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October 2019 Volume 7 Number 1

Technical Knowledge for Independent BMW Service Professionals

Cooling Systems | Fuel Delivery | Diagnostics | Engine Oil | BMW Effect

Welcome to San Diego, California and to the 23rd Annual Meeting of the BIMRS organization. We welcome members from over 20 states and 4 countries to enjoy the Southern California weather, some outstanding training and great fellowship. We encourage you all to make the most of your time with this group. Introduce yourself, eat a meal with a friend you haven't met yet, and soak up some information to help your business run more efficiently.

If you have been to these meetings in the past, you will see some new initiatives. We will have elections at the General Session this year and every year going forward. Also, at this particular location, we will have live vehicle instruction, hopefully making procedures and strategies clearer to the students.

Since 1995, this group has relied on founders and members that have shared a vision of being a credible, professional and respected group in the automotive industry. That vision takes a lot of effort, often after the shop lights have been turned off for the day. BIMRS is a viable and growing organization that is listening and responding to its members' needs. We need your help and support as ever-changing technology continues to present both opportunities and obstacles. In order to support our 225 members and continue to grow, we must continue to define our objectives so that we remain focused on what our membership wants from BIMRS.

We are thankful for the opportunity to experience the relationships that we have developed in this industry. The vendors, the educators, and the members come together in a way that is enviable to many groups. BIMRS has been blessed through the years with volunteer leaders, teamwork, and a spirit of cooperation and growth that are unmatched in the industry.

We thank you all for joining us in San Diego and for supporting the industry. We encourage you to thank the vendors, sponsors, and educators that have made this event possible. Enjoy this opportunity to network with fellow members. Your commitment to training and membership is to be commended, and together we can impact the future of our industry and the next generation of automotive service professionals.

Thank you –

The BIMRS Board of Directors

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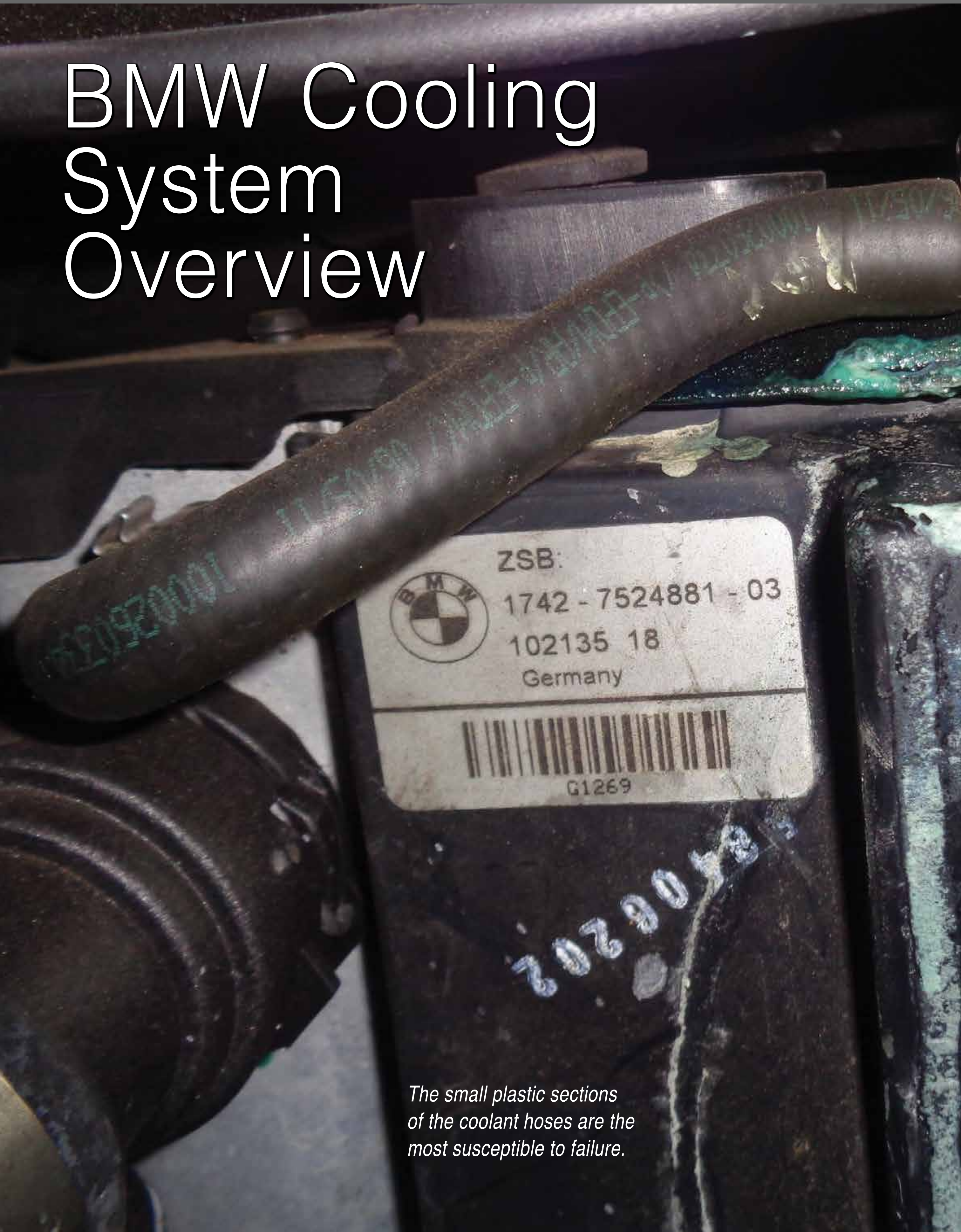
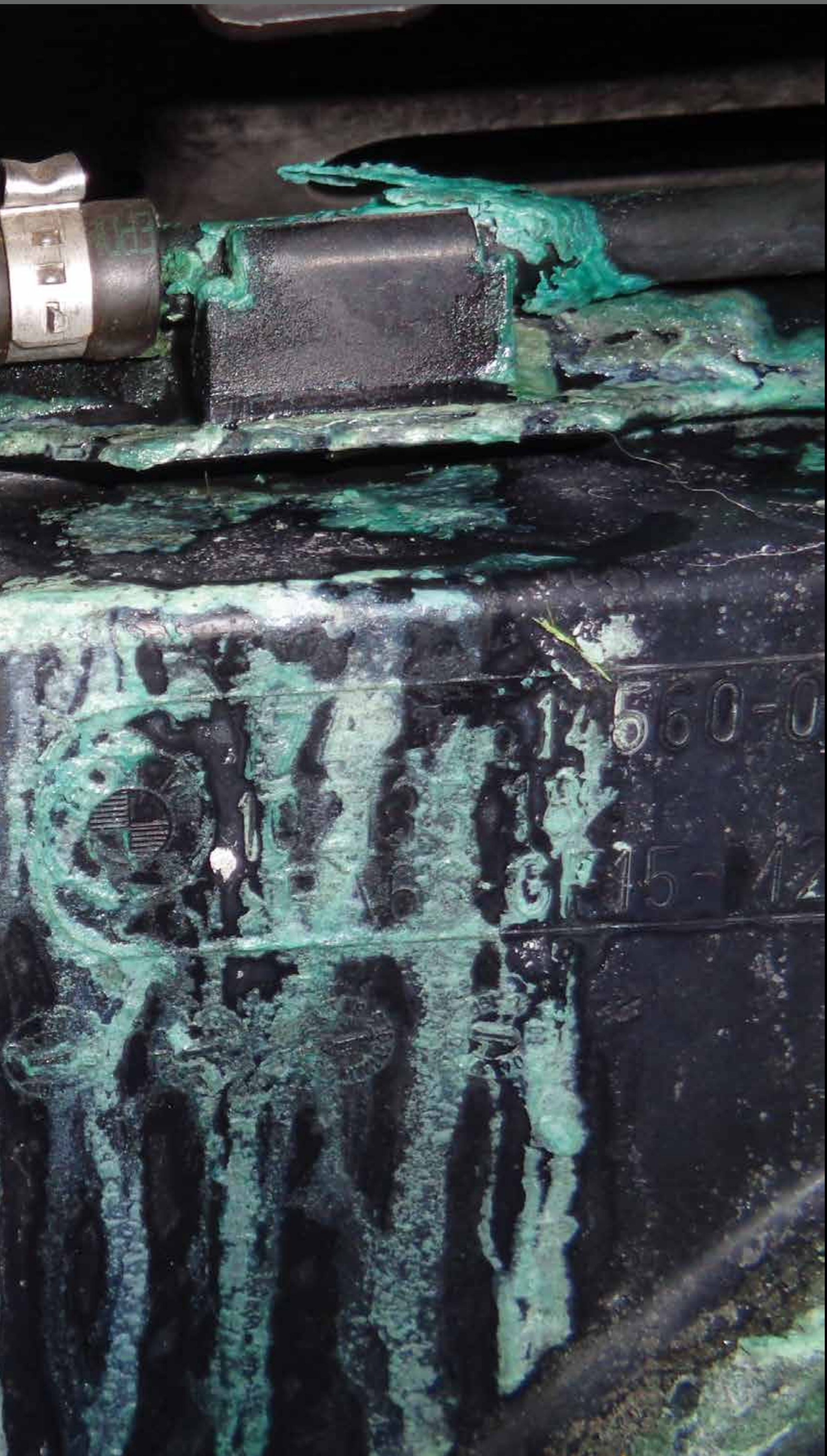
Cover Photo: Peter Caro

BMW Cooling System Overview



The small plastic sections of the coolant hoses are the most susceptible to failure.



BMW cooling systems have been keeping repair technicians and enthusiasts busy for a long time. Cooling system issues almost seem like the Achilles heel for BMW vehicles as they are quite common. As far back as the E30, clogged radiators and blown coolant hoses were common.

By Peter Caro


Oil leaks wreak havoc

Moving to the E36, the electric cooling fans were notorious for failing, resulting in overheating cars and owners. Even the venerable E46 had many cooling system weak points such as the common expansion tank leak and thermostat failures. With each new generation of vehicles, there are new and different problems to overcome.

BMWs are designed to be driven to the limit. This means the cooling system must operate under extreme conditions and still keep the engine running well within temperature specifications. Even though these systems are engineered and tested in Deutschland, they still sporadically suffer failures.

With BMW's design, many aspects of the cooling system have been adapted to help lower emissions and fuel consumption. Lighter composite materials are an easy way for manufacturers to lower vehicle weight and increase fuel efficiency. This is the primary reason there are so many plastic components on modern BMWs.

Many cooling system components are made of light-weight plastics, which eventually degrade over time. Constant heat cycling flexes and eventually weakens many of these components. Add hot coolant and oil to the mix, and these parts really take a beating. Keep this in mind when removing cooling system components during repair work. Any seal ring that has been removed during the repair should be replaced or at least inspected to verify its integrity. Coolant outlet flanges on E90 engines commonly fall apart during removal as they reside in the hot cylinder head and are also exposed to oil leaks.

Engine oil has the nasty habit of swelling rubber seals when allowed to leak. Some of the most common oil leaks on newer BMWs are from the valve cover gaskets as well as the oil filter stand gasket. Unfortunately, because these components sit at the top of the engine, oil can leak over the entire front area of the engine. This lets engine oil seep into coolant outlet seals, coolant hose seals, and many other sensors and gaskets as well as the primary drive belt.

Most BMW technicians are aware of what damage the drive belt will do once it becomes degraded from oil contamination. Best case scenario is just a shredded drive belt. Worst case scenario is bent valves from the belt sucking into the crank seal and jumping the camshaft timing. Keep this in mind when replacing engine components from oil damage. And it's necessary to fix the oil leak too, or the same failures will occur again.

BMW engine management systems monitor coolant temperature closely. Coolant temperature is one of the inputs used to help determine proper fuel/air mixture in BMW vehicles. The coolant temperature is basically the running temp of the entire engine other than

The evolution of the engine coolant pump

In certain cases, if the vehicle has overheated, fault codes may be stored in the DME for Coolant Temperature Implausible. Using freeze frame data it's usually possible to see how hot the cylinder head has gotten. As most BMW technicians know, these vehicles do not like to be overheated. Head gaskets go quickly when abused on BMWs.

Most modern BMWs are designed to efficiently operate between 176 degrees F and 220 degrees F (80-105 degrees C). An engine operating at too low a coolant temperature is not as fuel efficient. More fuel is required at lower temperatures to sustain a full combustion cycle.

FAULT CODES

2F6C Exhaust gas flap, activation

2AAF Fuel pump, plausibility

2E81 Electrical coolant pump, speed deviation

2E82 Electric coolant pump, cutoff

2EFE Electric fan, activation

Speed deviation and coolant pump cut-off faults are the most common faults related to a failing coolant pump.

the exhaust system. Coolant temperature is a critical piece of information used to determine proper engine running characteristics.

BMW coolant temperature sensors rarely fail. In cases where a temp sensor has failed, they commonly read at an extremely low temperature. Think –30 degrees F. This makes the vehicle run extremely rich, if it starts at all. Black smoke and strong gas odors from the tailpipe are the give-aways here.

One key design of the efficient dynamics system is to reach full operating temperature as quickly as possible. This allows for less fuel consumption as well as getting the catalytic converter to operating temperature quickly to further lower tailpipe emissions. Operating the engine at the highest temperature that is safe [for the engine] is an excellent way to increase fuel economy. A hot engine is a lean, fuel-efficient machine. Until it gets too hot.

In order to manage the engine coolant temperature, BMW employs many tactics to strictly control the coolant temperature. Depending on driving characteristics, the system may request a higher or lower temperature. Primarily when fuel economy is desired, a higher coolant temp will be requested. In high engine output mode, lower temps are generally requested by the engine. This helps to protect the engine and can also lower the temperature of incoming air through the engine, which can slightly increase power.

Since its introduction in the E90 generation, BMW began using electric coolant pumps on many models. The electric pump has many advantages over a standard drive belt run coolant pump. The most obvious advantage is lower drag on the engine from the accessory drive. This alone can slightly improve fuel economy.

On turbocharged vehicles, the electric coolant pump can continue to run after the vehicle has been parked and turned off. This is used to safely cool the turbochargers and residual oil in the turbo assembly. A blazing hot turbo can literally cook the oil in the turbo, causing coking, clogs, and many other issues. Hot turbochargers need to be cooled, otherwise damage can occur. The electric water pump makes it easy to safely cool them down.

With the use of electric coolant pumps, the engine management system is able to fine tune coolant flow through the engine. During the warm-up phase of engine running, the coolant pump may be slowed down or even completely turned off. This unsurprisingly will quickly raise the coolant temperature of the engine. Once the coolant is at a suitable temperature, the pump begins to circulate again. Scary, but this system does work well.

These electric coolant pumps aren't without their own problems. These pumps do operate in a cramped, hot engine bay, and must have a waterproof electric motor that can run at multiple varying speeds. These pumps do eventually fail, commonly from coolant contamination or the electric motor failing.

The most common complaint from customers with a failed electric water pump is warning lights on the dash. If a problem is detected with the pump, the orange coolant warning light generally comes on. If the pump has failed completely, the red coolant warning light comes on the dash. This is the warning to pull over and turn off the engine.

In cases where the coolant pump has failed, the engine management system will try to

Here you can see the connector and impeller for the pump.

Flexible drivers and universal sockets are a necessity here.

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save the vehicle from overheating. This includes turning off the air conditioning to lower radiator temperatures. The engine will even try to slow the vehicle and safely stop the engine from running in order to save itself from overheating. This is accomplished by locking the torque converter at low speed to initiate a stall. If the customer ignores the warning lights, they will notice a problem when the engine stalls out.

BMW thermostats have been relatively unchanged for many years.

When diagnosing a BMW for almost any problem, it's important to start with a full scan of the vehicle for faults. If the electric coolant pump has problems, there will be fault codes stored in the DME.

When diagnosing a failed water pump, inspecting the electrical connection to the pump should be one of your first steps. Always check for power and ground. Don't make the rookie mistake of forgetting this important step in your diagnosis.

These pumps commonly fail from coolant contamination at the plug end of the pump. Once coolant reaches the electrical connector, the damage has probably been done to the pump. Coolant will quickly short circuit the electronics in the pump and destroy it. Close examination and cleaning of the electrical connector may be necessary after coolant pump replacement. It's also wise to inspect the coolant pump for blockage or damage from foreign material. This is rare, but a small piece of plastic or other foreign material can jam the pump impeller, impeding flow.

Removal and replacement of the coolant pump is generally a straightforward procedure. The pump is located on the passenger side lower front corner of the engine block on most models. The coolant pump and thermostat assembly are assembled closely together in this location on many six-cylinder engines.

Accessibility of the pump during replacement can seem daunting as the pump is barely visible. If possible, it is recommended to remove the electric fan as a first step during pump replacement. This may not always be necessary, but the extra room given at the front of the engine can make a big difference in ease of removal. On models with oil coolers, fan removal may be more trouble than it's worth as they can be time-consuming to safely remove.

If the coolant pump and thermostat have aluminum mounting bolts, always replace them once removed. These are one-time use fasteners and will break if re-used. If replacing the coolant pump, it's wise to replace the thermostat assembly at the same time, particularly if it needs to be removed during coolant pump replacement.

The coolant hoses at the coolant pump/ thermostat junction can be difficult to access. It's necessary to remove the hose connections and thermostat assembly before fully accessing the coolant pump. Be careful not to lose or damage the securing clips on the coolant hoses after disconnecting them. They will fly across the shop or into the deep recesses of the engine bay, never to be seen again if you're not careful.

Flexible drivers are the only way to access and successfully loosen the worm gear

The coolant pump can be heard to run and coolant flow can be visible at the expansion tank during the process.

Vacuum coolant fillers can be a big time saver, especially on hard to bleed engines.

clamps that secure the additional coolant lines at the pump and thermostat. If you are repairing an xDrive coolant pump, access is even more limited, and it may be necessary to remove the underbody brace and paneling on the passenger side wheel well to fully access the coolant hose connections.

The thermostat plays a small but important role in the BMW cooling system. Its job is to help control the coolant temperature by limiting coolant flow through the engine during the warm-up phase. Once the engine is up to operating temperature, the thermostat is fully open.

BMW uses a standard thermostat design with the addition of a heater circuit integrated into the assembly. The heater is used to open the thermostat at a lower temperature, allowing for quicker warm-ups. The heater circuits are known to fail on these thermostats just like the old M54 thermostats. Faults are commonly stored in the DME as Thermostat Heater Circuit. In rare cases, the electrical connection seal at the thermostat can give out and begin wicking coolant through the engine harness. A failure like this can wreak havoc on vehicle electrical systems.

After any cooling system repairs are made to BMWs with electric coolant pumps, the system must be bled fully. BMW has included activations through the DME to run a bleeding procedure for the pump. This function runs the coolant pump at varying speeds to fully circulate coolant through the entire system. The bleeding procedure should be allowed to run for 5-10 minutes to complete fully.

It's also necessary to have a battery maintainer on the vehicle during the bleeding procedure. Low battery voltage will terminate the bleeding procedure. Maintaining the battery voltage is a critical step on BMWs any time the ignition is left on for any amount of time.

BMW has also given us a trick to bleed the coolant system without the scanner if desired. Key on engine off, turn the fan to the lowest speed setting and set the temperature to max. After this step, press and hold the gas pedal to the floor for ten seconds. This will initiate the bleed procedure. The coolant bleed procedure works on most BMWs with electric coolant pumps installed.

The coolant expansion tank continues to be a weak point on new BMWs. Splitting at the sides and leaking where the tank is bonded are the most common. Also be wary of the bleeding screw if equipped. These soft plastic screws do not like to be over-tightened. Keep in mind not to overfill these expansion tanks when filling. BMW uses level indicators on the tanks for a reason. Too much coolant in the expansion tank will force its way out when it expands. This alone can damage the expansion tank as well as the tank cap.

BMW coolant hoses and coolant lines have a habit of failing too. Typically, the plastic becomes brittle from heat and eventually blows apart under pressure. Be cautious when moving these coolant lines during other repairs. They can be extremely fragile. The expansion tank hard line that runs across the top of the radiator on many BMWs is notorious for breaking.

The valley pan is a notorious location for coolant leaks.

A reliable coolant pressure tester with BMW adapters is an absolute necessity when chasing down leaks.

On The N62 V-8 engines, the valley between the cylinder heads contains a lot of coolant leak potential. There are small coolant return lines that leak. The valley pan gasket can leak, as can the large coolant transfer pipe running to the water pump. Get out your pressure tester and inspection mirror here when searching for coolant leaks. On turbocharged engines such as the N55, the coolant feed lines for the turbochargers are known to eventually degrade from heat. Once these fail, they can be a bear to replace.

The radiator and electric fan play a critical role in the cooling system. Without a way to exchange heat out of the engine during normal use, engine damage would rapidly occur. The radiator and fan setup on modern BMWs are fairly reliable. Not many issues occur here except from impact damage and occasional radiator leakage from end tanks.

Remember, these cooling systems are always under pressure when running and cooling the engine. Do not open a hot expansion tank cap quickly or remove coolant lines when the system is under pressure. Scalding hot coolant can and will burn! Always let the system cool down to safe temperatures before beginning repairs. •

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Diagnosing Fuel Delivery Issues

By Luke Murray

Inadequate fuel delivery may be as simple as an empty gas tank or may be a more involved issue with electrical circuitry.

Luke Murray penned this article in 2016. Although a few of you may have seen it, It had very limited exposure at that time and we felt the topic would be especially appropriate given Luke's training schedule at the BIMRS Conference this year.

When a vehicle presents itself with a crank but no start condition, a few items must first be determined, one of which is, "Does it have fuel?" While this might seem like a simple question of whether or not the gas tank is empty, what we really need to know is whether or not there is adequate fuel delivery to the engine. This question can be answered with a standard fuel pressure and volume test. If the answer is no, it's time to figure out why.

Checking the flow

First, let's talk about that initial fuel pressure and volume test. Modern port injected engines have a test port with a Schraeder fitting to allow for convenient measurement. On most BMWs this is located on the fuel rail. However, some models have the test port built into the fuel filter and pressure regulator assembly.

Pressure specifications vary, so be sure to look them up. For a while all BMWs had a standard spec of 50 psi. Over the last decade that has changed. We now see pressures up to 87 psi, and some vehicles call for a variable pressure. As far as volume goes, a good rule of thumb is to look for fuel delivery of a quart in 30 seconds.

No or low pressure or volume can be caused by an empty tank, bad pump, faulty pump control circuit, or a leak in the system. While a lack of fuel delivery will certainly cause a no start condition, low or inadequate delivery may still allow the engine to run. In this latter scenario, the complaint may be a lack of power or misfires, with or without a Check Engine light. In all cases a complete vehicle scan should always be performed. Fuel trim faults indicating a lean mixture in both the "Additive" and "Multiplicative" ranges may indicate a failure to deliver enough fuel volume. Newer vehicles may also have a fuel pump plausibility fault.

The logical starting point

Fuel delivery starts at the tank, so let's look there first. BMW uses what is referred to as a "saddle tank." This refers to the shape of the tank. In order to achieve optimal weight distribution, the fuel tank is located beneath the rear seat. To allow room for the exhaust and drivetrain, the tank is shaped like a saddle. This results in two storage areas with a common connection on top.

There is only one fuel pump, located on the right side, so fuel must be transferred from the left side of the tank in order to feed the pump. These design elements are where we can encounter the first possible issues when dealing with no fuel delivery.

Is there gas in the tank? Because of the design, there are two fuel level senders, one on each side. Depending on the model you're servicing, these provide direct inputs to the instrument cluster, JBE or FEM. The control module evaluates both signals to determine the total fuel level to display to the operator. Obviously a problem with one or both sensors can result in a false display. Another problem can be the failure to transfer fuel from the left side of the tank to the right side. In both of these scenarios, the vehicle will effectively run out of gas even though the gauge does not show empty.

Using an enhanced scan tool, with the ability to communicate with the instrument cluster, you can view live data from both fuel level sensors. You can also go into "Instrument Cluster Test Mode" and call up fuel level data directly out of the vehicle without a scan tool via test number 6. Test 6 may also display the raw data, or actual resistance, of each sender unit. This is displayed in ohms.

The first thing to note is the comparison of the fuel level in both sides of the tank. There should never be more fuel on the left side than the right side. If so, there may be a transfer problem or a failure with a level sensor. Due to the possibility of a sensor problem, actual fuel level should be confirmed visually. Removal of the access covers for both sides of the tank is relatively straightforward on most models, with the notable exception of “Z” chassis.

Make sure sensors are telling the truth

If, after visual inspection, it is determined that the level readings are incorrect, continue with electrical diagnosis of the level sensor circuit. Sensors are potentiometers, so a voltage drop test while moving the float arm is the easiest test.

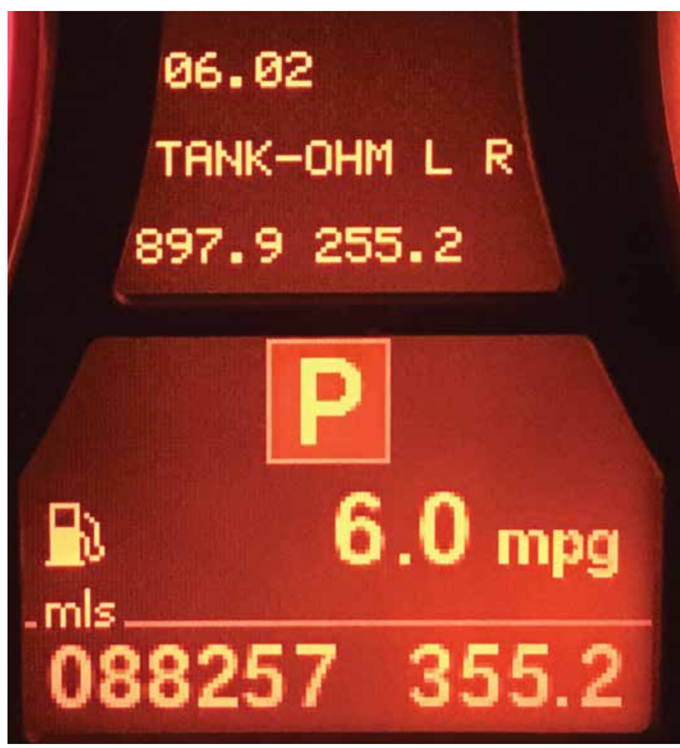
When the replacement of a fuel lever sender is needed, either as a result of failure or as part of a replacement fuel pump assembly, there is an important step that is often overlooked. Because this is an analog signal being generated by a mechanical component, wear results in signal degradation. This problem is addressed using adaptation values stored in the instrument cluster or appropriate processing control module.

Now if the sensor was bad, the software has been applying a lot of inaccurate adaptations to that signal. As a result, when the sensor is replaced, the signal will be modified to a point that it too is inaccurate. This can, and often times does, lead to the same symptom the vehicle first presented itself with until adaptations shift back to zero, which can take several full tank refills.

To avoid this problem and a dissatisfied customer, these adaptation values must be reset. This resetting is accomplished via test number 21 in the instrument cluster test mode. Remember, the cluster must first be unlocked. When asked to enter the unlock code, simply add the last five digits of the VIN together. For more information on cluster test mode, visit the BMWTIS website (bmwtis.com) and read the “Driver Information and Displays” section of the body electric training manuals.

If visual inspection reveals that the left side level is in fact higher than the right side, there is a problem with the siphon jet pump circuit inside the fuel tank. This system relies on return flow and pressure after the fuel pressure regulator. A restriction in the system, like a clogged filter, could result in low flow. A bad fuel pump can also result in insufficient flow.

Another possibility is an internal leak. A hose in this siphon jet circuit can break or come loose at a service connection fitting. While the access covers are still off, activate the in-tank pump. In the case of a broken or disconnected line, there will be fuel spraying out from this leak. A disconnection due to improper installation may be repairable. However, a broken line will likely require the replacement of the entire tank. Some technicians are finding that the plastic corrugated lines used inside of BMW fuel tanks



Using test 6 within the instrument cluster is an easy way to check the status of fuel level sensors. Some vehicles even allow the resistance values to be displayed.

are starting to fail. This is probably a result of the ethanol content in today's gasoline.

Time to check the circuitry

If initial testing did not reveal any problems with fuel levels, it's time to check the fuel pump circuit. On early vehicles the pump control circuit is pretty straightforward, consisting of little more than a fuse-protected relay. Now, however, all new BMWs utilize a control module to operate the in-tank pump. At this point we will be doing some electrical circuit diagnosis.

Before starting, be sure the vehicle battery and charging system are in good order. If the vehicle doesn't start, obviously the charging system can't be tested. However, the battery may be low on charge due to the several unsuccessful attempts to get it started. Electrical system

Because the fuel level sender is often incorporated into the pump assembly, remember to clear the adaptation values for the sensor circuit in the instrument cluster when replacing.

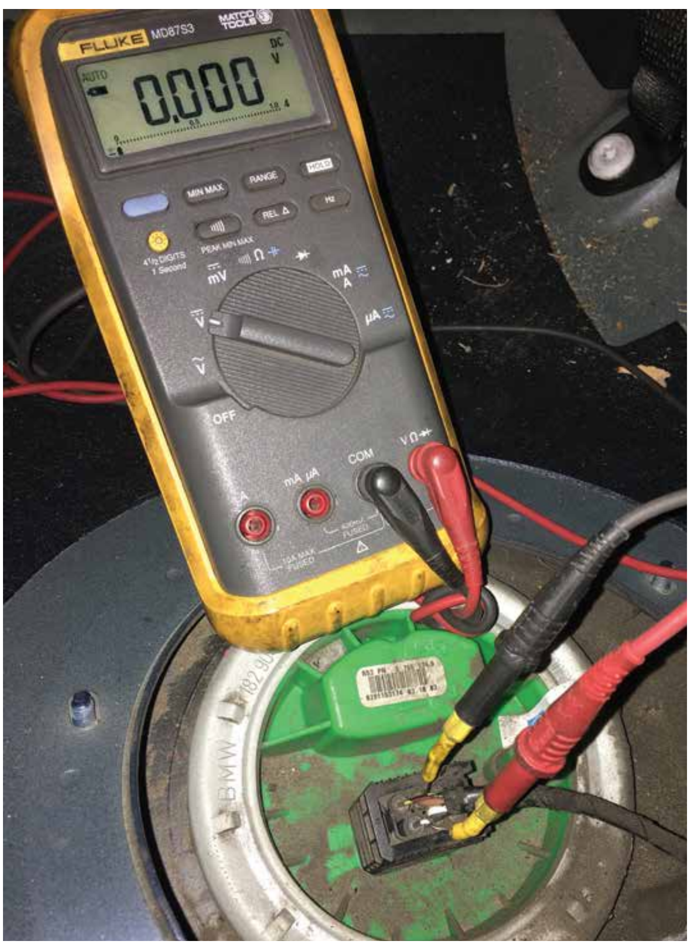
test results are only accurate with appropriate system voltage. Connecting an auxiliary power supply will assure consistent system voltage throughout the diagnostic process.

To test the fuel pump circuit, you will first need to activate it. Depending on the model and year, this can be done in one of two ways. On earlier BMWs the pump circuit is controlled using a conventional relay. This relay may be located in many different locations, from the engine compartment to the trunk. Once the relay is located, simply jump it via a purpose built tool or a small fused wire with spade connectors on each end. You will need to connect terminal 30 to terminal 87 at the relay socket.

Starting in the early 2000s BMW started varying the fuel pump speed to match load conditions. This first appeared on the E39 and E46 Motorsport vehicles and was later introduced on all chassis. The reason for this was to deliver only the fuel volume needed to meet current load demands plus a little extra to ensure the return system could still transfer fuel via the siphon pump system in the tank. This concept saves energy, reduces wear on the fuel pump, reduces the overall temperature of the electric motor, and therefore helps to prevent unnecessary fuel vaporization in the tank.

When this hose was crimped onto its fitting, it was not completely inserted. The result was an internal leak.

On the E65/E66 chassis, an airbag system control module, the SBSR, is used for EKP regulation. Because the SBSR incorporates accelerometers used for crash detection, do not manipulate it while the key is on. This is a common cause of fuel pump circuit failure.



A DVOM and a solid understanding of voltage drop theory is all you need to fully analyze the fuel pump circuit.

All in all this is a great feature. In order to do this, the conventional relay is replaced by an ECU. On those early "M" cars, this ECU was little more than a smart relay. The engine control module, or DME, out puts a Pulse Width Modulated (PWM) square wave pattern to indicate the desired delivery. On these models you can jump the circuit the same way as you would on earlier relay-controlled circuits.

Now all BMWs have a fuel pump control module that is on a bus network. These ECUs are called EKP modules. The first chassis to use this was the E65/66, although on this vehicle it is a unique setup. Instead of a dedicated ECU for fuel pump regulation, the electronics were incorporated into a pre-existing control unit. The module chosen for this task was one of the safety system satellites, specifically the right side B pillar satellite, or SBSR.

The SBSR is on the Byteflight network. This means that the command path for fuel pump control goes from the DME over PT-CAN to the central gateway module, or ZGM. From there the activation signal is sent over Byteflight to the SIM and passed on to the SBSR. Suddenly the importance of a complete vehicle scan becomes clear. On all other BMWs with a dedicated EKP module, the module is on the PT-CAN. So the signal path is much less complicated. As a side note, the EKP module contains one of the two terminating resistors for PT-CAN.

Because the EKP modules are on a vehicle network, they can be accessed via a scan tool. Using your scan tool, live data like pump speed and current draw can be viewed, fault codes can be stored, and the pump can be commanded to run. The speed is controlled via fixed frequency variable duty cycle, also known as PWM.

Your scope is your friend

To ensure accurate circuit analysis, you will have to test using a lab scope. If using a

DVOM, the low sample rate will only display an average. For example, 12 volts at a 50 percent duty cycle will be displayed as 6 volts. If you were unaware of this, you would find yourself chasing a power supply problem that doesn't exist. To avoid this issue, either use a high sample rate digital oscilloscope, or when commanding the pump to run with scanner, select the option of running the pump at 100 percent.

Now that the circuit is complete, or commanded on via scan tool, perform a voltage drop test across the fuel pump connector under the rear seat. You should be measuring within half a volt of system voltage (some will be lost through various connections). If measurement is within spec, and you cannot hear the pump running, clearly the problem is in the tank. Remove the electrical connector and visually confirm that the contacts are not burnt before proceeding with a pump replacement.

However, if the measured voltage is more than half a volt lower than system voltage, there is a problem with the circuit. First determine if the problem is on the power or ground side. This is done by doing a voltage drop test of the complete circuits on either side of pump to the battery. Connect the ground lead of your DVOM to the negative post of the battery, and connect the positive lead to the ground pin on the pump connector. This is a complete ground circuit voltage drop test. A reading of anything over half a volt is a problem.

To check the supply side of the circuit, place the positive lead on the positive post of battery and the negative lead to the power pin of the pump connector. This is a voltage drop test of the entire positive circuit. This test can determine if there are any bad connections or open circuits. Don't forget, a blown fuse is an open circuit.

Once you have determined which side of the pump control circuit is faulty, it is time to further isolate the issue. Using a wiring diagram, locate all the connections in the circuit. Continue to perform the described drop test at additional locations to divide the circuit. Potential issues can be anything from a burnt connector, loose ground, worn relay contacts, or even cold solder joint failures on the circuit board of the EKP control module. Note that the SBSR is a common failure point with solder joint failures.

Everything discussed here can also be applied to the low pressure side of the fuel supply system in vehicles equipped with direct injection engines. The primary difference is that, in these vehicles, fuel pressure is controlled by EKP regulation using feedback from a fuel pressure sensor located in the fuel line. This is opposed to a mechanical fuel pressure regulator. These systems do not have a pressure test port. Measurements are done via live data stream with your scan tool, or by using an adapter to the tee into the fuel line.

When replacing a faulty fuel pump, you should always replace the fuel filter too. If the repair requires replacement of the EKP module, it will likely need coding or programming. If you are replacing the SBSR, after coding and programming don't forget to re-start the system time for the passive safety system. •

Always replace the fuel filter when replacing a faulty pump. This in-tank filter has become heavily contaminated after less than 120,000 miles of use.

A Thoughtful Approach to Diagnostics

By Gary Smith

BMW's newer modular engines are quite complex, both in construction and operational theory, especially in the case of Gasoline Direct Injected (GDI) engines. The industry is now acutely aware of the carbon issues plaguing these GDI vehicles.

This year's live, hands-on training event at the BIMRS conference introduces the strategy of baseline scan data diagnosis combined with mechanical testing with a lab scope and pressure transducer to identify the root causes of common GDI driveability issues quickly and effectively. Read on for the overview discussion of this unique diagnostic approach.

Another year at the BIMRS conference is upon us. This is an event where we can all get together from shops and dealerships located all over the planet, to network with owners, service advisers, technicians, instructors and vendors, all of us operating with one common purpose, which is the accurate and profitable diagnosis, maintenance and repair of BMW vehicles.

And hopefully, we all come together to improve our ability to satisfy our customers with a heart of service, good workmanship, improved diagnostic accuracy, professionalism and pride in our work.

Being able to network with other technicians that work exclusively on BMW vehicles is sometimes just as important as the training classes themselves. Networking time with other technicians is invaluable for learning new "tricks of the trade," figuring out how that tech has been getting that diagnosis done more accurately, learning new work-arounds for problems, and learning from both the old school guys, as well as the sharp young crowd too…

But when we return to our shops after the event, how do we actually make hands-on use of all of this great subject matter training?

Enter the concept of targeted physical testing of the vehicle.

Gary Smith is presenting three training sessions at this year's BIMRS Conference.

In addition to learning theory and information on new technology, we must get better at putting physical testing into practice in our actual diagnostics. Failure to do so can be costly to the shop, the technician, and the customer.

These classes follow a similar theme; how do we accurately flow a diagnosis in a reasonable amount of time on a coding or no-code driveability problem, specifically on a GDI vehicle, more importantly, without firing the parts cannon at the car based on guesswork via scan data or parts swapping?

This is where becoming a diagnostic wizard requires some learning, a solid, dependable physical testing regimen, some study of chemistry, and some adjustable-on-the-fly testing methodology.

What if we could develop a basic strategy of approach and a set of generic tests that could be applied to all vehicles and pretty much all diagnostic problems, regardless of vehicle manufacturer, model year, or complexity? Could that help to improve diagnostic speed and accuracy?

You bet.

There is one big thing we typically don't know during an average scanner diagnosis, which is the bane of the technician's existence – what is REALLY going on down in that engine or transmission… mechanically? That, folks, has always been the one thing that we cannot "see" in conjunction with - and in confirmation of — the electronic scan data we rely on during these tricky diagnoses. Until now.

The ability to answer the mechanical AND carbon interference question quickly and accurately without disassembly of the engine or component is the challenge.

This is the basis of what our live classes show at the event — how to put these diagnostic concepts and testing strategies together in a controlled process without getting bogged down in the technology. Theory to testing. Keep it simple.

We can easily out-tech ourselves, or we can be out-teched by the sheer complexity of the technology when diagnosing one of these vehicles. We approach with a scanner, get a code or multiple codes, and we make decisions about where to start. This is how we have been trained over the years.

Most experienced techs have a pretty good flow for this kind of approach, but due to the actual technical complexity of how these circuits work, we can quickly get lost in data, schematics, testing, re-testing and theory. And we can go down the wrong path quickly, causing hours of needless work.

None of us, including factory/OEM field engineers, are immune from this. The car always acts differently in real-time service with time, mileage, mechanical wear, and deposit buildup, than it does for an engineer on a test bench at the factory with a brand new vehicle in his hands while writing a diagnostic procedure. Any experienced tech knows that!

Deposit removal chemistry or shell blasting flat out have been known to resolve a driveability issue that had been otherwise unresolved with a lot of electrical diagnosis and parts replacement.

Is chemistry magic?

No, but it is necessary, and it needs to be in the mix always with the diagnosis of driveability problems in GDI vehicles. Baseline theory using scan data allows us to identify these carbon issues very effectively.

It is wise to never discount a fuel, oil, or carbon issue as the potential cause of a driveability problem, especially in GDI vehicles. You do so at your own flat rate peril. Nobody wants to become the Comeback King.

Years of experience suggest that a mechanical issue or a carbon deposit related issue that have caused a concern was missed, after the obvious parts had been replaced already.

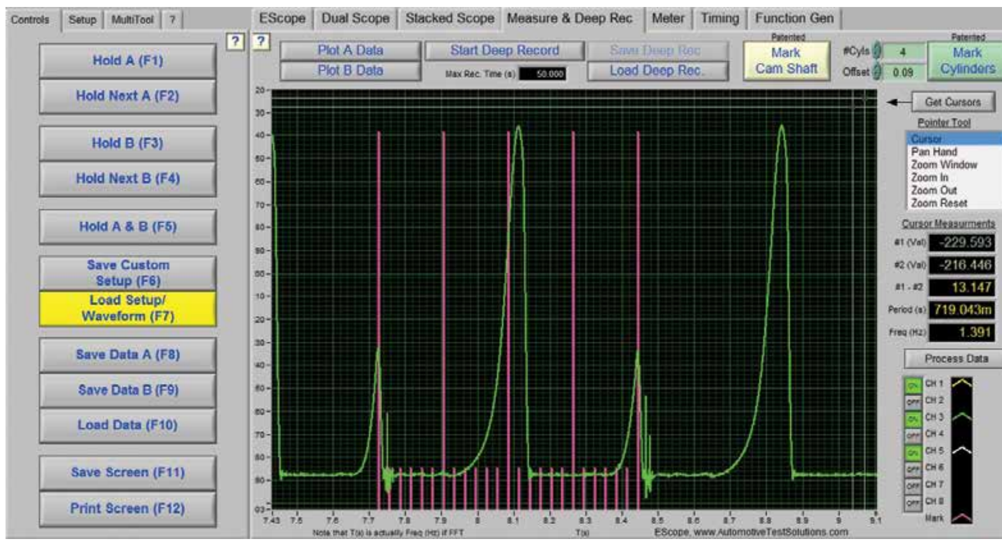
The reason that technicians often miss these mechanical causes is that traditional compression tests, and worse, static cylinder leak-down tests, are not sufficient tests for tracking down these intermittent misfires and driveability issues in the GDI platforms. To explain this requires more space than is allotted here…

We also find that once that part has failed, for example the high pressure pump, injector, engine component, turbo, catalytic converter, etc… it was a deposit problem that started the slippery slope to failure. Should we, then, learn how to identify these issues before the component fails?

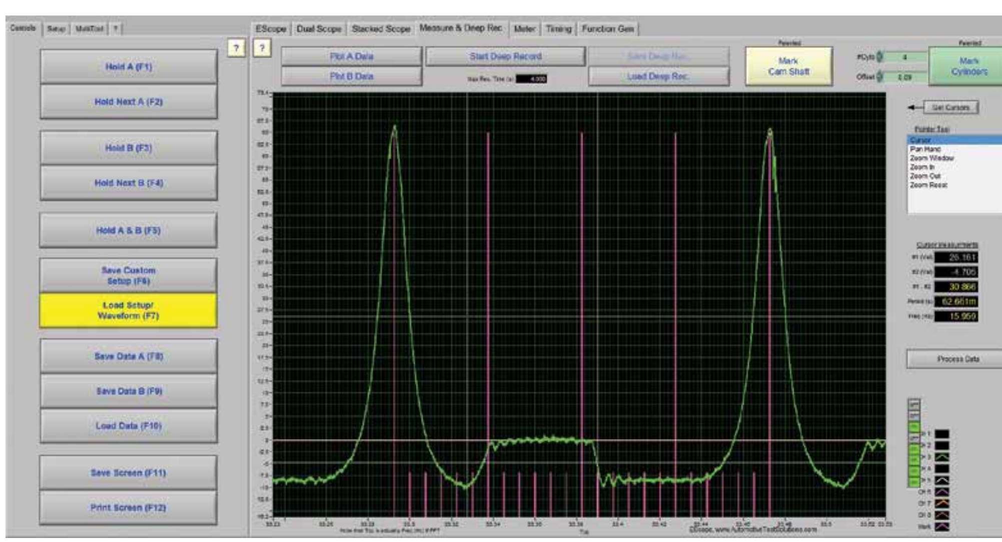
In the live classes, we demonstrate that, with the advent of pressure transducers and in-cylinder dynamic compression testing, we can use a lab scope to literally see, and accurately diagnose, the inside of the engine and carbon depositing issues most times without any engine disassembly.

As a result of baselining scan data strategy and scope testing combined, we have also learned and have recorded proof that cleaning carbon does restore good driveability, and lab scopes really are a great tool for finding faults of all kinds quickly.

The lab scope is the one tool in our arsenal that allows us to see the behavior of the electricity in



This image shows an in-cylinder running waveform capture of a BMW 7 Series engine with a jumped timing chain. These waveforms are particularly helpful in identifying internal engine issues and VANOS concerns.



This is the scope capture of a BMW 750Li compression waveform from a vehicle that now runs correctly after timing chain replacement.

any given circuit. This is the key to determining an accurate direction while diagnosing these difficult GDI driveability issues, especially those that are intermittent, without missing the causal issue or replacing unnecessary parts.

If we combine the scope with some physical transducers, where we can convert mechanical actions to electrical waveforms, and teach our technicians how to interpret and leverage this technology, we have pure magic, and the great unknown actually begins to reveal itself in the service bay.

Here is the real beauty of this diagnostic methodology: The tests we are teaching are the same tests, no matter the vehicle year, model or engine configuration.

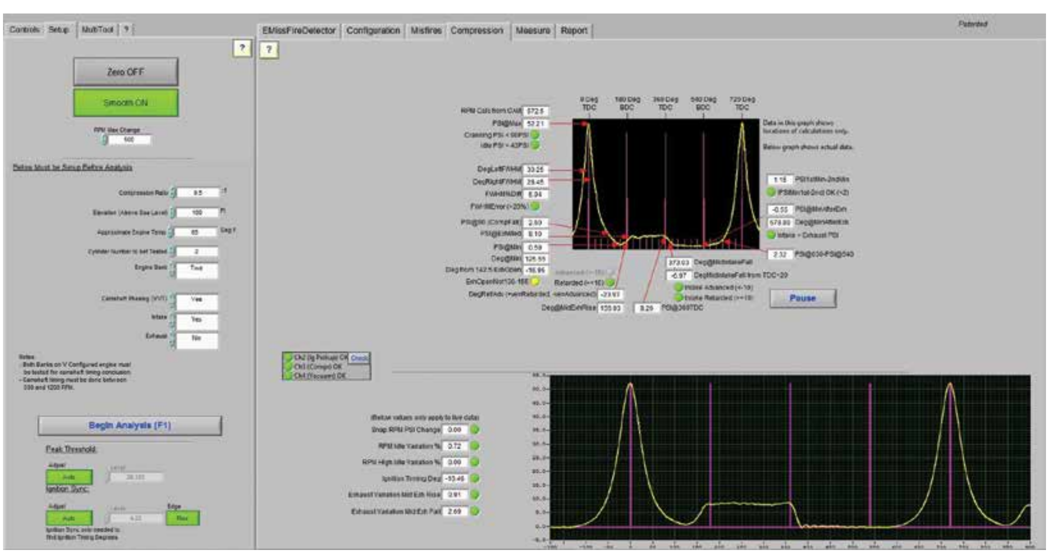
This means a tech can take a set of repeatable test methods from vehicle to vehicle and be diagnostically productive without spending tons of time in researching and schematics. The procedures simplify the technology and focus the technician on what is really ailing the car.

In the live lab scope session, we cover testing methods using mechanical transducers for testing VANOS and ECU input/output behavior, cam timing codes, and carbon deposit diagnosis in the valve and combustion chamber areas.

We pay particular attention to the concept of signal rationality and combining both mechanical and electrically processed signals together, or signal overlay. This strategy answers a lot of unknowns in a traditional diagnostic process. Signal overlay allows us to confirm beyond a shadow of a doubt whether or not the ECU is receiving and processing a signal properly in relation to actual crankshaft rotation.

This concept allows us to diagnose VANOS issues very quickly and accurately, and also allows us to identify carbon issues, deposits on rings, valves that intermittently aren't seating, worn cam lobes, cam timing issues, even down to details like weak valve springs. We can see all of this without engine disassembly if we are willing to equip ourselves, study, and practice how to do it. •

These photos show just how important baselining and scoping the mechanical engine have become. This GDI vehicle had a repeat misfire, after coil and plug replacement and induction service.



New technology analysis for the mechanical engine. The ATS Automated Compression Waveform Analyzer can detect VANOS problems, cam timing issues, valve leakage, and more. it can be a game changer in diagnostics.

Photo by Karen Winton on FreeImages.

Engine Oil

Decoding the alphabet soup

By Glenn Quagmire

It used to be oh, so easy. Grab a few quarts of 10W-30 and fillerup. Check to make sure the can or bottle had the correct API service designation and you were good to go.

Those days are long gone.

Today the choice of engine oil is not a simple exercise, even within a single marque like BMW. Different engine families have different requirements, and those requirements are spelled out in great detail in BMW service literature. It is worth noting that there are industry standards and classifications for automotive engine oil, and there are BMW's standards as stated above.

It is helpful to understand all of the various standards, categories, and classifications as well as understanding where they overlap and where they do not. So here's what you need to know (and, perhaps, some information you don't need to know, but might want to know...). Do note that this article will focus primarily on oils for gasoline engines. Oil for diesel BMWs can be covered separately.

Dino? Synthetic? Semi?

Today's engine oils are marketed under a variety of descriptions. Conventional. Synthetic. Semi-synthetic. High Mileage. And a few more as well. So just exactly what makes an oil synthetic, semi-synthetic, or "other?"

We turn to our good friends at the American Petroleum Institute for their always-clear and detailed explanations. In this case, API divides oil types into five groups, referred to as base oil groups, describing their chemical basis before additives are blended in. Groups one through three are conventional motor oils. Groups four and five are made up of various types of synthetics. Here's how it works.

Group 1 oils come from petroleum crude oil. The refining process for these oils is a basic solvent refining process, and these oils have modest performance characteristics.

Group 2 oils are more highly refined oils from petroleum crude oil, refined by using a process called hydrocracking. They have better anti-oxidation properties than Group 1 oils, lower levels of sulfur, and higher levels of saturates.

Group 3 oils are also based on petroleum crude oils, produced by hydrocracking. Like Group 2 oils, they have low levels of sulfur, higher levels of saturates, and a higher viscosity index. Viscosity index is a measure of the oil's ability to maintain its viscosity and lubricity over a wide range of operating temperatures, and can be enhanced through the addition of task-specific additives in the blending process. Higher is better.

Oils falling into Groups 1-3 are all considered "conventional" or "mineral" oil, although Group 3 oils are sometimes referred to as Synthetic Technology oils.

Group 4 oils are synthetic oils. This means they are developed from base fluids other than petroleum crude oils. These base fluids are most often based on polyalphaolefins, or PAOs, although they may also include synthetic esters and alkylated aromatics. They are developed using a process called synthesizing.

What makes synthetic oils special is the size of the molecules that comprise them. Conventional oils (Group 1-3 oils...) have molecules of varying sizes. Synthetics have molecules that are very consistent in size and shape. The result is reduced friction when they collide. That's why they're "slipperier." These oils have improved shear strength and a more broad temperature operating range, making them especially well-suited for use in cold climates as well as in high operating temperature conditions.

Finally, there are Group 5 oils which are all oils not covered in Groups 1-4. They may include a variety of base oils, and include semi-synthetics, or synthetic blends. These may include the so-called High Mileage oils, designed for cars that have accumulated, typically, 75,000 miles or more. These oils commonly have additives that cause modest swelling of gaskets, seals, and o-rings, allowing them to seal better in well-used engines.

There. Got all that?

Now, let's dig into more familiar territory – the API service designations. You may be aware that the current service designation from API is SN, a standard first introduced in 2010. Oil meeting this standard provides better oil performance than oil meeting previous standards. Improved features include better high temperature deposit protection for valves and pistons, better sludge control, and enhanced seal compatibility.

In addition, the API now identifies some SN oils as "Resource Conserving" oils, designated SN RC. These oils have been shown to provide a number of important features, including improved fuel economy with better compatibility with emission control systems, better lubrication for turbochargers, and better lubrication in engines run on ethanol fuels up to E85.

And just to make things even more interesting, API also provides a "Plus" designation for SN oils that offer protection against low-speed pre-ignition in forced induction gasoline powered vehicles.

Now, with all of that background, what is it we need to know about the proper oils to use in BMW engines?

BMW engineers have gone to great lengths to determine the optimal engine oil characteristics for their various engine families. Those recommendations are all based on extended oil change intervals. Hence the BMW standards are all designated LL, for Long Life oils. The BMW standards add a few more "vegetables" to our alphabet soup of oil chemistry, but they are well worth digesting.

As you'll see from the accompanying chart, BMW has established six categories of oil characteristics and their application to various models going back as far as early 2000's model years. And you can glean specifics by studying the chart. But here's the Cliff's Notes version for U.S. models.

- In general, for model years up to 2013, non M-series gasoline engines can use LL01 oil.
- M20 engines 2013 and newer can use LL14FE+ oil.
- LL17FE+ oil supersedes LL14FE+ and is backwards compatible to LL14FE+. It is not backwards compatible to LL01.
- All 2018 and newer models except M models must use LL17FE+.

BMW Specification	LL-01	LL-01FE	LL-04	LL-12 FE	LL-14 FE+	LL-17 FE+
Application	Minimum level for Gasoline from MY 2002 Minimum level for non-DPF Diesels from MY 2003 OK for older engines Not allowed for M-engines in general, only for new S55- and S63-M-engines	All Gasoline engines from MY 2005 OK for older Gasoline engines with Valvetronic Not allowed for Diesel Engines Not allowed for M-engines in general, only for new S55- and S63-M-engines	Mandatory for DPF Diesels OK for non-DPF Diesels OK for gasoline from MY 2002 in Europe only Not allowed for M-engines in general, only for new S55- and S63-M-engines	Standard BMW Diesels from MY 2013 onwards. (Not backward compatible) Not allowed for high power Diesels. Check manual for details. (Rule of thumb: Multiple turbos) Ok for gasoline from MY 2002 in Europe only Not allowed for M-engines in general, only for new S55- and S63-M-engines	ONLY for EU and USA! Allowed for Gasoline from MY 2013 with N20 and "Baukasten" engines NOT allowed for other engines Not allowed for M-engines in general, only for new S55- and S63-M-engines	Backward compatible with LL-14 FE+ ONLY for EU and USA! Mandatory for engines with Gasoline Particulate Filters (GPFs) OK for Gasoline from MY 2013 with N20 and "Baukasten" engines NOT allowed for other engines Not allowed for M-engines in general, only for new S55- and S63-M-engines
ACEA basis	A3/B4^{-15}	A5/B5^{-16}	C3^{-15} excl. P limit	C2^{-15}	C5^{-15} excl. S. Ash limit	C5^{-15}
SAE Viscosity grade	0/5W-30/40	xW-30	0/5W-30/40	xW-30	xW-20	xW-20
HT/HS viscosity (CEC L-036-90), mPas, min.	3.5	3.0	3.5	2.9	2.6	2.6
Kin. Viscosity at 100°C, mm^2/s	SAE J300	≥10.0	SAE J300	≥8.8	≥7.8 & <9.3	≥7.8 & <9.3
Noack (ASTM D5800), %	ACEA	ACEA	ACEA	ACEA	ACEA	ACEA
TBN (ASTM D2896), mg KOH/g, min.	10.0	10.0	6.0	6.0	9.5	6.0
Sulfated ash (ASTM D874), %m/m	≥1.0 & ≤1.6	≤1.6	0.8	≤0.8	≤1.3	≤0.8
Pour Point (ASTM D97) °C, max.	-42 for 0W-xx, TBD for 5W-xx	-42 for 0W-xx, TBD for 5W-xx	-42 for 0W-xx, TBD for 5W-xx	-42 for 0W-xx, TBD for 5W-xx	-42	-42

You'll see details and exceptions in the chart, but the above information should provide much of what you need to know.

What's this about SAPS?

SAPS stands for Sulfated Ash, Phosphorus, and Sulfur. These materials serve as anti-friction modifiers and provide wear protection for internal engine components. However they are sometimes associated with increased levels of carbon deposits. So refiners and blenders must achieve a careful balance of SAPS for optimal performance.

For instance, LL01 oils have high SAPS content, making them a good choice for older BMWs. Oil blends for newer BMWs have lower SAPS content.

What problems occur with the wrong oil?

If you're reading this publication, you know that BMW engines enjoy sophisticated design features and advanced materials. So ordinary oils just won't do. The use of non-compliant oils can lead to a host of problems, not the least of which are carbon deposits within the rotating assembly and on induction system components. We're all familiar with problems of deposits on the backs of intake valves on all types of GDI engines. BMW engines are no exceptions.

But problems can be even more serious and invasive. Inferior oils can break down and lose lubricity, causing internal damage to engine bearings, piston rings, and turbochargers. We know that there are many reports of excessive oil consumption with specific engine families. With such consumption comes the risk of vehicles being driven with critically low levels of oil in the sump, providing the opportunity for catastrophic engine damage. And this is exacerbated by extended oil change

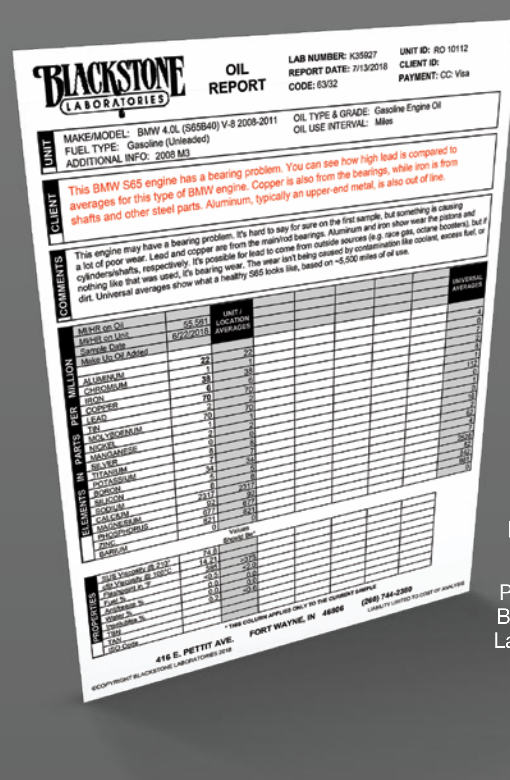
What's my oil telling me?

Oil analysis can reveal a great deal about an engine's condition and operating environment. It's a valuable diagnostic tool that can reveal how, and how much, internal engine components are wearing. It can also identify if inappropriate fuel and oil have been used.

Oil analysis is done by highly-qualify labs, at very reasonable prices, and can provide reports and observations in a matter of just a couple of days. As you'll see from the sample report here, analysis was performed on an oil sample from an M3 with 4 liter S65 powerplant. The presence of lead, copper, iron, and aluminum point to possible excessive wear on the engine bearings. This, of course, could be confirmed with oil pressure readings hot and cold.

Particularly helpful are comments/observations from the lab, which not only provides statistical data, but also presents conclusions about possible causes and developments. It is also apparent from this report that the lab providing this report has an extensive database of normal measurements, presumably based on data accumulated from many analyses performed on similar engine architecture.

An initial oil analysis can provide useful information to the repair technician which can then be shared with the vehicle owner. Subsequent follow-up oil analyses can reveal patterns of engine wear and component degradation that can suggest that more frequent maintenance or internal engine repairs may be needed. •



BLACKSTONE LABORATORIES
OIL REPORT
LAB NUMBER: K35927
REPORT DATE: 7/13/2018
CODE: 63/32
UNIT ID: RO 10112
CLIENT ID:
PAYMENT: CC: Visa

UNIT
MAKE/MODEL: BMW 4.0L (S65B40) V-8 2008-2011
FUEL TYPE: Gasoline (Unleaded)
ADDITIONAL INFO: 2008 M3
OIL TYPE & GRADE: Gasoline Engine Oil
OIL USE INTERVAL: Miles

CLIENT
This BMW S65 engine has a bearing problem. You can see how high lead is compared to averages for this type of BMW engine. Copper is also from the bearings, while iron is from shafts and other steel parts. Aluminum, typically an upper-end metal, is also out of line.

COMMENTS
This engine may have a bearing problem. It's hard to say for sure on the first sample, but something is causing a lot of poor wear. Lead and copper are from the main/rod bearings. Aluminum and iron show wear the pistons and cylinders/shafts, respectively. It's possible for lead to come from outside sources (e.g. race gas, octane boosters), but if nothing like that was used, it's bearing wear. The wear isn't being caused by contamination like coolant, excess fuel, or dirt. Universal averages show what a healthy S65 looks like, based on ~5,500 miles of oil use.

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Photo courtesy Blackstone Laboratories, Inc.

intervals made possible through the use of synthetic oils with carefully-blended additive packages. The decreasing level of oil during extended oil change intervals may not be noticed by the driver. See "catastrophic engine damage" reference above...

We're all likely familiar with heat-related problems in the N63 family of "hot-vee" engines. Because the twin turbochargers are located in the vee of the engine, exhaust heat is concentrated there, which cooks valve stem seals, with the resulting increased oil consumption you'd expect from such conditions. The factory reduced the recommended oil change interval from 15,000 miles to 10,000 miles, but many interpret this as a band-aid rather than a fix for the problem.

And then there's the issue of Low Speed Pre-Ignition (LSPI). This is an evolving phenomenon and, without getting too deep into the quicksand, LSPI is a condition which manifests as premature combustion of the fuel/air mixture under low speed high load conditions. It is commonly found in forced induction GDI engines. While the causes are complex and not fully understand, it is believed that lubricating oil that is drawn into the combustion chamber likely contributes to this condition. This is just one more reason to choose engine oil carefully in order to avoid this condition.

Finally, non-compliant engine oil will not contain the additives and supplements necessary to prevent the formation or accumulation of acids and other nasty chemicals that can cause consequential damage to precision internal engine components.

But you knew that...

So how's a technician to choose? And where to buy?

Well, let's start off with, you're not going to find compliant BMW oil at your local big-box store. You'll need to choose oil from a specialty blender who certifies that their products comply with the various BMW LL standards. Such oils are available through various distributors, direct from refiners/blenders, or perhaps from your local dealer.

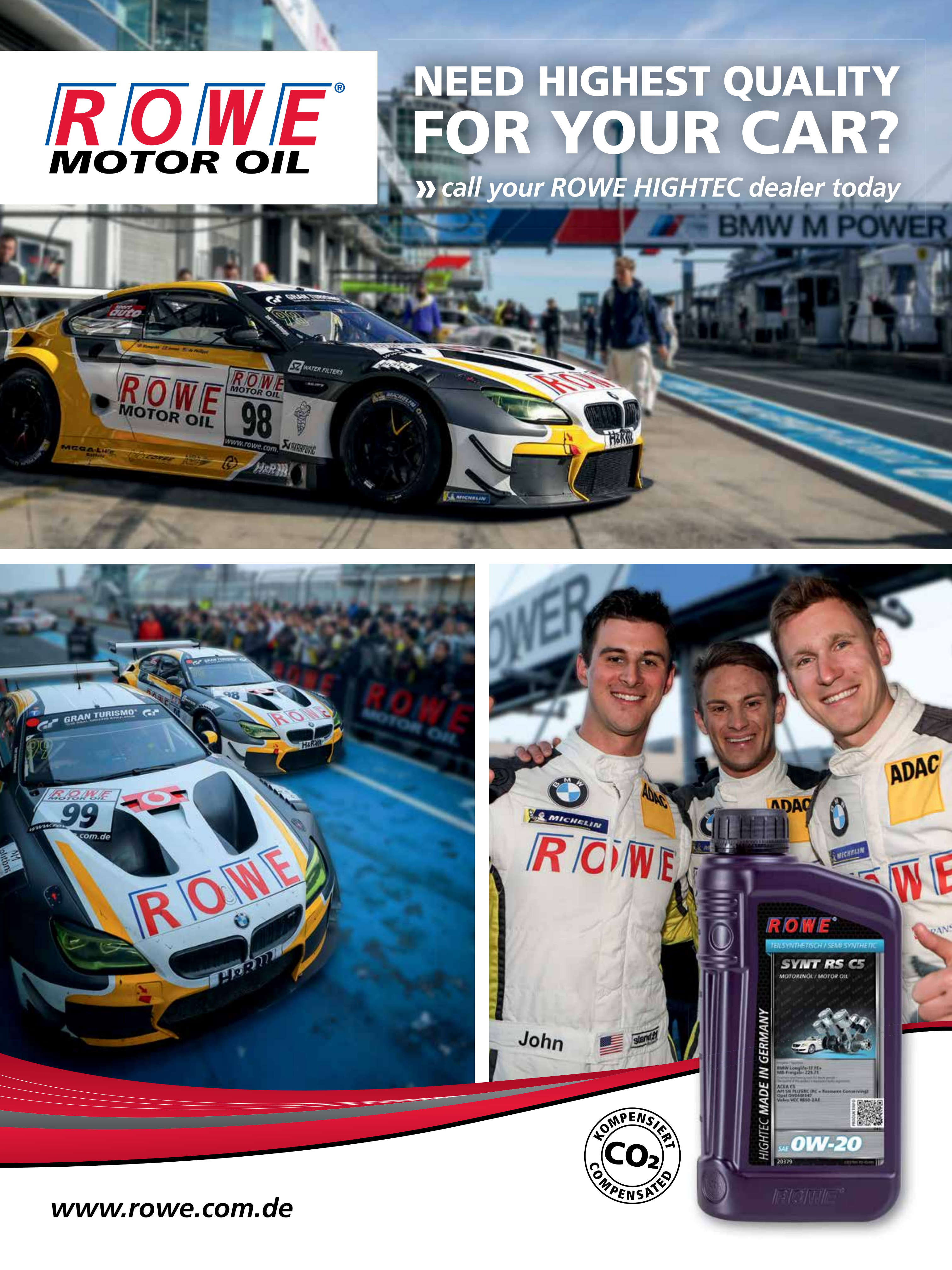
You should carefully choose oil for each customer's vehicle based on the chart above. And while 0W-20 is a common choice for new BMWs, you should select the viscosity based on recommendations for the specific vehicle you're servicing. These recommendations can be found in the owner's handbook or in appropriate service literature. Bear in mind that your choice of viscosity can vary depending on your geography and its prevailing climate as spelled out in owner's handbooks and elsewhere.

Also, consider that the correct specification is even more important than the correct weight, so be sure to choose oil that meets the appropriate specification. Documented approval by BMW further reinforces compliance with their standards.

You may encounter oil specifying compliance with other international standards. They may be those developed by ILSAC, the International Lubricants Standardization and Approval Committee, and you may also see reference to ACEA, the Association of Constructors of European Automakers.

The bottom line is, the choice of oil for BMWs is more critical than ever. Understanding the alphabet soup of it all will allow you to make more informed decisions, and will allow you to make the best recommendations to your customers and their prized BMWs. •

Some technical information for this article courtesy of Atlantic Import and Export Corp. (Atlanticim.com), the NAFTA marketing company for Rowe Motor Oil USA.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Sales and Service Booms from 25 Years of "The BMW Effect"

Twenty five years after BMW came to the United States with full scale manufacturing, service and support, its entrance is known as "The BMW Effect." Since then, auto manufacturing with BMW and 400 other organizations that followed or joined with The Ultimate Driving Machine in the South Carolina region has quadrupled in size to a $27 billion annual impact. And BMW's national presence has taken off, significantly upgrading the importance of BMW vehicle service at independent BIMRS shops as well as at BMW dealerships, tremendously enhancing the brand's image.

By Wayne Riley

Today, BMW maintains one of the worldwide firm's largest manufacturing plants in Spartanburg, South Carolina, building nearly 500,000 vehicles a year and basically the firm's entire mix of SUVs. This plant will build the first salvo of hybrid electric vehicles as 2020 models, with technical support for service and maintenance throughout the country.

Near Spartanburg, the rise of the automotive industry led to the creation of the Clemson University International Center for Automotive Research (CU-ICAR). Since opening in 2007, CU-ICAR (unrelated to I-CAR, the Inter-Industry Conference on Auto Collision Repair) has become a strong player in the automotive industry, offering masters and doctorate degrees in automotive engineering, giving staff and students the ability to conduct cutting-edge research.

BMW built its International Technical Research Center (ITRC) on the campus, offering advanced degrees and the ability for students to study vehicle service as well as manufacturing. A large number of automotive firms including BMW, Michelin, and Bosch have partnered with CU-ICAR and contributed to its mission or have headquarters on the campus.

Nearby, the Center for Manufacturing Innovation, a partnership between Greenville Technical College and CU-ICAR, offers an in-house vehicle assembly center to train students.

Training Is Paramount

Ultimate Driving Machines are highly advanced, high powered vehicles that demand superior service and maintenance, and BMW has moved quickly to give owners in this country cutting edge service supported by superior training, both for management at the shops which perform the service and maintenance, and for the technicians who work on the vehicles.

BMW has seen 25 years of quadruple growth in the South Carolina region with installation of its sprawling Spartanburg plant.

BMW plant at Spartanburg, SC is state of the art, turns out nearly 500,000 mostly SUV vehicles every year.

BMW built its International Technical Research Center (ITRC) on the CU-ICAR campus to offer advanced automotive engineering degrees and studies of manufacturing and automotive service.

Of vital importance to superior service is up-to-the minute training and support for hundreds of independent BIMRS shops. With members in four continents, BIMRS is the non-profit educational association serving the needs of hundreds of top BMW Service Professionals (bimrs.org). BIMRS hosts an annual conference where shop owners and technicians can receive training, on the latest topics, that are presented by top industry authorities on BMW service and repair (bimrsmeeting.com). An exclusive members-only forum provides access to years of information, resources, tech tips and more on their organization's website bimrs.org.

Current hot topics include:

- Mini PHEV Plug-In Hybrid Vehicles
- GDI Technology, Diagnosis & Field Issues
- BMW Active Hybrid Vehicles
- Diagnosing Difficult Deposit Related Driveability Concerns
- BMW ADAS
- BMW Coding, Programming and Initialization
- Technology Needs for Today's Diagnostics
- And many additional topics.

BMW also operates tech centers in Woodcliff Lake, NJ; Dallas/Ft. Worth, TX; Greer, SC; Ontario, CA; Orlando, FL; Oxnard, CA; Phoenix, AZ; and Atlanta, GA, primarily to train technicians for their own dealerships in the latest service requirements and techniques – including servicing the new breed of hybrid or fully electric vehicles.

BMW Boosts Battery Production, Doubles EV Growth

Preparing for the next stage in electric propulsion, BMW is two years early with electric vehicles, plans 25 electrified models by 2023, with sales of electric vehicles more than doubling between 2019 and 2021 and climbing more than 30 percent per year up to 2025. Supporting this, BMW is significantly boosting U.S. battery production to support all electric vehicle (BEV) production, and dramatically upgrading the X3 and X5 plug-in hybrids on existing platforms.

The just-announced 2020 BMW 330e plug-in hybrid gets more electric range, XtraBoost performance, a bigger battery, stronger acceleration, and a new Predictive mode that decides when to go all-electric. Obviously, this greatly enhances already mastered service capabilities on E3 and E5 vehicles.

Curing "Throttle Lag"

Some owners are complaining about "throttle lag" on several 3 and 5 series vehicles. Not a turbo lag, this hesitation frustrates drivers who push on the accelerator to go – but don't go. Inexplicably, the car just sits there for a while, then takes off with a surge, or hesitates when accelerating to pass.

The problem is probably related to the system "memory" studying driving style and basically programming the throttle to respond in exactly the way the current driver – or an earlier driver – has driven. A couple of ways to defeat this "memory" include a simple maneuver with the key and accelerator pedal, and/or a software update from BMW.

The maneuver, recommended in several BMW forums, is:

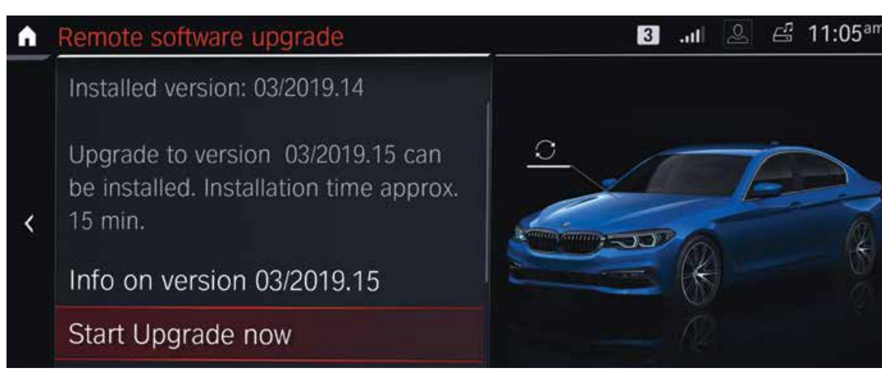
- Take foot off brake (and do not push brake!)
- Press Start to turn on car (but do not start, and no brake or car will start)
- Press accelerator down and hold for about 30-60 seconds
- Press Start to turn off car
- Release accelerator
- Wait two minutes
- Start car

This should mitigate the "memory," and allow quicker acceleration, at least for a while.

If this workaround doesn't help, request a software update at bmw.com/en/footer/software-updates.html. This will bring up a form requesting the vehicle VIN. Once supplied and the appropriate update selected, BMW will provide the means to download the update to a USB drive on your computer. Once the update is downloaded to the USB drive, insert the drive in the USB slot in the vehicle console and follow instructions, which should appear on the dash display, to execute the vehicle update,

Hopefully, once the update is installed, this should make the driver happy to be driving the Bimmer that goes when he says go, as he or she is expecting. •

BMW tech centers train auto technicians in what they need to know to handle technical aspects of BMW vehicle service, including servicing and maintaining electric vehicles.



Progress on the update will be illustrated in the dashboard display, giving the user the option of choosing to install update, which usually takes a short time. When completed, the display will indicate the update is completed.

Installing an easily accessible electric vehicle charging station, even a small one, gives BMW drivers a convenient place to charge their vehicle, and is a signal the shop is on top of electric vehicle maintenance.

Promote Shop EV Service Readiness!

As BMW begins rolling out several new models of its advanced EVs, why not make everybody who visits your shop aware of your readiness to be right on top of the new EVs. You can bring in service now and line up future EV service with a few simple steps that will keep your shop first in the minds of EV drivers who will be in the need for service on EVs:

Several versions of BMW wallboxes are available.

- Install one or two electric vehicle charging stations available to any electric vehicle driver. Several different charging station outlets are available from simple wall units to more elaborate free standing chargers, with all needing to be plugged into a 240v NEMA 6-20R wall receptacle charging at 3.6kW. *The NEMA 6-20R outlet requires a dedicated 20 amp circuit (240 volt) installed by a licensed electrician.
- Prepare and make available a printed post card or larger card promoting your shop as a center for electric vehicle service, and note that BMW has installed 100 electric vehicle charging stations in national parks throughout the country to aid EV drivers traveling, and has also partnered with other services to make hundreds of charging stations available.
- On the reverse side of card include a small version of the colorful "PlugShare" map and point out that drivers can find several hundred charging facilities nationwide by going to plugshare.com. The comprehensive online national map can zero in on the driver's location and shows several types of charging facilities, plus a list of various charging networks.
- Hand out the card to any drivers charging their vehicles or otherwise interested, and place the card in your waiting room, near the charging station, or at the shop desk for any takers and potential EV customers. •

Showing electric vehicle drivers a map of the hundreds of charging stations that can be located through "PlugShare" is a "savable" good promotion for the shop and useful to any current or future EV vehicle driver.

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