
NGK
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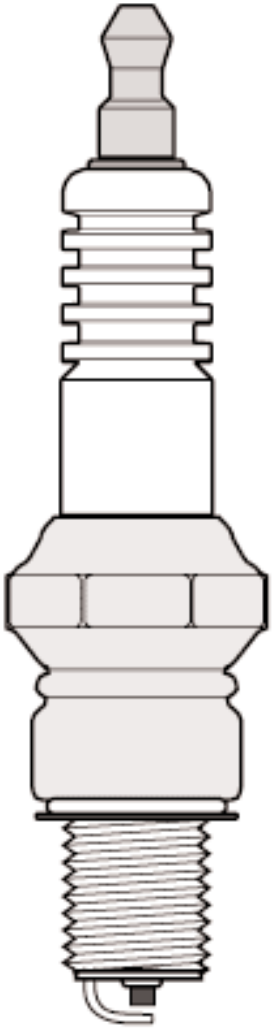
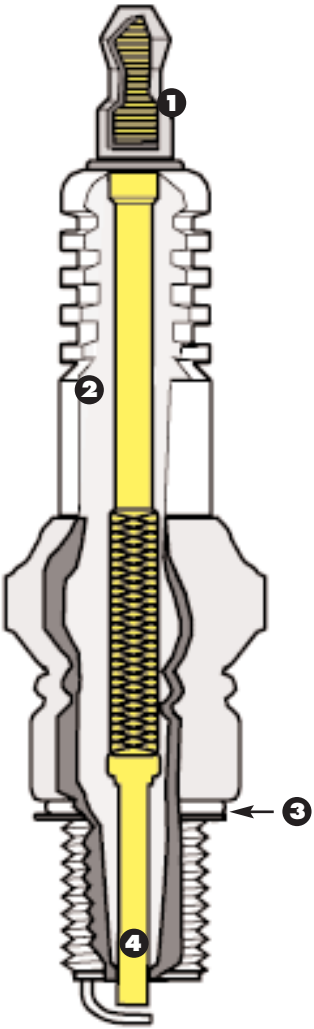
The spark plug transmits electric energy that turns fuel into working energy. Enough voltage must be supplied by the ignition system to cause the spark to jump across the spark plug gap, creating what is called electrical performance, It is this action that essentially starts up a car at the turn of a key. The remarkable invention of the spark plug, and my fascination with cars inspired me to explore the working of an automobile engine. Starting with one very small and important element — the spark plug.

Spark Plug



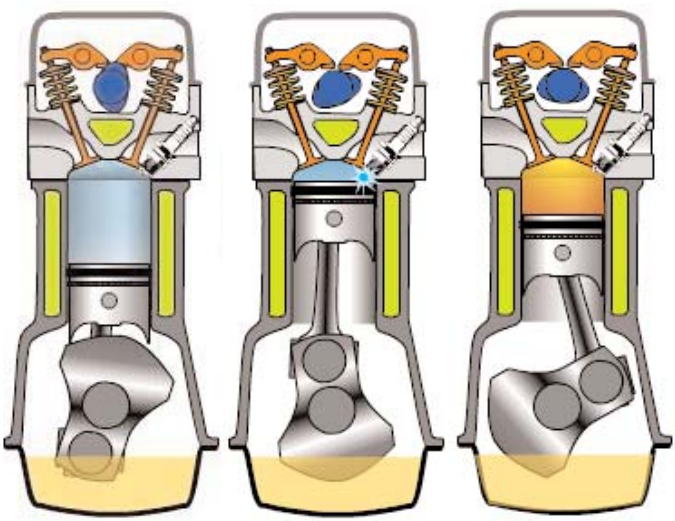
Spark Plug Cutaway

1. connector (to plug wire)
2. ceramic insulator
3. gasket
4. electrode



Spark Timing

The ignition system on your car has to work in perfect concert with the rest of the engine. The goal is to create a spark to ignite the fuel at exactly the right time so that the expanding gases can do the maximum amount of work. If the ignition system fires at the wrong time, power will fall and gas consumption and emissions can increase. When the fuel/air mixture in the cylinder burns, the temperature rises and the fuel is converted to exhaust gas. This transformation causes the pressure in the cylinder to increase dramatically and forces the piston down.



The History of the Spark Plug

Edmond Berger invented the spark plug.

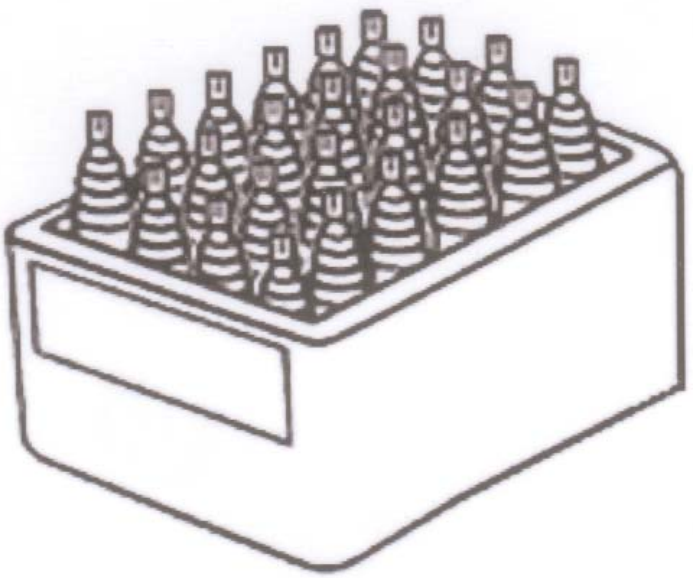
1839

First manufactured engine, which used an electric spark plug ignition system by Etienne Lenoir's.

1860

France dominated the spark plug market, supplying manufacturers with only a limited line of plug design, that was expensive and had imperfect quality.

1900



Albert Champion began making his own spark plugs and sold them to his friends.

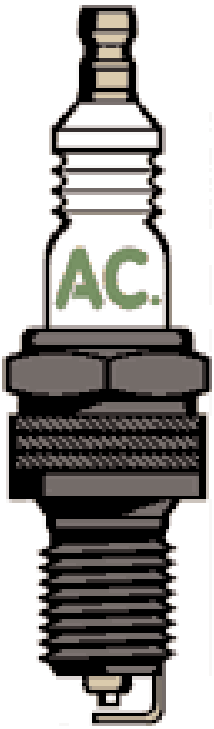
1889

Albert Champion founded Champion Ignation Co. in Michigan for the manufacturing of spark plugs.

1904

Buick Motor Co., & Champion began a new company called the AC Spark Plug Company.

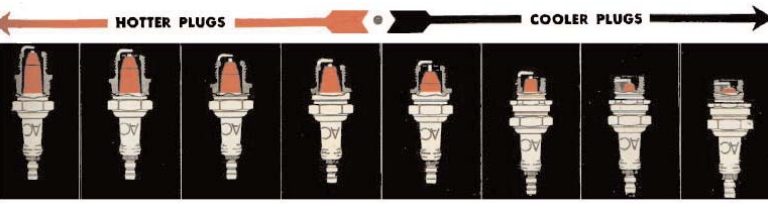
1908



Alfred P. Sloan formed United Motors Corp. and eventually acquired Buick and AC Spark Plug.

1916

unitedmotors



NGK manufactures thier first spark plug.

1921

General Motors purchased the remaining stock held by Champion's estate and took over the AC Company.

1927

NGK begins the development of high quality spark plugs for the automobile industry building on experience from the ceramics industry in Japan.

1936

NGK branch offices open in Europe.

1975-1990

Today various manufacturers supply the spark plug worldwide.

2003

Street Cars

NGK makes spark plugs for virtually every automotive application in the world. With a wide variety of materials, from standard copper-core type to Iridium, the next generation of spark plug technology, NGK is the world's leader in spark plug engineering.

standard

The workhorse, at the heart of smooth running engines around the world. Available in standard or resistor. OEM quality, triple - gasket sealing process, consistent performance, plug of choice in millions of vehicles.

platinum

NGK is the largest original equipment supplier of platinum spark plugs in the world. Companies like General Motors, Honda, Nissan, Toyota, and others all specify NGK platinum spark plugs as standard equipment. Today, all of the U.S. automakers have begun to specify platinum spark plugs as original equipment. Platinum spark plugs last much longer than conventional spark plugs and perform more consistently over the course of their service life.

V-Power

The V-Power, is the only spark plug with a v-groove center electrode on the market today. The v-groove center electrode on a V-Power spark plug forces the spark to the outer edge of the ground electrode, placing it closer to the air/fuel mixture. What this does is allow the spark to more quickly ignite the mixture, providing more complete combustion.

multi power

This spark plug features multiple ground electrodes for extra - long life. Multi power plugs are not for all applications, as they can tend to quench the spark, or hamper the ability of the flame to grow from the initial ignition point. However, the multiple ground electrode configuration can help alleviate a number of problems, including hard starting, excessive fouling or misfiring.

iridium

Iridium is a precious, silver - white metal and one of the densest materials found on earth. The result are spark plugs that require less voltage to spark, burns fuel more efficiently, sparks at leaner air fuel mixtures, and delivers higher horsepower and better gas mileage.

NGK offers two choices of this precious metal plug. The iridium which is a high quality iridium plug installed as original equipment (OE) in the automotive industry since 1994, and the new iridium IX, the ultimate evolution of a performance spark plug.

Racing Cars

NGK makes spark plugs for virtually every possible type of racing engine. From stock cars to drag racing, from snowmobiles to Formula 1 motorcycles, NGK has a plug.

V-Power racing

NGK's V-grooved center electrode moves the spark to the outer edge of the electrode for improved ignitability in all combustion chamber conditions. This configuration is especially helpful for throttle responsiveness, quicker corner exits, and more power on the bottom end in a drag race engine. NGK V-Power racing spark plugs are available in a wide variety of heat ranges to fit most drag race, circle track or road racing applications. The high-purity alumina silicates used in the insulators of NGK Spark Plugs helps keep the spark plug tip warm enough to burn off deposits at low-speed, yet still be able to transfer enough heat during high-speed operation to prevent detonation and pre-ignition.

racing

NGK racing spark plugs are designed for high powered engines with increased compression ratios and higher rpms. They're designed for use under severe conditions, including repeated cycles of acceleration and deceleration and long hours of high-speed running. To meet the stringent requirements of racing engines and sparking voltage, NGK racing plugs have characteristics such as easy sparking and enhanced ignitability, as well as excellent heat resistance, thermal conductivity, durability and mechanical strength. To withstand the severe conditions that occur in racing engines, racing spark plugs feature electrode materials and configurations.

How to Read Spark Plug Color

Knowing how to read a spark plug can be a valuable performance tuning aid. By examining the spark plug insulator color, valuable information about the engine's overall operating condition can be determined.

normal condition

An engine's condition can be judged by the appearance of the spark plug's firing end. If the firing end of a spark plug is brown or light gray, the condition can be judged to be good and the spark plug is functioning optimally.

deposits

The accumulation of deposits on the firing end is influenced by oil leakage, fuel quality and the engine's operating period.

dry and wet fouling

Although there are many different cases, if the insulation resistance between the center electrode and the shell is over 10M, the engine can be started normally in all cases. If the insulation resistance drops to zero the firing end is fouled be either wet or dry carbon.

lead fouling

Lead fouling usually appears as yellowish brown deposits on the insulator nose and this can not be detected by a resistance tester at room temperature. Lead compounds combine at different temperatures; those formed at 700–790 °F having the greatest influence on the resistance.

overheating

When overheated, the insulator tip is glazed or glossy from melted deposits which have accumulated on the insulator tip. Some times these deposits may appear to be blistered.

breakage

Breakage is usually caused by thermal expansion and thermal shock due to sudden heating or cooling.

melting

Melting is caused by overheating. Mostly the electrode surface is rather lustrous and uneven. The melting point of nickel alloy is 2,200–2, 400 °F.

normal life

A worn spark plug not only wastes fuel but also strains the whole ignition system because the expanded gap requires higher voltages. As a result a worn spark will result in damage to the engine itself, and will also increase air pollution.

erosion, corrosion & oxidation

When the material of the electrodes has oxidized, and when the oxidation is heavy it will be green on the surface. The surface of the electrodes are also fretted and rough.

abnormal erosion

Abnormal electrode erosion is caused by the effects of corrosion, oxidation, reaction with lead, all resulting in abnormal gap growth.

lead erosion

Lead erosion is caused by lead compounds in the gasoline which react chemically with the material at the electrodes (nickel alloy) as high temperatures; crystal of nickel alloy fall off because of the lead compounds permeating and separating the grain boundary of the nickel alloy. Typical lead erosion causes the surface of the ground electrode to become thinner, and the tip of the electrode looks as if it has been chipped.

Bibliography

on-line:

www.howstuffworks.com

www.ngksparkplugs.com

www.atlanticjetsports.com

Colophon

Designed by:
Patrycja Weglarz
AD 412 Graphic Design Senior Thesis
University of Illinois at Chicago
School of Art ans Design
Spring 2003

paper: hp brochure and flyer, gloss, inkjet 44lb
fonts: futura book & futura extrabold
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computer: PC - Windows XP
program: QuarkXPress