TECHDRIVE

VOLUME 3 NUMBER 2

A PUBLICATION FOR INDEPENDENT BMW SERVICE PROFESSIONALS MAY 2006

TECHDRIVE Magazine

For the independent BMW service professionals

The Ultimate Driving Machine®

OBD II • DYNAMIC STABILITY CONTROL • FLUIDS

TO OUR READERS

— What could be more useful to independent service technicians who work on BMWs than a publication dedicated specifically to them?

— That's the idea behind the magazine you're holding, TECHDRIVE. BMW of North America both sponsors the publication and provides much of the information that's included. A big part of the rationale behind TECHDRIVE is the belief that if you are able to diagnose, repair and maintain BMW vehicles properly and efficiently, your reputation and ours will be enhanced.

— TECHDRIVE's combination of feature service articles (written from both BMW tech information and interviews with successful independent BMW specialists), new technical developments, systems evolution, as well as the correct BMW replacement part, and service bulletins are intended to help you fix that BMW right the first time, on time. Our list of BMW dealers will assist you in finding Original BMW Parts.

— There's more to this effort, including highly-informative and user-friendly web sites, which we'll explain in future issues.

— We want to make TECHDRIVE the most useful and interesting technical magazine you receive, and you can help us do that. Please email us at editor@techdrivemag.com and let us know what topics you'd like to see covered, and provide any other comments you might have. With your involvement, this publication can evolve into one of your most important tools.

Thanks for your continued interest.

For more information please email us at:
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TECHDRIVE

Original BMW Parts

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Happy Birthday OBD II

Emission Control System becomes diagnostic tool

Bring out the birthday cake and light the candles, the second generation of on-board diagnostics, universally known as OBD II is now 10 years old. And if the candles don't light, plug your scan tool into the cake and see if any DTCs (Diagnostic Trouble Codes) have been set!

The tenth anniversary of this powerful tool seems like a good time to review just how OBD II came to be and the basics of how it works in a BMW. A good understanding of how OBD II works in a BMW is especially important if you haven't made the investment in the BMW GT1 diagnostic tool.

If you're working without benefit of the GT1, OBD II's capabilities are especially important.

Historical perspective

When the first emission control standards were imposed in the 1960s (PCV was federally-required for the 1963 model year) and on into the 1970s, carmakers initially relied on mechanical systems to meet the standards. As anyone who drove or serviced cars of that era knows, mechanical technology to control emissions left a lot to be desired. Vehicles ran hot, got terrible gas mileage, and had anemic performance. The myriad of different systems and the spaghetti of vacuum lines made service frustrating work.

As emission levels got stricter, electronic and computer-controlled systems were needed to monitor exhaust gases and adjust both ignition and fuel to limit harmful emissions.

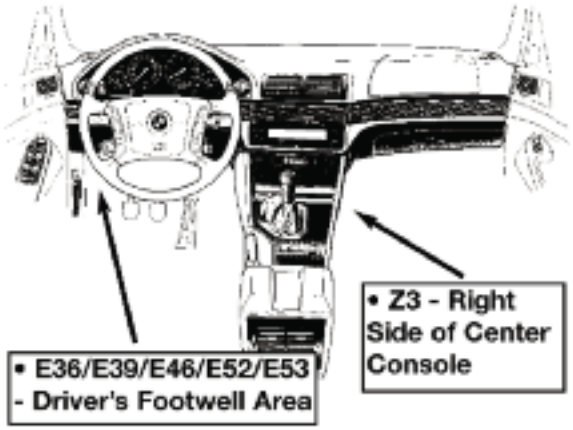
The more sophisticated electronic technology allowed manufacturers to meet strict standards, but there was a problem. Emissions remained within regulated limits as long as everything was working properly. But a problem in any system could send emission output soaring. Unless the defect had a severe impact driveablity, motorists would not notice that anything was wrong. They would continue operating their vehicles even though they pumped out unacceptably high levels of pollution.

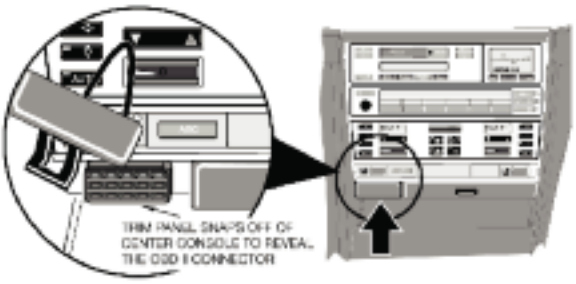
To ensure that drivers knew when their emission control systems were not working properly, the federal Environmental Protection Agency, following the lead of California (which has always been the pace setter in U.S. emission standards), mandated that by 1989, carmakers develop and

While the Check Engine lamp has been around since the beginning of OBD I, for OBD II its function has changed and it's referred to as a MIL (Malfunction Indicator Lamp).

install a system that showed when there was a problem with anything aboard a vehicle that could affect emissions. BMW complied with the federal mandate for OBD I.

OBD I launched the era of the instrument panel "Check Engine" light that was turned on when the vehicle's computer detected a problem. On a BMW, the trouble or fault codes stored in the computer could be accessed by using the BMW 2013 and MoDiC diagnostic units, or by counting the flashes of the "Check Engine" or "Service Engine Soon" light using a key on/engine off procedure. The Check Engine light prompted drivers to have their vehicles serviced, even if they didn't notice any problem with performance.





• E38 Center Console (next to cup holder)

Most BMWs have the OBD II DLC (Data Link Connector) under the dash to the left of center. There are exceptions, however, such as the Z3 and the E38.

Every piece of diagnostic equipment that purports to be OBD II-compatible must have this standardized connector

These initial diagnostics monitored electrical/electronic components used in emission control, especially the quality of sensor signals, but it was necessarily passive -- it had to wait for a problem to occur before setting a code and turning on the warning lamp -- and its trouble codes amounted to hints to technicians. There was much more to be learned about the state of the electronic engine management system by accessing the data stream, but many techs either never bought the equipment to enable them to do that, or never learned how to interpret the information.

In the early 1990s, the federal government, pushing for even stricter emission control, mandated the next generation diagnostic system, OBD II, be in place by model year 1996. The first BMW OBD II system was used on MY 1995 vehicles with the 12-cylinder engine. All BMWs had OBD II starting in MY 1996.

Uniformity is one of the basic goals of OBD II. This has several facets, all based on SAE standards. For example, we got a standard 16-pin DLC (Data Link Connector) regardless of what brand of car we're working on. With just a few exceptions (such as the Z3),

it must be located under the dash to the left of center. Some of its pins are required to have specific purposes, while others are for the carmaker's own use, or are left unused at this time with the possibility of being employed in the future. Scan tools can be from any aftermarket manufacturer, but they must fit the 16-pin DLC and display all the required information.

OBD II At Work

OBD II keeps tabs on literally everything that could impact emissions, including not only the electronics, but also all systems and processes. While that may sound similar to the previous generation of diagnostics, this goes way beyond that by actually performing tests on various systems and issuing a passing or failing grade. This technology ensures that the vehicle is always in compliance with applicable emission regulations. If a fault is detected, the MIL (Malfunction Indicator Lamp) is turned on, signaling the driver that the vehicle must be checked and serviced.

In a BMW, OBD II watches over:

- All engine sensors and the engine control module
- The transmission control module
- Any actuators used on the engine and transmission
- Fuel system integrity to detect any vapor leaks

To set a code and trigger the MIL, OBD II must see a problem, then see the same problem during a later drive cycle more than one time. If the MIL glows steadily, the problem(s) detected require prompt attention, but will not cause damage. If the MIL blinks, there is a misfire that could damage the catalytic converter. Drivers should stop driving and turn off the engine, as soon as it is safe to do so, when they see a blinking MIL.

A MIL that comes on, then goes off several drive cycles later indicates the system no longer senses the original problem. After a trouble code is stored in the system memory, if OBD II does not see the problem for three consecutive cycles, the MIL will be turned off. If OBD II does not see the problem for three consecutive cycles, the MIL will be turned off.

You should remind your customers that the MIL is different from the oil pressure or engine temperature warning lamps. When those warnings are illuminated, the driver must safely pull over as quickly as he or she can, turn off the engine, and get help.

The MIL only indicates that this BMW needs service, but the driver doesn't have to stop immediately. When the MIL comes on, the motorist should call you to make an appointment to bring the car in for diagnosis.

Misfiring is definitely taboo, so whenever you find a spark plug with a large gap or fouling, that's probably the cause of the flashing MIL.

In fact, you can build good will with your customers by instructing them on how to “fix” the most common fault detected by OBD II -- a loose gas cap! OBD II will turn on the MIL if the system senses gas vapors escaping into the atmosphere because the cap isn’t on. Tell your customers to make

sure the fuel cap is secured if the MIL comes on, especially if they have just refueled. Tightening the cap should cause the MIL to go out within a few drive cycles. The loose gas cap problem is so common, many late model BMWs have a warning light to advise the driver when the cap isn't secure.

OBD II Drive Cycle

OBD II does not monitor all components all of the time. Some functions are checked continuously while others are checked only once per "drive cycle." Systems that are continuously monitored include:

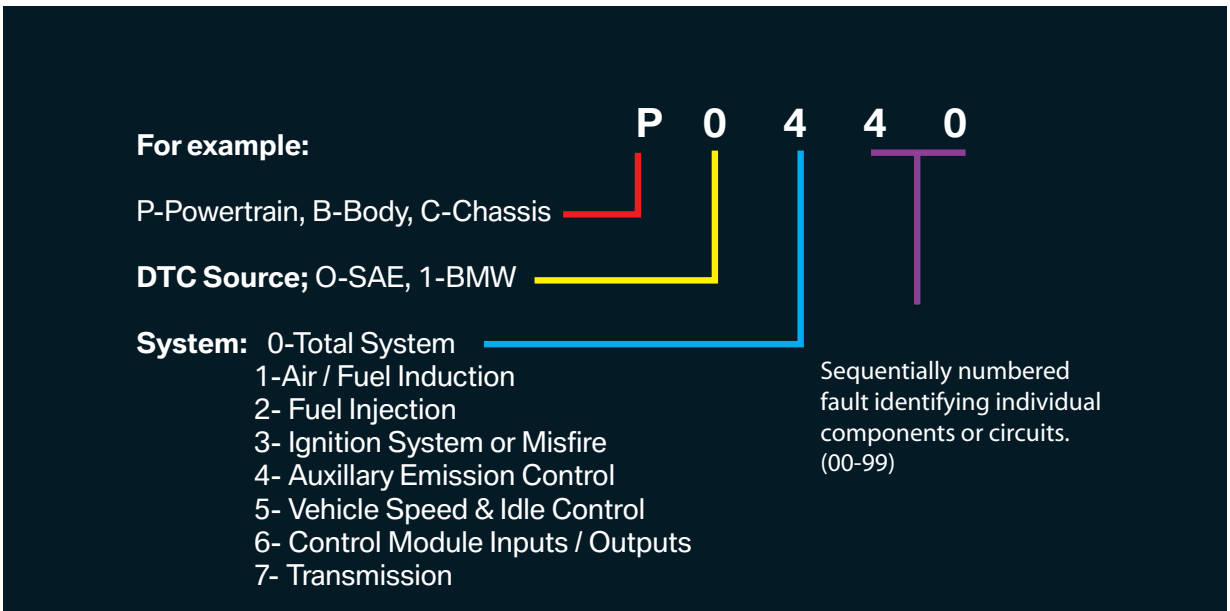
- Misfire Detection
- The fuel system, including the duration of injector opening (pulse width)
- Any electrical circuits and components directly related to emissions control, including the engine control module, the transmission control module and the electronic throttle control module

Systems monitored only once per driving cycle will trigger a code and turn on the MIL after certain driving conditions are completed. These systems specifically will not be checked if the engine is started and then shut off before reaching normal operating temperature:

Oxygen Sensor Function
Secondary Air Injection System
Catalytic Converter Function (efficiency)
Evaporative Vapor Recovery System

In a BMW, different vehicle operations can qualify as a drive cycle. For example, the following checks will be done during these drive cycles:

- During an engine cold start following by three minutes of idling, OBD II will check the Secondary Air System and, if equipped, the Evaporative Leak Detection system.
- During steady driving between 20 and 30 mph for about four miles, OBD II will check the oxygen sensors' response time and switching time (crossover) after the engine reaches operating temperature and goes into closed loop operation.



The alpha/numeric structure of any OBD II DTC.

- Steady driving at 40 to 60 mph for about 15 minutes will allow the OBD II to check catalytic converter efficiency and further check the oxygen sensors' response and switching times.
- If the engine is idled for about five minutes, a tank leak diagnosis will be done. These drive cycle tests will be interrupted if:
- Engine speed exceeds 3,000 RPM.
- Vehicle speed exceeds 60 mph
- There are wide fluctuations in engine speed

The ability to cover all types of drive cycles within one trip depends on how closely the driver sticks to the criteria for each test phase.

Lighting the MIL

On a BMW, the MIL will be illuminated under the following conditions:

- After completing the next consecutive driving cycle where the previously faulted system is monitored again and the emissions relevant fault is again present.
- Immediately if a “catalyst damaging” fault occurs (misfire detection).
- If a condition requires the MIL to be turned on according to the Federal Test Procedure (FTP). Incidents that could trigger the lamp because of FTP include:
- A malfunction of a component that can affect the emission performance of the vehicle occurs and causes emissions to exceed 1.5 times the standards required by the FTP.
- Manufacturer-defined specifications are exceeded.
- An implausible input signal is generated.
- Catalyst deterioration causes HC-emissions to exceed a limit equivalent to 1.5 times the standard (FTP).
- Misfire faults occur.
- A leak is detected in the evaporative system, or “purging” is defective.
- ECM fails to enter closed-loop oxygen sensor control operation within a specified time interval.
- Engine control or automatic transmission control enters a "limp home" operating mode.
- Ignition is on (KL15) position before cranking (bulb check function).

Protocol

The following chart shows when the MIL can be activated based on your customer’s driving style:

Condition 1. A fault code is stored within the ECM upon the first occurrence of a fault in the system being checked.

Condition 2. The "Malfunction Indicator Light” will not be illuminated until the completion of the second consecutive "customer driving cycle" where the previously faulted system is again monitored and a fault is still present or a catalyst damaging fault has occurred.

Condition 3. If the second drive cycle was not complete and the specific function was not checked as shown in the example, the ECM counts the third drive cycle as the “next consecutive“ drive cycle. The "Malfunction Indicator Light” is illuminated if the function is checked and the fault is still present.

Condition 4. If there is an intermittent fault present and it does not cause a fault to be set through multiple drive cycles, two complete consecutive drive cycles with the fault present are required for the "Malfunction Indicator Light” to be illuminated.

Condition 5. Once the "Malfunction Indicator Light” is illuminated it will remain illuminated unless the specific function has been checked without fault through three complete consecutive drive cycles.

Condition 6. The fault code will also be cleared from memory automatically if the specific function is checked through 40

CONDITION	DRIVE CYCLE # 1			DRIVE CYCLE # 2			DRIVE CYCLE # 3			DRIVE CYCLE # 4			DRIVE CYCLE # 5			* DRIVE CYCLE # 43		
	FUNCTION CHECKED	FAULT CODE SET	MIL STATUS CHECK ENGINE	FUNCTION CHECKED	FAULT CODE SET	MIL STATUS CHECK ENGINE	FUNCTION CHECKED	FAULT CODE SET	MIL STATUS CHECK ENGINE	FUNCTION CHECKED	FAULT CODE SET	MIL STATUS CHECK ENGINE	FUNCTION CHECKED	FAULT CODE SET	MIL STATUS CHECK ENGINE	FUNCTION CHECKED	FAULT CODE ERASED	MIL STATUS CHECK ENGINE
1.	YES	YES	OFF															
2.	YES	YES	OFF	YES	YES	ON												
3.	YES	YES	OFF	NO	NO	OFF	YES	YES	ON									
4.	YES	YES	OFF	YES	NO	OFF	YES	NO	OFF	YES	YES	OFF	YES	YES	ON			
5.	YES	YES	OFF	YES	YES	ON	YES	NO	ON	YES	NO	ON	YES	NO	OFF			
6.	YES	YES	OFF	YES	YES	ON	YES	NO	ON	YES	NO	ON	YES	NO	OFF	YES	FAULT CODE ERASED	OFF

consecutive drive cycles without the fault being detected or with the use of either the DIS, MODIC or scan tool.

Because potential damage to the catalyst is so serious, OBD II will not clear a misfire detection code unless 80 consecutive drive cycles occur without the fault being detected again.

Readiness Code

With your scan tool, you can check to see if the necessary drive cycles have been completed by checking the “readiness code.” OBD II uses readiness codes to prevent anyone with an emissions related fault and a MIL on from disconnecting the battery or clearing the fault memory before taking an emission control test. A vehicle cannot be emissions tested if the MIL is on, it must be serviced before testing. (Note: Because of hardware and software issues, 1995 and 1996 BMWs with the V12, OBD II works properly, but does not set a readiness code. The federal EPA and I/M stations know about this problem. The code gives you a Yes/No indication of whether the checks have been done. You will get either a “0” or a “1” for the code.

A “0” means Test Not Completed or Not Applicable for six-cylinder engines or “Not Ready for V8s and V12s.

A “1” means Test Completed for six-cylinder vehicles or “Ready” for V8s and V12s.

A readiness code will be stored after any clearing of fault memory or disconnection of the ECM. A readiness code of "0" will be stored after a complete diagnostic check of all components/systems that can turn on the MIL is performed.

The complete readiness code is one “byte” or 8 bits of data. Each bit represents one complete test and will be displayed on your scan tool. For example:

0 = EGR Monitoring (=0, N/A with BMW)
1 = Oxygen Sensor Heater Monitoring
1 = Oxygen Sensor Monitoring
0 = Air Condition (=0, N/A with BMW)
1 = Secondary Air Delivery Monitoring
1 = Evaporative System Monitoring
0 = Catalyst Heating
1 = Catalyst Efficiency Monitoring

When all "readiness codes" are "1" (ready), the necessary drive cycles and system tests have been successfully completed. OBD-II is “ready” to begin monitoring the vehicle.

You promised the car by 5, so he could start his trip

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...but that knock off part won't fit and it's 4:30.

Will fit parts that usually don't and knock off parts that cause expensive comebacks, the story's not new. ZF first started supplying driveline and chassis components to BMW in 1937. Today we continue to do our part to ensure the driving machines from BMW remain "the Ultimate". Since 1979 ZF Sales and Service North America LLC has worked with BMW North America to provide technical support, parts, and remanufactured components to keep owners enjoying their cars. We'll keep working with BMW to raise the driveline and chassis technology benchmark. You just take care of that customer who needs his car by 5 with original BMW Parts available at your local BMW Center.

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Driveline and Chassis Technology

Keep the Rubber On the Road

DSC prevents loss of control

You're cruising in your BMW, pushing hard down the highway when you come to a tight right hand turn. You begin your turn in, then suddenly see debris on your side of the center line.

You cut the wheels to the right—too much, too fast, and the rear end begins to swing out. But as quickly as the rear starts to move, the car stabilizes. Instead of spinning out, the rear end stops moving, tucks back into place, and you continue driving as if nothing happened.

Did your guardian angel suddenly take control of the car and maneuver you out of danger? Well, sort of. But this guardian angel isn't spiritual, it is man-made. You have just experienced BMW's Dynamic Stability Control (DSC) system in action. The technology continuously monitors the vehicle's position as it travels down the road and immediately corrects potentially dangerous understeer and oversteer by selectively regulating braking force to individual wheels and reducing engine speed.

Most of the time on the highway, vehicle speeds are slow enough, and road conditions are good enough, that it is relatively easy to control a car, especially a BMW. However, when the combination of speed, road conditions, and steering wheel input causes the tires to lose their grip, understeer or oversteer can occur. With understeer, the vehicle slides toward the outside of the curve. With oversteer, the back end comes around and could put the vehicle into a complete spin.

Without training, most drivers don't recognize potential out-of-control situations early enough to do anything to avert disaster. And when a car does go into a serious understeer or oversteer condition, the typical reaction is to slam on the brakes and hope you don't hit anything. With DSC, the driver doesn't have to recognize and respond to possible out of control situations because the system will do that automatically.

First introduced on certain models in 1995, DSC is now standard on all BMWs. One experience with DSC and you understand why the National Highway Traffic Safety Administration (NHTSA) has taken the first steps toward making stability control mandatory on all new cars, SUVs, and light trucks. Although BMW's DSC and similar technology used by other carmakers has been on the street in significant numbers for only a few years, the impact on reducing crashes, deaths, and injuries has been dramatic. Based on studies of stability control's effectiveness, NHTSA says that if all cars, light trucks and SUVs had such a system, up to 40% of the nearly two million single-vehicle crashes that now occur in the United States every year might be prevented.

One reason stability control is such an effective safety technology is that, unlike seat belts, airbags, crash/crumple zones, and similar systems, DSC is pro-active. Other safety devices come into play when a crash occurs. DSC helps prevent some crashes from happening in the first place.

DSC works in conjunction with ABS, with which it shares the hydraulic control unit (courtesy Bosch).

No matter how many driving schools a motorist might attend, he or she will never be able to make the kind of corrections that DSC does automatically and instantaneously.

ABS, AST, and DSC

DSC is built on the foundation established by anti-lock brake and all season traction (ABS and AST) systems. ABS and AST essentially keep a BMW pointed straight ahead by eliminating both wheel lockup or wheel spin that can cause unintentional swerving. DSC is the next step in control, helping to stabilize the vehicle as the driver makes a turn, especially at high speeds.

Just as ABS "pumps" the brakes to prevent wheel lockup faster than any human being ever could, DSC corrects loss of control by electronically "turning into a skid" more effectively than is humanly possible. The stability system is so fast, it corrects problems before many drivers even realize they are on the verge of losing control, especially when road conditions are poor because of rain, snow, ice, etc.

DSC works at all times, no matter if the vehicle is accelerating, braking, or maintaining a constant speed. It is effective on rough roads and slick surfaces. The system works with any tires recommended by BMW for the vehicle, but all four tires should be the same make, style, and have equal inflation and about the same mileage so that grip is equal on all four corners. Any difference in tire adhesion caused by mixing sizes, brands, or very new tires with older tires reduces the effectiveness of not only DSC, but also ABS and AST.

Mild oversteer and understeer conditions are not inherently bad. In fact, slight oversteer or understeer may be desirable depending upon the road surface and driving conditions. The ability to recognize and respond to mild oversteer and understeer is one of the marks of a skilled driver. So drivers who are trained and experienced in handling near the limits of control may not need DSC. Some drivers may think they can do a better job controlling the vehicle than any electronic system. Even the greatest driver, however, cannot do what DSC does: regulate braking at each wheel individually to correct a problem. So even for a skilled driver, DSC is an important safety backup system.

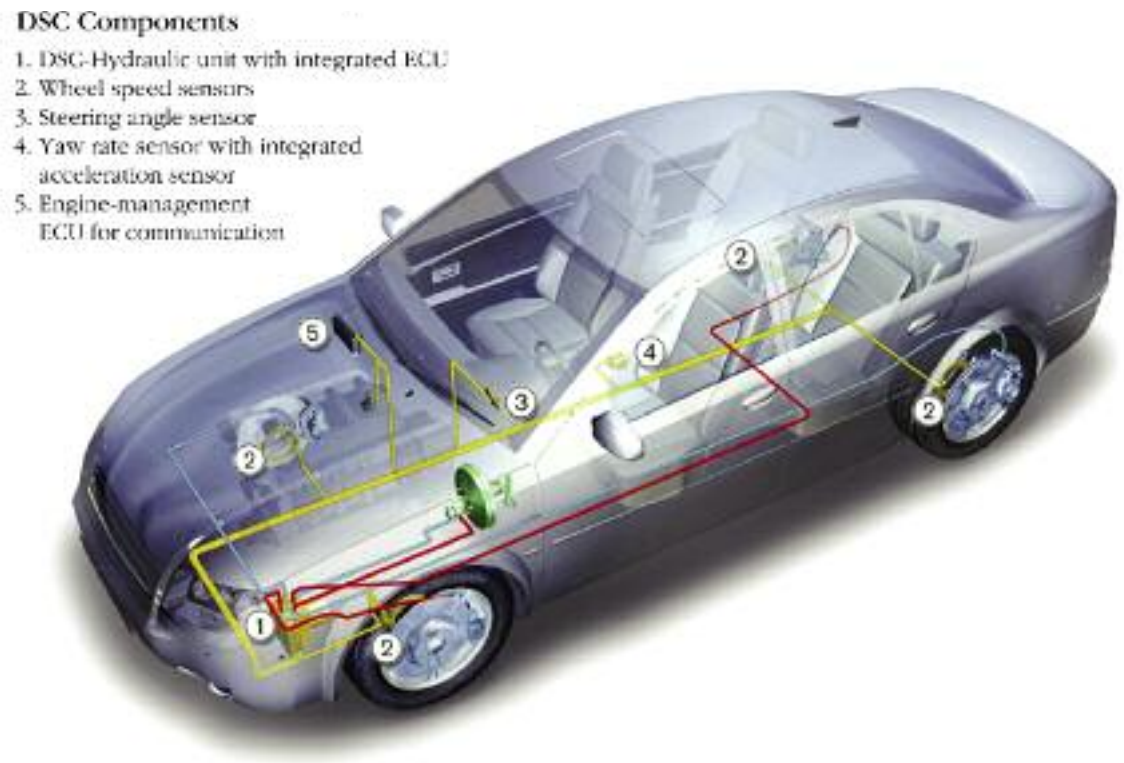
To appeal to all owners, BMW allows drivers the choice of using DSC or not. The system is normally on, but can be turned off when a driver wants full manual control over vehicle handling. On the Z4 and E90 series, BMW even offers Directional Traction Control (DTC), a midpoint setting between "off" and "on." The DTC mode allows partial DSC operation, without full system control.

DSC on the job

The first generation DSC, introduced in 1995, was programmed to monitor the rotational speed of each front wheel, vehicle speed and how much the driver had turned the steering wheel. In addition to the sensors, the system shared the hydraulic modulator with the ABS to regulate braking force at individual wheels. All sensor inputs go to the DSC controller, which regulates braking based on its pre-programmed response to sensor inputs.

Whenever any vehicle turns, the outside front wheel must go faster than the inside wheel because each wheel follows a different turning radius. The relative difference between front wheel rotation speed is determined by how much the steering wheel is turned and how fast the car is going. When the difference in front wheel speeds exceeded pre-programmed limits, DSC considers the vehicle to be in an oversteer or understeer condition. Selective braking force is then applied to correct the situation and bring the vehicle's actual direction of travel back in line with the direction the driver wants to go.

DYNAMIC STABILITY CONTROL



Third generation DSC, introduced in 2000, can reduce engine speed, in addition to regulating braking, for optimal stability control (courtesy Bosch).

Continued on page 18

Original BMW Remanufac

Why Buy Original?

Replace — We replace more parts than aftermarket brands.

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Assembled — Completely assembled from components and not just repaired.

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Quality, Reliability and Value

The quality, reliability and value of the Original BMW Remanufactured A/C Compressor wasn't meant to be taken lightly. It is not only an exact replacement for the original unit, it's also remanufactured 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 a two-year warranty. In fact, the only detectable difference you'll find between a Original BMW Remanufactured A/C Compressor and a new one is the price. Which we're sure you'll find quite refreshing.

It's All In the Process

Remanufacturing Process (Original BMW)

1. Dismantle core and clean all components.
2. Replace key components 100% with new OE part.
3. Test all other critical components.
4. Replace components that do not meet specs.
5. Assemble, test and box.

Rebuilt Process (Typical Aftermarket)

1. Identify damaged part or parts.
2. Replace damaged part with non-OE part and clean.
3. Re-assemble, test and box.

TURED A/C COMPRESSORS

Remanufactured for BMW by

DENSO

Available only through your local BMW Dealer

 Continued from page 15

For example, in an oversteer condition, with the rear end sliding to the left (driver's side), DSC applies braking force only to the left rear wheel -- the right rear continues to roll unimpeded. This effectively causes the rear end of the car to "pivot" at the left rear corner -- the left wheel is stopping while the right rear wheel keeps going. The rear of the car stops skidding to the left so that the direction of travel isn't veering alarmingly toward the right as it would if the rear end let go altogether. When the car is again pointing in the direction the driver wants to go, DSC releases all braking pressure.

Understeer is the opposite of oversteer and DSC applies the opposite corrective action. Instead of applying brake force to the outside wheel, it brakes the inside wheel to force the car to pivot into the curve, effectively making it turn more.

DSC has been continually refined since its introduction. The third generation DSC has been installed on BMWs since model year 2000. Compared to the first generation, the latest system:

- Monitors vehicle dynamics up to 25 times per second.
- Operates up to four times faster than ABS does.
- Regulates braking at all four wheels individually, instead of just the rear wheels.
- Has the ability to reduce engine speed to reduce power applied to the drive wheels.
- Generation 3 DSC has several additional sensor inputs besides wheel speed, vehicle speed, and steering wheel direction, including:
- A lateral-acceleration sensor that measures the "sideways" forces or how hard the vehicle is turning. Inputs from this sensor help regulate the corrective braking force that DSC applies. As lateral acceleration increases, more braking force must be applied.
- A yaw sensor to measure vehicle rotation. From a bird's eye view looking straight down on a car, if the centerline of the vehicle is exactly on the direction of travel, the amount of yaw is zero. If the rear end has swung around so that the center line of the vehicle is at right angles to the direction of travel (the car is literally going sideways), the yaw value is 90 degrees. The greater the yaw, the more out-of-control the vehicle is. DSC responds very quickly when yaw increases because if the yaw is too great, it may be impossible to prevent a complete loss of control and spin out.
- A brake light sensor that determines if the driver is applying the brakes.
- A brake-pressure sensor that monitors how hard the driver is applying the brakes.
- Readings from the wheel speed sensor, vehicle speed sensor, lateral-acceleration sensor and the yaw sensor tell the DSC system exactly what the vehicle is doing as it turns in terms possible oversteer or understeer compared to the direction the driver wants to go. The brake-pressure sensor reading tells the system what, if anything, the driver is doing to correct the situation. DSC is programmed to complement or assist the driver's corrective efforts because over-correcting can be almost as bad as not taking any action at all.

DSC is a very reliable system and no routine maintenance is required. Because the system works in the background, many BMW owners might not even be aware they have DSC on their vehicles.

An owner complaint about DSC is very rare. Typically, drivers will only know about a DSC problem when a code or codes trigger the MIL. As with any electronic system, follow the appropriate BMW diagnostic procedure for the year, make, model, and code.

Based on informal surveys of dealership and independent shop technicians, the most common DSC problems that do occur are sensor failures, typically the yaw-sensor. Electrical problems such as intermittents or open circuits are rare.

Packaged for Performance

BMW High Performance Ignition Wire Sets

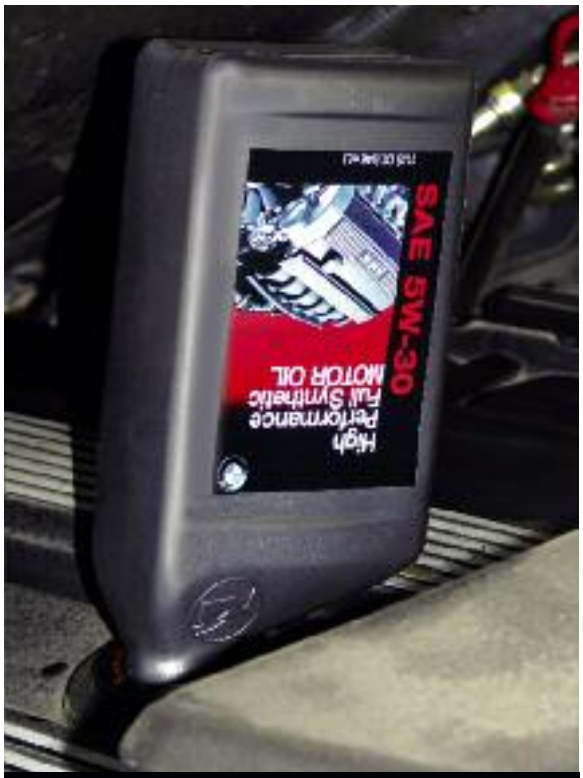
BMW vehicles are engineered for optimum performance. So why would you accept less than that very same engineering for anything that goes under your customer's hood? Our High Performance Ignition Wire Sets are custom designed for each BMW model to ensure optimum performance and an exact fit. Contact your authorized BMW Center for specific model information.

Original BMW Accessories

The Ultimate Driving Machine®

Use The Right Juice

It’s best to follow BMW’s requirements -- use the best



This is what you should see if you follow BMW oil change recommendations.

Your customers are passionate about The Ultimate Driving Machine. They had many options when it came time to buy a vehicle, but they selected a BMW because they wanted to enjoy its amazing performance.

Just as your customers specifically picked a BMW to be their car, they specifically selected your shop to ensure that their BMW passion is a long-term relationship. They count on you to keep their BMWs in optimal condition, ready to go at any time, wherever they want, for as long as they are an owner. To fulfill the trust they've placed in you requires that you do more than just follow recommended service intervals. You are also responsible for using the oils, lubricants, and other fluids specified by BMW.

These fluid recommendations didn't just materialize out of thin air. As part of its ongoing commitment to continually raising the performance bar, BMW engineers invested long hours running demanding test procedures to evaluate many different products. And the BMW engineers didn't work alone. They often shared testing and analysis duties with their counterparts from the fluid manufacturers and refiners. With an attention to detail that matches BMW's approach to designing and building cars, this product testing has resulted in a very specific set of recommendations on what works best in a BMW.

To cut corners or deviate from any recommended fluid could compromise the performance, reliability and longevity your customers expect from their vehicles. Make sure every fluid you use meets BMW's standards.

Engine Oil

When you see this tag, only use BMW synthetic oil. BMW converted to all synthetic in 1999.

Since 1999, BMW, like some other premium carmakers, has used synthetic engine oil as its factory fill and recommended replacement. But Bayerische Motoren Werke has done other carmakers

one better by developing its own brand of synthetic—BMW High Performance Synthetic Oil, a 5W-30 with SJ/CF ratings, that can be used in the BMW gasoline engines you find in North America and the diesels the company offers in other countries. The oil is packaged in both quarts (P/N 07 51 017 866) and bulk dispensing barrels (P/N 07 51 0 022 545).

For motorsports applications, including M3, M5, and Z8 applications, BMW recommends its BMW High Performance Synthetic Oil Castrol RS SAE 10W-60 (P/N 51 0 009 420).

BMW is very clear on this point: "It is recommended to use BMW High Performance Synthetic Oil in 1999 model year and later BMW models and recommend to use either BMW High Performance Synthetic Oil, High Performance Mineral Oil or one of today's highly advanced brand name lubricating oils conforming to API classification SH or higher in 1998 and earlier BMW models."

The use of synthetic oil allowed BMW to extend normal service oil change intervals up to 15,000 miles, far longer than conventional, petroleum-based oils can endure. But this longer oil change interval is only one advantage of synthetic, and it isn't even the greatest advantage.

Many different tests are done to evaluate engine oil performance, including antiwear, resistance to oxidation and sludge formation, ability to keep the internal parts clean, and "viscosity consistency" which is a measure of how well oil maintains its viscosity rating over a wide range of temperatures. In every performance test, synthetics beat mineral or petroleum-based oils.

Oil At Work

If lubrication and/or friction reduction was oil's only job, it would be relatively easy to produce and refine oil. But at the same time oil is lubricating, it must also:

- Clean the engine by holding microscopic contaminants in suspension until the particles can be trapped and held in the oil filter.
- Reduce internal engine temperature by absorbing and redistributing heat energy.
- Seal the spaces between the piston grooves, rings and cylinder walls as the piston travels up and down.
- Reduce engine wear by cutting friction and absorbing the impact force between the connecting rod bearings and crankshaft rod journals when the piston changes its direction of travel.
- Cling to internal surfaces to provide lubrication and protection during start-up until the oil is flowing normally.
- Maintain viscosity at a wide range of temperatures. Oil that gets too thick when it's cold won't be able to flow swiftly and smoothly enough during start-up, causing rod knock and rapid wear. Oil that thins out too much when hot won't provide proper film strength. BMW synthetic oil maintains a very consistent viscosity. It will flow smoothly during a cold start-up and still provides excellent lubrication at very high temperatures.
- Resist oxidation. Any oil, synthetic or petroleum, will fail if it becomes oxidized. To prevent oxidation, the additives added to oils during refining contain an oxidation inhibitor. These inhibitors work better in synthetic oil.

Because synthetic oil works so well, should you recommend it to customers with older (prior to 1999) BMWs? The answer is a qualified "yes."

On 1980 or older models, there can be serious problems with the engine seals because synthetics are not compatible with some obsolete types of seals. For these vehicles, don't use a synthetic if the seals have not been replaced. Seals made after 1980 are compatible with synthetic oils.

Through Thick and Thin

Viscosity is a rating of how smoothly oil pours at different temperatures. In the United States, viscosity ratings are based on test procedures developed by the Society of Automotive Engineers (SAE). A low viscosity number indicates a "thin" oil that flows easily. A high viscosity number means the oil is "thick" and will resist breakdown at high temperatures.

SAE has two viscosity test procedures. The winter viscosity value is measured at 0 degrees F. and has a "W" after the number, as in SAE 5W, 10W, or 20W. For warm weather use, viscosity is tested at 210 degrees F. and the rating is just a number, with no letter behind it. So, we have SAE 20, 30, 40, and 50.

Back in the day, many petroleum-based oils were single viscosity. Motorists in the snow belt used a low winter viscosity oil during the cold months and switched to a high viscosity oil for warm weather driving. Very few single-viscosity oils are sold anymore. In fact, BMW, in its oil recommendations, states that because of the limited performance of single viscosity oils, "…they are no longer used in BMW engines, and thus no longer listed in the BMW Engine Oil Temperature/Viscosity Table."

BMW High Performance Synthetic Oil has a 5W-30 viscosity. The 5W means that at cold temperatures, the oil flows easily. The 30 rating indicates that the oil maintains a thick consistency at high temperatures to provide optimal protection after the engine reaches operating temperature.

Before converting any engine from conventional to synthetic, however, you should make sure there are no oil leaks. Because synthetics are more "slippery" than conventional oils, a leak with petroleum-based oil can become a gusher with synthetics. For maximum protection, sell your customer an engine cleaning and a "black light" dye test to spot any leaks before converting from mineral based to synthetic oil. Obviously, fix any leak before making the oil switch.

On the question of using any aftermarket oil additives, BMW is again very clear -- don't do it. According to BMW, "The use of engine oil additives is not recommended and not necessary on BMW engines."

Coolant

BMW is fairly liberal on coolant use, requiring only that all cooling systems be filled with a "reputable brand name ethylene glycol long-term antifreeze having corrosion inhibitors that are compatible with aluminum radiators."

But this becomes a risk for you and your reputation because now some aftermarket manufacturers are selling generic antifreeze with essentially the same formula as the troublesome one used in certain domestic cars that everybody in the auto service business has heard of, and making the same claims about extended change intervals.

The exclusively-formulated antifreeze that BMW specifies and makes available through its dealerships' parts departments is a different story. It's an ethylene glycol-based silicated OAT (Organic Acid Technology) formula, which contains no nitrates or phosphates, and has been chemically designed to prevent excessive silicate dropout. Also, the silicates leave an anti-corrosive coating on metal that remains even if the coolant level should be allowed to drop.

Give your customers optimal cooling system protection by using only BMW brand coolant. The standard 50/50 mix is correct unless your customers' vehicles are exposed to extremely cold weather.

While genuine BMW antifreeze doesn't say "Long Life" anywhere on the jug, the fact is that if the car's cooling system maintenance is neglected, there will be less damage from corrosion and clogging than would be the case with a less sophisticated formula.

BMW's engineers are prudent where maintenance is concerned. So, they're sticking with the sensible recommendation that the coolant be changed every three years for maximum protection. Sound wisdom in our opinion, and something you can easily justify to your customers. The one-gallon container carries Part Number 82 14 1 467 704.

You can mix with other brands for topping off, but only if the other product does not contain any nitrites or phosphates, nor has a high-silicate formulation, so read the label carefully.

The factory fill is the standard 50% coolant/50% water mixture, which protects down to -34o F (-37o C). In severely cold areas, where -34o F (-37o C) isn't enough, you can increase the mixture to 60% coolant/40% water, which protects to -62o F (-52o C). Or, you could consider moving. Under no circumstances should you ever exceed a 60% coolant/40% water ratio. Ironically, mixtures with more than 60% coolant actually reduce, not increase, freezing protection.

By the way, it's very important to go the extra mile for your customers and use only distilled or de-ionized water in the mix. This will differentiate you from your competitors, and will go a long way in preventing deposit formation.

BMW does not approve the use of any coolant additives, including those intended to improve corrosion resistance or seal minor leaks.

Brake Fluid

Only glycol-based, DOT 4 brake fluid is approved. BMW sells its brake fluid in 12 oz. (P/N 81 22 0 142 156) or one-gallon (P/N 81 22 0 142 155) containers.

Brake fluid should be completely flushed and replaced at least every two years (have you priced a replacement ABS unit lately?). Bleed the entire brake system, not just the master cylinder, because vapor bubbles and corrosion typically start in the calipers. Flush the system with all bleeder valves open and continue flushing until all fluid from the bleeders is clear and free of bubbles. When flushing the brakes, also flush the hydraulic clutch system.

Power Steering Fluid

Dexron III Automatic Transmission Fluid is used in both ball and nut and rack and pinion power steering systems. BMW has no recommended change interval for power steering fluid. Fluid normally is added only during repairs. That's an especially good time, however, to flush the system because there are probably particles of debris in the fluid that can cause problems in spite of new parts.

Manual Gear Lube

Look for a tag on BMW manual transmissions to determine what fluid to use.

BMW has four recommendations for manual transmission oil depending on the year and model.

- If there is no tag on the transmission bell housing, you can use any reputable brand of mineral-based transmission or gear lube oil with a SAE 80 viscosity rating. The lube must meet a MIL-L-215 and/or API GL-4 rating.
- For 325e and 528e manual transmissions produced before mid-1986 and without a dual mass flywheel, use Mobil SHC 630 synthetic transmission fluid. These transmissions should have a green label "Special Oil" affixed next to the oil drain plug.
- Dexron III can be used on manual trans missions with dual mass flywheels, direct drive 5th gear after 9/90, or on six-speed transmissions. These trans missions will have an orange label on the bell housing that reads:

  ATF-Oil!
  Automatic Transmission Fluid

- On some 1998 cars, if there is a yellow label, "MTF-LT-1" use Exxon MTF-LT-1 lifetime fluid.

Always use the transmission lube recommended by BMW. No other brands are approved. And never use a synthetic transmission lube in a manual transmission unless specifically called for. Premature wear will result because the synchronizers in other transmissions are not compatible with synthetic oil -- there will not be enough friction present for the blocking rings to do their job.

ATF

If the vehicle has one of the General Motors automatic transmissions used by BMW, the fluid choice is easy—any quality brand of Dexron III. No other fluid is approved for the GM automatics. GM transmission can be identified by the following codes:

- A4S 270R (THM-RIW), A4S 310R (THM-R1), A5S 360R (GM5), and A5S390R (GM5).

If the vehicle has a ZF automatic, things are not as simple:

Check the transmission ID carefully to make sure you use the correct ATF.

- ZF 3 HP22, 4HP22, and 4HP24 trans missions require Castrol TQ or Havoline Dexron III.
- The A5S 310Z (5HP18) used on the 1995-1999 M3 uses Esso LT 71141 synthetic ATF available as BMW (P/N 83 22 9 407 807).
- The A5S 310Z (5HP18) used on the 1993-1995 520i/iT uses Castrol TQ or Havoline Dexron III.
- A5S325Z (5HP19) takes Esso LT 71141 synthetic ATF.
- A5S 440Z (5HP24) transmission Esso LT 71141 synthetic ATF.
- The A5S 560Z (5HP30) used on the 840ci with the M60 engine; the 740i/il from 1993 to 1994, the 540i/iT from 1993 to 1995; takes Shell LA 2634, available as BMW (P/N 83 22 9 407 765).
- The A5S 560Z (5HP30) used on the 840Ci equipped with the M62 engine and the 850Ci with the M73 engine; 805Ci from 10/94 to 6/97; 840Ci from 12/95 to 8/96; 750iL from 1/95 to present; 740i/iL 7/94 to 12/96; 540i/iT 3/96 to 12/96 requires Esso LT 711 41.
- GA6HP19Z; GA6HP26Z; and GA6HP26Z automatics require Shell M-1375, available from BMW as (P/N 83 22 0 142 516).

Although the variations in ATF can be confusing, pay close attention to the transmission model and application so you use the right fluid. BMW states that only the specified ATF must be used and that ATFs cannot be mixed.

Check the owner's or service manual for ATF change intervals. Many BMW automatics, especially those in later models, have no ATF change interval. Fluid is added or replaced only when the transmission is repaired. Of course, it's common wisdom in the auto service business that ATF changes every 30,000 miles go a long way in preventing eventual failures.

Differential Oil

For vehicles with limited slip differentials, BMW has a new synthetic final drive oil, BMW SAF-XJ (P/N 83 22 1 470 080), which replaces the old SAF-XLS. Although in-stock supplies of the old oil can be used in most models, the Z3 must use SAF-XJ.

For vehicles without a limited slip differential, use BMW SAF-XO synthetic oil (P/N 83 22 9 407 768).

Convertibles and Sun Roofs

There are three different BMW convertible top hydraulic fluids:

- On the E36/7 models, use (P/N 54 34 8 410 306).
- On the E46 models, use (P/N 54 34 7 117 733).
- On the E52, use (P/N 54 34 8 234 324).
- On the E85, use (P/N 54 34 7 117 733).
- On the E64, use (P/N 54 34 7 117 733)

Check vehicle service or owner's manual if you have any question about the correct maintenance fluid for any application. All of the recommended fluids are available from any BMW dealer.

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