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Information for the Independent Mercedes-Benz Service Professional

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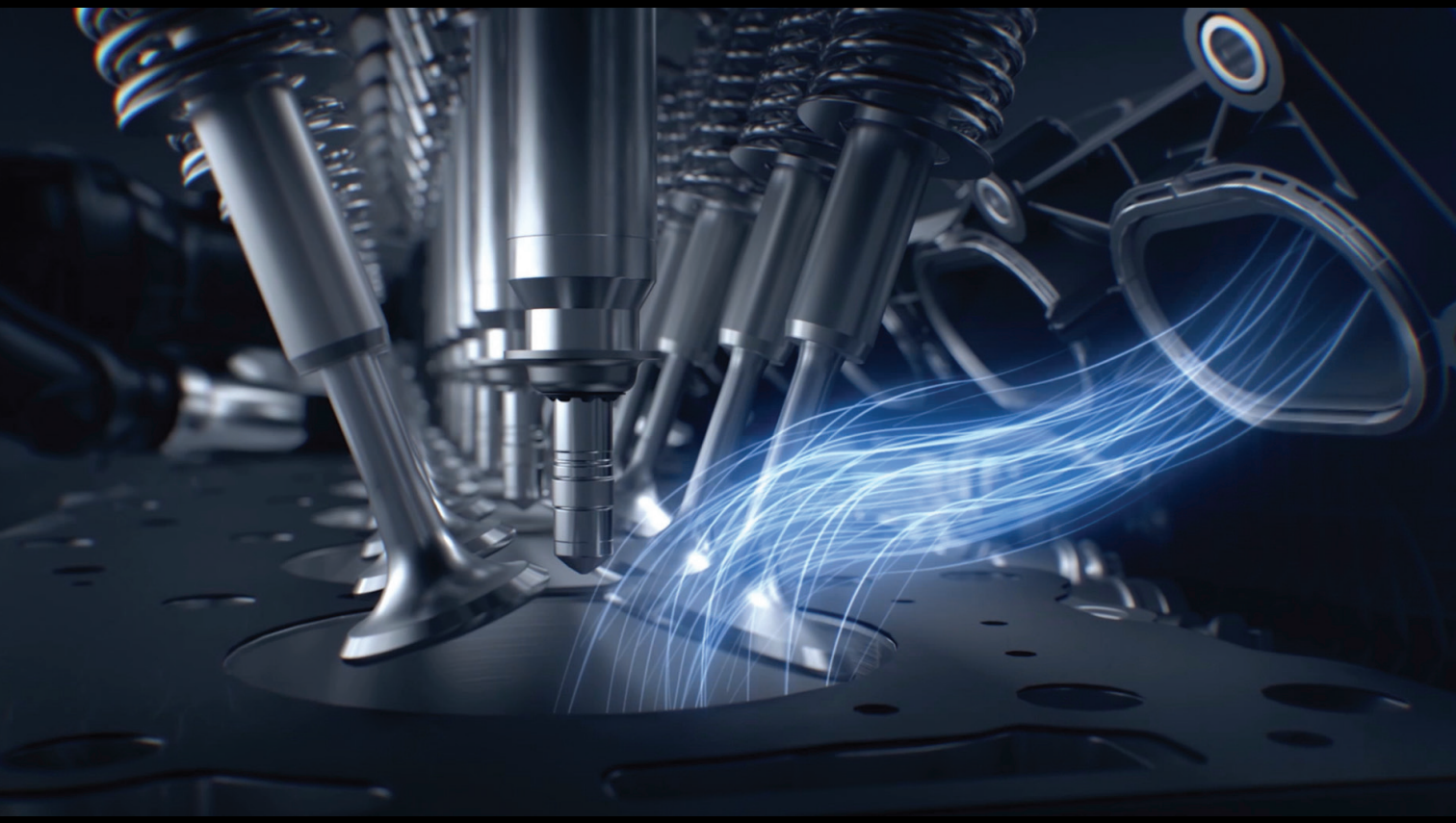

Inside:

Mercedes-Benz
The best or nothing.

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That's right: The warranty includes replacement labor by a dealer. Almost every part is warranted for...

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The Mercedes-Benz Classic Center specializes in both hard-to-find and common parts for older models. Here we see a fuel tank for the W198 Gullwing.

Classic Parts

Did you know that Mercedes-Benz USA has a Classic Center in Irvine, California? They specialize in repairs of classic vehicles, including high-value models as well as daily drivers. Perhaps you don't see many Gullwings in your shop, but that fellow with the 108 model needs parts just like a new S-Class owner, and that's where the Classic Center really shines. With over 50,000 Genuine Classic Parts available, they set the industry benchmark in classic vehicle support.

The Classic Center sells genuine Mercedes-Benz parts to workshops just like yours. While most of the parts they sell are also available from your local dealer, some are...

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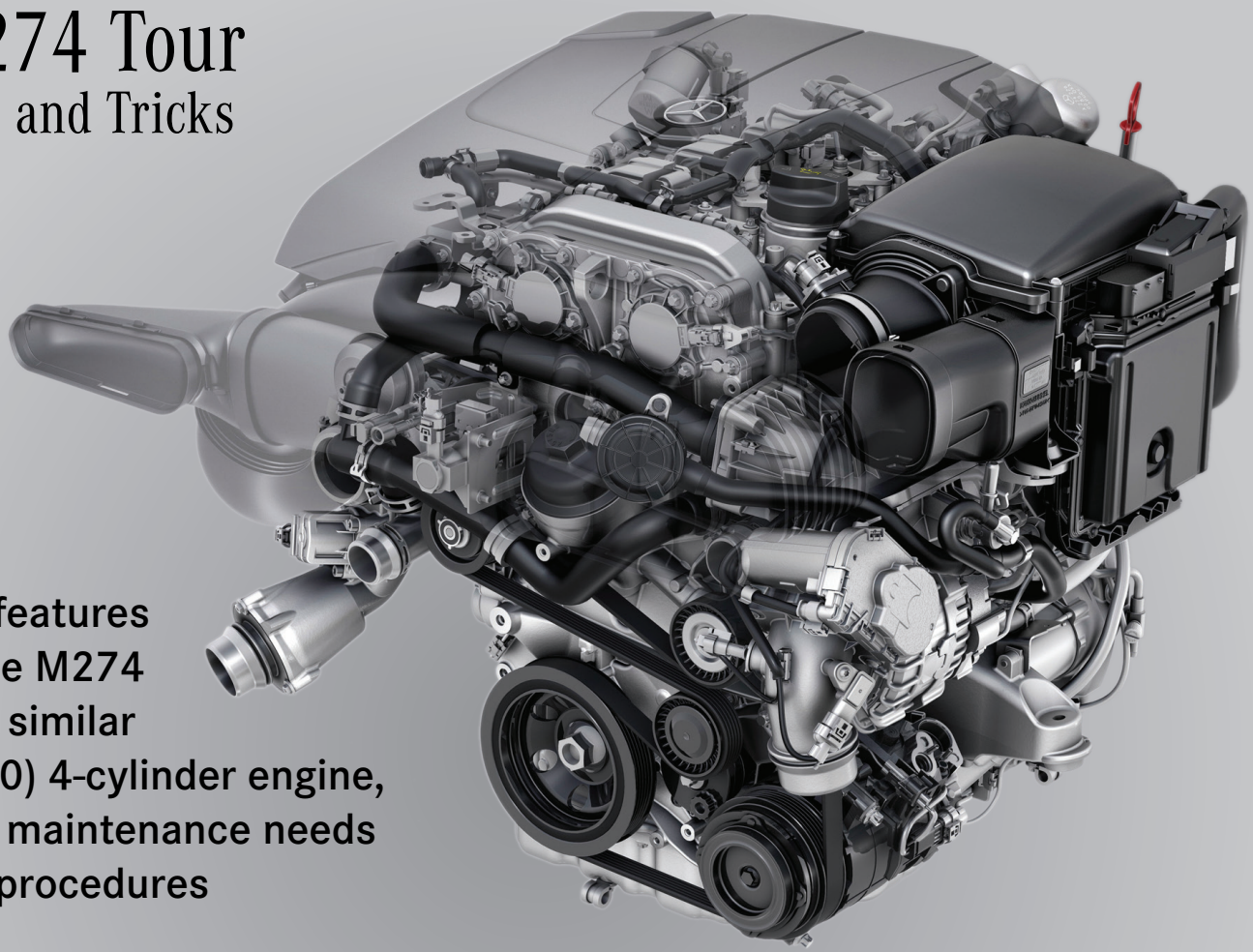
M274 Tour
Tips and Tricks



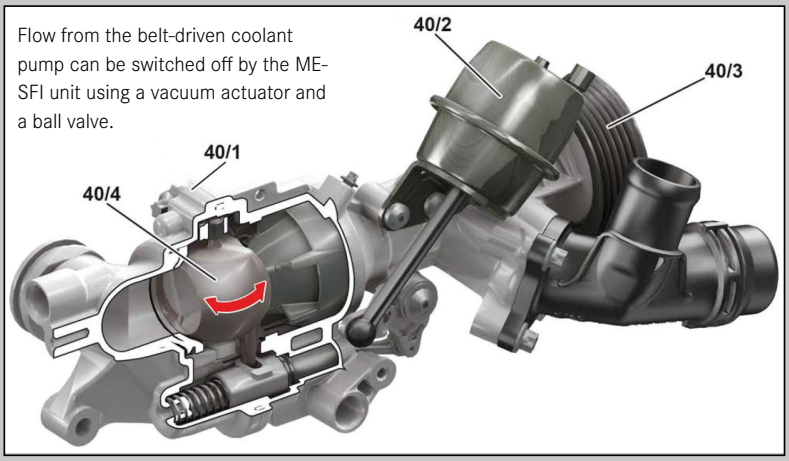
The features of the M274 (and similar M270) 4-cylinder engine, with maintenance needs and procedures

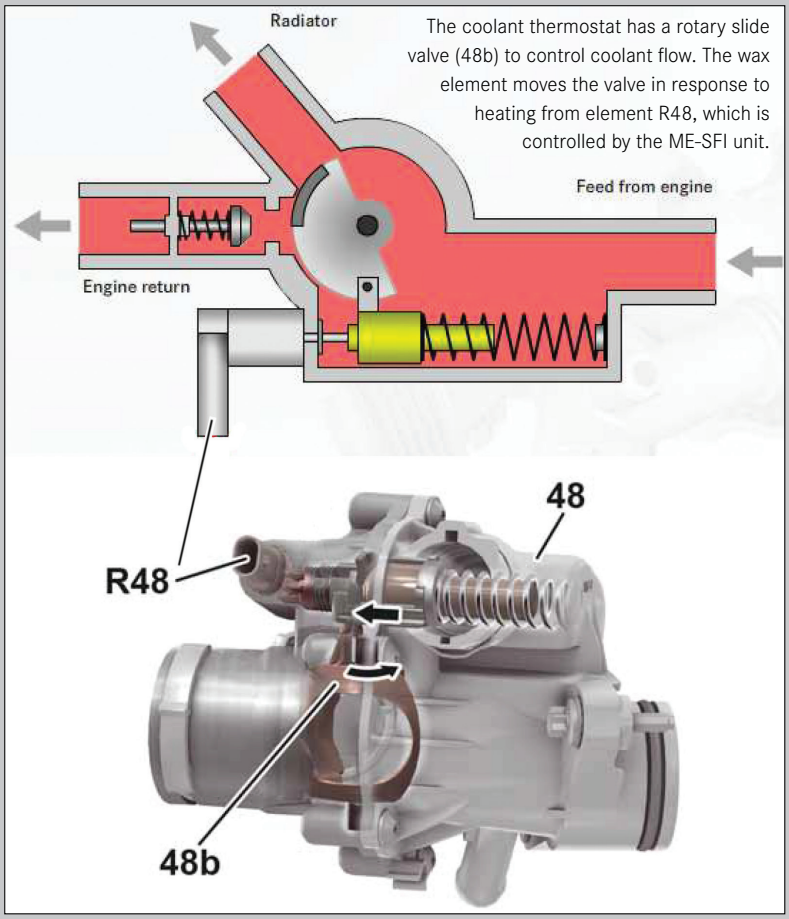
Introduced to the United States in the Model 205 C-Class in Model Year 2015, the M274 4-cylinder engine joined its year-old sister engine M270. While our focus will be on the longitudinally-mounted M274 intended for rear-wheel-drive vehicles, the transverse-mounted M270 is essentially the same engine, and much of this information applies to both. While not as widely installed as the big brother M276 and M278 engines, there are still millions of these engines on the road worldwide, many of them needing to visit your shop for maintenance and service.

Overview

The M274 is a gasoline direct-injection (DI) engine equipped with a single turbocharger. Improvements in CO_2 emissions, power, torque and engine noise were the goals for the design of this M271 replacement. Intake air and engine thermal management are especially new systems, and the ECO Start/Stop function is standard equipment. In the United States, the M274 is a 2 liter engine, but other displacement variants are found elsewhere.

The DI system uses Piezoelectric fuel injectors for extremely fast and precise fuel delivery. A high-pressure fuel pump delivers up to 200 Bar (nearly 3,000 psi) and is driven mechanically by the intake camshaft. The single turbocharger is vacuum-controlled. The cooling and oil circuits are carefully regulated and controlled for better efficiency. The crankcase and oil pans are made of die-cast





aluminum with an open-deck crankcase, with high-strength aluminum alloy cylinder heads. Two overhead camshafts, each with solenoid adjusters and driven by a conventional timing chain, actuate a total of four valves for each cylinder. The oil pump is driven by a separate chain from the crankshaft.

Thermal Management

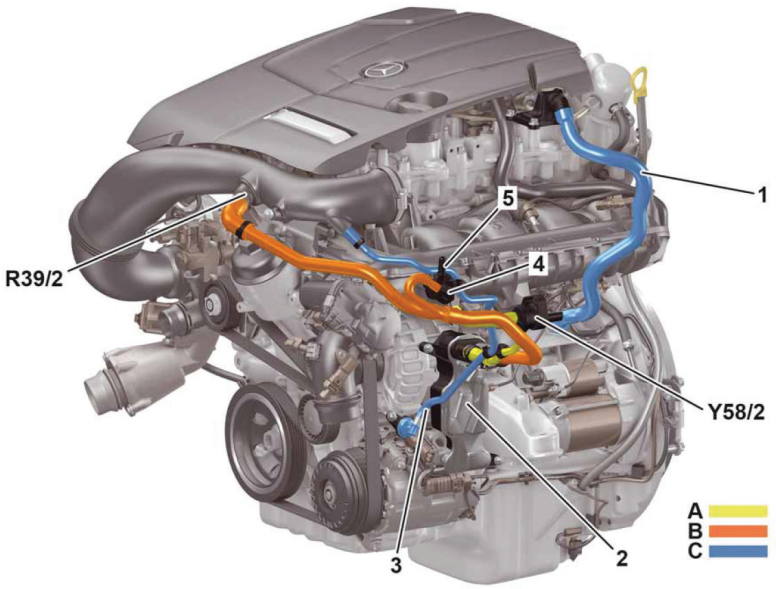
The ME-SFI engine control unit (ME) closely regulates the coolant temperature in the engine. This allows the engine to reach operating temperature more quickly, which is intended to reduce exhaust emissions while improving heating performance. After a cold start, ME switches off the coolant pump switchover ball valve via a vacuum actuator, stopping coolant flow.

The coolant thermostat contains a heating element, activated by a ground signal from ME, which is used to control engine temperature via the thermostat. Within the thermostat is a wax element that, when heated, adjusts the position of a rotary ball valve. This allows for fine-tuning of the warm-up process while still allowing coolant to flow to the cabin heating system, as well as careful regulation of the coolant temperature to a range of 98°C to 108°C.

The Power Train Control Unit controls the electric cooling fan. Using a Pulse-Width-Modulated (PWM) signal, the fan speed can be varied from off (10% PWM) to full speed (90% PWM). The reason these values are not 0% and 100%, respectively, is to allow for diagnosis: PWM values below 10% or above 90% should never be seen, and if they are, there is a fault somewhere. If a problem is detected, the fan is commanded to maximum speed. The fan can run for up to about 5 minutes at a PWM setting of 40% after key-off to help cool the engine,

but if battery voltage sinks too low, this can be suppressed. For safety, allow some time before getting under the hood.

In case of detected overheating of the engine, engine timing is retarded to help reduce heat generation. According to the specifications, this adjustment starts around an engine coolant temperature of 90°C and charge air temperature of 20°C, and depends on engine speed and load. Assuming wide-open throttle (WOT), at 100°C coolant and 20°C charge air temperatures, a 2° CKA (Crankshaft Angle) retardation is expected; while at 100°C coolant and 60°C charge air temperature, the adjustment is 8° CKA; at 125°C coolant and 60°C charge air temperature, 11° CKA is expected.



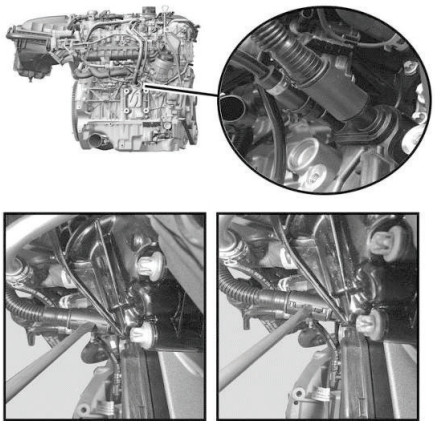
Crankcase ventilation in the M274. At partial load (A) gases are routed from the oil separator (2) through a switchover valve (Y58/2) to the charge air pipe. At wide-open throttle (B), the turbo pressurizes the charge air pipe, so gases have to be routed to the air intake pipe instead. R39/2 ensures the line doesn't freeze. The purge valve (4) manages fuel tank ventilation (5).

Engine Ventilation

As with the M270, the crankcase ventilation is somewhat complex. The nearby image shows the hoses, connections and routing. Be aware that there have been several variants of this system, so be sure to check in the Mercedes-Benz Workshop Information System (WIS) for model-specific information and be careful to trace the lines accurately to avoid mix-ups. The M270 is similar, but components are placed differently.

Be aware that some engine ventilation components are not able to be replaced separately. Instead an assembly must be installed. To help with any costly errors, check the Mercedes-Benz Parts Information application, WIS, or ask your local dealer about which parts are available before disassembling any part of the engine ventilation system.

Basically, gases within the engine are collected and routed to the intake to be burned. At partial load, the Partial Load Operation Crankcase Ventilation System Valve (Y58/2) is opened, and gases are extracted from the oil separator at the lower front left of the engine and delivered to the charge air distributor (intake manifold). In WOT operation (when the manifold is at pressure due to turbocharging), ventilation occurs from the oil separator to the air intake pipe, using a venturi. In the WOT vent line there is a heating element (R39/2) that keeps the crankcase ventilation system from freezing. Blow-by gases are collected at the oil filler neck, via a passage in the crankcase to the oil separator. A purge valve handles fuel tank ventilation needs.



The vent line connector is destroyed during removal and must be replaced. Cut open the rubber sleeve and use a screwdriver to fracture the connector as shown. This image shows the M270; the M274 is similar.

Between the oil separator and the WOT vent line, there is a connector that is destroyed when disconnecting and must always be replaced. To remove it, cut open the rubber lining and position a flat-blade screwdriver at the predetermined fracture point. Twist to break open the sleeve.

Chain Drive and Camshaft Adjustment

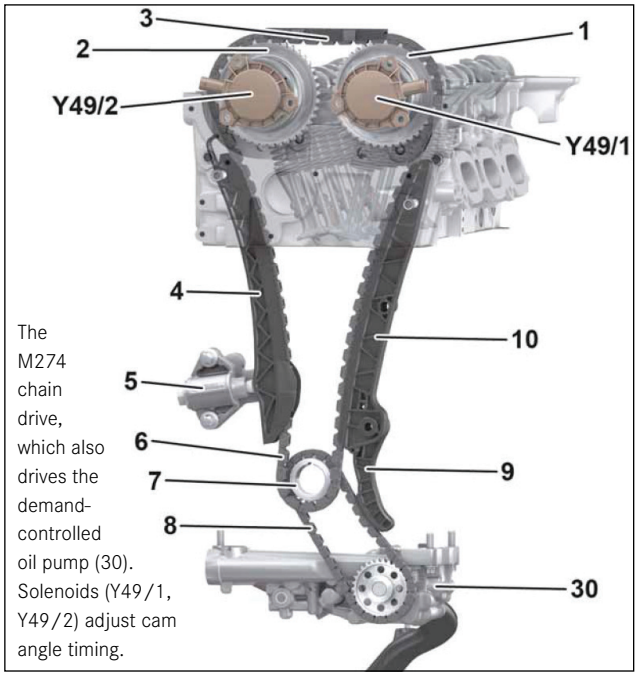
If you are familiar with other Mercedes-Benz engines, this system will be familiar, so we'll just touch on it. Intake and exhaust camshaft angles can be varied about 30° CKA (intake, advanced) and 40° CKA (exhaust, retarded) using solenoid adjusters. A 150 Hz PWM signal from the ME controls these solenoids using a characteristic map in the partial-load and WOT range. Hall sensors monitor camshaft

angles and report this back to the ME as a variable voltage. In this way, variations between commanded angle and actual angle are sensed and, in case of a mismatch, a Diagnostic Trouble Code (DTC) may be stored.

Removing the cylinder 1 ignition coil and the camshaft Hall-effect sensors allows you to check the basic timing. Look in WIS for the exact procedure. Do this any time you suspect a valve timing issue or see a related DTC.

Engine Air Supply

To help engine efficiency, an air intake path needs to have a low resistance to air flow, yet maintain favorable flow conditions under all possible circumstances. Intake air is passed through a relatively large air filter to minimize flow resistance and is delivered to the cold side of the turbocharger. The expelled exhaust gases drive the hot side of the turbo and cause the incoming air to be compressed. This air, heated by the act of compression, is cooled as it passes through the charge air cooler. In cars, the charge air cooler uses the low-temperature (liquid) coolant circuit, while in the Metris van, an air-to-air charge air cooler (mounted below the coolant radiator) is used. From there, it enters the engine via the charge air distributor pipe at a pressure of about 10 psi.

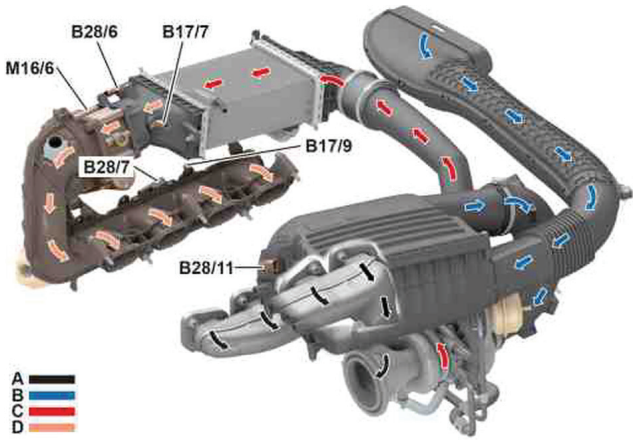


The M274 chain drive, which also drives the demand-controlled oil pump (30). Solenoids (Y49/1, Y49/2) adjust cam angle timing.

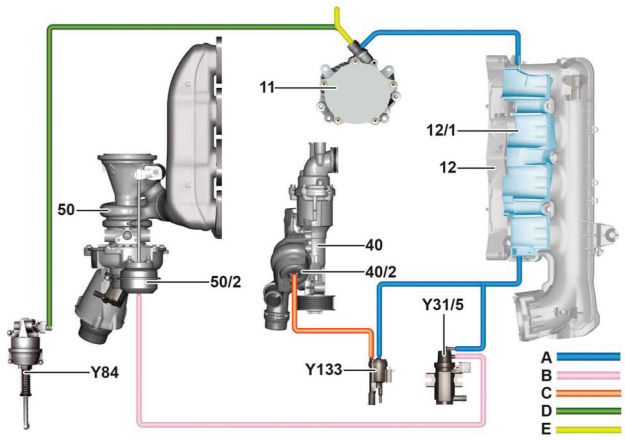
As a side note, in the Mercedes-AMG high-performance cousin of this engine, the M133 uses a similar system at a boost pressure exceeding 25 psi to extract more than one horsepower per cubic centimeter of displacement.

As is typical in a turbocharged engine, the intake manifold is not a reliable source of vacuum, so an engine-mounted vacuum pump is used. Although the days of vacuum-actuated climate control systems are long gone, vacuum is used for the brake booster, the boost pressure control flap, and controlling the coolant pump, for example. A vacuum reservoir is integrated into the molded charge air distribution pipe.

For the full-load crankcase ventilation system, the intake pipe has a small narrowing (venturi) to produce limited vacuum. At low or partial load, when the turbocharger is not producing appreciable boost, the charge air pipe also has a limited vacuum.



M274 air intake as seen in passenger cars. Filtered intake air (B) is compressed by a turbocharger (50) powered by exhaust gases (A). The heated, compressed air (C) is cooled by the charge air cooler and fed into the engine (D).



The M274 vacuum system. In a turbo engine, manifold vacuum is inconsistent, so a vacuum pump (11) is used in combination with a vacuum reservoir (12/1) housed within the intake manifold (12).

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

Fuel Injection

The Piezoelectric fuel injectors allow for very precise fuel delivery, again to help manage fuel economy and emissions. The fuel feed line is sealed at the high-pressure end by a sealing unit consisting of an O-ring and anti-extrusion rings. The seal between the fuel injector and cylinder head is a Teflon ring. Any time an injector is removed, it is absolutely critical that the WIS instructions for reinstallation are followed closely, particularly concerning the use of the special tools for this job, to ensure a leak-free installation. All seals and the hold-down spring must always be replaced. Never use a slide hammer, since the rail is soldered, and both the rail and injector will be damaged.

During operation, the injectors operate at voltages between 125V and 210V and a current of up to 8 amperes, which can be fatal if contacted by the body. Never expose yourself to these voltages by, for example, attempting to measure them directly as opposed to using a contact-free current clamp. If the ignition must be switched on, do not touch any part of the system or testing instruments/probes while energized. Accidentally shorting either injector control wire to ground will damage the ME, and accidentally reversing the polarity of the wires will damage the injector.

The injectors themselves are fragile, as the piezoelectric elements are similar to thin glass. Never apply a voltage to a piezo injector, as it will be damaged. Dropping an injector or subjecting one to any kind of shock (such as a hammer blow) will destroy it, requiring replacement. Any contamination of either end of the fuel injector will also damage it, so always use clean protective caps at every removal.

Lastly, the high-pressure side of the fuel system (which includes the injectors) can remain at over 200 Bar (3,000 psi) for a very long time after the engine is switched off. Use extreme care in depressurizing the system prior to repair work to avoid having fuel penetrate your skin under pressure, which can be fatal.

Ignition

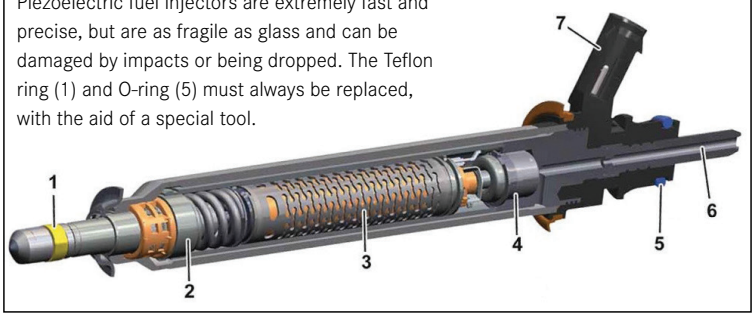
In a conventional engine, the ignition system generates a single pulse for the spark plug to ignite the combustion mixture. The M274 family of engines operates in both single-spark and multi-spark modes. Initially the same as a single-spark cycle, in a multi-spark cycle the ignition coil energy is not fully discharged, but is recharged in the interim so it can again provide enough energy for additional sparks. These multiple sparks allow for a slower, yet more complete combustion, increasing fuel efficiency while reducing emissions and engine noise (particularly after a cold start and during the warm-up phase).

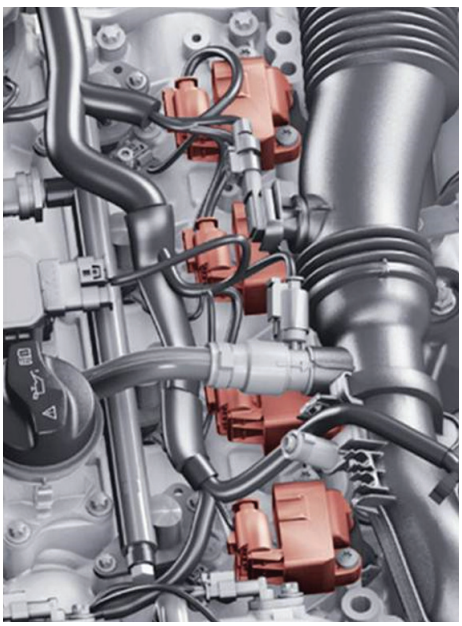
Each spark plug has its own coil. The spark plugs are connected to the coil by a short boot. The ME controls each coil through individual direct connections. The ignition coils also deliver diagnosis information back to the ME through the same wire.

Maintenance

Vehicles equipped with the M274 (and M270) engine are equipped with the Mercedes-Benz ASSYST PLUS system. As always, check the owner's maintenance booklet or the maintenance sheet in WIS or STAR TekInfo for the most accurate information, but in general these engines need an

Piezoelectric fuel injectors are extremely fast and precise, but are as fragile as glass and can be damaged by impacts or being dropped. The Teflon ring (1) and O-ring (5) must always be replaced, with the aid of a special tool.





The coil-on-plug ignition coils have a short boot for the connection to the spark plug. See the text for why only genuine Mercedes-Benz spark plugs should be used.

oil and filter change every 10,000 miles (or one year). The engine oil dipstick is used to check the oil level.

As with virtually every vehicle, the maintenance sheet also calls for engine air filter replacement every 40,000 miles (or 4 years) and fuel filter and coolant replacement at 120,000 miles (or 10 years). Check the maintenance sheet for a complete rundown of all the required maintenance points.

Service Notes

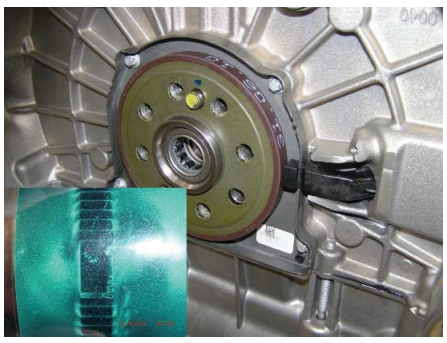
Aside from those already mentioned, a few service tips might help save some time.

The crankshaft position sensor is mounted near the flywheel, but it cannot be placed straight into the opening. Instead, it needs to be guided 'around the corner' and into a slot. See the nearby image showing the 'hidden' part of the sensor mounting. Instead of sensing flywheel tabs or slots, a magnetic 'increment wheel' is used. The increment wheel is fragile and can be damaged by rough handling, metal shavings or exposure to another magnet.

When checking ignition angles, the only possibility is to use XENTRY Diagnostics. The ignition angle cannot be measured with conventional tools and equipment.

When working on the injectors and fuel rail, the stainless steel lines can be reused as long as they pass the test as specified in WIS. At over 200 Bar, you don't want a leak, so if you're not sure, replace it.

Use only genuine Mercedes-Benz spark plugs. Aftermarket plugs are not always indexed, meaning the electrode gap needs to be facing a specific direction. Install incorrectly indexed plugs and the M274 will, as with the other Direct Injection engines from Mercedes-Benz, suffer from melted or cracked pistons from incorrect combustion patterns. If you haven't read the article on spark plugs in the March 2021 issue of *StarTuned*, now is the time to go look at it.



The increment wheel has magnetic 'stripes' (visible on the testing film) which are read by the hall-effect crankshaft position sensor. The wheel itself is fragile. The sensor, seen here from the inside, doesn't go in straight but needs to be maneuvered 'around the corner' and fitted into its slot during installation.

Connected in parallel with the ME's piezo actuator module is a 200 Ohm discharge resistor. This value can be measured on the injector plug after disconnecting it from the injector. Be absolutely certain the ignition is off and the key is in your pocket, since this connector carries dangerous voltages when the ignition is on.

It probably goes without saying, but we'll say it anyway: All work around the fuel system must be surgically clean, since even the slightest speck of dust can ruin the system.

While beyond the scope of this article, the M274 is also installed in vehicles equipped with 4MATIC. These models have a conventional transmission/transfer case arrangement, while vehicles with M270 have a very different setup due to the transverse mounting. Check in WIS for those details.

One Last Thing

We often refer to the Mercedes-Benz Workshop Information System for 'more details,' but not because we want to leave you in the dark. In fact, except for the simplest of jobs, working without WIS often leads to frustration, broken parts, incorrect (or even unsafe) repairs and just a boatload of trouble. If your shop already has a subscription to WIS (part of STAR TekInfo) you know its value, but in our travels we meet shop owners and technicians who don't use WIS, often saying "it's too expensive."

All we can say is 'give it a try.' Working without WIS is working blind.

Visit startekinfo.com and select the application (passenger cars, commercial vans, or ISPPI parts catalog). Hundreds of documents are available for free, without registration, but if you want a full subscription, just either log in (if you already have a "C7" user ID) or register as a new user. Once you're logged in, there should be a "Subscribe/Renew" button on the top right. Click that and follow the instructions. If you end up on the UMAS page, you're headed in the wrong direction: Go back to the home page, log out and start again.

We hope you found this article about the M274 engine informative and practical. We covered some of the newer systems and functions, and offered some of the more common service tips we've come across in our work. If there's something you'd like to see in *StarTuned*, please drop us a note. We'd love to hear from you!

Fiber Optics

D2B and MOST Bus

How they work, wake-up signals, testing and repairs

Fiber optics are generally relegated to the infotainment systems of Mercedes-Benz vehicles, including the sound system, navigation screens, backup cameras, etc. But first things first: Why fiber optics? The short answer is simplicity. Vast amounts of information needs to be sent in the case of body and comfort systems. This would require extremely complex wiring which can be reduced by using a fiber optic network. Just as a fiber optic internet service provides superior information transfer in a single fiber optic cable to your home, fiber optics provides that in spades in Mercedes-Benz comfort systems. In the case of the MOST fiber optic network, the data rate of 24.8 Megabits-per-second (initially; subsequent generations increased this to about 150 Mb/s today) is significantly faster than the D2B predecessor at about 5.6 Mb/s. A secondary benefit of fiber optics is they are nonmagnetic so they are not subject to RFI (radio frequency interference). Also corrosion, water damage and intrusion are a non-issue.

Fiber optics used by Mercedes-Benz are plastic fibers that pass light signals from one component to another. Each component has two fiber optic cables, an in and an out. These light signals get converted to electrical signals and the components either use the information to either operate or pass it further along to the next component.

The first version of fiber optics developed by Mercedes-Benz was introduced in Model Year 1998. This fiber optic system was called Domestic Digital Bus (D2B), which was later upgraded to Media Oriented System Transport (MOST) bus starting around 2003 with the introduction of the E-Class type 211. Though both operate the same way, the MOST systems are faster and tougher. In general, the minimum bend radius of a fiber optic cable is 25mm (about an inch) but in any case they must not be kinked or cut.

In contrast to the D2B system, MOST is an industry-wide system with somewhat lower costs and greatly increased...

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High Energy

48-volts and some seriously cool technology get wrapped into the Mercedes-Benz EQ Boost System, and techs beware: There's lots to learn.

Many of us have entered the world of hybrid and high-voltage EV repair in one way or another over the last few years. Our learning curve on things medium and high voltage, in general, has begun.

The leap toward all-electric vehicles is accelerating at a staggering pace. Mercedes-Benz is all-in with the recent introduction and roll-out of its EQ lineup of vehicles, along with a commitment to a 100% electric lineup by the end of this decade. The all-electric platform, known as EQ, the EQ Power series of full hybrid and plug in cars, and now the mild-hybrid solution, EQ Boost.

EQ Boost is a 48-volt light hybrid system, which boosts the combustion engine with up to 21 additional horsepower when needed, much like the ERS-K and ERS-H systems in Formula 1.

The relatively new (to the industry) 48-volt technology is creeping into dealer service bays and independent repair shops everywhere. It's the latest trend. Why? 48-volt technology is fast becoming the industry's preferred method for light electrification–and to an extent, hybridization of the traditional ICE-only (Internal Combustion Engine) equipped vehicle. The big advantage is that for a given power, both motors and wiring can be about a quarter the size of the 12-volt equivalent, saving money and, more importantly, weight.

Mild hybrids are nothing new. Many manufacturers including Mercedes-Benz have recently jumped on the 48-volt bandwagon and for good reason. This is because 48-volt power brings huge benefits to not only fuel economy and emissions reductions, which are significant, but also, 48-volts provides an acceptable level of energy and current supply for the modern vehicle's high-load electronic options and drive by wire systems.

Back in 1995 into the 2000 model year, we remember an industry-wide discussion on movement toward a standardized 42 Volt system to augment the 12-volt...

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Sprinter “B” Service: Major Service

A step-by-step walk through of a major service on a 2014-2017 Model 906 Sprinter van

Routine maintenance is the bread and butter of the automotive service industry. You could call it the “sine qua non” of your business, arguably the most essential aspect of the services you provide. It’s usually not glamorous or highly technical, but there is great satisfaction in keeping your customers mobile by being able to provide a proper scheduled maintenance routine for their vehicles, as well as keeping an eye on the whole vehicle to help ward off future problems.

One of the plusses is that there is rarely anything to go wrong with doing a routine service—no major problems to troubleshoot or customer concerns, although there may be some listed separately on the work order. Having the proper Mercedes-Benz service schedule and following it is paramount to giving your customer the service they deserve.

To help drivers manage service visits and costs, the Sprinter uses the Flexible Service System (FSS). This means alternating Service A and Service B routines are needed after a certain amount of time or distance to maintain vehicle performance and reliability. With the Active Service System (ASSYST), the maintenance computer tracks distance driven and the time elapsed since the last service. The maintenance service needed is shown in the multifunction display in the instrument cluster. Approximately one month before the maintenance service is due, the multifunction display shows a message. It indicates when the next maintenance service is due in miles or days. The icons or letters on the service indicator show the type of service that is due: A single wrench or letter A means an Oil Service Plus is needed, while two wrenches or the letter B means a Maintenance Service. In addition, there are some time-based recommended service intervals: Every 24 months replace the brake fluid and cabin air filters,

Left: These are some of the usual parts you’ll need to perform a proper B service on a Sprinter van.

every 120 months replace the rear axle fluid and every 180 months (15 years) replace the engine coolant.

Here are the step by step procedures for the B or Maintenance Service for a 2016 Mercedes-Benz Sprinter 2500 Base Model; others are similar.

Maintenance Service

Drain

Diesel Exhaust Fluid: Drain the DEF fluid from tank and refill. DEF does break down chemically over time, so draining and replacing older fluid is necessary.

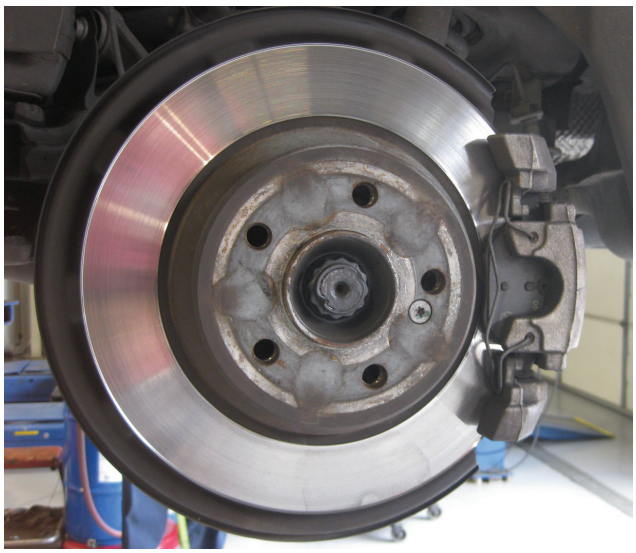
Inspect

These inspections are to ensure that any potential issues are recognized early enough to prevent them from becoming a problem.

Brake System: This includes inspecting fluid level, parking brake, all lines and hoses for leaks or faults, and condition of friction pads and rotors.

Chassis Components: Check vehicle for corrosion, accident or paint damage.

Diesel Particulate Filter (DPF): This service is due every 4th maintenance (B) service. Internal inspection is not possible without removing the filter but you should look for any signs of external damage that might indicate an internal issue. If there is a blockage you can expect to have a code set in the control module. Short trip driving can lead to failed regeneration attempts, clogging the DPF.



Removing the wheels for a thorough inspection of the brake components ensures the safety of your customers.

Door Check Straps: You should also inspect the sliding door hardware and water drains.

Exterior Lamps: Check all bulbs for proper operation and note any lens damage, etc.

Fluid and Lubricant Levels: Inspect for proper fill level and general condition. All assemblies: engine, transmission, transfer case, axles, steering, power steering pump, brakes. If there is fluid loss determine the cause and correct it.

Lines and Hoses: Inspect all lines, hoses and sensor cables, particularly on the underbody. Observe line routing and check carefully for chafing.

Leakage: Inspect all systems including engine cooling system (corrosion inhibitor/antifreeze), hydraulic brake...

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