Let's talk about Corvair Ignition systems. Part one.

I will start with "inductive" ignition systems. Technically all coils have the output voltage "induced" in the secondary coil windings by a magnetic field traveling through them. In a stock system the primary windings create the magnetic field. When turned off, the field collapse, and some oscillations, induce the voltage in the secondary windings, firing through the plug to ground. This was the ignition type used in every original Corvair. A few Corvairs – 62-63 Spyders, specifically – had a separate resistor block wired into the engine compartment. This is the same method General Motors had used since moving to 12 Volt ignition systems on almost all cars in the mid-50s. As GM moved from 6-volt systems to 12 Volt systems, they could use an external resistor to "adjust" the output capability of the ignition. With proper wiring, the engine coil, while running, would use power supplied through that resistor circuit, 8-9 volts. Or the matching Spyder coil (the same, or similar to, the coil used on High-performance Corvettes) would produce enough voltage to fire the plugs, even under boost on a turbo. The Corvair coil primary resistance is listed as "1.28 to 1.42 Ohms". That said, Chevy still supplied only one coil as a replacement, at least by 1969. That coil is listed as 1.8 Ohms. I measured three of the stock coils at 1.4 Ohms. A wire from the cranking circuit to the output side of the resistor block still provided a full 12 volts to raise the coil output voltage while starting the motor. (A measurement note – At low Ohms readings, many Ohm-meters can vary in accuracy. I used three separate meters for every reading done.)

But GM found a cheaper way to provide the same effect. (big surprise!) And starting in about 1960 – on most Corvairs and other GM products, GM substituted a resistance wire in the engine compartment harness to drop the voltage feed to the coil for normal running. Ingenious wiring would still allow a 12 Volt feed while cranking. Almost all Corvairs have that resistance wire – identified by the glass/cloth braid - and rated at "1.8 Ohms"in the shop manual. (I measured two originals and a new replacement. All tested at 2.2 Ohms). On most Corvairs, this wire is inserted into the harness starting at the main terminal connector plug, running a few feet into the harness, making an internal U-turn, then exiting the harness and heading out to the two-prong starter connector plug. The actual terminal has a pair of wires crimped into it. One is that resistance wire, the other is a regular copper wire that goes around to the coil positive (+) side. When the ignition is switched on, the power feed to the coil comes from the ignition switch, through the resistance wire to the crimped connector and back through the harness on to the coil, feeding the reduced voltage. The other side of that starter plug terminal connects to the starter solenoid. The solenoid, if properly wired and in good condition, will provide a replacement straight 12 Volt feed out whenever the engine is cranking over, helping the ignition starting voltage. (It does not add to the resistance feed, it replaces it). Some later Corvairs (68-69?) have the dual crimped terminal at the coil positive post. But it functions exactly the same. The resistance wire feeds the coil during run conditions, the bypass wire feeds it 12 Volts (full battery voltage) while cranking.

With those specified and tested values there is a total of 3.5 to 4 Ohms resistance in the stock ignition circuit. (Voltage divided by resistance = amperage (current). With the 12-volt feed, the current in the circuit, while running, is around 3.4 Amps (Yeah, only when the points are closed). Using stock points, and an effective stock condenser, you can get 8,000 miles or more out of a point set. The condenser inside the distributor is connected to the points wire and absorbs and stores, for a fraction of a second, the current still present when the points are opening. (This helps reduce arcing across the points as they open). As the flowing current stops, and the magnetic field begins to drop in the coil, (to "induce" the

output voltage) and the spark starts across the plug, the condenser discharges what it has stored into the coil primary windings, (Often several times) helping to continue to induce the coil secondary voltage – and fire the plug! A friend described it like this: "When the Points "interrupt" the current in the Primary Coil Winding the collapsing Magnetic Field produces a voltage of OPPOSITE POLARITY that tries to 'maintain' that current and creates an ARC across the points as they open! The Capacitor "shunts" this current to ground, reducing the ARC. This allows the Magnetic Field to collapse faster, generating the High Voltage."

So, 3.4 Amps of current with a stock system. If you just swap a "hot" coil, what happens? Well, it depends on which coil. Most of the original "Hot" coils were 1.2 to 1.4 Ohms, a little less than the stock (1.4 to 1.8 Ohm) coil. So with the original resistance feed, the current in the system jumps to about 3.5 Amps. That is why points may not last as long even with just the hot coil added. The total resistance has gone down and the amount of current has gone up. Greater current across the points causes more arcing and material breakdown. If you bypass the resistance block/wire and feed a full 12 Volts to the coil, a set of points might only last 50 miles before failing and mis-firing.

Once the decision is made to move away from points, there is another variable added. An electronic system in a standard inductive system acts as a "virtual" set of points, switching the supplied current through the coil to ground, then releasing it. (This type of system is what the original 1974 GM "HEI" distributor was.) Whichever electronic system is used, it is designed to handle some maximum amount of current. There are switching transistors in the distributor that will fail if too much current has to be switched. Almost all can handle more current than the stock points. But all will have a maximum "suggested" current. Asking an electronic circuit to handle a higher current than the design calls for will shorten the component life. Sometimes drastically. Sometimes instantly.

Other variables:

One of the issues is "Hot Rodders". From day one, the hotrodders motto has been: "If some is good, more is better and too much is just right". Sometimes, maybe, but not here. In the quest to provide a bulletproof ignition, it is easy to exceed the limits of electronic components. Like many places on a performance car, the ignition should work as an integrated system. The electronic triggering systems actually have a pair of variables. The system itself has to have power to operate. Some systems really need the regular full 12 Volts, some will work fine on 8-9 volts, and some will work on anything from 5 Volts to 18 Volts. The manufacturers will tell you their recommended voltage, sometimes the optimum voltage. So you need to match the operating voltage of the system to your power feed. This can be independent of the input voltage needed by the coil to fire the plugs. It usually is not, since most aftermarket systems are just powered off the ignition feed at the coil. The voltage feed at the power input to the coil includes the resistor drop, if any, but not the coil resistance. If desired, the ignition power could be pulled off prior to the resistor circuit, and feed 12 volts to the system and 9 volts to the coil. The manufacturers do not want to tell you the max amount of current their systems will handle. Maybe they think it will be taken as a dare! About the only way you can tell is by their coil recommendations and their wiring suggestions.

Pertronix writes the following for the Ignitor 1 coil installation:

“The ignitor is compatible only with a “points type” coil. Eight cylinder engines require a minimum of 1.5 Ohms of resistance in the primary circuit. Four & six cylinder engines require a minimum of 3.0 Ohms of resistance (primary).”

I do not believe the resistance in the note indicates total primary resistance, just the coil. (The next Pertronix paragraph is why I believe it is referring to the coil only)

“How do I check my coil for resistance? A. First you need an ohmmeter. Remove all the wires from the coil. Attach the ohmmeter to both the positive and negative terminals. The reading should be 1.5 Ohms or greater for eight cylinder engines and 3.0 Ohms or greater for six cylinder engines.”

If you install a 3.0 Ohm coil and feed it with the stock resistance wire (2.2 Ohms) you have 5.2 Ohms total. – That works out to 2.3 Amps of current, less than stock. If you use the Pertronix 3.0 Ohm coil, (their recommendation) and bypass the resistor, it uses the same current as the stock points, 3 Amps. According to Pertronix, the Ignitor requires 8 volts minimum, so, unless you have a voltage drop somewhere else in the ignition feed circuit, bypassing the resistor is fine. But - If you bypass the resistor feed on an Ignitor 1 installation and feed a full 12 Volts with a stock (1.4 to 1.8 ohm) coil, you will be exceeding the Pertronix current limit at 6.6 to 8.6 Amps. This may cause problems and is likely why Pertronix does not recommend it. If, in the true spirit of Hot Rodding, you use the Ignitor with the resistance bypassed and add a really hot aftermarket coil, like the MSD Blaster 2, (.7 Ohms) you will be asking the Pertronix Ignitor to switch 17 Amps of current. Good luck. This applies to ANY aftermarket ignition system, including the Ready-to-run TSP distributors. Measure and do the math ahead of time.

Let’s talk about Corvair Ignition systems. Part Two.

1960 was 60 years ago. At that time new cars had short intervals for service. Oil and filter changes, and tune-ups were how the dealership made a lot of their money. In the early 60s, new smog regulations (and extended warranties) forced the car manufacturers to supply cars that would last longer between service intervals and make Fuel and Ignition systems more reliable, to reduce smog output due to deterioration over time. Points needed adjustment and points plate wear, leading to strange timing changes. This change resulted in the use of better quality and longer lasting components. Many smog-system components had to last a full 50,000 miles. And the car had to pass, with only minimal service, a smog test during that period. The first OEM electronic ignition systems in regular use was a Chrysler system in 1972, Ford in 1973, then GM “HEI” system in 1974 (on several models). All three systems used magnetic triggers inside the dist. Chrysler and Ford used external boxes, GM built the circuitry inside, with a coil mounted on top of the cap (on most models). AT the time of the assembly of the last Corvair in 1969, these systems were only a glint in an engineer’s eye. (GM, and others, had flirted with electronics in a few specialty models in prior years, but these were the first large scale adoptions.) If the Corvair had lasted until 1974, GM would likely have added the electronic ignition systems, as they did with the several safety systems added in 1967. The full line of cars got the HEI distributor as standard in 1975. The GM HEI distributor was much larger in diameter than the original Corvair dist, either the 60-61 or the 62-69 styles. To fit it into the corvair, the unit must be mounted much higher than the Corvair unit. In addition several main parts must be changed to make it compatible with the Corvair installation.

But several people have done this installation. It became easier in 1982, when Chevy brought out an S10 pickup V6 distributor which was smaller in diameter. It still needed housing and shaft changes to fit into the Corvair engine. Many people have also done these conversions. Both the in-line six and the S10 distributor used an external coil. Back in the 70s, many racers opened up the Corvair distributor, mounted a Chrysler magnetic reluctor (That is what the spinning magnet is called) and the magnetic pick-up. These parts were originally designed for the Chrysler "Slant 6". The smaller cap diameter was a limit to the voltage handling capability of the Corvair size dist. Some people just used the Chrysler ignition control box. Others used the magnetic pulse to trigger aftermarket ignition systems.

Aftermarket Ignition Systems

It is worth noting that the ignition system is really two systems working together. One system is designed to properly read in the inputs and schedule the firing of the spark plug. The other system just does what it is told to do. When told, it fires the plug. The triggering can be done with many methods. On the stock Corvair, the points are the trigger. The spinning cam in the distributor opens and closes the points, at a time dictated by the position of that cam, the points and the amount of gap. In a regular point-type system, the current through the points also ends up firing the plug, based on the induction of the output spark in the coil. When the points open, the spark plug fires.

Although the car dealers loved the shorter service intervals through the 1950s and 1960s, many car owners didn't like the constant "drain" on their budget. The first route the ignition aftermarket took was to address the short service intervals – save money by not having to replace parts and pay labor. At this point, the aftermarket ignition manufacturers took a couple of different routes or approaches to the aftermarket. Some manufacturers de-coupled the two functions, using the original trigger (the points), and substituting their own electronics for the inductive system of the original manufacturers. Others offered a complete replacement system. Points, even if not working so hard, can still wear and change timing. One of the advantages of decoupling the position reading and the actual firing of the system is that it allows you to modify the output timing based on other factors, such as boost on supercharged motors and pinging, via some sophisticated devices, such as the Safeguard box.

Capacitive Discharge (CD) ignitions.

These systems were usually a small aluminum box where the original points were connected, instead of connecting directly to the coil. The box was connected to the coil and had electronic circuitry that took the point open signal – in the form of reading the grounding through the points and the open as they were lifted up, then using the circuitry when to tell the coil when to fire. The box controlled the power out to the coil, not the points directly. The role of the points shifted, they no longer had to carry much current since they were just an indicator switch/trigger for the box. The points could now (theoretically) last much longer, the faces of the points did not arc across, because the current carried across them was so small. The only downside to that is a spec of dust on the points can cause misfiring, so they must be kept clean, even though they don't burn. The famous Delta Mk 10 and Mark 10B are these types of systems. They are both capacitor discharge (CD) designs and both use the original points for triggering. These systems were often offered in kit form, for the do-it-yourself electronics guy (think Heath Kits and Radio Shack). There really were a dozen manufacturers of these systems at one point.

The Delta Mark 10 capacitive discharge ignition system is a good example of a decoupled system. They used the original trigger, but addressed only the coil firing portion.

The CD ignition is fundamentally a different method of firing the plug at the right time. Instead of building a magnetic field in the primary windings of the coil, then allowing it collapse and induce a multiplied voltage in the secondary (based on the winding ratio of the coil), and firing the plug, a CD system loads the current in the capacitor inside the external box and, at the appropriate time, stops loading, and then that capacitor discharges the built-up power through the primary windings of the coil, instantly "inducing/creating" the same effect on the secondary windings as the collapsing magnetic field does on an normal "inductive" system. It still induces the current in the secondary windings. This fires across the plug. And it does it very, very quickly. It can be a more powerful, but shorter duration, spark. But the short duration (and no wait for the next field to build) allows the circuitry to load and discharge the capacitor several times in quick succession. (Multiple-Spark Discharge) MSD, now part of Holley, was the company to first market this technology. (It is questionable technically, but great marketing!) The Multi-spark technology goes away as the RPM goes up, as the systems runs out of time.

The MSD-6A and the other dozen or more units still on sale can be triggered by the stock points, just like the Delta Mark 10. Almost all new systems, however, can also be triggered by a magnetic pulse from the distributor. Do you remember that Chrysler/Ford/GM magnetic pulse distributors that replaced the points in the 70s? They can plug directly into most aftermarket ignition boxes. In the last 20 years, the market has also added replacement magnetic pulse distributors which plug directly into these boxes. The industry calls these "Pro-billet" units. No electronics inside, just the magnets. To cover the market, most of the current distributor suppliers are now also supplying "Ready-to-run" distributors with the electronics contained inside. No external box needed. For clearance reasons, most of these are based on the smaller GM distributor design, used before the HEI units came out. GM built the "Dwell-adjust window in-cap" units from 1957-1974. The theory is the same as the original GM HEI of the 70s, but the parts inside are not GM parts and are not interchangeable with actual GM HEI parts. Both types of distributors are now available for the Corvair engine. If looking at one, check the wiring, if two wires come out, it is a magnetic pulse unit. If three (or more) wires come out it is likely a ready to run unit.

Besides the External boxes, several manufacturers have built systems that can fit partially into the Corvair distributor, and partially outside with a separate box. The F.A.S.T. (formerly Crane/Allison) system uses an optical trigger and an external box. You might even find an old Mallory distributor around. Besides the Dual-point units, they built a Uni-lite version with self-contained electronics.

The last 20 years of shift in the car manufacturers to even newer systems, waste-spark and coil-on-plug type, will eventually end the market for the older systems, but that is likely a long way down the road.

Compatibility with Electronic Fuel Injection

In the last 10 years, several companies have built on the last 35 years of OEM technology, and parts availability, to bring out retro-fit Electronic Fuel Injection systems to replace carburetors on older cars. Since most aftermarket buyers do not have the capability of "tuning" the new Fuel injection systems – which really requires an engine or chassis dynamometer – many of the new systems have self-learning capability. You install them, plug in some basic parameters, then drive them. They "listen and listen" – via an exhaust Oxygen sensor – to how the motor is running and make the fuel feed adjustments for you. These systems can control ignition timing, as well as the fuel flow. For many older cars, like the

Corvair, this means changing the function of the distributor to a data input for the system, locking out any advance, and no longer controlling the spark timing, although it will still “distribute” the spark via the rotor, cap and wires. All new cars have a crank position sensor – and sometimes a cam position sensor – built into the basic design of the motor. Since these systems were not even a glint in the eye of the 50s/60s engineers who designed the Corvair motor, the sensors, if needed, are usually added to the outside of the Corvair engine. Both the Pro-billet and the Ready-to-run distributors can be locked out to provide the (virtual) crank position signal to an EFI systems, or to a programmable Ignition system.

What to do, What to do?

So, in terms of action on your part. It is important to note that the most sophisticated ignition system will only provide enough spark to fire across the spark plug in your car. If your engine really only needs 18 thousand volts to fire the spark plug, that is what the systems will actually produce. The newest High-Tech system may be “capable” of producing a 45-thousand-volt spark to fire an IndyCar Turbo motor. But when installed on your car - - it will fire those plugs of yours at 18 thousand volts, then go on to the next cylinder.

So - If you are just trying to lower maintenance on your regular street driven Corvair, you can keep a set of points, on a good point plate, and add an external box to heat up the spark. Almost all aftermarket CD boxes can be triggered from a point set wire out. Or you can add a points replacement system, like the Pertronix Ignitor or the FAST/Crane units. The Ignitor replaces the points plate, the optical trigger on the FAST/Crane unit lessens the impact of any wear of the plate. Be sure to match the wiring feed and the ignition coil needs, dictated by the system manufacturer. (Do the math) Next up is the “Ready-to-run” distributor. Available with either the OEM style cap for stock wires, or a pin type cap for HEI style wires, the units come with extra parts which will let you customize the unit’s advance curve for your engine. Again, match the power feed and the coil load for your system.

Performance Systems

If you have made other changes to your engine, different carbs or cam, things that will increase the RPM and Horsepower output, you may need a more powerful ignition system. If everything is working okay, a hotter coil might be enough. If you want a more precise spark, an electronic distributor is usually more precise and can be used to trigger a hotter coil or a Capacitive Discharge box. With a hotter cam, the vacuum advance can start acting weird, with pulsing and erratic idle. It can be removed and locked out For anything short of track racing, a Pro-billet distributor, set to 140 advance specs, driving an external CD box with a matching coil should be fine. Beyond that might be a programmable advance box, with a fixed position sensor, or an external control with an EFI system. The skies (and $$$) are the limit. We are lucky that we have all these options open to us.

Seth Emerson – Silicone Wire Systems - Stinger Ignition Products