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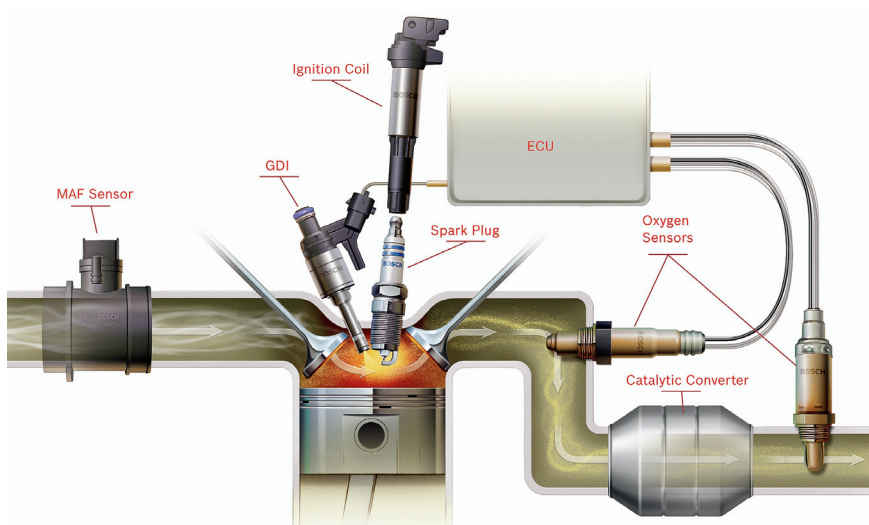
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WE HAVE IGNITION

BY LARRY JEWETT

Maintaining an engine doesn't have to involve complex science, but the process of developing parts to keep up with the latest technology can call on modern developments to seek out the advantages offered today.



1 This illustration (courtesy of Bosch) shows the spark plug relationship in the combustion process. In this case, it's a modern car using the Coil-on-Plug technology.

The common spark plug has become the central focus in the quest for better performance, greater fuel economy, and overall functionality of vehicles. It has been anything goes with design changes, material use, and so much more. The enthusiast market has been somewhat skeptical when some brands were busted for offering up unsubstantiated claims, putting a black eye on innocent companies that were developing product with true benefit. The contenders separated themselves

from the pretenders and the consumers stood to benefit.

Accessing a spark plug on modern cars is nowhere near as convenient as 40 years ago. Ask anyone who tried to access the innermost bank on a transverse six-cylinder and you'll see what I mean. Despite the fact that plugs are not as accessible as they once were, they still need attention and have to be changed on occasion. It falls into the idea of maintaining proper performance because, over time, that

performance will begin to decrease.

There are plenty of signs that may indicate a problem might be (but not necessarily) related to a plug issue. If the car has a rough idle, plug performance may have a hand in it. Worn spark plugs lead to poor spark and that could make the car harder or impossible to start (the spark plug performance can also drain a battery). Even if you do get it started, running performance may not be as expected due to the plugs being fouled or otherwise affected and a cylinder or more could be underperforming. A noticeable drop in fuel economy and unresponsive acceleration can also be signs that the plugs are not as good as they can be.

The job of a spark plug is simple. It utilizes the creation of an electric spark to ignite the compressed air-fuel mixture in an engine's cylinder. The quality of the spark has a direct bearing on the quality of the combustion process and the related quality of the "burn." The force of the explosion is what drives the internal parts on a consistent basis with a direct impact on power and consistency.

For a spark plug to do its job, there needs to be energy. That energy comes from the distributor or coil via wiring, which plays an important role in performance as well. Like any system, performance is directly impacted by the strength of the weakest link. When the weakest links are detrimental to performance expectations, the best option is replacement.

Spark plug manufacturers have suggested replacement intervals. Nothing lasts forever, especially when you consider the conditions that spark plugs or wires may be subjected to. Bosch recommends you follow the replacement interval in the owner's manual of your car. E3 Spark Plugs recommendations vary with the type of driving being done and the vehicle. Their plugs offer a five-year or 100,000-mile warranty.

According to Bosch, the spark plug undergoes changes that increase its required ignition voltage, eventually leading to engine misfires in the course

of its service life. These changes can be caused by electrode wear, engine wear, and abnormal operating conditions.

The spark plug manufacturers can do little to control two of those three elements. Their focus is on decreasing electrode wear, which has led to technological breakthroughs. It wasn't long ago that every spark plug offered on the market had the "J" shaped wire that stretched below the electrode. As the ignition occurs, the wire was subjected to the explosive forces, essentially in the way. It led designers to consider other designs that would not impede the flame kernel.

E3's DiamondFIRE design was built around the principle of getting the flame front to the compressed gasses as quickly as possible for an immediate burn. The open-ended design essentially directs the flame kernel where it needs to go. They have tested the design at Michigan Tech and found pleasing results in the areas where performance was increased.

Another new design comes from Enerpulse with their Pulstar line. Pulstar worked with a U.S. Department of Energy research and development lab. The plug uses pulsed power, the slow accumulation of energy followed by rapid release. The pulsed power leads to plasma-assisted combustion, which enhances the burn and ignition process.

The performance of Bosch spark plugs rests with the materials used in construction. Bosch Iridium Spark Plugs are engineered to deliver both high performance and long life, representing the best of OE spark plug technology. The ultra-fine wire design and laser welded tapered ground electrode deliver optimum performance, while the iridium center electrode and platinum ground electrode work together.

There are many more examples, but this proves the point that not all spark plugs are made alike. The simple science that drove the creation of the plug has been taken to the next level, due in part to the demands of the modern engine technology. The aftermarket companies are working



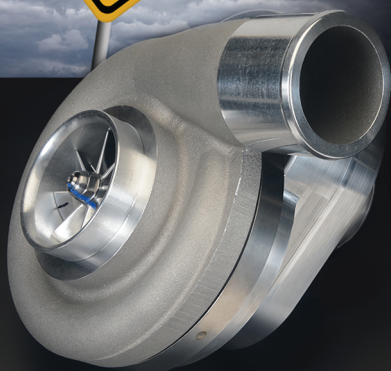
2 The Bosch Double Platinum plug utilizes the technology of new materials to get the proper spark for better performance.

in conjunction with the manufacturers to stay on top of developments and creating products that fit the needs. Brand loyalty plays a key role in a consumer's decision at this level as well. Often, a plug is replaced with a similar brand as much for convenience rather than to increase performance.

Extensive testing has gone into the modern product developments. E3 has worked with extreme applications of racing programs to develop products for more conventional use. While others have followed the same course, every company spends an enormous amount of time in laboratories before bringing a product to market in order to gain consumer confidence.

When it comes time to replace the plugs, whether due to the interval or performance degradation, it is generally a do-it-yourself activity on older cars with more challenging scenarios developed with newer cars, depending upon the model. The days of actually fitting into an engine compartment are long gone.

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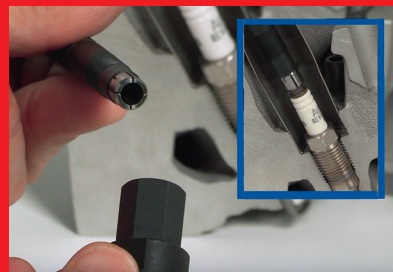
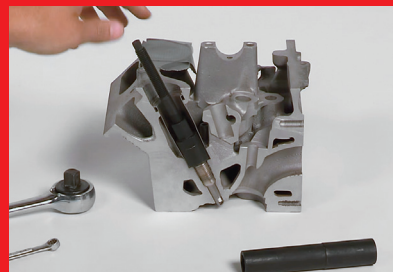
PLUGS AND WIRES

FORD PLUG EXTRACTOR

OTC, a division of Bosch, offers a plug extraction kit for hard-to-reach plugs on certain Ford products, including the 2005-2008 Mustang.

There were plenty of complaints about broken spark plugs developing when trying to remove the plug from the Triton 3V engine. The tool is designed to extract the plug before breakage. You simply place the collet holder assembly onto the spark plug head. Next, you bring the upper socket over the hex of the collet. With your ratchet, you can begin the extraction process.

It also works if the standard socket was used and only the hex portion came out, leaving the porcelain insulator and electrode shield inside. Instructions are included.



the OBD-II (onboard diagnostic) system that tracks ignition misfires. Increased frequency of misfires, which causes emissions to vary by more than a certain acceptable percentage, will often trigger a code and light up the Malfunction Indicator Light — also known as the “check engine” light. Changing plugs can reduce emissions substantially and keep the OBD-II happy.

The plugs operate in an extreme environment and are susceptible to fouling. Gasoline can soak the plugs to smother a spark and materials can build up when deposits such as ash, carbon, and oil can accumulate. Normal deposits will be light brown in color and not much accumulation. Pre-ignition, detonation, and too much heat can, over time, minimize the plug's performance.

WHAT ABOUT WIRES

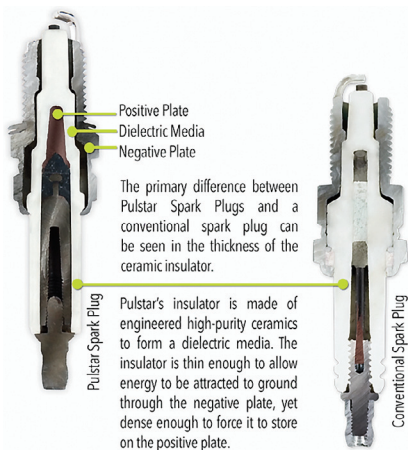
It stands to reason that replacing the plug wires can be a far easier task than reaching down into a cylinder head and extracting a plug that had to be carefully unscrewed for complete

removal. Replacing plug wires is simply taking one off and putting one on, but what are you putting on there?

The typical spark plug needs anywhere from 5,000 to 25,000 volts from the ignition coil before it can do its job. The wires have to deliver the voltage from point A to point B.

Replacing factory wires with aftermarket wires allows you to step up in quality. Companies like Taylor Cable Products (Vertex Ignition) and Performance Distributors with their LiveWires brand have been doing their research to help the consumer. These companies have made their names in the extreme application world of racing and allowed the technology to work its way to the consumers looking for better performance from their wires. Remember, the performance is only as strong as its weakest link and the wiring shouldn't be the weak link.

Construction of the wires is key. It's more than just a fiber of metal connected at each end. The wiring's core is the heart of success. “Don't spend big money on everything and then go cheap on your plug wires,”



3 A comparison between the Pulstar plug (left) and a convention plug shows the inner workings.

said Brian Caruth, office manager of Performance Distributors. "We offer an 8mm spiral core wire that is designed for low resistance. The HEI ignition requires low resistance and our wires have a value of 300-350 ohms per foot for optimal spark travel."

The Vertex tech staff added, "Everyday drivers benefit from the more efficient transfer of the lower resistance spiral wound wires. Advantages are more torque and horsepower, enhanced fuel economy, and engines generally running more efficiently."

The underhood temperatures serve as an enemy to the wiring performance. "Cars with headers are especially hot," added Caruth, "which is why we build our wires with fiberglass heat sleeves to withstand up to 1,400 degrees." Vertex's tech staff advised that the 100 percent silicone insulation is critical in combating heat. Proper boot angles and the use of wire looms to keep the wires from touching manifolds and headers can be helpful. Another threat comes from arcing and Taylor Vertex recommends using a thicker insulation to keep the energy in the wire until it reaches the plug. In extreme racing applications, 10.4 mm is recommended, which provides a 102,000 volt dielectric strength.

Certain engine modifications can lead to changes in wiring strategy. Vertex cited headers as an example,

IT'S TIME TO CHANGE YOUR PLUG



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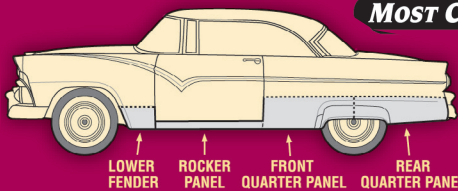
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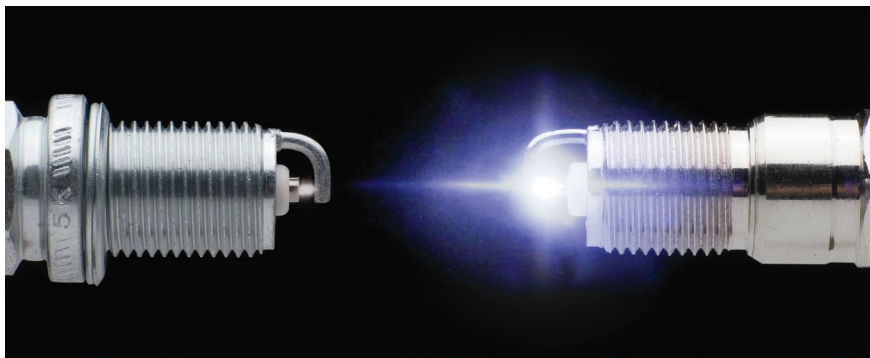
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PLUGS AND WIRES



4 The plug on the left shows a spark jumping to the electrode in a conventional plug. The bigger explosion on the right is the plasma assisted spark of Pulsar's plugs.

SOURCES

Bosch / www.boschauto.com

E3 Spark Plugs / www.e3sparkplugs.com

Enerpulse / 888-800-6700 / www.pulstar.com

Performance Distributors / 901-396-5782 / www.performancedistributors.com

Taylor Cable Products / 800-821-3600 / www.taylorvertex.com

WHAT'S HAPPENING AT THE PETERSEN MUSEUM



JANUARY EVENTS

6 – Movie Night – 7 p.m.

10 – Carroll Shelby Cruise-in – 9 a.m. to 11 a.m.

11 – Curators Talk – 7 p.m.

16 – Stave Stanford art Show – 11 a.m. to 1 p.m.

20 – Movie Night – 7 p.m.

23 – Terry Brennan – Car Artist – 11 a.m. to 2 p.m.

24 – Breakfast Club Cruise In – 8 a.m. to 10 a.m.

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which may lead to a different plug boot to clear the pipes. "Forced induction and high compression can lead to raising the pressure in the combustion chamber, which makes the spark harder to jump across the electrode on the spark plug. Thicker insulation on the wires helps to keep the electricity flowing to the spark plug and not arcing out through the insulation."

Universal plug wire kits are available, but Performance Distributors LiveWires do not require assembly. All sets are custom fit and numbered on both ends for the correct cylinder placement. The company will make custom sets. Caruth advised changing plug wires if a distributor is changed.

Modern cars and the developments have changed some of the thinking when it comes to wires. The Vertex tech staff cites that higher voltages have led to thicker wires: "Most street rodders have installed higher voltage coils and electronic ignitions, which has led to the 8mm wire being today's standard, instead of the 7mm and smaller of yesteryear. Ceramic boots that can withstand 2,000 degrees and not break down are another example."



5 LiveWires sets are numbered at each end and have the proper boots; in this case, these wires are for cars that require 90-degree boots.



6 All LiveWires have fiberglass heat resistant sleeves and come in your choice of several colors. The company will also make custom wire sets.

Almost all Ford products since 1998 have utilized "coil-on-plug" technology as well as all LS engines which have a short wire. Vertex has developed their line to assist in keeping ignitions functioning well.

We'd be remiss in omitting a great story offered by the Vertex tech staff. When talking about the benefits of the silicone insulation, they related this occurrence: "There was a story out of Denver several years ago about people parking at the airport, coming back, and finding something had been eating their ignition wires. Turns out it was rabbits looking for food and wires that were not 100 percent silicone had something in them that rabbits like to eat. You don't need to be concerned about rabbits eating our 100 percent silicone wires." 