

Spark Plug Colours and Engine Problem Guide

A **spark plug** is an electrical device that fits into the cylinder head of some internal combustion engines and ignites compressed petrol by means of an electric spark. Spark plugs have an insulated centre electrode which is connected by a heavily insulated wire to an ignition coil circuit on the outside, forming, with a grounded terminal on the base of the plug, a spark gap inside the cylinder.

As the electrons flow from the coil, a voltage difference develops between the centre electrode and side electrode. No current can flow because the fuel and air in the gap is an insulator, but as the voltage rises further, it begins to change the structure of the gases between the electrodes. Once the voltage exceeds the dielectric strength of the gases, the gases become ionized. The ionized gas becomes a conductor and allow electrons to flow across the gap. Spark plugs usually require voltage in excess of 20,000 volts to 'fire' properly.

Because the spark plug is inside the engine and is the only easily removable part it can be used as an indicator to the state of tune and condition of the engine. The sparkplug also says if you need to change anything in the mechanics. Below is some photos and descriptions (source Champion spark plugs) of what spark plugs can look like given certain engine conditions. I have owned many classic cars from Minis to MGs and have yet to see a spark plug in the "normal" condition, most of mine have been a combination of the normal picture and the carbon fouled around the threaded base. These pictures look like the very extreme of what can happen if problems are allowed to continue and I don't think some of the plugs would actually fire in the condition that they are shown.



Normal
 Combustion deposits are slight and not heavy enough to cause any detrimental effect on engine performance. Note the brown to greyish tan colour, and minimal amount of electrode erosion which clearly indicates the plug is in the correct heat range and has been operating in a "healthy" engine.

Carbon Fouled
 Soft, black, sooty deposits easily identify this plug condition. This is most often caused by an over-rich, air/fuel mixture. Check for a sticking choke, clogged air filter, or a carburettor problem - float level high, defective needle or seat, etc. This may also be attributed to weak ignition voltage, an inoperative preheating system (carburettor intake air), or extremely low cylinder compression.

Denotation Failure
 This form of abnormal combustion has fractured the insulator core nose of the plug. The explosion that occurs in this situation applies extreme pressures on internal engine components. Prime causes include ignition time advanced too far, lean air/fuel mixtures, and insufficient octane rating of the petrol.



Oil Fouled

Too much oil is entering the combustion chamber. This is often caused by piston rings or cylinder walls that are badly worn. Oil may also be pulled into the chamber because of excessive clearance in the valve stem guides. A build-up of crankcase pressure which can force oil and oil vapours past the rings and valve guides into the combustion chamber can also cause this.



Mechanical Damage

May be caused by a foreign object that has accidentally entered the combustion chamber. When this condition is discovered, check the other cylinders to prevent a recurrence, since it is possible for a small object to "travel" from one cylinder to another where a large degree of valve overlap exists. This condition may also be due to improper reach spark plugs that permit the piston to touch or collide with the firing end.



Worn out Plug

This plug has served its useful life and should be replaced. The voltage required to fire the plug has approximately doubled and will continue to increase with additional miles of travel. Even higher voltage requirements, as much as 100% above normal, may occur when the engine is quickly accelerated. Poor engine performance and a loss in fuel economy are traits of a worn spark.



Ash Fouled Plug

A build-up of combustion deposits stemming primarily from the burning of oil and/or fuel additives during normal combustion, normally non-conductive. When heavier deposits are allowed to accumulate over a longer mileage period, they can "mask" the spark, resulting in a plug misfire condition.



Insulator Glazing

Glazing appears as a yellowish, varnish-like colour. This condition indicates that spark plug temperatures have risen suddenly during a hard, fast acceleration period. As a result, normal combustion deposits do not have an opportunity to "fluff-off" as they normally do. Instead, they melt to form a conductive coating and misfire will occur.



No Spark Plug Gap

Rarely occurs in car engines, however, this condition is caused by similar conditions that produce splash fouling. Combustion deposits thrown loose may lodge between the electrodes, causing a dead short and misfire. Fluffy materials that accumulate on the side electrode may melt to bridge the gap when the engine is suddenly put under a heavy load.



Overheated Spark Plug

A clean, white insulator firing tip and/or excessive electrode erosion indicates this spark plug condition. This is often caused by over advanced ignition, timing, poor engine cooling system efficiency, a very lean air/fuel mixture, or a leaking intake manifold. When these conditions prevail, even a plug of the correct heat range will overheat.



Splash Fouled Plug

Appears as "spotted" deposits on the firing tip of the insulator and often occurs after a long delayed tune-up. By-products of combustion may loosen suddenly when normal combustion temperatures are restored. During hard acceleration these materials shed from the piston crown or valve heads, and are thrown against the hot insulator surface.



Pre Ignition

Usually one or a combination of several engine operating conditions are the prime causes of pre-ignition. It may originate from glowing combustion chamber deposits, hot spots in the combustion chamber due to poor control of engine heat, cross-firing (electrical induction between spark plug wires), or the plug heat range is too high for the engine or its operating conditions.