



## **WeaponX Ignition Coil Technology**

WeaponX designs and employs the greatest performance proven technologies available. 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, new technology introduced into the market allows for the next generation of high performance ignition coils which offer the latest in ignition technology for improved spark output and engine reliability. WeaponX integrates all the latest technology on a platform by platform basis allowing WeaponX to improve all internal and when possible external components of the ignition coil for maximum reliability and performance. These new technologies, developed by WeaponX and other companies takes ignition coil performance to the next level.

One such example of this is the true coil on plug ignition which 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 interconnect placed between the ignition coil and the spark plug. True coil on plug systems, with the coil mounted directly to the plug, are superior and are now being introduced on both domestic and foreign engines. One such example is WeaponX designed EFX, true coil on plug ignition coil.

The benefit to true coil on plug units is that in order to maintain the high voltage we must ensure energy output is not compromised. Methods WeaponX uses to accomplish this is through circuit compression, positive CNC'd connections and large amounts of insulation where required. In this document we will detail a few of the steps WeaponX takes to ensure reliable high output performance from our products.

## **WEAPONX CIRCUIT COMPRESSION**

High-voltage circuits always risk degradation at any connection point between two parts. When this happens and there are poor connections high voltage also will escape from its intended circuit especially if it finds an easier path to ground. 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 energy must travel.



OE style ignition coils often use loose and poor fitting spring interconnects causing HV loss and poor performance characteristics.



When possible for the application WeaponX designs it's Internal circuitry to connect directly to spark plug, with a high tension CNC profiled connector for the best power transfer and minimal high voltage loss!



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

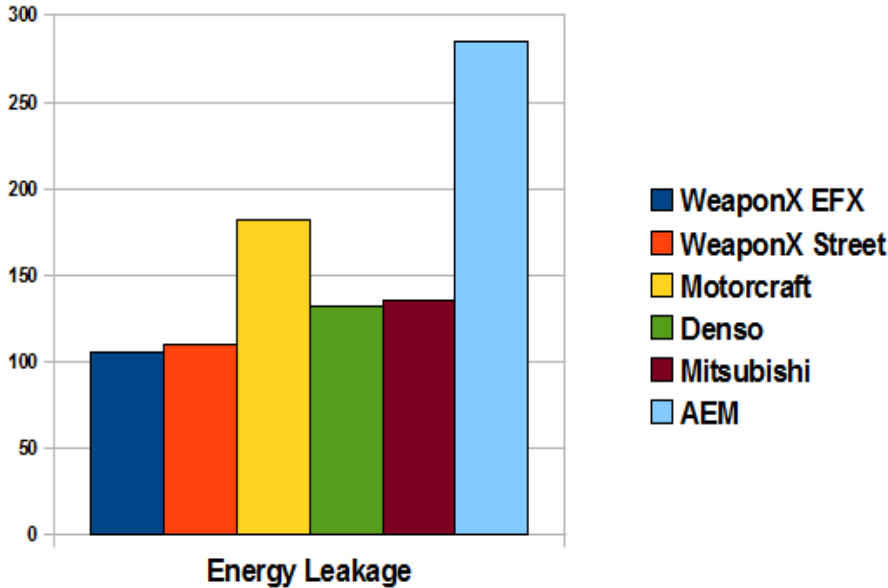
There are many types of power inductors such as toroidal, and axial. In the above figures the energy stored in WeaponX design is transferred more effectively than in the OEM style ignition coils due to the compression and removal of the ignition coil 'wire'. By compressing the ignition coil circuit the stored energy does not need to travel as far and has half the connection points as OEM designs increasing reliability, power output and increased efficiency.

## WEAPONX COP VS COMPETITOR COP VS OE MOTORCRAFT

Several companies are now producing ignition coils in direct competition to WeaponX.

### ENERGY LEAKAGE

The ability of the coil to convert it's stored energy into a spark is of high importance. The energy that is not converted into spark energy is electrical loss and poor electrical and component efficiency. The cost of our coil would half if we decided to use poor quality components. Below are measured values of the electrical loss with competitor ignition coils vs WeaponX.



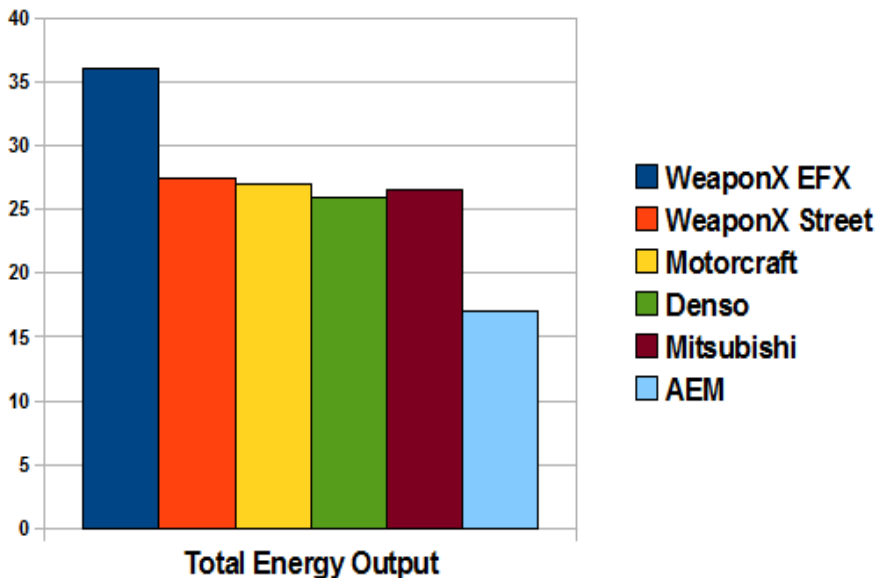
Pencil style ignition coils  
Denso/ Mitsubishi/ AEM/ WeaponX  
Standard style  
Motorcraft Coil Near Plug unit off of 04  
Mustang Cobra

**Lower is better.** The total is stated as pure magnetic loss (micro henry). As seen, certain competitor ignition coils have over twice as much loss as WeaponX designs. Even the first generation WeaponX Street ignition coil has less loss than all other designs, while the latest EFX version has the highest efficiency of all products listed. As seen the internal / external design of the Motorcraft coil leads to high magnetic losses meaning lost energy due to poor efficiency of overall design.

### TOTAL ENERGY OUTPUT

What puts all questions aside is the pure electrical output vs electrical input energy.

Perhaps the best indicator of an ignition coils ability to produce spark is finding it's rated output per given input. In the chart below all ignition coils are charged to 7 amps each and are then discharged with the same spark plug at the same gap size. What is measured and displayed in the chart below is the **total energy output** (voltage and current over time) which gives an excellent indication of the ignition coils ability to create a long burn, high output spark event.



Pencil style ignition coils  
Denso/ Mitsubishi/ AEM/ WeaponX  
Standard style  
Motorcraft Coil Near Plug unit off of 04  
Mustang Cobra

**Higher is better.** With each ignition coil charged to 7.0amps the WeaponX ignition coil outputs MORE total energy over time than all other competitor designs. This test isn't merely displaying voltage but overall energy discharged over the time it is firing.

## HIGH VOLTAGE INSULATION / PROTECTION

While other solutions focus on cost savings, WeaponX uses an approach that is quality first. Often times ignition coils use components that “get the job done”, while WeaponX focuses on getting the job done with the best components and technologies available.

All our ignition coils feature safety and performance enhancements that prevent premature ignition coil failure and ensure spark happens time after time at the spark gap, not via high voltage flashover.

Components such as high voltage sleeves and internal protective barriers ensure WeaponX components operate at top efficiency time after time. This protective method is especially useful when used in conjunction with high output ignition amplifiers or ignition boosters or in high boost applications where cylinder compression is extremely high. While other skim out on these components due to cost cutting you can be assured WeaponX has always used a cost is no object approach to deliver the best ignition coils available.

To the right is an example of a typical protective sleeve used on WeaponX pencil style ignition coils. As well as this protective barriers are used to isolate the outputs on our tower style ignition coils for enhanced reliability and performance.

Without these devices flash over can occur causing the spark event to happen outside the combustion chamber.

To further reduce flash over spark plugs have ribbed corrugations on the top portions of the insulator. WeaponX engineered our silicon boots to allow high voltage operation in the most demanding environments. As can be seen below the interior of the boot has corrugated ribs that conforms to popular brands of spark plugs. This extra rounded portion seals into the spark plug ribs further reducing spark flash over effects.



Protective high voltage sleeve insulates ignition coil from potential spark flashover issues.

Upper and Lower Silicone boots protect against high voltage flashover

OEM UNITS DO NOT HAVE CONTOURED RIBS

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



Engineered to harness extra energy through a variety of engineering enhancements the WeaponX ignition coils successfully transmit high energy to the spark plug without worry of spark flash over time after time.

## **CNC PROFILED CONNECTION POINTS**

A common phrase is, you can only pass as much energy as your weakest link allows. In the case of an ignition coil, when using poor fitting interconnects to the spark plug or the plug wire a loose connection is a poor connection which has very little surface area to transfer electrical energy. With a small connection area you increase resistance, as well as high voltage and current losses.

WeaponX effectively quadruples the effective surface contact area by CNC profiling our connection points to match the profile of all interconnects making for secure / reliable / low loss contact points. Our CNC profiles accurately match, 'LOCK' secure our components allowing for tighter tolerances and firmly gripped connections over any other alternative on the market reducing premature ignition coil failure and poor electrical conduction.

The WeaponX COP connection, to the right, acts as a 'LOCK' to the spark plug ensuring ideal operating parameters for the ignition coil and allowing for maximum performance vs any competitor design!



## **MATERIAL SELECTION AND MATERIAL CROSS SECTIONAL AREA**

Put simply, the larger cross section of material present, the more current carrying capability and higher voltage the material can conduct.

The connection to the spark plug is where all stored ignition coil energy is released. WeaponX specifies and uses thick cross sections of the material that connect directly to the spark plug. (LARGER = MORE EFFICIENCY, MORE CURRENT CARRYING CAPABILITY) The WeaponX proprietary blend of Copper and Zinc metals is optimized to create a brass material that conducts over 35 times more effectively than the average OEM type stainless steel wire!

Keep in mind that zero ohms is NOT zero resistance, 8 feet of stainless 16 gauge wire at the ignition coil input is like adding 10,000 ohms of resistance at the ignition coil output even though it reads ZERO ohms it does not mean it conducts as well as other alternatives. (see note below\*) WeaponX materials offer exceptional resistance to corrosion but still offers excellent electrical conduction.

\*Regular ohm meters only measure physical connections, not electrical conduction of a material. In order to truly measure resistance of a material you need an expensive device referred to as an Eddy current meter. Eddy current instruments are nondestructive testing (NDT) devices that induce detectable eddy currents in conductive materials. They are used to detect flaws, determine thickness, inspect welds, measure conductivity, and sort alloys. Using these methods we can distinctively see the superiority of brass as a conductive connector over stainless or spring steel.

**Electrical Conductivity of Metals** (Higher number = better conduction)

Copper 100 (70% WEAPONX)

Zinc 28.2 (30% WEAPONX)

Nickel 12-16 (STAINLESS)

Carbon Steel 3-15 (STAINLESS)

Vanadium 6.6 (STAINLESS)

*Copper is one of the best electrical conductors and our ignition coil uses it in spades to improve performance when possible. With our proprietary material selection, higher cross sectional area of material, superior material selection WeaponX has produced connections that resist corrosion and transfer electricity exceptionally well in any engine environment.*

## **EMI and RFI DEVELOPMENT and CONTROL**

EMI and RFI control are serious factors to take into consideration when designing part of an ignition system. If they are not accounted for properly, fuel injection, computer calculations and radio devices could be thrown off and cause automobiles poor running conditions. All electrical devices connected to your vehicle can be affected by EMI / RFI.

EMI and RFI interference reduction became a critical point in development for WeaponX. This is another reason we developed a true C.O.P. unit. Typically wires connected to the ignition coil output can become emitters that transmit RFI and EMI signals to your vehicles electronics. As a result many OEMS use suppression ferrits to help control these noises but can also 'suppress' what we don't want it to, our ignition energy. WeaponX ignition coils are designed when possible to be true C.O.P. units which do not have these wires or any emissions antennai which allows for superior signal processing for all onboard electronic systems due to reduced EMI / RFI and superior performance.

**WeaponX uses internal shields all ignition coils to reduce interference levels created by the ignition system.**



All WeaponX ignition coils include internal or external shielding which helps to control EMI and RFI within the ignition coil and ignition system. When these techniques are effectively introduced interference levels drop allowing us to develop higher output circuits without interference issues.

### **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.

*Once the spark starts the air between the spark plug electrode and ground electrode becomes ionized. When the air becomes ionized and the spark is bridged the energy needed to keep the spark maintained is much less and the power needed from the XCOPS to maintain spark from the coil drops. When the power requirements drop the ignition coil is allowed to supply supplemental high bursts of spark energy creating a simulated multiple spark discharge event. This event is created in WeaponX coils by controlling a natural electronic ring in the ignition coil which continues at the gap until the energy in the ignition coil has extinguished.*

### **ADVANTAGE WEAPONX IGNITION COMPONENTS**

WeaponX offers uncompromising performance in all our ignition coils while increasing overall ignition coil efficiency and improving ignition coil output over other designs.

Also, unlike typical ignition coil designs which require a mechanical interconnect from the coil to the spark plug (Coil Near Plug technology) WeaponX has designed a system that is superior in pure output, reliability and efficiency for engines that can fit these designs.

WeaponX designs are a cost is no object venue which consider many of the following aspects.

### **BENEFITS OF WEAPONX DESIGNS**

#### **COIL ON PLUG**

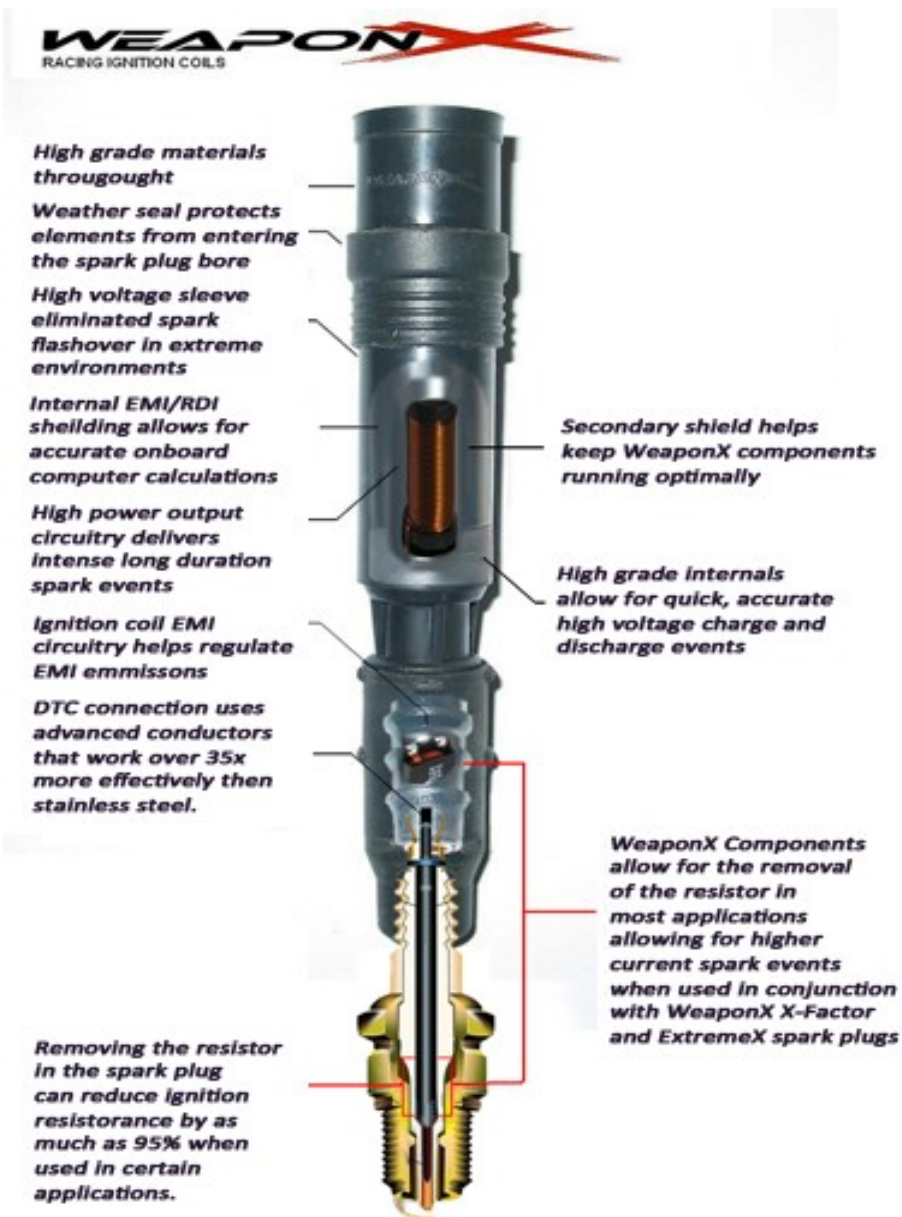
Benefits of producing and designing new COIL ON PLUG ignition coil from scratch

- \* 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.
- \* Reduced magnetic energy loss.
- \* Very expensive due to custom re-modeling, testing, prototyping and re-engineering components to fit.
- \* 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.
- \* Higher cross section conductors.
- \* Improved material selections.
- \* Highest output in the industry
- \* Passively, simulated multiple spark discharge event.
- \* Reduced circuit resistance.

## TOWER EFX DESIGN

- \* CNC profiled high-tension connection points.
- \* Determined that design considerations on engine require OE style ignition coil.
- \* Benefits include reduced engineering time for reduced cost.
- \* Re-modeling of internal components for high output internals and insulating barriers.
- \* Reduced energy loss, higher efficiency and higher output then standard models.
- \* Higher cross section conductors.
- \* Improved material selections.
- \* Highest output in the industry
- \* Passively, simulated multiple spark discharge event.
- \* *Reduced circuit resistance.*

## WeaponX Coil On Plug



## Original Equipment Coil Near Plug

*Designed for stock applications typical OE Coil Near Plug designs are inadequate for any type of performance advantage*

*Spark plug wire adds circuit resistance causing loss of power and poor electrical transfer characteristics due to loose fitting connections*

*Carbon resistor compromises power output and is used as a cheap method of controlling ignition interferences.*



### FINAL NOTE

WeaponX ignition coils are a combination of many high quality technologies and engineering principals to create a highly efficient ignition coil. You can also be assured that with the purchase of the XCOPs you will receive top notch customer service and quality ignition coils.

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