Buying Spark Plugs & Spark Plug Wires

By Sherlock9c1, 9/29/2009. Ready for real truth? Strap in and let's go. I'm an electrical engineer by training but I'll try to keep this as plain English as possible.

How does my ignition system work?

You need something to ignite the fuel in your gasoline engine. Spark ignition is really good at this because it's relatively safe, durable, and very controllable. The spark contains enough energy to cross the gap of the spark plug, and start the burning of the air/fuel mixture.

Spark plugs

When it all comes down to it, a spark plug is a gap, nothing more. Sounds simple, but then you have to put it in an engine, which means it gets exposed to gasoline, tremendous pressure, tremendous heat (think flame-kissed, but way beyond Burger-King style!), and oil/water/moisture/elements/whatever else ends up in the engine or through the engine bay. Next, it gets electricity zapped across it at hundreds or thousands of times per minute. With every zap, a little bit of the metal gets burned off the tips. In fact, the average wear for a standard-metal spark plug is 0.001" every 2500 miles. Finally, the best arc occurs at sharp edges, which is why several plug makers have either multiple ground electrodes or uniquely shaped (like V or U) to provides a better starting point for the arc. The closest point in the gap is invariably where the spark will go; it tends to have a "flattening" effect because it continually seeks the highest point and then erodes it down. Next time you pull out a used plug, look at the edges; you will see them worn down.

Resistance

As if all that were not enough, it has to run in a vehicle with a radio and other electronic equipment. The spark produces large amounts of electromagnetic interference, or EMI, which bothers those components. To limit this, most street spark plugs have a resistor built in, or the manufacturer specifies high-resistance wires, in order to limit the amount of current that passes over the gap once the spark is established. The resistor and high-resistances wires have no effect on the spark getting started, because no current flows until the spark is established.

Hot and Cold

Finally, the spark plug must be self-cleaning and self-cooling. It must operate hot enough that it can burn off any oil or other contaminants that otherwise might sludge up on the plug and provide a thin film of conductive material that would give the electricity a shortcut. But, it must not run so hot that it melts. It's a difficult balance, and it varies with engine type, power levels, and load conditions.

Gap Erosion – the #1 killer

As the plug sparks and sparks, the gap eventually gets worn bigger and bigger because the electricity literally vaporizes a little bit of metal off with each spark. The wider the gap gets, the higher the voltage (or "energy" each electron has) is needed to jump the gap. This higher voltage isn't just at the plug; it's all along the wire, in the distributor (if your engine has one) and inside the coil. That higher voltage electricity starts looking for other places to get back to ground, and if the wires or the coil is the weak point, so be it. I've heard a buzzing coil whose buzz sound was tied to engine RPM. It was actually sparking internally. I replaced it with a new coil; the sound was gone, the car ran better, got better gas mileage, and started with much more authority.

But anyway; if you want to preserve your ignition system, keep an eye on your spark plug gaps. The bigger those gaps get, the harder it will be on your ignition system. Sometimes you can get away with running your plug wires longer by replacing the plugs with new ones (with the corresponding smaller, factory-spec'd gap). On motors where the wires are difficult to replace such as the GM LT1 V8, this is a useful piece of information.

Exotic Metals

In an effort to slow gap erosion (which is the number one need for plug replacement), manufacturers searched for other metals which would resist the spark erosion process. Platinum and Iridium, among others, work very well at slowing this down. The problem is that these materials are insanely expensive, so mfgrs will usually only use a little bit on the ends of the gap. I call them "pucks" and when you look at a double-platinum plug, you'll see what I mean. A "double-platinum" plug means it has platinum on both ends of the gap. Some plugs are "single platinum" which means only one end (usually the outside, ground electrode has the puck on it). They are cheaper than double-platinum plugs, and they wear about half as fast as regular plugs. As you can imagine, double-platinum plugs wear MUCH slower than regular plugs. As an example, I pulled a set of Champion double-platinum plugs out of a Chrysler minivan that, after 75,000 miles, had only eroded 0.008." This is phenomenal. They really didn't need to be replaced. Be wary; not all special spark plugs are created equal. Based on my experience, AC Delco spark plugs have historically very poor quality control on their platinum plugs, both in the puck's placement on the electrode, and in longevity. 6 of 8 pucks were missing on one relatively low mileage set I pulled out, and this was also true of several other sets I've removed from various GM engines. Once those pucks are gone, the plugs wear as fast as a regular plug, which usually needs to be evaluated after 30,000 miles, not 100,000 miles like the ads state.

What about Bosch +4's or those fancy supercharged plugs?

Frankly, the +4's get in the way of the combustion process. This is the downside about ground electrodes (that, and their ends get very, very hot). I'd use two as an absolute max, but Bosch plugs have proven to be delicate in my hands, so I don't use them.

There's also another company named Pulstar that makes a plug with some special components inside to supposedly store up electricity and then release it all at once in a huge flash of energy. While that sounds nice, all you really need to do is start the fuel burning; how you do it isn't terribly important. A prominent corvette tuner shop spent a whole day testing on a stock and a heads/cam Z06 Corvette and found minor

gains with both. The shop finally recommended that based on the leaner Air-Fuel mixture seen with the Pulstar plugs, it would be most cost-effective to use them on an unmodified daily driver due to the potential increase in fuel economy. I do not know if the cost ($25 per plug) will be more than offset by the gains. I've also heard of other tests with these plugs that showed no gains at all, so take that for what it's worth.

Which should I buy?
If you can access your plugs easily, buy the cheap plugs and replace them every 30k. If you can't easily access them, buy double-platinum or similar plugs. If your stock plugs had resistors, make sure the new ones have resistors. Do not change heat ranges unless you know what you're doing.

Spark Plug Wires

What do they do?
Electricity is like water – it wants to flow from higher places to lower places. Spark plug wires provide a pipe, a protected path for the high-voltage electricity from the ignition coil to get to the spark plug wire, where it can finally reach ground and "relax" if you will.

How/when do they fail?
Spark plug wires fail when they no longer deliver the high voltage electricity to the spark plug. They can get burned and break, suffer water damage which leads to corrosion, come apart internally (usually between the wire and the connector), or the protective jacket can deteriorate and develop cracks through which the electricity can jump out and touch metal nearby, whether the engine or brackets or whatever – anything that's electrically connected to the negative terminal of the battery. This is what is happening when somebody opens their hood on a rainy night and sees a light show going on around the wires.

How do I buy good ones?
Just get ones with a lifetime warrantee. Seriously. Making spark plug wires is an established science. They wear out over time, but they're good enough where most folks will only need to replace a spark plug set once in the time they own a vehicle, unless there is a systemic problem with oil or water corrosion, particularly in OHC engines with really deep recesses where the spark plug resides; if oil or water collects in there, it has no place to go so it just degrades the plug wire.
If you really want to step up, buy silicone wires, which, if you are gentle with them, will last the life of the vehicle. Magnecor makes a good set, and their site is very informative as well.
What about thicker? Isn't that better?
You're not buying fuel line here folks. Seriously though, what if a company came out with an insulator that was sufficient without needing to be really thick? Thicker for the sake of thickness is meaningless. Plus, these big wires won't fit in stock wiring looms, which is a problem. If your stock wires are 7mm, stick with 7mm unless you're making major changes to a motor that require a stronger ignition system, such as forced induction or nitrous.

How about solid core?
If they made the wires out of silly putty in garden hose but your engine ran fine, who would care? Again, marketing. And a lot of things conduct electricity just fine at 30,000 volts. Humans do too, actually. In my experience, Bosch solid core wires put out a lot of radio interference. I swapped in a cheaper set of store-brand wires with the lifetime guarantee and the radio noise went away. Keep this in mind.

Low resistance?
If you want radio noise and accelerated gap erosion, sure. But again, low resistance doesn't help the spark get established at all; it only limits the maximum current once the spark is established. Keep the high-resistance wires. Checking the resistance of plug wires is meaningless, because what you REALLY care about is their ability to insulate 30,000 to 40,000 volts, and no voltmeter can test that.

Other buying tips:
House brands are almost always whitebox name brands, so you're really just buying warranty if you shop carefully. For example, spend a few minutes online cross-referencing brake pads between Advance, AutoZone, Napa, O'reillys, etc, and you'll quickly figure out who makes what parts at what price - it will surprise you.

When should I replace my plug wires?
When your radio noise in weak stations goes up, your plug wires are done - the extra noise is caused by the wires arc'ing somewhere due to dielectric breakdown. You can prolong this failure by protecting the wires with plastic loom anywhere where they may touch metal - never never fasten wires directly to a metal ground (like zip-tying the #7 LT1 wire to a brakeline to keep it away from the exhaust). Also, if the car starts misfiring in the rain, that's a dead giveaway that the insulation has deteriorated enough to allow water on the wires to conduct to a ground somewhere.

I've actually had times where I'm at a light listening to a weak station and another car pulls up to me and I get THEIR ignition noise on my radio! Then, they pull away, and the radio noise goes away too.

As always, diagnose FIRST before replacing parts. This is particularly true of ignition systems as well.