

Give 'Em The Juice: Why Ignition Upgrades Should Be In Your Combo

By BRADLEY IGER | JULY 02, 2020

Air, fuel, and spark are the three pillars of a combustion event. In the hot rodding world, the first two tend to garner the lion's share of attention when it comes time to do some upgrades, but the third is often overlooked until parts start to fail. A spark is just a spark, right?

Well, the answer isn't as binary as you might hope. And for those who are looking to upgrade, the buzzwords that get thrown around in the ignition world can be misleading.

"A lot of people want to talk about a 'hot spark', and that's a bit of a misnomer," says Garrett Weaver, product development manager for Pertronix Ignition Products in San Dimas, California. "It's a generic term that doesn't relate to millijoules of energy or anything like that — it has no specific value, and there's more than simply a voltage rating that something like a coil might carry that you would use to identify that a part is appropriate for an application."

The application in question today is the LS1 nestled in the engine bay of our mildly warmed-over 2000 Pontiac Firebird, which is notably supplemented by a 200-shot of nitrous. Here we'll take a closer look at the factors that are involved in determining the point at which it makes sense to step up from factory LS ignition parts, and the benefits that aftermarket components can provide under those circumstances.

When To Upgrade

Part of what's helped to make the LS platform such a juggernaut in the performance realm over the years is the robustness of the factory components, which offer substantial headroom for modification in most areas. Weaver is quick to point out that when it comes to ignition coils, the story is largely the same — up to a certain point.



Designed as a direct replacement to the LS factory coil (seen on the left in these images), the Pertronix Flame-Thrower coil not only delivers more spark energy, it also utilizes a bobbin made from specialized polyester compounds with improved shielding and increased dielectric strength, resulting in a more robust part overall.

"OEM LS coils can support many of the most common performance upgrades. Headers, cat-backs, and basic performance tunes are generally not enough to push OEM coils to their breaking point."

That means that typical bolt-ons are fair game with the factory coils, provided they're functioning as designed. But the story changes a bit when more ambitious modifications are introduced into the mix.

"When power adders such as superchargers, turbos, and nitrous systems are brought on, the demand for spark energy increases substantially," he adds. "As the cylinder pressures climb, you can run into a situation where you're essentially blowing out the spark with that pressure, and that's where you'll find the limitations of an OEM coil."

And the symptoms of exceeding those limitations can be fairly easy to spot.

"Combustion occurs up until the point where either the cylinder pressure gets too great and the coil is not capable of overcoming it, or the coil itself starts to fail due to age or other outside factors. That's where you get a lean misfire, or in some cases you can get a rich misfire. Typically, you're going to see that condition indicated by a code thrown by the engine."

But even if a coil isn't showing the obvious signs of creating a misfire condition, that doesn't mean that it is delivering adequate spark for the application.

"If the coil is the weak link in an engine combination, where it is not capable of providing enough spark energy at a certain RPM range or at a certain cylinder pressure level, you're not going to realize all of the power potential of the engine," Weaver explains. "You're in effect losing power in that condition, so by moving to a coil that can provide adequate spark energy, you're restoring the power that was lost to a coil that couldn't keep up with the rest of the engine combination. OEM coils are designed to support OEM performance levels. When performance modifications carry the engine beyond the normal operating range, the coil selection needs to be addressed. Taking an LS into the 7,000 rpm range and beyond will demand more spark energy from an OEM coil than it is capable of supplying."



The factory coil is a fairly stout part in its own right, but as a consumable component that's regularly exposed to heat and other abuses, they will inevitably need to be replaced soon or later, whether you're building power well beyond factory spec, or just freshening things up.

There's also the OE part's life span to consider, which is indeed finite and can be significantly shortened if they're used in a non-stock application.

"Heat is a big killer of coils," Weaver notes. "Radiated heat from the engine can create external coil failures like broken connections, damaged wire insulation, failed electronic modules, and other issues. Excessive heat from the coils' operation can also damage the secondary windings. Coils operating beyond their design limits can cause internal breakdowns, too, and that can be triggered by conditions like extreme cylinder pressure and excessive spark plug gaps."

"If the coil is the weak link in an engine combination, where it can't provide enough spark energy at a specific RPM range, or at a certain cylinder pressure level, you're not going to receive all of the power potential of the engine."

Above And Beyond OE

To keep the juice flowing even when the Firebird is running on spray, we ditched the factory LS1 coils for a set of Pertronix Flame-Thrower coils (PN 30821). These are direct factory replacements, keeping the installation simple. But while they might look nearly identical to the factory units, what's inside of them is significantly more robust.

"The Pertronix coils increase the spark energy by 10-15-percent (depending on the application) when compared to the OEM spec," Weaver says.

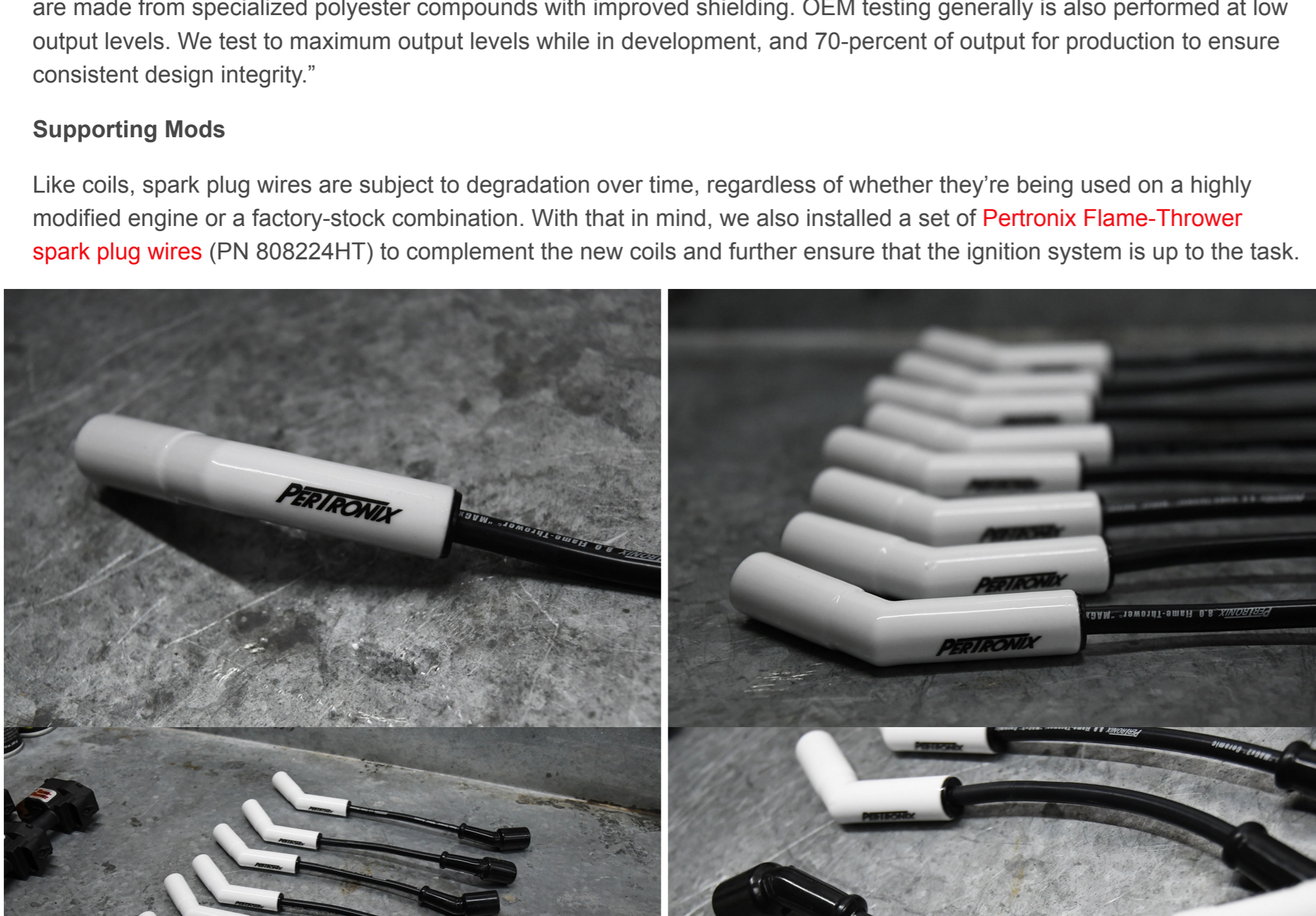
To accommodate the increase with the coils' output, the internal design also needed to be addressed. That includes the bobbin, one of the critical components in a coil's operation.



"The bobbin is responsible for insulating the primary and secondary winding from internal arcing. Warren explains. "As the spark is generated, any deficiencies in the bobbin result in a short. OEM coils use bobbins, which are rated at much lower output levels and are made from standard nylon. In contrast, we use bobbins with a much higher dielectric strength and are made from specialized polyester compounds with improved shielding. OEM testing generally is also performed at low output levels. We test to maximum output levels while in development, and 70-percent of output for production to ensure consistent design integrity."

Supporting Mods

Like coils, spark plug wires are subject to degradation over time, regardless of whether they're being used on a highly modified engine or a factory-stock combination. With that in mind, we also installed a set of Pertronix Flame-Thrower spark plug wires (PN 808224HT) to complement the new coils and further ensure that the ignition system is up to the task.

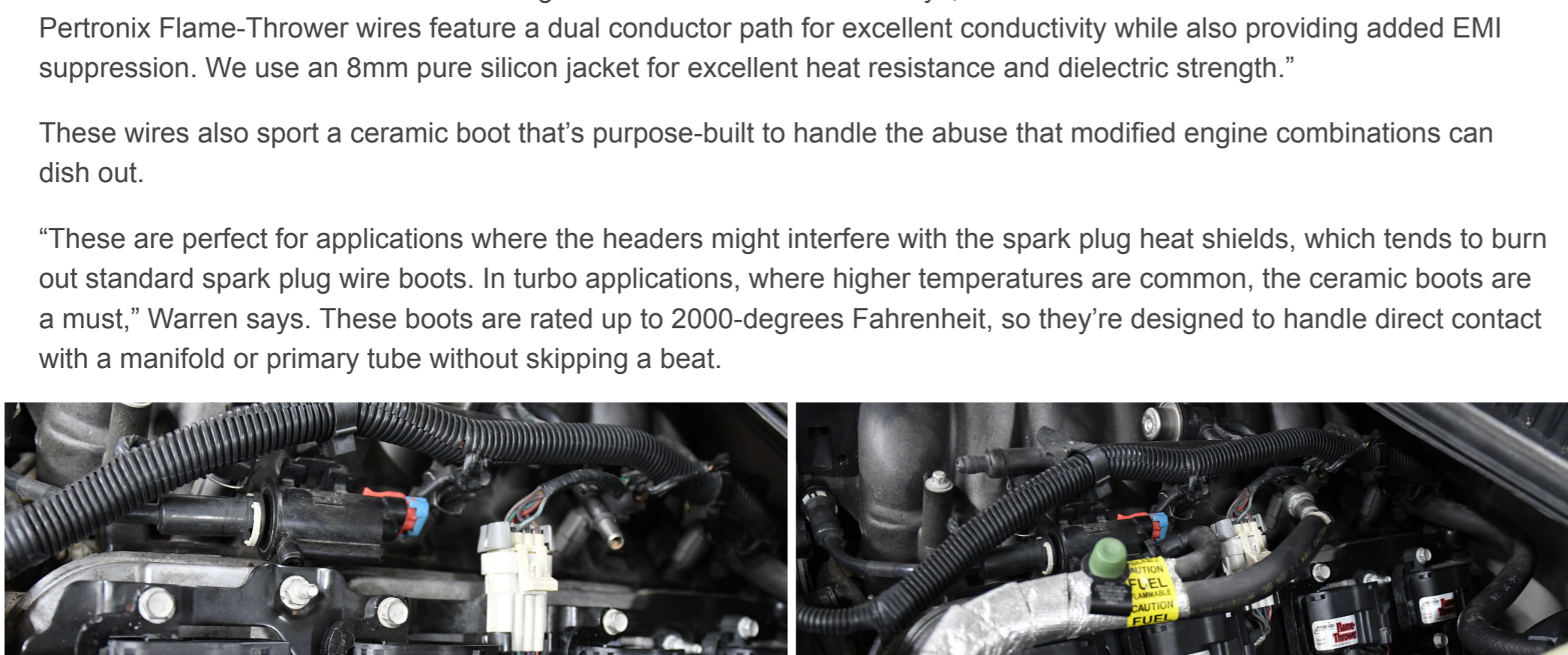


The Pertronix Flame-Throw spark plug wires are not only designed to handle the increased temperatures found in modified applications, they also look pretty sharp.

"Heat cycling, exposure to ozone, and other elements gradually wear down the wire's materials," Weaver tells us. "The wire's conductor can also become damaged in a number of different ways, and that results in increased resistance. The Pertronix Flame-Thrower wires feature a dual conductor path for excellent conductivity while also providing added EMI suppression. We use an 8mm pure silicon jacket for excellent heat resistance and dielectric strength."

These wires also sport a ceramic boot that's purpose-built to handle the abuse that modified engine combinations can dish out.

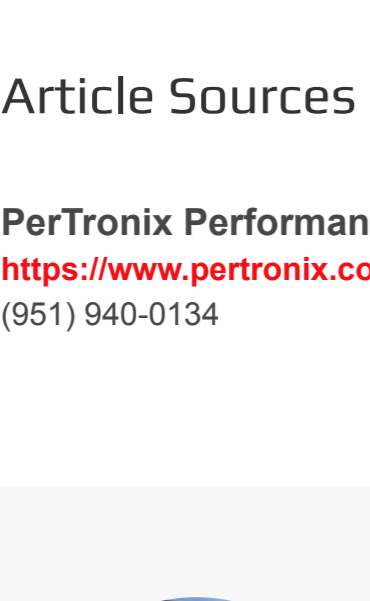
"These are perfect for applications where the headers might interfere with the spark plug heat shields, which tends to burn out standard spark plug wire boots. In turbo applications, where higher temperatures are common, the ceramic boots are a must," Warren says. These boots are rated up to 2000-degrees Fahrenheit, so they're designed to handle direct contact with a manifold or primary tube without skipping a beat.



With the Pertronix parts hooked up, we've got peace of mind that not only is the ignition system functioning as it should, it also has enough capability to keep up with our LS even under the most demanding circumstances. Can you say the same for your ignition system hardware?

Article Sources

Pertronix Performance Products
<https://www.pertronix.com/prodex/default.aspx>
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Lover of noisy cars, noisy music, and noisy buildings, Brad can often be found flogging something expensive along the twisting tarmac of the Angeles Forest.

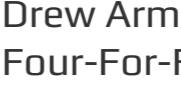
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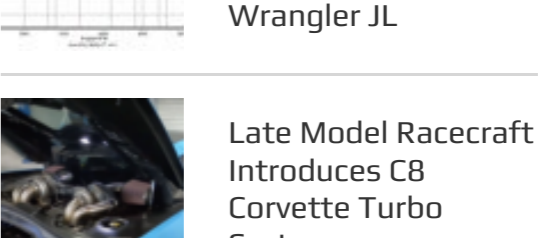
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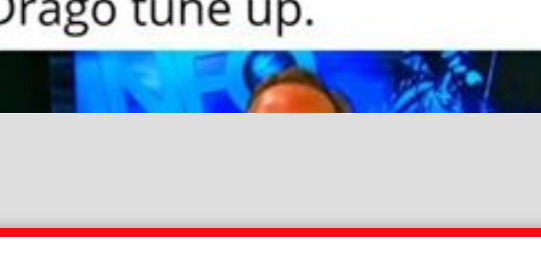


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