



COIL ON PLUG TECHNOLOGY

The creation of a high quality ignition system has been a challenging process for OEMs that has taken many years in research and development. Recently, technology has introduced to the automotive market the next generation of high performance ignition coils which offer the latest in ignition technology for improved spark output and engine reliability. With the latest cutting edge technology our engineering department has further refined ignition coil design to allow for improved power output with reduced noise emissions.

The Coil On Plug ignition is the latest development in precisely controlling spark intensity and timing for optimum power, fuel economy, and low emissions. Most 'coil on plug' (one coil for each spark plug) systems are actually 'coil near plug' because a short mechanical connector, or spark plug wire connects the coil to the plug. True coil on plug systems, with the coil mounted directly to the plug, are now being introduced on both domestic and foreign engines. One such example is the XCOP ignition coil which was developed for Ford engines.

A strong spark requires high voltage. In order to maintain the high voltage we must ensure energy output is not compromised. One such method to accomplish this is through advanced circuit compression models.

CIRCUIT COMPRESSION

High-voltage circuits always risk degradation at any connection point between two parts. High voltage also will escape from its intended circuit whenever it finds an easier path to ground due to component failure or insulation breakdown. With coil on plug, there is no high-tension lead between the spark plug and the ignition coil. The system 'compresses' the secondary ignition to the minimum number of components and reduces the distance high-voltage circuit must travel.



OEM STYLE COPS USE A TORROIDAL POWER INDUCTOR THAT REQUIRES INTERCONNECTING WIRES.



HIGH TENSION LEAD BETWEEN IGNITION COIL AND SPARK PLUG. OEM STYLE UNITS ARE A COIL NEAR PLUG DESIGN.



XCOP USES AN AXIAL DESIGNED POWER INDUCTOR ALLOWING THE POWER TRANSFER TO BE DIRECTED TO THE SPARK PLUG WITHOUT ANY INTERCONNECTING WIRES.

THE XCOPS ELIMINATE THE HIGH TENSION LEAD BETWEEN THE IGNITION COIL AND SPARK PLUG WHICH IS A TRUE HIGH EFFICIENCY COIL ON PLUG DESIGN.



Because of circuit compression overall system impedance and power loss is reduced, thus increasing the available power produced by the ignition core across the spark gap.

ADVANTAGE XCOP

Taking an existing coil and tweaking the internals for reproduction offers
COPY OEM COIL NEAR PLUG (CNP) DESIGN

- * Cost savings, since there is zero development time in re-designing the packaging.
- * Zero improvements on packaging, weight.
- * Same voltage and power loss through the OEM connections and interconnect.
- * Position, design and principals for the new ignition coils remains the same as OEM CNP units.
- * Internals can be revised.

Creating a new ignition coil from scratch offered
CREATING A NEW COIL ON PLUG (COP) DESIGN

- * Improved ignition coil position for improved energy transfers.
- * The cylindrical coil can be installed in the plug hole, which was previously a “dead space”.
- * Improved ignition coil position for reduced RFI/EMI.
- * Improved packaging.
- * Improved efficiency and output by reducing transmission length of high voltage to the spark plug.
- * Improved efficiency and output by reducing problem prone connection points.
- * Reduced noise output by reducing problem prone connection points.

MATERIAL SELECTION AND MATERIAL CROSS SECTIONAL AREA.

Simply, the larger cross section of material present, the more current and voltage carrying capability the material can conduct with reduced loss. CNC'd profiles of coil connection points accurately match and secure the spark plug terminal allowing for tighter tolerances and a more accurate connection to the spark plug over any other alternative.



A proprietary blend of Copper and Zinc metals is optimized to create a material that conducts over 35 times more effectively than stainless steel while resisting corrosion.

Electrical Conductivity of Metals (Higher number = better conduction)

Copper 100 (70% XCOP)
Zinc 28.2 (30%XCOP)
Nickel 12-16 (STAINLESS)

Steel 3-15 (STAINLESS)
Titanium 5 (STAINLESS)
Vanadium 6.6 (STAINLESS)

With our proprietary material selection, higher cross sectional area of material and reduced length from the power inductor (or coil) to the spark plug, conduction of the electricity to the spark plug is superior to any alternative material. It is also noted that our combination of materials is used extensively in electronics applications due to the nature of the metals ability to resist corrosion and transfer electricity exceptionally well.

EMI/EMC and RFI development

EMI/EMC and RFI control are serious factors to take into consideration when designing part of an ignition system. Electromagnetic interference (also called EMI, Radio Frequency Interference, and RFI) is electromagnetic radiation which is emitted by electrical circuits carrying rapidly changing signals, as a by-product of their normal operation, and which causes unwanted signals (interference or noise) to be induced in other circuits. This interrupts, obstructs, or otherwise degrades or limits the effective performance of those other circuits. It can be induced intentionally, as in some forms of electronic warfare, or unintentionally, as a result of spurious emissions and responses. If they are not accounted for properly, fuel injection, computer calculations and radio devices could be affected causing automobiles to run poorly.

During the spark event a great deal of radio frequency interference (RFI) and electromagnetic interference (EMI) is created. Uncontrolled in automobiles, this can show up as static in the radio or other electronic devices, or much more seriously, in electronic ignitions, fuel injection, and engine management systems. This interference with EFI and engine management systems can cause "cross talk" between wiring harnesses resulting in poor running, misfiring and decreased performance. Also note, if noise is left unchecked a large enough EMI pulse can actually damage onboard electrical circuits.

REDUCED TRANSMISSION LENGTH

EMI and RFI interference reduction became a critical point in development and is another reason we developed a true C.O.P. unit. Wires after an ignition coil can become emitters or antennas that can transmit RFI and EMI signals to your vehicles electronics. A true C.O.P. unit does not have these wires or any emissions antennai. OEM style units have a wire from the coil to the spark plug that can artificially increase the noise emissions in the system.

Using a true C.O.P. design our engineers have totally eliminated the interconnecting wire needed so that there is ZERO antenna for RFI and EMI transmissions resulting in reduced electrical system impedance for a higher quality spark output while reducing EMI and RFI interference.



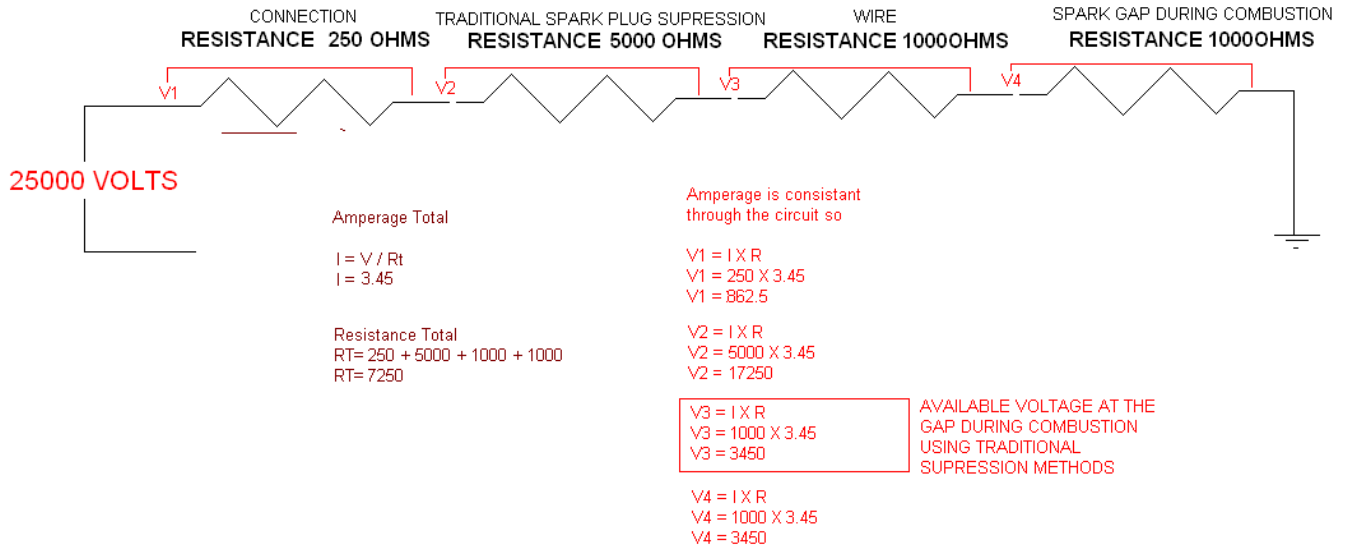
IMPROVED SHEILDING

Typically left out of electronic equipment due to cost restraints, our engineers have spared no expense developing a high quality EMI/EMC and RFI shield which, when combined with the ignition coil location, reduces harmful airborne noise emissions caused by the ignition circuit.

PATENT PENDING EMI AND RFI CONTROL

Internal to the OEM setup and spark plug is what is called a pill resistor designed for use in spark plugs as suppressors. Plug Pills are manufactured from a carefully selected mixture of clays, alumina and carbon. After blending, the material is pressed to the required shape and then fired, in a controlled atmosphere, at high temperature. These pills are not very effective conductors of heat or electricity and cause a reduction in power output in the ignition circuit by reducing voltage at the spark gap.

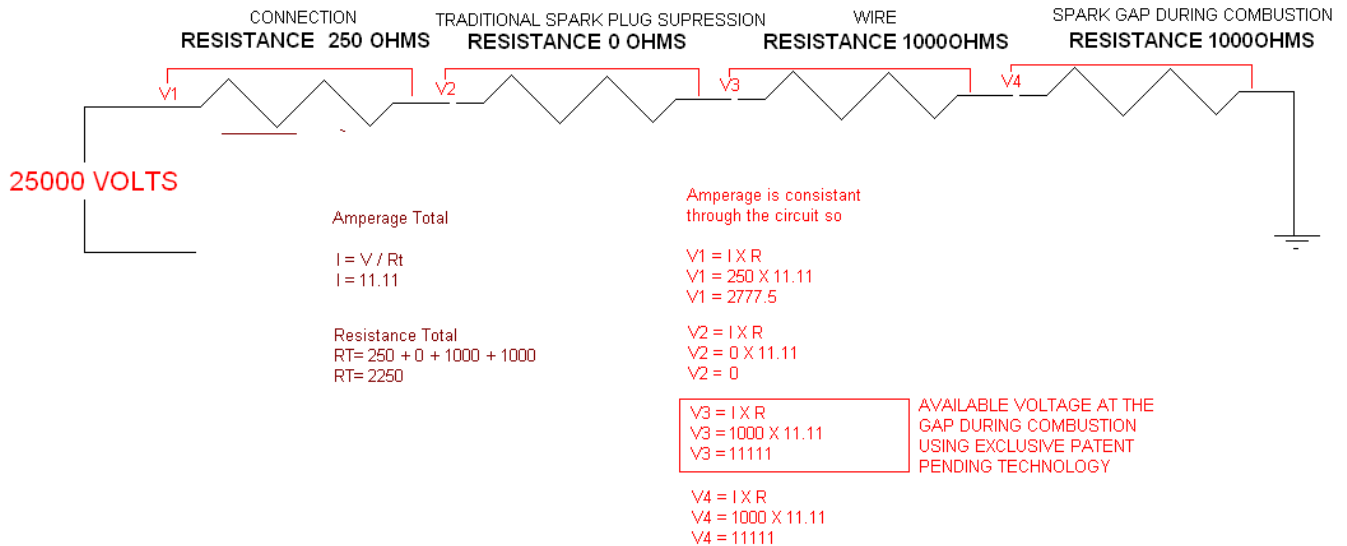
TRADITIONAL EMI SUPPRESSION METHODS



During the creation of a spark event most of the energy in the system is available at the spark gap. Once the spark is bridged and the gap is ionized there is a massive shift in energy. When the spark is bridged the energy shifts from the spark gap since the bridge dramatically alters from an infinite resistance to a resistance of less then 1000 ohms during the combustion event.

At this time conventional carbon noise suppression methods rapidly dissipate available energy at the gap through heat and voltage loss at the spark gap. In the best real world example typical carbon suppression uses a minimum value of 5000 ohms and diminishes 17250 volts across itself. The result is 3450 volts at the spark gap to help promote the flame front.

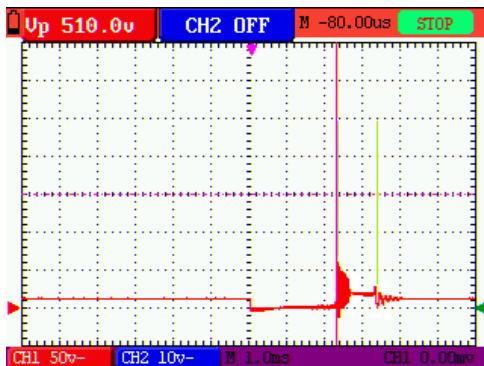
IMPROVED EMI SUPPRESSION METHODS



Through innovative and exclusive techniques our engineers have made many valuable improvements to the existing ignition system which include a traditional non suppressor spark plug and an ignition interference eliminator box with integrated electronics which drastically reduces ignition interference levels while increasing engine power response and output.

Using this technology in the same system there is a boost of voltage available at the spark gap during the spark process by over 300% vs the best performing traditional noise suppression methods and by over 1000% in a best case scenario. Best case standard suppressive methods allows for approximately 3500 volts at the spark gap after ionization occurs with a worst case of 1500 volts at the spark gap during the combustion process resulting in power loss in the combustion chamber. WeaponX's newly developed methods allow for approximately 12000 volts at the spark gap after ionization resulting in a cleaner more complete combustion all with better noise suppression.

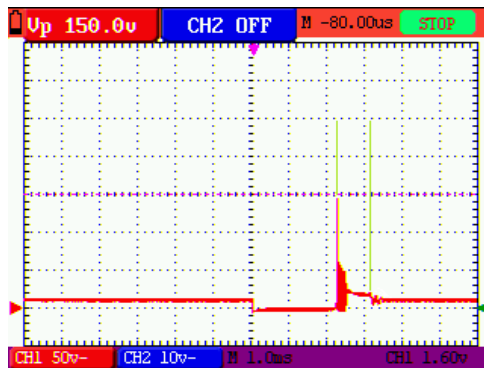
NO NOISE SUPPRESSION – NON SUPPRESSIVE SPARK PLUG (0 ohm)
TEST CONDITIONS 12V INPUT, 2.2mS DURATION ON TIME
NOISE AT THE IGNITION MODULE



Typical non resistance spark plugs produce counter emf voltage spikes in excess of 510Volts where our oscilloscope fails to read any higher. These spikes are the major contributor to interference issues in modern day engine management and electronic devices.

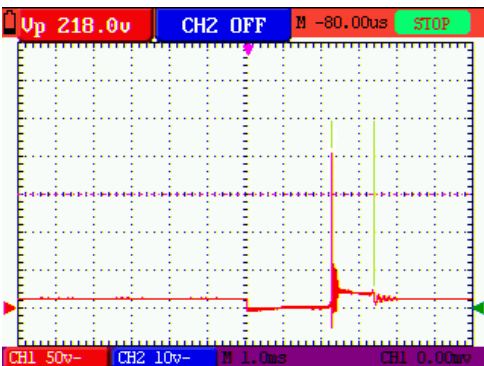
**NOTE: SPARK ON TIME IS SHOWN IN EACH EXAMPLE BETWEEN THE GREEN MARKERS*

STANDARD RESISTOR NOISE SUPPRESSION MODEL– SUPPRESSIVE SPARK PLUG (6000 ohm)
TEST CONDITIONS 12V INPUT, 2.2mS DURATION ON TIME
NOISE AT THE IGNITION MODULE



Standard resistor suppression allows for reduced counter emf voltage spikes which occur at an approximate amplitude of 150Volts. The discerning eye should also note the reduced ignition coil on time, highlighted between the green window, due to the series resistance causing energy loss as heat.

WEAPONX NOISE SUPPRESSION MODEL– NON SUPPRESSIVE SPARK PLUG (0 ohm)
TEST CONDITIONS 12V INPUT, 2.2mS DURATION ON TIME
NOISE AT THE IGNITION MODULE



WeaponX noise suppression models excel in two independent areas. The first being reduced counter emf voltage levels from the non-suppressor model. Interference voltage levels are reduced to 218Volts from +510Volts. The second area is that there is no appreciable loss of energy output at the spark gap vs the non suppression model. The ignition coil on time is identical to the non-suppressor model which shows improved 25% better spark on time (gains of 200uS) vs the standard resistor noise suppression model above.

Also, note that over time typical carbon suppression devices have a tendency to break down reducing power output and noise suppression abilities whereas the electronic components of the WeaponX Interference eliminator have a lifespan quadruple that of a typical automotive ignition coil and do not degrade over time.

ExtremeX spark plugs are available without the carbon resistor since electronic suppression devices and external shielding is installed on the ignition coils to control EMI and RFI output. When these techniques are effectively introduced interference levels drop below the typical threshold in comparison to using typical carbon pill suppressive means. This reliably allows for higher power output, lower circuit resistance, improved energy conservation all while reducing EMI/EMC and RFI emissions in the ignition circuit. Since carbon suppression methods are not used in the ExtremeX line of spark plugs these higher outputs can be achieved without issue.

FURTHER ADVANTAGES OF WEAPONX IGNITION COIL TECHNOLOGY

- *Reduced system impedance (resistance) of the COP design by removal of connection points and ignition wire which creates a better spark output.*
- *Reduced system impedance of the COP using electronic suppression techniques rather than the typical carbon pill.*
- *System impedance reduced by as much as 300% over the OEM coil near plug design. (250% depending on wire / spark plug used)*
- *Improved heat transfer abilities through the removal of ignition wire and carbon core suppressor resistor.*
- *Improved heat dissipation through removal of the coil covers.*
- *Cutting edge technology for your street machine.*

ENGINEERED TO PREVENT SPARK FLASHOVER

Engineered to harness extra energy through a variety of engineering enhancements the XCOP ignition coils successfully developed to transmit high energy to the spark plug, not loose it through spark flash over.

To reduce flash over in extreme voltage environments an all exclusive boot was developed to allow high voltage operation during harsh environments while preventing any voltage loss in the system in extreme operating conditions. The interior of the boot has corrugated ribs that conforms to most popular brands of spark plugs sealing the spark plug and reducing the probability of spark flash over.

In extreme operation spark can even travel from the ignition coil directly to the cylinder head bypassing the spark plug and boot all together. The development of an external high voltage sleeve also prevents any unnecessary voltage loss to any grounds in the engine bay.

Measures taken to encase the ignition coil in a quality high voltage sleeve prevents against power robbing engine misfire events all while allowing high output operation. This is especially useful when used in conjunction with high output ignition amplifiers allowing for energy containment all while directing it to the cylinder for reliable high output sparks.

**OEM UNITS DO NOT
HAVE CONTOURED
RIBS**

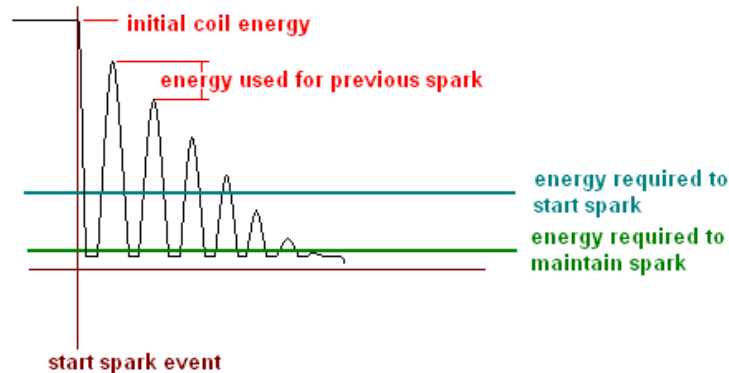
**INTERNAL RIBBING ON XCOP CONTOURS TO SPARK
PLUG ALLOWING FOR REDUCED SPARK FLASHOVER**



MULTIPLE SPARK DISCHARGE

It is possible to create a multiple spark discharge on an inductive ignition without an ignition source that is not triggering the spark event. When a typical inductive style solid state ignition unit interrupts power flow to the ignition coil the internal electronics proceed to induce a current flow into the inductive windings of the coil stepping up voltage and spark potential.

Once the spark starts the air between the spark plug electrode and ground electrode becomes ionized and the spark is bridged causing the remaining energy in the ignition coil to keep the spark maintained. This energy is much less than the starting energy and the power needed from the XCOPS to maintain spark drops. When the power requirements drop the ignition coil is allowed to supply supplemental high bursts of spark energy creating a unique multiple spark discharge event at specified frequencies. This event is created in the XCOP coils by controlling a natural electronic ring in the ignition coil similar to multi spark events. This continues at the gap until the energy in the ignition coil has extinguished.



MAGNETIC FIELD

One of the keys to producing a reliable and high output spark is to ensure the internal components and internal magnetic fields interact with as little loss as possible. The key to creating a high intensity spark is to create a large magnetic field with the available input power. This magnetic field is what is harnessed to step up the voltage internal to the ignition coils.

One way to increase the power output is to also increase the primary magnetic field. This is accomplished by supplementing that field with high output magnetic devices. Many suppliers do not use this technology due to cost cutting, but we have found it essential to providing a reliable, high output spark event. These devices ensure that the magnetic field created by the ignition coils are increased proportionally, thus increasing output power. Location, type, size and strength are all tested to ensure the highest possible output.

IGNITION DWELL TIME

Dwell time is a critical component when it comes to proper inductive ignition performance.

Dwell refers to many important ignition test parameters but primarily refers to the amount of time required to charge the ignition coil primary field to maximum energy capacity. Over charging the primary field will result in extra heat on the driver in the pcm and the coil. Over charging the ignition coil through excessive dwell time can damage ignition coils nearly instantly but due to WeaponX's high output construction we are able to have increased dwell time which results in more energy in the primary field of the coil. This results in a larger spark from the secondary field and offers increased performance benefits along with it. These dwell settings have been exclusively tested by WeaponX in order to achieve ideal operating performance, long service life for our equipment and are given EXCLUSIVELY to Delta Force tuning for all supported WeaponX applications. (www.deltaforcetuning.com)

O.E.'s configure dwell settings for O.E. Ignition coils and customers of our equipment can now take full advantage of our high performance ignition coils through use of Delta Force Tuning Software while knowing you will receive reliable, warranty approved settings and improved ignition performance!

These optimized value files, exclusive to DELTA FORCE TUNING (DeltaForceTuning software), further enhance the overall performance package of late model Ford engines. This enhanced feature is meant to improve overall horsepower, fuel mileage and engine performance and has R&D currently unseen in the industry for ignition coils. The WeaponX ignition coil lineup is the most technologically advanced, research intensive ignition coil on the market today.

FINAL NOTE

XCOP coils are a combination of many high quality technologies and engineering principals from various fields combined to create the next generation of high power ignition devices. You can also be assured that with the purchase of this equipment you will receive top notch customer service and quality ignition components.

Any questions? Please feel free to call or email us at.

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