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**CAN We Do This?  
Supply and Demand  
VW Fluids: Motor Oil  
We Have Ignition!**

# TechConnect



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Genuine Volkswagen  
repair information

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VOLUME 6 | NUMBER 1 | Summer 2014



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# Volkswagen

## Your Source for Genuine Volkswagen Repair Information

Volume 6 Number 1 Summer 2014

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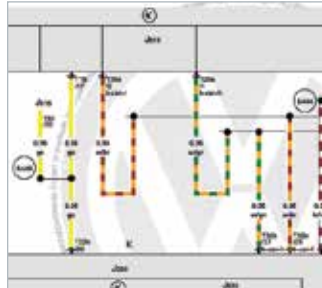
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**Caution:** Vehicle servicing performed by untrained persons could result in serious injury to those persons or others. Information contained in this publication is intended for use by trained, professional auto repair technicians ONLY. This information is provided to inform these technicians of conditions which may occur in some vehicles or to provide information which could assist them in proper servicing of these vehicles.

Properly trained technicians have the equipment, tools, safety instructions, and know-how to perform repairs correctly and safely. If a condition is described, DO NOT assume that a topic covered in these pages automatically applies to your vehicle or that your vehicle has that condition. For specific warnings pertaining to the servicing of specific Volkswagen systems and features, refer to: <https://www.erwin.volkswagen.de/erwin/showhome.do>.



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The job of the ignition system is to provide the spark that initiates combustion, and it's our job to keep this process going. To do that effectively, we need a firm grasp of how the system works.

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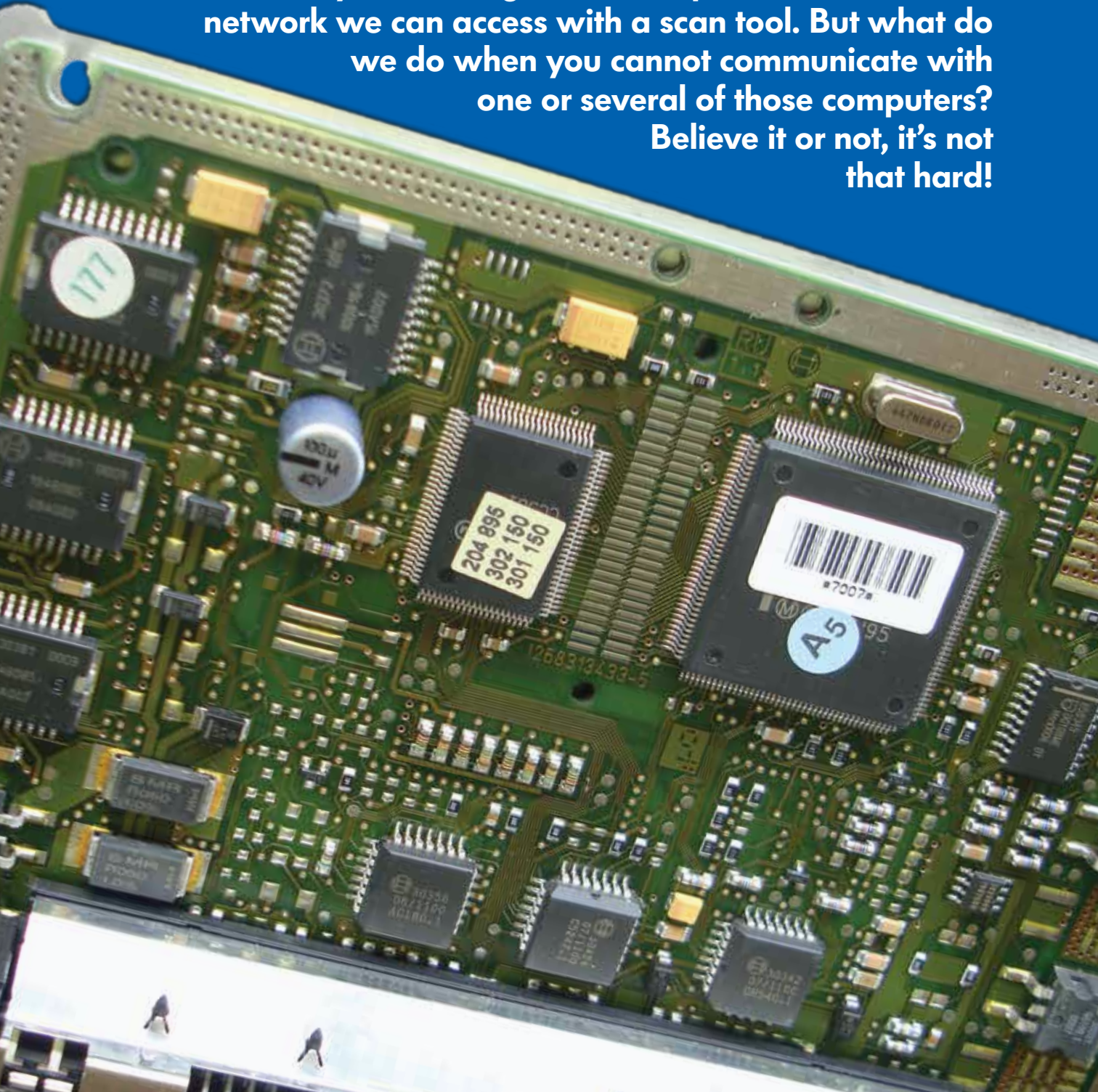


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# CAN We Do This?

The CAN (Controller Area Network) concept has made our lives easier by connecting all the computers in the car in a network we can access with a scan tool. But what do we do when you cannot communicate with one or several of those computers? Believe it or not, it's not that hard!



## CAN We Do This?

If you're just getting into the business of automotive repairs, everything probably seems normal to you. You don't remember when an ignition system had a pick-up and a module. You don't remember when fuel injection used the triggering of the ignition coil to tell the computer when to trigger the injectors. You probably don't even remember when there was only one computer in a car! Those of us who've been around this business for a couple of decades or more, on the other hand, have seen an evolution of modern electronics that might better be called a revolution.

Computers are everywhere now. It seems that just about every system on a modern car has some sort of electronic control. Power windows have convenience and safety features that are computer-controlled. Power seats have memory functions that require input requests, position sensors, and output drivers that supply power/ground to the motors. Multimedia is now all computer-controlled. While each system on the car has some sort of electronic logic controlling it, each has different needs.

### What's the frequency?

Body control systems do not need super-high-speed data transfer, but music and video does require a lot

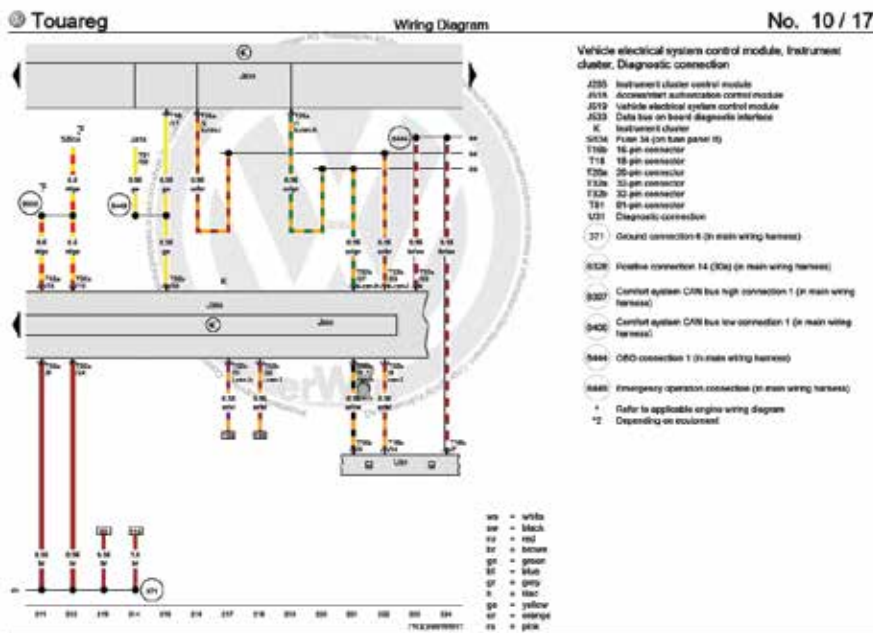
of data to be moved from place to place. Drivetrain systems are different. When a vehicle starts to lose traction in a corner, it is critical that the wheel speed of that tire is picked up by the ABS/Traction control module. The control unit will apply the brakes or the traction control system may request the PCM (Powertrain Control Module) to reduce power output by retarding ignition timing, limiting injection pulses, and closing the electronic throttle until the wayward tire regains its grip on the road. This needs to happen as quickly as possible, so powertrain systems operate at a higher baud rate than, say, body control functions.

Certain features require information from these different systems. For example, look at the power door locks. Technicians have the ability to program a control unit to lock the doors automatically when the vehicle reaches a specific speed. How does the body control unit know how fast the car is going? Does it have a speed sensor to provide that information? Some multimedia systems can increase the volume as road speed (and road noise) increases. Does the radio have a speed sensor also? That would mean three separate speed sensors would be needed, one for each system. These redundancies would increase the number of wires and the complexity of the system.

In an engineering effort to streamline and simplify wiring, all of these different systems share information. Since the ABS/Traction Control system reads the wheel speeds directly, it shares this information with the rest of the car. The body control module can use this information to determine when the power door locks should be locked, and so on.

### Lines of communication

As we mentioned earlier, the powertrain management system operates at a very high baud rate to be able to react quickly and keep the car under control. The body control system does not have to react as quickly to a request to open a window or



Using [erwin.vw.com](http://erwin.vw.com), your first step should be to look at the diagnostic communication wiring diagram. Here in the lower right hand corner is the OBD II connector (component U31) with three wires that go to different locations. Pin #7 goes to the OBD connection 1 and other locations in the main wiring harness, and pins #6 and #14 go to the instrument cluster control module.

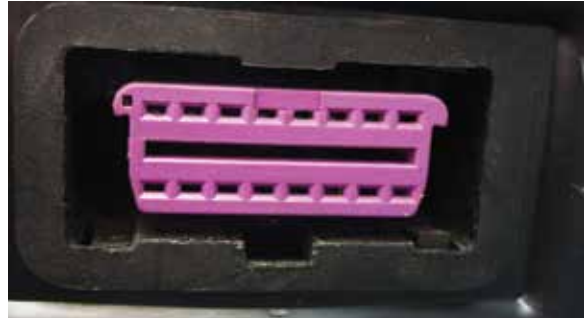
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adjust a seat. Two different systems operating at two different baud rates are like two people speaking two different languages. They are not going to understand one another. There has to be an interpreter. When computer systems operate with different software languages, they also need to have an interpreter, which is referred to as a “gateway.” The job of the gateway is to translate the information from one computer system into the language to the other system(s) can understand. How are we going to communicate with all those systems on Volkswagen vehicles? A VAG5052 factory scan tool is the best answer.

The job of a scan tool is to communicate with the vehicle on a software level. Software built into the computers or each system monitors the data coming in and going out. The scan tool can interpret this information and display this data. If the software in the computer detects a malfunction in the system, it will register a diagnostic trouble code (DTC). A technician can retrieve this DTC and use it as a starting point in diagnosing the problem. Once the repair is made, the DTC can be cleared and the car can be released to the owner. On more sophisticated systems, the scan tool can send commands to the car’s computers and request that outputs be turned on. As technicians, we can use electrical test equipment to measure the computer’s ability to supply power or ground to computer-controlled outputs, but with all the different computer systems on today’s vehicles, computerized diagnostics are a big help.

### Complexity or technology?

Imagine trying to diagnose a problem using only your Digital Multi-Meter (DMM). This involves removing panels to access electrical connectors, tapping into the system with your DMM while activating each output until you identify the one that’s malfunctioning. It sounds very time-consuming because it is. Using self-diagnostics and isolating the problem first by looking at the DTC speeds things up. You can then perform specific electrical tests on the malfunctioning system the self-diagnostics have identified as a problem. Younger technicians probably don’t remember when you had to check inputs and outputs manually. The first move everyone makes today is to reach for the scan tool, which is not a bad idea in this day and age (after you’ve done an over-all visual inspection, that is). Can you imagine your frustration with having complex diagnostic problems and not having a clue about what’s going on?



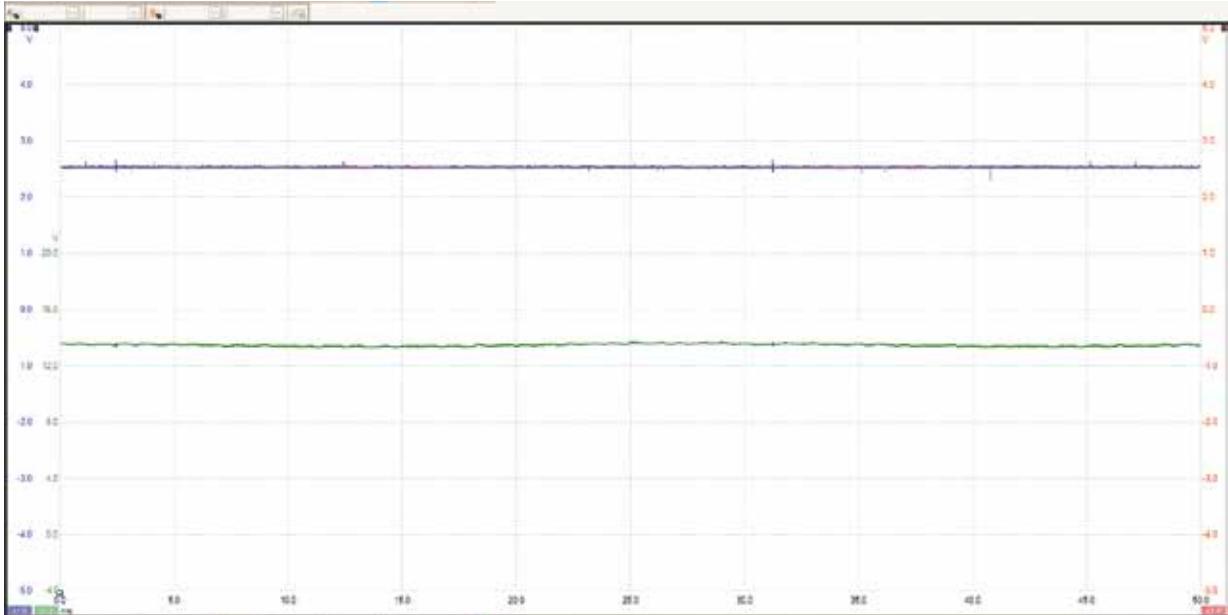
Locate the OBD II connector on the vehicle. You should know that an OBD II scan tool does not connect directly to the CAN system. Through pin #7 it sends diagnostic requests, but the CAN data wires of pins #6 and #14 only connect to the instrument cluster because it is the gateway to all the networks on the vehicle.



With an OBD II breakout box, you can connect to the vehicle, connect a scan tool, and attach test leads to the pins on which you want to monitor the voltage signals. Once again, this is a fast way to verify that you have what you need to communicate. Here, we are scoping pins #6, #14, and #7 for voltage signals.

But what if you have a problem with a car and you cannot communicate with the system even with your scan tool? How should you approach this challenge? We are lucky to be working on Volkswagen vehicles.

## CAN We Do This?



Scoping the pins at the diagnostic connector is a fast way to check if the system is up and running. Here, we are scoping pins #6 and #14 -- the upper trace. They are both at 2.5V, so the patterns are overlapping one another. Pin #7 is the lower trace and should read about battery voltage when dormant.

Their CAN is referred to as a “robust” system. This means most of the data from each computer system is put out on the bus. It is the job of the control unit receiving the information to detect the information that is important to them and retrieve that specific data. With all the information on the CAN bus, each individual control unit only monitors the data on the bus that it needs. It also sends its own information out on the bus. If an individual computer has lost power due to a blown fuse, or simply malfunctions, then it will not retrieve the information that it needs and it will not broadcast the information it has detected from its own sensors. The other control units could then detect the missing information and set a DTC indicating which control unit is not sharing its information.

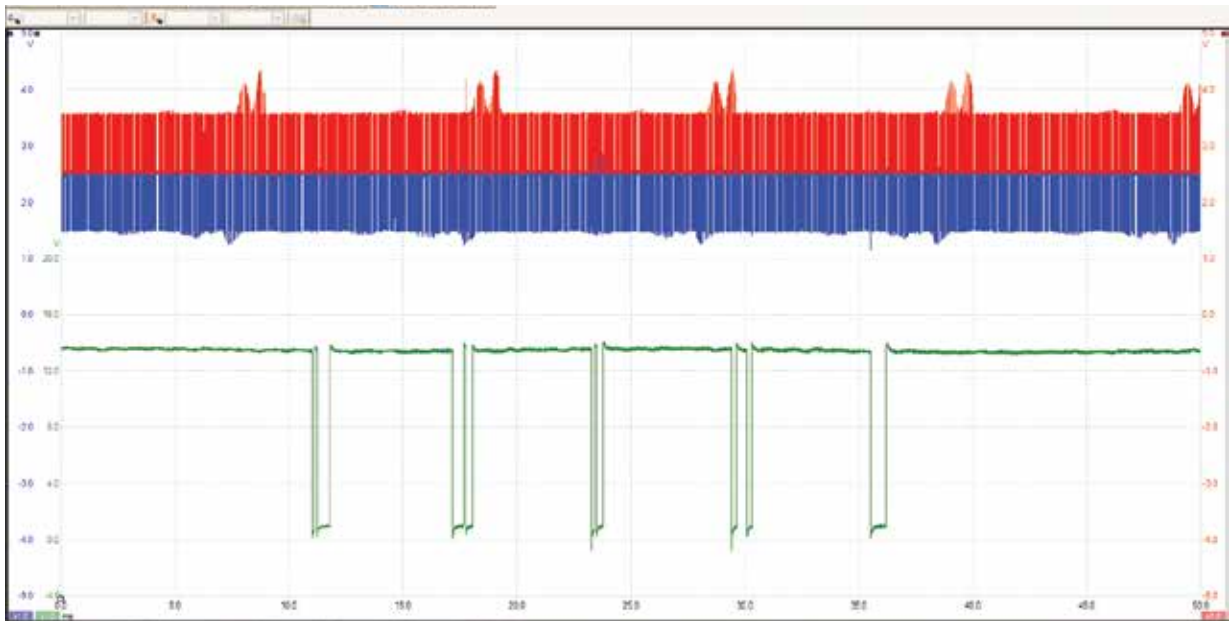
### Opening up the lines

This means if a control unit were to fail it, would probably not interfere with other control units communicating on the CAN. Diagnosing a problem of no communication sounds like a daunting task for an auto technician, but it is simpler than you might think. If you have a VAG 5052, you can scan all of the control units using the auto scan feature. Each control that cannot find information will flag a DTC indicating that information from a specific control unit is not received. If several control units do not receive information from one specific control unit, you need to find that control

unit and verify the failure with electrical testing. The first step is to verify the control unit is getting the power supply it needs. This is often through a fuse, so look at the wiring diagram to find out which fuses you need to check. Since control units are on the expensive side, you’ll want to verify at the control unit that the power supply and the grounds are present.

For this, you need access to the control unit and the pin locations of the voltage supplies, grounds, and the computer data lines. Most of the time, you can start by scoping the data line wires at the OBD II connectors. Look at the wiring diagram for the OBD II connector on the 2006 Touareg we are using as our example and you’ll see that pin #2 goes to the ABS traction control unit, probably for programming. The scan tool sends communication requests through pin #7 to the instrument cluster module, which is the gateway. This module acts as the go-between of the vehicle and the scan tool connection. It has one request wire and two CAN communication wires that go off to the diagnostic connector. These wires will have no communication signals unless a request is made from the scan tool through pin #7 (the request wire). Then, the module connects the two wires going to the OBD II connector to another two wires that connect to the CAN system on the vehicle.

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If you prompt your scan tool to communicate with the vehicle, then you will start to see square waves. Pin #7 is the request line from the scan tool to the various control units in the car, and is the lower trace. The instrument cluster will open up pins #6 and #14 to the OBD II connector and allow the CAN information to go to your scan tool -- the upper traces.

### How it actually works

Another way of looking at it is the instrument cluster is all the OBD II really connects to. Pin #7 of the OBD II connector carries the scan tool request, and pins #6 and #14 carry the CAN signals from the cluster to the scan tool. The instrument cluster is always connected and communicating with the car from a different pair of CAN wires on the cluster. Those are always communicating when the key is inserted into the ignition switch. If you were to scope pins #7, #6, and #14, you would see only straight voltage on each wire. Pin #7 would have battery voltage, and pins #6 and #14 would have 2.5V. As you request communication with your scan tool, you would see an intermittent wave form pattern on pin #7 from battery voltage to almost ground with your scan tool set to about 5ms time divisions. This is the scan tool request to the instrument cluster to start communicating.

The module would respond by opening up the lines of communication on pins #6 and #14 and you would see a very fast square wave on each. To see a clear pattern, you will have to set the scope to 50  $\mu$ s. This is not necessary to determine if the communication lines are open. For the CAN high signal, you will see the voltage square wave signal bounce up between 2.5 and 3.5V. The CAN low signal will also oscillate between 3.5

and 4.5V, and the two patterns will mirror each other. This same signal will come out of two different pins on the instrument cluster and communicate with the CAN system. For the entertainment systems, there is an additional CAN from the cluster to components such as the wiper module, radio, amplifier, telephone, etc. This is a separate CAN that is mainly for multimedia and entertainment components.

### Basics

If the CAN system wires do not have a square wave, then you either have a problem gateway, which is our case in the instrument cluster, or the CAN wires are physically shorted to power or ground. You will have to find the source of the problem by testing and inspecting the CAN wires directly. Knowing how the scan tool communicates with the car and what to do when it doesn't will help speed up your diagnosis. By the car giving you the information you need, you will also have a more accurate assessment of the problem and repair. Once you have determined that there is scan tool communication, you can start looking at the problem computer. This knowledge and a relationship with your Volkswagen parts department will allow you to make more complete and accurate repairs, and who wouldn't want that? ●





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# Supply & Demand

**When customers experience drivability problems, it is our job to isolate the cause. With systems changing all the time, we must keep pace. Even something as simple as fuel supply has had updates and changes that we need to be aware of.**





The first successful electronic fuel injection system on a production car was introduced by Volkswagen on the Type 3 back in 1968 -- that's 46 years ago! Called D-Jetronic (the "D" stands for "Druck," German for "vacuum"), it was not very sophisticated by today's standards, but it ushered in many basics that are still used in modern vehicles. For example, its fuel supply system was based on an electric pump, not a camshaft-driven mechanical diaphragm pump as was used on carbureted engines.

Electric fuel pumps don't have it easy. They run continuously at a wide range of temperatures, and have to tolerate both any particles that get past the pickup screen and the ethanol found in much of today's gasoline. But the evaporative emissions system (EVAP) self-testing of OBD II regulations adds another difficulty: the temperature of the fuel can affect whether or not the monitor passes or fails. This has resulted in the necessity of Volkswagen updating its fuel supply system designs to keep pace.

### New complications

On older EFI systems, the gasoline was pumped from the tank to the injector rail, and the pressure regulator would bleed off the excess fuel and return it to the tank. As a result of this looped flow, the fuel was warmed as it passed through the lines that ran along the hot engine, thus raising the temperature in the tank. This increased the vapor pressure, making it more difficult for OBD II to calculate whether or not the system is leaking.

Another factor that forced fuel supply system design changes was the adoption of "saddle" type gas-tanks to accommodate a driveshaft, in Volkswagen's case on 4-Wheel Drive/All-Wheel Drive SUVs and cars. This introduced the complication of transferring gasoline from one side of the tank to the other.

There are various ways engineers can address these design challenges. On later-model Volkswagen vehicles such as the Touareg, they chose to place the transfer pump on the passenger's side of the fuel tank, and the main system pump on the driver's side. Experienced technicians may remember the old CIS (Continuous Injection System -- also called Bosch K-Jetronic), which sometimes included a transfer pump depending on the model, but its function was different. On those older vehicles, the transfer pump was mounted inside the tank, and the main pump that supplied the injectors was mounted on the outside. They were different pumps with

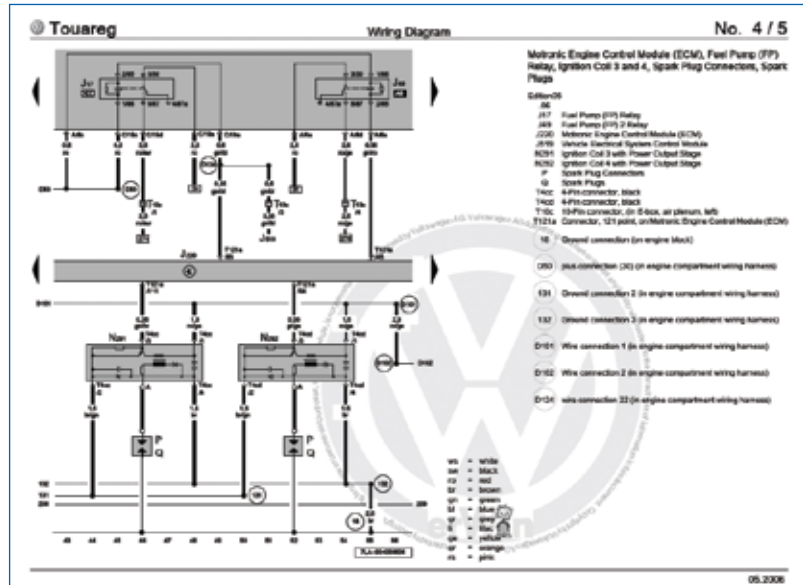
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different jobs. The in-tank pump was a low-pressure, high-volume design, while the external pump generated sufficient pressure to keep the injectors spraying. The in-tank pump was only there to make sure the main pump got an uninterrupted supply of gasoline, thus preventing the cavitation that would result in driveability problems.

### Main Pump & Transfer Pump

With modern Volkswagens, such as the Touareg already mentioned, the fuel the transfer pump supplies from the passenger's side of the tank is routed through the main system pump on the driver's side, and continues on to the engine through the same fuel lines. This is a returnless system -- pressure regulation happens in the pump module. The driver's side main fuel pump supplies the fuel injection rail. Both pumps can put out sufficient pressure and volume to run the engine, which can make diagnostics a bit tricky. If either pump stops working properly, the driver may not notice. When the engine is first started the PCM (Powertrain Control Module) activates both fuel pump relays, so both pumps begin generating pressure. These relays are mounted in the electrical power distribution center in the engine compartment on the driver's side along with the fuel system fuses.

The auxiliary fuel pump is energized for about 30 seconds after start-up, then it is shut off and the engine should continue to run on the main pump. If the main pump fails to operate for some reason, the engine can still start on the pressure supplied by the auxiliary pump, but will stall after 30 seconds or so when the PCM de-energizes that pump.

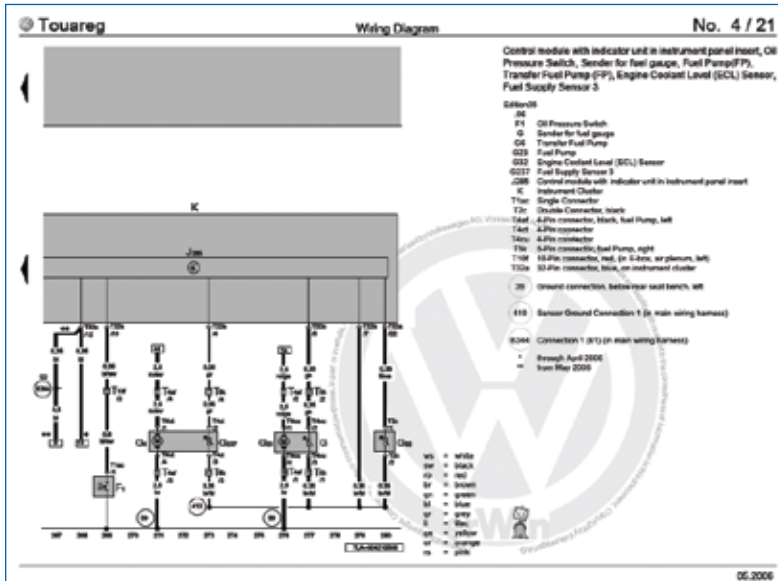


Using [erwin.vw.com](http://erwin.vw.com), you can look up wiring diagrams and component locations. Here are the two fuel pump relays mounted in the electronics box. The main fuel pump relay is component J17, and the transfer pump relay is component J49, also known as Relay 2. Two separate relays control two different fuel pumps.



Using an ammeter, you can read the current draw of the main pump at the fuse. This one shows about 10A with a cold engine. The 15A fuse below the meter is for the transfer pump, which should draw about 9A while the engine is running.

## Supply & Demand



Looking at the wiring diagram from [erwin.vw.com](http://erwin.vw.com), the two separate pumps can be seen. The main pump (G23) and the transfer pump (G6) both have sending units built into them. These individual sending units tell the instrument cluster how much fuel is in each side of the tank.



You can test the fuel pump relays at the driver's side electronics box. Here, relay testers are plugged in. The relay at the upper right is for the main pump, and the relay in the lower left is for the transfer pump relay on this 2006 Touareg.

Under "Activations" on your VAG 5052, you can activate the fuel pump relays. You can connect a fuel pressure gauge to the injector rail during the activation to find out how many psi are being generated. Activate each pump's relay individually to verify that both can provide sufficient pressure to run the engine.

## Testing

If you do not have a VAG 5052 or equivalent, you can go directly to the fuel pump relays and fuses and test the pumps electrically. As mentioned earlier, both the relays and fuses are located in the electronics box on the driver's side of the engine compartment by the firewall. On our 2006 Touareg example, the relay for the main pump is at position A6 in the box, and its fuse is at position S13. Of course, the fuse supplies power to the relay, and the relay provides power to the pump. You can get vehicle-specific wiring diagrams for the vehicle you are working on at [erwin.vw.com](http://erwin.vw.com) with a paid subscription.

The relay for the transfer pump is mounted in the driver's side electrical box in position C19 and is referred to in the diagrams as Fuel Pump Relay 2. The relay receives power from the fuse mounted in position S14. With the proper test equipment, you can check the amp draw of each fuel pump without pulling them out of the fuel tank. You can use an in-line amperage tester to monitor the amp draw from the fuses. The main system pump draws about 10A if it is working normally. The transfer pump, when it is activated, will draw about 9A if it is healthy. If the vehicle does not start, you can substitute a jumper instead of either relay and activate the pumps individually. If the engine starts with the jumper in place, the relay is at fault.

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### Servicing

With the Touareg, in the event that you do find a worn-out or otherwise inoperative main or transfer fuel pump, either can be easily serviced. Volkswagen has provided an inspection plate under the rear seat for each pump. Remove the lower portion of the rear seat to expose them.

In the case of the Touareg, you will also have to remove the mounts for the back portion of the rear seat. These mounting bolts are of the triple-square type, so be sure you have the right socket to remove them. The specific steps for replacing either fuel pump on the Touareg (as well as those for all Volkswagen vehicles) can also be found at [erwin.vw.com](http://erwin.vw.com).

**A Safety Note:** Before you start any fuel supply system service including fuel pump replacement, remove the fuses and relieve any residual pressure in the system at the tap on the injector rail through your fuel pressure gauge.

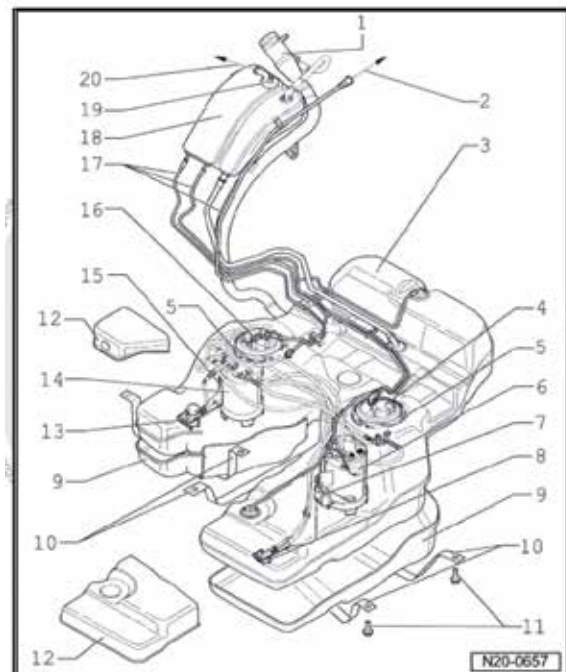
To ensure a proper and long-lasting repair, use only fuel pumps provided by your local Volkswagen dealer's parts department. Aftermarket pump manufacturers often cannot make the distinction between the transfer pump and the main pump, and on models with a saddle-type gas tank with two pumps you do not want to create a problem for yourself during installation. Also, aftermarket pumps can be noisy, and you don't want the customer coming back with a new complaint.

Consider your Volkswagen parts supplier a partner in your repair business providing you with the correct parts that were engineered to work specifically on the vehicle you are working on. This gives both you and your customer the peace of mind of knowing you've installed the right part. Who wouldn't want that kind of confidence? ●

Right: With a paid subscription to [erwin.vw.com](http://erwin.vw.com), you can access component location in the wiring diagrams. Here, you can see that the main fuel pump (component #6) is mounted in the fuel tank on the driver's side, and the transfer pump (component #14) is mounted in the passenger's side.



Always discharge residual pressure before opening any portion of the fuel supply system.



Fuel Tank and Attachments Assembly Overview - Engine code AXQ, BAA, BMX, BKW and BWF

6 - Fuel Level Sensor -G- integrated with Fuel Pump (FP) -G23-

For engine Codes BAR and BHK location, refer to => Item 14 (page 66)

14 - Fuel Level Sensors 3 -G237- integrated with Transfer Fuel Pump (FP) -G6-

Right side

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**Convert with Confidence**



# VW Fluids Raise the Performance Bar, Part 1: Motor Oil





**The trend in automotive fluids is to be application-specific. You can no longer select motor oil simply by viscosity, assume that any oil in the same multi-grade viscosity range offers adequate protection for a given engine, or select a lubricant without knowing in advance that it matches the engine technologies of the vehicle. Here we highlight critical information about motor oil to help you make your choice for a given Volkswagen application.**

Volkswagen stays at the leading edge of technology. Its vehicles have long been at the forefront of replacing iron and steel with lighter plastic, aluminum, and composite materials. The company has pioneered computerized controls that operate components at or near maximum load, temperature, and pressure. It has put a lot more science into each of the fluids used to keep today's Volkswagen systems operating within specification, yet close to their performance limits.

In this direct-injected, turbocharged, variable valve timing world, the lubricants and fluids that allow vehicle components to slip, grip, or stay cool have evolved to perform under new, more demanding engine operating conditions.

### **Application-specific Motor Oil**

Beginning in the mid-1990s, VW established its own motor oil specifications. They were more demanding than most U.S. standards, and added extra protections that went beyond even the ACEA (European Car Manufacturer Association) specs, which already were higher than American requirements.

The VW motor oil specifications were application-specific, and evolved as the company's engine technologies changed over time. They resulted in very different lubricant formulations for its turbo

direct injected (TDI) diesel than for an electronically fuel injected (EFI) gasoline engine, for extended drain versus regular oil change intervals, and for vehicles with or without various exhaust after-treatment devices. To have confidence when performing a VW oil change, make sure you look up the correct lubricant specification for the vehicle in your bay.

### **By the Numbers**

Here we offer a cheat sheet to help you understand when and why to use a given VW motor oil specification:

#### **VW 500.00/501.01 – Lighter Oils, Tougher Sludge Protection**

The VW 500.00 specification was designed for 1999 and older gasoline engines and some naturally-aspirated diesels. It was part of a shift to lighter weight multigrade oils that supported not only fuel economy, but also improved sludge protection and, to a lesser degree, oxidation and wear resistance.

#### **The 501.01 specification also applies to 1999 and older vehicles, and is very similar to VW 500.00.**

VW 502.00/505.00 – Severe Duty, Higher HTHS Viscosity Minimum

Throughout the 1990s, VW introduced new models as engineers found ways to beef up engine output and enhance durability. A new VW 502.00 specification was developed for gasoline engines that often are

[Opposite Page: Castrol was one of the first brands to earn Volkswagen certification in several motor oil categories.](#)

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Volkswagen developed a premium filter for use in its vehicles that feature a 10,000-mile extended oil change interval. The high-efficiency material traps particles of smaller micron size than traditional motor oil filters, extending the amount of time the filter protects against wear.

used in severe service -- a set of driving conditions characterized by frequent cold starts, short distance city round trips, heavy-load or racing, and cooler climates. The 502.00 specification established tougher oxidative thickening and piston deposit limits.

A 502.00-approved 5W-30 must maintain HTHS viscosity at 3.5 cSt and “stay in grade” for 30 flow cycles. The 502.00 specification also embraced lighter multi-grade oils, including 5W-30 and 0W-30, to help increase fuel economy.

The 502.00 specification is for use only in gasoline engines that have fixed oil change intervals. There are 505.00 and higher specifications for diesel, and 503.00 and higher numbers for vehicles with variable service intervals.

VW 502.00-certified oils must not be used in any vehicles with variable service intervals. These vehicles include an oil monitoring system that alerts the

operator if oil degradation exceeds limits before the extended drain interval is reached.

Software in the oil monitoring system is keyed to the performance properties of the specified oil. The VW software knows how long the correct oil should last under a given range of driving conditions.

502.00-certified oil is formulated for a regular oil change interval, not the longer extended drain that is typical of vehicles with variable service intervals. If the vehicle contains 502.00-certified oil, the monitoring system may give an inappropriate oil change recommendation.

*NOTE: Vehicles with variable oil change intervals must have the oil monitor reset after every oil change in order for the system to function properly.*

VW 502.00 supersedes both 500.00 and 501.01.

## Motor Oil



This used diesel fuel injector was removed from a Volkswagen TDI Pumpe Düse (PD) fuel delivery system. PD features a camshaft-activated pump built into the injector. Cam activation provides extremely high pressures (in excess of 2,000 bar or 29,000 psi). The higher pressures give better fuel atomization and more efficient combustion, resulting in higher performance, better fuel economy, and reduced emissions.

VW 505.00 is the diesel variation on 502.00. It is now used only on pre-2000 model year diesels with no unit injection system (and with or without turbochargers). For diesels from 2000 and up, 505.00 has been superseded by VW 505.01 and higher specifications.

### VW 505.01—Turbocharged, Direct-injected Diesel

When VW first applied its venerable electronic fuel injection (EFI) system to diesel, it hit all of its targets. The new diesel electronic control system, called Turbo Direct Injection (TDI), improved power output and cold start efficiency. Real-time sensors monitored engine conditions to inform the ME (Motor Electronics), thus allowing it to make accurate decisions, and to alert the operator immediately if emissions performance was deteriorating.

In 2003, Volkswagen introduced Pumpe-Düse (PD) technology, which combined fuel pump and fuel injection capabilities into one unit for each cylinder. The camshaft activates the fuel injector pump through a roller rocker arm.

The high stress on the lifters and their cams created a need for oil that offered greater protection against valve train wear.

To prevent oxidation and oil coking, and to avoid damaging the injector pump in these PD engines, Volkswagen created its VW 505.01 lubricant standard.

The VW 505.01 specification requires an oil to offer better protection against soot thickening, wear, piston deposit formation, and oxidation. Oil must conform to VW 505.01 in order to help prevent the formation of harmful sludge and deposits, according to Volkswagen technical bulletin #C 17-05-01. Use of non 505.01-certified oil in a PD engine can lead to excess valve train wear due to inadequate lubricant protection of lifters and the corresponding cam lobes in the TDI engine.

The VW 505.01 standard applies only to vehicles with a standard oil drain interval. It replaces the older VW 505.00 specification that applied to pre-2003 passenger car diesel engines without PD injector technology.

## Volkswagen TechConnect Feature Article



Volkswagen's diesel particulate filter (DPF) works with continuously regenerating trap (CRT) technology that helps burn off a higher percentage of particulates before they can reach and harm the substrates in the catalytic converter. Less soot or ash reaches the tail pipe, where it would otherwise be discharged as air pollution. Also thanks to CRT technology, the Volkswagen DPF functions far longer without becoming plugged.

### VW 503.00/506.00 – Long-life Service, Fuel Economy

Thanks to its tightly-controlled molecular structure, synthetic oil is able to provide excellent thermal stability, wide temperature range, and superior wear resistance while requiring fewer viscosity improvement and antioxidant additives. This superior heat and oxidation resistance of synthetic oils allowed Volkswagen to introduce longer drain intervals while also using thinner, more fuel-efficient oil formulations.

The VW 503.00 (gasoline) and 506.00 (diesel) specifications established requirements for oil to protect an engine for up to 30,000 kilometers (18,641 miles). VW 506.00 is not for use on diesel vehicles with a single fuel injection pump.

### VW 503.01/506.01 – High Shear Protection

The Volkswagen 503.00 and 506.00 specifications were fine in Europe, but suffered a bit in the U.S., where oil standards at the time emphasized fuel economy more than wear protection. Some U.S. oils could meet VW 503.00/506.00 without matching the 3.5 cSt high shear protection that was common in European oils.

Volkswagen promptly introduced 503.01/506.01, which added an explicit requirement that VW long-life oil provide 3.5 cSt high shear protection. The new specification strengthened antioxidant and piston deposit protection requirements in VW oil for gas and diesel engines used in high-stress driving conditions. VW 503.01/506.01 are now superseded by VW 504.00/507.00.

### VW 504.00/507.00 – Protecting Emissions Reduction Components

With the introduction of three-way catalysts, diesel particulate filters (DPF), and other emissions control technologies, engine oil formulators faced a new challenge. The things that reduce NO<sub>x</sub> in a diesel engine lead to increased soot load on the oil.

For example, exhaust gas recirculation (EGR) redirects unburned hydrocarbons away from the exhaust system upstream of the catalytic converter and back to the combustion chamber for a second chance to be burned. While this reduces emissions, it also creates a higher amount

## Motor Oil



You don't have to look far to see if a brand of oil that says it is "recommended", or "meets/exceeds" OE requirements is the correct oil for the Volkswagen vehicle in your bay. Any oil that has received Volkswagen certification will list on the back label the specifications it meets.

of combustion byproducts – soot – that must be contained by the lubricant.

To prevent soot from harming the catalyst in three-way converters, or reaching and plugging the diesel particulate filter, VW established its 504.00 / 507.00 oil standards.

Oils that meet VW 504.00/507.00 must have low sulphur, ash, and phosphorus (SAP) technology to prevent damage to after-treatment devices. They must also include high detergent and dispersant capabilities to encapsulate and hold contaminants in suspension until the next oil change.

VW 504.00 offers high temperature and high speed durability for turbocharged gasoline engines, and for pre-2000 model year diesels.

VW 507.00 can be used in almost all Volkswagen diesel engines from 2000 onwards, including turbocharged PD engines with unit injector pumps and extended service intervals (up to 30,000 km/18,641 miles, or 24 months). VW 507.00 is not to be used in vehicles that do not contain a diesel particulate filter (DPF). These vehicles must use VW 506.01 specified oil.

## Forget almost everything you just read

It helps to understand why an original equipment (OE) manufacturer requires motor oil to match a given application, but you don't have to memorize the details of the different specifications. And you don't have time to study the peculiarities of every lubricant rating system.

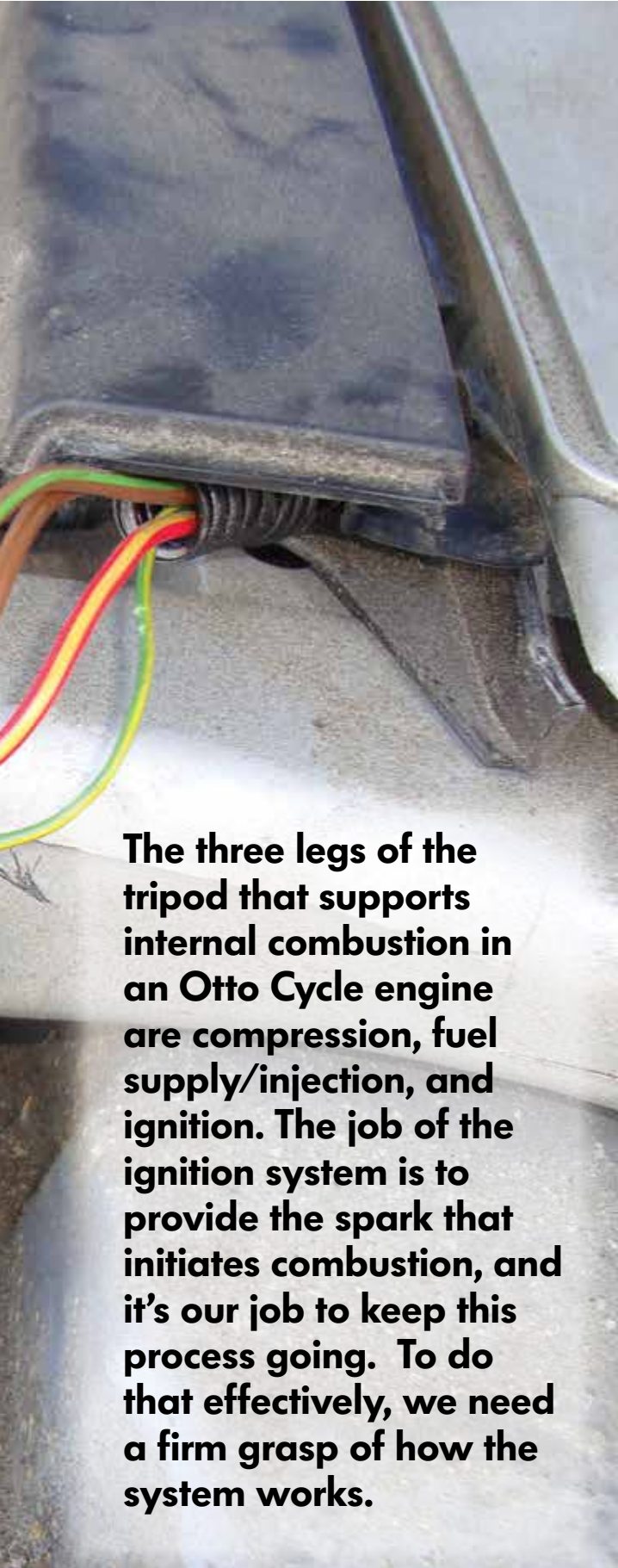
You do need to read the back of the motor oil label. Watch out for language that says a brand is recommended for use in all VW engines of a certain model, engine size, or year range. If it meets the Volkswagen certification, it will list the specification for which it is approved on the label.

OE lubricant specifications are a code, a type of shorthand to let you know which motor oil meets the exact requirements of the vehicle you are servicing. Match the specification to the vehicle. That's all you need to remember. ●

# We Have Ignition! Or, Do We?



## We Have Ignition! Or, Do We?



**The three legs of the tripod that supports internal combustion in an Otto Cycle engine are compression, fuel supply/injection, and ignition. The job of the ignition system is to provide the spark that initiates combustion, and it's our job to keep this process going. To do that effectively, we need a firm grasp of how the system works.**

Many of us hold a basic misconception about the gasoline-burning internal combustion engine: We think that the ignition spark is the instigator that ignites the mixture. Period. While this is true, it is not always true. As we've learned from the engine Rudolph Diesel designed, if we compress an air/fuel mixture enough, the charge will ignite on its own – ergo, the diesel engine. Diesels do need some help to get started in cold conditions, such as glow plugs that heat the combustion chamber before and during cranking, and block heaters that keep the engine relatively warm, but once started it generates its own heat and combustion pressure keeps the process going.

### Almost, but not quite

The Otto cycle internal combustion engine also compresses the air/fuel mixture to a point where it is about to ignite, but not compressed so much it ignites on its own. If it does ignite on its own, we have something called pre-ignition.

The Otto cycle internal combustion engine operates by compressing the air/fuel mixture to the point where it is about to ignite, and then a spark is created at a precisely-timed moment to start the ignition process. This process typically begins a few degrees before the piston has reached top dead center (TDC), which is known as ignition advance.

Advance is why an Otto cycle engine typically makes more horsepower than its diesel counterpart with similar displacement. A diesel brings the air/fuel mixture to compression ratios of 16 to 1 or higher, but ignition only happens at peak compression with the piston at TDC. The piston is now beginning to travel downward as the combustion process starts and the expanding gases force it down. This allows diesels to make exceptional amounts of torque, but relatively low horsepower.

### Suspensions

But what if you don't have ignition in a gasoline engine? Could the problem be coil-related? Ignition system diagnosis is in order, assuming you have made sure spark plug and coil wiring is properly connected – the system must have primary circuit current to produce the magnetic field that, when it collapses, induces the high voltage needed to fire the spark plugs.

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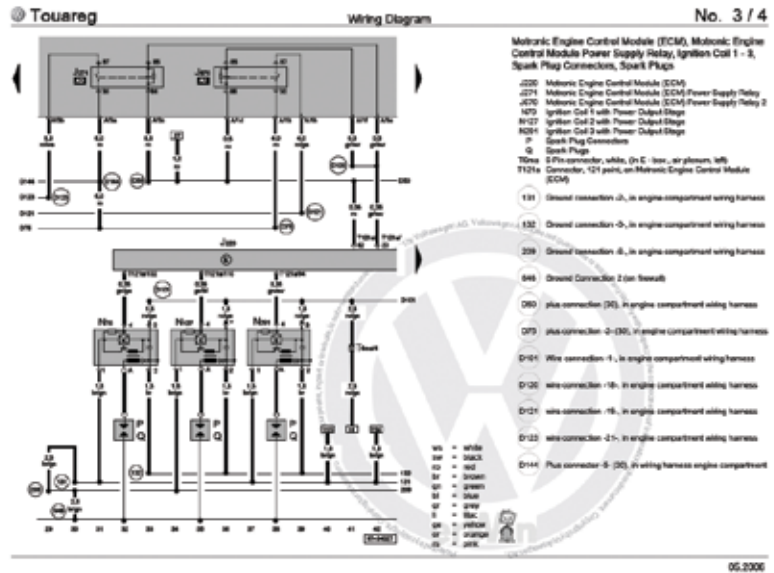
The gasoline-burning Otto cycle engine begins the ignition process with the spark across the plug electrodes. At low rpm, this begins a few degrees before the piston has reached TDC. This is due to a short lag called flame front travel. When the spark occurs, the entire combustion chamber is not immediately filled with burning gases -- it takes milliseconds of time for the fire to spread all the way to the cylinder walls, and by that time the piston is starting to move downward.

If the mixture ignites too early (as we said, pre-ignition) the gases will push down on the piston before it has reached TDC, slow it down and reducing horsepower. If the mixture is ignited too late, the piston will have passed TDC and the combustion gases will push down on a piston that is already traveling downward, and complete combustion may not take place, also reducing horsepower. The spark has to happen at just the right time for efficiency.

### Ahead of time

As engine rpm increases, there is less time to burn the mixture, and the timing must be advanced to start the ignition process earlier. In old-fashioned ignition systems, centrifugal weights and springs, and vacuum units were used to advance the spark as engine speed increased. A modern Powertrain Control Module (PCM) uses crankshaft and camshaft position sensors to detect where the piston is in its cycle, and takes other inputs into consideration while deciding when to start the ignition process.

This gives modern engine management systems complete control of when the spark occurs, and the PCM can immediately react to changes such as engine knock, load, and temperature. When a knock sensor tells the engine management system that detonation is occurring, which is damaging to the engine, the PCM retards the timing until the knocking stops. Other factors such as engine load signaled by the manifold absolute pressure (MAP) and mass air-flow (MAF) sensors, engine coolant temperature, and



One of the first steps in an ignition system diagnosis is to use [erwin.vw.com](http://erwin.vw.com) to access the information you need. A wiring diagram can tell you which wires are the power, trigger, and ground so you can check the voltage signals.

charge air temperature affect how the PCM regulates ignition timing.

While the voltage that rises quickly at the spark plug electrodes is obviously important in forming the spark, another key to efficient ignition is the amperage present, the actual energy of the spark. There's nothing a technician can do, however, to alter what the electronics make available to produce what's called the flame kernel.

### Triggering

The basic test of an old-fashioned ignition coil was simply to measure the resistance of the primary and secondary windings. But no more. Systems today are far more sophisticated and promote far greater engine efficiency -- and require more sophisticated testing.

Volkswagen electronic control units regulate the ignition coil ground in one of several ways. The PCM can ground the coil directly with an internal driver, or it can send a trigger signal to a transistor built into the coil. When engine management systems first began controlling the ignition system, they would often send these trigger signals to separate ignition modules that handled the heavy-lifting of grounding the coils,



## We Have Ignition! Or, Do We?



Using a low-current probe and a scope lead, you can monitor the amperage draw and trigger signal for each coil you are testing. Here, we've used the wiring diagram to identify the power supply wire and the coil trigger. We put the current probe around the power supply and back-probed the coil trigger with the scope lead.

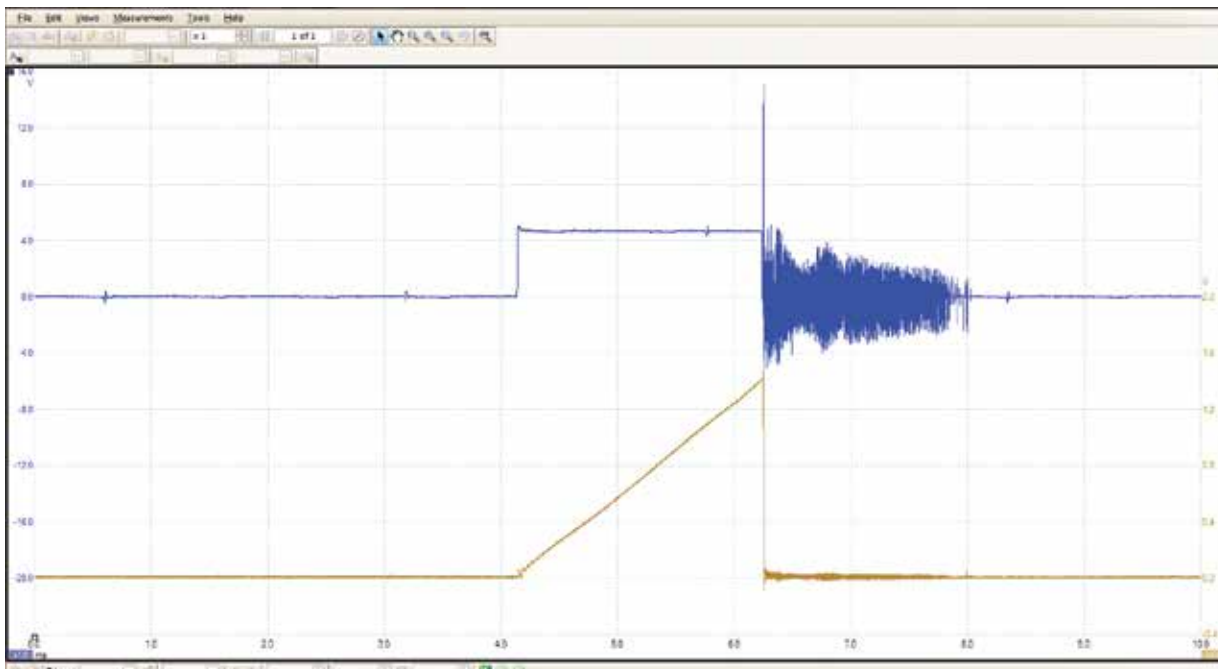
thus generating the spark. Most of today's ignition systems, however, use a coil over plug (COP) design, which means there is coil for each spark plug, and an ignition module for each coil, at the spark plug, each controlled independently. This allows the engine management computer to regulate ignition timing for each cylinder individually, and can help reduce misfires that are isolated to a single cylinder. This makes diagnosis a little more difficult since we now must test a separate ignition system for each cylinder.

With the ignition module built into the coil assembly at each plug, we can no longer check the resistance of the primary windings, but we can still check the

resistance of the secondary windings. However, there are other ways to check an ignition system rather than a resistance test of the two ignition coil windings. We can monitor the voltage of the primary and secondary windings by induction -- by measuring the voltage on the coil power supply wire we can see its fluctuations as it passes through the primary windings.

With the proper adapters, we can also monitor the voltage pattern on a lab scope by resting an inductive probe on the coil. We can also use an inductive low-amp probe to monitor the amperage draw of each coil, and we can compare the pattern of a good coil with that of a malfunctioning one.

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On the scope we can see that the upper trace is the coil trigger. The lower pattern is the amperage draw. Compare the coil patterns to one another and see if any are different. This is a sure sign the coil is starting to fail.

### COP

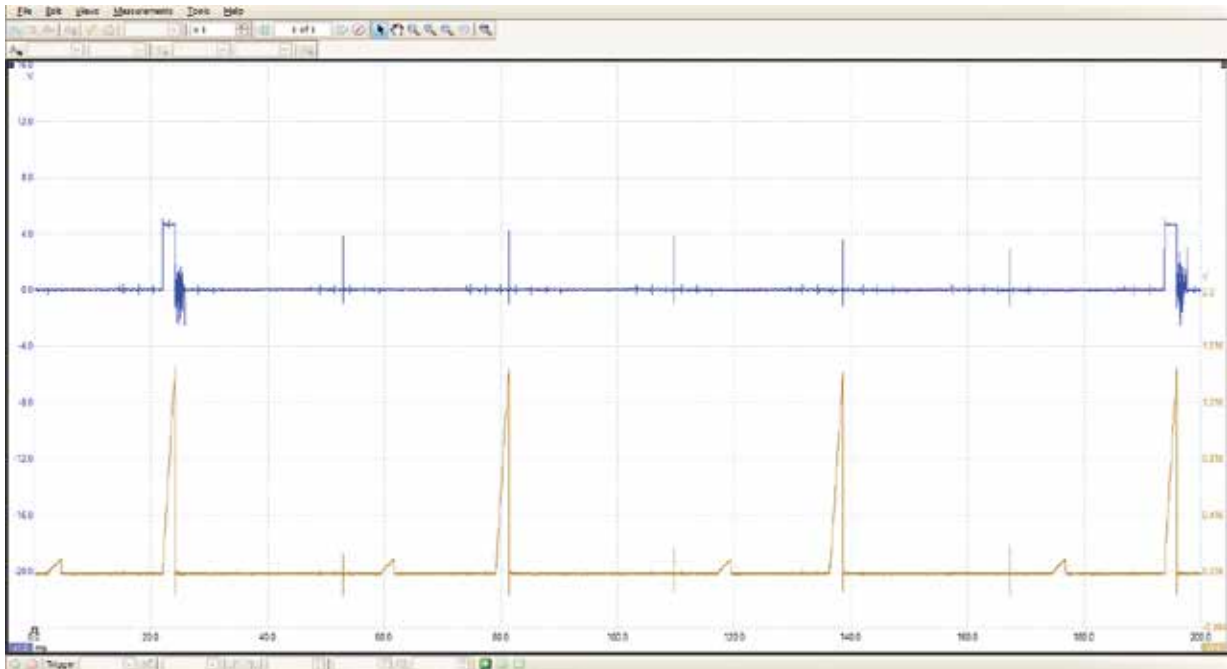
We'll use a 2006 Volkswagen Touareg ignition coil as our example of a modern unit with the power transistor incorporated into it. It is a four-wire coil. Pin #1 is the ground for the power transistor inside the coil and grounds on the firewall of the vehicle. Pin #2 is the ground for the secondary winding of the coil.

To compare it to something you may be more familiar with, picture a waste-spark coil winding. That is, one coil with two towers, and the spark is pulled from one spark plug through the coil winding to the second spark plug connected to the same coil. If you ground one of the coils, the other coil will still fire when



By moving the amp probe to the fuse that supplies the coils, you can watch the amp draw of the three coils. Here we are on fuse S7 supplying cylinders #1 through #3. We've installed a loop for the low-current probe.

## We Have Ignition! Or, Do We?



Looking at the scope pattern, we see the upper trace is still showing the trigger signal of the #1 cylinder, but the low-current probe is showing the amp draw of the other two coils as well. Follow the firing order to identify the cylinder showing the problem current draw pattern. Notice the bumps between the coil patterns. Since the fuse also powers the injectors, you are seeing the current draw pattern of the injectors as well.

the coil is energized. That is the way this Volkswagen coil is wound. One side of the coil goes to ground, and the other side goes to the spark plug. However, you cannot use measurement of secondary winding resistance as a viable test.

This coil grounds to the actual engine block. If you fail to have spark after engine work, check these grounds.

The third wire, Pin #3, is the power supply for the coil. It comes from fuse S7 for cylinders #1 through #3, and S8 for cylinders #4 through #6 on the 2006 Touareg with the six cylinder engine. This fuse also powers the fuel injectors. You can use it to monitor the amperage draw of each coil while the car is running, and you will see the amp draw of each injector as well.

The final wire on the coil, Pin #4, is the trigger wire from the Motronic electronic control unit. The computer uses cam, crank, and load sensors to determine engine rpm and load, and then triggers the coil with the proper ignition advance to produce the most power with the best fuel economy. Knock sensors can pick up knock, isolate it to a cylinder, and retard the timing on that cylinder only.

### Testing coils

You can monitor the knock retard in one of the value data blocks using your VAG 5052, and with a dual-trace oscilloscope also see if you have a problem coil (a misfire?) by looking at the amp draw pattern for each coil. Use the second pattern to form a trigger so you know which cylinder is firing at the time, and you can follow the firing order from there. You can also scope the amp draw from fuse S7 or S8 to watch the amperage patterns for cylinders #1 through #3, and cylinders #4 through #6.

You will still see one trigger of the coil you select, and also see two additional amperage patterns for the other two cylinders. Keep in mind the injectors are being fired on this circuit as well. Compare the amperage patterns to see if any do not match, and chances are those are problem coils.

Knowing how a system should work before testing leads to a more accurate diagnosis that you can stand behind. Using Volkswagen parts will give you (and your customers) confidence that the repair is going to last, and we call that a win-win situation. ●

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Pete Moore Imports  
(850) 457-1000

**Pompano Beach**  
Vista Motor Company  
(954) 942-3517

**Port Charlotte**  
Port Charlotte Volkswagen  
(941) 743-8883

## **Saint Augustine**

VW of Saint Augustine  
(904) 495-7070

## **Sanford**

Napleton's VW of Sanford  
(407) 365-3300

## **Sarasota**

Suncoast Volkswagen  
(941) 923-1700

## **Springfield**

Volkswagen of Panama City  
(850) 763-2388

## **St. Petersburg**

Bert Smith International  
(727) 527-1111

## **Stuart**

Wallace Volkswagen  
(772) 219-0007

## **Tallahassee**

Capital Volkswagen  
(850) 574-3777

## **Tampa**

Brandon Volkswagen  
(813) 630-4000

Kuhn Volkswagen  
(800) 678-3275

Reeves Import Motorcars, Inc.  
(813) 933-2817

## **West Palm Beach**

Schumacher Volkswagen  
(561) 615-3319

## **Georgia**

### **Alpharetta**

Nalley VW of Alpharetta  
(678) 795-3472

### **Atlanta**

Jim Ellis VW of Chamblee  
(770) 458-6811

### **Bogart**

Volkswagen of Athens  
(706) 549-6600

### **Buford**

Gunther VW Mall of Georgia  
(678) 745-9950

### **Columbus**

Carl Gregory Volkswagen  
(706) 243-3979

### **Dalton**

Al Johnson Volkswagen, Inc.  
(706) 278-9200

### **Kennesaw**

Jim Ellis VW of Kennesaw  
(770) 370-4900

### **Lithia Springs**

Heritage Volkswagen  
(770) 745-1470

### **Macon**

Butler Volkswagen, Inc.  
(478) 781-7701

### **Marietta**

Jim Ellis VW of Marietta  
(770) 955-2580

### **Martinez**

Gerald Jones VW, Inc.  
(706) 228-6900

### **Savannah**

Vaden Volkswagen  
(912) 629-6989

### **Snellville**

Stone Mountain Volkswagen  
(770) 979-2000

### **Union City**

Heritage Volkswagen, Inc.  
(770) 774-0758

### **Valdosta**

Pipkin's Motors, Inc.  
(229) 242-9920

## **Hawaii**

### **Honolulu**

Honolulu Volkswagen  
(808) 687-6289

### **Waipahu**

Tony Volkswagen  
(808) 680-7177

## **Idaho**

### **Boise**

Boise Volkswagen  
(208) 377-4977

### **Idaho Falls**

Teton Volkswagen  
(208) 522-4501

### **Post Falls**

Parker VW of North Idaho  
(208) 773-4939

### **Twin Falls**

Twin Falls Volkswagen  
(208) 735-3900

## **Illinois**

### **Bensenville**

Larry Roesch VW of Bensenville  
(630) 279-8806

### **Chicago**

Fletcher Jones Volkswagen  
(312) 628-4997

### **The Autobarn City VW**

(773) 794-7850

### **Countryside**

The Autobarn VW of Countryside  
(708) 354-6600

### **Crystal Lake**

Volkswagen Of Crystal Lake  
(815) 455-4330

### **Dixon**

Dixon Volkswagen  
(815) 288-3366

### **Downers Grove**

Pugi Volkswagen  
(630) 598-9900

### **Evanston**

The Autobarn Ltd. - VW  
(847) 570-3081

### **Glenview**

Jennings Volkswagen, Inc.  
(847) 729-3500

### **Gurnee**

Gurnee Volkswagen  
(847) 855-1500

### **Highland Park**

Volkswagen of Highland Park  
(847) 433-7900

### **Joliet**

D Arcy Volkswagen  
(815) 741-1100

### **Libertyville**

Liberty Import Center  
(847) 680-8000

### **Marion**

Volkswagen of Marion  
(618) 551-5100

### **Mount Prospect**

The Autobarn VW of Mount Prospect  
(888) 744-3820

### **Naperville**

Bill Jacobs Volkswagen  
(800) 519-4879

### **Normal**

VW Bloomington Normal  
(800) 345-1679

### **O'Fallon**

Auffenberg Volkswagen  
(618) 622-4645

### **Oak Lawn**

Mike Haggerty VW, Inc.  
(708) 425-8989

### **Orland Park**

Volkswagen of Orland Park  
(708) 428-5000

### **Ottawa**

Sierra Volkswagen, Inc.  
(815) 433-1666

### **Peoria**

Volkswagen of Peoria  
(309) 243-1101

### **Rockford**

Lou Bachrodt Volkswagen  
(815) 332-3001

### **Schaumburg**

Fox Valley VW Schaumburg  
(224) 353-2481

### **Springfield**

Green On Dirksen, Ltd.  
(217) 523-3643

### **Urbana**

O'Brien Volkswagen  
(800) 386-6767

### **West Chicago**

Fox Valley Volkswagen  
(630) 818-4181

## **Indiana**

### **Bloomington**

Royal VW of Bloomington  
(812) 332-9251

### **Clarksville**

Sam Swope VW of Clarksville  
(812) 948-1541

### **Evansville**

D-Patrick, Inc.  
(812) 473-6500

### **Fort Wayne**

Vorderman Volkswagen  
(260) 969-6065

### **Greenwood**

Dreyer & Reinbold of Greenwood  
(317) 885-4809

## **Highland**

Highland Volkswagen  
(219) 237-2200

## **Indianapolis**

Falcone Volkswagen  
(317) 263-0002

Tom Wood Volkswagen  
(317) 688-6109

### **Lafayette**

Mike Raisor Imports  
(765) 447-0808

### **Merrillville**

Team Volkswagen  
(888) 805-3689

### **Mishawaka**

Gurley-Leep Volkswagen  
(574) 254-7130

### **Muncie**

Volkswagen of Muncie  
(765) 216-3320

## **Iowa**

### **Cedar Falls**

Dick Witham Volkswagen  
(847) 277-8123

### **Davenport**

Volkswagen of Quad Cities  
(563) 386-1511

### **Hiawatha**

Volkswagen of Cedar Rapids  
(319) 743-6050

### **Iowa City**

Carousel Motors  
(319) 354-2550

### **Johnston**

Lithia VW of Des Moines  
(515) 253-0333

### **Mason City**

Schukei Volkswagen  
(641) 423-5402

### **Sioux City**

Volkswagen of Sioux City  
(712) 255-3000

## **Kansas**

### **Lawrence**

Crown Volkswagen  
(785) 843-7700

### **Olathe**

Bud Brown Volkswagen  
(913) 393-8183

### **Topeka**

Sunflower Motors, Inc.  
(785) 266-8480

### **Wichita**

Steven Volkswagen  
(316) 681-1211

## **Kentucky**

### **Florence**

Kerry Volkswagen  
(859) 371-8191

### **Lexington**

Don Jacobs Volkswagen  
(859) 260-2621

### **Louisville**

Bachman Volkswagen  
(502) 719-7250

Neil Huffman VW, Inc.  
(502) 448-6666

## **Louisiana**

### **Baton Rouge**

Southpoint Volkswagen  
(800) 291-0032

### **Bossier City**

Moffitt Volkswagen, Inc.  
(318) 746-2175

### **Lafayette**

Southwest Volkswagen  
(337) 456-7535

### **Lake Charles**

Volkswagen of Lake Charles  
(337) 419-1818

### **Mandeville**

Northshore Volkswagen  
(985) 626-1067

### **Marrero**

Ray Brandt VW Westbank  
(504) 349-7272

### **Metairie**

Walker Volkswagen  
(504) 465-2000

## **Maine**

### **Auburn**

Rowe Volkswagen  
(207) 784-2321

### **Augusta**

O'Connor Volkswagen  
(207) 622-6336

## **Bangor**

Darling's, Inc.  
(207) 941-1330

## **Brunswick**

Morong Brunswick  
(207) 725-4323

## **Falmouth**

Morong Falmouth VW  
(207) 781-4020

## **Saco**

Prime Volkswagen  
(207) 283-2900

## **Waterville**

Thompson Volkswagen, Inc.  
(207) 873-0777

## **Maryland**

### **Annapolis**

Fitzgerald Automall  
(410) 224-3480

### **Baltimore**

Heritage VW Parkville  
(410) 661-3400

### **Baltimore**

Russel Volkswagen  
(410) 744-2300

### **Capitol Heights**

Pohanka VW of Ritchie Station  
(301) 899-7900

### **Cockeysville**

Volkswagen of Hunt Valley  
(410) 666-7777

### **Fallston**

Cook Volkswagen, LLC  
(410) 877-1500

### **Frederick**

Fitzgerald Volkswagen  
(301) 696-9200

### **Gaithersburg**

King Volkswagen  
(240) 403-2300

### **Hagerstown**

Sharrett Volkswagen  
(301) 739-9999

### **Laurel**

Ourisman VW of Laurel  
(800) 288-6985

### **Owings Mills**

Heritage Volkswagen  
(410) 581-6696

### **Pasadena**

Antwerpen Volkswagen  
(410) 553-0843

### **Rockville**

Ourisman VW of Rockville  
(301) 340-7668

### **Salisbury**

Pohanka VW of Salisbury  
(410) 548-3400

### **Silver Spring**

DARCARS Volkswagen  
(301) 622-7000

### **Waldorf**

Waldorf Volkswagen  
(301) 843-8950

## **Massachusetts**

### **Auburn**

Patrick Motors  
(800) 367-7222

### **Bedford**

Minuteman Volkswagen, Inc.  
(781) 275-8000

### **Braintree**

Quirk Volkswagen  
(781) 917-1537

### **Brockton**

Paul Clark, Inc.  
(508) 587-9040

### **Danvers**

Kelly Volkswagen  
(978) 774-2600

### **Fall River**

Mattie Imports, Inc.  
(508) 678-5555

### **Hanover**

Coastal Volkswagen  
(781) 871-4600

### **Hyannis**

Tracy Volkswagen, Inc.  
(508) 775-3049

### **Lawrence**

Commonwealth Volkswagen  
(978) 687-3001

### **Medford**

Colonial VW of Medford  
(781) 475-5

**Inver Grove Heights**  
Volkswagen of Inver Grove  
(613) 204-4607

**Mankato**  
Mankato Volkswagen  
(507) 625-5641

**Maplewood**  
Schmelz Countryside VW  
(651) 484-0424

**Rochester**  
Rochester Motors, LLC  
(507) 282-9468

**Saint Cloud**  
Eich Motor Company, Inc.  
(320) 251-1737

**Saint Louis Park**  
Luther West Side Volkswagen  
(952) 374-0700

**Mississippi**  
**D'Iberville**  
VW of South Mississippi  
(228) 864-6622

**Jackson**  
Volkswagen Jackson  
(601) 368-3691

**Missouri**  
**Ballwin**  
The Dean Team of Ballwin  
(636) 227-0100

**Columbia**  
Joe Machens VW of Columbia  
(816) 668-1818

**Gladstone**  
Northtowne Volkswagen  
(816) 436-2275

**Hazelwood**  
Bommarito VW of Hazelwood  
(314) 731-7777

**Kansas City**  
Molle Volkswagen  
(816) 941-9500

**Kirkwood**  
The Dean Team of Kirkwood  
(314) 966-0303

**Springfield**  
Volkswagen of Springfield  
(417) 886-6000

**St Louis**  
Suntrup Volkswagen  
(314) 892-7790

**St. Peters**  
Bommarito VW of St. Peters  
(636) 928-2300

**Montana**  
**Billings**  
Volkswagen Billings  
(406)655-7500

**Bozeman**  
Volkswagen of Bozeman  
(406) 586-1771

**Great Falls**  
Taylor's Automax VW of Great Falls  
(406) 727-0380

**Missoula**  
Karl Tyler's Missoula VW  
(406) 721-2438

**Whitefish**  
DePratu Volkswagen  
(406) 863-2520

**Nebraska**  
**La Vista**  
Performance Volkswagen  
(402) 502-8671

**Lincoln**  
Schworer Volkswagen  
(402) 435-3300

**Omaha**  
Stan Olsen Auto Center  
(402) 397-8200

**Nevada**  
**Henderson**  
Findlay Volkswagen  
(702) 558-6600

**Las Vegas**  
AutoNation VW Las Vegas  
(702) 942-4000

Findlay North Volkswagen  
(702) 982-4800

**Reno**  
Lithia Volkswagen of Reno  
(775) 851-5826

**New Hampshire**  
**Greenland**  
Seacoast Volkswagen, Inc.  
(603) 436-6900

**Keene**  
Noyes Volkswagen, Inc.  
(888) 355-2488

**Lebanon**  
Miller Volkswagen  
(603) 448-6363

**Manchester**  
Quirk Volkswagen  
(800) 842-9600

**Merrimack**  
Autofair VW of Nashua  
(603) 943-8700

**Rochester**  
Volkswagen of Rochester  
(603) 332-6242

**Tilton**  
AutoServ Volkswagen  
(800) 775-3141

**New Jersey**  
**Bernardsville**  
Paul Miller VW of Bernardsville  
(908) 766-1600

**Bridgewater**  
Open Road VW of Bridgewater  
(908) 685-1068

**Burlington**  
Burlington Volkswagen, Inc.  
(609) 386-0084

**Cape May Court House**  
Burke Brothers, Inc.  
(609) 463-4903

**Cherry Hill**  
Cherry Hill Volkswagen  
(856) 654-5660

**Clifton**  
Gensinger Motors, Inc.  
(973) 778-8500

**Edison**  
Reydel Volkswagen, Inc.  
(732) 287-2444

**Englewood Cliffs**  
East Coast Volkswagen  
(201) 568-0053

**Fairlawn**  
Jack Daniels Motors, Inc.  
(201) 398-1209

**Flemington**  
Flemington Volkswagen  
(908) 782-2400

**Freehold**  
Volkswagen of Freehold  
(732) 339-6910

**Hamilton Square**  
Hamilton Volkswagen  
(800) 348-8816

**Lyndhurst**  
Three County VW Corp.  
(201) 933-6566

**Monroeville**  
Volkswagen of Salem County  
(856) 358-8103

**Neptune**  
World Volkswagen  
(732) 922-1500

**Newton**  
Volkswagen of Newton  
(800) 842-0562

**Pleasantville**  
Atlantic Volkswagen  
(609) 646-8600

**Pompton Plains**  
Crestmont Volkswagen  
(973) 839-6444

**Princeton**  
Princeton Volkswagen  
(609) 921-6401

**Ramsey**  
Joe Heidt Motors, Corp.  
(201) 327-2900

**Rockaway**  
Trend Motors, Ltd.  
(866) 448-7363

**Roselle**  
Linden Volkswagen  
(908) 486-6201

**Shrewsbury**  
Shrewsbury Volkswagen  
(732) 741-8500

**Summit**  
Douglas Motors Corp.  
(800) 672-1172

**Toms River**  
World VW of Toms River  
(732) 575-1800

**Turnersville**  
Prestige Volkswagen  
(856) 629-9200

**Union**  
Union Volkswagen  
(908) 687-8000

**New Mexico**  
**Albuquerque**  
University Volkswagen, Inc.  
(505) 761-1900

**Lebanon**  
Uptown Volkswagen  
(505) 260-5057

**Las Cruces**  
Sisbarro Autoworld, Inc.  
(575) 524-3561

**Santa Fe**  
Volkswagen of Santa Fe  
(505) 471-7007

**New York**  
**Amherst**  
Northtown Volkswagen  
(716) 836-4600

**Amityville**  
Legend Volkswagen  
(631) 691-7700

**Bayside**  
Bayside Volkswagen  
(516) 482-3346

**Bowmansville**  
Schmitt's Volkswagen  
(716)683-3343

**Bronx**  
Teddy VW of the Bronx, LLC  
(718) 920-1400

**Brooklyn**  
Bay Ridge Volkswagen  
(718) 351-7000

Volkswagen of Brooklyn  
(718) 646-6700

**Cicero**  
Burdick Volkswagen  
(800) 233-2002

**East Rochester**  
VW of East Rochester  
(585) 586-2225

**Endicott**  
Gault Volkswagen  
(607) 321-6450

**Fayetteville**  
Romano VW of Fayetteville  
(315) 637-4668

**Glenmont**  
Capital Cities Imported Cars, Inc.  
(518) 463-3141

**Greenburgh**  
Lash VW of White Plains  
(914) 931-9700

**Hicksville**  
Platinum Volkswagen  
(516) 822-4800

**Huntington Station**  
Volkswagen of Huntington  
(631) 470-8100

**Ithaca**  
Maguire Volkswagen  
(607) 257-1515

**Kingston**  
Volkswagen of Kingston  
(845) 336-6600

**Latham**  
Martin Nemer VW Corp.  
(518) 785-5581

**Lynbrook**  
Sunrise Volkswagen, Inc.  
(516) 596-5970

**Middletown**  
Compass Volkswagen  
(845) 344-4440

**Mohegan Lake**  
Mohegan Lake Motors, Inc.  
(914) 528-2528

**New York**  
Open Road VW of Manhattan  
(646) 358-8100

**Nyack**  
Palisades Volkswagen  
(845) 689-3536

**Oneonta**  
Volkswagen Oneonta  
(607) 432-8100

**Orchard Park**  
Volkswagen of Orchard Park  
(716) 662-5500

**Pleasantville**  
Prestige Imports  
(914) 769-5100

**Queensbury**  
Garvey Volkswagen, Inc.  
(518) 793-3488

**Rensselaer**  
Cooley Motors Corp.  
(518) 283-2902

**Riverhead**  
Riverhead Bay Volkswagen  
(631) 727-5590

**Rochester**  
Dorschel Volkswagen  
(585) 334-9440

**Rome**  
Volkswagen of Rome, Inc.  
(315) 337-8900

**Sayville**  
Donaldson's, Inc.  
(631) 567-8100

**Schenectady**  
Fuccillo VW of Schenectady  
(518) 374-9161

**St. James**  
Smithtown Volkswagen  
(631) 924-6600

**Staten Island**  
Open Road VW of Staten Island  
(718) 513-7515

**Wappingers Falls**  
Hudson Valley Volkswagen  
(845) 298-2365

**Watertown**  
F.X. Caprara Volkswagen  
(315) 788-7400

**West Islip**  
Atlantic Volkswagen  
(631) 650-3400

**Woodside**  
Koepfel Volkswagen, Inc.  
(718) 728-5300

**Yorkville**  
Steet Ponte Volkswagen  
(315) 736-8291

**North Carolina**  
**Asheville**  
Volkswagen of Asheville  
(828) 232-4002

**Burlington**  
Flow VW of Burlington  
(336) 290-7878

**Cary**  
Leith Volkswagen  
(919) 297-1640

**Charlotte**  
Carolina Volkswagen  
(800) 489-2336

VW of South Charlotte  
(704) 552-6500

**Concord**  
Hendrick VW of Concord  
(704) 456-3300

**Durham**  
Southern States VW of Durham  
(888) 998-0075

**Fayetteville**  
Valley Volkswagen  
(910) 867-7000

**Goldboro**  
Frema Motors, Inc.  
(919) 778-1010

**Greensboro**  
Flow Motors of Greensboro  
(336) 856-9050

**Greenville**  
Joe Pecheles VW, Inc.  
(252) 756-1135

**Hickory**  
Paramount Automotive Group  
(828) 328-4012

**Huntersville**  
Ketter Volkswagen  
(704) 766-2129

**Jacksonville**  
National Volkswagen  
(910) 938-1417

**Raleigh**  
Leith Volkswagen of Raleigh  
(919) 828-0828

**Wilmington**  
Bob King Volkswagen  
(910) 392-3889

**Winston-Salem**  
Flow Motors of Winston-Salem, LLC  
(336) 761-3698

**North Dakota**  
**Bismarck**  
Volkswagen of Bismarck  
(701) 258-1944

**Fargo**  
Valley Imports, Inc.  
(701) 277-1777

**Ohio**  
**Akron**  
Dave Walter Volkswagen  
(330) 434-8989

**Amherst**  
Spitzer Volkswagen  
(440) 988-4444

**Bedford**  
Ganley VW of Bedford  
(440) 439-3444

**Boardman**  
Volkswagen of Boardman  
(330) 726-8948

**Brunswick**  
Brunswick Volkswagen  
(330) 273-3300

**Canton**  
Kempthorn Volkswagen  
(330) 580-4916

**Cincinnati**  
Beechmont Volkswagen  
(513) 347-4477

Kings Volkswagen  
(513) 677-2710

Northland Volkswagen  
(800) 521-7278

**Columbus**  
Byers Imports  
(614) 552-5410

Hatfield Volkswagen  
(614) 465-8989

**Dayton**  
Evans Volkswagen  
(937) 890-6200

White-Allen European Auto Group  
(937) 291-6000

**Dublin**  
Midwestern Auto Group  
(800) 394-2571

**Fairfield**  
Fairfield Volkswagen  
(888) 932-4734

**Hudson**  
Collection VW of Hudson  
(330) 342-7000

**Mentor**  
Classic Volkswagen  
(440) 205-6504

**North Olmsted**  
Ganley Westside Imports, Inc.  
(440) 734-2000

**Perrysburg**  
Ed Schmidt Volkswagen  
(419) 874-4331

**Springfield**  
Bill Marine Auto Center, Inc.  
(937) 325-7091

**Steubenville**  
Sunset Motors Incorp  
(740) 264-1696

**Willoughby Hills**  
Eastside Volkswagen  
(440) 944-8700

**Wooster**  
Volkswagen of Wooster  
(330) 264-1113

**Oklahoma**  
**Norman**  
Fowler VW of Norman  
(405) 310-3700

**Oklahoma City**  
Cable Volkswagen  
(405) 787-0095

**Oklahoma City**  
Volkswagen of Edmond  
(405) 529-5600

**Tulsa**  
Don Thornton VW of Tulsa  
(918) 717-8989

**Oregon**  
**Beaverton**  
Herzog-Meier Volkswagen  
(503) 372-3298

**Bend**  
Volkswagen of Bend  
(541) 382-1711

**Corvallis**  
Volkswagen of Corvallis  
(541) 757-1415

**Eugene**  
Sheppard Motors  
(541) 343-8811

**Gladstone**  
Armstrong Volkswagen  
(503) 656-1215

**McMinnville**  
Mac Volkswagen  
(503) 472-4657

**Medford**  
Lithia Volkswagen  
(541) 774-7500

**Portland**  
Dick Hannah's VW of Portland  
(503) 256-3700

**Salem**  
Volkswagen of Salem  
(503) 581-1421

**Pennsylvania**  
**Allentown**  
Faulkner-Ciocca Volkswagen  
(800) 554-7165

**Ardmore**  
Piazza VW of Ardmore  
(601) 642-4275

**Butler**  
Mikan Volkswagen  
(724) 287-4763

**Colmar**  
North Penn Imports, Inc.  
(800) 887-2111

**Danville**  
Jack Metzger Volkswagen  
(570) 275-2212

**Devon**  
Fred Beans Volkswagen  
(800) 803-9829

**Downingtown**  
Jeff D'Ambrosio Volkswagen  
(610) 873-2400

**Easton**  
Young Volkswagen, Inc.  
(610) 991-9140

**Erie**  
New Motors, Inc.  
(800) 352-1052

**Feasterville**  
Colonial Volkswagen, Inc.  
(215) 355-8856

**Greensburg**  
Sendell Volkswagen  
(724) 837-9500

**Harrisburg**  
Sutliff Volkswagen  
(877) 203-5832

**Holidaysburg**  
Fiore Volkswagen  
(814) 695-5533

**Kingston**  
Wyoming Valley Motors  
(570) 288-7411

**Lancaster**  
Autohaus Lancaster, Inc.  
(717) 299-0325

**Langhorne**  
Volkswagen Langhorne  
(800) 298-4300

**Lebanon**  
H.A. Boyd, Inc.  
(717) 273-9385

**Leesport**  
Volkswagen Reading  
(610) 777-6500

**McMurray**  
Three Rivers Volkswagen  
(724) 941-6100

**Mechanicsburg**  
Faulkner VW of Mechanicsburg  
(717) 697-9448

**Monroeville**  
Day Volkswagen  
(724) 327-4950

**Montoursville**  
Fairfield Volkswagen  
(570) 368-8121

**Moon Twp**  
Day Apollo, Volkswagen  
(412) 264-0253

**New Kensington**  
Hillcrest Volkswagen, Inc.  
(724) 335-9847

**Newton Square**  
Y B H Sales & Service, Inc.  
(610) 356-3493

**Norristown**  
Wynn Volkswagen  
(610) 539-4622

**Orwigsburg**  
J. Bertolet, Inc.  
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Kelly Volkswagen  
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**State College**  
Volkswagen State College  
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Thompson Volkswagen  
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**West Chester**  
Garnet Volkswagen  
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Cochran VW of Wexford  
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Gilboy VW of Whitehall  
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Volkswagen Kennedy  
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Speedcraft Volkswagen  
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Wray Volkswagen  
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Randy Hiley VW of Arlington  
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Maund Automotive Group  
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VW of Alamo Heights  
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Volkswagen of Olympia  
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Dan Wilder Volkswagen, Inc.  
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Carter Volkswagen, Inc.  
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Volkswagen of Puyallup  
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