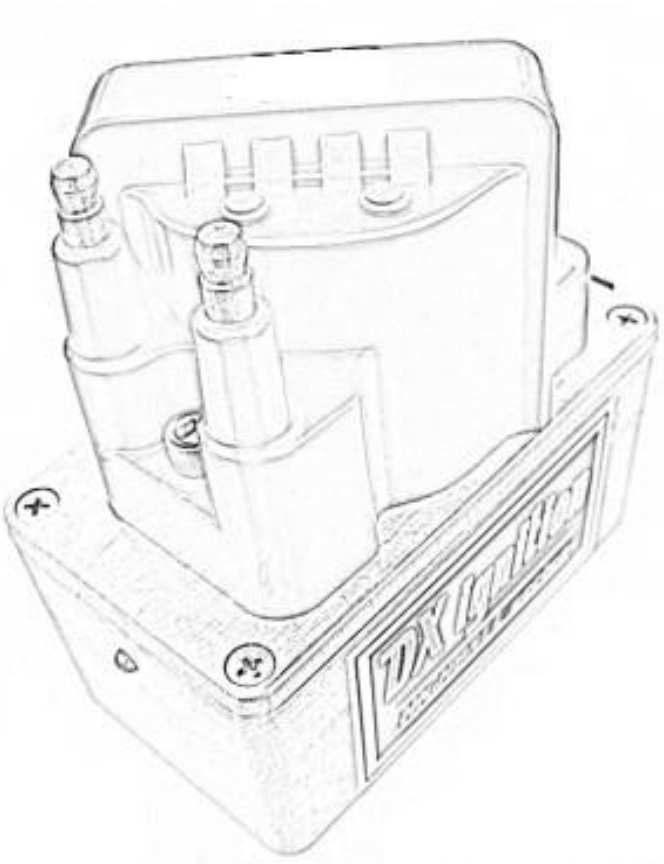
DX ignition



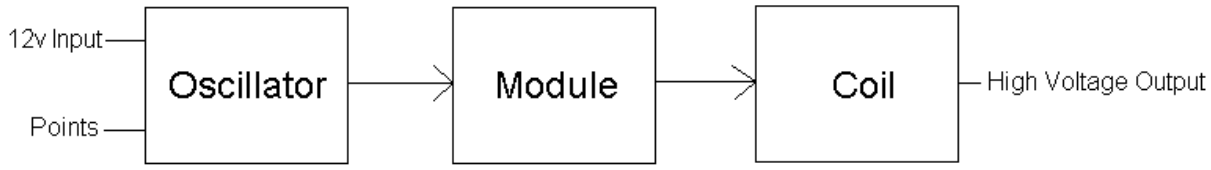
HIGHBALL series

Contents

1.0 Intent

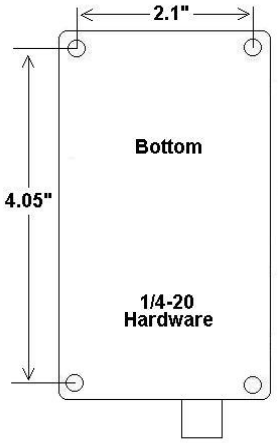
The purpose of this manual is to explain the operation of the electronic buzz coil kit and how to use it safely with reliable performance.

As with any high tension ignition care must be taken when installing, operating, or servicing the system. Voltages on the ignition coil secondary may be higher than 40Kv. The Highball series electronic ignitions require no adjustments and should never be serviced while connected to a power source. Should servicing be required the unit is a simple design using common components that are generally available at most auto part stores. The Highball series ignition has three electronic sections.

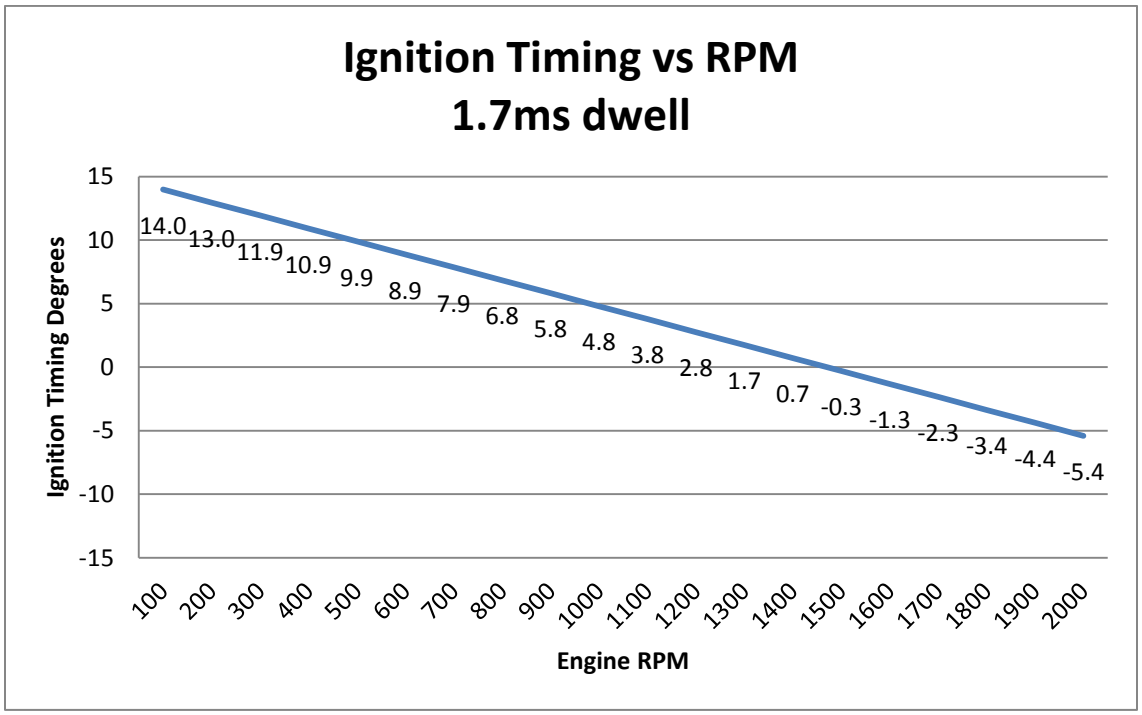


This combination electronically simulates the mechanical activity of an original buzz coil, but with greater spark gap performance and no moving parts to wear out. If there is a component failure the unit is field serviceable using basic hand tools. The general cause of failure in most electronic devices is heat. All active components in the Highball series ignition are rated to 105°C (221°F).

2.0 Specifications



Maximum Dimensions	5.0”L x 2.40”W x 4.60”H
Weight	2.2lbs
Operating Temperature	0°F-120°F typical
Input Voltage	10.5-15.5v Negative Ground
Idle Current	150ma
On Current	<2.1amp average/6amp peak
Output Voltage	40kv peak
Timer Current	18ma
Oscillator frequency	345Hz
Dwell	1.7 milliseconds
Spark Duration	1.2 millisecond



The above chart shows the relationship between ignition timing and RPM with the timer lever in the center or vertical position. At 100 RPM the timing is 14° advanced and at 2000 RPM the timing is retarded 5.4°. This is why the timer lever needs to be pulled back when starting the engine and pushed forward when running at higher RPM.

3.0 Installation

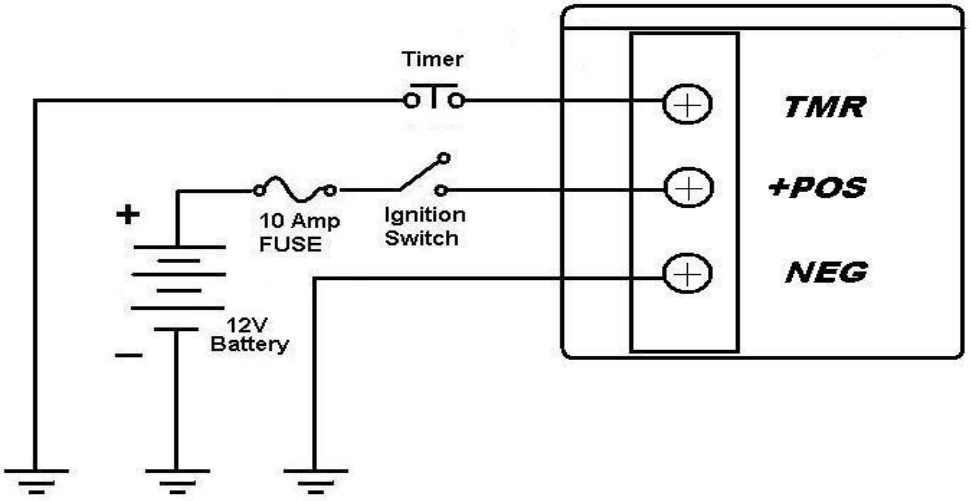
DX ignition is designed to operate in a harsh railroad motorcar environment. However, when installing the Highball series electronic buzz coil, consideration should be given to a location that provides some protection against extreme weather elements and also the length of the spark plug wires.

Note: the image to the left is configured using the jumper provided for use on a single cylinder engine. It is very important to install the spark plug wire jumper on the spark tower as shown to provide the correct spark polarity at the spark plug. The engine will run with the jumper on either tower, however engine performance may be reduced due to spark plug erosion. Copper core spark plugs are not designed to operate in reverse polarity.

The spark plug wires *must* be resistive or suppression wires. The recommended spark plug wires are 8mm carbon core with equal lengths to each cylinder. Due to the Highball series high output copper or steel core plug wires cannot be used because they act as an antenna causing RFI and may damage electronics.

The recommended spark plug gap for the twin cylinder Highball series ignition is 0.045”, up to 0.060” may be used on single cylinder engines. Resistor or non-resistor spark plugs may be used; however non resistor plugs may contribute noise to other electronic devices.

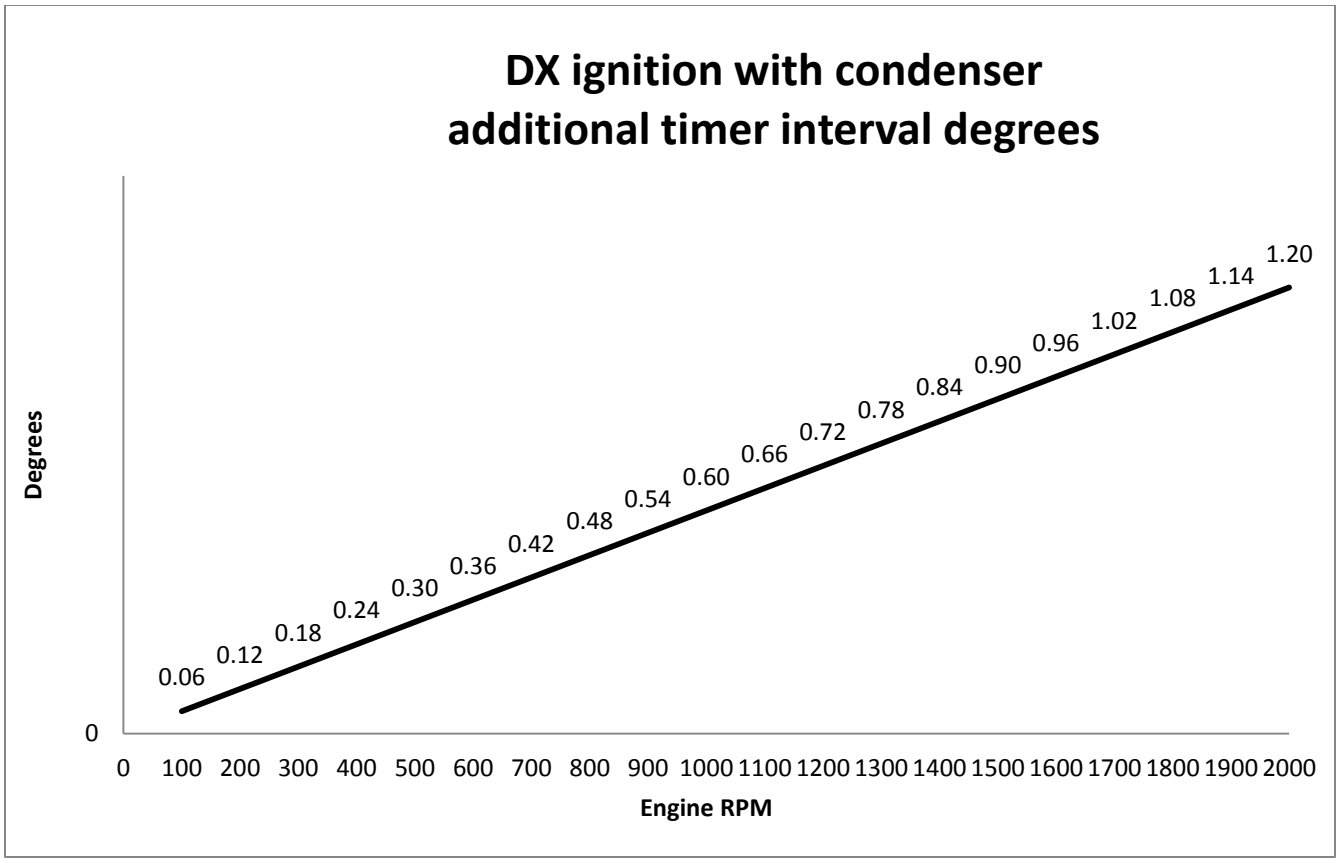
Installation Wiring



When wiring the input connections use at least 14ga stranded wire, 10 amp fuse, and ignition switch. It is a negative ground system so grounding is very important. It is recommended to make sure the aluminum case, negative terminal connection, engine, and battery have good chassis ground connections.

⚠ It is recommended to test and inspect timer points for proper electrical ground connection to engine.

The timer condenser is not required for the operation of DX ignition and it may be removed. If the condenser is good, you may choose to leave it connected allowing an easy switch between DX ignition and a wooden buzz coil. When using DX ignition with the timer condenser connected the equivalent timer interval is extended by approximately 1° at 1800rpm.



For the best engine performance clean and gap timer points. Follow the procedure defined by Fairmont to adjust the timer points. An interval of 1/12 of an engine revolution is the equivalent of 30°. The timer interval determines the number of crankshaft rotation degrees the buzz coil will fire. Significantly less than 30° may cause high RPM stalling, spark plug fouling and slow timer lever response. Greater than 30° effectively advances the ignition timing with relationship to timer lever position.

The red LED on the electronic buzz coil will indicate when the points are closed.

4.0 Operation & Precautions

Warning High Voltage!

When installing, operating, or servicing the electronic buzz coil use extreme care and recognize the high voltage potential.

Important!

Do not operate the electronic buzz coil without a defined high voltage path! Interrupting the high voltage path poses a health risk and also possible damage to the buzz coil. The High voltage path must be a complete circuit from one coil tower to the next coil tower. A failed or disconnected plug wire can cause the spark to arc internal to the coil causing failure.

⚠ Do not operate the electronic buzz coil for an extended time with the points or timer grounded while the engine is not running. Ionized gasses and radiation will build in the engine cylinder causing corrosion and spark plug wear. The glowing red LED is an indicator of when the points are grounded and the coil is firing.

⚠ The electronic buzz coil has an idle current draw of approximately 150ma. It is recommended to turn off ignition switch or open the battery connection when the engine is not running. Failing to do so may cause the battery to become depleted.

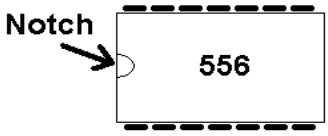
⚠ When removing cover for service re-torque screws to 8 in lbs.

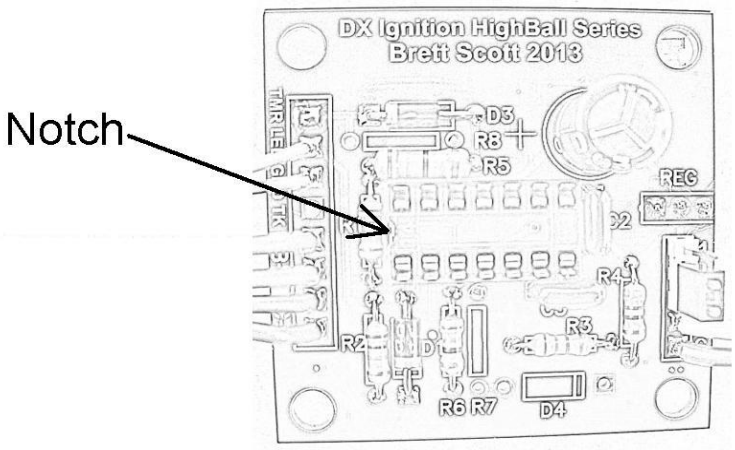
5.0 Repair

Oscillator IC

The oscillator section performs two functions in one Integrated Circuit (IC). The first function is to invert the signal from the engines timer. The second function is an oscillator that provides the correct coil dwell and coil fire patterns.

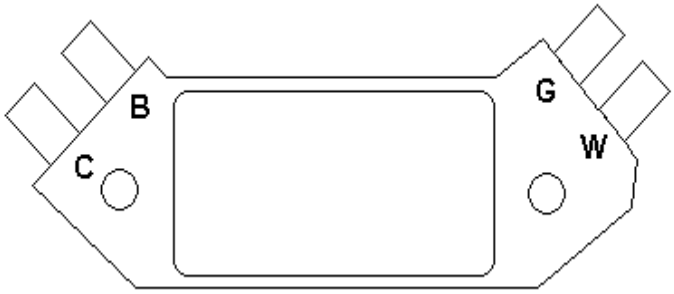
If the oscillator IC has failed and needs to be replaced precautions must be taken not to damage the IC from electrostatic discharge. The oscillator IC may be removed by carefully lifting the chip from the 14 pin socket. When inserting the IC align the notch on the chip with the notch on the socket respectively. Make sure all 14 pins are straight and press firmly into place.





Module

The primary function of the module is to act as an amplifier and current limiter. The module's input on pin G receives a square wave digital signal from the oscillator output. This signal corresponds to the proper dwell and fire duration of the coil. The module also limits the coil current to approximately 6 amps.



Module cross reference
BWD CBE4P

-
- B (RED) Battery Positive
- C (BLACK) Coil Negative
- W (WHITE) Battery Positive
- G (GREEN) Oscillator Output

To replace module the tools required are a #2 phillips, 11/32 socket, and a small needle nose pliers. Carefully remove the 4 wires by holding the body of each crimp connector with the needle nose pliers and sliding it away from the module. Do not pull on the wire as it may come out of the crimp connector. Remove hardware and module.

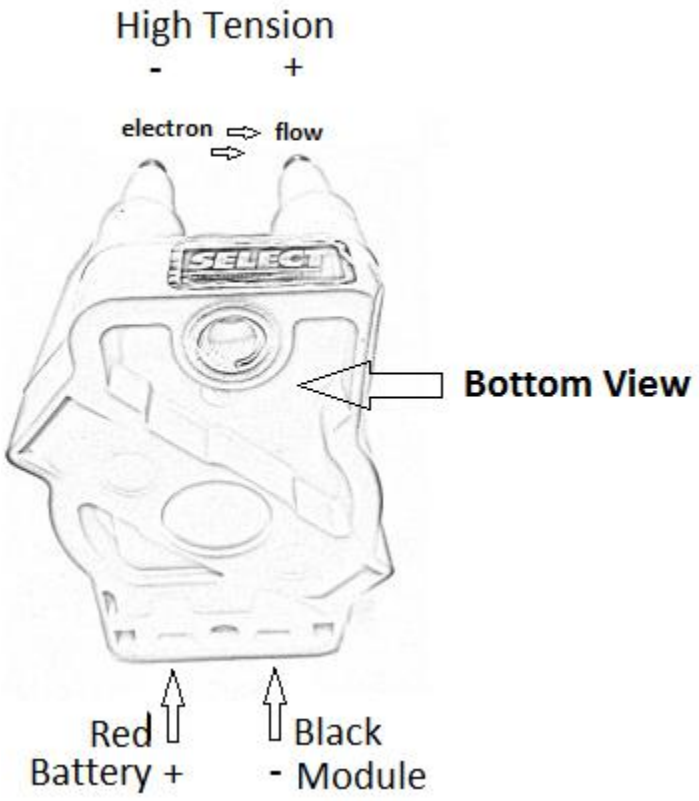
⚠ ***Important!*** **When replacing the module cut off the two alignment pins on the bottom of the new module and apply heat sink compound to the metal surface.**

With the new module in place tighten mounting hardware securely to promote good heat transfer and ground connection. DO NOT over tighten.

Coil

A high tension ignition coil is a storage device and transformer in one package. When the coil is connected to 12 volts a magnetic field builds on the primary side, this magnetic field is a form of energy storage. The time it takes to build the magnetic field to its maximum potential is called dwell. When the 12 volts is disconnected the magnetic field quickly collapses generating up to 400 volts on the primary side of the ignition coil. Using the known fundamentals of transformer theory, a coil with a turns ratio of 100:1 can potentially generate an output of 40kv (400x100). Factors to consider when selecting an ignition coil are resistance, inductance, and turns ratio. When replacing the coil it is very important to use a coil with the following specifications:

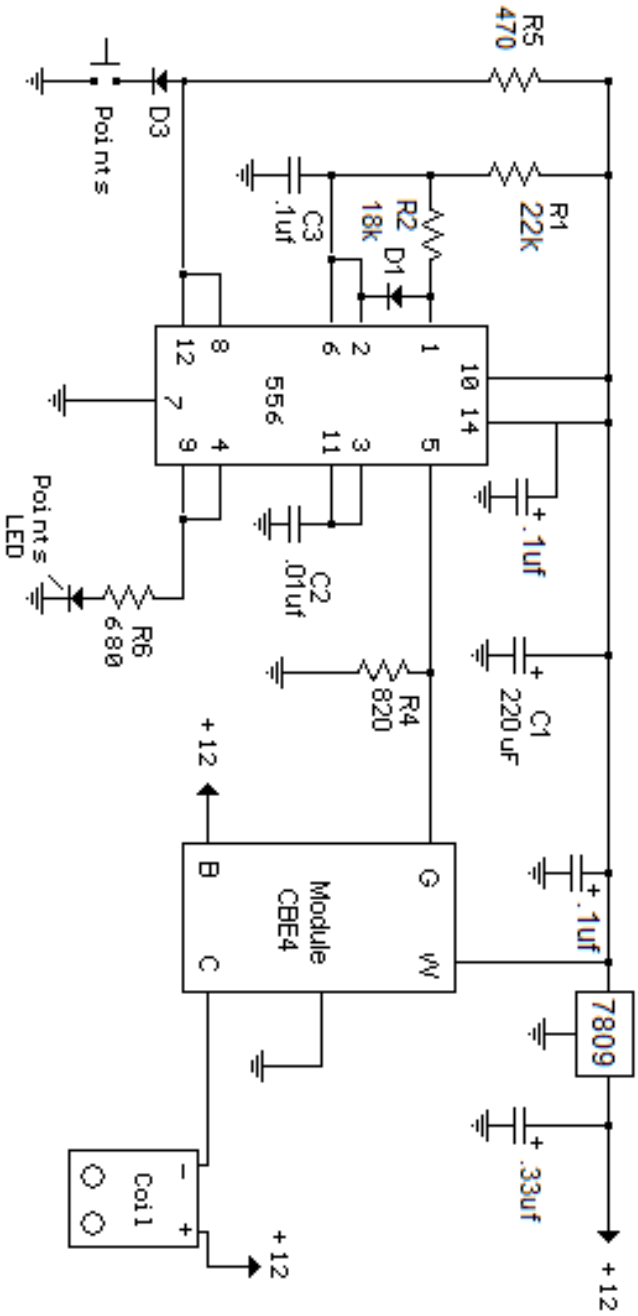
	Primary	Secondary
Resistance	0.5 ohm	5.6K ohm
Inductance	1.8mh	>20h
Turns Ratio	1	80



The Ignition coil is polarity sensitive. The figure to the left indicates the electron flow on the High Tension side of the coil. If the primary polarity is reversed the secondary polarity will reverse respectively.

Ignition Coil cross reference
BWD E51

Highball Series Schematic



6.0 Parts List

Quan	Description	Vendor	Part #
1	4.5x2.5 aluminum box	Digikey	377-1102-ND
1	3 CIR BARRIER STRIP	Digikey	WM5729
1	9V REG	Digikey	LM7809CTFS-ND
1	NA556	Digikey	296-21755-5-ND
1	220 UF 25V	Digikey	565-1546-ND
2	50V 1A DIODE	Digikey	1N4001FSCT-ND
1	14 POS SOCKET	Digikey	A100205-ND
1	.01uf	Digikey	P4513-ND
3	.1uf	Digikey	P4525-ND
1	.33uf	Digikey	P4669-ND
2	680 OHM .25W	Digikey	680QBK-ND
1	820 .25W	Digikey	820QBK-ND
1	22K .25W	Digikey	22KQBK-ND
1	18K .25W	Digikey	18KQBK-ND
1	470 .5W	Digikey	470H-ND
1	LED	Digikey	160-1964-ND
1	STAND OFF .25"	Digikey	492-1089-ND
3	STAND OFF .375"	Digikey	492-1091-ND
1	PC BOARD	Pad2Pad	
1	TWIN COIL	Advance Auto	BWD E51
1	MODULE	Advance Auto	CBE4P
4	4/40 X.75 SCREW	Fastenal	72655
4	4/40 NUT Nylon	Fastenal	1170854
2	8/32 X 1 SCREW	Fastenal	1172645
2	#8 LOCK NUT	Fastenal	1170856
2	1/4 20 screw 1.25"	Fastenal	1173463
2	1/4 20 nylon lock nut	Fastenal	70860
2	Rivet 1/8x.5		
4	INSULATED CRIMP female		
2	INSULATED CRIMP male		

7.0 Glossary of Terms

High Tension

High Voltage, voltage is electric tension measured between two points.

Low Tension

Low Voltage, voltage is electric tension measured between two points.

Dwell Time

Dwell refers to the time the ignition coil is charging.

Negative Ground

A negative ground system has the negative terminal of the battery connected to a common point such as a vehicle chassis to provide the same potential throughout the vehicle.

Positive Ground

A positive ground system has the positive terminal of the battery connected to a common point such as a vehicle chassis to provide the same potential throughout the vehicle. Positive ground potential promotes galvanic corrosion on vehicle body parts and frames and is not commonly used today. The electrical wiring itself is sacrificed however better insulation offers protection and reduces deterioration.

Spark Plug Heat Range

The heat range of a spark plug determines the temperature of the tip of the spark plug while the engine is running. The correct temperature maintains efficiency and keeps the plug clean. The temperature range does not significantly affect electrical characteristics of the plug.

Timer

The timer is a cam actuated mechanical device that provides a signal to a buzz coil.

Points

Points are a cam actuated mechanical switch that provides a signal to an ignition coil.

Condenser

The condenser is a capacitor that connects to ignition points. The function of the condenser is to provide a path for the collapsing magnetic field of the primary side of an ignition coil when the points open.

Average Current

Current measured with respect to time.

Peak Current

Current measured at its maximum value.

Ignition Coil

A device with a pulsing low voltage DC input and a high voltage output.

Ignition Module

The primary function of an automotive ignition module is to interpret incoming cam or crank shaft signals and deliver a pulsed regulated current flow to an ignition coil corresponding to engine position.

Coil Primary Inductance

Inductance measured on the primary or low voltage input side of an ignition coil. Inductance unit of measure is henrys. Typical ignition coil primary inductance ranges between 1-10mh (millihenry).

Primary Resistance

Resistance measured on the primary or low voltage input side of an ignition coil. Resistance is measured in ohms. Typical coil primary resistance ranges between 0.3-6 ohms.

Secondary Resistance

Resistance measured on the secondary or high voltage output side of an ignition coil. Typical coil secondary resistance ranges between 5K-10K ohms.

Coil Turns Ratio

Coil turns ratio refers to the number of winding on an ignition coil primary and secondary. Typical coil ratio is 1:100.

RFI

Radio Frequency Interference or Electromagnetic Interference

Resistor or Suppression Wires

Suppression spark plug wires have internal resistance that reduces the emission of RFI.

Resistor Spark Plug

A spark plug with internal resistance reduces the emission of RFI.

Ignition Timing

Ignition timing on an internal combustion engine determines when an ignition spark is initiated based on the position of mechanical components of the engine.

Ignition Coil Polarity

A typical ignition coil generally can operate polarity in either direction. When the polarity of the primary side of an ignition coil is reversed the output reverses respectively.

Spark Polarity

The polarity on the secondary side of an ignition coil determines the direction of high voltage electron flow. The ideal direction for a spark plug is for the spark to jump from the center electrode to the ground electrode. On a single coil two cylinder ignition system one spark plug always fires in reverse polarity.

Polarity

In a Direct Current circuit electrons flow in one direction from the negative pole to the positive pole. Identifying the poles identifies the polarity. When the poles are reversed the polarity is reversed.

Inductance

The current flowing through a conductor induces a magnetic field around the conductor. The voltage across an inductor is equal to the product of its inductance and the time rate of change of the current through it. Inductance is measured in henry.

Contact Information

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Serial Number _____
Purchase Date_____
Warranty End _____

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