driveable machine, a fifty-year-old car that can probably outperform your modern car in every measurable test.

Grundfor says the ability to deal with potential customers in a businesslike manner is as important for success in the restoration business as the actual restoration skills themselves. You can set monthly maximums or job totals; you can shoot and send photos at every step. But if there's a fixed charge for the job and, as is certain, unexpected costs occur, either you have to take the hit for a problem you couldn't have anticipated, or you shave expenditures somewhere else and produce an inferior restoration. Either way, one party or the other loses, probably both.

Make sure that everything is clear and in writing up front, perhaps even before the car shows up at your shop. Besides the clearest possible description of how the car should be restored, this should also include what happens should the customer decide during the restoration to halt the work or move the car to another shop. What happens to whatever money had been paid to that point, for instance? Who owns parts bought but not yet installed, parts ordered but not yet delivered? Parts delivered but not yet paid for? If you farmed out woodwork or upholstery, who pays your subcontractor to get the parts back?

Cash Flow/Keeping in Contact

A regular billing cycle not only carries the advantage of regular income for the shop and regular communication with the customer; it also minimizes the cost at any point for the customer. It's much easier for someone to pay $1000 a month for several years toward his restoration than the entire hit at the end. What's more, if there is a problem or delay with payment, it's only the last installment that is in dispute with the regular billing cycle method. If somebody wishes to haggle a price down, it's only that last billing-cycle time-slice on the block. If the customer gets regular notice what work is going on and what it has cost, his chance to raise questions and objections comes then, not a year or so later when the car is done. Besides, if the customer is current with his bill, you won't gnaw your fingernails quite so much if he shows up at the shop and wants to test drive the car (There have been cases when the customer didn't come back with the car).

Every piece of restoration work is a self-portrait of the worker (just as every photograph is, as you can see). To put a car back into the condition it was in the day it was built and to do it so well that your work sustains the closest scrutiny, that is a rare skill, indeed. Notice the superthin bead of weatherproofing around the mirror base. Dave Polson restored this car for a customer who uses it as a daily driver. Whether it had such detailed rustproofing when new, to make the car last indefinitely, such work is needed.

The reason to go through this worst-case-scenario is that same point about time and money – the project will take much more of both than you or your customer anticipate. Most people, kept apprised of how the work is going and what the current prob-

lems are, understand and cope. Some don't. Your restoration contract has to anticipate those latter. There's no reason you should take the hit for them; better to have it all sorted out in writing first. For a small shop, the risk is too great.

But that's not unreasonable. Nobody *need*s a restored car, and few shops can really do the work properly. It will take many more work hours to restore any car than it took to build it in the first place. That will be at least as true of a current Mercedes-Benz vehicle fifty years from now when someone sets out to restore it. A car factory is not only a location for precision work; it is also a place of the most serious time discipline, focused on the efficient production of vehicles. Nobody will ever be able to replicate that work in the same time without the factory's mass-production equipment or without the factory's long-skilled workforce. Nor can the restorers pound out a classic nearly as fast as the factory did back when they were on the assembly line. Compare instead how long it takes the factory to install, say, a water pump with how long it takes you to replace it in your shop. Now add all the complications of extreme rarity, parts-location problems, repairing dubious fixes over the intervening years and the need to restore everything else on the way in and on the way out. You can't scrape off the old gasket in the time it took the factory to bolt the original to the block.

Small trim pieces, like taillight surrounds or the numbers on the trunk of this 300 SL may sometimes be the most difficult pieces to find, if they're missing. When you do find them, you may be astonished at the asking price, so make the effort to find a car as complete as possible to begin with. Sometimes it's easier to find whole cars than individual trim pieces!

There's no beating the clock when there's no flatrate 'clock' to beat, just the real one on the wall. Put in eight hours at a restoration shop, and you've clocked eight billable hours, not more, not less. If that seems unproductive to you... well, tough. Do other work for a living. This kind of approach would drive the manager of a high-volume maintenance and repair shop nuts; it conflicts with everything he's come to think of as businesslike.

Interior and trim work is unlike most other automotive work, involving upholstery skills, woodworking, leather craftsmanship and an attention to detail unparalleled anywhere else on a car. This is one of those areas where you just have to invent your own skills, at whatever cost of time and effort it takes.

But a businesslike approach is critical to restoration work; it's just not the same business. Even though completion of a restoration is far from an everyday thing at even the busiest restoration shops, they keep a steady income stream by billing their customers regularly. One of our correspondents bills monthly, another weekly. Sometimes the only charge is for storage while waiting for parts or while waiting for someone who can start the project. Sometimes the charge is for international phone calls and translators, necessary to chase down that elusive rearview mirror or grille bar or to find out what colors a carpet came in.

Restoration work, according to each of the shops we spoke with, is very different from ordinary repair and maintenance work. If you're used to a fast, 'productive' pace, quickly rolling cars in and out of workbays; if you work with hard and fast quotes, based on flatrate manuals and wholesale parts catalogs, factored against what you've calculated is the cashflow each workbay must generate every hour to cover a high overhead and generate the expected

It looks rough, but mostly because of the aborted amateur restoration begun before Dave Polson got the car. He notices rust on the underside in the predictable places, but all the parts are there! This one's a keeper.

profit – well, you're not going to be comfortable with restoration. If your notion of a productive worker is someone who can hammer cars in and out faster than anyone else in the shop, well again, you're not going to be comfortable with the kind of artisan who can do restoration work.

About the worst business approach to restoration is by analogy with a home contracting model: half up front, the other half when done. But these are entirely different kinds of enterprise. An experienced home contractor knows very accurately what he will pay carpenters, plumbers and electricians, and he knows how much work they can do in a day. He knows accurately what he will pay for 2x4's, sheetrock and shingles, and he knows from the blueprints almost exactly how many boards and nails he'll need for the job. Usually, all of his costs remain predictable and stable.

Restoration of a classic car shares none of these characteristics. There's no way to tell what parts you'll need until you're a considerable way into the project, and there's no way to guess what those parts you don't know you'll need are going to cost when it's time to buy them. Or where you'll get them. Worse still, the rarer the part, the higher and more volatile the price: Every time an original headlight bezel for a Gullwing is sold, the price for the next one goes up.

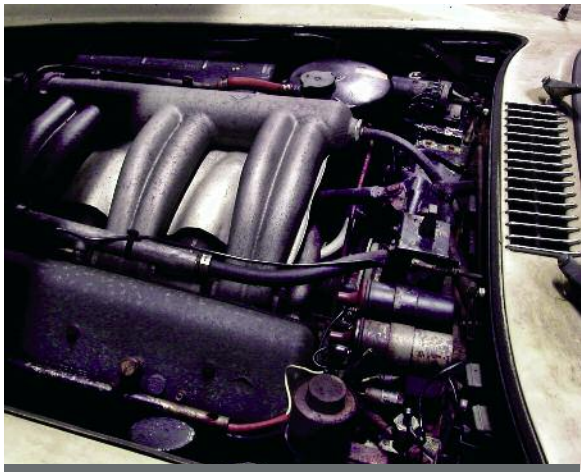
This can sometimes lead to problems with certain customers, especially the most successful in other businesses. Someone used to barking orders and getting quick results may decide to put several people on the trail of some part needed. Trim pieces are particularly hard to come up with because they're not available new anymore. It is surprising that a small plastic or cast-metal dashboard ornament may cost more than a fender, but a skilled sheetmetal worker can make a new fender. Gearing up to mold new plastic pieces exactly as they were made 50 years ago can, paradoxically, be very expensive. Some of those parts were made by independent suppliers, small businesses that closed long ago, suppliers that left no records. Send a gang of people after those parts, however, and watch the prices soar and the counterfeits multiply. Anyone in the business who has a real one, seeing the demand suddenly rise, will just hoard it in anticipation of more rise still.

You can never make a promise about when a car will be done for just that reason. Polson goes further. When someone drops off a car for restoration at his shop, Dave makes sure they understand he not only can't promise a completion date, he can't promise a date he'll start the project, either. He's been doing this long enough and has a large enough number of good restorations in his record people just have to work with any reasonable conditions he sets, or he'll work with different people. With all the projects underway, everyone has to understand that fixed schedules and deadlines don't make sense here. It will take a long time to restore a car, certainly longer than the customer expects.

No restoration is inexpensive. One thing you should certainly make clear to a potential restoration

A car with a complete set of parts is worth much more than an otherwise good car with critical pieces missing. This 300 SL has everything that was there originally, even pads for the sun visors. Restoration work can begin right away, without waiting to spend hours or days on the phone, chasing pieces in faraway places.

customer: For less money than a thorough, frame-up restoration will cost — probably for much less — he can get a new Mercedes-Benz with better performance, better fuel economy and higher reliability than any restoration, however well done. The designers and craftsmen who build Mercedes-Benz cars have worked for over 100 years not only to build the best cars they can, but also to constantly improve their product over time. They don't 'build 'em like they usta.' They build 'em much better. Restore a classic car to better-than-new, it still can't compare to a modern car as a useful vehicle. Even the most luxurious car built in, say, 1925 rides about like an old tractor, and your customer should know that up front. Perhaps not every automotive design change proved a good idea in the long run (tailfins withered away, after all!), but carmakers kept the ones that did and corrected the ones that didn't. So a Benz of today really is dramatically better than one from 50 years ago, including such legends as the Gullwing (What could you do if the car flipped over in a race or sank in a lake, for instance? How could you open a door to get out?).



The 50 year-old engine is in good condition and will require little more than cleaning. Many cars restored to original condition will never drive another 1000 miles, so there is minimum need to overhaul the engine. Oil leaks, however, are a common problem, often from gaskets that have dried or cracked in place.

Many classics also require much higher driving skills, because they were built with square-cut, non-synchronized gears (double-clutch up and down, every time!), hand-adjustable spark advance and fuel mixtures and the like. Automatic transmissions? Power steering? Power brakes? Heater? Defroster? Air conditioning? Seat belts? Crush zones? Roll bars? Collapsible steering columns? Ha!

Mercedes-Benz was the first carmaker to routinely employ experimental crash-testing as well as analytic examination of actual accidents, beginning in the early 1950's. Over the decades, that knowledge has accumulated to quite an applied science, but on earlier cars, from the 1930's and before, automotive safety is almost entirely a matter of driver skill and prudence. Some old cars require the driver to light the carbide headlamps with a match. Many use 'suicide' doors, hinged at the back, easier to get in and out, but very exciting if they come open underway. Some used tiny drum brakes, operated by lever and cables, working only on the rear axle. Lots have skinny tires with inner tubes, mounted on flexible wire-spoked wheels, with no more traction for steering or stopping than you'd suspect. Others with hand cranks not only require considerable strength of arm, they may be impossible to start for someone who is left-handed (Try it. You can crank much more easily clockwise than counterclockwise if you're right-handed, and vice-versa if you're a lefty. But there *aren't* any counterclockwise-turning engines from the crank-start era!). And should the motorist forget to retard the spark lever, a backfiring crank can break bones. Your customer should know all of these kinds of things up front.

Doing the Work

Space, lots of space, much more space than you need even for a high-line body and paint shop is the first requirement for restoration. You'll notice all three of the successful shops we listed at the beginning of this article are located in relatively remote areas, areas where nobody crowds them next door, areas where rents are low or you can raise your own building inexpensively. They're relatively inconspicuous, too, since there's no walk-in traffic to speak of, and you don't want gawkers. Even though his shop sports a discreet heliport out back, Polson's sign in front is not much larger than this magazine opened flat.

This is not a business for someone renting very expensive workspace in a downtown area. None of the three shops we talked to are in central cities; many of them have never even met most of their customers — the cars just show up in sealed car carriers after all the business arrangements are final and go back the same way. Have lots of room and no immediate demand for it, or move someplace where you can get it.

Next, Scott Grundfor mentioned that most people who can do restoration work are more like artists, often people with developed interests in music or fine arts, people who work on their own without an

The six-cylinder 2.6-liter 1937 flathead engine was high-tech at the time, if not motorsport material. This 1937 260, restored to functional, not perfect condition is one of the few cars you've ever seen with functional Landau bars. Amazingly, it also has independent suspension on all four wheels, including a very ingenious and intricate four-spring geometry for the rear axle.

overseer, people who focus on the quality of their work first, last and always, not on the clock. If they need a special skill they don't have, whether it's leather upholstery or working with burled walnut veneer or noodling out a 1930's magneto, they go out and learn that skill on their own. Pieter van Rossum said the couple of people who work at his shop just figure out how to do whatever comes along, whether they've done it before or not. When I visited Dave Polson's shop, one item I couldn't miss: a meticulously equipped enclosed trailer with innumerable ingenious devices, storage bins, winches and structural lifts — all beautifully hand-built by Greg Bickford, one of his artisans. Autowerkes has four or five such trailers and a spectacular tractor-trailer combination, all just to transport customers' vehicles in safety. The implicit message was clear: Whatever they need, they can make.

At the same time, restoration work is hardly a relaxed kind of work. Very many problems are novel, and you have to solve them if you expect to finish the work. You have to be able to sustain hard work under conditions of uncertainty — sometimes your solution won't work, and you'll need to think of something else. This is not the easiest way to make a living.

Cherry-Picking

After you have the workspace and find some skilled associates, the next hard step in restoring a classic car is finding the right car to restore. Not to put too sharp an edge on it, the easiest car to restore is the one that requires the least restoration, the one with no damage and all of its parts. Obviously, the rarer a car is or the more insistent you are upon a specific model, the harder it will be to find a good, complete example to restore. You're not going to find a '55 Gullwing or a '36 540K at the boneyard for cheap because the people there don't know what it's worth and have scheduled it for the crusher tomorrow. Most people with an old, restorable car on their hands think it's worth much more than it really is.

Get a car with a complete set of parts if at all possible. Otherwise, Murphy's Law insures several critical missing parts will be unobtainable. While the factory can still make a surprising number of parts for older Mercedes-Benz vehicles, it's not as though they have a roomful of doors for SSK's in various colors, just waiting for orders. They can build or cast or machine all sorts of things, but not on a moment's notice, and they don't work cheap. If possible, hold out for the best example you can find — it's easier to keep looking for a better example for a while than to search for missing parts later or fabricate them yourself. Getting a clapped-out beater as a parts car is dubious: Chances are the same parts you'll need have already been stripped off the donor, fallen off or rusted away, or worn out. Genuinely rare cars, of course may be another story: If your customer wants a 1911 Daimler-Mercedes skiff-body, he'll have to talk to Scott Isquick, who has the one and only.

A partially restored car can be even more of a problem. Each of our informants has horror stories about botched and aborted restorations that were more trouble to fix than a straight fixup job would have been.

Don't store any vehicle over a dirt floor. It can hold prodigious amounts of moisture, which percolates up and rusts out the car in all the most vulnerable places. A vehicle stored over a dirt floor may not be restorable for that reason. Barns are not garages.

Rust is a very difficult problem because it's often hard to tell when to remove the rust and when to replace the metal. Often the most serious rust damage is deep inside, invisible without very careful inspection, including dismantling. Most cars, you

already know, rust out rather than wear out. The more valuable the car is and the less it is used for everyday transportation, the more likely this is to happen, a major problem for museums and other automotive historic centers. This is, in fact, a major problem even for cars that have already been restored. Somebody parks them in a garage or a museum, and they sit and rust or seize in place internally. Then a few years later, even with fresh fuel and a new battery, they can't start and need extensive repair.

A surprising aspect of restoration, however, and strikingly at odds with ordinary work, is the comparative unimportance of restoring the engine. But after all, a car that only drives a few hundred miles a year is not going to wear out an engine soon. This argues for finding one with an engine that needs little work, obviously.

While as we mentioned, you can get new fenders, hoods and other sheetmetal from the factory for many classic Mercedes-Benz cars, you'll want to preserve what you can, both from a historical and economic perspective. But this is not like bashing out the day's dents on Brooklyn cabs: You don't yank a rear quarter roughly into place with a slide hammer and then slather over the zits and ripples in the steel with trowel-loads of bondo followed by paint from a spraycan. You learn, by practicing with scrap, to make a butt-to-butt joint with no bulge or visible seam; you learn to duplicate whatever compound curvature the piece had with a Yoder hammer or on an English wheel you learn the same skills those master German machinists had so long ago.

When inspecting a prospective car for restoration, pay attention only to the condition of the car, not to its purported history. Maybe once upon a time it did belong to Greta Garbo or Al Capone, maybe not. That won't affect your restoration work. Leave all that for your customer to collect from official vehicle records, both the factory and licensing bureaus. Similarly, with a car that's 50 or more years old, it makes no difference whether it's from Florida, Texas or California – it probably didn't spend all the intervening time there. Any car that old will have been maintained and serviced by a variety of people in a variety of ways, not all of them optimal.

Digipix Records

The general structure of a restoration is straightforward: Take the car carefully apart, keeping track of where everything fits and what needs replaced. If you're working on more than one car at a time or if the car will be in your shop a long time waiting for parts, shoot photos to remind yourself where things were when you started. With an old car they may not be in the right places, but at least you'll know where everything was when the car rolled in the door.

Grundfor mentioned also the importance of keeping the work organized. A typical classic car worth restoring has about 30,000 parts, virtually all of which you'll remove at least for inspection and cleaning in the course of the work. If you just pile these parts in whichever corner looks least crowded at the moment, will you be able to get everything back where it belongs 18 months or two years later, when you're reassembling the vehicle for the final time? And what if you have several restorations going at the same time? 'Where on earth did this odd-shaped blackmetal shoulder bolt with the reverse thread come from?' Will you remember?

The best way to do this is with a digital camera because you have the photo record immediately. If one shot doesn't work, change the settings and shoot again. Digital photos for a specific car can all be stored in the same folder on your computer or burned onto a car-specific CD. Clarity is what counts. You're after a rebuild record, not art; the art will come from your hands and eyes, through your tools to the finished car. You don't need the best camera or the best lens to shoot such photos, but you will find a tripod – even the cheapest tripod – makes more difference in the clarity of your photo records than anything else does. If possible, use as much light as you can conveniently get around the car. Many lights will yield false colors, either on film or on a digital camera, but you're really not after perfect color replication – you want to know exactly where which part was to begin with. Use your camera's timer and your tripod, and the photos will, whatever else, be usable to put things back where they were.

Knowing where the parts came from is only half the organization, obviously. Get a set of bins to keep the pieces you remove in some sort of order. You don't want to have to look through everything loose in the shop to find that odd shoulder bolt in the digiphoto.

Final Touches …

Scott Grundfor emphasized paint and surface quality. This is not, of course, a particularly accurate way to duplicate the original finish, since modern paints are much better than those earlier. They come in more colors, too, so if a customer wants a perfectly accurate restoration, you'll have to do some research to find out what colors were originally offered. Classic Mercedes-Benzes came in more colors than Henry Ford's 'whatever you want as long as it's black,' but not in every color available today. Of course, if your customer wants the car in Coast Guard rescue orange, you can do it; but that's his vanity, not restoration.

Classic cars were almost entirely handmade, and this adds to their value because of the skills of the workers who built them. It's actually an advantage, when working with older cars, that they were built mostly by hand. That required a high level of work on the part of the manufacturer, but you can duplicate that quality of handwork if you're careful and painstaking. It may not be as perfectly consistent as a laser-guided welding robot, but the carmakers didn't use that technology to build the cars you'll be restoring in the first place. But this is a hopeful factor for restorers because these are all skills you either already have — welding, painting, metalforming — or can learn on your own. What will happen when cars from the early 1980's, the first cars with microprocessors and PROM's, start to appear as restored classics is anybody's guess. At this point, nobody can provide or build replacements for those control units if they prove needed, and given their sensitivity to small static discharges, moisture and other environmental assaults, they will. But that's a problem for restorers in the future. Maybe they'll develop the capacity to fabricate microcontrol units of their own design.

Canning the Preserves

There's a continuing last step in classical vehicle restoration: Often such a car is not really suited for general driving, so you have to either pickle it for the ages or explain in great detail to the owner how to preserve it between his annual parade excursions. You don't just fire the thing up and drive a few hundred yards around a display: That will leave the engine's internal surfaces as well as the inside of the exhaust system covered with water vapor, condensed out of the fuel burned. Run a restored classic up to operating temperature and hold it there long enough to blow out all the water you make — run it until the inside of the tailpipe is completely dry. Do this every time you start the engine. That's a good rule with any car, but with one that may not be started again for a year, it's standard procedure, a necessity.

Other preservative measures are well known: Use gas stabilizer; trickle-charge the battery from time to time; keep the tires pumped up and fix any that develop leaks (no occasional task with cars using old-style, inner-tube tires); pull the plugs and spray oil into the cylinders to prevent internal rust; bag the car to prevent dust accumulation and put an oil pan under it (those old rope, horsehair and leather seals don't work any better now than they did back then). Some people set a restored car up on jackstands to preserve the springs, which may be hard to replace if they sag. Irreplaceable springs can sometimes be stretched and heat-treated/oil-quenched to their original tension. Vintage tires (or usually better, vintage-looking tires that are really modern tires in ancient disguise) often need covered if they are to last in storage. Tires for antiques are expensive, but as little as the cars are driven, they may well be a one-time expense.

Mercedes-Benz may be the only carmaker to regularly include instructions for layup and storage in most of their shop manuals. While these procedures are similar for all cars, check those for the vehicle you've restored for its particulars. Largely complete technical information is available directly from the manufacturer for all Mercedes-Benz vehicles built since 1947. Owners clubs and restorers often have extensive knowledge of earlier models, even to maddening detail.

Genuinely classic cars are part of the historical technical treasure of humankind. Even if an early car is not, or is no longer by modern standards, a useful machine, it holds a place of importance in our technical history. An old car is just an obsolete machine; it has no rights. But we owe it to our grandparents — who built the cars — and to our grandchildren, maybe not yet born — to preserve enough of these machines that they can have a direct perception of what it was to be a person in past times.

Each of our sources has an Internet website, where you can learn more about his slant on Mercedes-Benz restoration:

www.dbp-autowerkes.com

www.scottgrundfor.com

www.silverstarrestorations.com

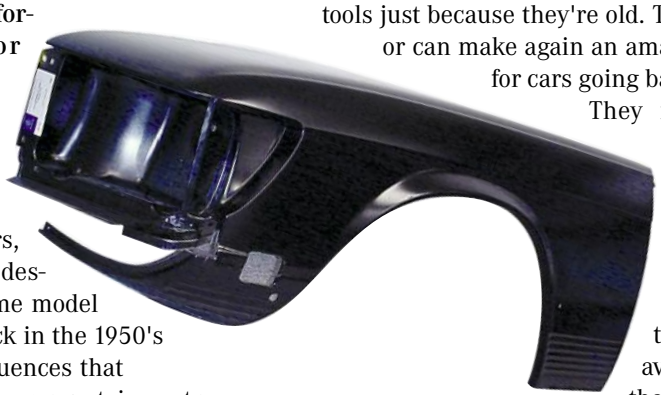
and last but hardly least, www.mbusa.com

STARTUNED

PARTS NEWS

We always try to choose items in this section, Parts News, to reflect our main themes in the rest of the issue. But when it comes to parts for classic cars in a restoration project, maybe we should call them "Parts Olds," not "Parts News." Nonetheless, we aim for useful parts information, be it current or antique.

SHEETMETAL

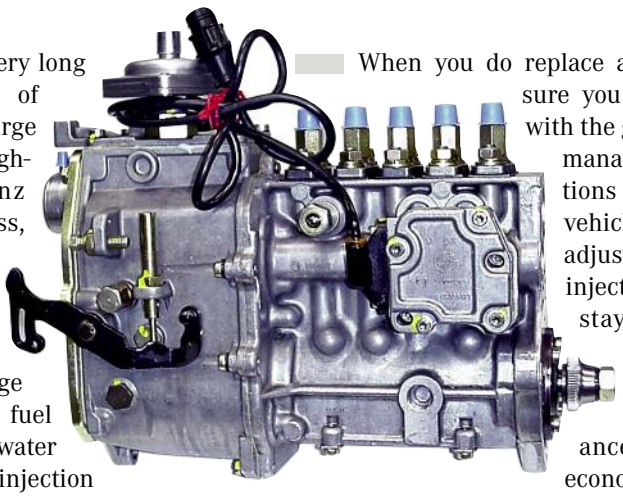


Unlike domestic carmakers, Europeans including Mercedes-Benz built essentially the same model for some years at a stretch back in the 1950's and 1960's. Whatever consequences that had for sales and styling, it means certain parts are common for some cars for longer than you'd think. The same fender might fit cars built for eight or ten years. The same hoods and doors as well.

One thing those carbulders in Untertuerkheim learned was this: Don't throw away perfectly good tools just because they're old. The factory either has or can make again an amazing variety of parts for cars going back to the late 1940's. They not mass-producing SL quarter panels, of course, so they're not as inexpensive as they were during the Eisenhower administration. But they are available, in a variety that can amaze you.

DIESEL INJECTION PUMPS

Some components last a very long time, and the components of Diesel engines figure large among them. Most of the highest-mileage Mercedes-Benz cars are Diesels. Nonetheless, eventually everything can wear out. Even more likely, components like injection pumps and injectors themselves can sustain damage caused by either the wrong fuel or fuel contaminated with water or grit. New or refurbished injection pumps are available to solve that problem, but make sure to find what went wrong with the original and make sure you eliminate that as well.



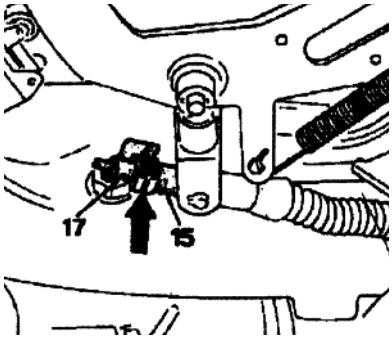
When you do replace an injection pump, make sure you set the injection timing with the greatest precision you can manage, following the instructions for that pump in that vehicle to the letter. The timing adjustment you make on an injection pump will probably stay where it is for the remainder of the life of the vehicle. When you consider the performance, emissions and fuel economy of mistakenly setting that timing even a degree wrong, here is a place to do exactly what the engineers have determined from their extensive tests.

StarTuned

Factory Service Bulletins

These suggestions and solutions for technical problems come from service bulletins published by Mercedes-Benz, selected and rewritten for independent repair shops. Your Mercedes-Benz parts source can obtain any designated by parts number.

Early full-load upshifts. Downshifts delayed. Model 124 with transmissions 722.3 /4 /5



If the control pressure slide valve travel is insufficient, you can get just these symptoms. To set the adjustment correctly, make sure the accelerator lever on the throttle valve housing or the fuel injection pump rests against the full-load stop with the pedal fully depressed but not to the kickdown position.

On some vehicles with engine 102, the adjusting screw is too loose and does not maintain the adjustment. On them, pull off the accordion boot from the control pressure cable and press the cylindrical extension of the knurled adjusting nut together until the nut is hard to turn or works like a clicking detent when turned.

AF27.60-U-3101A

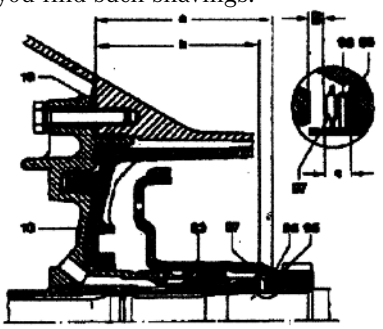
Transmission noise when coasting or in reverse

Models 124, 126 and 129

Check the service bulletin number below for exact application.

Unusual transmission noises on the vehicles affected may come from wear at the thrust bearing of clutch K1. The first indications of this is grinding audible when coasting or in reverse. Remove the transmission pan and check for steel shavings. Replace the transmission if you find any.

If not remove the valve body and large intermediate plate. Replace the transmission if you find steel shavings on the intermediate plate. Flush the torque converter and transmission lines anytime you find such shavings.

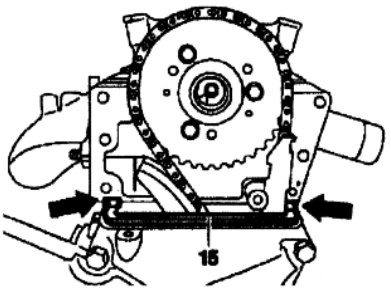


In the absence of shavings, remove the transmission, remove the front cover and replace the thrust washer and compensating shim. Measure the axial play of clutch K1 and correct if needed (see job 27-640, step 83). Flush the torque converter and coolant lines clean. If you find steel shavings in the cleaning fluid (usually kerosene), replace the torque converter.

AF27.00-U-1102AG

Oil leakage at top front cover

Engines 103, 104, 120



If oil leaks where the five parts meet between the cylinder heads gasket and the cover gasket, remove the top front cover and its gasket. Apply one drop of Loctite 5900 sealant to the right and left ends once they're entirely oil-free. This fills the gap between the cylinder head gasket and the cover gasket. This repair can't work if the parts are not entirely free of oil!

Dry the new cover gasket and insert it into an oil-dry groove in the timing case. Don't use sealant here. Lubricate the top of the gasket lightly with oil so the front cover can slide over it without damage to the gasket. Apply a thin layer of Loctite 5900 to the surfaces of the front cover that contact the cylinder head.

Press all parts joined with Loctite together for ten minutes or you can't be confident of the leak-tightness of your repair. Should this repair fail, the next step requires replacement of the cylinder head gasket.

AF01.40-U-4040CU

STARTUNED

MERCEDES-BENZ PARTS... NEARBY

Alabama

Dothan
Mike Schmitz Automotive
334-794-6716

Hoover
Crown Automobile
205-985-4200

Huntsville
Regal Auto Plaza
256-837-5752

Mobile
McConnell Automotive
251-476-4141

Montgomery
Jack Ingram Motors
334-277-5700

Tuscaloosa
Leigh Automotive
205-556-1111

Alaska

Anchorage
Mercedes-Benz of Anchorage
907-277-3383

Fairbanks
A & B Auto
907-456-6161

Arizona

Phoenix
Phoenix Motor
602-264-4791

Scottsdale
Schumacher European
480-991-1155

Tucson
Mercedes-Benz of Tucson
520-886-1311

Arkansas

Fayetteville
Jones Motorcars
501-521-7281

Little Rock
Riverside Motors
501-666-9457

California

Anaheim
Caliber Motors
714-777-1900

Bakersfield
Mercedes-Benz of Bakersfield
661-836-3737

Belmont
Autobahn Motors
650-637-2333

Beverly Hills
Beverly Hills
310-659-2980

Buena Park
House of Imports
714-562-1100

Calabasas
Calabasas Motorcars
818-591-2377

Carlsbad
Hoehn Motors
760-438-4454

Chico
Courtesy Motors Auto Center
530-893-1300

Encino
Auto Stiegler
818-788-0234

Escondido
Mercedes-Benz of Escondido
760-745-5000

Fremont
Claridge's
510-623-1111

Fresno
Herwaldt Motors
559-438-0300

Glendale
Calstar Motors
818-246-1800

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

La Jolla
Heinz Gietz Autohaus
858-454-7137

Long Beach
Mercedes-Benz of Long Beach
562-426-7301

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

Modesto
Modesto European
209-522-8100

Monterey
Stahl Motor
831-375-2456

Newport Beach
Fletcher Jones Motor Cars
949-718-3000

Oakland
Mercedes-Benz of Oakland
510-832-6030

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

Palo Alto
Park Avenue Motors
650-494-0311

Pasadena
Rusnak Pasadena
626-795-8004

Pleasanton
Mercedes-Benz of Pleasanton
925-463-2525

Riverside
Walter's
909-688-3332

Rocklin
Von Housen Motors
916-924-7278

Sacramento
Mercedes-Benz of Sacramento
916-924-8000

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

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

San Jose
Smythe European
408-983-5200

San Luis Obispo
Kimball Motor
805-543-5752

San Rafael
R.A.B. Motors
415-454-0582

Santa Barbara
Cutter Motors
805-682-2000

Santa Monica
W.I. Simonson
310-829-4511

Santa Rosa
Smothers European
707-542-4810

Stockton
Berberian European Motors
209-944-5511

Thousand Oaks
Silver Star A.G.
805-371-5400

Torrance
Mercedes-Benz of South Bay
310-534-3333

Van Nuys
Keyes European
818-461-3900

Walnut Creek
Stead Motors of Walnut Creek
925-937-1655

West Covina
Penske Motorcars
626-859-1200

Colorado

Colorado Springs
Phil Long European Imports
719-575-7950

Denver
Murray Motor Imports
303-759-3400

Littleton
Mercedes-Benz of Littleton
303-738-7700

Connecticut

Danbury
Mercedes-Benz of Danbury
203-778-6333

Fairfield
Mercedes-Benz of Fairfield
203-368-6725

Greenwich
Mercedes-Benz of Greenwich
203-869-2850

Hartford
New Country Motor Cars
860-522-6134

New London
Carriage House of New London
860-447-3361

North Haven
Mercedes-Benz of North Haven
203-239-1313

Delaware

Milford
I.G. Burton
302-424-3042

Wilmington
Wilmington Motor Cars
800-800-1949

Florida

Clearwater
Lokey Motor
727-530-1661

Coral Gables
Bill Ussery Motors
305-445-8593

Daytona Beach
Mercedes-Benz of Daytona Beach
386-274-4775

Ft. Lauderdale
Mercedes-Benz of Fort Lauderdale
954-462-4381

Ft. Myers
Mercedes-Benz of Fort Meyers
941-433-8300

Ft. Pierce
Coggin Motor Mall
561-466-7000

Ft. Walton Beach
Quality Imports
850-863-2161

Gainesville
Kraft Motorcar
352-332-7571

Jacksonville
Brumos Motor Cars
904-724-1080

Lakeland
Robert G. Waters
863-688-8111

Maitland
Mercedes-Benz of Orlando
407-645-4222

Melbourne
Continental Motorcars
321-956-0600

Miami
Mercedes-Benz of Miami
305-919-8000

Naples
Regency Autohaus
941-643-5006

Pensacola
Centennial Imports
850-432-9903

Pompano Beach
Autohaus Pompano
954-943-5000

Sarasota
Glauser
941-923-3441

St. Petersburg
Crown Eurocars
727-526-3738

Tallahassee
Capital Eurocars
850-574-3777

Tampa
Mercedes-Benz of Tampa
813-870-0010

West Palm Beach
Mercedes-Benz of Palm Beach
561-689-6363

Guam

Tamuning
Atkins, Kroll
671-646-2360

Georgia

Albany
Hentschel Motorcars
912-883-2040

Athens
Mercedes-Benz of Athens
706-549-6600

Atlanta
Carriage House Imports
770-964-1600

Atlanta
RBM of Atlanta
770-390-0700

Augusta
Rader
706-860-1111

Columbus
Columbus Motor
706-327-3636

Decatur
Atlanta Classic Cars
404-296-1313

Macon
Jackson Automotive
478-477-4858

Savannah
Critz
912-354-7000

Hawaii

Honolulu
Theo Davies Euromotors
808-592-5600

Idaho

Boise
Lyle Pearson
208-377-3900

Pocatello
Park Price Motor
208-232-1062

Illinois

Arlington Heights
Mark Motors
847-259-4455

Barrington
Motor Werks of Barrington
847-381-8900

Bourbonnais
Napleton's Autowerks
815-933-8221

Champaign
Sullivan-Parkhill Imports
217-352-4161

Chicago
Mercedes-Benz of Chicago
312-944-0500

DeKalb
Brian Bemis Imports
815-758-5451

Lake Bluff
Knauz Continental Autos
847-234-1700

Lincolnwood
Loeber Motors
847-675-1000

Loves Park
Napleton's Autowerks
815- 636-6600

Marion
Foley-Sweitzer
618-997-1313

Naperville
Mercedes-Benz of Naperville
630-305-4560

Normal
Sud's Motor Car
309-454-1101

Northbrook
Autohaus on Edens
847-272-7900

Orland Park
Mercedes-Benz of Orland Park
708-460-0400

Pekin
Mid/Town Imports
309-347-3191

Peru
J.P. Chevrolet GEO Nissan
815-223-7000

Springfield
Isringhausen Imports
217-528-2277

Westmont
Laurel Motors
630-654-8100

Indiana

Evansville
D-Patrick
812-473-6500

Fort Wayne
Shaver Imports
260-432-7200

Highland
Terry Shaver Imports
260-432-7200

Indianapolis
World Wide Motors
317-580-6810

Lafayette
Mike Raisor Imports
765-448-4582

Mishawaka
Gurley Leep Motorwerks
219-256-1500

Iowa

Davenport
Lujack's Northpark
563-388-8610

Des Moines
Mercedes-Benz of Des Moines
515-334-8339

Iowa City
Chezik-Sayer Imports
319-337-6100

Kansas

Shawnee Mission
Aristocrat Motors
913-677-3300

Topeka
Sunflower Motors
785-266-8480

Wichita
Scholfield Auto Plaza
316-688-5000

Kentucky

Ashland
Sim Fryson Motor
606-329-2288

Bowling Green
Bowling Green Imports
270-745-0001

Lexington
James Motor
859-268-1150

Louisville
Tafel Motors
502-896-4411

Louisiana

Alexandria
Walker Automotive
318-445-6421

Baton Rouge
Audubon Imports
225-296-7290

Lafayette
Moss Motors
337-235-9086

Metairie
Benson Motor
504-456-3727

Shreveport
Holmes European Motors
318-212-1212

Maine

Bangor
Quirk Auto Park of Bangor
207-941-1017

Falmouth
Performance Motors
207-781-3207

Maryland

Annapolis
Mercedes-Benz of Annapolis
410-268-2222

Bethesda
Euro Motorcars
301-986-8800

Cockeysville
Valley Motors
410-666-7777

Hagerstown
Mercedes-Benz of Hagerstown
301-733-2301

Owings Mills
R & H Motor Cars
410-363-3900

Salisbury
Pohanka TM
410-543-3411

Silver Spring
Herb Gordon
301-890-3030

Massachusetts

Boston
Clair International
617-469-1000

Boylston
Wagner
508-869-6766

Haverhill
Smith Motor
978-372-2552

Hyannis
Trans-Atlantic Motors
508-775-4526

Lynnfield
Flagship Motorcars
781-596-9700

Natick
Foreign Motors West
508-655-5350

Somerville
Chambers Motorcars of Boston
617-666-4100

West Springfield
Lewbar Imports
413-733-5102

Michigan

Acme
Black Forest Motors
231-938-2840

Ann Arbor
Auto-Strasse
734-663-3300

Bloomfield Hills
Mercedes-Benz of Bloomfield Hills
248-644-8400

Grand Blanc
Grand Blanc Motorcars
810-695-4400

Grand Rapids
Betten Imports
616-241-2671

Kalamazoo
Orrin B. Hayes
616-345-0167

Novi
Mercedes-Benz of Novi
248-426-9600

Okemos
Williams
517-484-1341

Rochester
Mercedes-Benz of Rochester
248-652-3800

Minnesota

Bloomington
Terry Feldmann's Imports
612-837-6300

Maplewood
Maplewood Imports
651-483-2681

Minnetonka
Sears Imported Autos
952-546-5301

Mississippi

Gulfport
Bert Allen Imports
228-864-6622

Jackson
Higginbotham
601-956-4211

Missouri

Columbia
Legend
573-875-5000

Creve Coeur
Plaza Motor
314-301-1715

Ellisville
Tri-Star Imports
636-458-5222

Joplin
Tri-State Import Cars
417-781-1177

Springfield
Elite
417-889-5750

Montana

Missoula
DeMarois Olds-GMC
406-721-4000

Nebraska

Lincoln
Husker
402-434-5100

Omaha
Mercedes-Benz of Omaha
402-384-9999

Nevada

Las Vegas
Fletcher Jones Imports
702-364-2758

New Hampshire

Greenland
Dreher-Holloway
603-431-8585

Manchester
Holloway Motor Cars
of Manchester
603-669-6788

New Jersey

Bridgewater
Millennium
908-685-0800

Cherry Hill
Mercedes-Benz of Cherry Hill
856-663-0984

Edison
Ray Catena Motor Car
732-549-6600

Englewood
Benzel-Busch
201-567-1400

Fairfield
Globe
973-227-3600

Freehold
David Michael
732-462-5300

Lawrenceville
Mercedes-Benz of Princeton
609-771-8040

Little Silver
Contemporary Motor Cars
732-842-5353

Millville
Joseph Pontiac-GMC-Buick
856-293-0003

Morristown
Mercedes-Benz of Morristown
973-267-9200

Newton
Intercar
973-383-8300

Paramus
Prestige Motors
201-265-7800

Union
Ray Catena Motor Car
908-964-4000

West Atlantic City
Precision Cars of Atlantic City
877-5MB-PARTS

New Mexico

Albuquerque
Premier Motorcars
505-821-4000

New York

Bayside
Helms Brothers
718-631-8181

Binghamton
Feduke Motors
607-772-0700

Brooklyn
Sovereign Motor Cars
718-258-5100

Fayetteville
Romano Motors
315-637-4500

Goldens Bridge
Estate Motors
914-232-8122

Huntington
Mercedes-Benz of Huntington
631-549-2369

Latham
Keeler Motor Car
518-785-4197

Long Island City
Silver Star Motors
718-361-2332

Massapequa
Sunrise Motors
631-789-1600

Nanuet
Mercedes-Benz of Nanuet
845-623-1500

New York
Mercedes-Benz Manhattan
212-629-1600

Rochester
Holtz House of Vehicles
716-424-4740

Rockville Centre
Lakeview
516-766-6900

Roslyn
Rallye Motors
516-625-1600

Smithtown
Competition Imports
631-265-2204

Southampton
Mercedes-Benz of Southampton
631-283-0888

Wappingers Falls
Friendly Motorcars
845-298-0600

White Plains
Mercedes-Benz of White Plains
914-949-4000

Williamsville
Mercedes-Benz of Buffalo
716-633-0088

North Carolina

Ashevillle
Skyland
828-667-5213

Charlotte
Beck Imports of the Carolinas
704-535-6400

Fayetteville
Valley Motors
910-487-0000

Greensboro
Mercedes-Benz of Greensboro
336-856-1552

Hickory
Hendrick Motors
828-322-5640

Raleigh
Leith
919-876-5432

Wilmington
Bob King Autohaus
910-799-3520

Winston-Salem
Mercedes-Benz of Winston-Salem
336-760-4580

North Dakota

Fargo
Valley Imports
701-277-1777

Ohio

Akron
Ganley
330-733-7511

Bedford
Motorcars East
440-439-0100

Canton
Kempthorn Motors
330-452-6511

Centerville
Ross Motor Cars
937-433-0990

Cincinnati
Mercedes-Benz of Cincinnati
610-984-9080

Columbus
Ed Potter
614-299-2144

Dublin
Crown Eurocars
614-799-4666

Mansfield
Weidner Motors
419-529-7800

North Olmsted
Motorcars West
440-716-2700

Sylvania
Vin Devers
419-885-5111

Tiffin
Coppus Motors
419-447-8131

Willoughby
Leikin Motor
440-946-6900

Youngstown
Fred Martin Ford
330-793-2444

Oklahoma

Oklahoma City
Mercedes-Benz of Oklahoma City
405-236-1224

Tulsa
Jackie Cooper Imports
918-249-9393

Oregon

Bend
Mercedes-Benz of Bend
541-749-2500

Eugene
Mercedes-Benz of Eugene
541-687-8888

Medford
Crater Lake Motors
541-773-3673

Portland
Mercedes-Benz of Portland
503-228-8351

Salem
Valley Motor
503-585-1231

Wilsonville
Mercedes-Benz of Wilsonville
503-454-5000

Pennsylvania

Allentown
Knopf
610-439-1555

Camp Hill
Sun Motor Cars
717-737-3030

Devon
Mercedes-Benz of Devon
610-688-7905

Doylestown
Keenan Motors
215-348-0800

Erie
Contemporary Motorcar
814-868-8622

Ft. Washington
R&S Imports
215-646-6045

Greensburg
Bud Smail Motorcars
724-838-1200

Lancaster
Mercedes-Benz of Lancaster
717-569-2100

Reading
Tom Masano
610-777-6587

State College
Leitzinger Imports
814-238-2447

Washington
John Sisson Motors
724-206-6000

West Chester
Brandywine Motor Cars
800-220-7278

Wexford
Bobby Rahal Motorcar
724-935-9300

Wilkes-Barre
Motorworld
570-829-3500

Puerto Rico

Carolina
Garage Isla Verde
787-620-1313

Rhode Island

Tiverton
Viti
401-624-6181

Warwick
Inskip
401-821-1515

South Carolina

Charleston
Baker Motor of Charleston
843-852-4000

Columbia
Dick Dyer and Associates
803-786-8888

Conway
Fowler Motors
843-347-4271

Florence
Newsome
843-662-8711

Greenville
Carlton Motorcars
864-213-8000

Hilton Head Island
Modern Classic Motors
843-681-8500

South Dakota

Sioux Falls
Vern Eide Motorcars
605-362-9500

Tennessee

Chattanooga
Long of Chattanooga
423-855-3726

Kingsport
Rick Hill Imports
423-224-2117

Knoxville
Mercedes-Benz of Knoxville
865-777-2222

Memphis
Mercedes-Benz of Memphis
901-345-6211

Nashville
Mercedes-Benz of Nashville
615-742-8000

Texas

Austin
Mercedes-Benz of Austin
512-454-6821

Beaumont
Mike Smith Autoplex
German Imports
409-840-2000

Bedford
Park Place Motorcars
214-443-8290

Corpus Christi
Ed Hicks Imports
361-854-1955

Dallas
Park Place Motorcars
214-526-8701

El Paso
Mercedes-Benz of El Paso
915-778-5341

Harlingen
Cardenas Autoplex
956-425-6000

Houston
Mercedes-Benz of Houston Greenway
713-986-6705

Houston
Mercedes-Benz of Houston North
713-986-6250

Houston
Star Motor Cars
713-868-6800

Laredo
Powell Watson Motors
956-722-5182

Midland
Britt Imports
915-699-7993

Plano
Ewing Autohaus
972-599-0909

San Antonio
Mercedes-Benz of San Antonio
210-366-9600

Temple
Garlyn Shelton Imports
254-771-0128

Texarkana
Pete Mankins Pontiac-Cadillac
254-793-5661

Tyler
Classic-Tyler Motors
903-581-0600

Waco
Allen Samuels Chevrolet-GEO
254-772-8850

Wichita Falls
Patterson Auto Center
940-766-0293

Utah

Salt Lake City
Ken Garff Imports
801-521-6111

Vermont

Shelburne
The Automaster
802-985-8482

Virginia

Arlington
American Service Center
703-525-2100

Charlottesville
Brown European Imports
804-817-3380

Fredericksburg
Noble Cars
540-373-5200

Hampton
Tysinger Motor
757-865-8000

Lynchburg
Kenneth Hammersley Motors
804-385-6226

Richmond
David R. McGeorge
804-755-9300

Roanoke
West Motor
540-344-6284

Vienna
H.B.L.
703-442-8200

Virginia Beach
Phillips
757-499-3771

Washington

Bellevue
Mercedes-Benz of Bellevue
425-455-8535

Bellingham
Wilson Toyota
360-676-0600

Fife
Mercedes-Benz of Tacoma
253-922-6820

Pasco
McCurley Imports
509-547-5555

Seattle
Phil Smart
206-324-5959

Spokane
Sutherland Motors
509-455-9100

Yakima
Hahn Motor
509-453-9171

West Virginia

Charleston
Smith Company Motor Cars
304-746-0600

Morgantown
University Motors
304-296-4401

Parkersburg
Astorg Motor
304-422-6403

Wisconsin

Appleton
Enterprise Motorcars
920-749-2020

Glendale
Concours Motors
414-290-1400

Madison
Z European
608-258-4000

Wausau
Rosemurgy International
Auto Mall, Inc.
715-675-7775

West Allis
International Autos
414-543-3000

Finding a Classic is Rare. Finding Its Parts Shouldn't Be.

Relive the good ol' days. Mercedes-Benz makes it easier to find classic car parts Call 1-866-MBCLASSIC, and Mercedes works to track down the genuine Mercedes-Benz classic part you need. So you can be sure of one thing: they really do still make 'em like they used to. Visit MBUSA.com/classic. **Genuine Mercedes-Benz Parts**

Mercedes-Benz

THERE'S NO BETTER PROTECTION FOR YOUR REPUTATION.

There's nothing like trust to keep your customers coming back. Which is why Mercedes-Benz and AMG rely on Mobil 1. Now Mobil 1 features the new SuperSyn anti-wear system. This patented technology represents the most advanced Mobil 1 engine protection ever. The more heat and friction threaten an engine, the more you can trust Mobil 1. So why give your customers anything less than Mobil 1? There's no better way to take care of a Mercedes-Benz. Or business. For more information, call 1-800-ASK-MOBIL or log on to www.mobil1.com. Nothing outperforms new Mobil 1.

THE MORE YOU KNOW ABOUT NEW MOBIL 1, THE BETTER IT IS FOR YOU, AND YOUR CUSTOMER.

Mobil® Command Performance