

Frequently Asked Questions; **BOSCH** Spark Plug Function -- General

Courtesy of <http://www.boschusa.com/AutoParts/FAQs/SparkPlugs/>

Q. What is the function of a spark plug and why is it a vital engine component?

A. The function of the spark plug is to introduce the ignition energy into the combustion chamber and to initiate combustion of the compressed air-fuel mixture. It accomplishes this task by generating a spark between its electrodes, which then generates the required heat to ignite a smooth burn of the air/fuel mixture. The spark plug is an important factor in determining optimal performance and reliable functioning of an engine. It must permit reliable cold starting, it must guarantee that there is no misfiring during acceleration, and it must withstand the engine being operated for hours on end at maximum power. These requirements apply throughout the entire service life of the spark plug. For 100 years, Bosch Spark Plugs have been designed for optimal performance, reliable functioning, and to withstand extreme operating conditions. Today, the continuously developing spark plug is a key engine system component. It plays a major role in fuel economy, clean, efficient combustion, and the reliable operation of engines and catalytic converters.

Q. What are the different types of spark plugs?

A. There is a large variety of different spark plug designs with more than 1,400 variations. Design variants and special materials such as platinum, silver, or yttrium allow Bosch spark plugs to be used in a wide variety of applications today. In all, Bosch has developed more than 20,000 different types of spark plugs over the last 100 years.

Q. Why do we need to change spark plugs?

A. During operation, the spark plug is subjected to both wear and to fouling and should be replaced at regular intervals. In the course of its service life, the spark plug undergoes changes that increase the required ignition voltage. When the required voltage reaches a level that can no longer be compensated for by the voltage reserve, the result is misfiring. These changes can be caused by:

- Electrode wear
- Engine wear
- Abnormal operating conditions (pre-ignition, detonation, high oil consumption)

Independent tests have shown that installing premium spark plugs such as Bosch's Platinum+4 improves fuel mileage by as much as 4.8% over original equipment plugs. Platinum+4 uses race-tested technology including multiple electrode paths and large amounts of platinum to generate strong, consistent sparks.

Q. How do I "read" a spark plug?

A. Reading the spark plugs provides valuable information on spark plug and engine operating conditions. Refer back for more information on how to read a spark plug.

Q. How should spark plugs be tightened for best performance?

A. Bosch recommends when installing spark plugs to use a torque wrench and the correct torque in ft.-lbs. As listed below:

	10mm With <u>Gasket</u>	12mm With <u>Gasket</u>	14mm With <u>Gasket</u>	14mm Tapered <u>Seat</u>	18mm With <u>Gasket</u>	18mm Tapered <u>Seat</u>
Torque FT.-LBS.	8-11	12-15	19-22	12-15	20-23	14-17

If a torque wrench is not available, hand tighten the plug until it is seated in the cylinder head. Spark plugs with gaskets should be tightened an additional 90°. Spark plugs with tapered seats should be tightened an additional 15°. **NOTE: AVOID OVER TIGHTENING OR UNDER**

TIGHTENING AS SPARK PLUG OR ENGINE DAMAGE MAY RESULT.

Q. Are Bosch Spark Plugs pre-gapped at the factory?

A. Most Bosch Spark Plugs are factory pre-gapped for popular vehicle applications. The gap measurements are indicated either on the box, or by the part number located on the spark plug shell.

- X suffix = .044"
- Y suffix = .060"
- Z suffix = .080"

Gaps should never be adjusted on dual or triple ground electrode spark plugs, Platinum+4 or Platinum2. These plugs have factory pre-set gaps, and should never be gapped by the installer.

Bosch Platinum and Super Spark Plugs also have factory-set gaps. For most plugs, the setting is shown on the plug package. These gaps are correct for the most popular applications of these plugs. There are applications, however, for which the gap setting has to be adjusted according to the vehicle manufacturer's specifications. To avoid damage to a spark plug in the process of adjusting the gap, it is important to follow these guidelines:

- To widen the electrode gap, use a tool that only pulls back the ground electrode, without applying pressure to the center electrode. The tool must not be wedged between the electrodes as that may cause damage to the insulator nose.
- To close the electrode gap, carefully tap the plug, electrode first, on a hard surface, as shown in the illustration.

Q. What is detonation?

A. Detonation or "knocking" is uncontrolled combustion with a very steep rise in pressure. It is caused by spontaneous ignition of the fuel mixture, which has not yet been reached by the ignition spark. As the high-pressure waves hit the walls of the combustion chamber, their impact produces a metallic knocking sound. Failure to recognize and deal with knocking will inevitably lead to serious engine damage.

Q. What is pre-ignition?

A. Pre-ignition is an uncontrolled ignition process in which the temperatures in the combustion chamber can rise to such an extent as to cause serious damage to the engine and the spark plug. Full-throttle operation can generate localized hot spots and cause pre-ignition at the following locations:

- At the tip of the spark plug's insulator nose
- On the exhaust valve
- On the protruding sections of the head gasket
- On loose deposits (ash and carbon residue)

Pre-ignition of the air/fuel mixture can cause severe damage to an engine and this is one reason why the heat range of a spark plug is so important.

Q. What is a heat range?

A. The spark plugs' heat range is an index of its capacity to dissipate thermal energy. The different characteristics of automotive engines regarding operating load, compression, engine speed, cooling, and fuel make it impossible to run all engines with a standard spark plug. The same spark plug may get very hot in one engine type, but may reach only a relatively low temperature in

another. In the first case, the air-fuel mixture would ignite on the glowing parts of the spark plug projecting into the combustion chamber (pre-ignition) and, in the second case, the insulator tip would soon become so badly fouled by combustion deposits that misfiring would occur. To ensure that the plug runs between the desired temperatures, plugs with different heat capacities were developed. The so called "heat range", which is assigned to each spark plug, is used to characterize these heat dissipation capacities. A plug with a low heat range number (e.g., 2-4) indicates a cold plug that quickly dissipates heat to the engine block and cooling system, while a high code (e.g., 7-10) indicates a hot plug that retains heat. By properly selecting the heat range of the plug, it ensures that the plug will operate between the plug's designed operating range of 500-900 degrees Celsius. In this range, the spark plug will be self-cleaning, yet will not be hot enough to pre-ignite the air/fuel mixture.

Q. How does Bosch test engines to determine the heat range and what heat range should I use?

A. To ensure optimal performance in your car, Bosch has tested each vehicle model and the various engines available for that model listed in the Spark Plug catalog or our web-page. Using a special spark plug with a thermocouple built in, Bosch engineers find the hottest cylinder in an engine and then test various spark plugs in that cylinder until the ideal plug is found. This ensures that you will always get the best performance possible.

Q. I want to use Bosch Spark Plugs, but have modified my engine by adding a performance system. Can I still use the plug listed in the catalog for my vehicle?

A. If you have modified your engine with a performance system such as a turbocharger, supercharger, or nitrous, the recommended spark plug may not be correct. You may need to use a plug with a colder heat range to compensate for the additional heat generated by the engine. Bosch recommends that in these situations, you consult a qualified engine builder for assistance in determining the appropriate heat range.

Q. How often do I need to change my plugs?

A. As a rule, Bosch recommends that you follow the replacement interval listed in your vehicle owners manual, however we highly recommend that you inspect (read) your spark plugs annually and replace as required, to insure optimum engine performance.

Q. Do Bosch Spark Plugs meet original equipment requirements?

A. Yes! Bosch Spark Plugs meet or exceed warranty requirements of all vehicle and engine manufacturers, and when properly installed in accordance with the recommended application, will not adversely affect the emission control system of any vehicle.

Q. What about vehicle manufacturer warranties?

A. Consumers are sometimes told by an automobile dealer's service writer or mechanic that a brand of replacement spark plug cannot be used in the consumer's vehicle during the warranty period. The claim is made that use of the brand will "void the warranty", with the statement or implication that only the original equipment brand of spark plugs may be used. This, of course, tends to cast doubt on the quality of the replacement spark plug. That claim is not true. Under the Magnuson-Moss Warranty Act and general principles of the Federal Trade Commission Act, a manufacturer may **not** require the use of any brand of spark plug (or any other article) **unless** the manufacturer provides the item **free of charge** under the terms of the warranty.

So, if the consumer is told that only the original equipment spark plug will not void the warranty, they should request that the OE spark plug be provided free of charge. If they are charged for the spark plug, the manufacturer or dealer is in violation of the Magnuson-Moss Warranty Act.

Q. Does the Bosch part number have meaning to help determine the specifications of the plug?

A. Yes! Refer back for more information

Q. Does technology used in racing plugs find its way into Bosch Premium plugs?

A. YES! Racing, as it has for 100 years, provides a great developmental impetus and test bed for spark plug durability and performance, and what is learned at Indy or Darlington, or Le Mans helps improve the spark plugs installed in today's cars or trucks. From the first Indy 500 won by

Ray Harroun's Marmon Wasp to the last 17 Indy 500 winners, and many in between, each have used Bosch spark plugs. Many premium passenger car spark plugs use multiple ground electrodes and precious metals, such as platinum, which are a direct result of their development and testing in long distance racing. Refer back for more information on racing technology.

Glossary:

Multi Ground- Plugs with multiple ground electrodes are called multi ground. These plugs also use surface gap spark patterns and the multiple ground electrodes increase service life.

Surface Gap- Surface gap technology is when the ground electrode is to the side of the center electrode. There can be no ground electrode (racing applications), multiple ground electrodes (PT+4 and PT2), or a single ground electrode. These spark plugs have improved efficiency and a higher probability of igniting a lean air/fuel mixture.

Resistor- Many spark plugs have a special conductive glass seal between the center electrode and the terminal stud. This seal acts as a resistor in the plug which reduces the transmission of pulses of energy to the ignition cables. These pulses can cause Radio Frequency Interference (RFI) with electrical components in the car. For some newer cars, resistor plugs are required for effective communication between the plugs and the electronic ignition.

Radio Frequency Interference (RFI)- When the spark plug creates a spark, a high frequency burst of energy is created. If this energy was to travel through the ignition wires, it could cause interference with other sensitive electronic devices, such as the radio or electronic control units. The resistor in the spark plug reduces this energy before it causes interference with other electrical components.

Fouling- Fouling occurs when a plug becomes contaminated with fuel, oil, or other contaminants that prevent the plug from generating a spark. Most plugs today are designed to reduce fouling and become self-cleaning when they reach 500 degrees Celsius. However, short trips, low speed driving, improper spark plug heat range (too cold), improper timing, or an oil leak in the combustion chamber can cause a spark plug to become fouled.

Bridging- Over time, contaminants can build on the surface of the spark plug if it does not reach self-cleaning temperature often. These buildups can grow between the electrodes until they are actually connected by a bridge of contaminants. This will often cause misfire.

Flashover- Occurs when the spark does not jump between the electrodes within the combustion chamber, but instead jumps between the metal shell and the terminal on top of the plug. This will always cause a misfire since the air/fuel mixture will not be ignited. Bosch spark plugs have a ribbed insulator to prevent flashover.

Quenching- The purpose of a spark plug is to introduce enough heat into the combustion chamber to initiate a smooth burn of the air/fuel mixture. Quenching occurs when that heat generated by the spark is reabsorbed back into the ground electrode, the center electrode, and the ceramic insulation. To reduce quenching and ensure an efficient transfer of heat, Bosch dual and triple electrode ground and Platinum+4 and Platinum2 spark plugs use surface gap technologies.